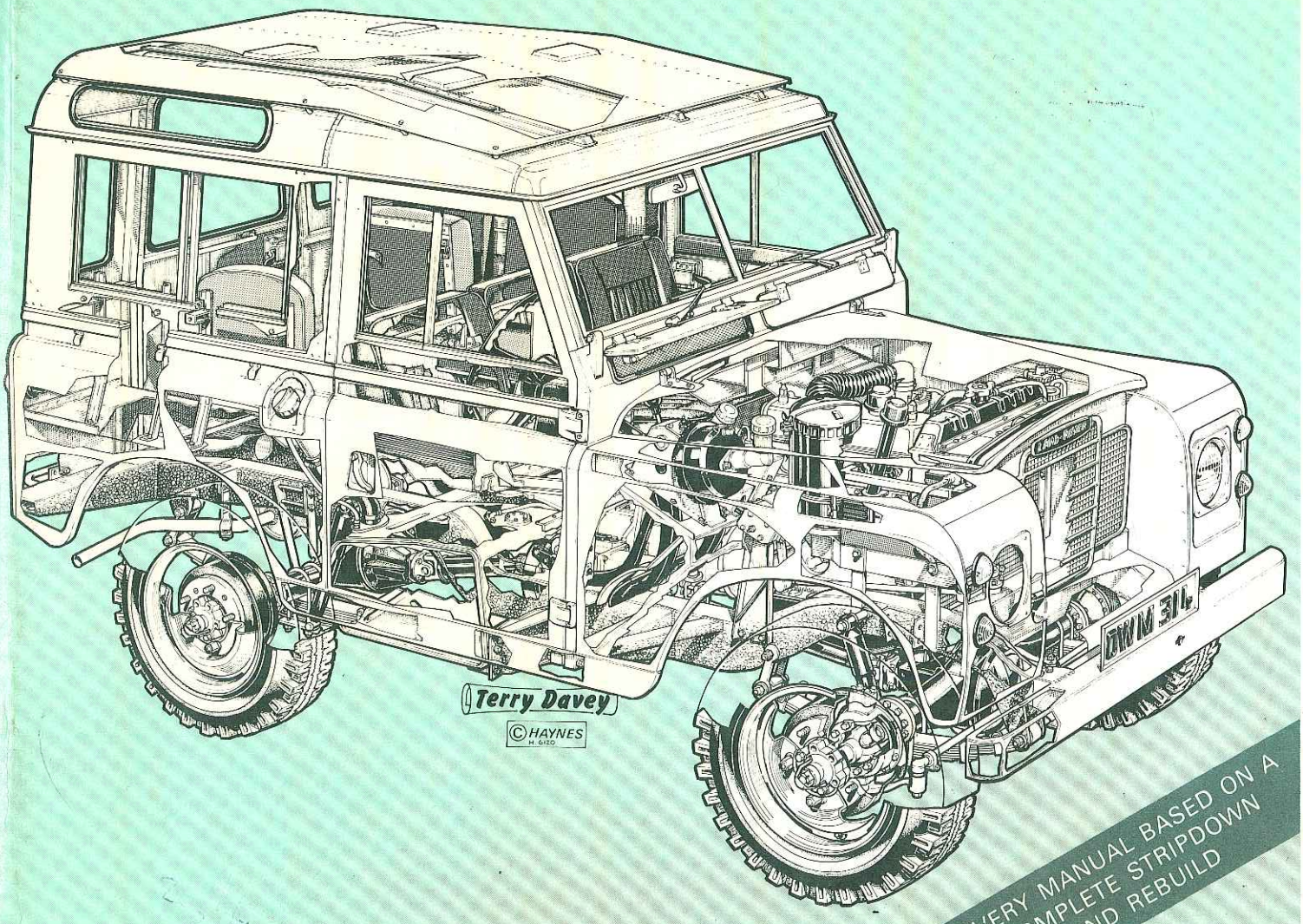
LAND ROVER SERIES II, IIA & III

1958 to 1984 ▫ 2286 cc
4-cyl, petrol ▫ 88 & 109 in wheelbase

Haynes®

THE BOOK

Owners Workshop Manual



EVERY MANUAL BASED ON A COMPLETE STRIPDOWN AND REBUILD

Chapter 9 Braking system

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

Contents

Specifications

Type	Hydraulically operated drum brakes. Mechanically operated transmission brake
10 in diameter type (SWB models)	
Lining	
Length	8½ in (215 mm)
Width	1½ in (38 mm)
Thickness	3/16 in (4.75 mm)
Drum regrinding limit	+ 0.030 in (+ 0.75 mm) oversize
11 in diameter type (LWB models)	
Lining (front)	
Length	10.45 in (265 mm)
Width	2¼ in (57 mm)
Thickness	3/16 in (4.75 mm)
Lining (rear)	
Length	8.6 in (218 mm)
Width	2¼ in (57 mm)
Thickness	3/16 in (4.75 mm)
Drum regrinding limit	As for 10 in drums
Transmission brake	
Lining	
Length	8.64 in (219 mm)
Width	1¾ in (44.5 mm)
Thickness	3/16 in (4.75 mm)
Drum diameter	9 in (228.6 mm)
Drum regrinding limit	As for 10 in drums
Master cylinder	
Type (SWB models)	Girling CV
Bore	¾ in (19 mm)
Stroke	1½ in (38 mm)
Type (LWB models)	Girling CV
Bore	1 in (25 mm)
Stroke	1½ in (38 mm)
Pushrod free movement	1/16 in (1.5 mm)

1 General description

The braking system on the 2¼ litre Land Rovers is comprised of drum brakes on the front and rear wheels operated by an hydraulic master cylinder connected to the brake pedal. The handbrake lever is mechanically linked to a drum brake mounted on the rear of the gearbox. Application of the lever locks the rear propeller shaft and if four-wheel drive is selected, also the front propeller shaft.

The short wheel based (SWB) models are fitted with 10 in (254 mm) diameter drums on the front and rear wheels, while the long wheel based (LWB) models are equipped with 11 in (279 mm) diameter drums.

The Series III model has the option of a dual braking system with servo assistance.

