Chapter 9 Brakes

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Specifications

General

Brake fluid type	See Chapter 1
Power brake booster pushrod from firewall surface protrusion	10.275 to 10.525 mm

Disc brakes

Brake pad thickness	
Front	
Standard	11.5 mm
Minimum	3.0 mm
Rear	
Standard	11.0 mm
Minimum	2.0 mm
Disc runout (front and rear)	0.15 mm
Front disc thickness*	
Petrol	
Standard	20 mm
Minimum	18 mm
Diesel	
Standard	26 mm
Minimum	24 mm
Disc runout, maximum	0.07 mm
Rear disc thickness (all models with rear disc brakes)*	
Standard	18 mm
Minimum	16 mm
Caliper bore	
Front	68.1 mm
Rear	51.1 mm

Drum brakes

Shoe thickness	
Standard	6.1 mm
Minimum	1.5 mm
Drum inside diameter*	
Standard	295 mm
Maximum	296.5 mm
Drum out-of-round, maximum	0.03 mm
Drum runout, maximum	0.05 mm
Wheel cylinder bore	25.4 mm

***Note:** *If different specifications are cast into the disc or drum, they supersede information printed here.*

Parking brake

Drum diameter	
Standard	203.2 mm
Maximum	204.5 mm
Drum out-of-round, maximum	0.03 mm
Drum runout, maximum	0.05 mm
Shoe lining thickness	
Standard	5.1 mm
Minimum	1.5 mm
Lever travel with normal force	7 to 9 notches
Pedal height and freeplay	See Chapter 1

*__Note:__ *If different specifications are cast into the disc or drum, they supersede information printed here.*

Torque specifications

	Nm
Caliper anchor bolts	
Front	72 to 97
Rear	38 to 52
Caliper fitting banjo bolt	17 to 20
Disc brake caliper guide pin bolts	
Front caliper	22 to 31
Rear caliper	31 to 41
Load sensing valve bolts	8 to 11
Master cylinder-to-brake booster nuts	
Models prior to 8/95	8 to 11
Models from 8/95	12 to 15
Parking brake backing plate bolts	42 to 52
Pedal pivot nut	8 to 11
Power brake booster mounting nuts	
Models prior to 8/95	8 to 11
Models from 8/95	13 to 16
Rear backing plate bolts	50 to 68
Rotor (front) bolts	50 to 68
Tubing nuts	15 to 18
Wheel cylinder mounting bolts	6 to 7

1 General information

The vehicles covered by this manual are equipped with hydraulically operated front and rear brake systems. The front brakes are all disc type. Rears may be drum or disc. Both the front and rear brakes are self adjusting. The disc brakes automatically compensate for pad wear, while the rear drum brakes (if equipped) incorporate an adjustment mechanism which is activated as the brakes are operated.

Hydraulic system

The hydraulic system consists of two separate circuits. The master cylinder is designed for the split system and incorporates a primary piston for one circuit and a secondary piston for the other, and, in the event of a leak or failure in one hydraulic circuit, the other circuit will remain operative. A load sensing valve adjusts brake fluid pressure to the rear brakes according to how much weight is in the rear of the vehicle.

Power brake booster

The power brake booster, utilising engine manifold vacuum and atmospheric pressure to provide assistance to the hydraulically operated brakes, is mounted on the firewall in the engine compartment.

Parking brake

The parking brake operates on the rear of the transmission. It is activated by the parking brake lever which is mounted on the console.

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 force. The vehicle should stop evenly without pulling to one side or the other. Avoid locking the brakes, because this slides the tyres and diminishes braking efficiency and control of the vehicle.

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

2 Disc brake pads - renewal

Refer to illustrations 2.5 a through 2.5n

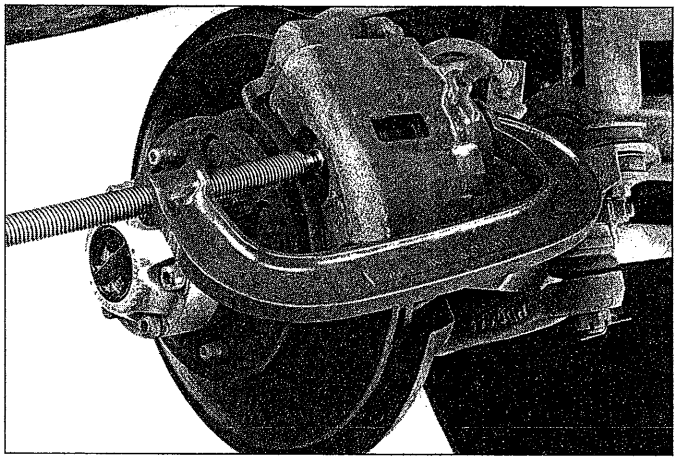
Warning: *Disc brake pads must be renewed on both front or rear wheels at the same time - never renew the pads on only one wheel. Also, the dust created by the brake system may contain asbestos, which is harmful to your health. Never blow it out with compressed air and don't inhale any of it. An approved 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 cleaner or denatured alcohol only! When servicing the disc brakes, use only high-quality, brand-name pads.*

Note: *This procedure applies to both the front and rear disc brakes.*

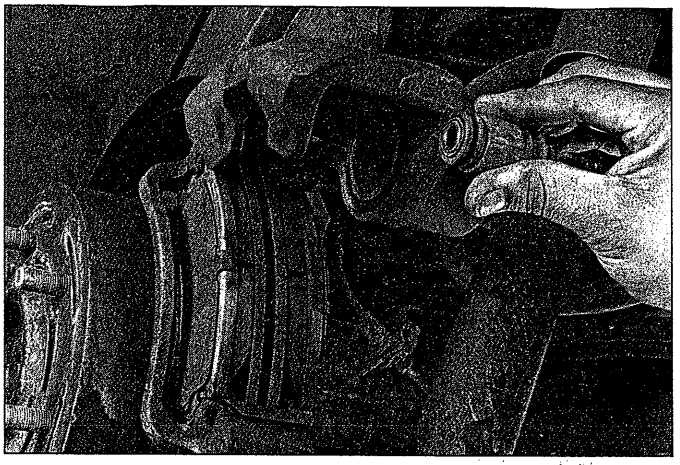
1 Remove the cap from the brake fluid reservoir.

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

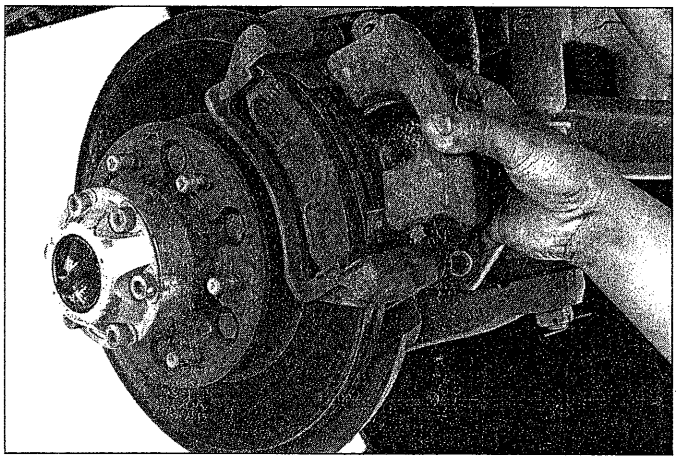
3 Remove the wheels. Work on one brake assembly at a time, using the assembled



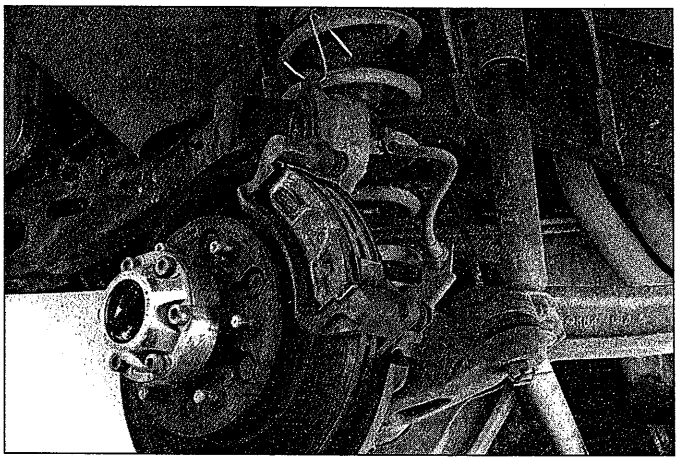
2.5a Use a large C-clamp to compress the piston back into its bore



2.5b Remove the lower guide pin bolt to swing the caliper up out of the way . . .



2.5c . . . or remove both bolts to remove the caliper completely



2.5d If you decide to remove the caliper completely, hang it from a wire like this to avoid having its weight stretch the hose

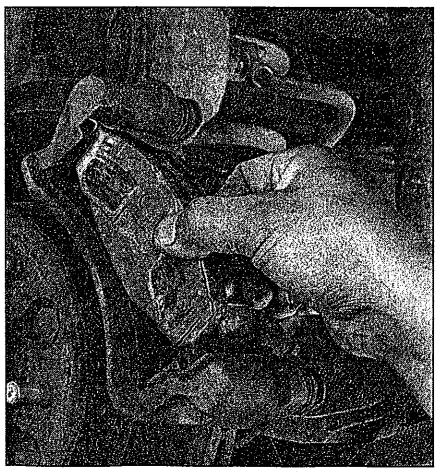
brake for reference if necessary.

4 Inspect the brake disc carefully as outlined in Section 4. If machining is necessary, follow the information in that Section to remove the disc, at which time the pads can be removed as well.

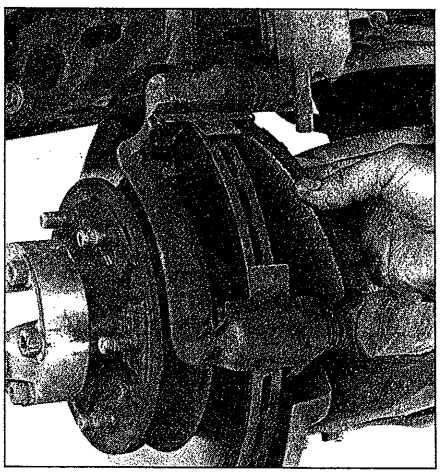
5 Follow the accompanying photos **(see illustrations)** for the actual pad renewal procedure. Most of the illustrations are of a front brake job, but the rear procedure is identical. Be sure to stay in order and read the caption under each illustration.

Note 1: *As the caliper piston is depressed to the bottom of the caliper bore, the fluid in the master cylinder will rise. Make sure that it doesn't overflow. Check it and, if necessary, siphon off some of the fluid.*

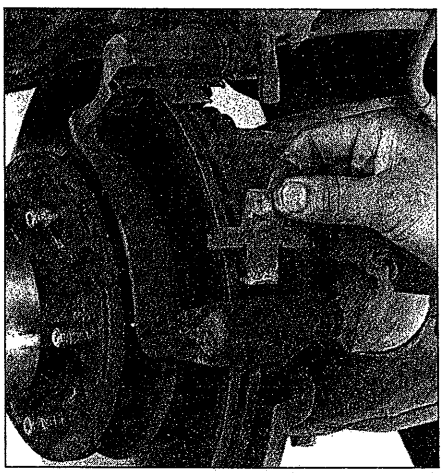
Note 2: *Be sure to transfer the wear indica-*



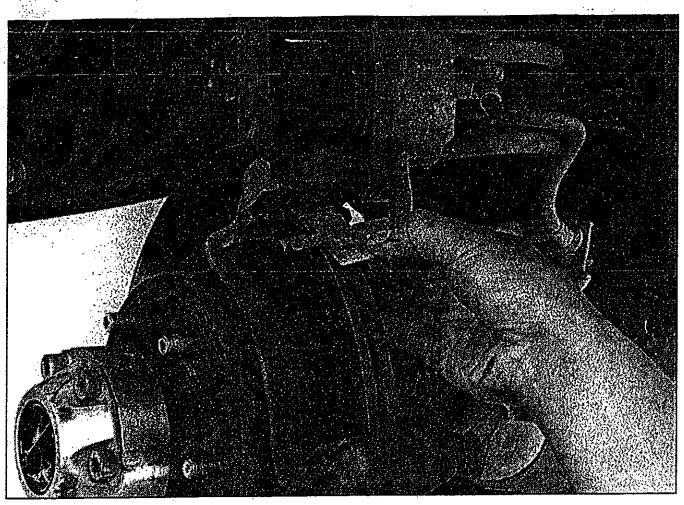
2.5e Lift out the outer pad . . .



