






Chapter 10

Braking system

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Degrees of difficulty

<p>Easy, suitable for novice with little experience</p> 	<p>Fairly easy, suitable for beginner with some experience</p> 	<p>Fairly difficult, suitable for competent DIY mechanic</p> 	<p>Difficult, suitable for experienced DIY mechanic</p> 	<p>Very difficult, suitable for expert DIY or professional</p> 
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Specifications

Front brakes

Type	Solid or ventilated disc, with opposed-piston caliper
Disc diameter	299 mm
Disc thickness	N/A
Maximum disc run-out	0.15 mm
Brake pad friction material minimum thickness	3.0 mm

Rear brakes

Type	Solid disc, with opposed-piston caliper
Disc diameter	290 mm
Disc thickness	N/A
Maximum disc run-out	0.15 mm
Brake pad friction material minimum thickness	3.0 mm

Torque wrench settings

	Nm	lbf ft
Brake caliper mounting bolts (front and rear)	82	61
Brake disc bolts (front and rear)*	73	54
Brake pipe unions	15	11
Handbrake backplate bolts	25	18
Handbrake linkage to transfer box	29	21
Master cylinder mounting nuts	26	19
Roadwheel nuts	129	95
Vacuum servo unit mounting nuts	26	19

*Use thread-locking fluid

1 General information

The braking system is of the servo-assisted, dual-circuit hydraulic type, operating from a tandem master cylinder. On early models, the arrangement of the hydraulic system is such that the primary circuit operates one set of opposed-pistons of each front brake caliper, and the secondary circuit operates the other set of pistons and the rear brake calipers. On later models, the primary circuit operates the rear brake calipers, and the secondary circuit operates the front brake calipers. Under normal circumstances, both circuits operate in unison. However, in the event of hydraulic failure in one circuit, braking force will still be available at least at two wheels.

On diesel models, since there is insufficient vacuum in the inlet manifold to operate the braking system servo unit, a vacuum pump is fitted to the engine to provide the required vacuum.

All models have disc brakes all round as standard. An Anti-lock Braking System (ABS) was fitted to some high-specification models, and offered as an option on all later models (refer to Section 20 for further information on ABS operation).

Both the front and rear disc brakes are actuated by opposed-piston type calipers, which ensure that equal pressure is applied to each disc pad.

On all models, the handbrake is in the form of a drum brake assembly mounted onto the rear of the transfer box. When the handbrake is applied, it locks the rear axle by preventing propeller shaft rotation.

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 Land Rover 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. Finally, 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.

**HAYNES
HINT**

Hydraulic fluid is an effective paint stripper, and will attack plastics; if any is spilt, it should be washed off immediately using copious quantities of fresh water.

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. On models with ABS, disconnect the battery negative lead.
- 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. 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, use the basic (two-man) method 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 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 working in the following sequence:

- a) Passenger's side rear brake.
- b) Driver's side rear brake.
- c) Passenger's side front brake.
- d) Driver's side front 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. On early models with three front bleed screws, two pieces of tubing will be needed, as two of the three bleed screws must be bled simultaneously. The help of an assistant will also be required.
- 14 Remove the dust cap from the bleed screw on the passenger's side rear brake. 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 rear brake.
- 21 The procedure for bleeding the front brakes differs for early and later models. Early models were fitted with front calipers having three bleed screws each, while later models

had a conventional caliper with just one bleed screw.

Early models

22 Bleeding the front brakes is similar to that described for the rears, but there are three bleed screws on each front caliper.

23 The two screws on the inner side of the caliper must be bled simultaneously, using the method described previously - ie a tube should be connected to both screws, both should be opened and bled, then both should be tightened before the pedal is released.

24 Once the two inner screws have been bled, the remaining outer screw should be bled on its own.

25 On completion of bleeding the passenger's side front caliper, the driver's side front caliper should be bled.

Later models

26 Later models have only one bleed screw per front caliper, and can be bled in exactly the same way as described previously for the rear calipers.

Bleeding - using a one-way valve kit

Note: *The inner side of the front caliper on early models has two bleed screws which must be bled simultaneously. Two one-way valves will be needed.*

27 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 (see illustration).

28 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.

29 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.

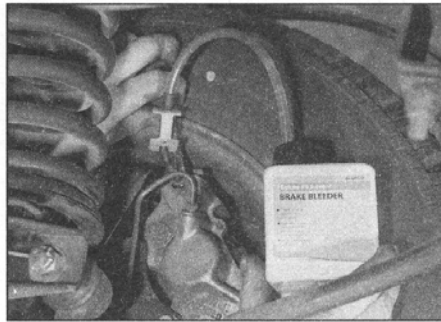
Bleeding - using a pressure-bleeding kit

Note: *Ensure that the pressure in the reservoir does not exceed 4.5 bars (60 psi approx).*

30 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 tyre pressure to a lower level than normal; refer to the instructions supplied with the kit.

31 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.

32 This method has the advantage that the



2.27 Bleeding a rear brake caliper using a one-way valve kit

large reservoir of fluid provides an additional safeguard against air being drawn into the system during bleeding.

33 Pressure bleeding is particularly effective when bleeding difficult systems, or when bleeding the complete system at the time of routine fluid renewal.

All methods

34 When bleeding is complete and firm pedal feel is restored, wash off any spilt fluid, tighten the bleed screws securely and refit their dust caps.

35 Check the hydraulic fluid level, and top-up if necessary (see *Weekly checks*).

36 Discard any hydraulic fluid that has been bled from the system; it will not be fit for re-use.

37 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.

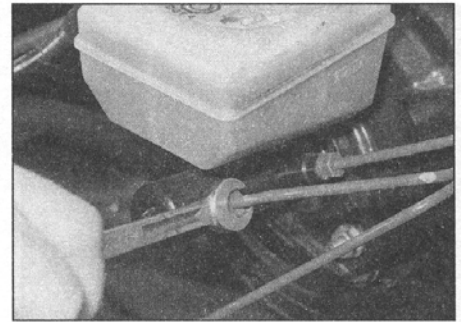
3 Hydraulic pipes and hoses - renewal

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 as follows. Remove the master cylinder reservoir cap, then tighten 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 (where fitted).

3 To unscrew the union nuts, it is preferable to obtain a brake pipe spanner of the correct



3.3 Using a brake pipe spanner to slacken and union nut

size; these are available from most large motor accessory shops (see illustration). 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.

HAYNES
HINT

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 Land Rover 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.

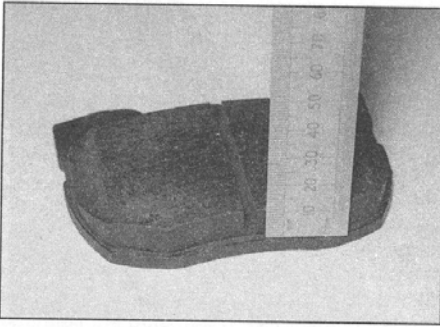
5 On refitting, do not overtighten the union nuts. It is not necessary to exercise brute force to obtain a sound joint.

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*



4.6 Measuring brake pad friction material thickness

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.

Note: Models for certain markets may be fitted with ventilated front discs. These discs are fitted to compensate for the fitment of asbestos-free brake pads, which are required by law in some countries. To accommodate the thicker ventilated disc, the caliper is modified by the fitment in production of a wider spacer between the caliper halves (the caliper halves must NOT be separated). The procedures in this Chapter are unaffected by this, but it does mean that the front discs and callipers may not be interchangeable - bear this in mind when ordering new parts, or when obtaining second-hand items from vehicle breakers.

1 Apply the handbrake, then loosen the front roadwheel nuts. Jack up the front of the vehicle and support it on axle stands. Remove both front roadwheels, and proceed as described under the relevant sub-heading.

Early models

2 Trace the pad wear sensor wiring (where fitted) back from the pad, and disconnect it at the wiring connector.

3 Noting the correct fitted locations of the pad anti-rattle springs, withdraw the pad retaining split-pins, and recover the springs from the top of the caliper.

4 Withdraw the pads from caliper.

5 Brush the dirt and dust from the caliper, but take care not to inhale it. Carefully remove any rust from the edge of the brake disc.

6 First measure the thickness of each brake pad's friction material (see illustration). If either pad is worn at any point to the specified minimum thickness or less, all four pads must be renewed.

7 The pads should also be renewed if any are fouled with oil or grease; there is no satisfactory way of degreasing friction material, once contaminated. If any of the brake pads are worn unevenly, or are fouled with oil or grease, trace and rectify the cause before reassembly.

8 New pad retaining pins and anti-rattle springs should be fitted if the pads are to be renewed. New brake pads, pins and springs are available from Land Rover dealers.

9 If the brake pads are still serviceable, carefully clean them using a clean, fine wire brush or similar, paying particular attention to the sides and back of the metal backing. Clean out the grooves in the friction material, and pick out any large embedded particles of dirt or debris. Carefully clean the pad locations in the caliper body/mounting bracket.

10 Prior to fitting the pads, brush the dust and dirt from the caliper pistons, but do not inhale it, as it is a health hazard. Inspect the dust seal around the piston for damage, and the piston for evidence of fluid leaks, corrosion or damage. If attention to any of these components is necessary, refer to Section 8.

11 If new brake pads are to be fitted, the caliper pistons must be pushed back into the caliper, to make room for them. Either use a G-clamp or similar tool, or use suitable pieces of wood as levers. Provided that the master cylinder reservoir has not been overfilled with hydraulic fluid there should be no spillage, but keep a careful watch on the fluid level while retracting the piston. If the fluid level rises above the MAX level line at any time, the surplus should be syphoned off, or ejected via a plastic tube connected to the bleed screw (see Section 2). **Note:** Do not syphon the fluid by mouth, as it is poisonous; use a syringe or an old poultry baster.

12 Apply a thin smear of high-temperature

brake grease or anti-seize compound to the sides and back of each pad's metal backing, and to those surfaces of the caliper body which bear on the pads. Do not allow the lubricant to foul the friction material.