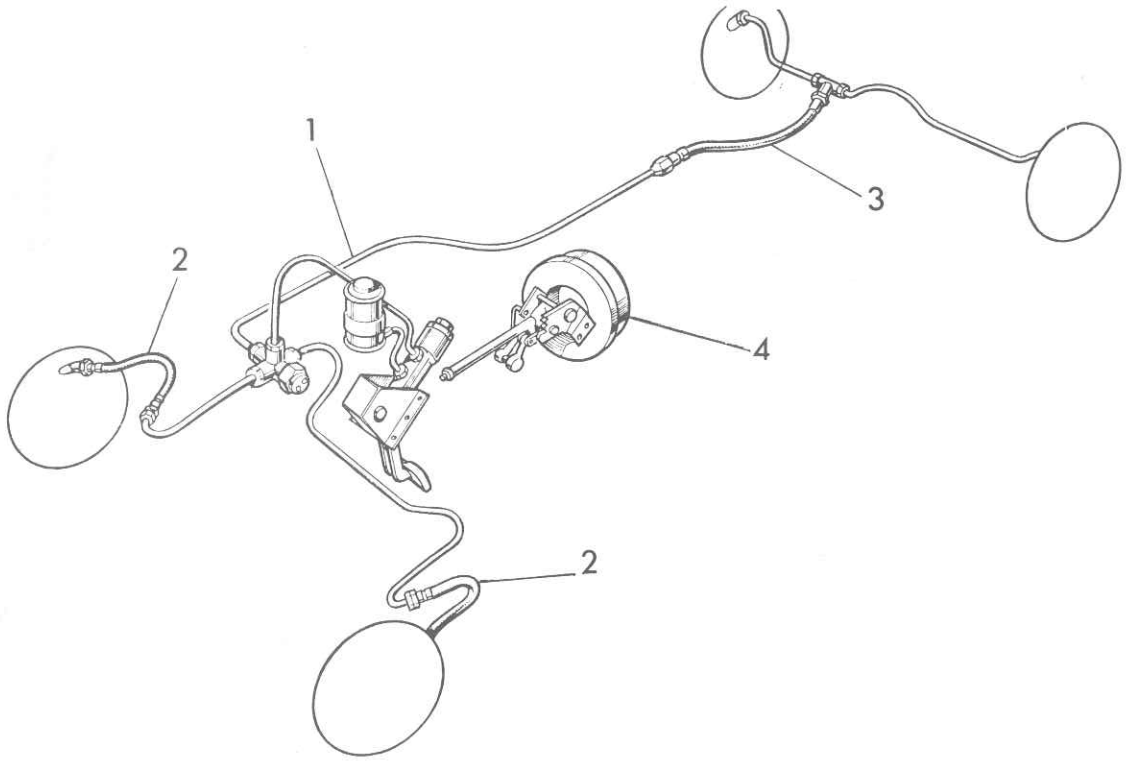


Fig. 9.1. Layout of earlier type braking system

1 Brake fluid reservoir *2 Front flexible brake pipes* *3 Rear flexible brake pipe* *4 Transmission brake*

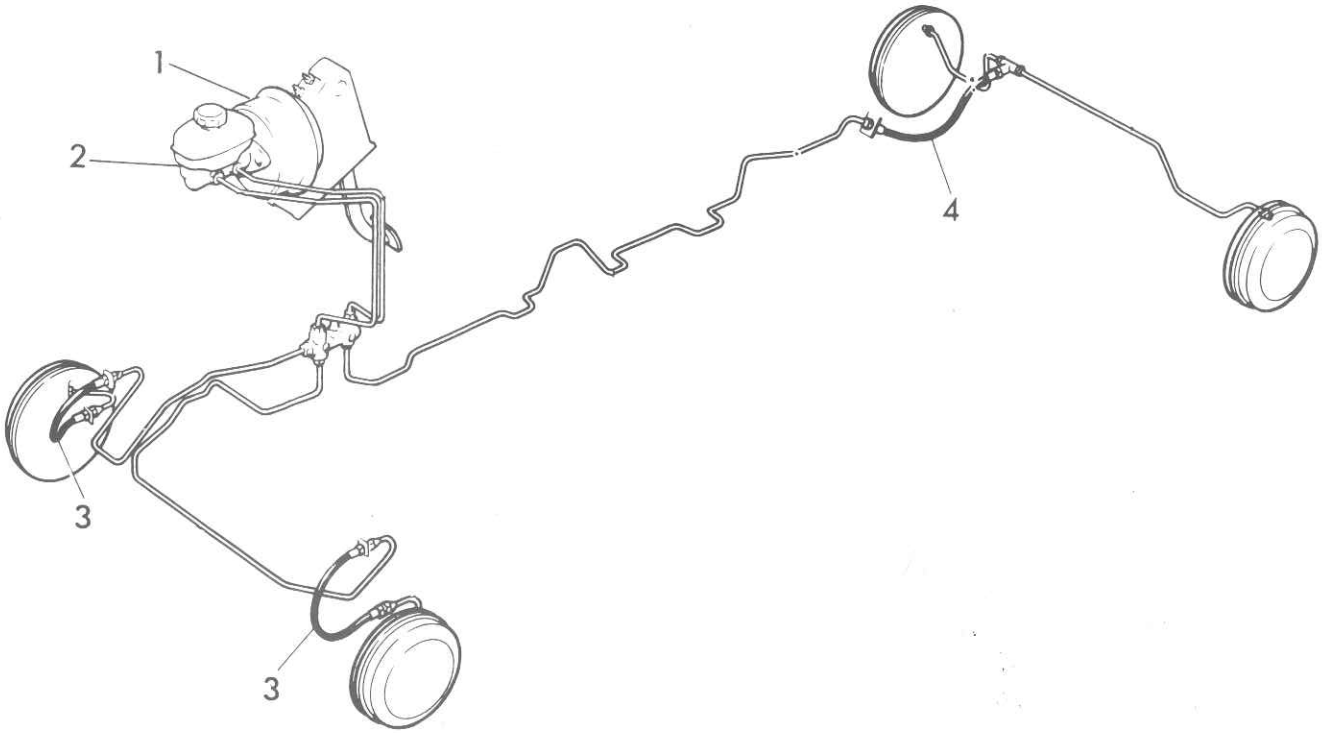


Fig. 9.2. Dual braking system with servo unit

1 Servo unit *2 Master cylinder* *3 Front flexible brake pipes* *4 Rear flexible brake pipes*

2 Front and rear brakes - adjustment

1 At the service intervals detailed in the Routine Maintenance Section at the beginning of the Manual, it will be necessary to adjust the brakes to compensate for lining wear.
2 The SWB models are fitted with a single hexagon adjustment bolt at the back of each brake anchor plate (see photo), while the LWB models are equipped with two hexagon adjusters on each anchor plate. **Note:** On some earlier LWB models a single square-headed adjuster is fitted on the rear brakes.
3 The method of adjusting the brakes on all models is basically the same. Jack-up each wheel in turn until the tyre is just clear of the ground and support the vehicle on axle stands. It is not necessary to remove the wheels.
4 From the rear of the anchor plate, check that the wheel turns freely (slacken the adjuster(s) if necessary) and then turn the adjuster(s) clockwise until the brake shoes are in firm contact with the drum.
5 Slacken the adjuster(s) anti-clockwise just enough to enable the wheel to rotate freely.
6 Lower the vehicle to the ground and repeat the operation on the other three wheels.
7 For handbrake adjustment refer to Section 4.

3 Brake drums and shoes - removal, inspection and refitting

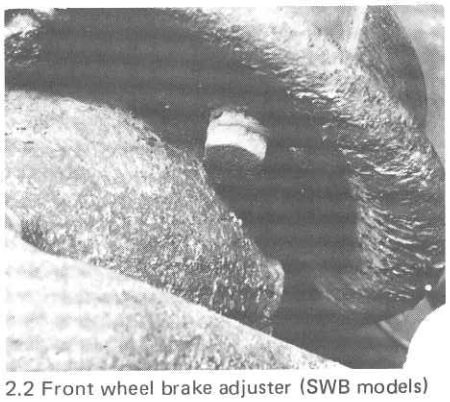
1 If, after adjusting the brakes they are still inefficient and there are no signs of hydraulic leaks, the drums should be removed and the linings checked for wear.
2 The procedure for removing the brake drums and shoes is basically the same for all models. Commence by jacking-up the front of the vehicle, place axle stands under the chassis and remove the road-wheels.
3 Slacken off the brake adjuster(s) as described in Section 2, remove the screws securing the drum to the hub and draw it off. If the drum tends to stick, tap the periphery with a soft-faced mallet to loosen it.
4 Examine the friction surface on the interior of the drum. Normally this should be completely smooth and bright. Remove any dust with a dry cloth and examine the surface for any score marks or blemishes. Very light hairline scores running around the surface are not serious but indicate that the shoes may be wearing out, or heavy grit and dirt have got into the drum at some time. If there are signs of deep scoring the drum needs reconditioning or renewal.
5 The brake linings should be renewed if they are so worn that the rivet heads are flush with the surface of the lining. If bonded linings are fitted they must be renewed when the material has worn down to 1/32 inch at its thinnest point. If the shoes are being removed to give access to the wheel cylinders, then cover the linings with masking tape to prevent any possibility of their becoming contaminated with grease.
6 Using a screwdriver, scratch a mark alongside the holes in each shoe through which the return springs are hooked. This will avoid any confusion when the springs are refitted.
7 Slacken the adjuster(s) right back.
8 On the SWB models, remove the anchor plate securing the trailing shoe to the pivot post (see Fig. 9.3).
9 Using a screwdriver or a pair of grips, carefully lever the bottom ends of the shoes away from the anchor post. If working on the LWB model, lever the trailing end of each shoe from the plain end of each wheel cylinder (see Fig. 9.4).
10 Release the other end of each shoe and remove them complete with springs.
11 Place a rubber band round each wheel cylinder piston to prevent their coming out causing loss of brake fluid and the necessity of bleeding the braking system.
12 Thoroughly clean all traces of dust from the shoes, backplates and brake drums with a dry paint brush and compressed air if available. Do not breathe in any dust as it will be of asbestos nature. Brake dust can cause squeal and judder and it is therefore important to clean out the brakes thoroughly.
13 Check that the pistons are free in their cylinders and that the rubber dust covers are undamaged and in position and that there are no hydraulic fluid leaks.
14 Prior to reassembly smear a trace of white brake grease to all sliding surfaces. It is vital that no grease or oil comes into contact with the brake drums or the brake linings.
15 Refitting is a straight forward reversal of the removal procedure but note the following points:

a) Ensure that the return springs are located in the correct holes in the shoes.
b) Check that the snail type adjusting cam(s) are correctly located against the post on the shoe.
c) After refitting the drums, adjust the brakes as described in Section 2.
d) If brake shoe steady posts are fitted and have been disturbed, these should be adjusted to the position shown in Fig. 9.5.

