BRAKES

BASIC OPERATING PRINCIPLES

Hydraulic systems are used to actuate the brakes of all modern automobiles. The system transports the power required to force the frictional surfaces of the braking system together from the pedal to the individual brake units at each wheel. A hydraulic system is used for two reasons.

First, fluid under pressure can be carried to all parts of an automobile by small pipes and flexible hoses without taking up a significant amount of room or posing routing problems.

Second, a great mechanical advantage can be given to the brake pedal end of the system, and the foot pressure required to actuate the brakes can be reduced by making the surface area of the master cylinder pistons smaller than that of any of the pistons in the wheel cylinders or calipers.

The master cylinder consists of a fluid reservoir along with a double cylinder and piston assembly. Double type master cylinders are designed to separate the front and rear braking systems hydraulically in case of a leak. The master cylinder coverts mechanical motion from the pedal into hydraulic pressure within the lines. This pressure is translated back into mechanical motion at the wheels by either the wheel cylinder (drum brakes) or the caliper (disc brakes).

Steel lines carry the brake fluid to a point on the vehicle's frame near each of the vehicle's wheels. The fluid is then carried to the calipers and wheel cylinders by flexible tubes in order to allow for suspension and steering movements.

In drum brake systems, each wheel cylinder contains two pistons, one at either end, which push outward in opposite directions and force the brake shoe into contact with the drum.

In disc brake systems, the cylinders are part of the calipers. At least one cylinder in each caliper is used to force the brake pads against the disc.

All pistons employ some type of seal, usually made of rubber, to minimize fluid leakage. A rubber dust boot seals the outer end of the cylinder against dust and dirt. The boot fits around the outer end of the piston on disc brake calipers, and around the brake actuating rod on wheel cylinders.

The hydraulic system operates as follows: When at rest, the entire system, from the piston(s) in the master cylinder to those in the wheel cylinders or calipers, is full of brake fluid. Upon application of the brake pedal, fluid trapped in front of the master cylinder piston(s) is forced through the lines to the wheel cylinders. Here, it forces the pistons outward, in the case of drum brakes, and inward toward the disc, in the case of disc brakes. The motion of the pistons is opposed by return springs mounted outside the cylinders in drum brakes, and by spring seals, in disc brakes.

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Upon release of the brake pedal, a spring located inside the master cylinder immediately returns the master cylinder pistons to the normal position. The pistons contain check valves and the master cylinder has compensating ports drilled in it. These are uncovered as the pistons reach their normal position. The piston check valves allow fluid to flow toward the wheel cylinders or calipers as the pistons withdraw. Then, as the return springs force the brake pads or shoes into the released position, the excess fluid reservoir through the compensating ports. It is during the time the pedal is in the released position that any fluid that has leaked out of the system will be replaced through the compensating ports.

Dual circuit master cylinders employ two pistons, located one behind the other, in the same cylinder. The primary piston is actuated directly by mechanical linkage from the brake pedal through the power booster. The secondary piston is actuated by fluid trapped between the two pistons. If a leak develops in front of the secondary piston, it moves forward until it bottoms against the front of the master cylinder, and the fluid trapped between the pistons will operate the rear brakes. If the rear brakes develop a leak, the primary piston will move forward until direct contact with the secondary piston takes place, and it will force the secondary piston to actuate the front brakes. In either case, the brake pedal moves farther when the brakes are applied, and less braking power is available.

All dual circuit systems use a switch to warn the driver when only half of the brake system is operational. This switch is usually located in a valve body which is mounted on the firewall or the frame below the master cylinder. A hydraulic piston receives pressure from both circuits, each circuit's pressure being applied to one end of the piston. When the pressures are in balance, the piston remains stationary. When one circuit has a leak, however, the greater pressure in that circuit during application of the brakes will push the piston to one side, closing the switch and activating the brake warning light.

In disc brake systems, this valve body also contains a metering valve and, in some cases, a proportioning valve. The metering valve keeps pressure from traveling to the disc brakes on the front wheels until the brake shoes on the rear wheels have contacted the drums, ensuring that the front brakes will never be used alone. The proportioning valve controls the pressure to the rear brakes to lessen the chance of rear wheel lock-up during very hard braking.

Warning lights may be tested by depressing the brake pedal and holding it while opening one of the wheel cylinder bleeder screws. If this does not cause the light to go on, substitute a new lamp, make continuity checks, and, finally, replace the switch as necessary.

The hydraulic system may be checked for leaks by applying pressure to the pedal gradually and steadily. If the pedal sinks very slowly to the floor, the system has a leak. This is not to be confused with a springy or spongy feel due to the compression of air within the lines. If the system leaks, there will be a gradual change in the position of the pedal with a constant pressure.

Check for leaks along all lines and at wheel cylinders. If no external leaks are apparent, the problem is inside the master cylinder.

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DISC BRAKES

Instead of the traditional expanding brakes that press outward against a circular drum, disc brake systems utilize a disc (rotor) with brake pads positioned on either side of it. An easily-seen analogy is the hand brake arrangement on a bicycle. The pads squeeze onto the rim of the bike wheel, slowing its motion. Automobile disc brakes use the identical principle but apply the braking effort to a separate disc instead of the wheel.

The disc (rotor) is a casting, usually equipped with cooling fins between the two braking surfaces. This enables air to circulate between the braking surfaces making them less sensitive to heat buildup and more resistant to fade. Dirt and water do not drastically affect braking action since contaminants are thrown off by the centrifugal action of the rotor or scraped off the by the pads. Also, the equal clamping action of the two brake pads tends to ensure uniform, straight line stops. Disc brakes are inherently self-adjusting. There are three general types of disc brake:

1. A fixed caliper.
2. A floating caliper.
3. A sliding caliper.

The fixed caliper design uses two pistons mounted on either side of the rotor (in each side of the caliper). The caliper is mounted rigidly and does not move.

The sliding and floating designs are quite similar. In fact, these two types are often lumped together. In both designs, the pad on the inside of the rotor is moved into contact with the rotor by hydraulic force. The caliper, which is not held in a fixed position, moves slightly, bringing the outside pad into contact with the rotor. There are various methods of attaching floating calipers. Some pivot at the bottom or top, and some slide on mounting bolts. In any event, the end result is the same.

DRUM BRAKES

Drum brakes employ two brake shoes mounted on a stationary backing plate. These shoes are positioned inside a circular drum which rotates with the wheel assembly. The shoes are held in place by springs. This allows them to slide toward the drums (when they are applied) while keeping the linings and drums in alignment. The shoes are actuated by a wheel cylinder which is mounted at the top of the backing plate. When the brakes are applied, hydraulic pressure forces the wheel cylinder's actuating links outward. Since these links bear directly against the top of the brake shoes, the tops of the shoes are then forced against the inner side of the drum. This action forces the bottoms of the two shoes to contact the brake drum by rotating the entire assembly slightly (known as servo action). When pressure within the wheel cylinder is relaxed, return springs pull the shoes back away from the drum.

Most modern drum brakes are designed to self-adjust themselves during application when the vehicle is moving in reverse. This motion causes both

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shoes to rotate very slightly with the drum, rocking an adjusting lever, thereby causing rotation of the adjusting screw. Some drum brake systems are designed to self-adjust during application whenever the brakes are applied. This on-board adjustment system reduces the need for maintenance adjustments and keeps both the brake function and pedal feel satisfactory.

POWER BOOSTERS

Virtually all modern vehicles use a vacuum assisted power brake system to multiply the braking force and reduce pedal effort. Since vacuum is always available when the engine is operating, the system is simple and efficient. A vacuum diaphragm is located on the front of the master cylinder and assists the driver in applying the brakes, reducing both the effort and travel he must put into moving the brake pedal.

The vacuum diaphragm housing is normally connected to the intake manifold by a vacuum hose. A check valve is placed at the point where the hose enters the diaphragm housing, so that during periods of low manifold vacuum brakes assist will not be lost.

Depressing the brake pedal closes off the vacuum source and allows atmospheric pressure to enter on one side of the diaphragm. This causes the master cylinder pistons to move and apply the brakes. When the brake pedal is released, vacuum is applied to both sides of the diaphragm and springs return the diaphragm and master cylinder pistons to the released position.

If the vacuum supply fails, the brake pedal rod will contact the end of the master cylinder actuator rod and the system will apply the brakes without any power assistance. The driver will notice that much higher pedal effort is needed to stop the car and that the pedal feels harder than usual.

VACUUM LEAK TEST

1. Operate the engine at idle without touching the brake pedal for at least one minute.
2. Turn off the engine and wait one minute.
3. Test for the presence of assist vacuum by depressing the brake pedal and releasing it several times. If vacuum is present in the system, light application will produce less and less pedal travel. If there is no vacuum, air is leaking into the system.

SYSTEM OPERATION TEST

1. With the engine *OFF*, pump the brake pedal until the supply vacuum is entirely gone.
2. Put light, steady pressure on the brake pedal.
3. Start the engine and let it idle. If the system is operating correctly, the brake pedal should fall toward the floor if the constant pressure is maintained.

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Power brake systems may be tested for hydraulic leaks just as ordinary systems are tested.

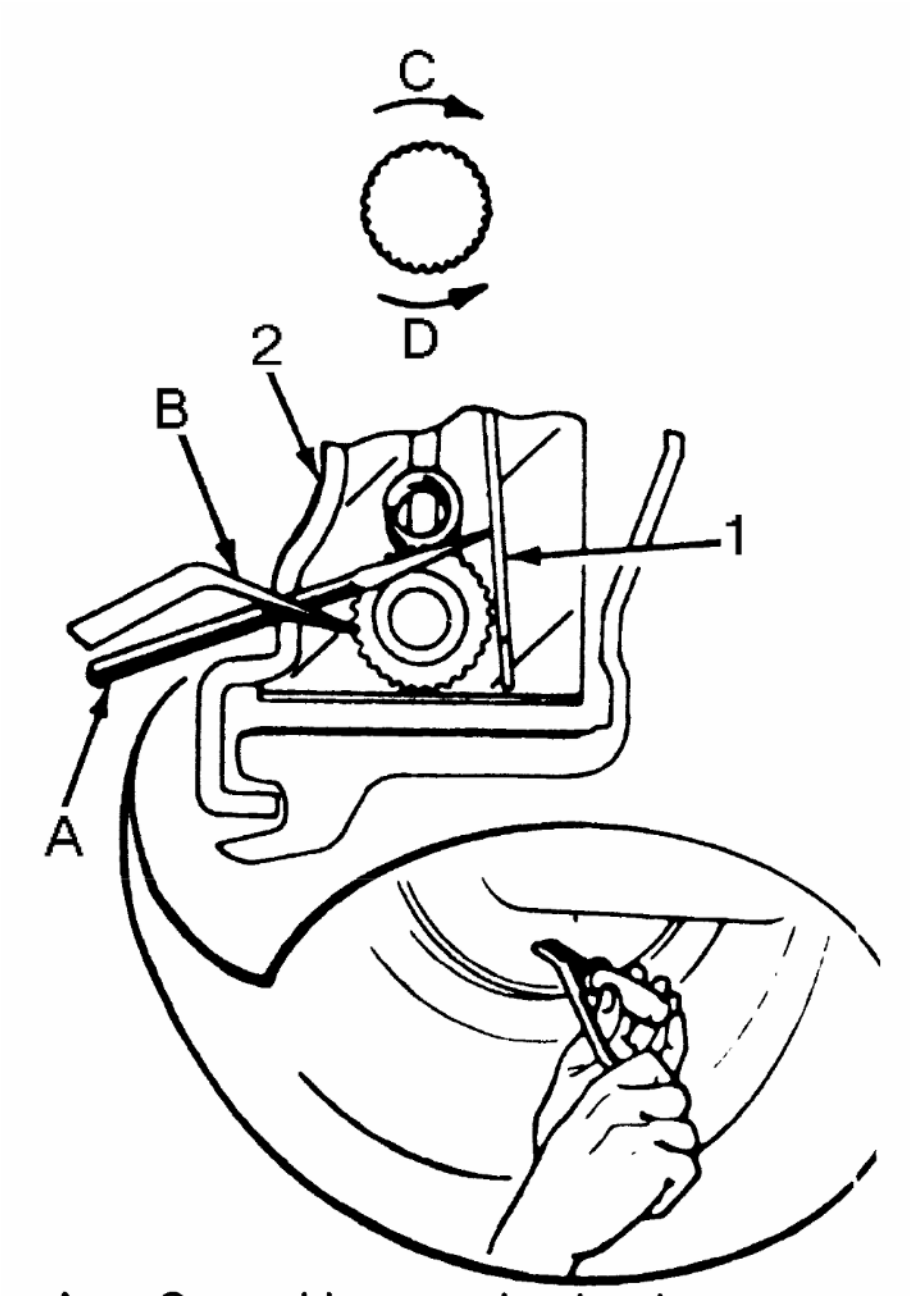
BRAKE SYSTEMS

ADJUSTMENT

DISC BRAKES

Disc brakes are self-adjusting. No adjustment is possible or necessary. Check fluid level of reservoir, for as brake pads wear, the piston moves out and the piston void must be replaced with brake fluid.

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A. Screwdriver used only when backing off adjuster
B. Brake adjusting tool
C. Star wheel rotation to retract brake shoes
D. Star wheel rotation to expand brake shoes
1. Actuator lever
2. Backing plate

Fig. 1: Cutaway view of a rear drum brake adjuster

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Fig. 2: Adjusting the rear drum brakes

The drum brakes are designed to self-adjust when applied with the car moving in reverse. However, they can also be adjusted manually. This manual adjustment should also be performed whenever the linings are replaced.

1. Use a punch to knock out the lanced area in the brake backing plate. If this is done with the drum installed on the car, the drum must then be removed to clean out all metal pieces. After adjustments are complete, obtain a hole cover to prevent entry of dirt and water into the brakes.

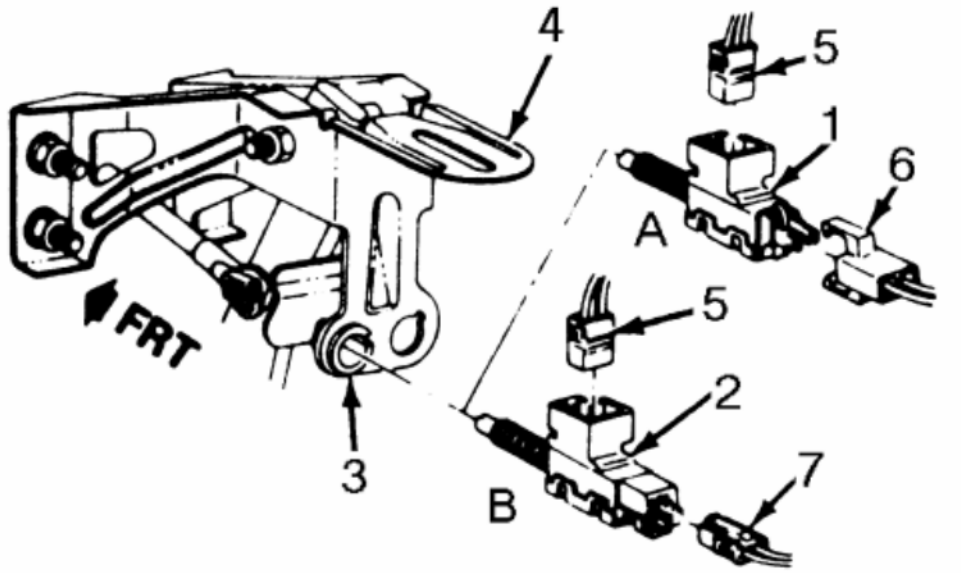
On many vehicles the metal plate may have already been removed and replaced with a rubber plug

2. Use an adjusting tool especially made for the purpose to turn the brake adjusting screw star wheel. Use a small screwdriver to push the adjusting lever away from star wheel when adjusting brakes. Expand the shoes until the drum can just be turned by hand. The drag should be equal at all the wheel.
3. Back off the adjusting screw 12 notches. If the shoes still are dragging lightly, back off the adjusting screw one or two additional notches. If the brakes still drag, the parking brake adjustment is incorrect or the parking brake is applied. Fix and start over.
4. Install the hole cover into the drum.
5. Check the parking brake adjustment.

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BRAKE LIGHT SWITCH

REMOVAL & INSTALLATION



A. Without cruise control
B. With cruise control
1. Switch
2. Switch
3. Retainer
4. Brake pedal bracket
5. Stoplamp connector
6. Transmission converter clutch connector
7. Cruise control connector

Fig. 1: Brake light switch

1. Disconnect the wiring harness from the brake light switch.
2. Remove the switch.

To install:

3. Depress the braked pedal, insert the switch into the tubular clip until the switch body seats on the clip. Clicks should be heard as the threaded portion of the switch is pushed through the clip toward the brake pedal.
4. Pull the brake pedal fully rearward (towards the driver) against the pedal stop, until the click sounds can no longer be heard. The switch will be moved in the tubular clip providing adjustment.
5. Release the brake pedal, and then repeat Step 4, to assure that no click sound remains.
6. Connect the wiring harness to the brake light switch.

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MASTER CYLINDER

REMOVAL & INSTALLATION

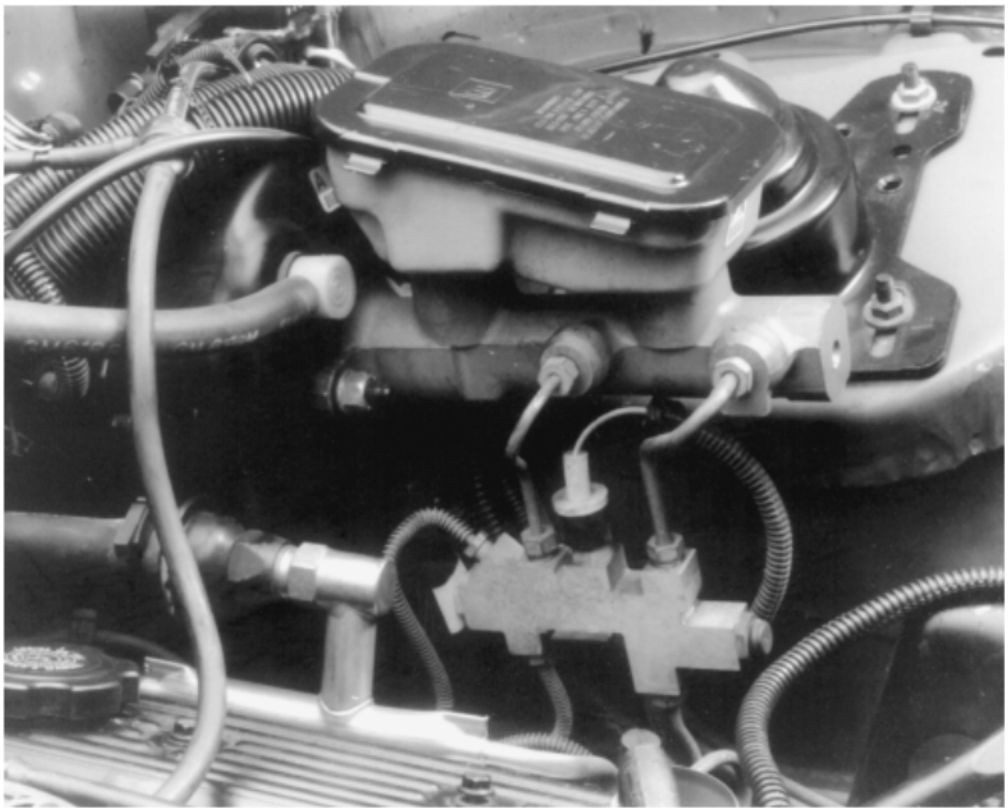


Fig. 1: Master cylinder

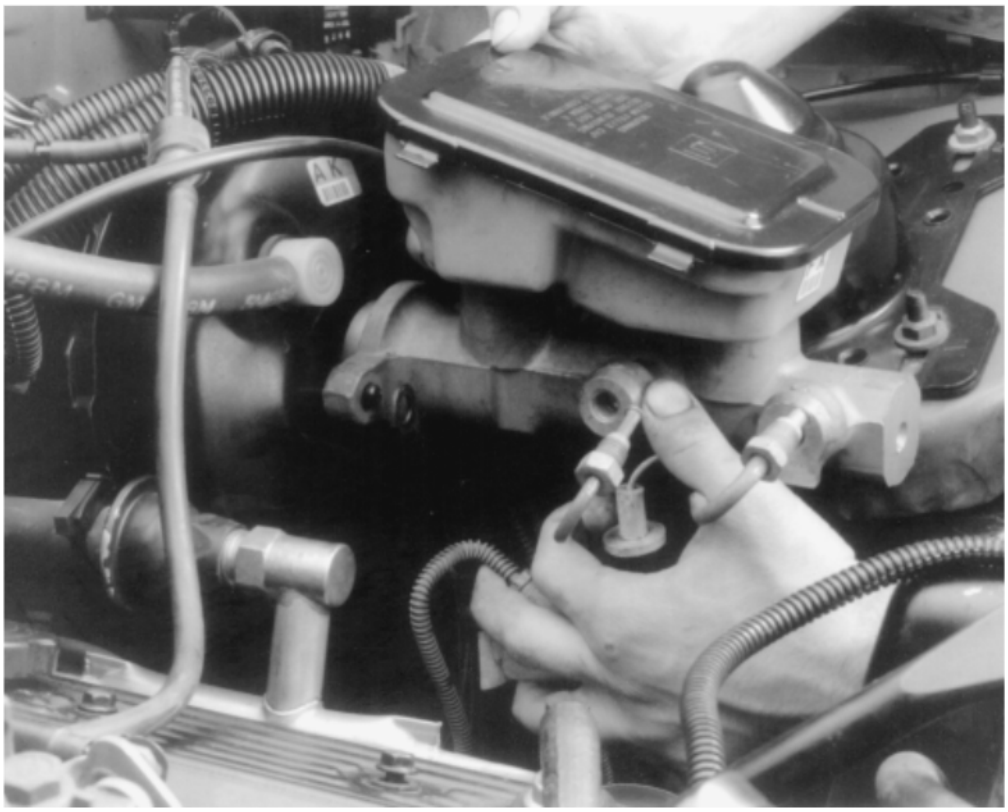


Fig. 2: Brake pipe removal

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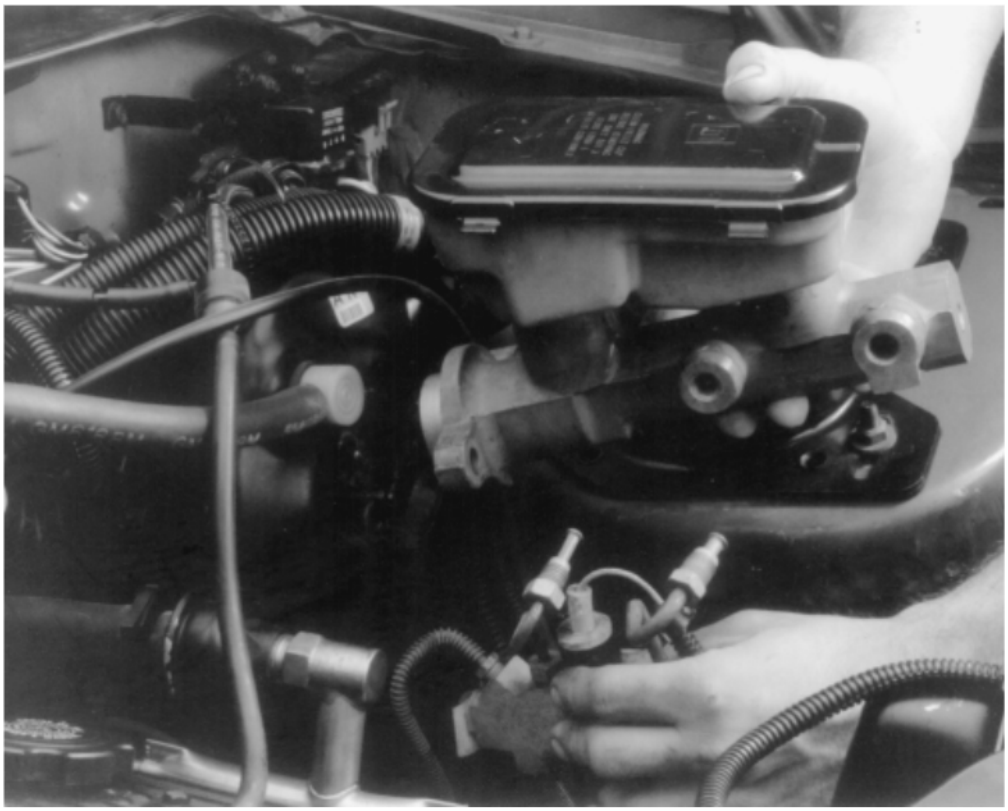


Fig. 3: Master cylinder removal

1. Disconnect hydraulic lines at master cylinder.
2. Remove the retaining nuts and lockwashers that hold cylinder to firewall or the brake booster. Disconnect pushrod at brake pedal (non-power brakes only).
3. Remove the master cylinder, gasket and rubber boot.
4. On non-power brakes, position master cylinder on firewall, making sure pushrod goes through the rubber boot into the piston. Reconnect pushrod clevis to brake pedal. With power brakes, install the cylinder on the booster.
5. Install nuts and lockwashers. Torque nuts to 22-30 ft. lbs. (30-45 Nm).
6. Install hydraulic lines then check brake pedal free play.
7. Bleed the brakes.

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OVERHAUL

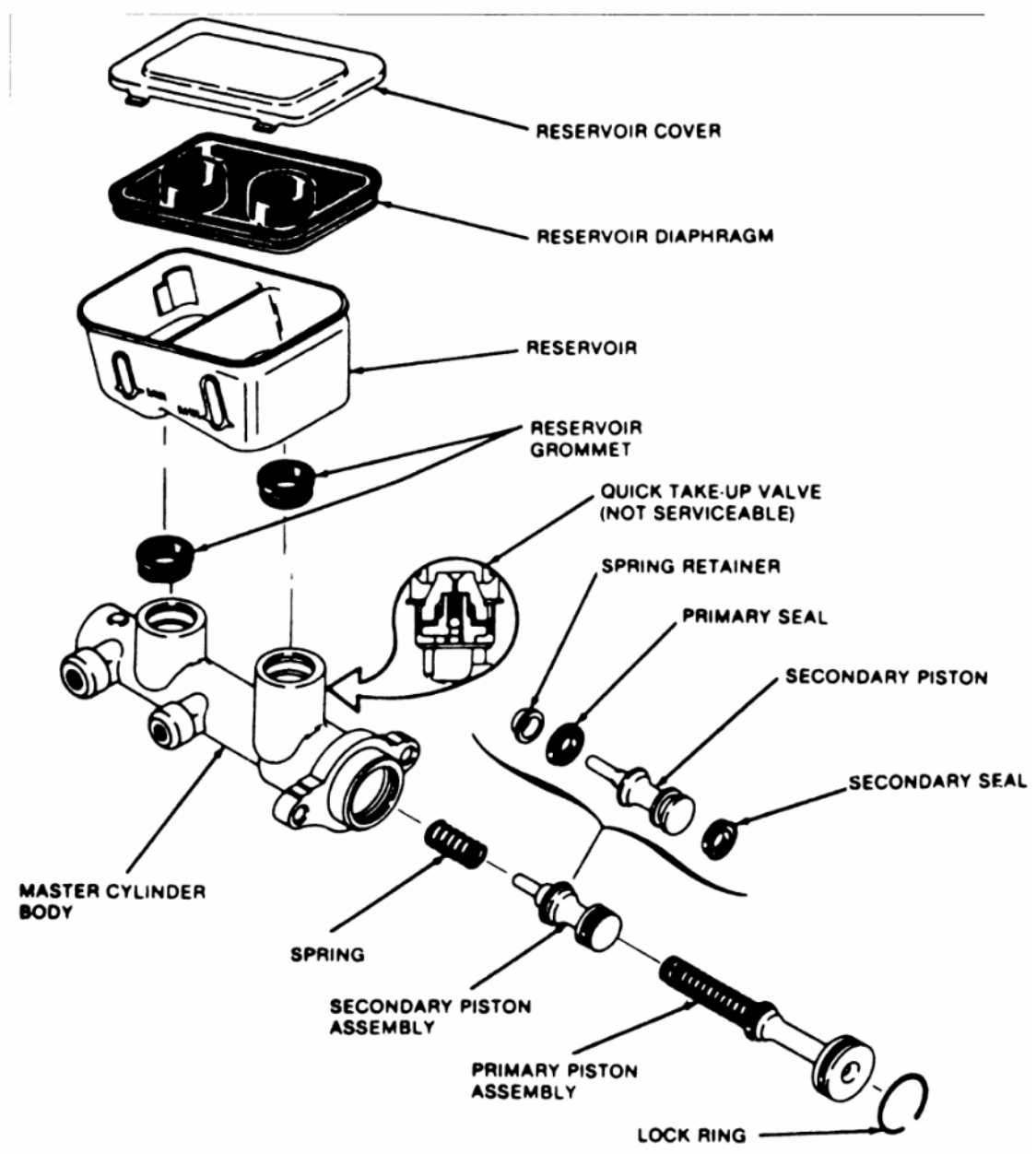


Fig. 4: Exploded view of a master cylinder

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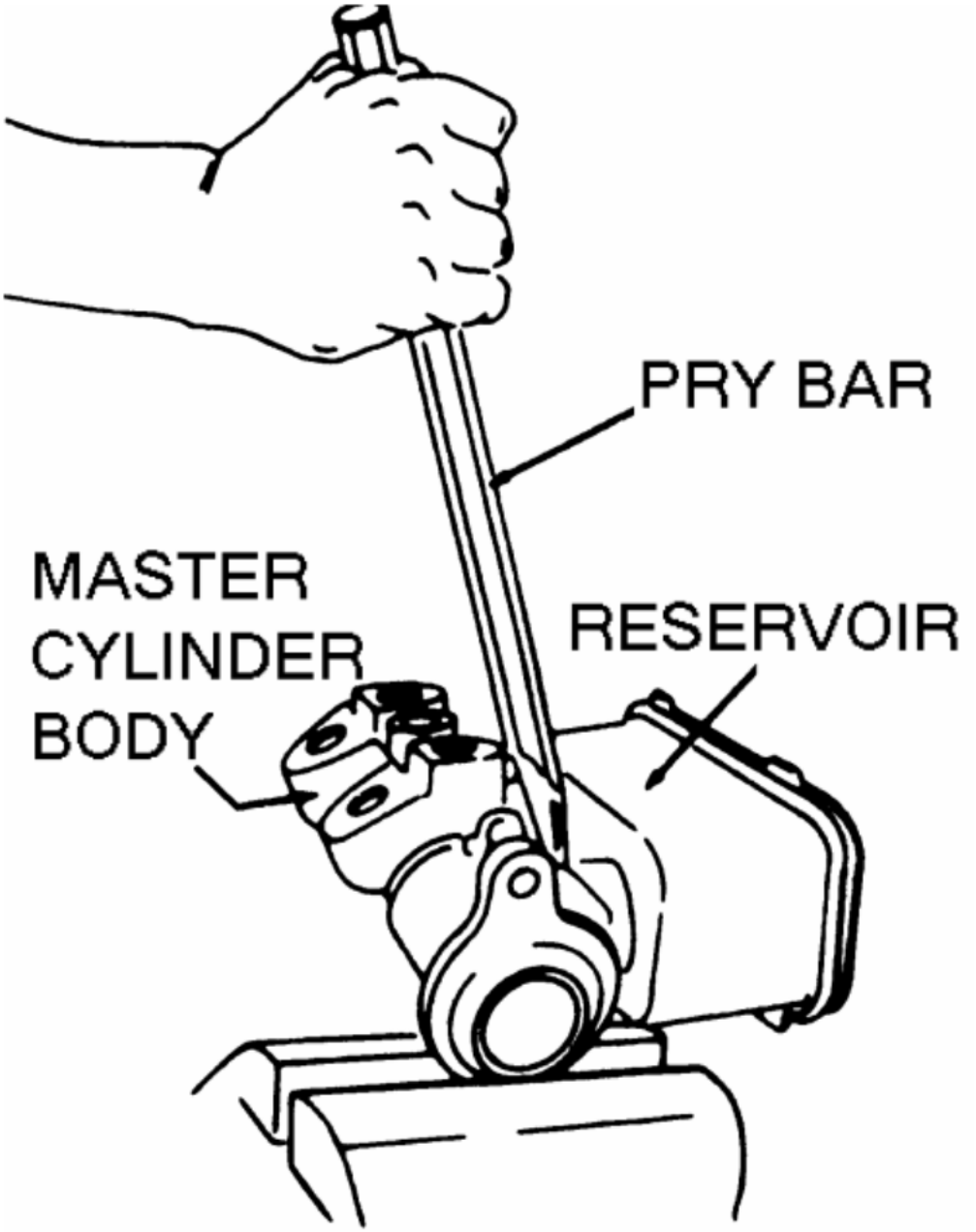


