9

BRAKES

Section

1 General information
2 Anti-lock Brake System (ABS) - general information
3 Disc brake pads - replacement
4 Disc brake caliper - removal and installation
5 Brake disc - inspection, removal and installation
6 Drum brake shoes - replacement
7 Wheel cylinder - removal and installation
8 Master cylinder - removal, installation and reservoir/O-ring replacement
9 Brake hoses and lines - inspection and replacement
10 Brake hydraulic system - bleeding
11 Power brake booster - check, removal and installation
12 Brake pedal travel - check
13 Parking brake - adjustment
14 Parking brake pedal and cables - replacement
15 Parking brake shoes - replacement
16 Brake light switch - check, adjustment and replacement

Reference to other Chapters

Brake fluid level check - See Chapter 1
Brake system check - See Chapter 1

1 General information

GENERAL

The vehicles covered by this manual are equipped with hydraulically operated front and rear disc brake systems. Both the front and rear brakes are self adjusting (disc brakes automatically compensate for pad wear).

HYDRAULIC SYSTEM

The hydraulic system consists of two separate circuits, split front-to-rear. The master cylinder has separate reservoirs for the two circuits, and, in the event of a leak or failure in one hydraulic circuit, the other circuit will remain operative and a warning indicator will light up on the instrument panel when a substantial amount of brake fluid is lost, showing that a failure has occurred.

POWER BRAKE BOOSTER

The power brake booster uses either engine manifold vacuum or hydraulic pressure from the power steering pump to provide assistance to the brakes. It is mounted on the firewall in the engine compartment, directly behind the master cylinder.

PARKING BRAKE

The parking brake operates the rear brakes only, through cable actuation. It's activated by a pedal mounted under the left end of the instrument panel. The parking brake cables actuate a pair of parking brake shoes mounted inside of the drum (hub) portion of each rear brake disc.

SERVICE

After completing any operation involving disassembly of any part of the brake system, always test drive the vehicle to check for proper braking performance before resuming normal driving. When testing the brakes, perform the tests on a clean, dry, flat surface. Conditions other than these can lead to inaccurate test results.

Test the brakes at various speeds with both light and heavy pedal pressure. The vehicle should stop evenly without pulling to one side or the other.

Tires, vehicle load and wheel alignment are factors which also affect braking performance.

⁂ CAUTION:

On models equipped with the "Theftlock" audio system, be sure the lockout feature is turned off before performing any procedure which requires disconnecting the battery (see the information at the front of this manual).

2 Anti-lock Brake System (ABS) - general information

♦ Refer to illustration 2.2

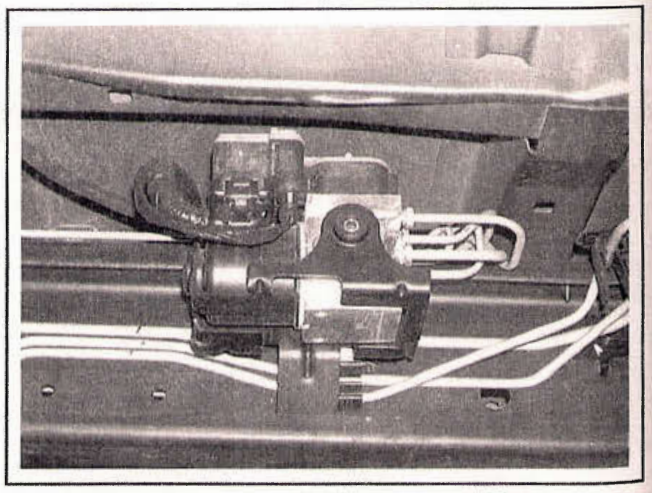
Anti-lock Brake Systems (ABS) maintain vehicle maneuverability, directional stability, and optimum deceleration under severe braking conditions on most road surfaces. It does so by monitoring the rotational speed of the wheels and controlling the brake line pressure to the wheels during braking. This prevents the wheels from locking up on slippery roads or during hard braking.

The ABS system on these vehicles is a three-sensor system; each front wheel is equipped with its own sensor, and the rear wheels share a sensor (mounted in the extension housing of the transmission on 2WD models and in the transfer case on 4WD models). This means that the brake line pressure to the front wheels can be controlled individually, but the two rear brakes are controlled together.

ELECTRO-HYDRAULIC CONTROL UNIT (EHCU)

The Electro-Hydraulic Control Unit (EHCU), mounted on the left-side frame rail underneath the cab, controls hydraulic pressure to the brake calipers by modulating hydraulic pressure to prevent wheel lock-up (see illustration). It is made up of the Brake Pressure Modulator Valve (BPMV) and the Electronic Brake Control Module (EBCM). Basically, the BPMV bleeds off pressure in a brake line when the Electronic Brake Control Module (EBCM) detects an abnormal deceleration in the speed of a wheel (via a wheel speed sensor signal). When the speed of the wheel is restored to normal, the modulator once again allows full pressure to the brake. This cycle is repeated as many times as necessary, which results in a pulsing of the brake pedal.

➡Note: The EHCU can't increase brake line pressure above that which is generated by the master cylinder, and it can't apply the brakes by itself.



2.2 The ABS Electro-Hydraulic Control Unit (EHCU) is located along the left frame rail, underneath the driver

In addition to sensing and processing information received from the brake switch and wheel speed sensors to control the hydraulic line pressure and avoid wheel lock up, the EBCM also continually monitors the system and stores fault codes which indicate specific problems.

TRACTION CONTROL SYSTEM

Some later models are equipped with the Traction Control System (TCS). When wheel slip is detected, the Electronic Brake Control Module (EBCM) will activate the traction control mode. A signal is sent from the EBCM to the PCM (Powertrain Control Module) commanding less torque to the drive wheels. Torque is reduced by retarding the ignition timing and by controlling the throttle control actuator (TCA).

The Traction Control System (TCS) is deactivated when the transmission shift lever is selected into the LOW position, the driver manually selects OFF on the TCS switch on the dash or the EBCM automatically shuts off the TCS during cruising or non-hazard conditions. The Traction Control System (TCS) can be programmed for the auto-engagement feature. This allows the TCS to activate automatically at start-up.

WHEEL SPEED SENSORS

Each front wheel is equipped with a speed sensor, which is mounted on each front hub and wheel bearing assembly. A toothed sensor ring is integral with the bearing; if it becomes damaged, the entire hub/wheel bearing assembly must be replaced. If the actual sensor which bolts to the hub and bearing assembly malfunctions, it can be replaced separately. The sensors are neither adjustable nor rebuildable.

Rear wheel speed is monitored by the Vehicle Speed Sensor (VSS), which is located in the extension housing on 2WD models and the transfer case on 4WD models. For more information on the VSS, see Chapter 6.

A wheel speed sensor measures wheel speed by monitoring the rotation of a toothed ring. As the teeth of the ring move through the magnetic field of the sensor, an AC voltage signal is generated. This signal frequency increases or decreases in proportion to the speed of the wheel. The EBCM monitors these signals for changes in wheel speed; if it detects the sudden deceleration of a wheel, i.e. wheel lockup, the EBCM activates the ABS system.

WARNING LIGHTS

The ABS system has self-diagnostic capabilities. Each time the vehicle is started, the EBCM runs a self-test. There are two warning lights on the instrument panel, a red BRAKE light and an amber ABS light, each with their own functions. During starting, these lights should come on briefly then go out. If the red BRAKE light stays on, it indicates a problem with the main braking system, such as low fluid level detected or the parking brake is still on. If the light stays on after the parking brake is released, check the brake fluid level in the master cylinder reservoir (see Chapter 1).

The amber ABS light indicates a problem with the ABS system, not the main or basic brake system. If the light stays on, it indicates that there is a problem with the ABS system, but the main system is still working. Take the vehicle to a dealer service department or other qualified repair shop for diagnosis and repair.

CHECKS

Although a special electronic tester is necessary to properly diagnose the system, the home mechanic can perform a few preliminary checks before taking the vehicle to a dealer service department or other repair shop which is equipped with this tester:

a) Check the fuses.
b) Check the electrical connectors at the EBCM and the hydraulic modulator/motor pack.
c) Follow the wiring harness to the speed sensors and brake light switch and make sure all connections are secure and the wiring isn't damaged.
d) Make sure the brake lines, calipers and wheel cylinders are in good condition.
e) Check the resistance of the front wheel speed sensors and compare your readings with the values listed in this Chapter's Specifications (see Chapter 6 for the Vehicle Speed Sensor check, which monitors the speed of the rear wheels). If any sensor is out of range, replace it (the sensors are integral with the hub/wheel bearing assemblies).

If the above preliminary checks don't rectify the problem, the vehicle should be diagnosed by a dealer service department or other qualified repair shop.

3 Disc brake pads - replacement

Refer to illustrations 3.5a through 3.5n

WARNING:

Disc brake pads must be replaced on both front or both rear wheels at the same time - never replace the pads on only one wheel. Also, the dust created by the brake system is harmful to your health. Never blow it out with compressed air and don't inhale any of it. An approved filtering mask should be worn when working on the brakes. Do not, under any circumstances, use petroleum-based solvents to clean brake parts. Use brake system cleaner only!

Note: This procedure applies to the front and rear brake pads.

1 Remove the cap from the brake fluid reservoir. Remove about two-thirds of the fluid from the reservoir, then reinstall the cap.

CAUTION:

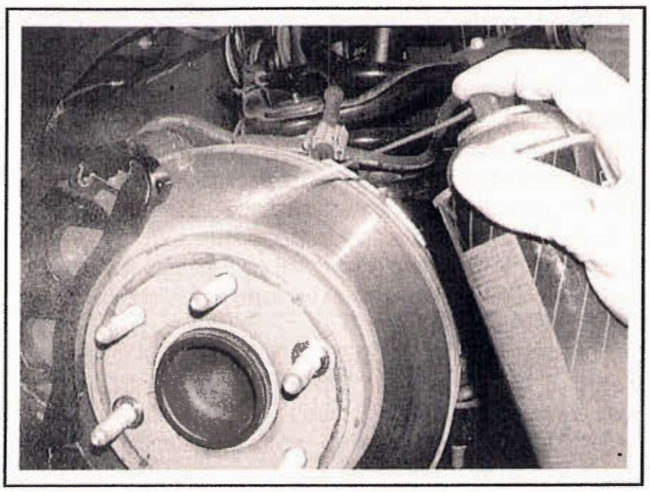
Brake fluid will damage paint. If any fluid is spilled, wash it off immediately with plenty of clean, cold water.

2 Loosen the front or rear wheel lug nuts, raise the front or rear of the vehicle and support it securely on jackstands. Block the wheels at the opposite end.

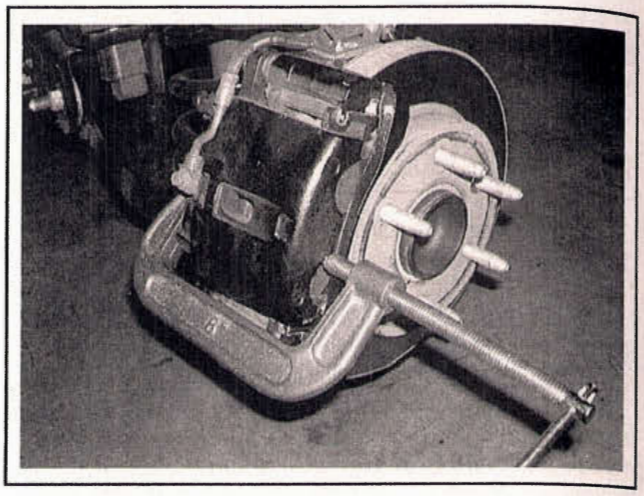
3 Remove the wheels. Work on one brake assembly at a time, using the assembled brake for reference if necessary.

4 Inspect the brake disc carefully as outlined in Section 5. If machining is necessary, follow the information in that Section to remove the disc.

5 Follow the accompanying photo sequence for the actual pad replacement procedure (see illustrations 3.5a through 3.5n). Be sure to

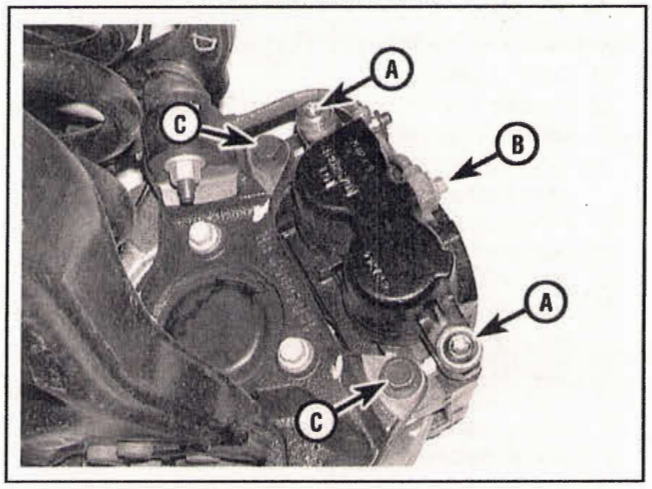


3.5a Before disassembling the brake, wash it thoroughly with brake system cleaner and allow it to dry - position a drain pan under the brake to catch the residue - DO NOT use compressed air to blow off brake dust!