16 After reassembling the front brakes, carry out the same procedure on the rear brakes. It will be noticed that there are differences in design between the slave cylinders fitted to the SWB and LWB models, but providing reference is made to the exploded diagrams in this Chapter no major problems should be encountered.

4 Transmission brake - adjustment

1 The transmission brake, located at the rear of the transfer box, has a single adjuster which protrudes from the front of the backplate (see Fig. 9.8).
2 Access can be gained to the brake adjuster either by removing the centre seat box panel, or from beneath the vehicle. If working beneath the vehicle place chocks on either side of two wheels as the handbrake must be in the off position while adjusting the brake.
3 Rotate the adjuster clockwise until the brake shoes are in firm contact with the drum.
Note: The adjuster is not very accessible and a proper square-jawed brake adjusting spanner should be used to avoid burring over the head of the adjuster.
4 Unscrew the adjuster just enough to release the brake (approximately two clicks) and then apply and release the handbrake lever to centralise the shoes.
5 Adjust the two locknuts on the handbrake lever vertical adjuster rod so that the lever has two clicks free movement on the ratchet before the brake is applied, (photo).


2.2 Front wheel brake adjuster (SWB models)

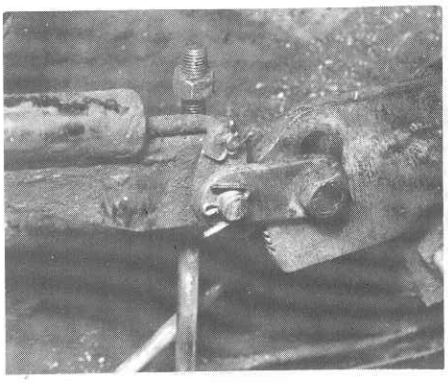
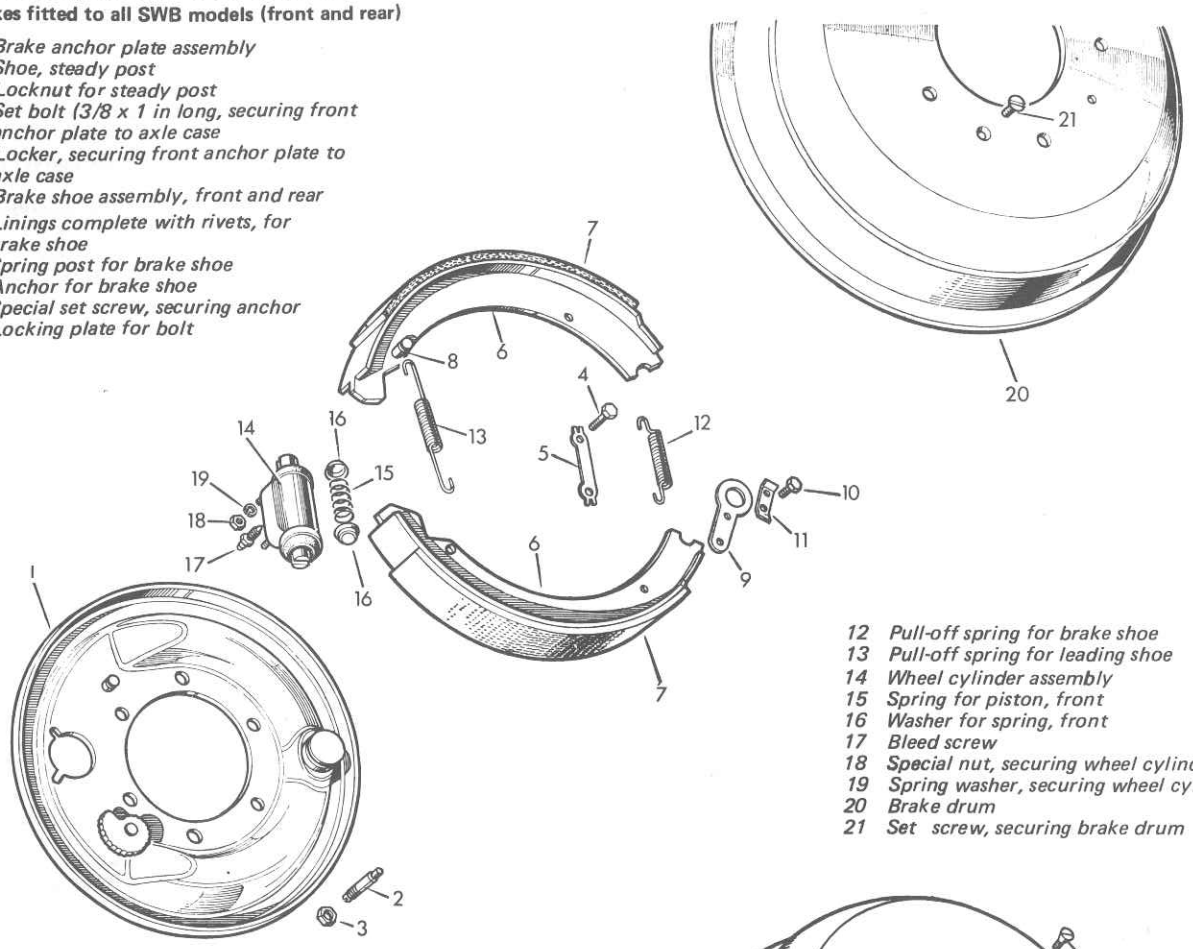
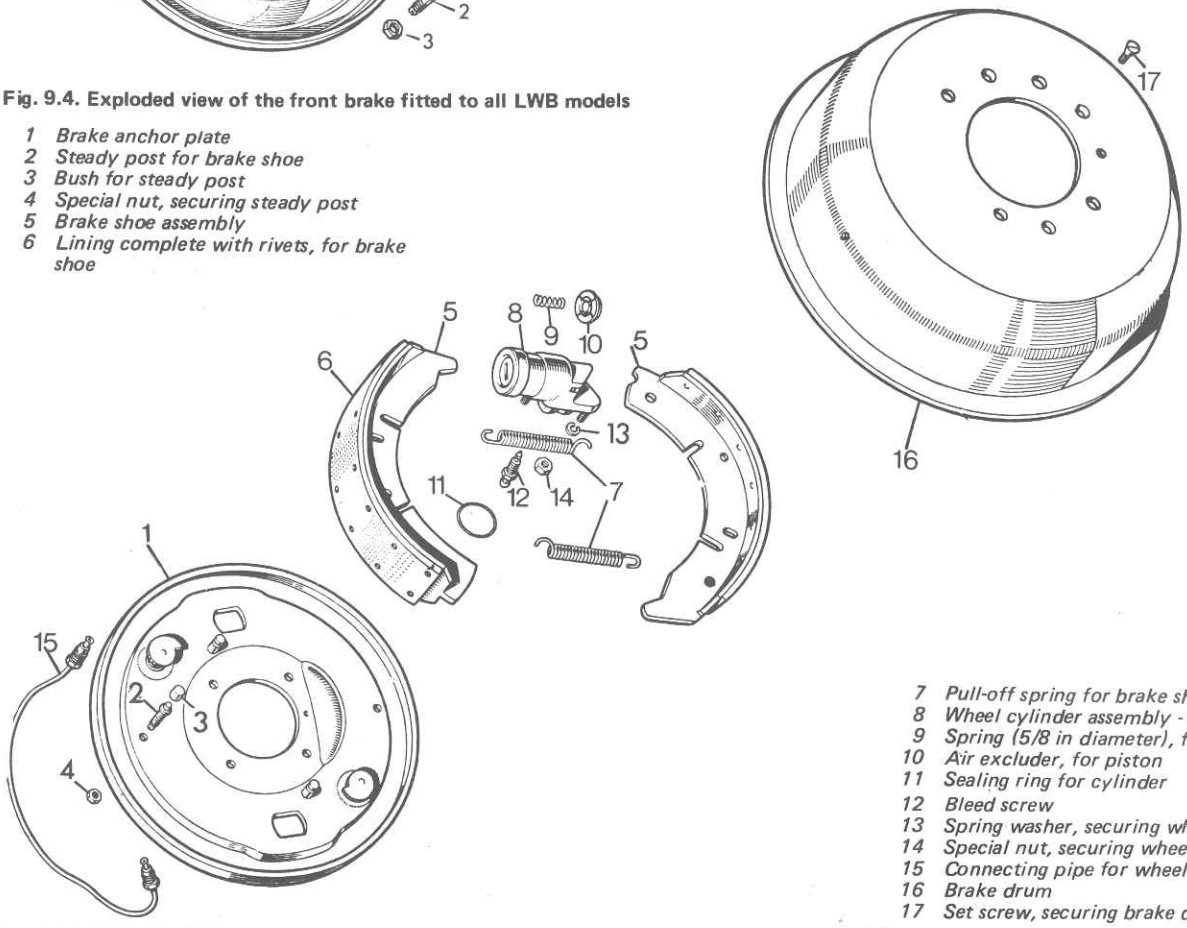