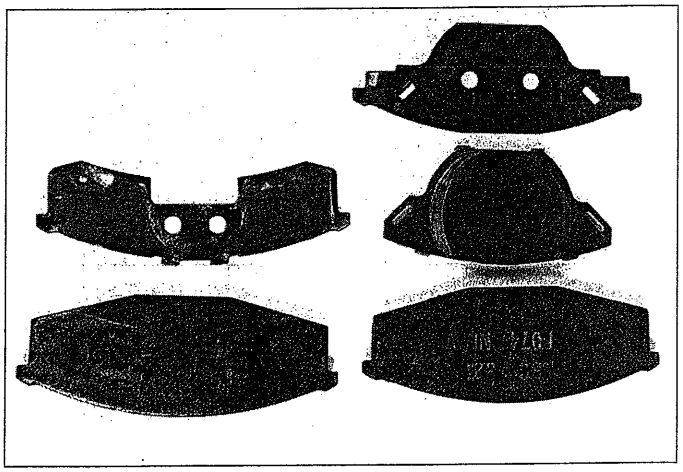
2.5f . . . and then the inner pad



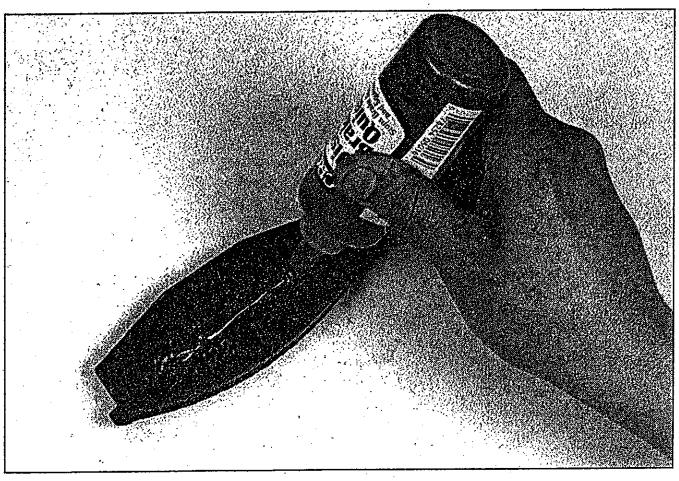
2.5g Take out the lower pad retainer clip . . .



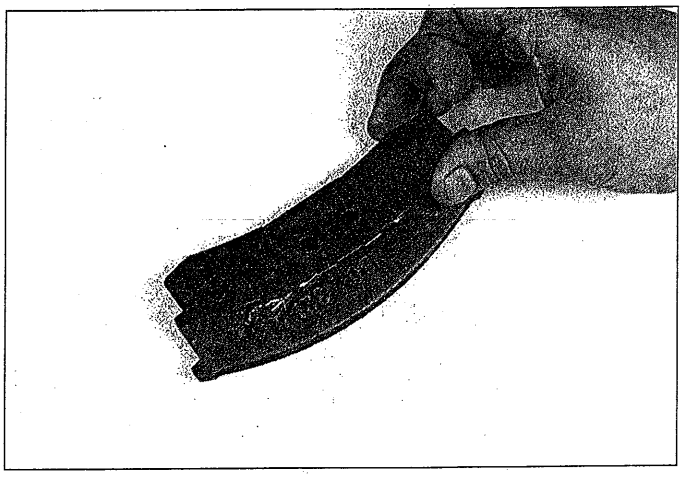
2.5h . . . and the upper retainer



2.5l Note that the outer pad uses one shim and the inner pad uses a shim and a shim cover



2.5j Apply anti-squeal to the outside of the outer pad . . .



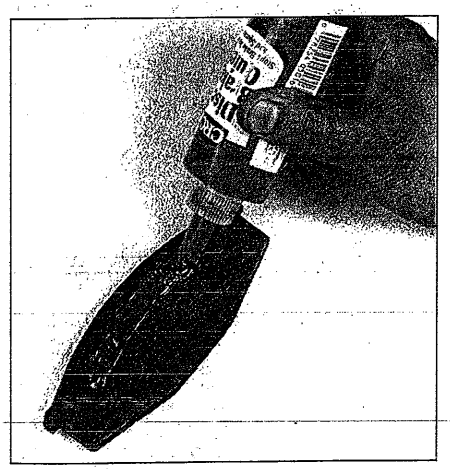
2.5k . . . and then refit the outer shim to it

tors from the old brake pads onto the new pads. If they are worn or bent, renew them.

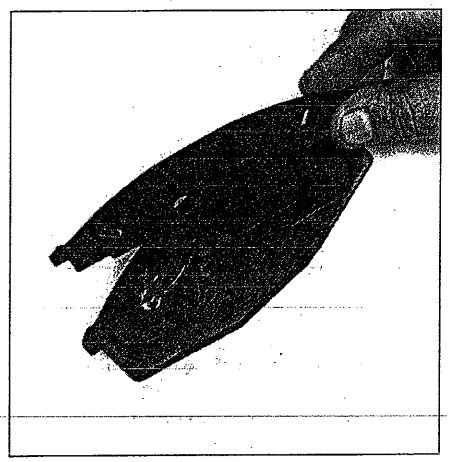
6 When refitting the caliper, be sure to tighten the mounting bolts to the torque listed in this Chapter's Specifications. **Warning:** *After the job has been completed, firmly depress the brake pedal a few times to bring the pads into contact with the disc. The brakes will not operate until this is done.* Check the level of the brake fluid, adding some if necessary. Check the operation of the brakes carefully before placing the vehicle into normal service.

3 Disc brake caliper - removal, overhaul and refitting

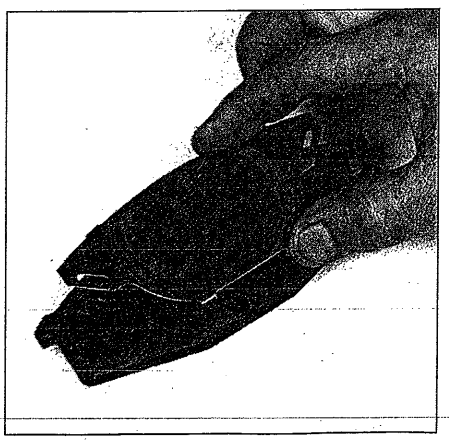
Warning: *Dust created by the brake system may contain asbestos, which is harmful to your health. Never blow it out with com-*



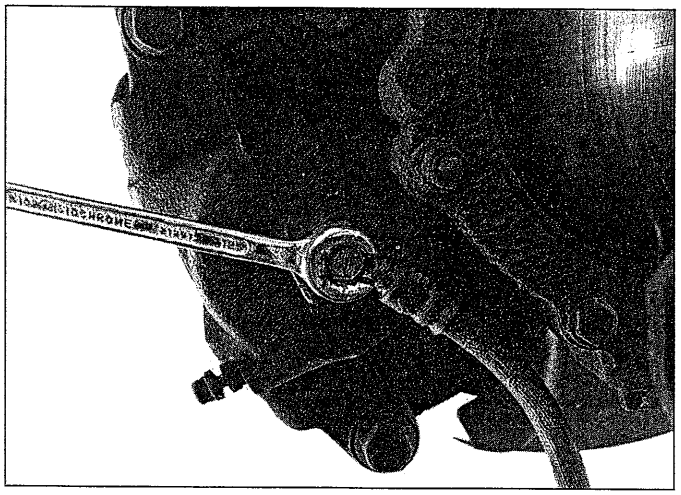
2.5l Apply anti-squeal to the outside of the inner pad . . .



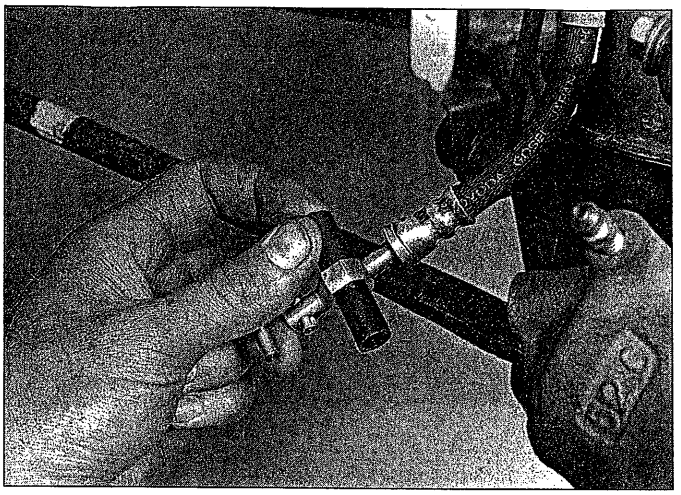
2.5m . . . followed by the inner pad shim . . .



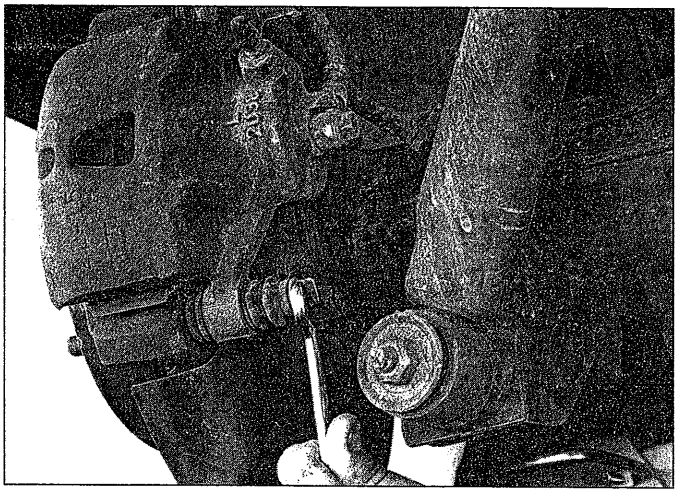
2.5n . . . and the small shim cover. Reverse the removal procedure to refit the brake components



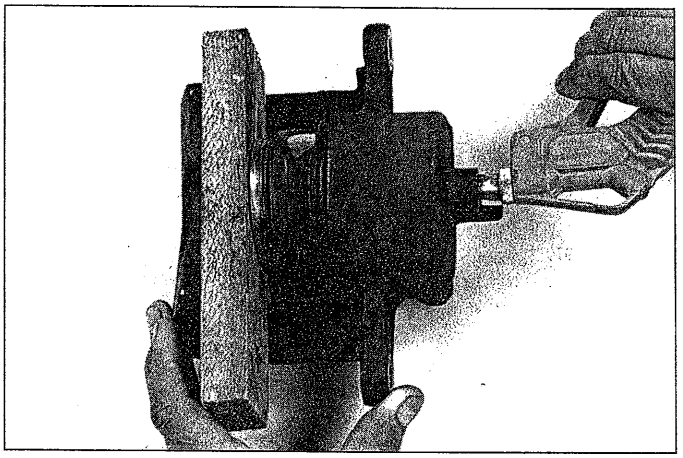
3.1 Remove the banjo fitting bolt from the brake line



3.2 Using a piece of rubber hose of the appropriate size, plug the brake line



3.3 Remove the caliper mounting bolts



3.5a With the caliper padded to catch the piston, use compressed air to force the piston out of its bore - make sure your hands or fingers are not between the piston and caliper

pressed 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 cleaner or denatured alcohol only!

