






Chapter 9

Braking system

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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	
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Specifications

Front brakes

Type	Disc, with single piston sliding caliper
Disc diameter:	
2.0 litre models	256 mm
All other models	236 mm
Disc thickness:	
New:	
1.2 and 1.3 litre Saloon and Hatchback models	10.0 mm
1.3 litre Van and Estate models	12.7 mm
1.6 litre models	12.7 mm
1.8 litre models	20.0 mm
2.0 litre models	24.0 mm
Minimum thickness (after refinishing*):	
1.2 and 1.3 litre Saloon and Hatchback models	8.0 mm
1.3 litre Van and Estate models	10.7 mm
1.6 litre models	10.7 mm
1.8 litre models	18.0 mm
2.0 litre models	22.0 mm
Brake pad thickness (including backing plate):	
New	15.5 to 15.9 mm
Minimum	7.0 mm

**When this dimension is reached, only one more set of brake pads are permissible, then renew the discs*

Rear brakes

Type:	
2.0 litre GTE models	Disc, with twin piston caliper
All other models	Single leading shoe drum
Drum diameter:	
New:	
Pre 1989 models:	
Hatchback and 1.3 litre Estates with manual transmission	200 mm
All other Estate models and all Vans	230 mm
1989 onwards models (all models)	200 mm

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Rear brakes (continued)

Drum diameter (continued):

Maximum diameter:

Pre 1989 models:

Hatchback and 1.3 litre Estates with manual transmission 201 mm

All other Estate models and all Vans 231 mm

1989 onwards models (all models) 201 mm

Maximum drum out-of-round 0.1 mm

Minimum friction material-to-rivet head depth 0.5 mm

Disc diameter 260 mm

Disc thickness:

New 10.0 mm

Minimum thickness (after refinishing*) 8.0 mm

Brake pad thickness (including backing plate):

New 15.0 mm

Minimum 7.0 mm

**When this dimension is reached, only one more set of brake pads are permissible, then renew the discs*

Torque wrench settings

	Nm	lbf ft
Bleed screws	9	7
Brake pipe/hose union	25	18
Front brake caliper:		
GMF caliper:		
Mounting bracket bolts	95	70
Caliper to mounting bracket bolts	95	70
ATE caliper:		
Mounting bracket bolts	95	70
Slide bolts	30	22
Rear brake caliper mounting bolts	60	44
Wheel cylinder mounting bolt	9	7
Master cylinder mounting nuts	18	13
Wheel cylinder hydraulic union	11	8
Pressure regulating valve:		
Rear axle mounted valve - Estate and Van	20	15
Master cylinder mounted valve:		
GMF cylinder	40	30
ATE cylinder	12	9
Master cylinder stop screw (ATE)	6	4
Servo to bracket	18	13
Servo bracket to bulkhead	18	13
Rear brake backplate bolts (use thread-locking compound)	30	22
Handbrake lever bolts	20	15
ABS components:		
Hydraulic unit to bracket bolts	8	6
Front wheel speed sensor bolt	8	6
Rear wheel speed sensor bolt	15	11

1 General description

The footbrake operates on all four wheels. On 2.0 litre GTE models disc brakes are fitted at both the front and rear, and on all other models, disc brakes are fitted at the front and self-adjusting drums at the rear. On all models, actuation is hydraulic with servo assistance.

The hydraulic system is split into two circuits, each circuit acting on one front and one diagonally opposite rear brake. In the event of rupture of the hydraulic system in one circuit, the remaining circuit will still function so that some braking capability remains. In such a case the pedal travel will increase and greater effort will be needed.

The hydraulic supply to the rear brakes is regulated so that the front brakes always lock first under heavy braking. On Hatchback models the regulation is by pressure-sensitive valves screwed into the master cylinder; on Estate and Van models the valve is load-sensitive and is located near the rear axle, by whose movement it is modulated.

The brake servo is of the direct-acting type, fitted between the pedal and the master cylinder. It is powered by vacuum developed in the inlet manifold. Should the servo fail, the brakes will still operate, but increased pedal pressure will be required.

The handbrake provides an independent mechanical means of rear brake application. On 2.0 litre GTE models the handbrake operates a set of brake shoes, the shoes act on the brake drum which is incorporated inside the rear disc. On all other models, the

handbrake provides a mechanical means of operating the brake shoes.

Depending on operating territory and equipment level, warning lights may be fitted to indicate low brake fluid level, handbrake application and brake pad wear. Sometimes one warning light has a dual function: refer to the owner's handbook for details.

Note: *When servicing any part of the system, work carefully and methodically; also observe scrupulous cleanliness when overhauling any part of the hydraulic system. Always renew components (in axle sets, where applicable) if in doubt about their condition, and use only genuine Vauxhall/Opel replacement parts, or at least those of known good quality. Note the warnings given in 'Safety first' and at relevant points in this Chapter concerning the dangers of asbestos dust and hydraulic fluid.*

2 Hydraulic system - bleeding



Note: Hydraulic fluid is poisonous; wash off immediately and thoroughly in the case of skin contact and seek immediate medical advice if any fluid is swallowed or gets into the eyes. Certain types of hydraulic fluid are inflammable and may ignite when allowed into contact with hot components; when servicing any hydraulic system it is safest to assume that the fluid is inflammable and to take precautions against the risk of fire as though it is petrol that is being handled. Hydraulic fluid is also an effective paint stripper and will attack plastics; if any is spilt, it should be washed off immediately using large quantities of fresh water. Finally, as it is hygroscopic (it absorbs moisture from the air) - old fluid may be contaminated and unfit for further use. When topping-up or renewing the fluid, always use the recommended type and ensure that it comes from a freshly opened sealed container.

General

- 1 The correct operation of any hydraulic system is only possible after removing all air from the components and circuit; this is achieved by bleeding the system.
- 2 During the bleeding procedure, add only clean, unused hydraulic fluid of the recommended type; never re-use fluid that has already been bled from the system. Ensure that sufficient fluid is available before starting work.
- 3 If there is any possibility of incorrect fluid being already in the system, the brake components and circuit must be flushed completely with uncontaminated, correct fluid and new seals should be fitted to the various components.
- 4 If hydraulic fluid has been lost from the system, or air has entered, because of a leak ensure that the fault is cured before proceeding further.
- 5 Park the vehicle on level ground, switch off the engine and select first or reverse gear, then chock the wheels and release the handbrake.
- 6 Check that all pipes and hoses are secure, unions tight and bleed screws closed. Clean any dirt from around the bleed screws.
- 7 Unscrew the master cylinder reservoir cap and top the master cylinder reservoir up to the 'MAX' level line; refit the cap loosely and remember to maintain the fluid level at least above the 'MIN' level line throughout the procedure or there is a risk of further air entering the system.
- 8 There are a number of one-man, do-it-yourself brake bleeding kits currently available from motor accessory shops. It is recommended that one of these kits is used whenever possible as they greatly simplify the bleeding operation and also reduce the risk of expelled air and fluid being drawn back into the system. If such a kit is not available the

basic (two-man) method must be used which is described in detail below.

9 If a kit is to be used, prepare the vehicle as described previously and follow the kit manufacturer's instructions as the procedure may vary slightly according to the type being used; generally they are as outlined below in the relevant sub-section.

10 Whichever method is used, the same sequence must be followed (paragraphs 11 and 12) to ensure that the removal of all air from the system.

Bleeding sequence

- 11 If the system has been only partially disconnected and suitable precautions were taken to minimise fluid loss, it should be necessary only to bleed that part of the system (ie. the primary or secondary circuit).
- 12 If the complete system is to be bled, then it should be done in the following sequence.

Non ABS models

- a) Left-hand rear brake.
- b) Right-hand front brake.
- c) Right-hand rear brake.
- d) Left-hand front brake.

Models equipped with ABS

- a) Left-hand front brake.
- b) Right-hand front brake.
- c) Left-hand rear brake.
- d) Right-hand rear brake.

Bleeding - basic (two-man) method

- 13 Collect a clean glass jar, a suitable length of plastic or rubber tubing which is a tight fit over the bleed screw and a ring spanner to fit the screw. The help of an assistant will also be required.
- 14 Remove the dust cap from the first screw in the sequence. Fit the spanner and tube to the screw, place the other end of the tube in the jar and pour in sufficient fluid to cover the end of the tube.
- 15 Ensure that the master cylinder reservoir fluid level is maintained at least above the 'MIN' level line throughout the procedure.
- 16 Have the assistant fully depress the brake pedal several times to build up pressure, then maintain it on the final stroke.
- 17 While pedal pressure is maintained, unscrew the bleed screw (approximately one turn) and allow the compressed fluid and air to flow into the jar. The assistant should maintain pedal pressure, following it down to the floor if necessary and should not release it until instructed to do so. When the flow stops, tighten the bleed screw again, release the pedal slowly and recheck the reservoir fluid level.
- 18 Repeat the steps given in paragraphs 16 and 17 until the fluid emerging from the bleed screw is free from air bubbles. If the master cylinder has been drained and refilled and air is being bled from the first screw in the sequence, allow approximately five seconds between cycles for the master cylinder passages to refill.

19 When no more air bubbles appear, tighten the bleed screw securely, remove the tube and spanner and refit the dust cap. Do not overtighten the bleed screw.

20 Repeat the procedure on the remaining screws in the sequence until all air is removed from the system and the brake pedal feels firm again.

Bleeding - using a one-way valve kit

- 21 As their name implies, these kits consist of a length of tubing with a one-way valve fitted to prevent expelled air and fluid being drawn back into the system; some kits include a translucent container which can be positioned so that the air bubbles can be more easily seen flowing from the end of the tube.
- 22 The kit is connected to the bleed screw, which is then opened. The user returns to the driver's seat and depresses the brake pedal with a smooth, steady stroke and slowly releases it; this is repeated until the expelled fluid is clear of air bubbles.
- 23 Note that these kits simplify work so much that it is easy to forget the master cylinder reservoir fluid level; ensure that this is maintained at least above the 'MIN' level line at all times.

