

BRAKES

TABLE OF CONTENTS

	page	page
BASE BRAKE SYSTEM	1	ANTILOCK BRAKE SYSTEM 65

BASE BRAKE SYSTEM

TABLE OF CONTENTS

	page	page
DESCRIPTION AND OPERATION		
BASE BRAKE SYSTEM OPERATION	2	
BASE BRAKE SYSTEM COMPONENTS	2	
DIAGNOSIS AND TESTING		
BASE BRAKE SYSTEM DIAGNOSIS CHARTS	9	
POWER BRAKE BOOSTER	11	
DRUM BRAKE AUTOMATIC ADJUSTER	12	
BRAKE ROTOR	12	
BRAKE DRUM	15	
PROPORTIONING VALVE	15	
BRAKE FLUID CONTAMINATION	17	
SERVICE PROCEDURES		
BRAKE FLUID LEVEL CHECKING	17	
BASE BRAKE BLEEDING	17	
MASTER CYLINDER BLEEDING	19	
BRAKE TUBE REPAIR	19	
BRAKE ROTOR MACHINING	21	
BRAKE DRUM MACHINING	22	
PARKING BRAKE AUTOMATIC ADJUSTER LOCK OUT	22	
REMOVAL AND INSTALLATION		
SERVICE WARNINGS AND CAUTIONS	23	
BRAKE PEDAL	24	
BRAKE LAMP SWITCH	27	
MASTER CYLINDER	28	
BRAKE FLUID RESERVOIR	29	
BRAKE FLUID LEVEL SWITCH	30	
POWER BRAKE BOOSTER	30	
PROPORTIONING VALVE	32	
BRAKES TUBES AND HOSES	33	
DISC BRAKE CALIPER (FRONT)	33	
DISC BRAKE SHOES (FRONT)	35	
BRAKE ROTOR (FRONT)	37	
DISC BRAKE CALIPER (REAR)	38	
DISC BRAKE SHOES (REAR)	39	
BRAKE ROTOR (REAR)	41	
DRUM BRAKE WHEEL CYLINDER (REAR)	41	
DRUM BRAKE SHOES (REAR)	43	
BRAKE DRUM (REAR)	45	
DRUM BRAKE SHOE SUPPORT PLATE (REAR)	46	
PARKING BRAKE LEVER	48	
PARKING BRAKE CABLE (REAR)	49	
PARKING BRAKE SHOES (REAR DISC BRAKE)	53	
DISASSEMBLY AND ASSEMBLY		
DISC BRAKE CALIPER (FRONT AND REAR)	55	
CLEANING AND INSPECTION		
BRAKE TUBES AND HOSES	59	
DISC BRAKES (FRONT)	59	
DISC BRAKES (REAR)	60	
DRUM BRAKES (REAR)	60	
ADJUSTMENTS		
BRAKE LAMP SWITCH	61	
DRUM BRAKE SHOES	61	
PARKING BRAKE SHOES (REAR DISC BRAKES)	62	
SPECIFICATIONS		
BRAKE FLUID	63	
BRAKE ACTUATION SYSTEM	63	
BRAKE FASTENER TORQUE SPECIFICATIONS	63	
SPECIAL TOOLS		
BASE BRAKE SYSTEM	64	

DESCRIPTION AND OPERATION

BASE BRAKE SYSTEM OPERATION

When a vehicle needs to be stopped, the driver applies the brake pedal. The brake pedal pushes the input rod of the power brake booster into the booster. The booster uses vacuum to ease pedal effort as force is transferred through the booster to the master cylinder. The booster's output rod pushes in the master cylinder's primary and secondary pistons applying hydraulic pressure through the chassis brake tubes and proportioning valves (rear only) to the brakes at each tire and wheel assembly.

Front disc brakes control the braking of the front wheels; rear braking is controlled by rear drum brakes as standard equipment. Rear disc brakes and an antilock brake system (ABS) with traction control are optional.

The hydraulic brake system is diagonally split on both the non-antilock and antilock braking systems. This means the left front and right rear brakes are on one hydraulic circuit and the right front and left rear are on the other.

Vehicles equipped with the optional antilock brake system (ABS) use a system designated Mark 20e. This system shares most base brake hardware used on vehicles without ABS. A vehicle equipped with ABS, however, uses a different master cylinder and brake tubes. Also included in the ABS system is an integrated control unit (ICU) and four wheel speed sensors. These components are described in detail in the ANTILOCK BRAKE SYSTEM section in this group of the service manual. All vehicles with ABS come standard with four-wheel-disc brakes and traction control.

The parking brakes are hand-operated. When applied, the parking brake lever pulls on cables that actuate brake shoes at each rear wheel. The parking brake lever has an automatic adjusting feature that takes up any excessive slack in the parking brake cable system.

BASE BRAKE SYSTEM COMPONENTS

BRAKE PEDAL

A suspended-type brake pedal is used on this vehicle. The pedal pivots on a shaft mounted in the pedal support bracket under the instrument panel. The pedal connects to the power brake booster input rod and pushes it in when the pedal is applied.

The brake pedal and its pad are serviceable separately.

POWER BRAKE BOOSTER

There are two different power brake booster designs, although externally they appear the same. All vehicles use a 205 mm tandem diaphragm power brake booster. The two boosters are internally tuned differently depending on whether the vehicle is equipped with the standard front disc/rear drum brake combination or the optional front disc/rear disc (four-wheel disc) brake combination. If the power brake booster requires replacement, be sure it is replaced with the correct part.

The power brake booster can be identified by the tag attached to the body of the booster assembly (Fig. 1). This tag contains the following information: The production part number of the power brake booster, the date it was built and who manufactured it.

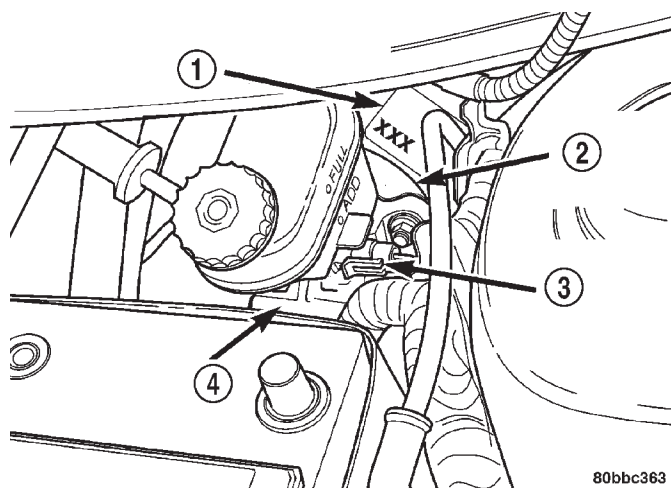


Fig. 1 Master Cylinder and Power Brake Booster

- 1 - POWER BRAKE BOOSTER PARTS IDENTIFICATION TAG
- 2 - POWER BRAKE BOOSTER
- 3 - BRAKE FLUID PRESSURE SWITCH
- 4 - MASTER CYLINDER

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

The power brake booster is vacuum-operated. The vacuum is supplied from the intake manifold on the engine through the power brake booster check valve (Fig. 2).

As the brake pedal is depressed, the power booster input rod moves forward. This opens and closes valves in the power brake booster, allowing atmospheric pressure to enter on one side of a diaphragm. Engine vacuum is always present on the other side. This difference in pressure forces the output rod of the power booster out against the primary piston of the master cylinder. As the pistons in the master cylinder move forward, hydraulic pressure is created in the brake system.

DESCRIPTION AND OPERATION (Continued)

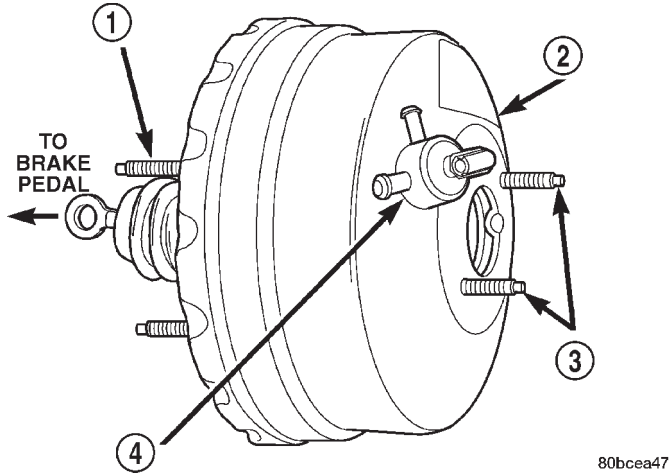


Fig. 2 Power Brake Booster

- 1 - MOUNTING STUD
- 2 - PARTS IDENTIFICATION TAG
- 3 - MASTER CYLINDER MOUNTING STUDS
- 4 - VACUUM CHECK VALVE

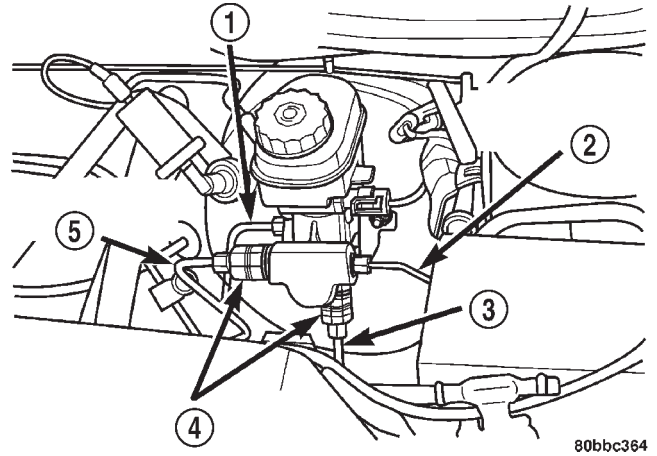


Fig. 3 Non-ABS Master Cylinder

- 1 - RIGHT FRONT BRAKE TUBE
- 2 - LEFT FRONT BRAKE TUBE
- 3 - LEFT REAR BRAKE TUBE
- 4 - REAR PROPORTIONING VALVES
- 5 - RIGHT REAR BRAKE TUBE

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

MASTER CYLINDER

The base brakes on a vehicle not equipped with ABS use a standard compensating port master cylinder, while vehicles equipped with ABS use a center valve design master cylinder. The information provided here applies only to the non-ABS master cylinder. For information on the master cylinder used on vehicles with ABS, refer to the ANTILOCK BRAKE SYSTEM section in this service manual group.

The non-ABS master cylinder is a four-outlet design with two screw-in proportioning valves. One is attached directly to the inboard side of the master cylinder housing while the other is attached to the bottom (Fig. 3). Vehicles equipped with rear drum brakes use a master cylinder with a 22.23 mm (0.875 in.) bore diameter, while vehicles equipped with rear disc brakes use a 23.82 mm (0.937 in.) bore diameter master cylinder.

The master cylinder body is an anodized aluminum casting. It has a machined bore to accept the master cylinder piston and also has threaded ports with seats for hydraulic brake line connections.

The master cylinder's primary outlet ports supply hydraulic pressure to the right front and left rear

brakes while the secondary outlet ports supply hydraulic pressure to the left front and right rear brakes (Fig. 3).

BRAKE FLUID RESERVOIR

The master cylinder has the brake fluid reservoir mounted on top of it which gravity feeds brake fluid to the master cylinder when it is required. The reservoir is made of see-through plastic and it houses the brake fluid level switch.

BRAKE FLUID LEVEL SWITCH

The brake fluid level switch is located in the brake fluid reservoir on the master cylinder (Fig. 1). It senses the level of the brake fluid within the reservoir and when the level drops below an acceptable level, the switch closes and completes the ground circuit for the red BRAKE warning lamp. This turns on the red BRAKE warning lamp. For additional information, refer to RED BRAKE WARNING LAMP also in this section.

PROPORTIONING VALVE

NOTE: Only vehicles without antilock brakes have proportioning valves. Vehicles with antilock brakes have electronic brake distribution that is built into the integrated control unit.

DESCRIPTION AND OPERATION (Continued)

Proportioning valves balance front to rear braking by controlling the brake fluid hydraulic pressure to the rear brakes. Under light pedal application, the proportioning valve allows normal fluid flow to the rear brakes. Under higher pedal effort, the valve reduces fluid pressure to the rear brakes.

The non-antilock master cylinder is a four-outlet design with two screw-in proportioning valves attached directly to the master cylinder housing (Fig. 3). One proportioning valve controls each rear brake.

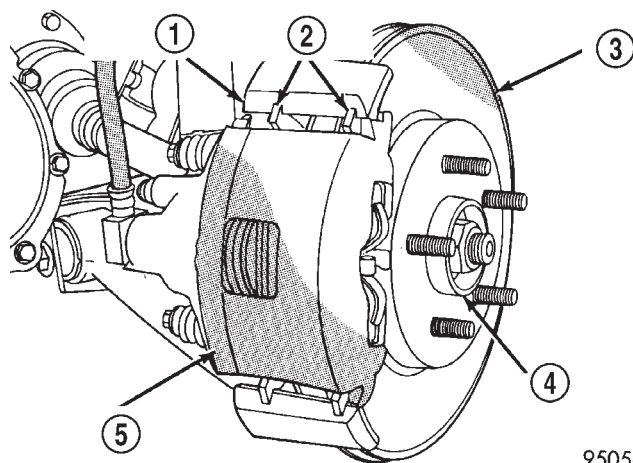
BRAKE TUBES AND HOSES

The purpose of the brake tubes and flex hoses is to transfer the pressurized brake fluid developed by the master cylinder to the brakes at each wheel of the vehicle. The flex hoses connect the chassis brake tubes, which are mounted to the vehicle's underbody, to the brake at each wheel, allowing for movement of the vehicle's suspension. The brake tubes are steel with a corrosion-resistant nylon coating applied to the external surfaces. The flex hoses are made of reinforced rubber.

DISC BRAKES (FRONT)

The front disc brakes consist of the following components (Fig. 4):

- Brake caliper - single-piston, floating type
- Brake shoes and linings
- Brake rotor



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Fig. 4 Front Disc Brakes

- 1 - STEERING KNUCKLE
- 2 - BRAKE PADS AND LININGS
- 3 - BRAKE ROTOR
- 4 - DRIVING HUB
- 5 - CALIPER ASSEMBLY

When the brakes are applied, fluid pressure is sent to each brake caliper. The pressure at the caliper is exerted equally against the caliper piston. The pressure applied to the piston is transmitted directly to the inboard brake shoe. This forces the shoe lining against the inner surface of the brake rotor. At the same time, fluid pressure within the caliper piston bore forces the caliper to slide inward on its guide pins. This action brings the outboard shoe lining into contact with the outer surface of the brake rotor. This pressure on both sides of the brake rotor causes friction, bringing the vehicle to a stop.

BRAKE CALIPER

The caliper is a one-piece casting with the inboard side containing a single piston cylinder bore (Fig. 5).

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

A square-cut rubber piston seal is located in a machined groove in the caliper cylinder bore. This provides a hydraulic seal between the piston and the cylinder wall (Fig. 6). The piston seal is designed to pull the piston back into the bore of the caliper when the brake pedal is released. This maintains the proper brake shoe-to-rotor clearance.

A rubber dust boot is installed in the cylinder bore opening and in a groove in the piston (Fig. 6). This prevents contamination in the bore area.

The caliper is mounted to the steering knuckle using bushings, sleeves and two guide pin bolts (Fig. 5). The guide pin bolts thread directly into bosses on the steering knuckle.

Two machined abutments on the steering knuckle position the caliper. The guide pin bolts, sleeves, and bushings control the side-to-side movement of the caliper. All of the front brake force generated during braking of the vehicle is taken up directly by the steering knuckles of the vehicle.

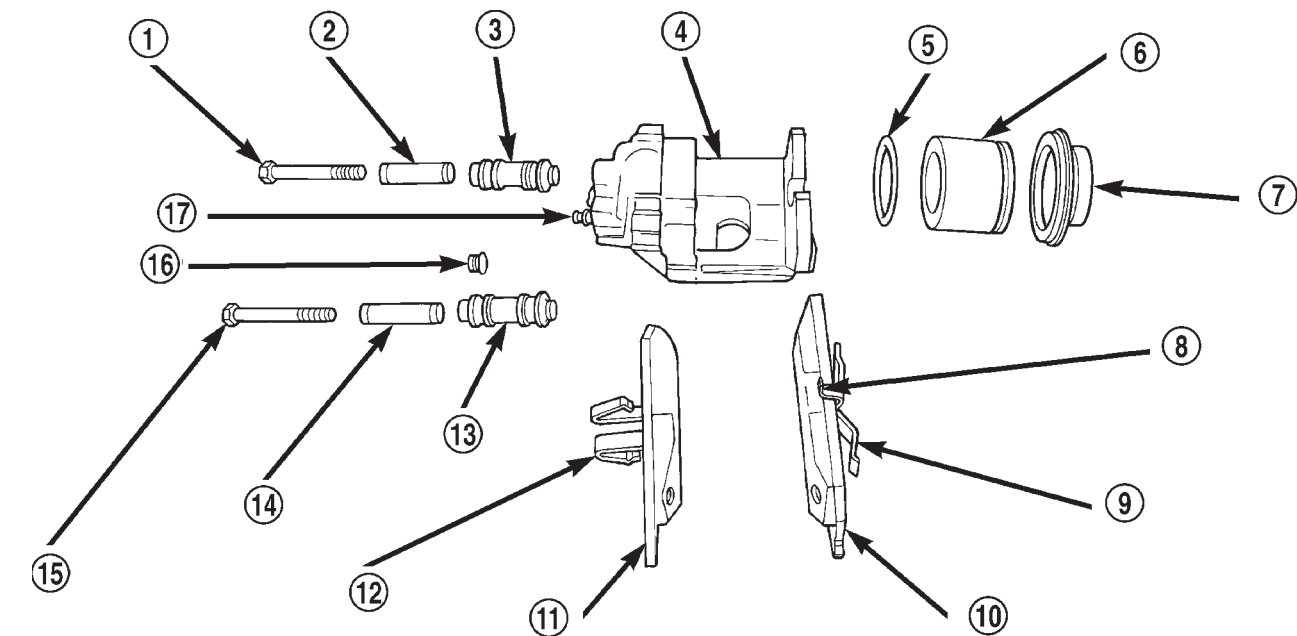
BRAKE SHOES AND LININGS

There are two brake shoes mounted to each caliper, one inboard and one outboard (Fig. 5). When brake shoes are replaced, only brake shoes meeting the original equipment manufacturer (OEM) formulation (such as Mopar® replacement parts) should be used.

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

Front disc brakes are equipped with an audible wear indicator on the outboard brake pad (Fig. 5). This sensor emits a sound when the brake lining may need inspection or replacement.

DESCRIPTION AND OPERATION (Continued)



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Fig. 5 Front Disc Brake Caliper

- 1 – CALIPER GUIDE PIN BOLT

2 – SLEEVE

3 – BUSHING

4 – CALIPER

5 – PISTON SEAL

6 – PISTON

7 – DUST SEAL

8 – WEAR INDICATOR

9 – ANTI-RATTLE CLIP
- 10 – BRAKE SHOE

11 – BRAKE SHOE

12 – ANTI-RATTLE CLIP

13 – BUSHING

14 – SLEEVE

15 – CALIPER GUIDE PIN BOLT

16 – CAP

17 – BLEEDER SCREW

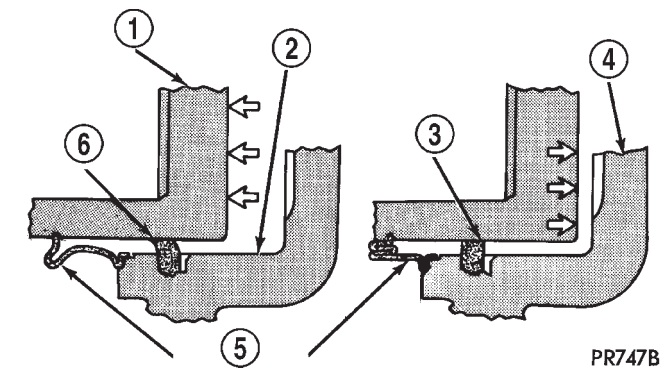


Fig. 6 Piston Seal Function

- 1 – PISTON

2 – CYLINDER BORE

3 – PISTON SEAL BRAKE PRESSURE OFF

4 – CALIPER HOUSING

5 – DUST BOOT

6 – PISTON SEAL BRAKE PRESSURE ON

BRAKE ROTOR

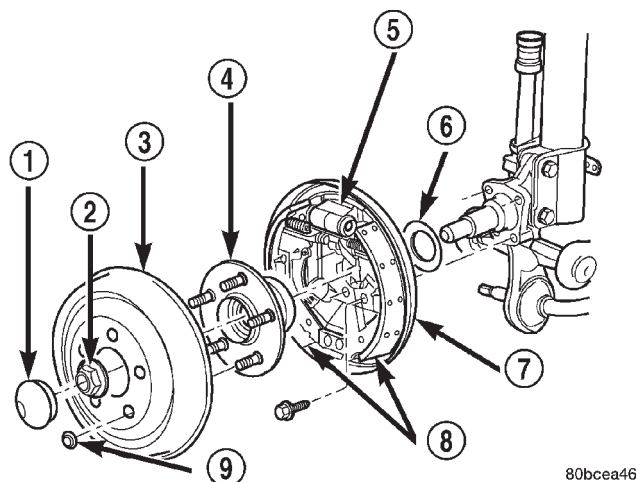
The brake shoe linings contact the brake rotor. Each front brake rotor is vented to help cool it during and after brake applications. It is mounted on the studs of the front wheel bearing hub.

DRUM BRAKES (REAR)

Rear drum brakes are standard equipment on this vehicle. The rear drum brakes consist of the major components listed in the figure (Fig. 7). Other components related to the brake shoes themselves can be seen in the next figure (Fig. 8).

The rear wheel drum brakes are a two-shoe, internal-expanding type with an automatic adjuster screw (Fig. 8). The automatic adjuster screw is actuated each time the brakes are applied. The automatic adjuster screw is located directly below the rear brake wheel cylinder.

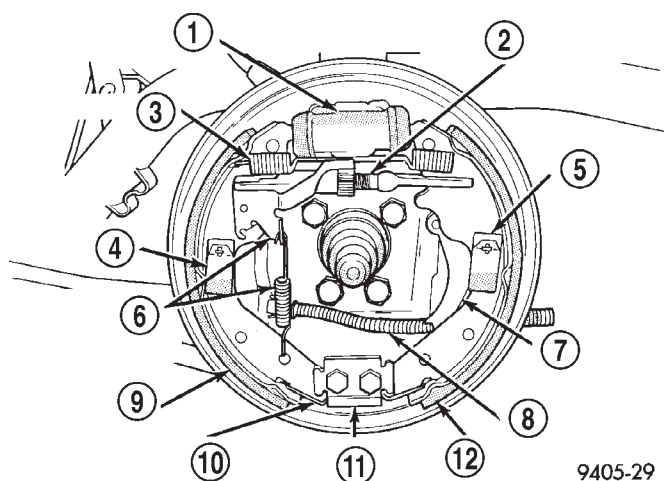
DESCRIPTION AND OPERATION (Continued)



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Fig. 7 Rear Drum Brakes

- 1 - DUST CAP
- 2 - NUT
- 3 - DRUM
- 4 - HUB AND BEARING
- 5 - WHEEL CYLINDER
- 6 - SEAL
- 7 - SUPPORT PLATE
- 8 - BRAKE SHOES
- 9 - RETAINER CLIP



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Fig. 8 Drum Brake Shoes (Left Side Shown)

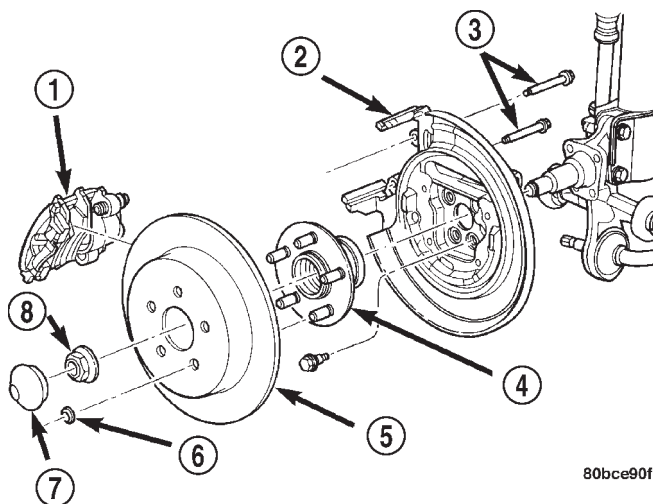
- 1 - WHEEL CYLINDER
- 2 - AUTOMATIC ADJUSTER SCREW ASSEMBLY
- 3 - RETURN SPRING
- 4 - HOLD DOWN CLIP
- 5 - HOLD DOWN CLIP
- 6 - AUTOMATIC ADJUSTER LEVER AND SPRING
- 7 - PARK BRAKE LEVER
- 8 - PARK BRAKE CABLE
- 9 - FRONT BRAKE SHOE
- 10 - BRAKE SHOE TO ANCHOR SPRING
- 11 - BRAKE ANCHOR PLATE
- 12 - REAR BRAKE SHOE

DISC BRAKES (REAR)

Rear disc brakes are optional equipment on some models of this vehicle (Fig. 9). The rear disc brakes are similar to the front disc brakes; however, there are several distinctive features that require different service procedures. The rear disc brakes consist of the following components:

- Brake caliper - single-piston, floating type
- Brake caliper adapter
- Brake shoe and linings
- Brake rotor - drum-in-hat type

All vehicles equipped with rear disc brakes have a small duo-servo drum brake mounted to the caliper adapter. This is part of the parking brake system. The drum brake shoes expand out against a braking surface (hat section) on the inside area of the disc brake rotor.



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Fig. 9 Rear Disc Brakes

- 1 - DISC BRAKE CALIPER
- 2 - DISC BRAKE ADAPTER
- 3 - GUIDE PIN BOLTS
- 4 - HUB AND BEARING
- 5 - BRAKE ROTOR
- 6 - RETAINER CLIP
- 7 - DUST CAP
- 8 - NUT

BRAKE CALIPER

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

The caliper assembly for all applications floats on rubber bushings using internal metal sleeves that are attached to the adapter using threaded guide pin bolts.

BRAKE CALIPER ADAPTER

The brake caliper adapter and rotor shield are mounted to the rear suspension knuckles of vehicle.

DESCRIPTION AND OPERATION (Continued)

The adapter is used to mount the brake caliper to the vehicle (Fig. 9). The adapter has two machined abutments, which are used to position and align the caliper and brake pads for movement inboard and outboard. The adapter also mounts the parking brake shoes and actuating cables to the vehicle.

PARKING BRAKES

The parking brakes (Fig. 4) consist of the following components:

- Hand-operated park brake lever - automatic-adjusting
- Parking brake cables
- Actuation levers and struts
- Duo-servo parking brake assembly (rear disc only)

PARKING BRAKE LEVER

All vehicles are equipped with a center-mounted, hand-operated parking brake lever mounted between the front seats (Fig. 10). This lever is an automatic-adjusting type that continuously applies minimal tension to the parking brake cables to keep them in adjustment at all times. Due to this feature, the parking brake cable system does not require adjustment. Proper parking brake system adjustment is obtained by proper drum brake or drum-in-hat brake shoe adjustment. When service is needed, the lever auto-adjust mechanism must be reloaded and locked out before service can be performed.

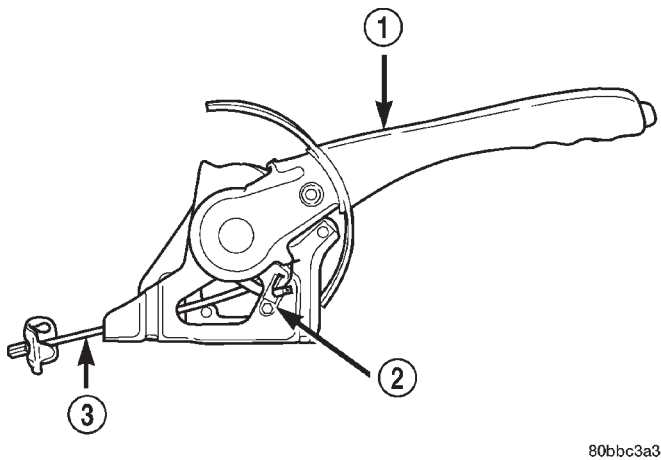


Fig. 10 Parking Brake Lever

- 1 - PARKING BRAKE LEVER
- 2 - PARKING BRAKE WARNING LAMP SWITCH
- 3 - OUTPUT CABLE

The parking brake lever has a short output cable with an equalizer bracket attached to it that connects to the parking brake cables (Fig. 10). The output cable can only be serviced as part of the parking brake lever.

PARKING BRAKE CABLES

There is an individual parking brake cable for each rear wheel that joins a parking cable equalizer, attached to the parking brake lever, to the rear parking brakes. The parking brake cables are made of flexible steel cable. Both drum rear brakes and disc rear brakes use the same parking brake cable configuration, but the cables are different.

PARKING BRAKES

On vehicles equipped with rear drum brakes, the rear wheel service brakes also act as the vehicle's parking brakes. The rear drum brake shoes, when acting as parking brakes, are mechanically operated using an internal actuating lever and strut connected to the flexible steel parking brake cable.

The parking brakes on vehicles equipped with rear disc brakes consist of a small duo-servo brake assembly mounted to the disc brake caliper adapter (Fig. 11). The hat (center) section of the rear brake rotor serves as the braking surface (drum) for the parking brakes (Fig. 12). This parking brake application uses the same operating cable configuration as the drum brake equipped vehicles, but different cables.

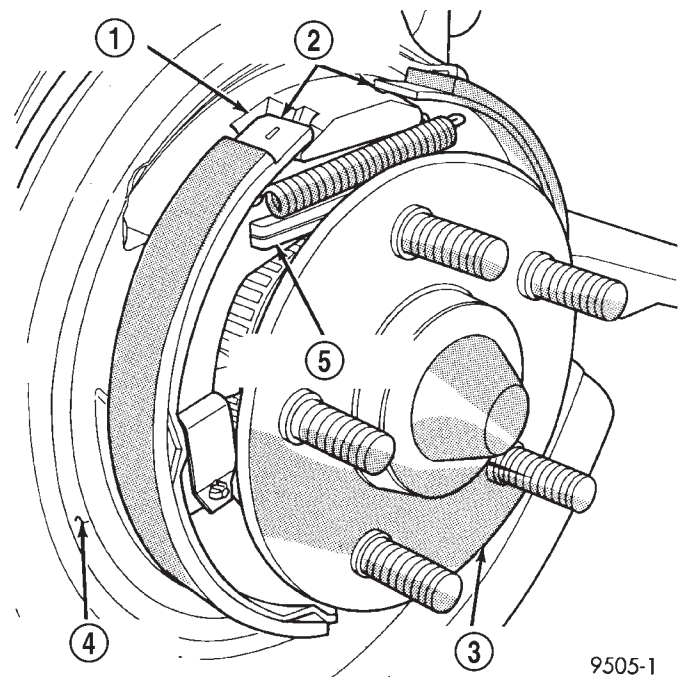
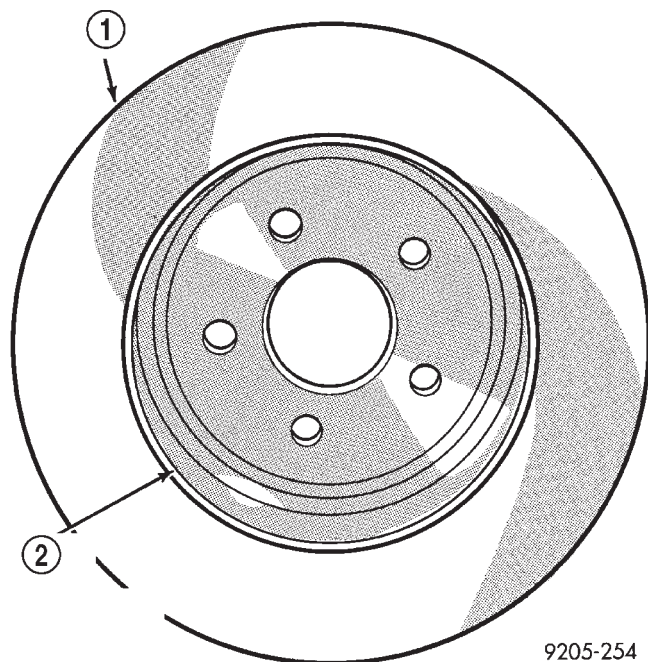


Fig. 11 Parking Brake Assembly With Rear Disc Brakes

- 1 - DISC BRAKE ADAPTER
- 2 - PARKING BRAKE BRAKE SHOES
- 3 - HUB/BEARING ASSEMBLY
- 4 - BRAKING DISC STONE SHIELD
- 5 - PARKING BRAKE ACTUATING STRUT

DESCRIPTION AND OPERATION (Continued)



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Fig. 12 Drum-In-Hat Brake Rotor

- 1 - REAR BRAKING DISK ROTOR
- 2 - HAT SECTION OF REAR BRAKING DISC (PARKING BRAKE BRAKING SURFACE)

RED BRAKE WARNING LAMP

The red BRAKE warning lamp is located in the instrument panel cluster and illuminates when a low brake fluid condition occurs or when the parking brake lever is applied with the ignition key in the ON position. In addition, the red BRAKE warning lamp illuminates when the ignition switch is moved from the OFF to the ON or CRANK position. This is done to check the bulb's operation.

Problems with this system will generally be of the type where the warning lamp fails to turn on when it should, or remains on when it should not.

The red BRAKE warning lamp LED is supplied with current anytime the ignition switch is ON. The bulb is illuminated by completing the ground circuit using any of the following components:

- the brake fluid level switch located in the master cylinder reservoir
- the parking brake switch mounted on the parking brake lever (Fig. 10)
- the ignition switch when the ignition switch is first moved to the ON or CRANK position
- the mechanical instrument cluster (MIC) (with ABS)
- the ABS electronic brake distribution (EBD)

The brake fluid level switch is located in the brake fluid reservoir of the master cylinder assembly (Fig. 1). The purpose of the switch is to provide the driver with an early warning that the brake fluid level in

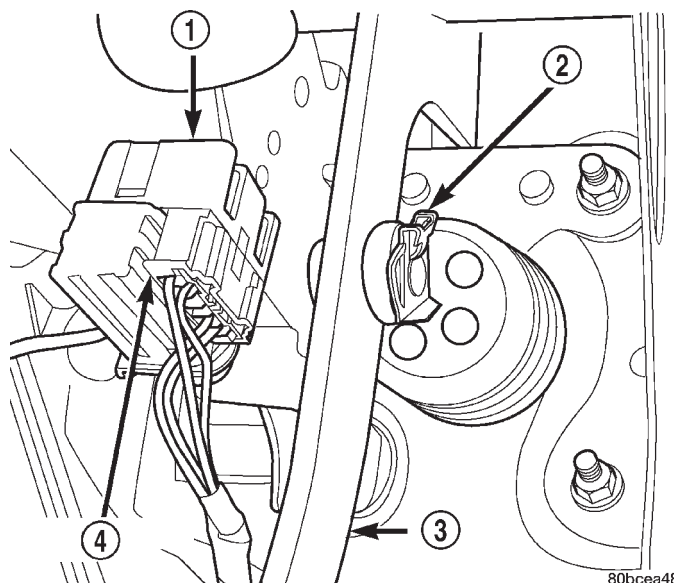
the master cylinder reservoir has dropped below an acceptable level.

As the fluid drops below the minimum level, the fluid level switch closes and grounds the red BRAKE warning lamp circuit. This turns on the red BRAKE warning lamp. At this time, the master cylinder fluid reservoir must be checked and filled to the full mark with DOT 3 brake fluid. An abnormal loss of brake fluid in the master cylinder fluid reservoir could be caused by a leak in the hydraulic system. The entire brake hydraulic system should be checked for evidence of a leak.

The red BRAKE warning lamp can be turned on by the MIC in the case where the ABS is experiencing a problem where the amber ABS warning lamp needs to be illuminated and cannot. The MIC will then illuminate the red BRAKE warning lamp.

BRAKE LAMP SWITCH

The brake lamp switch is located under the instrument panel, at the brake pedal arm (Fig. 13). It controls operation of the vehicle's stop lamps. Also, if the vehicle is equipped with speed control, the brake lamp switch will deactivate the speed control when the brake pedal is depressed.



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Fig. 13 Brake Lamp Switch

- 1 - SWITCH
- 2 - CLIP
- 3 - BRAKE PEDAL
- 4 - CONNECTOR

When the brake pedal is depressed, the brake lamp switch contacts are closed, completing the circuit to the stop lamps, thus illuminating the stop lamps and the center-high-mounted stop lamp (CHMSL).

DIAGNOSIS AND TESTING

BASE BRAKE SYSTEM DIAGNOSIS CHARTS

NOTE: There are three diagnosis charts following that cover the **RED BRAKE WARNING LAMP**, **BRAKE NOISE** and **OTHER BRAKE CONDITIONS**.

RED BRAKE WARNING LAMP

CONDITION	POSSIBLE CAUSES	CORRECTION
RED BRAKE WARNING LAMP ON	1. Parking brake lever not fully released. 2. Parking brake warning lamp switch on parking brake lever. 3. Brake fluid level low in reservoir. 4. Brake fluid level switch. 5. Mechanical instrument cluster (MIC) problem. 6. ABS EBD malfunction.	1. Release parking brake lever. 2. Inspect and replace switch as necessary. 3. Fill reservoir. Check entire system for leaks. Repair or replace as required. 4. Disconnect switch wiring connector. If lamp goes out, replace switch. 5. Refer to Chassis Diagnostic Procedures manual. 6. Refer to ABS section and Chassis Diagnostic Procedures manual.

BRAKE NOISE

CONDITION	POSSIBLE CAUSES	CORRECTION
DISC BRAKE CHIRP	1. Excessive brake rotor runout. 2. Lack of lubricant on brake caliper slides.	1. Follow brake rotor diagnosis and testing. Correct as necessary. 2. Lubricate brake caliper slides.
DISC BRAKE RATTLE OR CLUNK	1. Broken or missing anti-rattle spring clips on shoes. 2. Caliper guide pins loose.	1. Replace brake shoes. 2. Tighten guide pins.
DISC BRAKE SQUEAK AT LOW SPEED (WHILE APPLYING LIGHT BRAKE PEDAL EFFORT)	1. Brake shoe linings.	1. Replace brake shoes.
DRUM BRAKE CHIRP	1. Lack of lubricant on brake shoe support plate where shoes ride. 2. Wheel cylinder out of alignment.	1. Lubricate shoe contact areas on brake shoe support plates. 2. Loosen wheel cylinder mounting bolts, realign wheel cylinder with brake shoes and tighten mounting bolts.
DRUM BRAKE CLUNK	1. Drum(s) have threaded machined braking surface.	1. Reface or replace brake drums as necessary.
DRUM BRAKE HOWL OR MOAN	1. Lack of lubricant on brake shoe support plate where shoes ride and at the anchor. 2. Rear brake shoes.	1. Lubricate shoe contact areas on brake shoe support plates and at the anchor. 2. Replace rear brake shoes.
DRUM BRAKE SCRAPING OR WHIRRING	1. ABS wheel speed sensor or tone wheel.	1. Inspect, correct or replace faulty component(s).
SCRAPING (METAL-TO-METAL).	1. Foreign object interference with brakes. 2. Brake shoes worn out.	1. Inspect brakes and remove foreign object. 2. Replace brake shoes. Inspect rotors and drums. Reface or replace as necessary.

DIAGNOSIS AND TESTING (Continued)

OTHER BRAKE CONDITIONS

CONDITION	POSSIBLE CAUSES	CORRECTION
BRAKES CHATTER	1. Rear brake drum out of round or disc brake rotor has excessive thickness variation.	1. Isolate condition as rear or front. Reface or replace brake drums or rotors as necessary.
BRAKES DRAG (FRONT OR ALL)	1. Contaminated brake fluid. 2. Binding caliper pins or bushings. 3. Binding master cylinder. 4. Binding brake pedal.	1. Check for swollen seals. Replace all system components containing rubber. 2. Replace pins and bushings 3. Replace master cylinder. 4. Replace brake pedal.
BRAKES DRAG (REAR ONLY)	1. Parking brake cables binding or froze up. 2. Parking brake cable return spring not returning shoes. 3. Service brakes not adjusted properly (rear drum brakes only). 4. Obstruction inside the center console preventing full return of the parking brake cables.	1. Check cable routing. Replace cables as necessary. 2. Replace cables as necessary. 3. Follow the procedure listed in the adjustment section. 4. Remove console and remove obstruction.
BRAKES GRAB	1. Contaminated brake shoe linings. 2. Improper power brake booster assist.	1. Inspect and clean, or replace shoes. Repair source of contamination. 2. Refer to power brake booster in the diagnosis and testing section.
EXCESSIVE PEDAL EFFORT	1. Obstruction of brake pedal. 2. Low power brake booster assist. 3. Glazed brake linings. 4. Brake shoe lining transfer to brake rotor.	1. Inspect, remove or move obstruction. 2. Refer to power brake booster in the diagnosis and testing section. 3. Reface or replace brake rotors as necessary. Replace brake shoes. 4. Reface or replace brake rotors as necessary. Replace brake shoes.
EXCESSIVE PEDAL TRAVEL (VEHICLE STOPS OK)	1. Air in brake lines. 2. Rear drum brake auto-adjuster malfunctioning.	1. Bleed brakes. 2. Inspect and replace drum brake components as necessary. Adjust rear brakes.
EXCESSIVE PEDAL TRAVEL (PEDAL GOES TO FLOOR - CAN'T SKID WHEELS)	1. Power brake booster runout (vacuum assist).	1. Check booster vacuum hose and engine tune for adequate vacuum supply. Refer to power brake booster in the diagnosis and testing section.
EXCESSIVE PEDAL TRAVEL (ONE FRONT WHEEL LOCKS UP DURING HARD BRAKING)	1. One of the two hydraulic circuits to the front brakes is malfunctioning.	1. Inspect system for leaks. Check master cylinder for internal malfunction.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
PEDAL PULSATES/SURGES DURING BRAKING	1. Rear brake drum out of round or disc brake rotor has excessive thickness variation.	1. Isolate condition as rear or front. Reface or replace brake drums or rotors as necessary.
PEDAL IS SPONGY	1. Air in brake lines. 2. Power brake booster runout (vacuum assist).	1. Bleed brakes. 2. Check booster vacuum hose and engine tune for adequate vacuum supply. Refer to power brake booster in the diagnosis and testing section.
PREMATURE REAR WHEEL LOCKUP	1. Contaminated brake shoe linings. 2. Inoperative proportioning valve (non-ABS vehicles only). 3. ABS EBD not functioning. 4. Improper power brake booster assist.	1. Inspect and clean, or replace shoes. Repair source of contamination. 2. Test proportioning valves following procedure listed in diagnosis and testing section. Replace valves as necessary. 3. Refer to the ABS section and Chassis Diagnostic Procedures manual. 4. Refer to power brake booster in the diagnosis and testing section.
STOP LAMPS STAY ON	1. Brake lamp switch out of adjustment. 2. Brake pedal binding. 3. Obstruction in pedal linkage. 4. Power Brake Booster not allowing pedal to return completely.	1. Adjust brake lamp switch. 2. Inspect and replace as necessary. 3. Remove obstruction. 4. Replace power brake booster.
VEHICLE PULLS TO RIGHT OR LEFT ON BRAKING	1. Frozen brake caliper piston. 2. Contaminated brake shoe lining. 3. Pinched brake lines. 4. Leaking piston seal. 5. Suspension problem.	1. Replace frozen piston or caliper. Bleed brakes. 2. Inspect and clean, or replace shoes. Repair source of contamination. 3. Replace pinched line. 4. Replace piston seal or brake caliper. 5. Refer to the Suspension group.
PARKING BRAKE - EXCESSIVE HANDLE TRAVEL	1. Rear brakes out of adjustment.	1. Adjust rear drum brake shoes, or rear parking brake shoes on vehicles with rear disc brakes.

POWER BRAKE BOOSTER

BASIC TEST

(1) With engine off, depress and release the brake pedal several times to purge all vacuum from the power brake booster.

(2) Depress and hold the pedal with light effort (15 to 25 lbs. pressure), then start the engine.

The pedal should fall slightly, then hold. Less effort should be needed to apply the pedal at this time. If the pedal fell as indicated, perform the VACUUM LEAK TEST listed after the BASIC TEST. If the

pedal did not fall, continue on with this BASIC TEST.

(3) Disconnect the vacuum hose on the side of the vacuum check valve that leads to the speed control, then connect a vacuum gauge to the open vacuum port on the valve.

(4) Start the engine.

(5) When the engine is at warm operating temperature, allow it to idle and check the vacuum at the gauge.

DIAGNOSIS AND TESTING (Continued)

If the vacuum supply is 12 inches Hg (40.5 kPa) or more, the power brake booster is defective and must be replaced. If the vacuum supply is below 12 inches, continue on with this BASIC TEST.

(6) Shut off the engine.

(7) Connect the vacuum gauge to the vacuum reference port on the engine intake manifold.

(8) Start the engine and observe the vacuum gauge.

If the vacuum is still low, check the engine tune and repair as necessary. If the vacuum is above 12 inches, the hose or check to the booster has a restriction or leak.

Once an adequate vacuum supply is obtained, repeat the BASIC TEST.

VACUUM LEAK TEST

(1) Disconnect the vacuum hose on the side of the power brake booster vacuum check valve that leads to the speed control, then connect a vacuum gauge to the open vacuum port on the valve.

(2) Remove the remaining hose on the vacuum check valve that is not the vacuum supply hose coming from the intake manifold. Cap off the open port on the check valve.

(3) Start the engine.

(4) Allow the engine to warm up to normal operating temperature and engine idle.

(5) Using vacuum line pliers, close off the vacuum supply hose near the booster and observe the vacuum gauge.

If the vacuum drop exceeds 1.0 inch Hg (3.3 kPa) in one minute, repeat the above steps to confirm the reading. The vacuum loss should be less than 1.0 inch Hg in one minute time span. If the loss is more than 1.0 inch Hg, replace the power brake booster. If it is not, continue on with this test.

(6) Remove the pliers from the hose temporarily.

(7) Apply light effort (approximately 15 lbs. of force) to the brake pedal and hold the pedal steady. Do not move the pedal once the pressure is applied or the test results may vary.

(8) Have an assistant reattach the pliers to the vacuum supply hose.

(9) Allow 5 seconds for stabilization, then observe the vacuum gauge.

If the vacuum drop exceeds 3.0 inches Hg (10 kPa) in 15 seconds, repeat the above steps to confirm the reading. The vacuum loss should be less than 3.0 inches Hg in 15 seconds time span. If the loss is more than 3.0 inches Hg, replace the power brake booster. If it is not, the booster is not defective.

DRUM BRAKE AUTOMATIC ADJUSTER

To properly test the drum brake automatic adjuster, the aide of a helper inside the vehicle to apply the brakes will be necessary.

(1) Raise the vehicle. Refer to HOISTING in the LUBRICATION AND MAINTENANCE group for the proper lifting procedure.

(2) Remove the access plug from the rear adjustment slot in each brake support plate.

(3) Insert a thin screwdriver in the adjustment slot and push back the adjustment lever. With the lever in this position, back the star wheel adjustment off approximately 10 notches. This will eliminate the possibility that the brake is at full adjustment, and can be adjusted no further.

(4) Remove the screwdriver from the adjustment slot.

(5) Watch the star wheel through the adjustment slot, while a helper applies the brake pedal. As the brake shoes apply, the adjustment lever should move downward, turning the star wheel. A definite rotation of the adjuster star wheel can be observed if the automatic adjuster is working properly.

If the star wheel does not move as indicated, the brake drum needs to be removed and further inspection of the rear brakes is necessary.

(6) If the star wheel is operating properly, readjust the brakes. Refer to ADJUSTMENTS in this section of this service manual group.

(7) Reinstall the adjustment slot access plug.

(8) Lower the vehicle.

BRAKE ROTOR

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

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

When diagnosing a brake noise or pulsation, the machined disc braking surface should be checked and inspected.

BRAKING SURFACE INSPECTION

Light braking surface scoring and wear is acceptable. If heavy scoring or warping is evident, the rotor must be refaced or replaced. Refer to SERVICE PROCEDURES in this section of this group for information on brake rotor machining.

Excessive wear and scoring of the rotor can cause improper lining contact on the rotor's braking surface. If the ridges on the rotor are not removed before new brake shoes are installed, improper wear of the shoes will result.

If a vehicle has not been driven for a period of time, the rotor's braking surface will rust in the areas not covered by the brake shoes at that time. Once the vehicle is driven, noise and chatter from the disc brakes can result when the brakes are applied.

DIAGNOSIS AND TESTING (Continued)

Some discoloration or wear of the rotor surface is normal and does not require resurfacing when linings are replaced. If cracks or burned spots are evident, the rotor must be replaced.

ROTOR MINIMUM THICKNESS

Measure rotor thickness at the center of the brake shoe contact surface. Replace the rotor if it is worn below minimum thickness or if machining the rotor will cause its thickness to fall below specifications.

CAUTION: Do not machine the rotor if it will cause the rotor to fall below minimum thickness.

Minimum thickness specifications are cast on the rotor's unmachined surface (Fig. 14). Limits can also be found in the table at the end of this brake rotor information.

