# Chapter 8 Braking system

*For modifications, and information applicable to later models, see Supplement at end of manual*

## Contents


Brake disc - inspection, renovation or renewal . . . . . 6
Brake drum - inspection, renovation or renewal . . . . . 8
Brake pedal - removal and refitting . . . . . 18
Caliper - removal, overhaul and refitting . . . . . 5
Disc pads - inspection and renewal . . . . . 3
Fault finding - braking system . . . . . See end of Chapter
General description . . . . . 1
Handbrake - adjustment . . . . . 16
Handbrake cable - renewal . . . . . 17
Hydraulic hoses and pipes - inspection and renewal . . . . . 11
Hydraulic system - bleeding . . . . . 12
Maintenance . . . . . 2
Master cylinder - removal, overhaul and refitting . . . . . 9
Pressure regulating valve . . . . . 10
Rear brake shoes - inspection and removal . . . . . 4
Rear wheel cylinder - removal, overhaul and refitting . . . . . 7
Stop lamp switch . . . . . 19
Vacuum servo unit - description . . . . . 13
Vacuum servo unit - removal and refitting . . . . . 15
Vacuum servo unit - servicing and testing . . . . . 14


## Degrees of difficulty

**Easy,** suitable for novice with little experience 

**Fairly easy,** suitable for beginner with some experience 

**Fairly difficult,** suitable for competent DIY mechanic 

**Difficult,** suitable for experienced DIY mechanic 

**Very difficult,** suitable for expert DIY or professional 

## Specifications

| | |
|---|---|
| **System type** | Dual-circuit hydraulic with servo unit and pressure regulating valve. Discs front, drums rear. Handbrake mechanical to rear wheels. |
| **Disc brakes** | |
| Type | Single cylinder, sliding caliper |
| Disc diameter | 227.0 mm (8.94 in) |
| Disc thickness | 10.7 to 10.9 mm (0.42 to 0.43 in) |
| Minimum regrind thickness | 9.0 mm (0.35 in) |
| Minimum wear thickness of pad friction material | 1.5 mm (0.06 in) |
| Caliper cylinder diameter | 48.0 mm (1.89 in) |
| **Drum brakes** | |
| Type | Single cylinder, with automatic adjusters |
| Drum internal diameter | 185.24 to 185.53 mm (7.30 to 7.31 in) |
| Maximum regrind diameter | 187.0 mm (7.37 in) |
| Minimum shoe lining friction material thickness | 1.5 mm (0.06 in) |
| Cylinder diameter | 19.05 mm (0.75 in) |
| **Master cylinder bore diameter** | 19.05 mm (0.75 in) |
| **Vacuum servo diameter** | 158.5 mm (6.0 in) |
| **Hydraulic fluid type/specification** | Hydraulic fluid to DOT 3 or 4, or SAE J1703C |
| **System capacity** | 0.33 litre (0.58 pint) |

| **Torque wrench settings** | **Nm** | **lbf ft** |
|---|---|---|
| Caliper mounting bracket bolts | 53 | 39 |
| Rear wheel cylinder mounting bolts | 10 | 7 |
| Pressure regulating valve mounting bolts | 20 | 15 |
| Master cylinder mounting nuts | 25 | 18 |
| Rear brake backplate bolts | 20 | 15 |

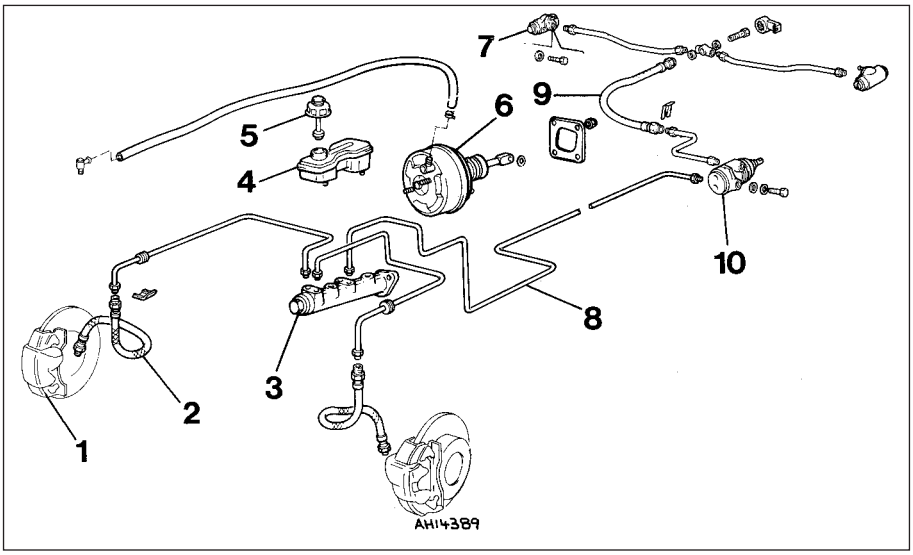



**Fig. 8.1 Components of the braking system (LHD shown) (Sec 1)**

*1 Caliper*
*2 Hose*
*3 Master cylinder*
*4 Fluid reservoir*
*5 Cap and fluid level sensor*
*6 Vacuum servo unit*
*7 Rear wheel cylinder*
*8 Pipeline*
*9 Hose*
*10 Pressure regulating valve*

## 1 General description

The braking system is of four wheel hydraulic type with discs on the front wheels and drums on the rear.

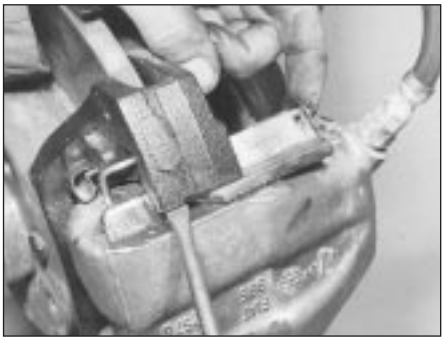
The hydraulic system is of dual-circuit type and incorporates a pressure regulator valve to limit pressure to the rear brakes during heavy braking to prevent rear wheel lock up.

A vacuum servo unit is fitted to some models.

The handbrake is mechanically operated on the rear wheels.