4.5 Handbrake lever vertical adjuster rod

Fig. 9.3. Exploded view of the 10 in diameter brakes fitted to all SWB models (front and rear)



1 *Brake anchor plate assembly*
2 *Shoe, steady post*
3 *Locknut for steady post*
4 *Set bolt (3/8 x 1 in long, securing front anchor plate to axle case*
5 *Locker, securing front anchor plate to axle case*
6 *Brake shoe assembly, front and rear*
7 *Linings complete with rivets, for brake shoe*
8 *Spring post for brake shoe*
9 *Anchor for brake shoe*
10 *Special set screw, securing anchor*
11 *Locking plate for bolt*
12 *Pull-off spring for brake shoe*
13 *Pull-off spring for leading shoe*
14 *Wheel cylinder assembly*
15 *Spring for piston, front*
16 *Washer for spring, front*
17 *Bleed screw*
18 *Special nut, securing wheel cylinder*
19 *Spring washer, securing wheel cylinder*
20 *Brake drum*
21 *Set screw, securing brake drum*

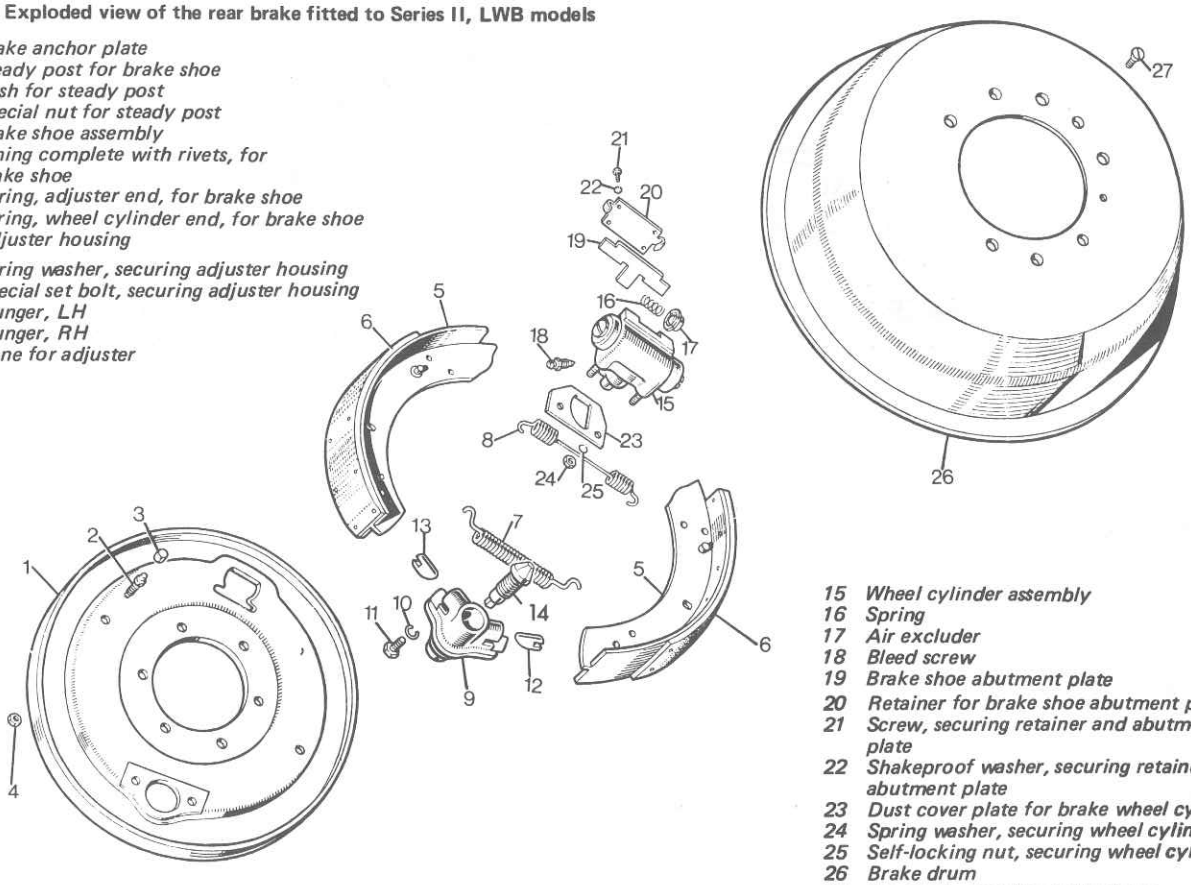
Fig. 9.4. Exploded view of the front brake fitted to all LWB models



1 *Brake anchor plate*
2 *Steady post for brake shoe*
3 *Bush for steady post*
4 *Special nut, securing steady post*
5 *Brake shoe assembly*
6 *Lining complete with rivets, for brake shoe*
7 *Pull-off spring for brake shoe*
8 *Wheel cylinder assembly - 2 off*
9 *Spring (5/8 in diameter), for piston*
10 *Air excluder, for piston*
11 *Sealing ring for cylinder*
12 *Bleed screw*
13 *Spring washer, securing wheel cylinder*
14 *Special nut, securing wheel cylinder*
15 *Connecting pipe for wheel cylinder*
16 *Brake drum*
17 *Set screw, securing brake drum*

Fig. 9.5. Exploded view of the rear brake fitted to Series II, LWB models

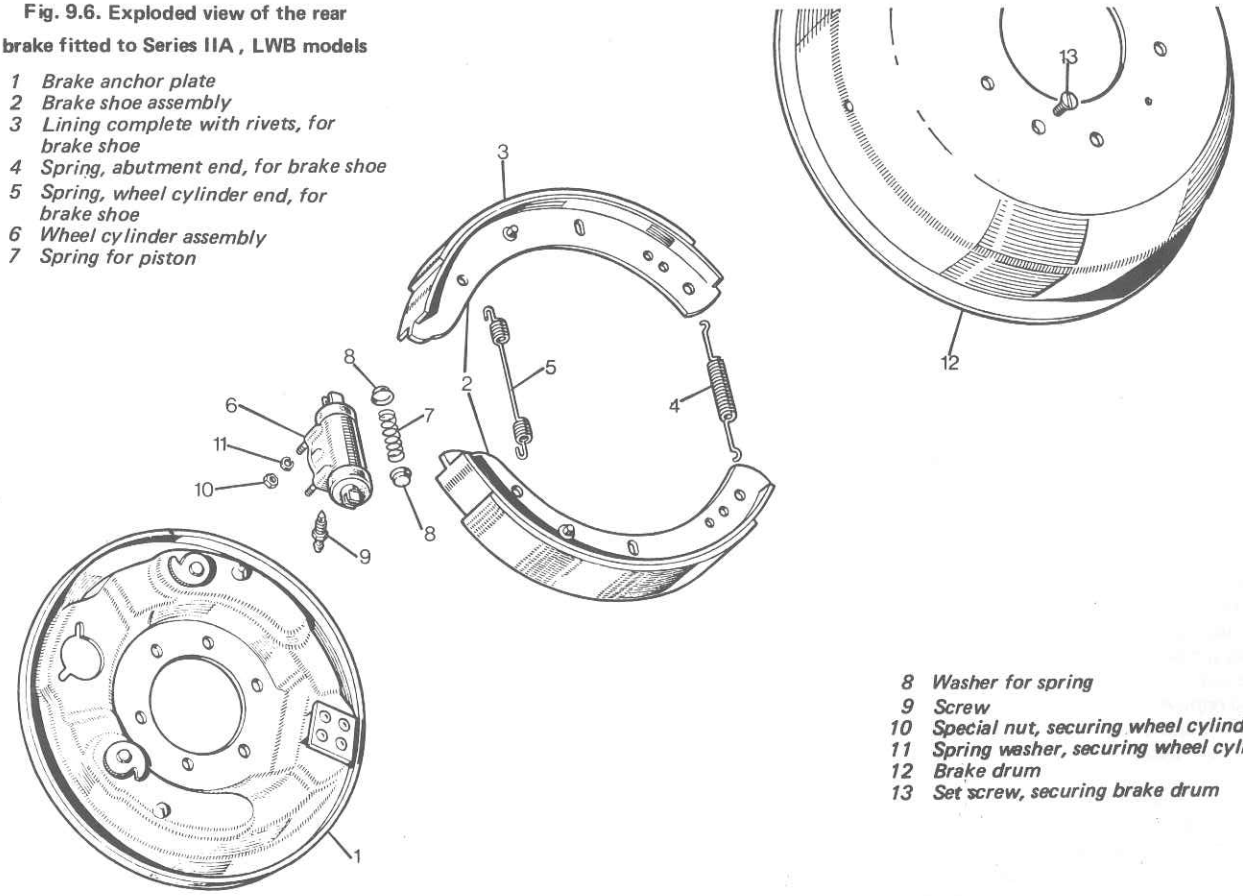
1 *Brake anchor plate*
2 *Steady post for brake shoe*
3 *Bush for steady post*
4 *Special nut for steady post*
5 *Brake shoe assembly*
6 *Lining complete with rivets, for brake shoe*
7 *Spring, adjuster end, for brake shoe*
8 *Spring, wheel cylinder end, for brake shoe*
9 *Adjuster housing*
10 *Spring washer, securing adjuster housing*
11 *Special set bolt, securing adjuster housing*
12 *Plunger, LH*
13 *Plunger, RH*
14 *Cone for adjuster*