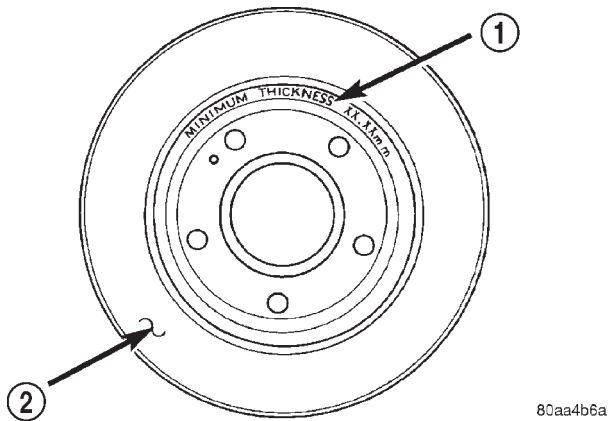


Fig. 14 Minimum Brake Rotor Thickness Markings (Typical)

- 1 – ROTOR MINIMUM THICKNESS MARKING
2 – ROTOR

ROTOR THICKNESS VARIATION

Thickness variation in a rotor's braking surface can result in pedal pulsation, chatter and surge. This can also be caused by excessive runout in the rotor or the hub.

Rotor thickness variation measurements should be made in conjunction with measuring runout. Measure thickness of the brake rotor at 12 equal points around the rotor braking surface with a micrometer at a radius approximately 25 mm (1 inch) from edge of rotor (Fig. 15). If thickness measurements vary by more than 0.013 mm (0.0005 inch), the rotor should refaced or replaced. Refer to SERVICE PROCEDURES in this section of this group for information on brake rotor machining.

ROTOR RUNOUT

On-vehicle rotor runout is the combination of the individual runout of the hub face and the runout of

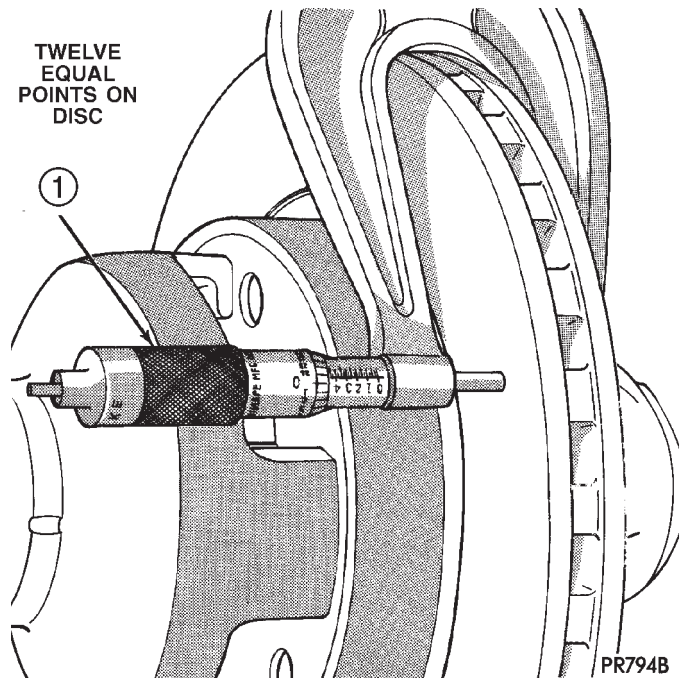


Fig. 15 Checking Rotor For Thickness

- 1 – CALIPER

the rotor. (The hub and rotor runouts are separable). To measure rotor runout on the vehicle, first remove the tire and wheel assembly. Reinstall the wheel mounting nuts on the studs, tightening the rotor to the hub. Mount the Dial Indicator, Special Tool C-3339, with Mounting Adaptor, Special Tool SP-1910 on steering arm. The dial indicator plunger should contact braking surface of rotor approximately one inch from edge of rotor (Fig. 16). Check lateral runout on both sides of the rotor, marking the low and high spots on both. Runout limits can be found in the table at the end of this brake rotor information.

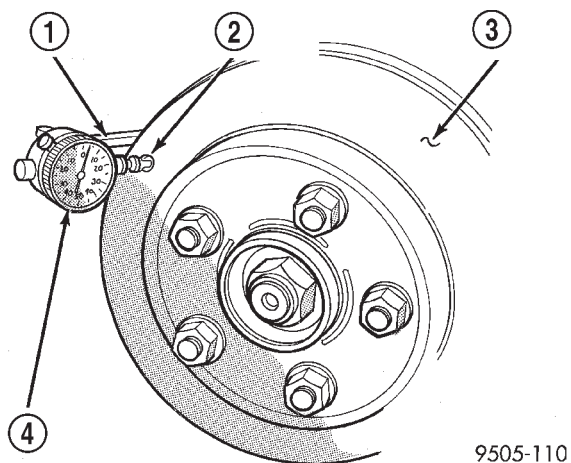
If runout is in excess of the specification, check the lateral runout of the hub face. Before removing the rotor from the hub, place a chalk mark across both the rotor and the one wheel stud closest to where the high runout measurement was taken. This way, the original mounting spot of the rotor on the hub is indexed (Fig. 17).

Remove the rotor from the hub.

NOTE: Clean the hub face surface before checking runout. This provides a clean surface to get an accurate indicator reading.

Mount Dial Indicator, Special Tool C-3339, and Mounting Adaptor, Special Tool SP-1910, to the steering knuckle. Position the indicator stem so it contacts the hub face near the outer diameter. Care must be taken to position stem outside of the stud circle, but inside of the chamfer on the hub rim (Fig. 18).

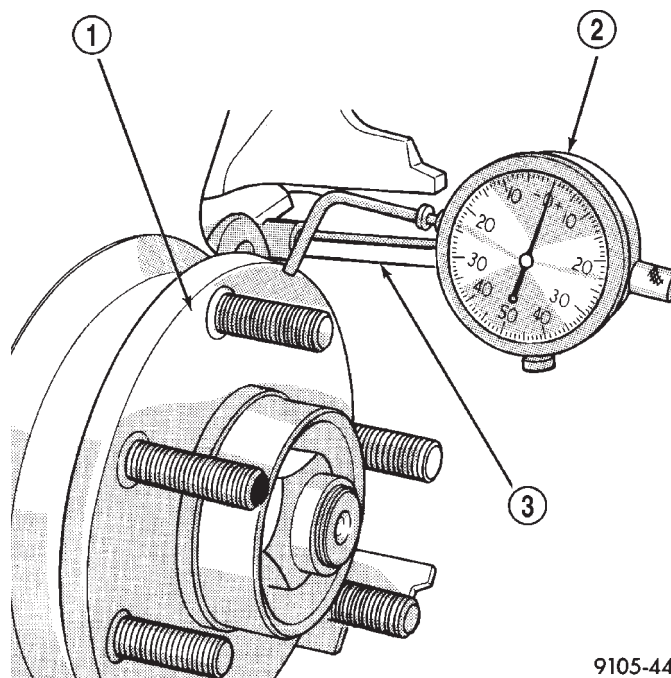
DIAGNOSIS AND TESTING (Continued)



9505-110

Fig. 16 Checking Rotor Runout

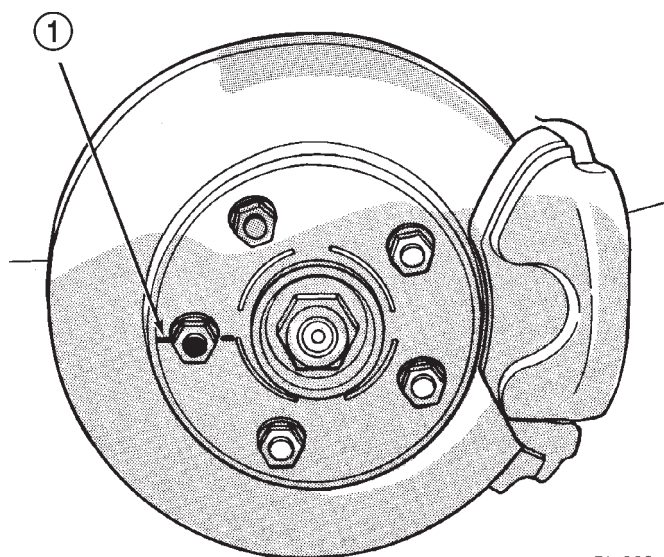
- 1 - SPECIAL TOOL SP-1910
- 2 - 10 MILLIMETERS FROM EDGE
- 3 - DISC SURFACE
- 4 - SPECIAL TOOL C-3339



9105-44

Fig. 18 Checking Hub Runout

- 1 - HUB SURFACE
- 2 - SPECIAL TOOL C-3339
- 3 - SPECIAL TOOL SP-1910



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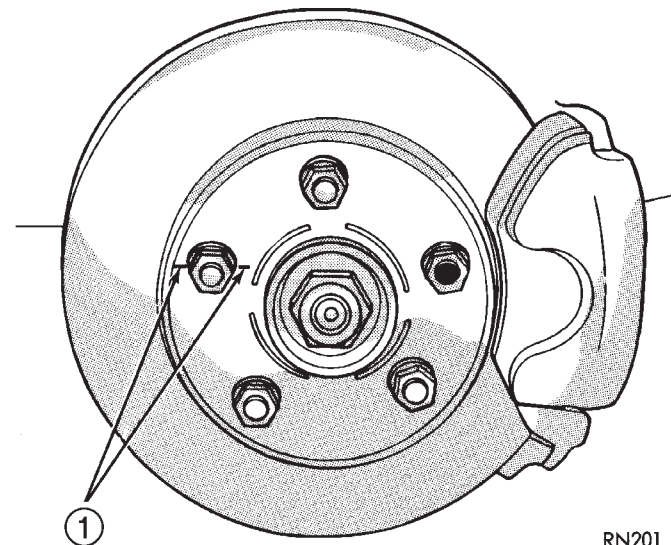
Fig. 17 Marking Rotor and Wheel Stud

- 1 - CHALK MARK

Hub runout should not exceed 0.08 mm (0.003 inch). If runout exceeds this specification, the hub must be replaced. Refer to the SUSPENSION group in this service manual for the replacement procedure.

If the hub runout does not exceed this specification, install the rotor back on the hub, aligning the chalk marks on the rotor with a wheel mounting stud, two studs apart from the original stud (Fig. 19). Tighten nuts in the proper sequence and torque to specifications.

Recheck brake rotor runout to see if the runout is now within specifications.



RN201

Fig. 19 Index Rotor And Wheel Stud

- 1 - CHALK MARK

If runout is not within specifications, reface or replace the brake rotor. Refer to SERVICE PROCEDURES in this section of this group for information on brake rotor machining.

DIAGNOSIS AND TESTING (Continued)

BRAKE ROTOR LIMITS

Braking Rotor	Rotor Thickness	Minimum Rotor Thickness	Rotor Thickness Variation	Rotor Runout*	Rotor Micro Finish
Front Rotor	21.87–22.13 mm 0.861-0.871 in.	20.4 mm 0.803 in.	0.013 mm 0.0005 in.	0.13 mm 0.005 in.	15-80 RMS
Rear Rotor	8.75–9.25 mm 0.344 -0.364 in.	7.25 mm 0.285 in.	0.013 mm 0.0005 in.	0.13 mm 0.005 in.	15-80 RMS
* TIR Total Indicator Reading (Measured On Vehicle)					

BRAKE DRUM

With the drum off the vehicle, measure the drum for diameter variation (oval shape). The diameter variation of the drum braking surface must not exceed either 0.0635 mm (0.0025 inch) in 30° or 0.0889 mm (0.0035 inch) in 360°.

Measure brake drum runout. Brake drum runout should be checked with the drum mounted on a brake lathe. Brake drum runout should not exceed 0.1524 mm (0.006 inch).

If either of these measurements are not within specification, reface or replace the drum. Refer to BRAKE DRUM MACHINING in the SERVICE PROCEDURES section of this service manual group for refacing procedures.

Always replace the drum if machining will cause the diameter to exceed drum maximum diameter. All brake drums are marked with the maximum allowable brake drum diameter (Fig. 20).

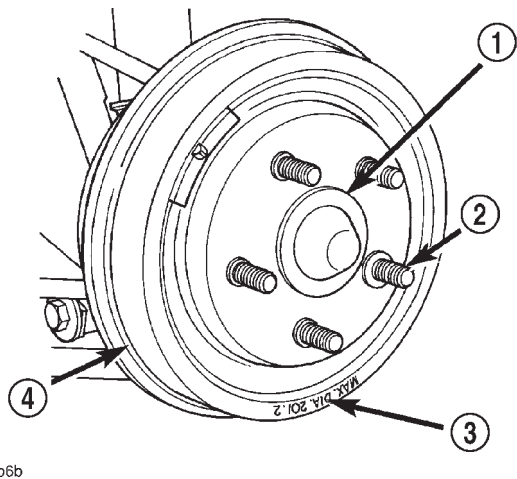


Fig. 20 Brake Drum Maximum Diameter Identification

- 1 – HUB/BEARING ASSEMBLY
- 2 – WHEEL MOUNTING STUDS
- 3 – BRAKE DRUM MAXIMUM DIAMETER MARKING
- 4 – REAR BRAKE DRUM

PROPORTIONING VALVE

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

One proportioning valve controls the right rear brake, and the other proportioning valve controls the left rear brake (Fig. 21). Therefore, a road test to determine which rear brake skids first is essential.

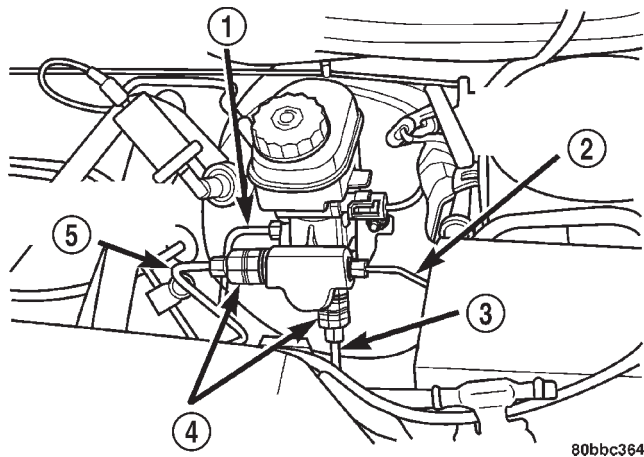


Fig. 21 Proportioning Valve Location

- 1 – RIGHT FRONT BRAKE TUBE
- 2 – LEFT FRONT BRAKE TUBE
- 3 – LEFT REAR BRAKE TUBE
- 4 – REAR PROPORTIONING VALVES
- 5 – RIGHT REAR BRAKE TUBE

Before testing the proportioning valve in question, inspect the rear brake linings for contamination or for replacement shoes not meeting the OEM brake lining material specifications.

The proportioning valve should always be tested prior to being replaced.

DIAGNOSIS AND TESTING (Continued)

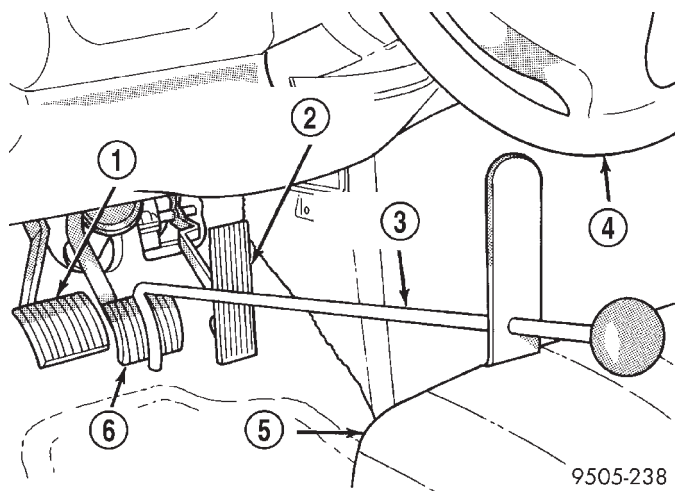
The in-line proportioning valves used on this vehicle require special pressure fittings to test the proportioning valves for proper proportioning valve function. The pressure fittings are installed before and after the proportioning valve being tested to verify proportioning valve is maintaining the required hydraulic pressure to the rear wheel brake which it controls.

The testing of proportioning valves for this vehicle, if equipped with ABS, can be found in the ANTILOCK BRAKE SYSTEM section.

PROPORTIONING VALVE TEST

The test procedure is the same for either rear proportioning valve. After road testing the vehicle to determine which wheel skids first, follow the procedure below for testing the suspect proportioning valve.

(1) Using a brake pedal holding tool as shown (Fig. 22), depress the brake pedal past its first one inch of travel and hold it in this position. This will isolate the master cylinder from the brake hydraulic system and will not allow the brake fluid to drain out of the master cylinder reservoir.

**Fig. 22 Brake Pedal Holding Tool**

- 1 - CLUTCH PEDAL (IF EQUIPPED WITH MANUAL TRANSAXLE)
- 2 - THROTTLE PEDAL
- 3 - BRAKE PEDAL HOLDING TOOL
- 4 - STEERING WHEEL
- 5 - DRIVER'S SEAT
- 6 - BRAKE PEDAL

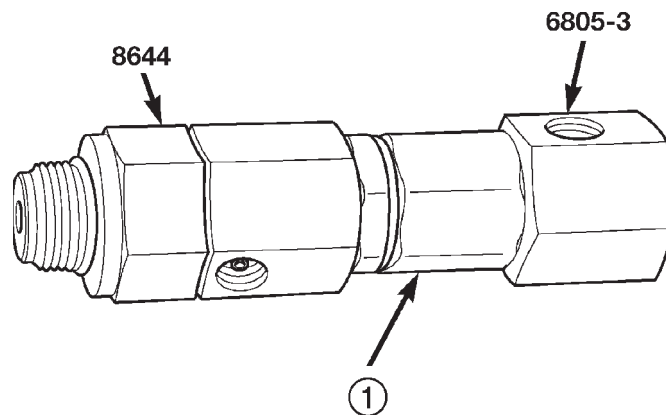
(2) Use the figure shown to determine which proportioning valve needs to be tested (Fig. 21).

(3) Remove the hydraulic brake tube from the proportioning valve controlling the rear wheel of the vehicle that has premature wheel skid.

(4) Remove the proportioning valve from its outlet port on the master cylinder.

CAUTION: Be sure the pressure test fittings being installed into master cylinder and proportioning valve, have the correct thread sizes needed.

(5) Install the Brake Pressure Adapters, Special Tool 8644 and 6805-3 onto the proportioning valve (Fig. 23).



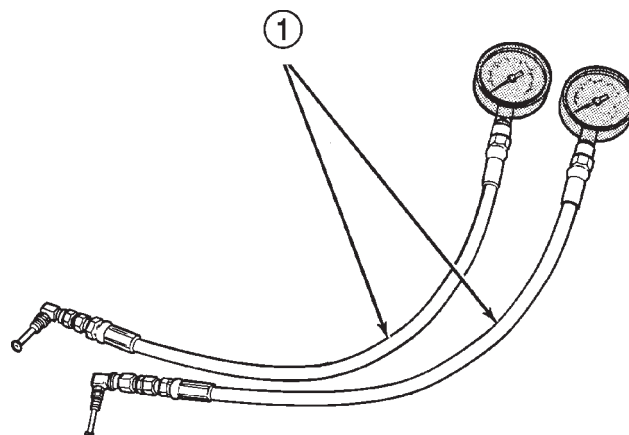
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Fig. 23 Tools On Valve

- 1 - PROPORTIONING VALVE

(6) Install the proportioning valve (with tools) back into the outlet port on the master cylinder.

(7) Attach a Pressure Gauge, Special Tool C-4007-A, to each pressure adapter (Fig. 24).



9505-62

Fig. 24 Pressure Gauge Set

- 1 - SPECIAL TOOL C-4007-A

(8) Remove the brake pedal holding tool. Bleed any air out of the pressure gauge hoses at the pressure gauge.

(9) With the aid of a helper, apply pressure to the brake pedal until the reading on proportioning valve inlet gauge is at the target inlet pressure shown in the BRAKE PROPORTIONING VALVE APPLICATIONS AND PRESSURE SPECIFICATIONS table

DIAGNOSIS AND TESTING (Continued)

following this procedure. If the inlet gauge pressure overshoots its target pressure when the pedal is depressed, release the brake pedal, relieving the pressure in the system, before reapplying the pedal to reach the target pressure at the inlet gauge. This is necessary to get an accurate reading of the outlet pressure.

(10) Once inlet pressure has been achieved, check the pressure reading on the proportioning valve outlet gauge. If the proportioning valve outlet pressure does not agree with value shown in the table, replace the proportioning valve. If proportioning valve is within pressure specifications, the valve is good and does not require replacement.

(11) Reinstall the brake holding tool on the brake pedal and remove the test equipment from the vehicle.

(12) Remove the tools from the proportioning valve.

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

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

(15) Bleed the affected brake line. See BASE BRAKE BLEEDING in this section of this service manual group.

BRAKE PROPORTIONING VALVE APPLICATIONS AND PRESSURE SPECIFICATIONS

Sales Code	Brake System Type	Split Point	Slope	Identification	Inlet Pressure	Outlet Pressure
BRA	14" Disc/Drum	300 psi	0.34	Black Band	1000 psi	550-650 psi
BRD	14" Disc/Disc	400 psi	0.43	Bar Code Band	1000 psi	600-700 psi

BRAKE FLUID CONTAMINATION

Indications of fluid contamination are swollen or deteriorated rubber parts. Swelling indicates 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 the fluid separates into layers, there is mineral oil or other fluid contamination of the brake fluid.

If the brake fluid is contaminated, drain and thoroughly flush the brake system. Replace all the rubber parts or components containing rubber coming into contact with the brake fluid including: the master cylinder; proportioning valves; caliper seals; wheel cylinder seals; ABS hydraulic control unit; and all hydraulic fluid hoses.

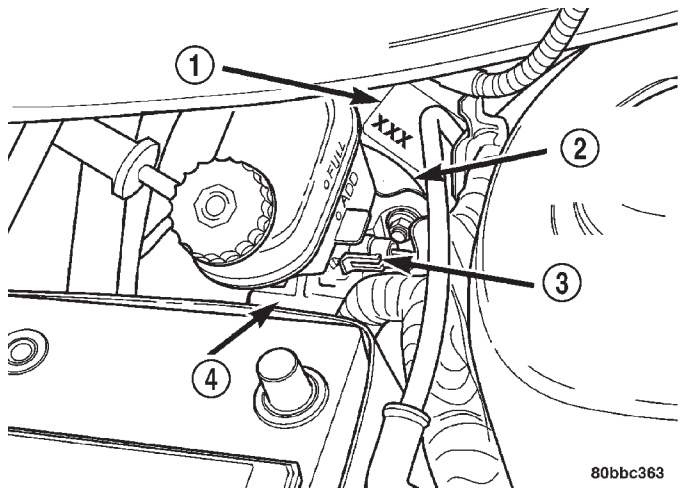


Fig. 25 Master Cylinder

- 1 – POWER BRAKE BOOSTER PARTS IDENTIFICATION TAG
- 2 – POWER BRAKE BOOSTER
- 3 – BRAKE FLUID PRESSURE SWITCH
- 4 – MASTER CYLINDER

SERVICE PROCEDURES

BRAKE FLUID LEVEL CHECKING

Brake fluid level should be checked a minimum of twice a year.

Master cylinder reservoirs are marked, FULL and MIN, indicating the allowable brake fluid level range in the master cylinder brake fluid reservoir (Fig. 25).

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

Although there is a range, the preferred level is FULL. If necessary, adjust the brake fluid level to the FULL mark on the side of the master cylinder brake fluid reservoir.

BASE BRAKE BLEEDING

NOTE: For bleeding the ABS hydraulic system, refer to ANTILOCK BRAKE SYSTEM BLEEDING in the ANTILOCK BRAKE SYSTEM section of this service manual group.

SERVICE PROCEDURES (Continued)

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

CAUTION: Use only Mopar® brake fluid or an equivalent from a fresh, tightly sealed container. Brake fluid must conform to DOT 3 specifications.

Do not pump the brake pedal at any time while having a bleeder screw open during the bleeding process. This will only increase the amount of air in the system and make additional bleeding necessary.

Do not allow the master cylinder reservoir to run out of brake fluid while bleeding the system. An empty reservoir will allow additional air into the brake system. Check the fluid level frequently and add fluid as needed.

The following wheel circuit sequence for bleeding the brake hydraulic system should be used to ensure adequate removal of all trapped air from the hydraulic system.

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

MANUAL BLEEDING

NOTE: To bleed the brakes manually, the aid of a helper will be required.

(1) Attach a clear plastic hose to the bleeder screw and feed the hose into a clear jar containing enough fresh brake fluid to submerge the end of the hose (Fig. 26).

(2) Have a helper pump the brake pedal three or four times and hold it in the down position.

(3) With the pedal in the down position, open the bleeder screw at least 1 full turn.

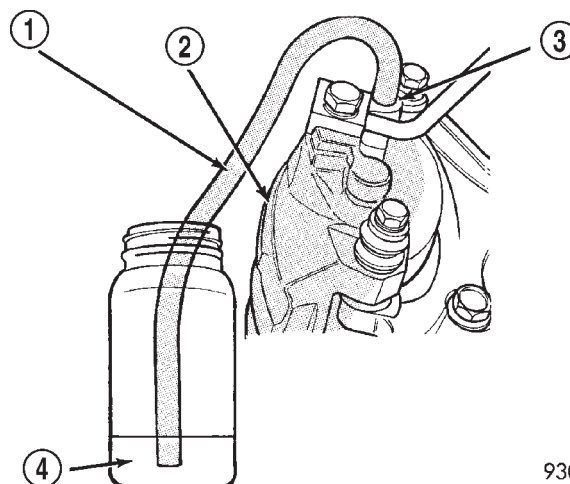
(4) Once the brake pedal has dropped, close the bleeder screw. After the bleeder screw is closed, release the brake pedal.

(5) Repeat the above steps until all trapped air is removed from that wheel circuit (usually four or five times).

(6) Bleed the remaining wheel circuits in the same manner until all air is removed from the brake system. Monitor the fluid level in the master cylinder reservoir to make sure it does not go dry.

(7) Check the brake pedal travel. If pedal travel is excessive or has not been improved, some air may still be trapped in the system. Rebleed the brakes as necessary.

(8) Test drive the vehicle to verify the brakes are operating properly and pedal feel is correct.



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Fig. 26 Proper Method for Purging Air From Brake System (Typical)

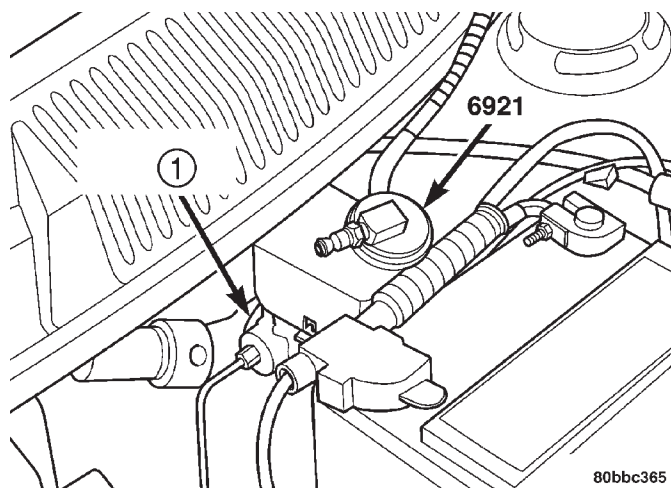
- 1 – CLEAR HOSE
- 2 – BRAKE CALIPER
- 3 – BLEEDER SCREW
- 4 – CLEAN BRAKE FLUID

PRESSURE BLEEDING

NOTE: Follow pressure bleeder manufacturer's instructions for use of pressure bleeding equipment.

Following the same wheel circuit sequence as prescribed for manual bleeding.

(1) Attach Adapter, Special Tool 6921, to the master cylinder reservoir (Fig. 27).



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Fig. 27 Special Tool 6921

- 1 – MASTER CYLINDER

SERVICE PROCEDURES (Continued)

(2) Attach Bleeder Tank, Special Tool C-3496-B, or an equivalent, to the adapter on the master cylinder.

(3) Attach a clear plastic hose to the bleeder screw and feed the hose into a clear jar containing enough fresh brake fluid to submerge the end of the hose (Fig. 26).

(4) Open the bleeder screw at least one full turn or more to obtain a steady stream of brake fluid.

(5) After approximately 4–8 ounces of fluid have been bled through the brake circuit and an air-free flow is maintained in the clear plastic hose and jar, close the bleeder screw.

(6) Repeat this procedure at all the remaining bleeder screws.

(7) Check the brake pedal travel. If pedal travel is excessive or has not been improved, some air may still be trapped in the system. Rebleed the brakes as necessary.

(8) Test drive the vehicle to verify the brakes are operating properly and pedal feel is correct.

MASTER CYLINDER BLEEDING

(1) Clamp the master cylinder in a vise.

(2) Attach four Master Cylinder Bleed Tubes, Special Tool 8358-1, to the four ports of the master cylinder and tighten each in place (Fig. 28). The bleed tubes for the ports pertaining to the rear brakes are made to attach to the proportioning valves screwed into the master cylinder. Position the other end of the tubes into the master cylinder reservoir so their outlets are below the surface of the brake fluid in the reservoir when filled.

(3) Fill the brake fluid reservoir with Mopar® brake fluid, or an equivalent conforming to DOT 3 specifications.

(4) Using a wooden dowel as a pushrod (Fig. 28), press the pistons inward slowly applying brake pressure, then release the pressure, allowing the pistons to return to the released position. Repeat this several times until all air bubbles are expelled out of the tubes and master cylinder bore.

(5) Remove the bleed tubes from the master cylinder and plug the outlet ports.

(6) Install the fill cap on the reservoir.

(7) Remove the master cylinder from the vise.

NOTE: It is not necessary to bleed the entire hydraulic system after replacing just the master cylinder unless the brake system has been open to air for an excessive amount of time or air is present in the lines. Only the master cylinder must be bled and filled.

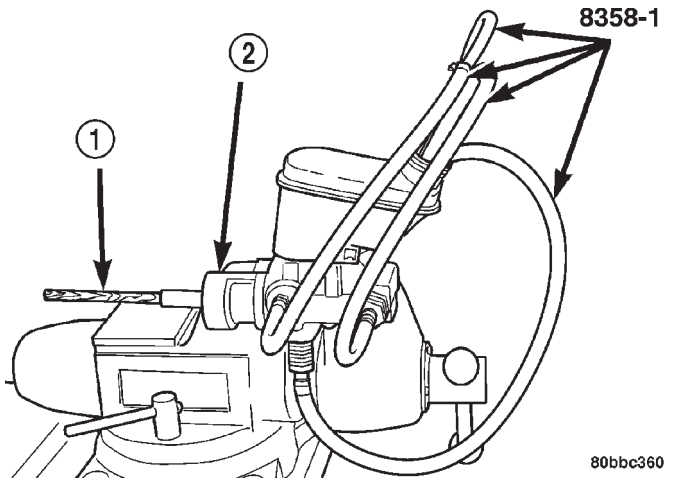


Fig. 28 Bleeding Master Cylinder

1 – WOODEN DOWEL

2 – MASTER CYLINDER

BRAKE TUBE REPAIR

Use only double wall 4.75 mm (3/16 in.) steel tubing with Nygal coating for hydraulic brake tube replacement. Nygal is nylon coated galvanized steel tubing.

Care must be taken when repairing brake tubing to avoid kinking the tube. Use the proper bending and flaring tools. Do not route the tubes against sharp edges, moving components, or into hot areas. All tubes should be attached with the recommended retaining clips.

PREPARING THE BRAKE TUBE FOR FLARING

(1) Use Tubing Cutter, Special Tool C-3478-A, or an equivalent to cut off the damaged flare or tubing (Fig. 29).

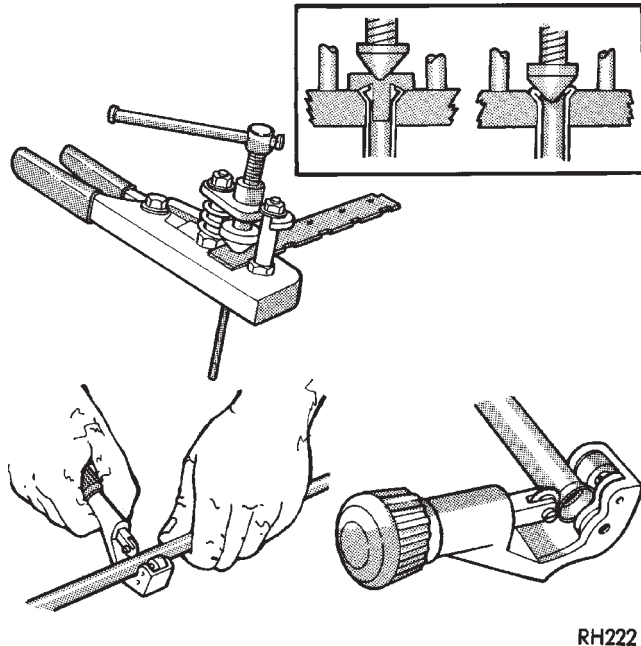
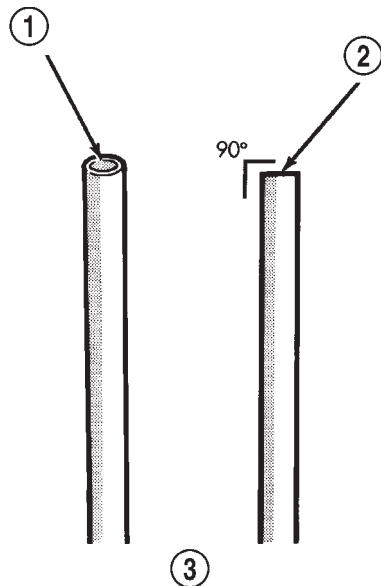
(2) Make the ends of the tubing to be repaired square (Fig. 30) to ensure better seating of the flared end tubing.

(3) Ream out any burrs or rough edges showing on the inside of the tubing to be flared (Fig. 30).

(4) Strip back enough of the nylon coating at the end of the length of tubing that will be flared so it will not be in the flare itself. At least 5 mm should be removed.

NOTE: Place a tube nut on the tubing before flaring it. It cannot be done after the tube is flared.

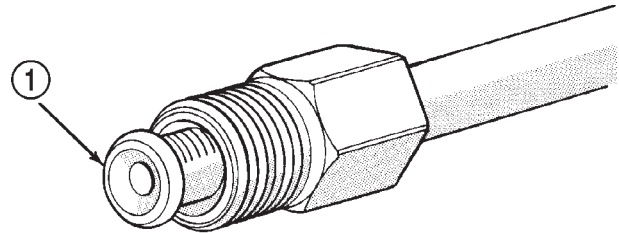
SERVICE PROCEDURES (Continued)

**Fig. 29 Cutting And Flaring Of Brake Fluid Tubing****Fig. 30 Brake Fluid Tube Preparation For Flaring**

- 1 - BE SURE ALL BURRS ARE REMOVED FROM INSIDE OF TUBING
- 2 - BE SURE END OF TUBING IS SQUARE BEFORE FLARING TUBE
- 3 - HYDRAULIC BRAKE LINE TUBING

DOUBLE INVERTED TUBING FLARES

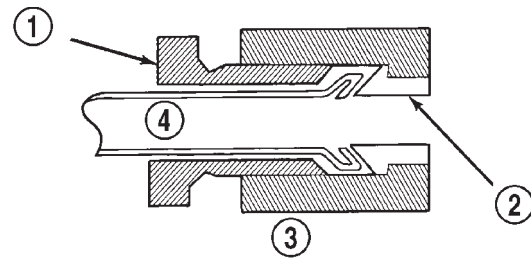
After preparing the tubing using the procedure in PREPARING THE BRAKE TUBE FOR FLARING, make a double inverted tubing flare using the following procedure (Fig. 31).

**Fig. 31 Double Inverted Brake Line Tubing Flare**

1 - DOUBLE INVERTED-STYLE FLARE

CAUTION: When using brake tubing with Nygal coating, always use flare nuts designed for this coating. They have a larger hole in the center to accommodate the coating on the tube.

(1) Install the replacement flare nut on the tube so the threads are facing the flare yet to be made (Fig. 32).

**Fig. 32 Double Wall Inverted Flare Connection**

- 1 - INVERTED FLARE TUBE NUT
- 2 - SEAT
- 3 - INVERTED DOUBLE FLARE
- 4 - TUBE

(2) Open the Flaring Tool, Special Tool C-4047 (or an equivalent), separating the tools vertical posts.

(3) Place the tubing in the jawed hole between the two vertical posts.

(4) Slowly bring the vertical posts together capturing the tube between the halves. Leave enough tubing sticking through the top of the vertical posts to allow for flaring. Apply only enough pressure to hold the tube in place.

SERVICE PROCEDURES (Continued)

- (5) Place the gauge (From A) over the end of the brake tube. Adjust the tube height in the tool's jaws until the end of the tube contacts the recessed notch in the gauge that matches the tubing size. Squeeze the handles of the flaring tool, locking the tubing in place. Remove the gauge.
- (6) Place the 3/16 inch plug gauge (A) down into the end of the tube. Tighten the flaring handle, pushing the gauge into the tube until the gauge contacts the vertical posts of the tool.
- (7) Release the flaring handle and remove the plug gauge from the partially flared tube.
- (8) Tighten the flaring handle down once more until the tools flaring tip has firmly seated the tube to the vertical posts, thus completing the flare.

CAUTION: When inspecting the flare, make sure no tubing nygal coating has been involved in the flare.

- (9) Remove the flared tube from the flaring tool and inspect the flare to make sure it is uniform.

BRAKE ROTOR MACHINING

NOTE: Refacing the rotor is not required each time the brake pads are replaced, only when the need is foreseen.

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

If the rotor surface is deeply scored or warped, or there is a complaint of brake roughness or brake pedal pulsation, the rotor should be refaced using a hub-mounted on-car brake lathe (Fig. 33), or replaced.

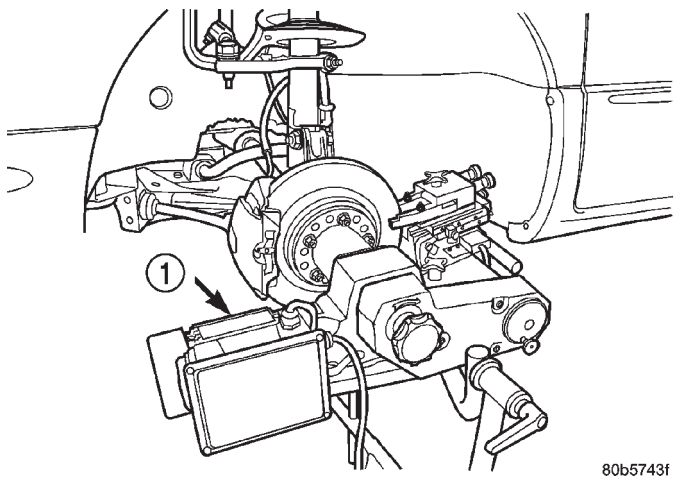


Fig. 33 On-Car Brake Lathe

1 – ON-CAR BRAKE LATHE

The use of a hub-mounted on-car brake lathe is highly recommended to eliminate the possibility of excessive runout. It trues the brake rotor to the vehicle's hub and bearing.

NOTE: All rotors have markings for minimum allowable thickness cast on an un-machined surface of the rotor (Fig. 34).

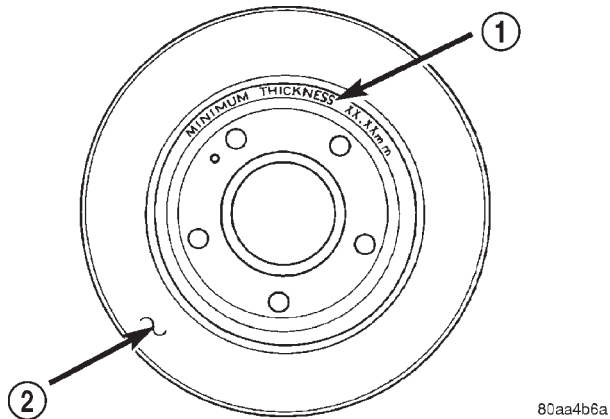


Fig. 34 Minimum Brake Rotor Thickness Markings (Typical)

1 – ROTOR MINIMUM THICKNESS MARKING
2 – ROTOR

Minimum allowable thickness is the minimum thickness which the brake rotor machined surface may be cut to.

CAUTION: Do not machine the rotor if it will cause the rotor to fall below minimum thickness.

Before installation, verify the brake rotor face and the hub adapters are free of any chips, rust, or contamination.

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

Machine both sides of the brake rotor at the same time. Cutting both sides at the same time minimizes the possibility of a tapered or uneven cut.

SPECIFICATIONS AND LIMITS

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

SERVICE PROCEDURES (Continued)

BRAKE ROTOR LIMITS

Braking Rotor	Rotor Thickness	Minimum Rotor Thickness	Rotor Thickness Variation	Rotor Run Out*	Rotor Micro Finish
Front Rotor	21.87–22.13 mm 0.861–0.871 in.	20.4 mm 0.803 in.	0.013 mm 0.0005 in.	0.08 mm 0.003 in.	15–80 RMS
Rear Rotor	8.75–9.25 mm 0.344–0.364 in.	7.25 mm 0.285 in.	0.013 mm 0.0005 in.	0.08 mm 0.003 in.	15–80 RMS
* TIR Total Indicator Reading (Measured On Vehicle)					

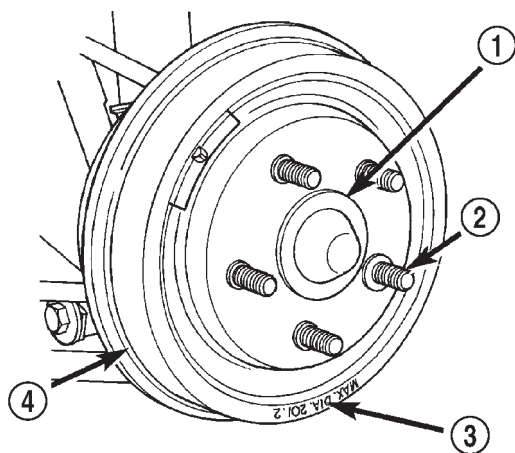
BRAKE DRUM MACHINING

If a brake drum is deeply scored or warped, it can be machined on a brake lathe equipped to machine brake drums. Follow the manufacturers instructions on the machining procedure.

Measure the brake drum diameter before machining. If machining the drum will cause the drum to exceed maximum allowable diameter, do not machine the brake drum. It needs to be replaced.

CAUTION: Do not machine the brake drum if it will cause the drum to exceed maximum allowable diameter.

All brake drums are marked with the maximum allowable brake drum diameter (Fig. 35).



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Fig. 35 Brake Drum Maximum Diameter Identification

- 1 – HUB/BEARING ASSEMBLY
- 2 – WHEEL MOUNTING STUDS
- 3 – BRAKE DRUM MAXIMUM DIAMETER MARKING
- 4 – REAR BRAKE DRUM

When machining, make sure the final finish feed cut is fine in order to avoid a screw effect on the brake shoes when the brakes are applied. This final

feed cut specification varies from lathe manufacturer to lathe manufacturer.

PARKING BRAKE AUTOMATIC ADJUSTER LOCK OUT

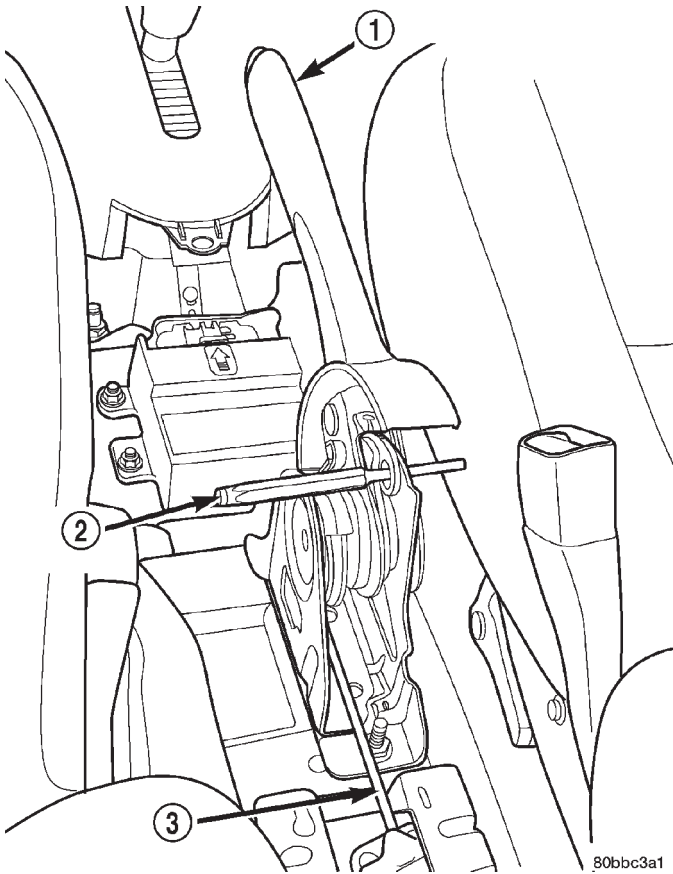
WARNING: THE AUTOMATIC ADJUSTING FEATURE OF THIS PARKING BRAKE LEVER CONTAINS A CLOCK SPRING LOADED TO APPROXIMATELY 25 POUNDS. DO NOT RELEASE THE AUTOMATIC ADJUSTER LOCKOUT DEVICE UNLESS THE REAR PARKING BRAKE CABLES AND EQUALIZER ARE CONNECTED TO THE LEVER OUTPUT CABLE. KEEP HANDS OUT OF AUTOMATIC ADJUSTER SECTOR AND PAWL AREA. FAILURE TO OBSERVE CAUTION IN HANDLING THIS MECHANISM COULD LEAD TO SERIOUS INJURY.

WARNING: WHEN REPAIRS TO THE PARKING BRAKE LEVER OR CABLES ARE REQUIRED, THE AUTOMATIC ADJUSTER MUST BE LOADED AND LOCKED OUT TO AVOID POSSIBLE INJURY.

ADJUSTER LOADING AND LOCKING OUT

- (1) Block the tire and wheels so the vehicle does not move once the vehicle parking brake lever is released.
- (2) Fully apply the parking brake lever, then shift the transmission into neutral.
- (3) Remove the screws attaching the center console, then remove the center console.
- (4) Lower the parking brake lever handle to the released position.
- (5) Grasp the parking brake lever output cable by hand and pull upward. Continue pulling on the cable until a pin punch can be inserted through the hole in the lever mechanism sector gear and the hole in the right side of its mounting bracket (Fig. 36). This will lock the parking brake automatic adjustment mechanism in place and take tension off the parking brake cables.

SERVICE PROCEDURES (Continued)

**Fig. 36 Pin Punch Installed**

- 1 - PARKING BRAKE LEVER
- 2 - PIN PUNCH
- 3 - OUTPUT CABLE

ADJUSTER UNLOADING (UNLOCKING)

NOTE: The parking brake lever can only be in the released position when releasing the automatic adjuster locking pin or pin punch.

(1) Be sure the rear parking brake cables are both properly installed in the equalizer.

(2) Keeping your hands clear of the automatic adjuster sector and pawl area, firmly grasp the parking brake lever pin punch (or locking pin if a new mechanism has been installed) (Fig. 36), then quickly remove it from the parking brake lever mechanism. This will allow the park brake lever mechanism to automatically adjust the parking brake cables.

(3) Cycle the parking brake lever once to position the parking brake cables, then return the parking brake lever its released position.

(4) Check the rear wheels of the vehicle. They should rotate freely without dragging with the lever in its released position.

(5) Fully apply the parking brake lever.

(6) Install the center console and its mounting screws.

(7) Remove the blocks from the tire and wheels.

REMOVAL AND INSTALLATION**SERVICE WARNINGS AND CAUTIONS**

WARNING: ALTHOUGH FACTORY INSTALLED BRAKE SHOE LININGS ARE MADE FROM ASBESTOS-FREE MATERIALS, SOME AFTERMARKET BRAKE SHOE LININGS MAY CONTAIN ASBESTOS. THIS SHOULD BE TAKEN INTO ACCOUNT WHEN SERVICING A VEHICLE'S BRAKE SYSTEM. IT IS POSSIBLE THAT AFTERMARKET BRAKE SHOES MAY HAVE BEEN INSTALLED ON THE VEHICLE. ALWAYS WEAR A RESPIRATOR WHEN CLEANING BRAKE COMPONENTS; ASBESTOS CAN CAUSE SERIOUS BODILY HARM SUCH AS ASBESTOSIS AND CANCER. NEVER CLEAN BRAKE COMPONENTS BY USING COMPRESSED AIR; USE ONLY A VACUUM CLEANER SPECIFICALLY DESIGNED FOR THE REMOVAL OF BRAKE DUST. IF A VACUUM CLEANER IS NOT AVAILABLE, CLEAN BRAKE PARTS USING ONLY WATER-DAMPENED SHOP TOWELS. DO NOT CREATE BRAKE LINING DUST BY SANDING THE BRAKE LININGS WHEN SERVICING A VEHICLE. DISPOSE OF ALL DUST AND DIRT SUSPECTED OF CONTAINING ASBESTOS FIBERS. USE ONLY SEALED AIRTIGHT BAGS OR CONTAINERS. FOLLOW ALL RECOMMENDED SAFETY PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) AND THE ENVIRONMENTAL PROTECTION AGENCY (EPA), FOR HANDLING AND DISPOSING OF PRODUCTS CONTAINING ASBESTOS.