Note 1: *If an overhaul is indicated (usually because of fluid leakage), explore all options before beginning the job. New and factory rebuilt calipers are available on an exchange basis, which makes this job quite easy. If it's decided to rebuild the calipers, make sure a rebuild kit is available before proceeding. Always rebuild the calipers in pairs - never rebuild just one of them.*

Note 2: *This procedure is illustrated with a single piston type caliper. The procedures are the same for the dual piston type. This procedure applies to both the front and rear disc brakes.*

Removal

Refer to illustrations 3.1, 3.2 and 3.3

1 Remove the bolt and disconnect the brake hose from the caliper **(see illustration)**.

2 Plug the brake hose to keep contaminants out of the brake system and to prevent losing any more brake fluid than is necessary **(see illustration)**.

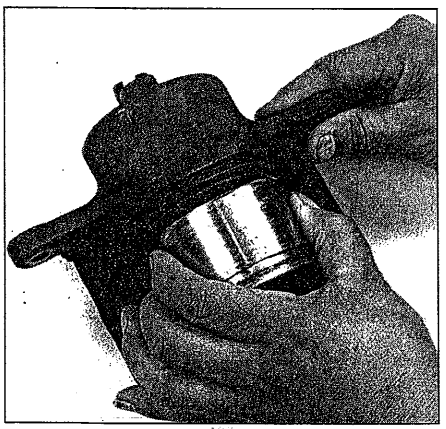
3 Slightly depress the piston (refer to Section 2), remove the upper and lower guide pin bolts and remove the caliper **(see illustration)**.

Overhaul

Refer to illustrations 3.5a, 3.5b, 3.7a, 3.7b, 3.11 and 3.12

4 Before you remove the piston, place a wood block between the piston and caliper to prevent damage as it is removed.

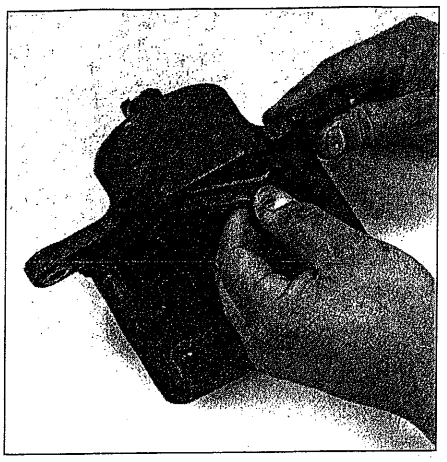
5 To remove the piston from the caliper, apply compressed air to the brake fluid hose connection on the caliper body **(see illustrations)**. Use only enough pressure to ease the piston out of its bore. **Warning:** *Be careful not to place your fingers between the piston and the caliper as the piston will come out with some force.*



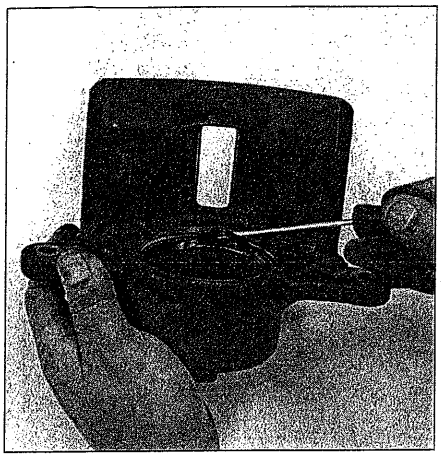
3.5b Slip the piston completely out and then inspect the bore and the piston

6 Inspect the mating surfaces of the piston and caliper bore wall. If there is any scoring, rust, pitting or bright areas, renew the complete caliper unit.

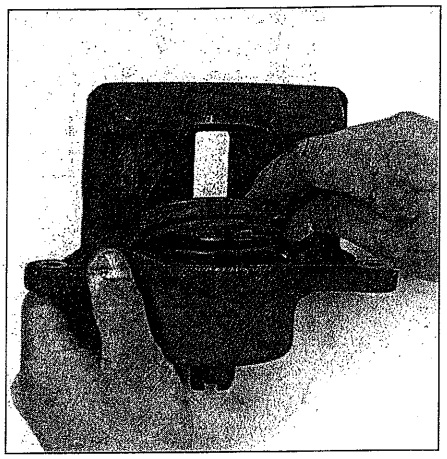
7 If these components are in good condi-



3.7a The dust boot can now be removed. Some calipers use a clip to retain the boot - remove it first



3.7b The piston seal should be removed with a plastic or wooden tool to avoid damage to the bore and seal groove - a pencil will do the job



3.11 Refit the seal into the bore and then press the dust boot into its groove

tion, remove the dust boot along with its retainer (if used), and the piston seal from the caliper bore using a wooden or plastic tool **(see illustrations)**. Metal tools may damage the cylinder bore.

8 On single piston type calipers, push the sliding bushes out of the torque plate and remove the dust boots from both ends.

9 Wash all the components in clean brake fluid or brake cleaner.

10 Submerge the new piston seal and the piston in brake fluid and refit the seal into the caliper bore.

11 Refit the new piston dust boot **(see illustration)**. Refit the dust boot retaining ring (rear brakes only).

12 Refit the piston. Do not force the piston into the bore, but make sure that it is squarely in place, then apply firm (but not excessive) force to refit it **(see illustration)**.

13 On single piston type calipers, apply silicone-based grease (supplied with the rebuild kit) to the sliding pins and the bushes. Refit the dust boots.

Refitting

14 Refit the caliper by reversing the removal procedure. Remember to renew the copper sealing washers (gaskets) at the brake hose-to-caliper connection (new washers normally come with the rebuild kit).

15 Bleed the brake circuit according to the procedure in Section 9. Make sure there are no leaks from the hose connections. Test the brakes carefully before returning the vehicle to normal service. **Note:** *The manufacturer recommends that the amount of torque required to rotate the disc be checked after final assembly to ensure that there is not a binding condition in the guide pins which could be preventing the caliper assembly from releasing completely. It is good practice to simply disassemble the sliding hardware (pins, bolts and boots), clean all the components and renew any parts that require it. Lubricate all the sliding components with high temperature brake grease before reassembly. Make sure that the sliding mechanism operates freely before refitting the caliper. This will eliminate binding calipers and dragging brakes.*

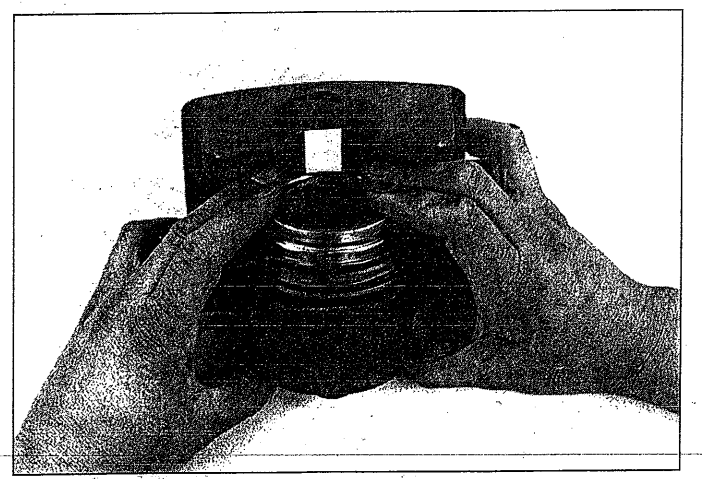
4 Brake disc - inspection, removal and refitting

Inspection

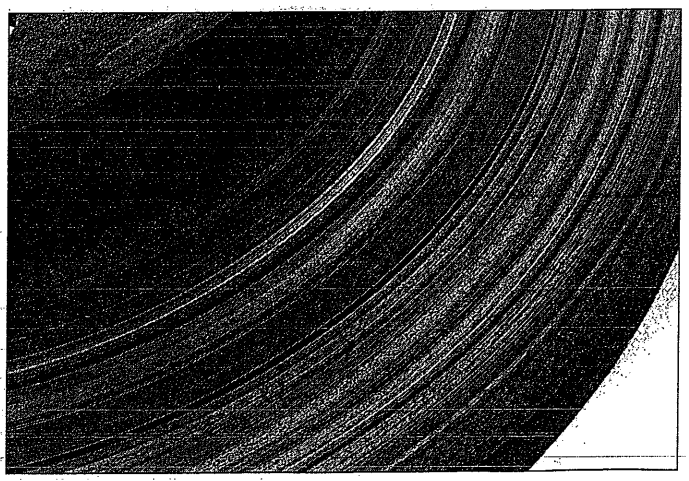
Refer to illustrations 4.3, 4.4a, 4.4b, 4.5a and 4.5b

1 Loosen the wheel lug nuts, raise the vehicle and support it securely on jackstands. Remove the wheel and refit two or three lug nuts to hold the disc in place (on rear brakes only). If the rear brake disc is being worked on, release the parking brake.

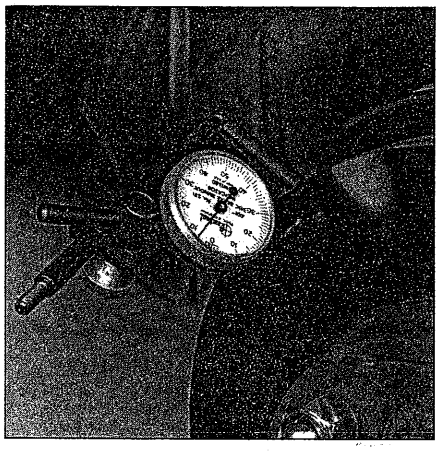
2 Slightly depress the caliper piston with a C-clamp (refer to Section 2), remove the caliper mounting bolts and remove the caliper **(refer to Section 3)**. It isn't necessary to disconnect the brake hose. After removing the caliper bolts, suspend the caliper out of



3.12 Lubricate all of the components with special brake system lubricant or brake fluid and then refit the piston through the dust boot and into the seal and bore

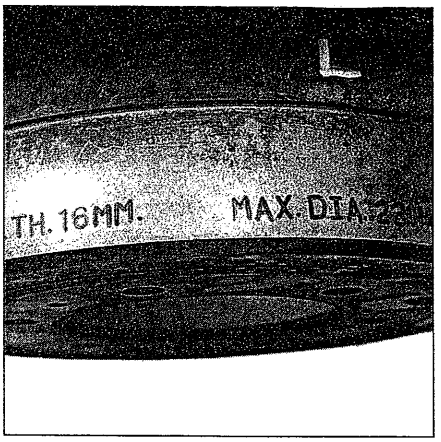


4.3 The brake pads on this vehicle were obviously neglected, as they wore down to the rivets and cut deep grooves into the disc - wear this severe will require renewal of the disc

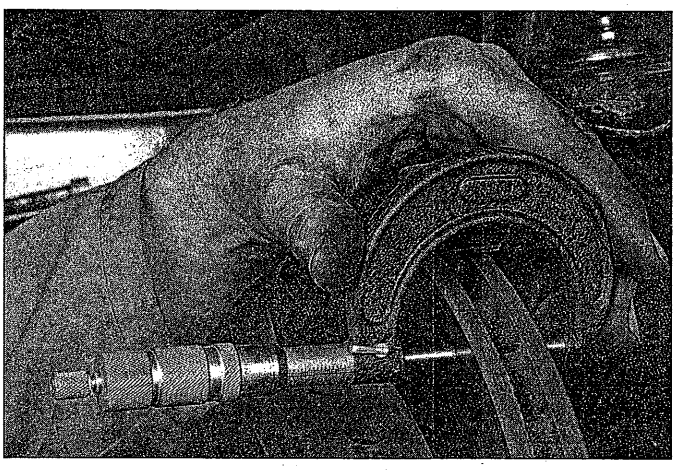


4.4a Use a dial indicator to check disc runout - if the reading exceeds the maximum allowable runout limit, the disc will have to be machined or renewed

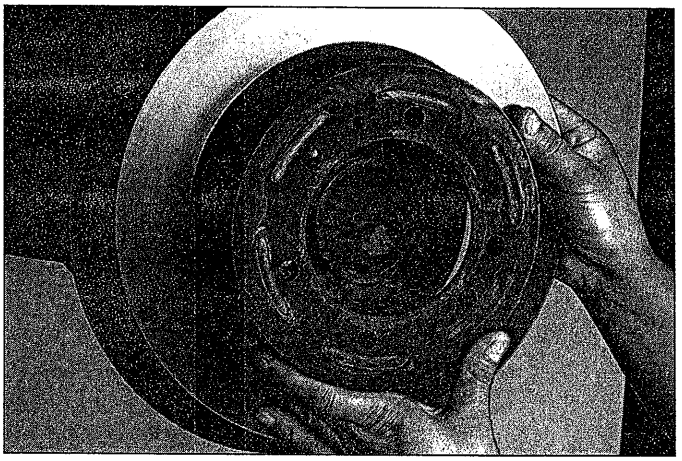
4.4b Using a swirling motion, remove the glaze from the disc surface with sandpaper or emery cloth



4.5a The minimum wear dimension is cast into the disc. It is not permissible to machine the disc smaller than this figure



4.5b Use a micrometer to measure disc thickness



4.11 After the rear caliper has been removed, the disc can be slipped off

the way with a piece of wire.