15 *Wheel cylinder assembly*
16 *Spring*
17 *Air excluder*
18 *Bleed screw*
19 *Brake shoe abutment plate*
20 *Retainer for brake shoe abutment plate*
21 *Screw, securing retainer and abutment plate*
22 *Shakeproof washer, securing retainer and abutment plate*
23 *Dust cover plate for brake wheel cylinder*
24 *Spring washer, securing wheel cylinder*
25 *Self-locking nut, securing wheel cylinder*
26 *Brake drum*
27 *Set screw, securing brake drum*

Fig. 9.6. Exploded view of the rear brake fitted to Series IIA, LWB models

1 *Brake anchor plate*
2 *Brake shoe assembly*
3 *Lining complete with rivets, for brake shoe*
4 *Spring, abutment end, for brake shoe*
5 *Spring, wheel cylinder end, for brake shoe*
6 *Wheel cylinder assembly*
7 *Spring for piston*



8 *Washer for spring*
9 *Screw*
10 *Special nut, securing wheel cylinder*
11 *Spring washer, securing wheel cylinder*
12 *Brake drum*
13 *Set screw, securing brake drum*

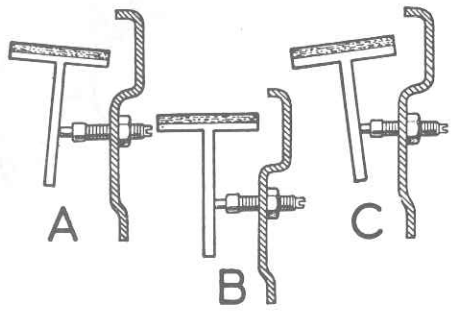


Fig. 9.7. Adjustment of brake shoe steady post

A Incorrect *B Correct*
C Incorrect

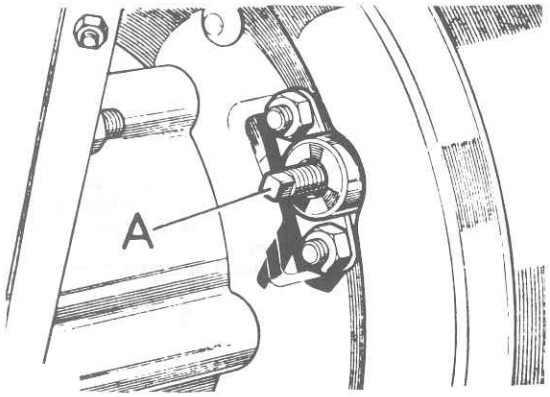


Fig. 9.8. Transmission brake adjuster 'A'

5 Transmission brake drum and shoes - removal, inspection and refitting

1 Access to the transmission brake is gained from beneath the vehicle. Ensure that the wheels are firmly chocked before commencing work.
2 Remove the six nuts securing the brake drum to the output shaft flange and withdraw the drum rearwards over the propeller shaft. If the drum is difficult to remove, slacken the brake adjuster several turns.
3 Using a screwdriver mark the holes in the shoes through which the return spring are hooked to ensure correct reassembly.
4 Lever the end of each shoe out of the adjuster unit and then slide the other ends out of the expander unit (Fig. 9.9). Remove the shoes and return springs.
5 Examine the drum and linings for wear as described in Section 3 and renew if necessary.
6 Check that the plungers in the adjuster unit move freely. If they are stiff or seized, unscrew the two securing nuts from the front of the backplate and remove the complete unit (see Fig. 9.10).
7 Unscrew the adjuster cone and tap out the two plungers. Clean all the components in petrol and allow to dry before reassembly using grease.
8 Do not forget to bend the locking tabs over the adjuster retaining nuts when refitting.
9 Check the brake shoe expander unit for correct operation.
10 If it is necessary to remove the expander unit from the backplate, first remove the clevis pin securing the expander rod fork to the handbrake linkage.
11 Unhook the return spring and remove the rubber dust cover from the front of the backplate.
12 On later models, remove the spring clip securing the expander unit to the backplate (see 9.12).
13 Withdraw the complete expander unit from the backplate.
14 Remove the spring clip and tap out the plungers and rollers from the expander unit. Note that on earlier models steel balls are used in place of rollers and the plungers are retained by split pins.
15 Clean the components in petrol and grease them before reassembling.
16 Reassembling of the brake adjuster unit, expander unit and brake shoes is basically the reverse procedure to removal. Refer to Figs. 9.13 and 9.14) for the correct reassembly of the expander unit and, (on later models) the securing clips.
Note: If difficulty is experienced in removing or refitting any of the transmission brake components it may be necessary to remove the propeller shaft as described in Chapter 7. Then undo the large castle nut and withdraw the output shaft flange complete with drum (see Fig. 9.15).
17 After reassembly, adjust the transmission brake as described in Section 4.

6 Handbrake lever - removal and refitting

1 The handbrake lever can be removed from beneath the vehicle. Ensure the wheels are firmly chocked before commencing work.
2 Remove the clevis pin securing the operating rod to the relay lever.
3 Remove the nut securing the relay lever to the chassis and withdraw the lever (Fig. 9.16). Disconnect the return spring.
4 Remove the two nuts and washers securing the handbrake lever assembly to the chassis bracket.
5 Carefully withdraw the complete handbrake assembly through the aperture in the front of the seat box.
6 Refit the handbrake using the reversal of the removal procedure. If necessary adjust the locknuts on the vertical operating rod as described in Section 4.

7 Wheel cylinders (SWB models) - removal, inspection and refitting

1 The procedure for overhauling either the front or rear wheel cylinders on the SWB models is basically the same.
2 Jack-up the vehicle, support it on stands and remove the roadwheel.
3 Remove the brake drum and shoes as described in Section 3.
4 Before continuing, examine the rubber boots on each end of the wheel cylinder for fluid leakage then get someone to gently press the footbrake, and check that the pistons push the shoes outwards and return fully. Do not push the pedal too far down as the piston may be ejected from the cylinder and it will become necessary to bleed the system after refitting it.
5 Disconnect the brake pipe from the rear side of the wheel cylinder. Note that the front brakes are fitted with a flexible pipe and this must first be disconnected from the pipe union on the side of the chassis member (see Fig. 9.17).
6 Plug the ends of the hydraulic pipes to reduce fluid loss.
7 Remove the two retaining nuts and withdraw the complete wheel cylinder from the backplate.
8 Withdraw the rubber boots, pistons, seals and spring from the wheel cylinder making a careful note of the assembly order (Fig. 9.18).
9 Inspect the surfaces of the pistons and cylinder bores. If any scoring or 'bright' wear areas are evident, renew the complete assembly.
10 If the components are in good condition, discard the rubber seals and obtain new ones in the form of a repair kit.
11 Install the new seals using the fingers only to manipulate them into position. Dip the pistons into clean hydraulic fluid before installing them and then fit the dust excluders.
12 Installation is a reversal of removal but make sure that the locating boss on the cylinder body is engaged correctly in the hole in the backplate.
13 Refit the brake shoes and drum and bleed the system as described in Section 18.
14 Refit the roadwheel, adjust the brakes and lower the vehicle to the ground.