13 Locate the pads in the caliper, ensuring that the friction material of each pad is against the brake disc. Where applicable, make sure that the pad with the wear sensor wiring is fitted on the inside.

14 Position the anti-rattle springs on top of the pads, ensuring that they are fitted the correct way around.

15 Insert the new retaining pins into the caliper, making sure that each pin is correctly engaged with its anti-rattle spring. Secure the pins in position by bending over their ends.

16 Depress the brake pedal repeatedly, until the pads are pressed into firm contact with the brake disc and normal (non-assisted) pedal pressure is restored.

17 Repeat the above procedure on the remaining front brake caliper.

18 Refit the roadwheels, then lower the vehicle to the ground and tighten the roadwheel nuts to the specified torque setting.

19 Check the hydraulic fluid level as described in *Weekly checks*.

Later models

20 Using a pair of pliers, remove the split-pin from the inner end of each pad retaining pin (see illustration).

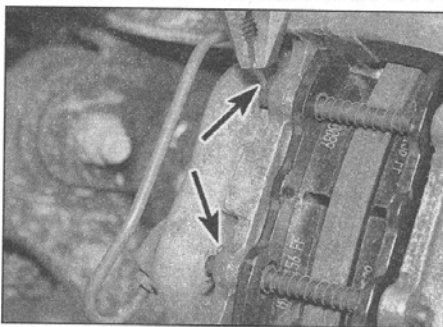
21 Carefully withdraw the pad retaining pins, recovering the anti-rattle springs as they are released (see illustration).

22 Withdraw both pads from the caliper, and carry out the operations listed above in paragraphs 5 to 12 (see illustration). Note that the retaining pin split-pins should also be renewed.

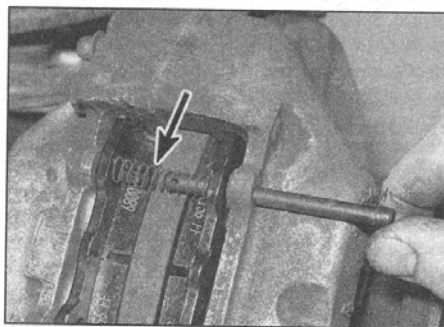
23 Locate the pads in the caliper, ensuring that the friction material of each pad is against the brake disc.

24 Fit the anti-rattle springs between the pads, then insert the pad retaining pins. Make sure that each pin passes through its anti-rattle spring.

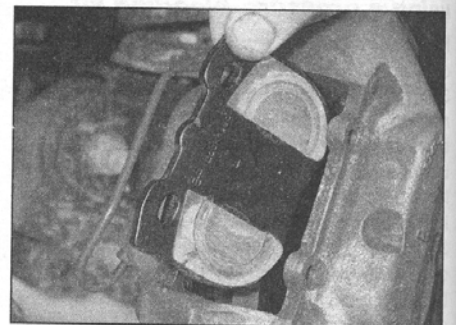
25 Secure each retaining pin in position with a new split-pin.



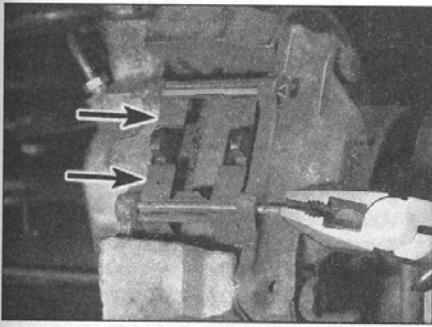
4.20 On later models, remove the split pins (arrowed) . . .



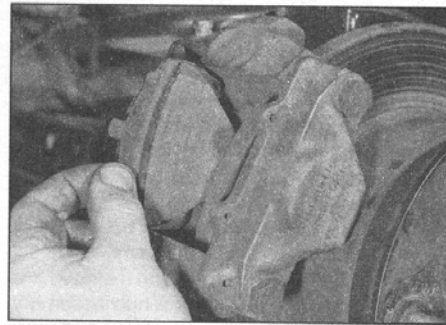
4.21 . . . then withdraw the pad retaining pins and recover the anti-rattle springs (arrowed)



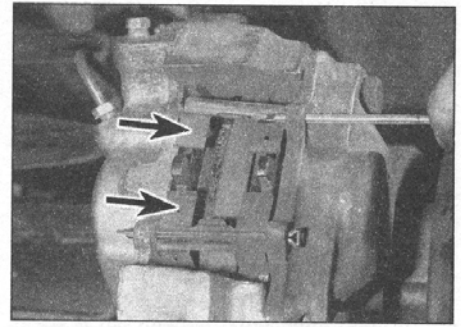
4.22 Lift the brake pads out from the caliper



5.1a Withdraw the pad retaining split pins, then remove the anti-rattle springs (arrowed) ...



5.1b ... and lift out the pads



5.1c On refitting, ensure that the anti-rattle springs (arrowed) are correctly seated, and engage with the retaining split pins as they are inserted

26 Depress the brake pedal repeatedly, until the pads are pressed into firm contact with the brake disc and normal (non-assisted) pedal pressure is restored.

27 Repeat the above procedure on the remaining front brake caliper.

28 Refit the roadwheels, then lower the vehicle to the ground and tighten the roadwheel nuts to the specified torque setting.

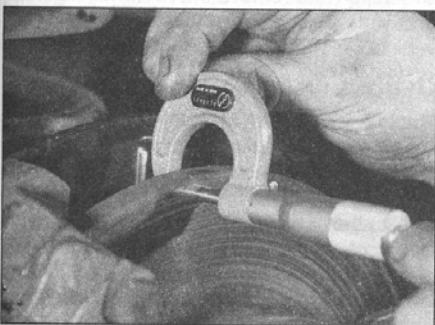
29 Check the hydraulic fluid level as described in *Weekly checks*.

5 Rear brake pads - renewal



Warning: Renew **BOTH** sets of rear 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.

The rear brake caliper is similar to the front brake caliper which is fitted to early models. Pad renewal can be carried out as described in paragraphs 1 to 19 of Section 4 (see



6.3 Measuring brake disc thickness using a micrometer

illustrations). Note that on some models, shims will be fitted to the rear of the brake pad(s). Where this is so, note their correct fitted locations on removal, and ensure that they are correctly positioned on refitting.

6 Front brake disc - inspection, removal and refitting

Note: Before starting work, refer to the warning and note at the beginning of Section 4.

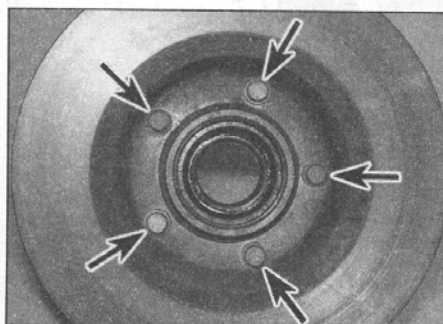
Inspection

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, then loosen the front roadwheel nuts. Jack up the front of the car and support it on axle stands. Remove the appropriate front roadwheel.

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 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 (see



6.8 Front brake disc retaining bolts (arrowed)

illustration). Take measurements at several places around the disc, at the inside and outside of the pad swept area. Since the manufacturer does not quote a specified minimum thickness for the brake discs, it will be necessary to seek the advice of a Land Rover dealer. They will be able to advise you on the best course of action, ie whether it is permissible to have the disc refinished, or if disc renewal will be necessary.

4 If the disc is thought to be warped, it can be checked for run-out as follows. Either use a dial gauge mounted on any convenient fixed point, while the disc is slowly rotated, or use feeler blades to measure (at several points all around the disc) the clearance between the disc and a fixed point such as the brake caliper. 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 axle hub bearing is in good condition (Chapter 9).

5 Check the disc for cracks, especially around the wheel studs, and any other wear or damage.

Removal

6 Remove the front hub assembly as described in Chapter 9.

7 Using chalk or paint, make alignment marks between the disc and hub.

8 Slacken and remove the bolts securing the brake disc to the hub assembly, and separate the two components (see illustration).

Refitting

9 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.
- Remove all traces of old locking compound from the brake disc holes in the hub assembly, ideally by running a tap of the correct size and pitch through them.
- Fit the disc to the hub, aligning (if

applicable) the marks made prior to removal.

- e) Apply a suitable locking compound to the threads of the disc retaining bolts, then fit the bolts and tighten them to the specified torque setting.
- f) Refit the roadwheel, lower the vehicle to the ground, and tighten the roadwheel nuts to the specified torque. On completion, repeatedly depress the brake pedal, until normal (non-assisted) pedal pressure returns.

7 Rear brake disc - inspection, removal and refitting



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

Inspection

- 1 Refer to Section 6.

Removal

- 2 Remove the rear hub assembly as described in Chapter 9. Using chalk or paint, make alignment marks between the disc and hub.
- 3 On models fitted with ABS, undo the retaining nuts, and remove the sensor ring from the rear hub assembly. Discard the retaining nuts - they must be renewed whenever they are disturbed.
- 4 On all models, slacken and remove the bolts securing the disc to the hub assembly, and separate the two.

Refitting

- 5 Refitting is the reverse of the removal procedure, noting the following points:
 - a) Ensure that the mating surfaces of the disc and hub are clean and flat.
 - b) If a new disc has been fitted, use a suitable solvent to wipe any preservative coating from the disc before refitting the caliper.

- c) Remove all traces of old locking compound from the brake disc holes in the hub assembly, ideally by running a tap of the correct size and pitch through them.
- d) Fit the disc to the hub, aligning (if applicable) the marks made prior to removal.
- e) Apply a suitable locking compound to the threads of the disc retaining bolts, then fit the bolts and tighten them to the specified torque setting.
- f) Refit the roadwheel, lower the vehicle to the ground, and tighten the roadwheel nuts to the specified torque. On completion, repeatedly depress the brake pedal, until normal (non-assisted) pedal pressure returns.