3.5b To make room for the new pads, use a C-clamp to depress the piston(s) into the caliper before removing the caliper and pads - do this a little at a time, keeping an eye on the fluid level in the master cylinder to make sure it doesn't overflow.

➡Note: On ABS models, remove the bleed screw (see illustration 10.8) before compressing the caliper pistons



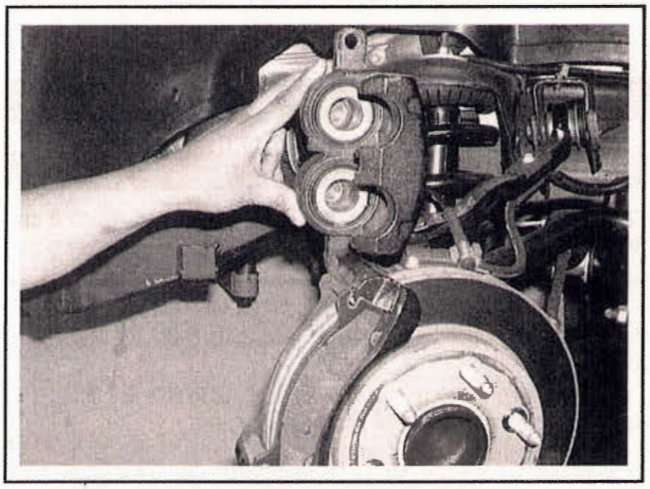
3.5c Front caliper mounting details

A Caliper mounting bolts
B Brake hose inlet fitting bolt
C Caliper mounting bracket bolts

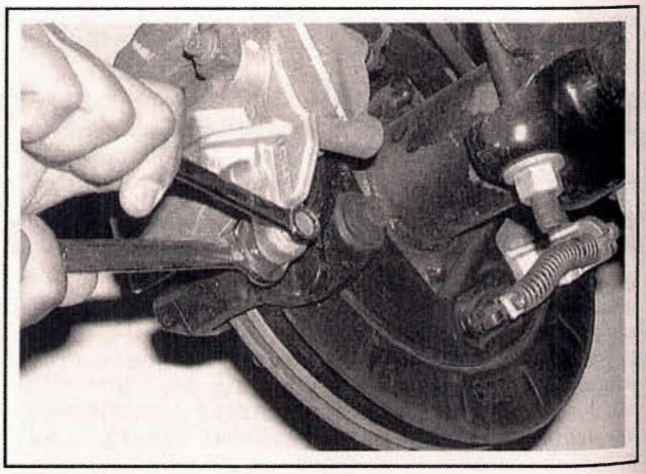
stay in order and read the caption under each illustration.

6 When reinstalling the caliper, be sure to tighten the mounting bolts to the torque listed in this Chapter's Specifications. Tighten the wheel lug nuts to the torque listed in the Chapter 1 Specifications.

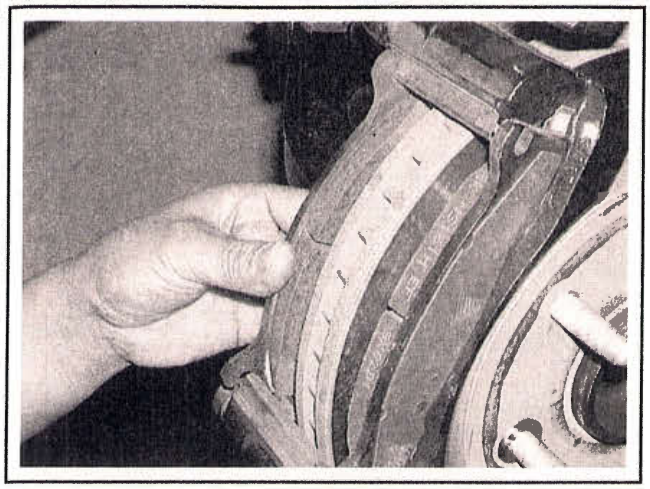
7 After the job has been completed, firmly depress the brake pedal a few times to bring the pads into contact with the disc. Check the level of the brake fluid, adding some if necessary (see Chapter 1). Check the operation of the brakes carefully before placing the vehicle into normal service.



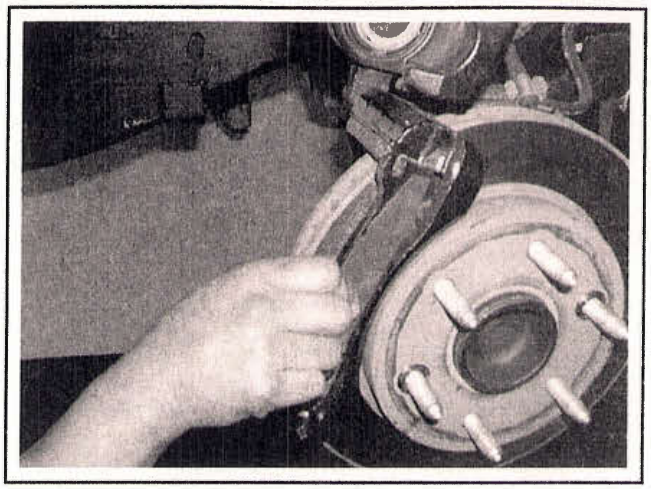
3.5d If you're replacing the front brake pads (or, on 2500 models, the rear pads), remove the lower mounting bolt and pivot the caliper up, supporting it in this position



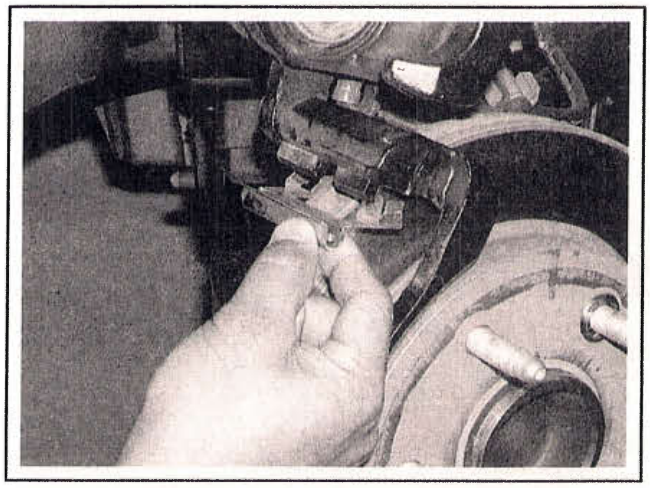
3.5e If you're replacing the rear pads on a 1500 model, hold the caliper slide pin with an open-end wrench, loosen the lower mounting bolt with another wrench, then pivot the caliper up and support it in this position for access to the brake pads



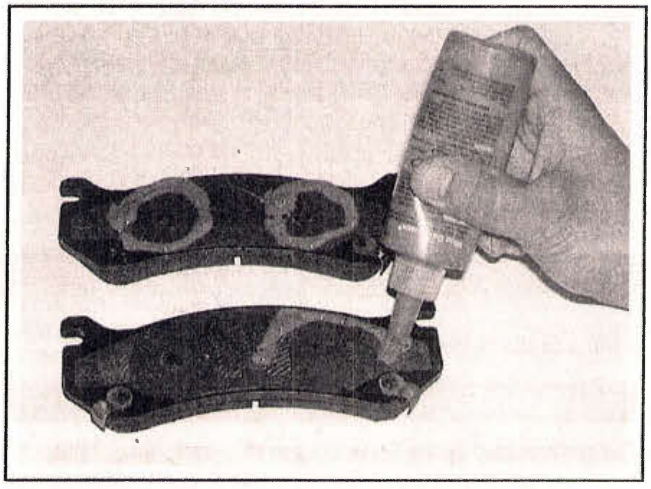
3.5f Remove the inner brake pad



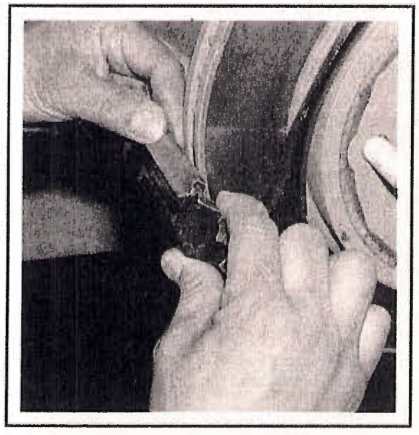
3.5g Remove the outer brake pad



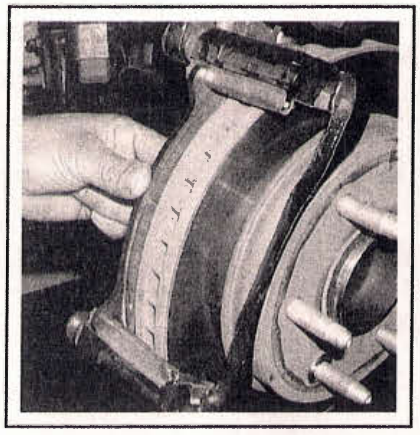
3.5h Remove the upper and lower pad retainers from the caliper mounting bracket; if they are cracked or distorted, replace them



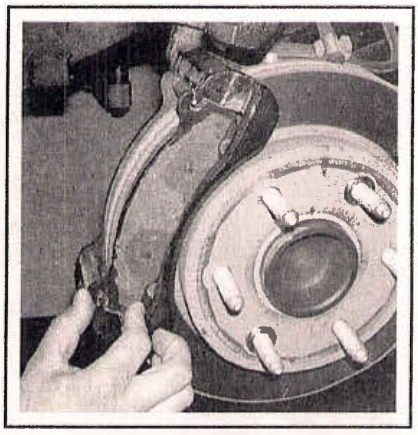
3.5i Apply anti-squeal compound to the back of both pads (let the compound "set up" a few minutes before installing them)



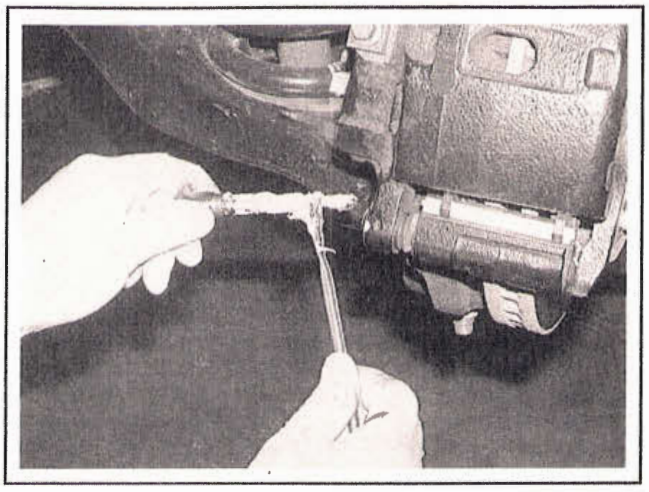
3.5j Install the upper and lower pad retainers on the caliper mounting bracket



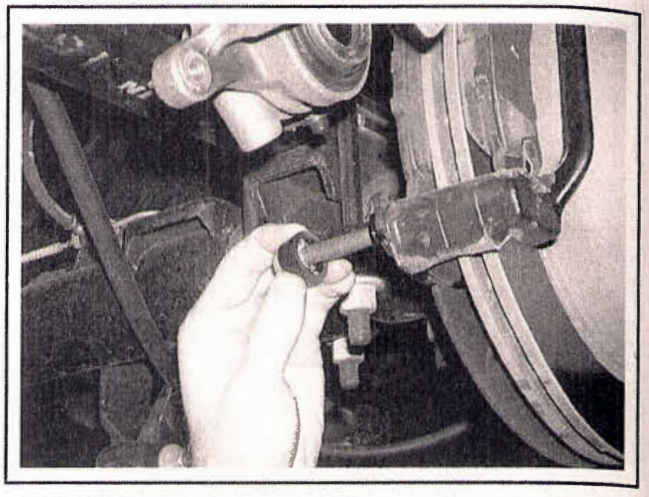
3.5k Install the inner brake pad . . .



3.5l . . . and the outer brake pad



3.5m Inspect the caliper mounting bolt for scoring and corrosion, then lubricate it with high-temperature brake grease. If it was dry, pivot the caliper up again, slide the upper mounting bolt out of the bracket and lubricate it, too.



3.5n Before lowering the rear caliper over the pads, check the condition of the slide pin and the rubber boot, then lubricate the pin with high-temperature brake grease (if it was dry, pivot the caliper up again, pull the upper slide pin and boot out of the bracket and lubricate it, too).

4 Brake caliper - removal and installation

Refer to illustration 4.2

WARNING:

The dust created by the brake system may contain asbestos, which is harmful to your health. Never blow it out with compressed air and don't inhale any of it. An approved filtering mask should be worn when working on the brakes. Do not, under any circumstances, use petroleum-based solvents to clean brake parts. Use brake system cleaner only!

4.2 There is a sealing washer on either side of the brake hose inlet fitting; be sure to replace these with new ones when reconnecting the hose

REMOVAL

1 Loosen the front or rear wheel lug nuts, raise the front or rear of the vehicle and place it securely on jackstands. Block the wheels at the opposite end. Remove the front or rear wheel.