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

CAUTION: Brake fluid will damage painted surfaces. If brake fluid is spilled on any painted surfaces, wash it off immediately with water.

CAUTION: During service procedures, grease or any other foreign material must be kept off the caliper assembly, surfaces of the brake rotor and external surfaces of the hub. Avoid deformation, scratching or nicking of the brake rotor and brake shoe linings.

REMOVAL AND INSTALLATION (Continued)

BRAKE PEDAL

NOTE: Before proceeding with this procedure, review **SERVICE WARNINGS AND CAUTIONS** at the beginning of **REMOVAL AND INSTALLATION** in this section.

WITH AUTOMATIC TRANSAXLE

REMOVAL

(1) Disconnect and isolate the battery negative cable from its post on the battery.

(2) Place the steering wheel and tires in the **STRAIGHT-AHEAD** position. Using a steering wheel holder, lock the steering wheel in place to keep it from rotating (Fig. 37). This keeps the clockspring in the proper orientation.

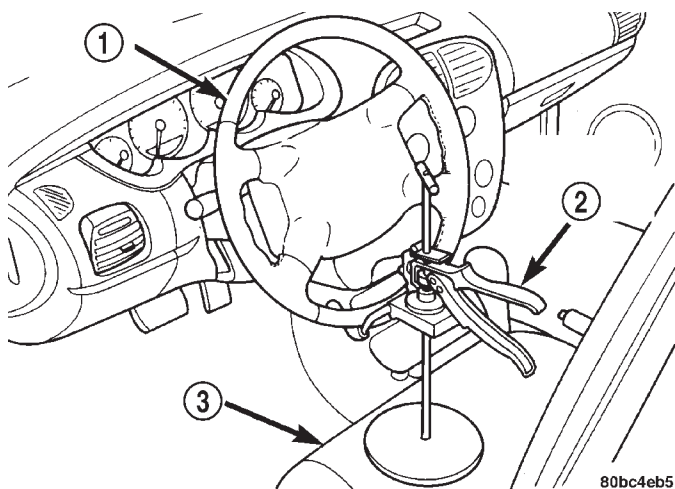


Fig. 37 Steering Wheel Holder

- 1 - STEERING WHEEL
- 2 - STEERING WHEEL HOLDER
- 3 - DRIVERS SEAT

(3) Remove the steering column coupling retainer pin, back off the pinch bolt nut, and remove the steering column coupling pinch bolt (Fig. 38) (the pinch bolt nut is caged to the coupling and is not removable). Separate the upper and lower steering column couplings.

(4) Depress and hold the brake pedal while rotating the brake lamp switch (Fig. 39) in a counterclockwise direction approximately 30 degrees.

(5) Pull the switch rearward and remove it from its mounting bracket.

(6) Remove the clip securing the power brake booster input rod to the brake pedal (Fig. 39). Remove the input rod from the brake pedal.

(7) Remove the two upper nuts fastening the brake pedal bracket to the power brake booster (Fig. 40).

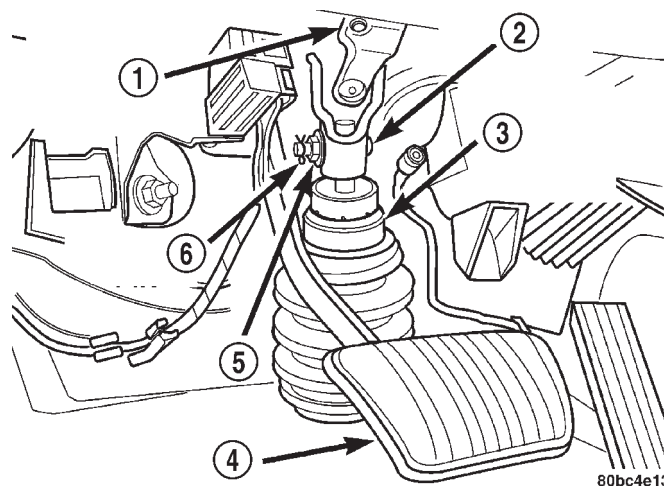


Fig. 38 Steering Column Couplings

- 1 - STEERING COLUMN UPPER COUPLING
- 2 - PINCH BOLT
- 3 - STEERING COLUMN LOWER COUPLING
- 4 - BRAKE PEDAL
- 5 - NUT
- 6 - RETAINER PIN

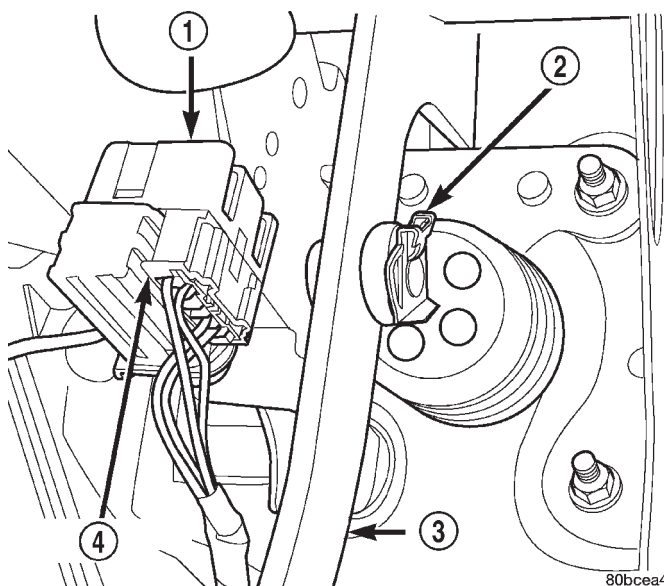


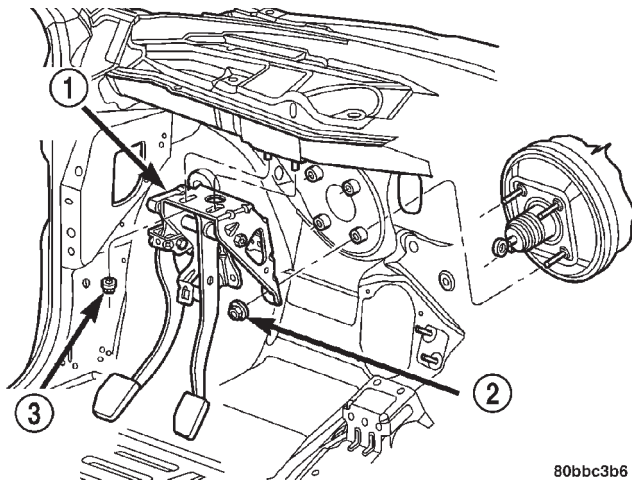
Fig. 39 Brake Lamp Switch

- 1 - SWITCH
- 2 - CLIP
- 3 - BRAKE PEDAL
- 4 - CONNECTOR

(8) Carefully pry the tie bar running between the two upper booster mounting studs from its plastic retaining fasteners.

(9) Remove the two remaining nuts fastening the brake pedal bracket to the power brake booster (Fig. 40).

REMOVAL AND INSTALLATION (Continued)

**Fig. 40 Brake Pedal Mounting**

- 1 - CLUTCH CABLE
2 - BOOSTER MOUNTING NUTS
3 - UPPER MOUNTING NUTS

(10) If the vehicle is equipped with antilock brakes, carefully push the power brake booster forward until the booster contacts the ABS ICU mounting bracket.

(11) If the vehicle does not have antilock brakes, carefully push the power brake booster forward one to two inches being careful not to stretch the brake lines from the master cylinder to the brakes.

(12) Remove the two nuts fastening the brake pedal bracket to the instrument panel support (Fig. 40).

(13) Carefully remove the brake pedal assembly by pulling the pedal bracket back toward the instrument panel, releasing the bracket from the booster studs. Next, tip the bracket down past the input rod, guiding the rod through the gap left by the missing brace removed in Step (8). Remove the brake pedal assembly out from under the instrument panel.

(14) The pedal can be removed from its bracket by grinding off the peened end of the shaft, removing the shaft, pedal and bushings. A service parts package is available to replace these items.

INSTALLATION

(1) If the pedal has been removed from its bracket, install the pedal, bushings and bolt-in-shaft on the bracket using the available service parts package.

(2) Install the brake pedal assembly by tipping the pedal bracket and guiding the power brake booster mounting portion up past the booster input rod. Guide the top of the bracket onto the studs protruding from the instrument panel support (Fig. 40), then guide the booster mounting portion onto the power brake booster mounting studs.

(3) Push the power brake booster back into mounting position from under the hood.

(4) Install the two nuts fastening the brake pedal bracket to the instrument panel support (Fig. 40). Install the nuts all the way, but do not tighten them at this time.

(5) Install the two lower power brake booster mounting nuts, but do not tighten them at this time.

(6) Place the tie bar running between the two upper booster mounting studs onto the studs with the long flat side facing upward and the curved side downward.

(7) Install the two upper power brake booster mounting nuts on their studs.

(8) Tighten all four nuts fastening the brake pedal bracket to the power brake booster to a torque of 34 N·m (300 in. lbs.).

(9) Tighten the two nuts fastening the brake pedal bracket to the instrument panel support to a torque of 34 N·m (300 in. lbs.).

(10) Install the power brake booster input rod on the pin mounted on the side of the brake pedal. Install a new retaining clip on the end of the pin (Fig. 39). Do not reuse the old clip.

NOTE: Prior to installing the brake lamp switch, make sure the plunger is at its fully extended position.

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

(12) Mount the brake lamp switch into the bracket using the following procedure:

- Depress the brake pedal as far down as possible.
- Install the switch in its bracket by aligning the index tab on the switch with the slot in the mounting bracket.
- When the switch is fully seated in its bracket, rotate the switch clockwise approximately 30° to lock the switch into place.

CAUTION: Do not use excessive force when pulling back on the brake pedal to adjust the brake lamp switch. If too much force is used, the switch or striker can be damaged.

(13) Gently pull back on the brake pedal until the pedal stops moving. This will ratchet the switch plunger backward to the correct adjustment position.

(14) Install the dash-to-lower coupling seal in place over the lower coupling's plastic collar and dash cover.

(15) Verify the front tires are still in the STRAIGHT-AHEAD position.

REMOVAL AND INSTALLATION (Continued)

(16) Reconnect the steering column lower coupling to the steering column upper coupling (Fig. 38). Install the coupling pinch bolt and tighten the pinch bolt nut to a torque of 28 N·m (250 in. lbs.). Install the pinch bolt retainer pin.

(17) Remove the steering wheel holder (Fig. 37).

(18) While looking under the instrument panel at the lower coupling, rotate the steering wheel back-and-forth to verify that the lower coupling does not squeak against the dash-to-coupling seal.

(19) Reconnect the battery negative terminal.

(20) Check the stop lamps to verify they are operating properly and not staying on when the pedal is in the released position.

(21) Road test the vehicle to ensure proper operation of the brakes.

WITH MANUAL TRANSAXLE

REMOVAL

(1) Remove the instrument panel. Refer to the INSTRUMENT PANELS AND SYSTEMS group in this service manual for the required procedure.

(2) Depress and hold the brake pedal while rotating the brake lamp switch (Fig. 39) in a counterclockwise direction approximately 30 degrees.

(3) Pull the switch rearward and remove it from its mounting bracket.

(4) Disconnect the clutch cable from the clutch pedal spacer (Fig. 41).

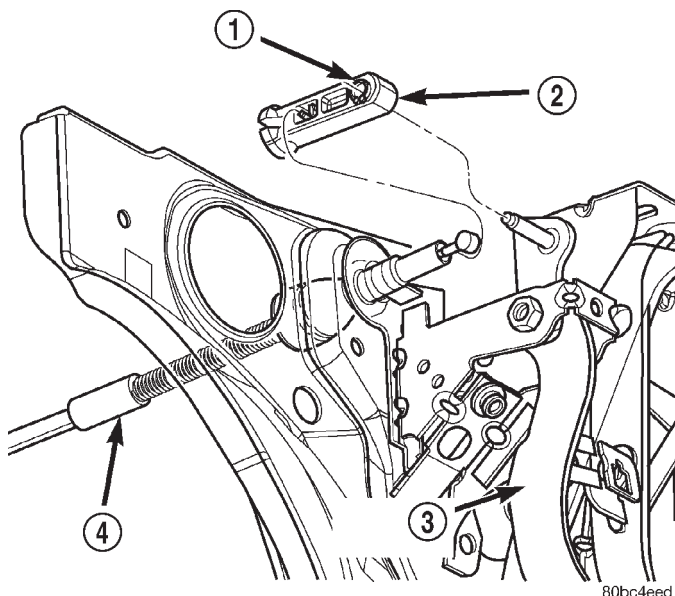


Fig. 41 Clutch Cable Connection

- 1 - SNAP RING
- 2 - CLUTCH PEDAL SPACER
- 3 - CLUTCH PEDAL
- 4 - CLUTCH CABLE

(5) Disconnect the wiring harness connector going to the clutch pedal switches (Fig. 42).

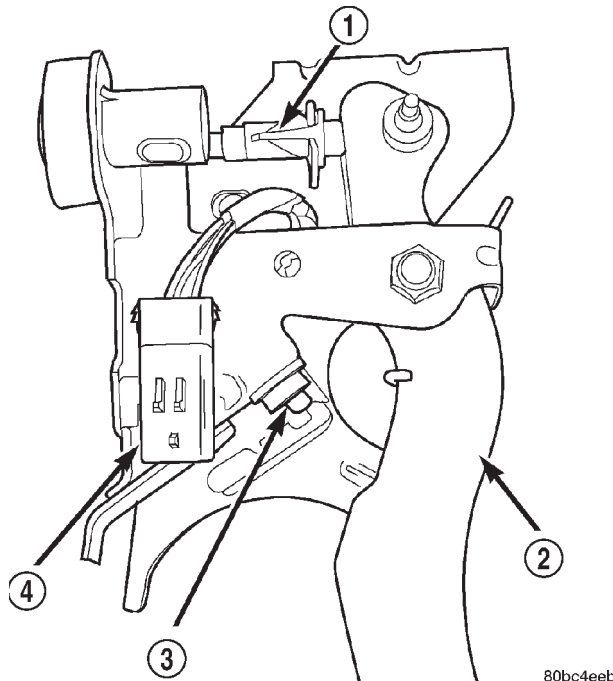


Fig. 42 Wiring Harness Connector

- 1 - UPSTOP SWITCH
- 2 - CLUTCH PEDAL
- 3 - INTERLOCK SWITCH
- 4 - CONNECTOR

(6) Remove the clip securing the power brake booster input rod to the brake pedal (Fig. 39). Remove the input rod from the brake pedal.

(7) Remove the four nuts fastening the brake pedal bracket to the power brake booster (Fig. 40).

(8) Remove the two nuts fastening the brake pedal bracket to the instrument panel support (Fig. 40).

(9) Remove the brake pedal assembly.

(10) The pedal can be removed from its bracket by grinding off the peened end of the shaft, removing the shaft, pedal and bushings. A service parts package is available to replace these items.

INSTALLATION

(1) If the pedal has been removed from its bracket, install the pedal, bushings and bolt-in-shaft on the bracket using the available service parts package.

(2) Install the brake pedal assembly onto the studs extending down from the instrument panel support and power brake booster (Fig. 40).

(3) Install the two nuts fastening the brake pedal bracket to the instrument panel support (Fig. 40). Install the nuts all the way, but do not tighten them at this time.

REMOVAL AND INSTALLATION (Continued)

(4) Install the power brake booster mounting nuts. Tighten the four nuts fastening the brake pedal bracket to the power brake booster to a torque of 34 N·m (300 in. lbs.).

(5) Tighten the two nuts fastening the brake pedal bracket to the instrument panel support to a torque of 34 N·m (300 in. lbs.).

(6) Connect the clutch cable to the clutch pedal spacer on the pedal (Fig. 41).

(7) Connect the wiring harness connector going to the clutch pedal switches (Fig. 42).

(8) Install the power brake booster input rod on the pin mounted on the side of the brake pedal. Install a new retaining clip on the end of the pin (Fig. 39). Do not reuse the old clip.

NOTE: Prior to installing the brake lamp switch, make sure the plunger is at its fully extended position.

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

(10) Mount the brake lamp switch into the bracket using the following procedure:

- Depress the brake pedal as far down as possible.
- Install the switch in its bracket by aligning the index tab on the switch with the slot in the mounting bracket.
- When the switch is fully seated in its bracket, rotate the switch clockwise approximately 30° to lock the switch into place.

CAUTION: Do not use excessive force when pulling back on the brake pedal to adjust the brake lamp switch. If too much force is used, the switch or striker can be damaged.

(11) Gently pull back on the brake pedal until the pedal stops moving. This will ratchet the switch plunger backward to the correct adjustment position.

(12) Install the instrument panel. Refer to the INSTRUMENT PANELS AND SYSTEMS group in this service manual for the required procedure.

(13) Check the stop lamps to verify they are operating properly and not staying on when the pedal is in the released position.

(14) Road test the vehicle to ensure proper operation of the brakes.

BRAKE LAMP SWITCH

REMOVAL

(1) Depress and hold the brake pedal while rotating the brake lamp switch (Fig. 43) in a counterclockwise direction approximately 30 degrees.

(2) Pull the switch rearward and remove it from its mounting bracket.

(3) Disconnect the wiring harness connector from the brake lamp switch.

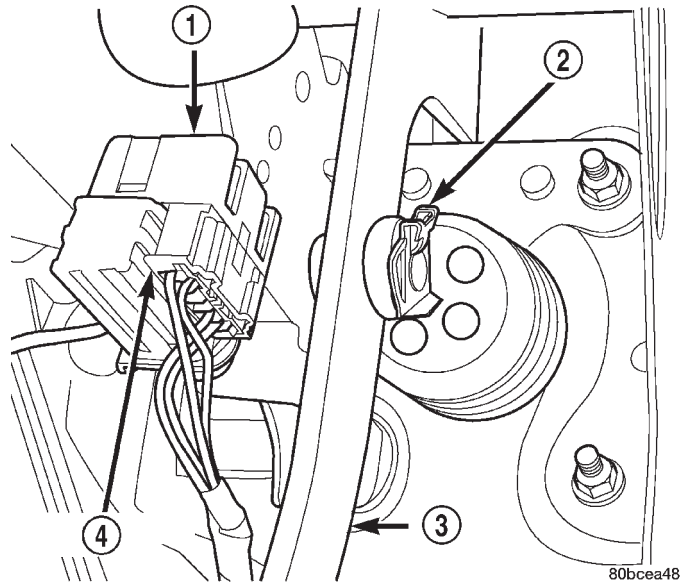


Fig. 43 Brake Lamp Switch

- 1 - SWITCH
- 2 - CLIP
- 3 - BRAKE PEDAL
- 4 - CONNECTOR

INSTALLATION

NOTE: Prior to installing brake lamp switch into bracket, the plunger must be moved to its fully extended position using the procedure in Step 1.

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

(2) Connect the wiring harness connector to the brake lamp switch.

(3) Mount the brake lamp switch into the bracket using the following procedure:

- Depress the brake pedal as far down as possible.
- Install the switch in its bracket by aligning the index tab on the switch with the slot in the mounting bracket.
- When the switch is fully seated in its bracket, rotate the switch clockwise approximately 30° to lock the switch into place (Fig. 43).

CAUTION: Do not use excessive force when pulling back on the brake pedal to adjust the brake lamp switch. If too much force is used, the switch or striker can be damaged.

REMOVAL AND INSTALLATION (Continued)

(4) Gently pull back on the brake pedal until the pedal stops moving. This will ratchet the switch plunger backward to the correct adjustment position.

(5) Check the stop lamps to verify they are operating properly and not staying on when the pedal is in the released position.

MASTER CYLINDER

NOTE: Before proceeding with this procedure, review **SERVICE WARNINGS AND CAUTIONS** at the beginning of **REMOVAL AND INSTALLATION** in this section.

REMOVAL

CAUTION: The vacuum in the power brake booster must be pumped down before removing the master cylinder to prevent the booster from sucking in any contamination. This can be done by pumping the brake pedal while the engine is not running until a firm brake pedal is achieved.

(1) With the engine not running, pump the brake pedal 4-5 strokes until the pedal feel is firm.

(2) Disconnect the negative (ground) cable from the battery and isolate the cable.

(3) Disconnect the positive cable from the battery, then remove the battery from the battery tray. There is one nut securing the clamp on the backside of the battery holding it in place.

(4) Remove the vehicle wiring harness connector from brake fluid level switch in master cylinder brake fluid reservoir (Fig. 44).

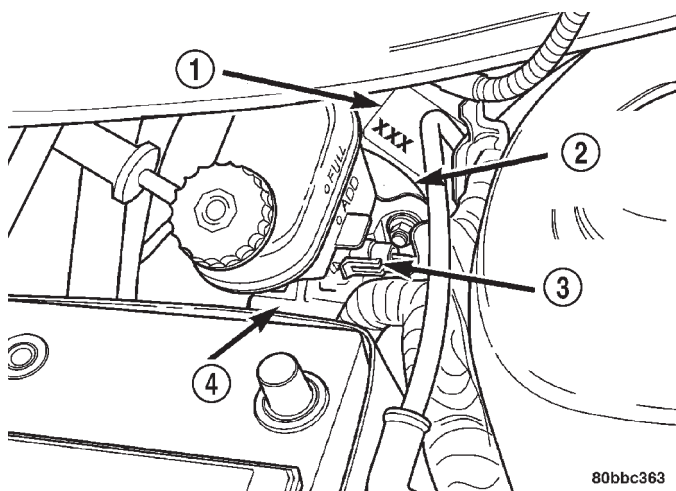
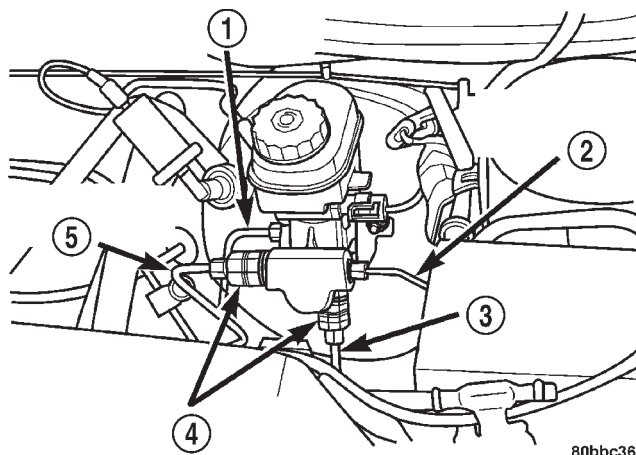


Fig. 44 Master Cylinder

- 1 - POWER BRAKE BOOSTER PARTS IDENTIFICATION TAG
- 2 - POWER BRAKE BOOSTER
- 3 - BRAKE FLUID PRESSURE SWITCH
- 4 - MASTER CYLINDER

(5) Disconnect the two brake tubes from the master cylinder, and two brake tubes from the proportioning valves (Fig. 45). Install plugs at all of the open brake tube outlets on the master cylinder.



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Fig. 45 Brake Tubes At Master Cylinder

- 1 - RIGHT FRONT BRAKE TUBE
- 2 - LEFT FRONT BRAKE TUBE
- 3 - LEFT REAR BRAKE TUBE
- 4 - REAR PROPORTIONING VALVES
- 5 - RIGHT REAR BRAKE TUBE

(6) Clean the area around where the master cylinder attaches to the power brake booster using a suitable brake cleaner such as Mopar® Brake Parts Cleaner or an equivalent.

(7) Remove the two nuts attaching the master cylinder to the power brake booster.

(8) Slide the master cylinder straight out of the power brake booster.

(9) To remove the proportioning valves, unthread each from the master cylinder.

INSTALLATION

NOTE: The master cylinder must be bled before installing it on the vehicle.

(1) If removed, install the proportioning valves in their master cylinder ports. The valves are identical, so they can be installed in either master cylinder port going to the rear brakes. Make sure the O-rings on the proportioning valves are new.

(2) Bleed the master cylinder before installing it on the vehicle. Refer to **MASTER CYLINDER BLEEDING** in **SERVICE PROCEDURES** within this section of this service manual group.

(3) Wipe the face of the power brake booster clean where the master cylinder seal comes in contact when it's installed. Do not get any cleaner or debris inside the booster.

REMOVAL AND INSTALLATION (Continued)

(4) Position the master cylinder on the studs of the power brake booster, aligning the push rod of the power brake booster with master cylinder piston push rod. Carefully push the master cylinder onto the studs until it contacts the face of the booster.

(5) Install the two master cylinder mounting nuts and tighten each to a torque of 28 N·m (250 in. lbs.).

(6) Connect the four brake tubes to the master cylinder and proportioning valve ports (Fig. 45). Tighten all tube nuts to a torque of 17 N·m (145 in. lbs.).

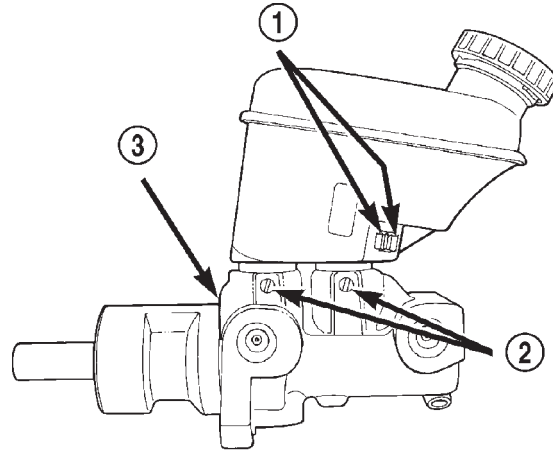
(7) Connect the brake fluid level switch wiring connector.

(8) Install the battery and clamp it in place.

(9) Connect the positive, then the negative (ground) cable on the battery.

(10) Fill the master cylinder to the proper level.

(11) Road test the vehicle to ensure proper operation of the brakes.



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Fig. 46 Master Cylinder Reservoir

- 1 – BRAKE FLUID LEVEL SWITCH RETAINING TABS
- 2 – RESERVOIR RETAINING PINS
- 3 – SEAL

BRAKE FLUID RESERVOIR

NOTE: Before proceeding with this procedure, review **SERVICE WARNINGS AND CAUTIONS** at the beginning of **REMOVAL AND INSTALLATION** in this section.

NOTE: The master cylinder does not need to be removed from the power brake booster for removal and installation of the brake fluid reservoir.

REMOVAL

(1) Clean the master cylinder housing and brake fluid reservoir exterior surfaces.

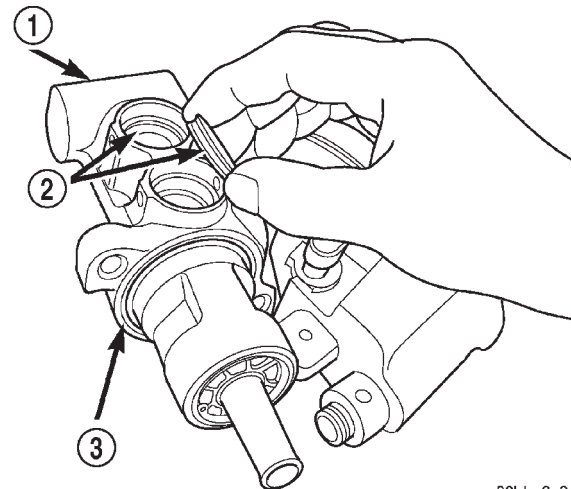
(2) Remove the brake fluid reservoir cap. Using a clean syringe or siphoning tool, empty as much brake fluid as possible from the reservoir.

(3) Remove the vehicle wiring harness connector from brake fluid level switch in master cylinder brake fluid reservoir (Fig. 44).

(4) Remove the two plastic pins holding the reservoir to the master cylinder (Fig. 46).

(5) Lift the reservoir from the master cylinder casting.

(6) Remove the grommets sealing the reservoir to the master cylinder housing (Fig. 47).



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Fig. 47 Sealing Grommets

- 1 – MASTER CYLINDER
- 2 – GROMMETS
- 3 – SEAL

INSTALLATION

(1) Install new sealing grommets in the master cylinder housing (Fig. 47).

(2) Lubricate the sealing grommets with fresh clean DOT 3 brake fluid. Place the reservoir in position over the grommets making sure the filler hole is towards the front of the vehicle. Seat the reservoir into the grommets. While holding the reservoir firmly against the grommets, install the two plastic pins previously removed through their mounting holes until they protrude out the other side of the master cylinder reservoir (Fig. 46).

(3) Connect the brake fluid level switch wiring connector (Fig. 44).

REMOVAL AND INSTALLATION (Continued)

(4) Fill the reservoir with fresh clean DOT 3 brake fluid. Refer to BRAKE FLUID LEVEL CHECKING in the SERVICE PROCEDURES section in this section of this service manual group.

BRAKE FLUID LEVEL SWITCH

NOTE: Before proceeding with this procedure, review SERVICE WARNINGS AND CAUTIONS at the beginning of REMOVAL AND INSTALLATION in this section.

REMOVAL

(1) Remove the vehicle wiring harness connector from brake fluid level switch in master cylinder brake fluid reservoir (Fig. 44).

(2) Push together the retaining tabs holding the brake fluid level switch in place in the brake fluid reservoir (Fig. 46).

(3) Pull the brake fluid level switch out the other side of the reservoir.

INSTALLATION

(1) Align the brake fluid level switch with its mounting hole on the left side of the master cylinder brake fluid reservoir. Push the switch into the fluid reservoir until the switch retaining tabs are expanded on the other side of the reservoir, locking it in place (Fig. 46).

(2) Connect the brake fluid level switch wiring connector (Fig. 44).

POWER BRAKE BOOSTER

NOTE: Before proceeding with this procedure, review SERVICE WARNINGS AND CAUTIONS at the beginning of REMOVAL AND INSTALLATION in this section.

REMOVAL

(1) Disconnect negative (ground) cable from the battery and isolate the cable.

(2) Disconnect the positive cable from the battery, then remove the battery from the battery tray. There is one nut securing the clamp on the backside of the battery holding it in place.

(3) Remove the one nut and one bolt securing the air cleaner box in place, then disconnect the wiring harness connector at the air inlet sensor.

(4) Lift the air cleaner box upward enough to clear its grommets alignment post (Fig. 48), then move the air cleaner box forward just enough to access the battery tray mounting bolts.

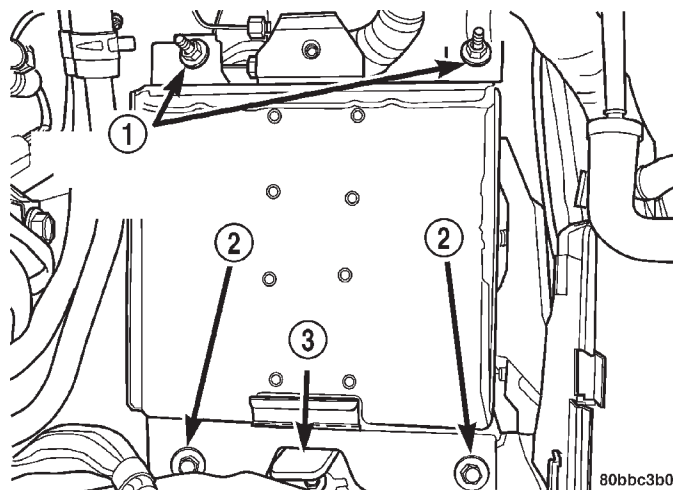


Fig. 48 Battery Tray Mounting

- 1 - BATTERY TRAY MOUNTING NUTS
- 2 - BATTERY TRAY MOUNTING BOLTS
- 3 - AIR CLEANER BOX POST

(5) Remove the 2 bolts, then the 2 nuts mounting the battery tray to its bracket (Fig. 48). Remove the battery tray.

CAUTION: The vacuum in the power brake booster must be pumped down before removing the master cylinder to prevent the booster from sucking in any contamination. This can be done by pumping the brake pedal 4-5 times while the engine is not running until a firm brake pedal is achieved.

(6) Remove the master cylinder. For the master cylinder without ABS removal and installation procedure, refer to MASTER CYLINDER in this section of this service manual group. For the master cylinder with ABS removal and installation procedure, refer to MASTER CYLINDER in the ANTILOCK BRAKE SYSTEM section of this service manual group.

(7) If the vehicle is equipped with ABS, remove the integrated control unit (ICU). Refer to INTEGRATED CONTROL UNIT in REMOVAL AND INSTALLATION within the ANTILOCK BRAKE SYSTEM section of this service manual group for the procedure.

(8) If the vehicle is equipped with ABS, remove the three bolts securing the ICU mounting bracket to the frame rail.

(9) Disconnect the vacuum hoses from the check valve on the power brake booster (Fig. 49), but do not remove the check valve from power brake booster.

(10) Locate the brake pedal-to-power brake booster input rod attachment under the instrument panel. Position a small screwdriver (Fig. 50) under the center tang of the retaining clip. Rotate the screwdriver enough to allow the retaining clip tang to pass over the end of the brake pedal pin. Remove the clip.

REMOVAL AND INSTALLATION (Continued)

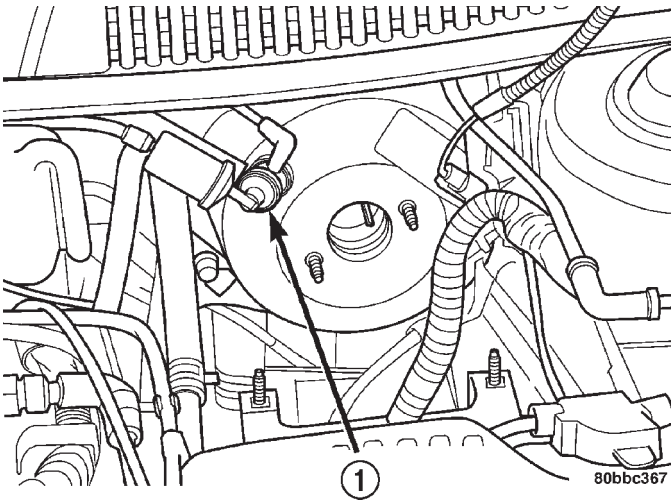


Fig. 49 Vacuum Check Valve

1 - VACUUM CHECK VALVE

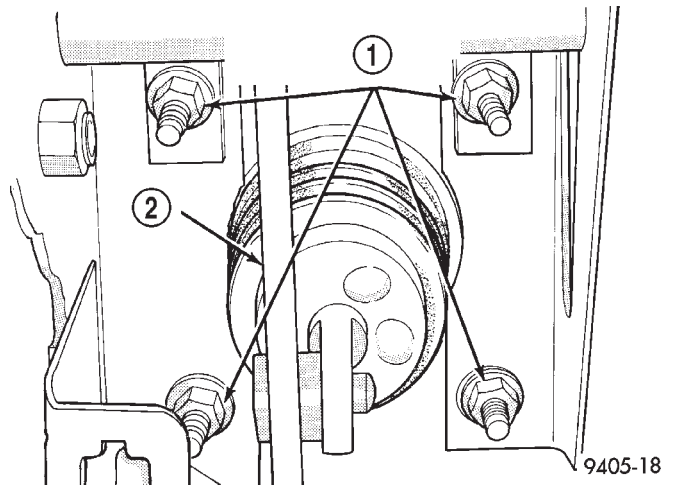


Fig. 51 Power Brake Booster Mounting

1 - POWER BRAKE BOOSTER MOUNTING NUTS
2 - BRAKE PEDAL

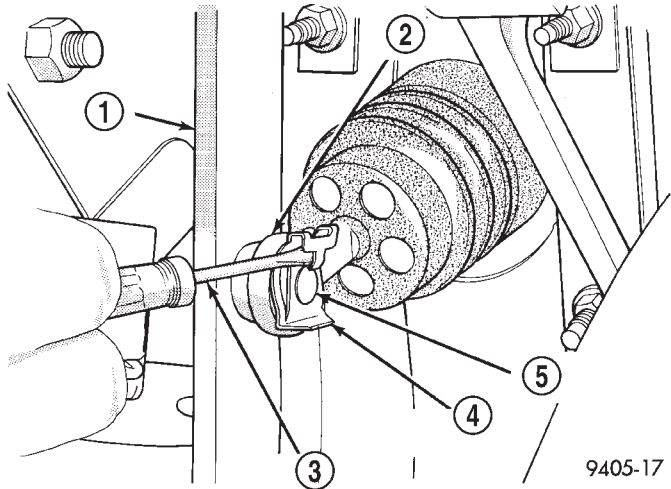


Fig. 50 Retaining Clip

1 - BRAKE PEDAL
2 - INPUT ROD
3 - SCREWDRIVER
4 - RETAINING CLIP
5 - BRAKE PEDAL PIN

CAUTION: Discard the used retaining clip, it is not to be reused. Replace the clip with a new one on reassembly.

(11) Remove the four nuts attaching the power brake booster to the instrument panel (Fig. 51). The nuts are accessible from under the instrument panel in the area of the brake pedal bracket.

(12) Slide the power brake booster forward until mounting studs clear the instrument panel. Turn the booster sideways (Fig. 52), then remove it from the vehicle.

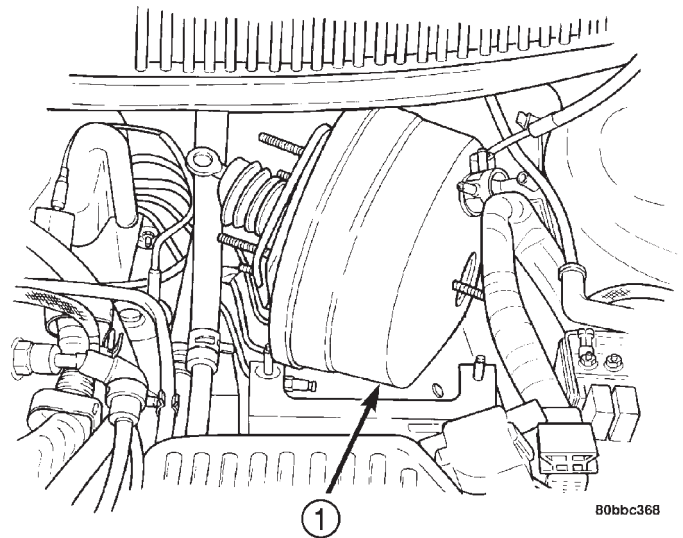


Fig. 52 Booster Removal/Installation

1 - POWER BRAKE BOOSTER

INSTALLATION

(1) Turn the power brake booster sideways (Fig. 52), then install it into the engine compartment down past the heater hoses and the strut tower. Rotate the booster so its four mounting studs and input rod are pointed straight toward the instrument panel. Slide the input rod and studs through the instrument panel and into mounting position.

(2) Under the instrument panel, install the four power brake booster mounting nuts (Fig. 51). Tighten the nuts to a torque of 34 N·m (300 in. lbs.).

(3) Using lubriplate, or an equivalent, coat the surface of the brake pedal pin where it contacts the brake booster input rod.

REMOVAL AND INSTALLATION (Continued)

CAUTION: Use only a new brake booster input rod-to-brake pedal retaining clip to ensure proper retainment.

(4) Connect the power brake booster input rod-to-brake pedal pin. Install a new retaining clip. Do not use the old clip.

(5) Connect all previously removed vacuum hoses to the vacuum check valve (Fig. 49).

(6) If the vehicle is equipped with ABS, install the ICU mounting bracket on the frame rail using its three bolts. Tighten the nuts to a torque of 23 N·m (200 in. lbs.).

(7) If the vehicle is equipped with ABS, reinstall the ICU. Refer to INTEGRATED CONTROL UNIT in REMOVAL AND INSTALLATION within the ANTILOCK BRAKE SYSTEM section of this service manual group for the procedure.

(8) Install the master cylinder. For the master cylinder without ABS removal and installation procedure, refer to MASTER CYLINDER in this section of this service manual group. For the master cylinder with ABS removal and installation procedure, refer to MASTER CYLINDER in the ANTILOCK BRAKE SYSTEM section of this service manual group.

(9) Position the battery tray back in place. Install the two bolts, then the two nuts mounting the battery tray to its bracket (Fig. 48). Tighten the two bolts and nuts to a torque of 34 N·m (25 ft. lbs.).

(10) Reinstall the air cleaner box onto its grommeted alignment post (Fig. 48).

(11) Install the one nut and one bolt securing the air cleaner box in place, then connect the wiring harness connector at the air inlet sensor.

(12) Install the battery and clamp it in place.

(13) Connect the positive, then the negative (ground) cable on the battery.

(14) Adjust the stop lamp switch as necessary. Refer to STOP LAMP SWITCH in the ADJUSTMENTS section of this group.

(15) Bleed the base brake system.

(16) Road test the vehicle to ensure proper operation of the brakes.

PROPORTIONING VALVE

NOTE: Before proceeding with this procedure, review SERVICE WARNINGS AND CAUTIONS at the beginning of REMOVAL AND INSTALLATION in this section.

REMOVAL

(1) Using a brake pedal holder, depress the brake pedal past its first one inch of travel and hold it in this position (Fig. 53). This will isolate the master cylinder from the brake hydraulic system and will

not allow the brake fluid to drain out of the master cylinder reservoir.

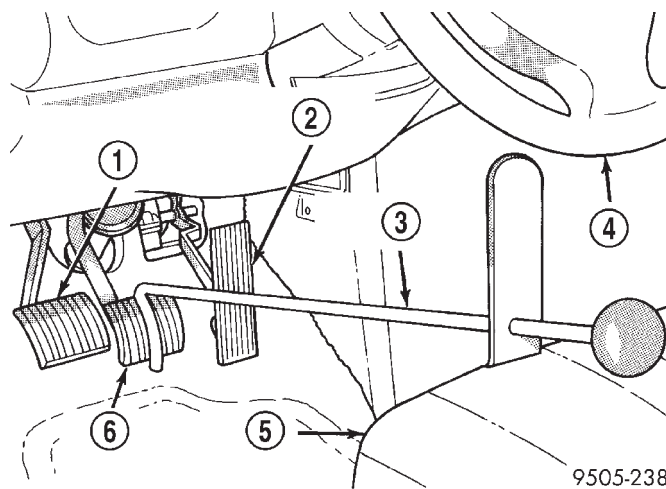


Fig. 53 Brake Pedal Holder

- 1 - CLUTCH PEDAL (IF EQUIPPED WITH MANUAL TRANSAXLE)
- 2 - THROTTLE PEDAL
- 3 - BRAKE PEDAL HOLDING TOOL
- 4 - STEERING WHEEL
- 5 - DRIVER'S SEAT
- 6 - BRAKE PEDAL

(2) Disconnect the brake tube from the proportioning valve requiring removal (Fig. 54).

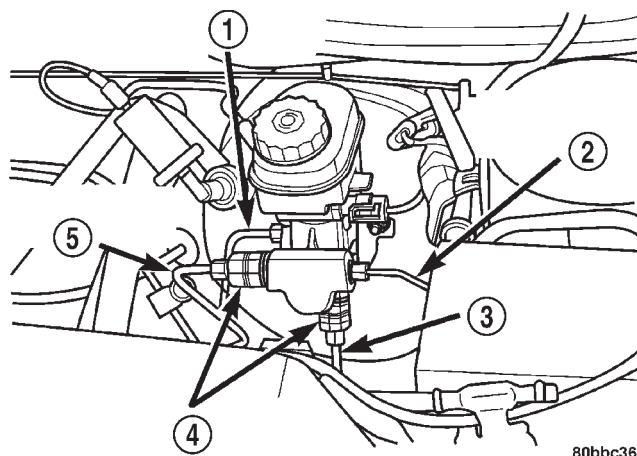


Fig. 54 Proportioning Valves On Master Cylinder

- 1 - RIGHT FRONT BRAKE TUBE
- 2 - LEFT FRONT BRAKE TUBE
- 3 - LEFT REAR BRAKE TUBE
- 4 - REAR PROPORTIONING VALVES
- 5 - RIGHT REAR BRAKE TUBE

(3) Unscrew the Proportioning valve from the master cylinder.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Lubricate the O-ring on the proportioning valve. Make sure the O-ring on the proportioning valve is new.

(2) Install the proportioning valve in its master cylinder port. Tighten the proportioning valve to a torque of 40 N·m (30 ft. lbs.).

(3) Connect the brake tube to the proportioning valve (Fig. 54). Tighten the tube nut to a torque of 17 N·m (145 in. lbs.).

(4) Remove the brake pedal holder (Fig. 53).

(5) Bleed the affected brake line. See BASE BRAKE BLEEDING in the SERVICE PROCEDURES section in this service manual group.

(6) Road test the vehicle to ensure proper operation of the brakes.

BRAKES TUBES AND HOSES

NOTE: Brake hoses for each brake are unique and are not interchangeable.

Always use Mopar® replacement brake hoses to ensure quality, correct length and superior fatigue life. Care should be taken to make sure that the tube and hose mating surfaces are clean and free from nicks and burrs.

Use new copper seal washers on all connections using banjo bolts and tighten all the fittings to their specified torques.

Follow the procedures in the next three paragraphs to reduce the potential for twisting the brake hose during installation.

The flexible front hydraulic brake hose should always be installed on the vehicle by first attaching the banjo fitting to the disc brake caliper. Attach the hose to the brake tubing before attaching it to the front frame rail. Tighten all brake line fittings to the specified torque.

On vehicles equipped with rear drum brakes, loosely install the rear brake hose to the wheel cylinder first, then bolt the intermediate routing bracket to the strut. Next, loosely install the hose to the steel tube coming from the master cylinder. Attach the hose bracket to the body. Finally, tighten the tube nuts at each end of the brake hose.

On vehicles equipped with rear disc brakes, attach the brake hose banjo fitting to the caliper first, then loosely install the hose to the steel tube coming from the master cylinder. Next, attach the brake hose bracket to the body. Finally, tighten the tube nut at the each of the end of the brake hose connecting to the steel tube coming from the master cylinder.

Only double wall 4.75 mm (3/16 in.) steel brake line tubing with Nygal coating should be used for replacement along with its special tube nuts. Care must be taken when replacing brake tubing; to be sure, use the proper bending and flaring tools, and procedures to avoid kinking. Do not route the tubes against sharp edges, moving components, or into hot areas. All tubes should be properly attached with the recommended retaining clips.

DISC BRAKE CALIPER (FRONT)

NOTE: Before proceeding with this procedure, review **SERVICE WARNINGS AND CAUTIONS** at the beginning of **REMOVAL AND INSTALLATION** in this section.

REMOVAL

(1) Using a brake pedal holding tool as shown (Fig. 55), depress the brake pedal past its first one inch of travel and hold it in this position. This will isolate the master cylinder from the brake hydraulic system and will not allow the brake fluid to drain out of the master cylinder reservoir when the lines are opened.

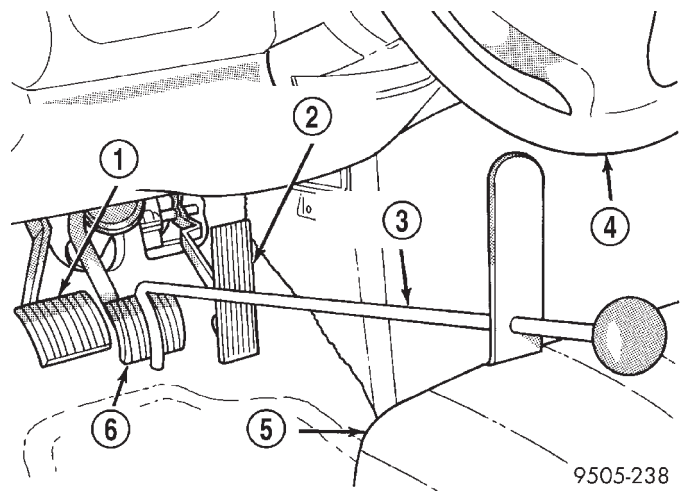


Fig. 55 Brake Pedal Holding Tool

- 1 – CLUTCH PEDAL (IF EQUIPPED WITH MANUAL TRANSAXLE)
- 2 – THROTTLE PEDAL
- 3 – BRAKE PEDAL HOLDING TOOL
- 4 – STEERING WHEEL
- 5 – DRIVER'S SEAT
- 6 – BRAKE PEDAL

(2) Raise the vehicle. Refer to **HOISTING** in the **LUBRICATION AND MAINTENANCE** group for the proper lifting procedure.

(3) Remove the front tire and wheel assembly.

REMOVAL AND INSTALLATION (Continued)

(4) Remove the banjo bolt connecting the brake hose to the brake caliper (Fig. 56). There are two washers (one on each side of the flex hose fitting) that will come off with the banjo bolt. Inspect and discard these if they are worn or damaged.

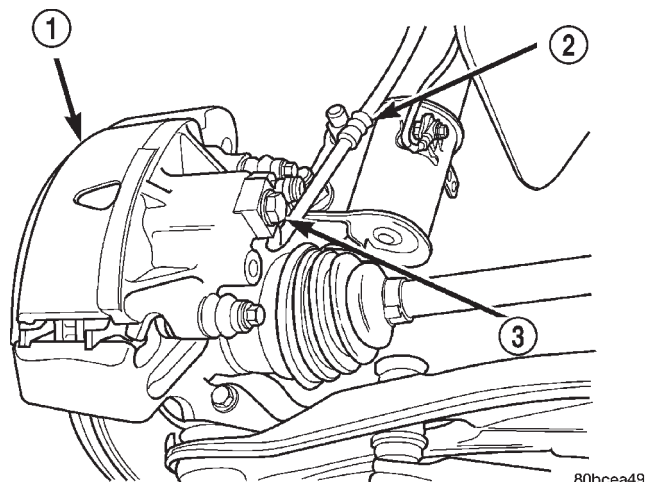


Fig. 56 Brake Hose Connection

- 1 - CALIPER
- 2 - HOSE
- 3 - BOLT

(5) Remove the two brake caliper to steering knuckle guide pin bolts (Fig. 57).