8 Front brake caliper - removal, overhaul and refitting



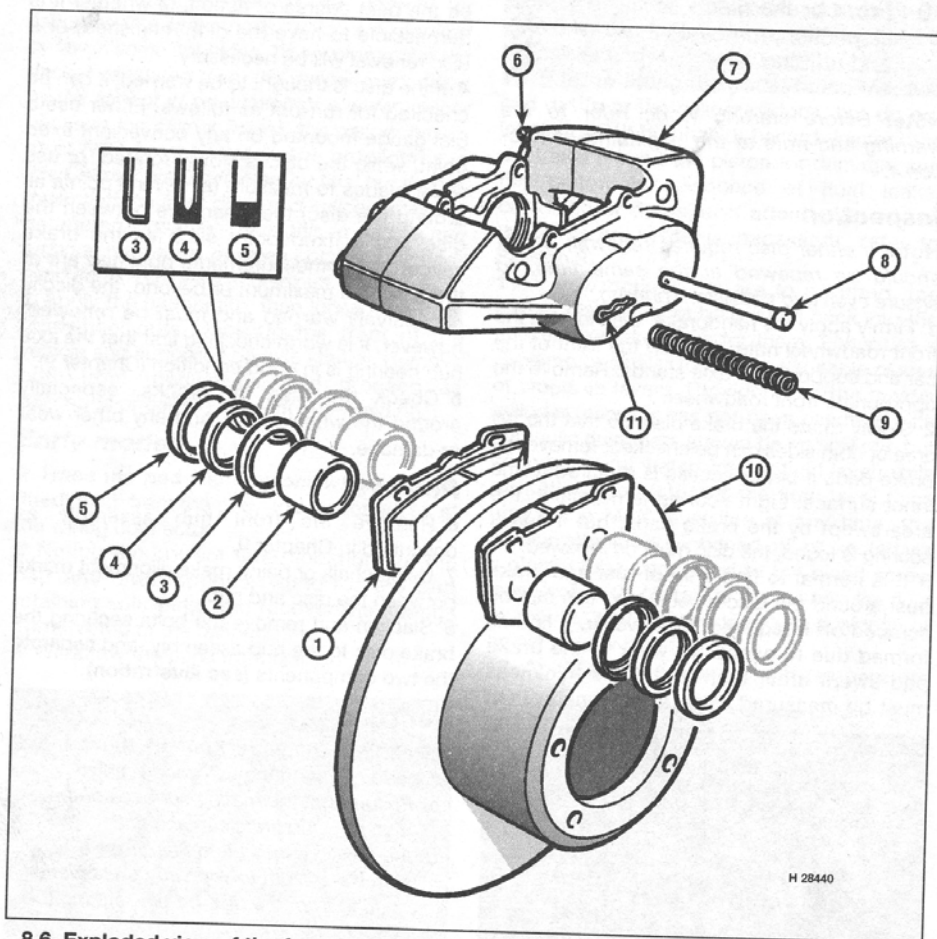
Note: Before starting work, refer to the note at the beginning of Section 2 concerning the dangers of hydraulic fluid, and to the warning and note at the beginning of Section 4.

Removal

- 1 Apply the handbrake, then loosen the relevant front roadwheel nuts. Jack up the front of the vehicle and support it on axle stands. Remove the appropriate roadwheel.
- 2 Remove the brake pads as described in Section 4.
- 3 To minimise fluid loss, remove the master cylinder reservoir cap, then tighten it down onto a piece of polythene to obtain an airtight seal. Alternatively, use a brake hose clamp, a G-clamp, or a similar tool to clamp the flexible hose at the nearest convenient point to the caliper.
- 4 Clean the area around the caliper brake hose union nut(s). Undo the union nut(s), and disconnect the brake pipe(s) from the caliper. Plug the hose end(s) and caliper hole(s), to minimise fluid loss and to prevent the ingress of dirt into the hydraulic system. **Note:** On early models where there are two brake pipes, make identification marks between the pipes and caliper to use on refitting.
- 5 Slacken and remove the two retaining bolts, and remove the caliper assembly from the vehicle.

Overhaul

- Note:** Prior to dismantling the caliper, check the availability of spares from your Land Rover dealer; on some models, it may prove difficult to obtain caliper components.
- 6 With the caliper on the bench, wipe away all traces of dust and dirt, but avoid inhaling the dust, as it is a health hazard (see illustration).
- 7 Push both the pistons on one side of the caliper fully into the caliper bore, and retain them in position with a suitable G-clamp.
- 8 Withdraw both the partially-ejected pistons



8.6 Exploded view of the front brake caliper and associated components. Inset shows cross-section of each seal - later models shown (early models similar)

- 1 Brake pad
- 2 Piston
- 3 Wiper seal retainer
- 4 Wiper seal
- 5 Fluid seal
- 6 Bleed screw
- 7 Caliper
- 8 Pad retaining pin
- 9 Anti-rattle spring
- 10 Brake disc
- 11 R-clip

from the opposite side of the caliper body. The pistons can be withdrawn by hand, if loose. If one or both of the pistons are not loose enough to be withdrawn by hand, they can be pushed out by applying compressed air to the (relevant) brake hose union hole. Only low pressure should be required, such as is generated by a foot pump. **Note:** On later models, ensure both pistons are expelled from the caliper at the same time.

9 Extract both pistons from the caliper. Make identification marks between the caliper and bore to use on refitting, to ensure each piston is refitted to its original bore.

10 Using a small screwdriver, carefully remove the wiper seal retainer from the caliper, taking great care not to mark the bore. Repeat the procedure, and remove the wiper seal and piston (fluid) seal in the same way.

11 This is the limit of dismantling. The caliper halves must NOT be separated, as there is no guarantee that the fluid passages between the halves will be sealed effectively when reassembled, resulting in fluid leaks and/or air entry.

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 bores and pistons; these should be renewed 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 Land Rover dealer. Renew the caliper seals and retainers 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 pistons and the new piston (fluid) seals in clean hydraulic fluid. Smear clean fluid on the cylinder bore surface.

17 Fit the new piston (fluid) seals, using only your fingers to manipulate them into the cylinder bore grooves.

18 Ensure that the piston (fluid) seals are correctly located, then fit the new wiper seals in the same way.

19 Make sure that each wiper seal is correctly seated, then install the new wiper seal retainers in the caliper body, ensuring both are fitted the correct way around.

20 Fit each piston using a twisting motion, ensuring that they enter the caliper bore squarely. If the original pistons are being re-used, use the marks made on removal to ensure that they are refitted to the correct bores.

21 Remove the G-clamp from the caliper, and repeat the operations described in paragraphs 7 to 20 on the remaining two pistons in the caliper.

Refitting

22 Refit the caliper assembly to the vehicle, and tighten its retaining bolts to the specified torque setting.

23 Refit the brake pipe(s) to the caliper, tightening the union nut(s) to the specified torque setting. On early models, use the marks made on removal to ensure that the pipes are correctly reconnected.

24 Refit the brake pads as described in Section 4.

25 Remove the brake hose clamp or polythene, as applicable, 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.

26 Refit the roadwheel, then lower the vehicle to the ground and tighten the roadwheel nuts to the specified torque.

9 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 Chock the front wheels, then loosen the relevant rear roadwheel nuts. Jack up the rear of the vehicle and support on axle stands. Remove the relevant rear wheel.

2 Remove the brake pads as described in Section 5.

3 To minimise fluid loss, remove the master cylinder reservoir cap, then tighten it down onto a piece of polythene to obtain an airtight seal. Alternatively, use a brake hose clamp, a G-clamp, or a similar tool to clamp the flexible hose at the nearest convenient point to the caliper.

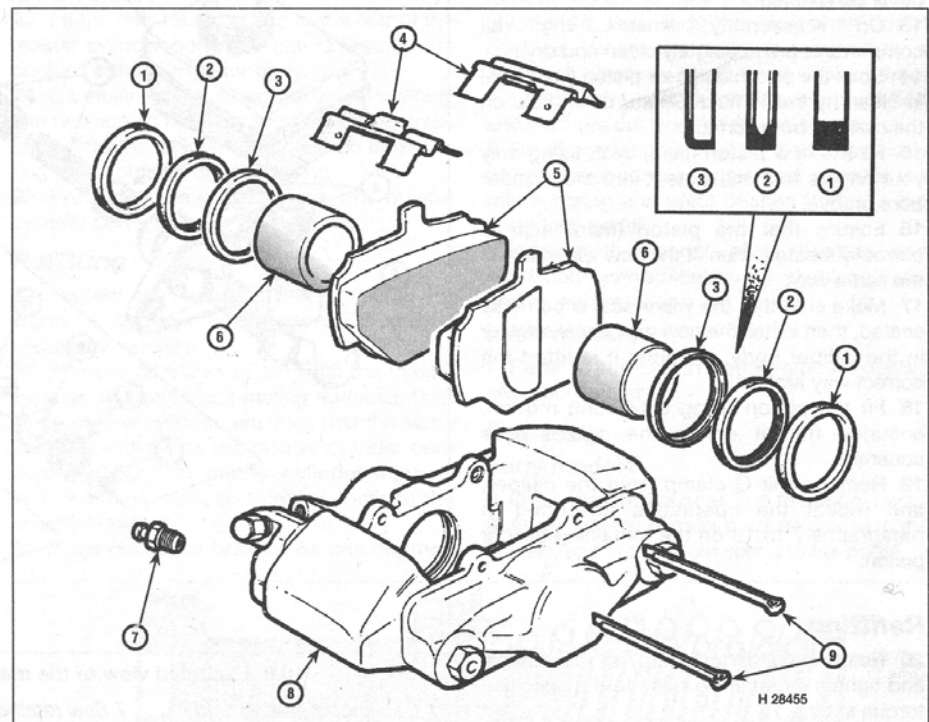
4 Wipe away all traces of dirt around the brake pipe union on the caliper, then undo the union nut and disconnect the brake pipe from the caliper. Plug the hose end and caliper hole, to minimise fluid loss and to prevent the ingress of dirt into the hydraulic system.