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 - over 1.0 mm - 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 excessive disc runout.

4 To check disc runout, place a dial indicator at a point about 12 mm 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:** *It is a good practice to have the discs resurfaced 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 using a swirling motion* **(see illustration)**.

5 It's absolutely critical that the disc not be machined to a thickness under the specified minimum allowable disc refinish thickness. The minimum wear (or discard) thickness is cast into the disc **(see illustration)**. The disc thickness can be checked with a micrometer **(see illustration)**.

Renewal

Front brakes

6 Refer to Chapter 8 and remove the hub assembly.

7 Remove the bolts which secure the disc to the hub.

8 Refitting is the reverse of removal. Tighten the fasteners to the torque listed in this Chapter's specifications.

9 Adjust the pre-load of the front wheel bearings (refer to Chapter 8).

Rear brakes

Refer to illustration 4.11

10 Remove the caliper anchor plate (refer to Section 3).

11 Lift the disc from the axle **(see illustration)**.

12 Refitting is the reverse of removal. Refit the caliper and tighten the mounting bolts to the specified torque.

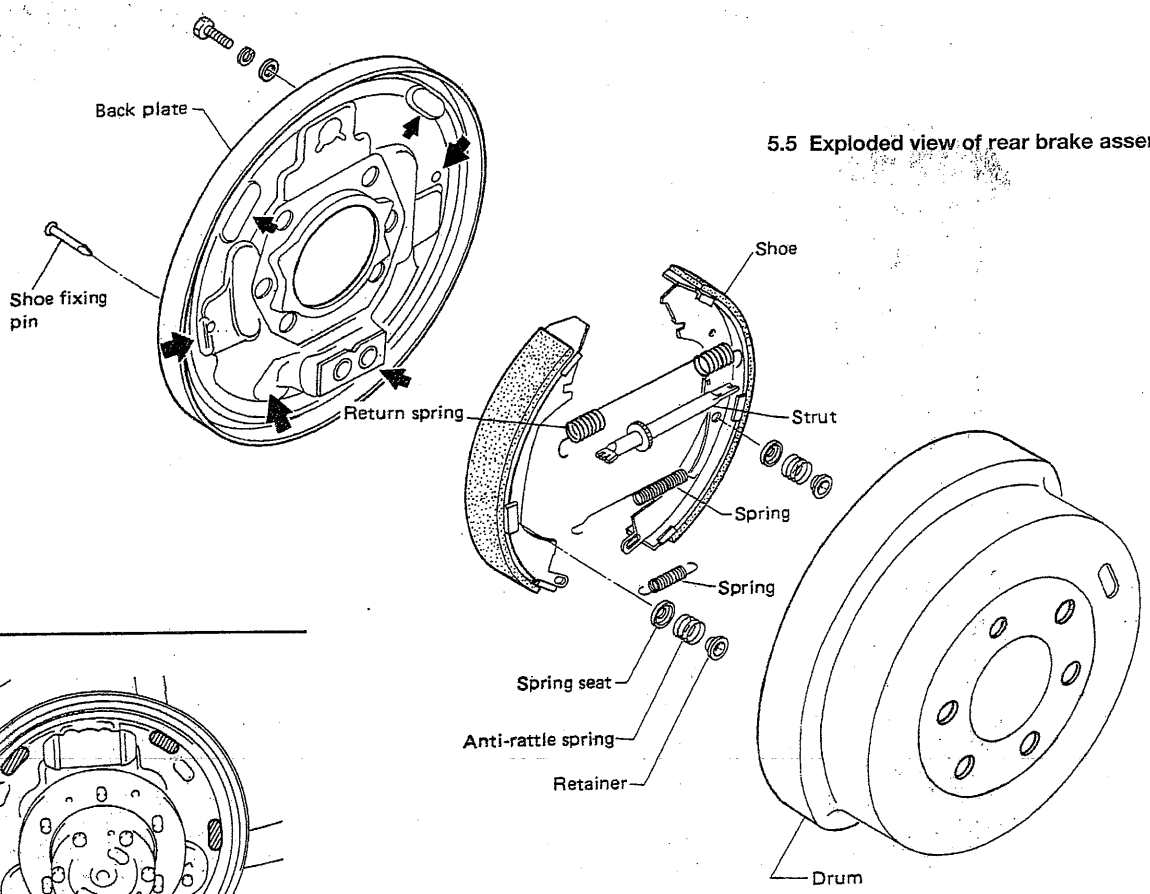
Front and rear brakes

13 Refit the wheel, then lower the vehicle to the ground. 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.

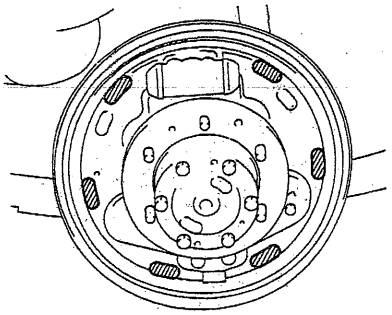
5 Drum brake shoes - renewal

Refer to illustrations 5.5, 5.13 and 5.14

Warning: *Drum brake shoes must be renewed on both wheels at the same time - never renew the shoes on only one wheel. Also, the dust created by the brake system*

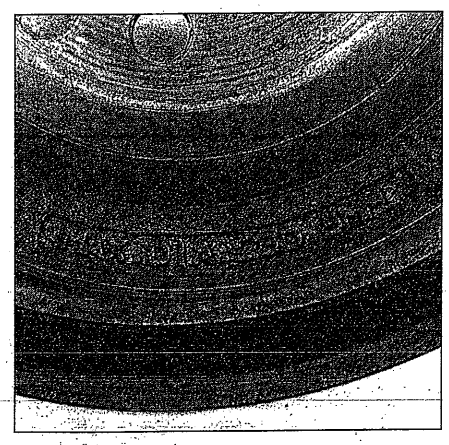


5.5 Exploded view of rear brake assembly



5.13 Lubricate the brake shoe contact points on the backing plate

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



5.14 The maximum brake drum diameter is cast directly into it

to clean brake parts. Use brake cleaner or denatured alcohol only!

Caution: *Whenever the brake shoes are renewed, the return and hold-down springs should also be renewed. Due to the continuous heating/cooling cycle the springs are subjected to, they lose tension over a period of time and may allow the shoes to drag on the drum and wear at a much faster rate than normal. When renewing the brake shoes, use only high-quality, brand-name parts.*

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

2 Release the parking brake.

3 Remove the wheels and brake drums. If the brake drums cannot be easily pulled off the axle and shoe assembly, apply some penetrating oil at the hub-to-drum joint. Allow the oil to soak in and try to pull the drum off. Insert two M8 x 1.25 bolts into the threaded holes in the brake drum and tighten them gradually. **Note:** *Before removing anything, clean the brake assembly with brake cleaner and allow it to dry - position a drain pan under the brake to catch the fluid and residue* - **Do not use compressed air to blow the dust from the parts!**

4 Always leave one brake assembly intact so that you can refer to it if necessary. Never disassemble both rear brakes at the same time.

5 Remove the shoe hold-down retainers, springs, seats and pins **(see illustration)**.

6 Remove the spring from the bottom of the shoes.

7 Pull the shoes apart at the top and remove them from the backing plate.

8 Disassemble the adjuster and spring from the shoes.

9 Remove the adjuster bracket from the top of the shoe.

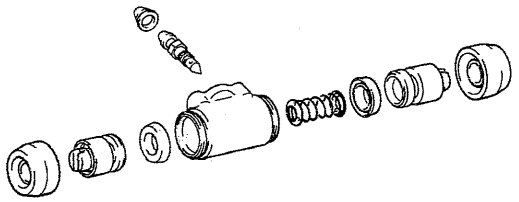
10 Clean all components including the backing plate thoroughly. Examine all components including the springs and adjuster for wear. Renew any worn parts.

11 Inspect the wheel cylinder for signs of leakage by carefully pulling back the dust boots.

12 Refitting is the reverse of removal.

13 Apply a small amount of brake grease to the wear surfaces of the backing plate and to the adjuster mechanism **(see illustration)**.

14 Before refitting the drum, it should be checked for cracks, score marks, deep scratches and hard spots, which will appear as small discoloured areas. If the hard spots cannot be removed with fine emery cloth or if any of the other conditions listed above exist, the drum must be taken to an automotive machine shop to be turned. **Note:** *Professionals recommend resurfacing the drums*



6.7 An exploded view of the wheel cylinder

each time a brake job is done. Resurfacing will eliminate the possibility of out-of-round drums. If the drums are worn so much that they can't be resurfaced without exceeding the maximum allowable diameter (cast into the drum), then new ones will be required **(see illustration)**. *At the very least, if you elect not to have the drums resurfaced, remove the glaze from the surface with emery cloth using a swirling motion.*

15 Refit the brake drum on the axle flange and check the preliminary brake adjustment. If the brake drum fits loosely over the shoes, remove the drum again and rotate the adjuster until the brake drum just barely slides over the brake shoes.

16 Mount the wheel, refit the lug nuts, then lower the vehicle.

17 Make a number of forward and reverse stops to adjust the brakes until satisfactory pedal action is obtained.

18 Check the operation of the brakes carefully before driving the vehicle.

6 Wheel cylinder - removal, overhaul and refitting

Note: *If an overhaul is indicated (usually because of fluid leaks or sticky operation), explore all options before beginning the job. New wheel cylinders are available, which makes this job quite easy. If it is decided to rebuild the wheel cylinder, make sure a rebuild kit is available before proceeding. Never overhaul only one wheel cylinder - always rebuild both of them at the same time.*

Removal

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

2 Remove the brake shoe assembly (see Section 5).

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

4 Disconnect the brake line with a flare-nut spanner, if available. Don't pull the brake line away from the wheel cylinder.

5 Remove the wheel cylinder mounting bolts.

6 Detach the wheel cylinder from the brake backing plate and place it on a clean workbench. Immediately plug the vehicle brake line to prevent fluid loss and contamination.

Overhaul

Refer to illustration 6.7

7 Remove the bleeder screw, cups, pistons, boots and spring assembly from the wheel cylinder body **(see illustration)**.