**2.3 Fluid reservoir cap and float for warning switch**

**3.2A Removing a disc pad locking block clip**



**3.2B Removing a locking block**

**3.4 Removing the caliper unit**

## 2 Maintenance

**1** At the weekly service check, inspect the fluid level in the master cylinder reservoir. Topping up should only be required at very infrequent intervals and should only be necessary owing to the need for extra fluid in the hydraulic system caused by wear of the friction material of the disc pads and shoe linings.

**2** The need for frequent or regular topping up will be due to a leak in the system, probably from a hydraulic cylinder seal or a flexible hose. Correct the problem immediately.

**3** Use only clean new fluid for topping up. It must be of the specified type and have been stored in a closed container and not have been shaken for at least 24 hours (photo).

**4** At regular intervals, check the hoses and pipelines for condition. Adjust the handbrake if the lever travel becomes excessive. Check the condition and security of the brake servo vacuum hose. All these operations are described later in this Chapter.

## 3 Disc pads - inspection and renewal

**1** Jack up the front of the car and remove the roadwheels.

**2** Extract the spring clips and slide out the locking blocks (photos).

**3** On SX versions, carefully disconnect the wear sensor lead connecting plug.

**4** Lift the caliper body from the disc and inspect the thickness of the friction material on each pad (photo). If it is 1.5 mm (0.06 in) or less, renew the pads.

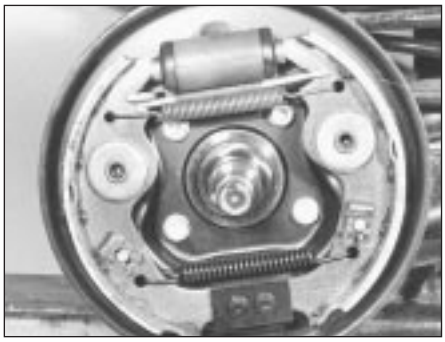
**5** Withdraw the pads and the anti-rattle springs.

**6** Brush away any dust and dirt from the caliper, taking care not to inhale the dust - this contains asbestos and is thus potentially injurious to health.

**7** As the new pads are thicker than the old ones, the caliper piston must be depressed

**3.8A Disc pad and anti-rattle spring**

**3.8B Cylinder body located on caliper bracket**



**4.7 Rear brake assembly**

**4.11 Rear hub showing cut-outs on rear face for shoe self-adjuster bosses**

into its cylinder to accommodate them. This will cause the fluid level to rise in the reservoir. Anticipate this by syphoning some out beforehand, but take care not to let it drip onto the paintwork - it acts as an effective paint stripperl

**8** Refit the anti-rattle springs, the pads (friction lining-to-disc), the cylinder body, the locking blocks and their retaining clips (photos).

**9** Refit the roadwheel and apply the footbrake hard, several times, to bring the pads into contact with the brake disc.

**10** Renew the pads on the opposite brake. The pads should always be renewed in axle sets.

**11** Top up the fluid reservoir.

## 4 Rear brake shoes - inspection and renewal

**1** Jack up the rear of the car and remove the roadwheels.

**2** Fully release the handbrake.

**3** Unscrew and remove the drum securing bolts. One of these is a long locating spigot for the roadwheel.

**4** Pull off the drum. If it is tight, clean off the rust at its joint with the hub flange, and apply a little penetrating fluid. Two bolts may be screwed into the drum securing bolt holes if necessary and the drum thus eased off the hub. The securing bolt holes are tapped for this purpose.

**5** Brush away all the dust and dirt from the shoes and operating mechanism, taking care not to inhale it.

**6** The friction linings fitted as original equipment are of the bonded type and the rivet heads normally used as a guide to wear are not, of course, fitted. However, if the thickness of the friction linings is down to 1.5 mm (0.06 in) or less, the shoes must be renewed. Always purchase new or factory relined brake shoes.

**7** Before removing the brake shoes, note the way in which the shoes are positioned, with respect to leading and trailing ends (the end of the shoe not covered by lining material). Note also into which holes in the shoe web the return springs are connected. Sketch the shoes or mark the holes on the new shoes with quick drying paint if you are doubtful about remembering (photo).

**8** Undo the steady springs by depressing and rotating their caps a quarter turn to disengage the slot from the pin. On later models a U-shaped steady spring is used. Depress and slide it out.

**9** Rotate the hub until the cut-outs in its rear flange face are in alignment with the shoe self-adjusters.

**10** Pivot the trailing shoe on the self-adjuster post and disengage the ends of the shoe from the slot in the wheel cylinder tappet and from the lower anchor block.

**11** Work the shoe up the self-adjuster pivot post until the self-adjuster boss enters the cut-out in the hub flange. The shoe can now be withdrawn (photo).

**12** Once off the self-adjuster post, the pull-off spring tension is eased, as the shoe can move towards the other, so the springs can be unhooked.

**13** Remove the leading shoe in a similar way.

**14** The new shoes will already be fitted with new self-adjusters.

**15** Fit the new shoes to their self-adjuster posts, making sure that the handbrake shoe lever is correctly located. Engage the ends of the shoes.

**16** Using a wooden or plastic-faced mallet, tap the shoes inwards against the friction of their self-adjuster coil springs. This will have the effect of reducing the overall diameter of the shoes to facilitate fitting of the shoe return springs and to allow the brake drum to slide over them.

**17** Using pliers, reconnect the upper (longer) and lower shoe return springs.

**18** Hold the steady pins in position from the rear of the backplate. Fit the small coil springs and the retaining cap, again using pliers to grip the cap and to depress and turn it to engage the pin. On later models fit the U-shaped springs.

**19** Before refitting the drum, clean it out and examine it for grooves or scoring (refer to Section 8).

**20** Fit the drum and the roadwheel.

**21** Apply the brakes two or three times to position the shoes close to the drum.

**22** Renew the shoes on the opposite brake in a similar way.

**23** The handbrake should be automatically adjusted by the action of the shoe adjuster. If the handbrake control lever has excessive travel, refer to Section 16 for separate adjusting instructions.