5 Slacken the two bolts securing the caliper assembly in position. Lift the caliper assembly away from the disc, and remove it from the vehicle.

Overhaul

Note: Prior to dismantling the caliper, check the availability of spares from your Land Rover dealer; on some models, it may prove difficult to obtain caliper components.

6 With the caliper on the bench, wipe away all traces of dust and dirt, but avoid inhaling the dust, as it is a health hazard (see illustration).



9.6 Exploded view of the rear brake caliper and associated components. Inset shows cross-section of each seal

- | | | |
|-----------------------|-----------------------|----------------------|
| 1 Fluid seal | 4 Anti-rattle springs | 7 Bleed screw |
| 2 Wiper seal | 5 Brake pads | 8 Caliper |
| 3 Wiper seal retainer | 6 Piston | 9 Pad retaining pins |

7 Push the piston on one side of the caliper fully into the caliper bore, and retain it in position with a suitable G-clamp.

8 Withdraw the partially-ejected piston from the opposite side of the caliper body. The piston can be withdrawn by hand, if loose, or can be 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.

9 Using a small screwdriver, carefully remove the wiper seal retainer from the caliper, taking great care not to mark the bore. Repeat the procedure, and remove the wiper seal and piston (fluid) seal in the same way.

10 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.

11 Check all components, and renew any that are worn or damaged. Check particularly the cylinder bore and piston; these should be renewed if they are scratched, worn or corroded in any way.

12 If the assembly is fit for further use, obtain the necessary components from your Land Rover dealer. Renew the caliper seals and retainers as a matter of course - these should never be re-used.

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

14 Soak the piston and new piston (fluid) seal in clean hydraulic fluid. Smear clean fluid on the cylinder bore surface.

15 Fit the new piston (fluid) seal, using only your fingers to manipulate it into the cylinder bore groove.

16 Ensure that the piston (fluid) seal is correctly located, then fit the new wiper seal in the same way.

17 Make sure that the wiper seal is correctly seated, then install the new wiper seal retainer in the caliper body, ensuring it is fitted the correct way around.

18 Fit the piston using a twisting motion, ensuring that it enters the caliper bore squarely.

19 Remove the G-clamp from the caliper, and repeat the operations described in paragraphs 7 to 18 on the remaining caliper piston.

Refitting

20 Refit the caliper assembly to the vehicle, and tighten its retaining bolts to the specified torque setting.

21 Refit the brake pipe to the caliper, and tighten its union nut to the specified torque setting.

22 Refit the brake pads as described in Section 5.

23 Remove the brake hose clamp of

polythene, as applicable, 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.

24 Refit the roadwheel, then lower the vehicle to the ground and tighten the roadwheel nuts to the specified torque.

10 Master cylinder - removal, overhaul and refitting



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

Removal

1 Disconnect the wiring connector from the brake fluid level sender unit, then 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

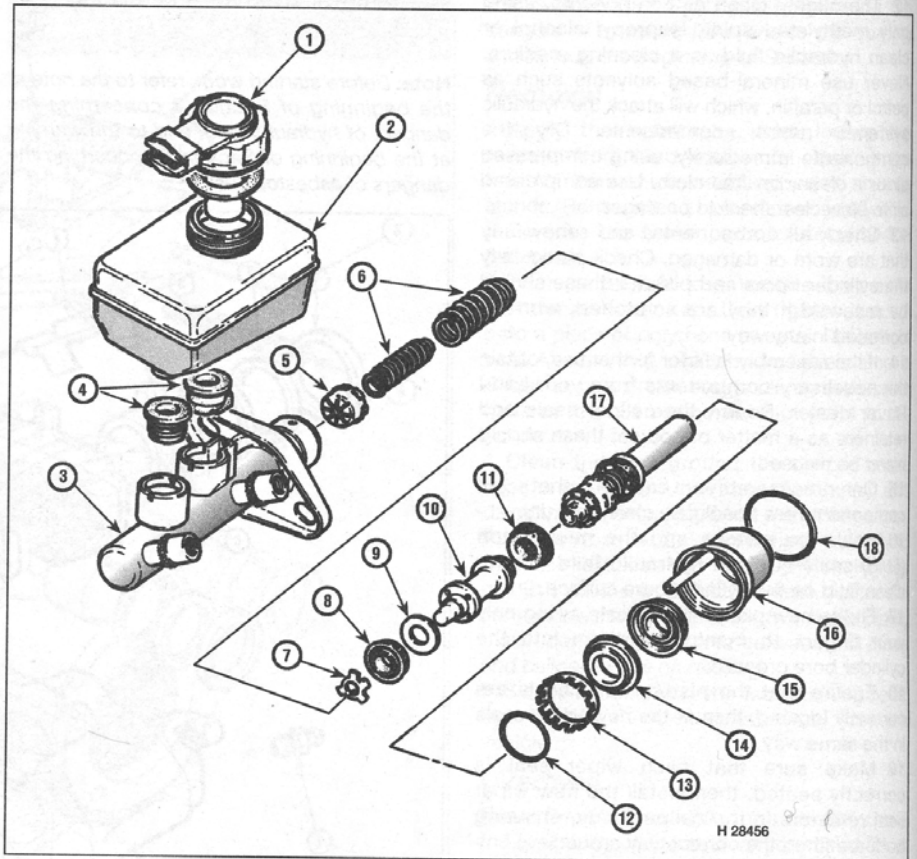
poisonous; use a syringe or an old poultry baster. Alternatively, open any convenient bleed screw in the system, and gently pump the brake pedal to expel the fluid through a plastic tube connected to the screw (see Section 2).

2 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 unscrew the union nuts and carefully withdraw the pipes. Wash off any spilt fluid immediately with cold water.



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.

3 Slacken and remove the two nuts and washers securing the master cylinder to the vacuum servo unit. Withdraw the master



10.6 Exploded view of the master cylinder - non-ABS models

- | | | |
|---|---------------------|----------------------------|
| 1 Cap (incorporating fluid level sender unit) | 7 Seal retainer | 13 Retaining ring |
| 2 Fluid reservoir | 8 Seal | 14 Guide ring |
| 3 Master cylinder | 9 Washer | 15 Vacuum seal |
| 4 Mounting seals | 10 Secondary piston | 16 Rear housing cover |
| 5 Swirl tube | 11 Seal | 17 Primary piston assembly |
| 6 Springs | 12 O-ring seal | 18 O-ring |

cylinder assembly from the engine compartment. Recover the O-ring from the rear of the master cylinder.

Overhaul

Models with ABS

4 At the time of writing, master cylinder overhaul was not possible, since spares are not available. If the cylinder is thought to be faulty, it must be renewed.

5 The only parts available individually are the fluid reservoir and its mounting seals - these can be renewed as described below for the non-ABS models.

Models without ABS

Note: Prior to dismantling the master cylinder, check the availability of spares from your Land Rover dealer.

6 Carefully ease the reservoir out from the master cylinder body, and recover the two mounting seals from the master cylinder ports, noting each seal's correct fitted location (see illustration opposite).

7 Carefully grip the master cylinder body in a vice fitted with soft jaws, then using a suitable pair of grips, ease the rear housing cover out from the cylinder. The housing should come away complete with the vacuum seal.

8 Carefully remove the retaining ring from the master cylinder, along with its O-ring.

9 Ease the guide ring out from the rear of the master cylinder. **Note:** The guide is not supplied with the repair kit, and will have to be re-used, so take care not to damage it.

10 Withdraw the primary piston assembly from the cylinder.

11 Noting the order of removal and the direction of fitting of each component, tap the body on a clean wooden surface, and withdraw the secondary piston assembly and springs, and the swirl tube, from the master cylinder. Note which way around the swirl tube is fitted.

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.

13 Check all components, and renew any that are worn or damaged. Check particularly the cylinder bores and pistons; the complete assembly should be renewed if these are scratched, worn or corroded. If there is any doubt about the condition of the assembly or of any of its components, renew it. Check that the body's fluid passages are clear.

14 If the assembly is fit for further use, obtain a repair kit from your Land Rover dealer. The kit consists of the primary piston assembly, all seals and springs, as well as a rear housing. Renew all seals disturbed on dismantling and the rear housing as a matter of course; these should never be re-used.

15 Prior to reassembly, soak the piston

assemblies and all new seals in clean hydraulic fluid. Smear clean fluid into the cylinder bore.

16 Using a small flat-bladed screwdriver, remove the seal retainer from the inner end of the secondary piston, and slide off the inner piston seal and washer. Remove the outer seal, taking great care not to mark the piston. Carefully manipulate the new outer seal into position on the piston, making sure that it is the correct way around. Fit the washer and inner seal, again making sure it is the correct way around, and secure it in position with the seal retainer (see illustration).

17 Fit the new swirl tube to the master cylinder bore, ensuring that it is fitted the correct way around.

18 Locate both springs on the end of the secondary piston assembly, and insert the assembly into the master cylinder body. Insert the piston assembly using a twisting motion, ensuring that the piston seals do not become trapped as they enter the cylinder.

19 Fit the new primary piston assembly as described above.

20 With both piston assemblies in position, refit the guide ring to the end of the cylinder bore.

21 Fit the smaller O-ring to the groove on the master cylinder body.

22 Fit the new vacuum seal to the new rear housing, making sure its sealing lip is correctly positioned (facing the towards the primary piston).

23 Fit the new retaining ring to the rear of the master cylinder body, so that its teeth are in contact with the cylinder body.

24 Carefully ease the rear housing assembly into position on the master cylinder, and press it fully into the cylinder body. Fit the larger O-ring to the outside of the housing.

25 Press the new seals into the master cylinder ports, and refit the reservoir.

Refitting

26 Inspect the master cylinder O-ring for signs of damage or deterioration and, if necessary, renew it.

27 Remove all traces of dirt from the master cylinder and servo unit mating surfaces, then fit the master cylinder, ensuring that the servo unit pushrod enters the master cylinder bore centrally. Refit the master cylinder washers and mounting nuts, and tighten them to the specified torque.