2 Remove the inlet fitting bolt and disconnect the brake hose from the caliper. Discard the old sealing washers (see illustration). Plug the brake hose immediately to keep contaminants and air out of the brake system and to prevent losing any more brake fluid than is necessary.

➡Note: If you are simply removing the caliper for access to other components, leave the brake hose connected and suspend the caliper with a length of wire - don't let it hang by the hose (see illustration 5.2).

3 Remove the caliper mounting bolts and detach the caliper from the mounting bracket. When removing a rear caliper on a 1500 model, hold the slide pins with an open-end wrench to prevent them from turning when the mounting bolts are unscrewed (see illustration 3.5e).

INSTALLATION

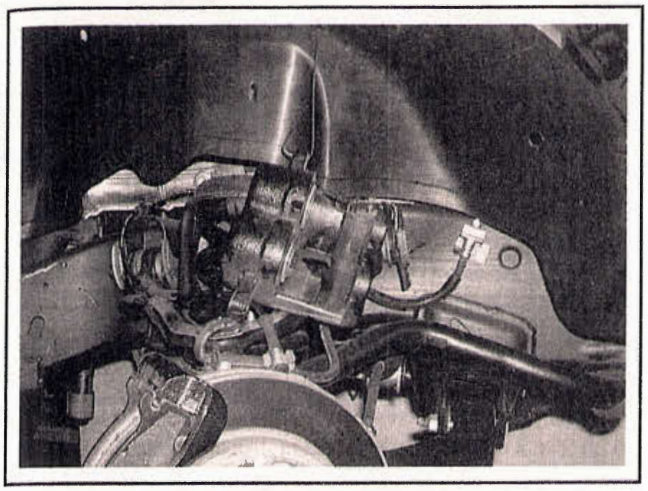
4 Installation is the reverse of removal. Don't forget to use new sealing washers on each side of the brake hose inlet fitting and be sure to tighten the fitting bolt and the caliper mounting bolts to the torque listed in this Chapter's Specifications.

5 Bleed the brake system (see Section 8).

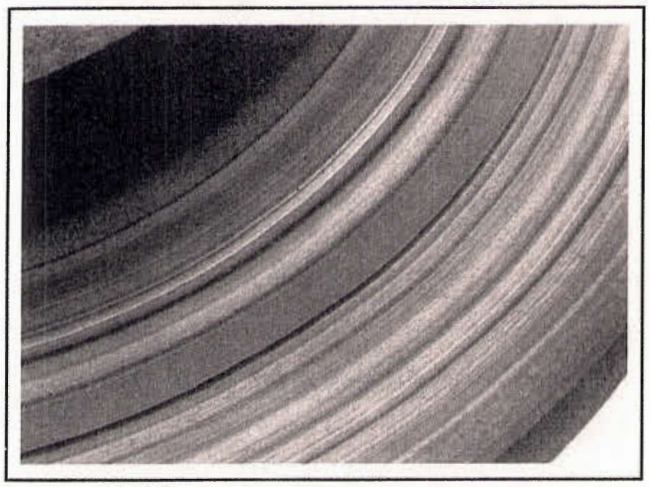
➡Note: If the brake hose was not disconnected, bleeding won't be required.

Make sure there are no leaks from the hose connections. Test the brakes carefully before returning the vehicle to normal service.

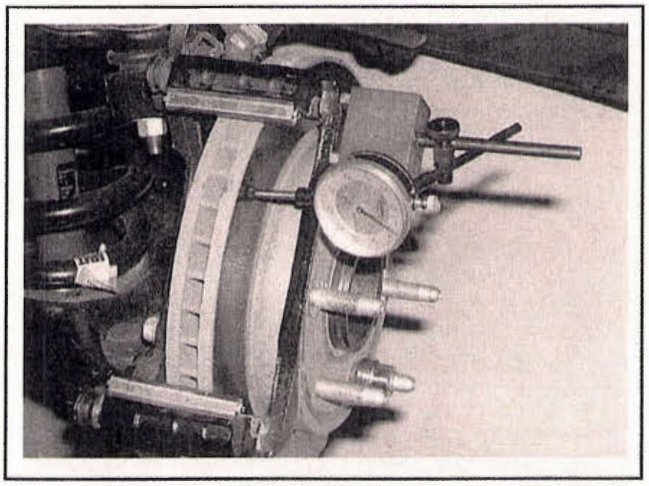
5 Brake disc - inspection, removal and installation



5.2 Hang the caliper out of the way with a piece of wire - don't let it hang by the brake hose!



5.3 The brake pads on this vehicle were obviously neglected, as they wore down completely and cut deep grooves into the disc - wear this severe means the disc must be replaced



5.4a To check disc runout, mount a dial indicator as shown and rotate the disc

INSPECTION

➧ Refer to illustrations 5.2, 5.3, 5.4a, 5.4b, 5.5a and 5.5b

1 Loosen the wheel lug nuts, raise the vehicle and support it securely on jackstands. Remove the wheel and install the lug nuts to hold the disc in place.

➡Note: If the lug nuts don't contact the disc when screwed on all the way, install washers under them.

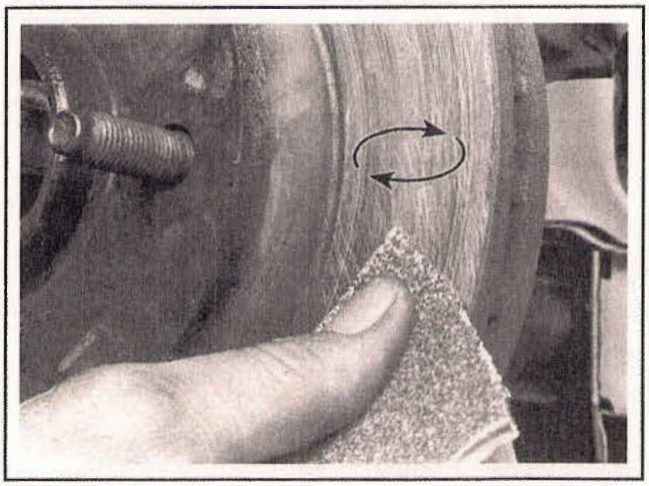
2 Remove the brake caliper. It isn't necessary to disconnect the brake hose. After removing the caliper bolts, suspend the caliper out of the way with a piece of wire (see illustration).

3 Visually inspect the disc surface for score marks and other damage. Light scratches and shallow grooves are normal after use and may not always be detrimental to brake operation, but deep scoring requires disc removal and refinishing by an automotive machine shop. Be sure to check both sides of the disc (see illustration). If pulsating has been noticed during application of the brakes, suspect disc runout.

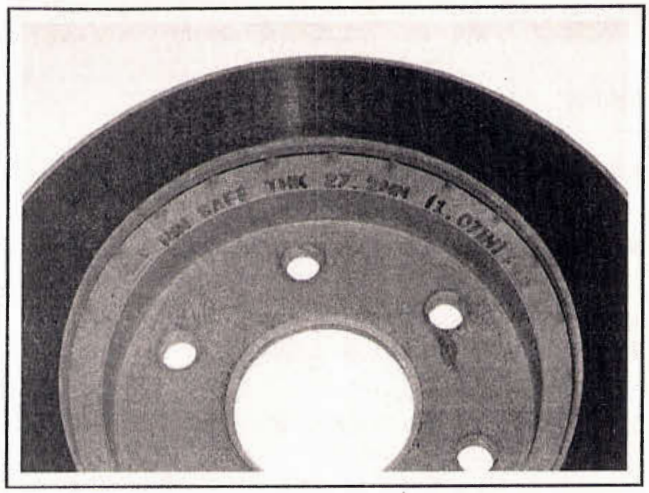
4 To check disc runout, place a dial indicator at a point about 1/2-inch from the outer edge of the disc (see illustration). Set the indicator to zero and turn the disc. The indicator reading should not exceed the specified allowable runout limit. If it does, the disc should be refinished by an automotive machine shop.

➡Note: When replacing the brake pads, it's a good idea to resurface the discs regardless of the dial indicator reading, as this will impart a smooth finish and ensure a perfectly flat surface, eliminating any brake pedal pulsation or other undesirable symptoms related to questionable discs. At the very least, if you elect not to have the discs resurfaced, remove the glaze from the surface with emery cloth or sandpaper, using a swirling motion (see illustration).

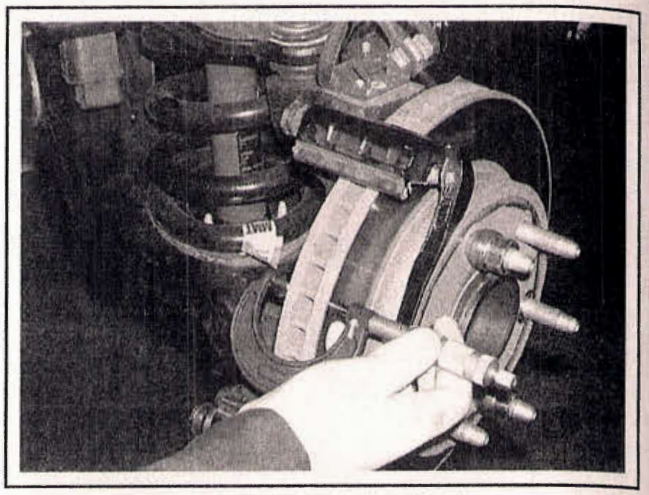
5 It's absolutely critical that the disc not be machined to a thickness under the specified minimum thickness. The minimum wear (or discard) thickness is cast into the underside of front discs (see illustration) and on the outside of rear discs. The disc thickness can be checked with a micrometer (see illustration).



5.4b Using a swirling motion, remove the glaze from the disc with sandpaper or emery cloth



5.5a The minimum thickness is cast into the disc



5.5b Use a micrometer to measure disc thickness

REMOVAL

Refer to illustrations 5.6a, 5.6b and 5.7

Note: On 2500 models equipped with dual rear wheels, the wheel hub must be removed (see Chapter 8) and the wheel studs pressed out of the hub/disc assembly.

6 Remove the two caliper mounting bracket bolts and detach the mounting bracket (see illustrations).

7 Remove the lug nuts which you installed to hold the disc in place and slide the disc off the hub. If pressed-metal retaining clips are present on any of the wheel studs, cut them off (see illustration).

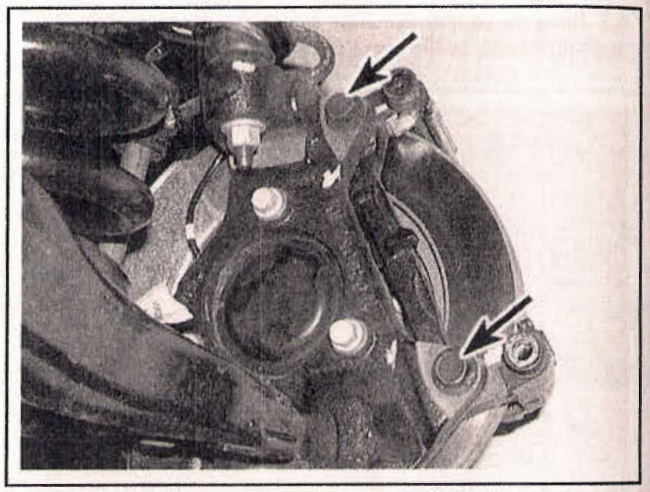
INSTALLATION

8 Place the disc in position over the threaded studs.

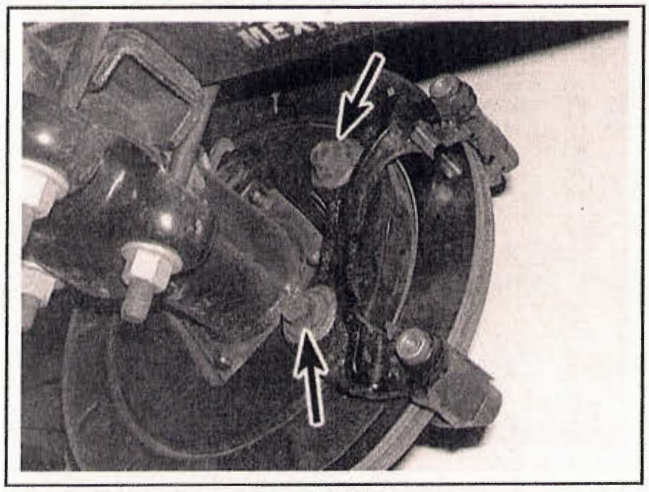
9 Install the mounting bracket and tighten the bolts to the torque listed in this Chapter's Specifications. Install the brake pads.

10 Install the caliper onto the mounting bracket, tightening the bolts to the torque listed in this Chapter's Specifications.