## 5 Caliper - removal, overhaul and refitting

**Note:** *Purchase a repair kit in advance of overhaul.*

**1** Jack up the front roadwheel and remove it.

**2** Brush away all dirt from the caliper

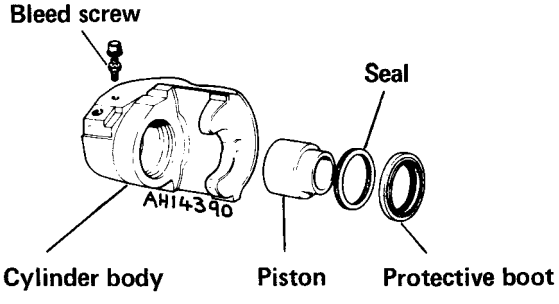



**Fig. 8.2 Exploded view of caliper (Sec 5)**

assembly and the flexible pipe, particularly the fixing bracket and union at the car end of the flexible pipe.
**3** Have ready a container suitable to catch the brake fluid, and sheets of clean newspaper on which to put parts.
**4** Take out the spring clips and locking blocks, and take the caliper off the support bracket.
**5** Disconnect the hydraulic flexible pipe at the under wing support bracket and cap both pipe ends. It may help to prevent loss of fluid if the vent in the reservoir cap is sealed with adhesive tape, to create a vacuum.
**6** Remove the caliper to the bench or other work surface, and clean it thoroughly with hydraulic fluid or methylated spirit.
**7** Depress the piston until the dust excluding boot can be removed.
**8** Now apply air pressure to the flexible hose and eject the piston. Quite a low pressure is required for this, such as can be generated with a hand or foot operated pump.
**9** Pick out the piston seal from its groove in the cylinder. Use a sharp probe, but take care to avoid scratching the cylinder bore.
**10** Examine the surface of the piston and cylinder bore. If either is corroded, scored or shows metal-to-metal rubbed areas, the complete assembly should be renewed.
**11** If the components are in good condition, discard the oil seals, clean the piston and cylinder and fit the new seal for the piston. This is included in the repair kit. Use the fingers only to manipulate it into its groove.
**12** Lubricate the piston with clean hydraulic fluid and insert it partially into the cylinder.
**13** Fit the new dust excluding boot to its projecting end, push the piston fully into the cylinder and engage the dust excluder with the rim of the cylinder.
**14** Refit the caliper, reconnect the flexible hose, then bleed the front hydraulic circuit (refer to Section 12).

## 6 Brake disc - inspection, renovation or renewal

**1** Whenever the front disc pads are being checked for wear, take the opportunity to inspect the discs for deep scoring or grooving. After a high mileage the disc may become reduced in thickness away from the extreme outer edge of the disc. If this wear is rapid, it is possible that the friction pads are of too hard a type.
**2** If the disc has evidence of many tiny cracks, these may be caused by overheating due to a seized caliper piston in the "applied" position.
**3** The foregoing conditions may be corrected by regrinding the disc provided that the thickness of the disc is not reduced below that specified by such action. Alternatively, fit a new disc.
**4** To remove a disc, take off the caliper and

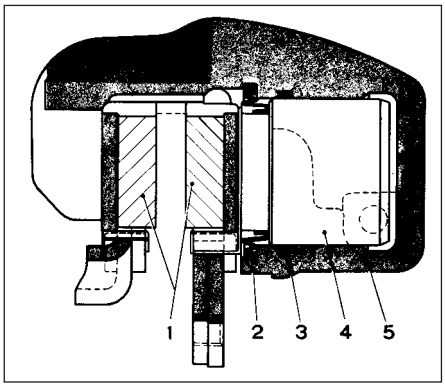



**Fig. 8.3 Sectional view of caliper (Sec 5)**

*1 Pads*
*2 Dust excluder*
*3 Piston seal*
*4 Piston*
*5 Cylinder body*

pads as described in Sections 3 and 5. Tie the caliper up, out of the way.
**5** Knock back the tabs of the lockplates and unbolt the caliper support bracket from the hub carrier.
**6** Unscrew and remove the two bolts which hold the disc assembly to the hub. One of these bolts is for wheel locating purposes.
**7** Pull the disc from the hub.
**8** Refitting is a reversal of the removal process. If the disc has excessive run-out, repositioning it in relation to the hub may bring it within tolerance by cancelling out the run-out characteristics in the hub and disc, once the most suitable fitted position has been found.

## 7 Rear wheel cylinder - removal, overhaul and refitting

**Note:** *Purchase a repair kit in advance of overhaul.*
**1** If fluid seepage is observed from the ends of the rear wheel cylinder when the brake drum has been removed, the seals are leaking and immediate action must be taken.
**2** Although the cylinder can be dismantled without taking it from the backplate, this is not recommended due to the possibility of under wing dirt and mud dropping onto the components as work proceeds.
**3** Remove the brake shoes, as described in Section 4.
**4** Disconnect the hydraulic line from the wheel cylinder and cap the open end of the pipe. It may help to reduce the loss of fluid if the vent hole in the reservoir cap is taped over to create a vacuum.
**5** Unscrew and remove the setscrews which hold the cylinder to the backplate and withdraw the cylinder. Prise off the rubber dust excluding boots.
**6** Apply gentle air pressure from a hand or foot operated pump to eject the pistons and spring. Alternatively, tap the end of the cylinder on a piece of hardwood and the pistons should move out.
**7** Inspect the piston and cylinder bore surfaces for scoring, corrosion or evidence of metal-to-metal rubbing areas. If these are found, discard the assembly and purchase a new one.
**8** If the components are in good condition, note which way round the lips are fitted, then discard the seals and boots and wash the pistons and cylinder bore in clean hydraulic fluid or methylated spirit.
**9** Manipulate the new seals into position, using the fingers only for this job.
**10** Dip the pistons in clean hydraulic fluid and insert them with the coil spring and washers into the cylinder.
**11** Fit the new dust excluding boots.
**12** Refit the wheel cylinder to the backplate, reconnect the hydraulic pipe, then refit the shoes, the drum and the roadwheel.
**13** Bleed the rear hydraulic circuit as described in Section 12.

## 8 Brake drum - inspection, renovation or renewal

**1** Whenever the rear brake linings are being checked for wear, take the opportunity to inspect the internal surfaces of the brake drums.
**2** If the drums are grooved or deeply scored, they may be reground, provided that their new internal diameter will not then exceed the specified dimension. If it will, or the drum is cracked, it must be renewed.
**3** Removal and refitting of a brake drum is described in Section 4.