28 Wipe clean the brake pipe unions, then

refit them to the master cylinder ports and tighten them to the specified torque setting.

29 Refill the master cylinder reservoir with new fluid.

30 Slowly depress the brake pedal to the floor, and then slowly release it - repeat this five times. Wait for 10 seconds, then repeat this process. As this is done, air bubbles will rise into the reservoir, effectively bleeding the master cylinder.

31 Repeat the operations described in paragraph 30 until resistance is felt at the brake pedal, then bleed the complete hydraulic system as described in Section 2.

11 Brake pedal - removal and refitting

Removal

Early models

1 Release the two fasteners, and remove the driver's side lower facia panel (see Chapter 12).

2 Slide off the spring clip, and withdraw the clevis pin securing the pedal to the servo unit pushrod.

3 To relieve the tension of the pedal return spring, carefully unhook the spring from behind the pedal.

4 Where the pedal is retained by a pivot shaft, remove the circlip from one end of the pedal pivot shaft, then slide the pivot shaft out of position. Where the pedal is retained by a pivot bolt, unscrew the nut and washers from the end of the bolt, then slide the pivot bolt and washers out from its mounting bracket.

5 On all models, remove the pedal assembly from its mounting bracket, and recover the return spring and pivot bushes from the top end of the pedal.

6 Inspect the pedal pivot bushes and shaft/bolt (as applicable) for signs of wear, and renew if necessary.

Later models

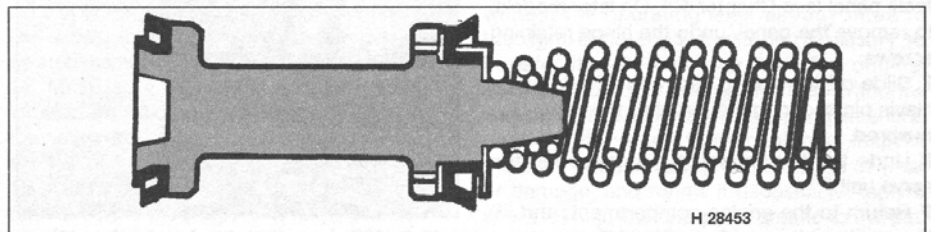
7 Refer to the clutch pedal removal details given in Chapter 6.

Refitting

Early models

8 Press the pivot bushes into the pedal bore.

9 Apply a smear of multi-purpose grease to the bushes, and fit the return spring to the pedal.



10.16 Assemble the secondary piston and associated components as shown, noting that the inner and outer seals are different

10 Manoeuvre the pedal and spring into position, ensuring that it is correctly engaged with the servo pushrod, and insert the pivot shaft/bolt and washers (as applicable). On models with a pivot shaft, secure the shaft in position with the circlip, making sure it is correctly located in the shaft groove. On models with a pivot bolt, fit the washers and retaining nut, tightening it securely.

11 Align the pedal hole with the pushrod end, and insert the clevis pin. Secure the pin in position with the spring clip.

12 Hook the return spring over the pedal, and check the operation of the brake pedal.

13 On completion, refit the fascia panel as described in Chapter 12.

Later models

14 Refer to the clutch pedal refitting details given in Chapter 6.

12 Vacuum servo unit - testing, removal and refitting



Testing

1 To test the operation of the servo unit, with the engine switched off, depress the footbrake several times to exhaust the vacuum. Keeping the pedal depressed, start the engine. As the engine starts, there should be a noticeable give in the brake pedal as the vacuum builds up. Allow the engine to run for at least two minutes, then switch it off. If the brake pedal is now depressed it should feel normal, but further applications should result in the pedal feeling firmer, with the pedal stroke decreasing with each application.

2 If the servo does not operate as described, first inspect the servo unit check valve as described in Section 13.

3 If the servo unit still fails to operate satisfactorily, the fault lies within the unit itself. Repairs to the unit are not possible, and if faulty, the servo unit must be renewed.

Removal

4 Remove the master cylinder as described in Section 10.

5 Release the retaining clip (where fitted), and disconnect the vacuum hose from the servo unit check valve.

6 From inside the vehicle, release the two fasteners and release the driver's side lower fascia panel (see Chapter 12). On later models, to remove the panel, undo the hinge retaining screws.

7 Slide off the spring clip, and withdraw the clevis pin securing the pedal to the servo unit pushrod.

8 Undo the two retaining nuts securing the servo unit.

9 Return to the engine compartment, and lift the servo unit out of position. Recover the spacer which is fitted between the servo unit and bulkhead.

10 Whilst the servo unit is removed, peel back the rubber gaiter from the rear of the unit, and inspect the servo unit filter. If the filter is clogged or dirty, renew it. Carefully prise the old filter out of position, and ease the new one into place. Fit the rubber gaiter, making sure that it is correctly seated on the servo.

Refitting

11 Apply a smear of grease to the pushrod fork, then refit the spacer to the rear of the servo unit, and manoeuvre the assembly into position.

12 From inside the vehicle, ensure that the servo unit pushrod is correctly engaged with the brake pedal. Refit the mounting nuts, and tighten them to the specified torque setting.

13 Refit the servo unit pushrod-to-brake pedal clevis pin, and secure it in position with the spring clip.

14 Refit the fascia panel as described in Chapter 12.

15 Return to the engine compartment, and reconnect the vacuum hose to the servo unit check valve.

16 Refit the master cylinder as described in Section 10.

13 Vacuum servo unit check valve - removal, testing and refitting



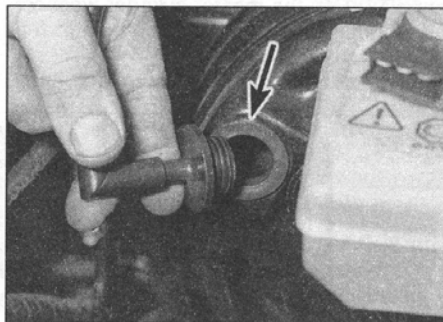
Removal

1 Slacken the retaining clip (where fitted), and disconnect the vacuum hose from the servo unit check valve.

2 Withdraw the valve from its rubber sealing grommet, using a pulling and twisting motion. Remove the grommet from the servo (see illustration).

Testing

3 Examine the check valve for signs of damage, and renew if necessary. The valve may be tested by blowing through it in both directions, air should flow through the valve in one direction only - when blown through from the servo unit end of the valve. Renew the valve if this is not the case.



13.2 Withdraw the check valve from the servo unit, and recover the rubber grommet (arrowed)

4 Examine the rubber sealing grommet and flexible vacuum hose for signs of damage or deterioration, and renew as necessary.

Refitting

5 Fit the sealing grommet into position in the servo unit.

6 Carefully ease the check valve into position, taking great care not to displace or damage the grommet. Reconnect the vacuum hose to the valve and, where necessary, securely tighten its retaining clip.

7 On completion, start the engine, and check the check valve-to-servo unit connection for signs of air leaks.

14 Handbrake shoes - renewal



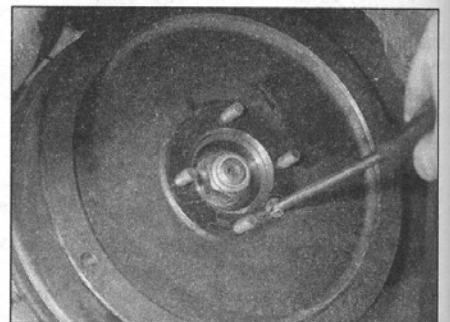
Note: There are two types of handbrake assembly fitted. To distinguish which type is fitted, examine the rear of the handbrake assembly. On early models, the brake assembly is operated by a cable, with a rod operating linkage which is mounted onto the transfer box; on later models, the brake assembly is operated directly by cable.

1 Chock the front wheels, then jack up the rear of the vehicle and support on axle stands.

2 Working as described in Chapter 8, disconnect the propeller shaft from the rear of the transfer box, and position the shaft clear of the handbrake assembly.

3 Apply the handbrake, then slacken and remove the handbrake drum retaining screw(s) (see illustration).

4 Release the handbrake, and remove the brake drum from the rear of the transfer box. It may be difficult to remove the drum, due to the brake shoes binding on the inner circumference of the drum. If the brake shoes are binding, first check that the handbrake is fully released then, referring to the relevant part of Chapter 1 for further information, fully slacken the handbrake cable adjuster nut to obtain maximum freeplay in the cable, and rotate the adjuster bolt anti-clockwise so the shoes are retracted clear of the drum. The brake drum should then slide easily off the transfer box.



14.3 Removing the handbrake drum retaining screw

5 With the drum removed, inspect the shoes for signs of wear or damage. If the friction material of either shoe has worn down to, or close to, the rivets, the shoes must be renewed.

6 The shoes should also be renewed if any are fouled with oil; there is no satisfactory way of degreasing friction material, once contaminated. If there are traces of oil on the shoes, the transfer box output shaft seal should be renewed before new handbrake shoes are fitted by first draining the oil (see the relevant part of Chapter 1), then remove the rear propshaft and output flange. Lever out the old seal and fit a new one.