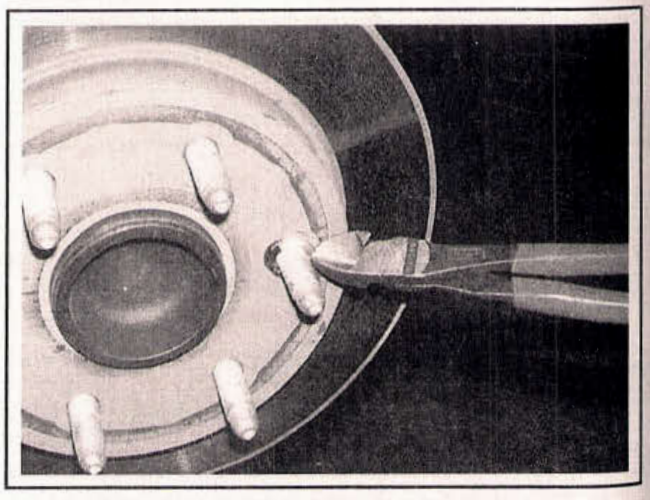
11 Install the wheel and lug nuts. Lower the vehicle and tighten the lug nuts to the torque listed in the Chapter 1 Specifications. Depress the brake pedal a few times to bring the brake pads into contact with the disc. Bleeding won't be necessary unless the brake hose was disconnected from the caliper. Check the operation of the brakes carefully before driving the vehicle.



5.6a Caliper mounting bracket bolts - front



5.6b Caliper mounting bracket bolts - rear



5.7 Cut off and discard the disc retaining washers, if present (it isn't necessary to reinstall them)

6 Drum brake shoes - replacement

Refer to illustrations 6.2a, 6.2b, 6.3, 6.4, 6.5, 6.9

WARNING:

Drum brake shoes must be replaced on both wheels at the same time - never replace the shoes on only one wheel. Also, the dust created by the brake system is harmful to your health. Never blow it out with compressed air and don't inhale any of it. An approved filtering mask should be worn when working on the brakes. Do not, under any circumstances, use petroleum-based solvents to clean brake parts. Use brake system cleaner only!

1 Loosen the wheel lug nuts, raise the rear of the vehicle and support it securely on jackstands. Block the front wheels to keep the vehicle from rolling. Remove the wheels.

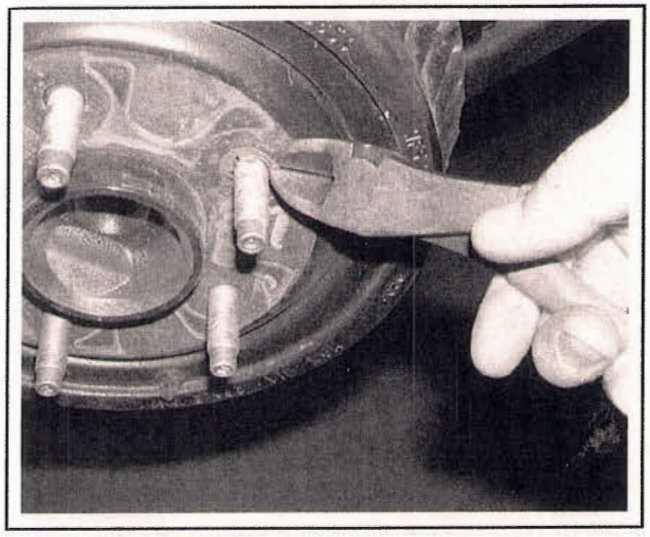
2 Release the parking brake and remove the brake drums (see illustration). If the shoes have worn into the drum, preventing drum removal, remove the access plug from the backing plate, push the lever off the adjuster star wheel with one narrow screwdriver while turning the adjuster star wheel with another narrow screwdriver (or a brake adjusting tool) (see illustration).

3 Before disassembling anything, clean off the brake assembly with brake system cleaner (see illustration).

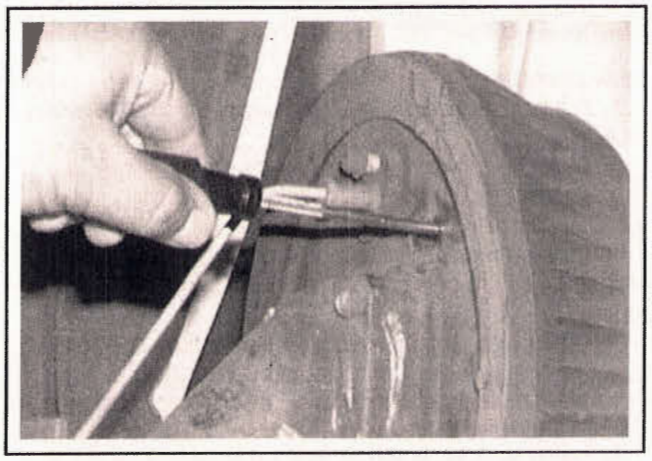
4 Detach the spring from the adjuster lever (see illustration).

5 Pull the retractor spring out of the hole in each shoe (see illustration).

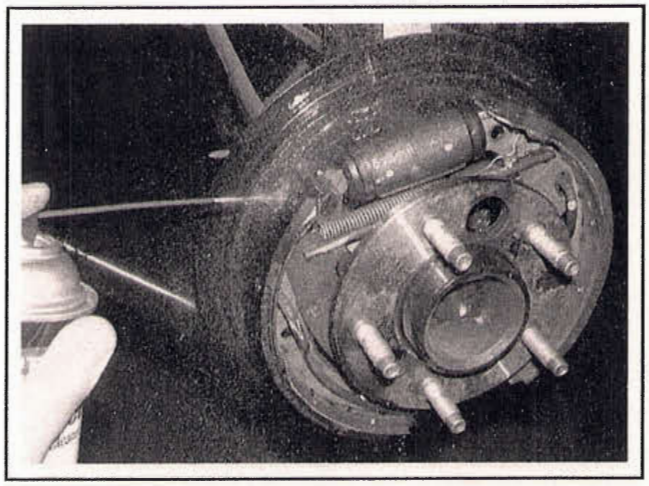
6 Remove the trailing shoe and adjuster lever, then the adjuster



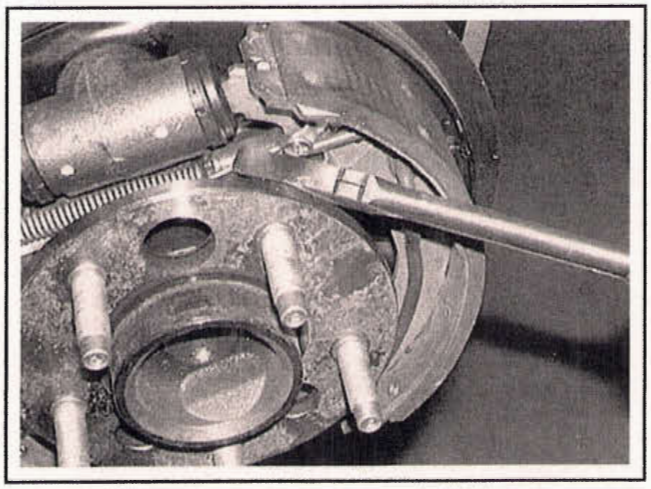
6.2a If the drum is retained by pressed-metal washers, cut them off and discard them (there is no need to reinstall them)



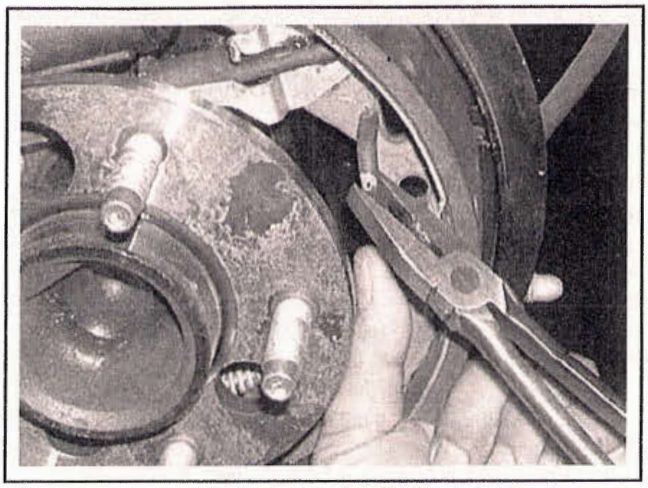
6.2b If the shoes have worn into the drum, preventing its removal, remove the plug from the backing plate and push the parking brake lever off its stop like this, then insert a brake adjusting tool or another screwdriver and turn the adjuster star wheel upward to retract the shoes



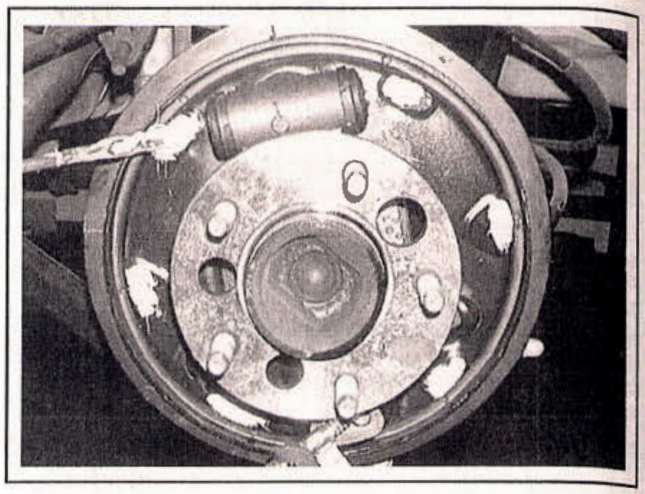
6.3 Before removing any internal drum brake components, wash them off with brake system cleaner and allow them to dry - position a drain pan under the brake to catch the residue - DO NOT USE COMPRESSED AIR TO BLOW THE DUST FROM THE PARTS



6.4 Grip the adjuster spring with a pair of pliers and detach its end from the adjuster lever



6.5 Pull the end of the retractor spring out of the hole in each shoe



6.9 Lubricate the brake shoe contact areas on the backing plate with high-temperature grease

screw assembly.

7 Pull the retractor spring out of the way, then remove the leading shoe.

8 Detach the parking brake lever from the trailing shoe.

9 Clean the backing plate, then lubricate the shoe contact areas with a thin film of high-temperature grease (see illustration).

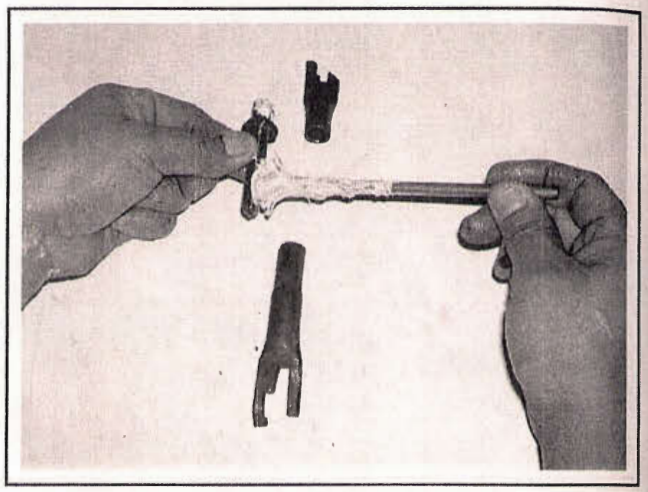
10 Connect the parking brake lever to the trailing shoe, position the shoe on the backing plate and install the end of the retractor spring in its hole.

11 Clean the adjuster screw assembly, then lubricate the threads and socket end with high-temperature grease (see illustration).

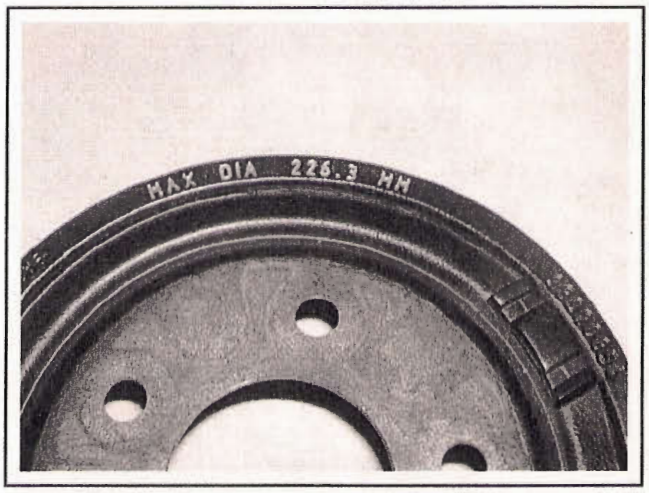
12 Install the adjuster screw assembly, making sure it engages properly with the leading shoe.

13 Lightly lubricate the adjuster lever and install it on the trailing shoe.

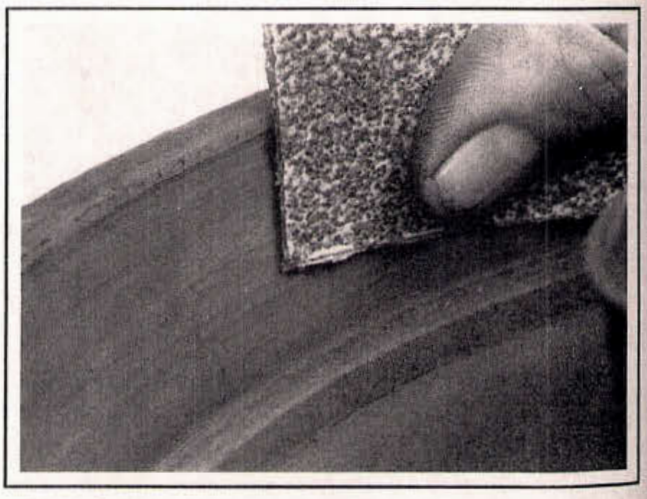
14 Position the trailing shoe on the backing plate, making sure it (and the parking brake lever and adjuster lever) engage properly with the adjuster screw assembly, then insert the retractor spring into its hole in the shoe.