8 Clean the wheel cylinder with brake fluid, denatured alcohol or brake system cleaner. **Warning:** *Do not, under any circumstances, use petroleum-based solvents to clean brake parts!*

9 Use compressed air to dry the wheel cylinder and blow out the passages.

10 Check the bore for corrosion and score marks. Crocus cloth or a brake cylinder hone can be used to remove light corrosion and stains, but the cylinder must be renewed if the defects cannot be removed easily, or if the bore is scored.

11 Lubricate the new cups with brake fluid.

12 Assemble the brake cylinder components. Make sure the cup lips face in.

Refitting

13 Place the wheel cylinder(s) in position and refit the bolts finger tight. Connect the brake line to the cylinder, being careful not to cross-thread the fitting. Tighten the wheel cylinder bolts to the torque listed in this Chapter's Specifications.

14 Tighten the brake line and refit the brake shoe assembly.

15 Bleed the brakes (see Section 9).

16 Check the operation of the brakes carefully before driving the vehicle.

7 Master cylinder - removal, overhaul and refitting

Note: *Before deciding to overhaul the master cylinder, check on the availability and cost of a new or factory rebuilt unit and also the availability of a rebuild kit.*

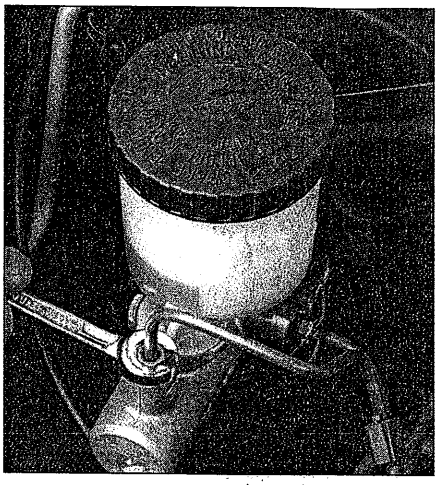
Removal

Refer to illustrations 7.4 and 7.6

1 The master cylinder is located in the engine compartment, mounted on the power brake booster.

2 Remove as much fluid as possible from the reservoir with a syringe.

3 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.*



7.4 Completely loosen the brake line fittings at the master cylinder, but don't bend the lines out of the way

4 Loosen the fittings at the ends of the brake lines where they enter the master cylinder **(see illustration)**. To prevent rounding off the flats, use a flare-nut spanner, which wraps around the fitting hex.

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

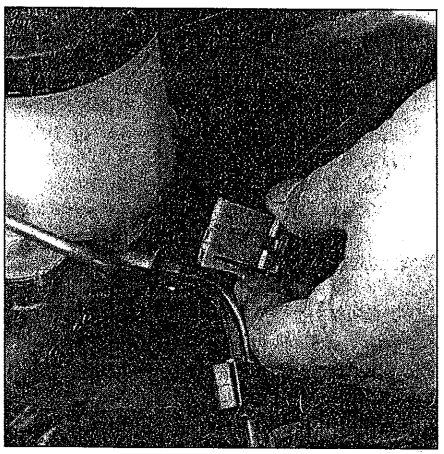
6 Disconnect the electrical connector at the master cylinder **(see illustration)**, then remove the nuts attaching the master cylinder to the power booster. Pull the master cylinder off the studs to remove it. Again, be careful not to spill the fluid as this is done.

Overhaul

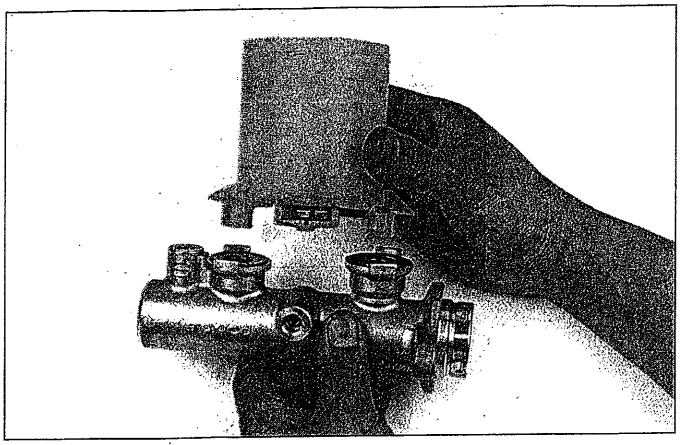
Refer to illustrations 7.8a, 7.8b, 7.9, 7.10a, 7.10b, 7.10c, 7.12a and 7.12b

7 **Note:** *Before attempting the overhaul of the master cylinder, obtain the proper rebuild kit, which will contain the necessary replacement parts and also any instructions which may be specific to your model.*

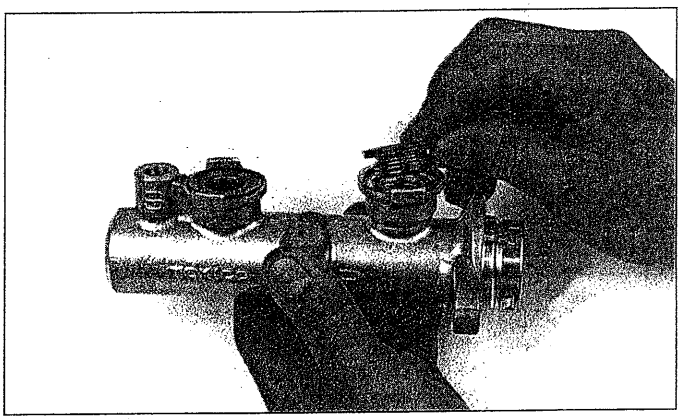
8 Remove the reservoir by carefully but



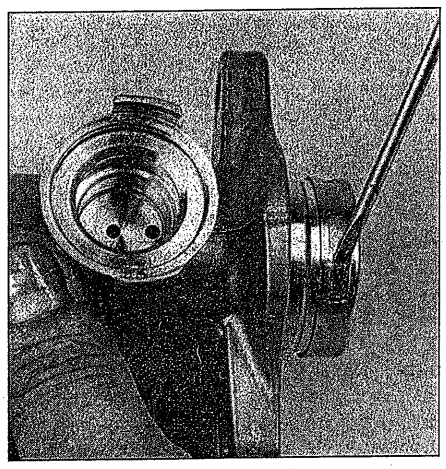
7.6 Disconnect the wiring from the unit



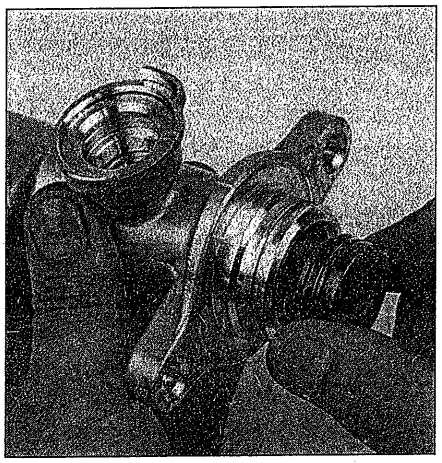
7.8a The master cylinder should be mounted carefully in a vise before attempting to remove the reservoir



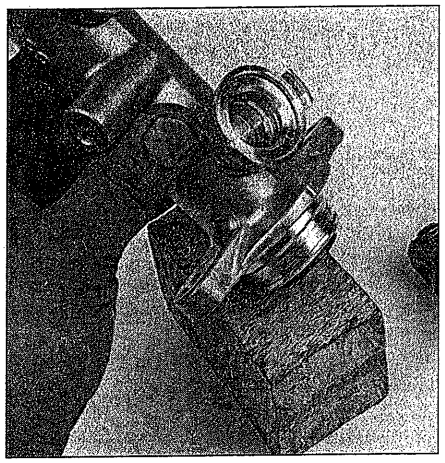
7.8b After the reservoir has been removed, pull the grommets from the master cylinder body. If they are hardened, damaged or appear to have been leaking, renew them



7.9 Straighten the lock tabs - if they are not in good condition, renew the end cap



7.10a Draw out the primary piston assembly



7.10b If necessary, tap the master cylinder on a block of wood to release the secondary piston assembly

forcefully levering it upwards. Inspect the reservoir grommets for indications of leakage near the base of the reservoir **(see illustrations)**.

9 Use a small screwdriver to straighten the locking tabs on the end cap **(see illustration)**. Pull the end cap off.

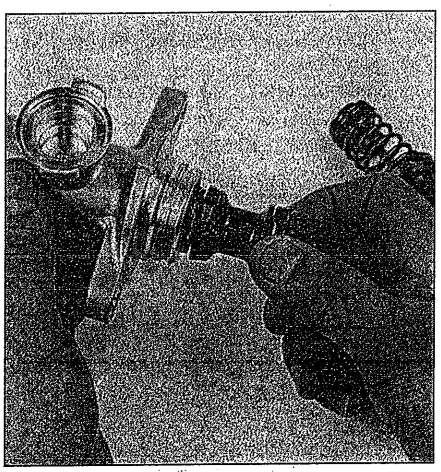
10 The internal components can now be removed from the bore **(see illustrations)**. Make a note of the proper order of the components so they can be returned to their original locations.

11 Carefully inspect the bore of the master cylinder. Any deep score marks or other damage will mean a new master cylinder is required. DO NOT attempt to hone the bore.

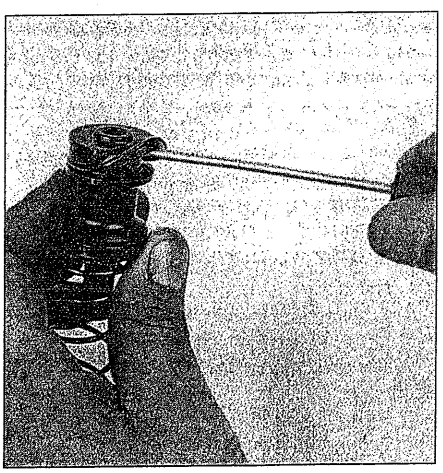
12 Renew all parts included in the rebuild kit, following any instructions in the kit **(see illustrations)**. Clean all reused parts with new brake fluid, brake system cleaner or denatured alcohol. **Warning:** *Do not use any petroleum-based solvents. During reassembly, lubricate all parts liberally with clean brake fluid.*

13 Push the assembled components into the bore, bottoming them against the end of the master cylinder, then refit the end cap.

14 Bend the locking tabs to securely fasten the cap in place.



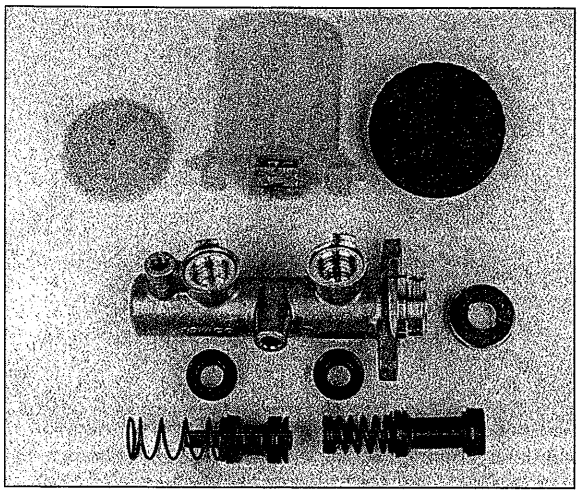
7.10c Pull out the secondary piston assembly. Lay out the parts in order as you remove them



7.12a Renew all of the rubber components with the new items in the overhaul kit. Make certain that they are refitted facing the proper direction

15 Refit new reservoir grommets and the reservoir in the reverse order of removal.

16 Before refitting the master cylinder, it should be bench bled. Since you'll have to apply force to the master cylinder piston and, at the same time, control flow from the brake line outlets, the master cylinder should be mounted in a vice, with the jaws of the vice clamping on the mounting flange.