7 To remove the handbrake shoes, proceed as described under the relevant sub-heading.

Early models (with rod-actuated brake assembly)

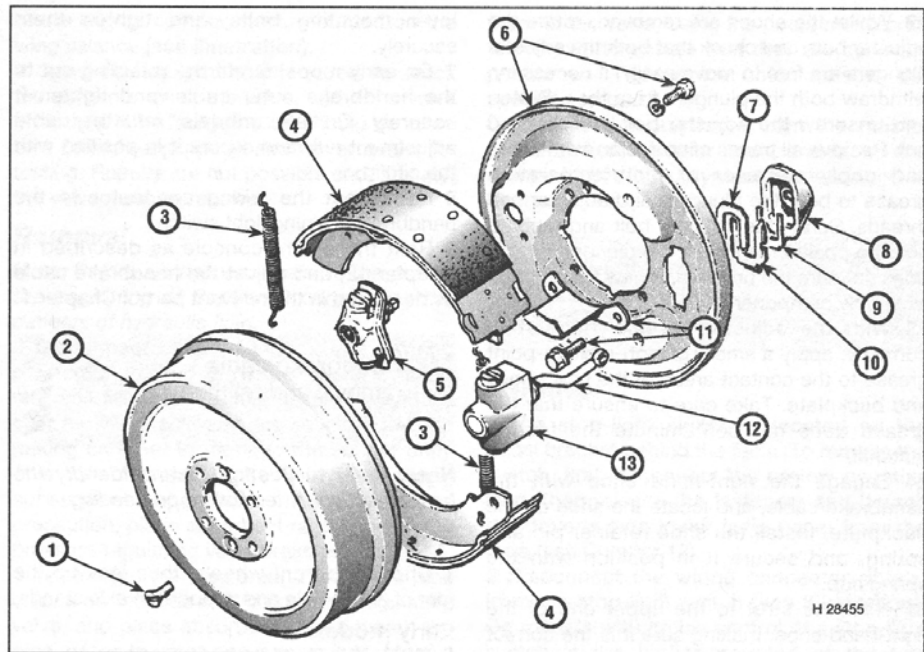
8 To remove the shoes, note the correct fitted locations of the shoes and springs, then carefully unhook the shoes from the expander and adjuster assemblies (see illustration). Remove the shoes and return spring assembly from the backplate, and separate the components.

9 Whilst the shoes are removed, take the opportunity to inspect the expander and adjuster assemblies as follows.

10 Operate the expander drawlink, and check that both plungers are free to move easily in the expander body. If necessary, withdraw both the plungers and their rollers from the expander body, and remove all traces of corrosion from them. Apply a smear of high-temperature grease to both rollers and the plungers, and refit them to the expander assembly. If this does not cure the problem, the expander assembly must be renewed as follows:

- a) Withdraw the split-pin and clevis pin securing the drawlink to the actuating mechanism, then undo the four bolts and remove the backplate assembly and oil catcher (where fitted) from the rear of the transfer box.
- b) Peel back the rubber cover from the rear of the expander, slide out the horseshoe-type retaining clip, and recover the spring plate and packing plate, noting their correct fitted locations.
- c) Withdraw the expander assembly from the backplate.
- d) Install the new expander, securing it in position with the spring plate, packing plate and retaining clip, then fit the rubber cover to the rear of the assembly.
- e) Refit the oil catcher (where fitted) and backplate assembly to the transfer box, and tighten its retaining bolts.
- f) Apply a smear of grease to the clevis pin, then align the drawlink with the operating rod. Slide in the pin, securing it in position with a new split-pin.

11 Rotate the adjuster bolt, and check that both the adjuster plungers are free to move easily. If necessary, withdraw both the



14.8 Exploded view of the handbrake assembly components - early models (with rod-actuated brake assembly)

- | | | |
|-------------------|--------------------------------|--|
| 1 Retaining screw | 6 Backplate and retaining bolt | 10 Packing plate |
| 2 Drum | 7 Spring plate | 11 Oil catcher and retaining bolt (where fitted) |
| 3 Return springs | 8 Rubber cover | 12 Drawlink |
| 4 Shoe | 9 Retaining clip | 13 Expander assembly |

plungers from the adjuster, and unscrew the adjuster bolt. Remove all traces of corrosion from them, and apply a smear of high-temperature grease to both the plungers and adjuster bolt threads. Screw the adjuster bolt into position, and refit the plungers. If this does not cure the problem, the adjuster assembly must be renewed. To renew the adjuster, undo the two retaining bolts and washers, and remove it from the backplate. Install the new adjuster assembly, and securely tighten the retaining bolts.

12 With both adjuster and expander assemblies operating correctly, apply a smear of high-melting point grease to the contact areas of the new shoes and backplate. Take care to ensure that the grease does not contaminate the friction material.

13 Position the handbrake shoes so that the fully-lined end of the lower shoe is next to the expander assembly, and the fully-lined end of the upper shoe is next to the adjuster assembly. Engage the new return springs with the shoes, then install the shoes and springs as an assembly.

14 Make sure that each shoe is correctly located on adjuster plunger slots, then refit the brake drum. Refit the brake drum retaining screws, and tighten them securely.

15 Adjust the cable as described in the relevant part of Chapter 1, then check the operation of the handbrake.

16 If all is well, reconnect the propeller shaft to the transfer box as described in Chapter 8.

Later models (with cable-actuated brake assembly)

17 Note the correct fitted locations of all components then, using a suitable pair of pliers, unhook the return springs and remove them from the brake shoes.

18 Using a pair of pliers, remove the left-hand shoe retainer spring cup by depressing and turning it through 90°. With the cup removed, lift off the spring, and withdraw the retainer pin from the rear of the backplate.

19 Remove the left-hand shoe, and recover the strut which is fitted between the shoe upper ends, noting which way around it is fitted.

20 Remove the right-hand shoe spring cup, spring and retainer pin as described in paragraph 18, then detach the shoe from the handbrake cable and remove it from the vehicle.

21 If the new handbrake shoes are supplied without the operating lever already fitted to the right-hand shoe, it will be necessary to transfer the old one over from the original shoe. Remove the spring clip, then withdraw the pivot pin and recover the spring washers, noting their correct fitted positions. Inspect the pivot pin and spring clip for signs of wear or damage, and renew if necessary. Apply a smear of high-melting-point grease to the pin, then fit the operating lever to the new shoe; insert the pin and spring washers, securing them in position with the spring clip.

22 Whilst the shoes are removed, rotate the adjuster bolt, and check that both the adjuster plungers are free to move easily. If necessary, withdraw both the plungers from the adjuster, and unscrew the adjuster bolt and tapered nut. Remove all traces of corrosion from them, and apply a smear of high-temperature grease to both the plungers and adjuster bolt threads. Screw the adjuster bolt and tapered nut into position, and refit the plungers. If this does not cure the problem, renew the adjuster assembly components.

23 With the adjuster assembly operating correctly, apply a smear of high-melting-point grease to the contact areas of the new shoes and backplate. Take care to ensure that the grease does not contaminate the friction material.

24 Engage the right-hand shoe with the handbrake cable, and locate the shoe on the backplate. Install the shoe retainer pin and spring, and secure it in position with the spring cup.

25 Refit the strut to the upper end of the right-hand shoe, making sure it is the correct way up.

26 Hook the lower return spring onto the right-hand shoe, then engage the left-hand shoe with the return spring. Locate the left-hand shoe on the backplate, engaging it with the adjuster plunger slot and strut, and secure it in position with its retainer pin, spring and spring cup.

27 Check that all components are correctly positioned, then refit the upper return spring.

28 Refit the brake drum to the transfer box, tightening its retaining screws securely.

29 Adjust the handbrake as described in the relevant part of Chapter 1 then, if all is well, reconnect the propeller shaft to the transfer box as described in Chapter 8.

15 Handbrake lever - removal and refitting



Removal

- 1 Remove the centre console as described in Chapter 12.
- 2 Disconnect the wiring connector from the handbrake warning light switch.
- 3 On early models, slacken the nut securing the handbrake outer cable to the base of the handbrake lever.
- 4 On later models, remove the circlip securing the cable to the lever assembly, and lift off the adjustment nut.
- 5 Undo the two mounting bolts and washers, then free the lever assembly from the outer cable, and lift it out of the vehicle (see illustration).

Refitting

- 6 Refit the handbrake lever assembly, making sure that it is correctly engaged with the handbrake outer cable. Refit the handbrake

lever mounting bolts, and tighten them securely.

7 On early models, refit the retaining nut to the handbrake outer cable, and tighten it securely. On later models, refit the cable adjustment nut, and secure it in position with the circlip.

8 Reconnect the wiring connector to the handbrake warning light switch.

9 Refit the centre console as described in Chapter 12, and adjust the handbrake cable as described in the relevant part of Chapter 1.

16 Handbrake cable - removal and refitting



Note: Refer to Section 14 and identify the handbrake type fitted before proceeding.

Removal

- 1 Chock the front wheels, then jack up the rear of the vehicle and support on axle stands.

Early models (with rod-actuated brake assembly)

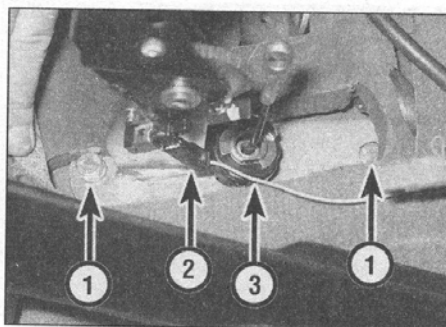
2 Release the handbrake lever gaiter from the console, then carefully prise out the switch panel. Disconnect all the switch wiring connectors, and remove the panel from the console. If necessary, to improve access further, remove the centre console as described in Chapter 12.

3 If not already done, remove the split-pin/spring clip (as applicable) then withdraw the clevis pin securing the handbrake inner cable to the lever. Where a split-pin is used, discard it - a new one will be needed on refitting.

4 Slacken the nut securing the handbrake outer cable to the base of the handbrake lever.

5 From underneath the vehicle, work back along the cable, freeing it from any relevant retaining clips and ties whilst noting its correct routing.

6 Remove the split-pin, then withdraw the clevis pin securing the handbrake inner cable to the rod linkage on the rear of the handbrake assembly. Discard the split-pin - a new one will be needed on refitting.



15.5 Handbrake lever retaining bolts (1), switch wiring connector (2) and cable adjusting nut (3) - later models

7 Slacken the cable locknut and adjuster nut, then free the cable from its mounting bracket and withdraw the cable from underneath the vehicle.

Later models (with cable-actuated brake assembly)

8 Release the handbrake lever gaiter from the console, and remove the switch panel cover plate. Undo the retaining screws, then withdraw the switch panel and disconnect its wiring connectors. If necessary, to improve access further, remove the centre console as described in Chapter 12.