Fig. 5: Removing the reservoir

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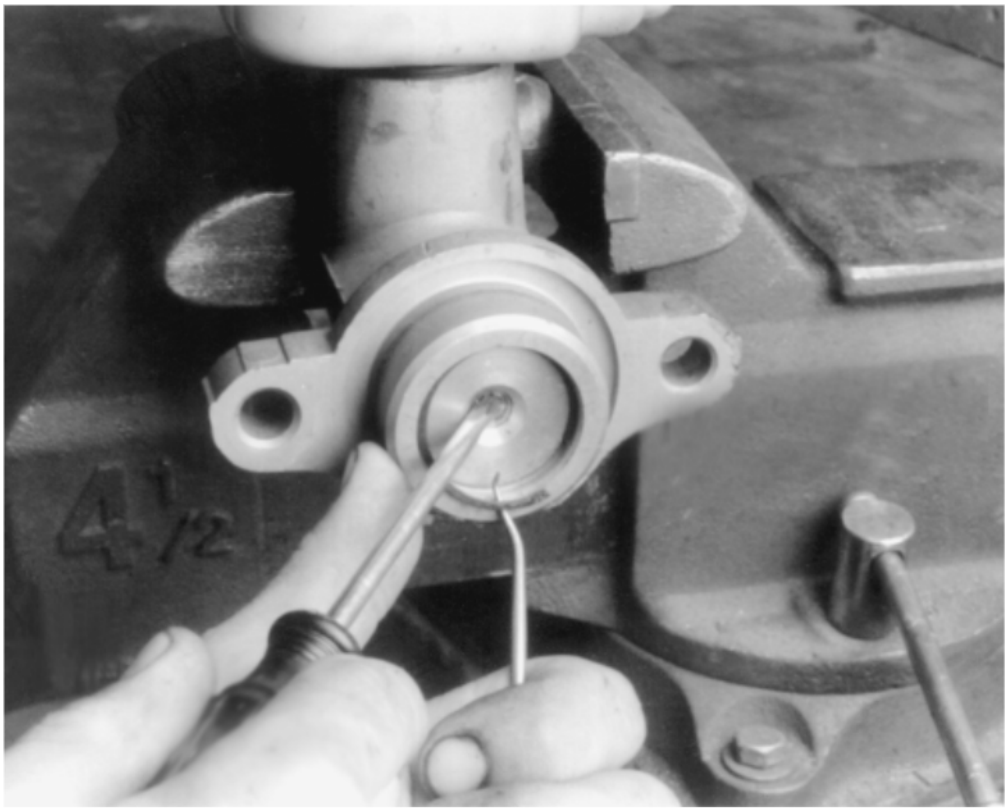


Fig. 6: Prying out the snapring

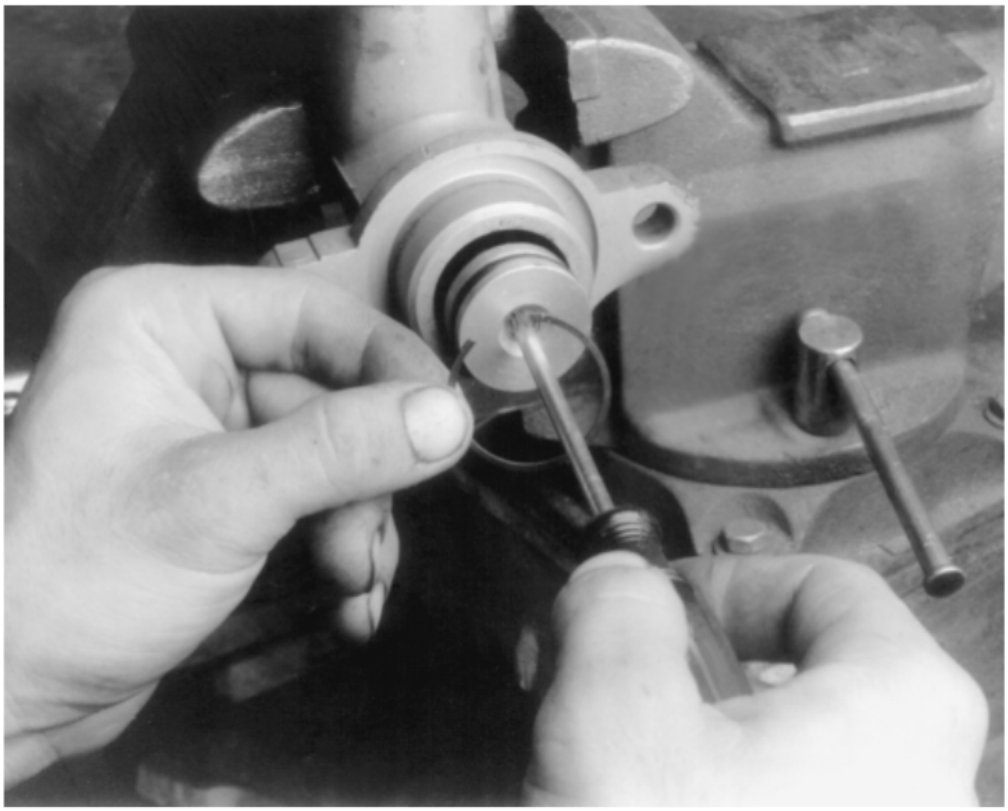


Fig. 7: Removing the snapring

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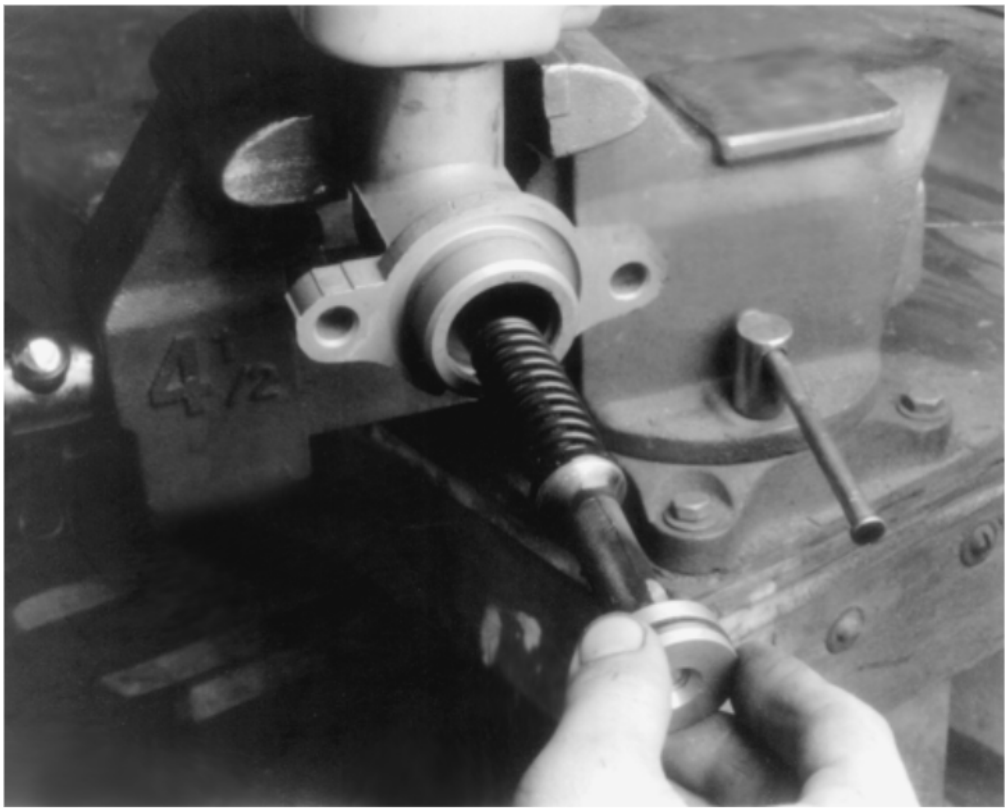


Fig. 8: Removing the primary piston

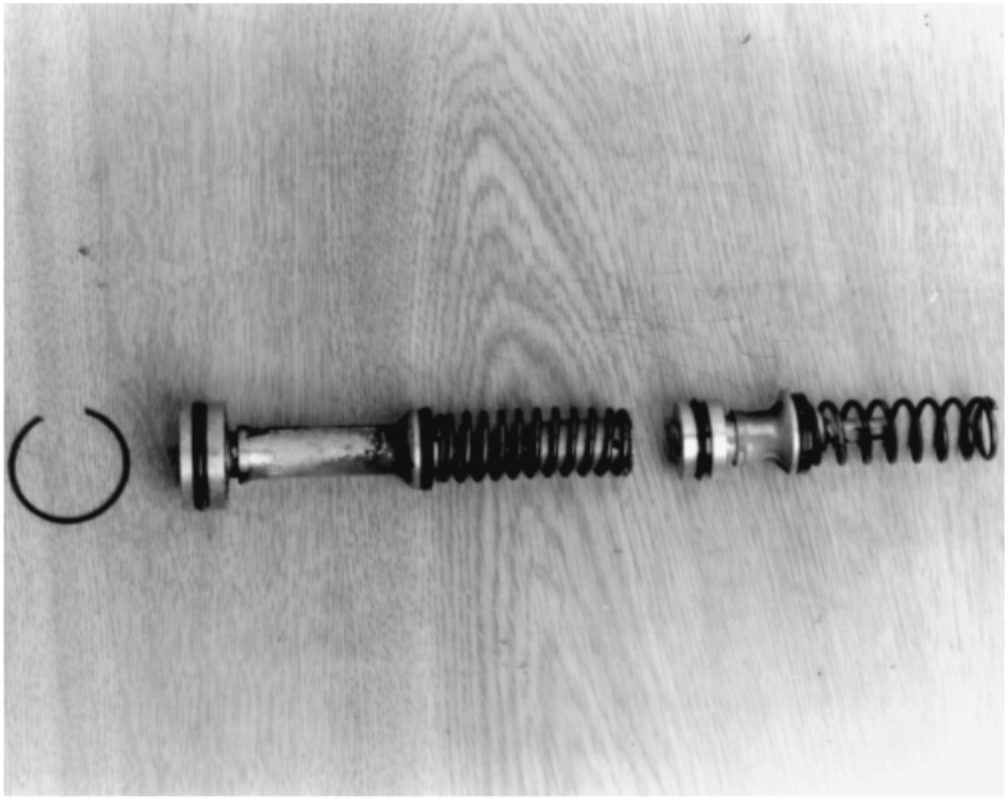


Fig. 9: Master cylinder parts

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Fig. 10: Removing the O-ring

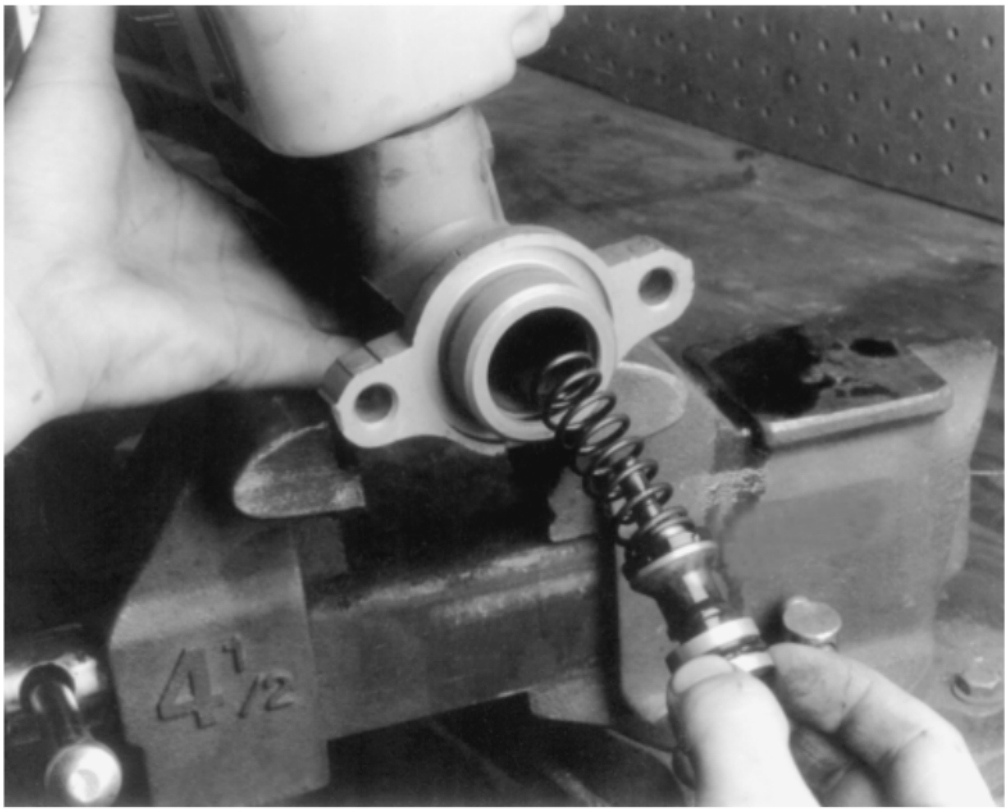


Fig. 11: Installing the secondary piston

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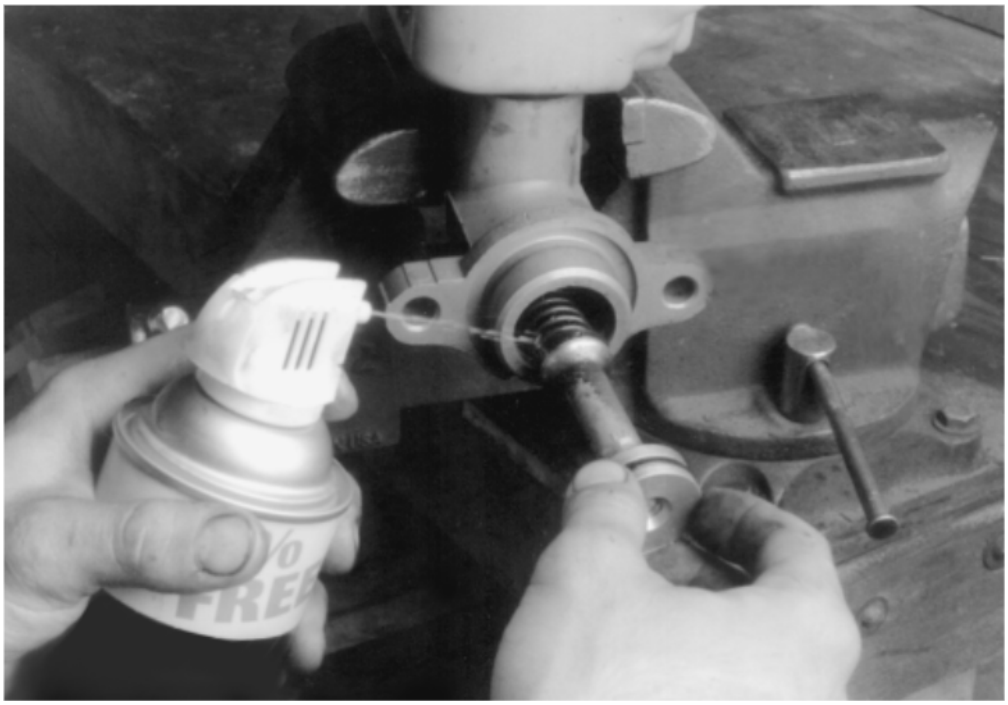


Fig. 12: Installing the primary piston

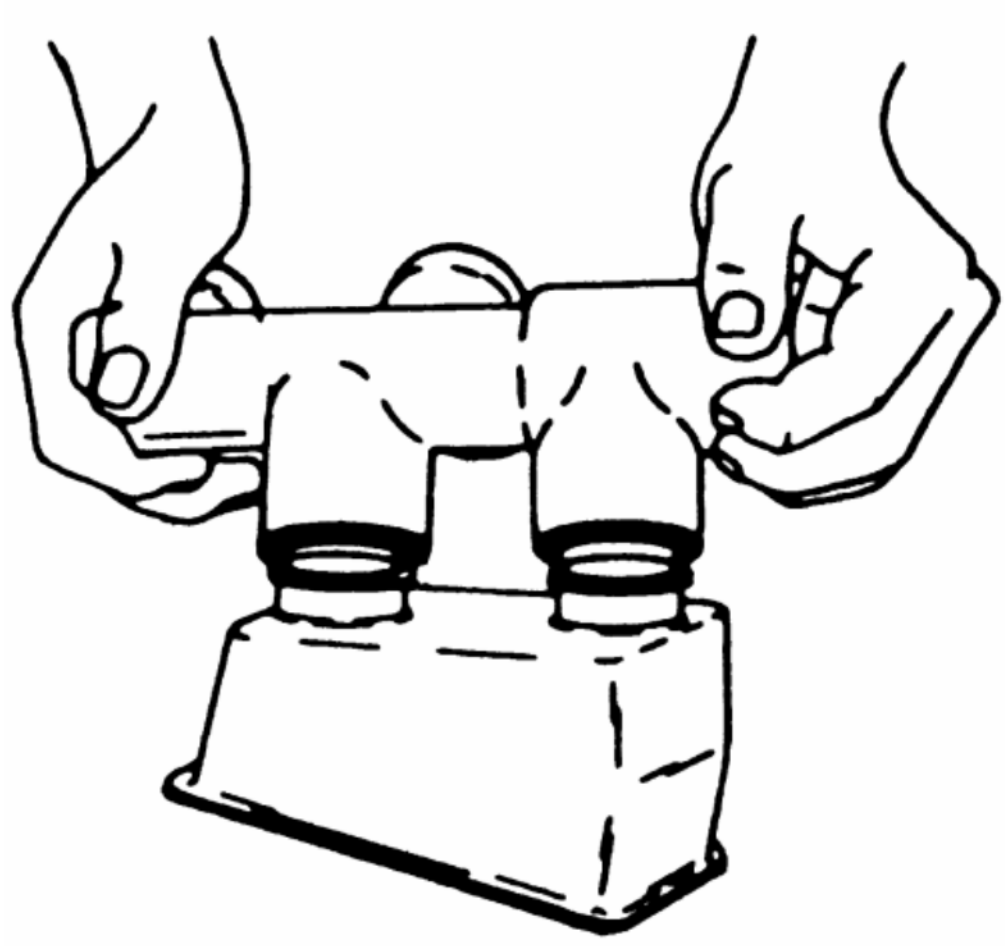


Fig. 13: Installing the reservoir

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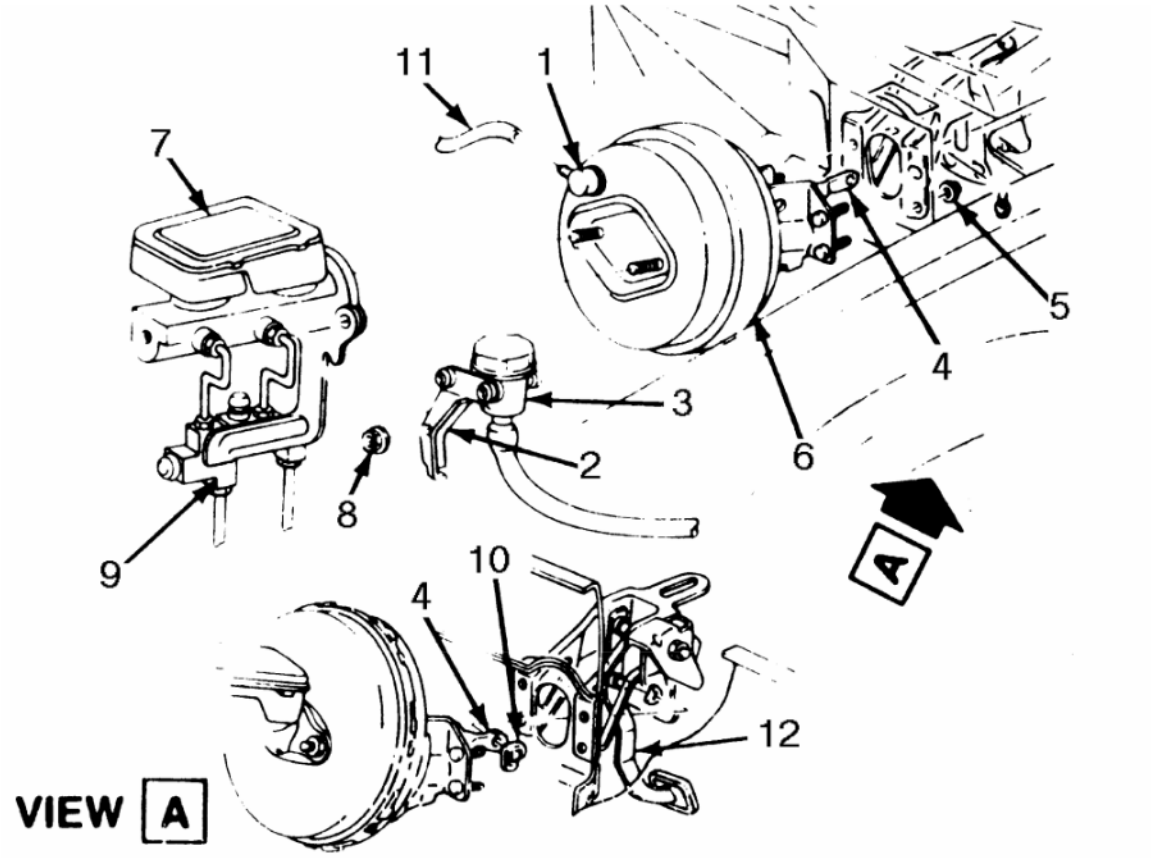
This is a tedious, time-consuming job. You can save yourself a lot of trouble by buying a rebuilt master cylinder from your dealer or parts supply house. The small difference in price between a rebuilding kit and a rebuilt part usually makes it more economical, in terms of time and work, to buy the rebuilt part.

1. Remove the reservoir cover and diaphragm. Discard any brake fluid in the reservoir.
2. Inspect the reservoir cover and diaphragm for cuts, cracks, or deformation. Replace any defective parts.
3. Depress the primary piston and remove the lock ring.
4. Direct compressed air into the outlet at the blind end of the bore and plug the other outlet to remove primary and secondary piston.
5. Remove the spring retainer and seals from the secondary piston.
6. Clamp the master cylinder in a vise. Do not clamp it on the master cylinder body. Use a pry bar to remove the reservoir.
7. Do not attempt to remove the quick take-up valve from the body. This valve is not serviced separately.
8. Remove the reservoir grommets.
9. Inspect the master cylinder bore for corrosion. If corroded, replace the master cylinder. Do not use any abrasive on the bore.
10. Reassemble, using new seals and grommets. Lubricate all parts with brake fluid.
11. Install the reservoir grommets.
12. Install the reservoir.
13. Install the spring retainer and seals from the secondary piston.
14. Install primary and secondary piston.
15. Depress the primary piston and install the lock ring.
16. Fill with brake fluid. Install the reservoir cover and diaphragm.
17. Bleed brake system.

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POWER BRAKE BOOSTER

REMOVAL & INSTALLATION



1. Check valve
2. Bracket
3. Reservoir
4. Pushrod
5. Nut
6. Booster
7. Master cylinder
8. Nut
9. Combination (proportioning) valve
10. Retainer
11. Vacuum hose
12. Brake pedal

Fig. 1: Power brake booster removal

1. Disconnect vacuum hose from vacuum check valve.
2. Unbolt the master cylinder and carefully move it aside without disconnecting the hydraulic lines.
3. Disconnect pushrod at brake pedal assembly.

Some brake boosters may also be held on with a sealant. This can be easily removed with tar remover.

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4. Remove nuts and lockwashers that secure booster to firewall and remove booster from engine compartment.
5. Install by reversing removal procedure. Make sure to check operation of stop lights. Allow engine vacuum to build before applying brakes.

COMBINATION VALVE

REMOVAL & INSTALLATION

This valve is not repairable and only serviced as a complete assembly.

1. Disconnect the hydraulic lines from the valve. Plug the lines to prevent fluid loss and dirt contamination.
2. Disconnect the electrical connection.
3. Remove the valve.

To install:

4. Position the valve.
5. Connect the electrical connection.
6. Connect the hydraulic lines to the valve.
7. Bleed the brake system.