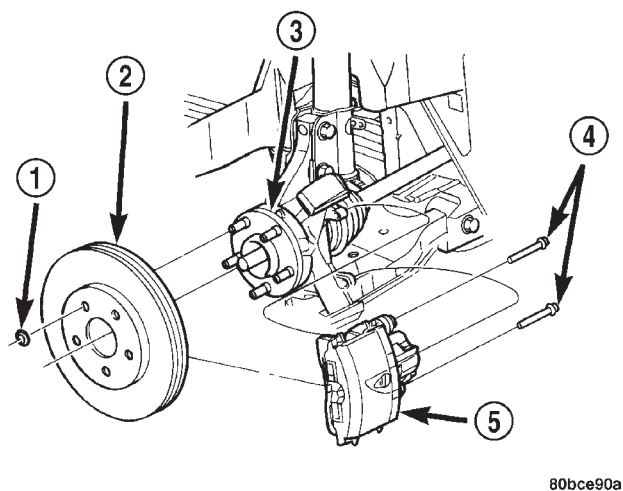


Fig. 57 Caliper Mounting

- 1 - RETAINER CLIP
- 2 - BRAKE ROTOR
- 3 - HUB
- 4 - GUIDE PIN BOLTS
- 5 - DISC BRAKE CALIPER

(6) Remove the disc brake caliper from the steering knuckle. The caliper is removed by first tipping either the top (right side caliper) or bottom (left side caliper) of the caliper away from the brake rotor,

then pulling the caliper off the opposite end's caliper slide abutment (on the knuckle) and brake rotor.

INSTALLATION

NOTE: Step 1 below is only required when installing a caliper after new brake shoes have been installed.

(1) Completely retract the caliper piston back into the bore of the caliper.

(2) Lubricate both steering knuckle caliper slide abutments with a liberal amount of Mopar® Multi-purpose Lubricant, or an equivalent.

CAUTION: Use care when installing the caliper assembly onto the steering knuckle so the seals on the caliper guide pin bushings do not get damaged by the steering knuckle bosses.

(3) Install the disc brake caliper (with pads) on the brake rotor and steering knuckle. The left side caliper is installed by first sliding the top of the caliper past the top caliper slide abutment on the steering knuckle to hook the top edge of the caliper, then pushing the lower end of the caliper into place against the knuckle (Fig. 58). The right side caliper is installed by first sliding the bottom edge of the caliper past the lower caliper slide abutment on the steering knuckle to hook the lower edge of the caliper, then pushing the top of the caliper into place against the steering knuckle.

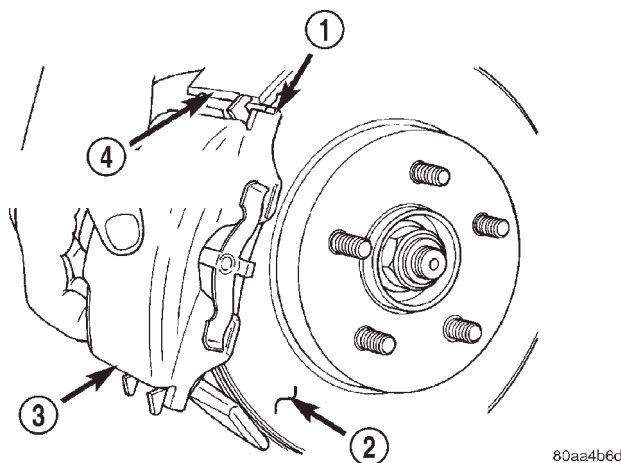


Fig. 58 Installing Left Caliper

- 1 - SLIDE TOP OF BRAKE CALIPER UNDER TOP ABUTMENT OF STEERING KNUCKLE AS SHOWN
- 2 - BRAKING DISC
- 3 - DISC BRAKE CALIPER
- 4 - STEERING KNUCKLE BRAKE ABUTMENT

REMOVAL AND INSTALLATION (Continued)

(4) Install the caliper guide pin bolts and tighten them to a torque of 22 N·m (192 in. lbs.) (Fig. 57).

(5) Install the banjo bolt connecting the brake hose to the brake caliper (Fig. 56). Place one fitting washer on each side of the hose fitting as the banjo bolt is guided through the fitting. Install new washers if they are worn or damaged at all. Thread the banjo bolt into the caliper and tighten it to a torque of 48 N·m (35 ft. lbs.).

(6) Install the tire and wheel assembly. Tighten the wheel mounting nuts to a torque of 135 N·m (100 ft. lbs.).

(7) Lower the vehicle.

(8) Remove the brake pedal holding tool.

(9) Bleed the caliper as necessary. Refer to **BASE BRAKE BLEEDING** in the **SERVICE PROCEDURES** section in this service manual group.

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

DISC BRAKE SHOES (FRONT)

NOTE: Before proceeding with this procedure, review **SERVICE WARNINGS AND CAUTIONS** at the beginning of **REMOVAL AND INSTALLATION** in this section.

NOTE: Vehicles that are equipped with optional Four-wheel-disc brake system use a different lining material on the front disc brake shoes than vehicles with front disc and rear drum brakes. When new brake shoes are installed, be sure the brake shoes for the correct type of brake system are used.

REMOVAL

(1) Raise the vehicle. Refer to **HOISTING** in the **LUBRICATION AND MAINTENANCE** group for the proper lifting procedure.

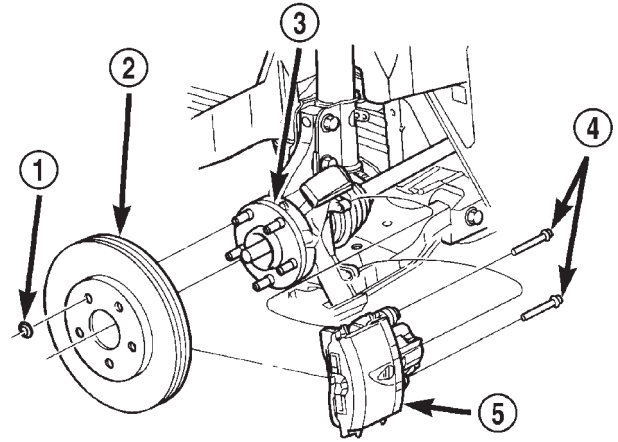
(2) Remove both front tire and wheel assemblies from vehicle.

(3) Begin on one side of the vehicle.

(4) Remove the two brake caliper guide pin bolts (Fig. 59).

(5) Remove the disc brake caliper from the steering knuckle. The caliper is removed by first tipping either the top (right side caliper) or bottom (left side caliper) of the caliper away from the brake rotor, then pulling the caliper off the opposite end's caliper slide abutment (on the knuckle) and brake rotor.

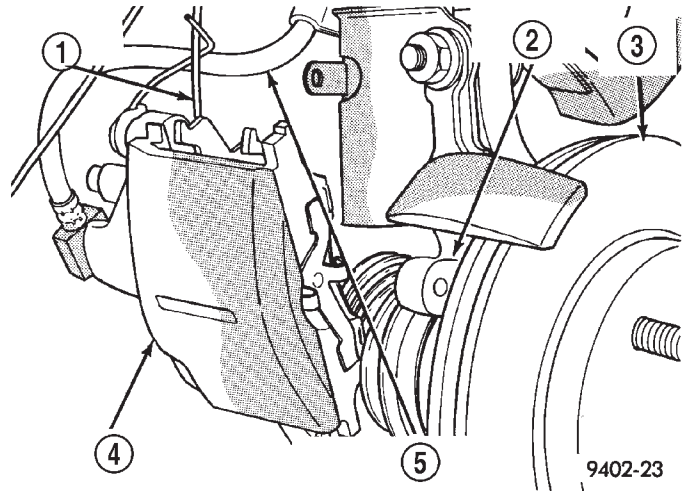
(6) Support the caliper using a wire or cord to prevent the weight of caliper from damaging the brake hose (Fig. 60). Do not let the caliper hang by the brake hose.



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Fig. 59 Caliper And Rotor Mounting

- 1 - RETAINER CLIP
- 2 - BRAKE ROTOR
- 3 - HUB
- 4 - GUIDE PIN BOLTS
- 5 - DISC BRAKE CALIPER



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Fig. 60 Supporting Caliper

- 1 - WIRE HANGER
- 2 - STEERING KNUCKLE
- 3 - BRAKE DISC
- 4 - DISC BRAKE CALIPER ASSEMBLY
- 5 - BRAKE HYDRAULIC HOSE

REMOVAL AND INSTALLATION (Continued)

(7) Remove the outboard brake shoe from the caliper by prying the shoe retaining clip over the raised area on the caliper. Slide the brake shoe down and off of the caliper (Fig. 61).

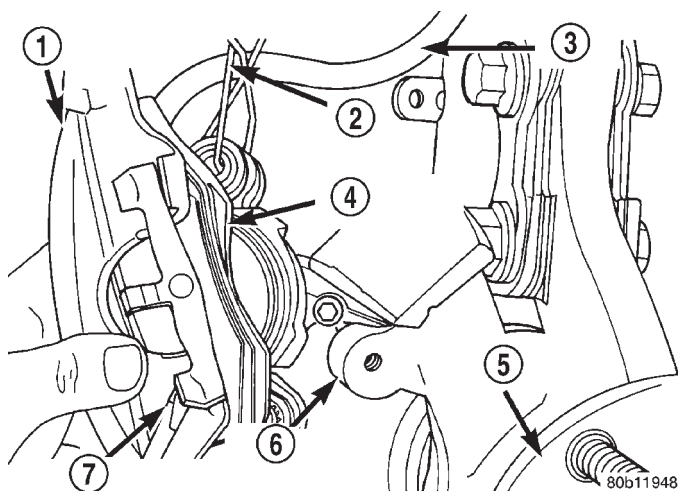


Fig. 61 Removing Outboard Brake Shoe

- 1 - CALIPER ASSEMBLY
- 2 - HANGER WIRE
- 3 - BRAKE FLEX HOSE
- 4 - OUTBOARD BRAKE PAD
- 5 - HUB/BEARING ASSEMBLY
- 6 - STEERING KNUCKLE
- 7 - SCREWDRIVER

(8) Pull the inboard brake shoe away from the caliper piston until the retaining clip is out of the cavity in the piston (Fig. 62) and remove the shoe.

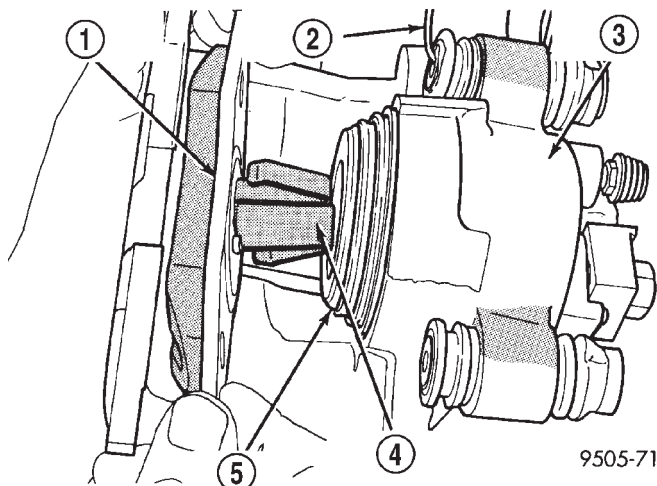


Fig. 62 Removing Inboard Brake Shoe

- 1 - INBOARD BRAKE SHOE
- 2 - HANGER WIRE
- 3 - CALIPER ASSEMBLY
- 4 - RETAINING CLIP
- 5 - PISTON

(9) Repeat the above procedure to the front brakes on the other side of the vehicle.

INSTALLATION

- (1) Begin on one side of the vehicle.
- (2) Completely retract the caliper piston back into the bore of the caliper. This is required to gain the necessary shoe-to-rotor clearance for the caliper installation onto the steering knuckle.
- (3) Remove any protective paper from the noise suppression gasket on both the inner and outer brake shoes (if equipped).
- (4) Install the inboard brake shoe into the caliper piston by firmly pressing the shoe in with the thumbs (Fig. 63). Be sure the inboard brake shoe is positioned squarely against the face of the caliper piston.

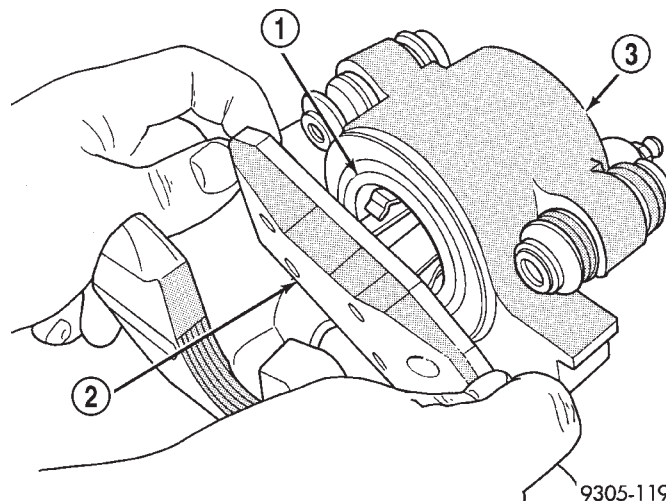


Fig. 63 Installing Inboard Brake Shoe

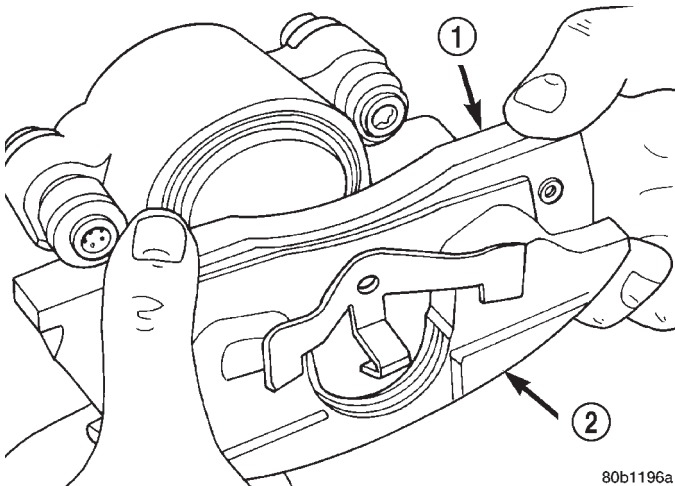
- 1 - PISTON
- 2 - BRAKE SHOE
- 3 - CALIPER ASSEMBLY

(5) Slide the new outboard brake shoe onto the caliper (Fig. 64).

(6) Lubricate both steering knuckle caliper slide abutments with a liberal amount of Mopar® Multi-purpose Lubricant, or an equivalent.

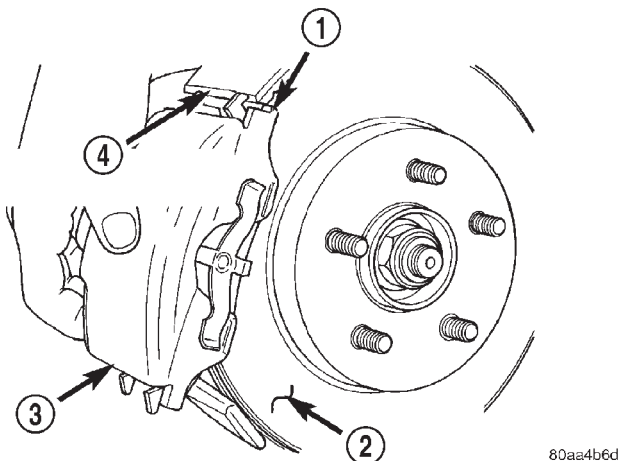
CAUTION: Use care when installing the caliper assembly onto the steering knuckle so the seals on the caliper guide pin bushings do not get damaged by the steering knuckle bosses.

REMOVAL AND INSTALLATION (Continued)

**Fig. 64 Installing Outboard Brake Shoe**

- 1 – BRAKE SHOE ASSEMBLY
2 – BRAKE CALIPER

(7) Install the disc brake caliper (with pads) on the brake rotor and steering knuckle. The left side caliper is installed by first sliding the top of the caliper past the top caliper slide abutment on the steering knuckle to hook the top edge of the caliper, then pushing the lower end of the caliper into place against the knuckle (Fig. 65). The right side caliper is installed by first sliding the bottom edge of the caliper past the lower caliper slide abutment on the steering knuckle to hook the lower edge of the caliper, then pushing the top of the caliper into place against the steering knuckle.

**Fig. 65 Installing Left Caliper**

- 1 – SLIDE TOP OF BRAKE CALIPER UNDER TOP ABUTMENT OF STEERING KNUCKLE AS SHOWN
2 – BRAKING DISC
3 – DISC BRAKE CALIPER
4 – STEERING KNUCKLE BRAKE ABUTMENT

(8) Install the caliper guide pin bolts and tighten them to a torque of 22 N·m (192 in. lbs.) (Fig. 59).

(9) Install the tire and wheel assembly. Tighten the wheel mounting nuts to a torque of 135 N·m (100 ft. lbs.).

(10) Repeat the above procedure to the front brakes on the other side of the vehicle.

(11) Lower the vehicle.

(12) Pump the brake pedal before moving the vehicle to set the brake shoes to the brake rotor.

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

BRAKE ROTOR (FRONT)**REMOVAL**

(1) Raise the vehicle. Refer to HOISTING in the LUBRICATION AND MAINTENANCE group for the proper lifting procedure.

(2) Remove the front tire and wheel assembly.

(3) Remove the front disc brake caliper assembly from the brake rotor and store it out of the way. Refer to DISC BRAKE SHOES (FRONT) in this REMOVAL AND INSTALLATION section of this service manual group.

(4) Remove the clips retaining the brake rotor (Fig. 59).

(5) Remove the brake rotor by pulling it straight off the wheel mounting studs.

INSTALLATION

(1) Install the brake rotor over the wheel mounting studs and onto the hub (Fig. 59).

(2) Install the front disc brake caliper. It may be necessary to retract the brake caliper piston back into the caliper to fit the shoes onto the rotor, if a new rotor is being installed. Refer to DISC BRAKE SHOES (FRONT) in this REMOVAL AND INSTALLATION section of this service manual group.

(3) Install the tire and wheel assembly. Tighten the wheel mounting nuts to a torque of 135 N·m (100 ft. lbs.).

(4) Lower the vehicle.

(5) Pump the brake pedal before moving the vehicle to set the brake shoes to the brake rotor.

REMOVAL AND INSTALLATION (Continued)

DISC BRAKE CALIPER (REAR)

REMOVAL

(1) Using a brake pedal holding tool as shown (Fig. 66), depress the brake pedal past its first one inch of travel and hold it in this position. This will isolate the master cylinder from the brake hydraulic system and will not allow the brake fluid to drain out of the master cylinder reservoir while the lines are disconnected.

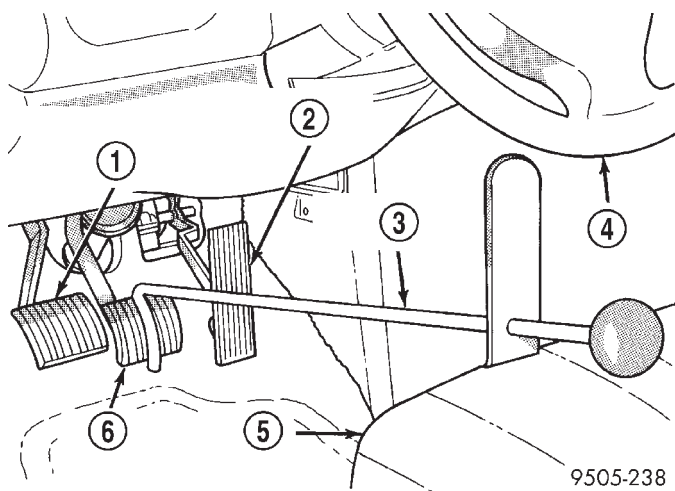


Fig. 66 Brake Pedal Holding Tool

- 1 - CLUTCH PEDAL (IF EQUIPPED WITH MANUAL TRANSAXLE)
- 2 - THROTTLE PEDAL
- 3 - BRAKE PEDAL HOLDING TOOL
- 4 - STEERING WHEEL
- 5 - DRIVER'S SEAT
- 6 - BRAKE PEDAL

(2) Raise the vehicle. Refer to HOISTING in the LUBRICATION AND MAINTENANCE group for the proper lifting procedure.

(3) Remove the rear tire and wheel assembly.

(4) Remove the banjo bolt connecting the brake hose to the brake caliper (Fig. 67). There are two washers (one on each side of the flex hose fitting) that will come off with the banjo bolt. Inspect and discard these if they are worn or damaged.

(5) Remove the two caliper guide pin bolts (Fig. 68).

(6) Remove the caliper assembly from the brake adapter by first rotating the top of the caliper away from the rotor, and then lifting the caliper assembly off the machined abutment on the adapter (Fig. 69).

INSTALLATION

NOTE: Step (1) below is only required when installing the disc brake caliper after new brake shoes have been installed.

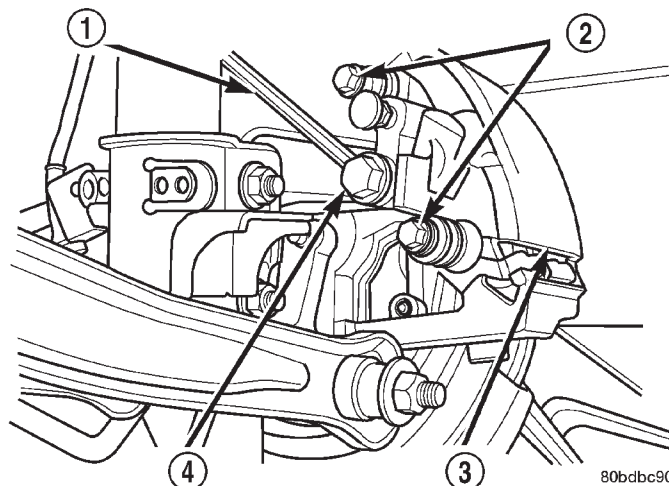


Fig. 67 Brake Hose Mounting

- 1 - BRAKE HOSE
- 2 - GUIDE PIN BOLTS
- 3 - CALIPER
- 4 - BOLT

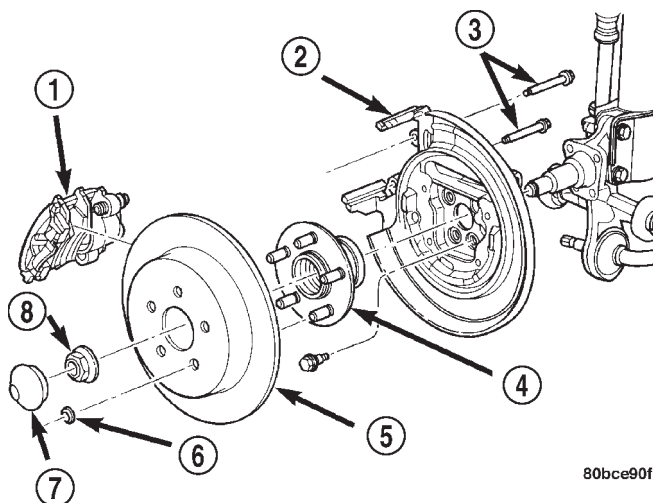
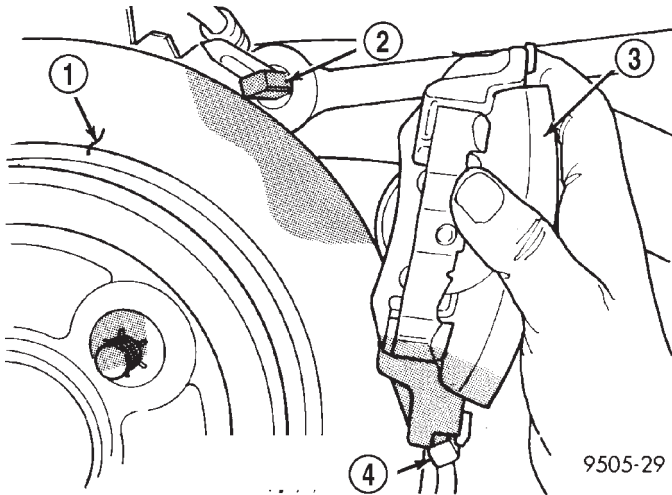


Fig. 68 Caliper Mounting

- 1 - DISC BRAKE CALIPER
- 2 - DISC BRAKE ADAPTER
- 3 - GUIDE PIN BOLTS
- 4 - HUB AND BEARING
- 5 - BRAKE ROTOR
- 6 - RETAINER CLIP
- 7 - DUST CAP
- 8 - NUT

REMOVAL AND INSTALLATION (Continued)

**Fig. 69 Removing Caliper From Adapter**

- 1 - BRAKING DISC
- 2 - CALIPER ADAPTER
- 3 - CALIPER
- 4 - LOWER MACHINED ADAPTER ABUTMENT

(1) Completely retract the caliper piston back into piston bore of the caliper.

(2) Lubricate both adapter caliper slide abutments with a liberal amount of Mopar® Multipurpose Lubricant, or an equivalent.

CAUTION: Use care when installing the caliper assembly onto adapter so the guide pin bushings and sleeves do not get damaged by the mounting bosses on adapter.

(3) Starting with the lower end, carefully lower the caliper and brake shoes over the brake rotor and catch the caliper's bottom edge behind the caliper slide abutment (Fig. 69). Rotate the top of the caliper into mounting position on the adapter.

CAUTION: Extreme caution should be taken not to cross thread the caliper guide pin bolts when they are installed.

(4) Carefully install the caliper guide pin bolts (Fig. 68), then tighten them to a torque of 22 N·m (192 in. lbs.).

(5) Install the banjo bolt connecting the brake hose to the brake caliper (Fig. 67). Place one fitting washer on each side of the hose fitting as the banjo bolt is guided through the fitting. Install new washers if they are worn or damaged at all. Thread the banjo bolt into the caliper and tighten it to a torque of 48 N·m (35 ft. lbs.).

(6) Install the tire and wheel assembly. Tighten the wheel mounting nuts to a torque of 135 N·m (100 ft. lbs.).

(7) Lower the vehicle.

(8) Remove the brake pedal holding tool.

(9) Bleed the caliper as necessary. Refer to BASE BRAKE BLEEDING in the SERVICE PROCEDURES section in this service manual group.

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

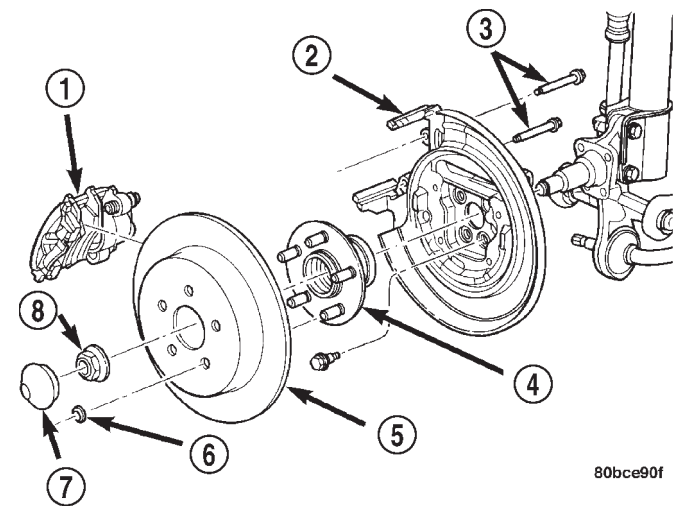
DISC BRAKE SHOES (REAR)**REMOVAL**

(1) Raise the vehicle. Refer to HOISTING in the LUBRICATION AND MAINTENANCE group for the proper lifting procedure.

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

(3) Begin on one side of the vehicle.

(4) Remove the two caliper guide pin bolts (Fig. 70).

**Fig. 70 Caliper And Rotor Mounting**

- 1 - DISC BRAKE CALIPER
- 2 - DISC BRAKE ADAPTER
- 3 - GUIDE PIN BOLTS
- 4 - HUB AND BEARING
- 5 - BRAKE ROTOR
- 6 - RETAINER CLIP
- 7 - DUST CAP
- 8 - NUT

REMOVAL AND INSTALLATION (Continued)

(5) Remove the caliper assembly from the brake adapter by first rotating the top of the caliper away from the rotor, and then lifting the caliper assembly off the machined abutment on the adapter (Fig. 71).

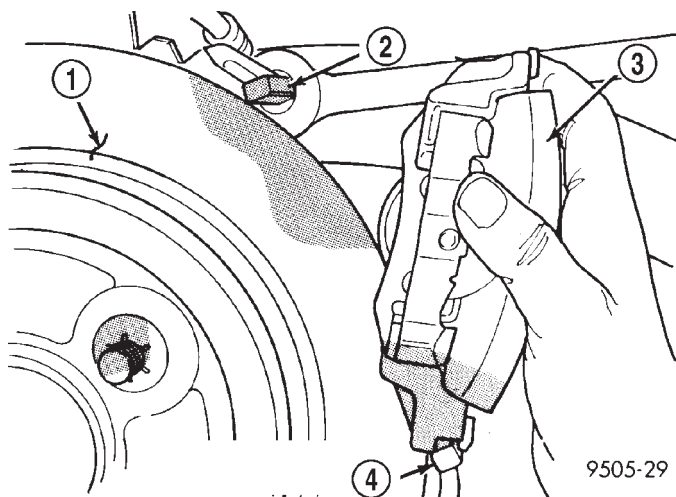


Fig. 71 Caliper Removal/Installation

- 1 - BRAKING DISC
- 2 - CALIPER ADAPTER
- 3 - CALIPER
- 4 - LOWER MACHINED ADAPTER ABUTMENT

(6) Hang the brake caliper from rear strut using wire or cord to prevent the weight of the caliper from damaging the brake hose (Fig. 72).

(7) Remove the outboard brake shoe from the caliper by prying the brake shoe retaining clip over the raised area on the caliper. Then slide the brake shoe down and off of the brake caliper (Fig. 73).

(8) Pull the inboard brake shoe away from caliper piston until the retaining clip is free from the cavity in the piston (Fig. 74).

(9) Repeat the above procedure to the rear brakes on the other side of the vehicle.

INSTALLATION

(1) Begin on one side of the vehicle.

(2) Completely retract the caliper piston back into piston bore of the caliper. This is required to gain the necessary shoe-to-rotor clearance for the caliper installation onto the steering knuckle.

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

(4) Install the inboard brake shoe into the caliper piston by firmly pressing the shoe in with the thumbs (Fig. 74). Be sure the inboard brake shoe is positioned squarely against the face of the caliper piston.

(5) Slide the outboard brake shoe onto the caliper assembly (Fig. 73). Be sure the retaining clip is squarely seated in the depressed areas on the caliper.

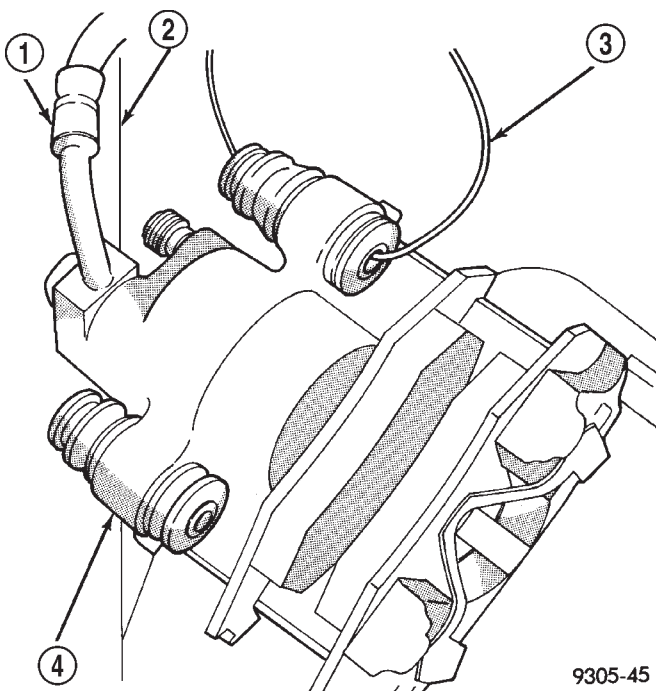


Fig. 72 Supporting Caliper

- 1 - FLEX HOSE
- 2 - STRUT
- 3 - WIRE HANGER
- 4 - CALIPER ASSEMBLY

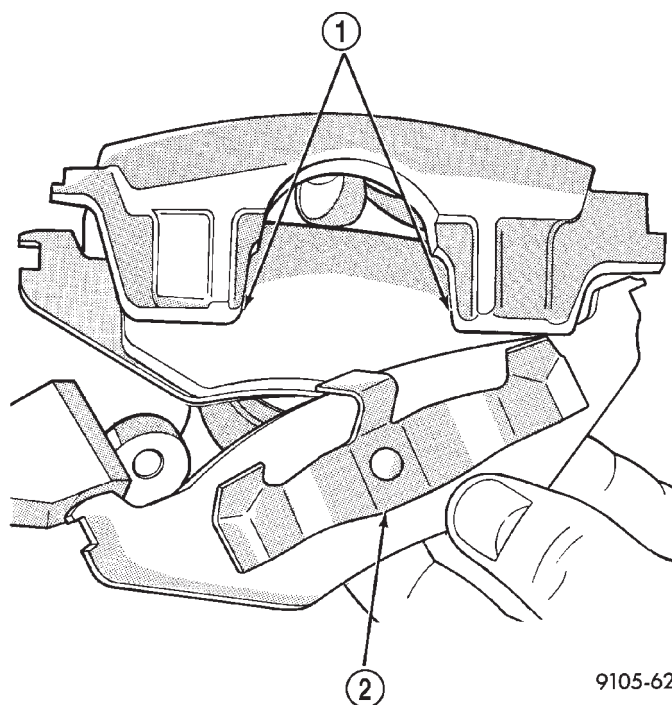
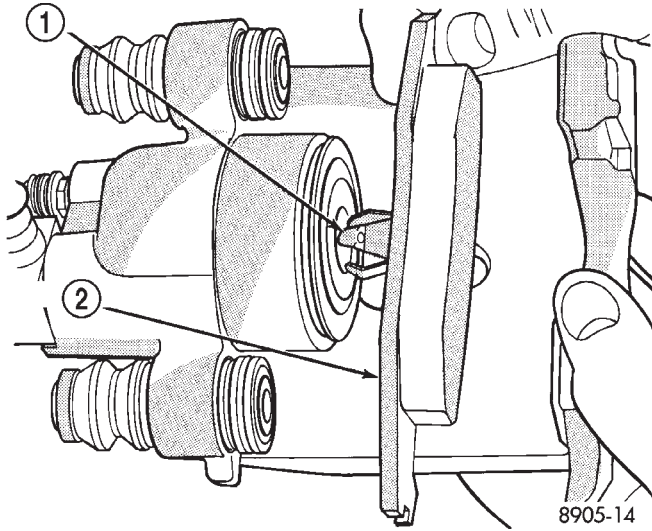


Fig. 73 Outboard Brake Shoe

- 1 - CALIPER FINGERS
- 2 - RETAINING CLIP

REMOVAL AND INSTALLATION (Continued)

**Fig. 74 Inboard Brake Shoe**

- 1 - RETAINING CLIP
2 - INBOARD SHOE

(6) Lubricate both adapter caliper slide abutments with a liberal amount of Mopar® Multipurpose Lubricant, or an equivalent.

CAUTION: Use care when installing the caliper assembly onto adapter so the guide pin bushings and sleeves do not get damaged by the mounting bosses on adapter.

(7) Starting with the lower end, carefully lower the caliper and brake shoes over the brake rotor and catch the caliper's bottom edge behind the caliper slide abutment (Fig. 71). Rotate the top of the caliper into mounting position on the adapter.

CAUTION: Extreme caution should be taken not to cross thread the caliper guide pin bolts when they are installed.

(8) Carefully install the caliper guide pin bolts (Fig. 70), then tighten them to a torque of 22 N·m (192 in. lbs.).

(9) Install the tire and wheel assembly. Tighten the wheel mounting nuts to a torque of 135 N·m (100 ft. lbs.).

(10) Repeat the above procedure to the rear brakes on the other side of the vehicle.

(11) Lower the vehicle.

(12) Pump the brake pedal several times to ensure the vehicle has a firm brake pedal before moving the vehicle.

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

BRAKE ROTOR (REAR)**REMOVAL**

(1) Raise the vehicle. Refer to HOISTING in the LUBRICATION AND MAINTENANCE group for the proper lifting procedure.

(2) Remove the rear tire and wheel assembly.

(3) Remove the rear disc brake caliper assembly from the brake rotor and store it out of the way. Refer to DISC BRAKE SHOES (REAR) in this REMOVAL AND INSTALLATION section of this service manual group.

(4) Remove any clips retaining the brake rotor (Fig. 70).

(5) Remove the brake rotor by pulling it straight off the wheel mounting studs.

INSTALLATION

NOTE: Inspect the disc brake shoes and parking brake shoes before brake rotor installation.

(1) Install the rear brake rotor over the wheel mounting studs and onto the hub (Fig. 70).

(2) Install rear disc brake caliper. Refer to DISC BRAKE SHOES (REAR) in this REMOVAL AND INSTALLATION section of this service manual group.

(3) Install the tire and wheel assembly. Tighten the wheel mounting nuts to a torque of 135 N·m (100 ft. lbs.).

(4) Adjust the parking brake shoes as necessary. Refer to ADJUSTMENTS in this section of this service manual group.

(5) Lower the vehicle.

(6) Pump the brake pedal before moving the vehicle to set the brake shoes to the brake rotor.

DRUM BRAKE WHEEL CYLINDER (REAR)

NOTE: Before proceeding with this procedure, review SERVICE WARNINGS AND CAUTIONS at the beginning of REMOVAL AND INSTALLATION in this section.

REMOVAL AND INSTALLATION (Continued)

REMOVAL

(1) Using a brake pedal holder, depress the brake pedal past its first one inch of travel and hold it in this position (Fig. 75). This will isolate the master cylinder from the brake hydraulic system and will not allow the brake fluid to drain out of the master cylinder reservoir.

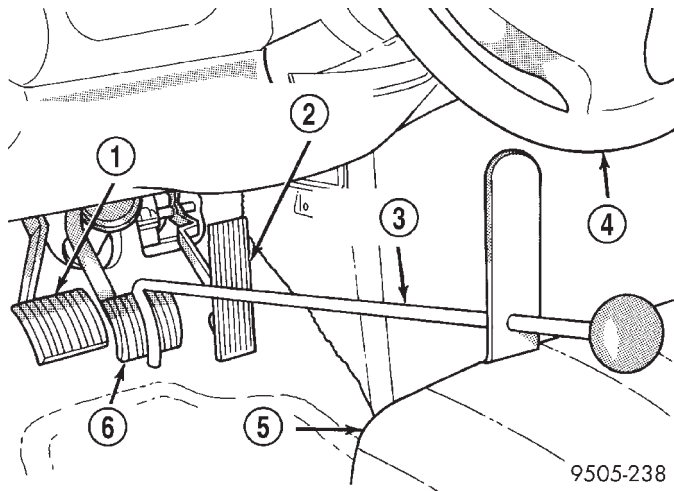


Fig. 75 Brake Pedal Holder

- 1 - CLUTCH PEDAL (IF EQUIPPED WITH MANUAL TRANSAXLE)
- 2 - THROTTLE PEDAL
- 3 - BRAKE PEDAL HOLDING TOOL
- 4 - STEERING WHEEL
- 5 - DRIVER'S SEAT
- 6 - BRAKE PEDAL

(2) Raise the vehicle. Refer to HOISTING in the LUBRICATION AND MAINTENANCE group for the proper lifting procedure.

(3) Remove the rear tire and wheel assembly.

(4) Disconnect the rear brake flex hose from the wheel cylinder (Fig. 76).

(5) Remove the rear brake drum.

(6) Remove the rear brake shoes from the brake support plate. Refer to DRUM BRAKE SHOES in this REMOVAL AND INSTALLATION section.

NOTE: If the brake shoes are wet with grease or brake fluid, replace them.

(7) Remove the brake wheel cylinder attaching bolts (Fig. 76).

(8) Remove the brake wheel cylinder from the brake support plate (Fig. 77).

INSTALLATION

(1) Install a new O-ring at the mating surface of the wheel cylinder-to-brake support plate (Fig. 77).

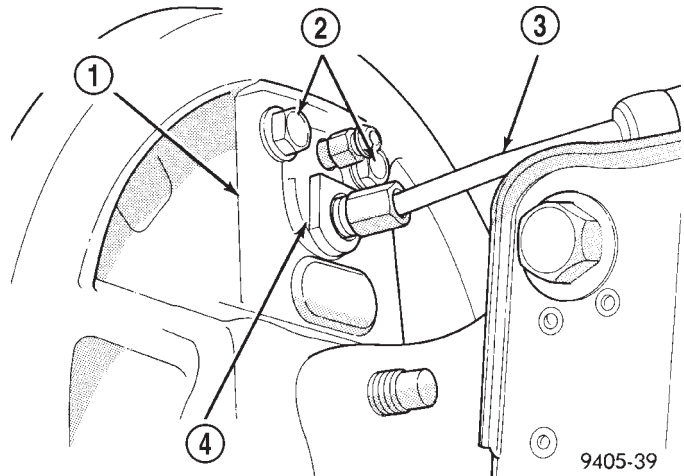


Fig. 76 Brake Flex Hose At Wheel Cylinder

- 1 - BRAKE SUPPORT PLATE
- 2 - WHEEL CYLINDER ATTACHING BOLTS
- 3 - REAR BRAKE FLEX HOSE TUBE
- 4 - WHEEL CYLINDER ASSEMBLY

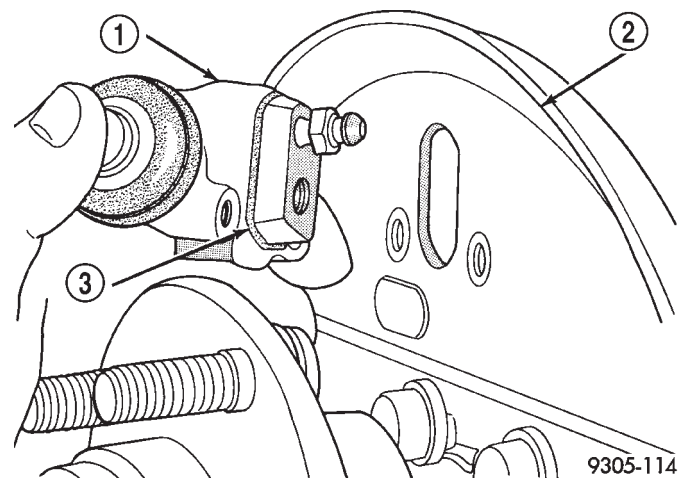


Fig. 77 Remove/Install Wheel Cylinder

- 1 - WHEEL CYLINDER
- 2 - SUPPORT PLATE
- 3 - O-RING

NOTE: When installing wheel cylinder on brake support plate, be sure it is positioned squarely (horizontal) to the brake assembly.

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

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

(4) Install the rear brake shoes on the brake support plate. Replace them as necessary.

(5) Install the rear brake drum onto the rear hub.

REMOVAL AND INSTALLATION (Continued)

(6) Install the tire and wheel assembly. Tighten the wheel mounting nuts to a torque of 135 N·m (100 ft. lbs.).

(7) Adjust the rear brakes. Refer to ADJUSTMENTS in this section of this service manual group.

(8) Lower the vehicle.

(9) Remove the brake pedal holder.

(10) Bleed the wheel cylinder as necessary. Refer to BASE BRAKE BLEEDING in the SERVICE PROCEDURES section in this service manual group.

(11) Road test the vehicle to make sure the brakes operate correctly.

DRUM BRAKE SHOES (REAR)

NOTE: Before proceeding with this removal and installation procedure, review the **SERVICE WARNINGS AND CAUTIONS** at the beginning of **REMOVAL AND INSTALLATION** in this section.

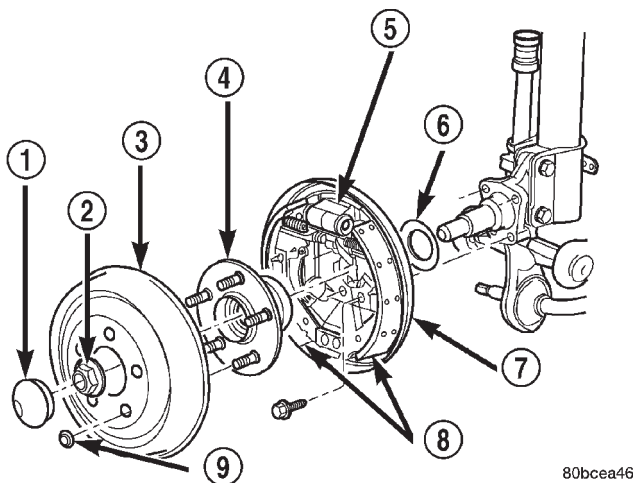
REMOVAL

(1) Raise the vehicle. Refer to HOISTING in the LUBRICATION AND MAINTENANCE group for the proper lifting procedure.

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

(3) Begin on one side of the vehicle.

(4) Remove the brake drum retaining clips (if equipped) (Fig. 78).



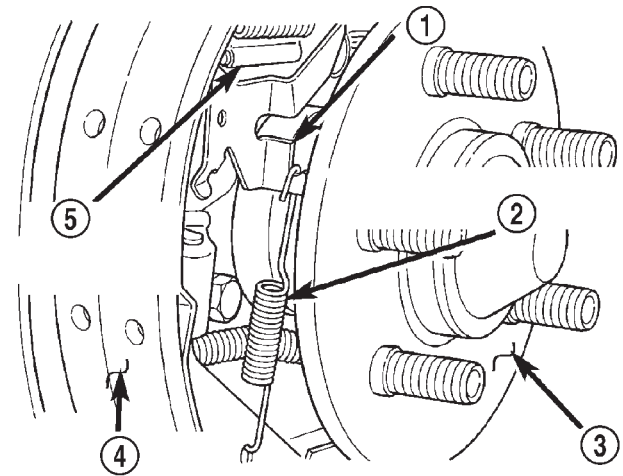
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Fig. 78 Drum Brakes

- 1 – DUST CAP
- 2 – NUT
- 3 – DRUM
- 4 – HUB AND BEARING
- 5 – WHEEL CYLINDER
- 6 – SEAL
- 7 – SUPPORT PLATE
- 8 – BRAKE SHOES
- 9 – RETAINER CLIP

(5) Remove the brake drum (Fig. 78).

(6) Remove the automatic adjustment lever-to-brake shoe spring (Fig. 79).

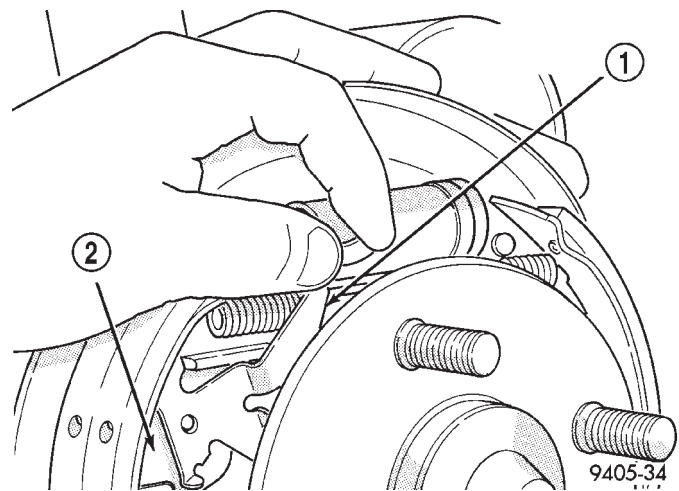


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Fig. 79 Automatic Adjustment Lever Spring

- 1 – ADJUSTMENT LEVER
- 2 – ADJUSTMENT LEVER TO BRAKE SHOE SPRING
- 3 – HUB/BEARING
- 4 – LEADING BRAKE SHOE
- 5 – AUTOMATIC ADJUSTER SCREW

(7) Remove the automatic adjustment lever (Fig. 80) from the brake shoe.



9405-34

Fig. 80 Automatic Adjustment Lever

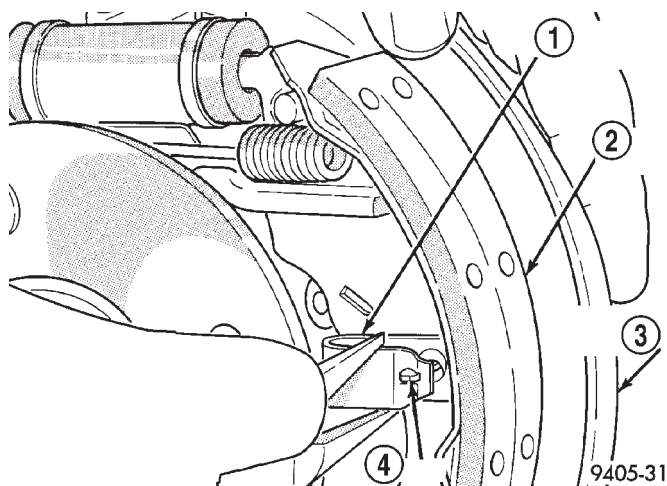
- 1 – AUTOMATIC ADJUSTMENT LEVER
- 2 – FRONT BRAKE SHOE ASSEMBLY

(8) Remove the hold down clips and pins attaching the leading and trailing brake shoes to the brake support plate (Fig. 81).