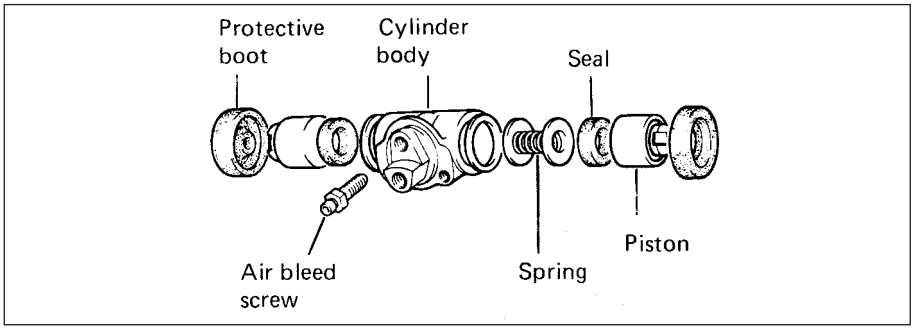



**Fig. 8.4 Exploded view of a rear wheel cylinder (Sec 7)**

## 9 Master cylinder - removal, overhaul and refitting

**Note:** *Purchase a repair kit in advance of overhaul.*

**1** The master cylinder is mounted on the front face of the brake vacuum servo unit (55 and 70 models) or directly to the bulkhead (45 models).

**2** Cover the front wings with polythene sheeting or similar material, in case hydraulic fluid spills onto the paintwork of the car during removal of the cylinder.

**3** Detach the leads from the terminals on the reservoir cap, then unscrew and remove the cap and float.

**4** Unscrew the pipe unions and prise the pipes carefully away from the master cylinder. Cap the open ends of the pipes and catch any fluid leaking from the master cylinder in a suitable container.

**5** Unscrew the mounting nuts and withdraw the master cylinder from the bulkhead or from the servo unit.

**6** Clean away all external dirt and tip out the fluid from the reservoir and cylinder body.

**7** The fluid reservoirs need not be removed from the master cylinder but if they are, renew the rubber sealing collars when refitting.

**8** Grip the master cylinder in a vice, then unscrew and remove the end plug. Catch the coil spring.

**9** Using a thin rod, apply pressure to the end of the primary piston then unscrew and remove the two stop bolts and sealing washers.

**10** The internal piston assemblies with seals and springs can now be pushed out of the cylinder body. Keep all the components in

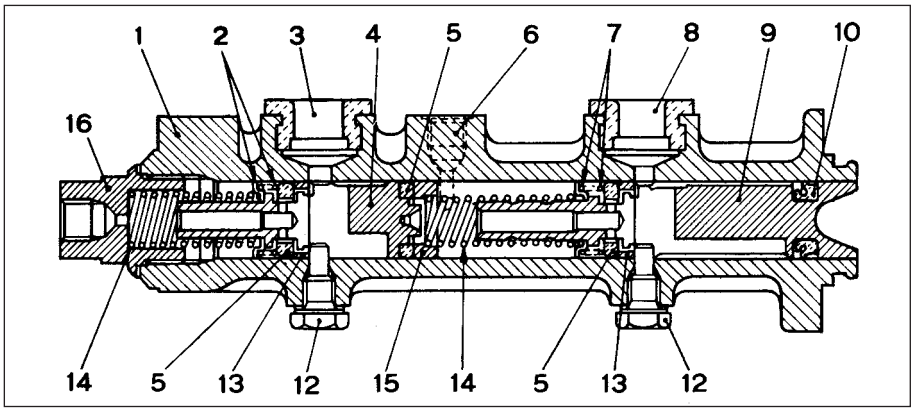



**Fig. 8.5 Sectional view of master cylinder (Sec 9)**

*1 Cylinder body*
*2 Spring and cup*
*3 Inlet from reservoir*
*4 Secondary piston*
*5 Seal*
*6 Fluid outlet to front brakes*
*7 Spring and cup*
*8 Inlet from reservoir*
*9 Primary piston*
*10 Seal*
*12 Stop bolts*
*13 Spacer*
*14 Springs*
*15 Seal*
*16 End plug and fluid outlet to rear brakes*