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BRAKE HOSES AND LINES

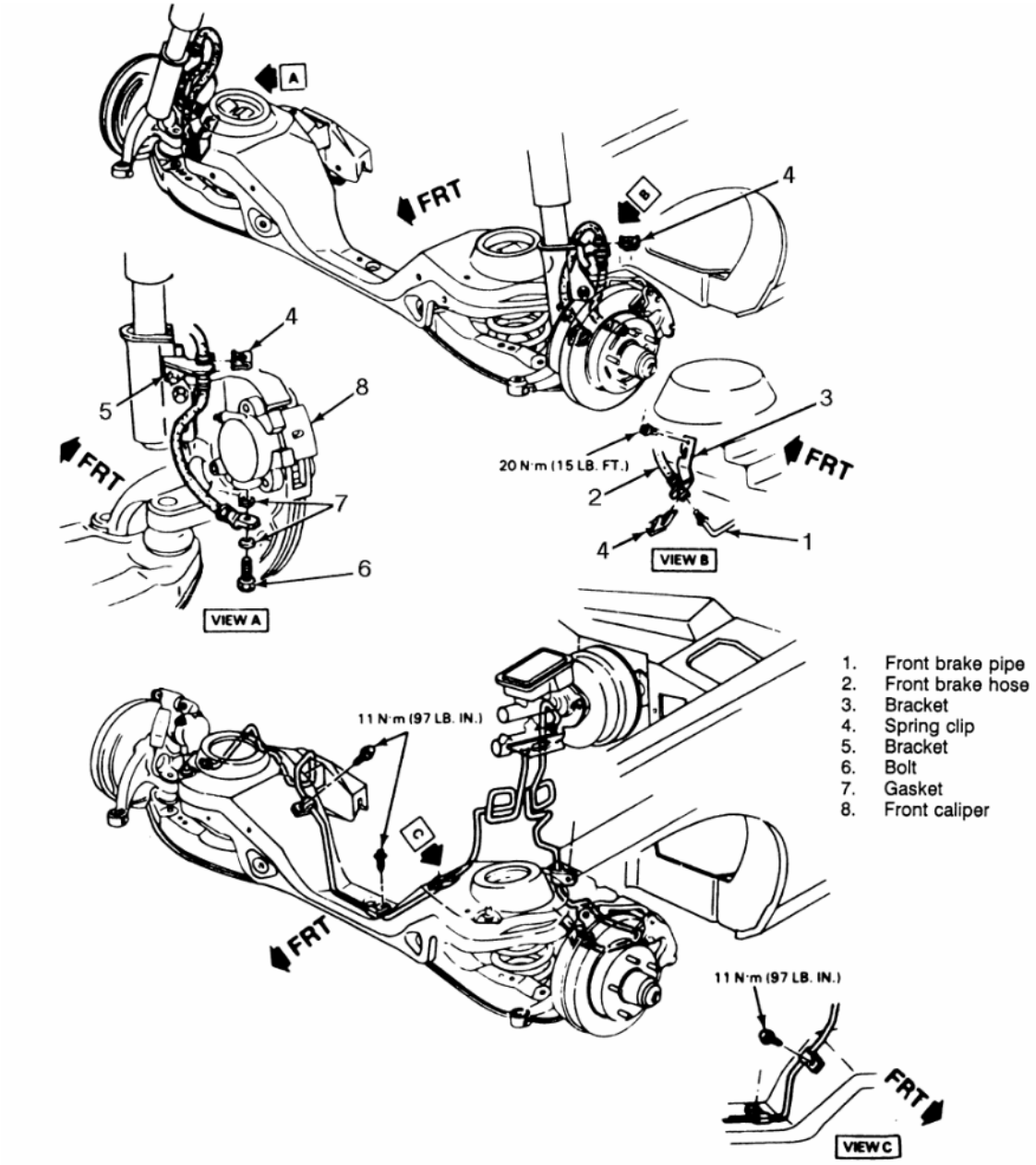


Fig. 1: Front brake lines

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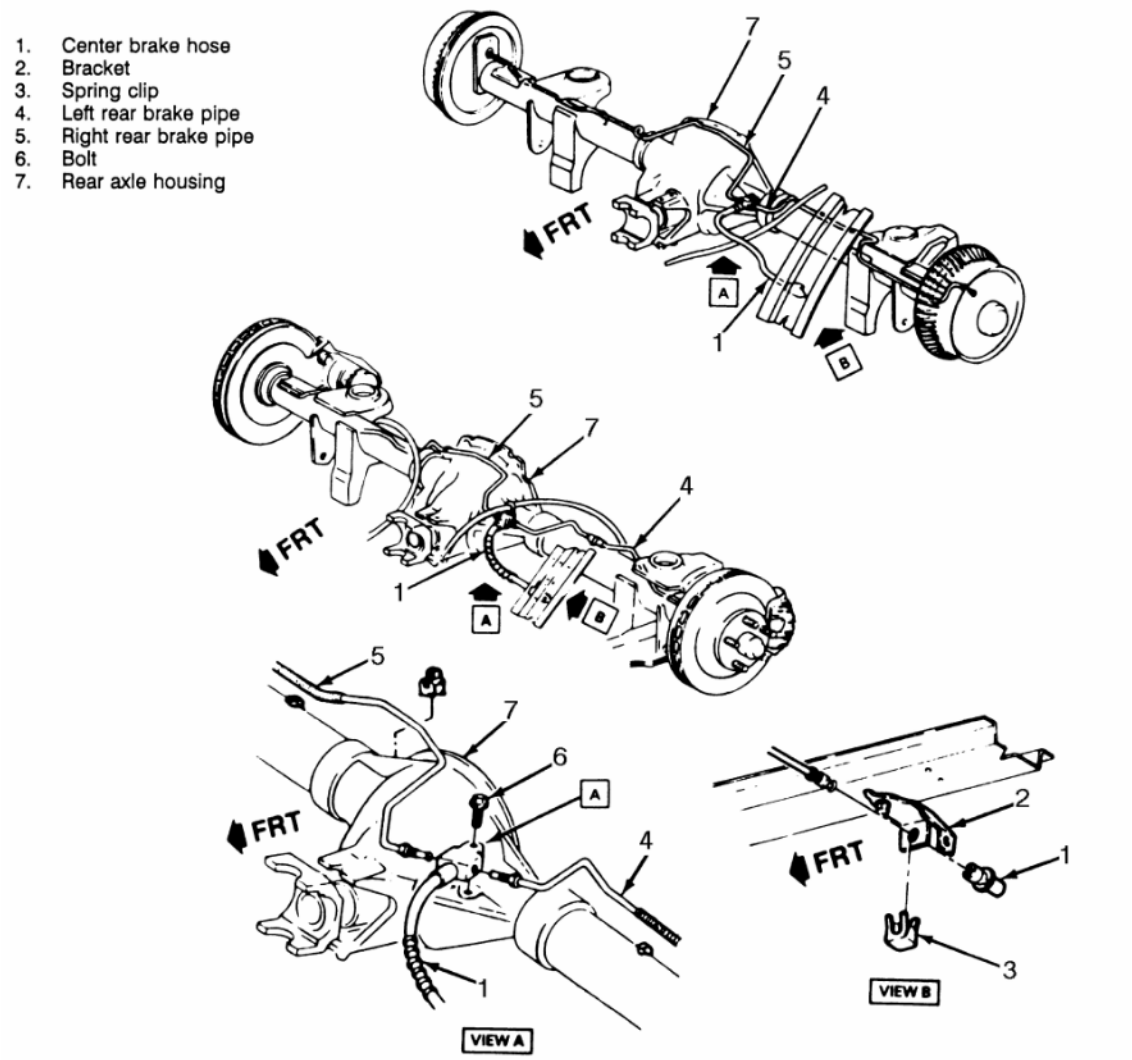


Fig. 2: Rear brake lines

Metal lines and rubber brake hoses should be checked frequently for leaks and external damage. Metal lines are particularly prone to crushing and kinking under the vehicle. Any such deformation can restrict the proper flow of fluid and therefore impair braking at the wheels. Rubber hoses should be checked for cracking or scraping; such damage can create a weak spot in the hose and it could fail under pressure.

Any time the lines are removed or disconnected, extreme cleanliness must be observed. Clean all joints and connections before disassembly (use a stiff bristle brush and clean brake fluid); be sure to plug the lines and ports as soon as they are opened. New lines and hoses should be flushed clean with brake fluid before installation to remove any contamination.

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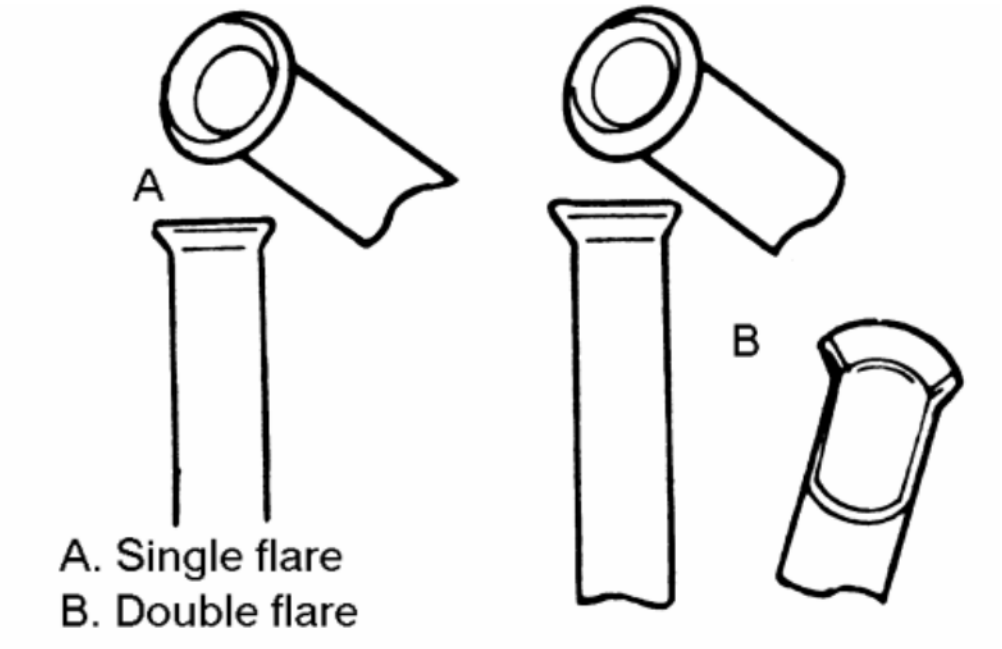


Fig. 3: Single (A) and double (B) flares

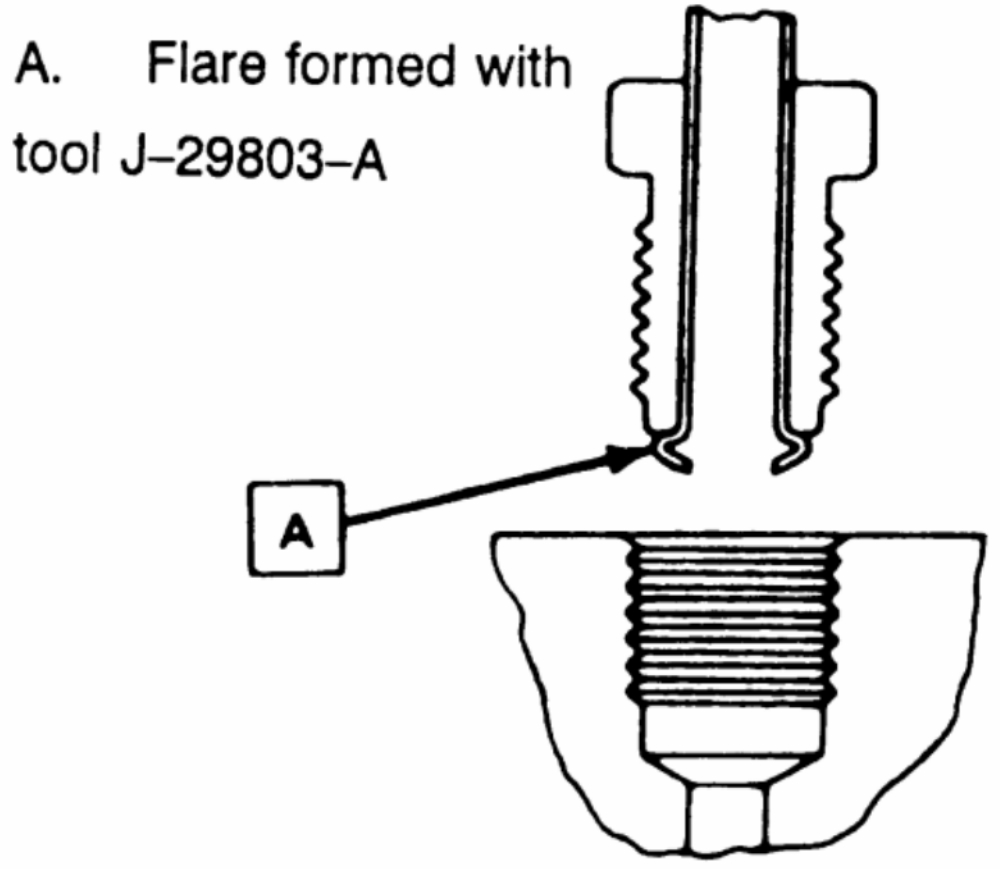


Fig. 4: ISO flare

- **REMOVAL & INSTALLATION**

1. Disconnect the negative battery cable.
2. Raise and safely support the vehicle on jackstands.

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3. Remove any wheel and tire assemblies necessary for access to the particular line you are removing.
4. Thoroughly clean the surrounding area at the joints to be disconnected.

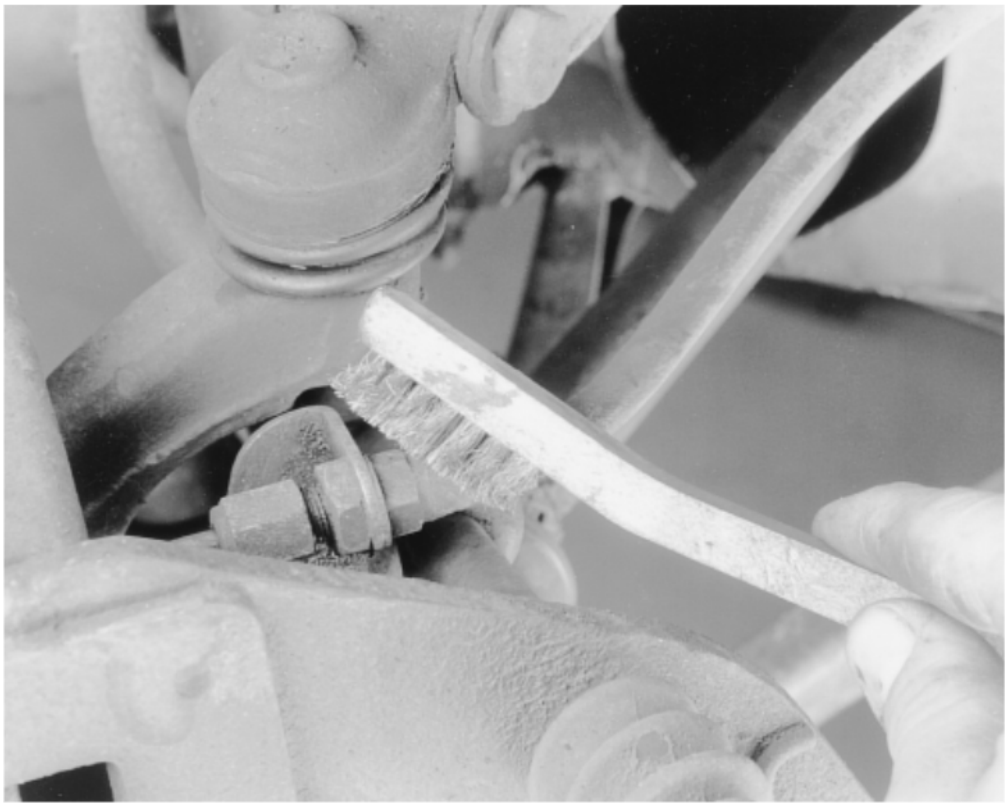


Fig. 5: Use a brush to clean the fittings of any debris

5. Place a suitable catch pan under the joint to be disconnected.
6. Using two wrenches (one to hold the joint and one to turn the fitting), disconnect the hose or line to be replaced.

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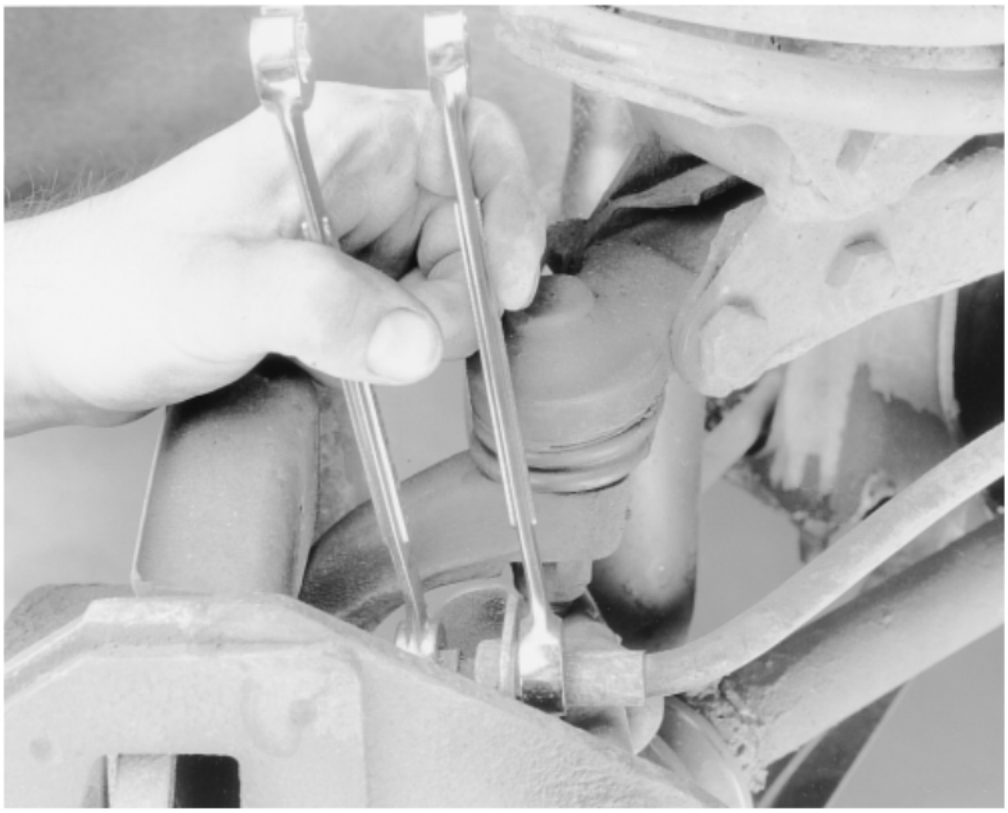


Fig. 6: Use two wrenches to loosen the fitting. If available, use flare nut type wrenches

7. Disconnect the other end of the line or hose, moving the drain pan if necessary. Always use a back-up wrench to avoid damaging the fitting.
8. Disconnect any retaining clips or brackets holding the line and remove the line from the vehicle.

If the brake system is to remain open for more time than it takes to swap lines, tape or plug each remaining clip and port to keep contaminants out and fluid in.

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Fig. 7: Any gaskets/crush washers should be replaced with new ones during installation



Fig. 8: Tape or plug the line to prevent contamination

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To install:

9. Install the new line or hose, starting with the end farthest from the master cylinder. Connect the other end, then confirm that both fittings are correctly threaded and turn smoothly using finger pressure. Make sure the new line will not rub against any other part. Brake lines must be at least 1/2 in. (13mm) from the steering column and other moving parts. Any protective shielding or insulators must be reinstalled in the original location.

WARNING - Make sure the hose is NOT kinked or touching any part of the frame or suspension after installation. These conditions may cause the hose to fail prematurely.

10. Using two wrenches as before, tighten each fitting.
11. Install any retaining clips or brackets on the lines.
12. If removed, install the wheel and tire assemblies, then carefully lower the vehicle to the ground.
13. Refill the brake master cylinder reservoir with clean, fresh brake fluid, meeting DOT 3 specifications. Properly bleed the brake system.
14. Connect the negative battery cable.

BLEEDING

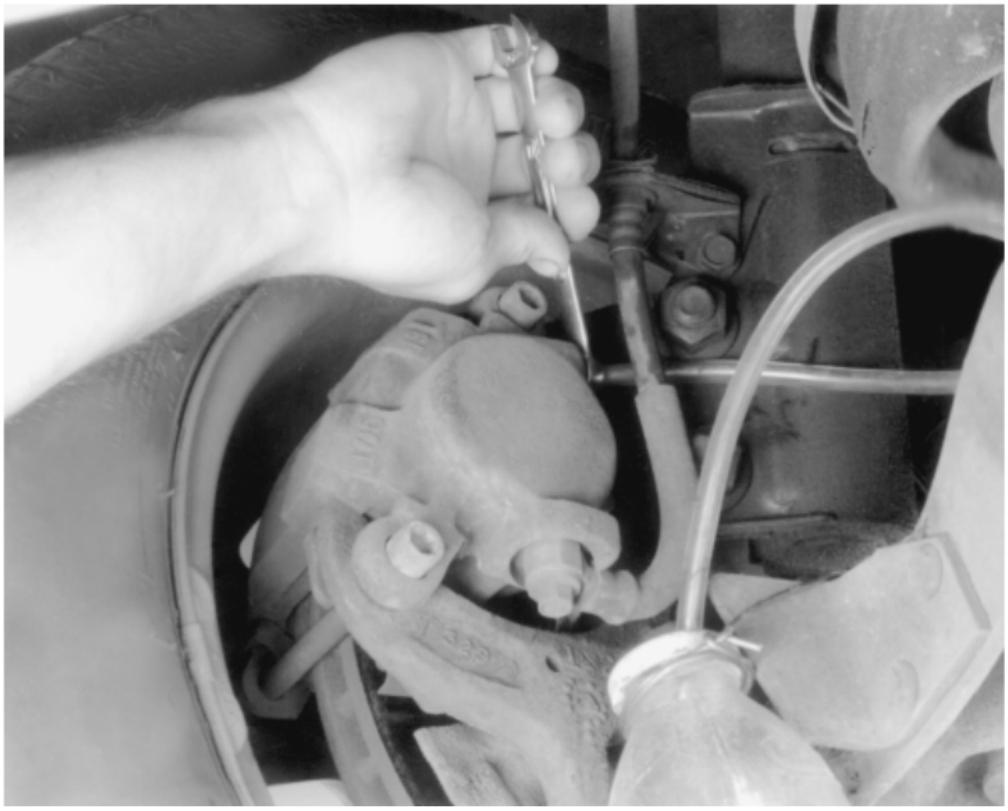


Fig. 1: Caliper bleeding

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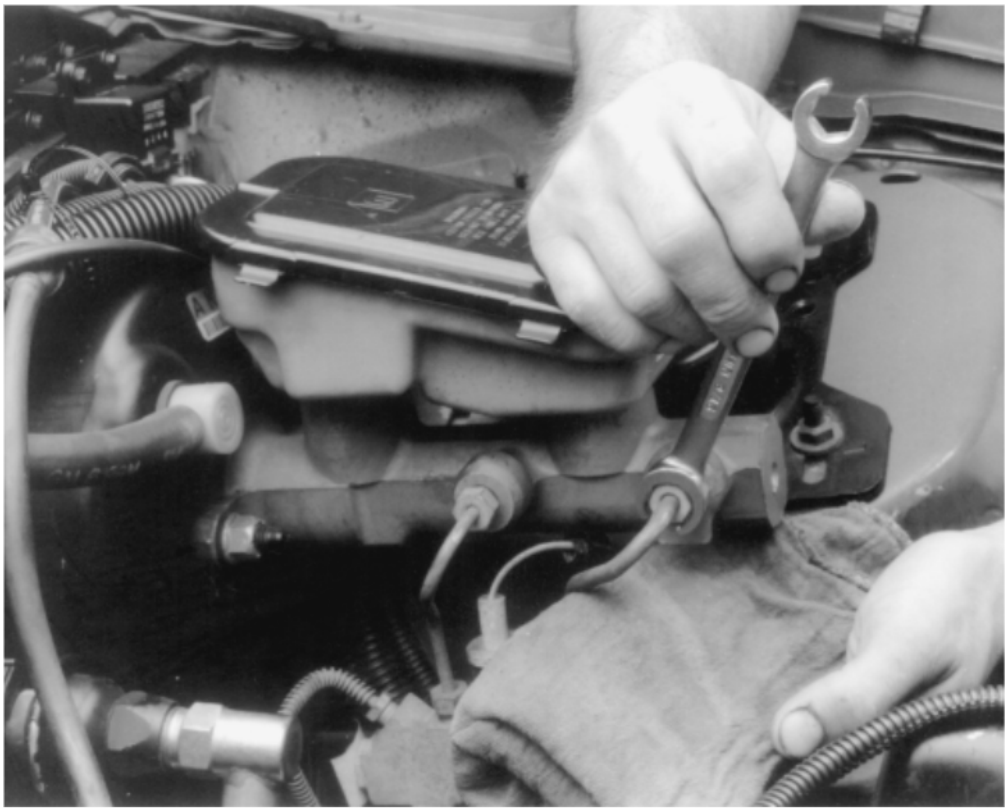


Fig. 2: Master cylinder bleeding

The purpose of bleeding the brakes is to expel air trapped in the hydraulic system. The system must be bled whenever the pedal feels spongy, indicating that compressible air has entered the system. It must also be bled whenever the system has been opened, repaired or the fluid appears dirty. You will need a helper for this job.

CAUTION - Never reuse brake fluid which has been bled from the brake system

1. The sequence for bleeding is right rear, left rear, right front and left front. If the car has power brakes, remove the vacuum by applying the brakes several times. Do not run the engine while bleeding the brakes.
2. Clean all the bleeder screws. You may want to give each one a shot of penetrating solvent to loosen it; seizure is a common problem with bleeder screws, which then break off, sometimes requiring replacement of the part to which they are attached.
3. Fill the master cylinder with good quality brake fluid.

Brake fluid absorbs moisture from the air. Don't leave the master cylinder or the fluid container uncovered any longer than necessary. Be careful handling the fluid; it eats paint. Check the level of the fluid often when bleeding and refill the reservoirs as necessary. Don't let them run dry or you will have to repeat the process.

4. Attach a length of clear vinyl tubing to the bleeder screw on the wheel cylinder. Submerge the other end of the tube into a clear, clean jar half filled with brake fluid.

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5. Have your assistant slowly depress the brake pedal. As this is done, open the bleeder screw $^{3}/_{4}$ of a turn and allow the fluid to run through the tube. Then close the bleeder screw before the pedal reaches the end of its travel. Have your assistant slowly release the pedal. Repeat this process until no air bubbles appear in the expelled fluid.
6. Repeat the procedure on the other three brakes, checking the level of fluid in the master cylinder reservoir often.
7. Upon completion, check the brake pedal for sponginess and the brake warning light for unbalanced pressure. If necessary, repeat the entire bleeding procedure.

FRONT DISC BRAKES

CAUTION - Some brake pads contain asbestos, which has been determined to be a cancer causing agent. Never clean the brake surfaces with compressed air! Avoid inhaling any dust from any brake surface! When cleaning brake surfaces, use a commercially available brake cleaning fluid.

BRAKE PADS

CAUTION - Some brake pads contain asbestos, which has been determined to be a cancer causing agent. Never clean the brake surfaces with compressed air! Avoid inhaling any dust from any brake surface! When cleaning brake surfaces, use a commercially available brake cleaning fluid.

INSPECTION

The pad thickness should be inspected every time that the tires are removed for rotation. The outer pad can be checked by looking in each end, which is the point at which the highest rate of wear occurs. The inner pad can be checked by looking down through the inspection hole in the top of the caliper. If the thickness of the pad is worn to within 0.030 in. (0.8mm) of the rivet at either end of the pad, all the pads should be replaced.

Always replace all pads on both front wheels at the same time. Failure to do so will result in uneven braking action and premature wear.

REMOVAL & INSTALLATION

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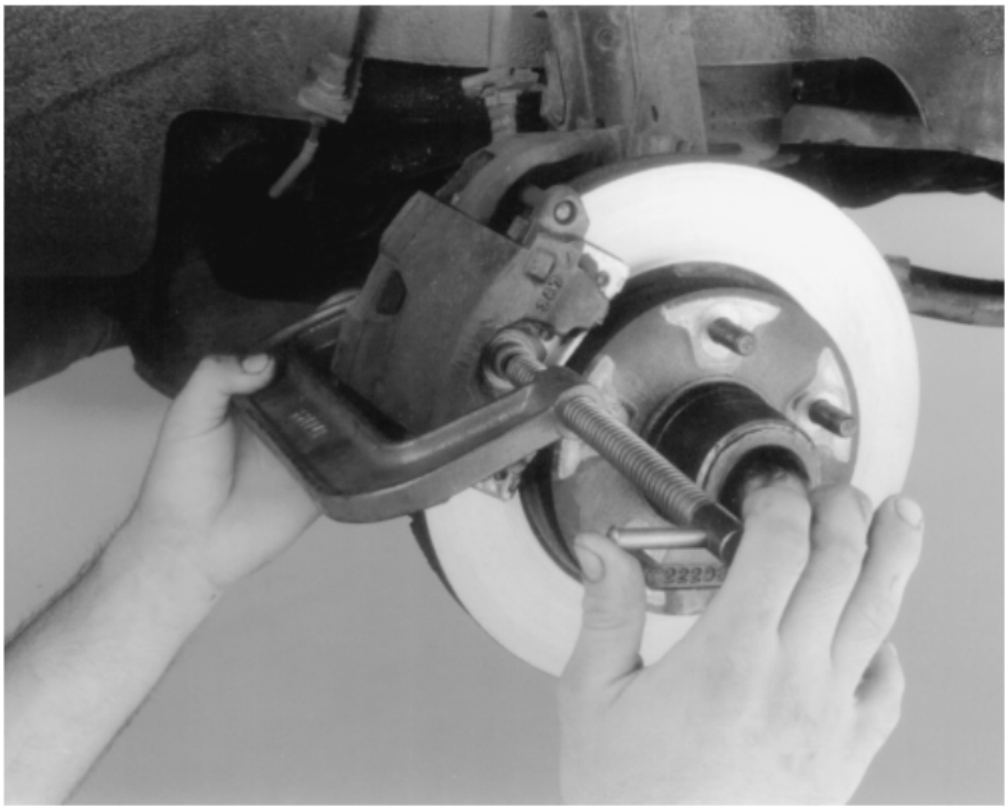