Bleeding - using a pressure bleeding kit

- 24 These kits are usually operated by the reservoir of pressurised air contained in the spare tyre, although note that it will probably be necessary to reduce the pressure to a lower limit than normal; refer to the instructions supplied with the kit.
- 25 By connecting a pressurised, fluid-filled container to the master cylinder reservoir, bleeding can be carried out simply by opening each screw in turn (in the specified sequence) and allowing the fluid to flow out until no more air bubbles can be seen in the expelled fluid.
- 26 This method has the advantage that the large reservoir of fluid provides an additional safeguard against air being drawn into the system during bleeding.
- 27 Pressure bleeding is particularly effective when bleeding 'difficult' systems or when bleeding the complete system at the time of routine fluid renewal.

All methods

- 28 On completion, when firm pedal feel is restored, wash off any spilt fluid, tighten the bleed screws securely and refit the dust caps.
- 29 Check the hydraulic fluid level and top-up if necessary (Chapter 1).
- 30 Discard any hydraulic fluid that has been bled from the system; it will not be fit for re-use.
- 31 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 required. Failure to bleed satisfactorily after a reasonable repetition of the bleeding procedure may be due to worn master cylinder seals.

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3 Hydraulic pipes and hoses - renewal



Note: Before starting work, refer to the note at the beginning of Section 2 concerning the dangers of hydraulic fluid.

1 If any pipe or hose is to be renewed, minimise fluid loss by removing the master cylinder reservoir cap and then tightening it down onto a piece of polythene to obtain an airtight seal. Alternatively flexible hoses can be sealed, if required, using a proprietary brake hose clamp, while metal brake pipe unions can be plugged (if care is taken not to allow dirt into the system) or capped immediately they are disconnected. Place a wad of rag under any union that is to be disconnected to catch any spilt fluid.

2 If a flexible hose is to be disconnected, unscrew the brake pipe union nut before removing the spring clip which secures the hose to its mounting bracket.

3 To unscrew the union nuts it is preferable to obtain a brake pipe spanner of the correct size; these are available from most large motor accessory shops. Failing this a close-fitting open-ended spanner will be required, though if the nuts are tight or corroded their flats may be rounded-off if the spanner slips. In such a case a self-locking wrench is often the only way to unscrew a stubborn union, but it follows that the pipe and the damaged nuts must be renewed on reassembly. Always clean a union and surrounding area before disconnecting it. If disconnecting a component with more than one union make a careful note of the connections before disturbing any of them.

4 If a brake pipe is to be renewed it can be obtained, cut to length and with the union nuts and end flares in place, from Vauxhall/Opel dealers. All that is then necessary is to bend it to shape, following the line of the original, before fitting it to the car. Alternatively, most motor accessory shops can make up brake pipes from kits, but this requires very careful measurement of the original to ensure that the replacement is of the correct length. The safest answer is usually to take the original to the shop as a pattern.



4.4a Removing an anti-rattle spring

5 On refitting, do not overtighten the union nuts. It is not necessary to exercise brute force to obtain a sound joint.

6 Ensure that the pipes and hoses are correctly routed with no kinks and that they are secured in the clips or brackets provided. After fitting, remove the polythene from the reservoir and bleed the hydraulic system as described in Section 2. Wash off any spilt fluid and check carefully for fluid leaks.

4 Front brake pads - renewal



Warning: Renew both sets of front brake pads at the same time - never renew the pads on only one wheel as uneven

braking may result. Note that the dust created by wear of the pads may contain asbestos, which is a health hazard. 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 use petroleum-based solvents to clean brake parts. Use brake cleaner or methylated spirit only.

1 Raise the front of the vehicle (see "Jacking and Vehicle Support"). If the roadwheels have been balanced on the vehicle (new vehicles are balanced this way in production) then mark the relative position of the roadwheel to the hub so that it can be aligned correctly when refitting.



4.4b Wear warning sensor clipped to pad

2 Inspect the thickness of the friction material on each pad. If any one is at or below the specified minimum, renew the pads as an axle set (four pads) in the following way.

GMF and early ATE type caliper

3 Drive out the pad retaining pins by applying a punch to their inboard ends.

4 Remove the springs and, where necessary, remove the pad wear warning sensor from the pad (see illustrations).

5 Using a pair of pliers, withdraw the outboard pad (see illustration).

6 Remove the inboard pad. If it is very tight, move the pad sideways slightly to depress the caliper piston (see illustration).

7 In order to accommodate the new thicker pads, the caliper piston must be depressed fully into its cylinder using a flat bar of metal such as a tyre lever. The action of depressing the piston will cause the fluid in the reservoir to rise, so anticipate this by syphoning some off using an old (clean) hydrometer or similar.

8 Brush out the jaws of the caliper, taking care not to inhale the dust.

9 Insert the pads, making sure that the lining side is against the disc. When fitting disc pads supplied by the vehicle manufacturer, it may be found that two pads out of the four have white marks on their backing plates. Where this is the case, the pads with the marks should be fitted to the piston sides of the calipers.

10 Locate the springs correctly and drive in the retaining pins (see illustrations).

11 Repeat the operations on the opposite brake.



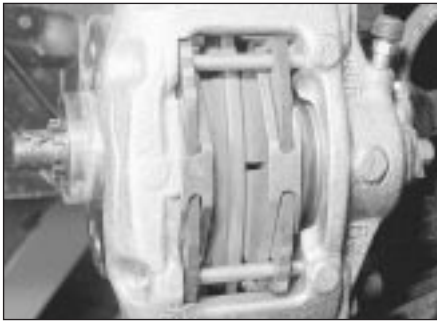
4.5 Removing the outboard pad



4.6 Removing the inboard pad



4.10a Inserting disc pad pin



4.10b Pad retaining pins and anti rattle springs correctly fitted

12 Refit the roadwheels and lower the vehicle.

13 Apply the footbrake hard several times to position the pads against the discs.

14 Top-up the fluid reservoir to the correct level.

15 New brake pads need to be carefully bedded in and, where possible, heavy braking should be avoided during the first 120 miles (200 km).

Later ATE type caliper

16 Extract the pad wear warning sensor and move it aside (see illustration).

17 Lever the ends of the spring clip from their locations and remove the clip (see illustration).

18 Remove the dust caps from the slide bolts (see illustration).

19 Using a 7 mm Allen key, unscrew the slide bolts and remove them.



4.18 Removing a dust cap from a slide bolt



4.16 On later ATE type calipers, unclip the pad wear sensor . . .

20 Lift the caliper body and inboard pad off the disc. The outboard pad will stay on the bracket (see illustration). Support the caliper body, or tie it up with a piece of wire, so that the flexible hose is not strained.

21 Unclip the inboard pad from the caliper piston and lift the outboard pad off the bracket (see illustrations). Clean the caliper and bracket.

22 If new pads are to be fitted, press the piston back into its bore. As the piston is pushed back, the fluid level in the master cylinder will rise. Syphon some fluid out if necessary with an old (clean) poultry baster or battery hydrometer.

23 Make sure that the steps of the caliper piston are positioned as shown (see illustration).

24 Fit the inboard pad to the piston and the outboard pad to the bracket. Fit the caliper to the bracket and secure it with the slide bolts



4.20 Lift the caliper off the disc . . .



4.17 . . . then lever out the spring clip

tightening them to the specified torque. Fit the dust caps.

25 Refit the pad wear warning sensor.

26 Carry out the operations described in paragraphs 11 to 15.

5 Rear brake pads - renewal



Warning: Disc brake pads must be renewed on both rear wheels at the same time. Never renew the pads on only one wheel as uneven braking may result. Also, the dust created by wear of the pads may contain asbestos, which is a health hazard. 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 use petroleum-based solvents to clean brake parts. Use brake cleaner or methylated spirit only.

1 Raise the front of the vehicle (see "Jacking and Vehicle Support"). If the roadwheels have been balanced on the vehicle (new vehicles are balanced this way in production) then mark the relative position of the roadwheel to the hub so that it can be aligned correctly when refitting.

2 Inspect the thickness of the friction material on each pad. If any one is at or below the specified minimum, renew the pads as an axle set (four pads) in the following way.

3 Using a pin punch, drive out the two pad retaining pins from the outside towards the



4.21a . . . then unclip the inboard pad from the caliper piston . . .



4.21b . . . and remove the outboard pad from the caliper bracket



4.23 Prior to fitting the pads, ensure that the caliper steps are positioned as shown

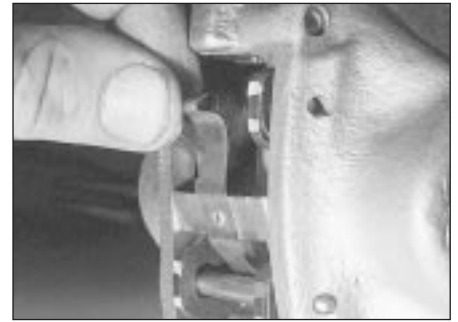
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5.3 Driving out a rear disc pad retaining pin



5.9a Fitting a rear pad



5.9b Hooking the spring under one retaining pin

middle of the vehicle (see illustration). Recover the spring.

4 Remove the pads from the caliper. If they are tight, use a slide hammer or grip them with self-locking pliers.

5 Clean the caliper with a soft wire brush, paying attention to the warning at the beginning of this operation.

6 In order to accommodate the new thicker pads, the caliper piston must be depressed fully into its cylinder using a flat bar of metal such as a tyre lever. The action of depressing the piston will cause the fluid in the reservoir to rise, so anticipate this by syphoning some off using an old (clean) hydrometer or similar.

7 Inspect the brake disc for deep grooving, scoring or cracks. Renew the disc, or have it refinished if this is possible, if such damage is found. Excessive run-out may be caused by wheel bearing play, so bearing adjustment should be checked before assuming that the disc is at fault.

8 Apply a little disc brake anti-squeal or

anti-seize compound to the backs of the new pads, and to the sides of the backplate. Be careful not to get any on the friction surface.

9 Insert the pads into the caliper with the friction material towards the disc. Fit one retaining pin (from the inside towards the outside) and tap it home. Hook one end of the spring under the pin (see illustrations).

10 Fit the other pin and tap it home, holding the other end of the spring down with a screwdriver so that the pin passes over it.

11 Repeat the operations on the opposite brake.

12 Refit the roadwheels and lower the vehicle.

13 Apply the footbrake hard several times to position the pads against the discs.

14 Top-up the fluid reservoir to the correct level.

15 New brake pads need to be carefully bedded in and, where possible, heavy braking should be avoided during the first 120 miles (200 km).