9 If not already done, remove the split-pin/spring clip (as applicable), then withdraw the clevis pin securing the handbrake inner cable to the lever. Where a split-pin is used, discard it - a new one will be needed on refitting.

10 Remove the circlip, and lift off the handbrake cable adjustment nut (see illustration).

11 From underneath the vehicle, work back along the cable, freeing it from any relevant retaining clips and ties whilst noting its correct routing.

12 Referring to Section 14, remove the upper and lower return springs, then remove the spring cup, spring and retainer pin, and remove the right-hand handbrake shoe. Note that the left-hand shoe and strut can be left in position on the backplate.

13 Free the handbrake cable from the rear of the backplate, and withdraw it from underneath the vehicle.

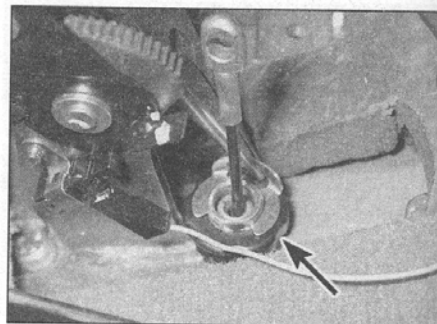
Refitting

Early models (with rod-actuated brake assembly)

14 Engage the lower end of the cable with its mounting bracket, and tighten the adjuster nut and locknut by hand only.

15 Apply a smear of grease to the clevis pin. Align the inner cable with the rod linkage, then insert the clevis pin and secure it in position with a new split-pin.

16 Work along the cable, routing it correctly and securing it in position with all the relevant clips and ties, and feed it up through the base of the floorpan.



16.10 On later models, remove the circlip and lift off the handbrake cable adjusting nut (arrowed)

- 17 From inside the vehicle, refit the retaining nut to the outer cable, and tighten it securely.
- 18 Apply a smear of grease to the clevis pin, then align the inner cable with the lever, and insert the pin. Refit the washer, and secure the clevis pin in position with the spring clip/new split-pin (as applicable).
- 19 Refit the centre console (where removed) as described in Chapter 12, and adjust the handbrake as described in the relevant part of Chapter 1.

Later models (with cable-actuated brake assembly)

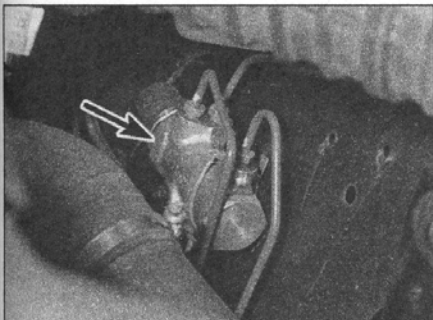
- 20 Apply a smear of high-melting-point grease to the cable lower end fitting, then insert the cable through the rear of the backplate.
- 21 Refit the right-hand brake shoe as described in Section 14, and refit the brake drum.
- 22 Work along the cable, routing it correctly and securing it in position with all the relevant clips and ties, and feed it up through the base of the floorpan.
- 23 From inside the vehicle, refit the adjustment nut to the cable, and secure it in position with the circlip.
- 24 Apply a smear of grease to the clevis pin, then align the inner cable with the lever, and insert the pin. Refit the washer, and secure the clevis pin in position with the spring clip/new split-pin (as applicable).
- 25 Refit the centre console (where removed) as described in Chapter 12, and adjust the handbrake as described in the relevant part of Chapter 1.

17 Rear brake pressure-regulating valve - testing, removal and refitting



Testing

1 A pressure-regulating valve is incorporated in the hydraulic braking circuit, to regulate the pressure applied to the rear brakes, and thereby reduce the risk of the rear wheels locking under heavy braking. The valve is situated on either the left- or right-hand side



17.1 The rear brake pressure-regulating valve (arrowed) is mounted onto the wing valance

of the engine compartment, mounted on the wing valance (see illustration).

2 Specialist equipment is required to check the performance of the valve, and if the valve is thought to be faulty, the car should be taken to a suitably-equipped Land Rover dealer for testing. Repairs are not possible and, if faulty, the valve must be renewed.

Removal

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

- 3 Disconnect the sender unit wiring connector, and unscrew the master cylinder reservoir filler cap. Place a piece of polythene over the filler neck, and securely refit the cap (taking care not to damage the sender unit). This will minimise brake fluid loss during subsequent operations. As an added precaution, place absorbent rags beneath the pressure-regulating valve brake pipe unions.
- 4 Wipe clean the area around the brake pipe unions on the side of the pressure-regulating valve, 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. Wash off any spilt fluid immediately with cold water.

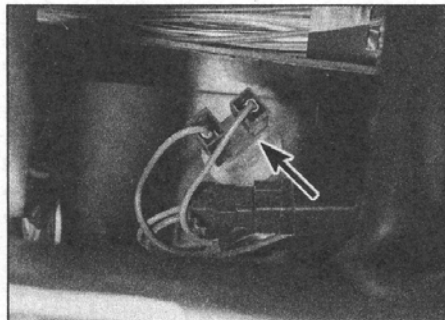


Plug or tape over the pipe ends and valve orifices to minimise the loss of brake fluid and to prevent the entry of dirt into the system.

- 5 Slacken the retaining bolt, and remove the valve from the engine compartment. Note that on some models, there is a spacer fitted behind the valve - take care not to lose this as the retaining bolt is withdrawn.

Refitting

- 6 Refit the pressure-regulating valve, positioning the spacer (where fitted) between the valve and body, and securely tighten its mounting bolt.
- 7 Wipe the brake pipe unions clean and refit



18.2 Stop-light switch (arrowed) is accessed from behind the driver's side lower fascia panel

them to the valve, using the notes made prior to removal to ensure that they are correctly positioned. Tighten the union nuts to the specified torque.

8 Remove the polythene from the master cylinder reservoir filler neck, and bleed the complete hydraulic system as described in Section 2.

18 Stop-light switch - removal, refitting and adjustment



Removal

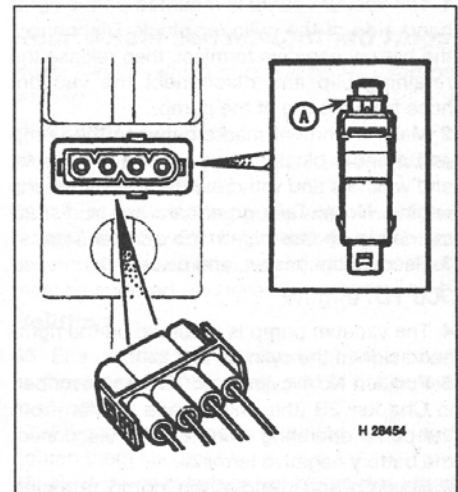
- 1 The stop-light switch is located on the pedal bracket behind the facia. To remove the switch, first disconnect the battery negative lead, then release the fasteners and detach the driver's side lower facia panel from the facia (see Chapter 12).
- 2 Disconnect the wiring connector plug(s) from the stop-light switch (see illustration). On models with cruise control, the stop-light switch is the higher-mounted of the two switches - the brake pedal vent valve switch is identified by its vacuum hose connection. If necessary, remove the brake pedal vent valve switch as described in Chapter 4B, Section 13.

Models without ABS

- 3 Depress the pedal, and remove the rubber from the front of the switch. Unscrew the switch retaining nut, and withdraw the switch from the rear of the pedal mounting bracket.

Models with ABS

- 4 Depress the pedal to gain access to the front of the switch. Pull the sleeve and plunger fully out of the front of the switch, then withdraw the switch from the rear of the mounting bracket (see illustration).



18.4 On models with ABS, to release the stop-light switch, fully pull out the plunger (A), then slide the switch out from the mounting bracket

Refitting and adjustment

Models without ABS

5 Fit the switch to the mounting bracket, tightening its retaining nut securely, and refit its rubber.

6 Reconnect the switch wiring connectors and the battery negative terminal, then check the operation of the switch. Note that no adjustment of the switch is possible; if the switch does not function properly, it must be renewed.

7 On completion, refit the fascia panel as described in Chapter 12.

Models with ABS

8 Make sure that the sleeve and plunger are pulled fully out of the front of the switch.

9 Depress the brake pedal, then push the switch fully into the mounting bracket so that its retaining clips are fully located. Hold the switch in this position, then pull the brake pedal back up towards the switch to lock the switch in position.

10 Reconnect the switch wiring connector and the battery negative terminal, then check the operation of the switch. If the switch does not function properly, first ensure that it is correctly located in the mounting bracket. If the switch is correctly located but fails to work, it must be renewed - no adjustment is possible.

11 On completion, refit the fascia panel as described in Chapter 12.

19 Vacuum pump (diesel models) - removal and refitting



Removal

200 TDi engine

1 The vacuum pump is mounted on the right-hand side of the cylinder block. Disconnect the battery negative terminal, then release the retaining clip and disconnect the vacuum hose from the top of the pump.

2 Make alignment marks between the pump and cylinder block, then undo the three bolts and washers and withdraw the pump from the engine. **Note:** Take great care not to disturb the drivegear assembly in the cylinder block.

3 Recover the gasket, and discard it.

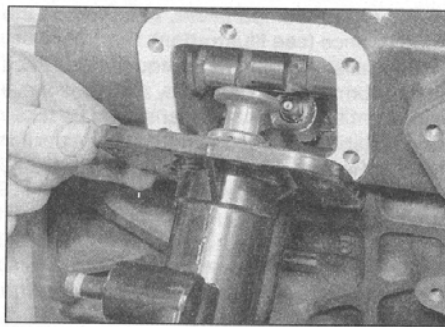
300 TDi engine

4 The vacuum pump is mounted on the right-hand side of the cylinder block.

5 Position No 1 cylinder at TDC as described in Chapter 2B (this will release tension from the pump operating plunger) then disconnect the battery negative terminal.

