BRAKES

TABLE OF CONTENTS

BRAKES - BASE BRAKE SYSTEM

TABLE OF CONTENTS

BRAKES - BASE BRAKE SYSTEM

DESCRIPTION - BASE BRAKES

The base brake system consists of the following components:

- Brake pedal
- Master cylinder
- Power brake booster
- Brake tubes and hoses
- Proportioning valves (2)
- Disc brakes (front and rear)
- Brake lamp switch
- Brake fluid level switch
- Parking brake

All brakes are power assist type through the use of a vacuum operated power brake booster.

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 from the master cylinder and the right front and left rear are on the other.

Front disc brakes control the braking of the front wheels; rear braking is controlled by rear disc brakes.

Vehicles equipped with the optional antilock brake system (ABS) (with and without traction control) use a system designated Mark 20i. This system shares most base brake hardware used on vehicles without ABS. All components differing from the base brake hardware are described in detail in the Antilock Brake System section.

The parking brake on this vehicle is pedal-operated.

For more information on the description of any individual base brake component, refer to that component elsewhere in this section. For information on the brake lamp switch, (Refer to 8 - ELECTRICAL/ LAMPS/LIGHTING - EXTERIOR/BRAKE LAMP SWITCH - DESCRIPTION)

OPERATION - BASE BRAKES

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, junction block, and proportioning valves to the brakes at each tire and wheel assembly.

The pedal-operated parking brake operates in the following manner. When applied, the parking brake lever pulls on cables that actuate parking brake shoes at each rear wheel.

For more information on the operation of any individual base brake component, refer to that component elsewhere in this section.

WARNING

WARNING: DUST AND DIRT ACCUMULATING ON BRAKE PARTS DURING NORMAL USE MAY CONTAIN ASBESTOS FIBERS FROM PRODUCTION OR AFTERMARKET BRAKE LININGS. BREATHING EXCESSIVE CONCENTRATIONS OF ASBESTOS FIBERS CAN CAUSE SERIOUS BODILY HARM. EXERCISE CARE WHEN SERVICING BRAKE PARTS. DO NOT SAND OR GRIND BRAKE LINING UNLESS EQUIPMENT USED IS DESIGNED TO CONTAIN THE DUST RESIDUE. DO NOT CLEAN BRAKE PARTS WITH COMPRESSED AIR OR BY DRY BRUSHING. CLEANING SHOULD BE DONE BY DAMPENING THE BRAKE COMPONENTS WITH A FINE MIST OF WATER, THEN WIPING THE BRAKE COMPONENTS CLEAN WITH A DAMPENED CLOTH. DISPOSE OF CLOTH AND ALL RESIDUE CONTAINING ASBESTOS FIBERS IN AN IMPERMEABLE CONTAINER WITH THE APPROPRIATE LABEL. FOLLOW PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) AND THE ENVIRONMENTAL PROTECTION AGENCY (EPA) FOR THE HANDLING, PROCESSING, AND DISPOSING OF DUST OR DEBRIS THAT MAY CONTAIN ASBESTOS FIBERS.

CAUTION

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: Never use gasoline, kerosene, alcohol, motor oil, transmission fluid, or any fluid containing mineral oil to clean system components. These fluids damage rubber cups and seals.

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

CAUTION: When handling the brake rotor and caliper, be careful to avoid damaging the brake rotor and caliper, and scratching or nicking the brake shoe lining.

CAUTION: If the vehicle is equipped with the Tire Pressure Monitoring (TPM) System, the tire/wheel assembly needs to be reinstalled in the same location it is removed from or the TPM System (sensors) will need to be retrained. Mark each tire/wheel assembly indicating location, prior to its removal. If the tire/wheel assemblies are switched, rotated or replaced, the TPM System needs to be retrained. (Refer to 22 - TIRES/WHEELS/TIRE PRESSURE MONITORING/SENSOR - STANDARD PROCEDURE)

STANDARD PROCEDURE - BASE BRAKE BLEEDING

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

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

NOTE: For bleeding this vehicles antilock brake hydraulic system, Refer to Antilock Brake System Bleeding.

NOTE: 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.

NOTE: 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 brake hydraulic system.

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

The base brake system can be bled using the pressure method or the manual method. Both methods are presented in this text.

PRESSURE BLEEDING METHOD

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

(1) Remove filler cap from the top of fluid reservoir on master cylinder.

(2) Install Adapter, Special Tool 8224, in the caps place on the reservoir (Fig. 1).

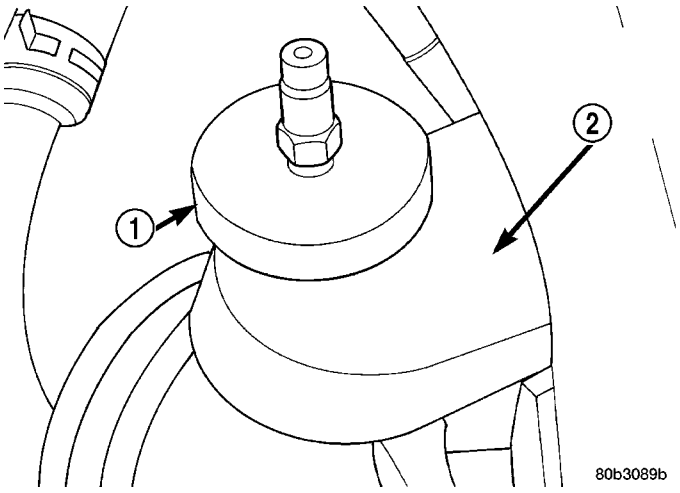


Fig. 1 Pressure Bleeding Adapter Mounted On Fluid Reservoir

1 - SPECIAL TOOL 8224
2 - MASTER CYLINDER FLUID RESERVOIR

(3) Attach Bleeder Tank, Special Tool C-3496-B, or equivalent, to Special Tool 8224. Pressurize the system following the pressure bleeder manufacturer's instructions.

(4) Remove rubber dust caps from all 4 bleeder screws.

BRAKES - BASE BRAKE SYSTEM (Continued)

(5) Starting at the first wheel circuit as listed earlier, attach a clear hose to the bleeder screw at that wheels brake caliper or wheel cylinder and feed the other end of hose into a clear jar containing enough fresh brake fluid to submerge the end of the hose (Fig. 2).

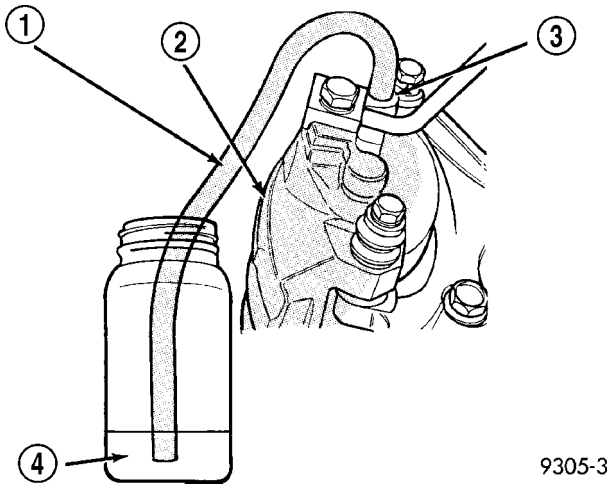


Fig. 2 Proper Method for Purging Air From Brake

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

CAUTION: Open the bleeder screw at least one full turn when instructed. Some air may be trapped in the brake lines or valves far upstream, as far as ten feet or more from the bleeder screw (Fig. 3). If the bleeder screw is not opened sufficiently, fluid flow is restricted causing a slow, weak fluid discharge. This will NOT get all the air out. Therefore, it is essential to open the bleeder screw at least one full turn to allow a fast, large volume discharge of brake fluid.

(6) Open bleeder screw (Fig. 2) at least one full turn or more to obtain an adequate flow of brake fluid.

(7) After 4 to 8 ounces of brake fluid has been bled through the brake hydraulic circuit, and an air-free flow (no bubbles) is maintained in the clear plastic hose and jar, close the bleeder screw.

(8) Bleed the remaining wheel circuits in the same manner until all air is removed from the brake hydraulic system.

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

(10) Reinstall all 4 bleeder screw dust caps.

(11) Test drive vehicle to ensure brakes are operating properly and pedal feel is correct.

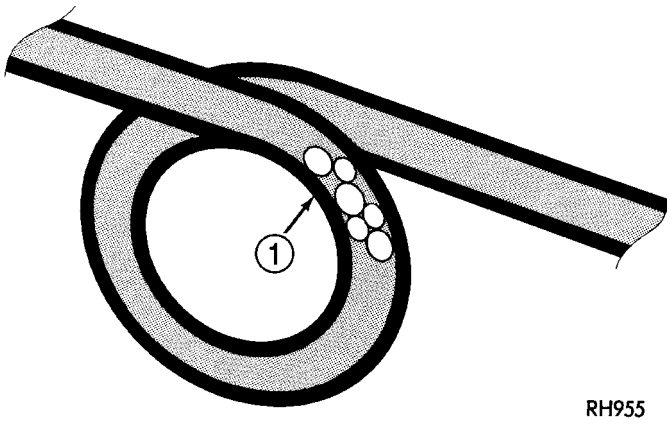


Fig. 3 Trapped Air in Brake Line

1 - TRAPPED AIR

MANUAL BLEEDING METHOD

NOTE: To bleed the base brake system manually, an assistants help is required.

(1) Remove rubber duct caps from all 4 bleeder screws.

(2) Attach a clear hose to the bleeder screw at one wheel and feed the other end of the hose into a clear jar containing fresh brake fluid (Fig. 2).

(3) Have an assistant pump the brake pedal three or four times and hold it down before the bleeder screw is opened.

CAUTION: Open the bleeder screw at least one full turn when instructed. Some air may be trapped in the brake lines or valves far upstream, as far as ten feet or more from the bleeder screw (Fig. 3). If the bleeder screw is not opened sufficiently, fluid flow is restricted causing a slow, weak fluid discharge. This will NOT get all the air out. Therefore, it is essential to open the bleeder screw at least one full turn to allow a fast, large volume discharge of brake fluid.

(4) While the pedal is being held down, open the bleeder screw at least 1 full turn. When the bleeder screw opens the brake pedal will drop all the way to the floor. Continue to hold the pedal all the way down.

(5) Once the brake pedal has dropped, close the bleeder screw. The pedal can then be released.

(6) Repeat steps (1) through (5) until all trapped air is removed from that wheel circuit (usually four or five times). This should pass a sufficient amount of fluid to expel all the trapped air from the brakes hydraulic system. Be sure to monitor brake fluid level in master cylinder fluid reservoir, to ensure it stays at a proper level. This will ensure air does not reenter brake hydraulic system through master cylinder.

NOTE: Monitor the brake fluid level in the fluid reservoir periodically to make sure it does not go too low. This will ensure that air does not reenter the brake hydraulic system.

(7) Bleed the remaining wheel circuits in the same manner until all air is removed from the brake hydraulic system.

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

(9) Reinstall all 4 bleeder screw dust caps.

(10) Test drive vehicle to ensure brakes are operating properly and pedal feel is correct.

SPECIFICATIONS

BRAKE COMPONENTS

DESCRIPTION	SPECIFICATION
Brake Hydraulic System	Dual Circuit - Diagonally Split
Brake Pedal Ratio	3.44:1
Brake Tube Fitting Type	ISO Flares
Master Cylinder Type - with ABS	Center Valve (Port)
Master Cylinder Type - without ABS	Vent Port
Master Cylinder Bore/Stroke	23.8 mm x 39.4 mm (0.937 in. x 1.55 in.)
Master Cylinder Split	50/50
Master Cylinder Outlet Port Primary Tube Nut Thread	M-12
Master Cylinder Outlet Port Secondary Tube Nut Thread - W/ABS	M-10
Master Cylinder Outlet Port Secondary Tube Nut Thread - W/O ABS	M-12
Power Brake Booster Type	205 mm Vacuum Assist
Power Brake Booster Boost	4690 At 20 inches Manifold Vacuum

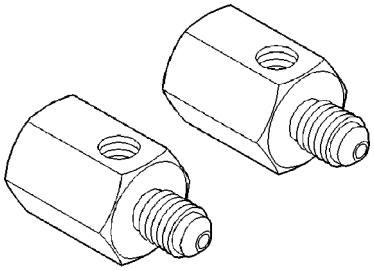
BRAKE FASTENER TORQUE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Brake Hose Intermediate Bracket Bolt	12	—	105
Caliper Banjo Bolt	48	35	—
Caliper Bleeder Screw	15	—	125
Caliper Guide Pin Bolts	22	16	192
Junction Block Support Bracket Bolts	26	19	230
Master Cylinder Mounting Nuts	28	21	250
Parking Brake Lever Mounting Bolts	28	21	250
Power Brake Booster Mounting Nuts	28	21	250
Tube Nuts	17	—	145
Wheel Mounting (Lug) Nuts	135	100	—

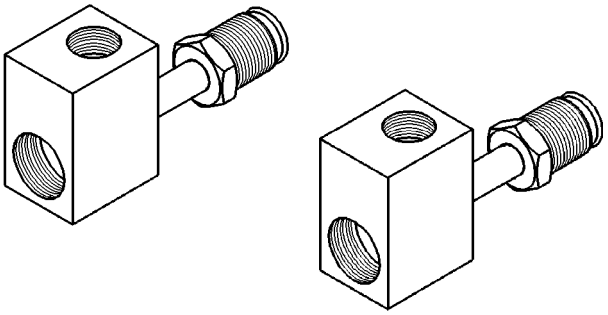
BRAKES - BASE BRAKE SYSTEM (Continued)

SPECIAL TOOLS

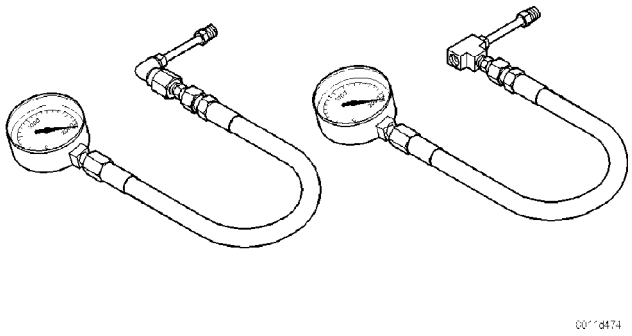
BASE BRAKE SYSTEM



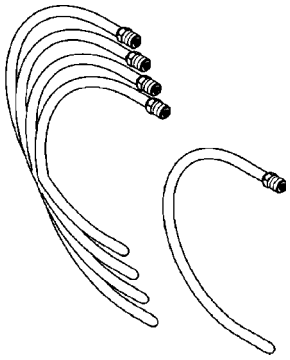
Adapters, Brake Pressure Test 6892



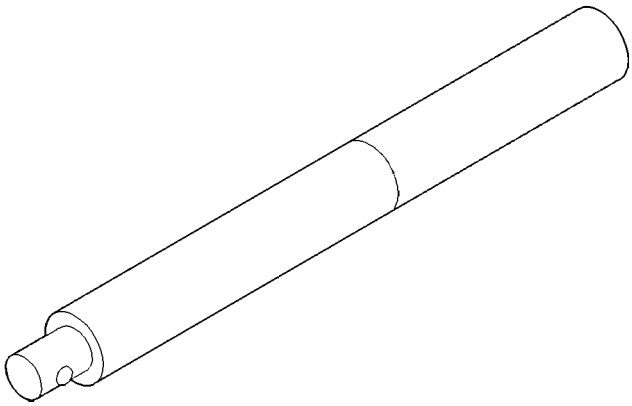
Adapters, Brake Pressure Test 8187



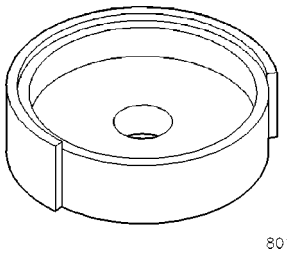
Gauge Set C-4007-A



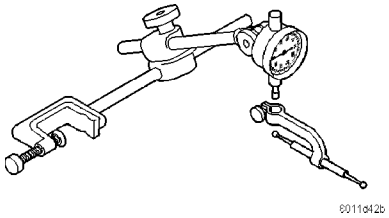
Tubes, Master Cylinder Bleed 8358



Handle, Universal C-4171



Installer, Dust Boot C-4689



Dial Indicator C-3339

BRAKE FLUID LEVEL SWITCH

DESCRIPTION

The brake fluid level switch used on this vehicle's master cylinder is internal to the master cylinder fluid reservoir (Fig. 4). The vehicle wiring harness has a connector which plugs directly into the brake fluid reservoir.

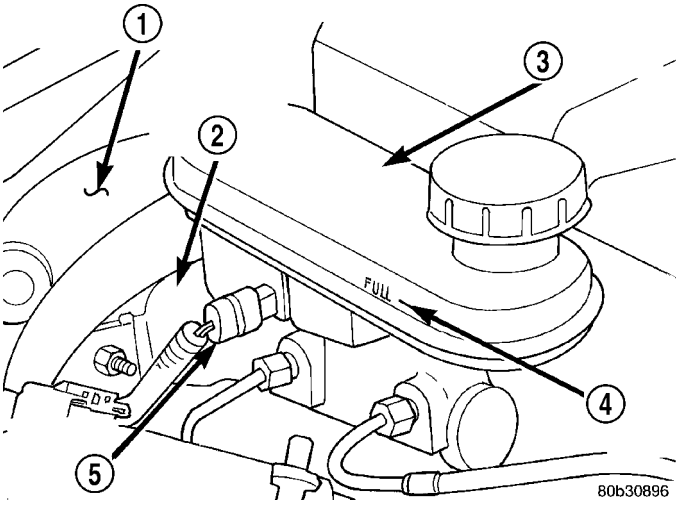


Fig. 4 Master Cylinder

1 - BOOSTER
2 - MASTER CYLINDER
3 - MASTER CYLINDER FLUID RESERVOIR
4 - FLUID LEVEL FULL MARK
5 - FLUID LEVEL SWITCH

The brake fluid level switch in the brake fluid reservoir is not a repairable item. If the switch is found to be defective the entire brake fluid reservoir must be replaced.

OPERATION

The purpose of the brake fluid level switch is to provide the driver with early warning that brake fluid in the master cylinder is below a normal level.

As the fluid drops below the designed level, the switch closes completing the red BRAKE warning indicator lamp circuit. This will illuminate the red BRAKE warning indicator lamp located in the instrument cluster. At this time, the master cylinder fluid reservoir should be checked and filled to the full mark with DOT 3 brake fluid. **If the brake fluid level has dropped in the brake fluid reservoir, the entire brake hydraulic system should be checked for evidence of a leak.**

HYDRAULIC/MECHANICAL

DESCRIPTION

DESCRIPTION - FRONT DISC BRAKES

The front disc brake assembly used on this vehicle consists of the following components:

- Disc brake caliper
- Brake Shoes (pads/linings)
- Caliper abutment rail shims
- Brake Rotor

The floating double pin single piston calipers (Fig. 5) used on this vehicle are mounted directly to the steering knuckles and use no adapter. The caliper is mounted to the steering knuckle using bushings, sleeves and two thru-bolts which thread directly into the steering knuckle (Fig. 6).

The caliper is a one piece casting with the inboard side containing a single piston cylinder bore. The front disc brake caliper phenolic piston is 60 mm (2.36 inch) in diameter.

There are two brake shoes (pads) mounted to the brake caliper (Fig. 5). One brake shoe mounts on each side of a brake rotor. The brake shoe lining material used has been specifically formulated to meet the braking requirements of the vehicle. An audible wear indicator is mounted on the outboard brake shoe.

Rail shims are mounted above and below the brake pads (when installed) on the machined caliper abutment rails of the knuckle.

The brake rotor is mounted on the hub and bearing. The rotor is made of iron and is vented to help cool it during brake applications.

Vehicles equipped with standard four-wheel-disc brakes utilize a conventional internally-vented hat style rotor. Internally-vented refers to the fact that the inner most diameter of the braking disc vents to the rear of the rotor (Fig. 7).

Vehicles equipped with performance four-wheel-disc brakes utilize an inverted-hat style rotor. This rotor is externally vented meaning the inner most diameter of the braking disc vents to the front (or face) of the rotor (Fig. 7).

Although there are two different style brake rotors depending on brake packages, they are serviced in the same manner.

HYDRAULIC/MECHANICAL (Continued)

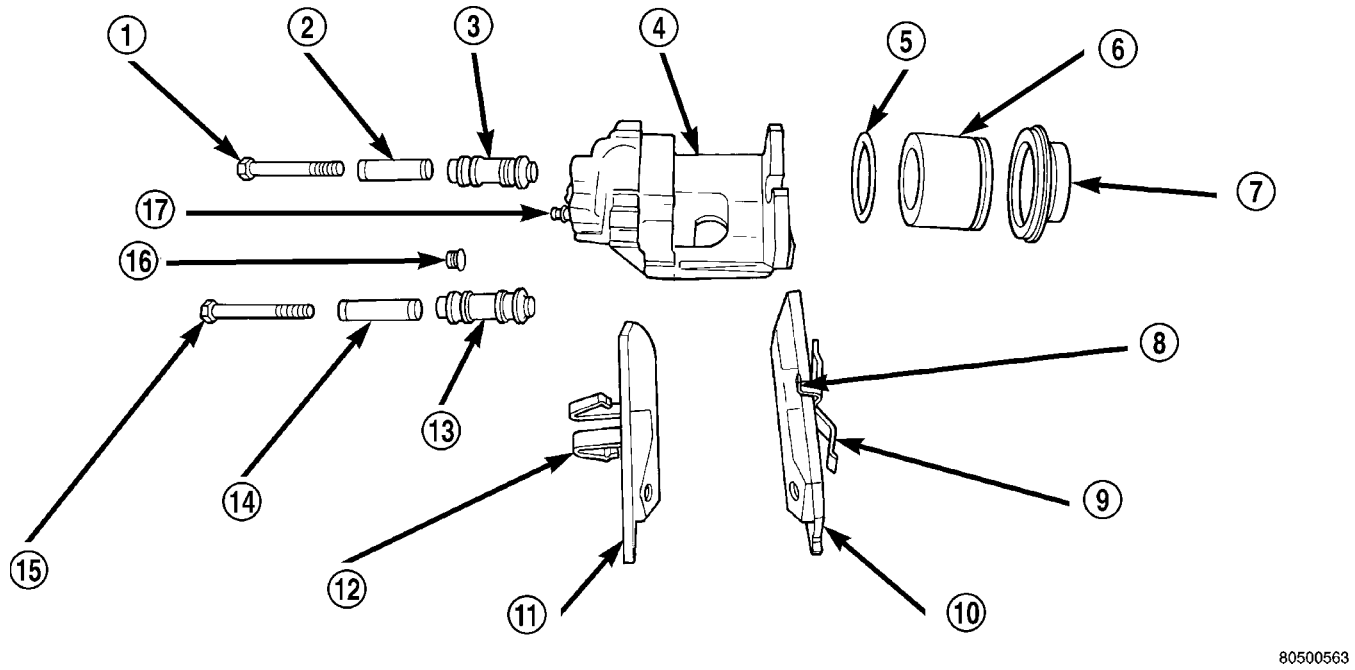


Fig. 5 Front Disc Brake Caliper Assembly

1 - 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 - OUTBOARD BRAKE SHOE
11 - INBOARD BRAKE SHOE
12 - ANTI-RATTLE CLIP
13 - BUSHING
14 - SLEEVE
15 - GUIDE PIN BOLT
16 - CAP
17 - BLEEDER SCREW

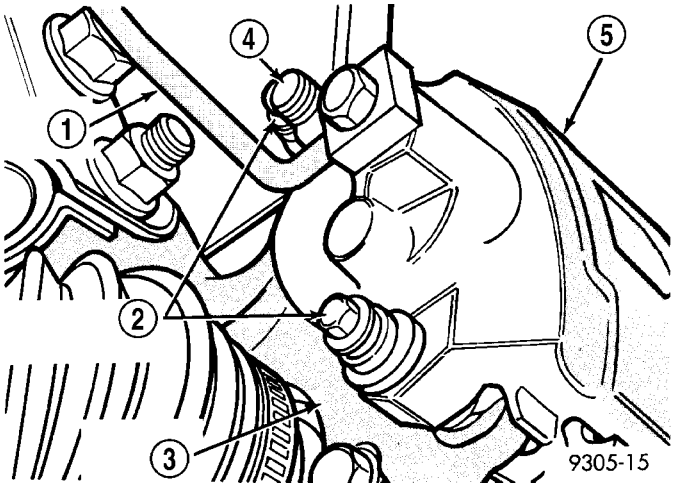


Fig. 6 Disc Brake Caliper Mounting

1 - BRAKE LINE
2 - CALIPER GUIDE PIN BOLTS
3 - STEERING KNUCKLE
4 - BLEEDER SCREW
5 - CALIPER ASSEMBLY

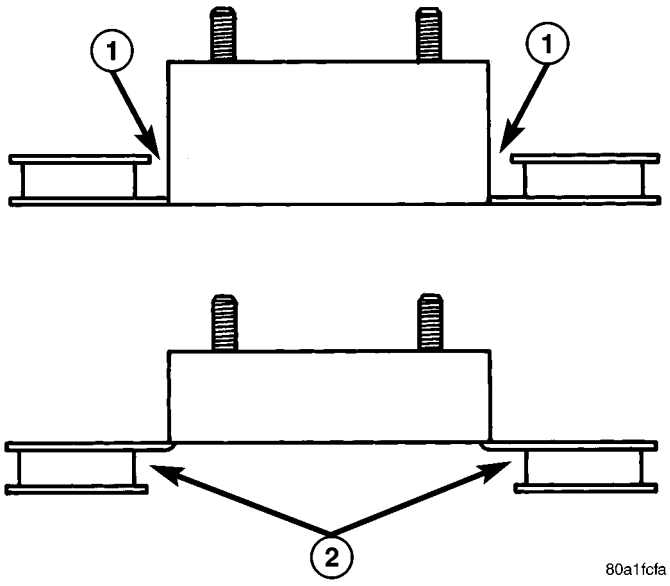


Fig. 7 Externally And Internally Vented Rotors (Cross-Sectional View)

1 - EXTERNAL VENTS
2 - INTERNAL VENTS

HYDRAULIC/MECHANICAL (Continued)

DESCRIPTION - REAR DISC BRAKES

The rear disc brakes are similar to front disc brakes, however, there are several distinctive features that require different service procedures. This single piston, floating caliper rear disc brake assembly includes (Fig. 8):

- Disc brake caliper
- Brake shoes (pads/linings)
- Brake rotor
- Disc brake caliper adapter

This vehicle is equipped with a caliper assembly that has a 36 mm (1.42 in.) piston.

The caliper assembly on all applications floats on rubber bushings using internal metal sleeves which are attached to the adapter using threaded guide pin bolts (Fig. 8).

The adapter and disc shield are mounted to the rear suspension knuckles of vehicle. The adapter is used to mount the brake shoes and actuating cables for the parking brake system. The adapter also mounts the rear caliper assembly to the vehicle. The adapter has two machined abutments which are used to position and align the caliper and brake shoes for movement inboard and outboard.

This vehicle uses a 14 inch solid non-vented rear disc brake rotor (Fig. 8). It is a drum-in-hat style. It serves a dual purpose. The braking disc area of the rotor functions as a normal brake rotor for disc brakes. The center section of the rotor has a built-in brake drum that is used by the parking brakes. Refer to Parking Brake for more information.

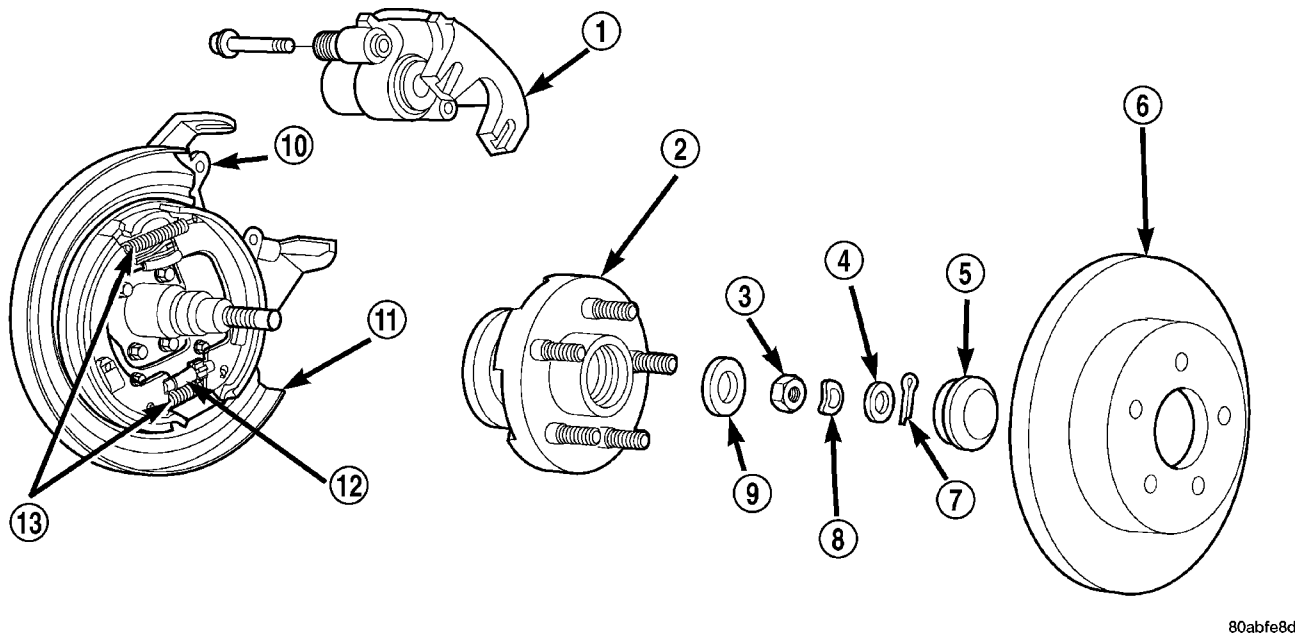


Fig. 8 Rear Disc Brake Assembly

1 - CALIPER
2 - HUB AND BEARING
3 - NUT
4 - NUT LOCK
5 - DUST CAP
6 - ROTOR (DISC)
7 - COTTER PIN
8 - ANTI-RATTLE WASHER
9 - WASHER
10 - ADAPTER
11 - DISC SHIELD
12 - ADJUSTER
13 - RETURN SPRINGS

HYDRAULIC/MECHANICAL (Continued)

OPERATION

OPERATION - FRONT DISC BRAKES

Two machined abutments on the steering knuckle (Fig. 6) position and align the caliper fore-and-aft. The guide pin bolts, sleeves, and bushings control the side-to-side movement of the caliper.

Although there are different disc brake systems available, they operate and are serviced in the same manner.

A square-cut rubber piston seal is located in a machined groove in the cylinder bore. This provides a hydraulic seal between the piston and the cylinder wall (Fig. 9). The piston seal is designed to pull the piston back into the bore of the caliper when the brake pedal is released. This, along with the brake shoe retractor clips, maintains the proper brake shoe to rotor clearance.

A molded rubber dust boot is installed in a groove in the cylinder bore and the piston, keeping contamination from the cylinder wall and the piston (Fig. 9).

The brake shoe lining material rides against the brake rotors braking surface. When the brakes are applied, the shoes apply pressure against the rotor, thus slowing the vehicle.

As brake shoe linings wear, master cylinder reservoir brake fluid level will go down. If brake fluid has been added to the reservoir, overflow may occur if the piston is pushed back into the recessed position.

An audible wear indicator (Fig. 5) is mounted on the outboard pad of the front disc brake assemblies. Upon contact with the brake rotor, this indicator emits a sound, signaling that brake shoes may need inspection or replacement.

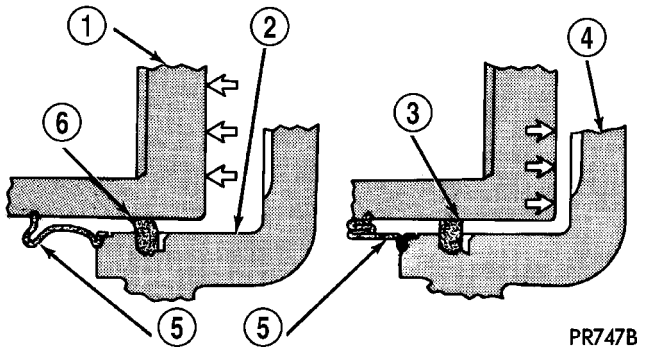


Fig. 9 Piston Seal Function for Automatic Adjustment Of Front Brakes

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

OPERATION - REAR DISC BRAKES

Rear disc brakes operate similarly to front disc brakes. Refer to Front Disc Brakes for additional information.

DIAGNOSIS AND TESTING - BASE BRAKE SYSTEM

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.	1. Release parking brake lever.
	2. Parking brake warning lamp switch on parking brake lever.	2. Inspect and replace switch as necessary.
	3. Brake fluid level low in reservoir.	3. Fill reservoir. Check entire system for leaks. Repair or replace as required.
	4. Brake fluid level switch.	4. Disconnect switch wiring connector. If lamp goes out, replace switch.
	5. Mechanical instrument cluster (MIC) problem.	5. Refer to Chassis Diagnostic Procedures manual.

HYDRAULIC/MECHANICAL (Continued)

BRAKE NOISE

CONDITION	POSSIBLE CAUSES	CORRECTION
DISC BRAKE CHIRP	1. Excessive brake rotor runout.	1. Follow brake rotor diagnosis and testing. Correct as necessary.
	2. Lack of lubricant on brake caliper slides.	2. Lubricate brake caliper slides.
DISC BRAKE RATTLE OR CLUNK	1. Broken or missing anti-rattle spring clips or rail shims on shoes.	1. Replace brake shoes, spring clips or rail shims as applicable.
	2. Caliper guide pins loose.	2. Tighten guide pins.
DISC BRAKE SQUEAK AT LOW SPEED (WHILE APPLYING LIGHT BRAKE PEDAL EFFORT)	1. Brake shoe linings.	1. Replace brake shoes.
SCRAPING (METAL-TO-METAL).	1. Foreign object interference with brakes.	1. Inspect brakes and remove foreign object.
	2. Brake shoes worn out.	2. Replace brake shoes. Inspect rotors. Reface or replace as necessary.

OTHER BRAKE CONDITIONS

CONDITION	POSSIBLE CAUSES	CORRECTION
BRAKES CHATTER	1. Disc brake rotor has excessive thickness variation.	1. Isolate condition as rear or front. Reface or replace brake rotors as necessary.
BRAKES DRAG (FRONT OR ALL)	1. Contaminated brake fluid.	1. Check for swollen seals. Replace all system components containing rubber.
	2. Binding caliper pins or bushings.	2. Replace pins and bushings
	3. Binding master cylinder.	3. Replace master cylinder.
	4. Binding brake pedal.	4. Replace brake pedal.
BRAKES DRAG (REAR ONLY)	1. Parking brake cables binding or froze up.	1. Check cable routing. Replace cables as necessary.
	2. Parking brake cable return spring not returning shoes.	2. Replace cables as necessary.
	3. Obstruction inside the center console preventing full return of the parking brake cables.	3. Remove console and remove obstruction.
BRAKES GRAB	1. Contaminated brake shoe linings.	1. Inspect and clean, or replace shoes. Repair source of contamination.
	2. Improper power brake booster assist.	2. Refer to Power Brake Booster in the diagnosis and testing section.
EXCESSIVE PEDAL EFFORT	1. Obstruction of brake pedal.	1. Inspect, remove or move obstruction.
	2. Low power brake booster assist.	2. Refer to power brake booster in the diagnosis and testing section.
	3. Glazed brake linings.	3. Reface or replace brake rotors as necessary. Replace brake shoes.

HYDRAULIC/MECHANICAL (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	4. Brake shoe lining transfer to brake rotor.	4. Reface or replace brake rotors as necessary. Replace brake shoes.
EXCESSIVE PEDAL TRAVEL (VEHICLE STOPS OK)	1. Air in brake lines.	1. Bleed 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.
PEDAL PULSATES/SURGES DURING BRAKING	1. Disc brake rotor has excessive thickness variation.	1. Isolate condition as rear or front. Reface or replace brake 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. 3. Improper power brake booster assist.	1. Inspect and clean, or replace shoes. Repair source of contamination. 2. Test proportioning valves folowing procedure listed in diagnosis and testing section. Replace valves as necessary. 3. 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 LEVER TRAVEL	1. Rear parking brake shoes out of adjustment.	1. Adjust rear parking brake shoes.

BRAKE LINES

DESCRIPTION - BRAKE TUBES AND HOSES

The chassis brake tubes are steel with a corrosion resistant coating applied to the external surfaces. The flex hoses are made of reinforced rubber.

All available brake systems on this vehicle use the same type of brake line fittings and tubing flares. The brake line fittings used are double-wall ISO style tubing flares and fittings at all tubing joint locations. Only the outlets of the proportioning valves and the rear flex hoses threading into them have non-ISO style flares (ABS and early production Non-ABS vehicles only). They utilize double-inverted style flares. Refer to (Fig. 10) for specific joint locations and tube fitting size.

Brake hose connections at disc brake calipers are made using banjo fittings permanently attached to the end of the hose. Banjo bolts with internal passageways for fluid flow connect the hose to the caliper. Copper washers are used to seal the banjo fittings and bolts at the caliper and must be replaced when the connection is broken.

OPERATION - BRAKE TUBES AND HOSES

The purpose of the chassis brake tubes and flex hoses is to transfer the pressurized brake fluid developed by the master cylinder to the wheel brakes of the vehicle. The flex hoses are made of rubber to allow for the movement of the vehicle's steering and suspension.

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.