6 Rear brake shoes - renewal



Warning: Drum brake shoes must be renewed on both rear wheels at the same time - never renew the shoes on only one wheel as uneven braking may result. Also, the dust created by wear of the shoes may contain asbestos, which is a health hazard. 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 use petroleum based solvents to clean brake parts. Use brake cleaner or methylated spirit only.

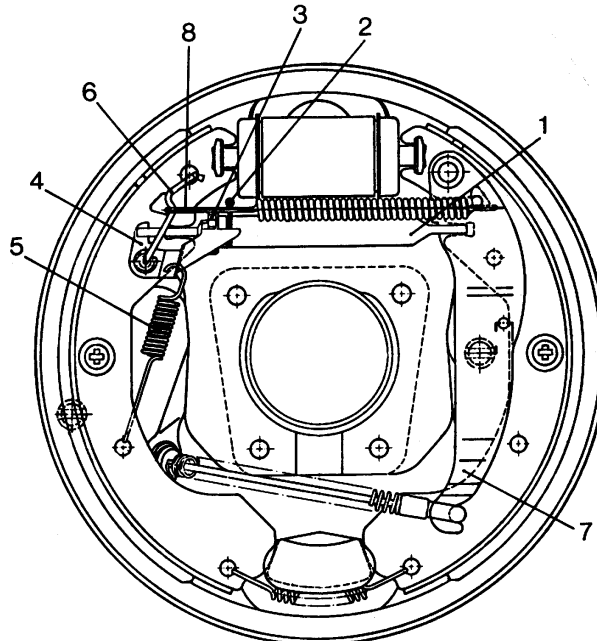
- 1 Remove the brake drum (Section 9).
- 2 Working carefully and taking the necessary precautions, remove all traces of brake dust from the brake drum, backplate and shoes.
- 3 Measure the depth from the friction material to each of the rivets. If this is equal or less than the specified minimum, all four shoes must be renewed as a set. Also, the shoes should be renewed if any are fouled with oil or grease; there is no satisfactory way of degreasing friction material once contaminated.
- 4 If any of the brake shoes are worn unevenly or fouled with oil or grease, trace and rectify the cause before reassembly. If the shoes are to be renewed proceed as described below. If all is well refit the drums (Section 9).
- 5 Remove the steady pins, springs and washers by depressing the washers and turning them anti-clockwise. Renew them if they are damaged (see illustrations).

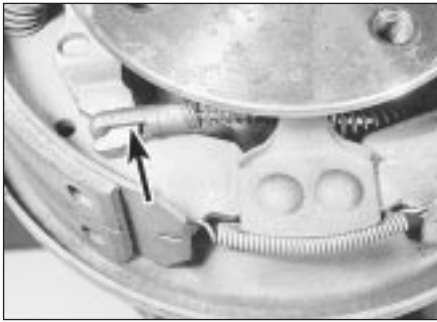


6.5b Brake shoe steady pin and washer (arrowed)

6.5a Rear brake components with drum removed

- 1 Strut
- 2 Thermoclip
- 3 Adjuster pinion
- 4 Adjuster lever
- 5 Adjuster lever spring
- 6 Adjuster lever bracket
- 7 Handbrake lever
- 8 Upper return spring





6.6 Handbrake cable attachment to operating lever (arrowed)

6 Disconnect the handbrake cable from the operating lever (**see illustration**). If there is insufficient slack at the cable, disconnect it at the equaliser yoke

7 The return springs may be unhooked now and the shoes removed separately, or the assembly of shoes, strut and springs may be removed together. The second course is particularly easy if the hub is removed (see Chapter 10), as has been done for some of the photographs. Be careful not to damage the wheel cylinder rubber boots.

8 If the shoes are to be removed for some time, secure the wheel cylinder pistons with a stout rubber band or a spring clip. In any event, do not press the brake pedal while the drum is removed.

9 Clean the brake backplate, again *being careful not to inhale the dust or to disperse it into the air*

10 Apply a smear of copper-based anti-seize compound to the shoe rubbing areas on the backplate.

11 Investigate and rectify any source of contamination of the linings (wheel cylinder or hub bearing oil seal leaking).

12 Unusually, linings are still available separately for these brake shoes. Renewal of the shoes complete with linings is to be preferred, however, unless the reader has the necessary skills and equipment to fit new linings to the old shoes.

13 Dismantle the shoes, strut and springs. Note how the springs are fitted, and which way round the strut goes. Be careful not to interchange left-hand and right-hand adjuster components: the threaded rod is marked L or R,



6.13 Self-adjusting strut components right-hand side

and the other 'handed' components are colour-coded: black for the left-hand side, and silver for the right (**see illustration**).

14 Dismantle and clean the adjusting strut. Apply a smear of silicone-based lubricant to the adjuster threads. If new brake linings are being fitted, the thermoclip (in the middle of the strut) must be renewed too.

15 Examine the shoe return springs. If they are distorted or if they have seen much service, renewal is advisable. Weak springs may cause the brakes to bind.

16 If a new handbrake lever was not supplied with the new shoes, transfer the old lever. It may be secured with a pin and circlip (**see illustration**), or by a rivet which will have to be drilled out.

17 Assemble the new shoes, springs and adjuster components. Expand the adjuster strut to ease fitting (**see illustrations**).

18 Offer the shoes to the brake backplate. Be careful not to damage the wheel cylinder boots or to displace the pistons. Remember to remove the rubber band or spring clip from the wheel cylinder, if one was used.

19 When the shoes are in position, insert the steady pins and secure them with the springs and washers. Reconnect the handbrake cable, and refit and adjust the hub if it was removed.

20 If fitting the shoes and springs together is found too difficult, it is possible to fit the shoes and secure them with the steady pins, then to introduce the adjuster strut and fit the springs and adjuster.

21 Back off the adjuster pinion to reduce the length of the strut until the brake drum will



6.16 Handbrake lever secured by pin

pass over the new linings. Make sure that the handbrake lever is correctly positioned (pin on the edge of the shoe web, not on top of it).

22 Refit and secure the brake drum as described in Section 9.

23 Repeat the operations on the other rear brake, then adjust the brakes by operating the footbrake at least 15 times. A clicking noise will be heard at the drums as the automatic adjusters operate; when the clicking stops, adjustment is complete.

24 Check the handbrake adjustment and correct it if necessary (see Chapter 1).

25 When new linings have been fitted, avoid harsh braking (if possible) for the first hundred miles or so to allow the linings to bed in.

7 Front brake disc - inspection, removal and refitting



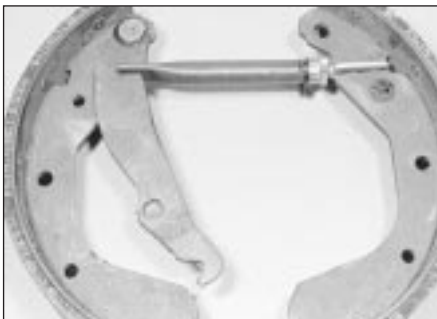
Note: Before starting work, refer to the note at the beginning of Section 4 concerning the dangers of asbestos dust.

Inspection

Note: If either disc requires renewal, both should be renewed at the same time to ensure even and consistent braking.

1 Firmly apply the handbrake, jack up the front of the car and support it on axle stands (see "Jacking and Vehicle Support"). Remove the appropriate front roadwheel, marking its correct fitted position on the hub.

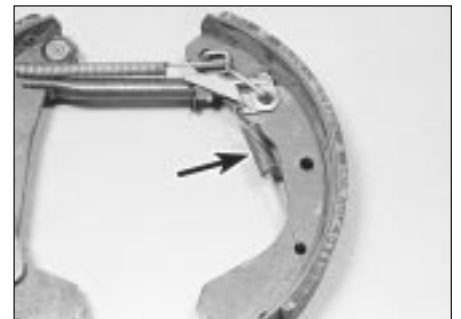
2 Slowly rotate the brake disc so that the full area of both sides can be checked; remove the brake pads if better access is required to the inner surface. Light scoring is normal in



6.17a Self-adjusting strut correctly fitted



6.17b Fitting the upper return spring to the adjuster lever bracket



6.17c Adjuster lever spring (arrowed) fitted



8.3 Levering off the grease cap

the area swept by the brake pads, but if heavy scoring is found the disc must be renewed.

3 It is normal to find a lip of rust and brake dust around the disc's perimeter; this can be scraped off if required. If, however, a lip has formed due to excessive wear of the brake pad swept area then the disc's thickness must be measured using a micrometer. Take measurements at several places around the disc at the inside and outside of the pad swept area; if the disc has worn at any point to the specified minimum thickness or less, the disc must be renewed.

4 If the disc is thought to be warped it can be checked for run-out either using a dial gauge mounted on any convenient fixed point, while the disc is slowly rotated, or by using feeler blades to measure (at several points all around the disc) the clearance between the disc and a fixed point such as the caliper mounting bracket. To ensure that the disc is squarely seated on the hub, fit two wheel bolts complete with spacers approximately 10 mm thick and tighten them securely. If the measurements obtained are at the specified maximum or beyond, the disc is excessively warped and must be renewed; however it is worth checking first that the hub bearing is in good condition (Chapters 1 and/or 10).

5 Check the disc for cracks, especially around the wheel bolt holes, and any other wear or damage and renew if necessary.

Removal

6 Remove the brake pads (Section 4).

7 Extract the small retaining screw and then tilt the disc and withdraw it from the hub.

Refitting

8 Refitting is the reverse of the removal procedure, noting the following points.

- Ensure that the mating surfaces of the disc and hub are clean and flat.
- If a new disc has been fitted, use a suitable solvent to wipe any preservative coating from the disc before refitting the caliper.
- On vehicles which are equipped with light alloy roadwheels, a facing sleeve is mounted on the collar of the brake disc.
- Refit the brake pads as described in Section 4.
- Refit the roadwheel, aligning the marks

made on removal, then lower the vehicle to the ground and tighten the roadwheel bolts to the specified torque. On completion, repeatedly depress the brake pedal until normal (non-assisted) pedal pressure returns.

8 Rear brake disc - inspection, removal and refitting

Note: Before starting work, refer to the note at the beginning of Section 5 concerning the dangers of asbestos dust.

Inspection

1 Refer to Section 7.

Removal

2 Slacken and remove the two bolts securing the brake caliper in position. Slide off the caliper and position it clear of the brake disc, taking care not to strain the brake pipe.