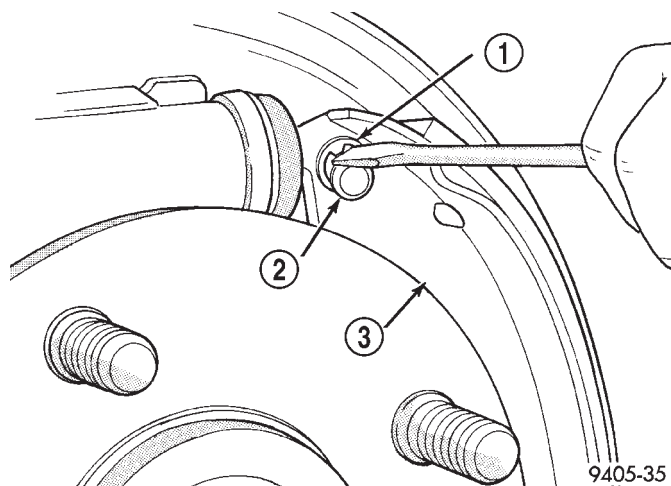
(9) Remove the lower brake shoe-to-anchor plate return spring (Fig. 82).

(10) Remove the parking brake lever pin-to-brake shoe retaining clip (Fig. 83).

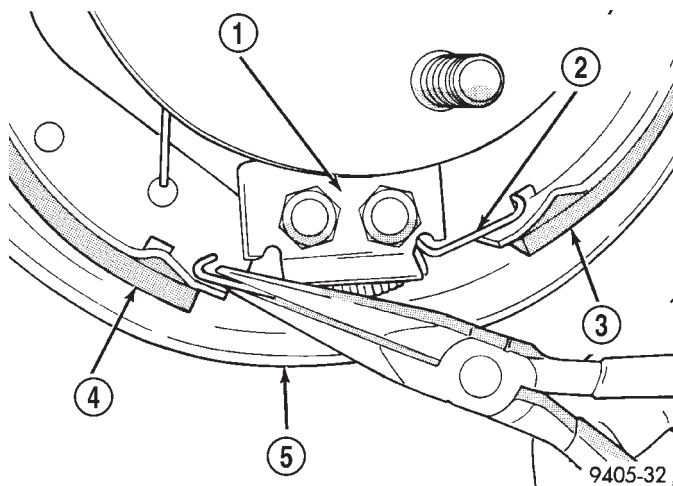
REMOVAL AND INSTALLATION (Continued)

**Fig. 81 Brake Shoe Hold Down Clips And Pins**

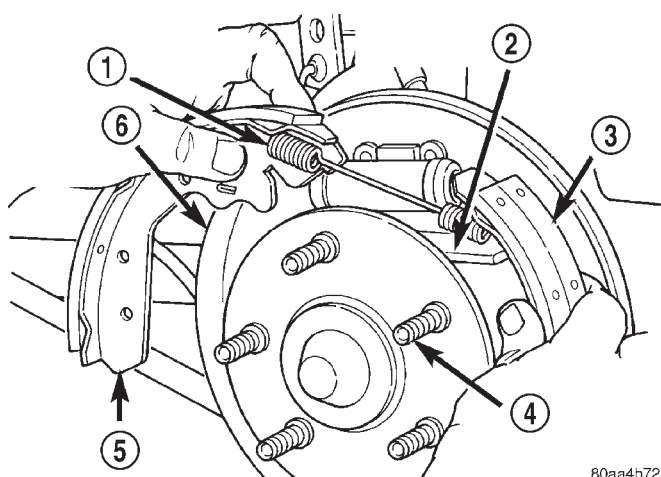
- 1 - HOLD DOWN CLIP
- 2 - BRAKE SHOE
- 3 - SUPPORT PLATE
- 4 - PIN

**Fig. 83 Parking Brake Lever Pin To Brake Shoe Retaining Clip**

- 1 - RETAINING CLIP
- 2 - PARK BRAKE LEVER PIN
- 3 - PARK BRAKE LEVER

**Fig. 82 Brake Shoe To Anchor Plate Return Spring**

- 1 - ANCHOR PLATE
- 2 - LOWER BRAKE SHOE RETURN SPRING
- 3 - REAR BRAKE SHOE
- 4 - FRONT BRAKE SHOE
- 5 - BRAKE SUPPORT PLATE

**Fig. 84 Brake Shoe Removal/Installation**

- 1 - UPPER RETURN SPRING
- 2 - AUTOMATIC ADJUSTER SCREW
- 3 - TRAILING BRAKE SHOE
- 4 - WHEEL MOUNTING STUDS
- 5 - LEADING BRAKE SHOE
- 6 - BRAKE SUPPORT PLATE

(11) Remove the leading and trailing brake shoes, upper return spring and automatic adjuster screw from the brake support plate as an assembly (Fig. 84).

(12) Disassemble the shoes completely once on the bench.

(13) Repeat the above procedure to the rear brakes on the other side of the vehicle.

INSTALLATION

(1) Begin on one side of the vehicle.

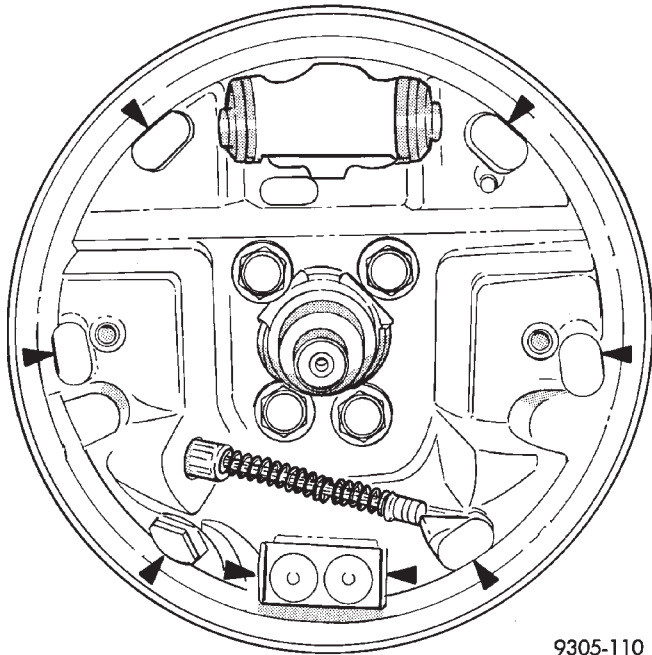
(2) Lubricate the eight shoe contact areas on the support plate and anchor using Mopar® Multi-Purpose Lubricant or equivalent (Fig. 85).

(3) Assemble the front and rear brake shoe assembly, automatic adjuster screw, and upper return spring before installation on the vehicle.

(4) Install the pre-assembled brake shoes, automatic adjuster screw and upper return spring on the brake support plate (Fig. 84).

(5) Install the wave washer on the pin of park brake lever.

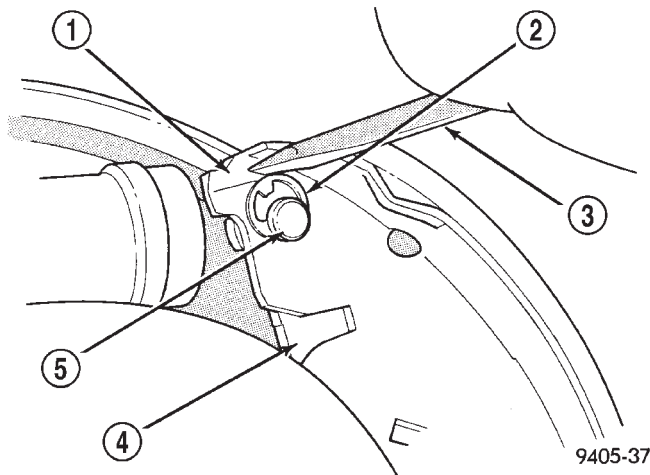
REMOVAL AND INSTALLATION (Continued)



9305-110

Fig. 85 Shoe Contact Areas on Support Plate

(6) Install the pin on the parking brake lever into the hole in rear brake shoe assembly (Fig. 86).



9405-37

Fig. 86 Parking Brake Lever Pin Retaining Clip Installation

- 1 - BRAKE SHOE ASSEMBLY
- 2 - RETAINING CLIP
- 3 - SCREWDRIVER
- 4 - PARK BRAKE LEVER
- 5 - PARK BRAKE LEVER PIN

(7) Install both brake shoe-to-brake support plate hold down pins and clips (Fig. 81).

(8) Install the lower brake shoe-to-anchor plate return spring (Fig. 82).

(9) Install the automatic adjustment lever on the leading brake shoe (Fig. 80).

(10) Install the automatic adjustment lever-to-brake shoe spring (Fig. 79).

(11) Adjust the brake shoes out until the drum lightly drags on the shoes when it is installed. Do not over-adjust the brakes.

(12) Install the brake drum (Fig. 78).

(13) Repeat the above procedure to the rear brakes on the other side of the vehicle.

(14) Install the tire and wheel assemblies. Tighten the wheel mounting nuts to a torque of 135 N·m (100 ft. lbs.).

(15) Adjust the rear brake shoes. Refer to ADJUSTMENTS in this section of this service manual group.

(16) Lower the vehicle.

(17) Road test vehicle stopping in both the forward and reverse directions. The automatic adjuster will continue to adjust the brakes during the road test of the vehicle.

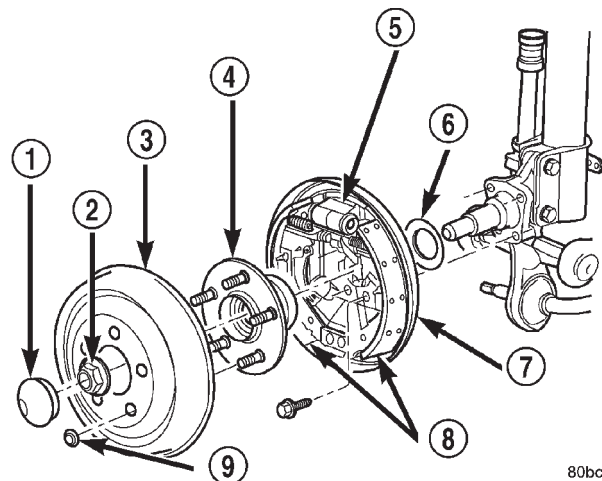
BRAKE DRUM (REAR)

REMOVAL

(1) Raise the vehicle. Refer to HOISTING in the LUBRICATION AND MAINTENANCE group for the proper lifting procedure.

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

(3) Remove the brake drum retaining clips (if equipped) (Fig. 87).



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Fig. 87 Drum Brakes

- 1 - DUST CAP
- 2 - NUT
- 3 - DRUM
- 4 - HUB AND BEARING
- 5 - WHEEL CYLINDER
- 6 - SEAL
- 7 - SUPPORT PLATE
- 8 - BRAKE SHOES
- 9 - RETAINER CLIP

REMOVAL AND INSTALLATION (Continued)

(4) Remove the brake drum (Fig. 87).

NOTE: If the drum does not come off, further brake clearance can be obtained by backing off the brake automatic adjuster screw. Remove the rubber plug from the top of brake support plate. Rotate the automatic adjuster screw in an upward motion, using a screwdriver.

INSTALLATION

NOTE: Before installing the drum, inspect the brake shoe linings for wear, shoe alignment, and contamination.

(1) Install the rear brake drum on rear hub and bearing (Fig. 87).

(2) Install the tire and wheel assembly. Tighten the wheel mounting nuts to a torque of 135 N·m (100 ft. lbs.).

(3) Adjust the rear brake shoes as necessary. Refer to ADJUSTMENTS in this section of this service manual group.

(4) Lower the vehicle.

DRUM BRAKE SHOE SUPPORT PLATE (REAR)

NOTE: Before proceeding with this procedure, review SERVICE WARNINGS AND CAUTIONS at the beginning of REMOVAL AND INSTALLATION in this section.

REMOVAL

(1) Using a brake pedal holding tool as shown (Fig. 88), depress the brake pedal past its first one inch of travel and hold it in this position. This will isolate the master cylinder from the brake hydraulic system and will not allow the brake fluid to drain out of the master cylinder reservoir.

(2) Raise the vehicle. Refer to HOISTING in the LUBRICATION AND MAINTENANCE group for the proper lifting procedure.

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

(4) Disconnect the rear brake flex hose from the wheel cylinder (Fig. 89).

(5) Remove the rear brake drum.

(6) Remove the dust cap (Fig. 90) from the rear hub and bearing.

(7) Remove the nut (Fig. 91) holding the rear hub and bearing to the spindle. Remove the hub and bearing from the spindle.

(8) Remove the rear brake shoes from the brake support plate. Refer to DRUM BRAKE SHOES in this REMOVAL AND INSTALLATION section.

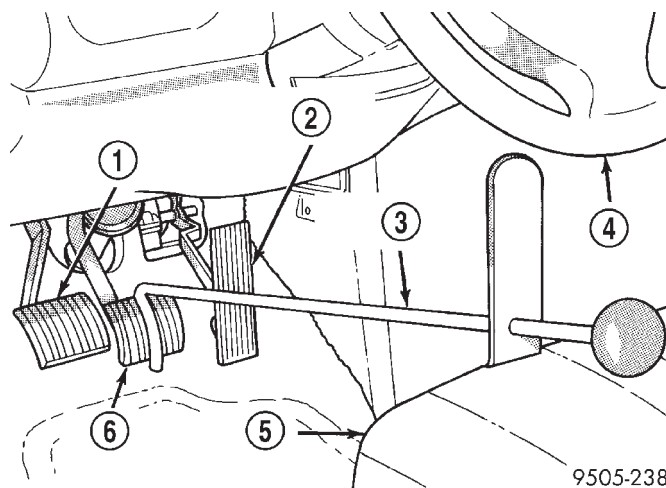


Fig. 88 Brake Pedal Holding Tool

- 1 - CLUTCH PEDAL (IF EQUIPPED WITH MANUAL TRANSAXLE)
- 2 - THROTTLE PEDAL
- 3 - BRAKE PEDAL HOLDING TOOL
- 4 - STEERING WHEEL
- 5 - DRIVER'S SEAT
- 6 - BRAKE PEDAL

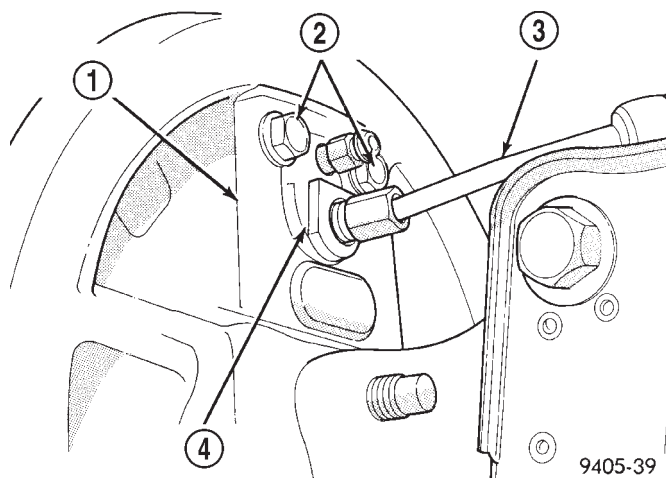


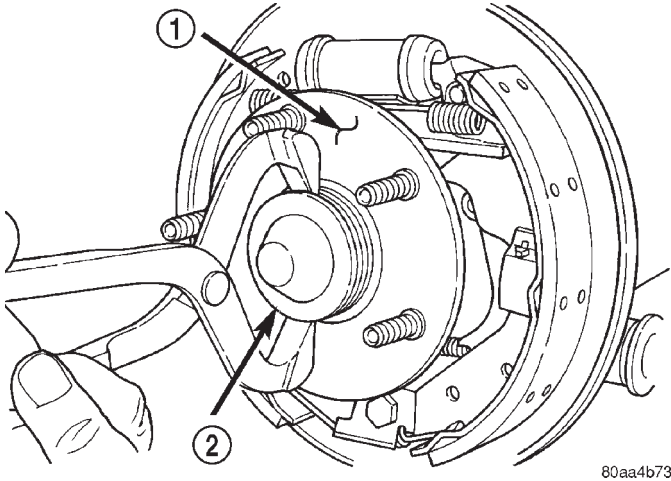
Fig. 89 Brake Flex Hose At Wheel Cylinder

- 1 - BRAKE SUPPORT PLATE
- 2 - WHEEL CYLINDER ATTACHING BOLTS
- 3 - REAR BRAKE FLEX HOSE TUBE
- 4 - WHEEL CYLINDER ASSEMBLY

(9) Remove the parking brake actuator lever from the parking brake cable.

(10) Position a 1/2 inch wrench over the retainer fingers on the end of the parking brake cable (Fig. 92). Compress the cable housing retaining fingers with the wrench, then pull the cable housing out of the support plate. Remove the wrench as the parking brake cable retainer is freed from the mounting hole in the brake support plate.

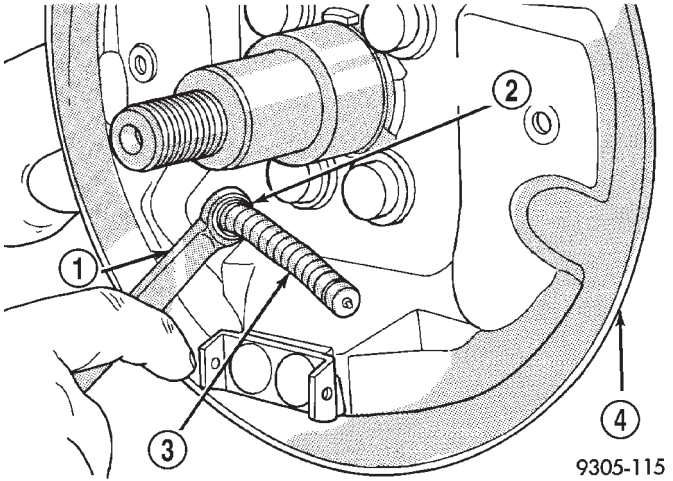
REMOVAL AND INSTALLATION (Continued)



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Fig. 90 Hub And Bearing Dust Cap

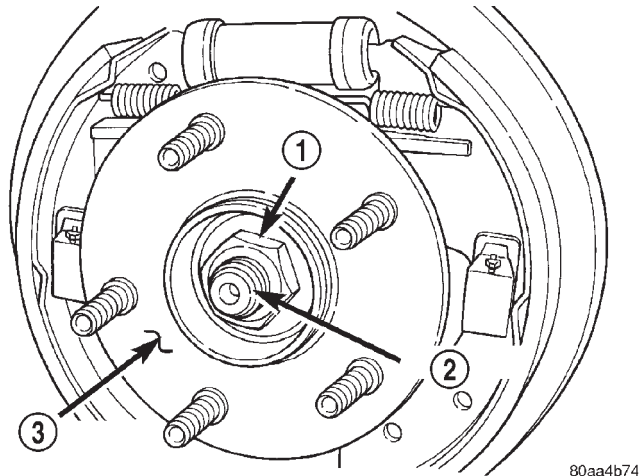
- 1 - HUB/BEARING ASSEMBLY
- 2 - DUST CAP



9305-115

Fig. 92 Removing Park Brake Cable From Support Plate

- 1 - WRENCH
- 2 - CABLE HOUSING RETAINER
- 3 - PARK BRAKE CABLE
- 4 - SUPPORT PLATE



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Fig. 91 Rear Hub And Bearing Retaining Nut

- 1 - RETAINING NUT
- 2 - SPINDLE
- 3 - HUB/BEARING ASSEMBLY

(11) Remove the 4 brake support plate mounting bolts and washers. Separate brake support plate from rear suspension knuckle.

(12) Remove the brake wheel cylinder attaching bolts.

(13) Remove the brake wheel cylinder from the brake support plate.

INSTALLATION

(1) Install a new O-ring at the mating surface of the wheel cylinder-to-brake support plate.

NOTE: When installing wheel cylinder on brake support plate, be sure it is positioned squarely (horizontal) to the brake support plate.

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

(3) Install the brake support plate and gasket on rear suspension knuckle. Tighten the support plate mounting bolts to a torque of 75 N·m (55 ft. lbs.).

(4) Insert the parking brake cable into its mounting hole in the brake support plate. Push the cable housing in until the retainer's fingers lock into place.

(5) Hand start the brake flex hose tube fitting to the wheel cylinder. Tighten the tube nut to a torque of 17 N·m (145 in. lbs.).

(6) Attach the parking brake cable to the parking brake actuator.

(7) Install the rear brake shoe assemblies on the brake support plate.

(8) Install the rear hub and bearing assembly on the spindle. Install a new hub and bearing retaining nut (Fig. 91). Tighten the retaining nut to a torque of 217 N·m (160 ft. lbs.). Install dust cap.

(9) Install the brake drum.

(10) Install the wheel and tire assembly. Tighten the wheel mounting nuts to a torque of 135 N·m (100 ft. lbs.).

(11) Adjust the rear brake shoes. Refer to ADJUSTMENTS in this section of this service manual group.

(12) Lower the vehicle.

(13) Remove the brake pedal holding tool.

(14) Bleed the wheel cylinder as necessary. Refer to BASE BRAKE BLEEDING in the SERVICE PROCEDURES section in this service manual group.

(15) Road test the vehicle to make sure the brakes operate correctly.

REMOVAL AND INSTALLATION (Continued)

PARKING BRAKE LEVER

WARNING: THE AUTOMATIC ADJUSTING FEATURE OF THIS PARKING BRAKE LEVER CONTAINS A CLOCK SPRING LOADED TO APPROXIMATELY 25 POUNDS. DO NOT RELEASE THE AUTOMATIC ADJUSTER LOCKOUT DEVICE UNLESS THE REAR PARKING BRAKE CABLES AND EQUALIZER ARE CONNECTED TO THE LEVER OUTPUT CABLE. KEEP HANDS OUT OF AUTOMATIC ADJUSTER SECTOR AND PAWL AREA. FAILURE TO OBSERVE CAUTION IN HANDLING THIS MECHANISM COULD LEAD TO SERIOUS INJURY.

WARNING: WHEN REPAIRS TO THE PARKING BRAKE LEVER OR CABLES ARE REQUIRED, THE AUTOMATIC ADJUSTER MUST BE LOADED AND LOCKED OUT TO AVOID POSSIBLE INJURY. THE LEVER ADJUSTMENT MECHANISM CAN BE LOADED AND LOCKED OUT AS OUTLINED IN THIS PROCEDURE.

REMOVAL

(1) Block the tire and wheels so the vehicle does not move once the vehicle parking brake lever is released.

(2) Fully apply the parking brake lever, then shift the transmission into neutral.

(3) Remove the screws attaching the center console, then remove the center console.

(4) Lower the parking brake lever handle to the released position.

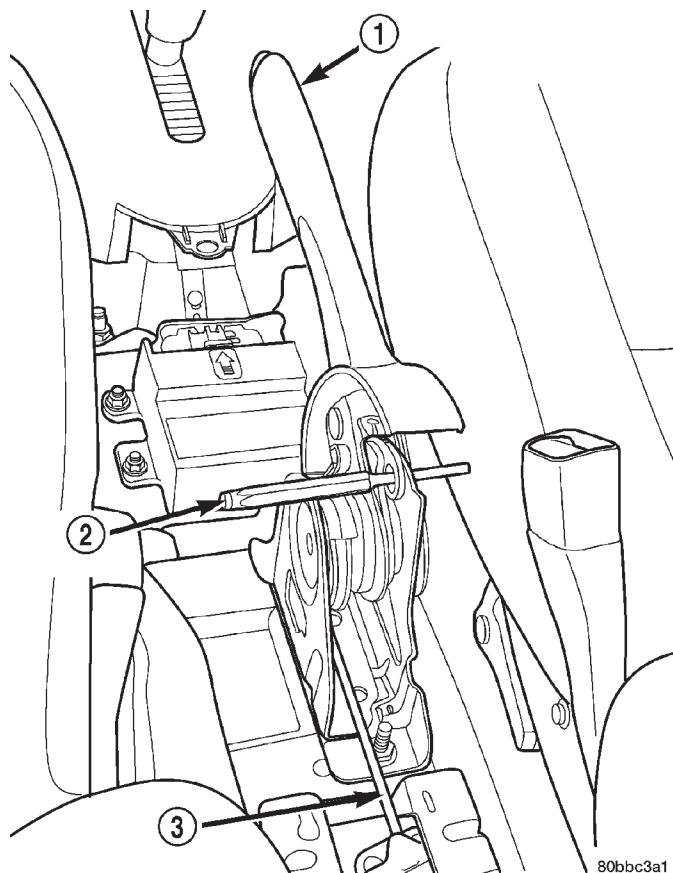
(5) Grasp the parking brake lever output cable by hand and pull upward. Continue pulling on the cable until a pin punch can be inserted through the hole in the lever mechanism sector gear and the hole in the right side of its mounting bracket (Fig. 93). This will lock the parking brake automatic adjustment mechanism in place and take tension off the parking brake cables.

(6) Remove both rear parking brake cables from the parking brake cable equalizer (Fig. 94).

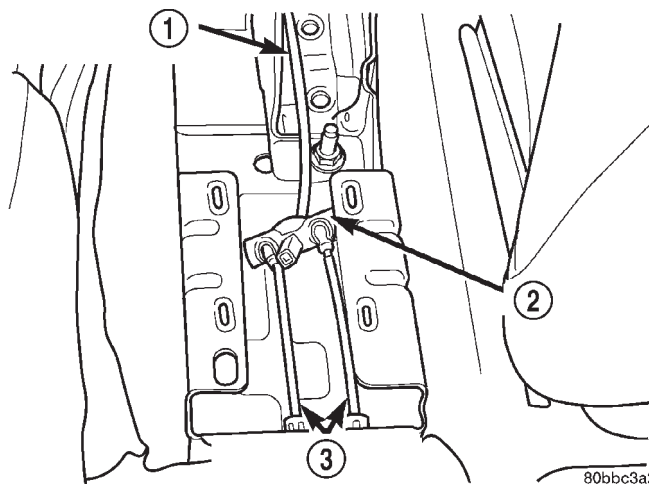
(7) Remove the wiring harness electrical connector from the parking brake warning lamp switch on the parking brake lever (Fig. 95).

(8) Remove the two nuts attaching the parking brake lever to the vehicle (Fig. 95).

(9) Remove the parking brake lever from the vehicle.

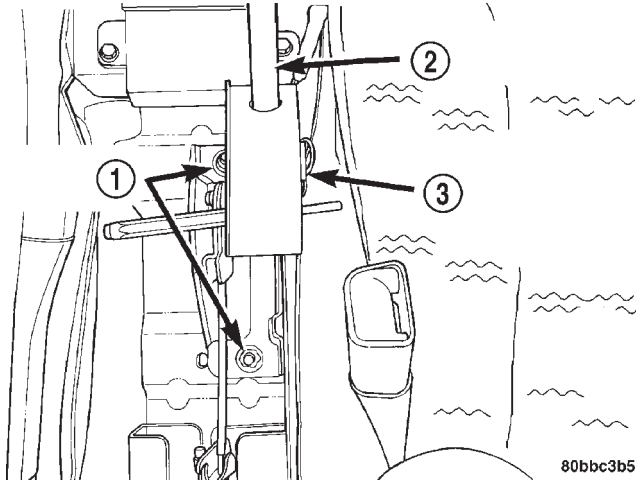
**Fig. 93 Pin Punch Installed**

- 1 - PARKING BRAKE LEVER
- 2 - PIN PUNCH
- 3 - OUTPUT CABLE

**Fig. 94 Parking Brake Cables At Equalizer**

- 1 - LEVER OUTPUT CABLE
- 2 - EQUALIZER
- 3 - REAR PARKING BRAKE CABLES

REMOVAL AND INSTALLATION (Continued)

**Fig. 95 Parking Brake Lever**

- 1 - MOUNTING NUTS
 2 - PARKING BRAKE LEVER
 3 - PARKING BRAKE WARNING LAMP SWITCH CONNECTOR

INSTALLATION

(1) Place the parking brake lever on the mounting studs on the vehicle floor. Install and tighten the two mounting nuts to a torque of 28 N·m (250 in. lbs.) (Fig. 95).

(2) Connect the wiring harness electrical connector on the parking brake warning lamp switch (Fig. 95).

(3) Install both rear park brake cables into the equalizer on the parking brake lever output cable (Fig. 94).

(4) Ensure that the parking brake cables are correctly installed on the equalizer and aligned with the cable track on the parking brake lever.

NOTE: The parking brake lever can only be in the released position when releasing the automatic adjuster.

(5) Keeping your hands clear of the automatic adjuster sector and pawl area, firmly grasp the parking brake lever pin punch (or locking pin if a new mechanism has been installed) (Fig. 93), then quickly remove it from the parking brake lever mechanism. This will allow the park brake lever mechanism to automatically adjust the parking brake cables.

(6) Cycle the parking brake lever once to position the parking brake cables, then return the parking brake lever its released position.

(7) Check the rear wheels of the vehicle. They should rotate freely without dragging with the lever in its released position.

(8) Fully apply the parking brake lever.

(9) Install the center console and its mounting screws.

(10) Remove the blocks from the tires and wheels.

PARKING BRAKE CABLE (REAR)

NOTE: Before proceeding with this procedure, review SERVICE WARNINGS AND CAUTIONS at the beginning of REMOVAL AND INSTALLATION in this section.

The procedure below applies to either of the two rear parking brake cables.

REMOVAL

(1) Block the tire and wheels so the vehicle does not move once the vehicle parking brake lever is released.

(2) Fully apply the parking brake lever, then shift the transmission into neutral.

(3) Remove the screws attaching the center console, then remove the center console.

(4) Lower the parking brake lever handle to the released position.

(5) Grasp the parking brake lever output cable by hand and pull upward. Continue pulling on the cable until a pin punch can be inserted through the hole in the lever mechanism sector gear and the hole in the right side of its mounting bracket (Fig. 93). This will lock the parking brake automatic adjustment mechanism in place and take tension off the parking brake cables.

(6) Remove both rear parking brake cables from the parking brake cable equalizer (Fig. 94).

(7) Remove the rear seat cushion from the vehicle.

(8) Fold the rear carpeting forward to expose the parking brake cables at the end of the rear floor.

(9) Install the box end of a 1/2 inch wrench over the parking brake cable retainer (Fig. 96). Push the wrench onto the retainer until the retainer fingers are collapsed. From under the carpeting, grasp the parking brake cable housing and pull cable straight out of the bracket attached to the floor.

(10) Raise the vehicle. Refer to HOISTING in the LUBRICATION AND MAINTENANCE group for the proper lifting procedure.

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

(12) On vehicles equipped with rear drum brakes, remove the brake drum. Refer to BRAKE DRUM in this section of this service manual group.

(13) On vehicles equipped with rear disc brakes:

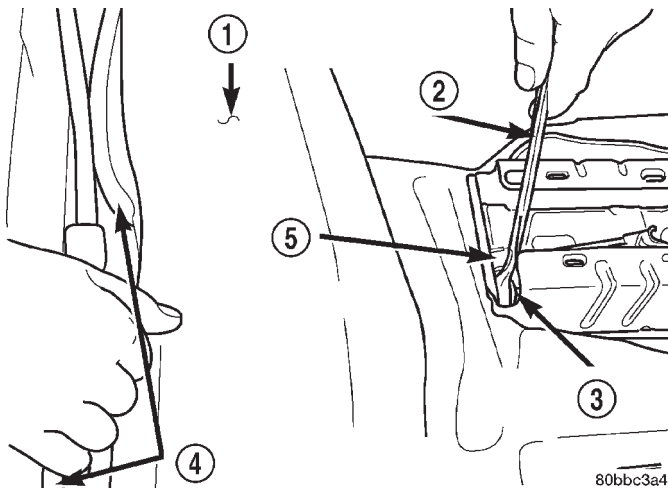
- Remove the disc brake caliper guide pin bolts, then the caliper from disc brake adapter (Fig. 97).

- Hang the caliper out of the way using a wire hanger or cord.

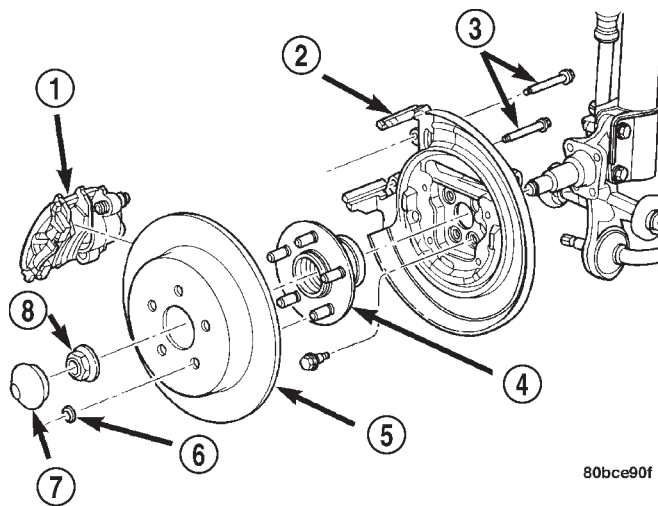
- Remove the brake rotor from the rear hub and bearing.

(14) Remove the dust cap from the rear hub and bearing.

REMOVAL AND INSTALLATION (Continued)

**Fig. 96 Compressing Cable Retainer**

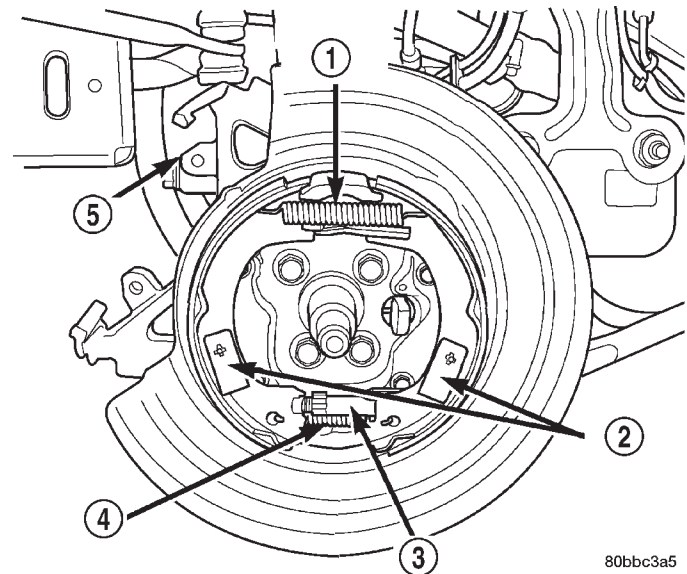
- 1 - CARPET ROLLED FORWARD
- 2 - WRENCH
- 3 - RIGHT REAR CABLE
- 4 - REAR PARKING BRAKE CABLES
- 5 - LEFT REAR CABLE

**Fig. 97 Rear Disc Brakes**

- 1 - DISC BRAKE CALIPER
- 2 - DISC BRAKE ADAPTER
- 3 - GUIDE PIN BOLTS
- 4 - HUB AND BEARING
- 5 - BRAKE ROTOR
- 6 - RETAINER CLIP
- 7 - DUST CAP
- 8 - NUT

(15) Remove the hub and bearing retaining nut from the knuckle spindle, then remove the hub and bearing (Fig. 97).

(16) On vehicles equipped with rear disc brakes, remove the upper return spring, both shoe hold-down clips, then spread the rear parking brake shoes apart at the top enough to clear the shoe anchor and remove the parking brake shoes as an assembly from the disc brake adapter (Fig. 98).

**Fig. 98 Parking Brake Shoes**

- 1 - UPPER RETURN SPRING
- 2 - SHOE HOLD DOWN CLIPS
- 3 - ADJUSTER
- 4 - LOWER REAR SPRING
- 5 - DISC BRAKE ADAPTER

(17) To remove the rear parking brake cable from the brake support plate on vehicles equipped with rear drum brakes:

- Remove the parking brake cable from the parking brake actuating lever (Fig. 99).
- Remove the actuating spring between the brake shoe adjustment lever and the brake shoe (Fig. 100).
- Remove the parking brake cable from the rear brake support plate. The parking brake cable can be removed from brake support plate using a 1/2 inch box wrench to compress the locking fingers on the parking brake cable retainer (Fig. 101).

(18) To remove the rear parking brake cable from the disc brake adapter on vehicles equipped with rear disc brakes:

- Remove the parking brake actuating lever from the parking brake cable (Fig. 102).

REMOVAL AND INSTALLATION (Continued)

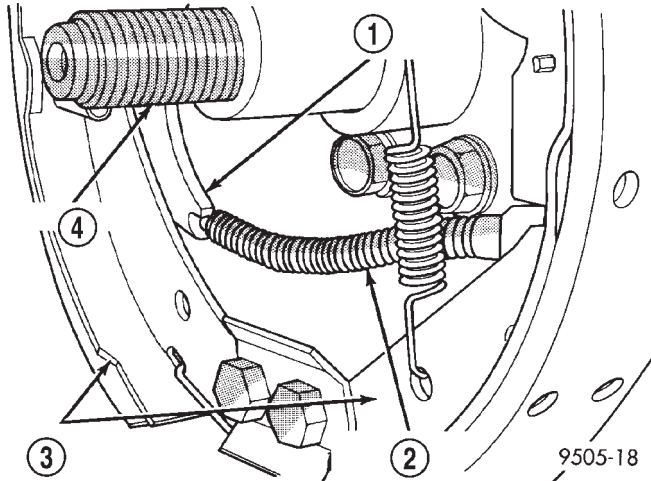


Fig. 99 Actuator Lever

- 1 - PARK BRAKE ACTUATING LEVER
- 2 - PARK BRAKE CABLE
- 3 - BRAKE SHOE ASSEMBLIES
- 4 - REAR SPINDLE

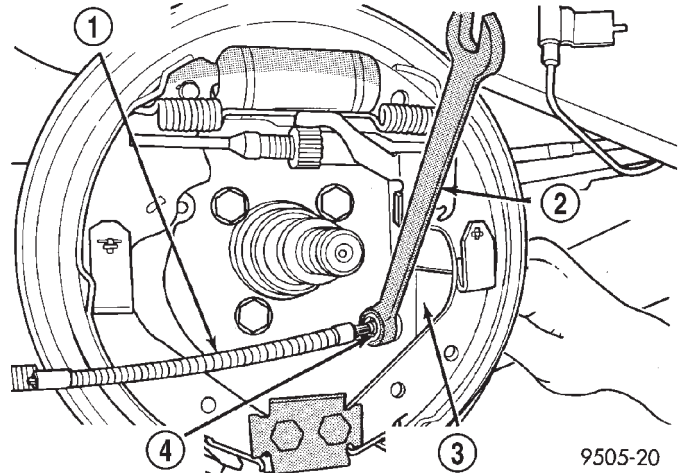


Fig. 101 Parking Brake Cable Removal

- 1 - PARK BRAKE CABLE
- 2 - 1/2" WRENCH
- 3 - REAR BRAKE SUPPORT PLATE
- 4 - PARK BRAKE CABLE RETAINER

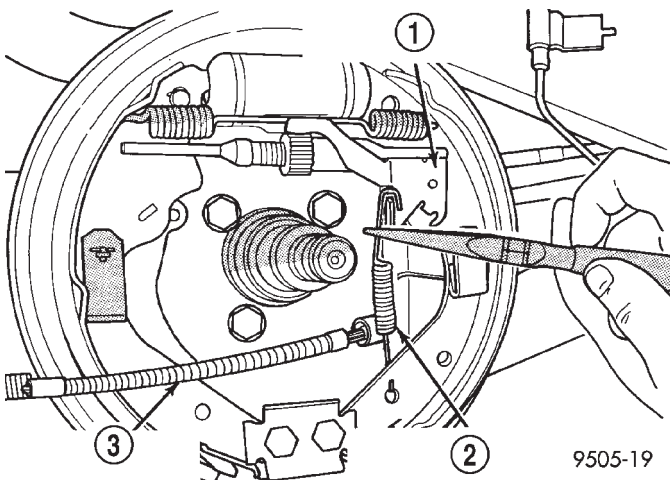


Fig. 100 Actuating Spring

- 1 - BRAKE SHOE ADJUSTMENT LEVER
- 2 - ADJUSTMENT LEVER ACTUATING SPRING
- 3 - PARK BRAKE CABLE

- Remove the parking brake cable from the rear disc brake adapter. The parking brake cable can be removed from the disc brake adapter using a 1/2 inch offset box wrench to compress the locking fingers on the parking brake cable retainer (Fig. 103).

(19) Remove the nut, then the parking brake cable routing bracket from the tension strut mounting bolt (Fig. 104).

(20) Remove the parking brake cable and sealing grommet from floor pan of the vehicle.

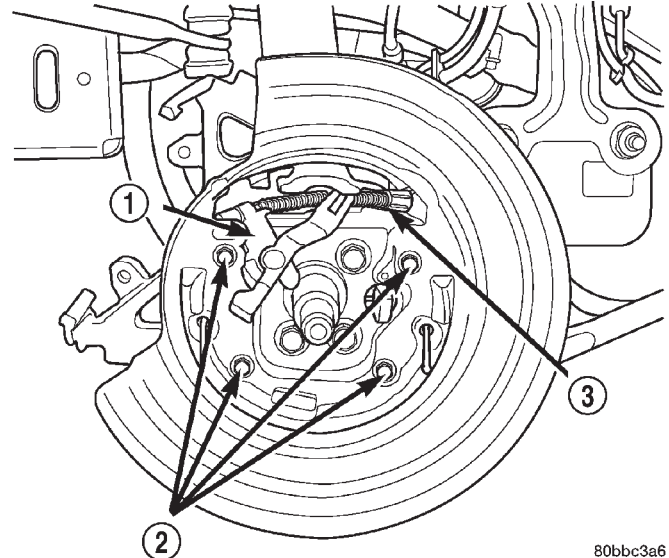


Fig. 102 Parking Brake Actuator Lever

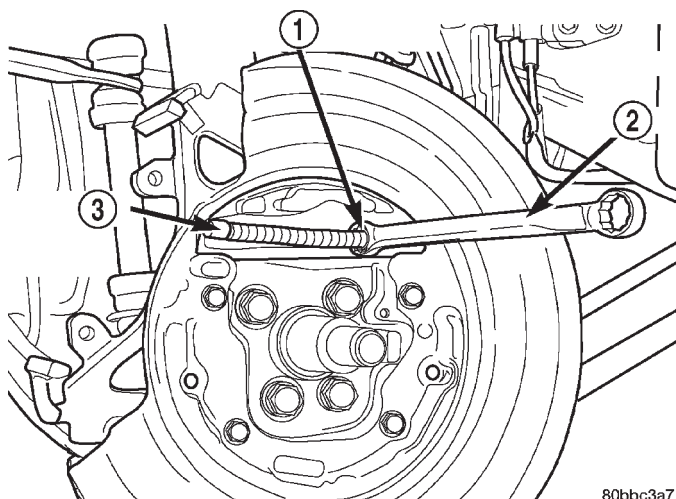
- 1 - SHOE ACTUATOR LEVER
- 2 - SHIELD MOUNTING SCREWS
- 3 - REAR PARKING BRAKE CABLE

INSTALLATION

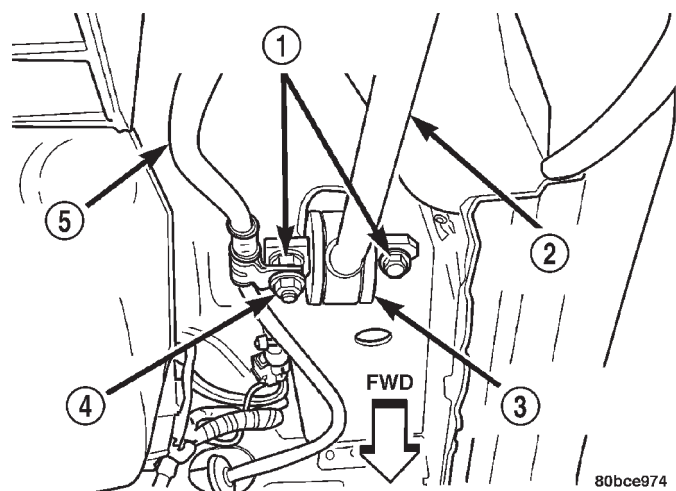
(1) From underneath push the parking brake cable through the hole in the floor pan of the vehicle making sure the cable sealing grommet is installed in the floor pan as far as possible to insure a good seal.

(2) Attach the parking brake cable routing bracket to the tension strut mounting bolt. Install and tighten the mounting nut to a torque of 28 N·m (250 in. lbs.).

REMOVAL AND INSTALLATION (Continued)

**Fig. 103 Parking Brake Cable Removal**

- 1 - CABLE RETAINER
- 2 - OFFSET BOX WRENCH
- 3 - PARKING BRAKE CABLE

**Fig. 104 Cable At Tension Strut**

- 1 - TENSION STRUT MOUNTING BOLTS
- 2 - TENSION STRUT
- 3 - SPOOL BUSHING
- 4 - NUT
- 5 - PARKING BRAKE CABLE

(3) Install the parking brake cable into the brake support plate or the rear disc brake adapter. Be sure the locking fingers on the cable retainer are expanded once the cable is pushed all the way into the support plate or brake adapter hole to ensure the cable is securely held in place.

(4) On vehicles equipped with rear drum brakes:

- Install the parking brake cable on the parking brake cable actuating lever (Fig. 99).
- Install the actuating spring to the brake shoe and the brake adjustment lever (Fig. 100).

(5) On vehicles equipped with rear disc brakes:

- Install the parking brake shoes actuator lever on the parking brake cable (Fig. 102).

- Install the parking brake shoe assemblies on the disc brake adapter (Fig. 98).

(6) Install the hub and bearing on the rear spindle. Install a new hub and bearing retaining nut. Tighten the retaining nut to a torque of 217 N·m (160 ft. lbs.).

(7) Install the hub and bearing dust cap.

(8) On drum brake equipped vehicles, install the rear brake drum.

(9) On vehicles equipped with rear disc brakes, install the brake rotor, then the disc brake caliper (Fig. 97). Install the two caliper guide pin bolts, then tighten them to a torque of 22 N·m (192 in. lbs.).

(10) Install the rear tire and wheel assembly. Tighten all wheel nuts to a torque of 135 N·m (100 ft. lbs.).

(11) Lower the vehicle.

(12) Ensure that the seal grommet on the cable that was installed from underneath is fully seated into the floor pan.

(13) Route the parking brake cable under the carpeting, up to parking brake cable retaining bracket on floor pan. Install the parking brake cable through the retaining bracket. Push the cable in until the locking fingers on the cable retainer lock the cable into place.

(14) Install the rear parking brake cables into the equalizer on the parking brake lever output cable (Fig. 94).

(15) Ensure that the parking brake cables are correctly installed on the equalizer and aligned with the cable track on the parking brake lever.

NOTE: The parking brake lever can be in any position when releasing the automatic adjuster.

(16) Keeping your hands clear of the automatic adjuster sector and pawl area, firmly grasp the parking brake lever pin punch (or locking pin if a new mechanism has been installed) (Fig. 93), then quickly remove it from the parking brake lever mechanism. This will allow the park brake lever mechanism to automatically adjust the parking brake cables.

(17) Cycle the parking brake lever once to position the parking brake cables, then return the parking brake lever its released position.

(18) Check the rear wheels of the vehicle. They should rotate freely without dragging with the lever in its released position.

(19) Reposition the rear carpeting into place.

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

(21) Fully apply the parking brake lever.

REMOVAL AND INSTALLATION (Continued)

(22) Install the center console and its mounting screws.

(23) Remove the blocks from the tires and wheels.

PARKING BRAKE SHOES (REAR DISC BRAKE)

NOTE: Before proceeding with this procedure, review **SERVICE WARNINGS AND CAUTIONS** at the beginning of **REMOVAL AND INSTALLATION** in this section.

REMOVAL

(1) Raise the vehicle. Refer to **HOISTING** in the **LUBRICATION AND MAINTENANCE** group for the proper lifting procedure.

(2) Remove the rear tire and wheel assembly.

(3) Remove the rear disc brake caliper assembly from the brake rotor and store it out of the way. Refer to **DISC BRAKE SHOES (REAR)** in this **REMOVAL AND INSTALLATION** section of this service manual group.

(4) Remove rear brake rotor.

(5) Remove the dust cap from the rear hub and bearing.

(6) Remove the rear hub and bearing assembly retaining nut and washer.

(7) Remove the rear hub and bearing assembly from the rear spindle.

(8) Remove the rear brake shoe assembly hold-down clip (Fig. 105).