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

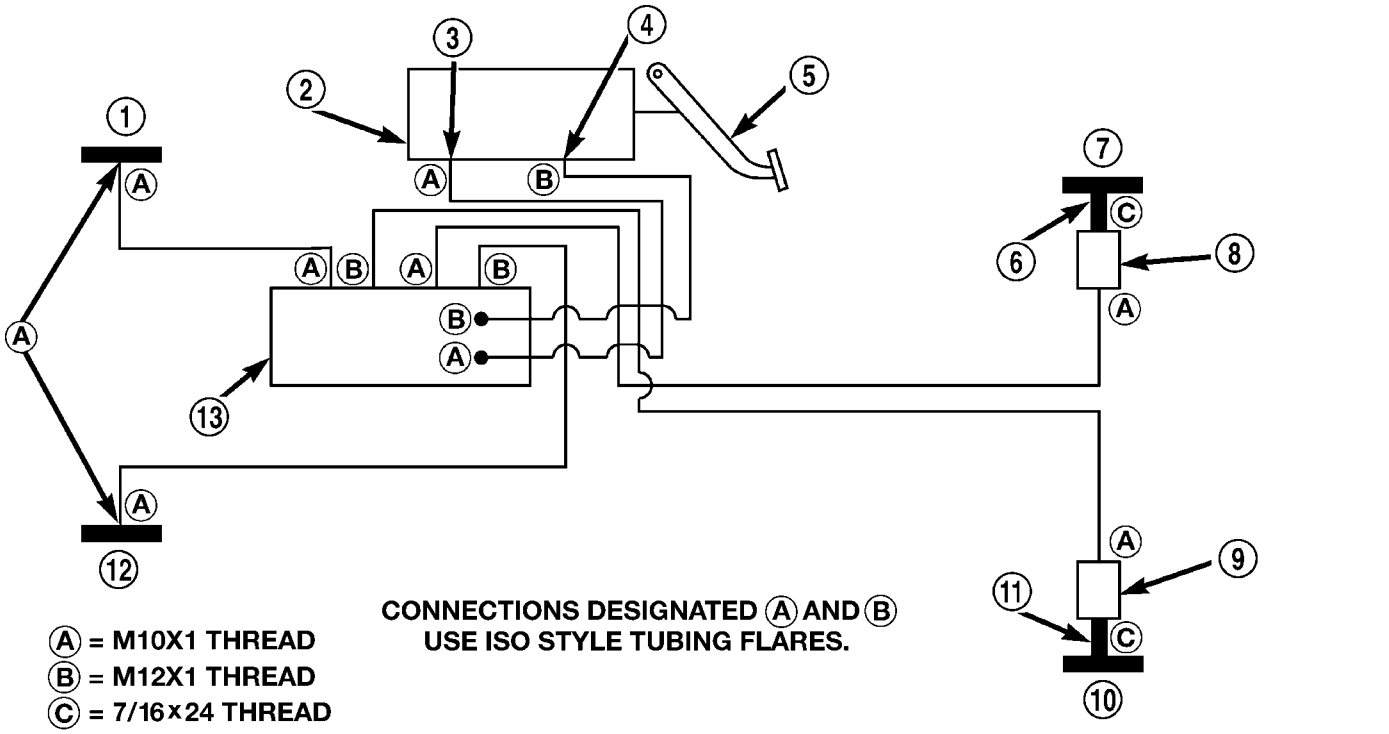


Fig. 10 Brake Tube Nut Thread Sizes And Tube Routing

1 - HOSE END RT. FRONT
2 - MASTER CYLINDER
3 - SECONDARY PORT
4 - PRIMARY PORT
5 - BRAKE PEDAL
6 - HOSE
7 - HOSE END RT. REAR
8 - PROPORTIONING VALVE *
9 - PROPORTIONING VALVE *
10 - HOSE END LT. REAR
11 - HOSE
12 - HOSE END LT. FRONT
13 - HYDRAULIC CONTROL UNIT/JUNCTION BLOCK
* ABS & Early Production Non-ABS Vehicles Only

BRAKE PADS/SHOES - FRONT

REMOVAL

REMOVAL - FRONT DISC BRAKE SHOES

(1) Raise vehicle. (Refer to LUBRICATION & MAINTENANCE/HOISTING - STANDARD PROCEDURE)

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

(3) Remove the two caliper guide pin bolts (Fig. 11).

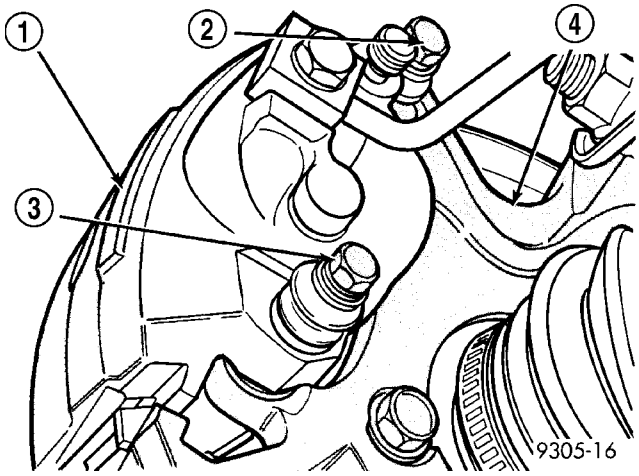


Fig. 11 Caliper Guide Pin Bolts

1 - CALIPER ASSEMBLY
2 - GUIDE PIN BOLT
3 - GUIDE PIN BOLT
4 - STEERING KNUCKLE

NOTE: Note the positioning of the two rail shims between the knuckle's machined abutments and the brake shoes.

(4) Remove caliper assembly from steering knuckle. Proceed by first rotating top of caliper away from steering knuckle, then lifting caliper off bottom machined abutment on steering knuckle (Fig. 12). Take care not to lose the two rail shims.

(5) Hang the caliper off to the side using wire or bungee cord (Fig. 13). Do not allow the caliper to be supported by the flexible brake hose. Damage to the flexible brake hose may result.

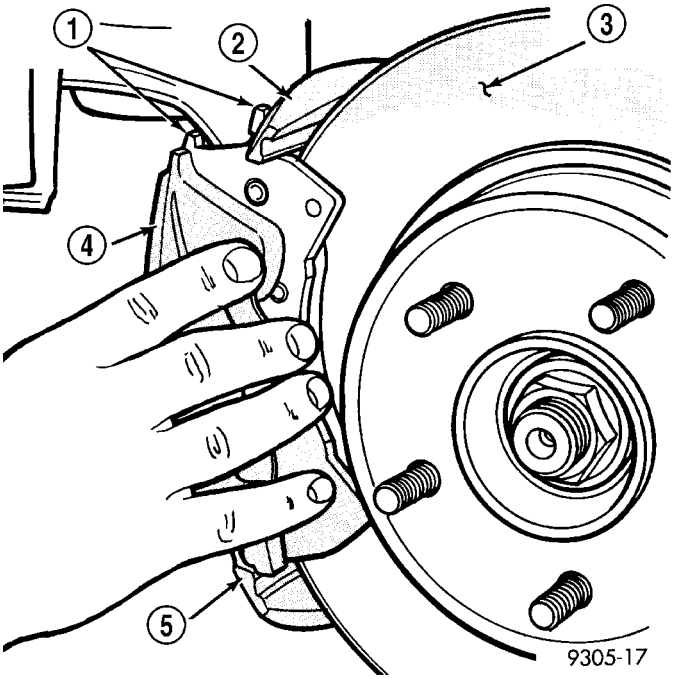


Fig. 12 Caliper Removal/Installation

1 - BRAKE SHOES
2 - STEERING KNUCKLE
3 - BRAKING DISC
4 - CALIPER ASSEMBLY
5 - MACHINED ABUTMENT

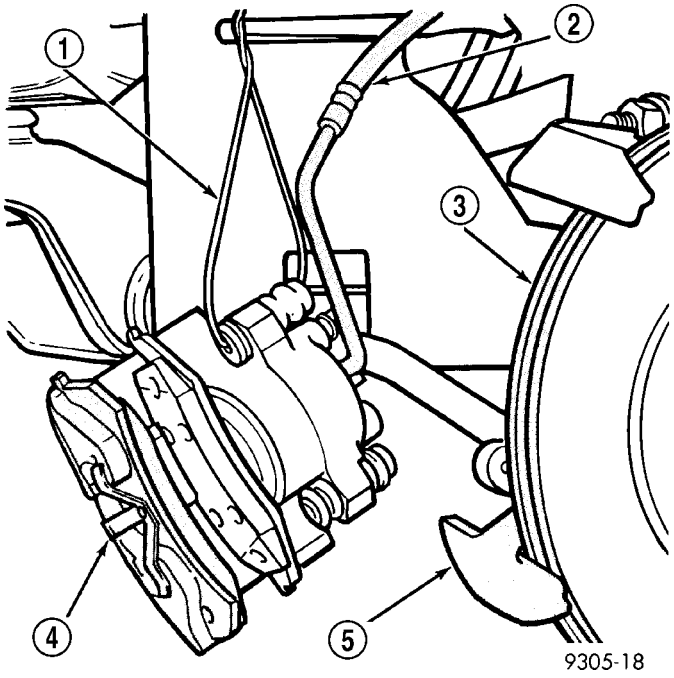


Fig. 13 Supported Caliper

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

BRAKE PADS/SHOES - FRONT (Continued)

(6) Remove outboard brake shoe by prying the shoe retaining clip over raised area on caliper. Then slide the brake shoe off the caliper (Fig. 14).

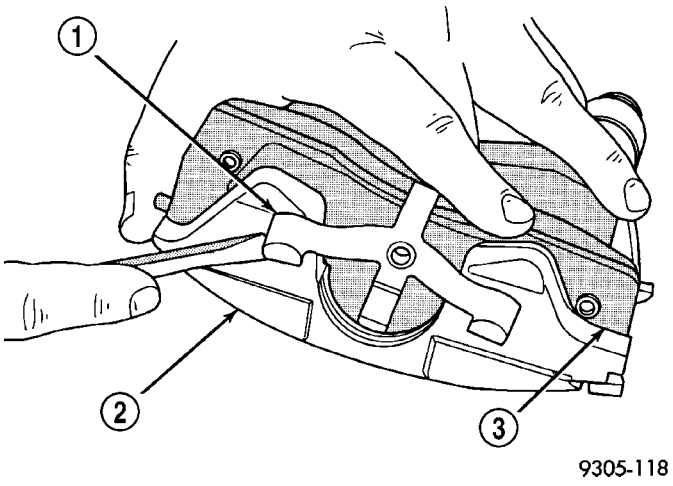


Fig. 14 Removing Outboard Brake Shoe

1 - RETAINING CLIP
2 - CALIPER ASSEMBLY
3 - BRAKE SHOE

(7) Pull inboard brake shoe away from piston until retaining clip is free from cavity in piston (Fig. 15).

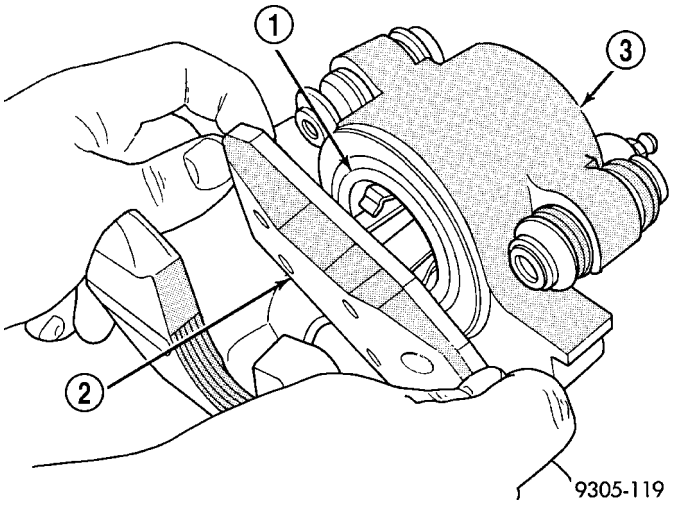


Fig. 15 Inboard Brake Shoe

1 - PISTON
2 - BRAKE SHOE
3 - CALIPER ASSEMBLY

(8) Repeat steps (3) through (7) on opposite side of vehicle to remove that sides brake shoes.

REMOVAL - FRONT DISC BRAKE SHOES (EXPORT)

(1) Raise vehicle. (Refer to LUBRICATION & MAINTENANCE/HOISTING - STANDARD PROCEDURE)

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

(3) Remove the two caliper guide pin bolts (Fig. 11).

(4) Remove caliper assembly from steering knuckle. Proceed by first rotating top of caliper away from steering knuckle and then lifting caliper off bottom machined abutment on steering knuckle (Fig. 12).

(5) Hang the caliper off to the side using wire or bungee cord (Fig. 13). Do not allow the caliper to be supported by the flexible brake hose. Damage to the flexible brake hose may result.

(6) Remove outboard brake shoe by prying the shoe retaining clip over raised area on caliper. Then slide the brake shoe off the caliper (Fig. 14).

(7) Pull inboard brake shoe away from piston until retaining clip is free from cavity in piston (Fig. 15).

(8) Repeat steps (3) through (7) on opposite side of vehicle to remove that sides brake shoes.

CLEANING - DISC BRAKE SHOES

WARNING: DUST AND DIRT ACCUMULATING ON BRAKE PARTS DURING NORMAL USE MAY CONTAIN ASBESTOS FIBERS FROM PRODUCTION OR AFTERMARKET BRAKE LININGS. BREATHING EXCESSIVE CONCENTRATIONS OF ASBESTOS FIBERS CAN CAUSE SERIOUS BODILY HARM. EXERCISE CARE WHEN SERVICING BRAKE PARTS. DO NOT SAND OR GRIND BRAKE LINING UNLESS EQUIPMENT USED IS DESIGNED TO CONTAIN THE DUST RESIDUE. DO NOT CLEAN BRAKE PARTS WITH COMPRESSED AIR OR BY DRY BRUSHING. CLEANING SHOULD BE DONE BY DAMPENING THE BRAKE COMPONENTS WITH A FINE MIST OF WATER, THEN WIPING THE BRAKE COMPONENTS CLEAN WITH A DAMPENED CLOTH. DISPOSE OF CLOTH AND ALL RESIDUE CONTAINING ASBESTOS FIBERS IN AN IMPERMEABLE CONTAINER WITH THE APPROPRIATE LABEL. FOLLOW PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) AND THE ENVIRONMENTAL PROTECTION AGENCY (EPA) FOR THE HANDLING, PROCESSING, AND DISPOSING OF DUST OR DEBRIS THAT MAY CONTAIN ASBESTOS FIBERS.

BRAKE PADS/SHOES - FRONT (Continued)

INSPECTION - DISC BRAKE SHOES

Visually inspect brake shoes (pads) for uneven lining wear. Also inspect for excessive lining deterioration. Check the clearance between the tips of the wear indicators on the shoes (if equipped) and the brake rotors.

If a visual inspection does not adequately determine the condition of the lining, a physical check will be necessary. To check the amount of lining wear, remove the disc brake shoes from the calipers.

Measure each brake shoe. The combined brake shoe and its lining material thickness should be measured at its thinnest point.

- For front disc brake shoes, when a set of brake shoes are worn to a thickness of approximately 7.95 mm (5/16 inch), they should be replaced.
- For rear disc brake shoes, when a set of brake shoes are worn to a thickness of approximately 7.0 mm (9/32 inch), they should be replaced.
- Typically, if front shoes are worn out, both fronts and rears need to be replaced. Make sure to check rears.

Replace **both** disc brake shoes (inboard and outboard) on each caliper. It is necessary to replace the shoes on the opposite side of the vehicle as well as the shoes failing inspection.

If the brake shoe assemblies do not require replacement, be sure to reinstall the brake shoes in the original position they were removed from.

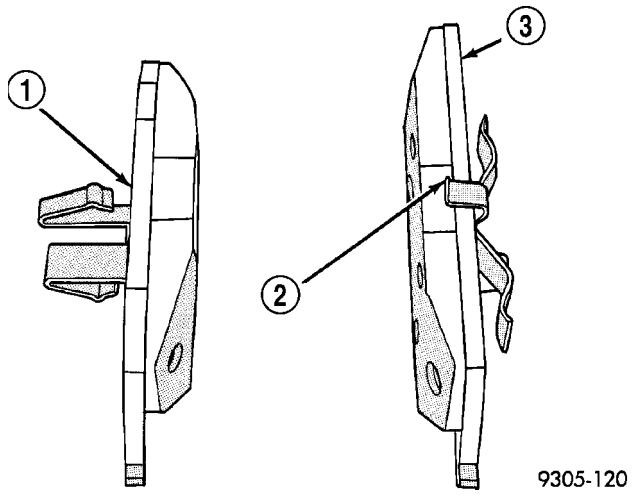


Fig. 16 Inboard And Outboard Shoes

1 - INBOARD BRAKE SHOE
2 - WEAR INDICATOR
3 - OUTBOARD BRAKE SHOE

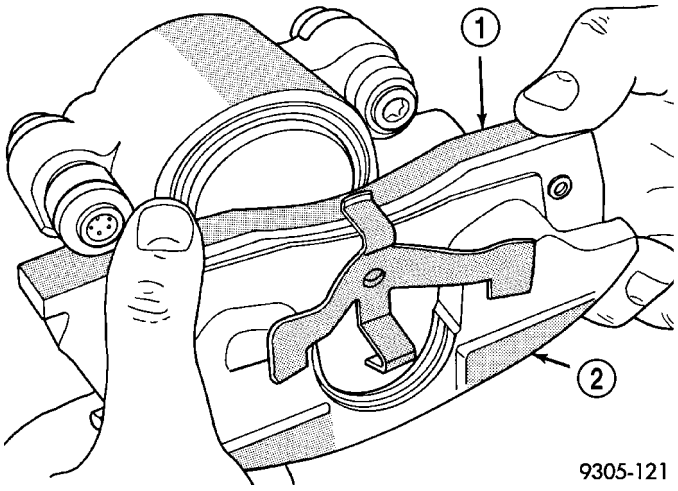


Fig. 17 Installing Outboard Brake Shoe Assembly

1 - BRAKE SHOE ASSEMBLY
2 - BRAKE CALIPER

INSTALLATION

INSTALLATION - FRONT DISC BRAKE SHOES

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

(2) Lubricate both steering knuckle abutments with a liberal amount of Mopar® Brake Grease For Caliper Slides Lubricant, or equivalent.

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

NOTE: The inboard and outboard brake shoes are not common, refer to (Fig. 16) for inboard and outboard brake shoe assembly identification.

NOTE: When installing inboard brake shoe into caliper piston, be sure brake shoe is positioned squarely against the face of the caliper piston.

(4) Install the new inboard brake shoe assembly into the caliper piston by firmly pressing it into bore of caliper piston with thumbs (Fig. 15).

(5) Slide the new outboard brake shoe assembly onto the caliper assembly (Fig. 17).

(6) Install one rail shim on each machined abutment where it will contact the brake shoes. Make sure the alignment tabs on the shims are positioned toward the abutments.

(7) Carefully position caliper and brake shoes over rotor by reversing the removal procedure (Fig. 12).

CAUTION: When being installed, extreme caution should be taken not to crossthread the caliper guide pin bolts.

(8) Install the caliper guide pin bolts (Fig. 11). Tighten guide pin bolts to a torque of 22 N·m (192 in. lbs.).

(9) Repeat the preceding steps on the opposite side of the vehicle, installing the brake shoes on that side of the vehicle.

(10) Install the wheel and tire assemblies.

BRAKE PADS/SHOES - FRONT (Continued)

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

(12) Lower vehicle.

CAUTION: After performing any service to the vehicle brake system, be sure to obtain a firm brake pedal before moving vehicle.

(13) Pump the brake pedal several times to ensure the vehicle has a firm brake pedal to adequately stop vehicle.

(14) Check and adjust the brake fluid level as necessary.

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

INSTALLATION - FRONT DISC BRAKE SHOES (EXPORT)

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

(2) Lubricate both steering knuckle abutments with a liberal amount of Mopar® Brake Grease For Caliper Slides Lubricant, or equivalent.

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

NOTE: The inboard and outboard brake shoes are not common, refer to (Fig. 16) for inboard and outboard brake shoe assembly identification.

NOTE: When installing inboard brake shoe into caliper piston, be sure brake shoe is positioned squarely against the face of the caliper piston.

(4) Install the new inboard brake shoe assembly into the caliper piston by firmly pressing it into bore of caliper piston with thumbs (Fig. 15).

(5) Slide the new outboard brake shoe assembly onto the caliper assembly (Fig. 17).

(6) Carefully position caliper and brake shoes over rotor by reversing the removal procedure (Fig. 12).

CAUTION: When being installed, extreme caution should be taken not to crossthread the caliper guide pin bolts.

(7) Install the caliper guide pin bolts (Fig. 11). Tighten guide pin bolts to a torque of 22 N·m (192 in. lbs.).

(8) Repeat the preceding steps on the opposite side of the vehicle, installing the brake shoes on that side of the vehicle.

(9) Install the wheel and tire assemblies.

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

(11) Lower vehicle.

CAUTION: After performing any service to the vehicle brake system, be sure to obtain a firm brake pedal before moving vehicle.

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

(13) Check and adjust the brake fluid level as necessary.

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

BRAKE PADS/SHOES - REAR

REMOVAL - REAR DISC BRAKE SHOES

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

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

(3) Remove the 2 caliper assembly to adapter guide pin bolts (Fig. 18).

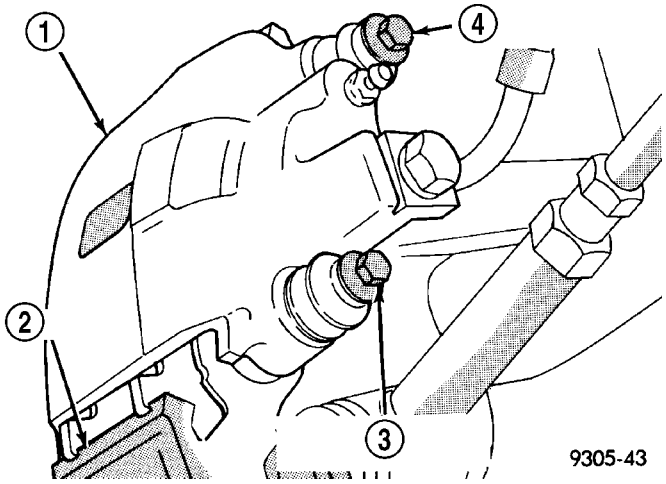


Fig. 18 Caliper Guide Pin Bolts

1 - CALIPER ASSEMBLY
2 - ADAPTER
3 - CALIPER ASSEMBLY ATTACHING BOLT
4 - CALIPER ASSEMBLY ATTACHING BOLT

BRAKE PADS/SHOES - REAR (Continued)

(4) Remove caliper from adapter using the following procedure. First rotate top of caliper away from adapter. Then lift caliper assembly off bottom abutment of adapter to remove it from the vehicle (Fig. 19).

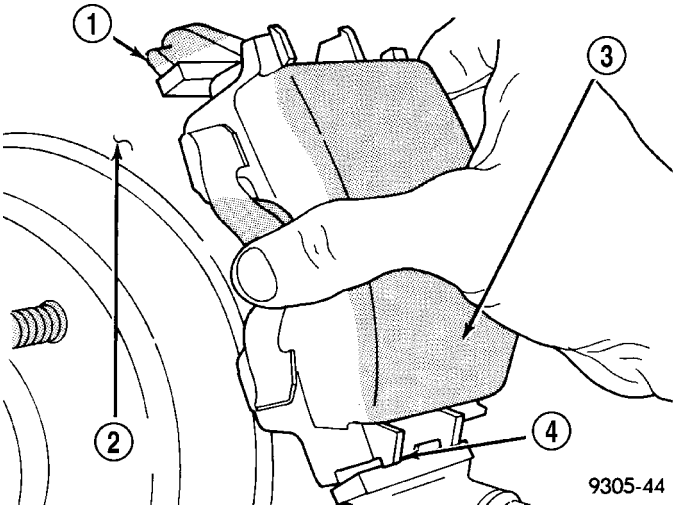


Fig. 19 Removing / Installing Caliper

1 - ADAPTER
2 - BRAKING DISC
3 - CALIPER ASSEMBLY
4 - ADAPTER ABUTMENT

(5) Support caliper assembly firmly from rear strut to prevent weight of caliper from damaging the flexible brake hose (Fig. 20).

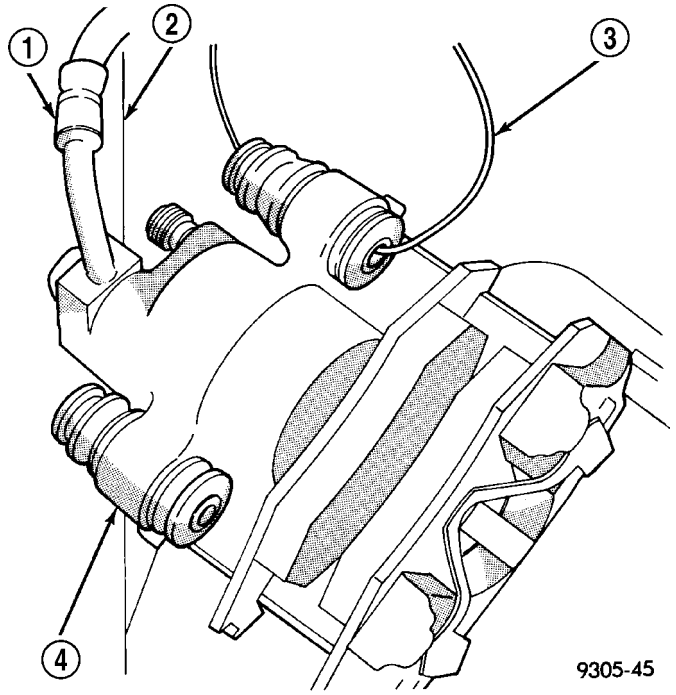


Fig. 20 Storing Caliper

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

(6) Remove the rear rotor from the hub by pulling it straight off the wheel mounting studs (Fig. 21).

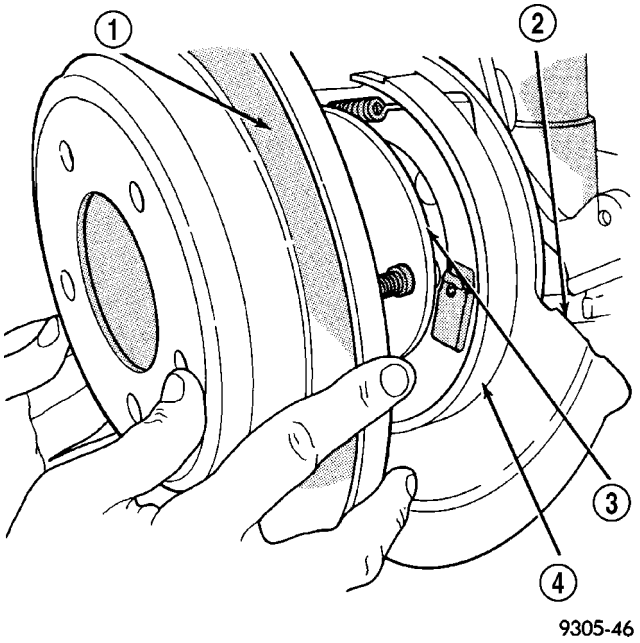


Fig. 21 Removing / Installing Rear Rotor

1 - BRAKE ROTOR (DISC)
2 - DISC SHIELD
3 - HUB
4 - DRUM-IN-HAT PARKING BRAKE

(7) Remove outboard brake shoe, by prying brake shoe retaining clip over raised area on caliper and sliding the shoe off the caliper (Fig. 22).

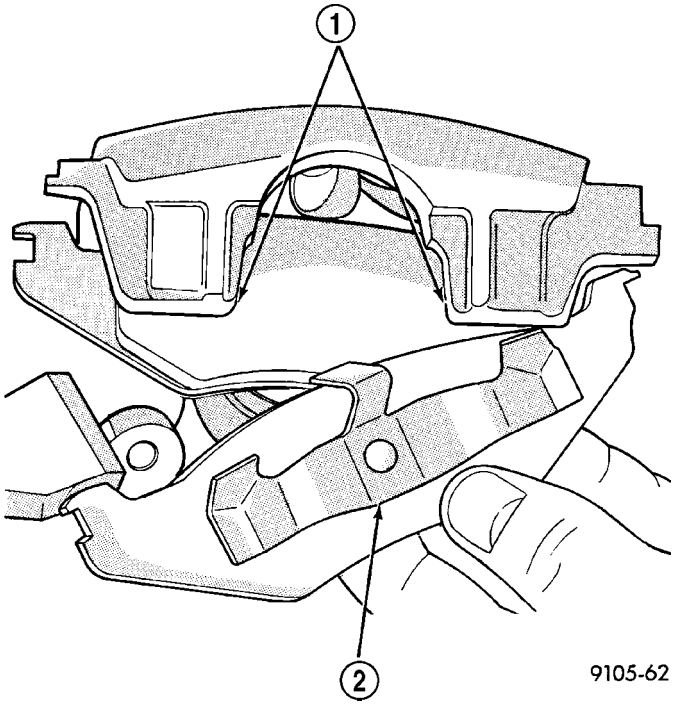


Fig. 22 Removing / Installing Outboard Brake Shoe

1 - CALIPER FINGERS
2 - RETAINING CLIP

BRAKE PADS/SHOES - REAR (Continued)

(8) Pull inboard brake shoe away from piston, until the retaining clip is free from the cavity in the piston (Fig. 23).

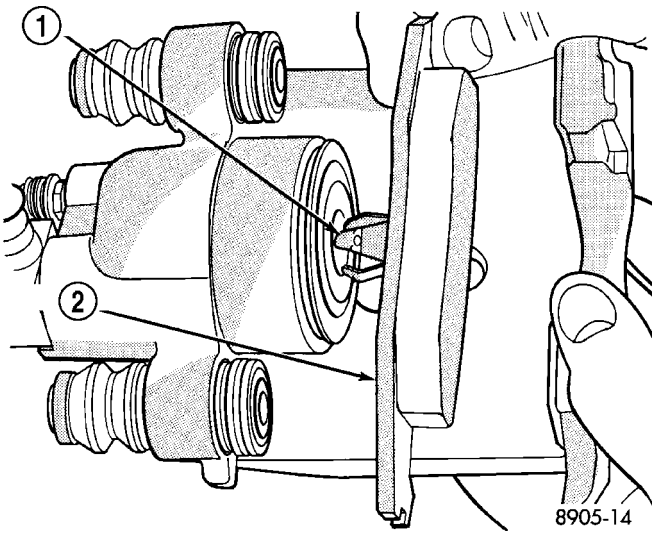


Fig. 23 Removing / Installing Inboard Brake Shoe

1 - RETAINING CLIP
2 - INBOARD SHOE

CLEANING - DISC BRAKE SHOES

WARNING: DUST AND DIRT ACCUMULATING ON BRAKE PARTS DURING NORMAL USE MAY CONTAIN ASBESTOS FIBERS FROM PRODUCTION OR AFTERMARKET BRAKE LININGS. BREATHING EXCESSIVE CONCENTRATIONS OF ASBESTOS FIBERS CAN CAUSE SERIOUS BODILY HARM. EXERCISE CARE WHEN SERVICING BRAKE PARTS. DO NOT SAND OR GRIND BRAKE LINING UNLESS EQUIPMENT USED IS DESIGNED TO CONTAIN THE DUST RESIDUE. DO NOT CLEAN BRAKE PARTS WITH COMPRESSED AIR OR BY DRY BRUSHING. CLEANING SHOULD BE DONE BY DAMPENING THE BRAKE COMPONENTS WITH A FINE MIST OF WATER, THEN WIPING THE BRAKE COMPONENTS CLEAN WITH A DAMPENED CLOTH. DISPOSE OF CLOTH AND ALL RESIDUE CONTAINING ASBESTOS FIBERS IN AN IMPERMEABLE CONTAINER WITH THE APPROPRIATE LABEL. FOLLOW PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) AND THE ENVIRONMENTAL PROTECTION AGENCY (EPA) FOR THE HANDLING, PROCESSING, AND DISPOSING OF DUST OR DEBRIS THAT MAY CONTAIN ASBESTOS FIBERS.

INSPECTION - DISC BRAKE SHOES

Visually inspect brake shoes (pads) for uneven lining wear. Also inspect for excessive lining deterioration. Check the clearance between the tips of the wear indicators on the shoes (if equipped) and the brake rotors.

If a visual inspection does not adequately determine the condition of the lining, a physical check will be necessary. To check the amount of lining wear, remove the disc brake shoes from the calipers.

Measure each brake shoe. The combined brake shoe and its lining material thickness should be measured at its thinnest point.

- For front disc brake shoes, when a set of brake shoes are worn to a thickness of approximately 7.95 mm (5/16 inch), they should be replaced.
- For rear disc brake shoes, when a set of brake shoes are worn to a thickness of approximately 7.0 mm (9/32 inch), they should be replaced.
- Typically, if front shoes are worn out, both fronts and rears need to be replaced. Make sure to check rears.

Replace **both** disc brake shoes (inboard and outboard) on each caliper. It is necessary to replace the shoes on the opposite side of the vehicle as well as the shoes failing inspection.

If the brake shoe assemblies do not require replacement, be sure to reinstall the brake shoes in the original position they were removed from.

INSTALLATION - REAR DISC BRAKE SHOES

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

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

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

(3) Install the rear rotor on the hub, making sure it is squarely seated on the face of the hub (Fig. 21).

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

(5) Install the new inboard brake shoe assembly into the caliper piston by firmly pressing into piston bore with thumbs. Be sure inboard brake shoe assembly is positioned squarely against the face of the caliper piston (Fig. 23).

(6) Slide the new outboard brake shoe assembly onto the caliper assembly (Fig. 22).

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

(7) Carefully lower caliper and brake shoes over rotor and onto adapter, reversing the removal procedure (Fig. 19).

BRAKE PADS/SHOES - REAR (Continued)

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

(8) Install the caliper guide pin bolts. Tighten the guide pin bolts to a torque of 22 N·m (192 in. lbs.).

(9) Install the wheel and tire assembly.

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

(11) Remove jackstands or lower hoist.

CAUTION: Before moving vehicle, pump the brake pedal several times to insure the vehicle has a firm brake pedal to adequately stop the vehicle.

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

DISC BRAKE CALIPER - FRONT

REMOVAL

REMOVAL - FRONT CALIPER

(1) Using a brake pedal holding tool, depress brake pedal past its first 1 inch of travel and secure in this position. This will isolate the master cylinder reservoir from the brake hydraulic system, not allowing the brake fluid to drain out of the reservoir.

(2) Raise vehicle on jackstands or centered on a hoist. See Hoisting in Lubrication and Maintenance.

(3) Remove front wheel and tire assembly from vehicle.

(4) Remove the banjo bolt connecting the brake flex hose to the caliper. There will be two washers (one on each side of the flex hose fitting) that will come off at the same time.

NOTE: Note the positioning of the two rail shims between the knuckle's machined abutments and the brake shoes.

(5) Remove the two caliper guide pin bolts (Fig. 24).

(6) Remove caliper assembly from steering knuckle. Proceed by first rotating top of caliper away from steering knuckle, then lifting caliper off bottom machined abutment on steering knuckle (Fig. 25). Take care not to lose the two rail shims.

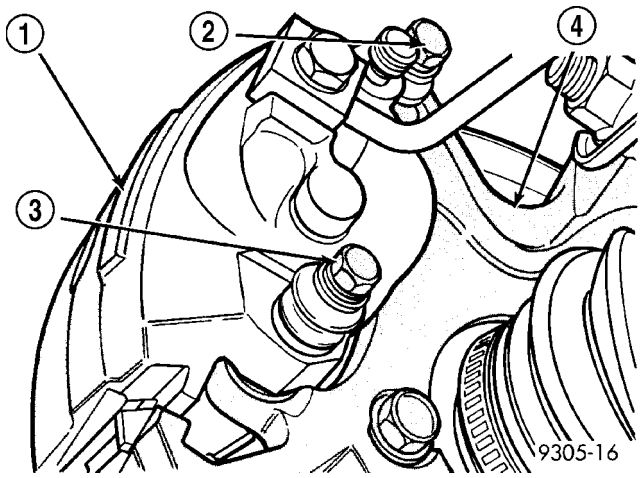


Fig. 24 Caliper Guide Pin Bolts

1 - CALIPER ASSEMBLY
2 - GUIDE PIN BOLT
3 - GUIDE PIN BOLT
4 - STEERING KNUCKLE

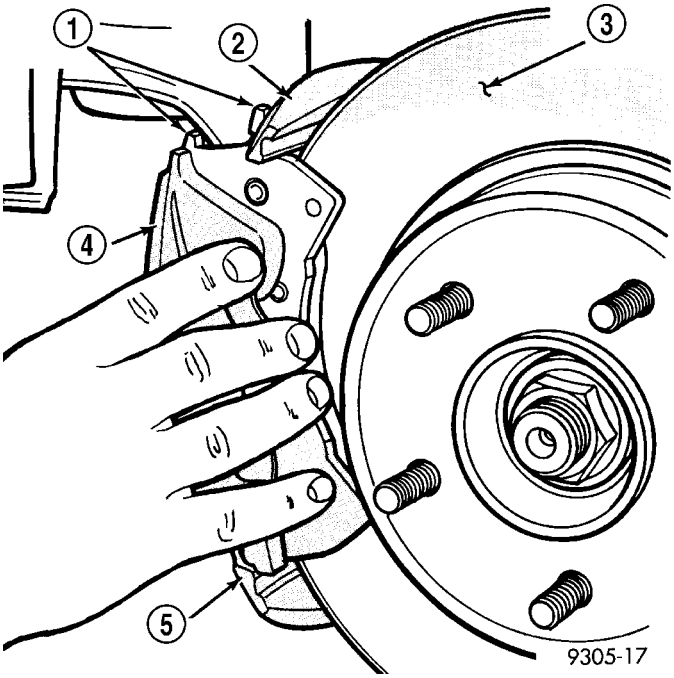


Fig. 25 Caliper Removal/Installation

1 - BRAKE SHOES
2 - STEERING KNUCKLE
3 - BRAKING DISC
4 - CALIPER ASSEMBLY
5 - MACHINED ABUTMENT

DISC BRAKE CALIPER - FRONT (Continued)

(7) If required, remove rotor from hub by pulling it straight off wheel mounting studs (Fig. 26).

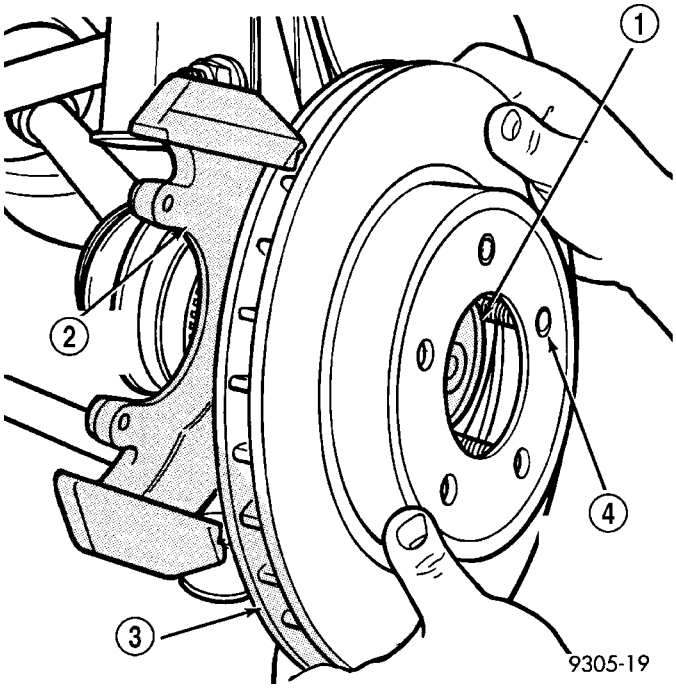


Fig. 26 Brake Rotor

1 - HUB
2 - STEERING KNUCKLE
3 - BRAKE ROTOR (DISC)
4 - WHEEL MOUNTING STUD

REMOVAL - FRONT CALIPER (EXPORT)

(1) Using a brake pedal holding tool, depress brake pedal past its first 1 inch of travel and secure in this position. This will isolate the master cylinder reservoir from the brake hydraulic system, not allowing the brake fluid to drain out of the reservoir.

(2) Raise vehicle. (Refer to LUBRICATION & MAINTENANCE/HOISTING - STANDARD PROCEDURE)

(3) Remove front wheel and tire assembly from vehicle.

(4) Remove the banjo bolt connecting the brake flex hose to the caliper. There will be two washers (one on each side of the flex hose fitting) that will come off at the same time.

(5) Remove the two caliper guide pin bolts (Fig. 24).

(6) Remove caliper assembly from steering knuckle. Proceed by first rotating top of caliper away from steering knuckle and then lifting caliper off bottom machined abutment on steering knuckle (Fig. 25).

(7) If required, remove rotor from hub by pulling it straight off wheel mounting studs (Fig. 26).

DISASSEMBLY

DISASSEMBLY - CALIPER GUIDE PIN BUSHINGS

Before disassembling the brake caliper, clean and inspect it. Refer to CLEANING or INSPECTION in this section.

(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. 27).