6.11 Lubricate the threads and socket end of the adjuster screw assembly with high-temperature grease



6.16a The maximum permissible diameter is cast into the drum (typical)



6.16b Remove the glaze from the drum surface with sandpaper or emery cloth

15 Insert the actuator spring into its hole in the leading shoe, then stretch it across and connect it to the adjuster lever.

16 Before reinstalling the drum it should be checked for cracks, score marks, deep scratches and hard spots, which will appear as small, discolored areas. If the hard spots cannot be removed with emery cloth or if any of the other conditions listed above exist, the drum must be taken to an automotive machine shop to have it resurfaced.

➡Note: Professionals recommend resurfacing the drums whenever a brake job is done. Resurfacing will eliminate the possibility of out-of-round or tapered drums. If the drums are worn so much that they can't be resurfaced without exceeding the maximum allowable diameter (stamped into the drum) (see illustration), then new ones will be required. At the very least, if you elect not to have the drums resurfaced, remove the glazing from the surface with emery cloth or sandpaper using a swirling motion (see illustration).

17 When installing the drum, adjust the brake shoes by turning the star wheel on the adjuster screw until the drum just slips over the shoes. When turning the drum, the shoes should not rub; if they do, remove the drum and back off the star wheel a little bit so they don't. This adjustment is just to get the shoes close to the drum; the brake shoes will self-adjust after you depress the pedal a few times).

7 Wheel cylinder - removal and installation

REMOVAL

1 Raise the rear of the vehicle and support it securely on jackstands. Block the front wheels to keep the vehicle from rolling.

2 Remove the brake shoe assembly (see Section 6).

3 Remove all dirt and foreign material from around the wheel cylinder.

4 Using a flare-nut wrench, unscrew the brake line fitting from the wheel cylinder. Don't pull the line away from the wheel cylinder (it could get bent).

5 Remove the wheel cylinder mounting bolts and detach the wheel cylinder from the brake backing plate.

INSTALLATION

6 Place the wheel cylinder in position and connect the brake line fitting, being careful not to cross-thread it. Install the mounting bolts, tightening them to the torque listed in this Chapter's Specifications, then tighten the brake line fitting securely.

7 Install the brake shoes (see Section 6).

8 Bleed the brakes (see Section 10).

9 Check the operation of the brakes carefully before driving the vehicle in traffic.

8 Master cylinder - removal, installation and reservoir/O-ring replacement

REMOVAL

▶ Refer to illustration 8.2

1 Disconnect the cable from the negative battery terminal.

✻✻ CAUTION:

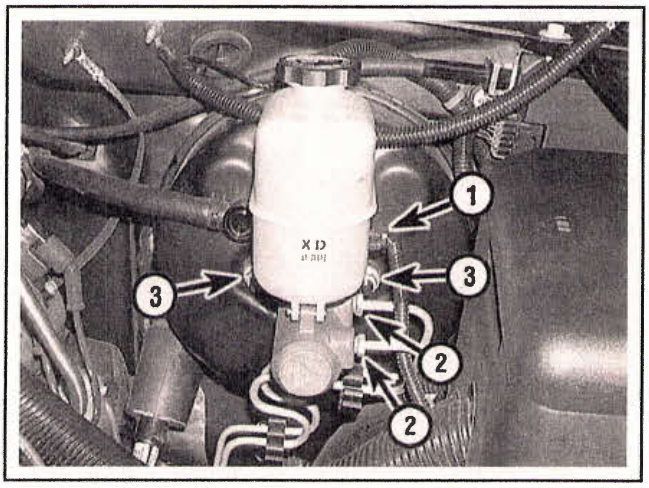
On models equipped with the "Theftlock" audio system, be sure the lockout feature is turned off before performing any procedure which requires disconnecting the battery (see the information at the front of this manual).

2 Unplug the electrical connector for the fluid level warning switch (see illustration).

3 Remove as much fluid as possible from the reservoir with a suction gun, large syringe or a poultry baster.

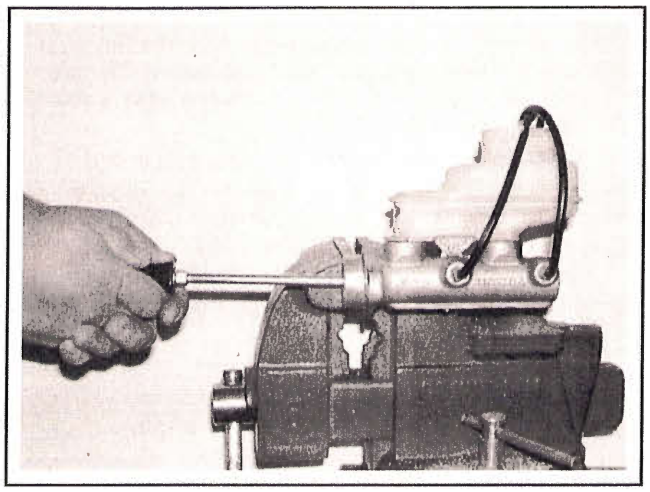
✻✻ WARNING:

If a poultry baster is used, never again use it for the preparation of food.



8.2 Master cylinder mounting details

1 Electrical connector for fluid level sensor
2 Brake line fittings
3 Mounting nuts



8.8 The best way to bleed air from the master cylinder before installing it on the vehicle is with a pair of bleeder tubes that direct brake fluid into the reservoir during bleeding

4 Place rags under the fittings and prepare caps or plastic bags to cover the ends of the lines once they're disconnected.

CAUTION:

Brake fluid will damage paint. Cover all body parts and be careful not to spill fluid during this procedure. Loosen the fittings at the ends of the brake lines where they enter the master cylinder. To prevent rounding off the flats, use a flare-nut wrench, which wraps around the fitting hex.

5 Pull the brake lines away from the master cylinder and plug the ends to prevent contamination.

6 Remove the nuts attaching the master cylinder to the power booster (see illustration 8.2). Pull the master cylinder off the studs to remove it. Again, be careful not to spill the fluid as this is done.

INSTALLATION

Refer to illustrations 8.8 and 8.16

7 Bench bleed the new master cylinder before installing it. Mount the master cylinder in a vise, with the jaws of the vise clamping on the mounting flange.

8 Attach a pair of master cylinder bleeder tubes to the outlet ports of the master cylinder (see illustration).

9 Fill the reservoir with brake fluid of the recommended type (see Chapter 1).

10 Slowly push the pistons into the master cylinder (a large Phillips screwdriver can be used for this) - air will be expelled from the pressure chambers and into the reservoir. Because the tubes are submerged in fluid, air can't be drawn back into the master cylinder when you release the pistons.

11 Repeat the procedure until no more air bubbles are present.

12 Remove the bleed tubes, one at a time, and install plugs in the open ports to prevent fluid leakage and air from entering. Install the reservoir cap.

13 Install the master cylinder over the studs on the power brake booster and tighten the attaching nuts only finger tight at this time. Don't forget to use a new gasket.

14 Thread the brake line fittings into the master cylinder. Since the master cylinder is still a bit loose, it can be moved slightly so the fittings thread in easily. Don't strip the threads as the fittings are tightened.

8.16 Have an assistant depress the brake pedal and hold it down, then loosen the fitting nut, allowing air and fluid to escape; repeat this procedure on both fittings until the fluid is clear of air bubbles

15 Tighten the mounting nuts to the torque listed in this Chapter's Specifications. Tighten the brake line fittings securely.

16 Fill the master cylinder reservoir with fluid, then bleed the lines at the master cylinder, followed by bleeding the remainder of the brake system (see Section 8). To bleed the lines at the master cylinder, have an assistant depress the brake pedal and hold it down. Loosen the fitting to allow air and fluid to escape (see illustration). Tighten the fitting, then allow your assistant to return the pedal to its rest position. Repeat this procedure on both fittings until the fluid is free of air bubbles, then bleed the rest of the system. Check the operation of the brake system carefully before driving the vehicle.

WARNING:

If you do not have a firm brake pedal at the end of the bleeding procedure, or have any doubts as to the effectiveness of the brake system, DO NOT drive the vehicle. Have it towed to a dealer service department or other qualified repair shop for diagnosis.

RESERVOIR/O-RING REPLACEMENT

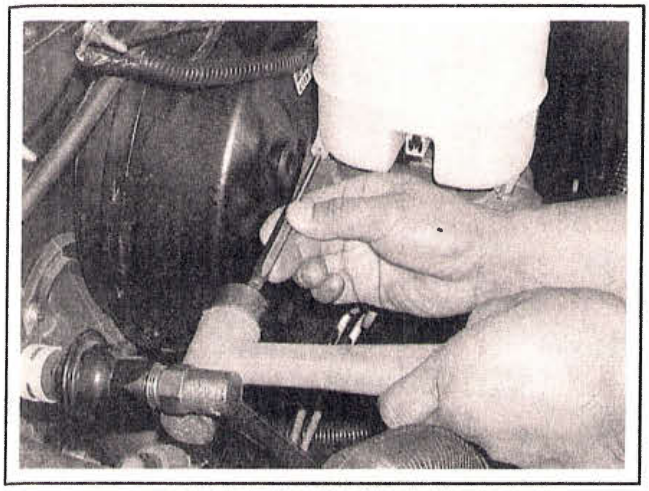
Refer to illustrations 8.19 and 8.21

Note: The brake fluid reservoir can be replaced separately from the master cylinder body if it becomes damaged. If there is leakage between the reservoir and the master cylinder body, the O-rings on the reservoir can be replaced.

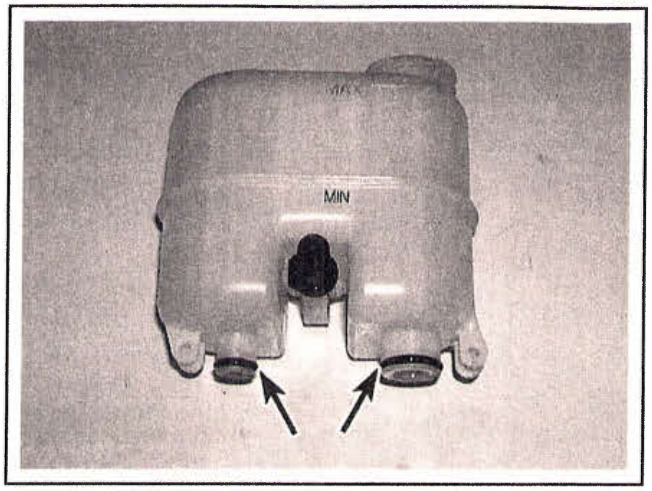
17 Remove as much fluid as possible from the reservoir with a suction gun, large syringe or a poultry baster.

WARNING:

If a poultry baster is used, never again use it for the preparation of food.



8.19 Driving out the roll pins that retain the master cylinder fluid reservoir



8.21 The reservoir O-rings (arrows) can be replaced if they are leaking

18 Place rags under the master cylinder to absorb any fluid that may spill out once the reservoir is detached from the master cylinder.

CAUTION:

Brake fluid will damage paint. Cover all body parts and be careful not to spill fluid during this procedure.

19 Using a hammer and a small punch, drive out the roll pins that retain the reservoir to the master cylinder (see illustration).

20 Pull the reservoir out of the master cylinder body.

21 If you are simply replacing the O-rings, carefully pry the old O-rings off and install new ones (see illustration).

22 Lubricate the reservoir O-rings with clean brake fluid, then press the reservoir into place on the master cylinder body and secure it with new roll pins.

23 Refill the reservoir with the recommended brake fluid (see Chapter 1) and check for leaks.

24 Bleed the master cylinder (see illustration 8.16).

9 Brake hoses and lines - inspection and replacement

INSPECTION

1 About every six months, with the vehicle raised and supported securely on jackstands, the rubber hoses which connect the steel brake lines with the front and rear brake assemblies should be inspected for cracks, chafing of the outer cover, leaks, blisters and other damage. These are important and vulnerable parts of the brake system and inspection should be complete. A light and mirror will be helpful for a thorough check. If a hose exhibits any of the above conditions, replace it with a new one.