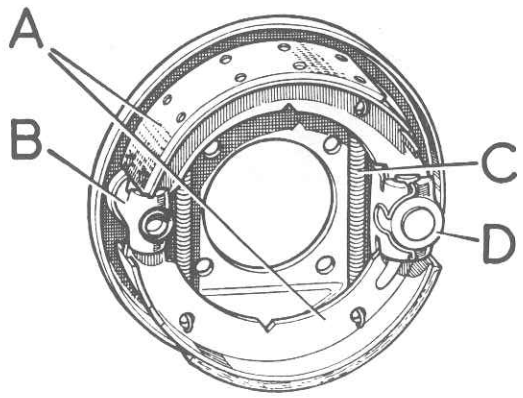


Fig. 9.9. Transmission brake assembly

A Brake shoes
B Adjuster unit
C Brake shoe return springs
D Expander unit

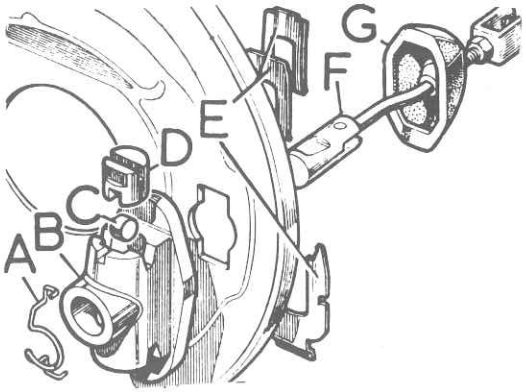


Fig. 9.12. Transmission brake expander assembly

A Spring clip
B Housing
C Roller
D Plunger
E Fixings for expander unit
F Operating rod
G Rubber dust excluder

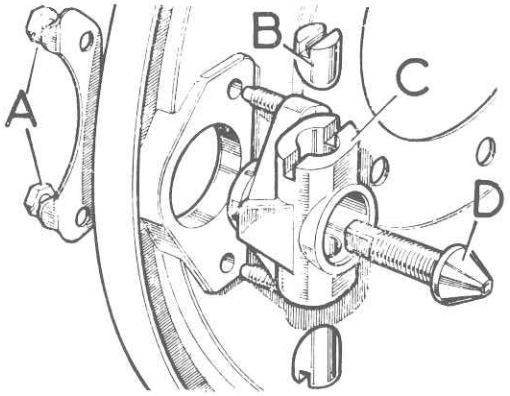


Fig. 9.10. Transmission brake adjuster assembly

A Securing nuts
B Plungers
C Housing
D Adjuster cone

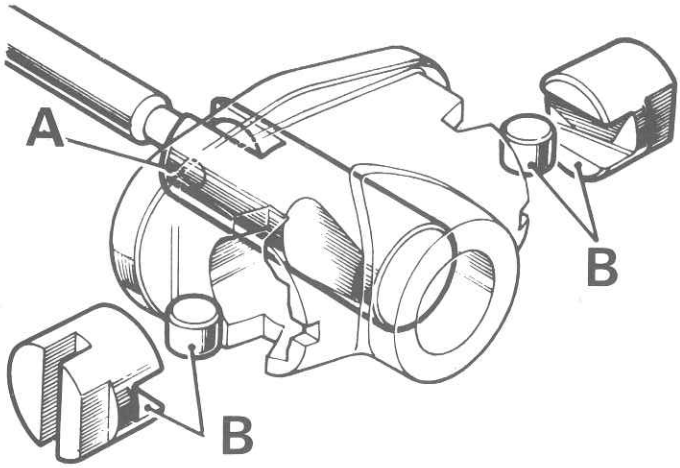


Fig. 9.13. Correct assembly of expander rod and plungers

A Expander rod
B Plunger and rollers

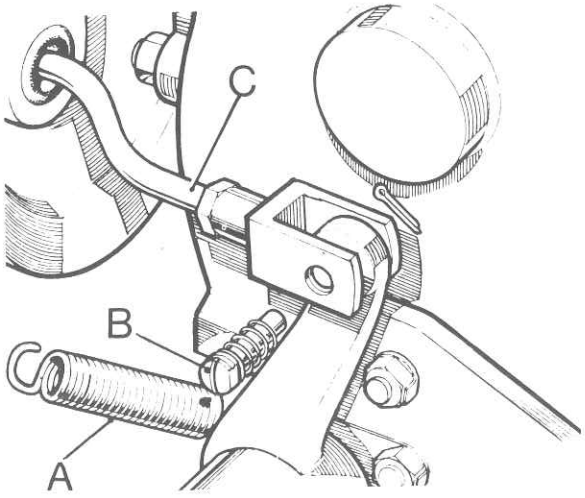


Fig. 9.11. Transmission brake operating rod

A Return spring
B Clevis pin
C Operating rod

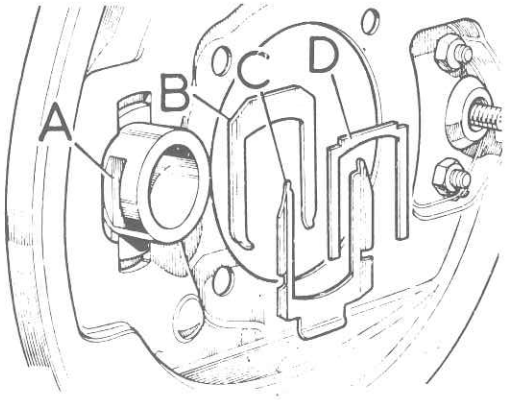


Fig. 9.14. Expander unit retaining plates (later models)

A Expander housing
B Packing piece
C Locking plate
D Retaining spring

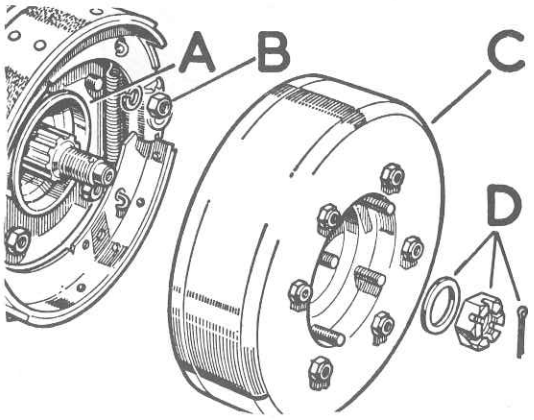


Fig. 9.15. Transmission brake drum and output drive flange removed

A Brake anchor plate
B Anchor plate securing nuts
C Brake drum and flange
D Securing nut