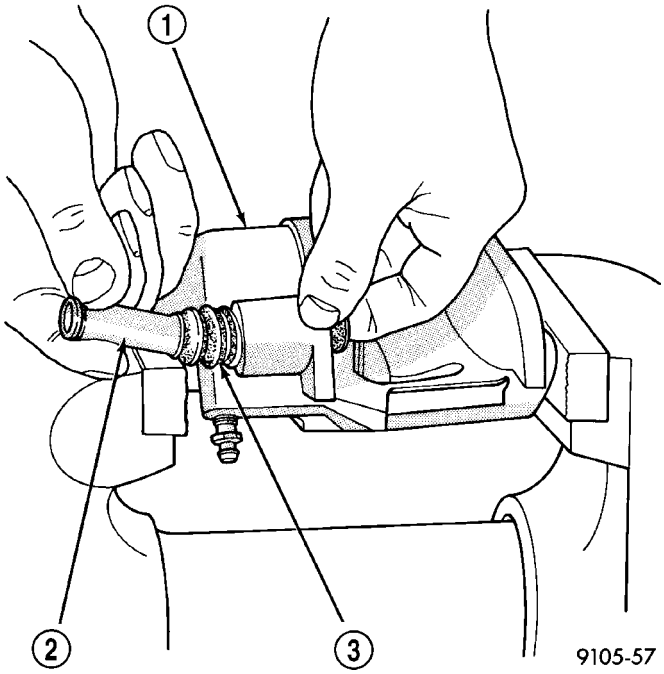


Fig. 27 Removing Sleeve From Bushing

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. 28).

DISASSEMBLY - CALIPER PISTON AND SEAL

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: Before disassembling the brake caliper, clean and inspect it. Refer to CLEANING AND INSPECTION in this section.

DISC BRAKE CALIPER - FRONT (Continued)

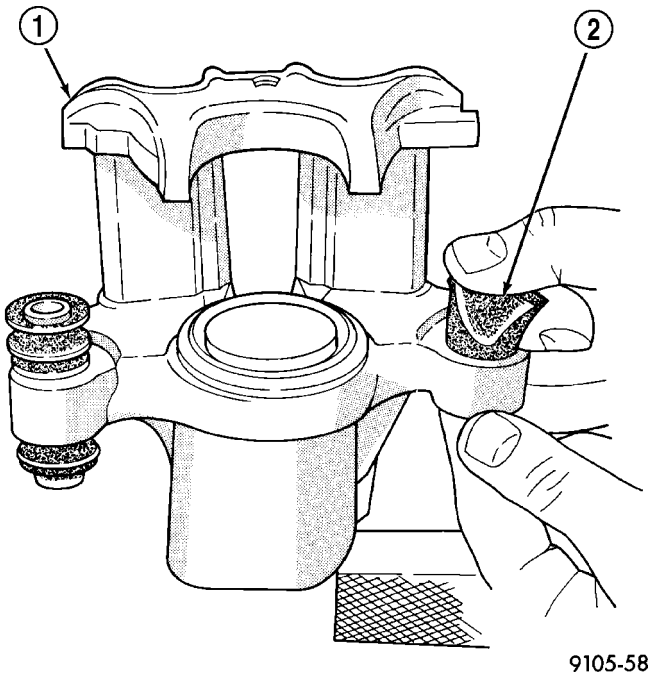


Fig. 28 Removing Bushing From Caliper

1 - CALIPER
2 - BUSHING

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.

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

(4) Mount the caliper in a vise equipped with protective jaws.

(5) Remove the piston dust boot from the caliper and discard (Fig. 29).

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.

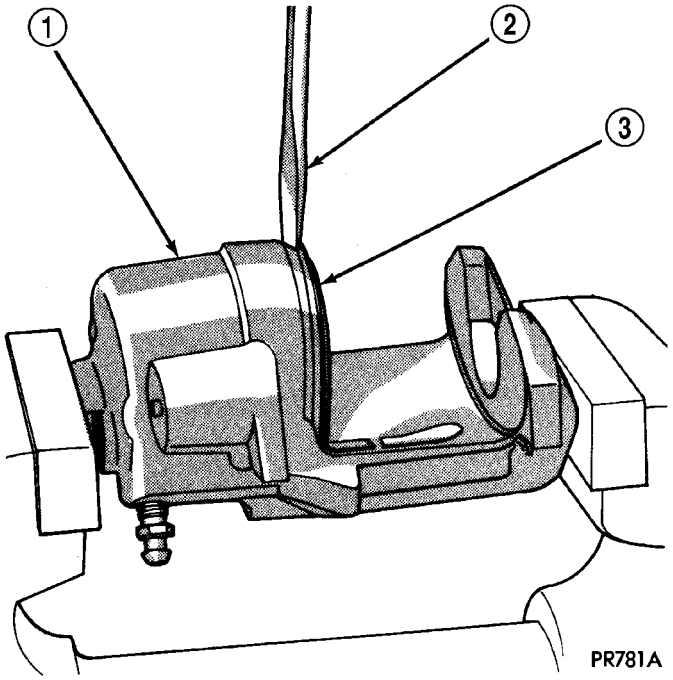


Fig. 29 Removing Caliper/Piston Dust Boot

1 - CALIPER
2 - SCREWDRIVER
3 - BOOT

(6) Using a soft tool such as a plastic trim stick, work the piston seal out of its groove in caliper piston bore (Fig. 30). Discard the old seal.

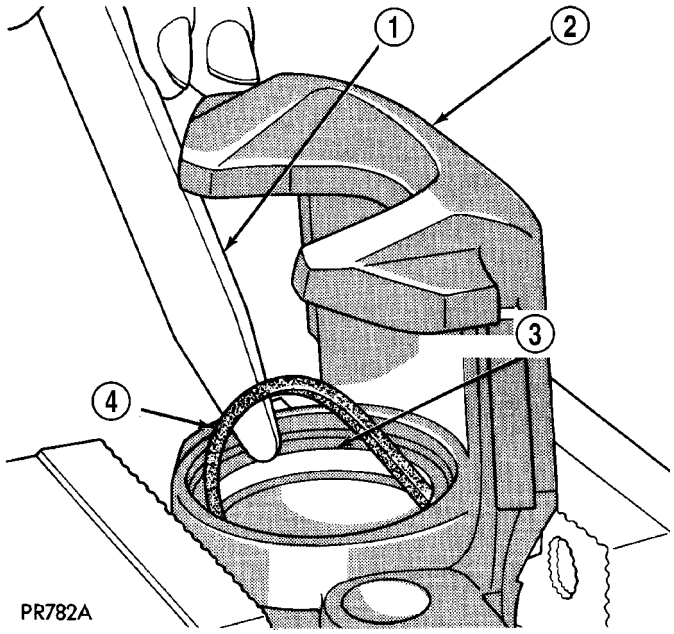


Fig. 30 Removing Piston Seal

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

DISC BRAKE CALIPER - FRONT (Continued)

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

(8) Inspect the piston bore for scoring or pitting. Bores that show light scratches or corrosion can usually be cleared of the light scratches or corrosion using crocus cloth. Bores that have deep scratches or scoring should be honed. Use Caliper Hone, Special Tool C-4095 or equivalent, to hone the bore. Do not over-hone the bore. Don not increase the diameter of the bore more than 0.0254 mm (0.001 inch) (Fig. 31). If the bore does not clean up within this specification, a new caliper housing should be installed.

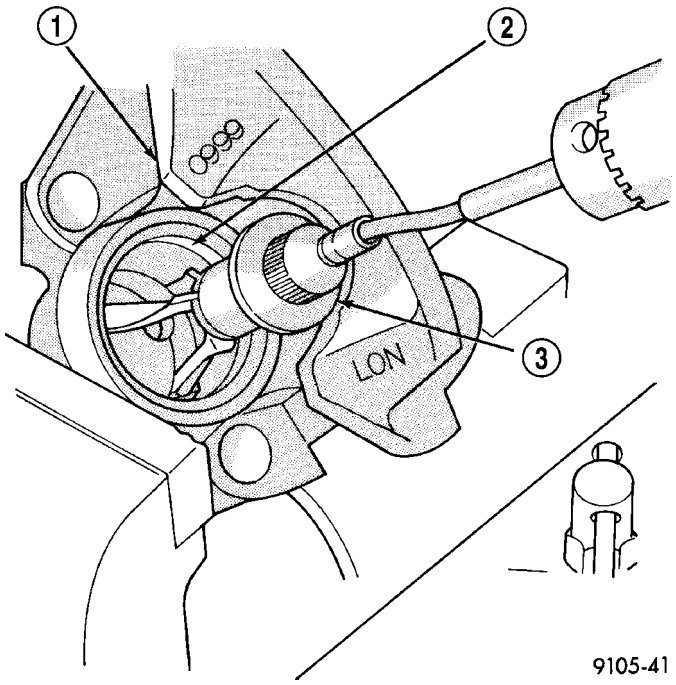


Fig. 31 Honing Brake Caliper Piston Bore

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

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.

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

CLEANING - CALIPER

WARNING: DUST AND DIRT ACCUMULATING ON BRAKE PARTS DURING NORMAL USE MAY CONTAIN ASBESTOS FIBERS FROM PRODUCTION OR AFTERMARKET BRAKE LININGS. BREATHING EXCESSIVE CONCENTRATIONS OF ASBESTOS FIBERS CAN CAUSE SERIOUS BODILY HARM. EXERCISE CARE WHEN SERVICING BRAKE PARTS. DO NOT SAND OR GRIND BRAKE LINING UNLESS EQUIPMENT USED IS DESIGNED TO CONTAIN THE DUST RESIDUE. DO NOT CLEAN BRAKE PARTS WITH COMPRESSED AIR OR BY DRY BRUSHING. CLEANING SHOULD BE DONE BY DAMPENING THE BRAKE COMPONENTS WITH A FINE MIST OF WATER, THEN WIPING THE BRAKE COMPONENTS CLEAN WITH A DAMPENED CLOTH. DISPOSE OF CLOTH AND ALL RESIDUE CONTAINING ASBESTOS FIBERS IN AN IMPERMEABLE CONTAINER WITH THE APPROPRIATE LABEL. FOLLOW PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) AND THE ENVIRONMENTAL PROTECTION AGENCY (EPA) FOR THE HANDLING, PROCESSING, AND DISPOSING OF DUST OR DEBRIS THAT MAY CONTAIN ASBESTOS FIBERS.

To clean or flush the internal passages of the brake caliper, use fresh brake fluid or Mopar® Non-Chlorinated Brake Parts Cleaner. Never use gasoline, kerosene, alcohol, oil, transmission fluid or any fluid containing mineral oil to clean the caliper. These fluids will damage rubber cups and seals.

INSPECTION - CALIPER

Inspect the disc brake caliper for the following:

- Brake fluid leaks in and around boot area and inboard lining
- Ruptures, brittleness or damage to the piston dust boot
- Damaged, dry or brittle guide pin dust boots

If caliper fails inspection, disassemble and recondition caliper, replacing the seals and dust boots.

DISC BRAKE CALIPER - FRONT (Continued)

ASSEMBLY

ASSEMBLY - CALIPER GUIDE PIN BUSHINGS

(1) Fold the guide pin bushing in half lengthwise at the solid middle section (Fig. 32).

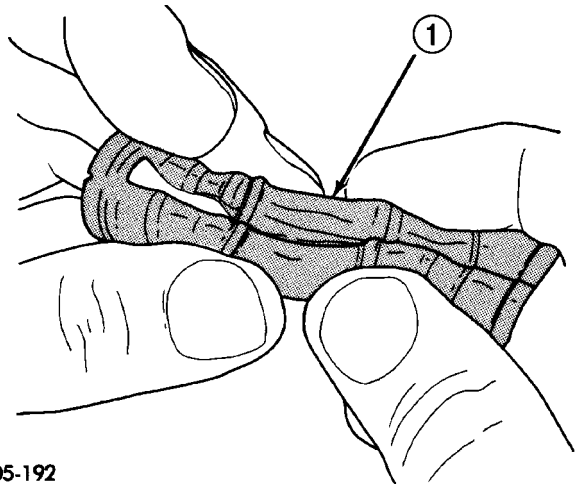


Fig. 32 Folded Caliper Guide Pin Bushing

1 - CALIPER GUIDE PIN BUSHING

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

(2) Insert the folded bushing into the caliper mounting boss using your fingers (Fig. 33).

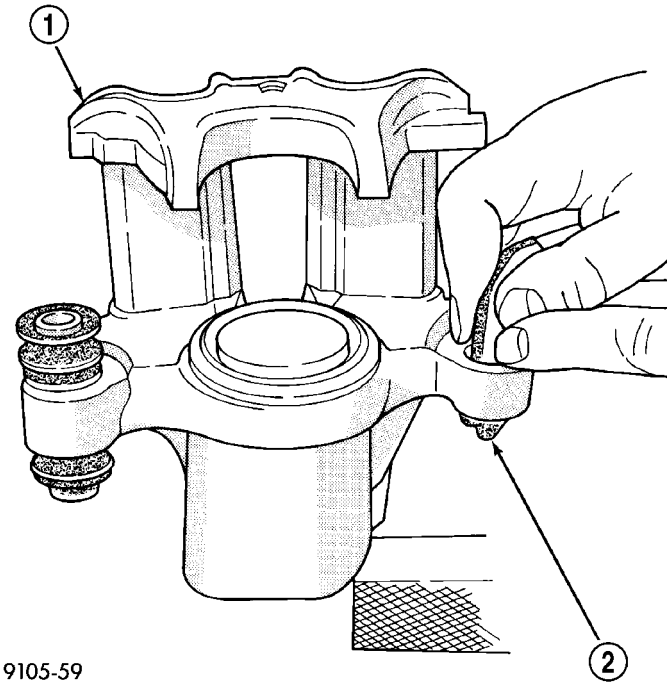


Fig. 33 Installing Caliper Guide Pin Bushing

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. 34).

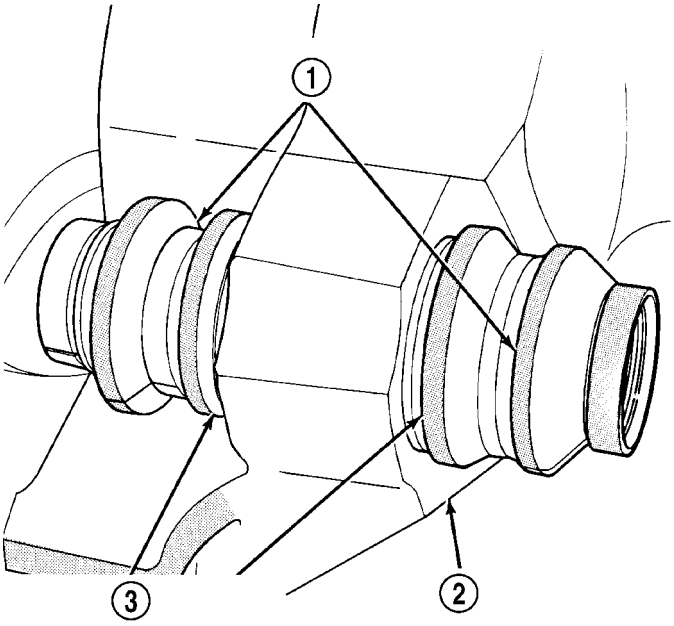


Fig. 34 Bushing Correctly Installed In Caliper

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

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

DISC BRAKE CALIPER - FRONT (Continued)

(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. 35).

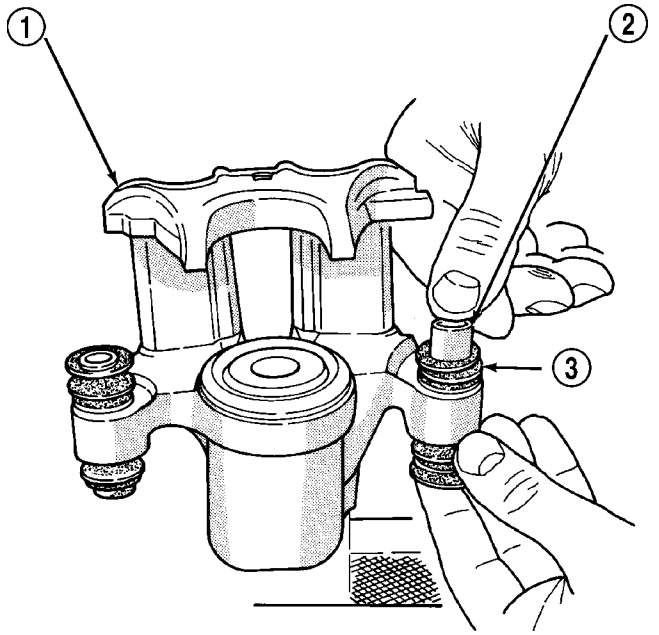


Fig. 35 Installing Sleeve In Bushing

1 - CALIPER
2 - SLEEVE
3 - BUSHING

(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. 35). 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 groves (Fig. 36). 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.

ASSEMBLY - CALIPER PISTON AND SEAL

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. 37)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.

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

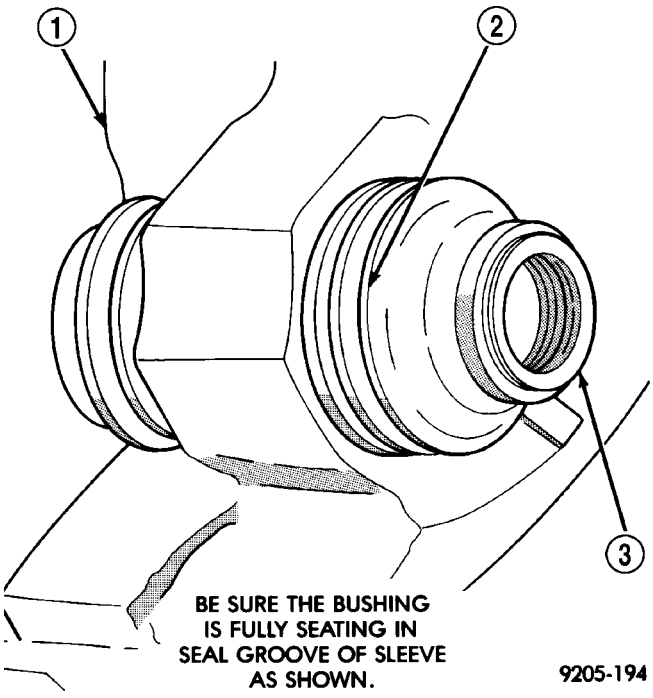


Fig. 36 Correctly Installed Guide Pin Sleeve And Bushing

1 - CALIPER
2 - BUSHING
3 - SLEEVE

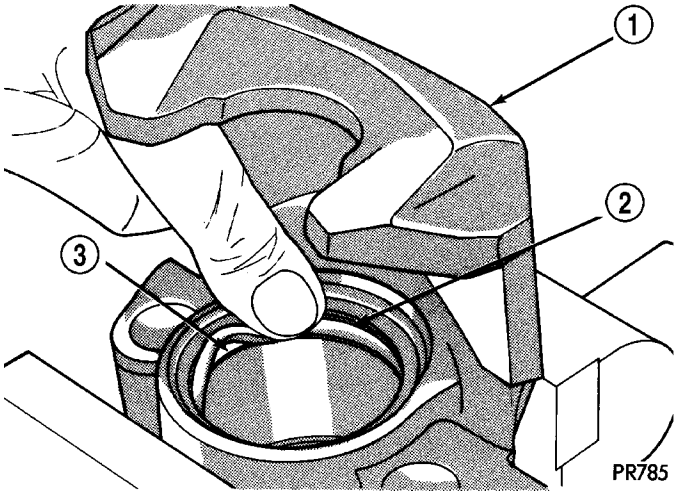


Fig. 37 Installing New Piston Seal

1 - CALIPER
2 - PISTON SEAL
3 - SEAL GROOVE

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

DISC BRAKE CALIPER - FRONT (Continued)

(4) Install piston into caliper bore pushing it past the piston seal until it bottoms in the caliper bore (Fig. 38).

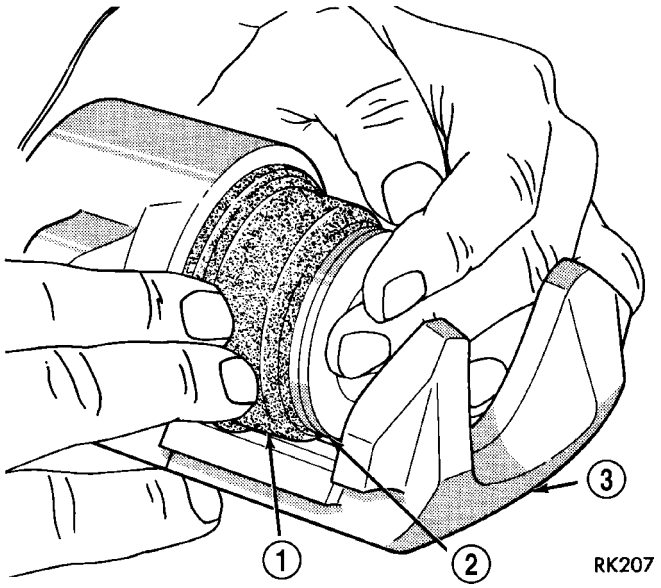


Fig. 38 Installing Piston Into Caliper Bore

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 or C-4842 (depending on piston size), and Handle, Special Tool C-4171, drive the boot into the counterbore of the caliper as necessary (Fig. 39).

(7) Reinstall the caliper on the vehicle and bleed the brakes as necessary. Refer to Installation in this section.

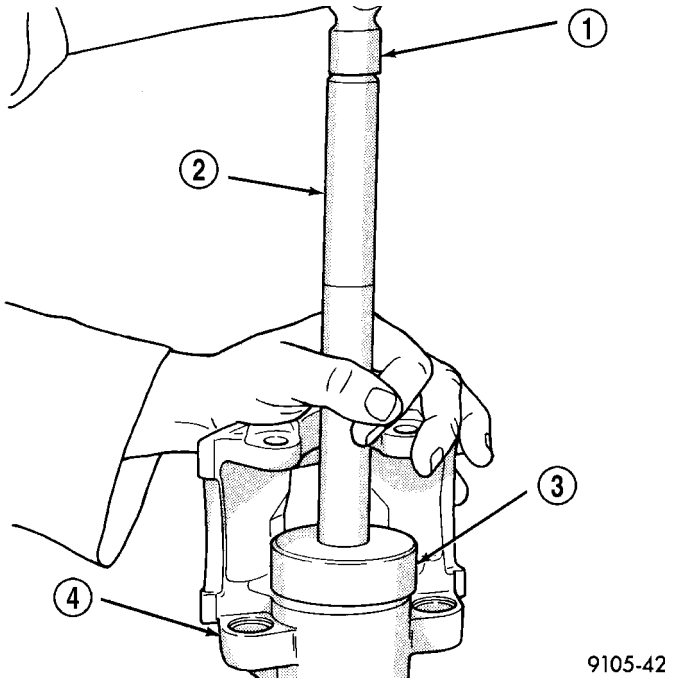


Fig. 39 Installing Dust Boot

1 - HAMMER
2 - SPECIAL TOOL C-4171
3 - SPECIAL TOOL C-4689 or C-4842
4 - CALIPER

INSTALLATION

INSTALLATION - FRONT CALIPER

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

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

(2) If removed, install brake rotor on hub (Fig. 26).

(3) Lubricate both machined knuckle abutments with a liberal amount of Mopar® Brake Grease For Caliper Slides Lubricant, or equivalent.

(4) Install one rail shim on each machined abutment where it will contact the brake shoes. Make sure the alignment tabs on the shims are positioned toward the abutments.

(5) Carefully position caliper and brake shoes over rotor by reversing removal procedure (Fig. 25).

CAUTION: When being installed, extreme caution should be taken not to crossthread the caliper guide pin bolts.

(6) Install the caliper guide pin bolts. Tighten guide pin bolts to a torque of 22 N·m (192 in. lbs.).

(7) Install the banjo bolt connecting the flex hose to the caliper. One washer should be installed on each side of the flex hose fitting before installing the banjo bolt. Tighten banjo bolt to a torque of 48 N·m (35 ft. lbs.).

(8) Install the wheel and tire assembly.

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

(10) Lower vehicle.

CAUTION: After performing any service to the vehicle brake system, be sure to obtain a firm brake pedal before moving vehicle.

(11) Remove the brake pedal holding tool.

(12) Bleed the base brakes. (Refer to 5 - BRAKES - BASE - STANDARD PROCEDURE)

DISC BRAKE CALIPER - FRONT (Continued)

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

INSTALLATION - FRONT CALIPER (EXPORT)

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

(1) Completely retract the caliper piston back into the piston bore of the caliper.
(2) If removed, install brake rotor on hub (Fig. 26).
(3) Lubricate both machined knuckle abutments with a liberal amount of Mopar® Brake Grease For Caliper Slides Lubricant, or equivalent.
(4) Carefully position caliper and brake shoes over rotor by reversing removal procedure (Fig. 25).

CAUTION: When being installed, extreme caution should be taken not to crossthread the caliper guide pin bolts.

(5) Install the caliper guide pin bolts. Tighten guide pin bolts to a torque of 22 N·m (192 in. lbs.).
(6) Install the banjo bolt connecting the flex hose to the caliper. One washer should be installed on each side of the flex hose fitting before installing the banjo bolt. Tighten banjo bolt to a torque of 48 N·m (35 ft. lbs.).
(7) Install the wheel and tire assembly.
(8) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).
(9) Lower vehicle.

CAUTION: After performing any service to the vehicle brake system, be sure to obtain a firm brake pedal before moving vehicle.

(10) Remove the brake pedal holding tool.
(11) Bleed the base brakes. (Refer to 5 - BRAKES - STANDARD PROCEDURE)
(12) Road test the vehicle and make several stops to wear off any foreign material off the brakes and to seat the brake shoe linings.

DISC BRAKE CALIPER - REAR

REMOVAL- REAR CALIPER

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this manual.
(2) Remove rear wheel and tire assemblies from vehicle.
(3) Remove the 2 caliper assembly to adapter guide pin bolts (Fig. 40).

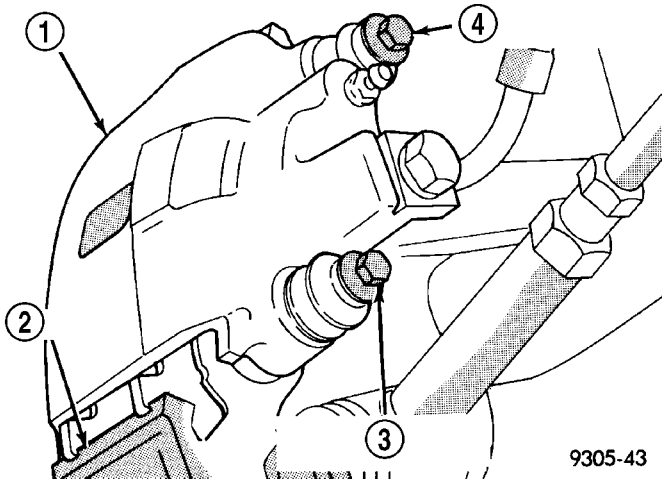


Fig. 40 Removing Caliper Guide Pin Bolts

1 - CALIPER ASSEMBLY
2 - ADAPTER
3 - CALIPER ASSEMBLY ATTACHING BOLT
4 - CALIPER ASSEMBLY ATTACHING BOLT

(4) Remove caliper from adapter using following procedure. First rotate top of caliper away from adapter. Then lift the caliper off the bottom abutment on the adapter (Fig. 41).

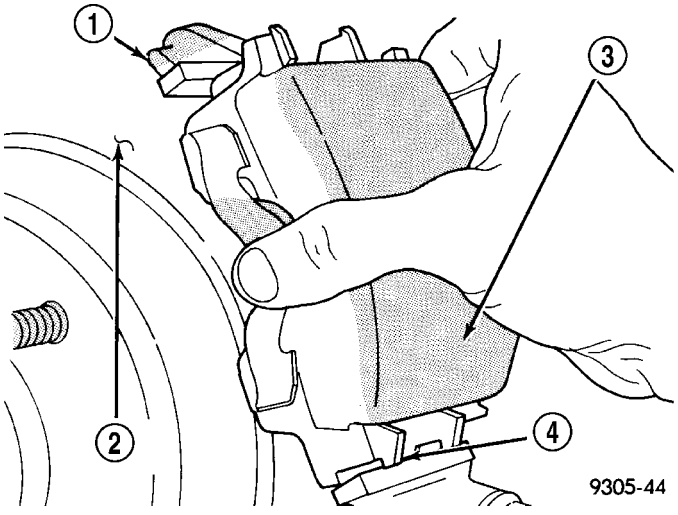


Fig. 41 Removing / Installing Caliper Assembly

1 - ADAPTER
2 - BRAKING DISC
3 - CALIPER ASSEMBLY
4 - ADAPTER ABUTMENT

DISC BRAKE CALIPER - REAR (Continued)

(5) Support caliper assembly firmly from rear strut to prevent weight of caliper from damaging the flexible brake hose (Fig. 42).

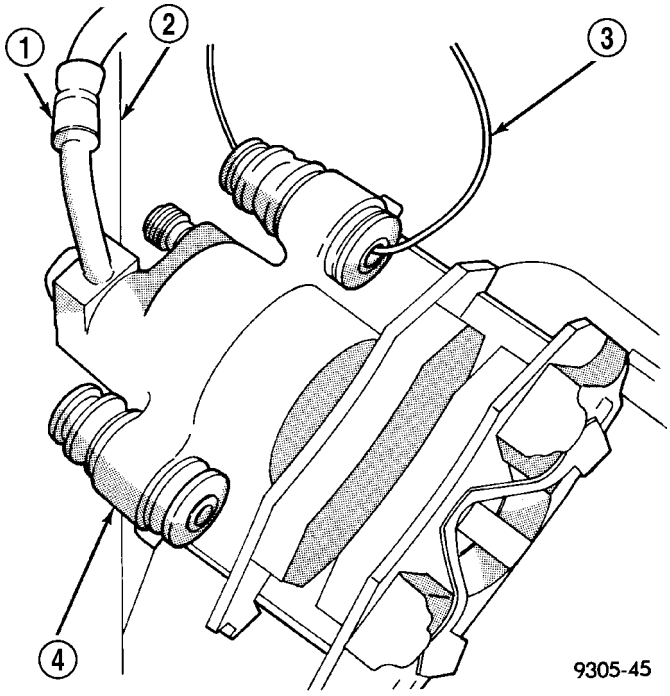


Fig. 42 Storing Caliper

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

(6) Remove the rear rotor from hub by pulling it straight off the wheel mounting studs (Fig. 43).

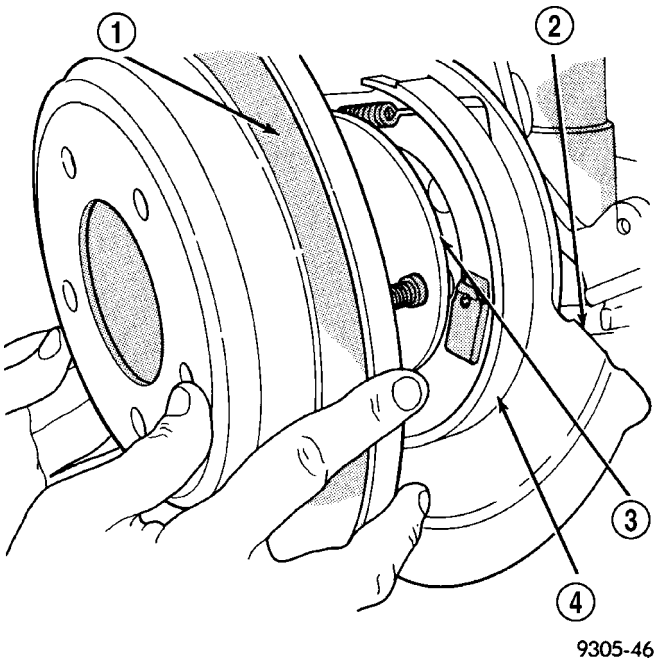


Fig. 43 Removing / Installing Rear Rotor

1 - BRAKE ROTOR (DISC)
2 - DISC SHIELD
3 - HUB
4 - DRUM-IN-HAT PARKING BRAKE

DISASSEMBLY

DISASSEMBLY - CALIPER GUIDE PIN BUSHINGS

Before disassembling the brake caliper, clean and inspect it. Refer to CLEANING or INSPECTION in this section.

(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. 44).

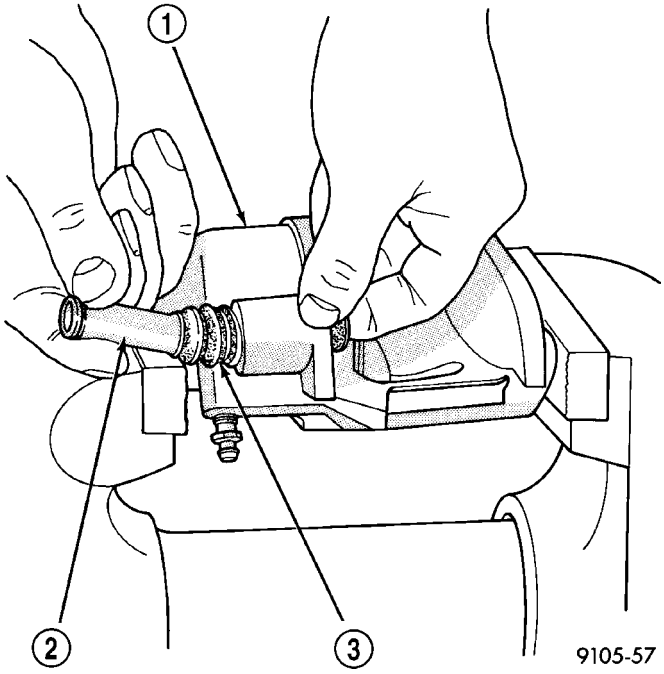


Fig. 44 Removing Sleeve From Bushing

1 - CALIPER
2 - SLEEVE
3 - BUSHING

DISC BRAKE CALIPER - REAR (Continued)

(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. 45).

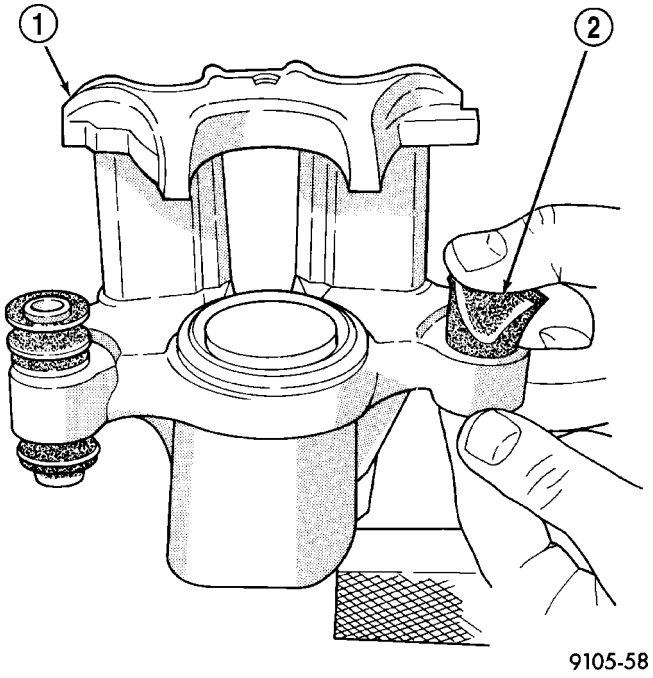


Fig. 45 Removing Bushing From Caliper

1 - CALIPER
2 - BUSHING

DISASSEMBLY - CALIPER PISTON AND SEAL

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: Before disassembling the brake caliper, clean and inspect it. Refer to CLEANING AND INSPECTION in this section.

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.

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

(4) Mount the caliper in a vise equipped with protective jaws.

(5) Remove the piston dust boot from the caliper and discard (Fig. 46).

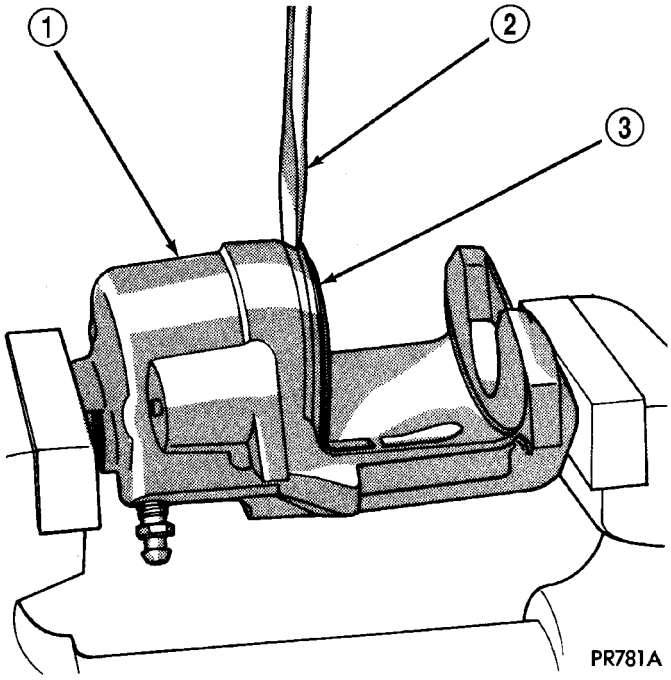


Fig. 46 Removing Caliper/Piston Dust Boot

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.

(6) Using a soft tool such as a plastic trim stick, work the piston seal out of its groove in caliper piston bore (Fig. 47). Discard the old seal.

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

(8) 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

DISC BRAKE CALIPER - REAR (Continued)

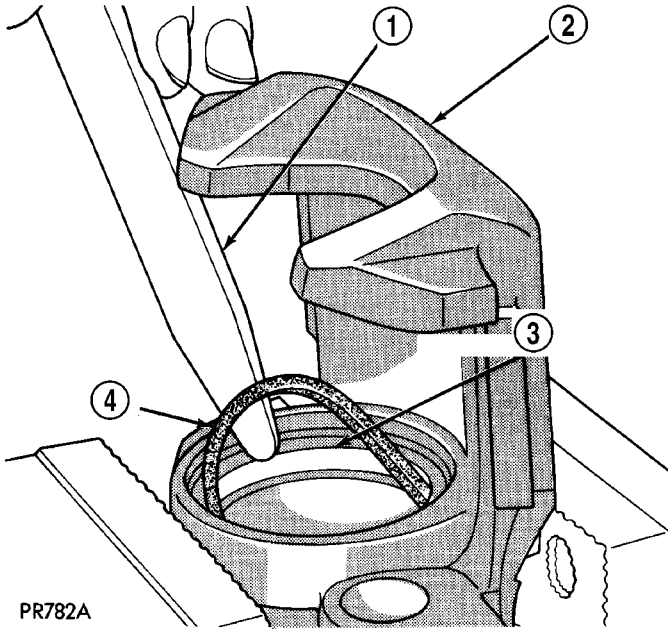


Fig. 47 Removing Piston Seal

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

Tool C-4095 or equivalent, to hone the bore. Do not over-hone the bore. Don not increase the diameter of the bore more than 0.0254 mm (0.001 inch) (Fig. 48). 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.