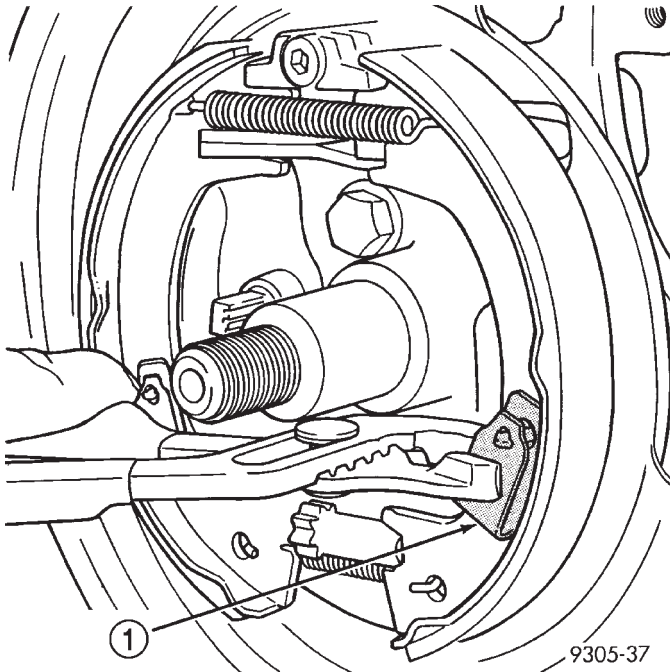


Fig. 105 Rear Brake Shoe Hold-Down Clip

1 - HOLD DOWN CLIP

(9) Turn the brake shoe adjuster wheel until the adjuster is at shortest length.

(10) Remove the adjuster assembly from the parking brake shoe assemblies (Fig. 106).

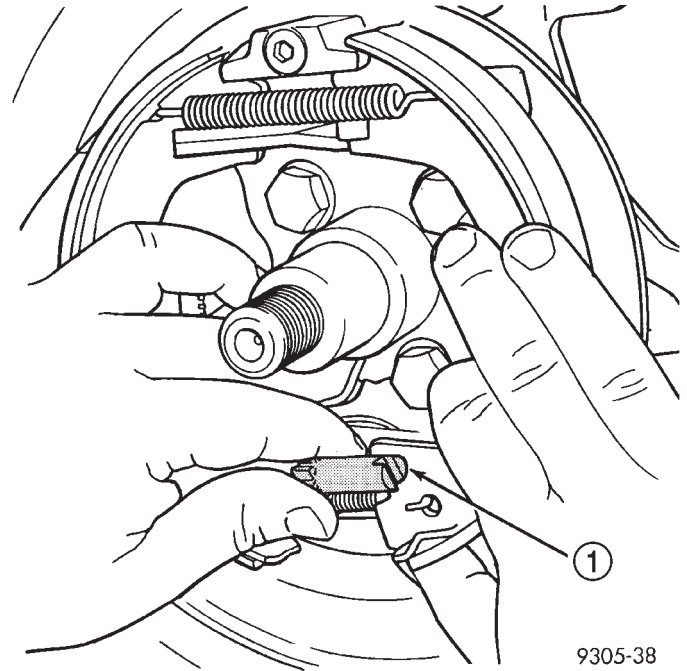


Fig. 106 Parking Brake Shoe Adjuster Assembly

1 - ADJUSTER

(11) Remove the lower shoe-to-shoe spring (Fig. 107).

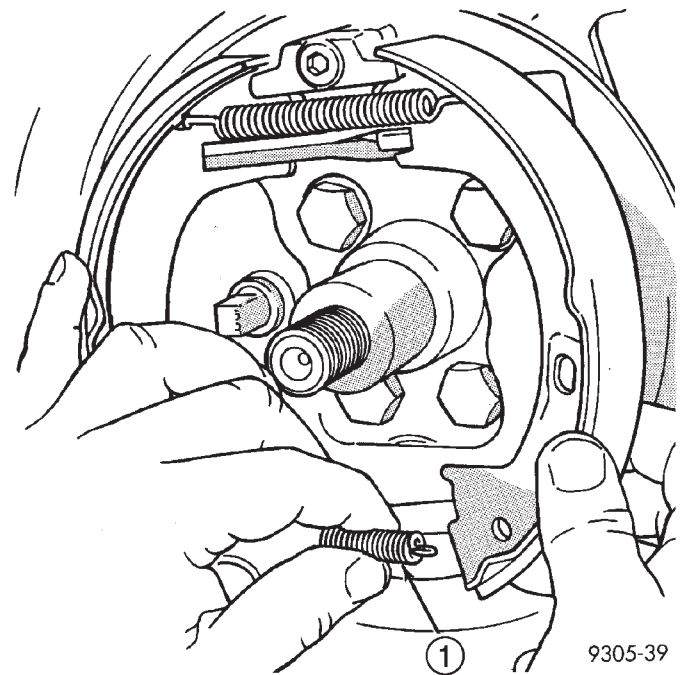
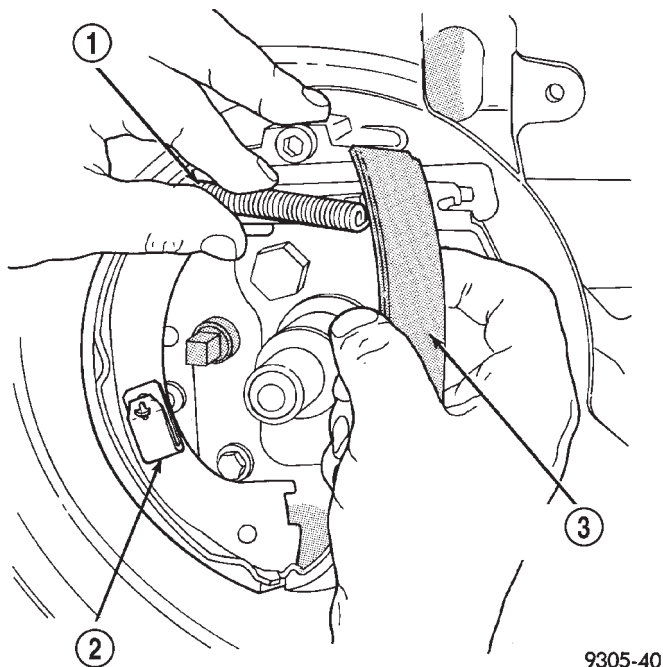


Fig. 107 Brake Shoe Lower Return Spring

1 - LOWER SPRING

REMOVAL AND INSTALLATION (Continued)

(12) Pull the rear brake shoe away from anchor. Remove the rear brake shoe and upper return spring (Fig. 108).



9305-40

Fig. 108 Brake Shoe and Upper Spring

- 1 - UPPER SPRING
- 2 - HOLD DOWN CLIP
- 3 - REAR PARKING BRAKE SHOE

(13) Remove the front brake shoe hold-down clip (Fig. 109). Remove the front brake shoe assembly.

INSTALLATION

(1) Install the front brake shoe and secure it in place with a hold-down clip (Fig. 109).

(2) Install the rear brake shoe and the upper shoe return spring (Fig. 108). Pull the rear brake shoe over the anchor block until it is properly located on the adapter.

(3) Install the lower shoe-to-shoe return spring (Fig. 107).

(4) Install the brake shoe adjuster assembly with the star wheel towards the rear (Fig. 106).

(5) Install the rear brake shoe hold down clip (Fig. 105).

(6) Adjust the parking brake shoes to a diameter to 171 mm (6.75 inch) (Fig. 110).

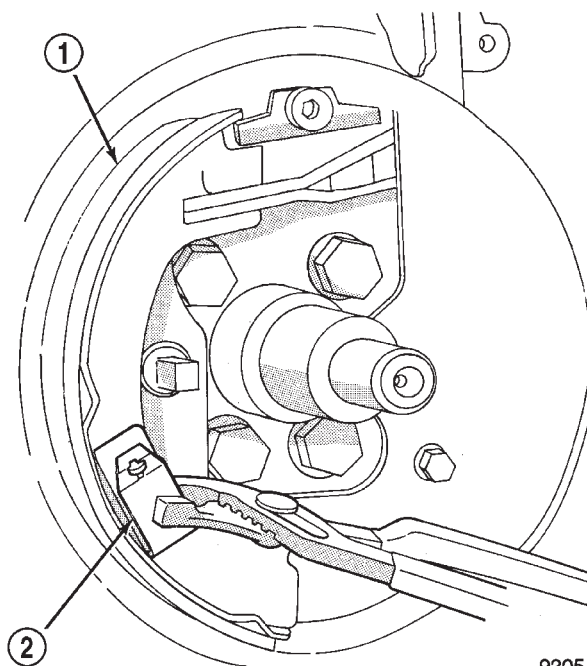
(7) Install the rear hub and bearing assembly on spindle.

(8) Install a new hub and bearing assembly retaining nut. Tighten the retaining nut to a torque of 217 N·m (160 ft. lbs.).

(9) Install the hub and bearing dust cap.

(10) Install the rear brake rotor.

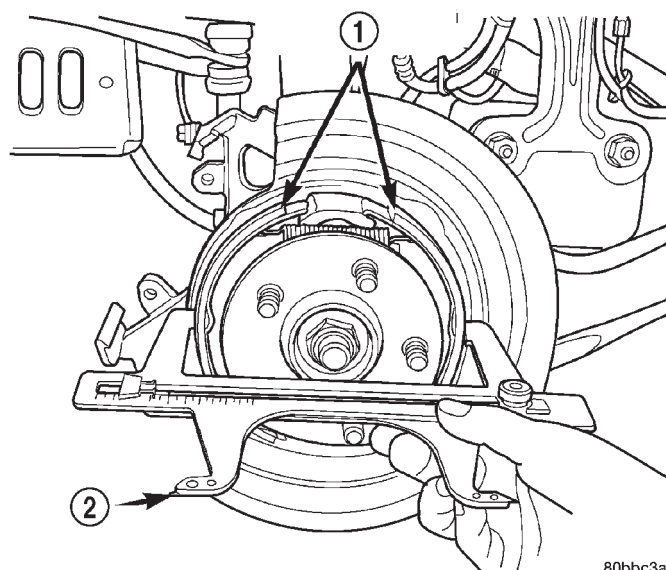
(11) Install rear disc brake caliper.



9305-41

Fig. 109 Front Hold Down Clip And Brake Shoe

- 1 - FRONT BRAKE SHOE ASSEMBLY
- 2 - HOLD DOWN CLIP



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Fig. 110 Measuring Brake Shoes

- 1 - REAR PARKING BRAKE SHOES
- 2 - BRAKE SHOE GAUGE

(12) Install the tire and wheel assembly. Tighten the wheel mounting nuts to a torque of 135 N·m (100 ft. lbs.).

(13) Repeat the above procedure to the parking brake shoes on the other side of the vehicle.

REMOVAL AND INSTALLATION (Continued)

(14) Adjust the parking brake shoes as necessary. Refer to ADJUSTMENTS in this section of this service manual group.

(15) Lower the vehicle.

DISASSEMBLY AND ASSEMBLY

DISC BRAKE CALIPER (FRONT AND REAR)

Before disassembling the brake caliper, clean and inspect it. Refer to CLEANING AND INSPECTION in this section of this service manual group.

CALIPER GUIDE PIN BUSHING

REMOVAL

(1) With one hand, push the guide pin bushing sleeve towards the back of the caliper, and at the same time, pull the sleeve out the back of the caliper and bushing (Fig. 111).

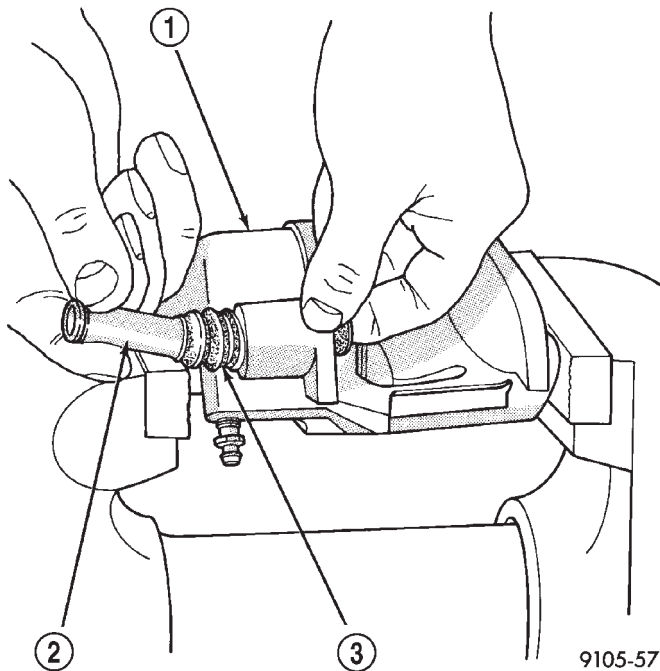
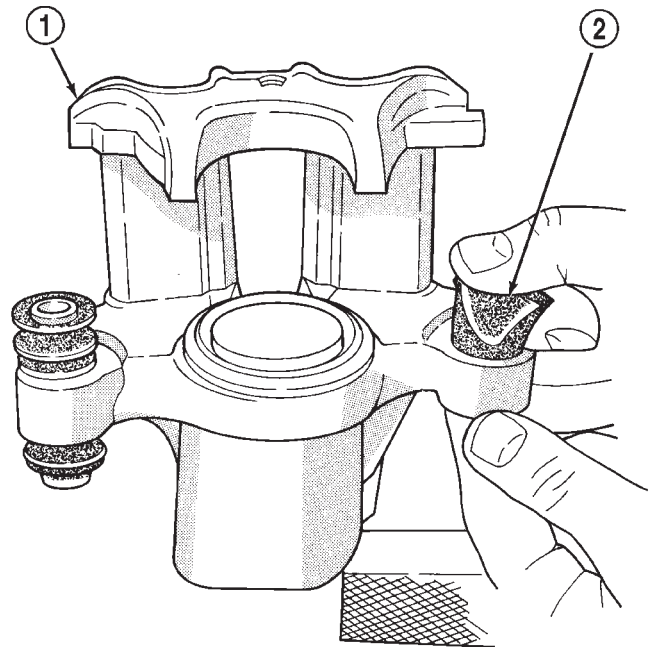


Fig. 111 Removing Sleeve From Bushing

- 1 - CALIPER
- 2 - SLEEVE
- 3 - BUSHING

(2) Using your fingers, collapse one side of the rubber guide pin bushing. Pull the guide pin bushing out the other side of the brake caliper mounting boss (Fig. 112).



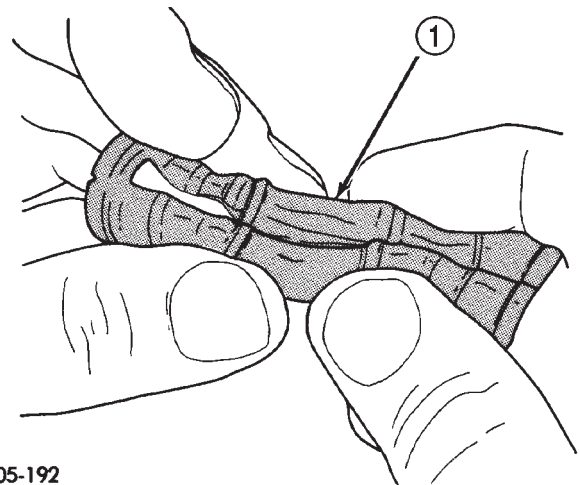
9105-58

Fig. 112 Removing Bushing From Caliper

- 1 - CALIPER
- 2 - BUSHING

INSTALLATION

(1) Fold the guide pin bushing in half lengthwise at the solid middle section (Fig. 113).



9205-192

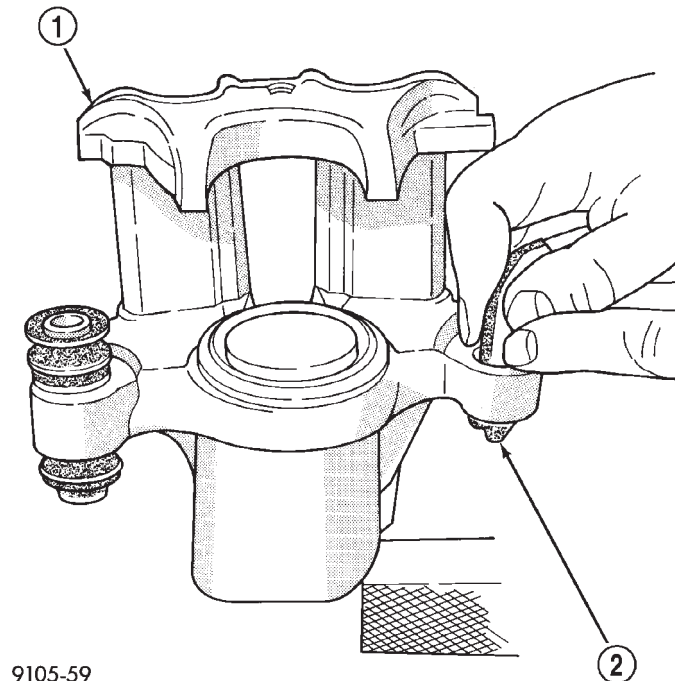
Fig. 113 Folded Caliper Guide Pin Bushing

- 1 - CALIPER GUIDE PIN BUSHING

NOTE: To avoid damage to the bushing, do not use a sharp object to install the guide pin bushing.

DISASSEMBLY AND ASSEMBLY (Continued)

(2) Insert the folded bushing into the caliper mounting boss using your fingers (Fig. 114).



9105-59

Fig. 114 Installing Caliper Guide Pin Bushing

- 1 - CALIPER
- 2 - BUSHING

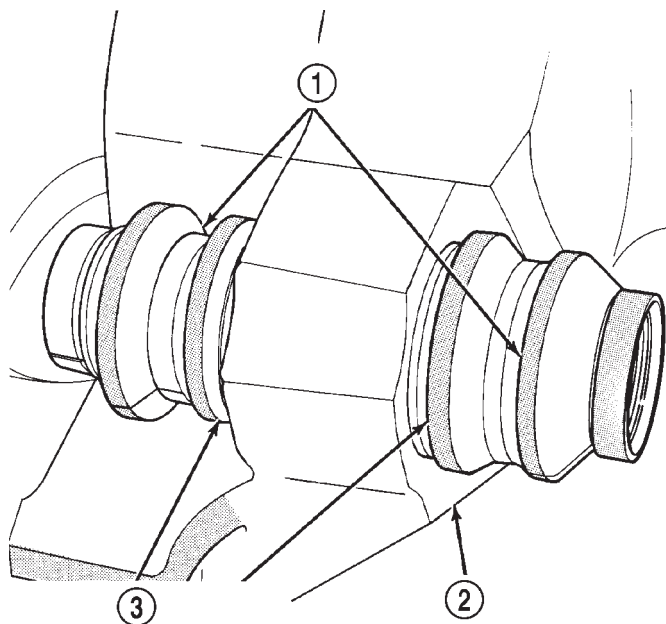
(3) Unfold the bushing using your fingers or a wooden dowel until the bushing is fully seated into the caliper housing. The bushing flanges should be seated evenly on both sides of the bushing hole (Fig. 115).

(4) Lubricate the inside surfaces of the bushing using Mopar® Dielectric Grease or an equivalent.

(5) Install the guide pin sleeve into one end of bushing until the seal area of bushing is past the seal groove in the sleeve (Fig. 116).

(6) Holding the convoluted boot on the opposite end of the bushing, push the steel sleeve through the bushing until the bushing boot is fully seated into the seal groove on that end of sleeve (Fig. 116). Install the other end bushing boot into the groove on that end of the bushing sleeve.

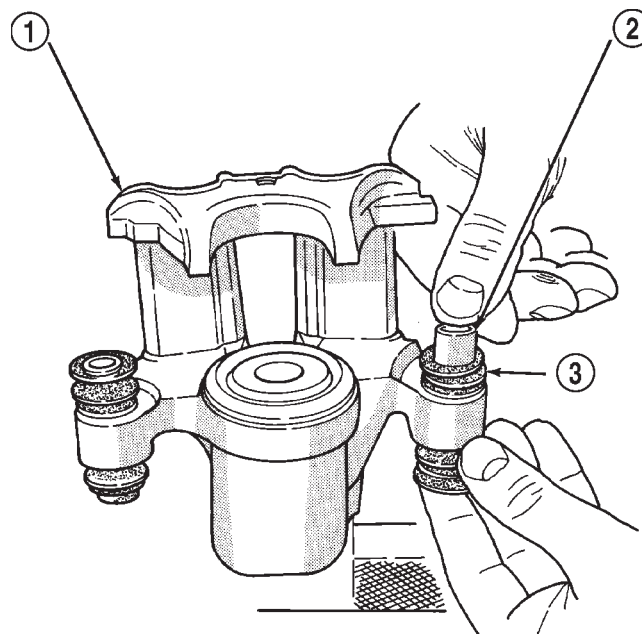
(7) Verify both ends of the bushing are seated in the sleeve grooves (Fig. 117). When the sleeve is seated properly into the bushing, the sleeve/bushing can be held between your fingers and easily slid back and forth without the bushing unseating from the sleeve groove.



9205-193

Fig. 115 Bushing Correctly Installed In Caliper

- 1 - BUSHING
- 2 - CALIPER
- 3 - BE SURE BOTH BUSHING FLANGES ARE FULLY SEATED AROUND CALIPER BUSHING BORES.



9105-60

Fig. 116 Installing Sleeve In Bushing

- 1 - CALIPER
- 2 - SLEEVE
- 3 - BUSHING

DISASSEMBLY AND ASSEMBLY (Continued)

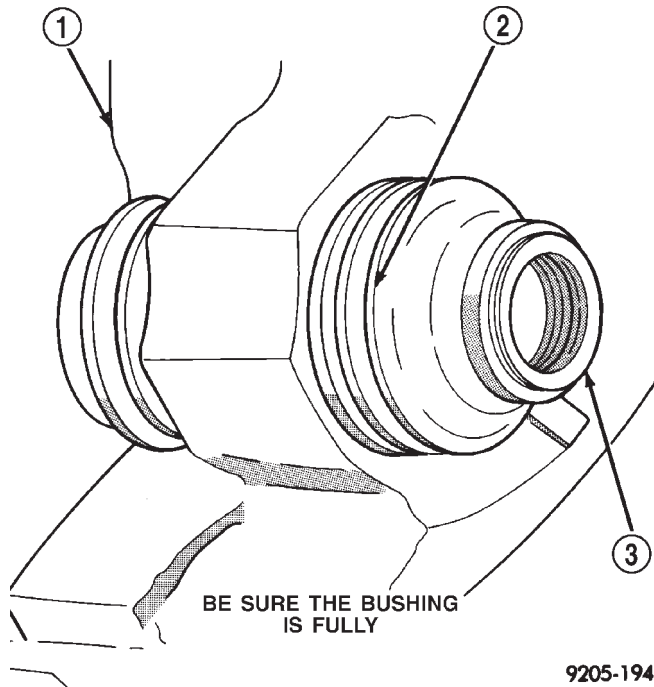


Fig. 117 Correctly Installed Guide Pin Sleeve And Bushing

- 1 - CALIPER
- 2 - BUSHING
- 3 - SLEEVE

CALIPER PISTON AND SEALS

CALIPER PISTON REMOVAL

WARNING: UNDER NO CONDITION SHOULD HIGH PRESSURE AIR EVER BE USED TO REMOVE A PISTON FROM A CALIPER BORE. PERSONAL INJURY COULD RESULT FROM SUCH A PRACTICE.

NOTE: The safest way to remove the piston from the caliper bore is to use the hydraulic pressure of the vehicle's brake system.

(1) Following the removal procedure in DISC BRAKE SHOES found in this section, remove the caliper from the brake rotor and hang the assembly on a wire hook away from rotor and body of the vehicle so brake fluid cannot get on these components. Remove the brake shoes, and place a small piece of wood between the piston and caliper fingers.

(2) Carefully depress the brake pedal to hydraulically push piston out of its bore. Once completed, apply and hold down the brake pedal to any position beyond the first inch of pedal travel using a brake pedal holding tool. This will prevent the fluid in the master cylinder reservoir from completely draining out.

(3) Disconnect the brake fluid flex hose from the caliper assembly and remove it from the vehicle.

CALIPER SEAL REMOVAL

CAUTION: Do not use excessive force when clamping caliper in vise. Excessive vise pressure will cause bore distortion.

(1) To disassemble the caliper, mount it in a vise equipped with protective jaws.

(2) Remove the piston dust boot from the caliper and discard (Fig. 118).

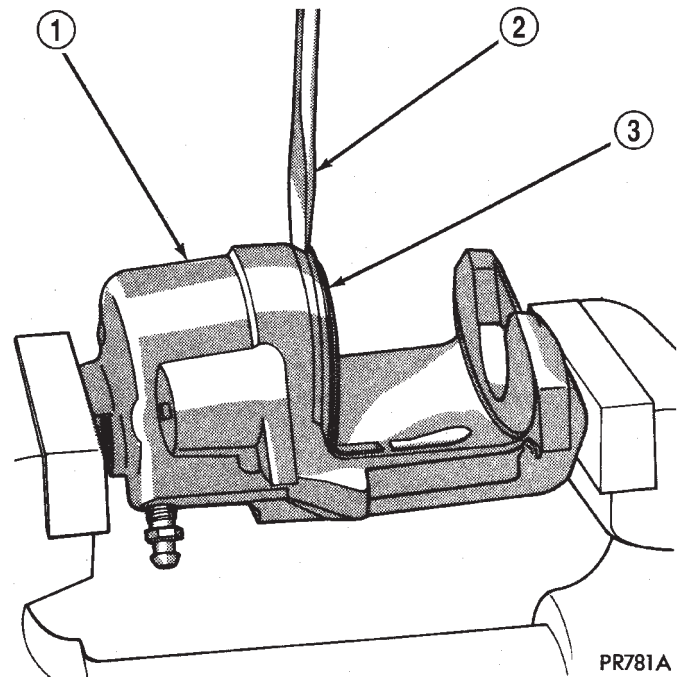


Fig. 118 Removing Caliper/Piston Dust Boot

- 1 - CALIPER
- 2 - SCREWDRIVER
- 3 - BOOT

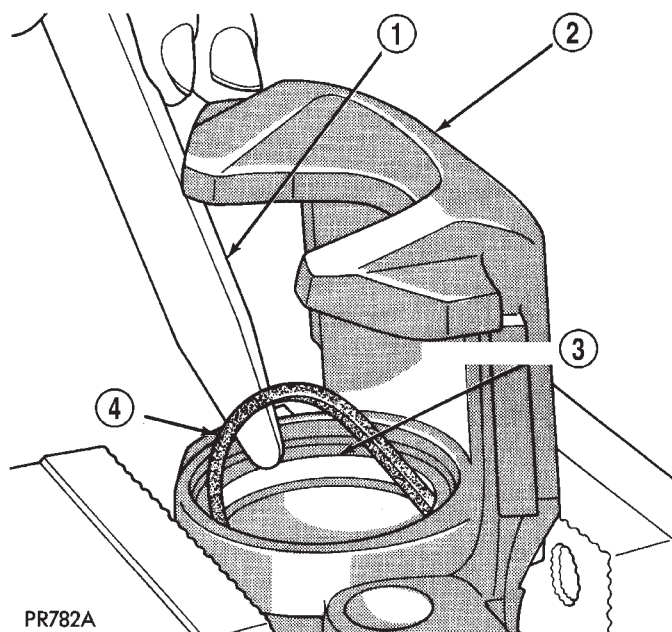
NOTE: Do not use a screw driver or other metal tool for seal removal. Using such tools can scratch the bore or leave burrs on the seal groove edges.

(3) Using a soft tool such as a plastic trim stick, work the piston seal out of its groove in caliper piston bore (Fig. 119). Discard the old seal.

(4) Clean the piston bore and drilled passage ways using alcohol or a suitable solvent. Wipe it dry using only a lint-free cloth.

(5) Inspect the piston bore for scoring or pitting. Bores that show light scratches or corrosion can usually be cleared of the light scratches or corrosion using crocus cloth. Bores that have deep scratches or scoring should be honed. Use Caliper Hone, Special Tool C-4095, or the equivalent to hone the bore. Do

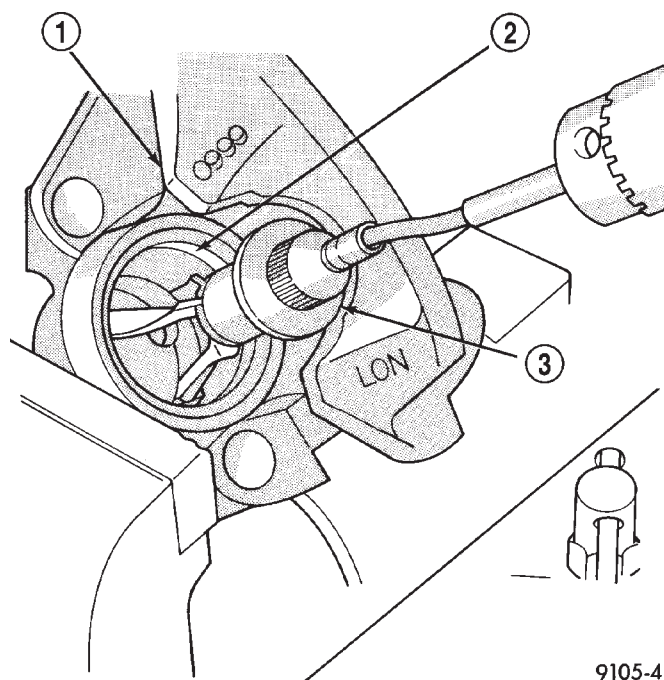
DISASSEMBLY AND ASSEMBLY (Continued)



PR782A

Fig. 119 Removing Piston Seal

- 1 - PLASTIC TRIM STICK
- 2 - CALIPER
- 3 - PISTON SEAL GROOVE
- 4 - PISTON SEAL



9105-41

Fig. 120 Honing Brake Caliper Piston Bore

- 1 - CALIPER
- 2 - CALIPER BORE
- 3 - SPECIAL TOOL C-4095

not over-hone the bore. Do not increase the diameter of the bore more than 0.0254 mm (0.001 inch) (Fig. 120). If the bore does not clean up within this specification, a new caliper housing should be installed.

NOTE: During the honing procedure, coat the stones and bore with brake fluid. After honing the bore, carefully clean the seal and boot grooves with a stiff non-metallic rotary brush. Use extreme care in cleaning the caliper after honing. Remove all dirt and grit by flushing the caliper bore with fresh clean brake fluid; wipe it dry with a clean, lint free cloth and then clean it a second time.

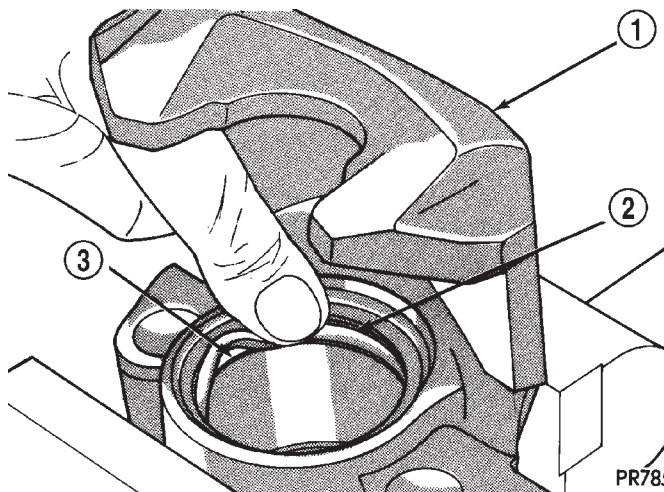
(6) Inspect the caliper piston for pitting, scratches, or any physical damage. Replace the piston if there is evidence of scratches, pitting or physical damage.

CALIPER SEAL AND PISTON INSTALLATION

NOTE: Never use an old piston seal.

(1) Dip the new piston seal in clean brake fluid and install it in the groove of the caliper bore. The seal should be started at one area of the groove and gently worked around and into the groove (Fig. 121) using only your clean fingers to seat it.

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



PR785

Fig. 121 Installing New Piston Seal

- 1 - CALIPER
- 2 - PISTON SEAL
- 3 - SEAL GROOVE

(3) Position the dust boot over the piston after coating it with brake fluid.

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

DISASSEMBLY AND ASSEMBLY (Continued)

(4) Install piston into caliper bore pushing it past the piston seal until it bottoms in the caliper bore (Fig. 122).

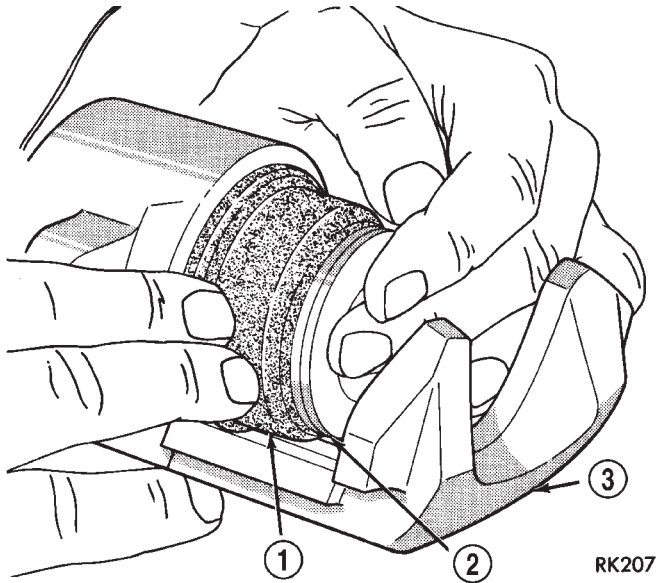


Fig. 122 Installing Piston Into Caliper Bore

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

(5) Position the dust boot into the counterbore of the caliper assembly piston bore.

(6) Using a hammer and Installer, Special Tool C-4689, and Handle, Special Tool C-4171, drive the boot into the counterbore of the caliper (Fig. 123).

(7) Install the brake shoes.

(8) Reinstall the caliper on the vehicle and bleed the brakes as necessary. Follow the installation procedure found in DISC BRAKE CALIPER in the REMOVAL AND INSTALLATION section in this section of this service manual group.

CLEANING AND INSPECTION

BRAKE TUBES AND HOSES

Flexible rubber hose is used at both front and rear brakes. Inspection of brake hoses should be performed whenever the brake system is serviced and every 7,500 miles or 12 months, whichever comes first (every engine oil change). Inspect hydraulic brake hoses for severe surface cracking, scuffing, worn spots or physical damage. If the fabric casing of the rubber hose becomes exposed due to cracks or abrasions in the rubber hose cover, the hose should be replaced immediately. Eventual deterioration of the hose can take place with possible burst failure. Faulty installation can cause twisting, resulting in wheel, tire, or chassis interference.

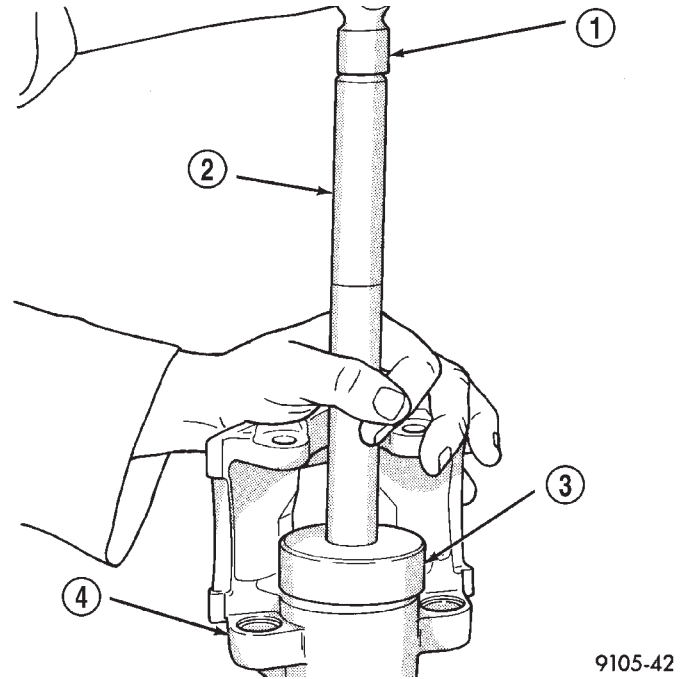


Fig. 123 Installing Dust Boot In Caliper Counterbore

- 1 - HAMMER
- 2 - SPECIAL TOOL C-4171
- 3 - SPECIAL TOOL C-4689
- 4 - CALIPER

The steel brake tubing should be inspected periodically for evidence of corrosion, physical damage or contact with moving or hot components of the vehicle.

DISC BRAKES (FRONT)

BRAKE SHOES

Clean the front brake shoes and calipers with a water-dampened cloth or with a brake cleaner. Do not use a petroleum based product.

If a visual inspection does not adequately determine the condition of the lining, a physical check will be necessary.

Remove the front disc brake shoes. Refer to DISC BRAKE SHOES in the REMOVAL AND INSTALLATION section in this section of this service manual group.

The combined brake shoe and lining material thickness should be measured at the thinnest part of the assembly.

When a set of brake shoes are worn to a total thickness of approximately 7.95 mm (5/16 inch) or less, they should be replaced.

Replace both brake shoe assemblies (inboard and outboard). It is necessary that both front wheel sets be replaced whenever brake shoe assemblies on either side are replaced.

CLEANING AND INSPECTION (Continued)

If the brake shoe assemblies do not require replacement, reinstall the assemblies making sure each brake shoe is returned to the original position. Refer to DISC BRAKE SHOES in the REMOVAL AND INSTALLATION section in this section of this service manual group.

CALIPER INSPECTION

Check for brake fluid leaks in and around the boot area. Check for any ruptures, brittleness or damage to the piston dust boot. If the boot is damaged, or a fluid leak is visible, disassemble the caliper assembly and install a new seal and boot, and a piston if it is scored. Refer to DISC BRAKE CALIPER in the DISASSEMBLY AND ASSEMBLY section in this section of this service manual group.

Check the guide pin dust boots to determine if they are in good condition. Replace if they are damaged, dry, or found to be brittle. Refer to DISC BRAKE CALIPER in the DISASSEMBLY AND ASSEMBLY section in this section of this service manual group.

DISC BRAKES (REAR)

BRAKE SHOES

Clean the rear brake shoes and calipers with a water-dampened cloth or with a brake cleaner. Do not use a petroleum based product.

If a visual inspection does not adequately determine the condition of the lining, a physical check will be necessary.

Remove the rear disc brake shoes. Refer to DISC BRAKE SHOES in the REMOVAL AND INSTALLATION section in this section of this service manual group.

The combined brake shoe and lining material thickness should be measured at the thinnest part of the assembly.

When a set of brake shoes are worn to a total thickness of approximately 7.0 mm (9/32 inch) or less, they should be replaced.

Replace both brake shoe assemblies (inboard and outboard). It is necessary that both front wheel sets be replaced whenever brake shoe assemblies on either side are replaced.

If the brake shoe assemblies do not require replacement, reinstall the assemblies making sure each brake shoe is returned to the original position. Refer to DISC BRAKE SHOES in the REMOVAL AND INSTALLATION section in this section of this service manual group.

CALIPER INSPECTION

Check for brake fluid leaks in and around the boot area. Check for any ruptures, brittleness or damage to the piston dust boot. If the boot is damaged, or a

fluid leak is visible, disassemble the caliper assembly and install a new seal and boot, and a piston if it is scored. Refer to DISC BRAKE CALIPER in the DISASSEMBLY AND ASSEMBLY section in this section of this service manual group.

Check the guide pin dust boots to determine if they are in good condition. Replace if they are damaged, dry, or found to be brittle. Refer to DISC BRAKE CALIPER in the DISASSEMBLY AND ASSEMBLY section in this section of this service manual group.

DRUM BRAKES (REAR)

BRAKE SHOES

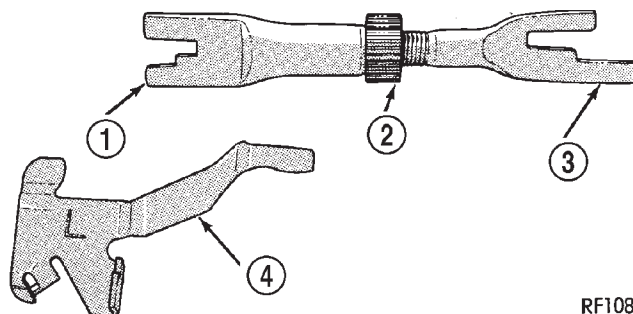
Clean the rear brake shoes and springs with a water-dampened cloth or with a brake cleaner. Do not use a petroleum based product.

Rear brake shoe lining should show contact across the entire width of the lining and also from the heel to the toe of the lining. Replace the shoes if noted otherwise.

Brake shoes with lack of contact at the toe or heel of the brake shoe lining may be improperly ground.

Clean and inspect the brake support plate and shoe adjuster screw. Apply a thin coat of Mopar® Multi-Purpose Lubricant or equivalent to the threads of the self-adjuster (Fig. 124). Replace the adjuster screw if it is corroded.

NOTE: Adjuster screws are different side-to-side. Left side adjuster screws have left-hand threads and right side adjuster screws have right-handed threads.



RF108

Fig. 124 Adjuster Screw And Lever (Typical)

- 1 - OUTBOARD FORWARD
- 2 - SELF ADJUSTER
- 3 - OUTBOARD REAR
- 4 - SELF ADJUSTER LEVER

If the old brake shoe return or hold down springs have overheated or are damaged, replace them. Overheating indications are paint discoloration or distorted end coils.

CLEANING AND INSPECTION (Continued)

WHEEL CYLINDER

With the brake drums removed, inspect the wheel cylinder boots for evidence of a brake fluid leak. Visually check the boots for cuts, tears, or heat cracks. If any of these conditions exist, the wheel cylinders should be completely cleaned, inspected and new parts installed.

If a wheel cylinder is leaking and the brake lining material is saturated with brake fluid, the brake shoes must be replaced.

ADJUSTMENTS

BRAKE LAMP SWITCH

(1) Depress and hold the brake pedal while rotating the brake lamp switch (Fig. 125) in a counter-clockwise direction approximately 30 degrees.

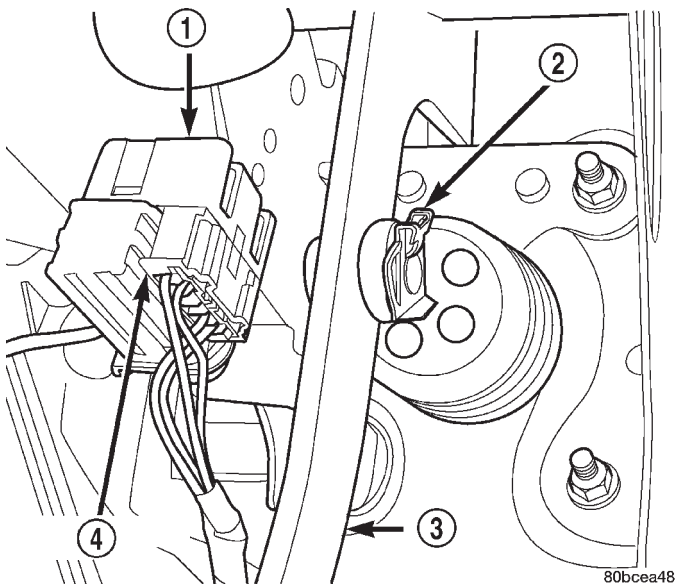


Fig. 125 Brake Lamp Switch

- 1 - SWITCH
- 2 - CLIP
- 3 - BRAKE PEDAL
- 4 - CONNECTOR

(2) Pull the switch rearward and remove it from its mounting bracket.

(3) If necessary, disconnect the wiring harness connector from the switch.

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

(5) If disconnected, connect the wiring harness connector to the stop lamp switch.

(6) Mount the brake lamp switch into the bracket using the following procedure:

- Depress the brake pedal as far down as possible.
- Install the switch in its bracket by aligning the index tab on the switch with the slot in the mounting bracket.
- When the switch is fully seated in its bracket, rotate the switch clockwise approximately 30° to lock the switch into place.

CAUTION: Do not use excessive force when pulling back on the brake pedal to adjust the brake lamp switch. If too much force is used, the switch or striker can be damaged.

(7) Gently pull back on the brake pedal until the pedal stops moving. This will ratchet the switch plunger backward to the correct adjustment position.

(8) Check the stop lamps to verify that they are operating properly and not staying on when the pedal is in the released position.

DRUM BRAKE SHOES

(1) Verify the parking brake lever is in the fully released position.

(2) Raise the vehicle. Refer to HOISTING in the LUBRICATION AND MAINTENANCE group for the proper lifting procedure.

(3) Remove the rear brake adjusting hole rubber plug from the rear brake shoe support plate (Fig. 126).

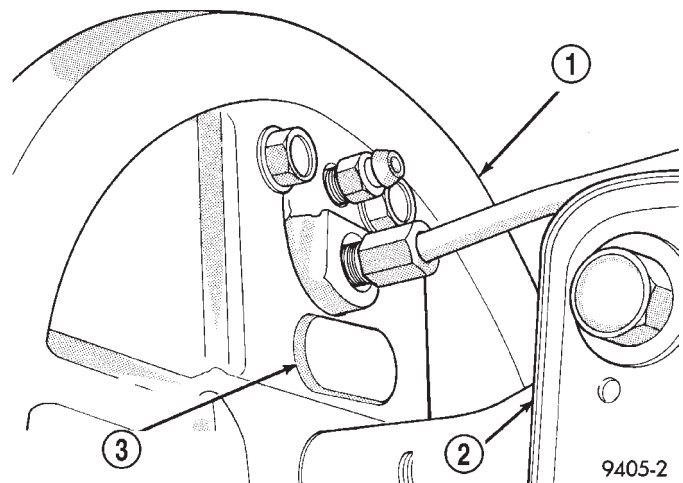


Fig. 126 Rear Brake Adjusting Hole Plug

- 1 - REAR BRAKE SUPPORT PLATE
- 2 - REAR STRUT
- 3 - BRAKE ADJUSTING HOLE PLUG

ADJUSTMENTS (Continued)

(4) Insert a brake adjustment tool, or a screwdriver, through the adjusting hole in support plate and against the star wheel of the adjuster screw. Move the handle of tool downward to adjust the brake drag. Rotate the tire and wheel assembly while adjusting the adjuster screw. Continue to adjust the shoes until a slight drag is noticed when the tire and wheel assembly is rotated.

NOTE: In the event the brake shoes are over-adjusted, the adjuster can be backed off using the following step. If not, proceed to step 6.

(5) If the shoes are in the over-adjusted position, insert a thin screwdriver into brake adjusting hole and push back the adjusting lever out of engagement with star wheel (Fig. 127). Take care not to bend the adjusting lever. While holding the adjusting lever out of engagement with star wheel, back off the star wheel until the tire and wheel assembly is free to turn without dragging. Repeat the adjustment procedure.

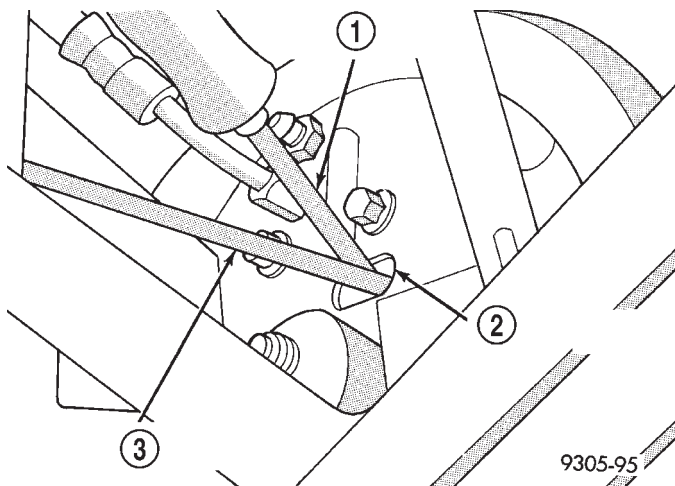


Fig. 127 Backing Off Brake Adjuster Screw

- 1 - MEDIUM SCREWDRIVER
- 2 - BRAKE ADJUSTING HOLE
- 3 - THIN SCREWDRIVER OR WELDING ROD

(6) Install adjusting hole rubber plug (Fig. 126).

(7) Repeat the above adjustment procedure to the other side brakes.

(8) Apply and release the park brake lever one time after the adjustment process is completed so the parking brakes can readjust themselves to the new brake shoe adjustment.

PARKING BRAKE SHOES (REAR DISC BRAKES)

NOTE: The parking brake shoes used in the drum-in-hat park brake system do not automatically adjust to compensate for brake shoe lining wear.

Therefore, it is necessary to manually adjust the parking brake shoes.

(1) Verify the parking brake lever is in the released position.

(2) Raise the vehicle. Refer to HOISTING in the LUBRICATION AND MAINTENANCE group for the proper lifting procedure.

(3) Remove the rubber plug from the adjusting hole in the disc brake caliper adapter.

(4) Adjust the parking brakes. Use the first bullet point for the adjustment of the left side parking brake shoes. Use the second bullet point for the adjustment of the right side parking brake shoes.

- Insert a medium size screwdriver through adjustment hole in the left backing plate. Position the screwdriver against the star wheel on the parking brake shoe adjuster. Using the screwdriver, rotate the star wheel downward until a slight drag is noticed when turning the rear tire and wheel assembly. Then, using the screwdriver, slowly rotate the star wheel upward, backing off the adjuster, just enough to allow the rear tire and wheel assembly to rotate without the parking brake shoes dragging. Do not back off the adjuster star wheel more than two clicks past the point of no drag. The parking brake shoe-to-drum clearance is now properly set.

- Insert a medium size screwdriver through adjustment hole in the right backing plate. Position the screwdriver against the star wheel on the parking brake shoe adjuster. Using the screwdriver, rotate the star wheel upward until a slight drag is noticed when turning the rear tire and wheel assembly. Then, using the screwdriver, slowly rotate the star wheel downward, backing off the adjuster, just enough to allow the rear tire and wheel assembly to rotate without the parking brake shoes dragging. Do not back off the adjuster star wheel more than two clicks past the point of no drag. The parking brake shoe-to-drum clearance is now properly set.