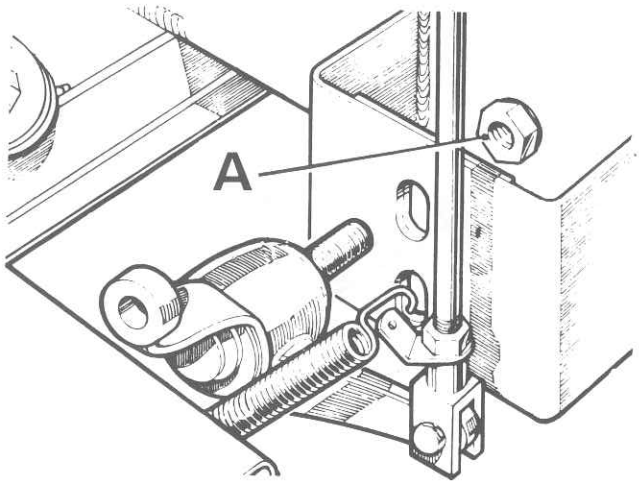


Fig. 9.16. Handbrake relay lever

A Securing nut

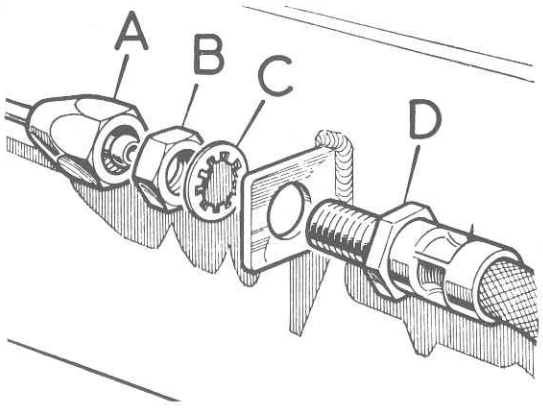


Fig. 9.17. Flexible brake hose connection

A Pipe from master cylinder
B Locknut
C Shakeproof washer
D Flexible brake pipe

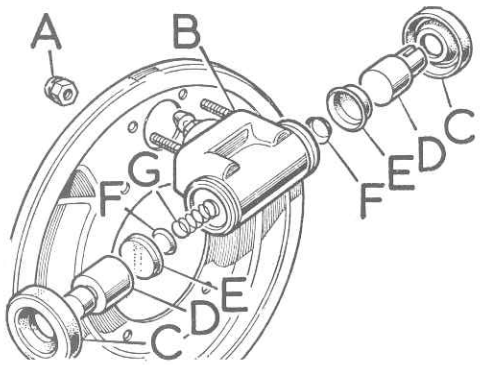
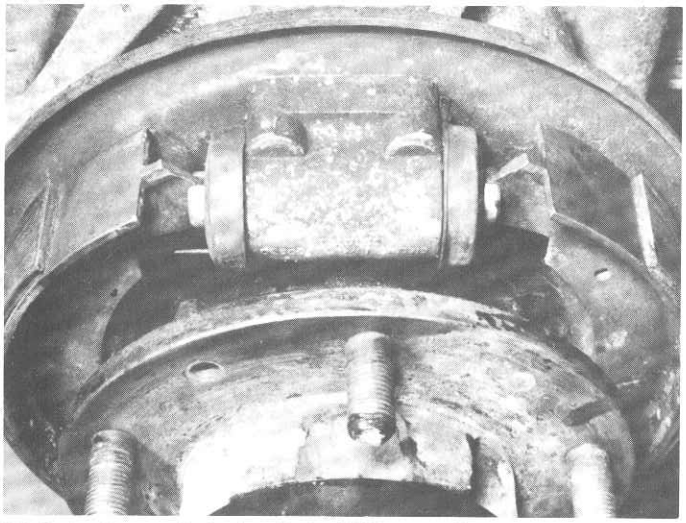


Fig. 9.18. Wheel cylinder components (SWB models)

A Fixings for wheel cylinder
B Wheel cylinder
C Dust cover
D Piston
E Seal
F Support for seal
G Spring



7.3 Brake shoes and wheel cylinder (SWB models)

8 Wheel cylinders (LWB models) - removal, inspection and refitting

1 The front brakes of the LWB model are fitted with two single piston wheel cylinders while the rear brakes have a single, twin piston wheel cylinder. The overhaul procedure for both types of cylinder is basically the same, but any differences will be detailed where necessary.
2 Remove the brake drum and shoes as described in Section 3.
3 Check the wheel cylinder(s) for leaks or faulty operation as described in Section 7, paragraph 4.
4 Disconnect the brake pipe from the rear wheel cylinder. In the case of the front wheels, remove the crossfeed pipe from each wheel cylinder and then disconnect the flexible hose from the chassis union first before unscrewing the other end from the wheel cylinder.
5 Plug the ends of the hydraulic pipes to reduce fluid loss.
6 Remove the securing nuts and withdraw the wheel cylinder(s) from the backplate.
7 Referring to Fig. 9.19 (front cylinder) or Fig. 9.20 (rear cylinder) as appropriate, remove the pistons, seals and spring from the wheel cylinder. Note that the rear cylinder fitted to the Series IIA model is exactly the same as that fitted to the SWB model (see Section 7, Fig. 9.18).
8 Examine the pistons and cylinders for wear and then fit new seals as described in Section 7, paragraphs 9 to 11 inclusive.
9 Refit the wheel cylinder(s) using the reversal of the removal procedure. Check the operation of the brake adjuster and if necessary, remove, clean and lubricate the plungers and threaded adjuster cone (see Fig. 9.21).
10 Refit the brake shoes and drum, and bleed the system as described in Section 18.
11 Refit the roadwheel, adjust the brakes and lower the vehicle to the ground.

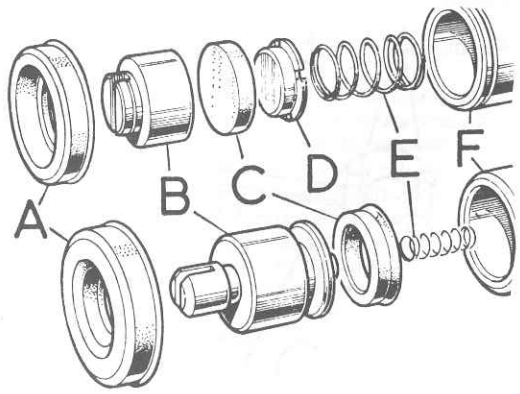


Fig. 9.19. The two types of piston and seals fitted in the front wheel cylinders of the LWB models

A Dust cover
B Piston
C Seal for piston
D Support for seal
E Spring
F Wheel cylinder

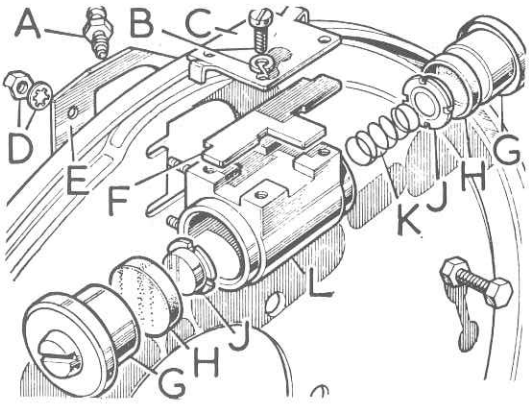


Fig. 9.20. Wheel cylinder assembly fitted to the rear brakes of LWB models

A Bleed nipple
B Screws for retainer
C Retainer for abutment plate
D Nuts for dust cover
E Dust cover
F Abutment plate for shoes
G Piston
H Seal for piston
J Support for seal
K Spring
L Wheel cylinder

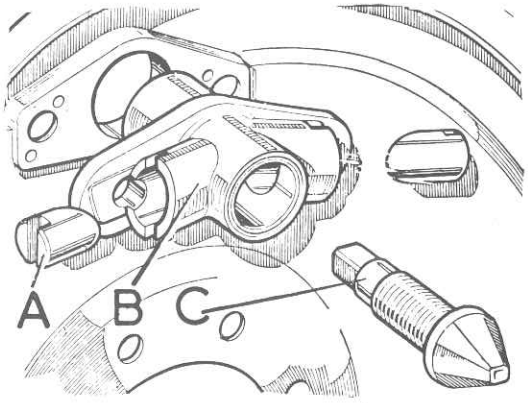


Fig. 9.21. Rear wheel brake adjuster (Series II, LWB)

A Plunger
B Adjuster housing
C Adjuster cone

9 Master cylinder - removal and refitting

1 Three different types of master cylinder have been fitted to the Land Rover. The Series II and IIA models are equipped with either the centre valve (CV) type or the compression barrel (CB) type (see Fig. 9.22).
2 Series III models are fitted with either the CV type or, on later models the dual system type (see Fig. 9.23). The latter type is fitted in conjunction with a servo unit.

CB type master cylinder

3 With a suitable container in readiness, remove the brake and clutch pipe unions from the combined fluid reservoir and allow the fluid to drain into the container.
4 Remove the single securing nut and lift the reservoir off the bracket.
5 Disconnect the two hydraulic pipes from the master cylinder.
6 From inside the vehicle, remove the brake pedal return spring and unscrew the bolts securing the pedal bracket to the bulkhead (see Fig. 9.24).
7 Withdraw the bracket and master cylinder from the engine compartment manoeuvring it as necessary to enable the pedal to pass through the bulkhead aperture.
8 Remove the top cover and gasket from the bracket.
9 Remove the nut and washer securing the master cylinder pushrod to the brake pedal trunnion. Remove the two nuts and bolts securing the cylinder to the bracket and withdraw the complete cylinder (see Fig. 9.25).
10 Refit the master cylinder and bracket using the reversal of the removal procedure. Adjust the pushrod nuts to obtain 1/16 in (1.5 mm) free-play on the pushrod (see Fig. 9.26).
11 Refit the fluid reservoir and bleed the brakes as described in Section 18.