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

CLEANING - CALIPER

WARNING: DUST AND DIRT ACCUMULATING ON BRAKE PARTS DURING NORMAL USE MAY CONTAIN ASBESTOS FIBERS FROM PRODUCTION OR AFTERMARKET BRAKE LININGS. BREATHING EXCESSIVE CONCENTRATIONS OF ASBESTOS FIBERS CAN CAUSE SERIOUS BODILY HARM. EXERCISE CARE WHEN SERVICING BRAKE PARTS. DO NOT SAND OR GRIND BRAKE LINING UNLESS EQUIPMENT USED IS DESIGNED TO CONTAIN THE DUST RESIDUE. DO NOT CLEAN BRAKE

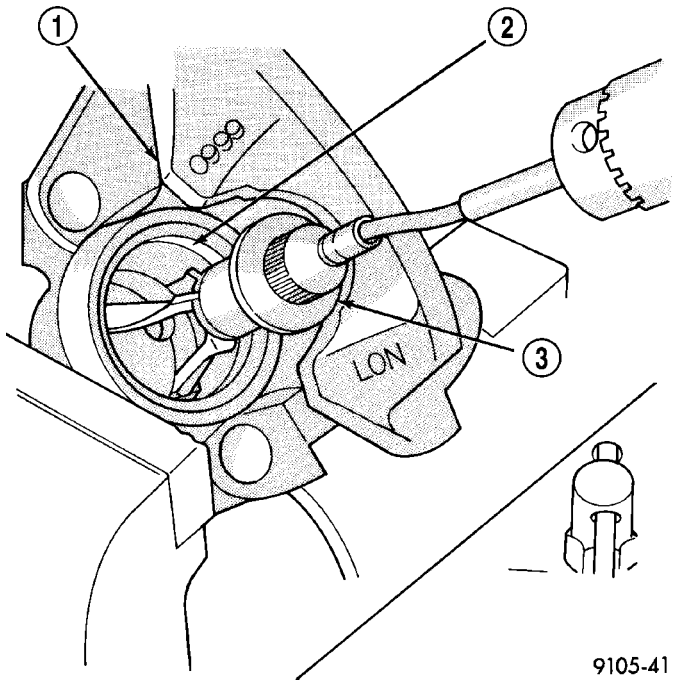


Fig. 48 Honing Brake Caliper Piston Bore

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

PARTS WITH COMPRESSED AIR OR BY DRY BRUSHING. CLEANING SHOULD BE DONE BY DAMPENING THE BRAKE COMPONENTS WITH A FINE MIST OF WATER, THEN WIPING THE BRAKE COMPONENTS CLEAN WITH A DAMPENED CLOTH. DISPOSE OF CLOTH AND ALL RESIDUE CONTAINING ASBESTOS FIBERS IN AN IMPERMEABLE CONTAINER WITH THE APPROPRIATE LABEL. FOLLOW PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) AND THE ENVIRONMENTAL PROTECTION AGENCY (EPA) FOR THE HANDLING, PROCESSING, AND DISPOSING OF DUST OR DEBRIS THAT MAY CONTAIN ASBESTOS FIBERS.

To clean or flush the internal passages of the brake caliper, use fresh brake fluid or Mopar® Non-Chlorinated Brake Parts Cleaner. Never use gasoline, kerosene, alcohol, oil, transmission fluid or any fluid containing mineral oil to clean the caliper. These fluids will damage rubber cups and seals.

INSPECTION - CALIPER

Inspect the disc brake caliper for the following:

- Brake fluid leaks in and around boot area and inboard lining
- Ruptures, brittleness or damage to the piston dust boot
- Damaged, dry or brittle guide pin dust boots

If caliper fails inspection, disassemble and recondition caliper, replacing the seals and dust boots.

DISC BRAKE CALIPER - REAR (Continued)

ASSEMBLY

ASSEMBLY - CALIPER GUIDE PIN BUSHINGS

(1) Fold the guide pin bushing in half lengthwise at the solid middle section (Fig. 49).

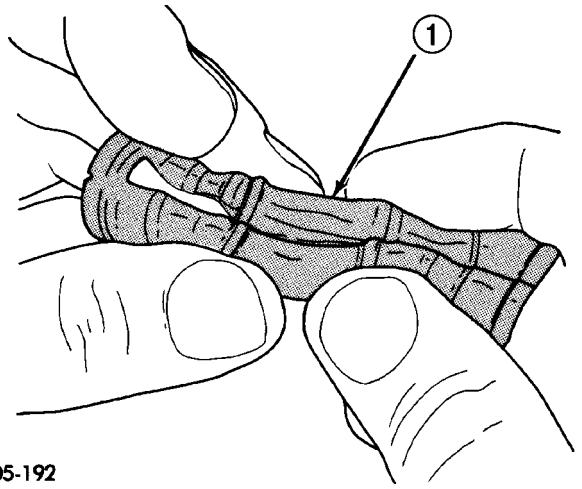


Fig. 49 Folded Caliper Guide Pin Bushing

1 - CALIPER GUIDE PIN BUSHING

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

(2) Insert the folded bushing into the caliper mounting boss using your fingers (Fig. 50).

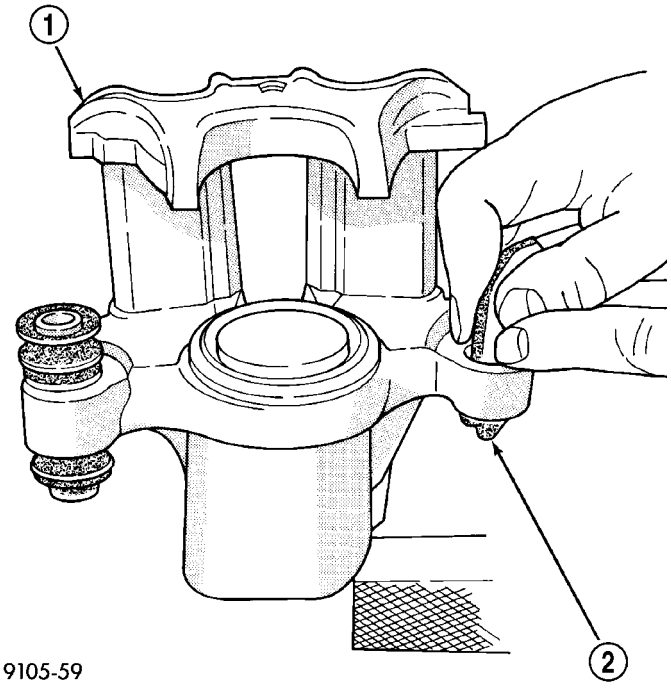


Fig. 50 Installing Caliper Guide Pin Bushing

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. 51).

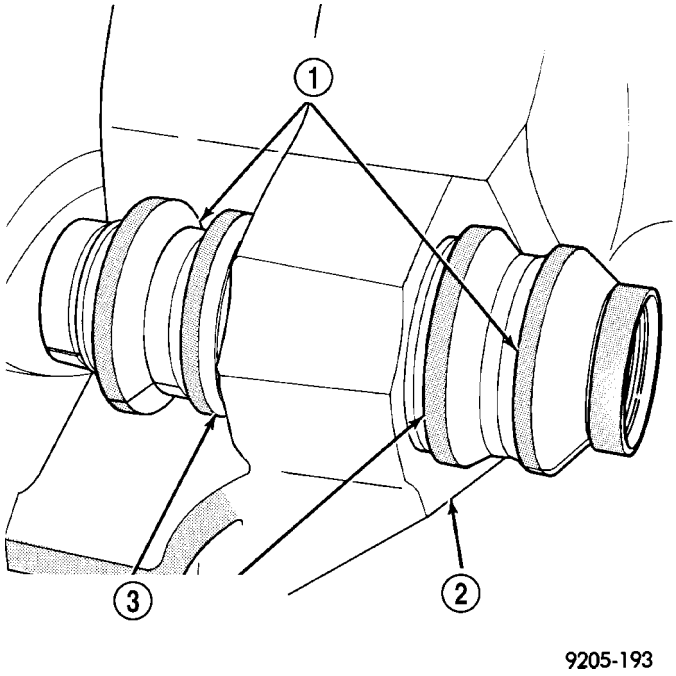


Fig. 51 Bushing Correctly Installed In Caliper

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

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

DISC BRAKE CALIPER - REAR (Continued)

(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. 52).

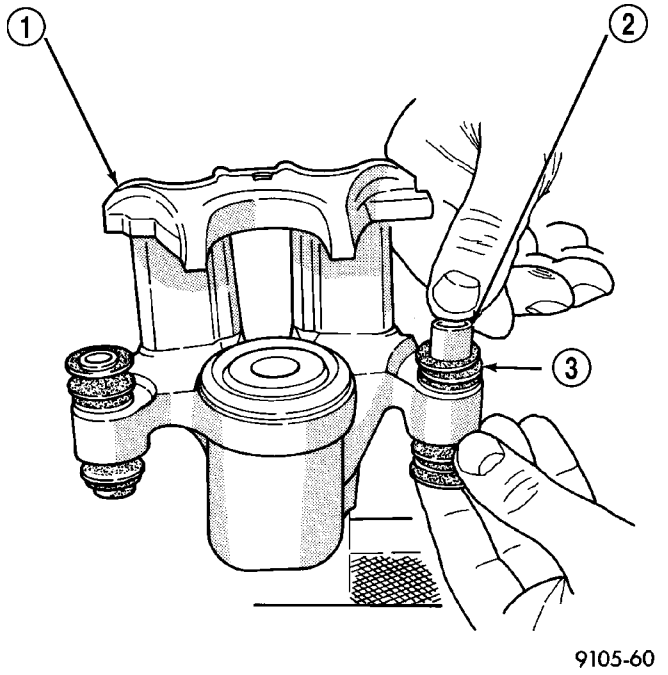


Fig. 52 Installing Sleeve In Bushing

1 - CALIPER
2 - SLEEVE
3 - BUSHING

(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. 52). 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 groves (Fig. 53). 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.

ASSEMBLY - CALIPER PISTON AND SEAL

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. 54)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.

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

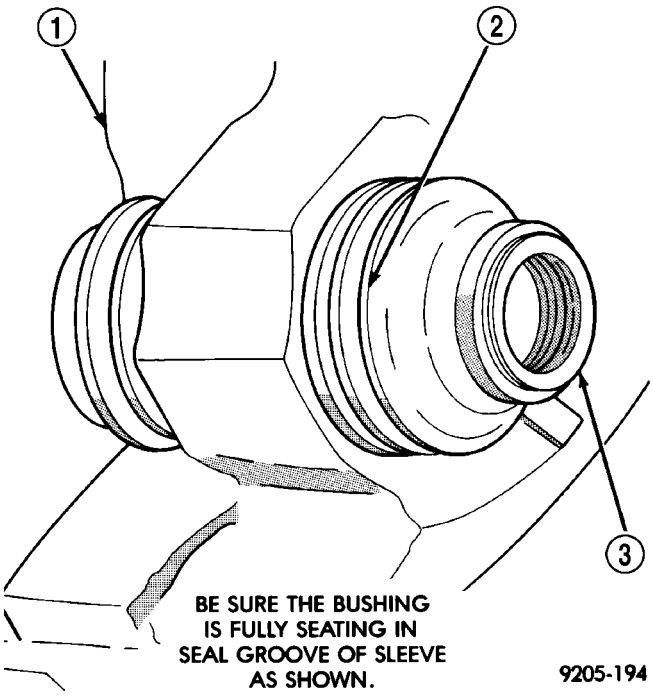


Fig. 53 Correctly Installed Guide Pin Sleeve And Bushing

1 - CALIPER
2 - BUSHING
3 - SLEEVE

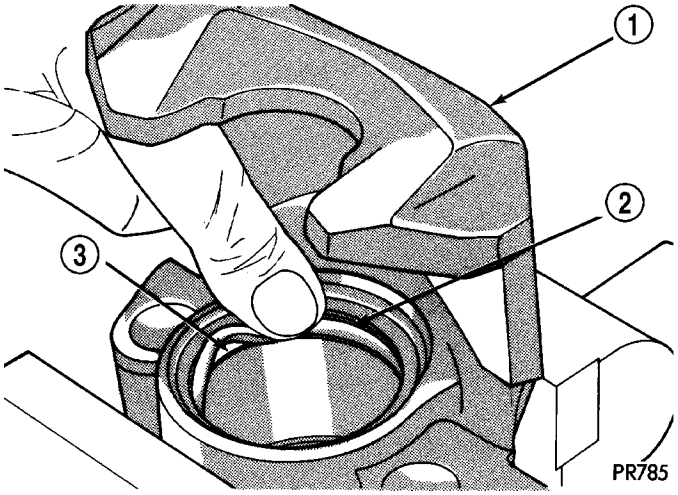


Fig. 54 Installing New Piston Seal

1 - CALIPER
2 - PISTON SEAL
3 - SEAL GROOVE

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

DISC BRAKE CALIPER - REAR (Continued)

(4) Install piston into caliper bore pushing it past the piston seal until it bottoms in the caliper bore (Fig. 55).

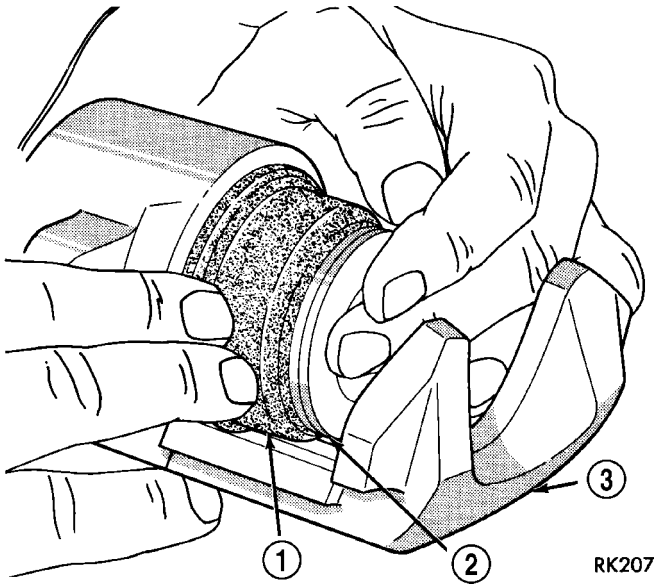


Fig. 55 Installing Piston Into Caliper Bore

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 or C-4842 (depending on piston size), and Handle, Special Tool C-4171, drive the boot into the counterbore of the caliper as necessary (Fig. 56).

(7) Reinstall the caliper on the vehicle and bleed the brakes as necessary. Refer to Installation in this section.

INSTALLATION- REAR CALIPER

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

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

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

(3) Install the rear rotor on the hub, making sure it is squarely seated on the face of the hub (Fig. 43).

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

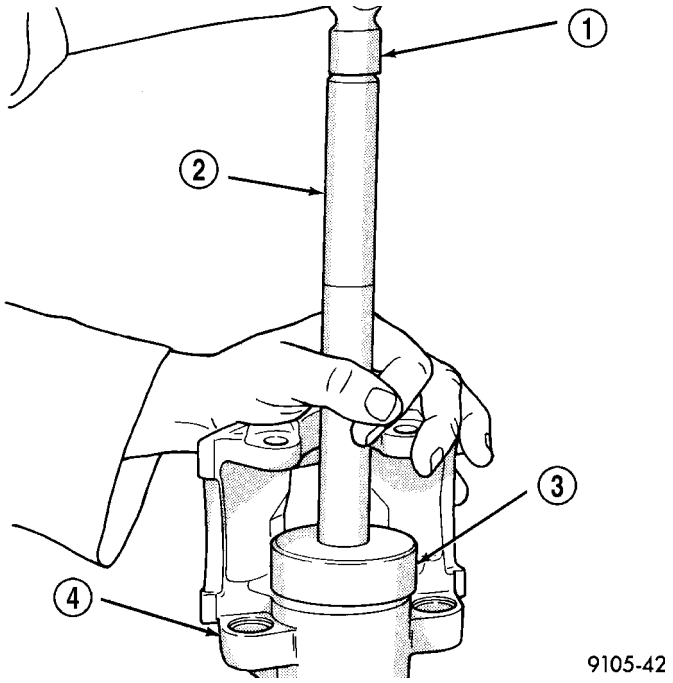


Fig. 56 Installing Dust Boot

1 - HAMMER
2 - SPECIAL TOOL C-4171
3 - SPECIAL TOOL C-4689 or C-4842
4 - CALIPER

(4) Carefully lower caliper and brake shoes over rotor and onto the adapter using the reverse procedure for removal (Fig. 41).

CAUTION: When installing guide pin bolts extreme caution should be taken not to crossthread the caliper guide pin bolts.

(5) Install the caliper guide pin bolts. Tighten the guide pin bolts to a torque of 22 N·m (192 in. lbs.).

(6) Install the wheel and tire assembly.

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

(8) Remove jackstands or lower hoist.

CAUTION: Before moving vehicle, pump the brake pedal several times to insure the vehicle has a firm brake pedal to adequately stop vehicle.

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

FLUID

DIAGNOSIS AND TESTING - BRAKE FLUID CONTAMINATION

Indications of fluid contamination are swollen or deteriorated rubber parts.

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

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

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

STANDARD PROCEDURE - BRAKE FLUID LEVEL CHECK

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

Master cylinder fluid reservoirs for both standard and antilock brake systems are marked with a FULL fill line indicating the reservoirs proper fluid level (Fig. 57).

NOTE: When filling brake fluid reservoir, use only Mopar® brake fluid or an equivalent stored in a tightly sealed container. Brake fluid must conform to DOT 3 specifications. Do not use brake fluid with a lower boiling point than DOT 3, as brake failure could result during prolonged hard braking. Do not use petroleum-based fluid because seal damage in the brake system will result.

If necessary, add brake fluid to reservoir, bringing brake fluid level to the FULL fill line shown on fluid reservoir (Fig. 57).

The master cylinder brake fluid reservoir used on this vehicle includes a brake fluid level switch. The brake fluid level sensor location is in the body of the brake fluid reservoir (Fig. 57). In the event of low brake fluid level in the brake fluid reservoir, the RED brake warning indicator lamp in the instrument cluster will turn on.

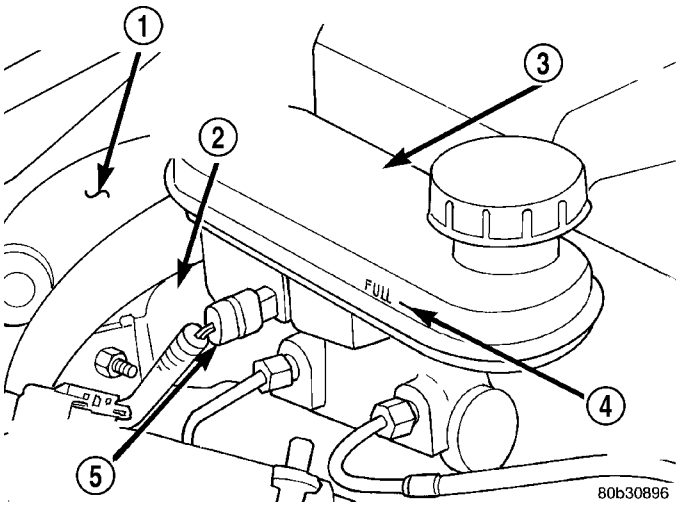


Fig. 57 Master Cylinder Fluid Level

1 - BOOSTER
2 - MASTER CYLINDER
3 - MASTER CYLINDER FLUID RESERVOIR
4 - FLUID LEVEL FULL MARK
5 - FLUID LEVEL SWITCH

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 a 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 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 include items such as engine oil, transmission fluid, power steering fluid, etc.

BRAKE JUNCTION BLOCK

DESCRIPTION

A junction block is used on vehicles that are not equipped with antilock brakes (ABS). The junction block is located in front of the driver's side front tire behind the front fascia (Fig. 63). The junction block mounts in the same location as the ABS integrated control unit (ICU) does on vehicles with ABS.

It has six threaded ports to which the brake tubes connect. Two are for the brake tubes coming from the master cylinder. The remaining four ports are for the brake tubes going to each brake assembly. The valve is permanently mounted to a bracket which fastens to the engine cradle crossmember.

BRAKE JUNCTION BLOCK (Continued)

Later production junction blocks have the proportioning valves for the rear brakes mounted in them. One valve is mounted in each end (Fig. 58). The proportioning valves are not serviced separately from the junction block. Vehicles with this type junction block no longer have proportioning valves mounted at the rear brake flex hoses.

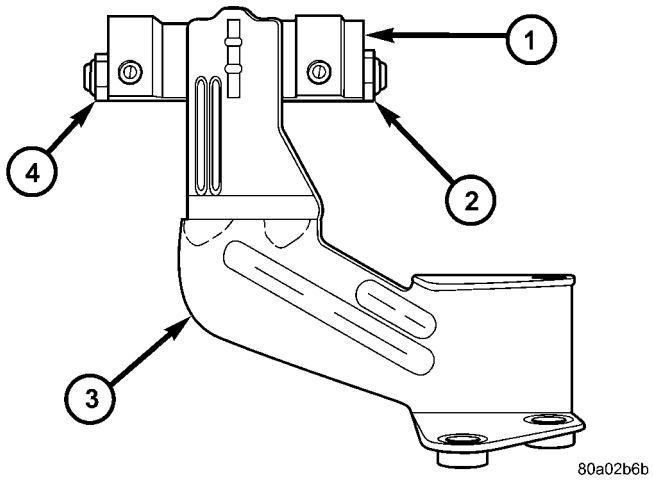


Fig. 58 Junction Block With Proportioning Valves

1 - JUNCTION BLOCK
2 - PROPORTIONING VALVE (LEFT REAR)
3 - BRACKET
4 - PROPORTIONING VALVE (RIGHT REAR)

OPERATION

The junction block distributes the brake fluid coming from the master cylinder primary and secondary ports to the four brake tubes leading to the brakes. Since the junction block mounts in the same location as the ABS integrated control unit (ICU), it allows for the common use of brake tubes on the vehicle whether it is equipped with or without ABS.

Later applications of the junction block include two proportioning valves. Placed in the fluid flow passages leading to the rear brake tube ports, they balance front-to-rear braking. (Refer to 5 - BRAKES - BASE/HYDRAULIC/MECHANICAL/PROPORTIONING VALVE - OPERATION)

REMOVAL

(1) Disconnect and isolate the negative battery connection at the right front strut tower.

(2) Using a brake pedal holding tool such as shown (Fig. 59), depress brake pedal past its first 1 inch of travel and secure in this position. This will isolate the master cylinder reservoir from the brake hydraulic system, not allowing the brake fluid to drain out of the reservoir.

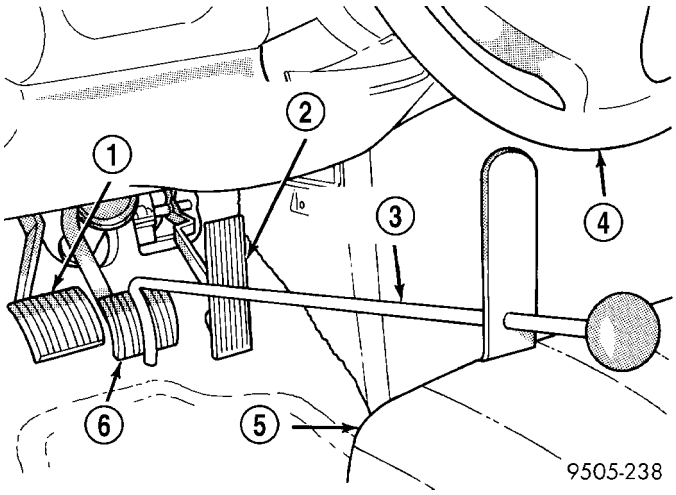


Fig. 59 Brake Pedal Holding Tool Installed

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

(3) Remove screw fastening the speed control servo to the upper radiator closure panel (Fig. 60).

(4) Remove screw fastening the washer filler tube to the upper radiator closure panel (Fig. 60).

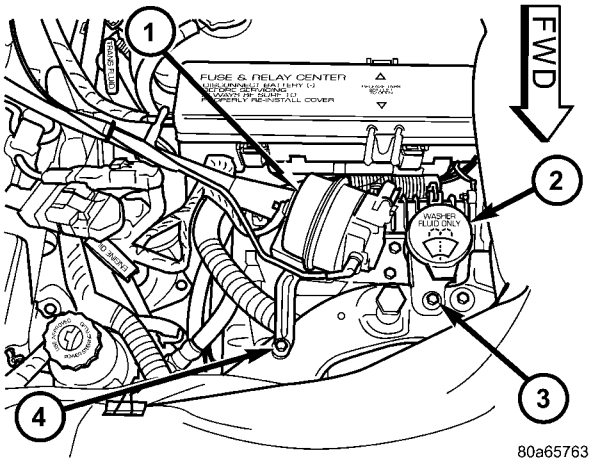


Fig. 60 Servo And Filler Tube Fasteners

1 - SPEED CONTROL SERVO
2 - WINDSHIED WASHER FILLER TUBE
3 - SCREW
4 - SCREW

BRAKE JUNCTION BLOCK (Continued)

(5) Remove nut and screw securing transmission control module to vehicle (Fig. 61).

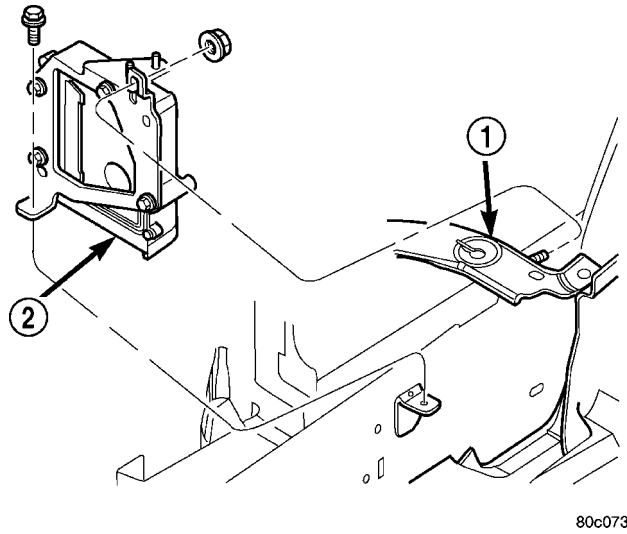


Fig. 61 Transmission Control Module (TCM)— Removal/Installation

1 - RADIATOR UPPER SUPPORT
2 - TCM

(6) Lift the transmission control module (with speed control servo attached) from its mount leaving its wiring harness attached. Move it off to the side toward the engine making sure not to strain the wires and speed control servo cable.

(7) Clean any debris away from the fittings on top of the junction block.

(8) Remove the two brake tubes coming from the primary and secondary master cylinder ports at the junction block (Fig. 62).

(9) Remove the four chassis brake tubes going to each brake, mounted across the front top of the junction block (Fig. 62).

(10) There are two bolts fastening the junction block and mounting bracket to the engine cradle crossmember. Remove the outboard bolt fastening the mounting bracket to the engine cradle crossmember.

(11) Raise the vehicle. See hoisting in Lubrication and Maintenance.

(12) Loosen, but do not remove, the remaining mounting bolt fastening the junction block mounting bracket to the engine cradle crossmember (Fig. 63).

(13) Pivot the junction block and bracket forward on the remaining mounting bolt and remove the junction block and bracket from the vehicle.

INSTALLATION

(1) If not already installed, install, but do not tighten, the one bolt in the junction block bracket (Fig. 63).

(2) Install the junction block with mounting bracket onto the engine cradle crossmember guiding the installed bolt into the slot in the engine cradle crossmember.

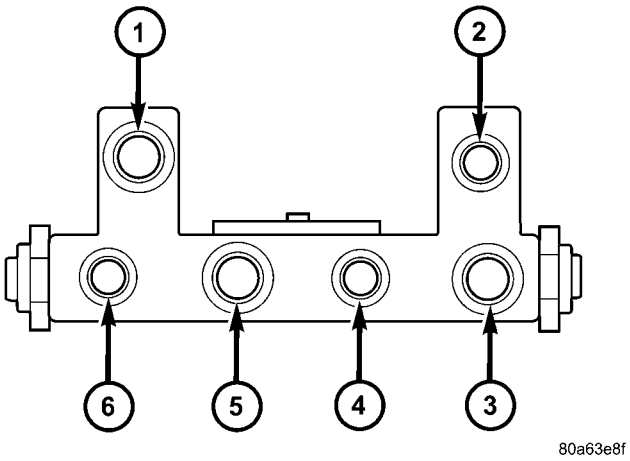


Fig. 62 Junction Block Fitting Identification

1 - FROM MASTER CYLINDER PRIMARY
2 - FROM MASTER CYLINDER SECONDARY
3 - TO LEFT FRONT BRAKE
4 - TO RIGHT REAR BRAKE
5 - TO LEFT REAR BRAKE
6 - TO RIGHT FRONT BRAKE

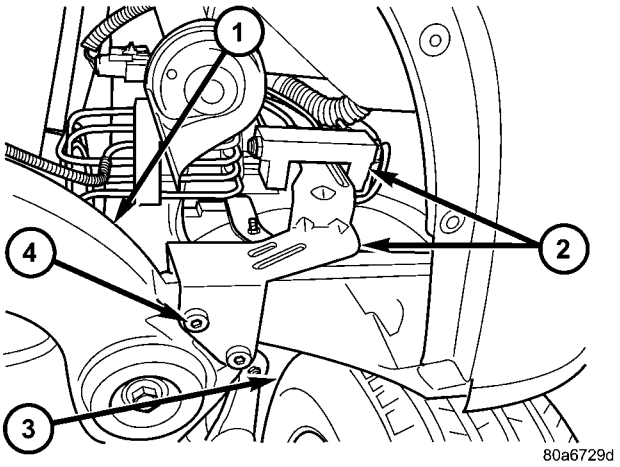


Fig. 63 Junction Block Mounting

1 - ENGINE CRADLE CROSSMEMBER
2 - JUNCTION BLOCK AND BRACKET
3 - LEFT FRONT TIRE
4 - REMAINING MOUNTING BOLT

(3) Align the remaining mounting bolt hole in the junction block bracket with its mounting hole in the engine crossmember and install, but do tighten, the remaining mounting bolt.

(4) Tighten the first mounting bolt (installed in engine cradle crossmember slot) (Fig. 63) to 26 N·m (230 in. lbs.) torque with the aid of a crow foot wrench.

(5) Lower the vehicle to the ground.

BRAKE JUNCTION BLOCK (Continued)

(6) Tighten the remaining junction block bracket-to-engine cradle crossmember mounting bolt to 26 N·m (230 in. lbs.) torque.

(7) Install the four chassis brake tubes (going to each brake) to the junction block (Fig. 62). Tighten the tube fittings to 17 N·m (145 in. lbs.) torque with the aid of a crow foot wrench.

(8) Install the two brake tubes coming from the primary and secondary master cylinder ports to the top rear corners of the junction block (Fig. 62). Tighten the tube fittings to 17 N·m (145 in. lbs.) torque with the aid of a crow foot wrench.

(9) Install the transmission control module (with speed control servo attached) in its normal position (Fig. 61). Install the nut and screw securing it in place

(10) Install the transmission control module mounting nut and screw securing it in place. Tighten the screw to 6 N·m (45 in. lbs.). Tighten the nut to 12 N·m (107 in. lbs.) torque.

(11) Install the screw attaching the washer filler tube to the upper radiator closure panel (Fig. 60).

(12) Install the screw attaching the speed control servo to the upper radiator closure panel (Fig. 60).

(13) Remove the brake pedal holding tool.

(14) Bleed the base brake system. (Refer to 5 - BRAKES - BASE - STANDARD PROCEDURE)

MASTER CYLINDER

DESCRIPTION

There are two different master cylinders used on this vehicle. A center-port master cylinder is used on ABS and Traction Control vehicles. A conventional vent-port master cylinder is used on vehicles without ABS. Both master cylinders appear the same externally except for the size of their outlet ports. The ABS master cylinder has outlet ports differing in size; the primary port is machined to accept a 12 mm tube nut, while the secondary port is machined for a 10 mm tube nut. Both the primary and secondary ports on a non-ABS master cylinder are machined to accept 12 mm tube nuts.

The master cylinder is mounted to the face of the power brake booster on the left side of the dash (Fig. 64). It has the brake fluid reservoir mounted on top and the brake fluid level switch is mounted in the side of that reservoir.

OPERATION

When the brake pedal is pressed, the master cylinder primary and secondary pistons apply brake pressure through the chassis brake tubes and proportioning valves to each brake assembly. The brake fluid reservoir supplies the brake hydraulic system with the necessary fluid to operate properly.

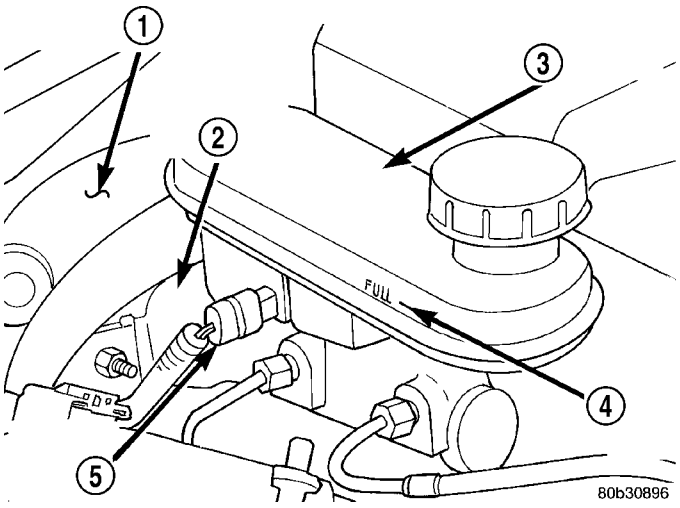


Fig. 64 Master Cylinder

1 - BOOSTER
2 - MASTER CYLINDER
3 - MASTER CYLINDER FLUID RESERVOIR
4 - FLUID LEVEL FULL MARK
5 - FLUID LEVEL SWITCH

The primary and secondary outlet tubes of the master cylinder are connected to a junction block on non-ABS equipped vehicles. The tube from the master cylinder primary outlet port connects to the inboard port of the junction block, and the tube from the secondary outlet port connects to the outboard port of the junction block. The inboard port of the junction block supplies the right front and left rear brakes. The outboard port of the junction block supplies the left front and right rear brakes.

On vehicles equipped with Antilock Brakes (with or without Traction Control), the master cylinder primary outlet port outlet tube connects to the inboard port of the ICU, and the secondary outlet port outlet tube connects to the outboard port of the ICU.

The master cylinder reservoir cap diaphragm is slit to allow atmospheric pressure to equalize on both sides of the diaphragm.

STANDARD PROCEDURE - MASTER CYLINDER BLEEDING

CAUTION: When clamping the master cylinder in a vise for bleeding, carefully tighten the vise just enough to hold the master cylinder from moving. Excessive pressure can damage the master cylinder.

(1) Clamp master cylinder in a vise.

MASTER CYLINDER (Continued)

NOTE: The master cylinder outlet ports use ISO style flares and metric threads. Special Tool Package 8822 includes ISO style flare adapters with metric threads to be used in conjunction with Bleeder Tubes, Special Tool Package 8358.

(2) Attach special tools for bleeding master cylinder in the following fashion:

(a) **For non-ABS master cylinders**, thread one Adapter, Special Tool 8822–2, into each outlet port. Tighten Adapters to 17 N·m (145 in. lbs.) torque.

(b) **For ABS master cylinders**, thread one Adapter, Special Tools 8822–2, into the primary outlet port and one Adapter, Special Tool 8822–1, into the secondary outlet port. Tighten Adapters to 17 N·m (145 in. lbs.) torque.

(c) Thread one Bleeder Tube, Special Tool 8358–1, into each Adapter. Tighten each tube to 17 N·m (145 in. lbs.) torque. Flex bleeder tubes and place open ends into mouth of fluid reservoir as far down as possible (Fig. 65).

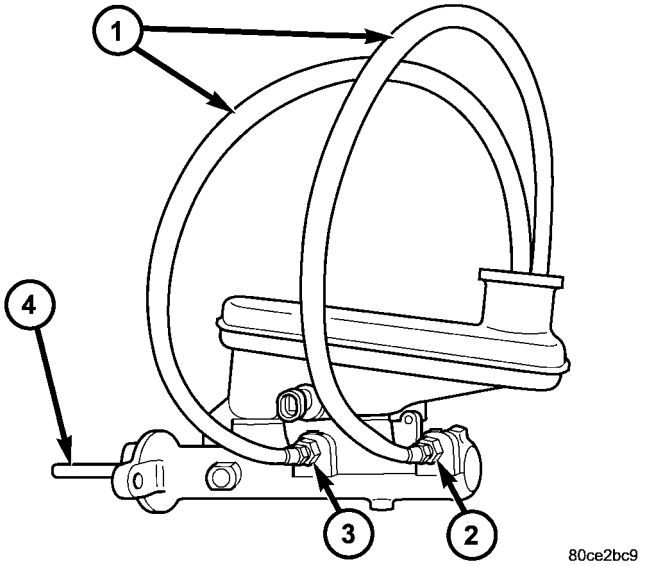


Fig. 65 Master Cylinder Set Up For Bleeding

1 - BLEEDER TUBES 8358
2 - NON-ABS - ADAPTER 8822-1; ABS - ADAPTER 8822-2
3 - ADAPTER 8822-2
4 - WOODEN DOWEL

NOTE: Make sure open ends of bleeder tubes stay below surface of brake fluid once reservoir is filled to proper level to avoid ingesting air while bleeding.

(3) Fill reservoir with Mopar® Brake Fluid or equivalent conforming to DOT 3 specifications. Make sure fluid level is above tips of bleeder tubes in reservoir.

(4) Using a wooden dowel as a pushrod (Fig. 65), slowly depress master cylinder pistons, then release pressure, allowing pistons to return to released position. Repeat several times until all air bubbles are expelled. Make sure fluid level stays above tips of bleeder tubes in reservoir while bleeding.

(5) Remove bleeding tubes. Plug outlets and install filler cap.

(6) Remove master cylinder from vise and install on power brake booster. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/MASTER CYLINDER - INSTALLATION)

REMOVAL

(1) Disconnect brake fluid level switch wire connector on the side of the master cylinder reservoir.

(2) Disconnect primary and secondary brake tubes from master cylinder housing. Install plugs at brake tube outlets.

(3) Remove the 2 nuts attaching the master cylinder to the power brake vacuum booster (Fig. 66).

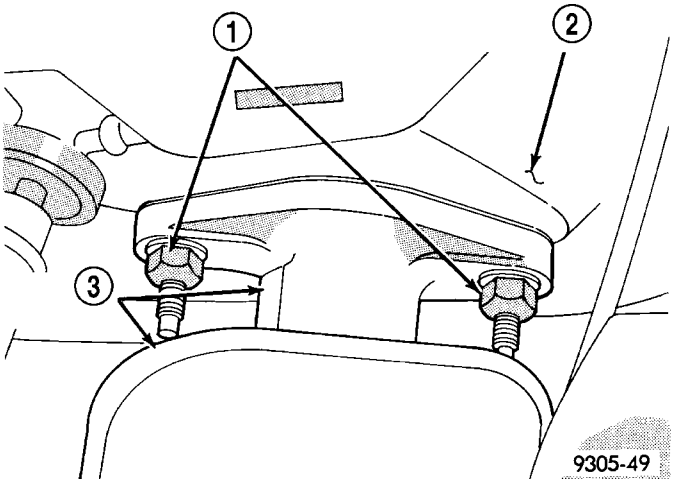


Fig. 66 Master Cylinder Mounting

1 - MASTER CYLINDER MOUNTING NUTS
2 - POWER BRAKE BOOSTER
3 - MASTER CYLINDER

(4) Slide master cylinder straight out from the booster.

MASTER CYLINDER (Continued)

DISASSEMBLY

(1) Remove the master cylinder from the power brake booster. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/MASTER CYLINDER - REMOVAL)

(2) Using an appropriate cleaner such as Mopar® Brake Parts Cleaner, clean the master cylinder housing and brake fluid reservoir.

(3) Remove the filler cap and empty all brake fluid from reservoir.

(4) Clamp the master cylinder in vise.

(5) Remove the 2 fluid reservoir to master cylinder retaining pins (Fig. 67).