(5) Install the rubber plug in the adjusting holes of the disc brake caliper adapter.

(6) Lower the vehicle until the rear tires are just clearing the floor.

(7) Reach inside the vehicle and fully apply and release the park brakes two times after adjusting the parking brake shoes.

(8) With the parking brake lever in the fully applied position, attempt to hand rotate each rear tire and wheel assembly to ensure that the parking brake shoes are working.

(9) With the parking brake lever in the released position, hand rotate each rear tire and wheel assembly to ensure that the parking brake shoes are not dragging.

SPECIFICATIONS

BRAKE FLUID

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

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

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

BRAKE ACTUATION SYSTEM

ACTUATION:

Vacuum Operated Power Brakes Standard Hydraulic System Dual-Diagonally Split

BRAKE PEDAL:

Pedal Ratio 3.41

POWER BRAKE BOOSTER:

Make/Type Bosch/Vacuum Mounting Studs M8 x 1.25 Diaphragm Size/Type 205 mm Tandem

MASTER CYLINDER ASSEMBLY:

Type Dual Tandem Body Material Anodized Aluminum Reservoir Material Polypropelene

MASTER CYLINDER BORE STROKE AND SPLIT:

Non ABS 22.23 mm x 34.0 mm (0.875 in. x 1.34 in.) ABS . . 23.82 mm x 34.0 mm (0.937 in. x 1.34 in.) Displacement Split 50 / 50

MASTER CYLINDER FLUID OUTLET PORTS:

Tube Fitting Type SAE 45° Inverted Flare W/ABS - Primary Tube Nut Thread 7/16 in.-24 W/ABS - Secondary Tube Nut Thread 3/8 in.-24 W/O ABS - All Tube Nut Threads 7/16 in.-24

ABS HYDRAULIC CONTROL UNIT:

Hydraulic Tube Fitting Type SAE 45° Inverted Flare All Tube Nut Threads 7/16 in.-24

PROPORTIONING VALVE:

Material Aluminum Function Hydraulic Pressure Proportioning

BRAKE FASTENER TORQUE SPECIFICATIONS

DESCRIPTION TORQUE
BRAKE TUBES:

Tube Nuts 17 N·m (145 in. lbs.)

MASTER CYLINDER:

Mounting Nuts 28 N·m (250 in. lbs.)

POWER BRAKE BOOSTER:

Mounting Nuts 34 N·m (300 in. lbs.)

DISC BRAKE CALIPER:

Caliper Banjo Bolt 48 N·m (35 ft. lbs.) Guide Pin Bolts 22 N·m (192 in. lbs.) Bleeder Screw 15 N·m (125 in. lbs.)

WHEEL CYLINDER (REAR):

Mounting Bolts 13 N·m (115 in. lbs.) Bleeder Screw 10 N·m (80 in. lbs.)

DRUM BRAKE SHOE SUPPORT PLATE (REAR):

Mounting Bolts 75 N·m (55 ft. lbs.)

DISC BRAKE ADAPTER (REAR):

Mounting Bolts 75 N·m (55 ft. lbs.)

HUB AND BEARING (REAR):

Retaining Nut 217 N·m (160 ft. lbs.)

PARKING BRAKE:

Lever Mounting Nuts 28 N·m (250 in. lbs.)

TIRE AND WHEEL:

Wheel Mounting Nut 109–150 N·m (80–110 ft. lbs.)

INTEGRATED CONTROL UNIT:

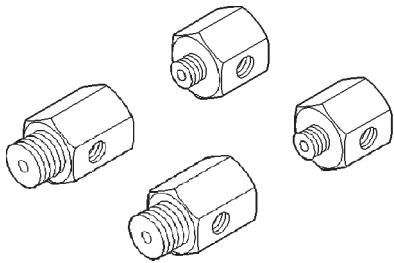
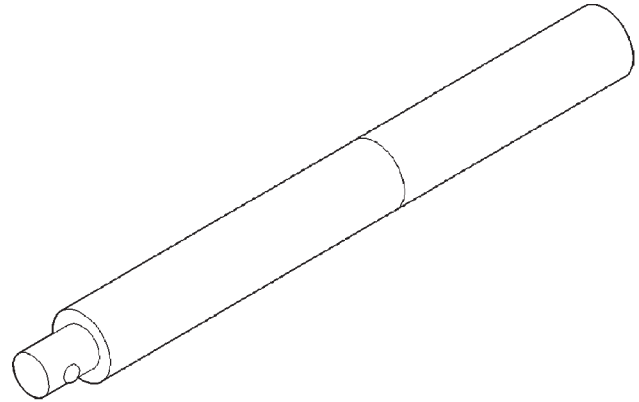
Mounting Bolts 11 N·m (97 in. lbs.) CAB Mounting bolts 2 N·m (17 in. lbs.) Bracket-to-Frame Rail Bolts 23 N·m (200 in. lbs.)

WHEEL SPEED SENSOR:

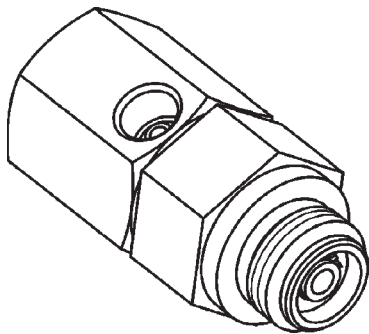
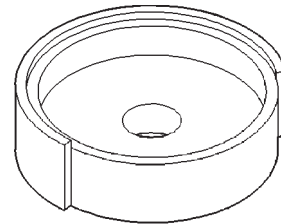
Head Mounting bolt 12 N·m (105 in. lbs.)

SPECIAL TOOLS

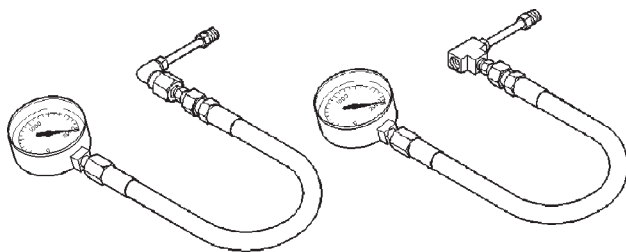
BASE BRAKE SYSTEM

**Adapters, Brake Pressure 6805**

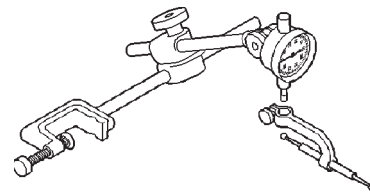
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Handle, Universal C-4171**Adapter, Brake Pressure 8644**

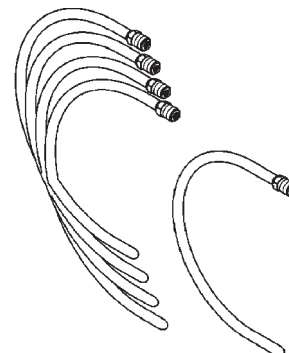
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Installer, Dust Boot C-4689

8011d474

Gauge Set C-4007-A

8011d42b

Dial Indicator C-3339**Tubes, Master Cylinder Bleed 8358**

ANTILOCK BRAKE SYSTEM

TABLE OF CONTENTS

	page	page
DESCRIPTION AND OPERATION		
ANTILOCK BRAKE SYSTEM OPERATION	65	ANTILOCK BRAKE SYSTEM BLEEDING 77
ANTILOCK BRAKE SYSTEM COMPONENTS	66	MASTER CYLINDER BLEEDING 77
ELECTRONIC BRAKE DISTRIBUTION	69	REMOVAL AND INSTALLATION
TRACTION CONTROL SYSTEM	70	SERVICE WARNINGS AND CAUTIONS 78
HYDRAULIC CIRCUITS AND VALVE		MASTER CYLINDER 78
OPERATION	71	INTEGRATED CONTROL UNIT 79
DIAGNOSIS AND TESTING		WHEEL SPEED SENSOR (FRONT) 81
SERVICE WARNINGS AND CAUTIONS	74	WHEEL SPEED SENSOR (REAR) 83
ABS GENERAL DIAGNOSTICS INFORMATION	74	DISASSEMBLY AND ASSEMBLY
ABS WIRING DIAGRAM INFORMATION	74	INTEGRATED CONTROL UNIT 84
ABS VEHICLE TEST DRIVE	74	SPECIFICATIONS
ABS ELECTRONIC DIAGNOSIS	75	TONE WHEEL RUNOUT 85
TONE WHEEL	76	WHEEL SPEED SENSOR-TO-TONE WHEEL
BRAKE FLUID CONTAMINATION	76	CLEARANCE 85
SERVICE PROCEDURES		BRAKE FASTENER TORQUE
BRAKE FLUID LEVEL CHECKING	77	SPECIFICATIONS 85

DESCRIPTION AND OPERATION

ANTILOCK BRAKE SYSTEM OPERATION

This section covers the physical and operational descriptions, and the on-car service procedures for the Mark 20e Antilock Brake System (ABS) with traction control. It is the only antilock brake system available on this vehicle.

The purpose of the antilock brake system is to prevent wheel lockup under braking conditions on virtually any type of road surface. Antilock braking is desirable because a vehicle that is stopped without locking the wheels retains directional stability and some steering capability. This allows the driver to retain greater control of the vehicle during braking.

The traction control system reduces wheel slip and maintains traction at the driving speeds below 56 kph (35 mph) when road conditions call for traction assistance. Refer to TRACTION CONTROL SYSTEM in this section for more information.

Vehicles equipped with ABS use electronic brake distribution (EBD) to balance front-to-rear braking when the brakes are applied in the partial braking range. Refer to ELECTRONIC BRAKE DISTRIBUTION in this section for more information.

There are a few performance characteristics of the Mark 20e Antilock Brake System that may at first seem abnormal, but in fact are normal. These characteristics are described below.

NORMAL BRAKING

Under normal braking conditions, the ABS functions the same as a standard base brake system with a diagonally split master cylinder and conventional vacuum assist.

ABS BRAKING

ABS operation is available at all vehicle speeds above 3–5 mph. If a wheel locking tendency is detected during a brake application, the brake system enters the ABS mode. During ABS braking, hydraulic pressure in the four wheel circuits is modulated to prevent any wheel from locking. Each wheel circuit is designed with a set of electric solenoids to allow modulation, although for vehicle stability, both rear wheel solenoids receive the same electrical signal. Wheel lockup may be perceived at the very end of an ABS stop and is considered normal.

During an ABS stop, the brakes hydraulic system is still diagonally split. However, the brake system pressure is further split into four control channels. During antilock operation of the vehicle's brake system, the wheels are controlled independently and are on separate control channels.

The system can build, hold and release pressure at each wheel, depending on signals generated by the wheel speed sensors (WSS) at each wheel and received at the controller antilock brake (CAB).

DESCRIPTION AND OPERATION (Continued)

NOISE AND BRAKE PEDAL FEEL

During ABS braking, some brake pedal movement may be felt. In addition, ABS braking will create ticking, popping, or groaning noises heard by the driver. This is normal and is due to pressurized fluid being transferred between the master cylinder and the brakes. If ABS operation occurs during hard braking, some pulsation may be felt in the vehicle body due to fore-and-aft movement of the suspension as brake pressures are modulated.

At the end of an ABS stop, ABS is turned off when the vehicle is slowed to a speed of 3–4 mph. There may be a slight brake pedal drop anytime that the ABS is deactivated, such as at the end of the stop when the vehicle speed is less than 3 mph or during an ABS stop where ABS is no longer required. These conditions exist when a vehicle is being stopped on a road surface with patches of ice, loose gravel, or sand on it. Also, stopping a vehicle on a bumpy road surface activates ABS because of the wheel hop caused by the bumps.

TIRE NOISE AND MARKS

Although the ABS system prevents complete wheel lockup, some wheel slip is desired in order to achieve optimum braking performance. Wheel slip is defined as follows: 0 percent slip means the wheel is rolling freely and 100 percent slip means the wheel is fully locked. During brake pressure modulation, wheel slip is allowed to reach up to 25–30 percent. This means that the wheel rolling velocity is 25–30 percent less than that of a free rolling wheel at a given vehicle speed. This slip may result in some tire chirping, depending on the road surface. This sound should not be interpreted as total wheel lockup.

Complete wheel lockup normally leaves black tire marks on dry pavement. The ABS will not leave dark black tire marks since the wheel never reaches a fully locked condition. However, tire marks may be noticeable as light patched marks.

START-UP CYCLE

When the ignition is turned on, a popping sound and a slight brake pedal movement may be noticed. The ABS warning lamp will also be on for up to 5 seconds after the ignition is turned on. When the vehicle is first driven off, a humming may be heard or felt by the driver at approximately 20–40 kph (12–25 mph). All of these conditions are a normal function of ABS as the system is performing a diagnosis check.

PREMATURE ABS CYCLING

Symptoms of premature ABS cycling include: clicking sounds from the solenoid valves; pump/motor running; and pulsations in the brake pedal. Prema-

ture ABS cycling can occur at any braking rate of the vehicle and on any type of road surface. Neither the red BRAKE warning lamp, nor the amber ABS warning lamp, illuminate and no fault codes are stored in the CAB.

Premature ABS cycling is a condition that needs to be correctly assessed when diagnosing problems with the antilock brake system. It may be necessary to use a DRB scan tool to detect and verify premature ABS cycling.

Check the following common causes when diagnosing premature ABS cycling: damaged tone wheels; incorrect tone wheels; damaged steering knuckle wheel speed sensor mounting bosses; loose wheel speed sensor mounting bolts; excessive tone wheel runout; or an excessively large tone wheel-to-wheel speed sensor air gap. Give special attention to these components when diagnosing a vehicle exhibiting premature ABS cycling.

After diagnosing the defective component, repair or replace it as required. When the component repair or replacement is completed, test drive the vehicle to verify that premature ABS cycling has been corrected.

ANTILOCK BRAKE SYSTEM COMPONENTS

The following is a detailed description of the antilock brake system components. For information on servicing base brake system components used in conjunction with these components, see the BASE BRAKE SYSTEM found at the beginning of this service manual group.

MASTER CYLINDER

A vehicle equipped with ABS uses a different master cylinder than a vehicle that is not equipped with ABS. Vehicles equipped with ABS use a center port master cylinder with only two outlet ports (Fig. 1).

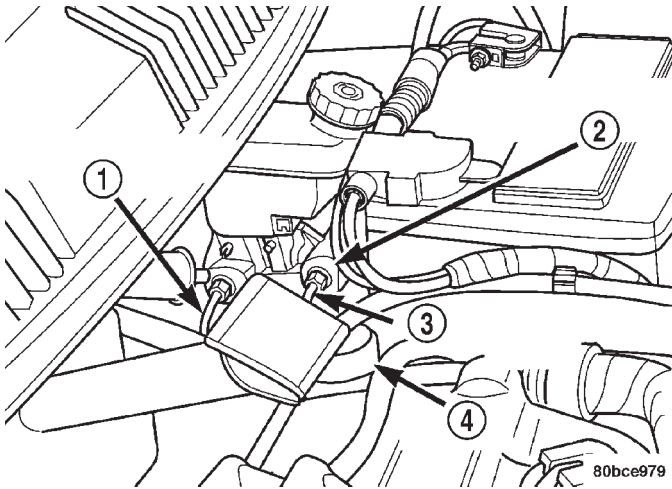
The brake tubes from the primary and secondary outlet ports on the master cylinder go directly to the integrated control unit (ICU).

The master cylinder mounts to the power brake booster in the same manner a non-ABS master cylinder does.

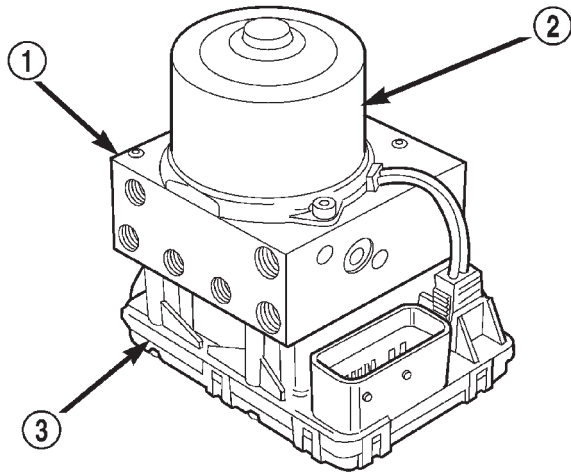
INTEGRATED CONTROL UNIT (ICU)

The hydraulic control unit (HCU) and the controller antilock brake (CAB) used with this antilock brake system are combined (integrated) into one unit, which is called the integrated control unit (ICU) (Fig. 2). The ICU is located on the driver's side of the vehicle, and is mounted to the left front frame rail below the master cylinder (Fig. 1).

DESCRIPTION AND OPERATION (Continued)

**Fig. 1 Master Cylinder And ICU**

- 1 - PRIMARY BRAKE TUBE
- 2 - MASTER CYLINDER
- 3 - SECONDARY BRAKE TUBE
- 4 - ABS ICU

**Fig. 2 Integrated Control Unit (ICU)**

- 1 - HCU
- 2 - PUMP/MOTOR
- 3 - CAB

The ABS with traction control ICU consists of the following components: the CAB, eight (build/decay) solenoid valves (four inlet valves and four outlet valves), two hydraulic shuttle valves, two traction control valves, valve block, fluid accumulators, a pump, and an electric pump/motor.

The replaceable components of the ICU are the HCU and the CAB. No attempt should be made to service any components found inside of the HCU or CAB.

CONTROLLER ANTILOCK BRAKE (CAB)

The controller antilock brake (CAB) is a microprocessor-based device which monitors the ABS system during normal braking and controls it when the vehicle is in an ABS stop. The CAB is mounted to the bottom of the HCU (Fig. 2). The CAB uses a 25-way electrical connector on the vehicle wiring harness. The power source for the CAB is through the ignition switch in the RUN or ON position. The CAB is on the PCI bus.

The primary functions of the (CAB) are to:

- (1) monitor the antilock brake system for proper operation.
- (2) detect wheel locking or wheel slipping tendencies by monitoring the speed of all four wheels of the vehicle.
- (3) control fluid modulation to the wheel brakes while the system is in an ABS mode or the traction control system is activated.
- (4) store diagnostic information.
- (5) provide communication to the DRB scan tool while in diagnostic mode.

The CAB constantly monitors the antilock brake system for proper operation. If the CAB detects a fault, it will send a message to the mechanical instrument cluster (MIC) instructing it to turn on the amber ABS warning lamp and disable the antilock braking system. The normal base braking system will remain operational.

The CAB continuously monitors the speed of each wheel through the signals generated by the wheel speed sensors to determine if any wheel is beginning to lock. When a wheel locking tendency is detected, the CAB commands the CAB command coils to actuate. The CAB command coils then open and close the valves in the HCU that modulate brake fluid pressure in some or all of the hydraulic circuits. The CAB continues to control pressure in individual hydraulic circuits until a locking tendency is no longer present.

The CAB contains a self-diagnostic program that monitors the antilock brake system for system faults. When a fault is detected, the amber ABS warning lamp is turned on and the fault diagnostic trouble code (DTC) is then stored in a diagnostic program memory. These DTC's will remain in the CAB memory even after the ignition has been turned off. The DTC's can be read and cleared from the CAB memory by a technician using the DRB scan tool. If not cleared with a DRB scan tool, the fault occurrence and DTC will be automatically cleared from the CAB memory after the identical fault has not been seen during the next 3,500 miles of vehicle operation.

DESCRIPTION AND OPERATION (Continued)

CONTROLLER ANTILOCK BRAKE INPUTS

- wheel speed sensors (four)
- stop lamp switch
- ignition switch
- system relay voltage
- ground
- traction control lamp
- diagnostic communication (PCI)

CONTROLLER ANTILOCK BRAKE OUTPUTS

- amber ABS warning lamp actuation (through MIC)
- red BRAKE warning lamp actuation (through MIC)
- traction control lamp actuation (through MIC)
- diagnostic communication. (PCI)

HYDRAULIC CONTROL UNIT (HCU)

The hydraulic control unit (HCU) is mounted to the CAB as part of the ICU (Fig. 2). The HCU controls the flow of brake fluid to the brakes using a series of valves and accumulators. A pump/motor is mounted on the HCU to supply build pressure to the brakes during an ABS stop.

VALVES AND SOLENOIDS

The valve block contains four inlet valves and four outlet solenoid valves. The inlet valves are spring-loaded in the open position and the outlet valves are spring-loaded in the closed position during normal braking. The fluid is allowed to flow from the master cylinder to the wheel brakes.

During an ABS stop, these valves cycle to maintain the proper slip ratio for each wheel. The inlet valve closes preventing further pressure increase and the outlet valve opens to provide a path from the wheel brake to the HCU accumulators and pump/motor. This releases (decays) pressure from the wheel brake, thus releasing the wheel from excessive slippage. Once the wheel is no longer slipping, the outlet valve is closed and the inlet valve is opened to reapply (build) pressure.

There are four other valves in the HCU. These four remaining valves are used for traction control. Two traction control (TC) valves, mounted in the HCU valve block, are normally in the open position and close only when the traction control is applied. There are also two shuttle valves which control pressure return to the master cylinder under ABS and traction control conditions.

These TC valves are used to isolate the rear (non-driving) wheels of the vehicle from the hydraulic pressure that the HCU pump/motor is sending to the front (driving) wheels when traction control is being applied. The rear brakes need to be isolated from the master cylinder when traction control is being

applied so the rear wheels do not drag. For more information on the TC and shuttle valves, see TRACTION CONTROL SYSTEM in this section.

BRAKE FLUID ACCUMULATORS

There are two fluid accumulators in the HCU: one for the primary hydraulic circuit, and one for the secondary hydraulic circuit. Each hydraulic circuit uses a 3 cc accumulator.

The fluid accumulators temporarily store brake fluid that is removed from the wheel brakes during an ABS cycle. This stored fluid is used by the pump/motor to provide build pressure for the brake hydraulic system. When the antilock stop is complete, the accumulators are drained by the pump/motor.

There are two noise dampening chambers in the HCU on this vehicle equipped with traction control.

PUMP/MOTOR

There are two pump assemblies in the HCU: one for the primary hydraulic circuit, and one for the secondary hydraulic circuit. Both pumps are driven by a common electric motor (Fig. 2). This DC-type motor is integral to the HCU and is controlled by the CAB.

The pump/motor provides the extra amount of brake fluid needed during antilock braking. Brake fluid is released to the accumulators when the outlet valve is opened during an antilock stop. The pump mechanism consists of two opposing pistons operated by an eccentric camshaft. In operation, these pistons are used to purge fluid from the accumulators back into the master cylinder circuits. When the antilock stop is complete, the pump/motor drains the accumulators.

The pump motor is also used to build pressure when the system goes into traction control mode. For more information, refer to TRACTION CONTROL SYSTEM in this section.

The CAB may turn on the pump/motor when an antilock stop is detected. The pump/motor continues to run during the antilock stop and is turned off after the stop is complete. Under some conditions, the pump/motor runs to drain the accumulators during the next drive-off.

The pump/motor is not a serviceable item; if it requires replacement, the HCU must be replaced.

ABS FUSES

The ABS fuse and the ABS pump/motor fuse are located in the power distribution center (PDC). Refer to the sticker on the inside of the PDC cover for the location of these fuses. The PDC is located on the driver's side of the engine compartment between the back of the battery and the brake master cylinder.

The CAB fuse can be found in the fuse junction block under the instrument panel.

DESCRIPTION AND OPERATION (Continued)

AMBER ABS WARNING LAMP

The amber ABS warning lamp is located in the instrument cluster. The purpose of the warning lamp is discussed in detail below.

When the ignition key is turned to the ON position, the amber ABS warning lamp is lit until the CAB completes its self-tests and turns off the lamp (approximately 4 seconds). The amber ABS warning lamp will illuminate when the CAB detects a condition that results in the shutdown of ABS function. The CAB sends a message to the mechanical instrument cluster (MIC) instructing it to turn on the amber ABS warning lamp.

Under most conditions, when the amber ABS warning lamp is on, only the ABS function of the brake system is affected; The electronic brake distribution (EBD), the base brake system and the ability to stop the vehicle are not affected.

WHEEL SPEED SENSOR (WSS)

At each wheel of the vehicle there is one wheel speed sensor (WSS) and one tone wheel (Fig. 3) (Fig. 4) (Fig. 5) (Fig. 6). Each front wheel speed sensor is attached to a boss in the steering knuckle. The front tone wheel is part of the driveshaft outboard constant velocity joint. The rear wheel speed sensor is mounted to the rear disc brake adapter. The rear tone wheel is an integral part of the rear wheel hub and bearing.

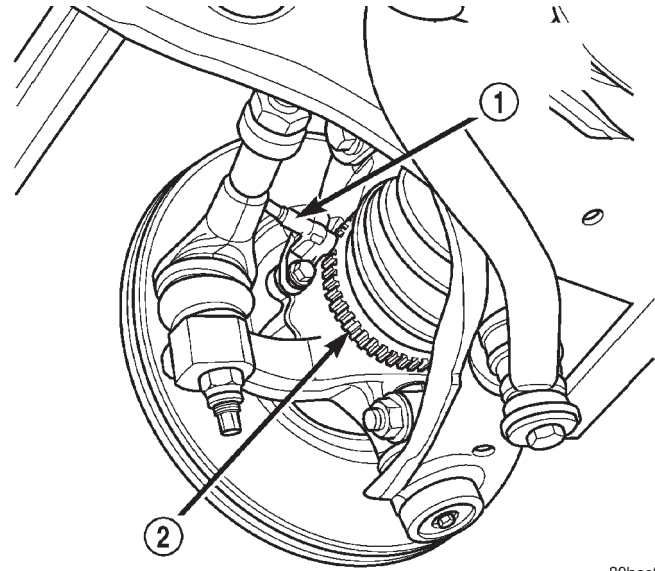
The wheel speed sensor operates on electronic energy supplied by the CAB and outputs a square wave signal whose current alternates between two constant levels. Its frequency is proportional to the speed of the tone wheel. The output is available as long as the sensor is powered and its state (high or low) corresponds to the presence or absence of tone wheel teeth. The output signal is sent to the CAB. If a wheel locking tendency is detected by the CAB, it will then modulate hydraulic pressure via the HCU to prevent the wheel(s) from locking.

Correct ABS operation is dependent on accurate wheel speed signals. The vehicle's tires and wheels all must be the same size and type to generate accurate signals. Variations in tire and wheel size can produce inaccurate wheel speed signals.

Improper speed sensor-to-tone wheel clearance can cause erratic speed sensor signals. The speed sensor air gap is not adjustable, but should be checked when applicable. Wheel speed sensor-to-tone wheel clearance specifications can be found in the SPECIFICATIONS section within this section in this service manual group.

ELECTRONIC BRAKE DISTRIBUTION

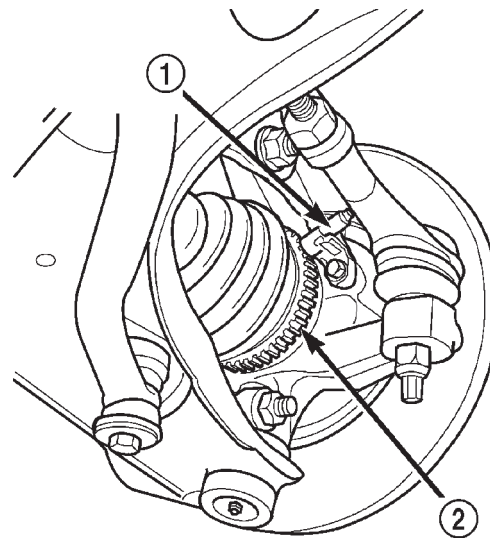
Vehicles equipped with ABS use electronic brake distribution (EBD) to balance front-to-rear braking.



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Fig. 3 Left Front Wheel Speed Sensor

- 1 - LEFT FRONT WHEEL SPEED SENSOR
- 2 - TONE WHEEL



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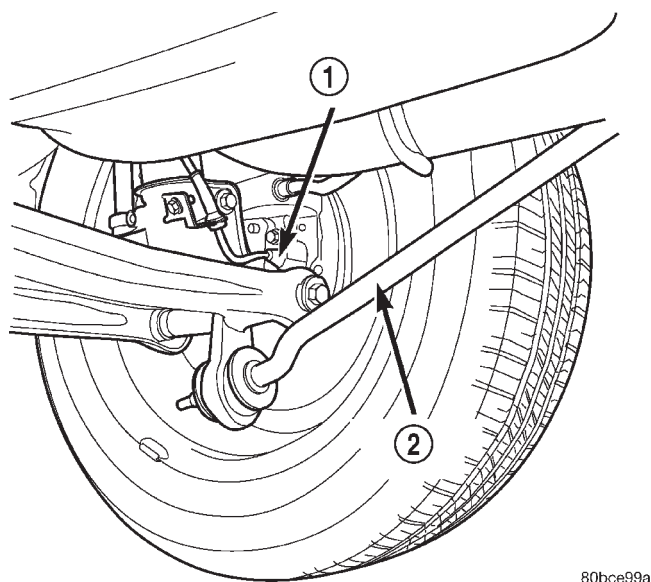
Fig. 4 Right Front Wheel Speed Sensor

- 1 - RIGHT FRONT WHEEL SPEED SENSOR
- 2 - TONE WHEEL

The EBD is used in place of a rear proportioning valve. The EBD 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.

Upon entry into EBD 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

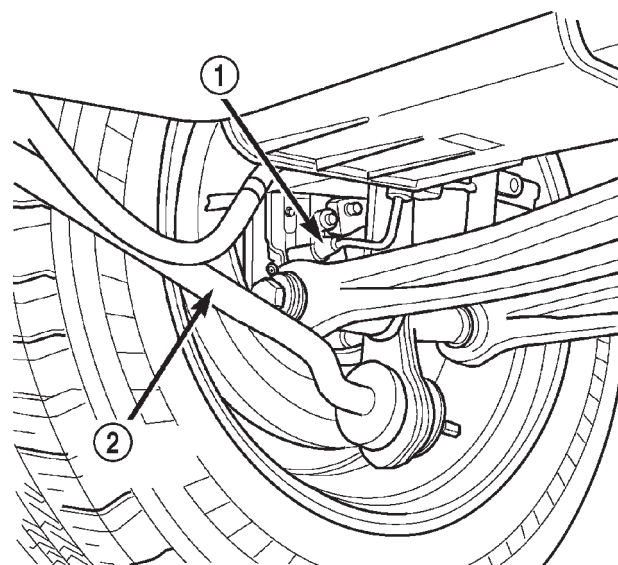
DESCRIPTION AND OPERATION (Continued)



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Fig. 5 Left Rear Wheel Speed Sensor

- 1 - LEFT REAR WHEEL SPEED SENSOR
2 - TENSION STRUT



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Fig. 6 Right Rear Wheel Speed Sensor

- 1 - RIGHT REAR WHEEL SPEED SENSOR
2 - TENSION STRUT

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. This back-and-forth process will continue until the required slip difference is obtained. At the end of EBD braking (brakes released) the fluid in the LPA drains back to the

master cylinder by switching on the outlet valve and draining through the inlet valve check valve. At the same time the inlet valve is switched on in case of another brake application.

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

TRACTION CONTROL SYSTEM

Traction control reduces wheel slip and maintains traction at the driving wheels at speeds below 56 kph (35 mph) when road surfaces are slippery. The traction control system reduces wheel slip by braking the wheel that is losing traction.

The CAB monitors wheel speed. During acceleration, if the CAB detects front (drive) wheel slip and the brakes are not applied, the CAB enters traction control mode. Traction control operation proceeds in the following order:

(1) Close the normally open traction control (TC) valves.

(2) Start the pump/motor and supply volume and pressure to the front (drive) hydraulic circuit. (The pump/motor runs continuously during traction control operation.)

(3) Open and close the build and decay solenoid valves to maintain minimum wheel slip and maximum traction.

The cycling of the build and decay valves during traction control is similar to that during antilock braking, except the valves work to control wheel spin by applying the brakes, whereas the ABS function is to control wheel skid by releasing the brakes.

HYDRAULIC SHUTTLE VALVES

Two pressure relief shuttle valves allow pressure and volume to return to the master cylinder reservoir when not consumed by the build and decay valves. These valves are necessary because the pump/motor supplies more volume than the system requires.

If the brakes are applied at anytime during a traction control cycle, the brake lamp switch triggers the control module to switch off traction control.

TRACTION CONTROL FUNCTION LAMP

The traction control function lamp illuminates during a traction control cycle, displaying TRAC on the instrument panel.

The traction control system is enabled at each ignition cycle. It may be turned off by depressing the traction control switch button. The traction control function lamp (TRAC OFF) illuminates immediately upon depressing the button. Pressing this button again, or turning off and restarting the vehicle will enable the traction control system.

DESCRIPTION AND OPERATION (Continued)

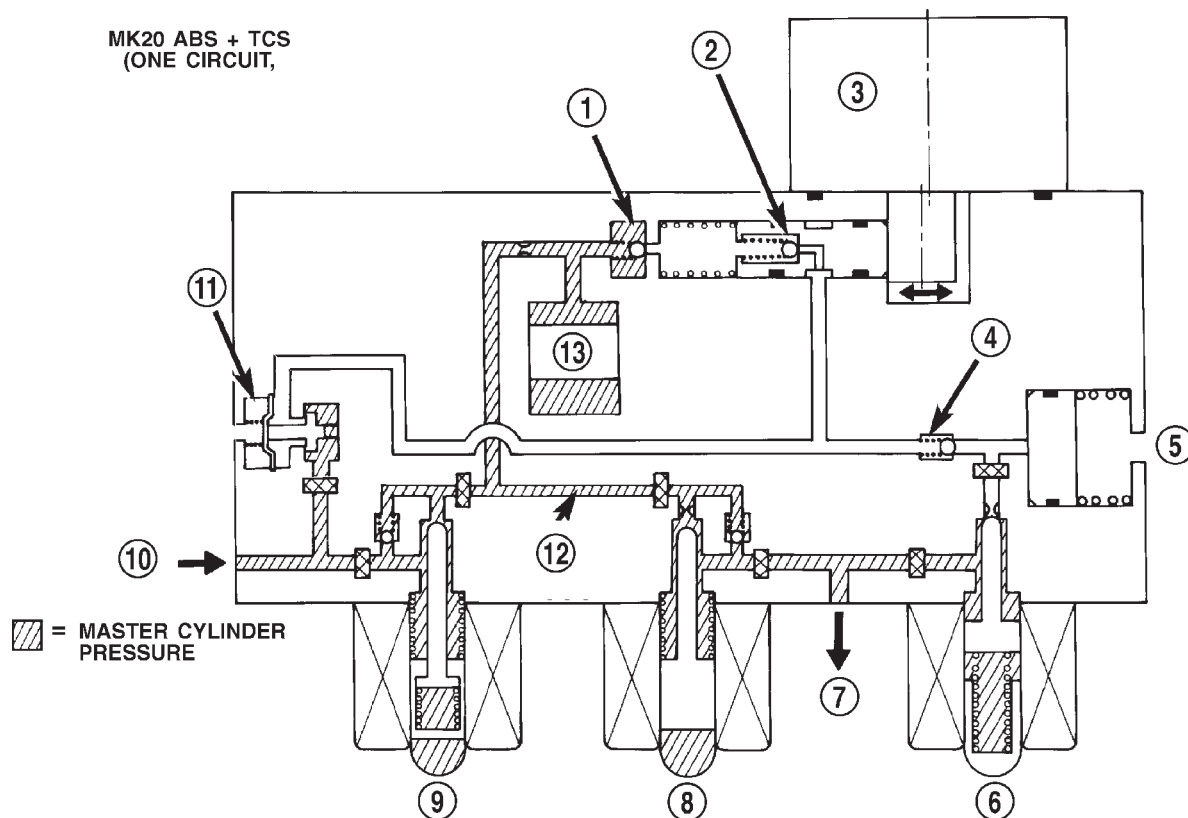
If the CAB calculates that the brake temperatures are high, the traction control system becomes inoperative until a time-out period has elapsed. During this "thermo-protection mode," the traction control function lamp illuminates TRAC OFF; note that no trouble code is registered.

HYDRAULIC CIRCUITS AND VALVE OPERATION

The hydraulic shuttle valves control the flow of pressurized brake fluid to the wheel brakes during the different modes of ABS braking. The following paragraphs explain how this works. For purposes of explanation only, it is assumed that only the right front wheel is experiencing antilock braking; the following diagrams show only the right front wheel in an antilock braking operation.

NORMAL BRAKING HYDRAULIC CIRCUIT, SOLENOID VALVE, AND SHUTTLE VALVE FUNCTION (ABS WITH TRACTION CONTROL)

The hydraulic diagram (Fig. 7) shows a vehicle with traction control in the normal braking mode. The diagram shows no wheel spin or slip occurring relative to the speed of the vehicle. The driver is applying the brake pedal; this builds pressure in the brake hydraulic system to engage the brakes and stop the vehicle. The hydraulic shuttle valve closes with every brake pedal application so pressure is not created at the inlet to the pump/motor.



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Fig. 7 ABS With Traction Control - Normal Braking Hydraulic Circuit

- | | |
|---------------------------------|-----------------------------------|
| 1 - OUTLET VALVE | 8 - NORMALLY OPEN VALVE (OFF) |
| 2 - PUMP PISTON | 9 - NORMALLY OPEN ASR VALVE (OFF) |
| 3 - PUMP MOTOR (OFF) | 10 - FROM MASTER CYLINDER |
| 4 - SUCTION VALVE | 11 - HYDRAULIC SHUTTLE VALVE |
| 5 - LOW PRESSURE ACCUMULATOR | 12 - MASTER CYLINDER PRESSURE |
| 6 - NORMALLY CLOSED VALVE (OFF) | 13 - NOISE DAMPER CHAMBER |
| 7 - TO RIGHT FRONT WHEEL | |

DESCRIPTION AND OPERATION (Continued)

ABS BRAKING HYDRAULIC CIRCUIT, SOLENOID VALVE, AND SHUTTLE VALVE FUNCTION (ABS WITH TRACTION CONTROL)

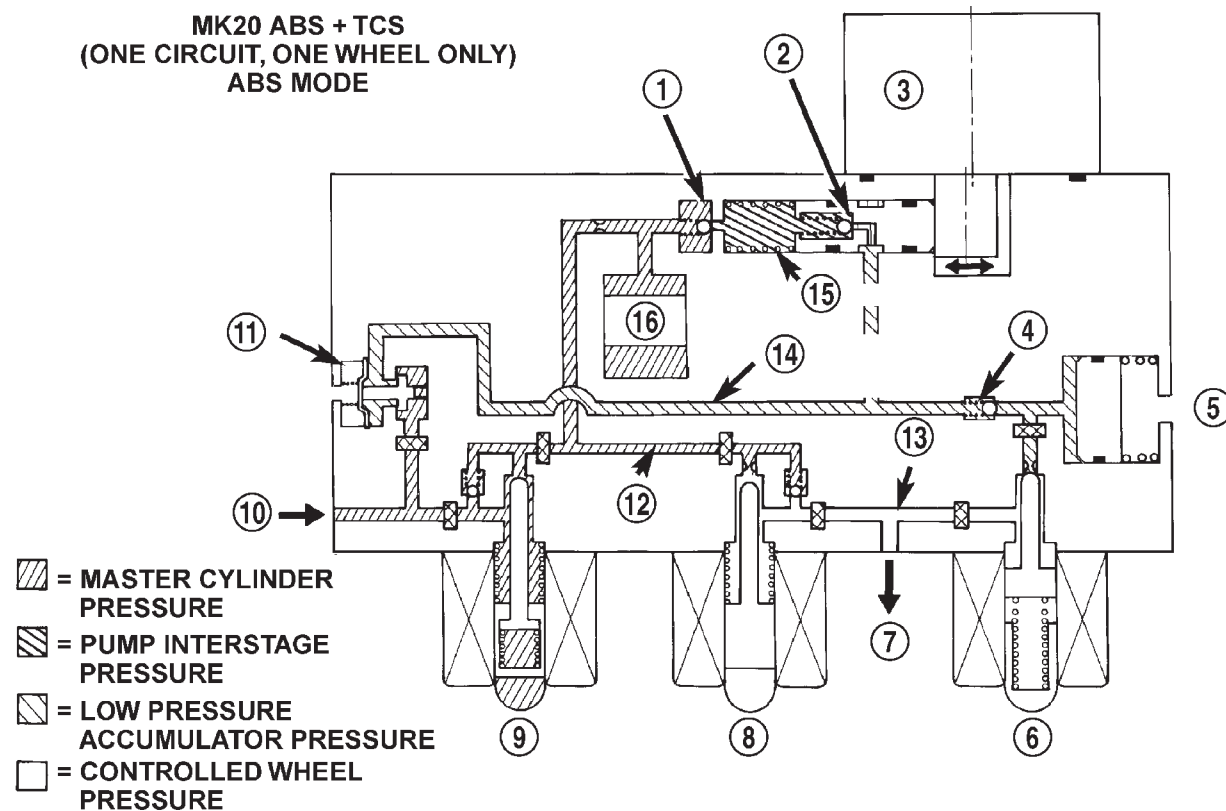
The hydraulic diagram (Fig. 8) shows the vehicle in the ABS braking mode. The diagram shows one wheel is slipping because the driver is attempting to stop the vehicle at a faster rate than is allowed by the surface on which the tires are riding.

- The hydraulic shuttle valve closes upon brake application so that the pump/motor cannot siphon brake fluid from the master cylinder.

- The normally open and normally closed valves modulate (build/decay) the brake hydraulic pressure as required.

- The pump/motor is switched on so that the brake fluid from the low pressure accumulators is returned to the master cylinder circuits.

- The brake fluid is routed to either the master cylinder or the wheel brake depending on the position of the normally open valve.



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Fig. 8 ABS With Traction Control - ABS Braking Hydraulic Circuit

- | | |
|--|--|
| 1 - OUTLET VALVE | 9 - NORMALLY OPEN ASR VALVE (OFF) |
| 2 - PUMP PISTON | 10 - FROM MASTER CYLINDER |
| 3 - PUMP MOTOR (ON) | 11 - HYDRAULIC SHUTTLE VALVE |
| 4 - SUCTION VALVE | 12 - MASTER CYLINDER PRESSURE |
| 5 - LOW PRESSURE ACCUMULATOR | 13 - CONTROLLED WHEEL PRESSURE |
| 6 - NORMALLY CLOSED VALVE (MODULATING) | 14 - LOW PRESSURE ACCUMULATOR PRESSURE |
| 7 - TO RIGHT FRONT WHEEL | 15 - PUMP INTERSTAGE PRESSURE |
| 8 - NORMALLY OPEN VALVE (MODULATING) | 16 - NOISE DAMPER CHAMBER |

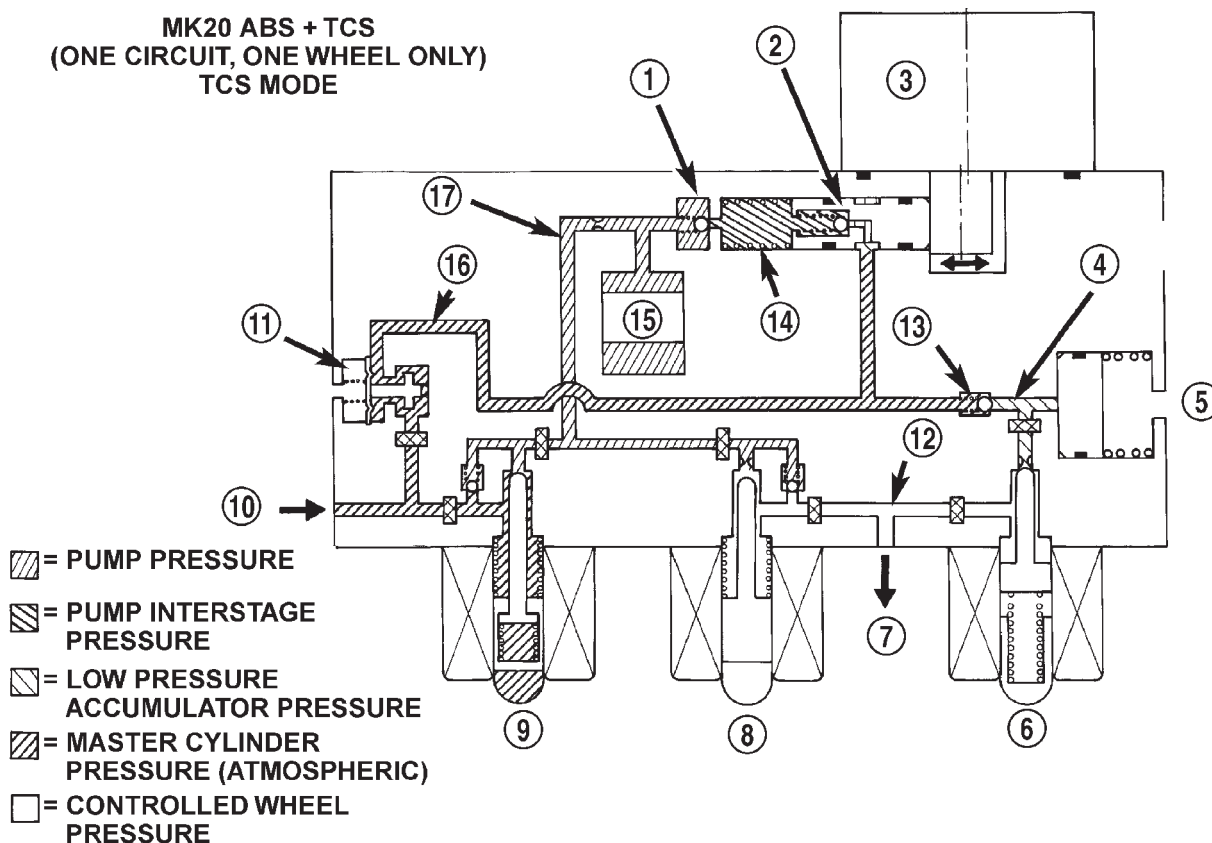
DESCRIPTION AND OPERATION (Continued)

ABS TRACTION CONTROL HYDRAULIC CIRCUIT, SOLENOID VALVE, AND SHUTTLE VALVE FUNCTION (ABS WITH TRACTION CONTROL)

The hydraulic diagram (Fig. 9) shows the vehicle in the traction control (TC) mode. The diagram shows a drive wheel is spinning and brake pressure is required to reduce its speed.

- The normally open TC (ASR) valve is energized to isolate the brake fluid being pumped from the master cylinder and to isolate the driven wheel.
- The normally open TC (ASR) valve bypasses the pump output back to the master cylinder at a fixed pressure setting.
- The normally open and normally closed valves modulate (build/decay) the brake pressure as required to the spinning wheel.

**MK20 ABS + TCS
(ONE CIRCUIT, ONE WHEEL ONLY)
TCS MODE**



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Fig. 9 Traction Control Hydraulic Circuit

- | | |
|---|--------------------------------|
| 1 – OUTLET VALVE | 10 – FROM MASTER CYLINDER |
| 2 – PUMP PISTON | 11 – HYDRAULIC SHUTTLE VALVE |
| 3 – PUMP MOTOR (ON) | 12 – CONTROLLED WHEEL PRESSURE |
| 4 – LOW PRESSURE ACCUMULATOR PRESSURE | 13 – SUCTION VALVE |
| 5 – LOW PRESSURE ACCUMULATOR | 14 – PUMP INTERSTAGE PRESSURE |
| 6 – NORMALLY CLOSED VALVE (MODULATING) | 15 – NOISE DAMPER CHAMBER |
| 7 – TO RIGHT FRONT WHEEL (SPINNING) | 16 – MASTER CYLINDER PRESSURE |
| 8 – NORMALLY OPEN VALVE (MODULATING) | 17 – PUMP PRESSURE |
| 9 – NORMALLY OPEN ASR VALVE ON (REGULATING) | |

DIAGNOSIS AND TESTING

SERVICE WARNINGS AND CAUTIONS

The ABS uses an electronic control module, the CAB. This module is designed to withstand normal current draws associated with vehicle operation. Care must be taken to avoid overloading the CAB circuits.

CAUTION: In testing for open or short circuits, do not ground or apply voltage to any of the circuits unless instructed to do so for a diagnostic procedure.

CAUTION: These circuits should only be tested using a high impedance multi-meter or the DRB scan tool as described in this section. Power should never be removed or applied to any control module with the ignition in the ON position. Before removing or connecting battery cables, fuses, or connectors, always turn the ignition to the OFF position.

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

ABS GENERAL DIAGNOSTICS INFORMATION

This section contains information necessary to diagnose the antilock brake system. Specifically, this section should be used to help diagnose conditions which result in any of the following:

- (1) amber ABS warning lamp turned on.
- (2) brakes lock-up on hard application.

Diagnosis of base brake conditions that are obviously mechanical in nature should be directed to BASE BRAKE SYSTEM at the beginning of this group.

Many ABS conditions judged to be a problem by the driver may be normal operating conditions. See ABS OPERATION in the DESCRIPTION AND OPERATION section of this group to become familiarized with the normal characteristics of this antilock brake system.

ABS WIRING DIAGRAM INFORMATION

During the diagnosis and testing of the antilock brake system it may become necessary to reference the wiring diagrams covering the antilock brake system and its components. For wiring diagrams refer to GROUP 8W of this service manual. It will provide you with the wiring diagrams and the circuit description and operation information covering the antilock brake system.

ABS VEHICLE TEST DRIVE

Most ABS complaints will require a test drive to properly duplicate and diagnose the condition.