REPLACEMENT

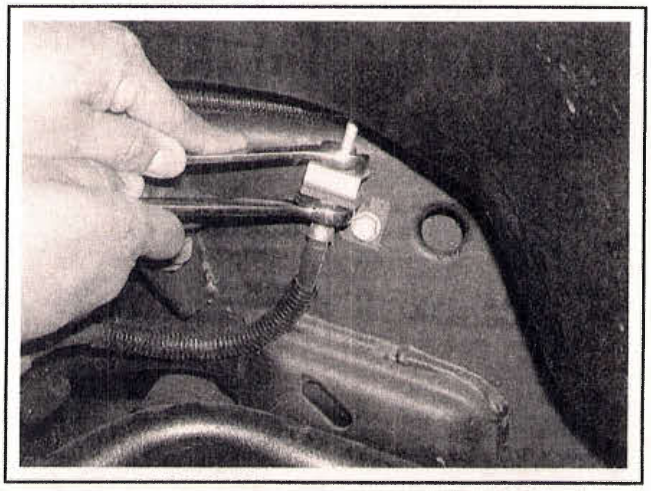
Flexible brake hose

Front

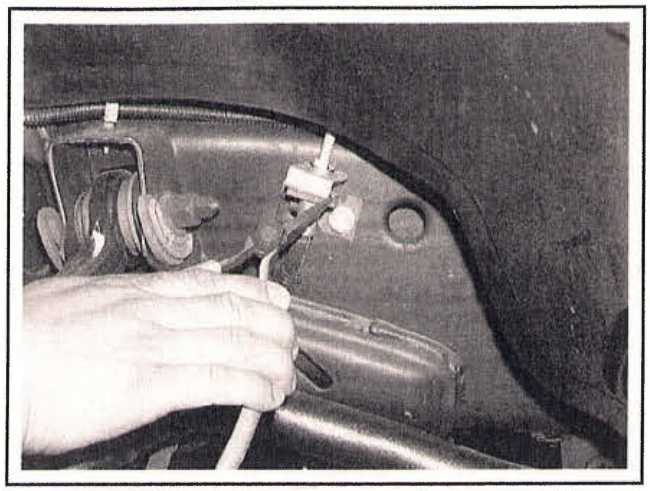
Refer to illustrations 9.3, 9.4 and 9.6

2 Loosen the wheel lug nuts, raise the vehicle and support it securely on jackstands. Remove the wheel.

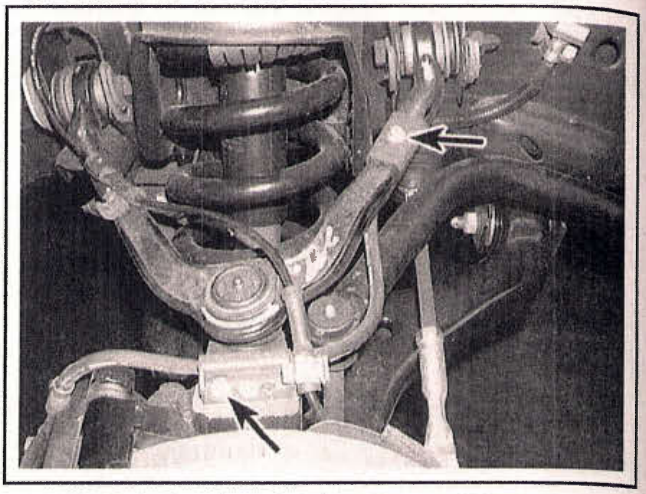
3 At the bracket, unscrew the brake line fitting from the hose (see illustration). Use a flare-nut wrench to prevent rounding off the corners of the fitting nut, and hold the hose end with a wrench to prevent twisting the frame bracket.



9.3 Using a flare-nut wrench, unscrew the threaded fitting on the brake line, while holding the hose end stationary with an open-end wrench . . .



9.4 . . . then remove the U-clip and detach the hose from the bracket



9.6 The brake hose is routed along the top of the steering knuckle and the upper control arm, and is held in place with two brackets

4 Remove the U-clip from the female fitting at the bracket with a pair of pliers, then pass the hose through the bracket (see illustration).

5 At the caliper end of the hose, remove the inlet fitting bolt, then separate the hose from the caliper. Note that there are two copper sealing washers on either side of the inlet fitting (see illustration 4.2) - they should be replaced with new ones during installation.

6 Remove the bolts that secure the hose brackets to the steering knuckle and the upper control arm, then remove the hose (see illustration).

7 To install the hose, connect the fitting to the caliper with the inlet fitting bolt and new sealing washers. Tighten the inlet fitting bolt to the torque listed in this Chapter's Specifications.

8 Route the hose along the top of the steering knuckle, upper control arm and into the frame bracket, making sure it isn't twisted. Tighten the hose bracket bolts securely. Connect the brake line fitting, starting the threads by hand. Install the U-clip, then tighten the fitting securely.

9 Bleed the caliper (see Section 8).

10 Install the wheel and lug nuts, lower the vehicle and tighten the lug nuts to the torque listed in the Chapter 1 Specifications.

Rear

Chassis-to-rear axle

Refer to illustrations 9.12 and 9.14

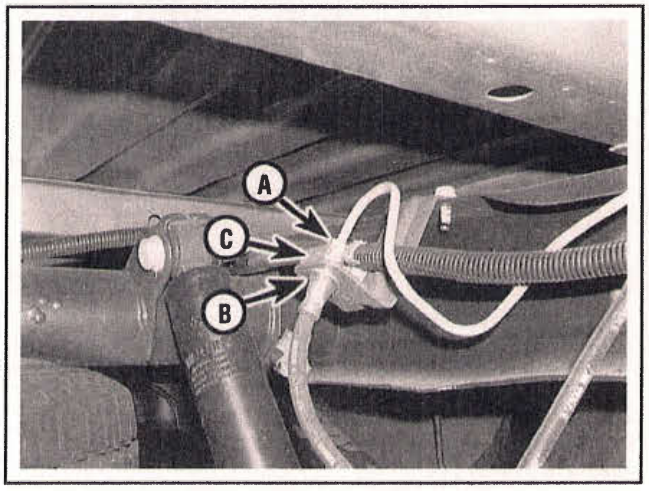
11 Raise the rear of the vehicle and support it securely on jackstands. Block the front wheels to prevent the vehicle from rolling.

12 At the chassis bracket, unscrew the brake line fitting from the hose (see illustration). Use a flare-nut wrench to prevent rounding off the corners of the fitting nut, and hold the hose end with a wrench to prevent twisting the bracket.

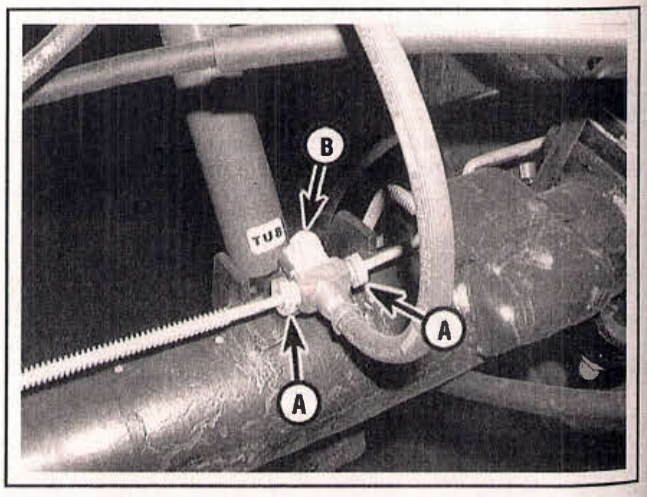
13 Remove the U-clip from the female fitting at the bracket with a pair of pliers, then pass the hose through the bracket.

14 At the axle end of the hose, unscrew the two brake line fittings with a flare-nut wrench, unscrew the bolt securing the fitting block to the axle housing, then separate the lines from the fitting block and remove the hose (see illustration).

15 To install the hose, reverse the removal procedure, then bleed both rear calipers (see Section 8).



9.12 At the upper end of the chassis-to-rear axle brake hose, unscrew the line fitting (A) with a flare-nut wrench while holding the end of the brake hose (B) with an open-end wrench, then remove the U-clip (C)



9.14 At the lower end of the chassis-to-rear axle brake hose, unscrew the brake line fittings (A) with a flare-nut wrench, then remove the bolt securing the junction block (B)

Rigid line-to-caliper hose

Refer to illustration 9.17

16 Loosen the wheel lug nuts, raise the rear of the vehicle and support it securely on jackstands. Block the front wheels to prevent the vehicle from rolling. Remove the wheel.

17 At the bracket, unscrew the brake line fitting from the hose (see illustration). Use a flare-nut wrench to prevent rounding off the corners of the fitting nut, and hold the hose end with a wrench to prevent twisting the bracket.

18 Remove the U-clip from the female fitting at the bracket with a pair of pliers, then pass the hose through the bracket.

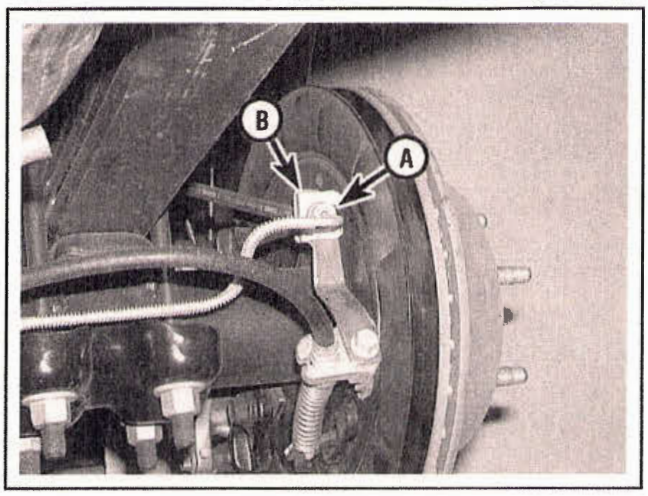
19 At the caliper end of the hose, remove the inlet fitting bolt, then separate the hose from the caliper. Note that there are two copper sealing washers on either side of the inlet fitting (see illustration 4.2) - they should be replaced with new ones during installation.

20 To install the hose, connect the fitting to the caliper with the inlet fitting bolt and new sealing washers. Tighten the inlet fitting bolt to the torque listed in this Chapter's Specifications.

21 Route the hose into its bracket, making sure it isn't twisted. Connect the brake line fitting, starting the threads by hand. Install the U-clip, then tighten the fitting securely.

22 Bleed the caliper (see Section 8).

23 Install the wheel and lug nuts, lower the vehicle and tighten the lug nuts to the torque listed in the Chapter 1 Specifications.



9.17 Unscrew the rigid line-to-caliper hose fitting with a flare-nut wrench (A), then remove the U-clip (B) and separate the hose from the bracket

Metal brake lines

24 When replacing brake lines, be sure to use the correct parts. Don't use copper tubing for any brake system components. Purchase steel brake lines from a dealer or auto parts store.

25 Prefabricated brake line, with the tube ends already flared and fittings installed, is available at auto parts stores and dealer parts departments. These lines must be bent to the proper shapes using a tubing bender.

26 When installing the new line, make sure it's securely supported in the brackets and has plenty of clearance between moving or hot components.

27 After installation, check the master cylinder fluid level and add fluid as necessary. Bleed the brake system (see Section 8) and test the brakes carefully before driving the vehicle in traffic.

10 Brake hydraulic system - bleeding

Refer to illustration 10.8

WARNING:

Wear eye protection when bleeding the brake system. If the fluid comes in contact with your eyes, immediately rinse them with water and seek medical attention.

Note: Bleeding the hydraulic system is necessary to remove any air that manages to find its way into the system when it's been opened during removal and installation of a hose, line, caliper or master cylinder.

1 You'll probably have to bleed the system at all four brakes if air has entered it due to low fluid level, or if the brake lines have been disconnected at the master cylinder.

2 If a brake line was disconnected only at a wheel, then only that caliper must be bled.

3 If a brake line is disconnected at a fitting located between the master cylinder and any of the brakes, that part of the system served by the disconnected line must be bled.

4 Remove any residual vacuum (vacuum booster) or pressure (hydraulic booster) from the power brake booster by applying the brake several times with the engine off.

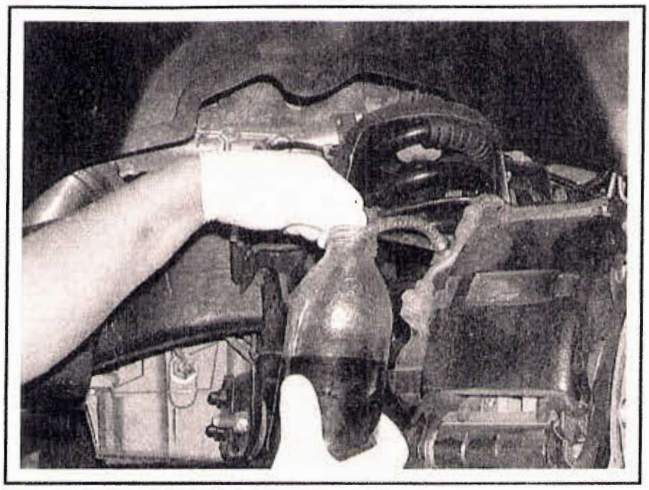
5 Remove the master cylinder reservoir cap and fill the reservoir with brake fluid. Reinstall the cap.

Note: Check the fluid level often during the bleeding operation and add fluid as necessary to prevent the fluid level from falling low enough to allow air bubbles into the master cylinder.

6 Have an assistant on hand, as well as a supply of new brake fluid, a clear container partially filled with clean brake fluid, a length of clear tubing to fit over the bleeder valve and a wrench to open and close the bleeder valve.

7 Beginning at the right rear wheel, loosen the bleeder valve slightly, then tighten it to a point where it's snug but can still be loosened quickly and easily.

8 Place one end of the tubing over the bleeder valve and submerge



10.8 When bleeding the brakes, a hose is connected to the bleed screw at the caliper and then submerged in brake fluid - air will be seen as bubbles in the tube and container (all air must be expelled before moving to the next wheel)

the other end in brake fluid in the container (see illustration).