3 Release the handbrake then remove the hub grease cap by levering or tapping it off (see illustration).

4 Remove the split pin from the hub nut. Remove the nut.

5 Pull the disc/hub unit off the stub axle, catching the washer and the bearing outer race (see illustration). If the handbrake shoes seem to be preventing removal, disconnect the handbrake cable from the lever on the brake backplate.

Refitting

6 Refitting is the reverse of the removal procedure, noting the following points:

- If a new disc has been fitted, use a suitable solvent to wipe any preservative coating from the disc before refitting the caliper.
- On refitting, adjust the hub bearings as described in Chapter 10.
- Use a new split pin, and if necessary a new grease cap.
- Adjust the handbrake (see Chapter 1).

9 Rear brake drum - removal, inspection and refitting

Note: Before starting work, refer to the note at the beginning of Section 6 concerning the dangers of asbestos dust.

Removal

1 Chock the front wheels then jack up the rear of the vehicle and support it on axle stands (see "Jacking and Vehicle Support").

2 Remove the appropriate rear wheel, marking its correct fitted position on the drum.

3 Remove the brake drum securing screw then release the handbrake and pull off the drum. If it is tight, collapse the brake shoes by removing the plug in the brake backplate and pushing the handbrake operating lever outwards with a screwdriver (see illustrations).



8.5 Removing the rear disc

Inspection

Note: If either drum requires renewal, both should be renewed at the same time to ensure even and consistent braking.

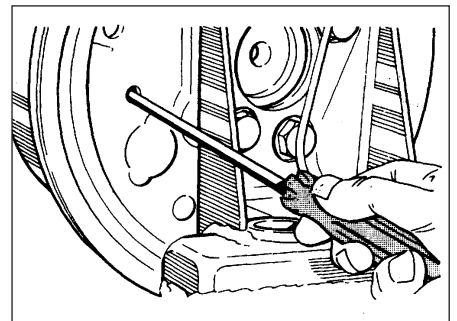
4 Working carefully, remove all traces of brake dust from the drum, but avoid inhaling the dust as it is injurious to health.

5 Scrub clean the outside of the drum and check it for obvious signs of wear or damage such as cracks around the roadwheel bolt holes; renew the drum if necessary.

6 Examine carefully the inside of the drum. Light scoring of the friction surface is normal, but if heavy scoring is found the drum must be renewed. It is usual to find a lip on the drum's inboard edge which consists of a mixture of rust and brake dust; this should be scraped away to leave a smooth surface which can be polished with fine (120 to 150 grade) emery paper. If, however, the lip is due to the friction



9.3a Removing a brake drum securing screw



9.3b Pushing back the handbrake lever

surface being recessed by excessive wear, then the drum must be renewed.

7 If the drum is thought to be excessively worn, or oval, its internal diameter must be measured at several points using an internal micrometer. Take measurements in pairs, the second at right angles to the first, and compare the two to check for signs of ovality. Provided that it does not enlarge the drum to beyond the specified maximum diameter, it may be possible to have the drum refinished by skimming or grinding; if this is not possible, the drums on both sides must be renewed. Note that if the drum is to be skimmed, both drums must be refinished to maintain a consistent internal diameter on both sides.

Refitting

8 If a new brake drum is to be installed, use a suitable solvent to remove any preservative coating that may have been applied to its interior.

9 Ensure that the drum and hub flange mating surfaces are clean and dry and remove all traces of corrosion.

10 Make sure that the handbrake lever stop peg is correctly repositioned against the edge of the brake shoe web then locate the drum on the hub. Note that it may be necessary to shorten the adjuster strut length by rotating the strut wheel to allow the drum to pass over the brake shoes.

11 Refit the drum retaining screw and tighten it securely.

12 Adjust the lining to drum clearance by repeatedly applying the footbrake at least fifteen times. Whilst applying the brake have

an assistant listen to the rear drums to check that the adjuster strut is functioning correctly; if this is so a clicking sound will be emitted by the strut as the pedal is depressed.

13 With the lining to drum clearance set check and, if necessary, adjust the handbrake as described in Chapter 1.

14 Refit the roadwheel, aligning the marks made on removal, then lower the vehicle to the ground and tighten the wheel bolts to the specified torque setting.

10 Front brake caliper - removal, overhaul and refitting

Note: Before starting work, refer to the note at the beginning of Section 2 concerning the dangers of hydraulic fluid and to the warning at the beginning of Section 4 concerning the dangers of asbestos dust.

Removal

1 Apply the handbrake, then jack up the front of the vehicle and support it on axle stands (see "Jacking and Vehicle Support"). Remove the appropriate roadwheel, marking its correct fitted position on the wheel hub.

2 Minimise fluid loss either by removing the master cylinder reservoir cap and then tightening it down onto a piece of polythene to obtain an airtight seal, or by using a brake hose clamp, a G-clamp or a similar tool to clamp the flexible hose.

3 Clean the area around the caliper brake hose union. Slacken and remove the union bolt and recover the sealing washer from either side of the hose union; discard the washers new ones must be used on refitting. Plug the hose end and caliper hole to minimise fluid loss and prevent the ingress of dirt into the hydraulic system.

4 Remove the brake pads as described in paragraphs Section 4.

5 On models with early ATE type calipers, slacken and remove the two caliper mounting bolts and remove the caliper assembly from the vehicle.

6 On models with GMF type calipers, prise off the mounting bolt caps to gain access to the bolts. Slacken and remove the bolts and remove the caliper from the vehicle (see illustrations).

Overhaul

Early ATE type caliper

7 With the caliper on the bench, wipe away all traces of dust and dirt, but *avoid inhaling the dust as it is injurious to health*.

8 Separate the caliper body from its bracket by sliding them apart. Recover the guide springs.

9 Using a screwdriver, prise off the retaining ring from the dust excluder then remove the excluder from the caliper.

10 Withdraw the partially ejected piston from the caliper body and remove the dust excluder. The piston can be withdrawn by hand, or if necessary pushed out by applying compressed air to the brake hose union hole. Only low pressure should be required such as is generated by a foot pump.

11 Once the piston has been removed, pick out the seal from its groove in the cylinder, using a plastic or wooden instrument.

12 Thoroughly clean all components using only methylated spirit, isopropyl alcohol or clean hydraulic fluid as a cleaning medium. Never use mineral-based solvents such as petrol or paraffin which will attack the hydraulic system's rubber components. Dry the components immediately using compressed air or a clean, lint-free cloth. Use compressed air to blow clear the fluid passages.

13 Check all components and renew any that are worn or damaged. Check particularly the cylinder bore and piston; these should be renewed (note that this means the renewal of the complete body assembly) if they are scratched, worn or corroded in any way.

14 If the assembly is fit for further use, obtain the necessary components from your Vauxhall dealer. Renew the caliper seals as a matter of course; these should never be re-used.

15 On reassembly, ensure that all components are absolutely clean and dry.

16 Soak the piston and the new seal in clean hydraulic fluid.

17 Smear clean fluid on the cylinder bore surface.

18 Fit the new seal using only the fingers to manipulate it into the cylinder bore groove.

19 Fit the new dust seal to the piston and refit it to the cylinder bore using a twisting motion, and ensure that the piston enters squarely into the bore. Push the piston into the caliper bore making sure that the piston step is positioned as shown (see illustration).



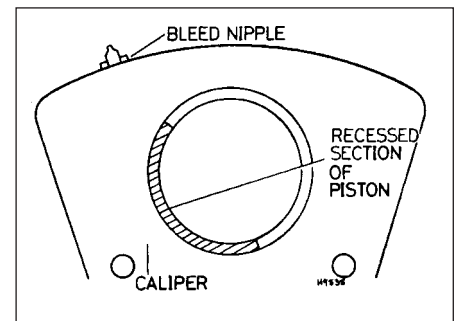
10.6a On the GMF caliper, remove the caliper bolt caps . . .



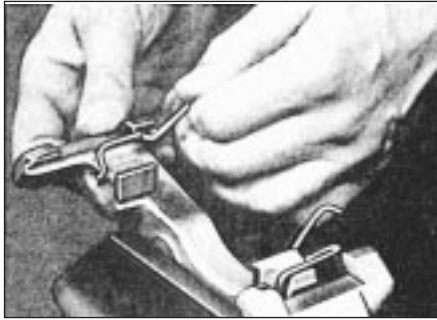
10.6b . . . then unscrew the caliper bolts . . .



10.6c . . . and remove the caliper



10.19 Caliper piston recess setting diagram - early type ATE caliper



10.22 Fitting caliper bracket guide springs - early type ATE caliper

20 When the piston has been partially depressed, engage the dust excluder with the rim of the cylinder and fit the retaining clip.
21 Press the piston fully into its cylinder bore.
22 Secure the caliper bracket in a vice and install the guide springs (see illustration).
23 Slide the caliper body into the bracket splines until the body and bracket are flush.

GMF type caliper

24 With the caliper on the bench, wipe away all traces of dust and dirt, but *avoid inhaling the dust as it is injurious to health*.
25 Prise the sliding sleeve inner dust caps from the caliper housing.
26 Push the caliper sliding sleeves inwards so that the dust caps can be disengaged from the sleeve grooves and removed.
27 Prise off the piston dust excluder.
28 Remove the piston dust excluder from the caliper.
29 Carry out the operations described earlier in paragraphs 10 to 12.
30 Press the sliding sleeves out from the caliper body, noting which way around they are fitted, and recover their sealing rings. Inspect the sleeves and caliper body for signs of wear or damage. Both should be undamaged and a reasonably tight, sliding fit in each other.
31 Check all components and renew any that are worn or damaged. Check particularly the cylinder bore and piston; these should be renewed (note that this means the renewal of the complete body assembly) if they are scratched, worn or corroded in any way.
32 If the assembly is fit for further use, obtain the necessary components from your Vauxhall dealer. Renew the caliper seals as a matter of course; these should never be re-used.
33 On reassembly, ensure that all components are absolutely clean and dry.
34 Soak the piston and the new seal in clean hydraulic fluid. Smear clean fluid on the cylinder bore surface.
35 Fit the new seal using only the fingers to manipulate it into the cylinder bore groove.
36 Fit the new dust seal to the piston and refit it to the cylinder bore using a twisting motion, and ensure that the piston enters squarely into the bore.
37 When the piston has been partially depressed, engage the dust excluder with the rim of the cylinder then depress the piston fully into its cylinder bore.