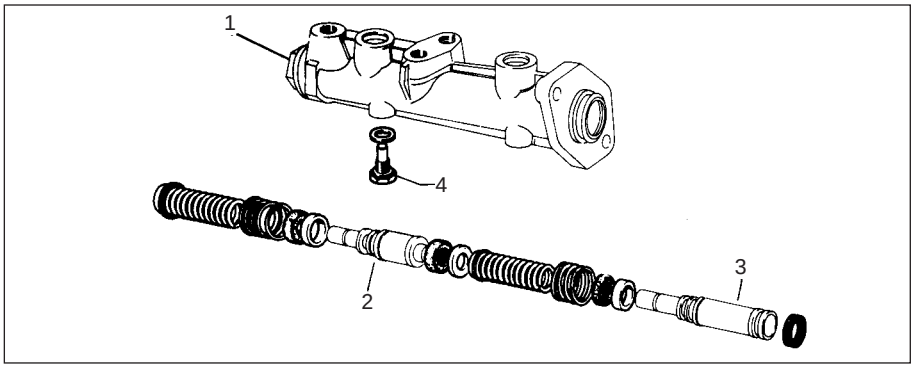



**Fig. 8.6 Exploded view of master cylinder (Sec 9)**

*1 Cylinder body 2 Secondary piston 3 Primary piston 4 Stop bolt*

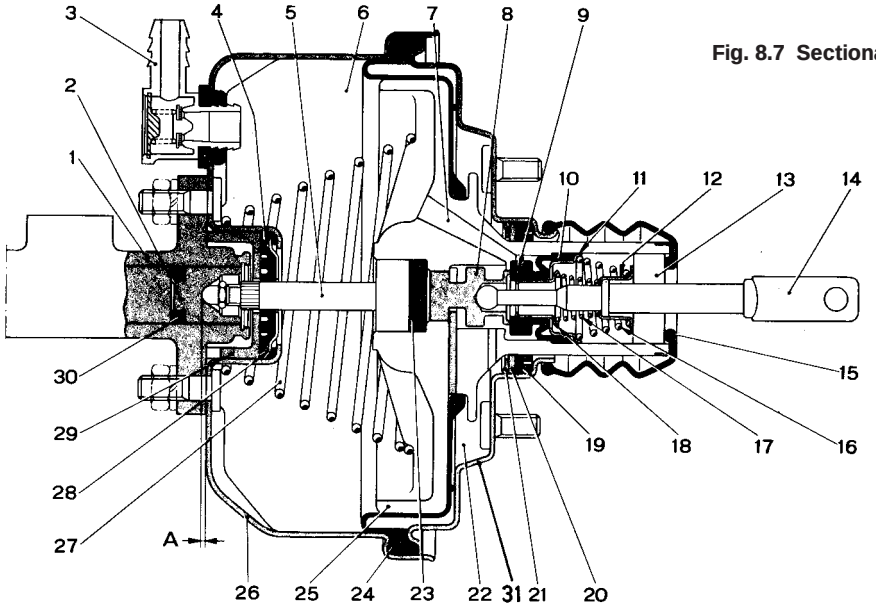



**Fig. 8.7 Sectional view of vacuum servo unit (Sec 9)**

*1 Master cylinder*
*2 Master cylinder primary piston*
*3 Non-return valve*
*4 Front seal*
*5 Pushrod*
*6 Front chamber*
*7 Vacuum port*
*8 Plunger*
*9 Seal centraliser*
*10 Valve*
*11 Spring cup*
*12 Spring cup*
*13 Filter*
*14 Pushrod*
*15 Dust excluding boot*
*16 Return spring*
*17 Valve spring*
*18 Valve cup*
*19 Rear seal*
*20 Seal*
*21 Cup*
*22 Rear chamber*
*23 Backing plate*
*24 Diaphragm*
*25 Vacuum piston*
*26 Front shell*
*27 Return spring*
*28 Cup*
*29 Guide bush*
*30 Seal*
*31 Rear shell*

*A = Projection of pushrod above vacuum cylinder face*

**10.4 Pressure regulating valve bracket and tension spring**

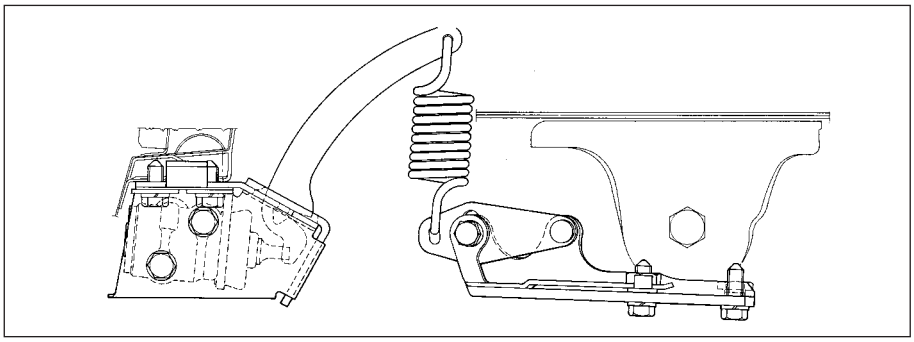


**Fig. 8.8 Pressure regulating valve (Sec 10)**

their originally fitted sequence and note in which direction the seal lips are located.

**11** Inspect the surfaces of the piston and cylinder bore. If scoring, corrosion or metal-to-metal rubbing areas are evident, renew the master cylinder complete.

**12** If the components are in good condition, discard the oil seals and manipulate the new ones into position, using the fingers only.

**13** Refit by reversing the removal operations; apply pressure to the piston ends so that the stop bolts can be fitted, then tighten the end plug. Make sure that the grooves in the pistons engage in the stop bolts.

**14** Before refitting the master cylinder to the servo, measure the projection of the servo piston pushrod. When the master cylinder is fitted, there must be a clearance (see A in Fig. 8.7) between the end of the pushrod and the primary piston end face of between 0.825 and 1.025 mm (0.03 and 0.04 in). A depth gauge will be required for these measurements, the reference point being the mating surfaces of the master cylinder and the vacuum servo.

**15** Alter the adjusting screw on the servo as necessary and lock it by applying locking fluid to the threads on completion.

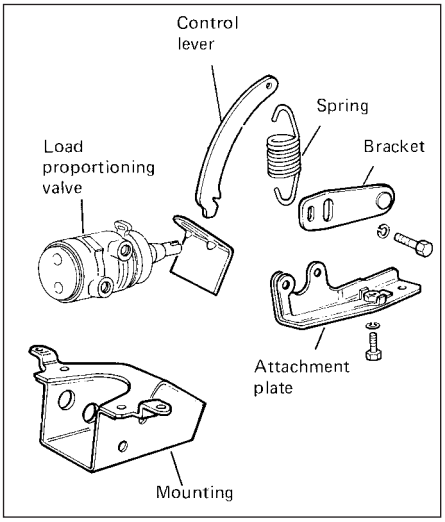



**Fig. 8.9 Components of the pressure regulating valve (Sec 10)**

**16** Bolt the master cylinder to the vacuum servo or bulkhead, then reconnect the pipelines and reservoir cap leads.

**17** Bleed the complete hydraulic system, as described in Section 12.

## 10 Pressure regulating valve

**1** The pressure regulating valve is a load proportioning valve which restricts the hydraulic pressure to the rear brakes according to car weight during heavy applications of the brake pedal. This prevents the rear wheels locking.

**2** A faulty or non-operational valve should be renewed complete, no repair being possible.

**3** To remove the valve, unscrew the pipe unions and disconnect the hydraulic pipes from the valve. Cap the ends of the pipes to prevent loss of fluid.

**4** Unbolt the valve mounting bracket, withdraw it and disconnect the tension spring (photo).

**5** Refit the new valve and then adjust it in the following way.

**6** Have the car standing on a level floor.

**7** The car should be normally loaded (kerb weight) with fuel, oil, spare wheel etc. Load the luggage compartment immediately behind the seat back with:

*65 kg (143 lbs) on three-door models or*
*55 kg (121 lbs) on five-door models*

**8** Refer to Fig. 8.10 and slacken the valve bracket securing bolt (1).

**9** Attach a 6.0 kg (13.2 lb) weight to the bracket eye (2) as shown and then tighten the bracket securing bolt.

**10** Bleed the braking system if a new valve has been fitted. Bleeding will not of course be required if only adjustment has been carried out to an existing valve.