Fig. 1: Compress the piston with a C-clamp

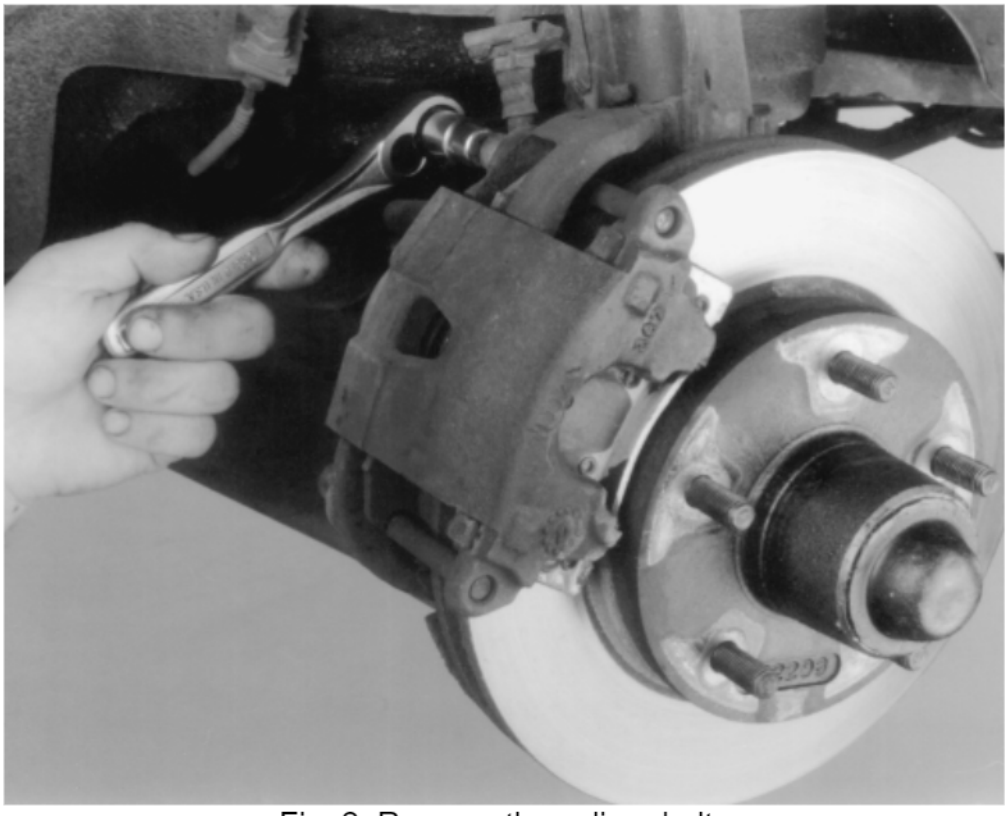


Fig. 2: Remove the caliper bolts

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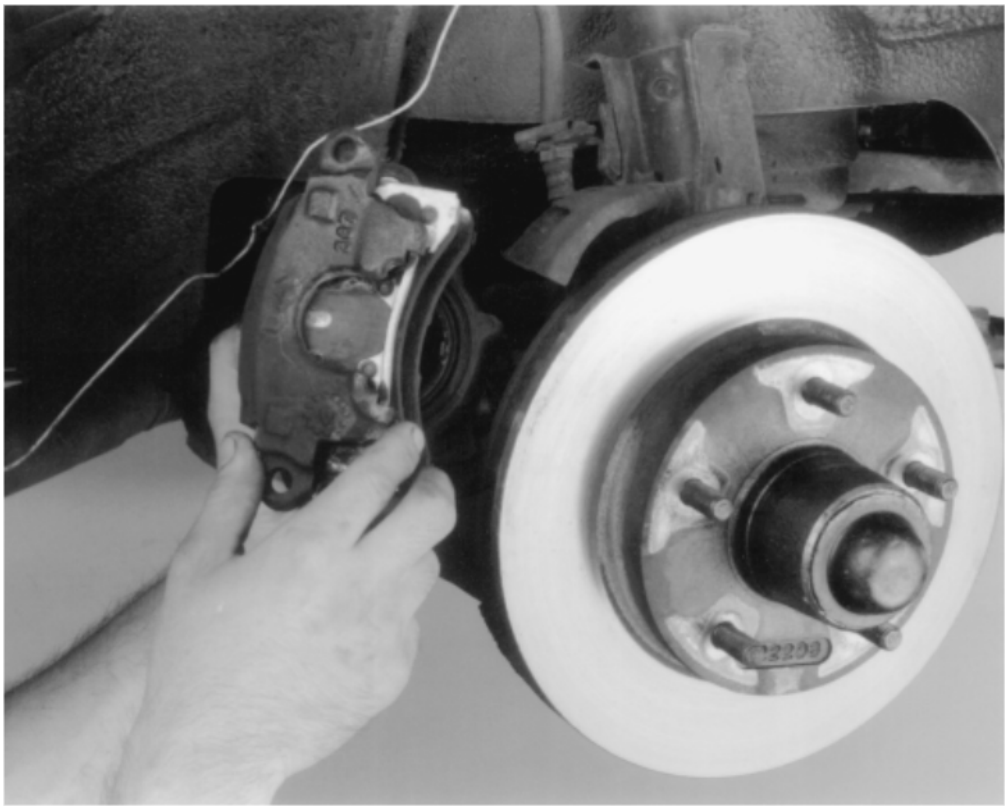


Fig. 3: Lift off the caliper



Fig. 4: Remove the inner pad

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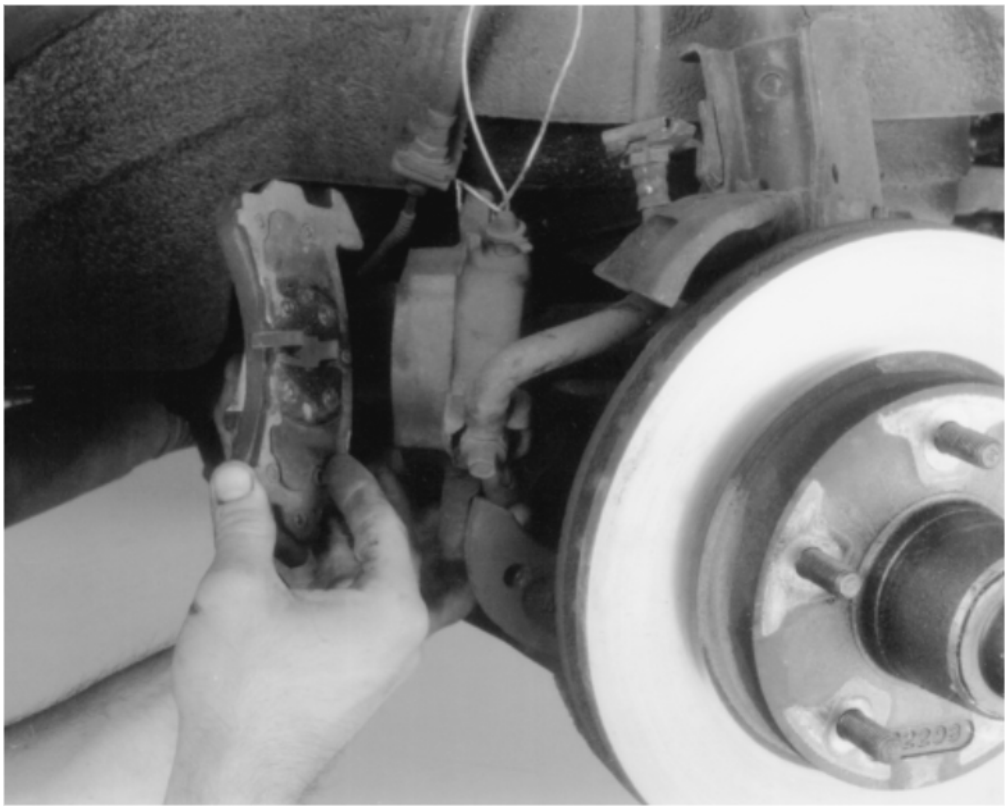
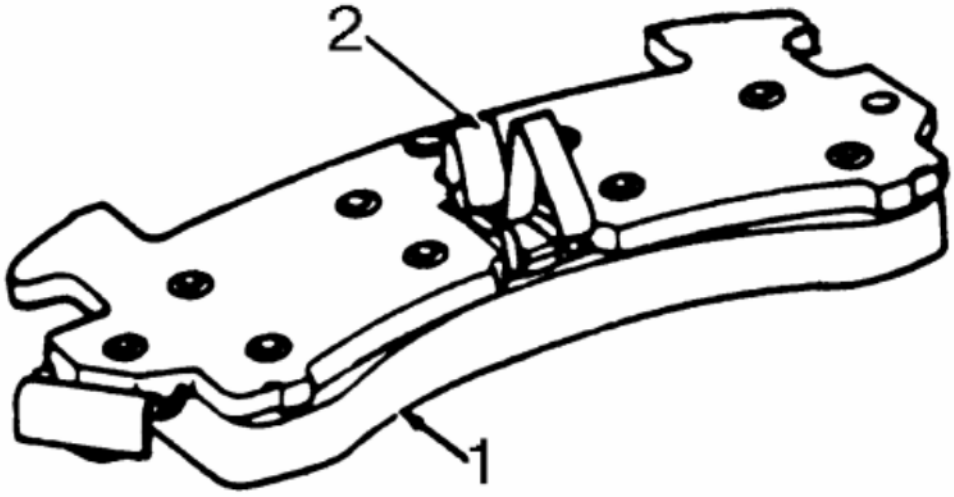


Fig. 5: Remove the outer pad



1. Inboard shoe & lining
2. Shoe retainer spring

Fig. 6: Install the inner pad retaining clip

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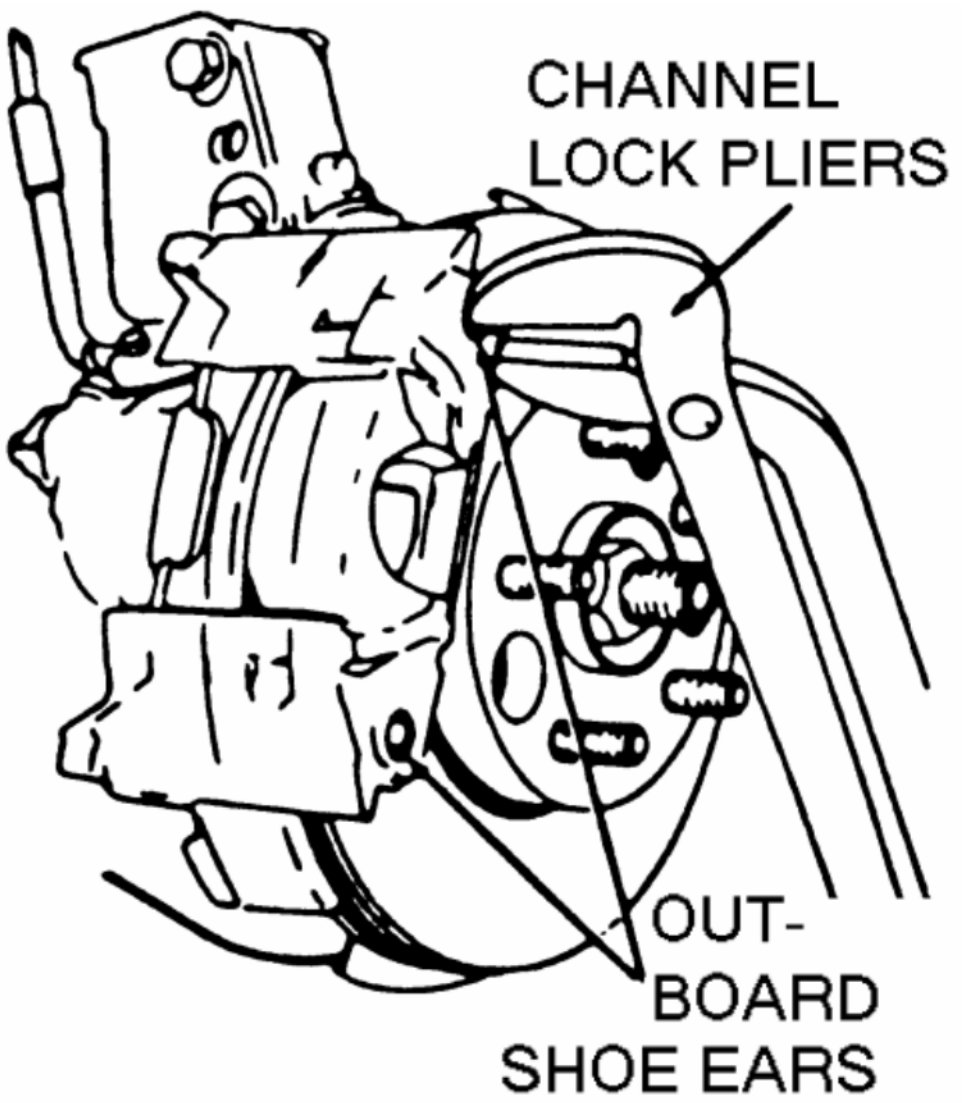


Fig. 7: Bend the outboard pad ears after installation

1. Siphon $^{2}/_{3}$ of the brake fluid from the master cylinder reservoir. Loosen the wheel lug nuts and raise the car. Remove the wheel.
2. Position a C-clamp across the caliper and press on the pads. Tighten it until the caliper piston bottoms in its bore.

If you haven't removed some brake fluid from the master cylinder, it may overflow when the piston is retracted.

3. Remove the C-clamp.

There are 2 different calipers being used, a single piston or dual piston design. The single piston design uses either an Allen head bolt, regular bolt or Torx® head bolt to secure the caliper to the mounting bracket. Do not use a socket in place of the Torx® socket, otherwise damage to the bolt may occur. The dual piston caliper uses a slide pin and circlip to secure it to the bracket.

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4. Remove the mounting bolts, if equipped with single piston caliper or the circlip and pin, if equipped with dual piston caliper. Inspect the bolts for corrosion and replace as necessary.
5. Remove the caliper from the steering knuckle and suspend it from the body of the car with a length of wire. Do not allow the caliper to hang by its hose.
6. Remove the pad retaining springs and remove the pads from the caliper.
7. Remove the plastic sleeves and the rubber bushings from the mounting bolt holes.
8. Obtain a pad replacement kit. Lubricate and install the new sleeves and bushings with a light coat of silicone grease.
9. Install the retainer spring on the inboard pad, if equipped with single piston caliper.

A new spring should be included in the pad replacement kit.

10. Install the new inboard pad into the caliper with the wear sensor at the leading end of the shoe during forward wheel rotation.
11. Install the outboard pad into the caliper.
12. Use a large pair of slip joint pliers to bend the outer pad ears down over the caliper, if equipped with the single piston caliper.
13. Install the caliper onto the steering knuckle. Tighten the mounting bolts to 21-35 ft. lbs. (28-47 Nm), if equipped. Install the wheel and lower the car. Fill the master cylinder to its proper level with a good quality brake fluid.
14. Pump the brake pedal slowly and firmly 3 times with the engine running before attempting to move the vehicle; bleed the brakes as required.

BRAKE CALIPER

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REMOVAL & INSTALATION

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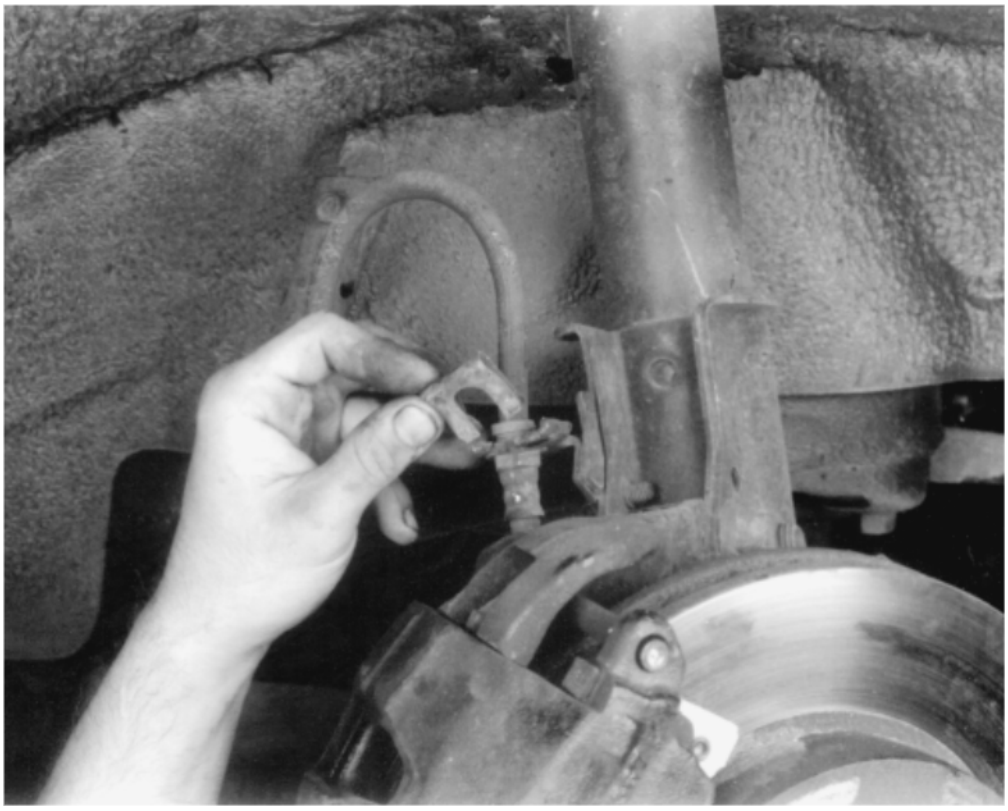


Fig. 1: Removing the hose retaining clip



Fig. 2: Removing the hose from the retainer

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Avoid inhaling any dust from any brake surface! When cleaning brake surfaces, use a commercially available brake cleaning fluid.

1. Remove $^{2}/_{3}$ of the brake fluid from the master cylinder. Raise the vehicle and remove the wheel.
2. Place a C-clamp across the caliper, positioned on the brake pads. Tighten it until the piston is forced into its bore.
3. Remove the C-clamp. Remove the bolt holding the brake hose to the caliper.
4. Remove the Allen head caliper mounting bolts. Inspect them for corrosion and replace them if necessary. Remove the caliper.

To install:

5. Position the caliper with the brake pad installed and install Allen head caliper mounting bolts. Mounting bolt torque is 21-35 ft. lbs. (28-47 Nm.) for the caliper.
6. Install the bolt holding the brake hose to the caliper and tighten to 18-30 ft. lbs. (24-40 Nm.).
7. Fill the master cylinder with brake fluid.
8. Install the wheels and lower the vehicle.

CAUTION - Before moving the vehicle, pump the brakes several times to seat the brake pad against the rotor

OVERHAUL

Some vehicles may be equipped dual piston calipers. The procedure to overhaul the caliper is essentially the same with the exception of multiple pistons, O-rings and dust boots.

1. Remove the caliper from the vehicle and place on a clean workbench.

CAUTION - NEVER place your fingers in front of the pistons in an attempt to catch or protect the pistons when applying compressed air. This could result in personal injury!

Depending upon the vehicle, there are two different ways to remove the piston from the caliper. Refer to the brake pad replacement procedure to make sure you have the correct procedure for your vehicle.

2. The first method is as follows:
   a. Stuff a shop towel or a block of wood into the caliper to catch the piston.
   b. Remove the caliper piston using compressed air applied into the caliper inlet hole. Inspect the piston for scoring, nicks, corrosion and/or worn or damaged chrome plating. The piston must be replaced if any of these conditions are found.

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Fig. 3: For some types of calipers, use compressed air to drive the piston out of the caliper, but make sure to keep your fingers clear

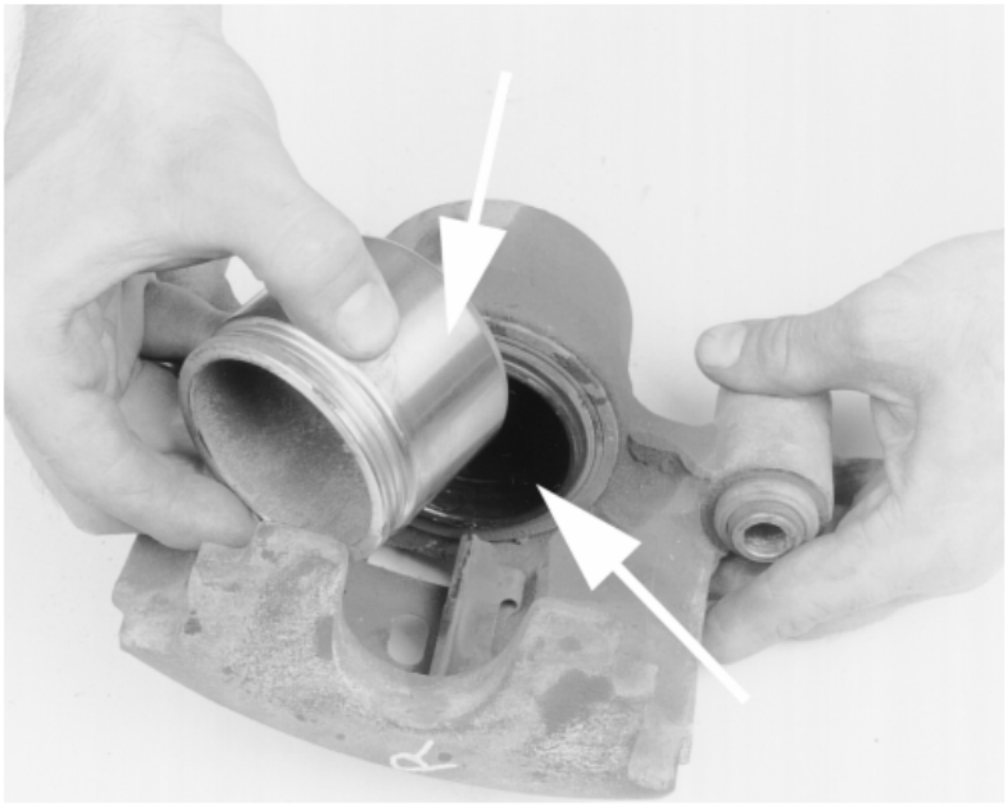


Fig. 4: Withdraw the piston from the caliper bore

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3. For the second method, you must rotate the piston to retract it from the caliper.

4. If equipped, remove the anti-rattle clip.



Fig. 5: On some vehicles, you must remove the anti-rattle clip

5. Use a prytool to remove the caliper boot, being careful not to scratch the housing bore.

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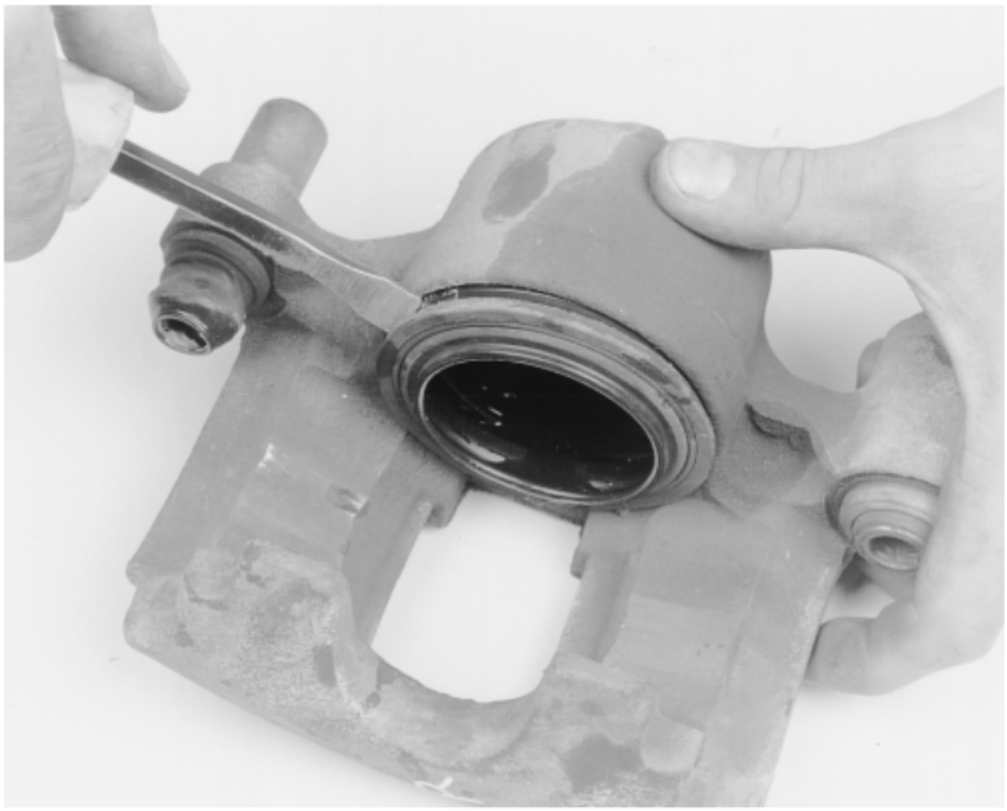


Fig. 6: Use a prytool to carefully pry around the edge of the boot ...

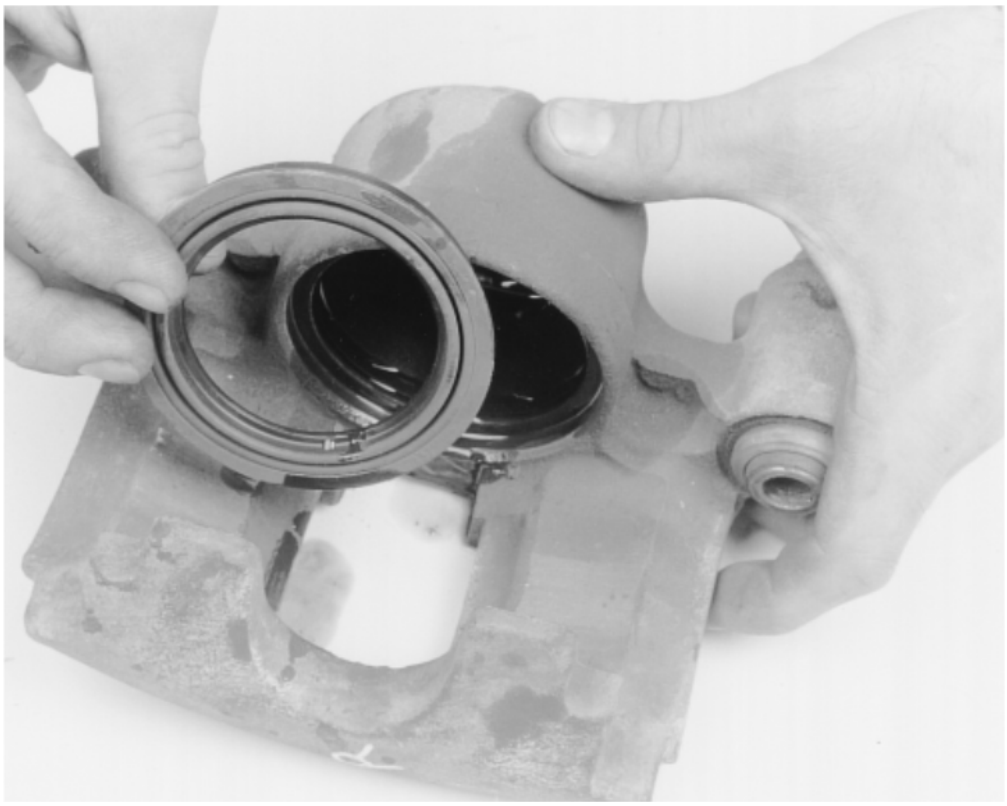


Fig. 7: ... then remove the boot from the caliper housing, taking care not to score or damage the bore

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6. Remove the piston seals from the groove in the caliper bore.



Fig. 8: Use extreme caution when removing the piston seal; DO NOT scratch the caliper bore

7. Carefully loosen the brake bleeder valve cap and valve from the caliper housing.
8. Inspect the caliper bores, pistons and mounting threads for scoring or excessive wear.
9. Use crocus cloth to polish out light corrosion from the piston and bore.
10. Clean all parts with denatured alcohol and dry with compressed air.

To assemble:

11. Lubricate and install the bleeder valve and cap.
12. Install the new seals into the caliper bore grooves, making sure they are not twisted.
13. Lubricate the piston bore.
14. Install the pistons and boots into the bores of the calipers and push to the bottom of the bores.
15. Use a suitable driving tool to seat the boots in the housing.

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Fig. 9: Use the proper size driving tool and a mallet to properly seal the boots in the caliper housing

16. Install the caliper in the vehicle.
17. Install the wheel and tire assembly, then carefully lower the vehicle.
18. Properly bleed the brake system.