38 Fit the new sealing rings to the sliding sleeve recesses and apply the grease supplied in the repair kit to the sleeves. Install the sleeves making sure they are fitted the correct way around.

39 Fit the inner dust caps, making sure they are correctly engaged with the sliding sleeves. Slide the sleeves into position and press the dust caps into position on the caliper body using a suitable tubular drift.

Later ATE type caliper

40 With the caliper on the bench, wipe away all traces of dust and dirt, but *avoid inhaling the dust as it is injurious to health*.
41 Press the sliding bolt sleeves out of their bore in the caliper body.
42 Carry out the operations described in paragraphs 10 to 19, positioning the piston as shown in **illustration 4.23**.
43 Ensure that the dust excluder is correctly located in the caliper body then coat the new slide bolt sleeves with washing-up liquid and press them into their bores by hand.

Refitting

44 On GMF and early ATE type calipers, prior to refitting, remove all traces of locking compound from the caliper mounting bolt threads and the hub carrier holes. Apply a drop of fresh locking compound to the bolt threads. Refit the caliper and insert the mounting bolts, tightening them to the specified torque setting.
45 On all calipers, refit the brake pads as described in Section 4 but do not depress the brake pedal yet.
46 Position a new sealing washer on each side of the hose union and connect the brake hose to the caliper. Ensure that the hose is correctly positioned against the caliper body lug then install the union bolt and tighten it to the specified torque setting.
47 Remove the brake hose clamp or polythene, where fitted, and bleed the hydraulic system as described in Section 2. Note that providing the precautions described were taken to minimise brake fluid loss, it should only be necessary to bleed the relevant front brake.
48 Refit the roadwheel, aligning the marks made on removal, then lower the vehicle to the ground and tighten the roadwheel bolts to the specified torque.



11.5 Removing the rear caliper

11 Rear brake caliper - removal, overhaul and refitting



Note: Before starting work, refer to the note at the beginning of Section 2 concerning the dangers of hydraulic fluid and to the warning at the beginning of Section 5 concerning the dangers of asbestos dust.

Removal

1 Apply the handbrake, then jack up the rear of the vehicle and support it on axle stands (see "Jacking and Vehicle Support"). Remove the appropriate roadwheel, marking its correct fitted position on the wheel hub.
2 Minimise fluid loss either by removing the master cylinder reservoir cap and then tightening it down onto a piece of polythene to obtain an airtight seal, or by using a brake hose clamp, a G-clamp or a similar tool to clamp the flexible hose at the nearest convenient point to the rear brake.
3 Clean the area around the caliper brake pipe union. Unscrew the union nut and disconnect the pipe from the caliper. Plug the pipe end and caliper hole to minimise fluid loss and prevent the ingress of dirt into the hydraulic system.
4 Remove the brake pads as described in paragraphs Section 5.
5 Slacken and remove the two caliper mounting bolts and remove the caliper assembly from the vehicle (see illustration).

Overhaul

Note: No attempt must be made to separate the caliper halves. If overhaul cannot be accomplished with the caliper assembled, it must be renewed.
6 With the caliper on the bench, wipe away all traces of dust and dirt, but *avoid inhaling the dust as it is injurious to health*.
7 Prise off the piston dust excluders.
8 Clamp one of the pistons in its bore using a G-clamp and a thin piece of wood then extract the opposite piston and associated components as described in paragraphs 9 to 20 of Section 10, position the piston step as shown (see illustration).



11.8 Correct position of rear caliper piston step, showing the inboard piston on the right-hand caliper. Opposite piston is the mirror image

9 Push the piston into its bore and repeat the operation on the opposite piston.

Refitting

10 Prior to refitting, remove all traces of locking compound from the caliper mounting bolt threads and the hub carrier holes. Apply a drop of fresh locking compound to the bolt threads. Refit the caliper and insert the mounting bolts, tightening them to the specified torque setting (see illustration).

11 Reconnect the brake pipe to the caliper and tighten its union nut to the specified torque setting.

12 Refit the brake pads as described in Section 5.

13 Remove the brake hose clamp or polythene, where fitted, and bleed the hydraulic system as described in Section 2. Note that providing the precautions described were taken to minimise brake fluid loss, it should only be necessary to bleed the relevant rear brake.

14 Refit the roadwheel, aligning the marks made on removal, then lower the vehicle to the ground and tighten the roadwheel bolts to the specified torque.

12 Rear wheel cylinder - removal, overhaul and refitting



Note: Before starting work, refer to the note at the beginning of Section 2 concerning the dangers of hydraulic fluid and to the warning at the beginning of Section 6 concerning the dangers of asbestos dust.

Removal

1 Remove the brake drum (Section 9).
2 Using pliers, carefully unhook the upper brake shoe return spring and remove it from both brake shoes. Pull the upper ends of the shoes away from the wheel cylinder to disengage them from the pistons.



11.10 Tighten the rear caliper mounting bolts to the specified torque setting

3 Minimise fluid loss by either removing the master cylinder reservoir cap and then tightening it down onto a piece of polythene to obtain an airtight seal, or by using a brake hose clamp, a G-clamp or a similar tool to clamp the flexible hose at the nearest convenient point to the wheel cylinder.

4 Wipe away all traces of dirt around the brake pipe union at the rear of the wheel cylinder and unscrew the union nut. Carefully ease the pipe out of the wheel cylinder and plug or tape over its end to prevent dirt entry. Wipe off any spilt fluid immediately.

5 Unscrew the two wheel cylinder retaining bolts from the rear of the backplate and remove the cylinder taking great care not to allow surplus hydraulic fluid to contaminate the brake shoe linings.

Overhaul

6 Brush the dirt and dust from the wheel cylinder, taking care not to inhale it, and pull off the rubber dust excluders from the cylinder body (see illustration).

7 The pistons will normally be ejected by pressure of the coil spring but if they are not, tap the end of the cylinder on a piece of hardwood or apply low air pressure from a tyre foot pump at the pipeline connection.

8 Inspect the surfaces of the piston and the cylinder bore for rust, scoring or metal-to-metal rubbed areas. If these are evident, renew the wheel cylinder complete.

9 If these components are in good order, discard the seals and dust excluders and obtain a repair kit which will contain all the renewable items.

10 Fit the piston seals (using the fingers only to manipulate them into position) so that the spring is between them. Dip the pistons in clean hydraulic fluid and insert them into the cylinder.

11 Fit the dust excluders.

Refitting

12 Ensure that the backplate and wheel cylinder mating surfaces are clean then spread the brake shoes and manoeuvre the wheel cylinder into position.

13 Engage the brake pipe and screw in the union nut two or three turns to ensure that the thread has started.

14 Insert the two wheel cylinder retaining bolts and tighten them to the specified torque setting. Now tighten the brake pipe union nut to the specified torque.

15 Remove the clamp from the flexible brake hose or the polythene from the master cylinder reservoir (as applicable).

16 Ensure that the brake shoes are correctly located in the cylinder pistons then carefully refit the brake shoe upper return spring, using a screwdriver to stretch the spring into position.

17 Refit the brake drum as described in Section 9.

18 Bleed the brake hydraulic system as described in Section 2. Providing suitable precautions were taken to minimise loss of fluid, it should only be necessary to bleed the relevant rear brake.

13 Master cylinder - removal and refitting



Note: Before starting work, refer to the warning at the beginning of Section 2 concerning the dangers of hydraulic fluid.

Removal

1 Remove the master cylinder reservoir cap and syphon the hydraulic fluid from the reservoir. **Note:** Do not syphon the fluid by mouth, as it is poisonous; use a syringe or an old poultry baster. Alternatively, open any convenient bleed screw in the system and gently pump the brake pedal to expel the fluid through a plastic tube connected to the screw (see Section 2).

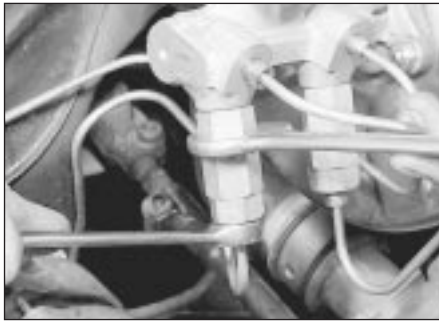
2 Release the cable retainer from around the master cylinder body (where applicable).

3 Wipe clean the area around the brake pipe unions on the side of the master cylinder and place absorbent rags beneath the pipe unions to catch any surplus fluid. Make a note of the correct fitted positions of the unions then

12.6 Exploded view of a rear wheel cylinder

- 1 Dust cap
- 2 Bleed screw
- 3 Cylinder body
- 4 Dust excluder
- 5 Piston
- 6 Seal
- 7 Spring





13.3 Slackening the brake pipe union from the pressure regulating valve

unscrew the union nuts and carefully withdraw the pipes (see illustration). Plug or tape over the pipe ends and master cylinder orifices to minimise the loss of brake fluid and to prevent the entry of dirt into the system. Wash off any spilt fluid immediately with cold water.

4 Where necessary, unscrew the pressure regulating valve(s) from the master cylinder.

5 Unbolt the master cylinder from the brake vacuum servo unit (booster) (see illustration).

Overhaul

Note: On models equipped with ABS, the master cylinder is a sealed unit and cannot be overhauled. If the cylinder is faulty it must be renewed.

ATE type cylinder

6 With the master cylinder removed, clean away all external dirt.

7 Prise the fluid reservoir from the cylinder body (see illustration).

8 Depress the primary (rear) piston slightly and remove its retaining circlip.

9 Withdraw the primary piston. Make sure that the stop washers do not catch in the circlip groove.

10 Depress the secondary (front) piston with a suitable rod and remove the stop screw from the cylinder body.

11 Shake or tap out the secondary piston.

12 Clean all the parts in brake fluid or methylated spirit. Examine the pistons and the cylinder bore for scoring, rust, or evidence of metal-to-metal contact; if found, renew the cylinder complete. Strip the seals from the primary piston if it is to be re-used noting which way round they are fitted.