WARNING: CONDITIONS THAT RESULT IN TURNING ON THE RED BRAKE WARNING LAMP MAY INDICATE REDUCED BRAKING ABILITY.

Before test driving a brake complaint vehicle, note whether the red BRAKE warning lamp, amber ABS warning lamp, or both are turned on. If it is the red BRAKE warning lamp, there is a brake hydraulic problem that must be corrected before driving the vehicle. Refer to the BASE BRAKE SYSTEM for diagnosis of the red BRAKE warning lamp. If the red brake warning lamp is illuminated, there is also a possibility that there is an ABS problem and the amber ABS warning lamp is not able to illuminate, so the MIC turns on the red Brake warning lamp by default.

If the amber ABS warning lamp is on, test drive the vehicle as described below. While the amber ABS warning lamp is on, the ABS is not functional. The ability to stop the car using the base brake system should not be affected.

If a functional problem of the ABS is determined while test driving the vehicle, refer to the Chassis Diagnostic Procedures manual.

(1) Turn the key to the OFF position and then back to the ON position. Note whether the amber ABS warning lamp continues to stay on. If it does, refer to the diagnostic manual.

(2) If the amber ABS warning lamp goes out, shift into gear and drive the car to a speed of 20 kph (12 mph) to complete the ABS start-up and drive-off cycles (see ABS ELECTRONIC DIAGNOSIS). If at this time the amber ABS warning lamp comes on, refer to the diagnostic manual.

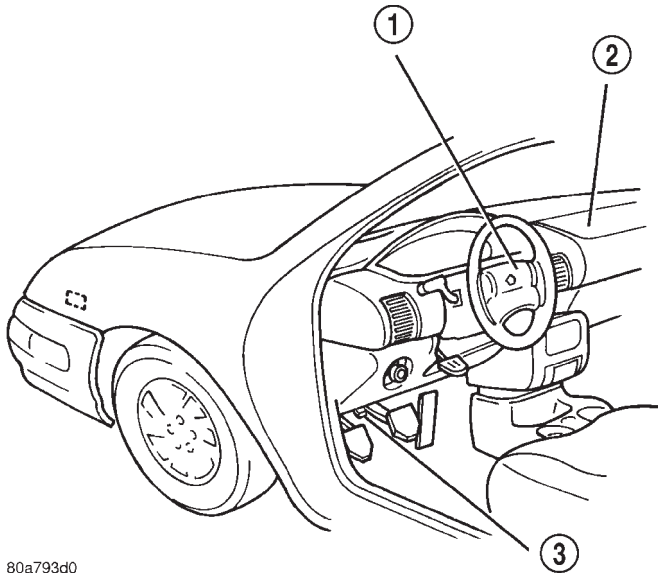
(3) If the amber ABS warning lamp remains out, drive the vehicle a short distance. Accelerate the vehicle to a speed of at least 40 mph. Bring the vehicle to a complete stop, braking hard enough to cause the ABS to cycle. Again accelerate the vehicle past 25 mph. Refer to the diagnostic manual for further testing of the antilock brake system.

DIAGNOSIS AND TESTING (Continued)

ABS ELECTRONIC DIAGNOSIS

The following information is presented to give the technician a general background on the diagnostic capabilities of the ABS system. Complete electronic diagnosis of the ABS system used on this vehicle is covered in the Chassis Diagnostic Procedures manual.

Electronic diagnosis of the ABS system used on this vehicle is performed using the DRBIII® scan tool. The vehicle's scan tool diagnostic connector is located under the steering column lower cover, to the left side of the steering column (Fig. 10).



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Fig. 10 ABS System Diagnostic Connector Location

- 1 – DRIVER AIRBAG MODULE
- 2 – PASSENGER AIRBAG MODULE
- 3 – DATA LINK CONNECTOR

ABS SELF-DIAGNOSIS

The ABS system is equipped with a self-diagnosis capability, which may be used to assist in the isolation of ABS faults. The features are described below.

START-UP CYCLE

The self-diagnosis ABS start-up cycle begins when the ignition switch is turned to the ON position. Electrical checks are completed on ABS components, including the CAB, solenoid continuity, and the relay system operation. During this check the amber ABS warning lamp is turned on for approximately 5 seconds and the brake pedal may emit a popping sound, moving slightly when the solenoid valves are checked.

DRIVE-OFF CYCLE

The first time the vehicle is set in motion after an ignition off/on cycle, the drive-off cycle occurs. This cycle is performed when the vehicle reaches a speed of approximately 20 kph (12 mph.).

- The pump/motor is briefly activated to verify function. When the pump/motor is briefly activated, a whirling or buzzing sound may be heard by the driver. This sound is normal, indicating the pump/motor is running.

- The wheel speed sensor output correct operating range is verified.

ONGOING TESTS

While the system is operating, these tests are performed on a continuous basis:

- solenoid continuity
- wheel speed sensor continuity
- wheel speed sensor output

DIAGNOSTIC TROUBLE CODES (DTC's)

Diagnostic trouble codes (DTC's) are kept in the controller's memory until either erased by the technician using the DRB, or erased automatically after 3500 miles or 255 ignition key cycles, whichever occurs first. DTC's are retained by the controller even if the ignition is turned off or the battery is disconnected. More than one DTC can be stored at a time. When accessed, the number of occurrences (ignition key cycles) and the DTC that is stored are displayed. Most functions of the CAB and the ABS system can be accessed by the technician for testing and diagnostic purposes using the DRB.

LATCHING VERSUS NON-LATCHING DIAGNOSTIC TROUBLE CODES

Some DTC's detected by the CAB are "latching" codes. The DTC is latched and ABS braking is disabled until the ignition switch is reset. Thus, ABS braking is non-operational even if the original DTC has disappeared. Other DTC's are non-latching. Any warning lamps that are turned on are only turned on as long as the DTC condition exists; as soon as the condition goes away, the amber ABS warning lamp is turned off, although, in most cases, a DTC is set.

INTERMITTENT DIAGNOSTIC TROUBLE CODES

As with virtually any electronic system, intermittent electrical problems in the ABS system may be difficult to accurately diagnose. Most intermittent electrical problems are caused by faulty electrical connections or wiring. A visual inspection should be done before trying to diagnose or service the antilock brake system; this will eliminate unnecessary diagnosis and testing time. Perform a visual inspection for loose, disconnected, damaged, or misrouted wires or connectors; include the following components and areas of the vehicle in the inspection.

(1) Inspect fuses in the power distribution center (PDC) and the wiring junction block. Verify that all fuses are fully inserted into the PDC and wiring

DIAGNOSIS AND TESTING (Continued)

junction block. A label on the underside of the PDC cover identifies the locations of the ABS fuses.

(2) Inspect the 25-way electrical connector at the CAB for damaged, spread, or backed-out wiring terminals. Verify that the 25-way connector is fully inserted in the socket of the CAB. Be sure that wires are not stretched tight or pulled out of the connector.

(3) Verify that all the wheel speed sensor connections are secure.

(4) Look for poor mating of connector halves or terminals not fully seated in the connector body.

(5) Check for improperly formed or damaged terminals. All connector terminals in a suspect circuit should be carefully reformed to increase contact tension.

(6) Look for poor terminal-to-wire connections. This requires removing the terminal from the connector body to inspect it.

(7) Verify pin presence in the connector assembly

(8) Check for proper ground connections. Check all ground connections for signs of corrosion, loose fasteners, or other potential defects. Refer to the wiring diagrams for ground locations.

(9) Look for problems with the main power sources of the vehicle. Inspect the battery, generator, ignition circuits and other related relays and fuses.

If a visual check does not find the cause of the problem, operate the car in an attempt to duplicate the condition and record any trouble codes.

Most failures of the ABS disable the ABS function for the entire ignition cycle even if the fault clears before key-off. There are some failure conditions, however, that allow ABS operation to resume during the ignition cycle in which the trouble occurred even if the trouble conditions are no longer present.

The following trouble conditions may result in intermittent illumination of the amber ABS warning lamp.

- Low system voltage. If Low System Voltage is detected by the CAB, the CAB will turn on the ABS Warning Lamp until normal system voltage is achieved. Once normal voltage is seen at the CAB, normal operation resumes.

- High system voltage. If high system voltage is detected by the CAB, the CAB will turn on the Amber ABS Warning Lamp until normal system voltage is achieved. Once normal voltage is again detected by the CAB, normal ABS operation resumes.

Additional possible causes that may result in the illumination of the amber ABS warning lamp are as follows:

- Any condition that interrupts electrical current to the CAB may cause the amber ABS warning lamp to turn on intermittently.

- If PCI communication between the body controller and the CAB is interrupted, the body controller can turn on the amber ABS warning lamp.

TONE WHEEL

Tone wheels can cause erratic wheel speed sensor signals. Inspect tone wheels for the following possible causes:

- missing, chipped, or broken teeth
- contact with the wheel speed sensor
- wheel speed sensor to tone wheel alignment
- wheel speed sensor to tone wheel clearance
- excessive tone wheel runout
- tone wheel loose on its mounting surface

If a front tone wheel is found to need replacement, the drive shaft must be replaced. No attempt should be made to replace just the tone wheel. Refer to the DIFFERENTIAL AND DRIVELINE group in this service manual for removal and installation.

If a rear tone wheel is found to need replacement, the rear hub and bearing must be replaced. No attempt should be made to replace just the tone wheel. Refer to the SUSPENSION group in this service manual for removal and installation.

If wheel speed sensor to tone wheel contact is evident, determine the cause and correct it before replacing the wheel speed sensor or tone wheel.

Check the gap between the speed sensor head and the tone wheel to ensure it is within specifications. Refer to SPECIFICATIONS in this section of the service manual for the minimum and maximum wheel speed sensor to tone wheel clearance.

Excessive wheel speed sensor runout can cause erratic wheel speed sensor signals. Refer to SPECIFICATIONS in this section of the service manual for the maximum allowed tone wheel runout. If tone wheel runout is excessive, determine if it is caused by a defect in the driveshaft assembly or hub and bearing. Replace as necessary.

Tone wheels are pressed onto their mounting surfaces and should not rotate independently from the mounting surface. Replacement of the front driveshaft or rear hub and bearing is necessary.

BRAKE FLUID CONTAMINATION

Indications of fluid contamination are swollen or deteriorated rubber parts. Swelling indicates 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 the fluid separates into layers, there is mineral oil or other fluid contamination of the brake fluid.

If the brake fluid is contaminated, drain and thoroughly flush the brake system. Replace all the rubber parts or components containing rubber coming into contact with the brake fluid including: the master cylinder; proportioning valves; caliper seals; wheel cylinder seals; ABS hydraulic control unit; and all hydraulic fluid hoses.

SERVICE PROCEDURES

BRAKE FLUID LEVEL CHECKING

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

Refer to SERVICE PROCEDURES in the BASE BRAKE SYSTEM section in this group for the proper procedure to check and adjust the brake fluid level in the master cylinder fluid reservoir.

ANTILOCK BRAKE SYSTEM BLEEDING

The base brake's hydraulic system must be bled anytime air enters the hydraulic system. The ABS though, particularly the ICU (HCU), should only be bled when the HCU is replaced or removed from the vehicle. The ABS must always be bled anytime it is suspected that the HCU has ingested air. Under most circumstances that require the bleeding of the brakes hydraulic system, only the base brake hydraulic system needs to be bled.

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

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

The ABS must be bled as two independent braking systems. The non-ABS portion of the brake system with ABS is to be bled the same as any non-ABS system.

The ABS portion of the brake system must be bled separately. Use the following procedure to properly bleed the brake hydraulic system including the ABS.

BLEEDING

When bleeding the ABS system, the following bleeding sequence must be followed to insure complete and adequate bleeding.

(1) Make sure all hydraulic fluid lines are installed and properly torqued.

(2) Connect the DRB scan tool to the diagnostics connector. The diagnostic connector is located under the lower steering column cover to the left of the steering column.

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

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

(4) Bleed the base brake system using the standard pressure or manual bleeding procedure as outlined in SERVICE PROCEDURES in the BASE BRAKE SYSTEM section at the beginning of this group.

(5) Using the DRB, select ANTILOCK BRAKES, followed by MISCELLANEOUS, then BLEED BRAKES. Follow the instructions displayed. When the scan tool displays TEST COMPLETED, disconnect the scan tool and proceed.

(6) Bleed the base brake system a second time. Check brake fluid level in the reservoir periodically to prevent emptying, causing air to enter the hydraulic system.

(7) Fill the master cylinder reservoir to the full level.

(8) Test drive the vehicle to be sure the brakes are operating correctly and that the brake pedal does not feel spongy.

MASTER CYLINDER BLEEDING

(1) Clamp the master cylinder in a vise.

(2) Attach Master Cylinder Bleed Tube, Special Tool 8358-1, to the primary port of the master cylinder and tighten in place (Fig. 11). Attach Master Cylinder Bleed Tube, Special Tool 8358-2, to the secondary port of the master cylinder and tighten in place. Position the other end of the tubes into the master cylinder reservoir so their outlets are below the surface of the brake fluid in the reservoir when filled.

(3) Fill the brake fluid reservoir with Mopar® brake fluid, or an equivalent conforming to DOT 3 specifications.

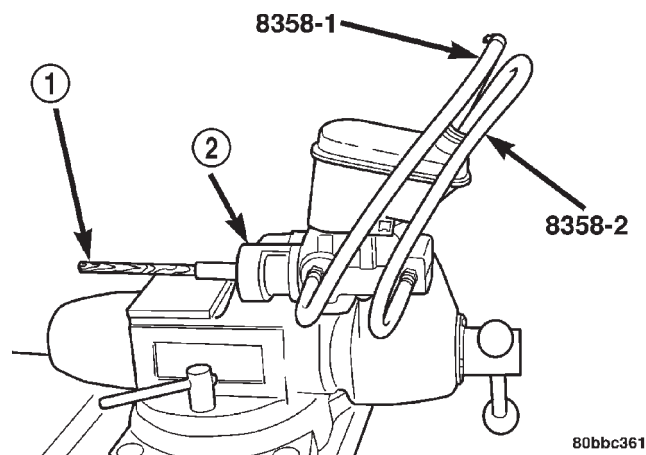
(4) Using a wooden dowel as a pushrod (Fig. 11), press the pistons inward slowly applying brake pressure, then release the pressure, allowing the pistons to return to the released position. Repeat this several times until all air bubbles are expelled out of the tubes and master cylinder bore.

(5) Remove the bleed tubes from the master cylinder and plug the outlet ports.

(6) Install the fill cap on the reservoir.

(7) Remove the master cylinder from the vise.

SERVICE PROCEDURES (Continued)

**Fig. 11 Bleeding Master Cylinder**

- 1 - WOODEN DOWEL
2 - MASTER CYLINDER

NOTE: It is not necessary to bleed the entire hydraulic system after replacing just the master cylinder unless the brake system has been open to air for an excessive amount of time or air is present in the lines. Only the master cylinder must be bled and filled.

REMOVAL AND INSTALLATION

SERVICE WARNINGS AND CAUTIONS

Review this entire section prior to performing any mechanical work on a vehicle equipped with ABS. This section contains information on precautions pertaining to potential component damage, vehicle damage and personal injury which could result when servicing an ABS equipped vehicle.

CAUTION: Only the recommended jacking or hoisting positions for this vehicle are to be used whenever it is necessary to lift a vehicle. Failure to raise a vehicle from the recommended locations could result in lifting a vehicle by the hydraulic control unit mounting bracket. Lifting a vehicle by the hydraulic control unit mounting bracket will result in damage to the mounting bracket and the hydraulic control unit.

CAUTION: An attempt to remove or disconnect certain system components may result in improper system operation. Only those components with approved removal and installation procedures in this manual should be serviced.

CAUTION: Brake fluid will damage painted surfaces. If brake fluid is spilled on any painted surfaces, wash off with water immediately.

CAUTION: When performing any service procedure on a vehicle equipped with ABS do not apply a 12-volt power source to the ground circuit of the pump motor in the HCU. Doing this will damage the pump motor and will require replacement of the entire HCU.

CAUTION: If welding work is to be performed on the vehicle, using an electric arc welder, the CAB connector should be disconnected during the welding operation.

CAUTION: The CAB 25-way connector should never be connected or disconnected with the ignition switch in the ON position.

Many components of the ABS System are not serviceable and must be replaced as an assembly. Do not disassemble any component which is not designed to be serviced.

MASTER CYLINDER

NOTE: Before proceeding with this procedure, review **SERVICE WARNINGS AND CAUTIONS** at the beginning of **REMOVAL AND INSTALLATION** in this section.

REMOVAL

CAUTION: The vacuum in the power brake booster must be pumped down before removing the master cylinder to prevent the booster from sucking in any contamination. This can be done by pumping the brake pedal while the engine is not running until a firm brake pedal is achieved.

(1) With the engine not running, pump the brake pedal 4-5 strokes until the pedal feel is firm.

(2) Disconnect the negative (ground) cable from the battery and isolate the cable.

(3) Disconnect the positive cable from the battery, then remove the battery from the battery tray. There is one nut securing the clamp on the backside of the battery holding it in place.

(4) Disconnect the wiring harness connector from the brake fluid level switch on the master cylinder reservoir (Fig. 12).

REMOVAL AND INSTALLATION (Continued)

(5) Disconnect the primary and secondary brake tubes from master cylinder (Fig. 12). Install plugs in the master cylinder outlet ports.

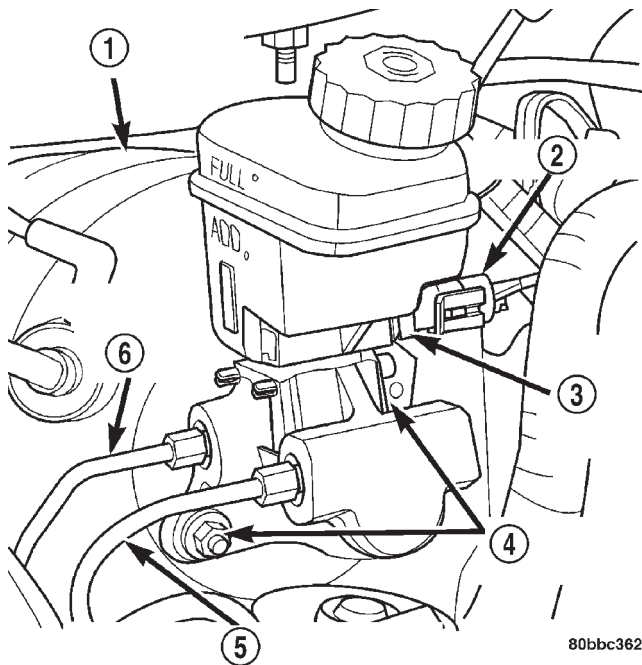


Fig. 12 Master Cylinder

- 1 - POWER BRAKE BOOSTER
- 2 - CONNECTOR
- 3 - BRAKE FLUID LEVEL SWITCH
- 4 - MOUNTING NUTS
- 5 - SECONDARY BRAKE TUBE
- 6 - PRIMARY BRAKE TUBE

(6) Clean the area around where the master cylinder attaches to the power brake booster using a suitable brake cleaner such as Mopar® Brake Parts Cleaner or an equivalent.

(7) Remove the 2 nuts attaching master cylinder to power brake booster (Fig. 12).

(8) Slide the master cylinder straight out of the power brake booster.

INSTALLATION

NOTE: The master cylinder must be bled before installing it on the vehicle.

(1) Bleed the master cylinder before installing it on the vehicle. Refer to MASTER CYLINDER BLEEDING in SERVICE PROCEDURES within this section of this service manual group.

(2) Wipe the face of the power brake booster clean where the master cylinder seal comes in contact when it's installed. Do not get any cleaner or debris inside the booster.

(3) Position the master cylinder on the studs of power brake vacuum booster aligning the booster push rod with the master cylinder push rod. Carefully push the master cylinder onto the studs until it contacts the face of the booster.

(4) Install the two master cylinder mounting nuts (Fig. 12). Tighten the mounting nuts to a torque of 28 N·m (250 in. lbs.).

(5) Connect the primary and secondary brake tubes to the master cylinder primary and secondary ports (Fig. 12). Tighten the nuts to a torque of 17 N·m (145 in. lbs.).

(6) Install the wiring harness connector on the master cylinder reservoir fluid level switch.

(7) Install the battery and clamp in place.

(8) Connect the positive, then the negative (ground) cable on the battery.

(9) Fill the master cylinder to the proper fill level.

(10) Road test the vehicle to ensure proper operation of the base and antilock brake systems.

INTEGRATED CONTROL UNIT

NOTE: Before proceeding with this procedure, review SERVICE WARNINGS AND CAUTIONS at the beginning of REMOVAL AND INSTALLATION in this section.

REMOVAL

(1) Using a brake pedal holder, depress the brake pedal past its first one inch of travel and hold it in this position (Fig. 13). This will isolate the master cylinder from the brake hydraulic system and will not allow the brake fluid to drain out of the master cylinder reservoir.

(2) Disconnect negative (ground) cable from the battery and isolate the cable.

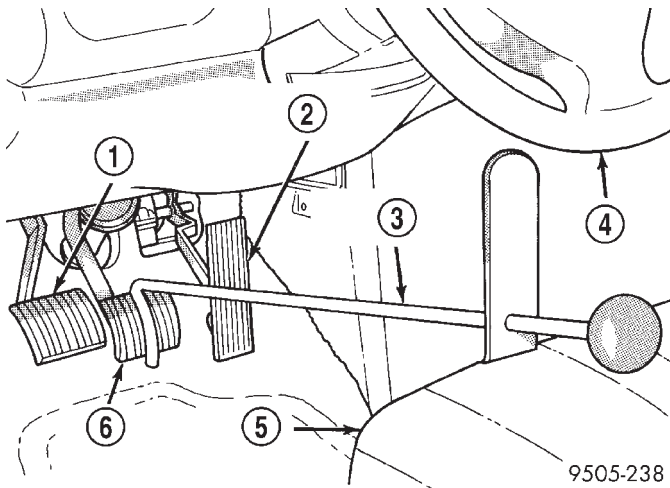
(3) Disconnect the positive cable from the battery, then remove the battery from the battery tray. There is one nut securing the clamp on the backside of the battery holding it in place.

(4) Remove the one nut and one bolt securing the air cleaner box in place, then disconnect the wiring harness connector at the air inlet sensor.

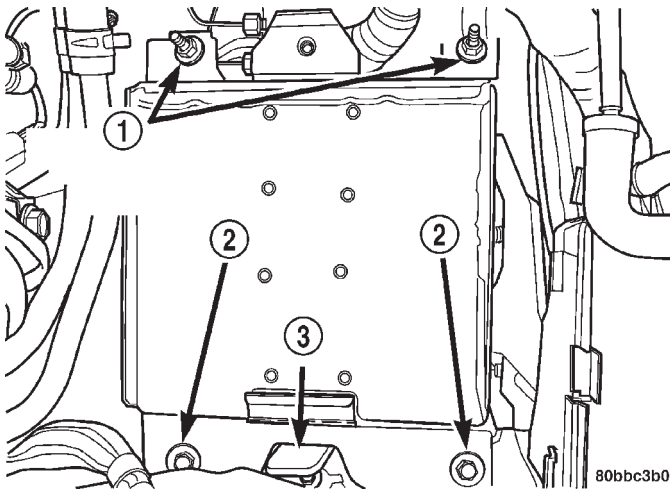
(5) Lift the air cleaner box upward enough to clear its grommated alignment post (Fig. 14), then move the air cleaner box forward just enough to access the battery tray mounting bolts.

(6) Remove the 2 bolts, then the 2 nuts mounting the battery tray to its bracket (Fig. 14). Remove the battery tray.

REMOVAL AND INSTALLATION (Continued)

**Fig. 13 Brake Pedal Holder**

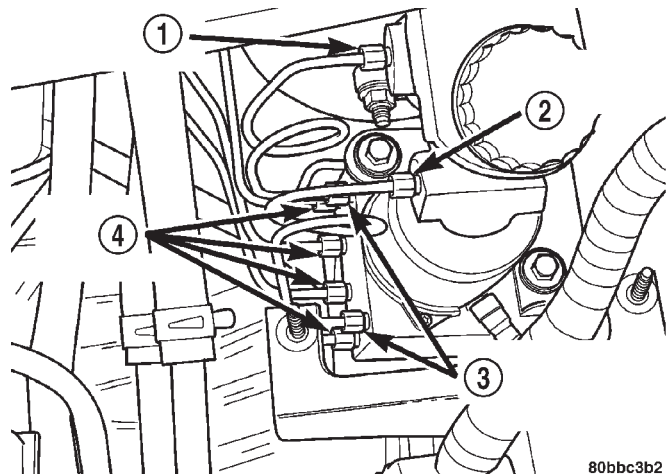
- 1 - CLUTCH PEDAL (IF EQUIPPED WITH MANUAL TRANSAXLE)
- 2 - THROTTLE PEDAL
- 3 - BRAKE PEDAL HOLDING TOOL
- 4 - STEERING WHEEL
- 5 - DRIVER'S SEAT
- 6 - BRAKE PEDAL

**Fig. 14 Battery Tray Mounting**

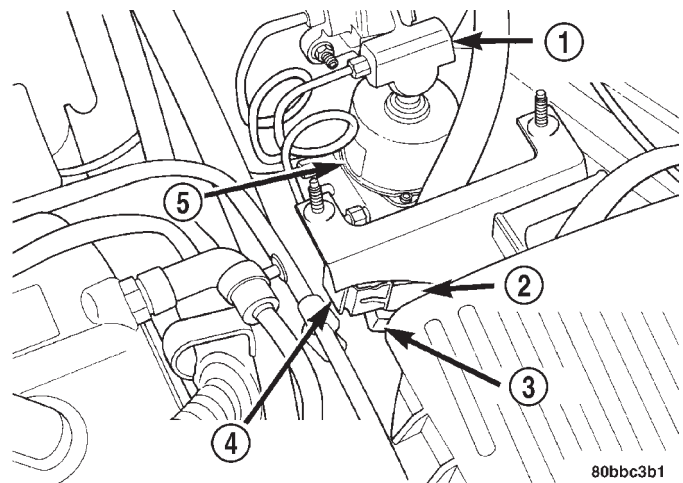
- 1 - BATTERY TRAY MOUNTING NUTS
- 2 - BATTERY TRAY MOUNTING BOLTS
- 3 - AIR CLEANER BOX POST

(7) Disconnect the primary and secondary brake tubes from the master cylinder (Fig. 15). Install plugs in the master cylinder outlet ports.

(8) Disconnect the 25-way connector from the controller antilock brake (CAB) mounted on the integrated control unit (ICU) and move it out of the way. The connector is disconnected by pulling outward on the connector lock (Fig. 16). This will unlock and raise the 25-way connector out of the socket on the CAB.

**Fig. 15 Brake Tube Locations**

- 1 - PRIMARY BRAKE TUBE
- 2 - SECONDARY BRAKE TUBE
- 3 - BRAKE TUBES FROM MASTER CYLINDER
- 4 - BRAKE TUBES TO BRAKES

**Fig. 16 Connector Lock Pulled Outward**

- 1 - MASTER CYLINDER
- 2 - 25-WAY CONNECTOR
- 3 - CAB
- 4 - CONNECTOR LOCK PULLED OUTWARD
- 5 - ICU

(9) Tag the brake tubes coming from the master cylinder as primary and secondary (Fig. 15). This is done to avoid mix-up once the tubes are removed from the vehicle.

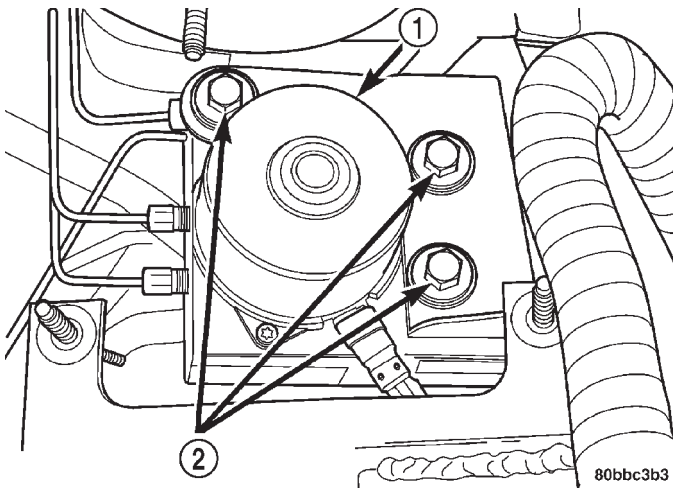
(10) Disconnect and remove the primary and secondary brake tubes coming from the master cylinder at the ICU hydraulic control unit (HCU) (Fig. 15).

(11) Disconnect the brake tubes going to each individual brake at the HCU (Fig. 15).

(12) Remove the 3 bolts attaching the ICU to its mounting bracket (Fig. 17).

(13) Remove the ICU from the vehicle.

REMOVAL AND INSTALLATION (Continued)

**Fig. 17 ICU Mounting Bolts**

- 1 - ICU
2 - ICU MOUNTING BOLTS

(14) Refer to **DISASSEMBLY AND ASSEMBLY** in this section of this group for the procedure on separating and reattaching the CAB to the HCU.

INSTALLATION

- (1) Install the ICU onto its mounting bracket.
- (2) Install the 3 bolts attaching the ICU to the mounting bracket (Fig. 17). Tighten the 3 mounting bolts to a torque of 11 N·m (97 in. lbs.).
- (3) Install the four brake tubes going to the brakes into their respective outlet ports on the ICU HCU (Fig. 15). Using a crow foot on a torque wrench, tighten the four brake tube nuts to a torque of 17 N·m (145 in. lbs.).

NOTE: When installing the brake tubes from the master cylinder on the HCU, the brake tube with the small tube nut is to be installed in the forward-most port on the HCU with the small end going toward the master cylinder secondary port.

- (4) Install the primary and secondary brake tubes from the master cylinder onto the HCU (Fig. 15). Do not completely tighten the primary and secondary tubes at this time.
- (5) Connect the primary and secondary brake tubes to the master cylinder ports (Fig. 15).
- (6) Using a crow foot on a torque wrench, tighten the primary and secondary brake tube nuts at both the master cylinder and HCU to a torque of 17 N·m (145 in. lbs.).

CAUTION: Before installing the 25-way connector in the CAB, be sure the seal is properly installed in the connector.

(7) Install the 25-way connector into the socket of the CAB as follows:

- Position the 25-way connector in the socket of the CAB and carefully push it down as far as possible (Fig. 16).
- When the connector is fully seated into the CAB socket, push the connector lock inward. This pulls the connector into the socket of the CAB and locks it in the installed position.

(8) Position the battery tray back in place. Install the two bolts, then the two nuts mounting the battery tray to its bracket (Fig. 14). Tighten the two bolts and nuts to a torque of 15 N·m (135 in. lbs.).

(9) Reinstall the air cleaner box onto its grommeted alignment post (Fig. 14).

(10) Install the one nut and one bolt securing the air cleaner box in place, then connect the wiring harness connector at the air inlet sensor.

(11) Install the battery and clamp it in place. Tighten the hold-down clamp bolt to a torque of 12 N·m (105 in. lbs.).

(12) Connect the positive, then the negative (ground) cable on the battery.

(13) Bleed the base and the ABS hydraulic systems. Refer to **ANTILOCK BRAKE SYSTEM BLEEDING** in this section of this service manual group.

(14) Fill the master cylinder to the proper fill level.

(15) Road test the vehicle to ensure proper operation of the base and antilock brake systems.

WHEEL SPEED SENSOR (FRONT)

NOTE: Before proceeding with this procedure, review **SERVICE WARNINGS AND CAUTIONS** at the beginning of **REMOVAL AND INSTALLATION** in this section.

REMOVAL

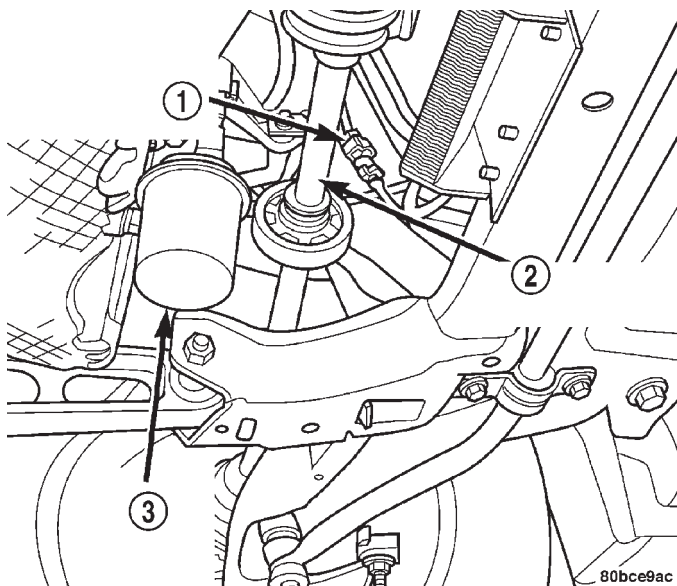
(1) Raise the vehicle. Refer to **HOISTING** in the **LUBRICATION AND MAINTENANCE** group for the proper lifting procedure.

(2) Disconnect the wheel speed sensor cable connector from the wiring harness on the inside of the frame rail above the front suspension crossmember (Fig. 18). The connector has a locking tab which that must be pulled back before the connector release tang can be depressed, releasing the connection.

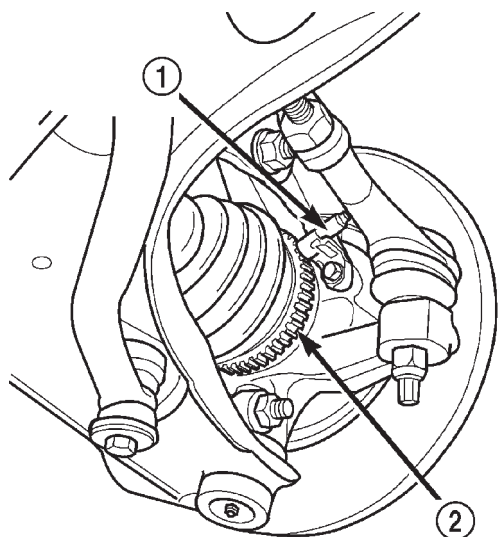
(3) Remove the speed sensor cable grommet from the retaining bracket attached to the brake hose on the outside of the frame rail.

(4) Remove the bolt mounting the wheel speed sensor head to the steering knuckle (Fig. 19).

REMOVAL AND INSTALLATION (Continued)

**Fig. 18 Wiring Harness Connector**

- 1 - RIGHT FRONT WHEEL SPEED SENSOR CONNECTOR
- 2 - RIGHT FRONT DRIVESHAFT
- 3 - ENGINE OIL FILTER

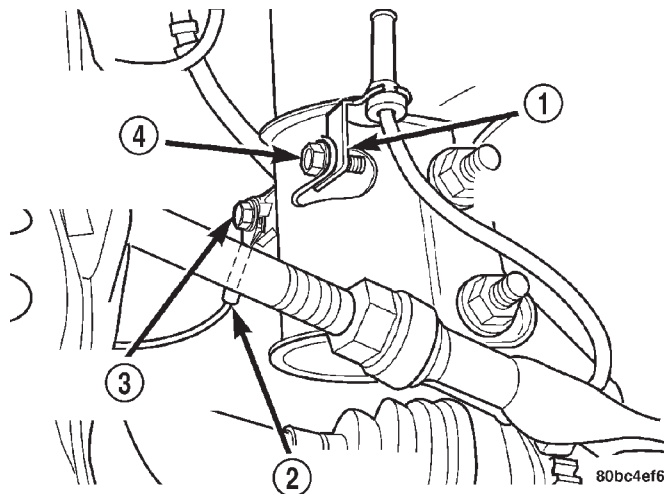
**Fig. 19 Wheel Speed Sensor**

- 1 - RIGHT FRONT WHEEL SPEED SENSOR
- 2 - TONE WHEEL

CAUTION: When removing a wheel speed sensor from the knuckle, do not use pliers on the sensor head. This may damage the sensor head. If the sensor has seized, use a hammer and a punch to tap the edge of the sensor head ear, rocking the sensor side-to-side until free.

(5) Carefully, remove the sensor head from the steering knuckle.

(6) Remove the screw securing the wheel speed sensor to the rear of the strut (Fig. 20). Remove the wheel speed sensor.

**Fig. 20 Wheel Speed Sensor At Strut**

- 1 - ABS WHEEL SPEED SENSOR ROUTING BRACKET (IF EQUIPPED)
- 2 - GROUND STRAP
- 3 - GROUND STRAP SCREW
- 4 - ABS SENSOR BRACKET SCREW (IF EQUIPPED)

INSTALLATION

CAUTION: Failure to install speed sensor cables properly may result in contact with moving parts or an over extension of cables causing an open circuit. Be sure that cables are installed, routed, and clipped properly.

(1) Attach the wheel speed sensor to the strut using the its mounting screw (Fig. 20).

(2) Install the wheel speed sensor head in the steering knuckle (Fig. 19). Install the mounting bolt. Tighten the mounting bolt to a torque of 12 N·m (105 in. lbs.).

(3) From the sensor bracket on the strut, loop the sensor cable upward, then downward at the outside of the frame rail. Install the speed sensor cable grommet onto the retaining bracket attached to the brake hose on the outside of the frame rail.

(4) Loop the wheel speed sensor cable around the bottom of the frame rail and connect it to the wiring harness connector on the inside of the frame rail (Fig. 18). Remember to push in the locking tab on the connector.

(5) Install the tire and wheel assembly.

(6) Lower the vehicle.

(7) Road test vehicle to ensure proper operation of the base brakes and ABS.

REMOVAL AND INSTALLATION (Continued)

WHEEL SPEED SENSOR (REAR)

NOTE: Before proceeding with this procedure, review **SERVICE WARNINGS AND CAUTIONS** at the beginning of **REMOVAL AND INSTALLATION** in this section.

REMOVAL

(1) Raise the vehicle. Refer to **HOISTING** in the **LUBRICATION AND MAINTENANCE** group for the proper lifting procedure.

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

(3) Disconnect the wheel speed sensor cable connector from the vehicle wiring harness (Fig. 21). Remove the clip attaching wheel speed sensor cable connector to the vehicle's body.

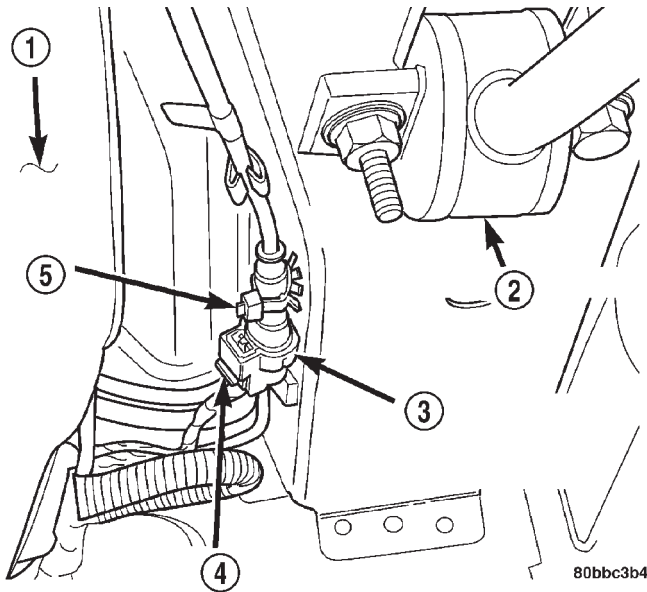


Fig. 21 Wheel Speed Sensor Connector

- 1 - FUEL TANK
- 2 - TENSION STRUT
- 3 - WHEEL SPEED SENSOR CONNECTOR
- 4 - LOCKING TAB
- 5 - CLIP

(4) Remove the wheel speed sensor cable routing bracket from under rear brake flex hose mounting bracket. Then remove the speed sensor cable from the routing clips on the rear brake flex hose and chassis brake tube.

(5) Remove the bolt attaching the wheel speed sensor cable routing bracket to rear strut.

CAUTION: When removing a wheel speed sensor from the rear disc brake adapter, do not use pliers on the sensor head. This may damage the sensor head. If the sensor has seized, use a hammer and a

punch to tap the edge of the sensor head ear, rocking the sensor side-to-side until free.

(6) Remove the bolt attaching the wheel speed sensor to the rear disc brake adapter (Fig. 22), then carefully remove the sensor head from the rear disc brake adapter and vehicle.

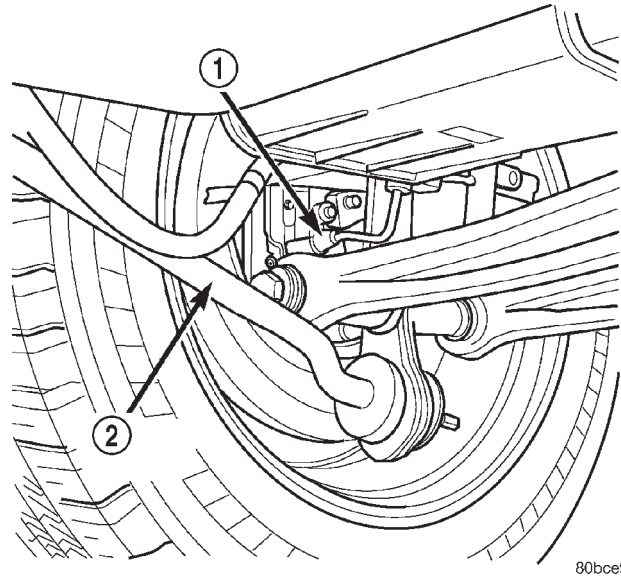


Fig. 22 Rear Wheel Speed Sensor

- 1 - RIGHT REAR WHEEL SPEED SENSOR
- 2 - TENSION STRUT

INSTALLATION

CAUTION: Failure to install speed sensor cables properly may result in contact with moving parts or an over extension of cables causing an open circuit. Be sure that cables are installed, routed, and clipped properly.

(1) Install the wheel speed sensor head into the disc brake adapter (Fig. 22).

(2) Install the wheel speed sensor mounting bolt. Tighten the mounting bolt to a torque of 12 N·m (105 in. lbs.).

(3) Install the wheel speed sensor cable routing bracket on the rear strut.

(4) Install wheel speed sensor cable into the routing clips on the rear brake hose and brake tube.

(5) Connect the wheel speed sensor cable connector into vehicle wiring harness (Fig. 21). Install the clip attaching the wheel speed sensor cable connector to vehicle's body.

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

(7) Lower the vehicle.

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

DISASSEMBLY AND ASSEMBLY

INTEGRATED CONTROL UNIT

REMOVAL

NOTE: To replace the hydraulic control unit (HCU) or the controller antilock brake (CAB) on this vehicle, the entire integrated control unit (ICU) needs to be removed from the vehicle. The CAB can then be separated from the HCU. Do not attempt to replace the CAB with the ICU mounted in the vehicle.

(1) Remove the ICU from the vehicle. Refer INTEGRATED CONTROL UNIT in the REMOVAL AND INSTALLATION section in this section of the service manual.

(2) Disconnect the pump/motor wiring harness (Fig. 23) from the CAB.

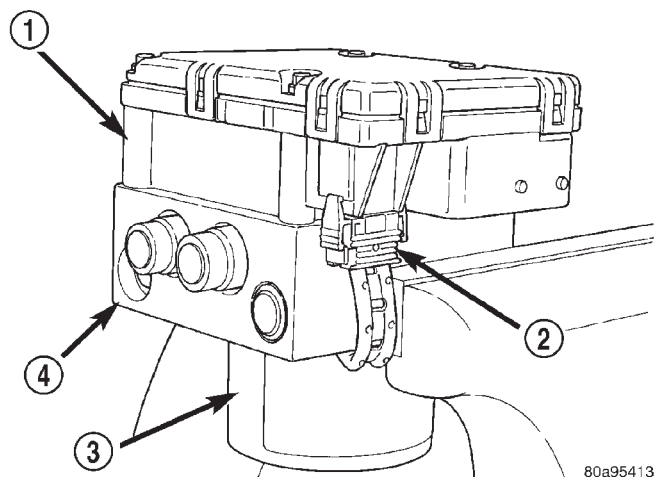


Fig. 23 Pump/Motor To CAB Wiring Harness

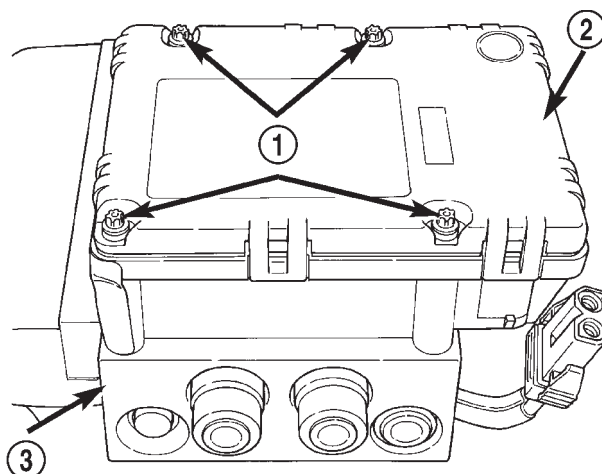
- 1 - CAB
- 2 - PUMP MOTOR WIRING HARNESS
- 3 - PUMP MOTOR
- 4 - HCU VALVE BLOCK

(3) Remove the 4 bolts (Fig. 24) attaching the CAB to the HCU.

(4) Remove the CAB from the HCU (Fig. 25).

INSTALLATION

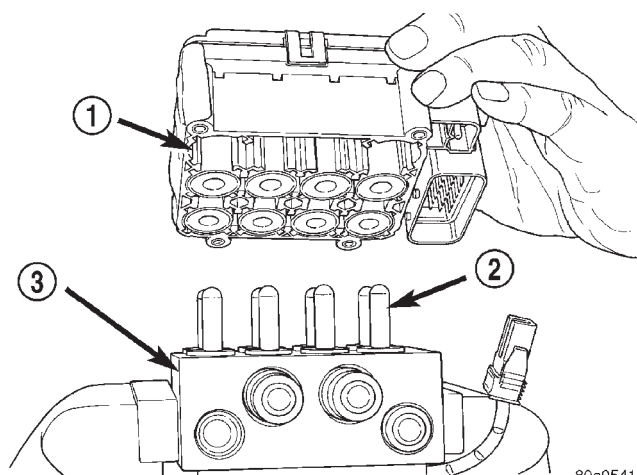
(1) Install the CAB (Fig. 25) on the HCU.



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Fig. 24 CAB Attaching Bolts

- 1 - MOUNTING BOLTS
- 2 - CAB
- 3 - HCU VALVE BLOCK



80a95415

Fig. 25 Remove/Install CAB

- 1 - CAB
- 2 - HCU VALVES
- 3 - HCU VALVE BLOCK

(2) Install the 4 bolts mounting the CAB (Fig. 24) to the HCU. Tighten the CAB mounting bolts to a torque of 2 N·m (17 in. lbs.).

(3) Plug the pump/motor wiring harness into the CAB (Fig. 23).

(4) Install the ICU in the vehicle.

(5) Bleed the base and ABS hydraulic systems. Refer to ANTILOCK BRAKE SYSTEM BLEEDING in this section of this service manual group.

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

SPECIFICATIONS

TONE WHEEL RUNOUT

FRONT TONE WHEEL:

Maximum Runout 0.25 mm (0.009 in.)

REAR TONE WHEEL:

Maximum Runout 0.25 mm (0.009 in.)

WHEEL SPEED SENSOR-TO-TONE WHEEL CLEARANCE

FRONT WHEEL:

Minimum Clearance 0.28 mm (0.011 in.)

Maximum Clearance 1.42 mm (0.056 in.)

REAR WHEEL:

Minimum Clearance 0.45 mm (0.018 in.)

Maximum Clearance 1.12 mm (0.044 in.)

BRAKE FASTENER TORQUE SPECIFICATIONS

DESCRIPTION	TORQUE
BRAKE TUBES:	
Tube Nuts	17 N·m (145 in. lbs.)
MASTER CYLINDER:	
Mounting Nuts	28 N·m (250 in. lbs.)
POWER BRAKE BOOSTER:	
Mounting Nuts	34 N·m (300 in. lbs.)
DISC BRAKE CALIPER:	
Caliper Banjo Bolt	48 N·m (35 ft. lbs.)
Guide Pin Bolts	22 N·m (192 in. lbs.)
Bleeder Screw	15 N·m (125 in. lbs.)
WHEEL CYLINDER (REAR):	
Mounting Bolts	13 N·m (115 in. lbs.)
Bleeder Screw	10 N·m (80 in. lbs.)
DRUM BRAKE SHOE SUPPORT PLATE (REAR):	
Mounting Bolts	75 N·m (55 ft. lbs.)
DISC BRAKE ADAPTER (REAR):	
Mounting Bolts	75 N·m (55 ft. lbs.)
HUB AND BEARING (REAR):	
Retaining Nut	217 N·m (160 ft. lbs.)
PARKING BRAKE:	
Lever Mounting Nuts	28 N·m (250 in. lbs.)
TIRE AND WHEEL:	
Wheel Mounting Nut	109–150 N·m (80–110 ft. lbs.)
INTEGRATED CONTROL UNIT:	
Mounting Bolts	11 N·m (97 in. lbs.)
CAB Mounting bolts	2 N·m (17 in. lbs.)
Bracket-to-Frame Rail Bolts	23 N·m (200 in. lbs.)
WHEEL SPEED SENSOR:	
Head Mounting bolt	12 N·m (105 in. lbs.)