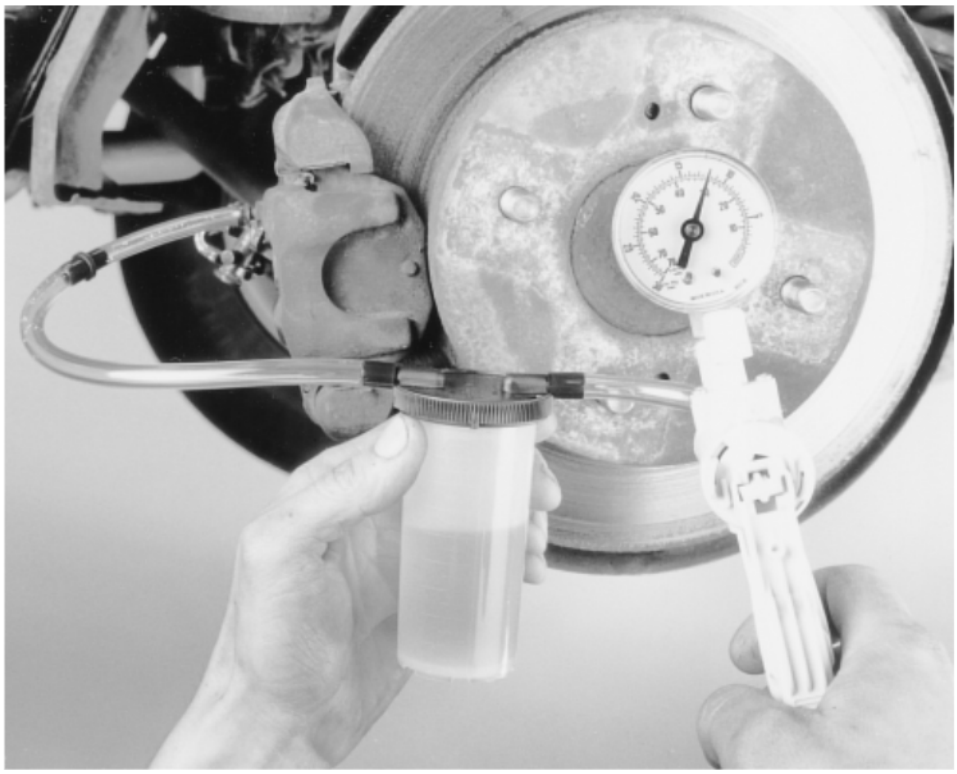


Fig. 10: There are tools, such as this Mighty-Vac, available to assist in proper brake system bleeding

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BRAKE DISC (ROTOR)

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REMOVAL & INSTALATION

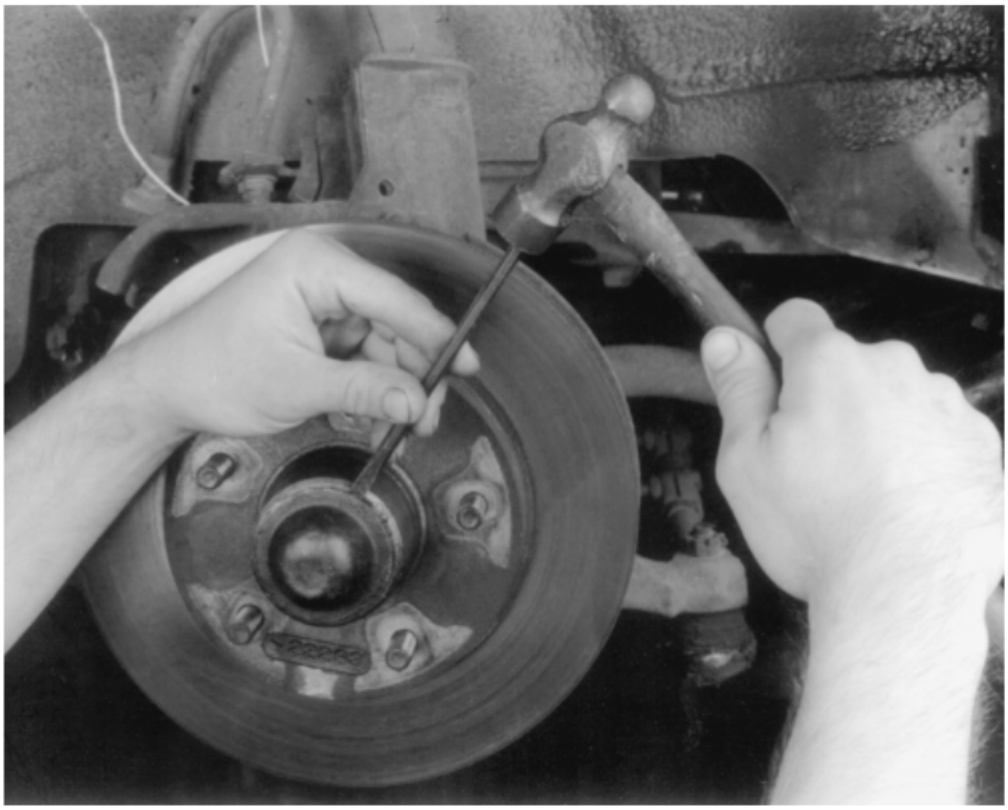


Fig. 1: Breaking loose the dust cap

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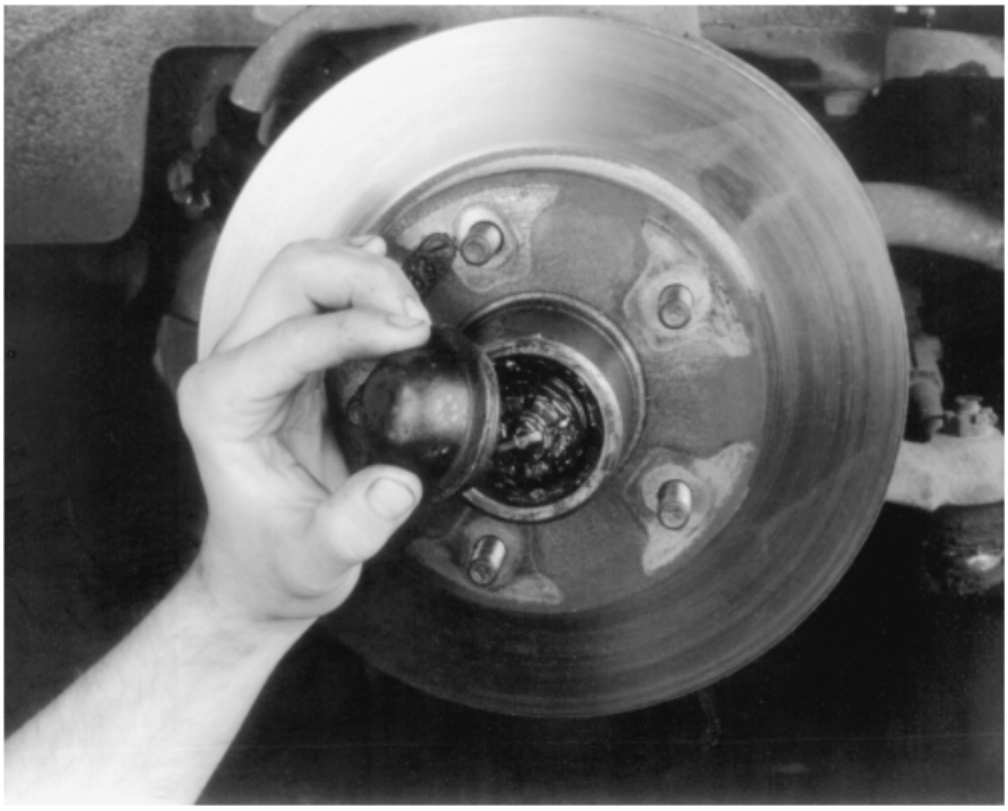


Fig. 2: Removing the dust cap

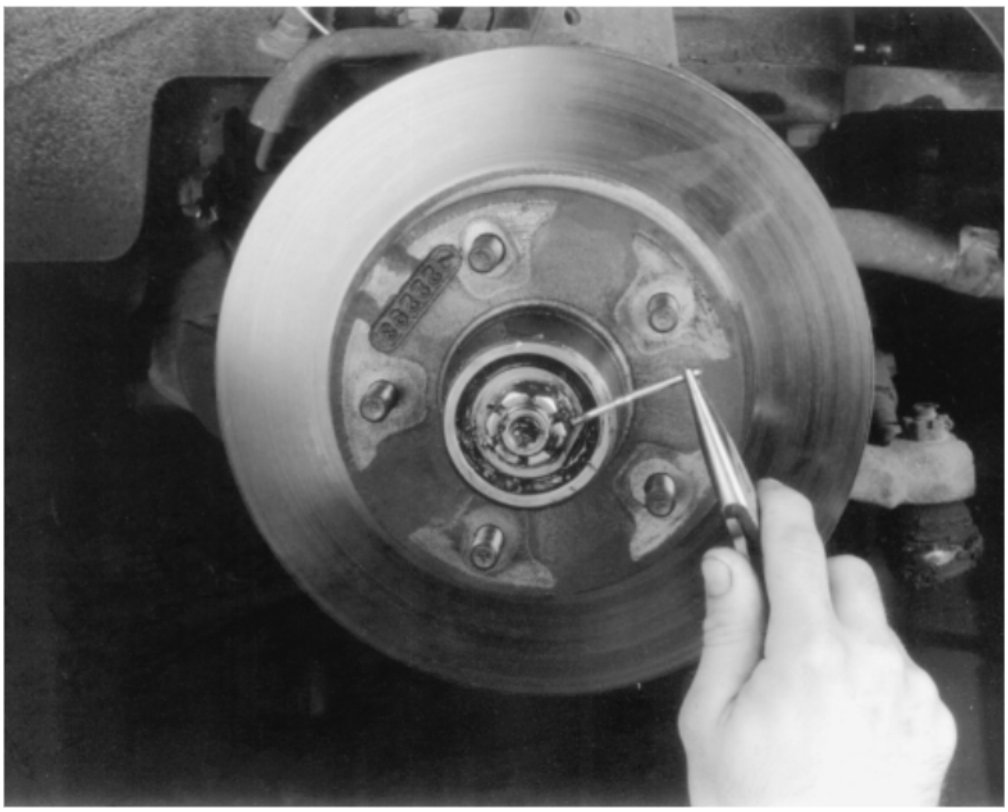


Fig. 3: Removing the cotter pin

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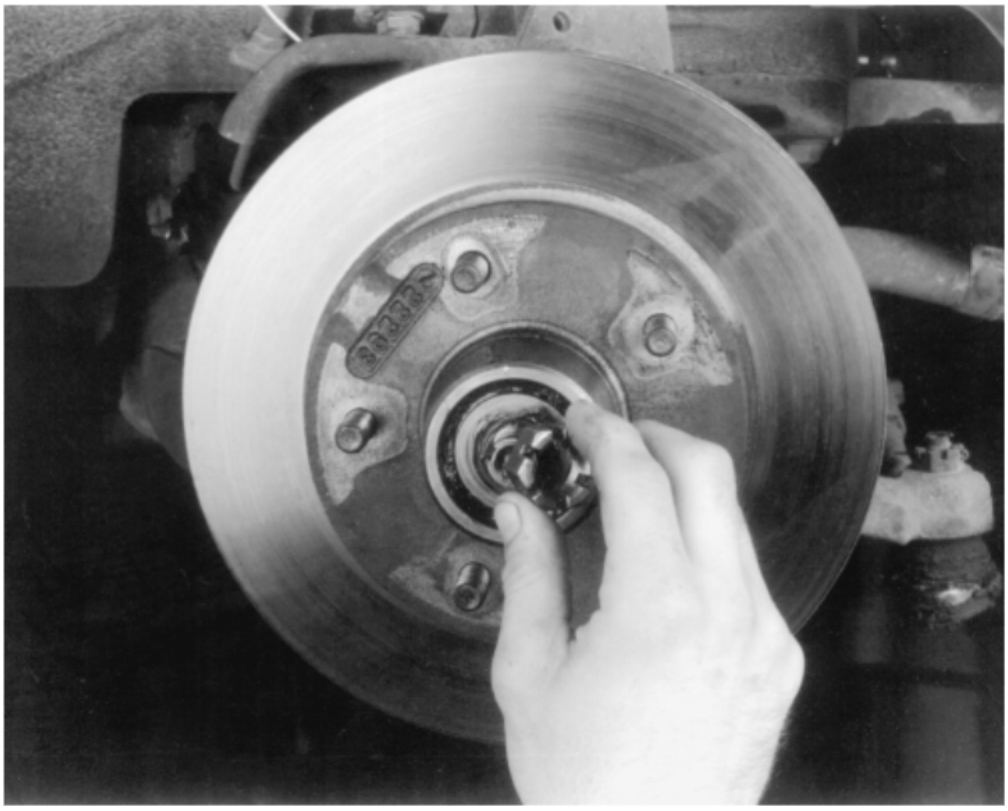


Fig. 4: Removing the spindle nut

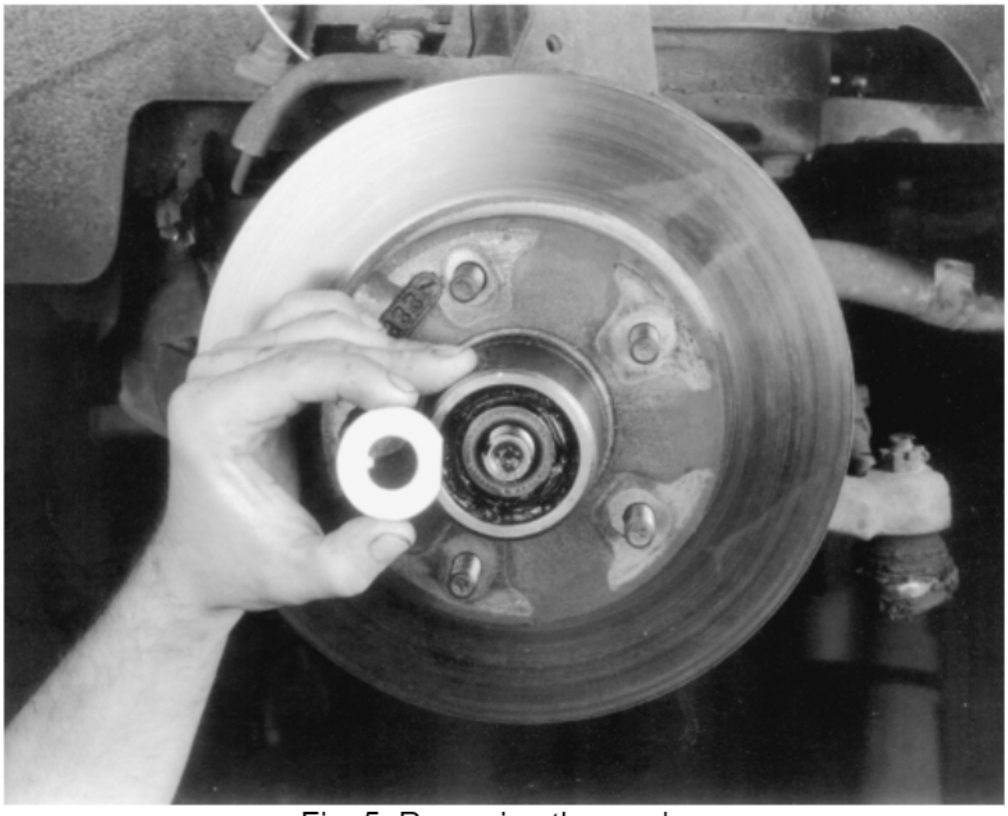


Fig. 5: Removing the washer

CAUTION - Brake pads contain asbestos, which has been determined to be a cancer causing agent. Never clean the brake surfaces with compressed air!

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Avoid inhaling any dust from any brake surface! When cleaning brake surfaces, use a commercially available brake cleaning fluid.

1. Remove the caliper by following instructions of caliper removal procedure.
2. Remove dust cap, cotter pin, castle nut, thrust washer and outside wheel bearing. Pull the disc/hub assembly from the steering knuckle.

To install:

3. Position the disc/hub assembly to the spindle/steering knuckle. Install the outside wheel bearing, thrust washer and castle nut. Tighten the castle nut until the bearing is snug. Back off the nut $^{1}/_{4}$ turn. Refer to Suspension & Steering for details on wheel bearing removal, installation, and adjustment. Install a new cotter pin and dust cap.
4. Install the brake caliper.

INSPECTION

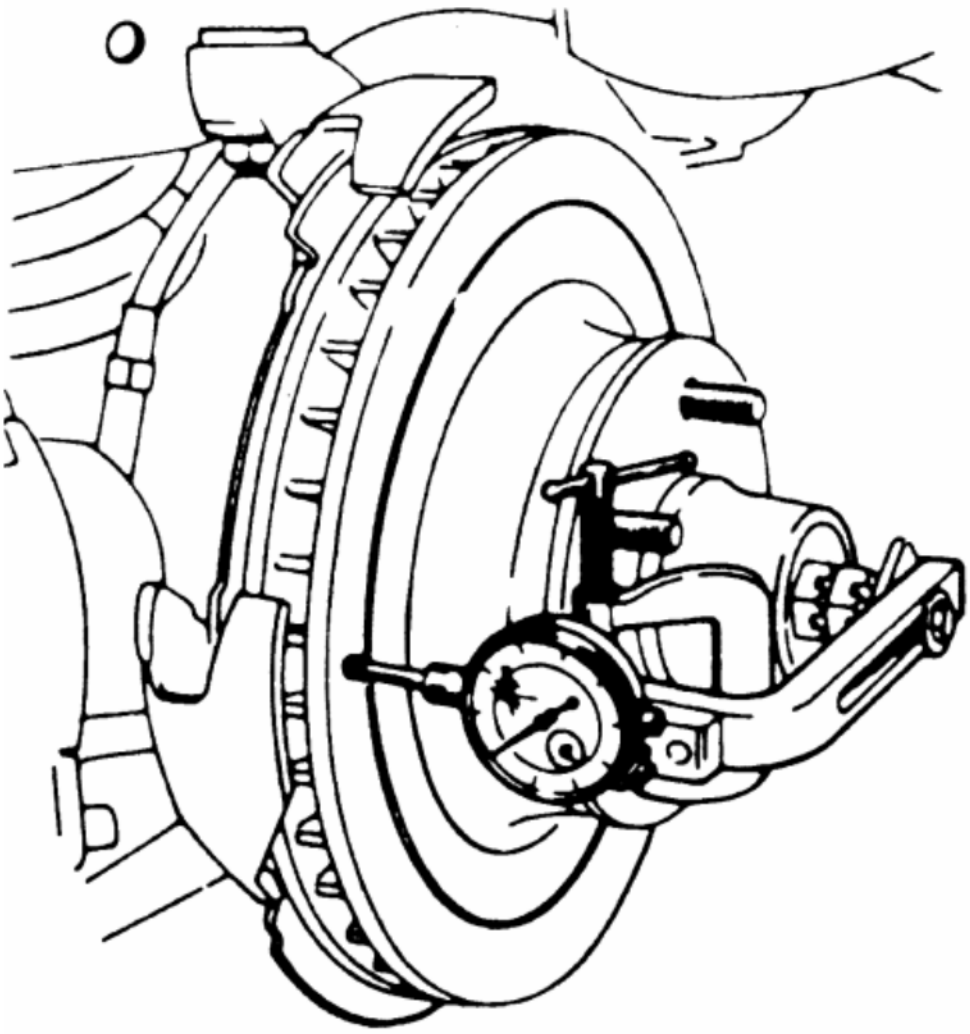


Fig. 6: Checking disc runout

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1. Check the rotor surface for wear, scoring, grooves or rust pitting. Rotor damage can be corrected by refacing, consult your local garage or machine shop. If the damage exceeds the minimum thickness, which is stamped on the rotor, replace the rotor.
2. Check the rotor parallelism at four or more points around the circumference, it must not vary more than 0.0005 in. (0.013mm). Make all measurements at the same distance in from the edge of the rotor. Refinish the rotor if it fails to meet specification.
3. Measure the disc runout with a dial indicator. If runout exceeds 0.004 in. (0.10mm), and the wheel bearings are okay (runout is measured with the disc on the car), the rotor must be refaced or replaced.

REAR DRUM BRAKES

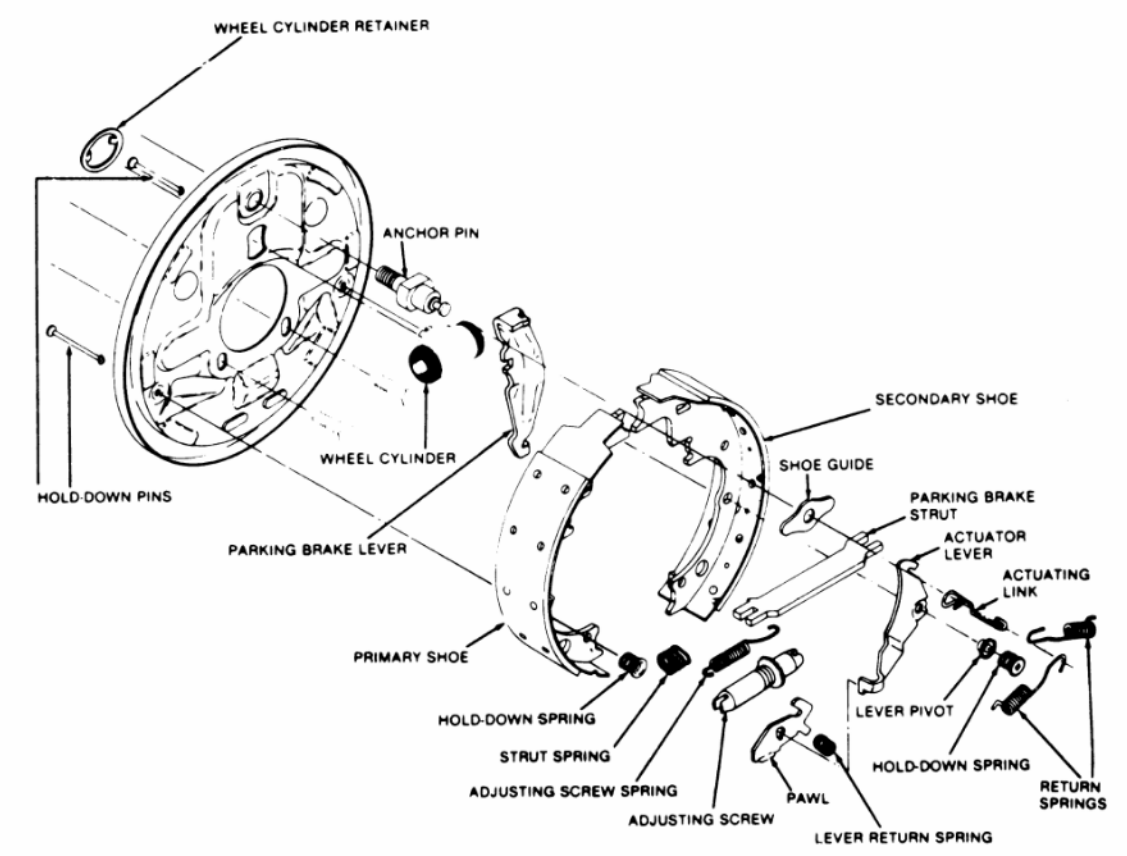


Fig. 1: Drum brake exploded view

BRAKE DRUMS

REMOVAL & INSTALLATION

CAUTION - Brake shoes may contain asbestos, which has been determined to be a cancer causing agent. Never clean the brake surfaces with compressed air! Avoid inhaling any dust from any brake surface! When cleaning brake surfaces, use a commercially available brake cleaning fluid.

1. Raise and support the car.

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2. Remove the wheel or wheels.
3. Pull the brake drum off. It may be necessary to gently tap the rear edges of the drum to start it off the studs.
4. If extreme resistance to removal is encountered, it will be necessary to retract the adjusting screw. Knock out the access hole in the backing plate and turn the adjuster to retract the linings away from the drum.
5. Install a replacement hole cover before reinstalling drum.
6. Install the drums in the same position on the hub as removed.

DRUM INSPECTION

1. Check the drums for any cracks, scores, grooves, or an out-of-round condition. Replace if cracked. Slight scores can be removed with fine emery cloth while extensive scoring requires turning the drum on a lathe.
2. Never have a drum turned more than 0.060 in. (1.524mm).

BRAKE SHOES

ADJUSTMENT

Rotate the star wheel adjuster until a slight drag is felt between the shoes and drum, then back off 12 clicks on the adjusting wheel. Put the car in reverse and, while backing up, apply the brakes several times. This will allow the self-adjusters to complete the adjustment.

REMOVAL & INSTALLATION

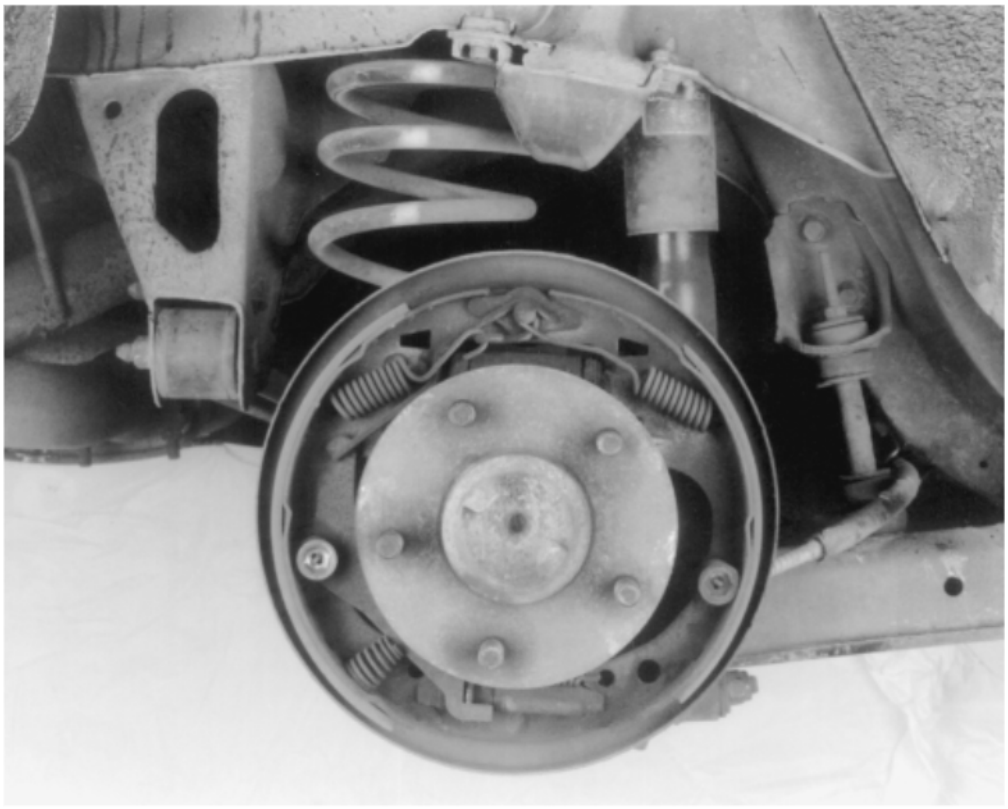


Fig. 1: Drum brake assembly

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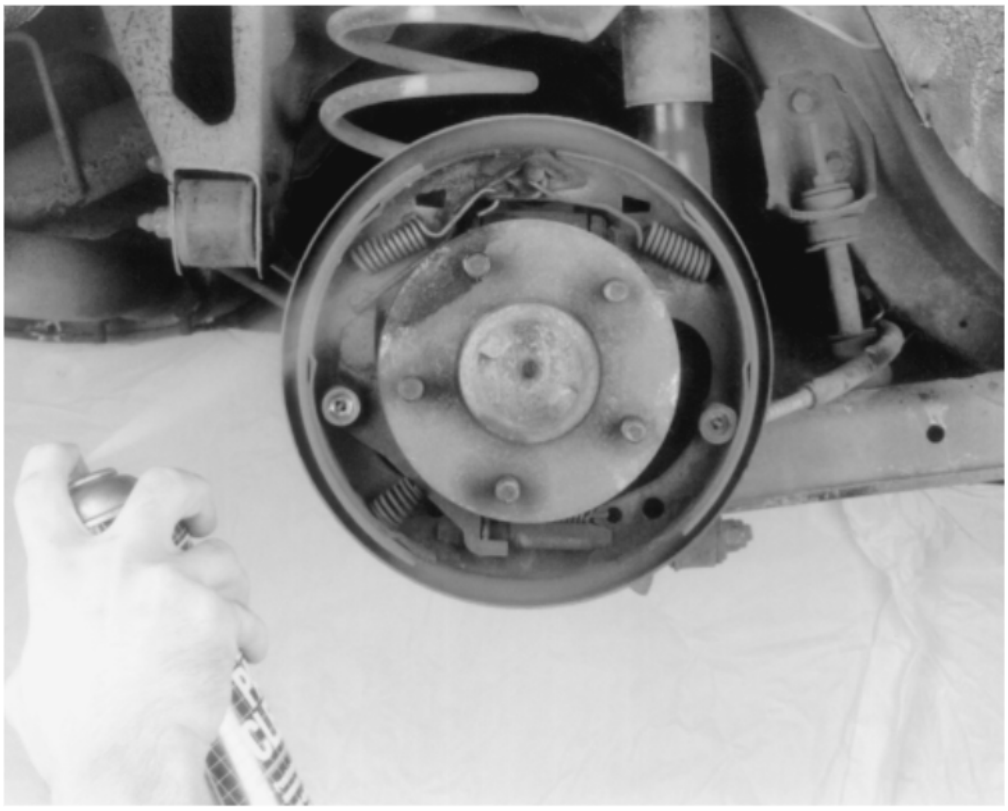


Fig. 2: Using a safe brake cleaning agent

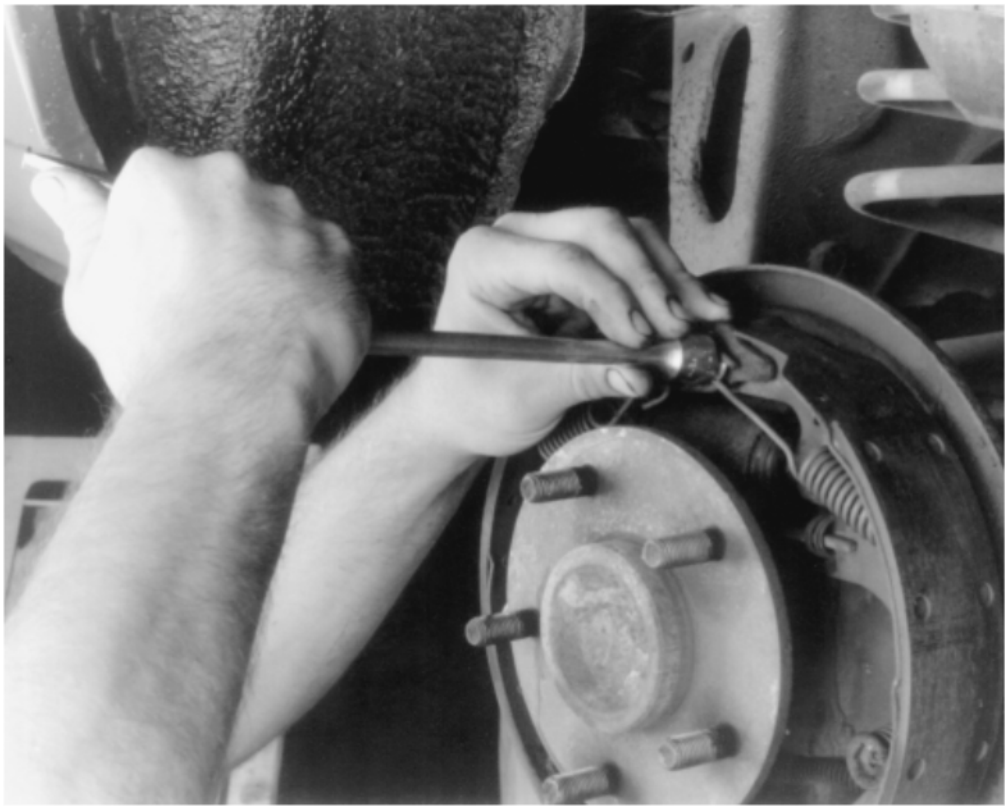


Fig. 3: Unclipping the return springs

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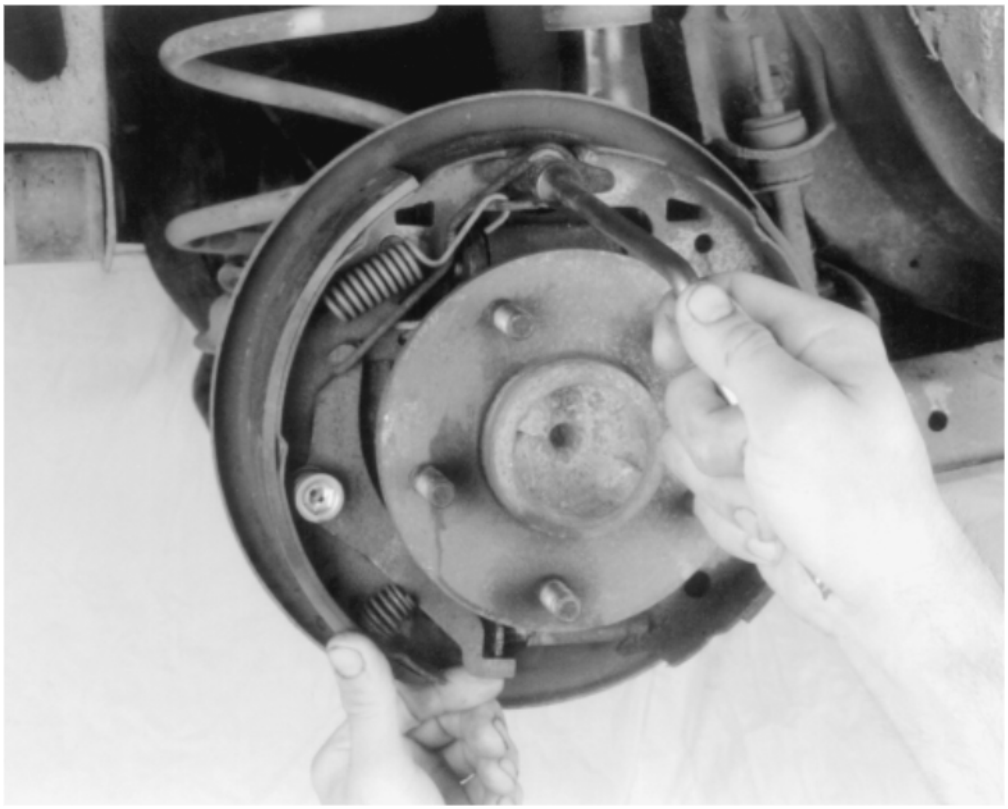