13.7 Exploded view of ATE master cylinder

3 Reservoir cap/low level switch

4 Float guide sleeve

5 Reservoir

6 Cylinder body

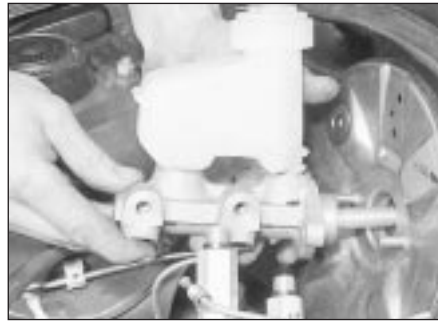
7 O-ring

8 Seals

9 Stop screw

10 Repair kit in assembly tube

11 Pressure regulating valve



13.5 Removing the master cylinder

13 The makers do not supply a seal kit alone, but provide a repair kit consisting of a complete secondary piston and the other necessary seals springs, washers etc in a special assembly tube. Should a proprietary seal kit be available, fit new seals using the fingers only, and make sure that the new seals are fitted the same way round as the old ones. The remainder of this Section describes the fitting of the maker's repair kit.

14 Lubricate the cylinder bore with brake fluid or brake rubber grease.

15 Clamp the cylinder in a soft-jawed vice with the bore more or less horizontal. Screw in the stop screw a little way, but not so far that it protrudes into the bore.

16 Remove the large plug from the assembly tube. Remove all the components from the short part of the tube and push the short part into the long part until they are flush.



17 Insert the assembly tube into the cylinder bore as far as the collar on the short sleeve. Use a blunt rod to push the secondary piston into the bore until it contacts the end of the cylinder. Nip up the stop screw, withdraw the rod and sleeve and tighten the stop screw fully.

18 Reposition the master cylinder in the vice with the bore opening facing upwards.

19 Smear the primary piston skirt and seal grooves with the special grease provided in the repair kit. Fit the stop washer to the piston.

20 Adjust the assembly tube so that the end of the long part is flush with the inner shoulder of the short part.

21 Fit the front seal to the primary piston with the open end of the seal facing the front of the master cylinder. Place the assembly tube over the cylinder to compress the seal, insert the piston and tube part way into the bore and withdraw the tube.

22 Place the intermediate ring on the primary piston, then fit the other seal using the assembly tube in a similar manner.

23 Place the end washer on the primary piston, then depress the piston slightly and fit the circlip. Make sure that the circlip is properly seated and that the piston is free to move.

24 Fit new sealing rings and press the fluid reservoir into position.

25 Prime the cylinder by pouring clean brake fluid into the reservoir and working the pistons with a rod until fluid is ejected from all orifices.

GMF type cylinder

26 With the master cylinder removed, clean off all external dirt (see illustration).

27 Remove the fluid reservoir by carefully pulling it away from the master cylinder, at the same time releasing the circlips with a screwdriver.

28 Clamp the cylinder in a soft-jawed vice, rear end uppermost, and prise out the pushrod seal.

29 Use a blunt rod to depress the primary (rear) piston by 10 mm or so until it can be retained in the depressed position by inserting a smooth rod (eg a knitting needle) onto the primary inlet hole.

30 Carefully extract the circlip from the end of the cylinder by prising it out with a screwdriver.

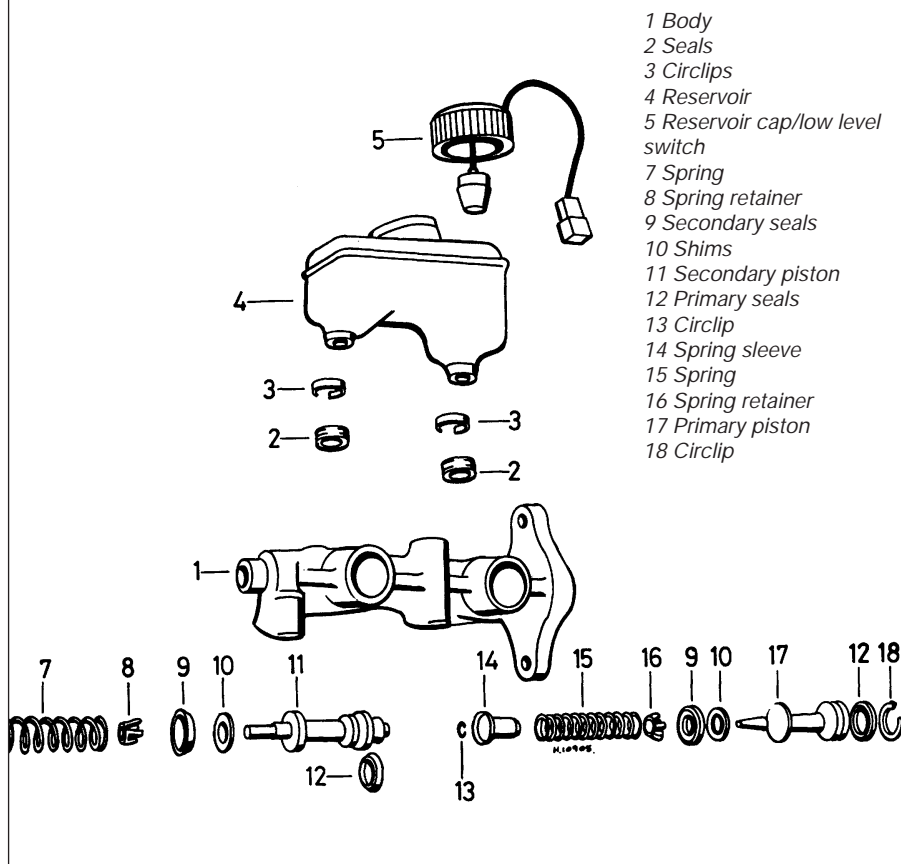
31 Knock, shake or blow the pistons out of the cylinder.

32 Clean all parts with brake fluid or methylated spirit. Examine the pistons and the cylinder bore for scoring, rust or evidence of metal-to-metal contact; if found, renew the cylinder complete.

33 The makers do not supply a kit of seals alone, but provide a repair kit consisting of both pistons in a special assembly tube. Should a proprietary seal kit be obtained, note the direction of fitting of the seals before removing them from the pistons.

34 Lubricate the cylinder bore with brake

13.26 Exploded view of GMF master cylinder



fluid or brake rubber grease. Clamp the cylinder with the bore horizontal.

35 Remove the plug from the assembly tube and insert the short part of the tube into the cylinder bore as far as the shoulder on the tube. Use a blunt rod to push the piston out of the tube and into the bore; retain the pistons in the bore with the smooth rod or needle used when dismantling. Withdraw the rod and the tube.

36 Fit a new circlip to the end of the cylinder. Depress the primary piston and withdraw the retaining rod or needle. Make sure that the circlip is properly seated and that the pistons are free to move.

37 Fit new sealing rings to the master cylinder and new circlips to the reservoir. Press the reservoir into position until the circlips click into place.

38 Prime the cylinder by pouring clean brake fluid into the reservoir and working the pistons with a rod until fluid is ejected from all orifices.

Refitting

39 Refitting is a reversal of removal, use new reservoir rubber seals and tighten all nuts and bolts to the specified torque settings (where given). On completion bleed the complete hydraulic system as described in Section 2.

14 Pressure regulating valves - testing, removal and refitting

Testing

1 Accurate testing of either type of pressure regulating valve (master cylinder mounted or underbody mounted) is not possible without special equipment. Malfunction may be suspected if the rear brakes lock prematurely in heavy braking, or if they seem not to be functioning at all.

2 A quick check of the underbody mounted valve fitted to Estate and Van models may be made by observing the valve whilst an assistant makes sharp applications of the brake pedal. (The weight of the vehicle must be on its wheels.) The lever on the valve must be seen to move as the pedal is depressed and released; if not, the valve is certainly defective.

Removal

Hatchback and Saloon models

Note: Renew both valves as a matched pair to ensure that the braking is not adversely effected.

3 Empty the master cylinder reservoir, as described in paragraph 1 of Section 13.

4 Wipe clean the area around the valves and place absorbent rags beneath the pipe unions to catch any surplus fluid. Make a note of the correct fitted positions of the unions then unscrew the union nuts and carefully withdraw the pipes. Plug or tape over the pipe ends and master cylinder orifices to minimise the loss of brake fluid and to prevent the entry of dirt into the system. Wash off any spilt fluid immediately with cold water.

5 Unscrew the valves from the master cylinder.

Estate and Van

6 Minimise fluid loss by first removing the master cylinder reservoir cap, and tightening it down onto a piece of polythene to obtain an airtight seal.

7 Raise and securely support the rear of the vehicle (see "Jacking and Vehicle Support").

8 Slacken the valve spring bracket, push the bracket rearwards and unhook the spring from it (see illustration).

9 Clean around the hydraulic unions. Identify the unions with tape or dabs of paint, then unscrew them from the valve. Be prepared for fluid spillage.

10 Unbolt and remove the valve.

Refitting

Hatchback and Saloon models

11 Make sure that both new valves are of the same type and are stamped with the same numbers (indicating their calibration). The valves must always be renewed in pairs, even if only one seems to be defective.

12 Fit the valves to the master cylinder and tighten them to the specified torque.

13 Reconnect the brake pipes, tightening the union nuts to the specified torque.

14 Bleed the complete hydraulic system, as described in Section 2.

Estate and Van

15 Transfer the stone guard to the new valve.

16 Bolt the new valve to the underbody and tighten the mounting bolts to the specified torque.

17 Connect the brake pipes, tightening the union nuts to the specified torque.

18 Bleed the complete hydraulic system, as described in Section 2.



14.8 Load-dependent pressure regulating valve, spring and bracket - Estate and Van models



15.2 Brake servo vacuum connection at inlet manifold (fuel injection model)

19 Attach the spring to the valve and to the spring bracket. Adjust the position of the spring bracket so that the spring is neither taut nor slack, then secure the bracket.

20 Lower the vehicle. Perform a road test to confirm that rear brake operation is satisfactory. Note that increasing the spring tension increases the pressure to the rear brakes, and *vice versa*.

15 Brake servo vacuum hose and non-return valve - renewal

1 The plastic hose fitted as original equipment cannot be re-used; to renew the valve, the hose must therefore be renewed as well. A serviceable valve can, however, be transferred to the new hose.