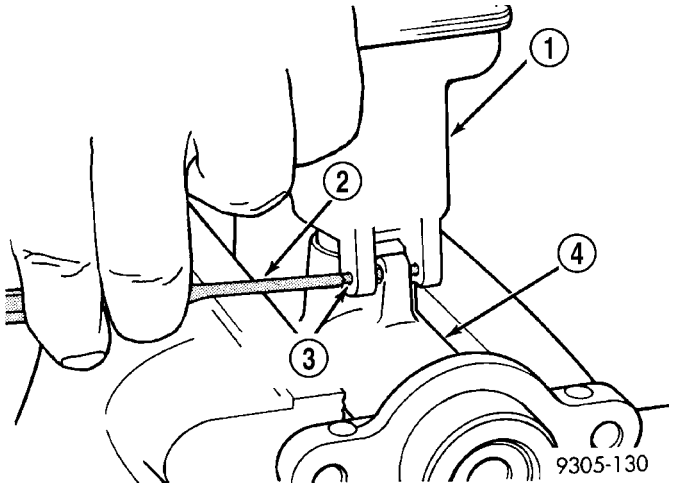


Fig. 67 Reservoir Retaining Pins

1 - BRAKE FLUID RESERVOIR
2 - DRIFT
3 - RETAINING PIN
4 - MASTER CYLINDER

NOTE: Do not pry off fluid reservoir using a tool, damage to reservoir may result.

(6) Remove reservoir from master cylinder by pulling upward on the reservoir while rock it from side-to-side (Fig. 68).

(7) Remove the master cylinder housing-to-reservoir grommets (Fig. 69).

(8) For reassembly, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/MASTER CYLINDER - ASSEMBLY).

ASSEMBLY

(1) Install new housing-to-reservoir grommets in master cylinder housing (Fig. 69).

(2) Lubricate brake fluid reservoir-to-grommet mounting area with clean brake fluid. Place reservoir in position over grommets. Seat reservoir into sealing grommets using a rocking motion while pushing down on reservoir.

(3) Make sure bottom of reservoir touches the top of both sealing grommets.

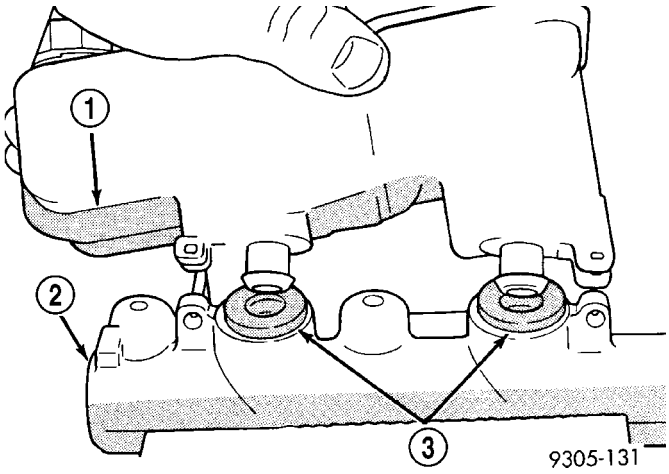


Fig. 68 Removing Reservoir

1 - FLUID RESERVOIR
2 - MASTER CYLINDER
3 - SEALING GROMMETS

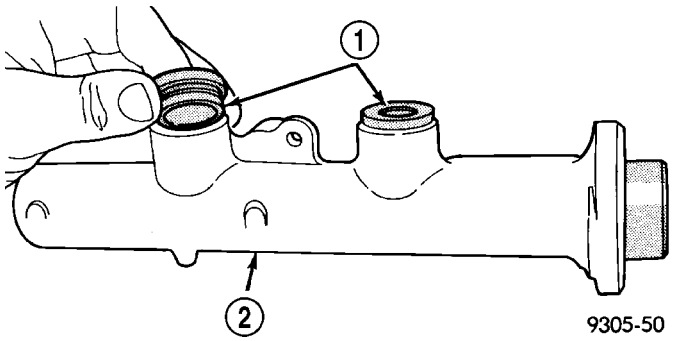


Fig. 69 Reservoir Sealing Grommets

1 - RESERVOIR SEALING GROMMETS
2 - MASTER CYLINDER

(4) Install the 2 fluid reservoir to master cylinder retaining pins (Fig. 67).

(5) Bleed and install master cylinder on vehicle. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/MASTER CYLINDER - STANDARD PROCEDURE)

INSTALLATION

CAUTION: If the master cylinder is being replaced or has been repaired, the master cylinder must be bled before installation. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/MASTER CYLINDER - STANDARD PROCEDURE)

(1) Install master cylinder on studs of power brake vacuum booster, aligning the booster push rod with master cylinder piston.

(2) Install the master cylinder mounting nuts (Fig. 66). Tighten the nuts to a torque of 28 N·m (250 in. lbs.).

(3) Connect brake tubes to master cylinder primary and secondary ports. Tighten fittings to 17 N·m (145 in. lbs.) torque.

MASTER CYLINDER (Continued)

(4) Reconnect brake fluid level switch.

(5) Check and adjust brake fluid level as necessary using Mopar® Brake Fluid or equivalent.

CAUTION: It will be necessary to bleed the entire base hydryaulic system if the brake system has been open to air for an excessive amount of time or air is present in the lines.

PEDAL

DESCRIPTION

A suspended type brake pedal is used on this vehicle (Fig. 70). The pedal pivots on a shaft mounted in the pedal support bracket under the instrument panel. The pedal also connects to the power brake booster input rod. The pedal ratio is 3.44:1.

OPERATION

When the brake pedal is depressed, it pushes in on the power brake booster input rod applying the brakes. At the same time, it allows the brake lamp switch's plunger to extend, thus applying the brake lamps.

REMOVAL

(1) Disconnect and isolate the remote ground battery cable from the ground stud on the right strut tower.

(2) Remove the brake lamp switch from its bracket (Fig. 70). The brake lamp switch is removed by depressing and holding the brake pedal while rotating brake lamp switch in a counterclockwise direction approximately 30 degrees. Pull the switch rearward and remove it from its mounting bracket.

(3) Remove the retaining clip from the brake pedal pin securing the power brake booster to the pedal using following procedure (Fig. 71). Position a small screwdriver between the center tang on the retaining clip and the brake pedal pin. Rotate blade of screwdriver enough so center tang on retaining clip can pass over end of brake pedal pin, then pull retaining clip off brake pedal pin.

(4) Remove the booster input rod from the brake pedal pin.

(5) Remove the nut from the brake pedal pivot shaft (Fig. 70). The pivot shaft has a flat on it to hold while the nut is removed.

(6) Remove the brake pedal pivot shaft from the brake pedal and pedal mounting bracket.

(7) Remove the brake pedal with bushings from mounting bracket (Fig. 70).

NOTE: The bushings can be easily removed from the pedal by pulling them straight out each side.

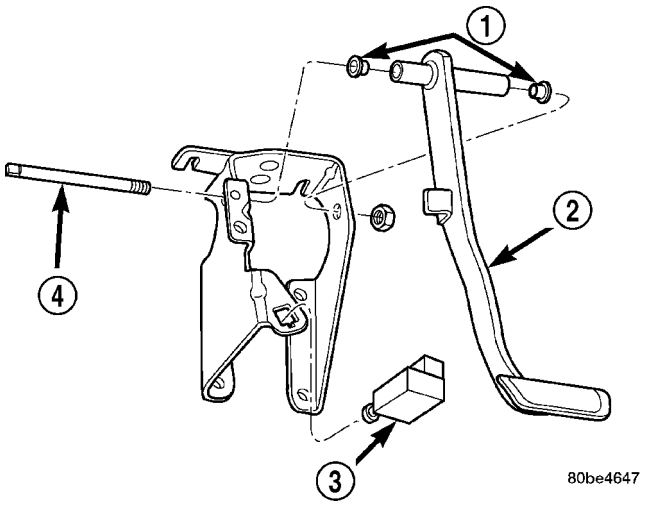


Fig. 70 Brake Pedal

1 - BUSHINGS
2 - BRAKE PEDAL
3 - BRAKE LAMP SWITCH
4 - PIVOT SHAFT

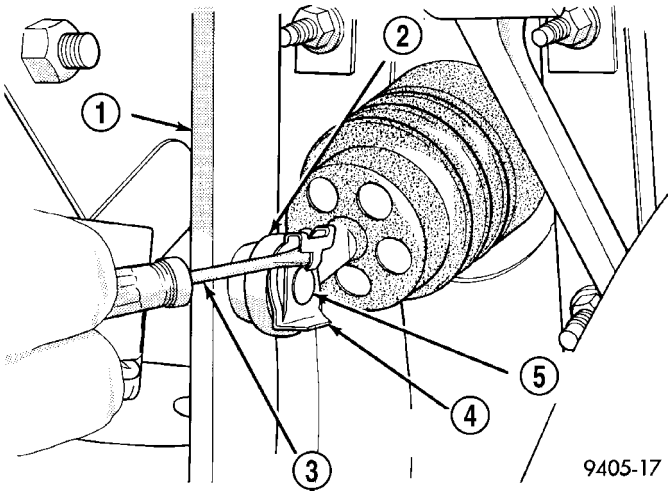


Fig. 71 Brake Pedal Retaining Clip

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

INSTALLATION

(1) Make sure the pedal has a properly installed bushing on each side of the pedal (Fig. 70).

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

(3) Install the brake pedal in the pedal bracket (Fig. 70). Align the hole in brake pedal with the pivot shaft holes in the pedal bracket.

(4) Install the brake pedal shaft (Fig. 70).

PEDAL (Continued)

(5) Install the nut on the end of the brake pedal pivot shaft. Tighten the nut to a torque of 34 N·m (25 ft. lbs.).

(6) Install the power brake booster input rod on the brake pedal pin.

CAUTION: When installing the retaining clip on the brake pedal pin, a NEW retaining clip must be used to ensure the retention of the power brake booster input rod.

(7) Install a **new** retaining clip (Fig. 71) on the brake pedal pin.

(8) Using Mopar Lubriplate or an equivalent, lightly lubricate the surface of the brake pedal striker where the plunger of the brake lamp switch contacts it.

NOTE: Prior to installing the brake lamp switch into its bracket, the plunger must be moved to its fully extended position using the procedure in Step 9.

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

(10) Install the brake lamp switch in the brake pedal bracket (Fig. 70). Install it using the following procedure. Depress the brake pedal as far down as possible. Then while holding brake pedal down, align the index key on switch with notch in square hole of mounting bracket. When the switch is fully installed into the bracket, rotate the switch in a clockwise direction approximately 30 degrees until it locks into place.

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

(11) Gently release/pull back the brake pedal until it stops moving. This will cause the switch plunger to ratchet back to its correctly adjusted position.

(12) Connect the remote ground cable to the ground stud on the right front strut tower.

(13) Check the operation of the brakes and brake lamp switch.

POWER BRAKE BOOSTER

DESCRIPTION

The power brake booster assembly mounts on the engine side of the dash panel. It is externally connected to the brake pedal by an input push rod extending out the rear of the booster (Fig. 72). The master cylinder is bolted to the front of the power brake booster assembly.

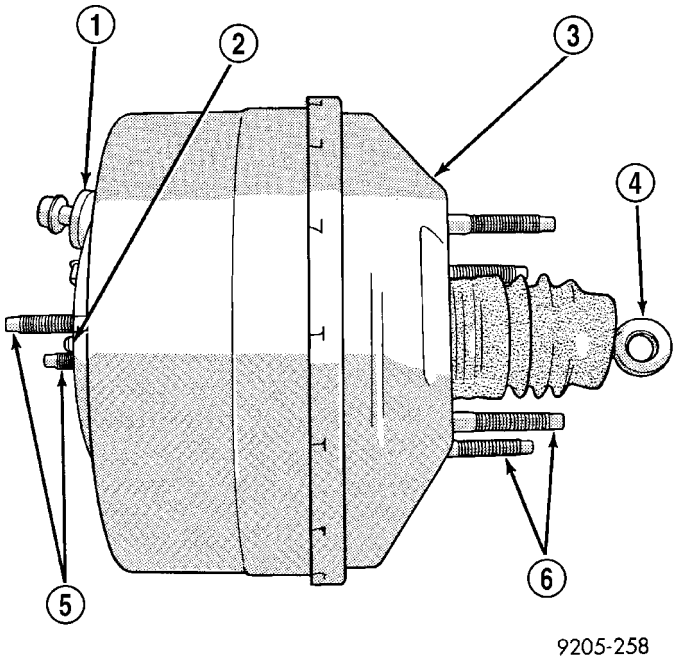


Fig. 72 Power Brake Booster

1 - VACUUM CHECK VALVE
2 - OUTPUT ROD
3 - POWER BRAKE BOOSTER ASSEMBLY
4 - INPUT ROD
5 - MASTER CYLINDER MOUNTING STUDS (2)
6 - POWER BOOSTER ASSEMBLY TO DASH PANEL MOUNTING STUDS (4)

A vacuum check valve is mounted on the power brake booster body. A vacuum line connects the booster (check valve) to the intake manifold. Depending on the engine combination, different vacuum hose routings are required.

POWER BRAKE BOOSTER (Continued)

The power brake booster can be identified by the tag attached to the body of the booster assembly (Fig. 73). This tag contains the following information:

- the production part number
- the date it was built
- who manufactured it

NOTE: The power brake booster assembly is not a repairable part and must be replaced as a complete unit if it is found to be faulty in any way. The power booster vacuum check valve is not repairable but can be replaced as an assembly.

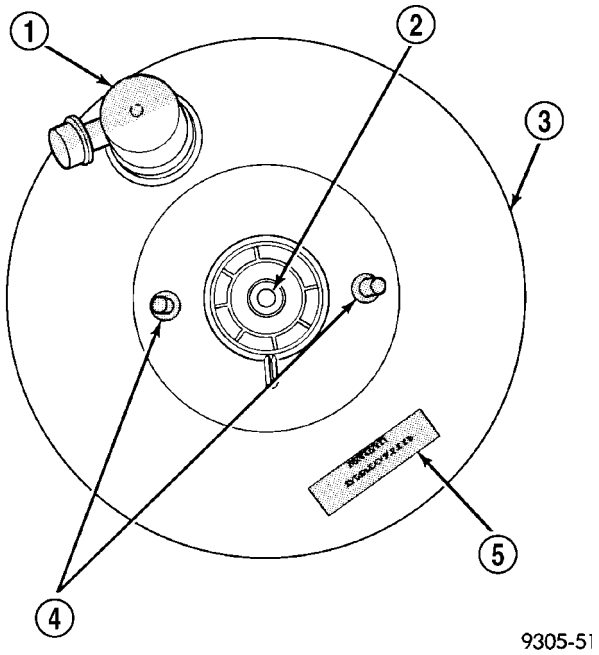


Fig. 73 Power Brake Booster Identification

1 - VACUUM CHECK VALVE
2 - MASTER CYLINDER PUSH ROD
3 - POWER BRAKE BOOSTER ASSEMBLY
4 - MASTER CYLINDER MOUNTING STUDS
5 - PART IDENTIFICATION TAG

OPERATION

The purpose of the power brake booster is to reduce the amount of force required by the driver (foot-pedal pressure) to obtain the required hydraulic pressure in the brake system to stop the vehicle. This vehicle utilizes a Bosch power brake booster to accomplish this task in all brake applications.

The power brake booster is vacuum operated. The vacuum is supplied from the intake manifold on the engine through the vacuum hose and power brake booster check valve (Fig. 72).

As the brake pedal is pressed, the power brake booster's input rod moves forward. This opens and closes valves in the power brake booster, creating a vacuum on one side of a diaphragm and allowing atmospheric pressure to enter on the other. 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 this creates the hydraulic pressure in the brake system.

DIAGNOSIS AND TESTING - 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.

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.

POWER BRAKE BOOSTER (Continued)

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.

REMOVAL - POWER BRAKE BOOSTER

(1) Remove the battery ground cable from the ground stud on the right strut tower. Then, correctly isolate the ground cable by installing the cable isolator on the ground stud (Fig. 74).

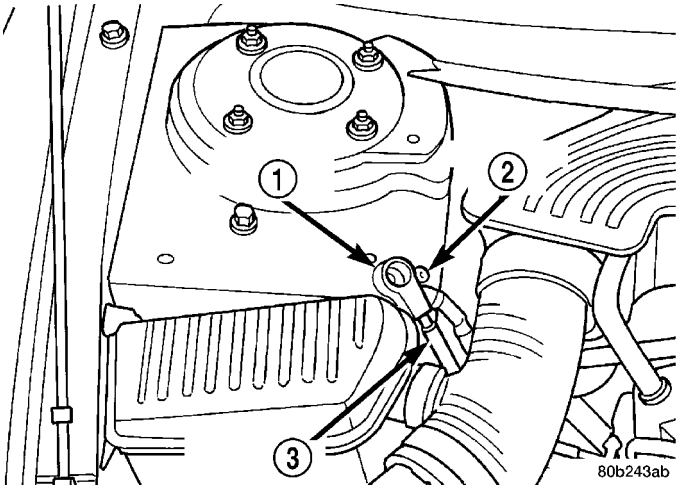


Fig. 74 Correctly Isolated Remote Ground Cable

1 - CABLE ISOLATOR
2 - GROUND STUD
3 - GROUND CABLE

(2) Remove caps from both wiper arms at the attachment to the pivots to expose the wiper arm attaching nut. Remove the nut attaching each wiper arm to its pivot (Fig. 75).

(3) Remove the wiper arms from the pivots. Wiper arms are removed from the pivots by rocking them back and force on the pivots until they can be pulled off the pivots.

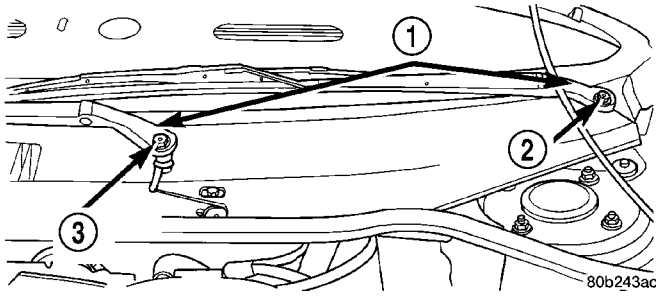


Fig. 75 Wiper Arm Attachment To Pivot

1 - WIPER ARMS
2 - ATTACHING NUT
3 - ATTACHING NUT

(4) Remove the wiper module cover and cowl cover (Fig. 76) from the vehicle.

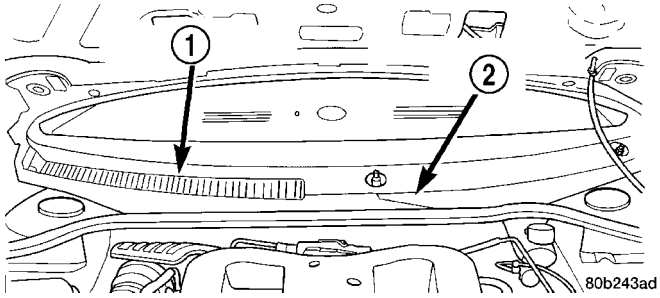


Fig. 76 Wiper Module And Cowl Cover

1 - COWL COVER
2 - WIPER MODULE COVER

(5) Remove the 8 bolts, attaching the reinforcement (Fig. 77) to the strut towers and the 1 bolt (Fig. 77) attaching the wiper module to the reinforcement. Remove the reinforcement from the vehicle.

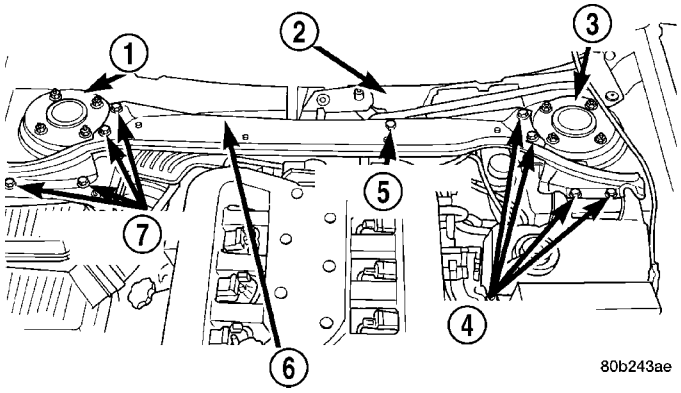


Fig. 77 Reinforcement Attachment To Vehicle

1 - RIGHT STRUT TOWER
2 - WIPER MODULE
3 - LEFT STRUT TOWER
4 - ATTACHING BOLTS
5 - ATTACHING BOLT
6 - REINFORCEMENT
7 - ATTACHING BOLTS

POWER BRAKE BOOSTER (Continued)

(6) Disconnect the wire connector from the brake fluid level sensor on the right side of the master cylinder reservoir.

(7) Remove the 2 nuts (Fig. 78) attaching the master cylinder to the vacuum booster.

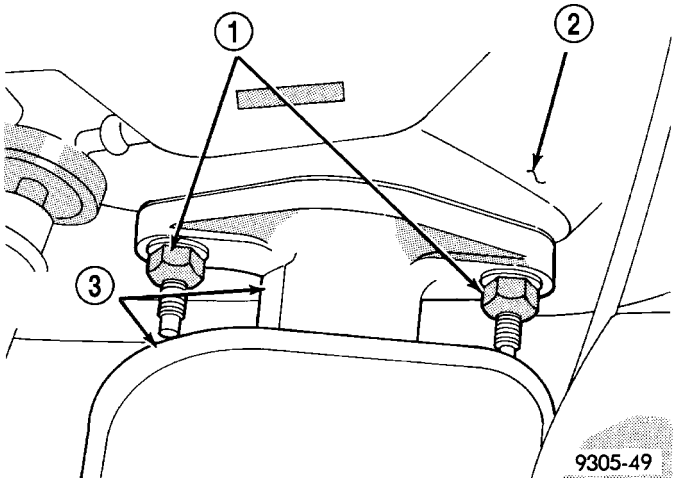


Fig. 78 Master Cylinder Mounting

1 - MASTER CYLINDER MOUNTING NUTS
2 - POWER BRAKE BOOSTER
3 - MASTER CYLINDER

(8) Carefully slide master cylinder off vacuum booster with brake lines attached, and position it backwards, on top of left engine cylinder head cover (Fig. 79).

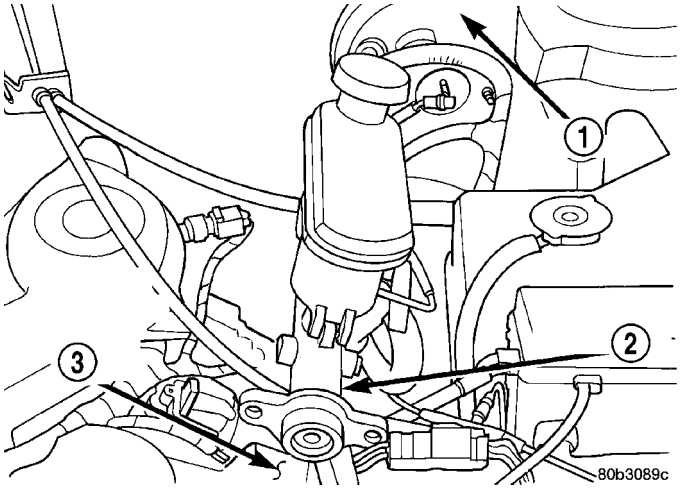


Fig. 79 Master Cylinder Positioning

1 - BOOSTER
2 - MASTER CYLINDER
3 - ENGINE CYLINDER HEAD COVER

(9) Disconnect vacuum hose from power brake booster check valve. **DO NOT REMOVE CHECK VALVE FROM POWER BRAKE BOOSTER.**

(10) From under instrument panel, position a small screwdriver between the center tang on the power brake booster input rod to brake pedal pin retaining clip.

(11) Rotate screwdriver enough to allow retainer clip center tang to pass over end of brake pedal pin and pull retainer clip off pin. **Discard retainer clip it is not to be reused, replace only with a new retainer clip.**

(12) Remove the four nuts that attach the power brake booster to the vehicle dash panel. Nuts are accessible from under the dash panel in the area of the steering column and pedal bracket.

(13) Rotate the windshield wiper motor crank lever until the crank lever points in the 12 o'clock position (Fig. 80).

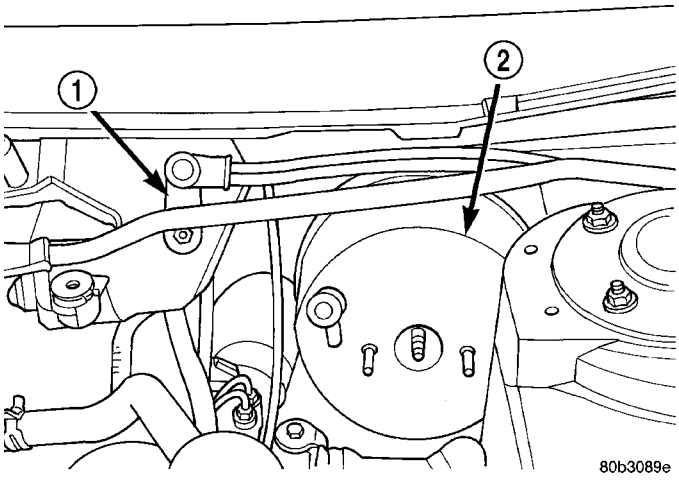


Fig. 80 Wiper Crank Lever Positioning

1 - WIPER MOTOR CRANK LEVER
2 - BRAKE BOOSTER

(14) Slide the power brake booster out of the dash panel and remove from vehicle.

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

INSTALLATION - POWER BRAKE BOOSTER

(1) Position power brake vacuum booster on dash panel.

(2) Install and tighten the 4 power brake booster to dash panel mounting nuts to 28 N·m (250 in. lbs.) torque.

(3) Using lubriplate or equivalent, coat the bearing surface of brake pedal pin.

(4) Connect booster input rod to brake pedal pin and install a NEW retainer clip. **Use only a new retainer clip DO NOT USE the old clip.**

NOTE: Before installing master cylinder, reposition under hood wiring harness above master cylinder mounting studs, in front of booster (Fig. 79).

(5) Carefully position master cylinder on booster. Position wire harness routing bracket onto right master cylinder mounting stud.

POWER BRAKE BOOSTER (Continued)

(6) Install and tighten the 2 master cylinder to booster mounting nuts (Fig. 78) to 28 N·m (250 in. lbs.) torque.

(7) Reconnect brake fluid level sensor connector.

(8) Connect all vacuum hoses onto the booster vacuum check valve.

(9) Check brake lamp switch operation.

(10) Install the wiper module reinforcement on the vehicle (Fig. 77). Install the 8 bolts, attaching the reinforcement to the strut towers. Install the bolt attaching the wiper module to the reinforcement.

(11) Install the covers over the wiper module and the cowl (Fig. 76). Install and securely tighten the attaching screws.

(12) Reconnect the battery ground cable to the ground stud on the shock tower.

(13) Turn windshield wipers ON, then OFF, in order to park wipers in the proper position before installing wiper arms.

(14) Install the wiper arms on the pivots (Fig. 75). Install and securely tighten the wiper arm to pivot attaching nuts. Install the caps on the wiper arms covering the pivot nuts.

(15) Verify proper operation of the power brake booster and brake system.

PROPORTIONING VALVE

DESCRIPTION

Two proportioning valves are used on each vehicle without antilock brakes. One valve is used for each rear brake hydraulic circuit. The proportioning valves that are located in the junction block (Refer to 5 - BRAKES - BASE/HYDRAULIC/MECHANICAL/ JUNCTION BLOCK - DESCRIPTION). The valves are not serviceable and must be replaced as part of the junction block.

OPERATION

Proportioning valves balance front to rear braking by controlling (at a given ratio) brake hydraulic pressure to the rear brakes above a preset level (split point). On light pedal applications equal brake pressure is transmitted to both the front and rear brakes. On heavier pedal applications, through the use of proportioning valves, the pressure transmitted to the rear will be lower than the front brakes. This prevents premature rear wheel skid.

If hydraulic pressure is lost in one-half of the diagonally split brake hydraulic system, the operation of the proportioning valve in the remaining half is not affected.

DIAGNOSIS AND TESTING - PROPORTIONING VALVE

Vehicles without Antilock Brakes have two proportioning valves. One proportioning valve controls the right rear brake, and the other proportioning valve controls the left rear brake. The proportioning valves are located in the junction block. Vehicle's with ABS do not have proportioning valves to test, they use Electronic Variable Brake Proportioning which is built into the Integrated Control Unit (ICU).

If premature wheel skid occurs on a hard brake application, it could be an indication that a malfunction has occurred with one of the two rear brake proportioning valves. Test the valve that controls the side of the vehicle on which the skid occurs. Both proportioning valves have the same pressure specifications and are tested in the same way.

(1) If the left rear proportioning valve is suspect, disconnect the tube nut fitting at the master cylinder primary port (port closest to power brake booster). Install Adapter, Special Tool 8494-2, in its place on the master cylinder.

(2) If the right rear proportioning valve is suspect, disconnect the tube nut fitting at the master cylinder secondary port (port furthest from power brake booster). Install Adapter, Special Tool 8494-2, in its place on the master cylinder.

(3) Connect primary brake tube to Adapter.

(4) Install a Pressure Gauge, Special Tool C-4007-A, to the Adapter.

(5) Tighten all tube nut fittings to 17 N·m (145 in. lbs.) torque.

(6) Remove screw fastening the speed control servo to the upper radiator closure panel (Fig. 81).

(7) Remove screw fastening the washer filler tube to the upper radiator closure panel (Fig. 81).

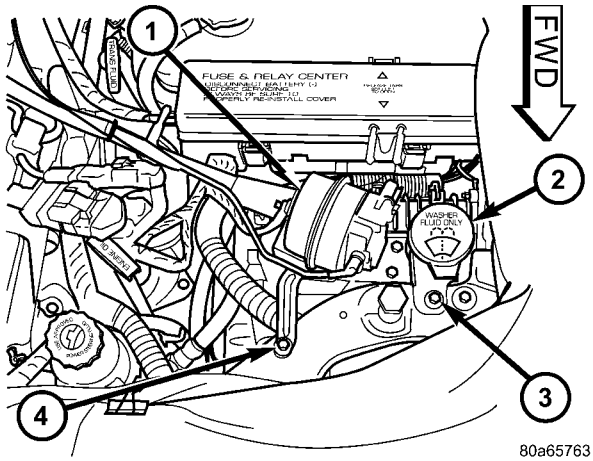


Fig. 81 Servo And Filler Tube Fasteners

1 - SPEED CONTROL SERVO
2 - WINDSHIED WASHER FILLER TUBE
3 - SCREW
4 - SCREW

PROPORTIONING VALVE (Continued)

(8) Remove nut and screw securing transmission control module to vehicle (Fig. 82).

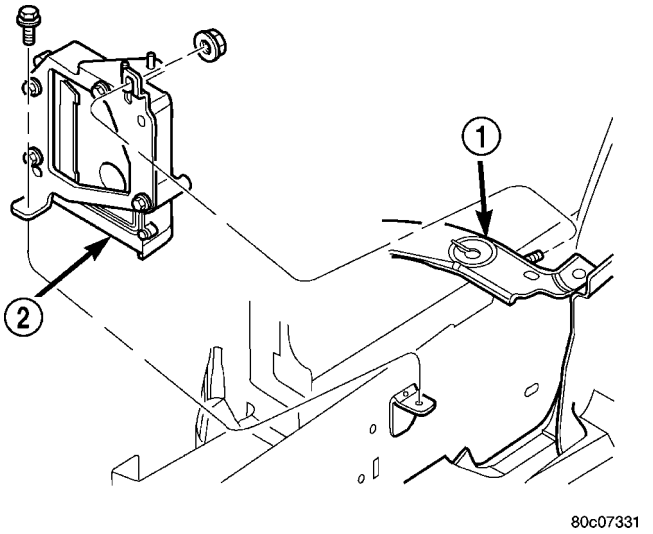


Fig. 82 Transmission Control Module (TCM)—Removal/Installation

1 - RADIATOR UPPER SUPPORT
2 - TCM

(9) Lift the transmission control module (with speed control servo attached) from its mount leaving its wiring harness attached. Move it off to the side toward the engine making sure not to strain the wires and speed control servo cable.

(10) Clean any debris away from the fittings on top of the junction block.

(11) Using the following figure, remove the chassis brake tube leading to either the left rear or right rear brake at the junction block (Fig. 83).

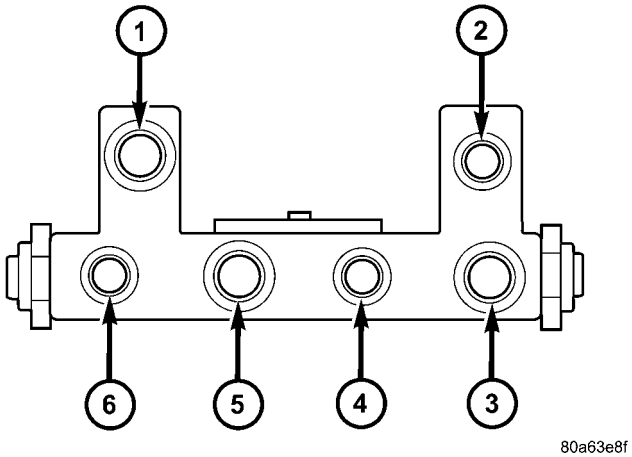


Fig. 83 Junction Block Fitting Identification

1 - FROM MASTER CYLINDER PRIMARY
2 - FROM MASTER CYLINDER SECONDARY
3 - TO LEFT FRONT BRAKE
4 - TO RIGHT REAR BRAKE
5 - TO LEFT REAR BRAKE
6 - TO RIGHT FRONT BRAKE

(12) If the left rear proportioning valve is suspect, install Adapter, Special Tool 8494-3, in its place on the junction block.

(13) If the right rear proportioning valve is suspect, install Adapter, Special Tool 8494-4, in its place on the junction block.

(14) Install a Pressure Gauge, Special Tool C-4007-A, to the Adapter.

(15) Tighten all tube nut fittings to 17 N·m (145 in. lbs.) torque.

(16) Bleed any air out of the system. This includes bleeding the air from the hose between the pressure test fitting and pressure gauge, which is done at the pressure gauge.

(17) With the aid of a helper, apply pressure to the brake pedal until reading on proportioning valve inlet gauge (at master cylinder) is at the pressure shown on the chart at the end of this procedure. Then check the pressure reading on the proportioning valve outlet gauge (at junction block outlet to rear brake). If proportioning valve outlet pressure does not agree with value shown on the chart (once inlet pressure shown on chart is obtained), replace the junction block (with internal proportioning valves) (Refer to 5 - BRAKES - BASE/HYDRAULIC/MECHANICAL/JUNCTION BLOCK - REMOVAL). If pressure is within specifications, do not replace proportioning valve and perform the following steps.

(18) Remove the Pressure Gauge and Adapter, Special Tool 8494-3 or 8494-4, from junction block.

(19) Reinstall the chassis brake tube to the junction block port. Tighten tube nut fitting to 17 N·m (145 in. lbs.) torque.

(20) Install the transmission control module (with speed control servo attached) in its normal position (Fig. 82). Install the nut and screw securing it in place.

(21) Install the transmission control module mounting nut and screw securing it in place. Tighten the screw to 6 N·m (45 in. lbs.). Tighten the nut to 12 N·m (107 in. lbs.) torque.

(22) Install the screw attaching the washer filler tube to the upper radiator closure panel (Fig. 81).

(23) Install the screw attaching the speed control servo to the upper radiator closure panel (Fig. 81).

(24) Remove the Pressure Gauge and Adapter from master cylinder.

(25) Install the brake tube to the master cylinder primary or secondary port. Tighten the tube nut to a torque of 17 N·m (145 in. lbs.).

(26) Bleed the affected brake line. (Refer to 5 - BRAKES - BASE - STANDARD PROCEDURE)

PROPORTIONING VALVE (Continued)

(27) If no problem is found with the proportioning valves, check the rear wheel brake shoe linings for contamination or for replacement brake shoes not meeting OEM brake lining material specifications. These conditions can also cause premature rear wheel skid.

PROPORTIONING VALVE APPLICATIONS AND PRESSURE SPECIFICATIONS

Sales Code	Brake System Type	Split Point	Slope	Identification	Inlet Pressure	Outlet Pressure
All	All Disc/Disc	400 psi	0.34	Bar Code Label	1000 psi	525-625 psi

ROTOR

DIAGNOSIS AND TESTING - 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 5 - BRAKES - BASE/HYDRAULIC/MECHANICAL/ROTORS - STANDARD PROCEDURE)

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.

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. 84). Limits can also be found in the table at the end of this brake rotor information.

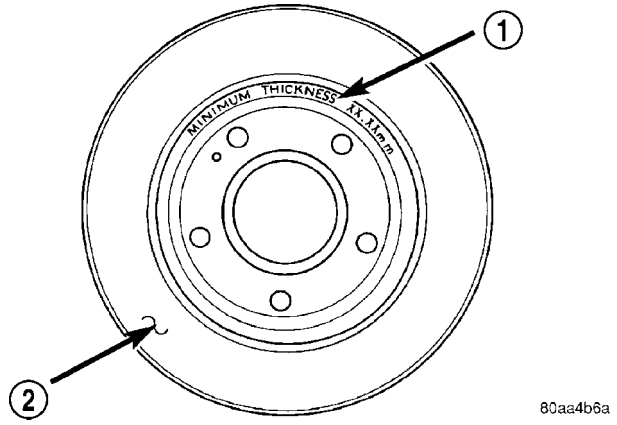


Fig. 84 Minimum Thickness Markings (Typical)

1 - ROTOR MINIMUM THICKNESS MARKING
2 - ROTOR

ROTOR (Continued)

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. 85). If thickness measurements vary by more than 0.013 mm (0.0005 inch), the rotor should refaced or replaced. (Refer to 5 - BRAKES - BASE/HYDRAULIC/MECHANICAL/ROTORS - STANDARD PROCEDURE)

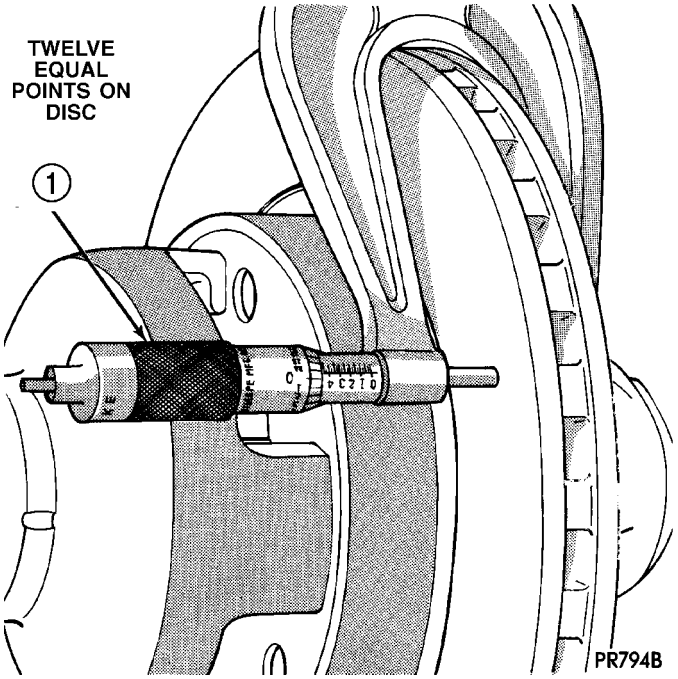


Fig. 85 Checking Rotor Thickness

1 - MICROMETER

ROTOR RUNOUT

On-vehicle rotor runout is the combination of the individual runout of the hub face and the runout of the rotor. (The hub and rotor runouts are separable). To measure 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 25 mm (one inch) from outer edge of rotor (Fig. 86). 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.