Fig. 4: Unclipping the parking brake cable rod

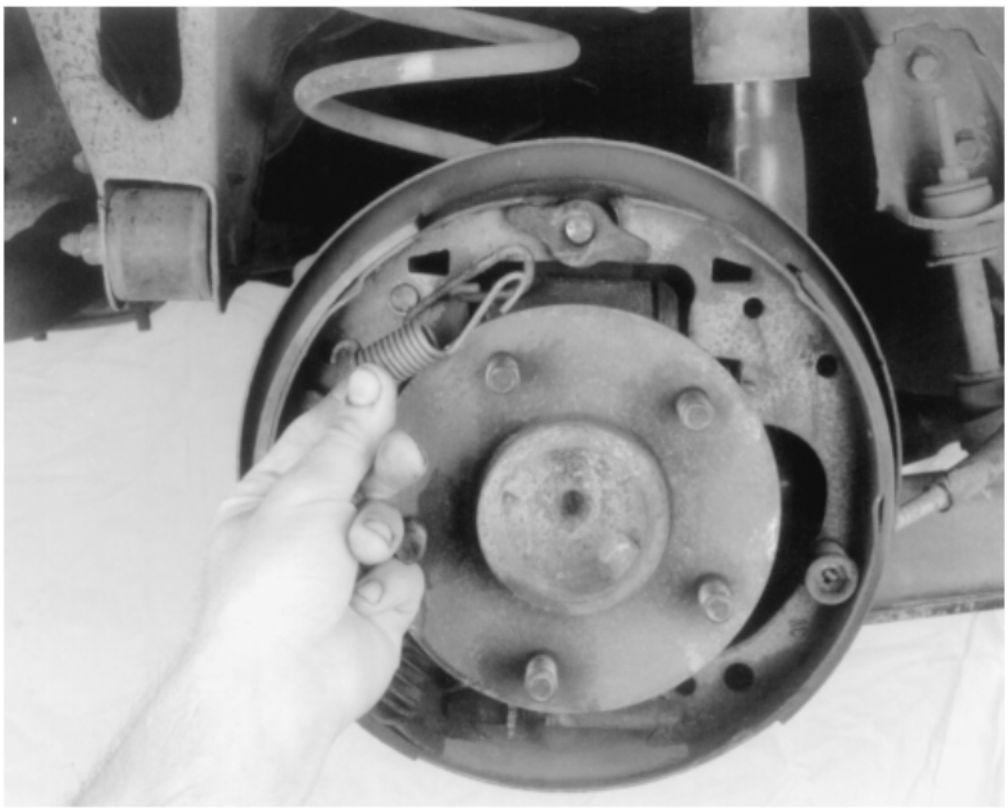


Fig. 5: Removing the rear return spring

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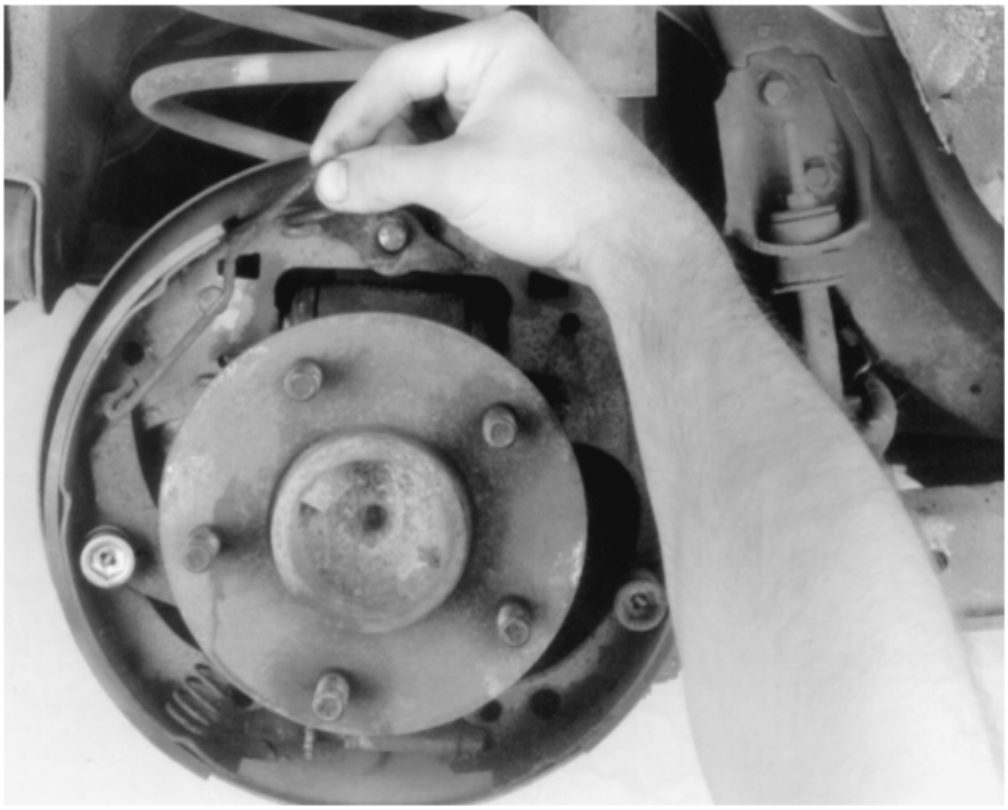


Fig. 6: Removing the parking brake rod

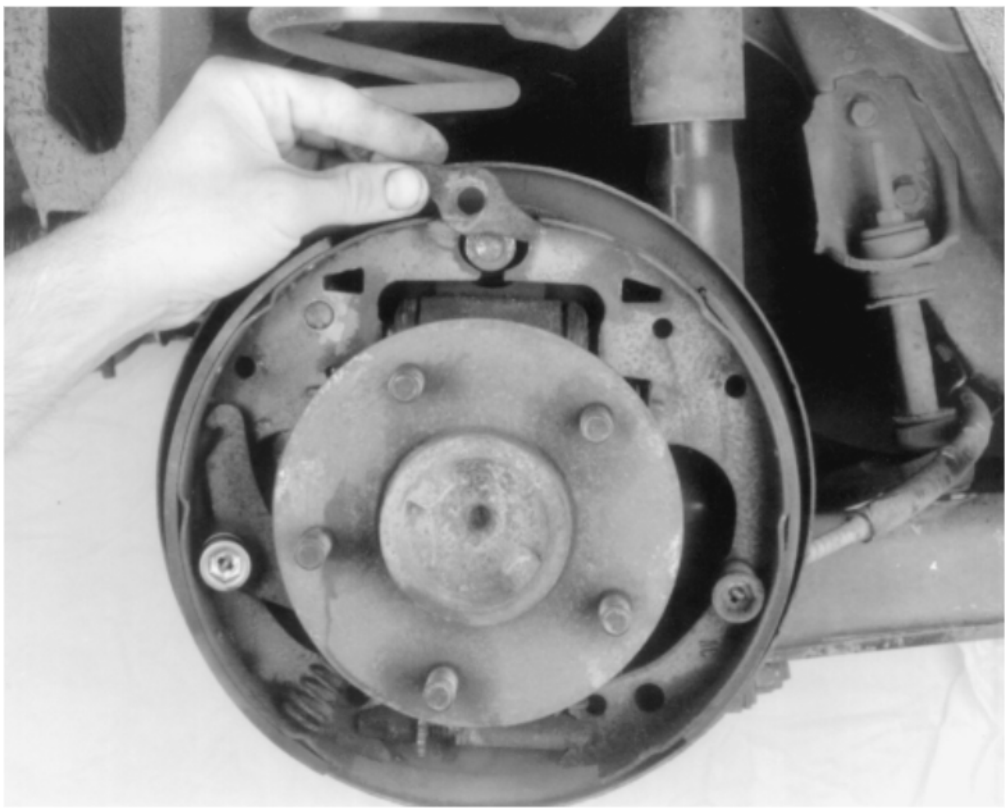


Fig. 7: Removing the shoe guide plate

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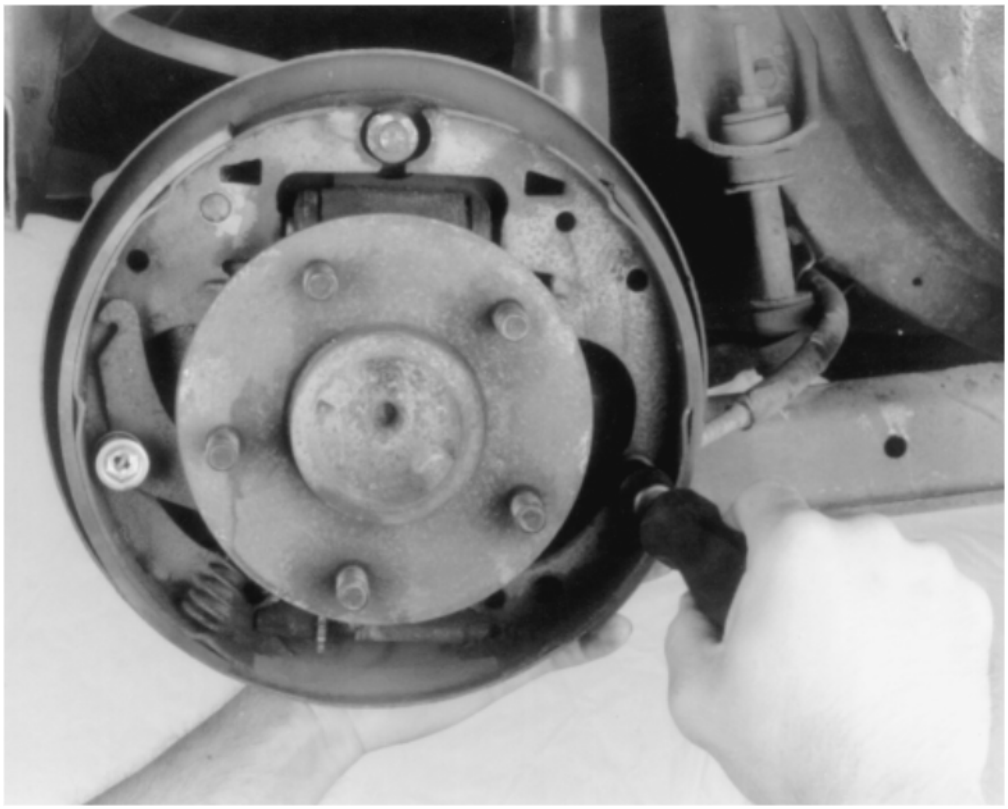


Fig. 8: Turning the hold-down spring lock plate



Fig. 9: Removing the hold-down springs

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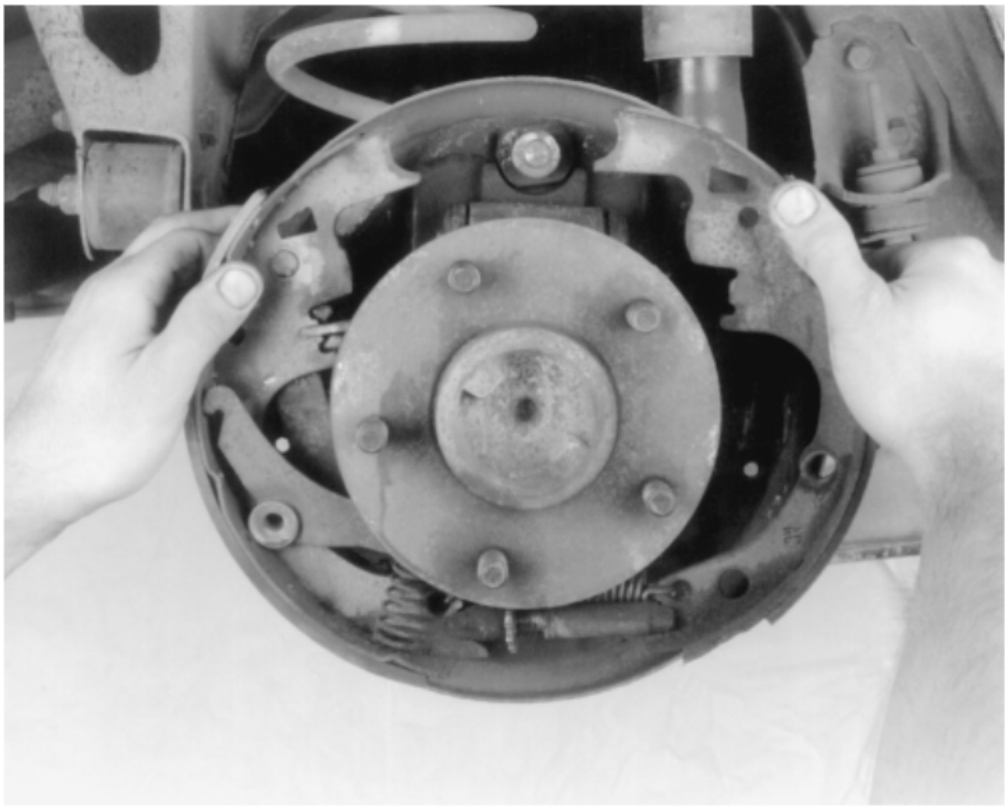


Fig. 10: Pulling off the shoes

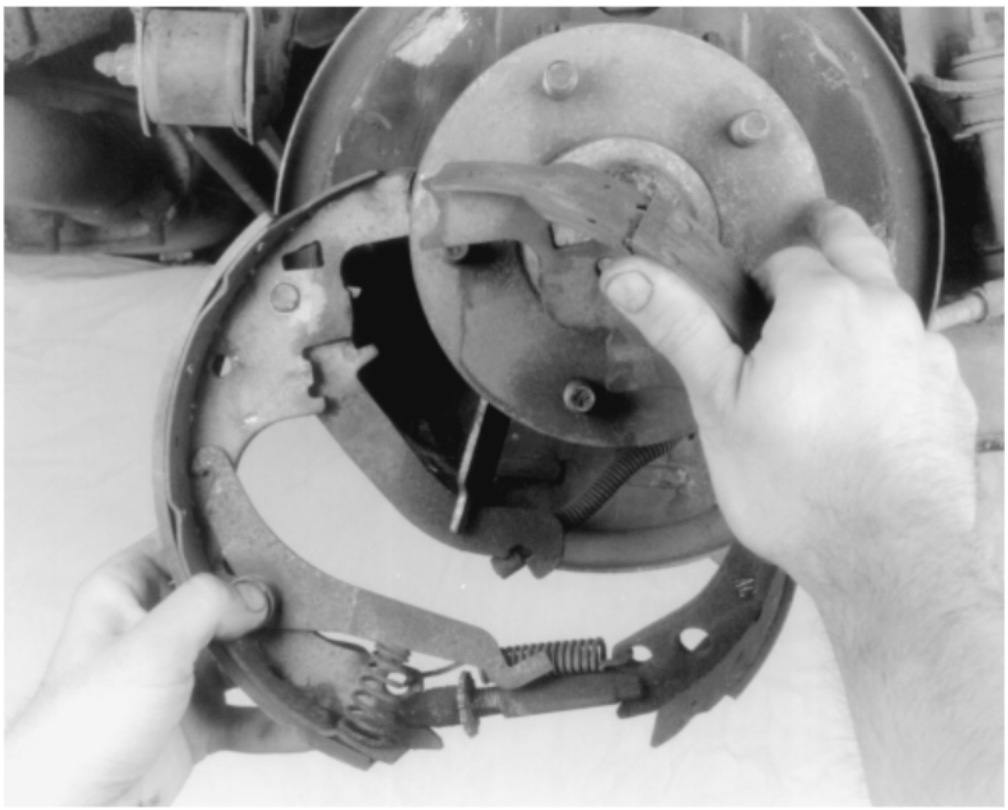


Fig. 11: Separating the shoes and lower spring

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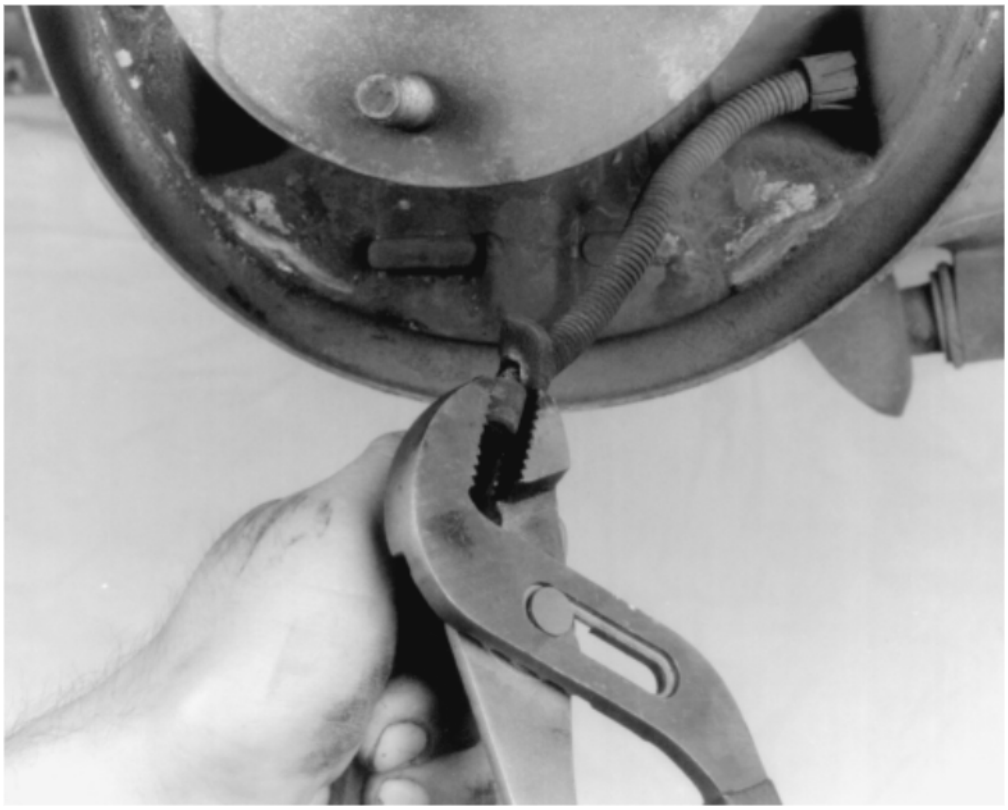


Fig. 12: Disconnecting the parking brake cable from the shoe lever

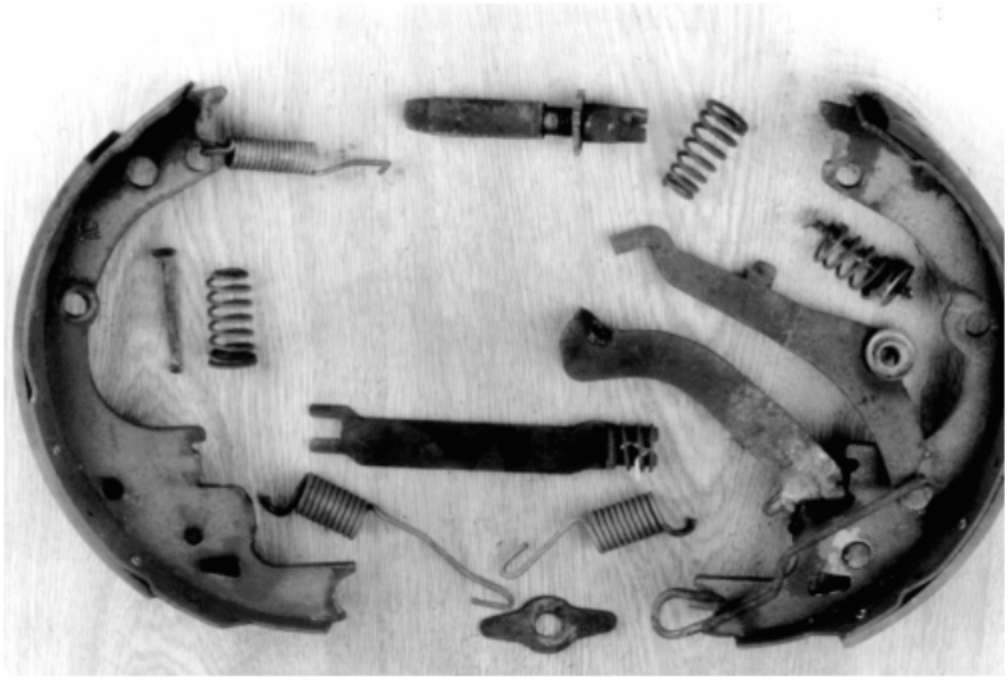


Fig. 13: Drum brake parts

CAUTION - Brake shoes may contain asbestos, which has been determined to be a cancer causing agent. Never clean the brake surfaces with compressed air! Avoid inhaling any dust from any brake surface! When cleaning brake surfaces, use a commercially available brake cleaning fluid.

1. Raise and safely support the vehicle.

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2. Remove the wheel and tire assemblies.
3. Remove the brake drum.
4. Remove the return springs.
5. Remove the hold-down springs and pins. Remove the lever pivot.
6. Remove the actuator link while lifting up on the actuator lever.
7. Remove the actuator lever and lever return spring.
8. Remove the shoe guide, parking brake strut and strut spring.
9. Remove the brake shoes and disconnect the parking brake lever from the shoe.
10. Remove the adjusting screw assembly and spring. Remove the retaining ring, pin from the secondary shoe.

To install:

Any part or spring which may appear worn should be replace. The short shoe (primary) should be installed to the front of the vehicle and the long shoe (secondary) should be installed to the rear. After complete installation of the brake shoes a clicking sound should be heard when turning the adjusting screw or self-adjuster. Do not switch parts from the left or right brake assembly, the adjusters are designated Left and Right.

11. Clean dirt from all parts and wire brush raised pads on backing plate. Lubricate backing plate pads and adjusting screw with brake grease.
12. Install the parking brake lever on the secondary shoe with the pin and new retaining ring.
13. Install the adjusting screw and spring. Lubricate the adjusting screw with brake (white) grease.
14. Clean and lubricate the contact points of the backing plate. Install the brake shoe assemblies after installing the parking brake cable on the shoe.
15. Install the parking brake strut and strut spring by spreading the shoes apart.
16. Install the shoe guide, actuator lever and lever return spring.
17. Install the hold-down pins, lever pivot and springs. Install the actuator link on the anchor pin.
18. Install the actuator link into the actuator lever while holding up on the lever.
19. Install the shoe return springs. Install the brake drum. Install the wheel and tire assemblies.
20. Adjust the brake and lower the vehicle. Check emergency brake for proper adjustment.

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WHEEL CYLINDERS

REMOVAL & INSTALLATION

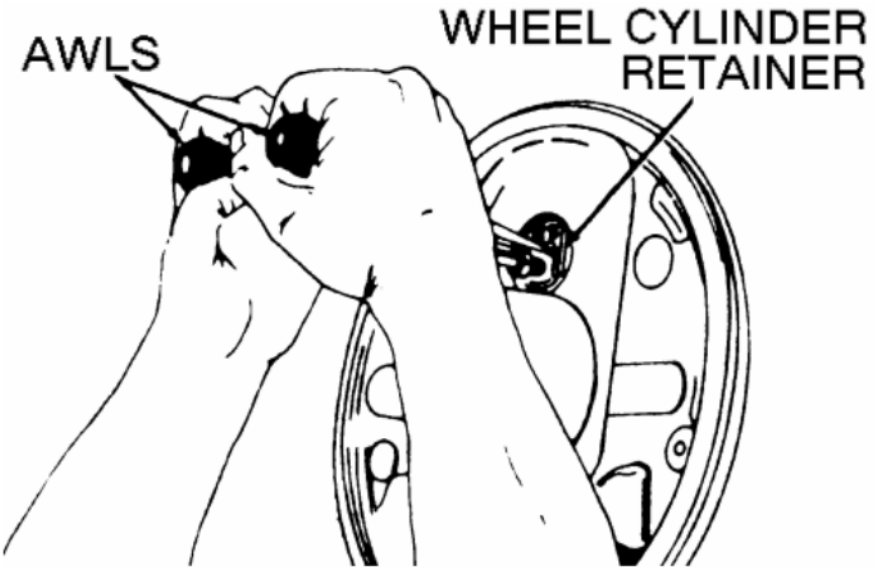


Fig. 1: Wheel cylinder removal using 2 awls

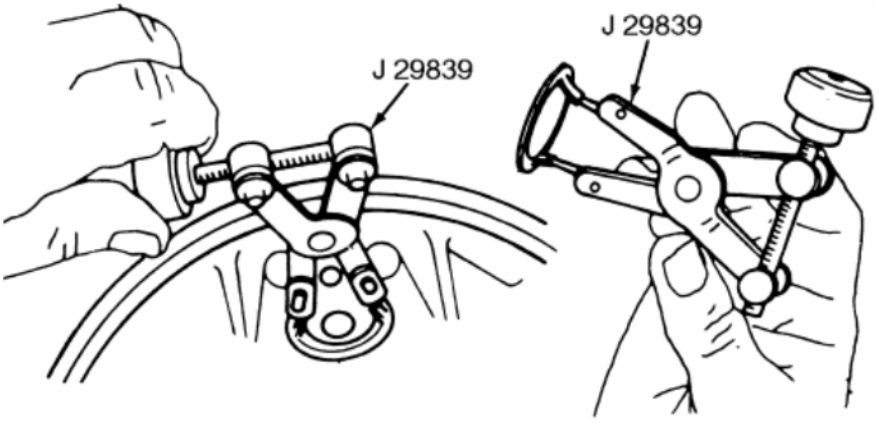


Fig. 2: Wheel cylinder removal using the special tool

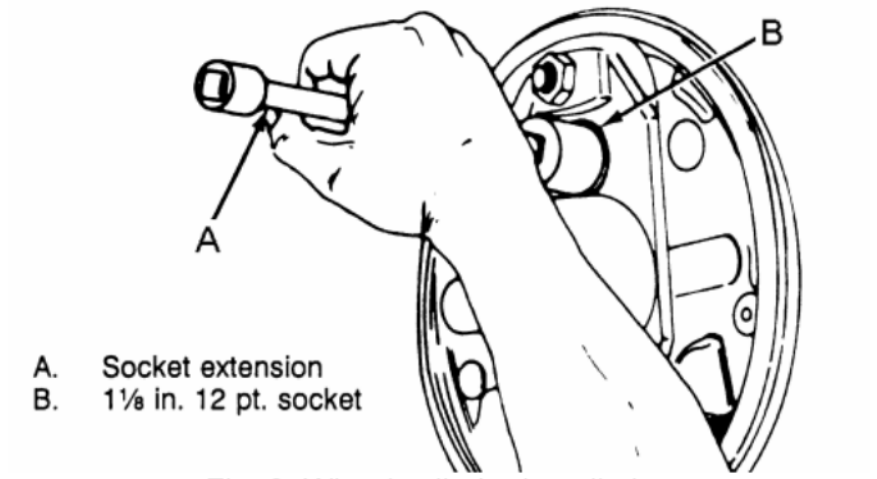


Fig. 3: Wheel cylinder installation

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CAUTION - Brake shoes may contain asbestos, which has been determined to be a cancer causing agent. Never clean the brake surfaces with compressed air! Avoid inhaling any dust from any brake surface! When cleaning brake surfaces, use a commercially available brake cleaning fluid.

1. Raise and support the car. Remove the wheel. Remove the brake shoes by following the Brake Shoe Replacement procedure.
2. Remove dirt from around the wheel cylinder inlet and pilot. Disconnect the inlet tube.
3. Using 2 awls, $^{1}/_{8}$ in. (3mm) in diameter, or J29839, remove the wheel cylinder retainer. Insert the awls into the access slots between the wheel cylinder pilot and retainer. Simultaneously, bend both tabs away from each other. Remove the wheel cylinder.

To install:

4. Place wheel cylinder into position and place a block of wood between it and the axle flange. Install a new retainer over the end of the wheel cylinder. Using a $1^{1}/_{8}$ in. 12-point socket with an extension, drive the new retainer into position.
5. Connect the inlet tube and torque 120-280 inch lbs. (13.6-20 Nm). Complete installation by reversing the removal procedure. Bleed the brakes.

OVERHAUL

Wheel cylinder overhaul kits may be available, but often at little or no savings over a reconditioned wheel cylinder. It often makes sense with these components to substitute a new or reconditioned part instead of attempting an overhaul.

If no replacement is available, or you would prefer to overhaul your wheel cylinders, the following procedure may be used. When rebuilding and installing wheel cylinders, avoid getting any contaminants into the system. Always use clean, new, high quality brake fluid. If dirty or improper fluid has been used, it will be necessary to drain the entire system, flush the system with proper brake fluid, replace all rubber components, then refill and bleed the system.

1. Remove the wheel cylinder from the vehicle and place on a clean workbench.
2. First remove and discard the old rubber boots, then withdraw the pistons. Piston cylinders are equipped with seals and a spring assembly, all located behind the pistons in the cylinder bore.

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Fig. 4: Remove the outer boots from the wheel cylinder

3. Remove the remaining inner components, seals and spring assembly. Compressed air may be useful in removing these components. If no compressed air is available, be VERY careful not to score the wheel cylinder bore when removing parts from it. Discard all components for which replacements were supplied in the rebuild kit.