16.8 Removing a servo bracket screw



16.9 Three of the four servo-to-bracket nuts (arrowed) servo and bracket removed for clarity

- 2 Unscrew the hose union nut at the inlet manifold (see illustration).
- 3 Pull or prise the elbow connector out of the servo (see illustration).
- 4 Cut the hose off the non-return valve, the elbow and the manifold connectors.
- 5 Cut the new hose to length - it is sold by the yard - and secure it to the valve and fittings using hose clips. Make sure that the arrows on the valve point towards the manifold.
- 6 Refit the connectors to the manifold and to the servo.

16 Vacuum servo unit - testing, removal and refitting

Testing

- 1 To establish whether or not the servo is operating, proceed as follows.
- 2 With the engine not running, apply the brake pedal several times to exhaust any residual vacuum.
- 3 Hold the brake pedal depressed and start the engine. The pedal should be felt to move down when the engine starts. If not, check the vacuum hose and non-return valve.
- 4 If the vacuum system is satisfactory, the servo itself is faulty and must be renewed.

Removal

Right-hand drive

- 5 Remove the vacuum connector from the servo.
- 6 Remove the nuts which secure the master cylinder to the servo and draw the cylinder away from the servo. There is no need to disconnect the hydraulic pipes, but be careful not to strain them.
- 7 Inside the car, remove the stop-lamp switch and disconnect the brake pedal clevis - see Section 17.
- 8 The servo must now be removed from its bracket. The recommended method is to undo the two 6 mm Allen screws which hold the bracket halves together. Access to these screws is obtained by removing the wiper arms, wind deflector and water deflector; the screws are then accessible through two holes which may have rubber plugs in them. The



15.3 Brake servo vacuum connection at servo

screws are extremely tight, and without doubt a well-fitting key and square drive adapter will be needed (see illustration).

9 If the Allen screws cannot be undone, it is possible to reach behind the servo and undo the four nuts which hold it to the bracket (see illustration). Small hands, some dexterity and a good deal of patience will be needed. The nuts are of the self-locking type and resist removal all the way.

10 With the screws or nuts removed, the servo can be removed from the car.

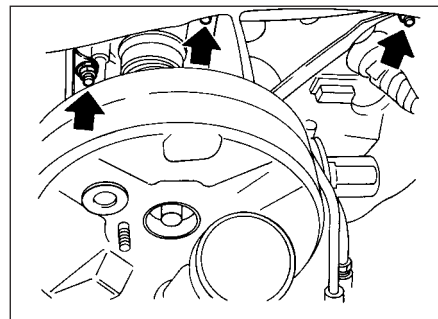
Left-hand drive

11 The procedure is similar to that just described, but access to the servo bracket fastenings is much easier. If power steering is fitted, a flexible head socket drive will be needed to reach the lower nut without disturbing the steering gear (see illustrations). On all models it will be necessary to remove the windscreen washer reservoir.

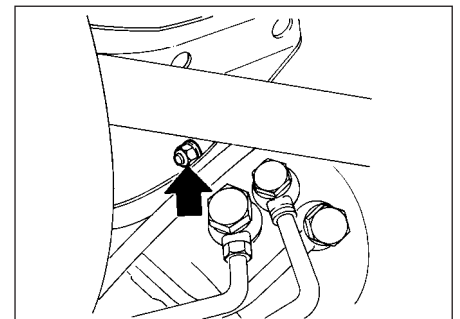
Refitting

12 If a new servo is to be fitted, transfer the clevis and locknut to it. On right-hand drive models, measure the fitted position of the clevis on the old servo pushrod and fit it in the same position on the new one. On left-hand drive models, when transferring the clevis and threaded sleeve to the new servo, set the clevis-to-servo distance as shown (see illustration).

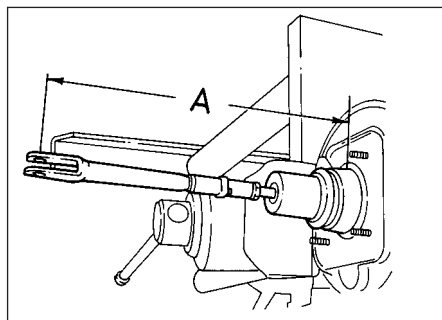
13 The remainder of refitting is a reverse of removal, noting the following points:



16.11a Three servo mounting nuts (arrowed) - Left-hand drive models



16.11b Servo mounting nut (arrowed) obscured by steering gear - Left-hand drive models



16.12 Servo clevis adjustment - Left-hand drive models

$A = 278.5 \text{ mm (10.97 in)}$

- Use sealing compound on the bracket halves if they were separated (see illustration).
- Make sure the vacuum connection point is in the correct position (see illustration).
- Use thread locking compound or new self-locking nuts, as appropriate.

17 Brake pedal - removal and refitting

Removal

- Remove the stop-lamp switch by turning it 90° left or right and withdrawing it from its bracket (see illustration).
- Unhook the pedal return spring.
- Detach the clevis from the brake pedal by



17.1 Stop-lamp switch 'keyhole' mounting (arrowed)



17.6 Stop-lamp switch plunger in extended position (top) and after fitting (bottom)



16.13a Servo mounting bracket lower half remains on bulkhead

removing the clevis pin retainer (split pin or spring clip) and pushing the pin out.

- Remove the split pin from the end of the brake pedal shaft. Undo the shaft nut, remove the washer and push the shaft out towards the steering column. The pedal can now be removed.

Refitting

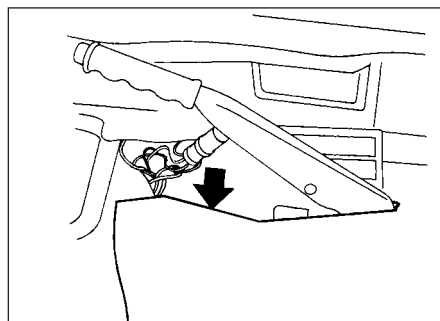
- Refit in the reverse order to removal, using new split pins or other safety securing devices. Lubricate the pivot points with grease.

- Before fitting the stop-lamp switch, pull its plunger out as far as it will go. The switch will adjust itself once it is fitted (see illustration).

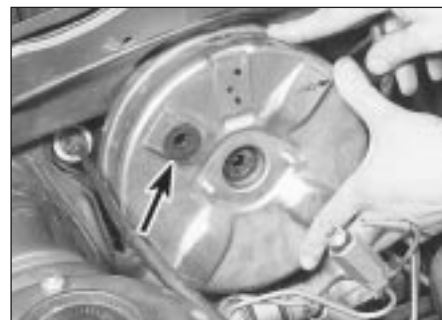
18 Handbrake cable - removal and refitting

Removal

- Unscrew the yoke adjustment nut completely and remove the yoke.
- On models with rear drum brakes, remove the brake drums, as described in Section 9.
- Free the cable from the brackets on the underbody, fuel tank and rear axle.
- Unhook the ends of the inner cable from the handbrake operating lever. On models with rear drum brakes the levers are on the leading brake shoes and on models with rear disc brakes the lever is situated at the rear of the backplate.
- Prise out the retaining ring and free the



19.4 Cut the carpet along the line shown (arrowed)



16.13b Fit the servo with the vacuum connector (arrowed) positioned as shown

plastic sleeve from each brake backplate.

- Withdraw the cable from the backplates and remove it.

Refitting

- Refit in the reverse order to removal, noting that the dark cable guide is fitted uppermost at the yoke, adjusting the handbrake as described in Chapter 1.

19 Handbrake lever - removal and refitting

Removal

- Unscrew the yoke adjustment nut completely and remove the yoke. Also remove the rubber boot from the pull-rod.
- Remove the driver's seat by unbolting its rails from the floor.
- Free the centre console by removing its single securing screw, which is concealed by a plastic plug. Remove the electric window and/or electric mirror switches, when fitted, then slide the console rearwards to free it and lift it off the handbrake lever.
- Cut the carpet, as shown (see illustration).
- Remove the two securing bolts and withdraw the handbrake lever (see illustration).
- The handbrake warning switch can be unbolted from the lever. The ratchet pawl and segment can be renewed if facilities exist for removing and refitting their fastening bushes and rivets.



19.5 Unbolting the handbrake lever

Refitting

7 Commence refitting by bolting the handbrake lever in place. Tighten the bolts to the specified torque.

8 Secure the carpet with glue and/or sticky tape. (The cut area will be covered by the console.)

9 Refit and secure the console, and its switches when applicable.

10 Refit and secure the front seat.

11 Refit the rubber boot and yoke. Adjust the handbrake, as described in Section 22.

20 Handbrake shoes (rear disc brake models) - renewal



Warning: Note that the dust created by wear of the shoes may contain asbestos, which is a health hazard. 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 use petroleum-based solvents to clean brake parts. Use brake cleaner or methylated spirit only.

- 1 Remove the rear brake disc (Section 8).
- 2 Disconnect the handbrake cable and the return spring from the backplate (see illustration).
- 3 Remove the steady washers and springs by depressing the washers and turning them through 90°. Remove the rear steady pin. The front pin is captive on the backplate (see illustrations).
- 4 Remove the shoes complete with springs, adjuster and expander mechanism (see illustration). Unhook the springs and separate the components.
- 5 Clean the components and renew worn or damaged items. Apply a little high melting-point grease or anti-seize compound to the adjuster threads, then screw the adjuster in so that it is as short as possible.
- 6 Apply a smear of anti-seize compound to the shoe rubbing areas on the brake backplate (see illustration).
- 7 Assemble the shoes, adjuster and expander. Hook the springs into the holes in the shoes (see illustration).



20.4 Removing the handbrake shoe assembly



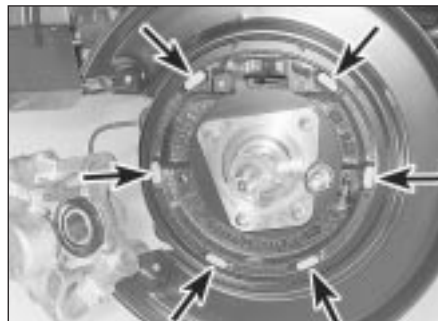
20.2 Handbrake cable and spring attachment (arrowed) on brake backplate - rear disc brake models

- 8 Offer the shoes to the backplate, fitting the leading shoe over the captive steady pin. Fit the other steady pin and the steady springs and washers.
- 9 Reconnect the handbrake cable and the return spring.
- 10 Refit the brake disc as described in Section 8.
- 11 Adjust the handbrake as described in Chapter 1.