7.12b Exploded view of the master cylinder

17 Insert threaded plugs into the brake line outlet holes and snug them down so no air will leak past them, but not so tight that they can't be easily loosened. If plugs are not available, hold your fingers tightly over the outlet ports.

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

19 Remove one plug (or finger) and push the piston assembly into the bore to expel the air from the master cylinder. A large Phillips screwdriver can be used to push on the piston assembly.

20 To prevent air from being drawn back into the master cylinder, the plug (or finger) must be renewed before releasing the force on the piston.

21 Repeat the procedure until only brake fluid is expelled from the brake line outlet hole. When only brake fluid is expelled, repeat the procedure at the other outlet hole and plug. Be sure to keep the master cylinder reservoir filled with brake fluid to prevent the introduction of air into the system.

Refitting

22 Refit the master cylinder over the studs on the power brake booster and tighten the nuts only finger-tight at this time.

23 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.

24 Tighten the mounting nuts and the brake line fittings.

25 Fill the master cylinder reservoir with fluid, then bleed the master cylinder (only if hasn't been bench bled) and the brake system (see Section 9). To bleed the master cylinder on the vehicle, have an assistant depress the brake pedal and hold it down. Loosen the fitting to allow air and fluid to escape. 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. Check the operation of the brake system carefully before driving the vehicle.

8 Brake hoses and lines - inspection and renewal

Inspection

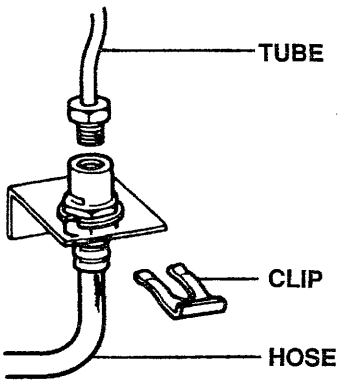
1 About every six months, with the vehicle raised and supported securely on jackstands, the rubber hoses which connect the steel brake lines with the front and rear brake assemblies should be inspected for cracks, chafing of the outer cover, leaks, blisters and other damage. These are important and vulnerable 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, renew it.

Renewal

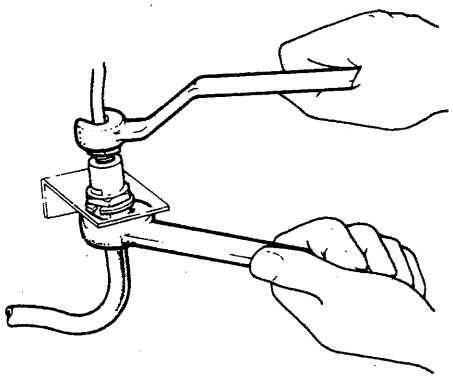
Front brake hose

Refer to illustrations 8.3, 8.4a and 8.4b

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



8.4a Once the tube nut has been completely loosened, remove the clip with a pair of pliers - some models may be equipped with an E-ring, as shown here, which can be removed with a screwdriver



8.3 Hold the hose fitting with a spanner to prevent twisting the line, then loosen the tube nut with a flare-nut spanner to prevent rounding off the corners of the nut

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

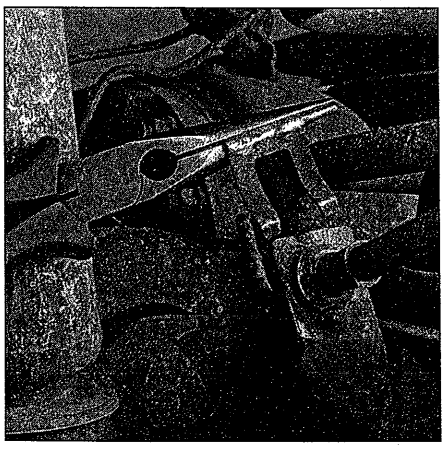
4 Remove the U-clip and E-ring, if equipped, from the female fitting at the bracket with a pair of pliers, then pass the hose through the bracket **(see illustrations)**.

5 At the caliper end of the hose, remove the banjo fitting bolt, then separate the hose from the caliper. Note that there is a copper sealing washer on each side of the fitting - they should be renewed during refitting.

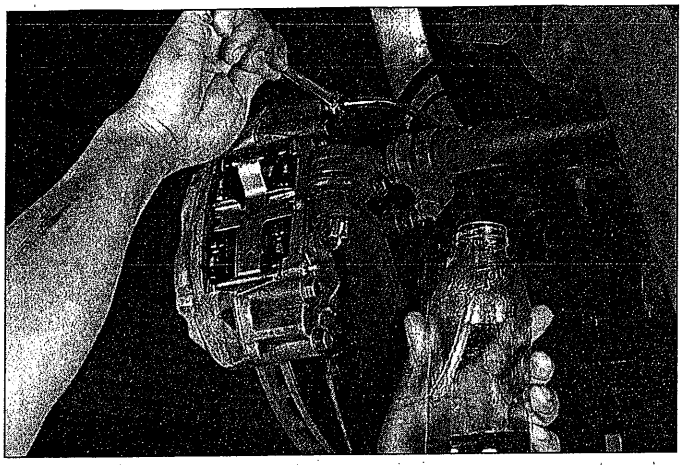
6 Remove the U-clip from the strut bracket, then feed the hose through the bracket.

7 To refit the hose, pass the caliper fitting end through the strut bracket, then connect the fitting to the caliper with the banjo bolt and copper washers. Make sure the locating lug on the fitting is engaged with the hole in the caliper, then tighten the bolt to the torque listed in this Chapter's Specifications.

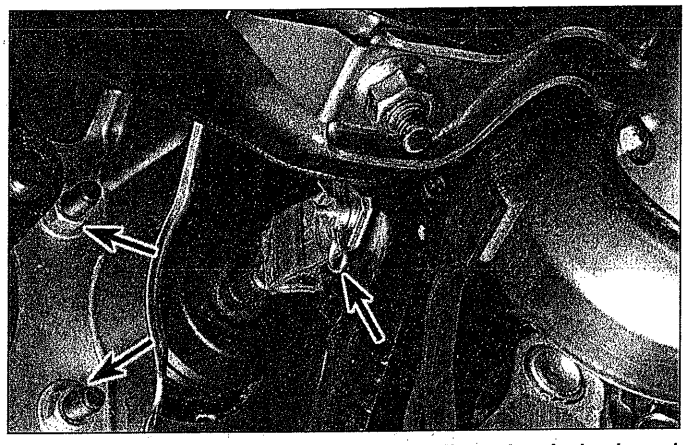
8 Push the metal support into the strut bracket and refit the U-clip. Make sure the hose isn't twisted between the caliper and the strut bracket.



8.4b Long-nose pliers work best for removing the clip



9.8 When bleeding the brakes, a hose is connected to the bleeder valve at the caliper or wheel cylinder 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



10.7 Remove this retaining clip (arrow), pull out the clevis pin and detach the pushrod from the brake pedal; the two left power brake booster mounting nuts (arrows) are visible in this photo (the two right nuts, not visible in this photo, are to the right of the booster mounting bracket)

9 Route the hose into the frame bracket, again making sure it isn't twisted, then connect the brake line fitting, starting the threads by hand. Refit the clip and E-ring, if equipped, then tighten the fitting securely.
10 Bleed the caliper (see Section 9).
11 Refit the wheel and lug nuts, lower the vehicle and tighten the lug nuts to the torque specified in Chapter 1.

Rear brake hose

12 Perform Steps 2, 3 and 4 above, then repeat Steps 3 and 4 at the other end of the hose. Be sure to bleed the wheel cylinder (or caliper) (see Section 9).

Metal brake lines

13 When renewing 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.
14 Prefabricated brake line, with the tube ends already flared and fittings refitted, is available at auto parts stores and dealer parts departments. These lines are also bent to the proper shapes.
15 When refitting the new line, make sure it's securely supported in the brackets and has plenty of clearance between moving or hot components.
16 After refitting, check the master cylinder fluid level and add fluid as necessary. Bleed the brake system (see Section 9) and test the brakes carefully before driving the vehicle in traffic.

9 Brake hydraulic system - bleeding

Refer to illustration 9.8

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 refitting 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. If you must bleed the entire system, start with the load sensing valve, then proceed to the left rear wheel, the right rear, the left front and the right front, in that order.
2 If a brake line was disconnected only at a wheel, then only that caliper or wheel cylinder 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 from the brake power booster by applying the brake several times with the engine off.
5 Remove the master cylinder reservoir cover and fill the reservoir with brake fluid. Refit the cover. **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 plastic container partially filled with clean brake fluid, a length of plastic, rubber or vinyl tubing to fit over the bleeder valve and a spanner to open and close the bleeder valve.
7 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 the other end in brake fluid in the container **(see illustration)**.
9 Have the assistant pump the brakes slowly a few times to get pressure in the system, then hold the pedal down firmly.
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 next bleeding position in the proper order (refer to Step 1). 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 will deteriorate the brake system components.
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. **Warning:** *Do not operate the vehicle if you're in doubt about the effectiveness of the brake system.*

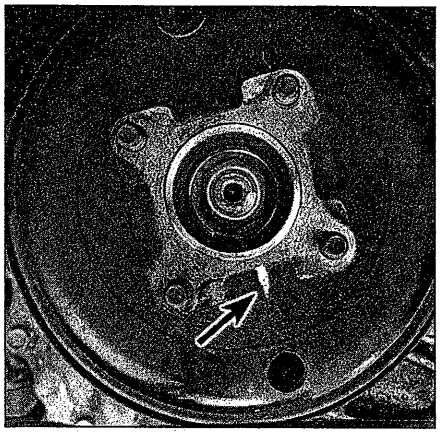
10 Power brake booster - check, removal and refitting

Operating check

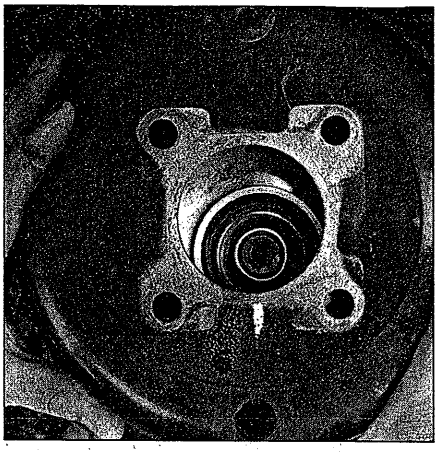
1 Depress the brake pedal several times with the engine off and make sure there's no change in the pedal reserve distance.
2 Depress the pedal and start the engine. If the pedal goes down slightly, operation is normal.

Airtightness check

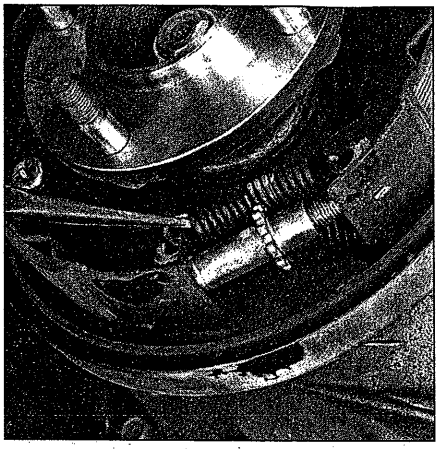
3 Start the engine and turn it off after one or two minutes. Depress the brake pedal slowly several times. If the pedal depresses less each time, the booster is airtight.
4 Depress the brake pedal while the engine is running, then stop the engine with the pedal depressed. If there's no change in the pedal reserve travel after holding the pedal for 30 seconds, the booster is airtight.