Fig. 5: Compressed air can be used to remove the pistons and seals

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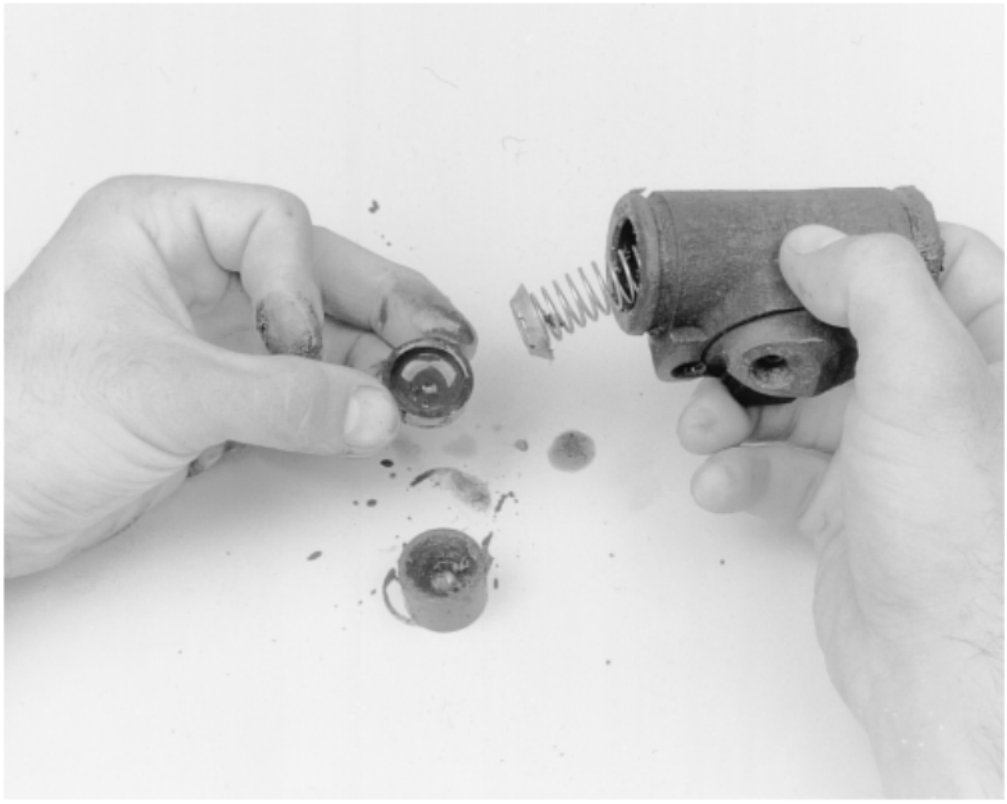


Fig. 6: Remove the pistons, cup seals and spring from the cylinder

4. Wash the cylinder and metal parts in denatured alcohol or clean brake fluid.



Fig. 7: Use brake fluid and a soft brush to clean the pistons ...

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Fig. 8: ... and the bore of the wheel cylinder

WARNING - Never use a mineral-based solvent such as gasoline, kerosene or paint thinner for cleaning purposes. These solvents will swell rubber components and quickly deteriorate them.

5. Allow the parts to air dry or use compressed air. Do not use rags for cleaning, since lint will remain in the cylinder bore.
6. Inspect the piston and replace it if it shows scratches.



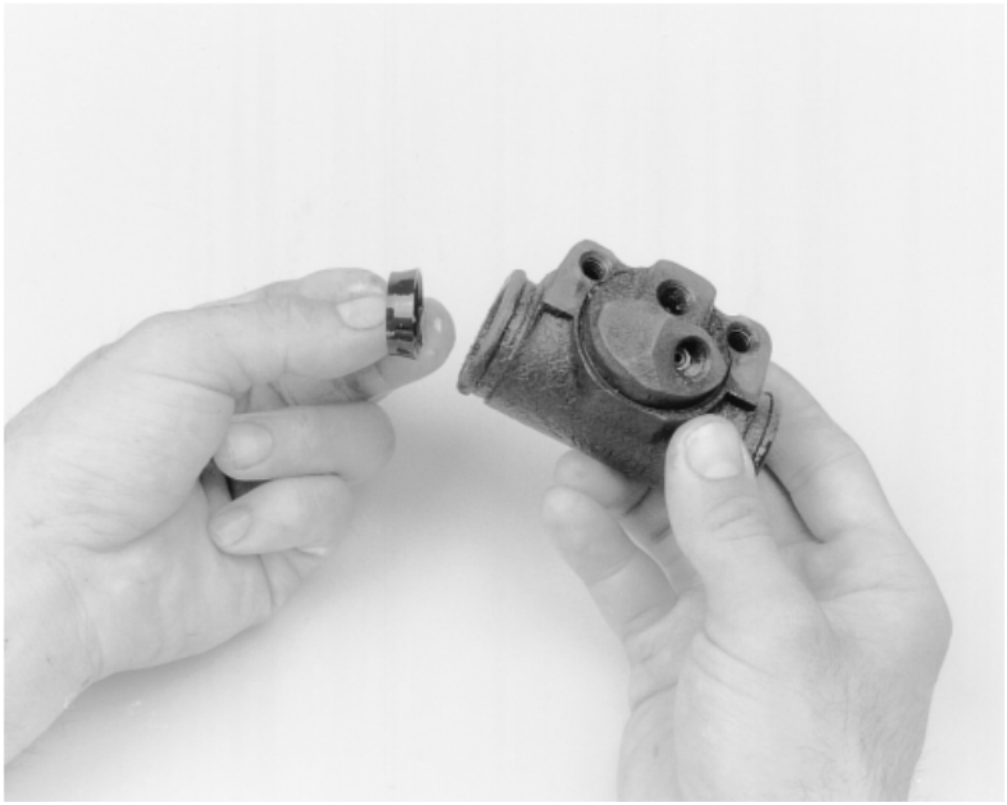
Fig. 9: Once cleaned and inspected, the wheel cylinder is ready for assembly

7. Lubricate the cylinder bore and seals using clean brake fluid.
8. Position the spring assembly.
9. Install the inner seals, then the pistons.

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Fig. 10: Lubricate the cup seals with brake fluid


Fig. 11: Install the spring, then the cup seals in the bore

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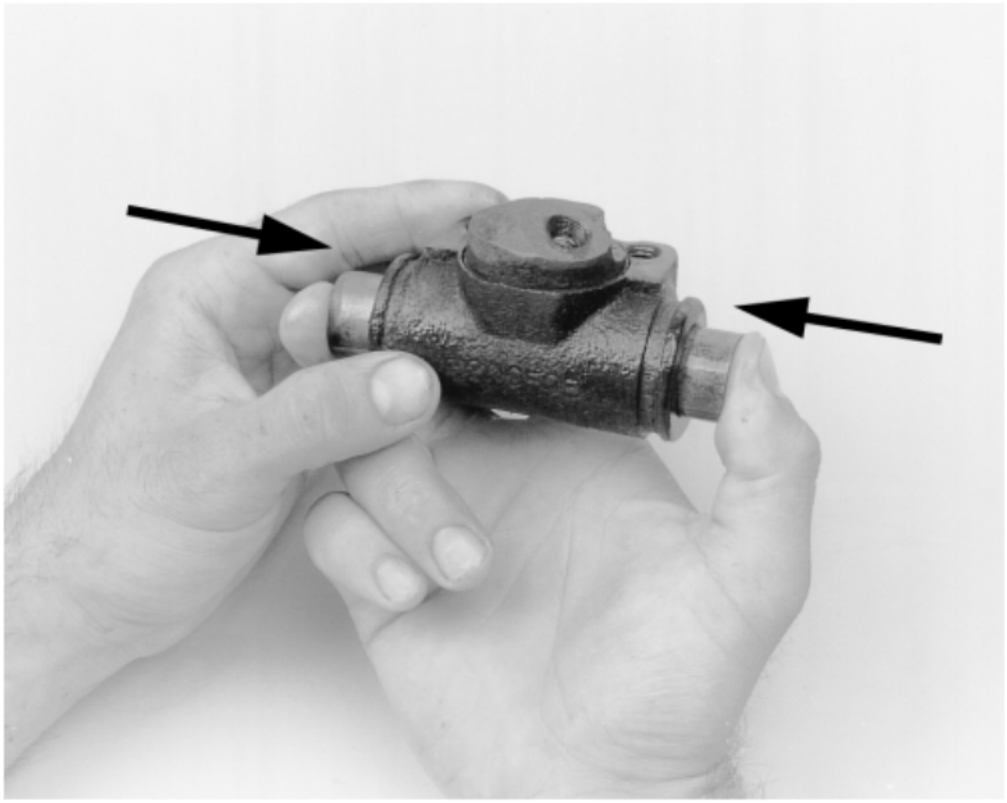


Fig. 12: Lightly lubricate the pistons, then install them

10. Insert the new boots into the counterbores by hand. Do not lubricate the boots.



Fig. 13: The boots can now be installed over the wheel cylinder ends

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11. Install the wheel cylinder.

REAR DISK BRAKES

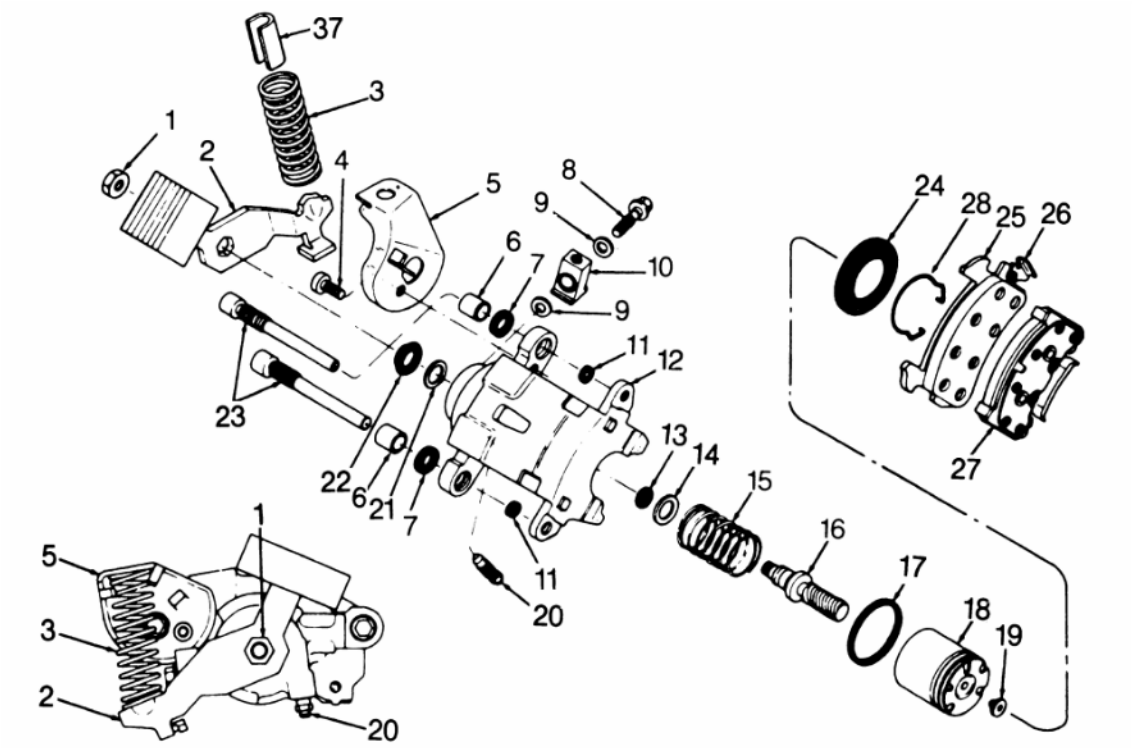
BRAKE PADS

INSPECTION

Refer to the Front Disc Brake Inspection procedure.

REMOVAL & INSTALLATION

1982-88 MODELS



1. Nut
2. Lever
3. Return spring
4. Bolt
5. Bracket
6. Sleeve
7. Bushing
8. Bolt
9. Copper washer
10. Fitting
11. Bushing
12. Caliper housing
13. Shaft seal
14. Thrust washer
15. Balance spring
16. Actuator screw
17. Piston seal
18. Piston assembly
19. Two-way check valve
20. Bleeder screw
21. Anti-friction washer
22. Lever seal
23. Mounting bolt
24. Boot
25. Inboard shoe & lining
26. Wear sensor
27. Outboard shoe & lining
28. Shoe dampening spring
29. Damper

Fig. 1: Exploded view of the rear disc brakes - 1982-88

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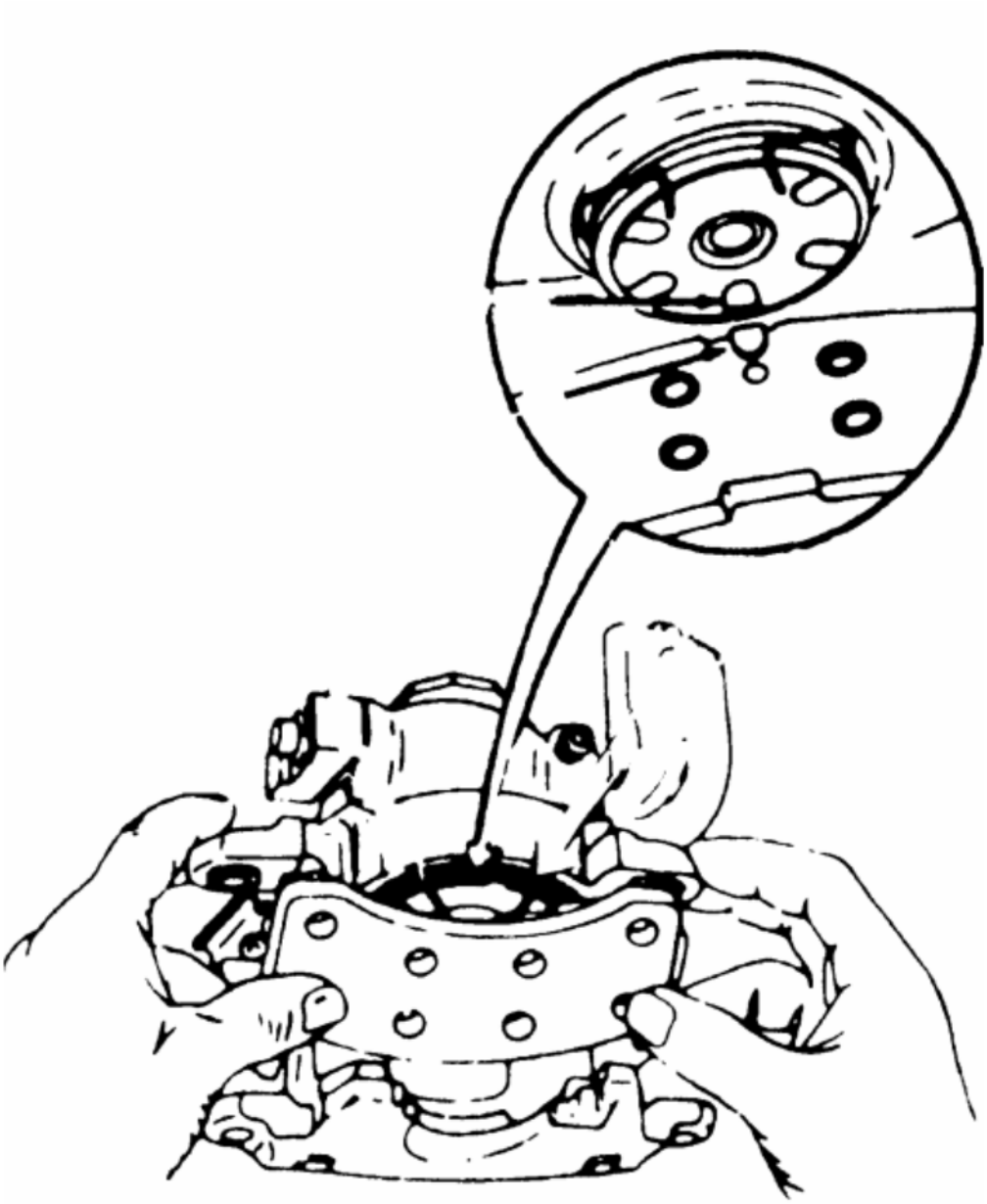


Fig. 2: Correct positioning of the inboard shoe

CAUTION - Brake pads contain asbestos, which has been determined to be a cancer causing agent. Never clean the brake surfaces with compressed air! Avoid inhaling any dust from any brake surface! When cleaning brake surfaces, use a commercially available brake cleaning fluid.

1. To remove the brake caliper, refer to the Rear Caliper Removal procedure.
2. Remove the brake pads from the calipers. Remove the sleeves from the mounting bolts and the bushings from the caliper.
3. Using a small screwdriver, remove the 2-way check valve from the end of the piston. Clean and check the valve for leakage.

If leakage is noted, the caliper must be overhauled.

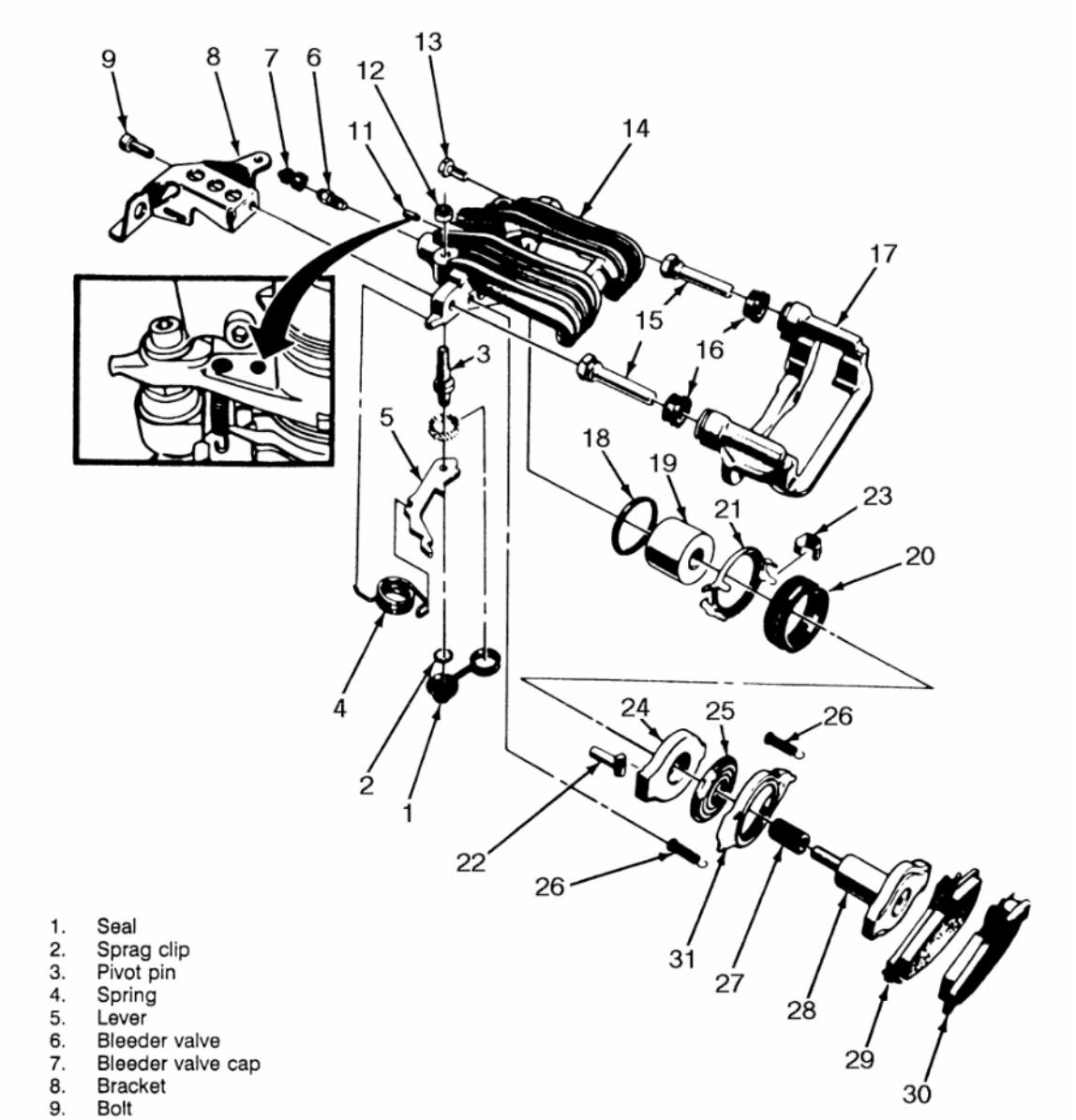
To install:

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4. Position the brake pads into the caliper. Lubricate and install new bushings, sleeves and check valve.
5. When installing the inner brake pad, make sure that the D-shaped tab of the pad engages with the D-shaped notch of the piston, as illustrated.
6. Upon installation of the inner pad, make sure that the wear sensor of the pad is at the leading edge of the shoe during forward wheel rotation. Slide the metal edge of the pad under the ends of the dampening spring and snap the pad into position against the piston.
7. Install the outer pad and caliper. After installing the caliper, apply the brakes, then bend the ears of the outer pad against the caliper and ensure that there is no excessive clearance.

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1989-92 MODELS



1. Seal
2. Sprag clip
3. Pivot pin
4. Spring
5. Lever
6. Bleeder valve
7. Bleeder valve cap
8. Bracket
9. Bolt
10. Adjuster screw
11. Nut
12. Bolt
13. Caliper housing
14. guide pin
15. Boot
16. Bracket
17. Seal
18. Piston
19. Boot
20. Retainer
21. Pushrod
22. Preload spring
23. Actuating collar
24. Boot
25. Return spring
26. Bushing
27. Clamp rod
28. Inboard shoe & lining
29. Outboard shoe & lining
30. Retainer

Fig. 3: Exploded view of the rear disc brakes - 1989-92

1. Remove $^{2}/_{3}$ of the brake fluid from the master cylinder reservoir.
2. Raise and safely support the vehicle.
3. Remove the wheel and tire assembly. Install 2 wheel nuts to retain the rotor.

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4. Position a C-clamp and tighten until the piston bottoms in the base of the caliper housing. Make sure 1 end of the C-clamp rests on the inlet fitting bolt and the other against the outboard disc brake pad.

It is not necessary to remove the parking brake caliper lever return spring to replace the disc brake pads.

5. Remove the upper caliper guide pin bolt and discard.
6. Rotate the caliper housing. Be careful not to strain the hose or cable conduit.
7. Remove the disc brake pads.

To install:

8. Clean all residue from the pad guide surfaces on the mounting bracket and caliper housing. Inspect the guide pins for free movement in the mounting bracket. Replace the guide pins or boots, if they are corroded or damaged.
9. Install the disc brake pads. The outboard pad with insulator is installed toward the caliper housing. The inboard pad with the wear sensor is installed nearest the caliper piston. The wear sensor must be in the trailing position with forward wheel rotation.
10. Rotate the caliper housing into it's operating position. The springs on the outboard brake pad must not stick through the inspection hole in the caliper housing. If the springs are sticking through the inspection hole in the caliper housing, lift the caliper housing and make the necessary corrections to the outboard brake pad positions.
11. Install a new upper caliper guide pin bolt and tighten to 26 ft. lbs. (35 Nm). Tighten the lower caliper guide pin bolt to 16 ft. lbs. (22 Nm).
12. With the engine running, pump the brake pedal slowly and firmly to seat the brake pads.
13. Check the caliper parking brake levers to make sure they are against the stops on the caliper housing. If the levers are not on their stops, check the parking brake adjustment.
14. Remove the 2 wheel nuts from the rotor and install the wheel and tire assembly.
15. Lower the vehicle, check the master cylinder fluid level and road test the vehicle.

BRAKE CALIPER

REMOVAL & INSTALLATION

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1982-88 MODELS

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1. Remove $^{2}/_{3}$ of the brake fluid from the master cylinder. Raise the car. Remove the wheel. Reinstall a wheel nut, with the flat side toward the rotor, to hold the rotor in place.
2. Loosen the parking brake cable at the equalizer. At the caliper, remove the parking brake cable, damper and spring from the lever.
3. Hold the parking brake lever and remove the lock nut. Remove the lever, seal and anti-friction washer.
4. Position a C-clamp over the caliper and force the piston into its bore. Remove the C-clamp. Reinstall the lever, seal and nut to the caliper.
5. Loosen the brake tube nut and disconnect the brake tube from the caliper. Plug the tube to prevent the loss of brake fluid.

At the right rear wheel, it may be necessary to remove the rear bolt from the lower control arm to allow the lower caliper mounting bolt to be removed.

6. Remove the mounting bolts using a $^{3}/_{8}$ in. Allen head socket. Remove the caliper and inspect the mounting bolts for corrosion. If necessary, replace the mounting bolts.

To install:

7. Place the caliper onto the rotor and install the mounting bolts. Torque the mounting bolts to 30-45 ft. lbs. (40.7-61 Nm).
8. Install a new anti-friction washer and lubricate the lever with silicone brake lube. Install the lever on the actuator with the lever pointing down. Rotate the lever toward the front of the car and hold while installing the nut. Torque the nut to 30-40 ft. lbs. (40.7-54.2 Nm), then rotate the lever back against the stop on the caliper.
9. Install damper and spring. Connect the parking brake cable. Tighten the cable at the equalizer until the lever starts to move off the stop on the caliper, then loosen the adjustment until the lever moves back against the stop.
10. Remove the nut holding the rotor in place and install the wheel. Lower the car and fill the master cylinder with brake fluid.

1989-92 MODELS

1. Raise and safely support the vehicle.
2. Loosen the parking brake cable at the equalizer.
3. Remove the wheel and tire assembly. Install 2 wheel nuts to retain the rotor.
4. Remove the bolt, inlet fitting and washers from the caliper housing. Plug the holes in the caliper housing and inlet fitting.
5. Remove the caliper lever return spring only if it is defective. Discard the spring if the coils are opened.
6. Disconnect the parking brake cable from the caliper lever and caliper bracket.
7. Remove the 2 caliper guide pin holes.
8. Remove the caliper housing from the rotor and mounting bracket.

To install:

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9. Inspect the guide pins and boots and replace if corroded, worn or damaged. Check the inlet fitting bolt for blockage.
10. Install the caliper housing over the rotor and into the mounting bracket. Install the 2 caliper guide pin bolts. Tighten the upper caliper guide pin bolt to 26 ft. lbs. (35 Nm) and the lower guide pin bolt to 16 ft. lbs. (22 Nm).
11. Connect the parking brake cable to the caliper bracket and caliper lever. Install the caliper lever return spring, if removed.
12. Install the inlet fitting, bolt and 2 new washers to the caliper housing. Tighten the bolt to 22 ft. lbs. (30 Nm).
13. Bleed the brake system.
14. Adjust the parking brake free travel if the caliper was overhauled.
15. Lower the vehicle and cycle the parking brake.
16. Raise and safely support the vehicle.
17. Inspect the caliper parking brake levers and ensure they are against the stops on the caliper housing. If the levers are not on their stop, refer to the parking brake adjustment.
18. Remove the 2 nuts securing the rotor and then install the wheel and tire assembly. Lower the vehicle.
19. With the engine running, pump the brake pedal slowly and firmly 3 times to seat the disc brake pads. Check the hydraulic system for leaks.