21 Anti-lock braking system (ABS) - general information

The anti-lock braking system (ABS) is available as an option on most models from 1989. The system monitors the rotational speed of each wheel and prevents lock-up during braking by reducing the hydraulic pressure to any wheel cylinder or caliper where lock-up is occurring. This is particularly valuable when braking on loose or slippery surfaces, or during emergency braking when steering corrections may also be taking place. However the system will not protect against skids caused by excessively fast cornering or heavy acceleration on poor surfaces.

The main components of the system are shown in illustration 21.2. Magnetic pulses are induced in the wheel speed sensors by a toothed disc which is part of the brake disc or drum. The pulses are monitored by the electronic control unit (ECU). The ECU alters the hydraulic pressure when necessary by means of solenoid valves located in the hydraulic unit. An electric pump in the hydraulic



20.6 Anti-seize compound applied to rubbing points (arrowed)



20.3a Removing a steady washer . . .



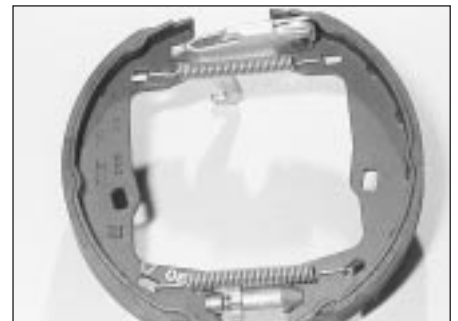
20.3b . . . and the rear steady pin

unit generates the hydraulic pressure, which is higher than that which would be produced by the master cylinder alone.

In use, the onset of the anti-lock function is indicated to the driver by a pulsating of the brake pedal. Any malfunction in the system is indicated by a warning light on the instrument panel. When the system is working correctly, the warning light will illuminate for a few seconds when the ignition is switched on, but will then go out and remain out. If it comes on during driving, there is a fault. Normal braking is not affected by malfunction of the ABS.

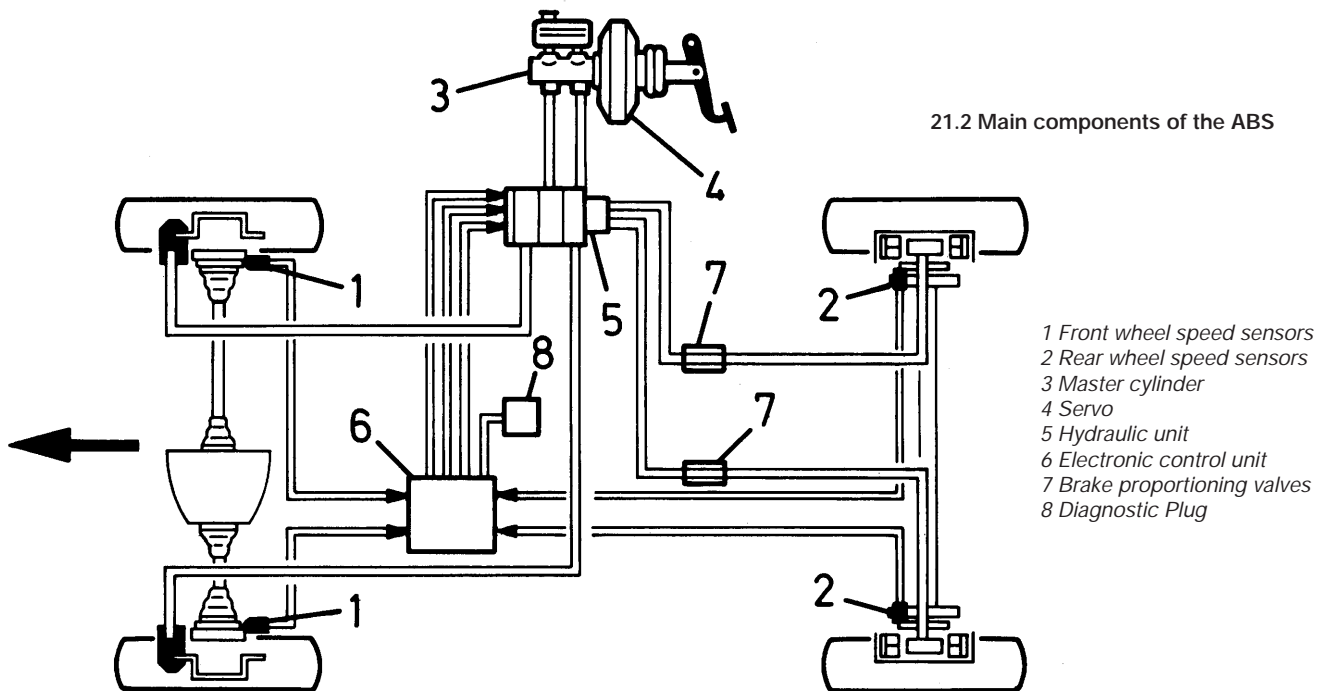
The ECU is mounted under the facia on the left-hand side. It is protected against voltage surges by a surge arrester relay and fuse mounted together under the bonnet. The ECU has its own fault diagnosis program, but this is only accessible to Vauxhall dealers or other specialists with the necessary test equipment.

No routine maintenance of the ABS



20.7 Handbrake shoe assembly ready for refitting

21.2 Main components of the ABS



components is required. The hydraulic pipes and unions must be inspected for condition and security in the same way as any other part of the brake hydraulic system

Note that the ECU is electrically fragile and should be treated with the same precautions as the fuel injection system control unit.

22 Anti-lock braking system (ABS) components - removal and refitting

Wheel speed sensor

Note: The rear wheel speed sensor on 1992 model year vehicles has its pulse pick-up point unit integral in the hub housing. In the event of the pick-up unit malfunctioning, it will need to be renewed complete with the rear wheel hub unit as described in Chapter 10.

1 Disconnect the battery earth (negative) lead.

2 Remove the single securing screw and withdraw the sensor (see illustrations).

3 Follow the wiring back from the sensor to the connector. Unclip the connector and separate the two halves (see illustrations).

4 Refitting is the reverse of the removal procedure, but apply a smear of grease or

anti-seize compound to the body of the sensor. Check for correct operation of the ABS on completion.

Electronic control unit (ECU)

5 Disconnect the battery earth (negative) lead.

6 Remove the under-dash trim on the passenger (left-hand) side. This is secured by four clips.

7 Remove the ECU from its bracket. Release the spring clip, disconnect the multi-plug and remove the ECU.

8 Refitting is the reverse of the removal procedure. Check for correct operation of the ABS on completion.

ABS surge arrester relay

9 Disconnect the battery earth (negative) lead.

10 Unscrew or unclip the relay bracket. It is on the left-hand suspension turret; the relay is



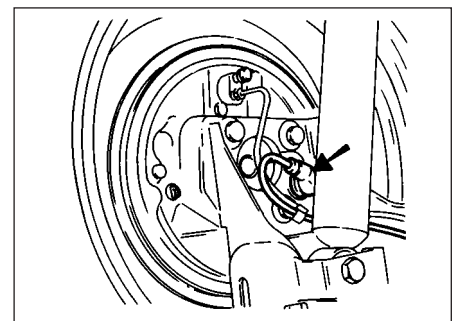
22.2a ABS rear wheel speed sensor on brake backplate securing screw arrowed



22.2b ABS front wheel speed sensor



22.2c Removing a front wheel speed sensor



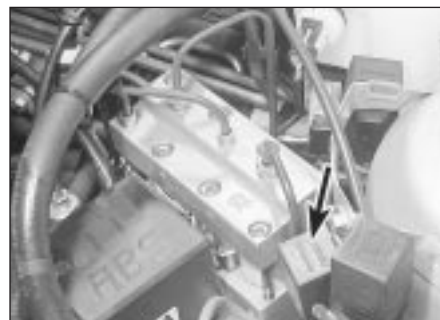
22.2d ABS rear wheel speed sensor (arrowed) on models with rear drum brakes



22.3a Rear sensor connectors next to petrol tank (earlier models)



22.3b Separating a front sensor connector



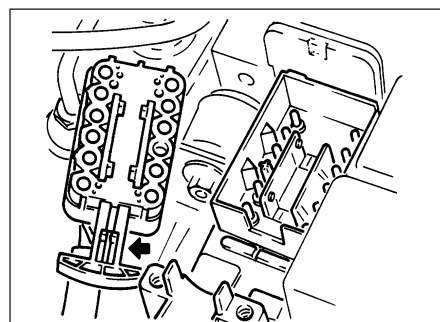
22.10 ABS surge arrester relay (arrowed)



22.15 Two screws (arrowed) which secure the hydraulic unit cover



22.16a Removing the relays from the hydraulic unit



22.16b Squeeze the multi-plug catch (arrowed) to realise it

the one nearest the ABS hydraulic unit (**see illustration**). Disconnect the multi-plug from the relay and remove it.

11 Note that the relay carries its own fuse. This fuse should be checked before condemning the relay.

12 Refitting is the reverse of the removal procedure.

ABS hydraulic unit removal and refitting

13 Disconnect the battery earth (negative) lead.

14 To minimise hydraulic fluid loss, top-up the reservoir to the maximum level and seal the cap by tightening it down over a piece of

cling film, or by blocking the vent hole temporarily with a piece of tape.

15 Remove the hydraulic unit cover, which is secured by two screws (**see illustration**).

16 Remove the two relays from the unit. Release the multi-plug catch by squeezing its two halves together and disconnect the multi-plug (**see illustrations**).

17 Clean around the hydraulic unions on the unit. Make identifying marks if necessary so that each pipe can be refitted to its original location, then disconnect the hydraulic pipes from the unit. Cap or plug open pipes and unions.

18 Undo the three mounting bolts. (Where

slotted mounting holes are used there is no need to remove the bolts completely.) Disconnect the earth strap from the hydraulic unit pump and remove the unit.

19 A defective hydraulic unit must be exchanged or renewed. Retain the relays from the old unit and fit them to the new one. The relay nearest the hydraulic connectors controls the solenoid valves and the other one controls the pump motor.

20 Refitting is the reverse of the removal procedure, noting the following points:

- a) *Tighten the mounting bolts to the specified torque*
- b) *Bleed the hydraulic system on completion*