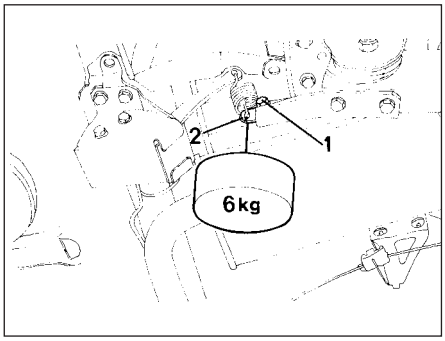



**Fig. 8.10 Weight attachment point for pressure regulating valve adjustment (Sec 10)**

*1 Fixing bolt 2 Bracket eye*

## 11 Hydraulic hoses and pipes - inspection and renewal

### *Flexible hoses*

**1** Periodically, all brake pipes, pipe connections and unions should be completely and carefully examined.

**2** First examine for signs of leakage where the pipe unions occur. Then examine the flexible hoses for signs of chafing and fraying and, of course, leakage. This is only a preliminary part of the flexible hose inspection, as exterior condition does not necessarily indicate the interior condition, which will be considered later.

**3** Flexible hoses are always mounted at both ends in a rigid bracket attached to the body or a sub-assembly. To remove them, it is necessary first of all to unscrew the pipe unions of the rigid pipes which go into them.

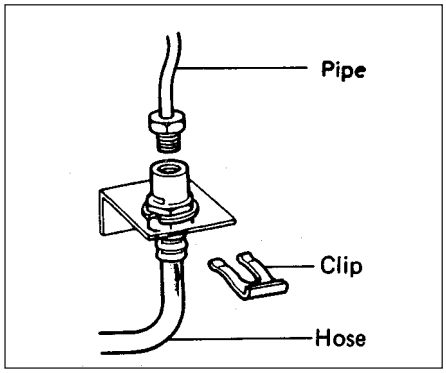



**Fig. 8.11 Typical hydraulic hose connection (Sec 11)**

**11.3 Front hydraulic hose bracket**

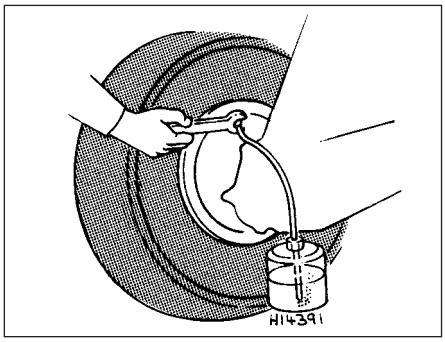



**Fig. 8.12 Bleeding a rear wheel cylinder (Sec 12)**

**12.8 Caliper bleed screw with dust cap fitted**

The hose ends can then be unclipped from the brackets. The mounting brackets, particularly on the body frame, are not very heavy gauge and care must be taken not to wrench them off (photo).

**4** With the flexible hose removed, examine the internal bore. If it is blown through first, it should be possible to see through it. Any specks of rubber which come out, or signs of restriction in the bore, mean that the inner lining is breaking up and the pipe must be renewed.

**5** When refitting the flexible hoses check they cannot be under tension, or rub, when the wheels are at the full range of suspension or steering movement.

**6** Bleed the system (see Section 12) on completion.

### *Rigid pipes*

**7** Inspect the condition of the braking system rigid pipelines at frequent intervals. They must be cleaned off and examined for any signs of dents (or other percussive damage) and rust and corrosion. Rust and corrosion should be scraped off and, if the depth of pitting in the pipes is significant, they will need renewal. This is particularly likely in those areas underneath the car body and along the rear axle where the pipes are exposed to the full force of road and weather conditions.

**8** Rigid pipe removal is usually straightforward. The unions at each end are undone, the pipe and union pulled out, and the centre sections of the pipe removed from the body clips where necessary. Underneath the car, exposed unions can sometimes be very tight. As one can use only an open-ended spanner and the unions are not large, burring of the flats is not uncommon when attempting to undo them. For this reason, a self-locking grip wrench (Mole) is often the only way to remove a stubborn union.

**9** Rigid pipes which need renewal can usually be purchased at any garage where they have the pipe, unions and special tools to make them up. All they need to know is the total length of the pipe, the type of flare used at each end with the union, and the length and thread of the union. Fiat is metric, remember.

**10** Fitting your new pipes is a straightforward reversal of the removal procedure. If the rigid pipes have been made up, it is best to get all the sets bends in them before trying to fit them. Also, if there are any acute bends ask your supplier to put these in for you on a tube bender. Otherwise, you may kink the pipe and thereby restrict the bore area and fluid flow.

**11** Bleed the system (see Section 12) on completion.

## 12 Hydraulic system - bleeding

**1** If the master cylinder or the pressure regulating valve has been disconnected and reconnected then the complete system (both circuits) must be bled.

**2** If a component of one circuit has been disturbed then only that particular circuit need be bled.

**3** The two disc brakes comprise the front circuit and the two rear brakes the rear circuit.

**4** Unless the pressure bleeding method is being used, do not forget to keep the fluid level in the master cylinder reservoir topped up to prevent air from being drawn into the system which would make any work done worthless.

**5** Before commencing operations, check that all system hoses and pipes are in good condition with all unions tight and free from leaks.

**6** Take great care not to allow hydraulic fluid to come into contact with the vehicle paintwork as it is an effective paint stripper. Wash off any spilled fluid immediately with cold water.

**7** As the system on 55 and 70 models incorporates a vacuum servo, destroy the vacuum by giving several applications of the brake pedal in quick succession. The car should be loaded with enough weight to actuate the pressure regulating valve before bleeding commences.

### *Bleeding - two man method*

**8** Gather together a clean glass jar and a length of rubber or plastic tubing which will be a tight fit on the brake bleed screws (photo).