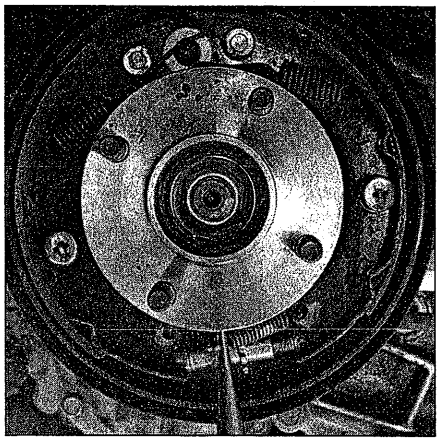
11.4a A dab of paint (arrow) can be used to mark the position of the parking brake drum relative to the lock tab on the nut



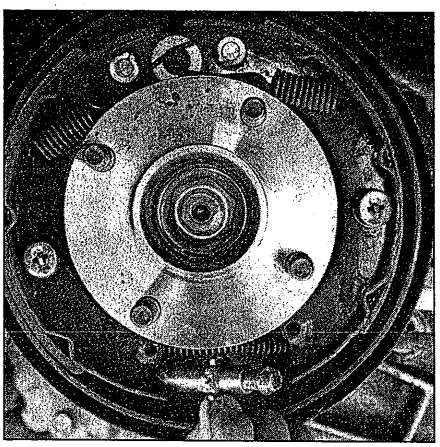
11.4b Lift the drum from the parking brake unit



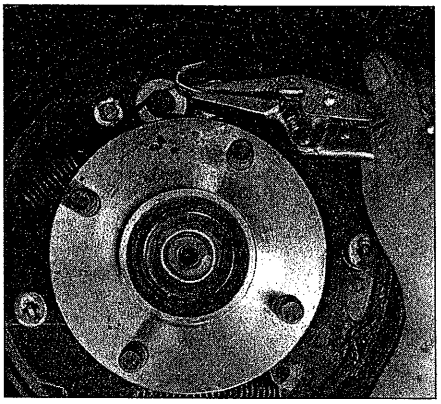
11.5a Lift the lower return spring from the shoes . . .



11.5b . . . and then remove it from the assembly



11.5c Remove the adjuster



11.6a Disconnect the upper return springs . . .

Removal

Refer to illustration 10.7

5 Power brake booster units shouldn't be disassembled. They require special tools not normally found in most automotive repair shops. They're fairly complex and, because of their critical relationship to brake performance, should be renewed with a new or rebuilt one.

6 To remove the booster, first remove the brake master cylinder (see Section 7).

7 Locate the pushrod clevis connecting the booster input rod to the brake pedal **(see illustration)**. It's accessible from inside the vehicle, under the dash board.

8 Remove the clevis pin retaining clip with pliers.

9 Holding the clevis with pliers, loosen the locknut with a spanner. Remove the clevis pin.

10 Disconnect the hose from the brake booster. Be careful not to damage the hose when removing it from the booster fitting.

11 Remove the four nuts and washers holding the brake booster to the firewall from under the dash (you may need a light to see them).

12 Slide the booster straight out from the firewall until the studs clear the holes.

Refitting

13 Refitting procedures are basically the reverse of removal. Tighten the clevis locknut securely and the booster mounting nuts to the torque listed in this Chapter's Specifications.

14 If the power booster unit is being renewed, the clearance between the firewall surface of the booster and the end of the output rod must be measured and, if necessary, adjusted to the value listed in the Specifications in this Chapter. Using calipers or a machinist's scale, measure the distance from the end of the booster output rod to the firewall surface of the booster (the distance which the rod protrudes). If it is not within specifications, hold the rod with long-nose pliers and turn the adjusting screw on the end of the power booster pushrod until the clearance is within the specified values.

15 After the final refitting of the master cylinder and brake hoses and lines, the brake pedal height and freeplay must be adjusted and the system must be bled (see Chapter 1 and also Section 9 of this Chapter).

11 Parking brake shoes - inspection and renewal

Refer to illustrations 11.4a, 11.4b, 11.5a, 11.5b, 11.5c, 11.6a, 11.6b, 11.6c, 11.7a, 11.7b, 11.7c, 11.8a, 11.8b, 11.9a, 11.9b, 11.9c, and 11.10

Warning: *Dust created by the brake system may contain asbestos, which is hazardous 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 cleaner or denatured alcohol only!*

1 Raise the vehicle and support it securely with jackstands.

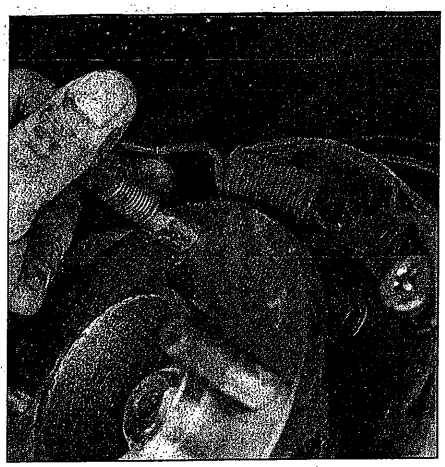
2 Remove the rear driveshaft (refer to Chapter 8).

3 Release the parking brake.

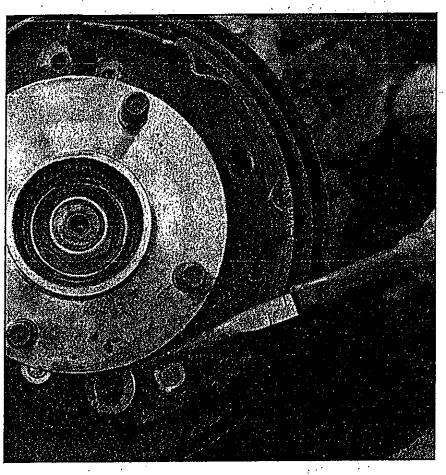
4 Use paint to mark the position of the drum on the drive flange so it can be refitted in the same position **(see illustration)**. Pull the parking brake drum from the rear of the transmission **(see illustration)**.

5 Remove the lower return spring and the adjuster mechanism **(see illustrations)**.

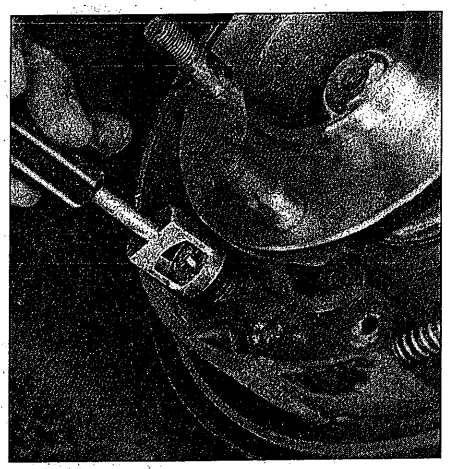
6 Remove the upper return springs **(see**



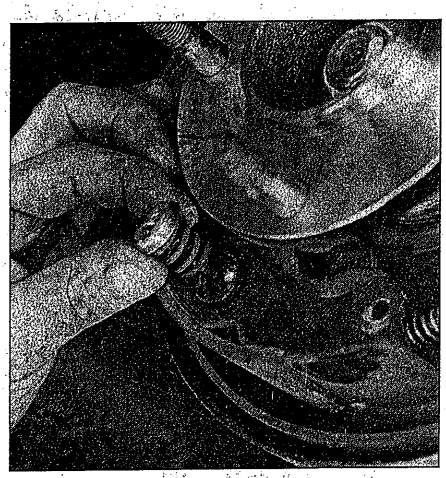
11.6b . . . then remove them



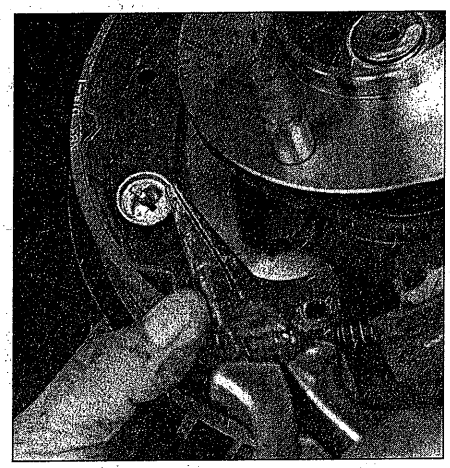
11.6c Remove the pivot washer



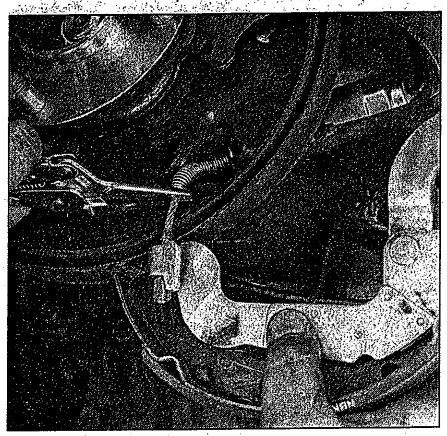
11.7a Use a hold-down spring tool to push in on the shoe retainers and turn them a quarter turn in either direction



11.7b Lift the spring and retainer from the shoe



11.7c Remove the retainer spring seat also, then push the pin through the backing plate and remove it



11.8a Disconnect the cable from the operating assembly by collapsing the spring

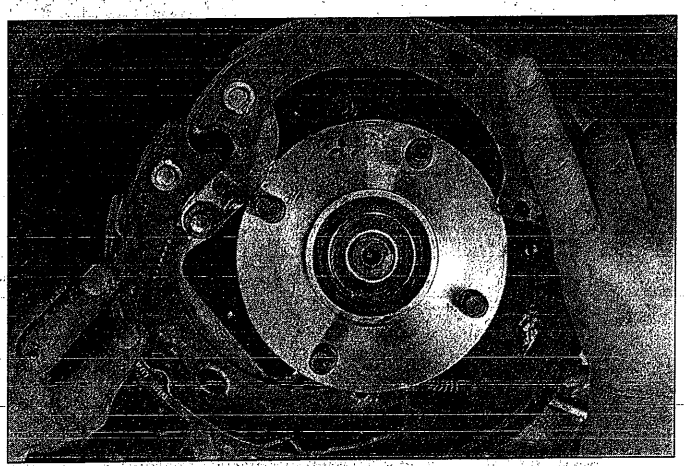
illustrations).

7 Release the shoe hold-down springs by pushing them in and turning them a quarter turn. Then remove the springs along with the retainers and spring seats **(see illustrations).** It is easiest to use a special brake spring tool to do this.

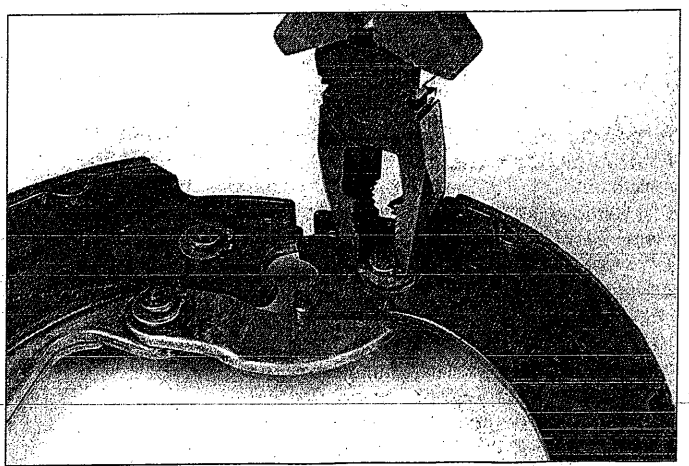
8 Disconnect the cable from the operating mechanism **(see illustration).** Remove the shoes from the vehicle **(see illustration).**

9 Remove the clips which retain the shoes to the operating mechanism **(see illustrations).**

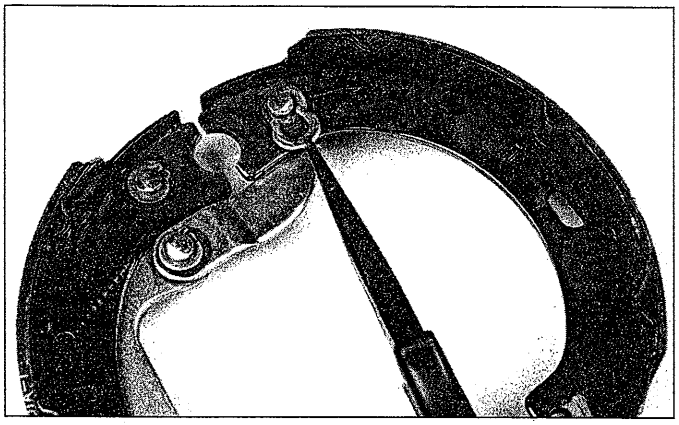
10 Inspect all components for wear and damage **(see illustration).** Pay special attention to the cable and the backing plate. Check the shoes for lining thickness and compare your findings with the Specifications in this Chapter. Check the drum carefully (refer to Section 5 and the Specification in this Chapter).