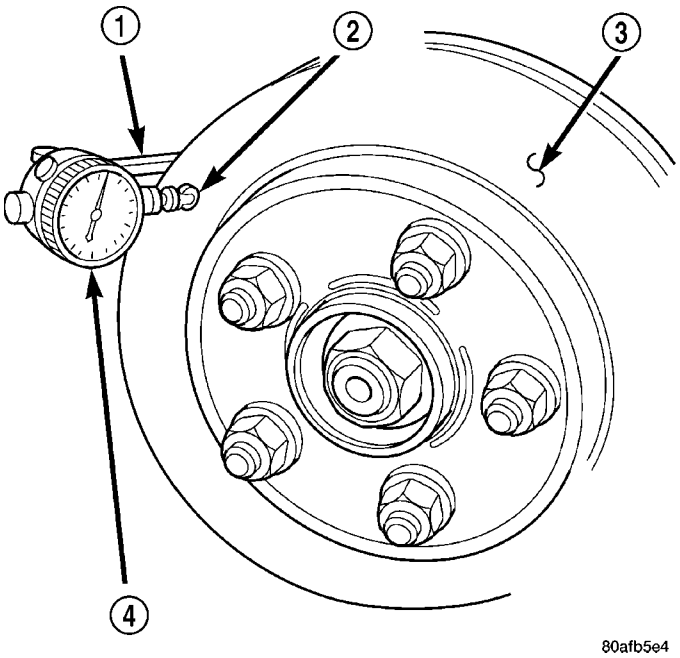


Fig. 86 Checking Rotor Runout

1 - SPECIAL TOOL SP-1910
2 - 25mm (1 INCH) FROM EDGE
3 - DISC SURFACE
4 - SPECIAL TOOL C-3339

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. 87).

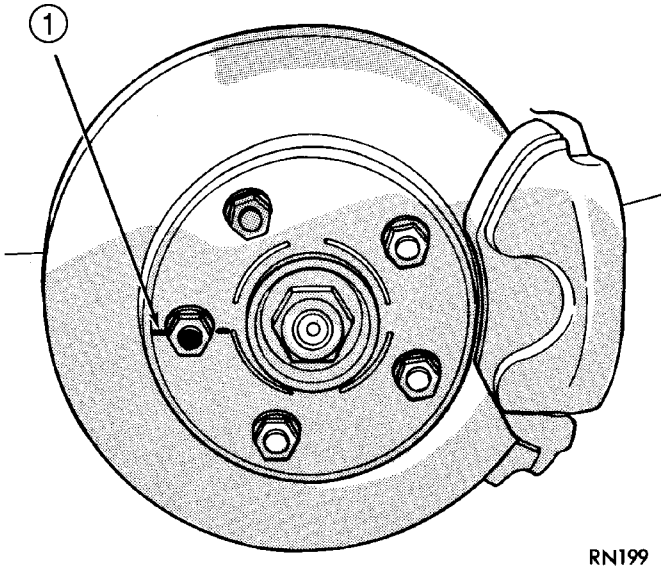


Fig. 87 Marking Rotor and Wheel Stud

1 - CHALK MARK

Remove the rotor from the hub.

ROTOR (Continued)

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. 88).

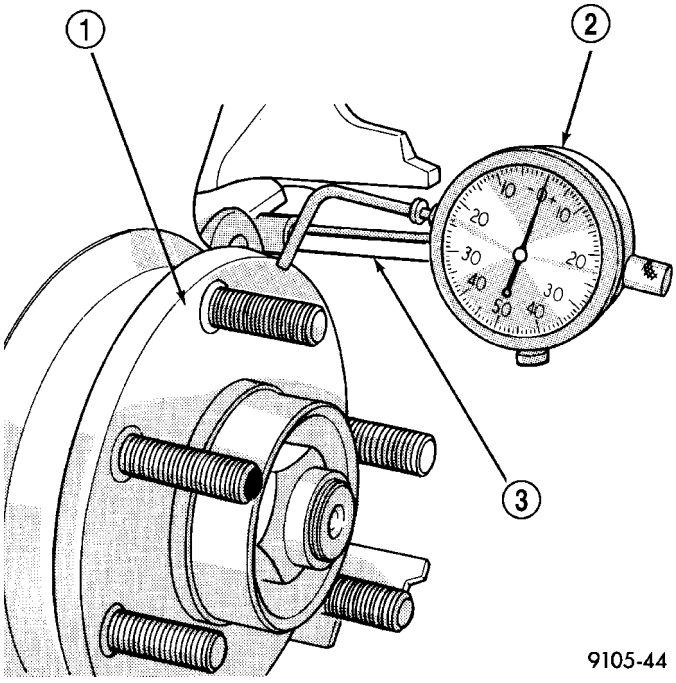


Fig. 88 Checking Hub Runout

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

Hub runout should not exceed 0.03 mm (0.0012 inch). If runout exceeds this specification, the hub must be replaced. Refer to SUSPENSION for the hub and bearing removal and installation 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. 89). Tighten nuts in the proper sequence and torque to specifications.

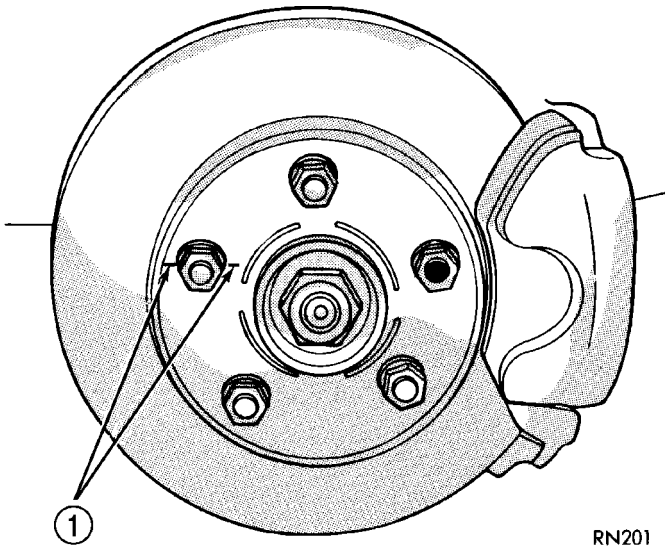


Fig. 89 Index Rotor And Wheel Stud

1 - CHALK MARK

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

If runout is not within specifications, reface or replace the brake rotor. (Refer to 5 - BRAKES - BASE/HYDRAULIC/MECHANICAL/ROTORS - STANDARD PROCEDURE)

BRAKE ROTOR LIMITS

Braking Rotor	Rotor Thickness	Minimum Rotor Thickness	Rotor Thickness Variation	Rotor Run Out*	Rotor Micro Finish
Front Rotor	25.87–26.13 mm 1.019 -1.029 in.	24.4 mm 0.960 in.	0.013 mm 0.0005 in.	0.08 mm 0.003 in.	15-80 RMS
Rear Rotor	11.63–12.13 mm 0.458 -0.478 in.	10.4 mm 0.409 in.	0.013 mm 0.0005 in.	0.08 mm 0.003 in.	15-80 RMS
* TIR Total Indicator Reading (Measured On Vehicle)					

ROTOR (Continued)

STANDARD PROCEDURE - BRAKE ROTOR MACHINING

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

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. 90), or replaced.

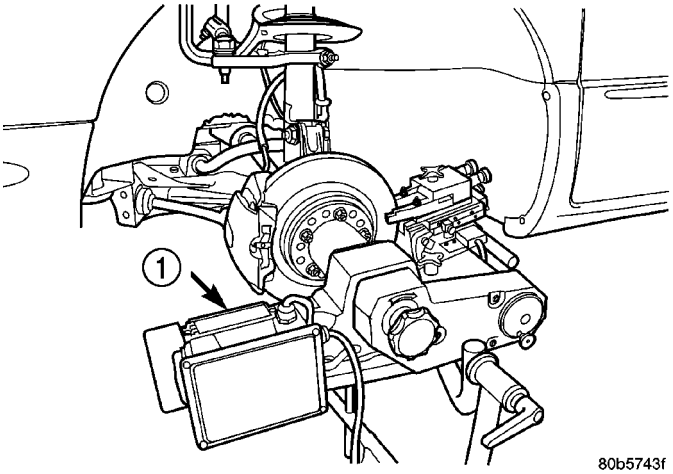


Fig. 90 Hub Mounted On-Car Brake Lathe

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. 91) or (Fig. 92).

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.

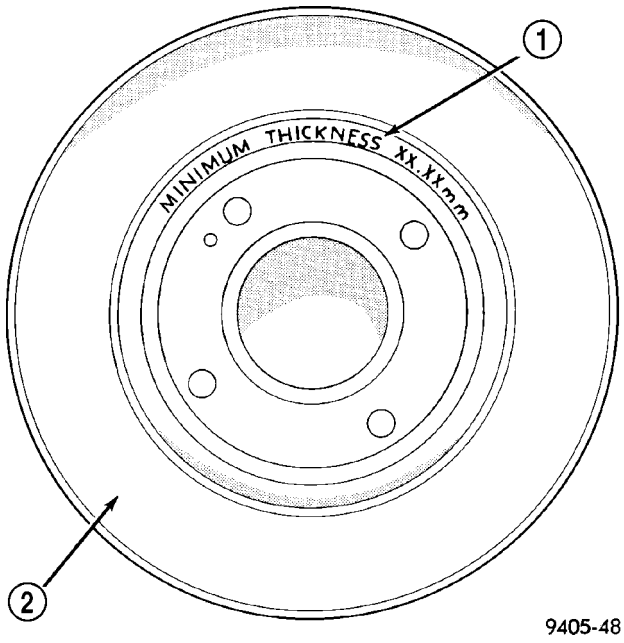


Fig. 91 Front Rotor Thickness Markings

1 - BRAKING DISC MINIMUM THICKNESS MARKING
2 - BRAKING DISC

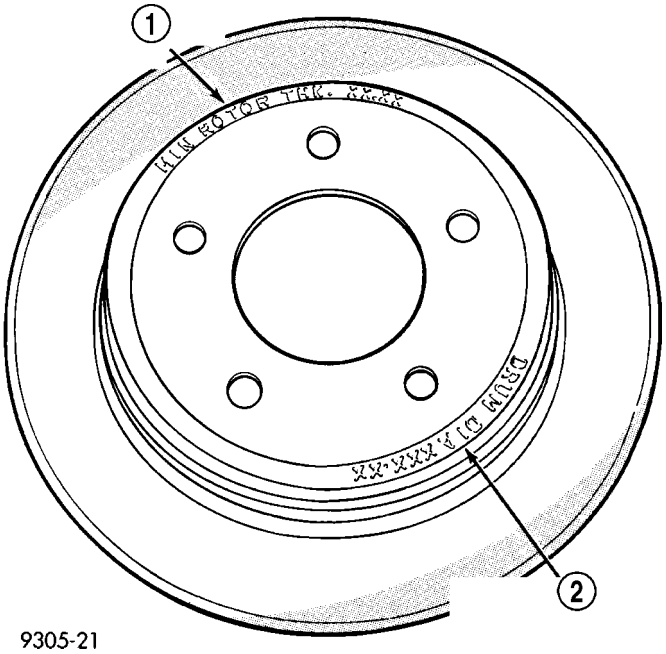


Fig. 92 Rear Rotor Thickness Markings

1 - BRAKING DISC MINIMUM THICKNESS MARKING
2 - PARK BRAKE DRUM MAXIMUM DIAMETER MARKING

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.

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.

ROTOR (Continued)

BRAKE ROTOR REFINISHING LIMITS

Braking Rotor	Rotor Thickness	Minimum Rotor Thickness	Rotor Thickness Variation	Rotor Run Out*	Rotor Micro Finish
Front Rotor	25.87–26.13 mm 1.019 -1.029 in.	24.4 mm .960 in.	.013 mm .0005 in.	.08 mm .003 in.	15-80 RMS
Rear Rotor	11.63–12.13 mm .458 -.478 in.	10.4 mm .409 in.	.013 mm .0005 in.	.08 mm .003 in.	15-80 RMS
* TIR Total Indicator Reading (Measured On Vehicle)					

REMOVAL

REMOVAL - BRAKE ROTOR (FRONT)

(1) Remove disc brake caliper and store (hang) it out of the way following the procedure found in Brake Pads/Shoes. (Refer to 5 - BRAKES - BASE/HYDRAULIC/MECHANICAL/BRAKE PADS/SHOES - REMOVAL)

(2) Remove any clips retaining the brake rotor to the wheel mounting studs.

(3) Remove brake rotor from hub by pulling it straight off wheel mounting studs (Fig. 93).

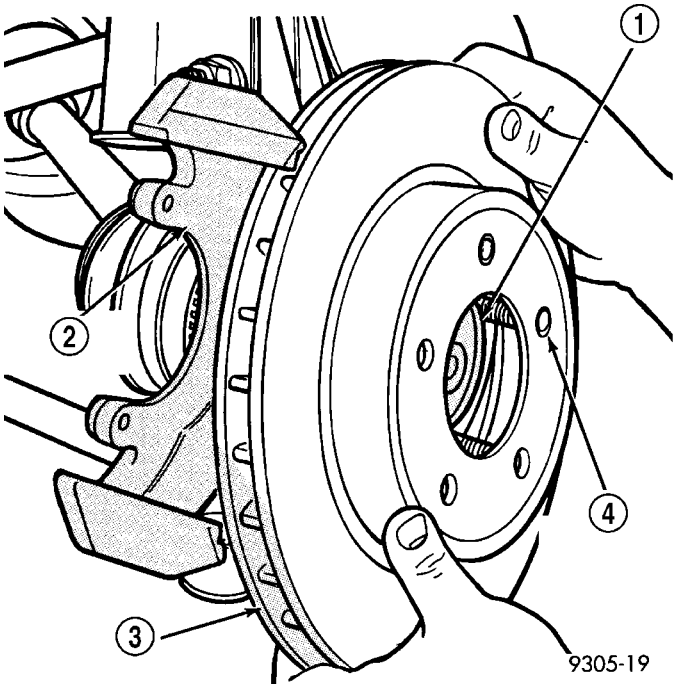


Fig. 93 Front Rotor Removal/Installation

1 - HUB
2 - STEERING KNUCKLE
3 - BRAKE ROTOR (DISC)
4 - WHEEL MOUNTING STUD

REMOVAL - BRAKE ROTOR (REAR)

(1) Remove disc brake caliper and store (hang) it out of the way following the procedure found in Brake Pads/Shoes. (Refer to 5 - BRAKES - BASE/HYDRAULIC/MECHANICAL/BRAKE PADS/SHOES - REMOVAL)

(2) Remove any clips retaining the brake rotor to the wheel mounting studs.

(3) Remove the rear rotor from hub by pulling it straight off the wheel mounting studs (Fig. 94).

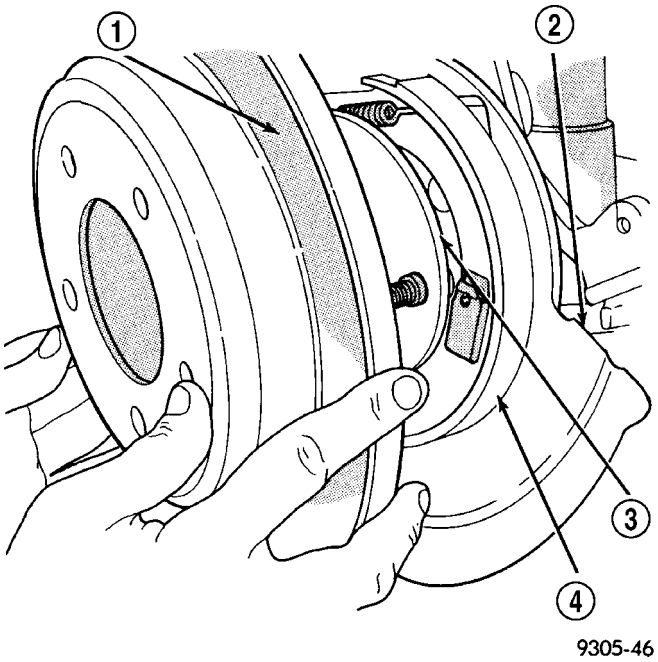


Fig. 94 Rear Rotor Removal/Installation

1 - BRAKE ROTOR (DISC)
2 - DISC SHIELD
3 - HUB
4 - DRUM-IN-HAT PARKING BRAKE

ROTOR (Continued)

INSTALLATION

INSTALLATION - BRAKE ROTOR (FRONT)

(1) Install brake rotor over the wheel mounting studs onto hub (Fig. 93).

(2) Install disc brake caliper and shoes following the procedure found in Brake Pads/Shoes. (Refer to 5 - BRAKES - BASE/HYDRAULIC/MECHANICAL/ BRAKE PADS/SHOES - INSTALLATION)

(3) Pump the brake pedal several times to ensure the vehicle has a firm brake pedal to adequately stop vehicle.

(4) Check and adjust brake fluid level as necessary.

INSTALLATION - BRAKE ROTOR (REAR)

(1) Install brake rotor over the wheel mounting studs onto hub (Fig. 94).

(2) Install disc brake caliper and shoes following the procedure found in Brake Pads/Shoes. (Refer to 5 - BRAKES - BASE/HYDRAULIC/MECHANICAL/ BRAKE PADS/SHOES - INSTALLATION)

(3) Adjust parking brake shoes as necessary.

(4) Pump the brake pedal several times to ensure the vehicle has a firm brake pedal to adequately stop vehicle.

(5) Check and adjust brake fluid level as necessary.

PARKING BRAKE

DESCRIPTION

The parking brake mechanism on vehicles equipped with rear disc brakes consists of a small duo-servo brake which is mounted to the disc brake caliper adapter. The hat (center) section (Fig. 95) of the rear rotor serves as the braking surface (drum) for the parking brakes.

The parking brake shoes are mechanically operated by an internal lever connected to a flexible steel (rear) cable. There are two rear cables, one for each rear wheel parking brake. The rear cables are joined at an equalizer bracket (and cable tensioner) which is attached to the intermediate cable. The opposite end of the intermediate cable is attached to the front cable which leads to the foot operated lever mounted inside the passenger compartment.

OPERATION

When the parking brake (foot) lever is pressed, the cables are pulled, thus actuating the parking brake shoes. The shoes expand outward against the drum section of the rear disc brake rotor.

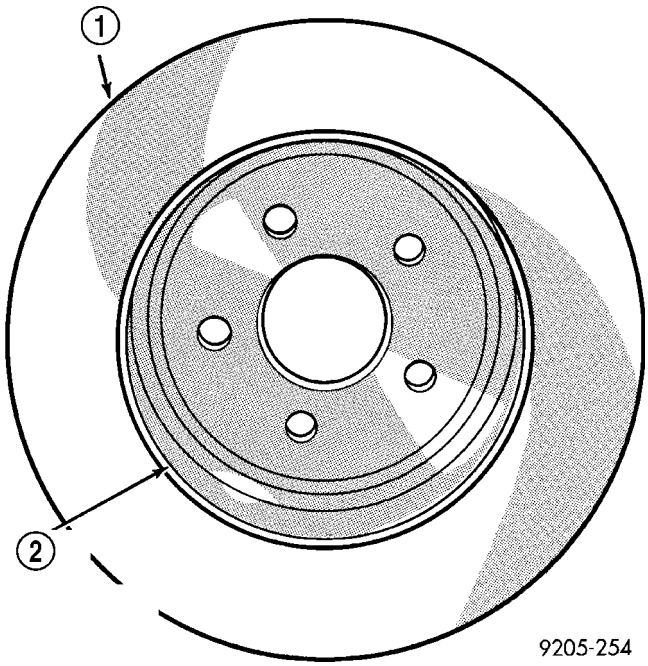


Fig. 95 Drum-In-Hat Braking Disc

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

ADJUSTMENTS

ADJUSTMENT - PARKING BRAKE

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

(1) Raise vehicle.

(2) Fully back off cable tensioner adjusting nut at equalizer to create slack in cables.

(3) Remove rear wheel/tire assemblies. Remove brake calipers and rotors.

(4) Verify park brakes are in good condition and operating properly.

(5) Verify park brake cables operate freely and are not binding, or seized.

(6) Check park brake shoe adjustment.

(7) Reinstall rotors and make sure rotors turn freely.

(8) Reinstall brake calipers. Tighten guide pin bolts to 41 n·m (30 ft.lbs.).

(9) Reinstall wheel/tire assemblies after brake shoe adjustment is complete.

(10) Lower vehicle enough for access to park brake foot pedal. Fully apply park brakes.

PARKING BRAKE (Continued)

NOTE: Leave park brakes applied until adjustment is complete.

(11) Raise vehicle again.
(12) Mark tensioner rod 6.35 mm (1/4 in.) from edge of tensioner bracket (Fig. 96).
(13) Tighten adjusting nut at equalizer until mark on tensioner rod moves into alignment with tensioner bracket.

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

(14) Lower vehicle until rear wheels are 15-20 cm (6-8 in.) off shop floor.
(15) Release park brake foot pedal and verify that rear wheels rotate freely without drag. Verify pedal returns to fully released position.
(16) Lower the vehicle.

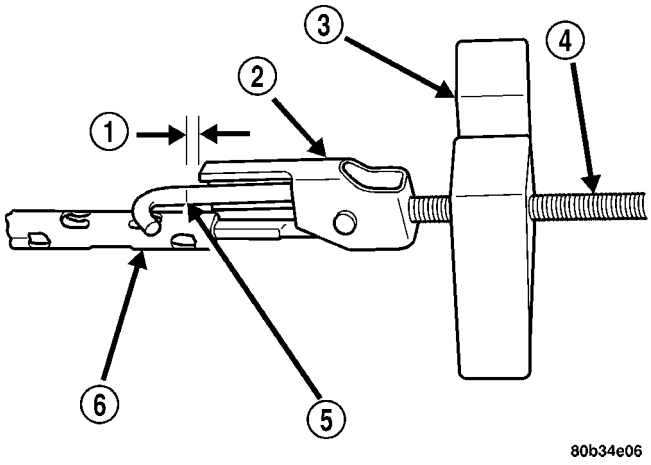


Fig. 96 Adjustment Mark On Cable Tensioner Rod

1 - MEASURE
2 - TENSIONER
3 - TENSIONER ISOLATOR
4 - THREADED ROD
5 - PLACE MARK HERE
6 - BRAKE CABLE CONNECTOR

PARKING BRAKE CABLE TENSIONER

REMOVAL

(1) Raise vehicle on jackstands or centered on a frame contact type hoist. See Hoisting in Lubrication and Maintenance.
(2) Remove the park brake tensioner adjuster nut (Fig. 97), releasing the tensioner from the equalizer bracket to the intermediate cable.
(3) Disconnect the connector and remove the park brake tensioner from the left rear parking brake cable (Fig. 97).

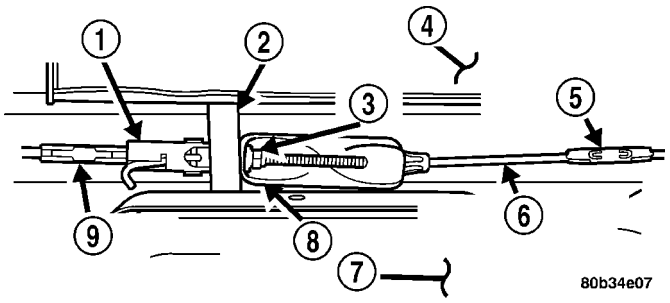


Fig. 97 Tensioner

1 - TENSIONER
2 - ISOLATOR
3 - ADJUSTER NUT
4 - MUFFLER
5 - RIGHT REAR CABLE CONNECTOR
6 - INTERMEDIATE PARK BRAKE CABLE
7 - FUEL TANK
8 - BRACKET
9 - LEFT REAR CABLE CONNECTOR

(4) Remove the park brake tensioner with its isolator from the vehicle.

INSTALLATION

(1) Mark tensioner rod 6.35 mm (1/4 in.) from edge of tensioner bracket (Fig. 98).

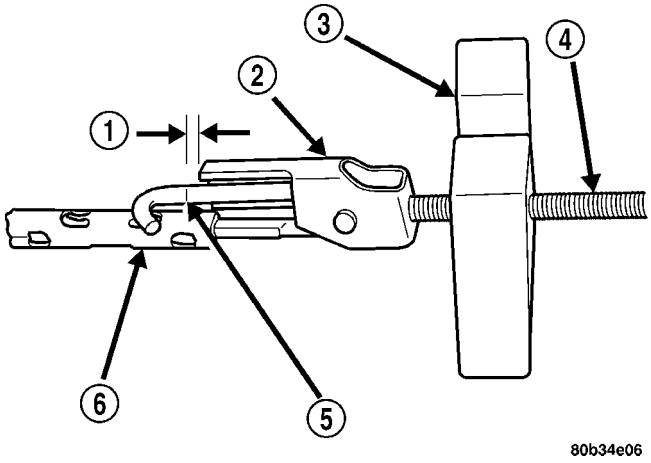


Fig. 98 ADJUSTMENT MARK ON CABLE TENSION

1 - MEASURE
2 - TENSIONER
3 - TENSIONER ISOLATOR
4 - THREADED ROD
5 - PLACE MARK HERE
6 - BRAKE CABLE CONNECTOR

(2) Install the park brake tensioner, with its isolator, in the vehicle, with the threaded adjustment stud pointed towards the right side of the vehicle (Fig. 97).
(3) Connect the left rear park brake cable to the cable connector on the tensioner (Fig. 97).
(4) Attach the threaded end of the tensioner to the equalizer bracket (Fig. 97) , and install a new adjuster nut. Do not tighten at this time.

PARKING BRAKE CABLE TENSIONER (Continued)

(5) Verify the rear park brake shoes are properly adjusted.

(6) Lower vehicle enough for access to park brake foot pedal. Fully apply park brakes.

NOTE: Leave park brakes applied until adjustment is complete.

(7) Raise vehicle again.

(8) Tighten adjusting nut at equalizer (Fig. 97) until mark on tensioner rod (Fig. 98) moves into alignment with edge of tensioner bracket.

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

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

(10) Release park brake foot pedal and verify that rear wheels rotate freely without drag. Verify pedal returns to the fully released position.

(11) Lower vehicle to the ground.

PARKING BRAKE CABLE - FRONT

REMOVAL - FRONT CABLE

The front parking brake cable is serviced with the parking brake lever. (Refer to 5 - BRAKES - BASE/ PARKING BRAKE/LEVER - REMOVAL)

INSTALLATION - FRONT CABLE

The front parking brake cable is serviced with the parking brake lever. (Refer to 5 - BRAKES - BASE/ PARKING BRAKE/LEVER - INSTALLATION)

PARKING BRAKE CABLE - INTERMEDIATE

REMOVAL - INTERMEDIATE CABLE

(1) Raise the vehicle using a frame contact type hoist or correctly supported on jackstands. See Hoisting in Lubrication and Maintenance.

(2) Loosen the park brake cable tensioner adjuster nut until tension is removed from cables.

(3) Disconnect the cable connector between the front and intermediate cable.

(4) Remove the bolt attaching the intermediate cable retainer to the body torque box (Fig. 99).

(5) Remove the intermediate cable from the body torque box (Fig. 99).

(6) Remove the connector from the intermediate cable at the right rear park brake cable.

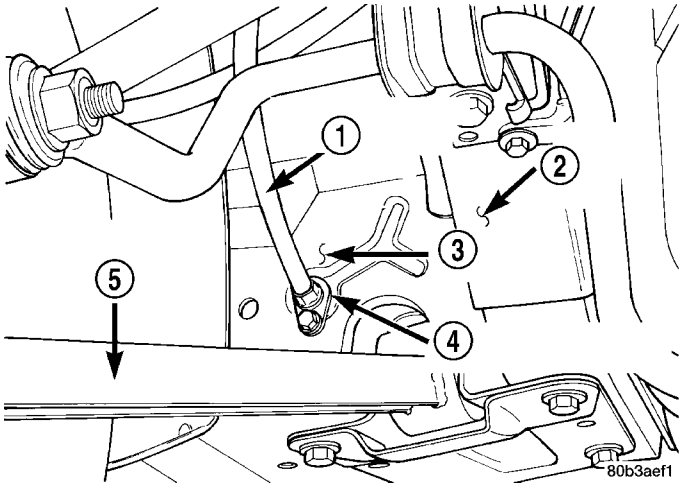


Fig. 99 Cable At Torque Box

1 - INTERMEDIATE PARK BRAKE CABLE
2 - LEFT FRAME RAIL
3 - TORQUE BOX
4 - CABLE RETAINER
5 - LEFT REAR TRAILING ARM

(7) Remove the intermediate cable from the tensioner bracket using the box end of a 1/2 inch wrench.

(8) Release the latch on the routing clip for the intermediate cable, mounted above the left rear cable retainer clip, on rear suspension crossmember.

(9) Remove the intermediate park brake cable.

INSTALLATION - INTERMEDIATE CABLE

(1) Install the intermediate park brake cable.

NOTE: When guiding the cable towards the front of the rear crossmember from the left side, make sure the cable is routed between the rear suspension crossmember and the frame rail crossing below the rear park brake cable. It should also be routed below the brake tubes at this point.

(2) Install the intermediate cable to the tensioner bracket by snapping it into place.

(3) Reinstall retainer clip on top of left side of crossmember, around intermediate cable and into place.

(4) Connect the intermediate cable to the right rear cable connector.

(5) Install the intermediate cable through the hole in the body torque box (Fig. 99). Install the bolt attaching the intermediate cable retainer to the body torque box.

(6) Connect the intermediate cable to the front cable connector.

(7) Adjust parking brake. (Refer to 5 - BRAKES - BASE/PARKING BRAKE - ADJUSTMENTS)

(8) Lower the vehicle.

PARKING BRAKE CABLE - REAR

REMOVAL - REAR CABLE

NOTE: This procedure can be used to remove either rear parking brake cable.

(1) Raise vehicle using a frame contact type hoist or correctly jack and support the vehicle using jack stands. See Hoisting in Lubrication And Maintenance.

(2) Loose the park brake cable tensioner nut until tension is removed from cables.

(3) **Left rear cable only -** Remove the rear cable from the connector at the park brake cable tensioner.

(4) **Right rear cable only -** Remove the rear cable from the connector at the intermediate cable.

(5) Remove the retainer clip securing the preferred rear park brake cable to the crossmember (Fig. 100).

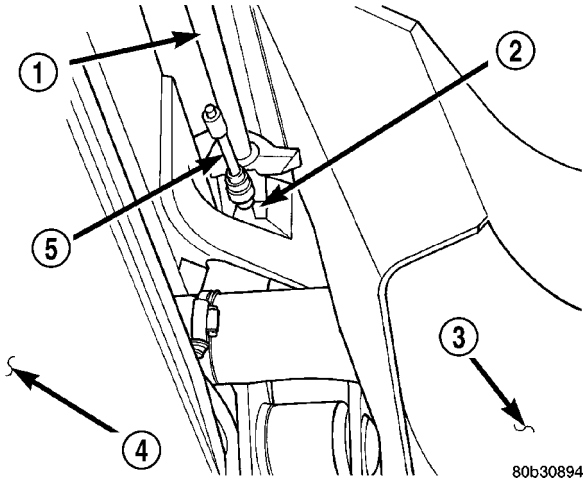


Fig. 100 Left Rear Parking Brake

1 - INTERMEDIATE PARKING BRAKE CABLE
2 - CLIP
3 - FUEL TANK
4 - MUFFLER
5 - REAR PARKING BRAKE CABLE

(6) Lower the vehicle enough to have rear brakes at good working height.

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

(8) Remove the rear disc brake caliper from the adapter and rotor. (Refer to 5 - BRAKES - BASE/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL)

(9) Remove the rear brake rotor from the rear hub/bearing assembly.

(10) Remove the parking brake shoes from the disc brake adapter. (Refer to 5 - BRAKES - BASE/PARKING BRAKE/SHOES - REMOVAL)

(11) Remove the park brake actuator lever from the rear park brake cable.

(12) Using a screwdriver, carefully compress the retainer tabs securing the rear park brake cable to the disc brake adapter.

(13) Remove the rear parking brake cable from the disc brake adapter and vehicle.

INSTALLATION - REAR CABLE

NOTE: This procedure can be used to install either rear parking brake cable.

(1) Install the rear parking brake cable by routing the leading end above the intermediate cable, then, between the frame, crossmember, and stabilizer bar.

(2) Install the other end of the cable into the disc brake adapter, allowing the retainer tabs to lock into place in the adapter.

(3) Install the park brake actuator lever onto the end of the rear park brake cable behind the spring.

(4) Install the parking brake shoes. (Refer to 5 - BRAKES - BASE/PARKING BRAKE/SHOES - INSTALLATION)

(5) Install the rear disc brake rotor on the hub/bearing.

(6) Install the brake caliper on the rotor and adapter. (Refer to 5 - BRAKES - BASE/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION)

(7) Install the caliper guide pin bolts and tighten to 41 N·m (30 ft. lbs.).

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

(9) Raise the vehicle back up.

(10) Install the rear park brake cable into the rear suspension crossmember mounting hole.

(11) Install a new retainer clip, on the end of the cable housing, to secure it in place.

(12) **Left rear cable only -** Connect the left rear park brake cable to the connector on the park brake cable tensioner.

(13) **Right rear cable only -** Connect the right rear park brake cable to the connector on the intermediate park brake cable.

(14) When repairs are complete, adjust parking brake shoes, then adjust parking brake tensioner. (Refer to 5 - BRAKES - BASE/PARKING BRAKE - ADJUSTMENTS)

PARKING BRAKE LEVER

REMOVAL - PARKING BRAKE LEVER AND CABLE

NOTE: The parking brake lever assembly on this vehicle is serviced with the front cable installed on it. They should be removed, replaced, and installed as an assembly.

(1) Remove remote ground cable from ground stud on shock tower. Then correctly isolate ground cable from vehicle by installing isolator on stud (Fig. 101).

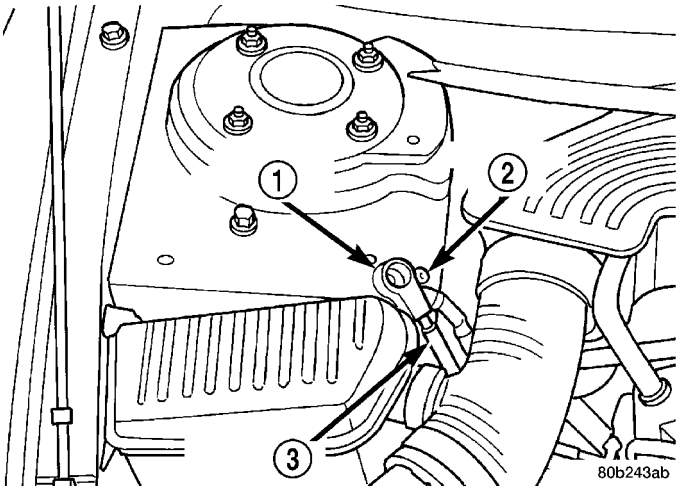


Fig. 101 Correctly Isolated Remote Ground Cable

1 - CABLE ISOLATOR
2 - GROUND STUD
3 - GROUND CABLE

(2) Raise the vehicle using a frame contact type hoist or correctly supported on jackstands. See Hoisting in Lubrication and Maintenance.

(3) Loosen the park brake tensioner adjuster nut, in front of the rear crossmember, until tension is removed from cables.

(4) Disconnect the cable connector between the front and intermediate cable.

(5) Lower the vehicle to the ground.

(6) Remove the driver's door opening sill cover.

(7) Remove the driver's side kick panel.

(8) Remove the fuse panel cover from the left end of the instrument panel (Fig. 102).

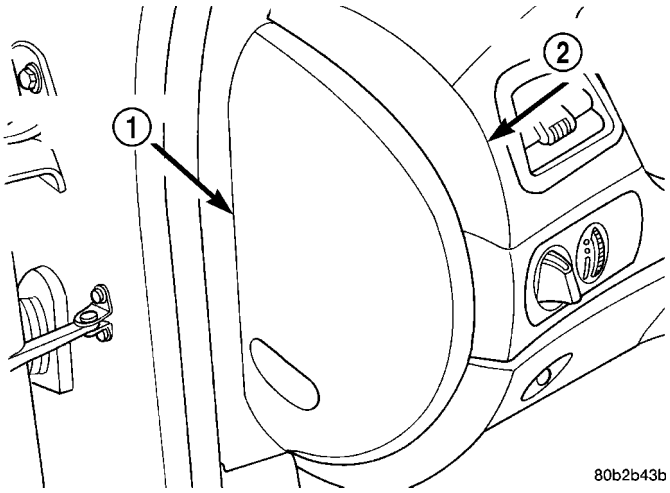


Fig. 102 Fuse Panel Cover

1 - FUSE PANEL COVER
2 - INSTRUMENT PANEL

(9) Remove the 2 screws behind the fuse panel cover attaching the lower instrument panel cover to the instrument panel mounting bracket (Fig. 103).

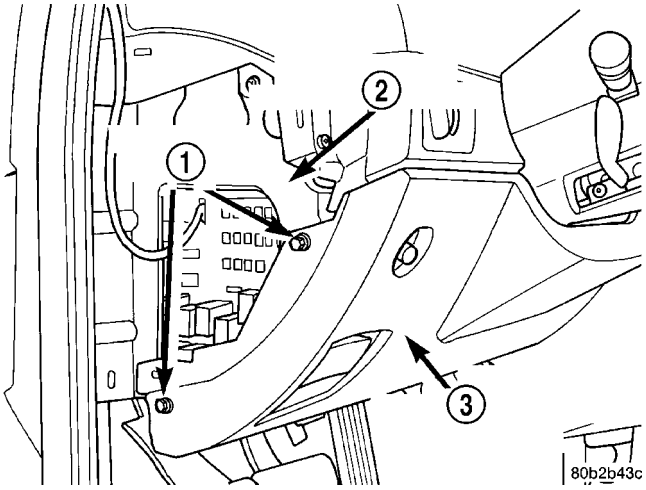


Fig. 103 Lower Instrument Panel Cover Mounting Screws

1 - MOUNTING SCREWS
2 - INSTRUMENT PANEL BRACKET
3 - LOWER INSTRUMENT PANEL COVER

PARKING BRAKE LEVER (Continued)

(10) Remove the lower instrument panel cover from the instrument panel. It is attached by retaining clips along the top and right edge.

(11) Remove the wiring harness connector from the trunk release switch in the lower instrument panel cover (Fig. 104).

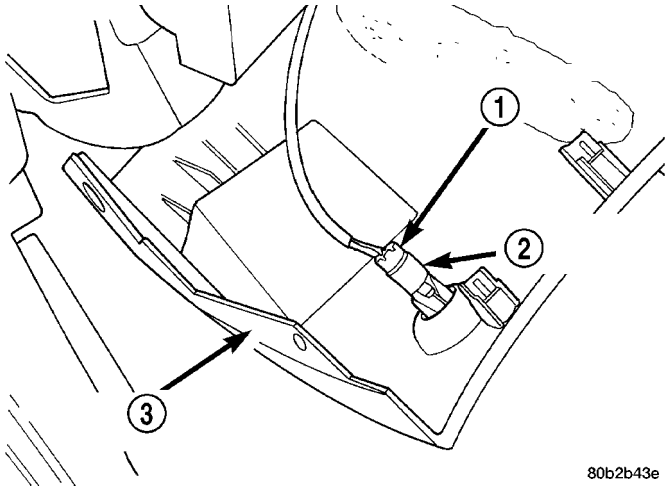


Fig. 104 Trunk Release Wiring

1 - WIRING HARNESS CONNECTOR
2 - TRUNK RELEASE SWITCH
3 - LOWER INSTRUMENT PANEL COVER

(12) Remove the park brake release cable from the park brake release handle in the lower instrument panel cover (Fig. 105).