6 Slacken and remove the pump retaining bolts and washers, noting the correct fitted location of the wiring bracket.

7 Remove the pump from the side of the block. Recover the gasket, and discard it.



19.13 On 300 TDi engines, ensure the mating surfaces are clean and dry, then fit a new gasket to the cylinder block and refit the braking system vacuum pump

Refitting

200 TDi engine

8 Ensure that the pump and drivegear mating surfaces are clean and dry, and position the new gasket on the driver gear.

9 Using the marks made prior to removal, refit the pump to the cylinder block, aligning its driveshaft correctly with the drivegear.

10 Refit the pump retaining bolts, and tighten them securely.

11 Reconnect the vacuum hose to the pump, and (where necessary) securely tighten its retaining clip.

300 TDi engine

12 Ensure that the pump and cylinder block mating surfaces are clean and dry.

13 Offer up a new gasket, and refit the pump to the cylinder block (see illustration).

14 Refit the pump retaining bolts, not forgetting to fit the wiring bracket to the relevant bolt, and tighten them securely.

15 Reconnect the vacuum hose to the pump, and (where necessary) securely tighten its retaining clip.

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

ABS is fitted as standard to some high-specification models, and is available as an option on most other models in the range. The system comprises of the electronic control unit (ECU), a modulator block (which contains the hydraulic solenoid valves and accumulators, and the electrically-driven return pump), and four roadwheel sensors; one fitted to each hub. The brake pedal stop-light switch is used to indicate to the ECU that the brakes are applied. The purpose of the system is to prevent wheel(s) locking during heavy braking. This is achieved by automatic release of the brake on the relevant wheel, followed by reapplication of the brake.

The solenoid valves are controlled by the ECU, which itself receives signals from the four wheel sensors (one fitted on each hub), which monitor the speed of rotation of each

wheel. By comparing these speed signals from the four wheels, the ECU can determine the speed at which the vehicle is travelling. It can then use this speed to determine when a wheel is decelerating at an abnormal rate compared to the speed of the vehicle, and therefore predicts when a wheel is about to lock. During normal operation, the system functions in the same way as a non-ABS braking system does.

During normal operation, the solenoid valves in the modulator assembly are closed, and the governor valves are in the at-rest position. The system then functions in the same way as a non-ABS braking system does.

If the ECU senses that a wheel is about to lock, the ABS operates the relevant solenoid valve in the modulator assembly, which then isolates the brake caliper on the wheel which is about to lock from the master cylinder, effectively sealing-in the hydraulic pressure.

If the speed of rotation of the wheel continues to decrease at an abnormal rate, the electrically-driven return pump operates, and pumps the hydraulic fluid back into the master cylinder, releasing pressure on the brake caliper so that the brake is released. Once the speed of rotation of the wheel returns to an acceptable rate, the pump stops and the solenoid valve opens, allowing the hydraulic master cylinder pressure to return to the caliper, which then reapplies the brake. This cycle can be carried out at many times a second.

The action of the solenoid valves and return pump creates pulses in the hydraulic circuit. When the ABS is functioning, these pulses can be felt through the brake pedal.

The operation of the ABS is entirely dependent on electrical signals. To prevent the system responding to any inaccurate signals, a built-in safety circuit monitors all signals received by the ECU. The first time the vehicle exceeds 5 mph (7 km/h) after the 'ignition' has been switched on, the ECU tests the readings from each wheel sensor, and the operation of the modulator solenoid valves. If a fault is present, the ABS is automatically shut down by the ECU, and the warning light on the instrument panel is illuminated to inform the driver that the ABS is not operational.

Every time the 'ignition' is switched on, the ECU performs a self-test and checks its memory for faults. This takes approximately 1 to 2 seconds, during which time the warning light in the instrument panel will illuminate. The warning light should then go out for approximately 0.5 seconds, indicating the end of the self-test, before illuminating again. The warning light will stay illuminated until the first time the vehicle speed exceeds 5 mph (7 km/h), at which point it should go out. If the warning light fails to go out, or illuminates whilst the vehicle is being driven, then a fault is present in the ABS.

If a fault does develop in the ABS, the vehicle must be taken to a Land Rover dealer for fault diagnosis and repair.

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



Modulator assembly

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

Removal

- 1 Disconnect the battery negative terminal.
- 2 Disconnect the two wiring connectors from the ABS modulator assembly.
- 3 Unscrew the master cylinder reservoir filler cap, and top-up the reservoir to the MAX mark (see *Weekly checks*).



HAYNES HINT Place a piece of polythene over the master cylinder filler neck, and securely refit the cap. This will minimise brake fluid loss during subsequent operations. As a precaution, place absorbent rags beneath the modulator brake pipe unions.

- 4 Wipe clean the area around the modulator brake pipe unions, then make a note of how the pipes are arranged, to use as a reference on refitting. Unscrew the union nuts, and carefully withdraw the pipes. Plug or tape over the pipe ends and modulator 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 Slacken and remove the mounting nuts, and release the modulator assembly from its mounting bracket. If necessary, unscrew the modulator rubber mounting bushes, and remove them. **Note:** Do not attempt to dismantle the modulator block hydraulic assembly; overhaul of the unit is not possible.

Refitting

- 6 Refitting is the reverse of the removal procedure, noting the following points:
 - a) Examine the rubber mounting bushes for signs of wear or damage, and renew if necessary.
 - b) Refit the brake pipes to their respective unions, and tighten the union nuts to the specified torque.
 - c) Ensure that the wiring is correctly routed, and that the connector is firmly pressed into position.
 - d) On completion, prior to refitting the battery, bleed the complete braking system as described in Section 2.

Electronic control unit (ECU)

Removal

- 7 The ABS electronic control unit (ECU) is mounted behind the glovebox. Prior to removing the ECU, disconnect the battery negative terminal.

- 8 Remove the central locking electronic control unit as described in Chapter 12.

- 9 Slacken and remove the two retaining screws, then lower the ABS ECU out of position.

- 10 Lift the wiring connector retaining clip, then twist the connector to release it and remove the ECU from the vehicle.

Refitting

- 11 Refitting is a reversal of the removal procedure, ensuring that the wiring connector is securely reconnected.

Front wheel sensor

Removal

Note: A new sensor mounting bush and seal will be required on refitting.

- 12 The front wheel sensors are mounted on top of the swivel housing. Prior to removal, disconnect the battery negative terminal.

- 13 Firmly apply the handbrake, then loosen the relevant front roadwheel nuts. Jack up the front of the vehicle and support on axle stands. Remove the appropriate front roadwheel.

- 14 Trace the wheel sensor wiring back to its wiring connector, and release it from its retaining clip. Disconnect the connector, and work back along the sensor wiring, freeing it from all the relevant retaining clips and ties.

- 15 Wipe clean the area around the top of the swivel housing, then carefully prise the sensor out from its mounting bush. Remove the sensor and lead assembly from the vehicle.

- 16 Undo the two retaining bolts securing the bracket to the top of the swivel housing, then withdraw the sensor mounting bush and seal.

Refitting

- 17 Remove all traces of locking compound from the threads of the bracket bolts and housing holes, ideally by running a tap of suitable size down them.

- 18 Carefully insert the new sensor mounting bush and seal into the switch housing.

- 19 Apply a drop of locking compound to the threads of the bracket bolts, then refit the bracket to the top of the swivel housing and securely tighten the retaining bolts.

- 20 Coat the outside of the sensor with a smear of EP90 gear oil to help aid installation, then carefully ease the sensor into position until it contacts the sensor ring. The sensor will then be pushed back by the ring, to set the correct air gap, the first time the vehicle is driven.

- 21 Ensure that the sensor wiring is correctly routed and retained by all the necessary clips. Reconnect it to its wiring connector, and clip the connector into the retaining clip.

- 22 Refit the roadwheel, then lower the vehicle to the ground and tighten the roadwheel nuts to the specified torque.

Rear wheel sensor

Note: A new sensor mounting bush and seal will be required on refitting.

Removal

- 23 The rear wheel sensors are mounted onto the rear of the hub assemblies. Prior to removal, disconnect the battery negative terminal.

- 24 Chock the front wheels, then jack up the rear of the vehicle and support it on axle stands.

- 25 Trace the wiring back from the sensor to its wiring connector. Free the connector from its retaining clip, disconnect it from the main wiring loom, then work back along the sensor wiring and free it from any relevant retaining clips.

- 26 Carefully prise the sensor out from its mounting bush, and remove it from underneath the vehicle.

- 27 Undo the retaining bolts, and remove the mudshield from the rear hub assembly.

- 28 Remove the sensor bush from the hub assembly.

Refitting

- 29 Carefully ease the new sensor bush into position in the hub.

- 30 Apply a thin coat of silicone grease to the sensor body to help aid installation, then carefully ease the sensor into position until it contacts the sensor ring. The sensor will then be pushed back by the ring, to set the correct air gap, the first time the vehicle is driven.

- 31 Ensure that the sensor wiring is correctly routed and retained by all the necessary clips. Reconnect it to its wiring connector, and clip the connector into the retaining clip.

- 32 Refit the roadwheel, then lower the vehicle to the ground and tighten the roadwheel nuts to the specified torque.

Front wheel sensor toothed rings

- 33 The front toothed rings are an integral part of the constant velocity (CV) joints, and cannot be renewed separately. If renewal is necessary, the complete constant velocity joint must be renewed as described in Chapter 9, Section 2.

Rear wheel sensor toothed rings

Note: New retaining nuts will be required on refitting.

Removal

- 34 Remove the rear hub assembly as described in Chapter 9.

- 35 Undo the retaining nuts, and remove the sensor ring from the rear hub assembly. Discard the retaining nuts - they must be renewed whenever they are disturbed.

Refitting

- 36 Ensure that the disc and sensor mating surfaces are clean and dry, and fit the sensor to the disc.

- 37 Fit the new sensor retaining nuts, and tighten them securely.

- 38 Refit the rear hub assembly as described in Chapter 9.

Relays

- 39 See Chapter 13.