9 Have the assistant depress the brake pedal slowly and hold it in the depressed position.

10 While the pedal is held down, open the bleeder valve just enough to allow a flow of fluid to leave the valve. Watch for air bubbles to exit the submerged end of the tube. When the fluid flow slows after a couple of seconds, close the valve and have your assistant release the pedal.

11 Repeat Steps 9 and 10 until no more air is seen leaving the tube, then tighten the bleeder valve and proceed to the left rear wheel, the right front wheel and the left front wheel, in that order, and perform the same procedure. Be sure to check the fluid in the master cylinder reservoir frequently.

12 Never use old brake fluid. It contains moisture which can cause the fluid to boil, rendering the brake system inoperative.

13 Refill the master cylinder with fluid at the end of the operation.

14 Check the operation of the brakes. The pedal should feel solid when depressed, with no sponginess. If necessary, repeat the entire process.

15 Before driving the vehicle, sit in the driver's seat and:

a) Take your foot off the brake pedal

b) Start the engine and let it run for a minimum of 10 seconds. Watch the amber ABS light on the dash.

c) If the light comes on and does not turn off after 10 seconds, have the vehicle towed to a dealer service department or other qualified repair shop. A scan tool will have to be used to diagnose the ABS system.

d) If the ABS light goes off after three seconds or so, turn off the ignition.

e) Repeat paragraphs a) through d) one more time. If the amber ABS light turns off, test drive the vehicle in an isolated area before returning the vehicle to normal service.

WARNING:

Do not operate the vehicle if you're in doubt about the effectiveness of the brake system.

11 Power brake booster - check, removal and installation

Refer to illustrations 11.10, 11.14 and 11.15

WARNING:

These models have airbags. Always disable the airbag system before working in the vicinity of any airbag system component to avoid the possibility of accidental deployment of the airbag(s), which could cause personal injury (see Chapter 12).

CHECK

Vacuum booster

Operating check

1 Depress the pedal and start the engine. If the pedal goes down slightly, operation is normal.

2 Depress the brake pedal several times with the engine running and make sure that there is no change in the pedal reserve distance.

Airtightness check

3 Start the engine and turn it off after one or two minutes. Depress the brake pedal several times slowly. If the pedal goes down farther the first time but gradually rises after the second or third depression, the booster is airtight.

4 Depress the brake pedal while the engine is running, then stop the engine with the pedal depressed. If there is no change in the pedal reserve travel after holding the pedal for 30 seconds, the booster is airtight.

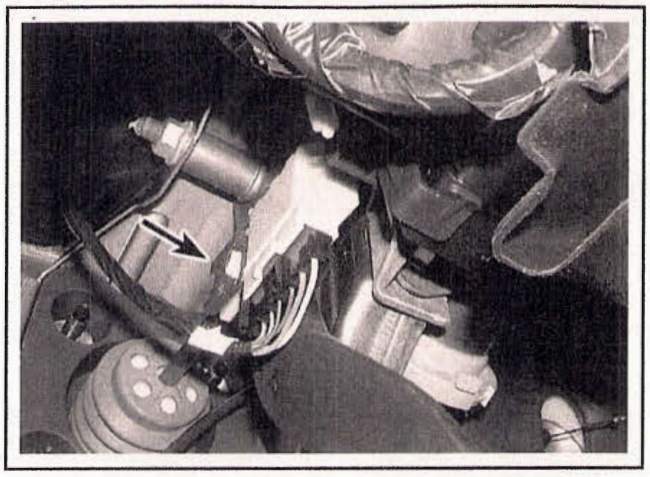
Hydraulic booster

5 Turn the engine off, then depress the brake pedal several times to deplete the pressure in the accumulator.

6 Push down on the brake pedal, exerting approximately 40 pounds of force, then start the engine. If the booster is working properly, the brake pedal will sink towards the floor then rise back up against your foot.

7 If the booster does not work as described, check the fluid level in the power steering reservoir, adding as necessary. Also check the hoses from the power steering pump to the booster for kinks. If everything checks out OK, the booster or power steering pump is defective. Have the power steering pump output pressure checked. If the pump is developing sufficient pressure, replace the booster.

11.10 Pull the vacuum hose fitting straight out of the grommet in the booster



11.14 Pry off the clip retaining the brake light switch and the booster pushrod to the pin on the brake pedal

REMOVAL

8 Disable the airbag system (see Chapter 12). Disconnect the cable from the negative terminal of the battery.

CAUTION:

On models equipped with the "Theftlock" audio system, be sure the lockout feature is turned off before performing any procedure which requires disconnecting the battery (see the information at the front of this manual).

9 If you're working on a model with a hydraulic booster, pump the brake pedal several times to deplete the pressure in the accumulator.

10 If you're working on a model with a vacuum booster, detach the vacuum hose from the booster (see illustration).

11 If you're working on a model with a hydraulic booster, detach the pressure and return lines from the booster. Cap the lines to prevent fluid leakage.

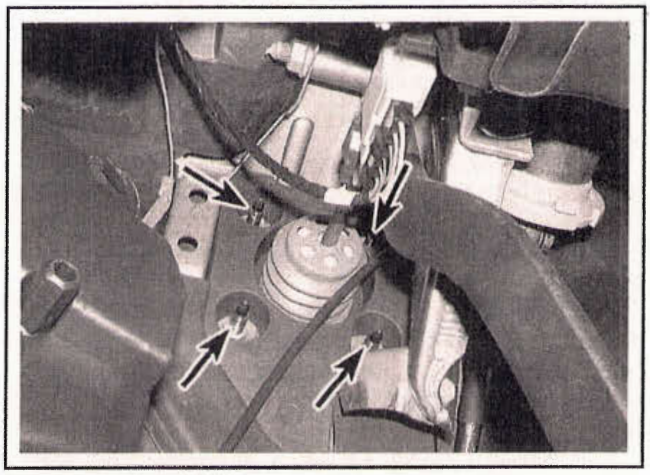
12 Remove the master cylinder without detaching the brake lines. Pull it forward and position it aside. Be careful not to bend or kink the brake lines.

13 Remove the left side under-dash panel (see Chapter 11) and the heater duct under the steering column.

14 Remove the pushrod retaining clip (see illustration) and slip the brake light switch and the pushrod off the pin.

15 Remove the four nuts holding the brake booster to the firewall (see illustration).

16 Slide the booster straight out from the firewall until the studs clear the holes and pull the booster and gasket from the engine compartment.



11.15 Unscrew the booster mounting nuts

INSTALLATION

17 Installation is the reverse of removal. Be sure to use a new gasket, and tighten the booster mounting nuts and the master cylinder mounting nuts to the torque values listed in this Chapter's Specifications.

18 If you're working on a model with a hydraulic booster, bleed the power steering system as described in Chapter 10. Check the power steering fluid level and add some, if necessary, to bring it up to the appropriate level.

12 Brake pedal travel - check

1 The brake pedal is not adjustable, but the travel should be checked if the pedal seems low. You'll need a tape measure, yardstick or ruler for this procedure.

2 Depress the pedal a few times to deplete the reserve in the power brake booster.

3 Measure the position of the pedal at rest. You can either measure from the floor to the pedal or from the pedal to the steering wheel. Record your reading.

4 Now, depress the pedal (exerting approximately 70 lbs. of force) and measure how far the pedal has traveled. Compare your findings with the measurement listed in this Chapter's Specifications.

5 If the pedal travel is excessive, check for air in the system (bleed the brakes - see Section 8). A failed seal in the master cylinder could also cause excessive pedal travel.

13 Parking brake - adjustment

The parking brake cable is self-adjusting, but if the parking brake pedal travel is excessive or won't hold the vehicle on an incline, the parking brake shoes may need to be adjusted or replaced (see Section 13).

14 Parking brake pedal and cables - replacement

PEDAL

Refer to illustration 14.2

1 Disconnect the cable from the negative terminal of the battery.

CAUTION:

On models equipped with the "Theftlock" audio system, be sure the lockout feature is turned off before performing any procedure which requires disconnecting the battery (see the information at the front of this manual). Release the parking brake.

2 From underneath the vehicle, loosen the equalizer nut to relieve tension on the cables (see illustration).

3 Inside the vehicle, remove the left-side under-dash panel and the kick panel.

4 Unplug the electrical connector for the parking brake warning light switch.

5 Unbolt the fuse block and position it aside.

6 Detach the parking brake release cable from the parking brake pedal.

7 Unscrew the nuts securing the parking brake pedal assembly, then pull the assembly off its mounting studs.

8 Detach the cable end from the parking brake lever, then depress the tangs on the cable casing to release the casing from the pedal bracket.

9 Installation is the reverse of removal. Be sure to securely tighten the nut at the equalizer. Depress and release the pedal a few times, which will automatically adjust the cables.

FRONT CABLE

Refer to illustration 14.12

10 Disconnect the cable from the negative terminal of the battery.

CAUTION:

On models equipped with the "Theftlock" audio system, be sure the lockout feature is turned off before performing any procedure which requires disconnecting the battery (see the information at the front of this manual). Release the parking brake.

11 From underneath the vehicle, loosen the equalizer nut (see illustration 14.2).

12 Disconnect the end of the front cable from the connector at the intermediate cable, then, depress the tangs on the cable casing and detach the cable from the bracket (see illustration).

13 Follow the cable towards the front of the vehicle, detaching it from any other brackets that may be present.

14 Remove the parking brake pedal assembly (see Steps 3 through 8).

15 Detach the cable from the pedal assembly.

16 Peel back the carpet, pry the cable grommet out of the floorpan and remove the cable.

17 Installation is the reverse of removal. Be sure to securely tighten the nut at the equalizer. Depress and release the pedal a few times, which will automatically adjust the cables.

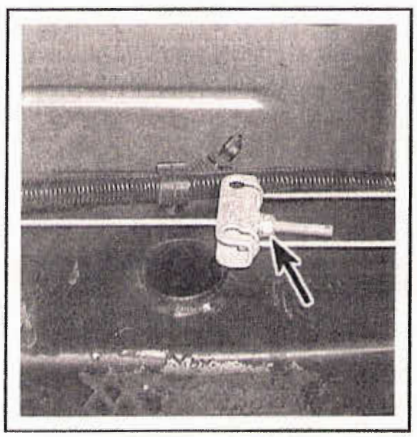
INTERMEDIATE CABLE

18 Release the parking brake.

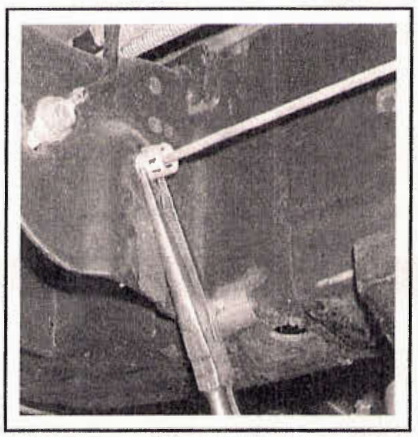
19 From underneath the vehicle, remove the equalizer nut (see illustration 14.2) and separate the intermediate cable from the equalizer.

20 Separate the intermediate cable from the front cable and remove it.

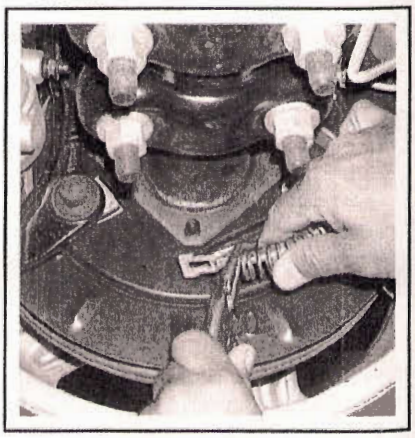
21 Installation is the reverse of removal. Be sure to securely tighten the nut at the equalizer. Depress and release the pedal a few times, which will automatically adjust the cables.



14.2 Loosen the equalizer nut to provide slack in the cables



14.12 Depress the tangs on the cable retainer and pass the cable and casing through the bracket



14.26 Unhook the cable end from the parking brake actuator lever

REAR CABLE(S)

Refer to illustrations 14.26 and 14.27

22 Raise the rear of the vehicle and support it securely on jackstands. Block the front wheels to prevent the vehicle from rolling.

23 Loosen the equalizer nut (see illustration 14.2) and detach the rear cable(s) from the equalizer.

24 Detach the cable casing from the bracket on the chassis by depressing the tangs of the retainer and passing the cable through the bracket.