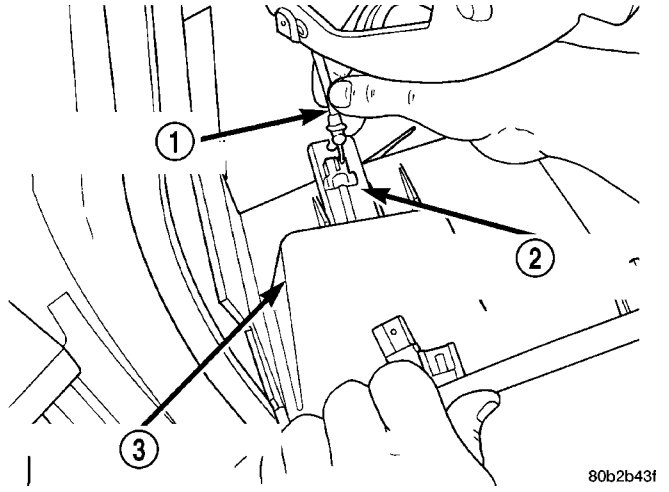


Fig. 105 Park Brake Release Cable

1 - PARK BRAKE RELEASE CABLE
2 - PARK BRAKE RELEASE HANDLE
3 - LOWER INSTRUMENT PANEL COVER

(13) Remove the 4 bolts mounting the reinforcement to the instrument panel (Fig. 106). Remove the reinforcement from the instrument panel. Remove the diagnostic connector from the reinforcement.

(14) Remove the lower A/C duct below the steering column. It is secured with 1 screw.

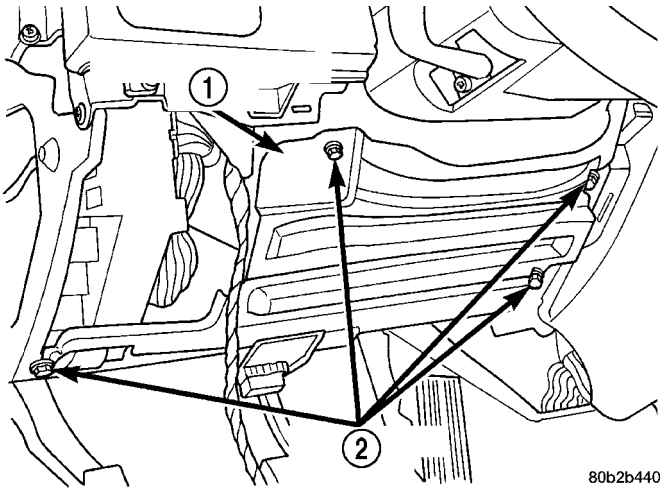


Fig. 106 Reinforcement Panel

1 - REINFORCEMENT PANEL
2 - MOUNTING BOLTS

(15) Remove the 2 lower mounting screws securing fuse junction block bracket to instrument panel end housing (Fig. 107).

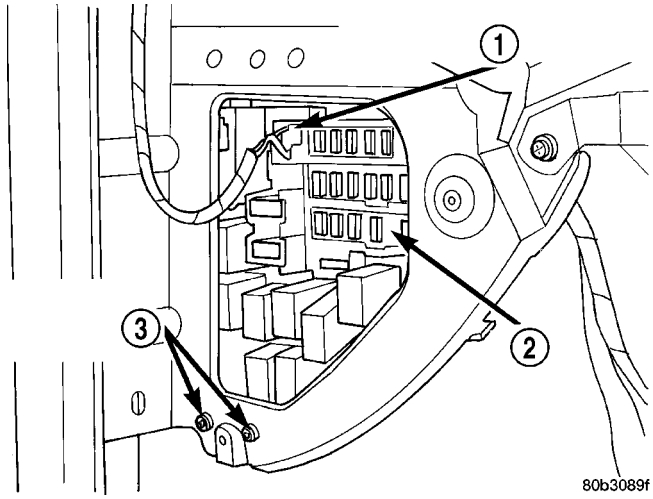


Fig. 107 Fuse Junction Block

1 - DOME LAMP WIRING HARNESS CONNECTOR
2 - FUSE JUNCTION BLOCK
3 - LOWER MOUNTING SCREWS

(16) Remove the 2 screws securing fuse junction block upper edge to the instrument panel bracket. These screws are installed from above the right side of the fuse junction block and mount to the left.

(17) Remove the dome lamp wiring harness connector from the fuse junction block (Fig. 107).

(18) Move fuse junction block as far down and to the right as possible without causing damage to the harness or fuse junction block.

(19) Remove left rear door opening sill cover.

(20) Remove front seat belt anchor bolt at base of left B-pillar.

PARKING BRAKE LEVER (Continued)

(21) Pull back floor carpeting on left side of passenger compartment to reveal front park brake cable.

(22) Remove the screw securing the foot rest to the floor. Remove the foot rest.

(23) Remove the 2 screws securing the front park brake cable retainer bracket to the rear floor pan (Fig. 108).

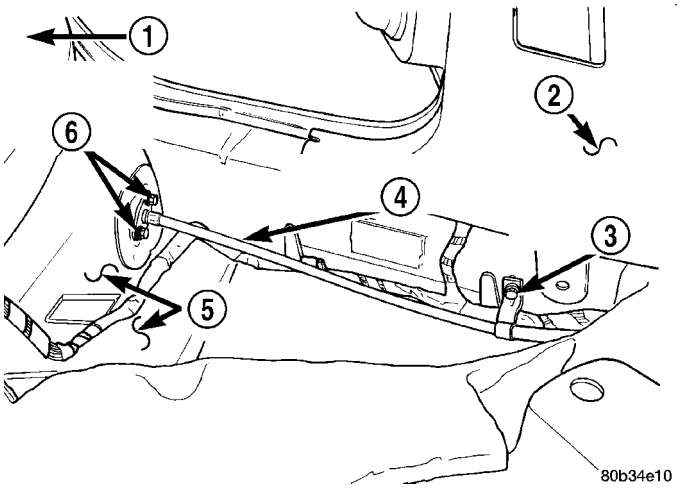


Fig. 108 Front Park Brake Cable At Rear Floor Pan

1 - REAR SEAT CUSHION
2 - B-PILLAR
3 - ROUTING BRACKET SCREW
4 - FRONT PARK BRAKE CABLE
5 - FLOOR PLAN
6 - RETAINER BRACKET SCREWS

(24) Remove 2 routing bracket screws securing front park brake cable to left side of the passenger compartment floor. One screw is at the base of the B-pillar by the seat belt anchor bolt (Fig. 108), and the other is below the park brake lever assembly on the floor pan (Fig. 109).

(25) Remove the rear bolt, and loosen the 2 front nuts on studs, securing the parking brake lever assembly in place.

(26) Lower the parking brake lever assembly enough to gain access to the warning lamp ground wire connector. Remove the brake warning light ground wire from the switch on the park brake lever assembly.

(27) Continue to move parking brake lever, with front park brake cable attached, downward, and remove both from vehicle together.

INSTALLATION - PARKING BRAKE LEVER AND CABLE

(1) Install the parking brake lever, with front cable, back in vehicle by first running the front cable, starting from front to the rear, along the left side of passenger compartment. Guide it into the hole at the rear of the floor pan.

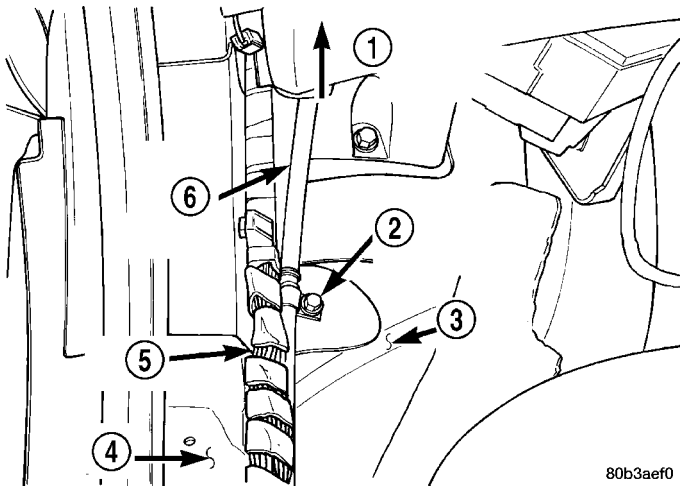


Fig. 109 Front Park Brake Cable Attachment At Front Floor Pan

1 - TO PARK BRAKE LEVER
2 - ROUTING BRACKET SCREW
3 - FLOOR PLAN
4 - DOOR SILL
5 - WIRE HARNESS
6 - FRONT PARK BRAKE CABLE

(2) Guiding the lever assembly up past the fuse junction block, position the park brake release cable into place. Also, reinstall the brake warning lamp wire, through access hole in lever assembly, onto switch.

(3) Position the lever assembly in its mounting place. Install the rear mounting bolt and tighten it to a torque of 27 N·m (19 ft. lbs.). Tighten the 2 mounting nuts to a torque of 27 N·m (19 ft. lbs.).

(4) Ensure that the park brake cable is properly routed and install the two routing bracket screws.

(5) Install the 2 screws securing the front park brake cable retainer bracket to the rear floor pan.

(6) Install the foot rest, securing it in place with its one mounting screw.

(7) Reposition the carpeting in place.

(8) Reinstall the front seat belt anchor bolt at the base of the B-pillar.

(9) Reinstall the rear door opening sill cover.

(10) Reposition the fuse junction block in place, and install the two lower, then, the two upper mounting screws.

(11) Reinstall the lower A/C duct in place.

(12) Install the diagnostic connector to the instrument panel steel reinforcement. Reinstall the steel reinforcement to the instrument panel.

(13) Connect the park brake release cable to the release handle.

(14) Reconnect the trunk release harness connector to the release switch.

(15) Reinstall the lower instrument panel cover below the steering column. Reinstall the 2 screws securing the lower instrument panel cover behind the fuse panel cover.

PARKING BRAKE LEVER (Continued)

(16) Reinstall the fuse panel cover on left side of instrument panel.
(17) Reinstall driver's side kick panel
(18) Reinstall driver's door opening sill cover
(19) Raise the vehicle up.
(20) Reconnect the cable connector between the front and intermediate cables.
(21) Adjust parking brake. (Refer to 5 - BRAKES - BASE/PARKING BRAKE - ADJUSTMENTS)
(22) Lower the vehicle.

PARKING BRAKE SHOES

REMOVAL - PARKING BRAKE SHOES

(1) Remove rear disc brake caliper assembly from adapter and rotor. (Refer to 5 - BRAKES - BASE/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL)
(2) Remove rear rotor from rear hub.
(3) Remove dust cap from rear hub.
(4) Remove the cotter pin, nut retainer, wave washer and rear hub/bearing assembly retaining nut and washer from the rear spindle.
(5) Remove rear hub and bearing assembly from rear spindle.
(6) Remove rear brake shoe assembly hold down clip.
(7) Turn brake shoe adjuster wheel until adjuster is at shortest length.
(8) Remove adjuster assembly from the parking brake shoe assemblies.
(9) Remove lower shoe to shoe spring.
(10) Pull rear brake shoe assembly away from anchor, then remove rear brake shoe and upper spring.
(11) Remove front brake shoe hold-down clip, then remove front brake shoe assembly.

INSTALLATION - PARKING BRAKE SHOES

(1) Install front brake shoe and hold down clip.
(2) Install rear brake shoe and the upper brake shoe to shoe return spring.
(3) Pull rear brake shoe over anchor block until properly located on adapter.
(4) Install the lower shoe to shoe return spring.
(5) Install brake shoe adjuster assembly with star wheel rearward.
(6) Install rear brake shoe hold down clip.
(7) Adjust brake shoes to a diameter to 171 mm (6.75 inch).
(8) Install rear hub and bearing assembly on spindle.
(9) Install hub and bearing assembly washer and retaining nut. Torque the hub and bearing assembly retaining nut to 168 N·m (124 ft. lbs.).
(10) Install the wave washer, retaining nut and cotter pin.
(11) Install hub and bearing assembly dust cap.
(12) Install rear brake rotor.
(13) Install rear disc brake caliper on the adapter. (Refer to 5 - BRAKES - BASE/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION)
(14) Install wheel and tire assemblies. Tighten wheel mounting nuts to 135 N·m (100 ft.lbs.).

BRAKES - ANTILOCK BRAKE SYSTEM

TABLE OF CONTENTS

BRAKES - ANTILOCK BRAKE SYSTEM

DESCRIPTION

DESCRIPTION - ANTILOCK BRAKES

This section covers the physical and operational descriptions and the on-car service procedures for vehicles equipped with the Mark 20e Antilock Brake System and the Mark 20e Antilock Brake System with traction control.

The purpose of this four-channel design 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.

This system features ABS Plus and Electronic Variable Brake Proportioning (EVBP). (Refer to 5 - BRAKES - ABS - ABS PLUS - DESCRIPTION)(Refer to 5 - BRAKES - ABS - ELECTRONIC VARIABLE BRAKE PROPORTIONING - DESCRIPTION)

For information on traction control equipped vehicles, (Refer to 5 - BRAKES - ABS - TRACTION CONTROL - DESCRIPTION).

DESCRIPTION - ABS PLUS

There is an ABS Plus function built into the ABS CAB. ABS Plus is a brake-on stability enhancement. It is designed to help maintain the directional stability of the vehicle during braking. There are no additional external components required for this function.

DESCRIPTION - ELECTRONIC VARIABLE BRAKE PROPORTIONING

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

EVBP activation is invisible to the customer since there is no pump motor noise or brake pedal feedback.

DESCRIPTION - TRACTION CONTROL

Traction control reduces wheel slip and maintains traction at the driving wheels at speeds below 56 km/h (35 mph) when road surfaces are wet or snow covered. The traction control system reduces wheel slip by braking the wheel that is losing traction.

OPERATION

OPERATION - ANTILOCK BRAKES

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 5–8 km/h (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 and each wheel receives its own separate 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 front wheels are controlled independently and are on two separate control channels, and the rear wheels are controlled together for better vehicle stability.

The system can build and release pressure at each wheel, depending on signals generated by the wheel speed sensors (WSS) at each wheel and received at the controller antilock brake (CAB).

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 5–7 km/h (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 5 km/h (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 indicator lamp will also be on for up to 5 seconds after the ignition is turned on. These conditions occur as part of ABS self-diagnosis check. The popping sound is a result of brief activation of the solenoids in the integrated control unit.

DRIVE-OFF CYCLE

When the vehicle is first driven off, a humming may be heard or felt by the driver at approximately 25–40 km/h (15–25 mph). This is caused by brief activation of the ABS pump/motor and is a normal function of ABS as part of the self-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. Premature ABS cycling can occur at any braking rate of the vehicle and on any type of road surface. Neither the red BRAKE warning indicator lamp, nor the amber ABS warning indicator 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 DRBIII® 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.

OPERATION - ABS PLUS

When the brake pedal is depressed far enough to actuate the brake lamp switch, the CAB monitors and compares the speeds of the front (driving) wheels. It senses vehicle speed, brake application, and detects vehicle cornering and applies the brakes selectively to stabilize the vehicle.

OPERATION - ELECTRONIC VARIABLE BRAKE PROPORTIONING

Upon entry into EVBP the inlet valve for the rear brake circuit is switched on so that the fluid supply from the master cylinder is shut off. In order to decrease the rear brake pressure, the outlet valve for the rear brake circuit is pulsed. This allows fluid to enter the low pressure accumulator (LPA) in the hydraulic control unit (HCU) resulting in a drop in fluid pressure to the rear brakes. In order to increase the rear brake pressure, the outlet valve is switched off and the inlet valve is pulsed. This increases the pressure to the rear brakes. This back-and-forth process will continue until the required slip difference is obtained. At the end of EVBP 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 EVBP will remain functional during many ABS fault modes. If both the red BRAKE and amber ABS warning indicators are illuminated, the EVBP may not be functioning.

OPERATION - TRACTION CONTROL

The traction control system monitors wheel speed. During acceleration, if the CAB detects front (drive) wheel slip and the brakes are not applied, the system enters traction control mode. Traction control operation proceeds in the following order:

(1) Close the normally open isolator 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 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 hydraulic 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 CAB to switch off traction control.

TRACTION CONTROL FUNCTION LAMPS

The traction control function lamp illuminates during a traction control cycle, displaying TRAC ON.

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.

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.

In the event that a system fault occurs thus illuminating the amber ABS warning lamp, the TRAC OFF lamp will also illuminate.

CAUTION

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 DRBIII® 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: The CAB 24-way connector should never be connected or disconnected with the ignition switch in the ON position.

CAUTION: This vehicle utilizes active wheel speed sensors. Do not apply voltage to wheel speed sensors at any time.

CAUTION: Use only factory wiring harnesses. Do not cut or splice wiring to the brake circuits. The addition of aftermarket 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.

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: 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: 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: 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.

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

DIAGNOSIS AND TESTING - INSPECTION AND ROAD TEST

(1) Visually inspect the ABS for damaged or disconnected components and connectors.

(2) Verify the brake lamps are operational. If they are not, repair them prior to continuing.

(3) Connect the DRBIII® scan tool to the Data Link Connector located under the instrument panel to the left of the steering column (Fig. 1). If the DRBIII® does not power-up, check the power and ground supplies to the connector.

(4) Turn the ignition key to the ON position. Select ANTILOCK BRAKES.

(5) Read and record any Diagnostic Trouble Codes (DTCs). If any DTCs are present, refer to the appropriate chassis diagnostic information.

NOTE: Diagnostic trouble codes (DTCs) are kept in the controller's memory until either erased by the technician using the DRBIII®, or erased automatically after 3500 miles. DTCs 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 and the DTC that is stored are displayed.

If no problems are observed, it will be necessary to road test the vehicle.

Many ABS conditions judged to be a problem by the driver may be normal operating conditions. See Antilock Brake System - Operation to become familiarized with the normal characteristics of this antilock brake system.

BRAKES - ANTILOCK BRAKE SYSTEM (Continued)

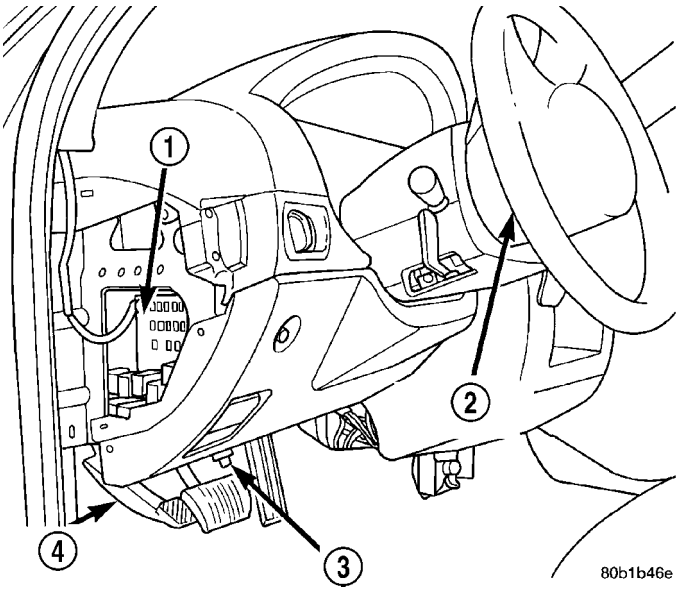


Fig. 1 Data Link Connector Location

1 - JUNCTION BLOCK
2 - STEERING WHEEL
3 - DATA LINK CONNECTOR
4 - PARKING BRAKE

WARNING: CONDITIONS THAT RESULT IN TURNING ON THE RED BRAKE WARNING INDICATOR LAMP MAY INDICATE REDUCED BRAKING ABILITY.

Before road testing a brake complaint vehicle, note whether the red BRAKE warning indicator lamp, amber ABS warning indicator lamp, or both are turned on.

If it is the red BRAKE warning indicator, there is a brake hydraulic problem that must be corrected before driving the vehicle. Refer to the Base Brake System - Diagnosis And Testing. If the MIC determines the amber ABS warning indicator is not functioning, it will illuminate the red BRAKE warning indicator.

If the amber ABS warning indicator is on, road test the vehicle as described below. While the amber ABS warning indicator is on, the ABS is not functional. The ability to stop the car using the base brake system should not be affected.

If both the red BRAKE and the amber ABS warning indicators are illuminated, there is possibility that there is an ABS problem. For some failures the ABS unit will discontinue ABS as well as EVBP and illuminate both the red BRAKE and the amber ABS warning indicators. **Braking ability may be reduced.** Before road testing, read DTC's and refer to the Appropriate Diagnostic Information. Also, the MIC will illuminate both the red BRAKE and the amber ABS warning indicators if the ABS CAB is not communicating on the BUS.

(6) 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.

(7) If the amber ABS warning indicator lamp stays on, shift into gear and drive the car to a speed of approximately 25 km/h (15 mph) to complete the ABS Start-Up and Drive-Off Cycles (see Antilock Brake System - Operation). If at this time the amber ABS warning indicator lamp stays on, refer to the Appropriate Diagnostic Information.

(8) If the amber ABS warning indicator lamp goes out at any time, drive the vehicle a short distance. Accelerate the vehicle to a speed of at least 64 km/h (40 mph). Bring the vehicle to a complete stop, braking hard enough to cause the ABS to cycle. Repeat this action several times. Using the DRBIII®, read and record any Diagnostic Trouble Codes (DTCs). If any DTCs are present, refer to the Appropriate Diagnostic Information.

STANDARD PROCEDURE - 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 need to 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.

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 DRBIII® scan tool to the Data Link Connector. The connector is located under the lower steering column cover to the left of the steering column.

(3) Using the DRBIII®, check to make sure the CAB does not have any fault codes stored. If it does, clear them using the DRBIII®.

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. (Refer to 5 - BRAKES - BASE - STANDARD PROCEDURE)

(5) Using the DRBIII®, 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.

SPECIFICATIONS

ABS FASTENER TORQUE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Brake Tubes	17	12	145
CAB To HCU Mounting Screws	2	—	17
ICU Mounting Screws	11	—	97
Wheel Speed Sensor Head Mounting Bolt	7	—	60

TONE WHEEL RUNOUT

DESCRIPTION	SPECIFICATION
Front Tone Wheel Maximum Runout	0.15 mm (0.006 in.)
Rear Tone Wheel Maximum Runout	0.15 mm (0.006 in.)

WHEEL SPEED SENSOR AIR GAP

DESCRIPTION	SPECIFICATION
Front Sensor	0.42 – 1.71 mm 0.017 – 0.067 in.
Rear Sensor	0.38 – 1.31 mm 0.015 – 0.052 in.

FRONT WHEEL SPEED SENSOR

DESCRIPTION

This system uses two-wire wheel speed sensors known as active wheel speed sensors. One wheel speed sensor (WSS) and one tone wheel is located at each front and rear wheel. Each front wheel speed sensor is attached to a boss in the steering knuckle (Fig. 2). The front tone wheel is part of the outboard constant velocity joint.

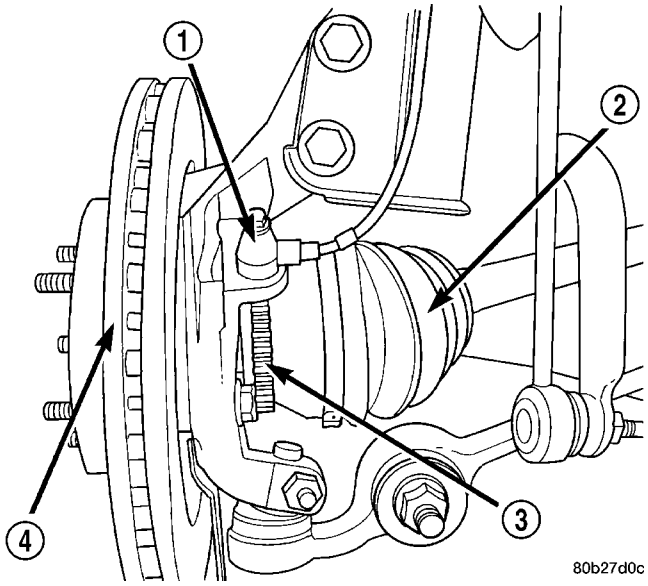


Fig. 2 Front Wheel Speed Sensor

1 - WHEEL SPEED SENSOR
2 - CV BOOT
3 - TONE WHEEL
4 - ROTOR

OPERATION

The CAB sends 12 volts to power an Integrated Circuit (IC) in the sensor. The IC supplies a constant 7 mA power supply to the CAB. The relationship of the tooth on the tone wheel to the permanent magnet in the sensor, signals the IC to enable a second 7 mA power supply. The output of the sensor, sent to the CAB, is a DC voltage signal with changing voltage and current levels. The ground for the IC and the current sense circuit is provided by the CAB.

When a valley of the tone wheel is aligned with the sensor, the voltage signal is approximately 0.8 volts and a constant 7 mA current is sent to the CAB. As the tone wheel rotates, the tooth shifts the magnetic field and the IC enables a second 7 mA current source. The CAB senses a voltage signal of approximately 1.6 volts and 14 mA. The CAB measures the amperage of the digital signal for each wheel. The resulting signal is interpreted by the ABS CAB as the wheel speed.

FRONT WHEEL SPEED SENSOR (Continued)

REMOVAL

(1) Raise vehicle. (Refer to LUBRICATION & MAINTENANCE/HOISTING - STANDARD PROCEDURE)

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

(3) Remove bolt securing the speed sensor cable routing bracket (Fig. 3) to the strut assembly.

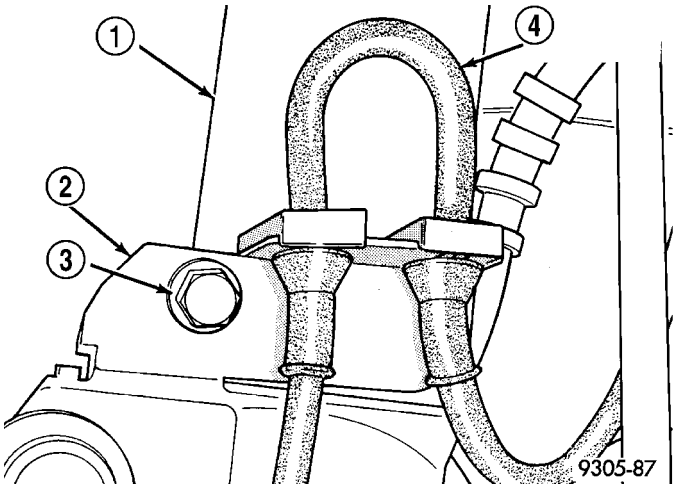


Fig. 3 Speed Sensor Cable Routing Bracket

1 - STRUT ASSEMBLY
2 - ROUTING BRACKET
3 - SCREW
4 - SPEED SENSOR CABLE

(4) Remove retainer, holding the speed sensor sealing grommet, from the inner fender. pull the grommet out, then unplug the speed sensor cable from the vehicle wiring harness

(5) Remove bolt attaching speed sensor to steering knuckle. Carefully remove speed sensor head from steering knuckle. If sensor is seized in place by corrosion, tap the edge of the sensor ear with a hammer and brass punch (Fig. 4), working it side to side.

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

INSTALLATION

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

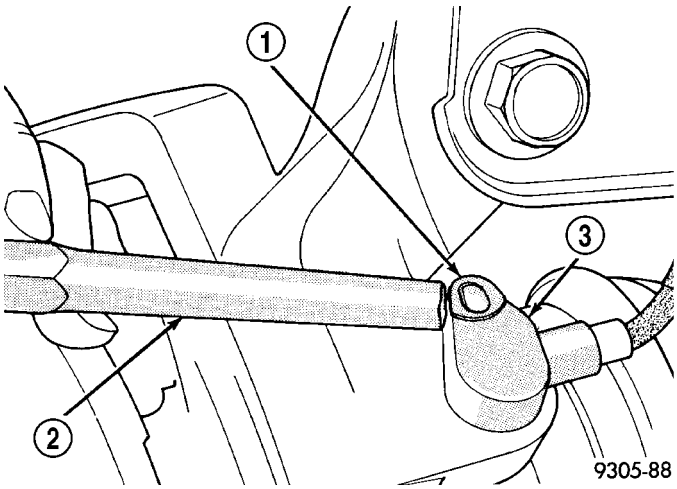


Fig. 4 Speed Sensor Head Removal

1 - SENSOR EAR
2 - PUNCH
3 - SPEED SENSOR HEAD

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

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

CAUTION: When installing the wheel speed sensor cable routing bracket on the strut, the speed sensor cable must be looped upward as shown (Fig. 3). If speed sensor cable is not routed in this direction it may rub, damaging the speed sensor cable.

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

(4) Apply a small amount of High Temperature Multipurpose grease to the sensor head before installation. Install speed sensor head on steering knuckle. Install the speed sensor head attaching screw and tighten to a torque of 7 N·m (60 in. lbs.).

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

(6) Lower the vehicle to the ground.

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

REAR WHEEL SPEED SENSOR

DESCRIPTION

This system uses two-wire wheel speed sensors known as active wheel speed sensors. One wheel speed sensor (WSS) and one tone wheel are located at each front and rear wheel. The rear wheel speed sensor on rear disc brake applications is mounted to the rear disc brake adapter (Fig. 5). The rear tone wheel is an integral part of the rear wheel hub and bearing.

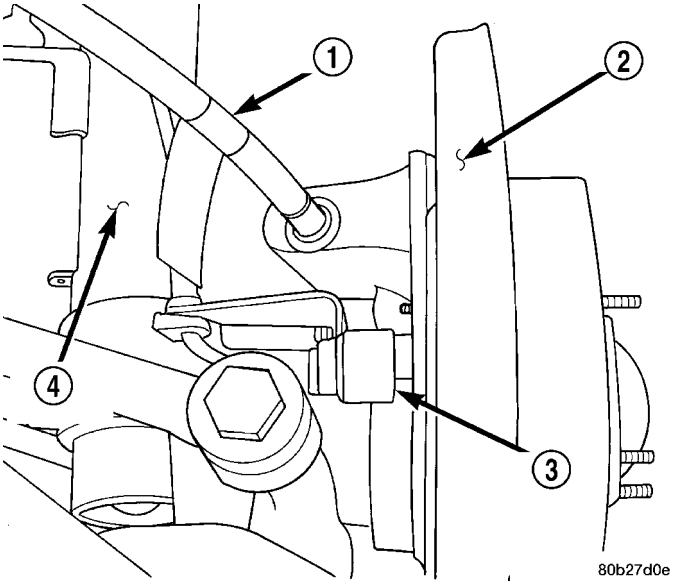


Fig. 5 Rear Wheel Speed Sensor

1 - PARKING BRAKE CABLE
2 - BACKING PLATE
3 - REAR WHEEL SPEED SENSOR
4 - REAR STRUT

OPERATION

The CAB sends 12 volts to power an Integrated Circuit (IC) in the sensor. The IC supplies a constant 7 mA power supply to the CAB. The relationship of the tooth on the tone wheel to the permanent magnet in the sensor, signals the IC to enable a second 7 mA power supply. The output of the sensor, sent to the CAB, is a DC voltage signal with changing voltage and current levels. The ground for the IC and the current sense circuit is provided by the CAB.

When a valley of the tone wheel is aligned with the sensor, the voltage signal is approximately 0.8 volts and a constant 7 mA current is sent to the CAB. As the tone wheel rotates, the tooth shifts the magnetic field and the IC enables a second 7 mA current source. The CAB senses a voltage signal of approximately 1.6 volts and 14 mA. The CAB measures the amperage of the digital signal for each wheel. The resulting signal is interpreted by the ABS CAB as the wheel speed.

REMOVAL

NOTE: When removing rear wheel speed sensor from vehicle, access to the wire harness connector is through the passenger compartment of the vehicle.

(1) Remove the rear seat cushion, and the rear seat back, from the interior of the car. Refer to Seats in the Body section of this manual for the required procedure to be used for this vehicle.

(2) Disconnect the wheel speed sensor cable from the wire harness.

(3) Raise vehicle. (Refer to LUBRICATION & MAINTENANCE/HOISTING - STANDARD PROCEDURE)

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

(5) Remove the grommet from the floor pan, along with the end of the cable that fastens to the wire harness.

(6) Remove the sensor cable from the routing bracket attached to the strut tower flange.

(7) Remove the wheel speed sensor head and routing bracket from the disc brake caliper adapter by removing the bolt, then the sensor (Fig. 6).

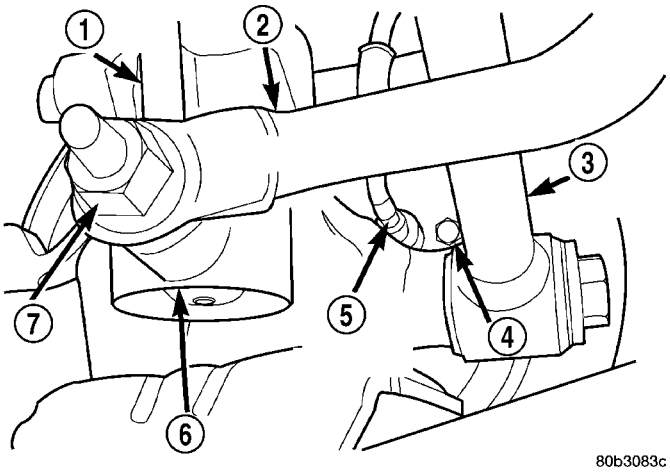


Fig. 6 Wheel Speed Sensor At Adapter

1 - STABILIZER BAR LINK
2 - STABILIZER BAR
3 - LATERAL LINK
4 - BOLT
5 - WHEEL SPEED SENSOR
6 - STRUT ASSEMBLY
7 - NUT

INSTALLATION

(1) Install rear wheel speed sensor and routing bracket into brake caliper adapter. Install head attaching bolt (Fig. 6) and tighten to 7 N·m (60 in. lbs.).

(2) Install the sensor cable to the routing bracket attached to the strut tower flange.

REAR WHEEL SPEED SENSOR (Continued)

(3) Guide the cable through the hole in the floor pan and install the grommet.

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

(5) Lower vehicle to the ground.

(6) Connect the sensor cable to the wiring harness.

(7) Reinstall the rear seat back and seat cushion.

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

TONE WHEEL

DESCRIPTION

The tone wheel is used in conjunction with the wheel speed sensors. (Refer to 5 - BRAKES - ABS/ELECTRICAL/FRONT WHEEL SPEED SENSOR - DESCRIPTION) or (Refer to 5 - BRAKES - ABS/ELECTRICAL/REAR WHEEL SPEED SENSOR - DESCRIPTION)

OPERATION

The tone wheel is used in conjunction with the wheel speed sensors. (Refer to 5 - BRAKES - ABS/ELECTRICAL/FRONT WHEEL SPEED SENSOR - OPERATION) or (Refer to 5 - BRAKES - ABS/ELECTRICAL/REAR WHEEL SPEED SENSOR - OPERATION)

INSPECTION

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 DIFFERENTIAL AND DRIVELINE 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 SUSPENSION 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.

Excessive wheel speed sensor runout can cause erratic wheel speed sensor signals. Refer to SPECIFICATIONS in this section 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.

TRACTION CONTROL SWITCH

REMOVAL

The traction control switch in located in the upper right trim bezel on the instrument panel. The upper right trim bezel must be removed to service the switch. Refer to Upper Right Trim Bezel Removal and Installation.

(1) With the bezel removed, press the tabs in at both sides of the switch and remove the switch from the bezel.

INSTALLATION

(1) Position the switch over the hole in the upper right bezel, push through hole and firmly snap into place.

(2) Install the upper right trim bezel. Refer to Body, Instrument Panel, Upper Right Trim Bezel, Installation.

HYDRAULIC/MECHANICAL

OPERATION - HYDRAULIC CIRCUITS AND VALVES

The hydraulic fluid control valves within the HCU 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.

HYDRAULIC/MECHANICAL (Continued)

NORMAL BRAKING HYDRAULIC CIRCUIT AND SOLENOID VALVE FUNCTION (ABS WITHOUT TRACTION CONTROL)

The hydraulic diagram (Fig. 7) shows the vehicle in the normal braking mode of the base brake hydraulic system. The diagram shows no wheel spin or slip occurring relative to the speed of the vehicle. The driver is applying the brake pedal which builds pressure in the brake hydraulic system to engage the brakes and stop the vehicle.

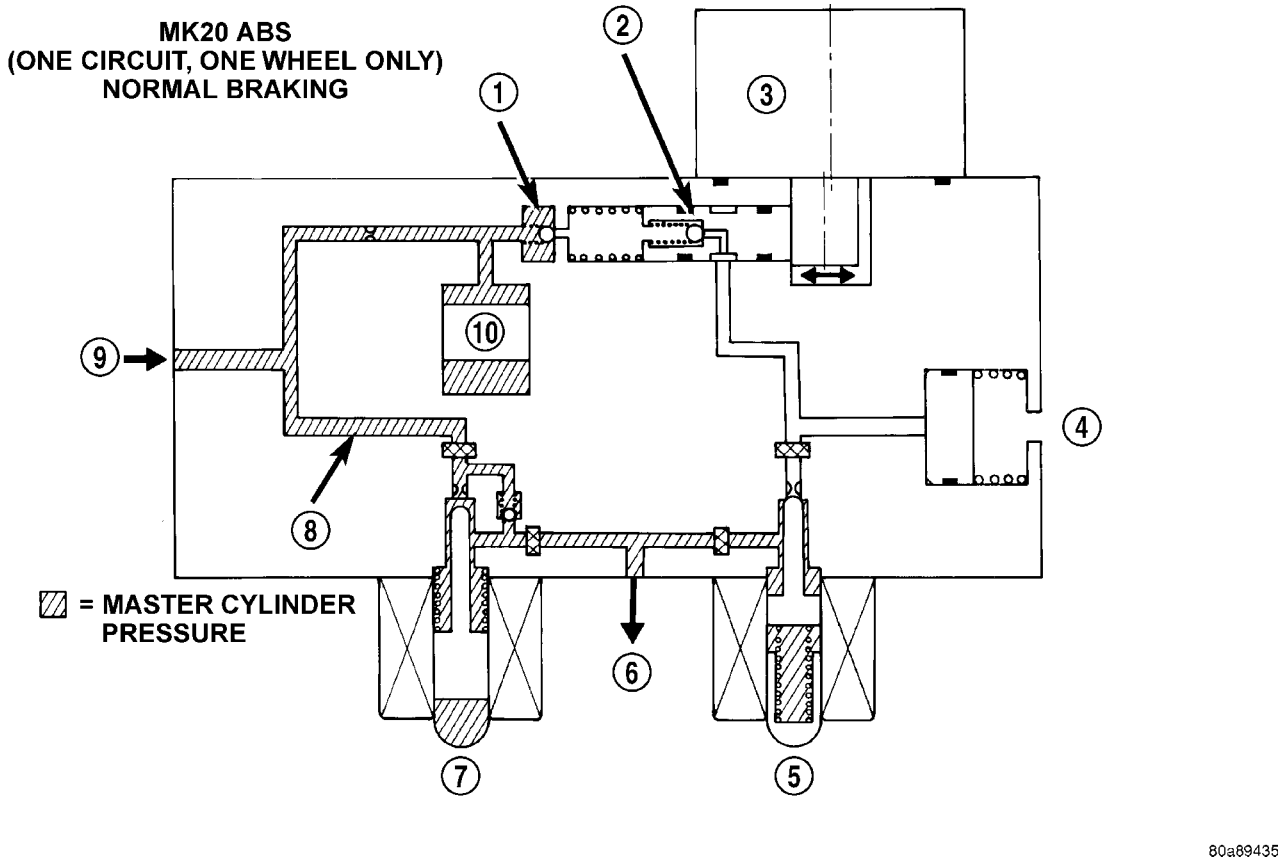


Fig. 7 Normal Braking Hydraulic Circuit (W/O Traction Control)

1 - OUTLET VALVE
2 - PUMP PISTON
3 - PUMP MOTOR (OFF)
4 - LOW PRESSURE ACCUMULATOR
5 - NORMALLY CLOSED VALVE (OFF)
6 - TO RIGHT FRONT WHEEL
7 - NORMALLY OPEN VALVE (OFF)
8 - MASTER CYLINDER PRESSURE
9 - FROM MASTER CYLINDER
10 - NOISE DAMPER CHAMBER

HYDRAULIC/MECHANICAL (Continued)

ABS HYDRAULIC CIRCUIT AND SOLENOID VALVE FUNCTION (ABS WITHOUT 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 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.