**9** Engage the help of an assistant.

**10** Push one end of the bleed tube onto the flrst bleed screw and immerse the other end of the glass jar which should contain enough hydraulic fluid to cover the end of the tube.

**11** Open the bleed screw one half a turn and have your assistant depress the brake pedal fully then slowly release it. Tighten the bleed screw at the end of each pedal downstroke to obviate any chance of air or fluid being drawn back into the system.

**12** Repeat this operation until clean hydraulic fluid, free from air bubbles, can be seen coming through into the jar.

**13** Tighten the bleed screw at the end of a pedal downstroke and remove the bleed tube. Bleed the remaining screws in a similar way.

### *Bleeding - using a one way valve kit*

**14** There are a number of one-man, one-way brake bleeding kits available from motor accessory shops. It is recommended that one of these kits is used wherever possible as it will greatly simplify the bleeding operation and also reduce the risk of air or fluid being drawn back into the system quite apart from being able to do the work without the help of an assistant.

**15** To use the kit, connect the tube to the bleedscrew and open the screw one half a turn.

**16** Depress the brake pedal fully and slowly release it. The one-way valve in the kit will prevent expelled air from returning at the end of each pedal downstroke. Repeat this operation several times to be sure of ejecting all air from the system. Some kits include a translucent container which can be positioned so that the air bubbles can actually be seen being ejected from the system.

**17** Tighten the bleed screw, remove the tube and repeat the operations on the remaining brakes.

**18** On completion, depress the brake pedal. If it still feels spongy repeat the bleeding operations as air must still be trapped in the system.

### *Bleeding - using a pressure bleeding kit*

**19** These kits too are available from motor accessory shops and are usually operated by air pressure from the spare tyre.

**20** By connecting a pressurised container to the master cylinder fluid reservoir, bleeding is then carried out by simply opening each bleed screw in turn and allowing the fluid to run out, rather like turning on a tap, until no air is visible in the expelled fluid.
**21** By using this method, the large reserve of hydraulic fluid provides a safeguard against air being drawn into the master cylinder during bleeding which often occurs if the fluid level in the reservoir is not maintained.
**22** Pressure bleeding is particularly effective when bleeding "difficult" systems or when bleeding the complete system at time of routine fluid renewal.

### *All methods*

**23** When bleeding is completed, check and top up the fluid level in the master cylinder reservoir.
**24** Check the feel of the brake pedal. If it feels at all spongy, air must still be present in the system and further bleeding is indicated. Failure to bleed satisfactorily after a reasonable period of the bleeding operation, may be due to worn master cylinder seals.
**25** Discard brake fluid which has been expelled. It is almost certain to be contaminated with moisture, air and dirt making it unsuitable for further use. Clean fluid should always be stored in an airtight container as it absorbs moisture readily (hygroscopic) which lowers its boiling point and could affect braking performance under severe conditions.

## 13 Vacuum servo unit - description

*A vacuum servo unit is fitted into the brake hydraulic circuit on 55 and 70 models in series with the master cylinder, to provide assistance to the driver when the brake pedal is depressed. This reduces the effort required by the driver to operate the brakes under all braking conditions.*

The unit operates by vacuum obtained from the induction manifold and comprises basically a booster diaphragm and non-return valve. The servo unit and hydraulic master cylinder are connected together so that the servo unit piston rod acts as the master cylinder pushrod. The driver's braking effort is transmitted through another pushrod to the servo unit piston and its built-in control system. The servo unit piston does not fit tightly into the cylinder, but has a strong diaphragm to keep its edges in constant contact with the cylinder wall, so assuring an air tight seal between the two parts. The forward chamber is held under vacuum conditions created in the inlet manifold of the engine and, during periods when the brake pedal is not in use, the controls open a passage to the rear chamber so placing it under vacuum conditions as well. When the brake pedal is depressed, the vacuum passage to the rear chamber is cut off and the chamber opened to atmospheric pressure. The consequent rush of air pushes the servo piston forward in the vacuum chamber and operates the main pushrod to the master cylinder.

The controls are designed so that assistance is given under all conditions and, when the brakes are not required, vacuum in the rear chamber is established when the brake pedal is released. All air from the atmosphere entering the rear chamber is passed through a small air filter.

Under normal operating conditions, the vacuum servo unit is very reliable and does not require overhaul except at very high mileages. In this case, it is far better to obtain a service exchange unit, rather than repair the original unit.

It is emphasised that the servo unit assists in reducing the braking effort required at the foot pedal and in the event of its failure, the hydraulic braking system is in no way affected except that the need for higher pressures will be noticed.

## 14 Vacuum servo unit - servicing and testing

**1** Regularly, check that the vacuum hose which runs between the servo unit and the inlet manifold is in good condition and is a tight fit at both ends.
**2** If broken or badly clogged, renew the air filter which is located around the brake pedal push rod. Access to this is obtained by disconnecting the pushrod from the cross-shaft or pedal arm, withdrawing the pushrod, dust excluding boot and end cap.
**3** If the new filter is cut diagonally from its centre hole, future renewal can be carried out without the need for disconnection of the pushrod.
**4** If the efficiency of the servo unit is suspect, it can be checked out in the following way.
**5** Run the engine, then switch off the ignition. Depress the footbrake pedal; the distinctive in-rush of air into the servo should be clearly heard. It should be possible to repeat this operation several times before the vacuum in the system is exhausted.
**6** Start the engine and have an assistant apply the footbrake pedal and hold it down. Disconnect the vacuuum hose from the servo. There should not be any in-rush of air into the servo through the connecting stub. If there is, the servo diaphragm is probably faulty. During this test, expect the engine to idle roughly, unless the open end of the hose to the inlet manifold is plugged. Reconnect the hose.
**7** With the engine off, depress the brake pedal fully. Start the engine with the brake pedal still depressed; the pedal should be felt to go down fractionally.
**8** If the results of these tests are not satisfactory, remove the unit and fit a new one as described in the next Section.