25 Follow the cable and remove any mounting bracket bolts or clips that may be securing the cable.

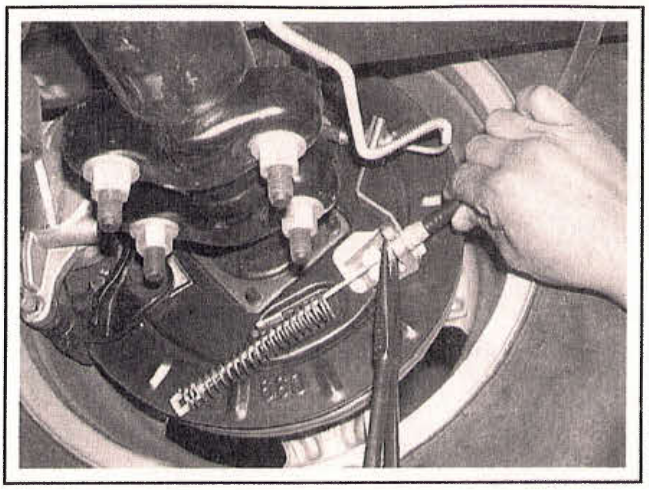
Disc brake models

26 Detach the end of the cable from the lever on the parking brake actuator (see illustration).

Drum brake models

27 Remove the brake shoes (see Section 6) and disconnect the parking brake cable from the parking brake lever.

28 Depress the tangs on the cable casing retainer and detach the cable casing from the bracket on the backing plate (see illustration). Remove the cable.



14.27 Depress the tangs on the cable retainer and detach the cable from the bracket on the backing plate

29 Installation is the reverse of removal. Be sure to securely tighten the nut at the equalizer. Depress and release the pedal a few times, which will automatically adjust the cables.

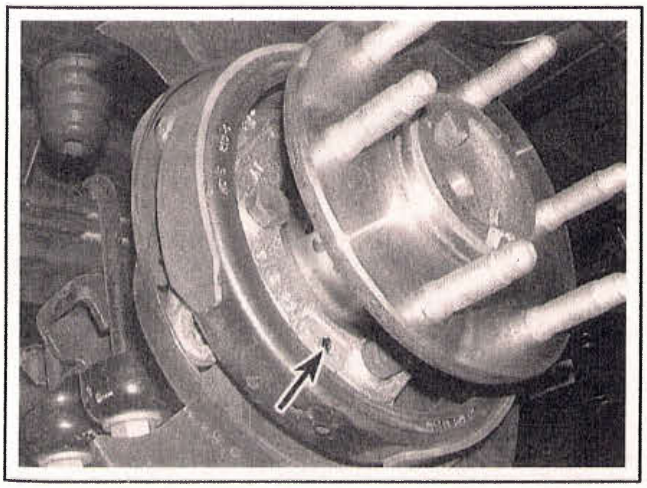
15 Parking brake shoes - replacement

WARNING:

The dust created by the brake system is harmful to your health. Never blow it out with compressed air and don't inhale any of it. An approved filtering mask should be worn when working on the brakes. Do not, under any circumstances, use petroleum-based solvents to clean brake parts. Use brake system cleaner only!

Note: This procedure applies to models with rear disc brakes.

1 Loosen the rear wheel lug nuts, raise the rear of the vehicle and support it securely on jackstands. Release the parking brake. Block the front wheels to prevent the vehicle from rolling, then remove the rear wheels.



15.3 On 1500 models, the parking brake shoe is secured at the bottom by a screw and a clip (arrow)

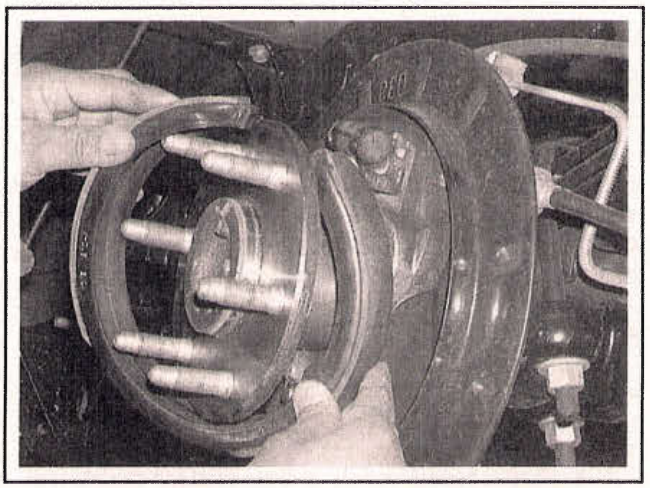
2 Remove the brake caliper (see Section 4), mounting bracket and the brake disc (see Section 5). Loosen the nut on the parking brake equalizer to provide some slack in the cables.

1500 MODELS

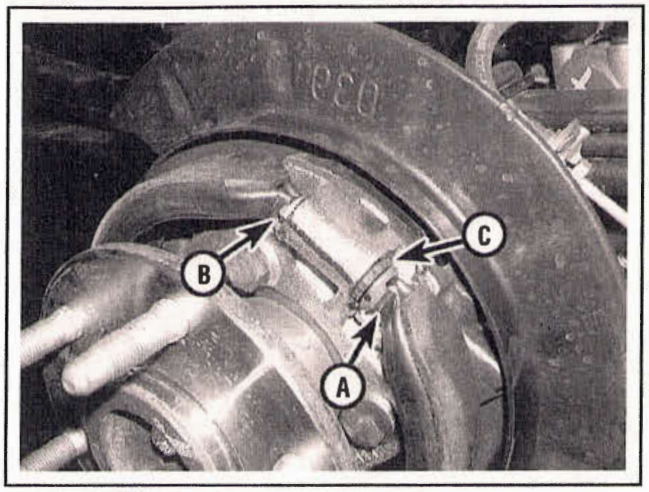
Refer to illustrations 15.3, 15.4 and 15.6

3 Wash the brake assembly with brake system cleaner. Remove the screw and clip securing the bottom of the shoe (see illustration), then slide the shoe up and off of the actuator.

4 Lift one end of the shoe over the axle flange, then work the shoe over the flange and remove it (see illustration).



15.4 Lift one end of the parking brake shoe over the axle flange, then "wind" the rest of the shoe over the flange (1500 models)



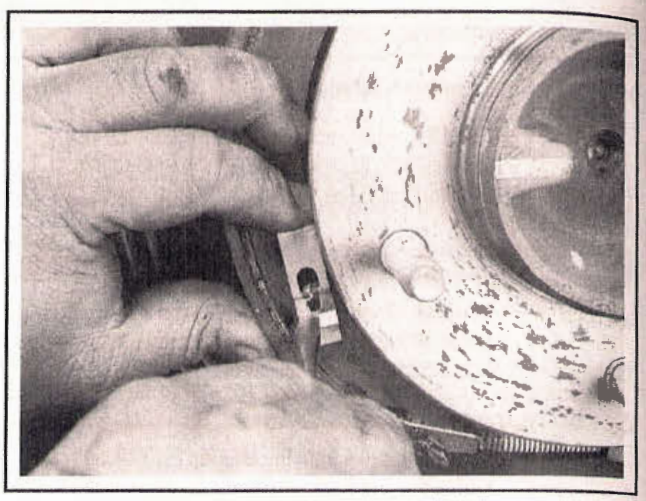
15.6 Make sure the ends of the shoe seat in the adjuster screw slot (A) and the tappet slot (B); C is the adjuster screw star wheel (1500 models)

5 Before installing the new shoe, turn the adjuster screw star wheel in, then make sure the slots in the adjusting screw and the tappet are parallel with the backing plate.

6 To install the shoe, reverse the removal procedure. Make sure the ends of the shoe seat properly in the slots in the adjuster screw and tappet (see illustration)

7 When installing the new shoe and lining assembly, turn the adjuster screw until the shoe lining just drags on the braking surface inside the disc. Then remove the disc and back-off the adjuster screw until the shoe lining doesn't drag when the disc is installed and turned. The actual clearance between the lining surface of the shoe and the braking surface inside the disc should be 0.026-inch.

8 Installation is otherwise the reverse of the removal procedure. Be sure to tighten the caliper bracket bolts and the caliper mounting bolts to the torque listed in this Chapter's Specifications, and the wheel lug nuts to the torque listed in the Chapter 1 Specifications.



15.9 Push in on the hold-down clip and turn the pin 90-degrees, then remove the clip (2500 models)

2500 MODELS

Refer to illustration 15.9

9 Wash the brake assembly with brake system cleaner, then remove the hold-down clip from each parking brake shoe (see illustration).

10 Unhook the return springs from the top and bottom of each shoe, then remove the shoes from the backing plate.

11 Installation of the new shoes is the reverse of the removal procedure. When installing the new shoes, turn the adjuster screw until the shoe lining just drags on the braking surface inside the disc. Then remove the disc and back-off the adjuster screw until the shoe lining doesn't drag when the disc is installed and turned. The actual clearance between the lining surface of the shoe and the braking surface inside the disc should be 0.026-inch.

12 Be sure to tighten the caliper bracket bolts and the caliper mounting bolts to the torque listed in this Chapter's Specifications, and the wheel lug nuts to the torque listed in the Chapter 1 Specifications.

16 Brake light switch - check, adjustment and replacement

Refer to illustration 16.1

CHECK

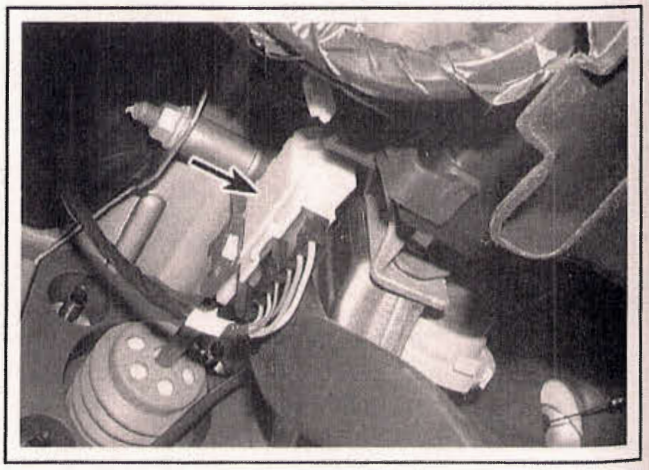
1 The brake light switch (see illustration) is located on the side of the brake pedal and is retained by the same clip that retains the booster pushrod. The switch activates the brake lights at the rear of the vehicle when the pedal is depressed. To gain access to the switch, remove the left-side under-dash panel and the heater/air conditioning duct.

2 If the brake lights are inoperative, check the fuse first (see Chapter 12).

3 If the fuse is good, check for voltage to the switch on the feed wire (refer to the wiring diagrams at the end of this manual for the proper color wire to check). If no voltage is present, repair the wire between the switch and the fuse box.

4 If voltage is present, depress the brake pedal and check for voltage at the output wire terminal (again, refer to the wiring diagrams). If no voltage is present, replace the switch.

5 If voltage is present, check for power on the brake light wires at



16.1 The brake light switch is mounted on the side of the brake pedal arm

the tail light housings (with the brake pedal depressed). If voltage is not present, repair the circuit between the switch and the brake lights.

6 If voltage is present, check for a bad ground; using a jumper wire connected to a good ground, probe the ground wire terminal at the tail light connector. If the brake lights go on, repair the ground circuit (follow the ground wire from the tail light housing).

7 Keep in mind that the brake light bulbs could be burned out, but the likelihood of all the bulbs being burned out is very slim.

ADJUSTMENT

8 The brake light switch on these vehicles is not adjustable. If it doesn't work as described above, replace it.

REPLACEMENT

9 Remove left-side under-dash panel and the heater/air conditioning duct, if not already done.

10 Unplug the electrical connector from the switch.

11 Remove the clip that retains the switch and pushrod to the pin on the brake pedal arm (see illustration 11.14) and slip the brake light switch off the pin.

12 To install the new switch, reverse the removal procedure. Make sure the retaining clip is properly installed.

Specifications

General

Brake fluid type	See Chapter 1
Front wheel speed sensor resistance	
1999 through 2002	850 to 1230 ohms (at 41 to 116-degrees F)
2003 and later	Not available
Brake pedal travel (maximum)	
With vacuum power brakes	
1999 through 2002	2.75 inches
2003 and later	2.56 inches
With hydraulic power brakes	
1999 through 2002	3.50 inches
2003 and later	3.54 inches

Disc brakes

Minimum pad thickness	See Chapter 1
Brake disc minimum thickness	Cast into disc
Maximum disc runout	0.003 inch
Maximum disc thickness variation	0.001 inch
Drum brakes	
Minimum shoe lining thickness	See Chapter 1
Maximum radial runout	0.0024 inch
Maximum drum diameter	Cast into drum

Torque specifications	Ft-lbs (unless otherwise indicated)
Brake booster mounting nuts (vacuum or hydraulic systems)	
1999 through 2003	27
2004 and later	24
Brake caliper	
Caliper mounting (guide pin) bolts	
Front	
2005 1500 models	74
All others	80
Rear	
1500 models	31
2500 models	80
Caliper mounting bracket bolts	
Front	
1500 models	
1999 through 2004	129
2005	133
2500 models	221
Rear	
1500 models	148
2500 models	
1999 through 2002	128
2003 and later	
JC3/JC5/JH2/JH5 calipers	148
JH6 calipers	122
JH7 calipers	221
Brake hose-to-caliper inlet fitting bolt	
1999 through 2001	
Front and rear	33
2002 and later	
Front and rear	30
Master cylinder-to-brake booster retaining nuts	27
Parking brake backing plate bolts	
1500	
1999 and 2000	71
2001 and later	100
2500	101
Wheel cylinder bolts	156 in-lbs
Wheel speed sensor (front) mounting screw	156 in-lbs
Wheel lug nuts	See Chapter 1