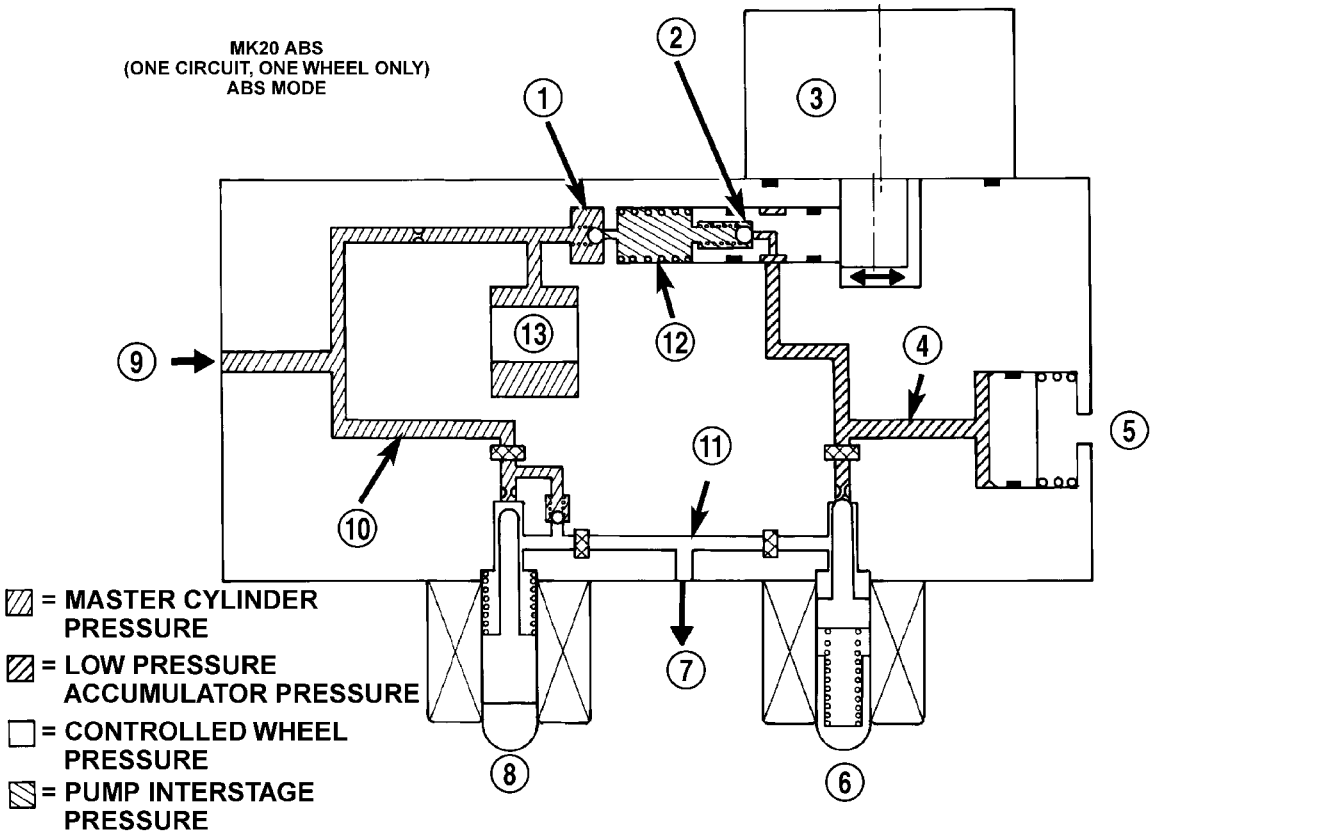


Fig. 8 ABS Mode Hydraulic Circuit (W/O Traction Control)

1 - OUTLET VALVE
2 - PUMP PISTON
3 - PUMP MOTOR (ON)
4 - LOW PRESSURE ACCUMULATOR PRESSURE
5 - LOW PRESSURE ACCUMULATOR
6 - NORMALLY CLOSED VALVE (MODULATING)
7 - TO RIGHT FRONT WHEEL
8 - NORMALLY OPEN VALVE (MODULATING)
9 - FROM MASTER CYLINDER
10 - MASTER CYLINDER PRESSURE
11 - CONTROLLED WHEEL PRESSURE
12 - PUMP INTERSTAGE PRESSURE
13 - NOISE DAMPER CHAMBER

HYDRAULIC/MECHANICAL (Continued)

NORMAL BRAKING HYDRAULIC CIRCUIT, SOLENOID VALVE, AND SHUTTLE VALVE FUNCTION (ABS WITH TRACTION CONTROL)

The hydraulic diagram (Fig. 9) 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 which 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.

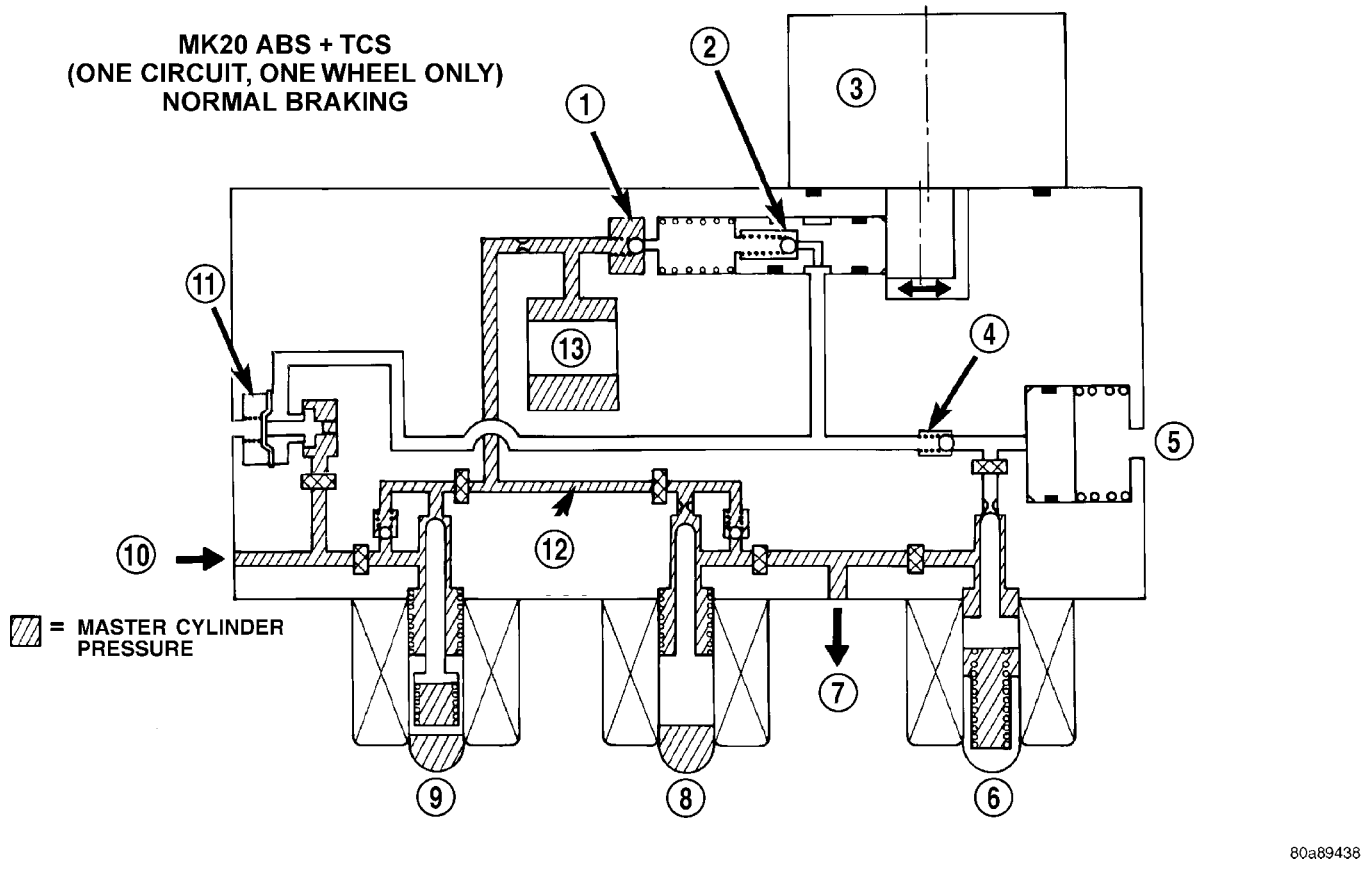


Fig. 9 ABS With Traction Control - Normal Braking Hydraulic Circuit

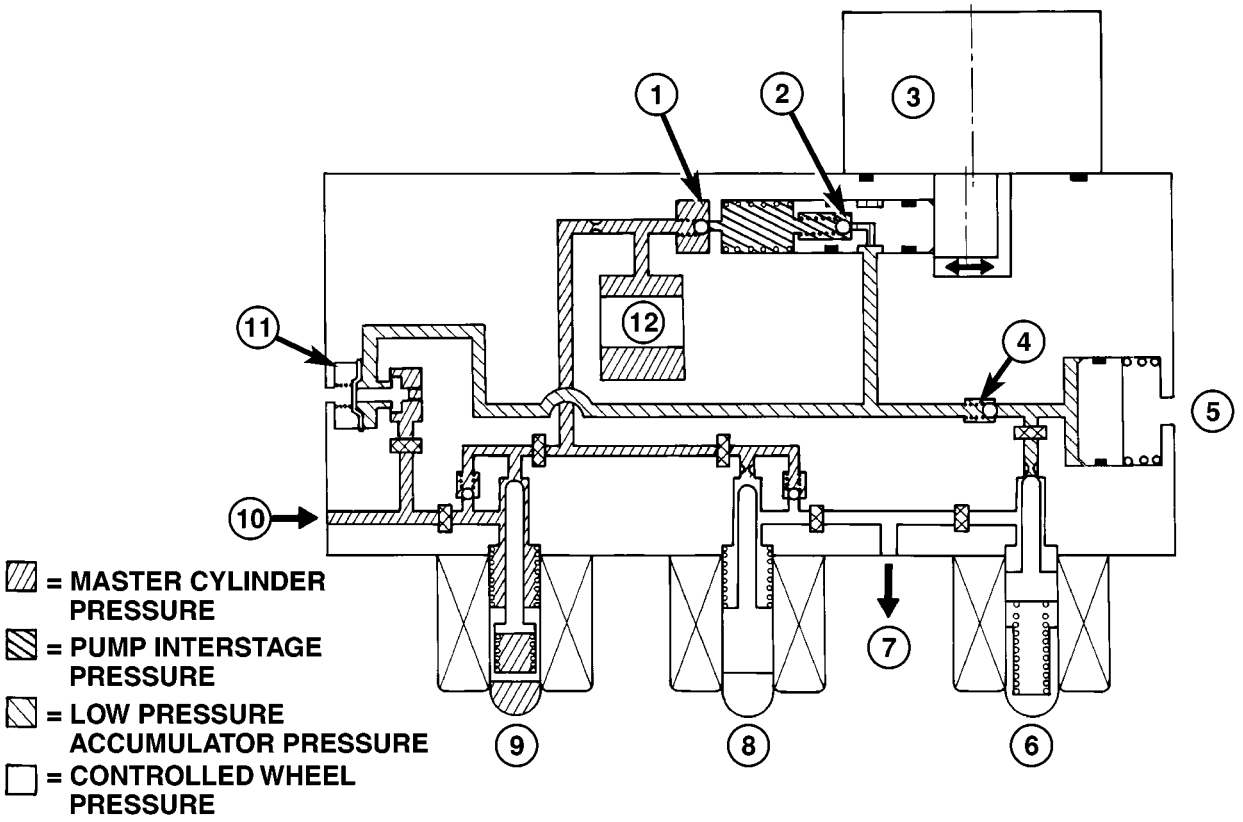
1 - OUTLET VALVE
2 - PUMP PISTON
3 - PUMP MOTOR (OFF)
4 - SUCTION VALVE
5 - LOW PRESSURE ACCUMULATOR
6 - NORMALLY CLOSED VALVE (OFF)
7 - TO RIGHT FRONT WHEEL
8 - NORMALLY OPEN VALVE (OFF)
9 - NORMALLY OPEN TC (ASR) VALVE (OFF)
10 - FROM MASTER CYLINDER
11 - HYDRAULIC SHUTTLE VALVE
12 - MASTER CYLINDER PRESSURE
13 - NOISE DAMPER CHAMBER

HYDRAULIC/MECHANICAL (Continued)

ABS BRAKING HYDRAULIC CIRCUIT, SOLENOID VALVE, AND SHUTTLE VALVE FUNCTION (ABS WITH TRACTION CONTROL)

The hydraulic diagram (Fig. 10) 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.



80d69d08

Fig. 10 ABS With Traction Control - ABS Braking Hydraulic Circuit

1 - OUTLET VALVE
2 - PUMP PISTON
3 - PUMP MOTOR
4 - SUCTION VALVE
5 - LOW PRESSRUE ACCUMULATOR
6 - NORMALLY CLOSED VALVE (MODULATING)
7 - TO RIGHT FRONT WHEEL
8 - NORMALLY OPEN VALVE (MODULATING)
9 - NORMALLY OPEN ASR VALVE (OFF)
10 - FROM MASTER CYLINDER
11 - HYDRAULIC SHUTTLE VALVE
12 - NOISE DAMPER CHAMBER

HYDRAULIC/MECHANICAL (Continued)

ABS TRACTION CONTROL HYDRAULIC CIRCUIT, SOLENOID VALVE, AND SHUTTLE VALVE FUNCTION (ABS WITH TRACTION CONTROL)

The hydraulic diagram (Fig. 11) 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.

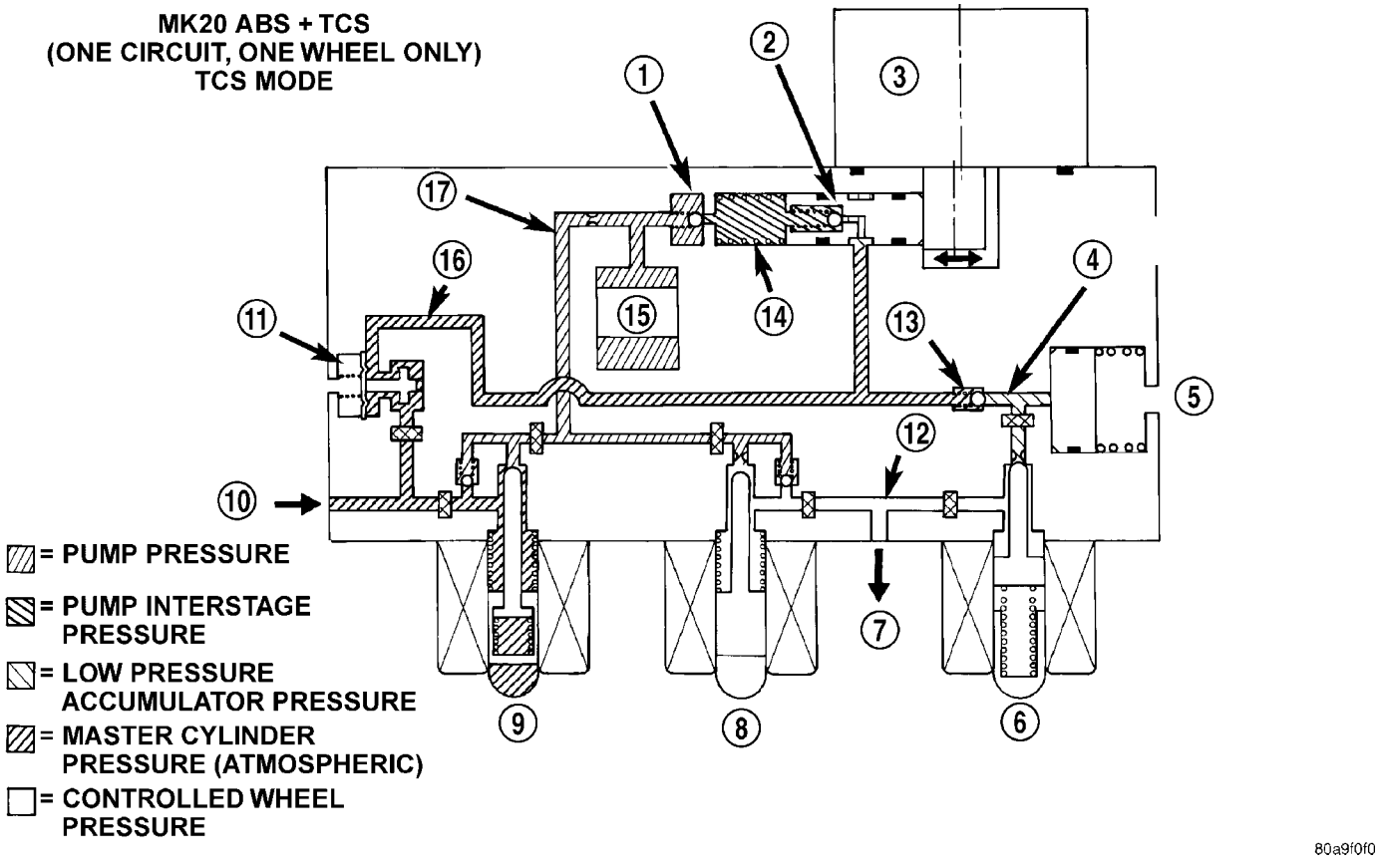


Fig. 11 Traction Control Hydraulic Circuit

1 - OUTLET VALVE
2 - PUMP PISTON
3 - PUMP MOTOR (ON)
4 - LOW PRESSURE ACCUMULATOR PRESSURE
5 - LOW PRESSURE ACCUMULATOR
6 - NORMALLY CLOSED VALVE (MODULATING)
7 - TO RIGHT FRONT WHEEL (SPINNING)
8 - NORMALLY OPEN VALVE (MODULATING)
9 - NORMALLY OPEN TC (ASR) VALVE ON (REGULATING)
10 - FROM MASTER CYLINDER
11 - HYDRAULIC SHUTTLE VALVE
12 - CONTROLLED WHEEL PRESSURE
13 - SUCTION VALVE
14 - PUMP INTERSTAGE PRESSURE
15 - NOISE DAMPER CHAMBER
16 - MASTER CYLINDER PRESSURE
17 - PUMP PRESSURE

HCU (HYDRAULIC CONTROL UNIT)

DESCRIPTION

The hydraulic control unit (HCU) is mounted to the CAB as part of the ICU (Fig. 12). The ICU is located in front of the driver's side front tire, behind the inner fender splash shield. 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.

The HCU on a vehicle equipped with traction control has a valve block that is approximately one inch longer than a HCU on a vehicle that is equipped with ABS only in order to incorporate the additional valves.

For more information, refer to the ICU. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ICU (INTEGRATED CONTROL UNIT) - DESCRIPTION)

OPERATION

The operation of the HCU's hydraulic circuits can be found in Hydraulic Circuits And Valve Operation. (Refer to 5 - BRAKES - ABS/HYDRAULIC/MECHANICAL - OPERATION)

The following topics explain how the different components within the HCU operate.

VALVES AND SOLENOIDS

The valve block contains four inlet valves and four outlet 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.

For information on the valves used with the traction control system, (Refer to 5 - BRAKES - ABS - TRACTION CONTROL - OPERATION).

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 5 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.

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. 12). 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, one piston draws fluid from the accumulators, and the opposing piston pumps fluid to the master cylinder circuits. When the antilock stop is complete, the pump/motor drains the accumulators.

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.

REMOVAL - HCU

To remove the HCU, the ICU must be removed from the vehicle and disassembled. (Refer to 5 - BRAKES - ABS/HYDRAULIC/MECHANICAL/ICU (INTEGRATED CONTROL UNIT) - REMOVAL)

INSTALLATION - HCU

To install the HCU, it must be attached to the CAB, forming the ICU. (Refer to 5 - BRAKES - ABS/HYDRAULIC/MECHANICAL/ICU (INTEGRATED CONTROL UNIT) - ASSEMBLY)

ICU (INTEGRATED CONTROL UNIT)

DESCRIPTION

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. 12). The ICU is located in front of the driver's side front tire (Fig. 13), behind the inner fender splash shield.

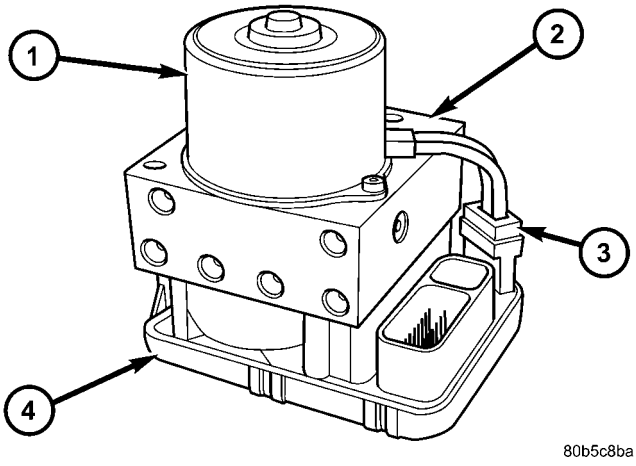


Fig. 12 Integrated Control Unit (ICU)

1 - PUMP/MOTOR
2 - HCU
3 - PUMP/MOTOR WIRING CONNECTOR
4 - CAB

Two different ICU's (HCU and CAB) are used on this vehicle depending on whether or not the vehicle is equipped with traction control. The HCU on a vehicle equipped with traction control has a valve block that is approximately one inch longer than a HCU on a vehicle that is equipped with ABS only.

The ABS-only ICU consists of the following components: the CAB, eight (build/decay) solenoid valves (four inlet valves and four outlet valves), valve block, fluid accumulators, a pump, and an electric motor.

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 traction control (ASR) valves, two hydraulic shuttle valves, valve block, fluid accumulators, a pump, and an electric motor.

The replaceable components of the ICU are the HCU and the CAB. No attempt should be made to service any individual components of the HCU or CAB.

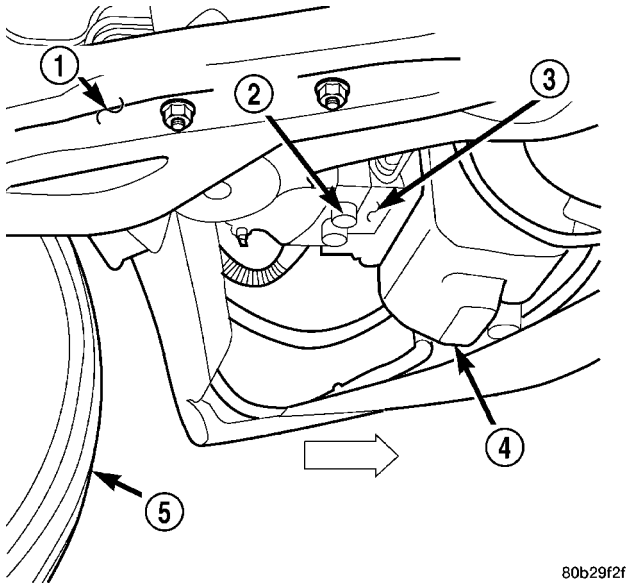


Fig. 13 Integrated Control Unit (HCU And CAB) Location

1 - ENGINE CRADLE
2 - HCU
3 - CONTROLLER ANTILOCK BRAKE (CAB)
4 - BOTTOM OF WINDSHIELD WASHER RESERVOIR
5 - LEFT FRONT TIRE

OPERATION

For information of the ICU, refer to these individual components of the ICU:

- CONTROLLER ANTILOCK BRAKE (CAB) (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/CONTROLLER ANTILOCK BRAKE - OPERATION)
- HYDRAULIC CONTROL UNIT (HCU) (Refer to 5 - BRAKES - ABS/HYDRAULIC/MECHANICAL/HCU (HYDRAULIC CONTROL UNIT) - OPERATION)

For information on the ICU's hydraulic circuits, refer to HYDRAULIC CIRCUITS AND VALVE OPERATION. (Refer to 5 - BRAKES - ABS/HYDRAULIC/MECHANICAL - OPERATION)

ICU (INTEGRATED CONTROL UNIT) (Continued)

REMOVAL - ICU

(1) Remove the remote ground cable from the ground stud on the right strut tower.

(2) Correctly isolate remote ground cable when servicing vehicle by installing the ground cable insulator on the strut tower ground stud as shown in (Fig. 14) and installing the nut on the stud. **This will prevent accidental grounding of the remote ground cable.**

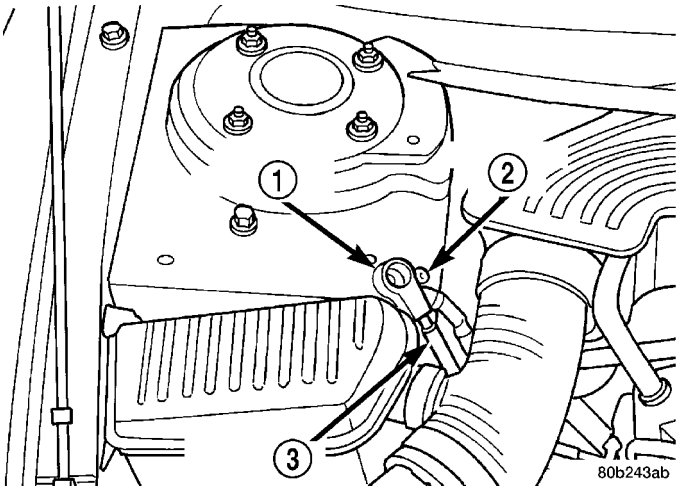


Fig. 14 Correctly Isolated Remote Ground Cable

1 - CABLE ISOLATOR
2 - GROUND STUD
3 - GROUND CABLE

(3) Using a brake pedal positioning tool such as shown in (Fig. 15) depress brake pedal past its first 1 inch of travel and hold in this position. This will isolate the master cylinder reservoir from the brake hydraulic system, not allowing the brake fluid to drain out of the reservoir.

(4) Remove the bolt and 2 nuts securing the speed control servo to vehicle. Disconnect the wire harness connector from speed control servo. Leaving the cable attached to the speed control servo, move it aside, out of the way.

(5) Remove the screw attaching the washer bottle filler neck to the vehicle. Move neck to the side without loosening the filler tube (Fig. 16).

(6) Remove the nut and bolt holding the transmission controller and bracket to vehicle (Fig. 16). Lift transmission controller up and move away from mounting position.

(7) Using Mopar® Brake Parts Cleaner or an equivalent, thoroughly clean all surfaces of the HCU. Also, thoroughly clean all brake tube to HCU connections.

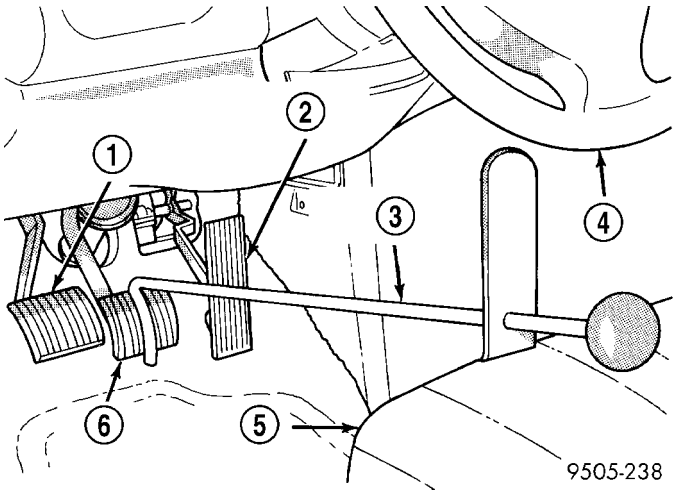


Fig. 15 Brake Pedal Holding Tool Installed

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

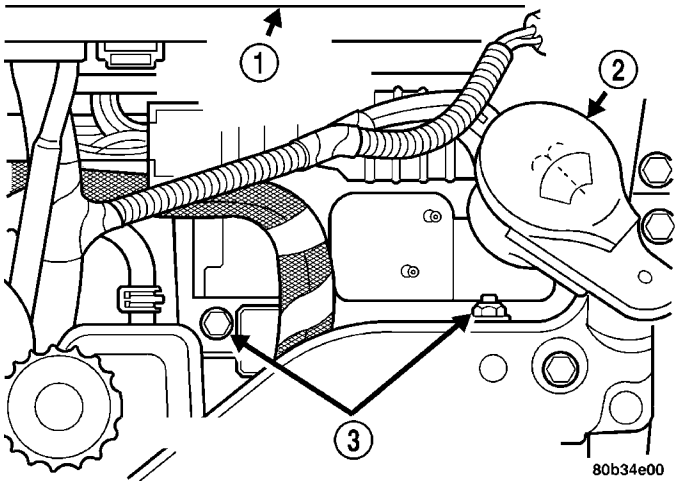


Fig. 16 Transmission Controller Mounting

1 - POWER DISTRIBUTION CENTER
2 - WASHER BOTTLE NECK
3 - TRANSMISSION CONTROLLER MOUNTING BOLT AND NUT

ICU (INTEGRATED CONTROL UNIT) (Continued)

(8) Remove the primary and secondary brake tubes coming from the master cylinder, at the HCU, using a crow foot wrench (Fig. 17).

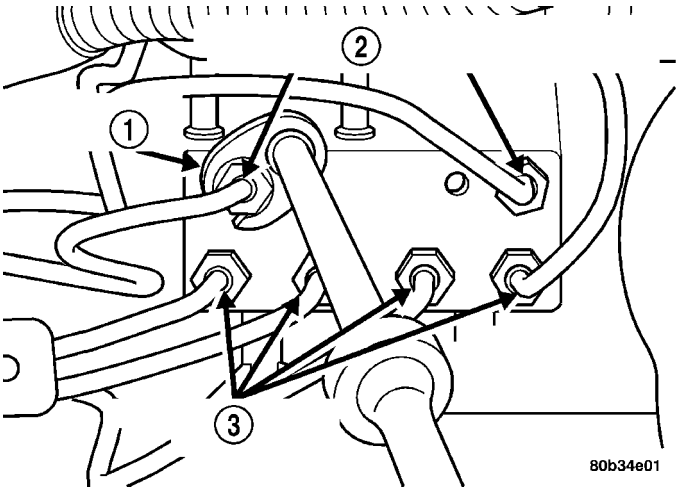


Fig. 17 Brake Tube Fittings

1 - CROW FOOT WRENCH
2 - PRIMARY AND SECONDARY BRAKE TUBES FROM MASTER CYLINDER
3 - CHASSIS BRAKE TUBES

(9) Remove the chassis brake tubes at the HCU (Fig. 17), using a crow foot wrench.

CAUTION: Do not apply a 12-volt power source to any terminals of the 24-way HCU connector when disconnected from the CAB.

(10) Disconnect the 24-way wiring harness connector from the CAB using the following procedure. Grasp the lock on the 24-way connector (Fig. 18), and pull it up from the connector as far as possible. This will unlock and raise the 24-way connector out of the socket on the CAB.

(11) Raise vehicle. (Refer to LUBRICATION & MAINTENANCE/HOISTING - STANDARD PROCEDURE)

(12) Remove the left front tire and wheel assembly.

(13) Remove fasteners securing the inner fender splash shield in place. Move the splash shield out of the way.

(14) Remove the 3 bolts attaching the ICU to the mounting bracket.

(15) Remove the ICU from its mounting bracket. Then, remove the ICU from the vehicle by pulling it out around the left side of the mounting bracket, then through the wheel well.

NOTE: To separate the CAB from the HCU, (Refer to 5 - BRAKES - ABS/HYDRAULIC/MECHANICAL/ICU (INTEGRATED CONTROL UNIT) - DISASSEMBLY)

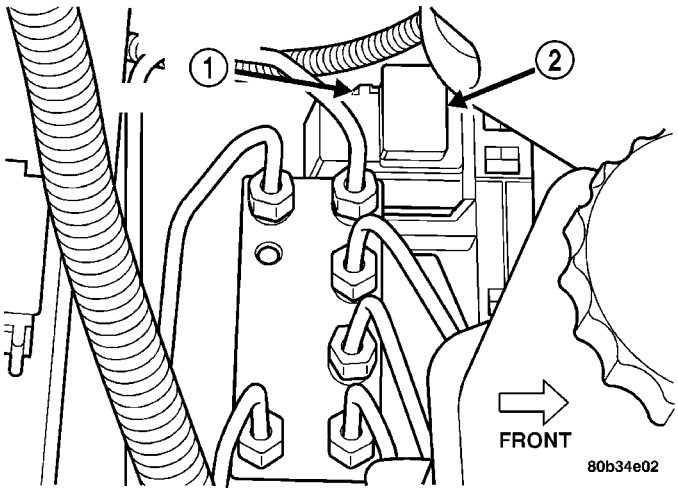


Fig. 18 24-way CAB Connector Lock

1 - 24–WAY CAB CONNECTOR
2 - CONNECTOR LOCK

DISASSEMBLY - ICU

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 to REMOVAL.

(2) Disconnect the pump/motor wiring harness from the CAB (Fig. 19).

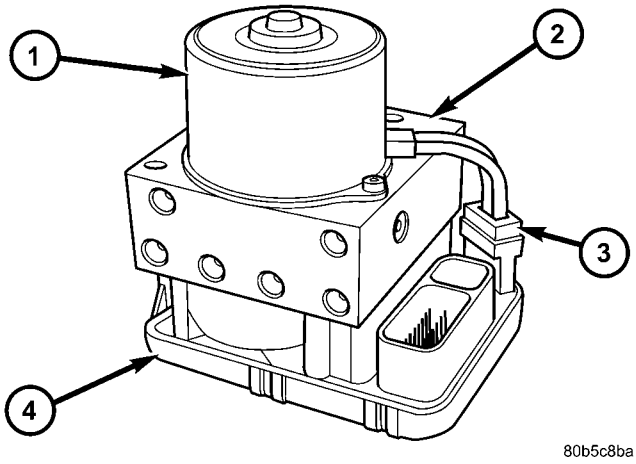


Fig. 19 Integrated Control Unit (ICU)

1 - PUMP/MOTOR
2 - HCU
3 - PUMP/MOTOR WIRING CONNECTOR
4 - CAB

ICU (INTEGRATED CONTROL UNIT) (Continued)

(3) Remove the 4 bolts (Fig. 20) attaching the CAB to the HCU.

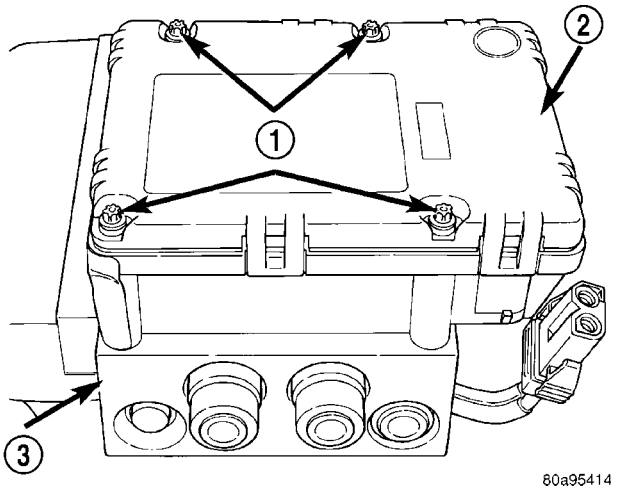


Fig. 20 CAB Attaching Bolts

1 - MOUNTING BOLTS
2 - CAB
3 - HCU VALVE BLOCK

(4) Remove the CAB from the HCU (Fig. 21).

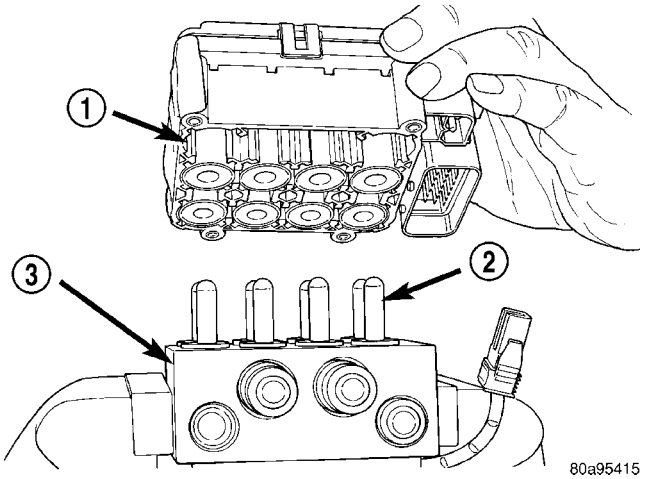


Fig. 21 Remove/Install CAB

1 - CAB
2 - HCU VALVES
3 - HCU VALVE BLOCK

ASSEMBLY - ICU

(1) Install the CAB (Fig. 21) on the HCU.

(2) Install the 4 bolts mounting the CAB (Fig. 20) 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. 19).

(4) Install the ICU in the vehicle. (Refer to 5 - BRAKES - ABS/HYDRAULIC/MECHANICAL/ICU (INTEGRATED CONTROL UNIT) - INSTALLATION)

INSTALLATION - ICU

(1) Install the ICU back in the vehicle and attach it to its mounting bracket. Tighten the 3 ICU mounting bolts to 11 N·m (97 in. lbs.).

(2) Reinstall the inner fender splash shield.

(3) Reinstall the tire and wheel assembly. (Refer to 22 - TIRES/WHEELS - INSTALLATION)

(4) Lower the vehicle.

CAUTION: Before installing the 24-way connector in the CAB be sure that the seal is properly installed in the connector.

(5) Install the 24-way connector into the socket on the CAB. The connector is installed using the following procedure. Position the 24-way connector in the socket on the CAB and carefully push it onto CAB as far as it will go. When connector is fully seated into the CAB socket push in the connector lock (Fig. 18) as far as it will go. This will pull the 24-way connector into the socket on the CAB and lock it in the installed position.

(6) Install the 4 chassis brake tubes on the HCU (Fig. 17). Tighten the chassis brake tubes to 17 N·m (145 in. lbs.).

(7) Install the primary and secondary brake lines from the master cylinder on the HCU (Fig. 17). Tighten the primary and secondary brake tubes to 17 N·m (145 in. lbs.).

(8) Reinstall the transmission controller (Fig. 16).

(9) Reattach the washer bottle filler neck to the radiator support.

(10) Reinstall the speed control servo to its mounting studs and radiator support.

(11) Remove brake pedal positioning tool.

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

NOTE: The ICU may need to be initialized using the DRBIII® scan tool after installation.

(13) Bleed the base brakes and the ABS brakes hydraulic system. (Refer to 5 - BRAKES - STANDARD PROCEDURE)

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