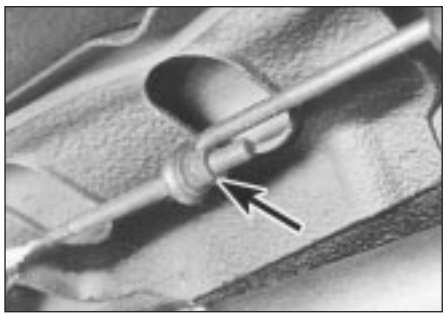
## 15 Vacuum servo unit - removal and refitting

**1** Syphon as much fluid as possible out of the master cylinder reservolr.
**2** Disconnect electrical leads from the terminals in the reservoir cap then uncouple the rigid pipelines from the master cylinder body. Be prepared to catch leaking fluid and plug the open ends of the pipelines.
**3** The master cylinder can be unbolted now from the servo unit, or detached later when the complete assembly is withdrawn.
**4** Working inside the car, disconnect the servo pushrod from the pedal then remove the servo mounting nuts.
**5** Withdraw the servo assembly into the engine compartment, then remove it to the bench. If the master cylinder is still attached, cover the wings with protective sheeting, in case brake fluid is spilled during removal.
**6** Refitting is a reversal of the removal process, but adjust the pushrod clearance as described in Section 9. On completion of refitting, bleed the complete hydraulic system as described in Section 12. Note: *Where the help of an assistant is available, the servo pushrod need not be disconnected from the pedal. The rod is a sliding fit in the servo and the servo can be simply pulled off the rod. Refitting without having disconnected the rod from the pedal can be difficult unless the help of an assistant is available.*

## 16 Handbrake - adjustment

*Adjustment is normally automatic, by the movement of the rear brake shoes on their automatic adjusters.*

However, owing to cable stretch, supplementary adjustment is occasionally required at the control lever adjuster nut. The need for this adjustment is usually indicated by excessive movement of the control lever when fully applied.
**1** The rear brakes should be fully applied when the handbrake control lever has been pulled over four or five notches.
**2** If adjustment is required, release the



**16.2 Handbrake adjuster nuts**

locknut and turn the adjuster nut on the handbrake primary rod (photo).
**3** Raise the rear roadwheels and check that they turn freely when the handbrake lever is fully released.

## 17 Handbrake cable - renewal

**1** There are two cables, either of which may be renewed independently
**2** Disconnect the cable, which is to be renewed, from the shoe lever at the brake backplate.
**3** Disconnect the longer cable from the primary link or rod and release the cable from its retainers. On later models with a plastic fuel tank, a cable bracket is moulded into the side of the tank (photo).

**17.3 Handbrake cable guide on fuel tank**

**4** Disconnect the shorter cable from the pivot lever at the pulley on the rear axle (photo).
**5** Refit the new cables by reversing the removal operations and then adjust as described in the preceding Section.

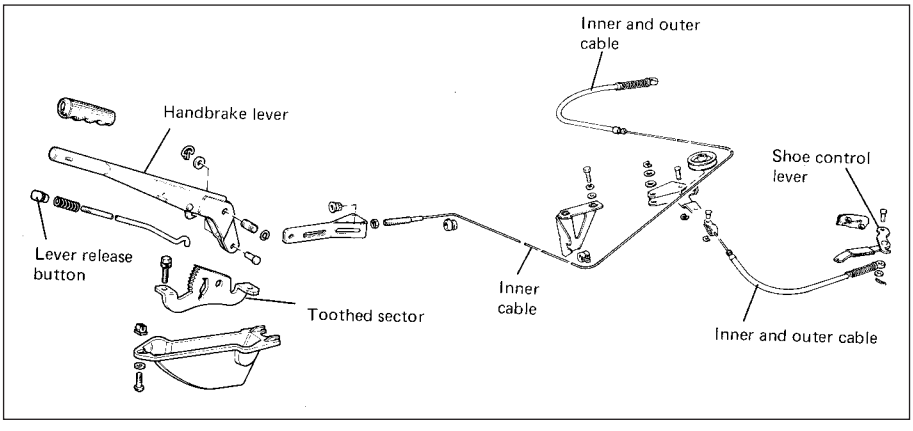



**Fig. 8.13 Handbrake components (Sec 17)**

**17.4 Handbrake cable pulley**

## 18 Brake pedal - removal and refitting

**1** The operations are described in conjunction with the clutch pedal in Chapter 5, Section 4.
**2** The brake pedal pushrod will slide out of the servo unit as the pedal is withdrawn.

## 19 Stop lamp switch

**1** The brake stop lamp switch is of plunger type acting on the pedal arm.
**2** Adjust the position of the switch by turning the locknuts until the stop lamps illuminate when the pedal arm is depressed through 1.0 mm (0.039 in).

# Fault finding - braking system

### *Excessive pedal travel*

- ☐ Pads or shoes excessively worn
- ☐ Incorrect pedal or servo pushrod adjustment
- ☐ Automatic adjusters faulty
- ☐ Seized wheel cylinder or caliper piston
- ☐ Master cylinder seals worn

### *Pedal feels spongy or soggy*

- ☐ Air in hydraulic system
- ☐ Low fluid level
- ☐ Loose connections
- ☐ Flexible hose perished
- ☐ Defective wheel cylinder or caliper seal

### *Pedal feels springy*

- ☐ New pads or linings not bedded-in
- ☐ Master cylinder mounting loose

### *Pedal vibrates when brakes applied*

- ☐ Discs or drums distorted
- ☐ Friction linings excessively worn
- ☐ Loose backplate or caliper mounting bolts
- ☐ Wear in steering or suspension components

### *Excessive effort required to stop car*

- ☐ Worn or contaminated linings or pads
- ☐ Incorrect grade of lining or pad material
- ☐ Servo vacuum hose leaking or disconnected
- ☐ Faulty servo or non-return valve (55 or 70 models)
- ☐ Seized caliper or wheel cylinder piston
- ☐ One circuit defective on dual circuit hydraulic system

### *Brakes pull to one side*

- ☐ Friction linings contaminated on one side of car
- ☐ Seized hydraulic piston on one side of car
- ☐ Different types of linings fitted on different sides of car, or new linings on one side only
- ☐ Seized automatic adjuster on one side of car

### *Brakes drag*

- ☐ Handbrake linkage overadjusted or seized
- ☐ Seized caliper or wheel cylinder piston

### *Brakes squeal*

- ☐ Drums or discs rusty or damp (temporary fault - no action necessary)
- ☐ Dust or grit in brake drums
- ☐ Linings excessively worn