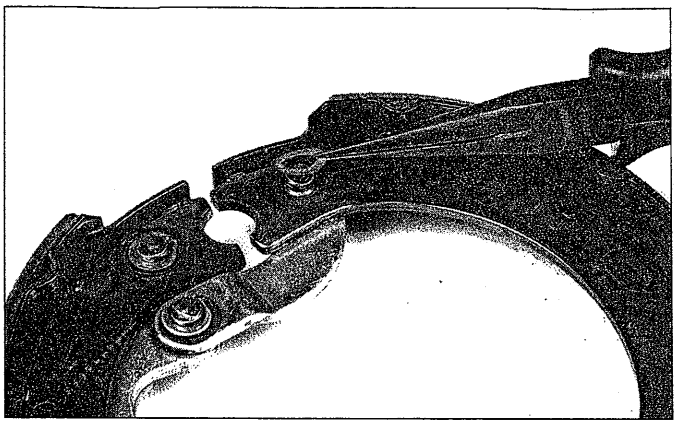
11.8b The entire assembly can now be lifted from the vehicle. Place it on a clean work bench to finish disassembly



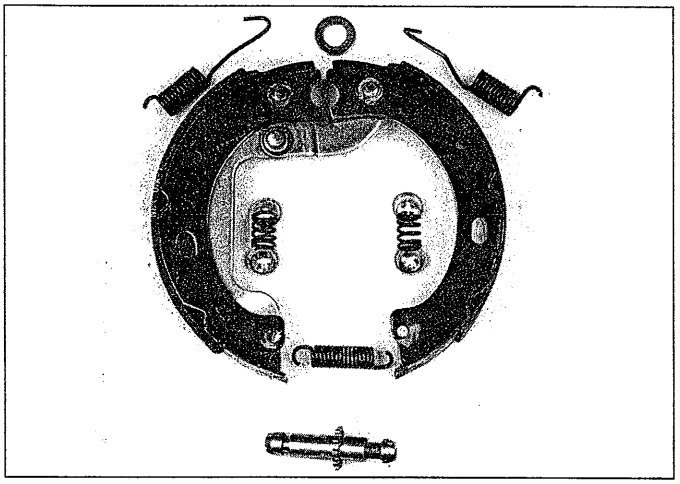
11.9a Remove the retaining clip from the pin . . .



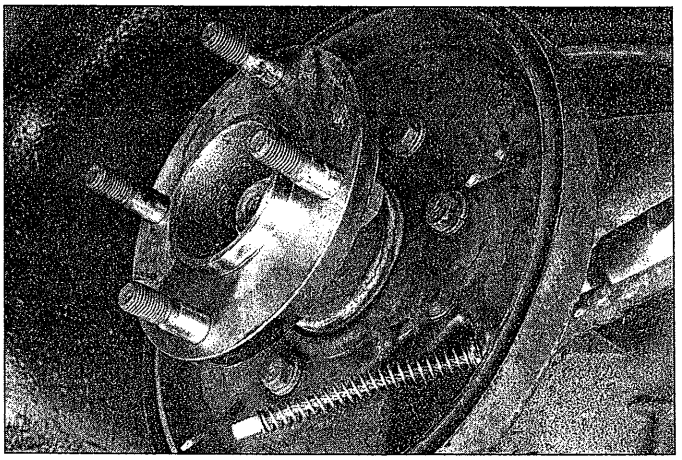
11.9b . . . then pull it off and repeat the procedure on the other pin



11.9c Remove the washers



11.10 The complete parking brake assembly



13.3 The complete parking brake shoe assembly must be removed in order to access the cable

11 Renew the shoes and machine the drum as required.
12 Lubricate the backing plate rubbing surfaces with a small amount of brake grease. Clean the adjuster mechanism and lightly lubricate its threads.
13 Refitting is the reverse of removal.
14 Rotate the drum until the adjustment hole is in line with the adjuster. Remove the rubber plug from the adjuster hole.
15 Insert a small screwdriver through the adjusting hole and rotate the star wheel until the shoes rub on the drum.
16 Back off the adjustment until there is a maximum of 0.2 mm clearance between the drum and the shoes.

12 Parking brake - adjustment

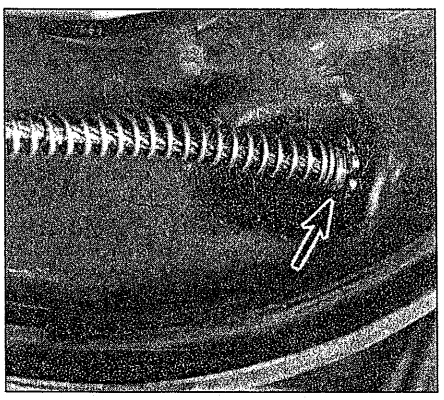
1 The parking brake lever, when properly adjusted, should travel seven to nine clicks when a moderate pulling force is applied. If it travels less than five clicks, there's a chance the parking brake might not be releasing completely and might be dragging on the drum or disc. If the lever can be pulled up more than ten clicks, the parking brake may not hold adequately on an incline, allowing the car to roll.
2 To gain access to the parking brake cable adjuster, remove the lever cover (refer to Chapter 11).
3 Loosen the locknut (the upper nut) while holding the adjusting nut (lower nut) with a spanner. Tighten the adjusting nut until the desired travel is attained. Tighten the locknut.
4 Recheck the parking brake travel.
5 Check the operation of the parking brake warning light. It should illuminate when the lever has been pulled two notches. It must go out when the lever is released.
6 Bend the switch mounting plate on the lever assembly to make an adjustment.

13 Parking brake cable - renewal

Refer to illustrations 13.3 and 13.4

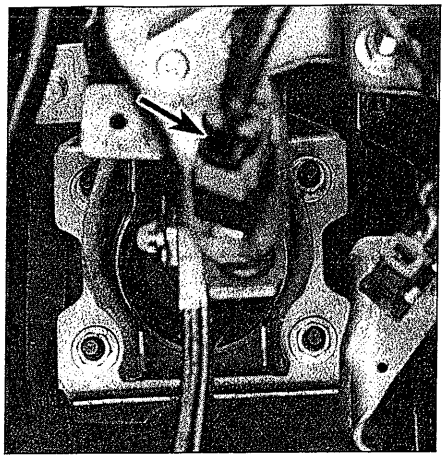
Renewal

1 Remove the cover to gain access to the parking brake cable adjuster (refer to Chapter 11).
2 With the lever in the down (off) position, remove the locknut and the adjusting nut and from the lever. Pull the clevis pin and remove the clevis from the cable end.

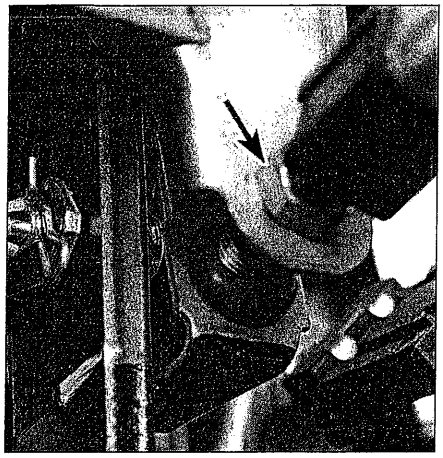


13.4 Collapse the spring and then remove the clip (arrow) to disconnect the cable from the backing plate

3 Remove the parking brake shoes **(see illustration)**(refer to Section 11).
4 Disconnect the cable from the parking brake backing plate **(see illustration)**.
5 Pull the cable through the floor grommet and out of the vehicle.
6 Refitting is the reverse of removal. Apply a light coat of grease to all wearing surfaces.
7 Adjust the cable (refer to Section 12).



14.3 The brake light switch is located on the chassis above the brake pedal (arrow)



14.4 Loosen the lock-nut (arrow) to unscrew the switch from its bracket

15.1a The load sensing valve is mounted to a bracket on the right frame rail

14 Brake light switch - removal, refitting and adjustment

Refer to illustrations 14.3 and 14.4

Removal and refitting

1 The brake light switch is located on a bracket at the top of the brake pedal. The switch activates the brake lights at the rear of the vehicle when the pedal is depressed.

2 Disconnect the negative battery cable from the battery.

3 Disconnect the wiring harness at the brake light switch **(see illustration)**.

4 Loosen the lock-nut **(see illustration)** and unscrew the switch from the pedal bracket.

5 Refitting is the reverse of removal.

Adjustment

6 Loosen the locknut, adjust the switch until the clearance is as specified, then tighten the locknut. The adjustment of the brake pedal switch is also the adjustment for the brake pedal freeplay. Refer to the brake pedal height and freeplay adjustment procedure in Chapter 1.

7 Connect the wires at the switch and the battery. Make sure the brake lights are functioning properly.

15 Load sensing valve - general information and renewal

Refer to illustrations 15.1a and 15.1b

Note: *The load sensing valve should not be disassembled for service.*

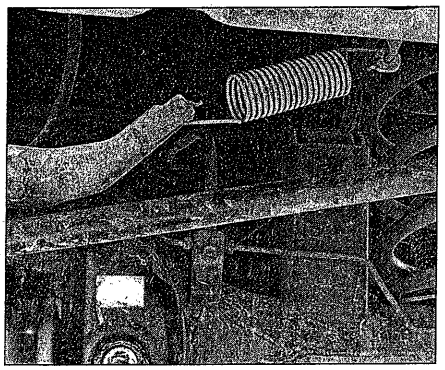
General information

1 The load sensing valve is a device incorporated into the brake system that senses the amount of weight (passengers, equipment, etc.) on the rear of the vehicle and increases the rear wheel brake fluid pressure to compensate for an additional load. This system is located above the rear axle assembly and it consists of a valve, spring and bracket **(see illustrations)**.

2 When bleeding the brake system, it is necessary to bleed the load sensing proportioning and by-pass valve first, before all the wheel cylinders and calipers are bled (see Section 9).

3 In the event of poor braking performance, have the system adjusted by a dealer service department. Poor braking performance could mean that the rear wheels lock when braking with little weight in the rear or that they do not provide enough braking when the rear is carrying a load.

4 If it becomes necessary to remove the assembly for renewal of another component, be sure to mark the position of the adjusting nut. It must be refitted in exactly the same position as before removal.



15.1b A spring connects the valve to the rear axle housing to detect how much the rear springs are collapsed. This informs the system of how much weight is on the rear of the vehicle

Renewal

5 Raise the vehicle and support it securely with jackstands.

6 Disconnect the brake lines from the valve. Plug the ends to prevent contamination and fluid loss.

7 Disconnect the spring and remove the bolts. Remove the valve.

8 Refitting is the reverse of removal. Bleed the valve and then the rest of the system in the proper order (refer to Section 9).