OVERHAUL

1982-88 MODELS

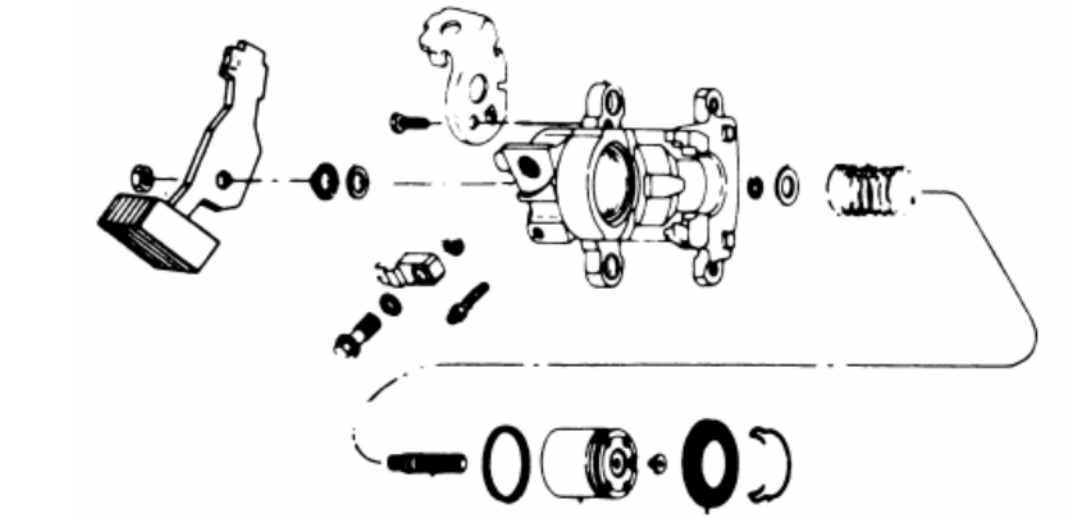


Fig. 1: Rear caliper exploded view

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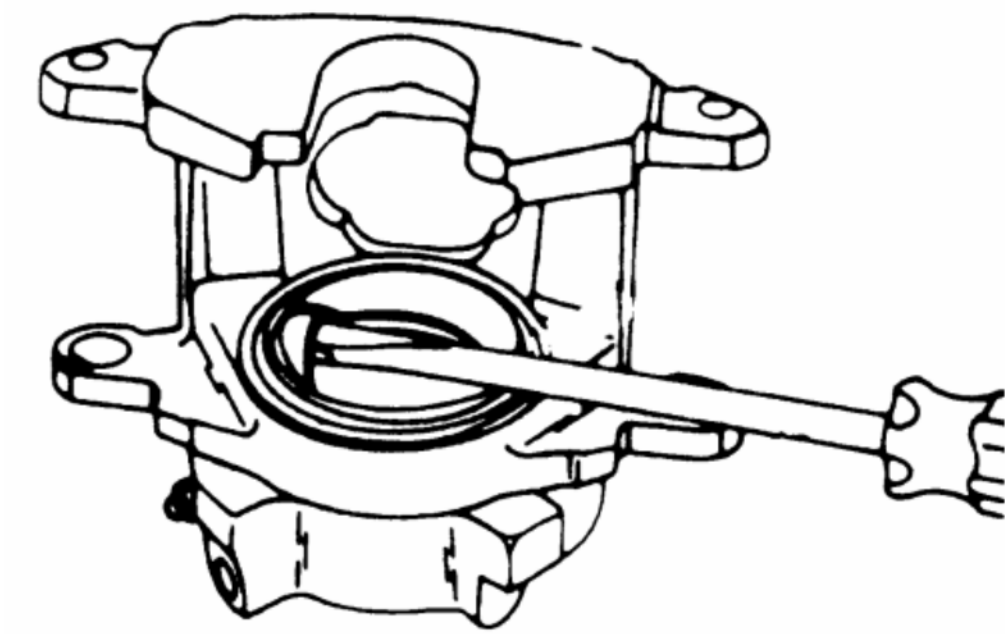


Fig. 2: Removing the boot

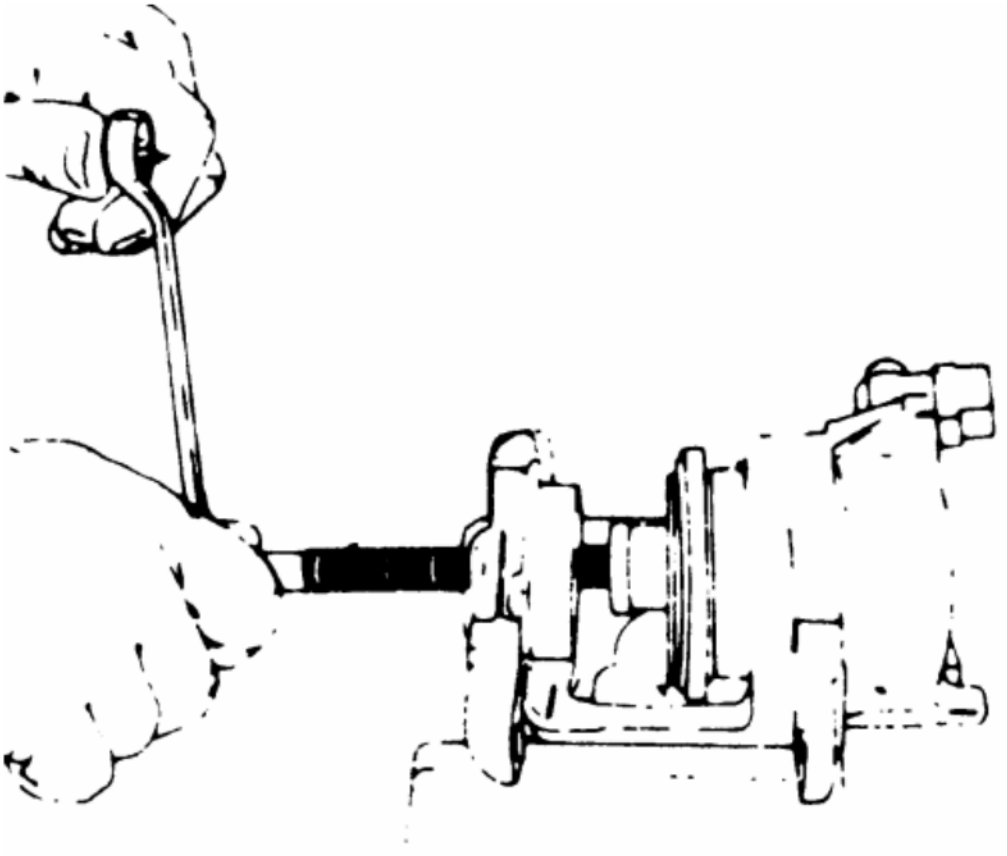


Fig. 3: Installing the piston

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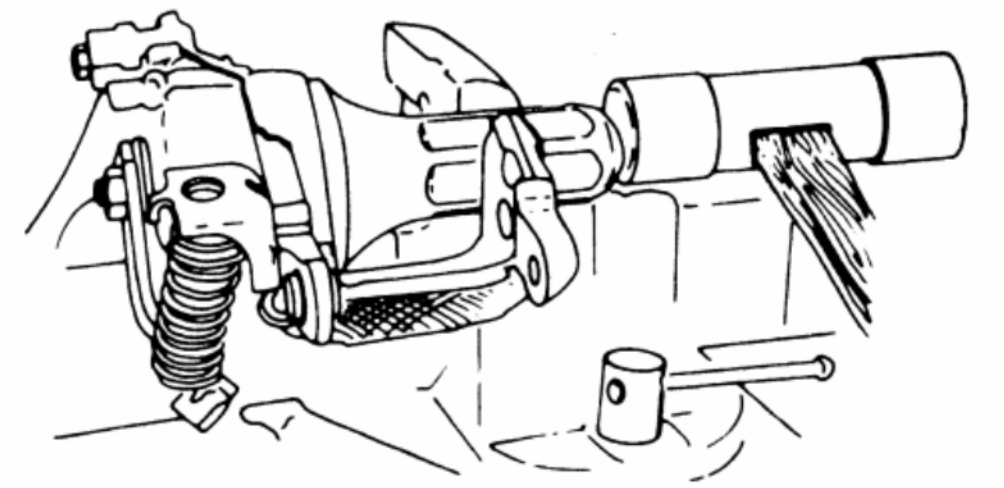


Fig. 4: Installing the boot

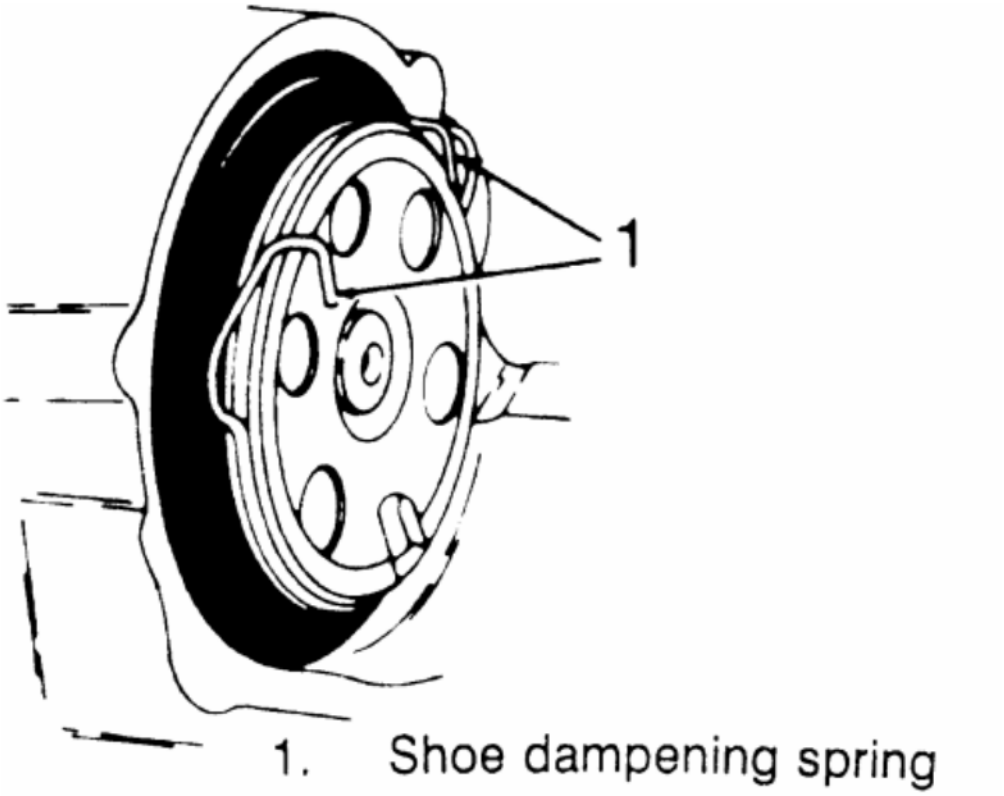


Fig. 5: Installing the damper spring

1. Remove the shoe dampening spring from the end of the piston.
2. Place the caliper in a vise. Move the parking brake lever back and forth to work the piston out of the caliper.

If the piston will not come out, remove the lever and use a wrench to rotate the adjusting screw. Rotate the screw in the direction of brake application. Remove the balance spring.

3. Remove the nut, lever, lever seal, and anti-friction washer.
4. Press on the threaded end of the actuator screw to remove it from the housing.

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5. Remove the shaft seal and washer.
6. Remove the dust boot. Be careful not to scratch the housing bore.
7. Remove the locator retainer if so equipped. Remove the piston locator if so equipped.
8. Remove the piston seal using a wooden or plastic tool.
9. Remove the bleeder screw, bolt, fitting, and copper washer. Remove the bracket only if it is damaged.
10. Inspect caliper bore for scoring, nicks, corrosion, and wear. Use crocus cloth for light corrosion. Replace caliper if bore will not clean up.

To install:

11. Replace the bleeder screw, bolt, fitting, and copper washer.
12. Install the piston. Lubricate seals and piston with brake fluid prior to reinstallation.
13. Install the locator retainer if so equipped. Install the piston locator if so equipped.
14. Install the dust boot.
15. Install the shaft seal and washer.
16. Install actuator screw to the housing.
17. Install the nut, lever, lever seal, and anti-friction washer. It may be necessary to rotate the parking brake lever away from the stop to install the nut. Torque the nut 30-40 ft. lbs. (41-54 Nm) and rotate the lever back to the stop.
18. Install the shoe dampening spring to the end of the piston.

It may be necessary to move the parking brake lever off the stop, extending the piston slightly, making the dampening spring groove accessible. If the piston is extended, push it back into the caliper before installing the caliper on the car.

1989-92 MODELS

1. Remove the caliper assembly. Remove the 2 collar return springs from the actuating collar. Remove the actuator collar assembly with parts attached out of the housing.
2. Remove the clamp rod and compliance bushing.
3. Remove the boot retainers, 2 boots and pushrod from the compliance bushing. Discard the retainers and boots.
4. Remove the preload spring from the retainer.
5. Using compressed air directed into the brake hose port, carefully extract piston.

CAUTION - Do not place fingers between piston and brake shoe flange, or personal injury may occur when piston breaks free from bore. Cover caliper assembly with a rag to prevent brake fluid from spraying when piston is extracted

6. Inspect and clean piston and bore assembly for cracks or scoring.
7. Remove the piston seal.
8. Remove the bleeder valve.

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9. Remove the caliper lever pivot pin seal, sprag clip, spring and lever. Discard the clip.
10. Inspect the caliper lever for worn spots, replace as necessary.
11. Remove the 2 guide pins from the mounting bracket.
12. Clean all parts not included in the rebuild kit in denatured alcohol. Use only dry filtered compressed air to dry parts. Replace the caliper housing if badly scored or corroded.

To install:

13. Lubricate the new piston seal with clean brake fluid. Place the seal into the caliper groove, making sure the seal is not twisted.
14. Install the piston. Lubricate seals and piston with brake fluid prior to reinstallation.
15. Assemble the pushrod, 2 new boots and new retainers to the actuating collar.
16. Lightly coat the actuating collar with the lubricant provided in the rebuild kit. Do not use any other type of lubricant.
17. Install the clamp retainers firmly against the actuating collar. Bend the tabs on the retainer to hold the assembly together.
18. Install the preload spring into the boot retainers.
19. Install the clamp rod to the actuating collar and boot. Lubricate the clamp rod with the lubricant supplied in the kit.
20. Slide the clamp rod through the holes in the boot and actuating collar. The boot must be against the reaction plate on the clamp rod.
21. Lubricate and install the new compliance bushing with the lubricant supplied in the kit.
22. Install the clamp rod with assembled parts into the connecting hole in the caliper piston.
23. Install a new bleeder valve.
24. Install the pivot pin and new nut into the housing, if removed.
25. Install the caliper pivot pin seal, parking brake lever, new sprag clip and spring, in that order. The teeth of the sprag clip must face away from the lever.
26. Install the 2 collar return springs to the retainer. The retainer must enter the return springs at the end of the second coil.
27. Install the adjuster screw into the caliper housing until the actuating collar is parallel to the piston bore face of the caliper housing.
28. Lubricate and then install the guide pins and boots. Install the pads and caliper assembly.
29. Bleed the brake system.

BRAKE DISC (ROTOR)

REMOVAL & INSTALLATION

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1. Raise and support the car. Remove the wheel.
2. Remove the caliper by referring to the Rear Caliper Removal procedure. Pull the brake disc from the axle.
3. To install, place the rotor onto the spindle and install caliper.
4. Install the wheel and lower the car.

INSPECTION

1. Raise and support the car. Remove the wheel. Replace wheel nuts to hold rotor in place.
2. Check the rotor surface for wear, scoring, grooves or rust pitting. Rotor damage can be corrected by refacing, consult your local garage or machine shop. If the damage exceeds the minimum thickness, which is stamped on the rotor, replace the rotor.
3. Using a dial indicator, check the rotor parallelism at several points around the circumference. The difference must not vary more than 0.0005 in. (0.013mm). Make all measurements at the same distance in from the edge of the rotor.
4. Using the same dial indicator, measure the rotor runout. The runout should not exceed 0.004 in. (0.10mm).
5. If any of these conditions are not met, reface or replace the rotor.

PARKING BRAKES

CABLES

REMOVAL & INSTALLATION

FRONT CABLE

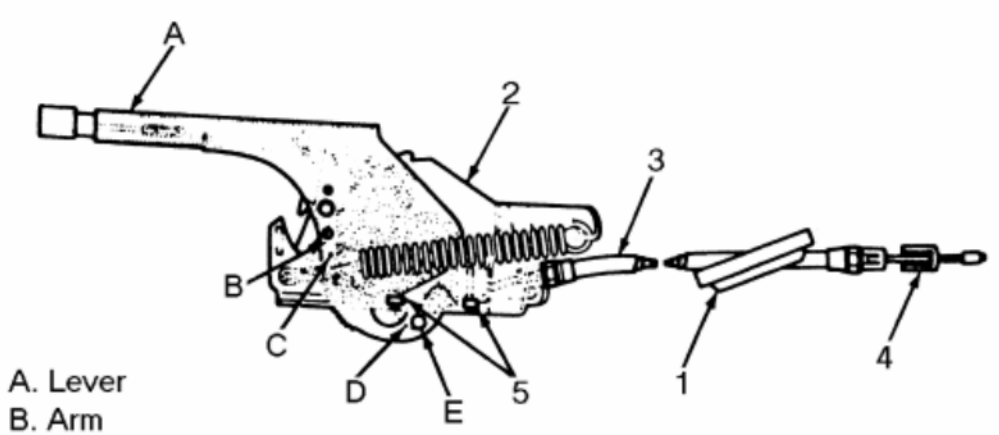


Fig. 1: Lever and front cable

1. Raise the car and support it with jackstands.

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2. Remove the adjusting nut at the equalizer.
3. Remove the spring retainer clip from the bracket.
4. Lower the car. Remove the upper console cover and lower console rear screws.
5. Lift the rear of the lower console for access to the cable retainer at the hand lever.
6. Remove the cable retainer pin, cable retainer, then the cable.

To install:

7. Position the cable retainer pin, cable retainer, then the cable.
8. Install the upper console cover and lower console rear screws. Raise the car and support it with jackstands.
9. Install the spring retainer clip from the bracket.
10. Install the adjusting nut at the equalizer.
11. Adjust the parking brake. Lower the car.

REAR CABLE

DRUM BRAKES

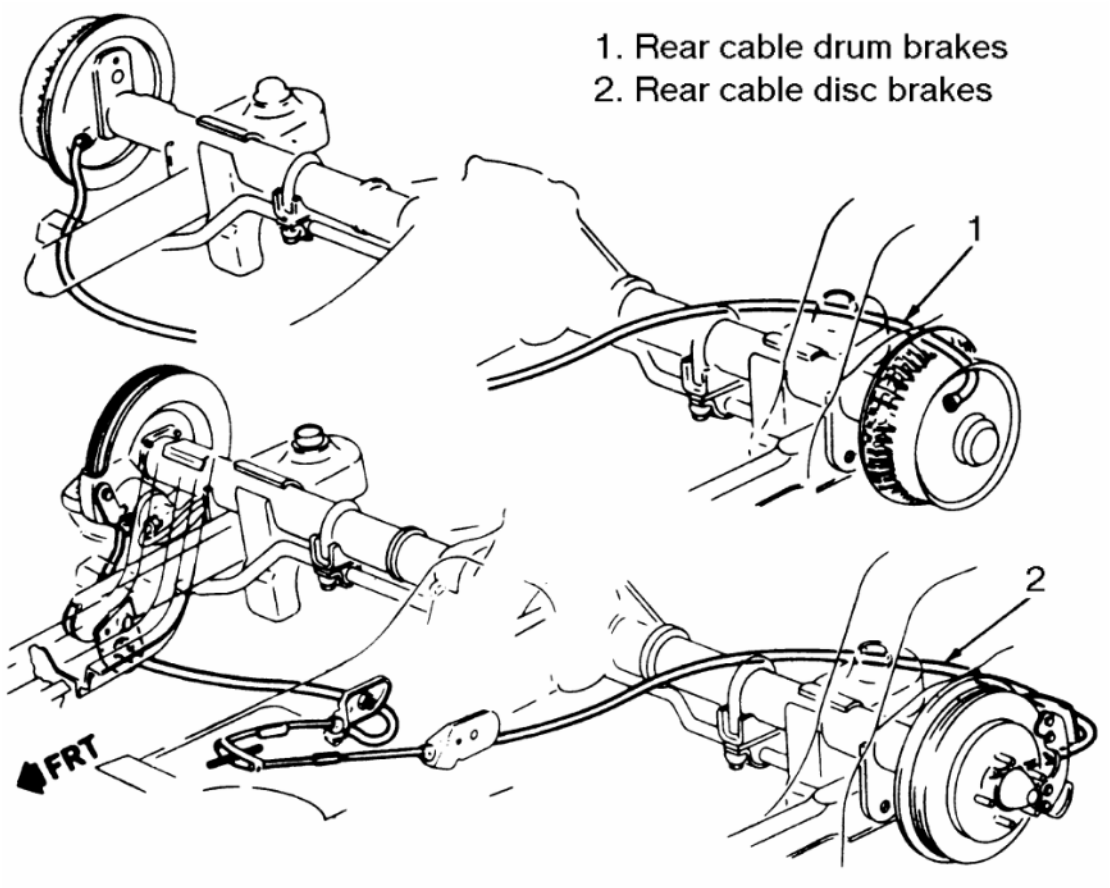


Fig. 2: Rear cables

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air! Avoid inhaling any dust from any brake surface! When cleaning brake surfaces, use a commercially available brake cleaning fluid.

1. Raise the car and support it with jackstands.
2. Loosen the adjusting nut at the equalizer.
3. Disengage the rear cable at the connector.
4. Remove the wheel assembly and brake drum.
5. Bend the retainer fingers.
6. Disengage the cable at the brake shoe operating lever.

To install:

7. Engage the cable at the brake shoe operating lever.
8. Bend the retainer fingers.
9. Install the wheel assembly and brake drum.
10. Engage the rear cable at the connector.
11. Adjust the parking brake by the adjusting nut at the equalizer.
12. Lower the car.

DISC BRAKES

1. Raise the car and support it with jackstands.
2. Loosen the adjusting nut at the equalizer.
3. Disengage the cable at the connector.
4. Push forward on the caliper parking brake apply lever. This allows the cable to be removed from the tang. Then, release the lever.
5. Pull on the caliper parking brake apply lever to engage the cable to the tang.
6. Engage the cable at the connector.
7. Adjust the parking brake cable by the adjusting nut at the equalizer.
8. Apply the parking brake 3 times with heavy pressure and repeat adjustment.
9. Lower the car.

ADJUSTMENT

The parking brake cable is adjustable only on 1982-89 vehicles. All 1990-92 vehicles feature a self-adjusting parking brake.

REAR DRUM BRAKES

1. Depress the parking brake lever exactly two ratchet clicks.
2. Raise the rear of the vehicle and support safely with jackstands.
3. Tighten the brake cable adjusting nut until the left rear wheel can be turned rearward with both hands, but locks when forward rotation is attempted.
4. Release the parking brake lever; both rear wheels must turn freely in either direction without brake drag.
5. Lower the vehicle.

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REAR DISC BRAKES

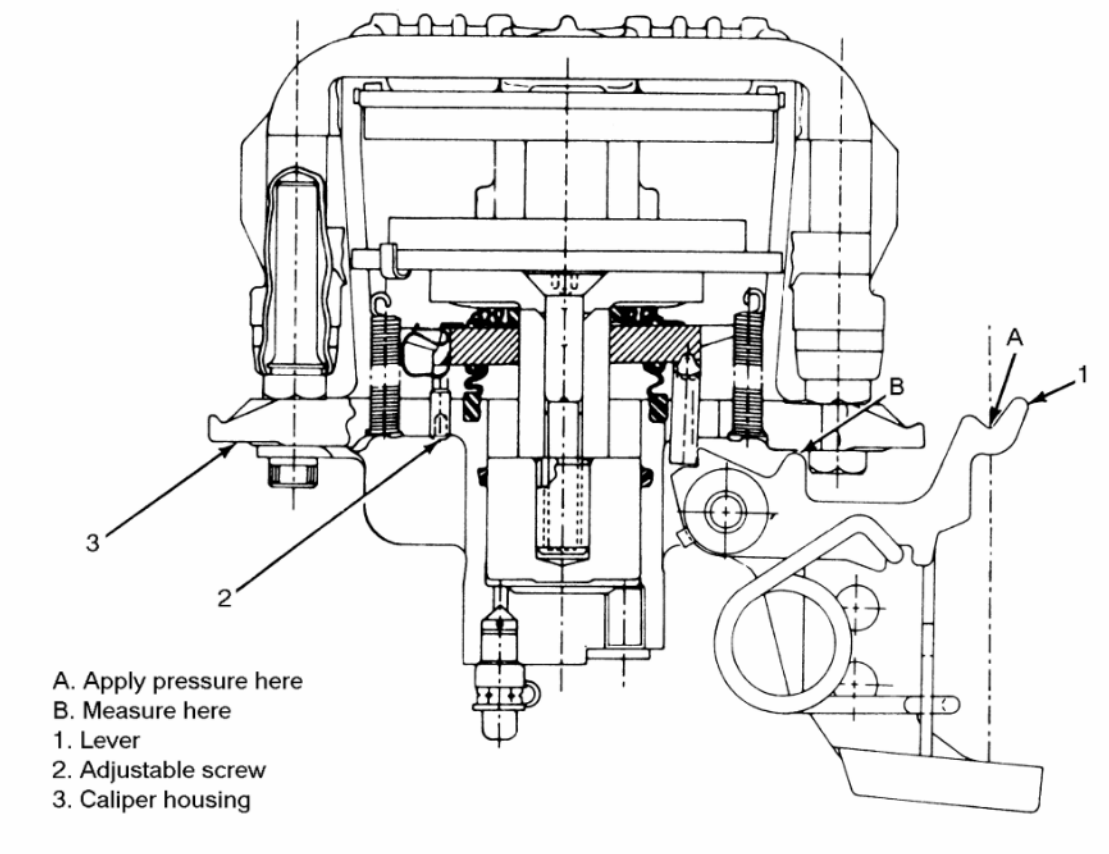


Fig. 3: Free travel adjustment; 1990-92

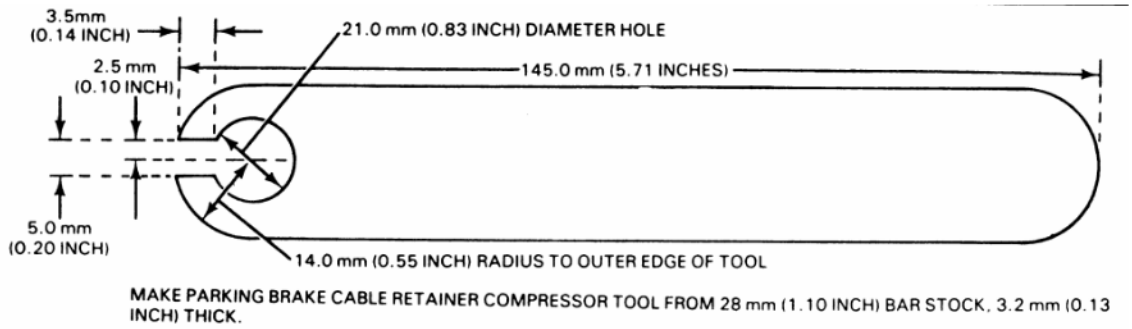


Fig. 4: Fabricated cable retainer compressing tool

1. Apply the brake pedal 3 times with a pedal force of approximately 175 lbs. (778 N). Apply and release the parking brake 3 times.
2. Raise and safely support the vehicle.
3. Check the parking brake lever for full release:
   a. Turn the ignition *ON*.
   b. The brake warning light should be *OFF*. If the brake warning light is still *ON* and the parking brake lever is completely released, pull downward on the front parking brake cable to remove slack from the lever assembly.
   c. Turn the ignition switch *OFF*.
4. Remove the rear wheels and tires. Reinstall 2 wheel nuts on each side to retain the brake rotors.

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5. Pull the parking lever 4 clicks. The parking brake levers on both calipers should be against the lever stops on the caliper housings. If the levers are not against the stops, check for binding in the rear cables and/or loosen the cables at the equalizer nut until both left and right levers are against their stops.
6. Adjust the equalizer adjusting nut until the parking brake levers on both calipers just begin to move off their stops.
7. Back off the adjuster nut until the levers move back, barely touching their stops.
8. Operate the parking brake lever several times to check adjustment. After cable adjustment, the parking brake lever should travel no more than 14 ratchet clicks. The rear wheels should not turn forward when the parking brake lever is applied 8-16 ratchet clicks.
9. Release the parking brake lever. Both rear wheels must turn freely in both directions. The parking brake levers on both calipers should be resting on their stops.
10. Remove the wheel nuts retaining the rotors. Install the wheel and tire assemblies.
11. Lower the vehicle.

PARKING BRAKE FREE-TRAVEL

ADJUSTMENT

1989-92 MODELS

REAR DISC BRAKES

Disc brake pads must be new or parallel to within 0.006 in. (0.15mm). Parking brake adjustment is not valid with heavily tapered pads and may cause caliper/parking brake binding. Replace tapered brake pads. Parking brake free-travel should only be made if the caliper has been taken apart. This adjustment will not correct a condition where the caliper levers will not return to their stops.

1. Have an assistant apply a light brake pedal load, enough to stop the rotor from turning by hand. This takes up all clearances and ensures that components are correctly aligned.
2. Apply light pressure to the caliper lever.
3. Measure the free-travel between the caliper lever and the caliper housing. The free-travel must be 0.0024-0.028 in. (0.6-0.7mm).
4. If the free-travel is incorrect, do the following:
   a. Remove the adjuster screw.
   b. Clean the thread adhesive residue from the threads.
   c. Coat the threads with adhesive.
   d. Screw in the adjuster screw far enough to obtain 0.024-0.028 in. (0.6-0.7mm) free-travel between the caliper lever and the caliper housing.
5. Have an assistant release the brake pedal, then apply the brake pedal firmly 3 times. Recheck the free-travel and adjust as necessary.

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BRAKE LEVER

REMOVAL & INSTALLATION

1982-89 MODELS

1. Raise and safely support the vehicle.
2. Remove the adjusting nut at the equalizer and remove the front cable from the equalizer and bracket.
3. Lower the vehicle.
4. Remove the upper console and lower console rear screws. Lift the rear of the lower console to gain access to the parking brake control.
5. Remove the pin and retainer from the control assembly and front cable.
6. Remove the cable and casing from the control assembly and bracket then remove the cable and grommet from the vehicle. Remove the parking brake lever mounting bolts and remove the assembly.
7. Installation is the reverse of the removal procedure. Adjust the parking brake.

1990-92 MODELS

1. Remove the carpet finish molding.
2. Remove the console assembly.
3. With the parking brake lever in the down position, rotate the arm toward the front of the vehicle until a 3mm metal pen can be inserted into the hole. Insert the metal pin into the hole, locking out the self adjuster.
4. Raise and safely support the vehicle.
5. Disconnect the rear cables from the equalizer.
6. Lower the vehicle.
7. Remove the barrel-shaped button from the adjuster track.
8. Remove the parking brake lever mounting bolts.
9. Remove the front cable and casing from the control assembly using a fabricated parking brake cable retainer compressor tool.
10. Installation is the reverse of the removal procedure. Cycle the lever to set the parking lever and cables in there proper location.

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SPECIFICATIONS CHARTS

BRAKE SPECIFICATIONS

Year	Master Cylinder Bore	Disc Minimum Thickness		Disc Maximum Runout		Drum Maximum Oversize	Caliper Bore		Wheel Cylinder Bore
		Front	Rear	Front	Rear		Front	Rear	
1982	①	0.980	0.980	0.005	0.005	9.560	2.500	1.890	0.748
1983	①	0.980	0.980	0.005	0.005	9.560	2.500	1.890	0.748
1984	①	0.980	0.980	0.005	0.005	9.560	2.500	1.890	0.748
1985	①	0.980	0.980	0.005	0.005	9.560	2.500	1.870	0.748
1986	①	0.980	0.986	0.005	0.005	9.560	2.500	1.870	0.748
1987	①	0.980	0.986	0.005	0.005	9.560	2.500	1.870	0.748
1988	①	0.980	0.986	0.005	0.005	9.560	②	1.595	0.748
1989	①	0.980	0.744	0.005	0.005	9.560	②	1.595	0.748
1990	①	0.980	0.744	0.005	0.005	9.560	②	1.595	0.748
1991	①	0.980	0.744	0.005	0.005	9.560	②	1.595	0.748
1992	①	0.980	0.744	0.005	0.005	9.560	②	1.595	0.748

① With rear drums: 0.945 in.
With rear discs: 1.000 in.
② Standard: 2.520 in.
Heavy Duty: 1.500 in. each

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