CV type master cylinder (without servo unit)

12 Drain and remove the fluid reservoir as described in paragraph 3 of this Section.
13 Disconnect the two hydraulic pipes from the master cylinder.
14 Remove the top cover and gasket from the brake pedal bracket.
15 Undo the master cylinder pushrod nut and the two flange nuts and withdraw the cylinder rearwards from the bracket.
16 Refit the master cylinder using the reverse procedure. Adjust the pushrod nuts as shown in Fig. 9.26.
17 Refit the fluid reservoir and bleed the brakes.

CV type and dual master cylinder (with servo unit)

18 Disconnect the hydraulic pipe(s) from the master cylinder.
19 Remove the two securing nuts and washers and withdraw the complete master cylinder and reservoir assembly from the servo unit.
20 Refit using the reverse procedure and bleed the brakes as described in Section 18.

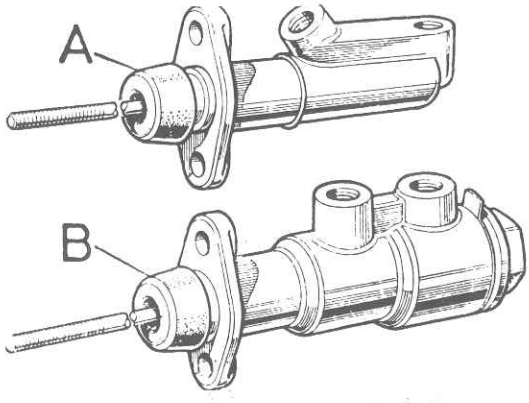


Fig. 9.22. Two types of master cylinder fitted to earlier models

A 'CV' type
B 'CB' type

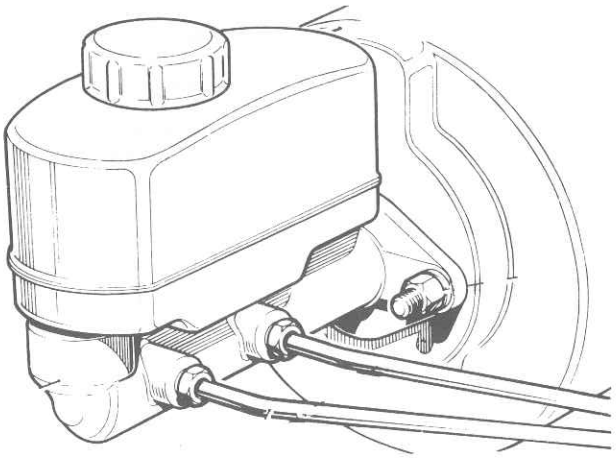


Fig. 9.23. Later type of dual master cylinder

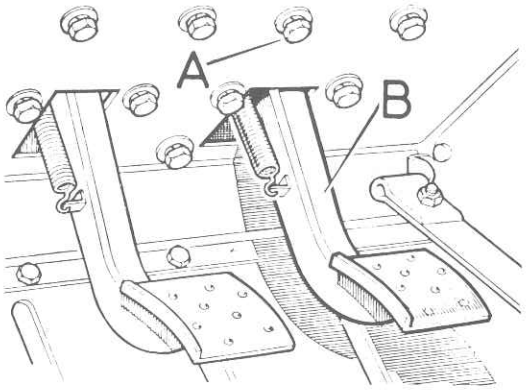


Fig. 9.24. Brake pedal attachment bolts

A Securing bolts *B Brake pedal*

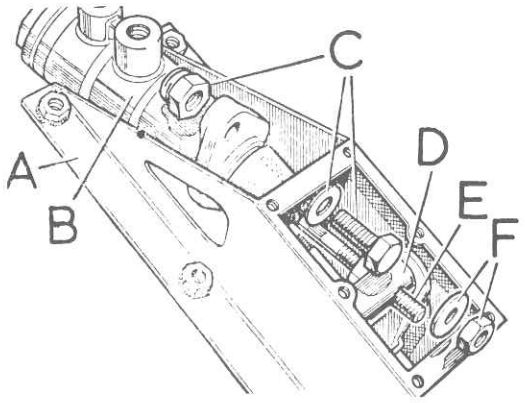


Fig. 9.25. Removing the CB type master cylinder

A Brake pedal bracket
B Master cylinder
C Securing nuts
D Brake pedal trunnion
E Pushrod
F Pushrod securing nuts

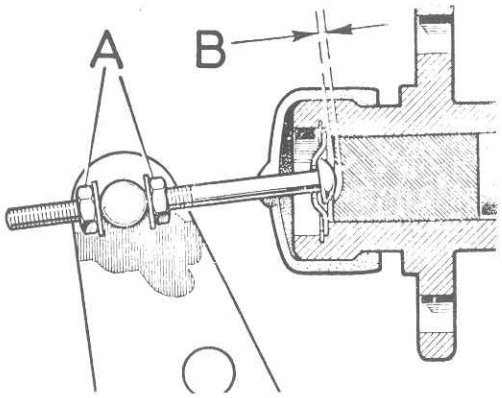


Fig. 9.26. Master cylinder pushrod adjustment

A Adjusting nuts *B Free-play - 1/16 in (1.5 mm)*

10 Master cylinder - overhaul

CB type master cylinder

1 With the master cylinder on the bench, remove the nut from the pushrod and prise off the rubber cover from the end of the cylinder.
2 Remove the circlip from inside the end of the cylinder and withdraw the pushrod and retaining washer.
3 Gently tap the cylinder on a wooden block until the piston emerges from the cylinder. Withdraw the piston and spring (Fig. 9.28).
4 Turning to the other end of the cylinder unscrew the end cap and remove the recuperating seal assembly (Fig. 9.29).
5 Examine the piston and cylinder bore surfaces for scoring or 'bright' wear areas. Where these are evident, renew the complete master cylinder.
6 If the components are in good order, discard the seals and obtain new ones, preferably in the form of a repair kit.
7 Lubricate the new seals and the cylinder barrel with brake fluid and fit the seal into the piston groove with the larger outside diameter of the seal facing away from the pushrod end of the piston (see Fig. 9.30).
8 Insert the piston into the cylinder taking care not to pinch the seal. Refit the pushrod, retaining washer and circlip.
9 Fit the washer and seal into the other end of the cylinder making sure that the flat face of the seal faces the piston (see Fig. 9.31).
10 Insert the spring into the centre bore of the piston and refit the seal support, gasket and end cap and tighten the cap.
11 Smear some rubber grease inside the rubber cover and fit it over the pushrod and cylinder.
12 Refit the master cylinder to the vehicle as described in Section 9.

CV type master cylinder

13 The CV type master cylinder is exactly the same as the clutch master cylinder and the overhaul procedure and illustrations given in Chapter 5 should be used when servicing this type of master cylinder.

Dual type master cylinder

14 Undo and remove the two screws holding the reservoir to the cylinder body. Lift away the reservoir. Using a suitable sized Allen key or wrench unscrew the tipping valve nut and lift away the seal. Using a suitable diameter rod, push the primary plunger down the bore, this operation enabling the tipping valve to be withdrawn (see Fig. 9.32).
15 Using a compressed air jet, carefully applied to the rear outlet pipe connection, blow out all the master cylinder internal components. Alternatively, shake out the parts. Take care that adequate precautions are taken to ensure all parts are caught as they emerge.
16 Separate the primary and secondary plungers from the intermediate spring. Use the fingers to remove the gland seal from the primary plunger.
17 The secondary plunger assembly should be separated by lifting the thimble leaf over the shouldered end of the plunger. Using the fingers, remove the seal from the secondary plunger.

18 Depress the secondary spring, allowing the valve stem to slide through the keyhole in the thimble, thus releasing the tension in the spring.
19 Detach the valve spacer, taking care of the spring washer which will be found located under the valve head.
20 Examine the bore of the cylinder carefully for scores, ridges or excessive wear. If the bore is found to be completely smooth, with only negligible wear, new seals can be fitted. If, however, there is any doubt about the condition of the bore, fit a new cylinder.
21 Thoroughly clean all parts in either fresh hydraulic fluid or methylated spirits. Ensure that the bypass ports are clear.
22 All components should be assembled wet by dipping in clean brake fluid. Using fingers only, fit new seals to the primary and secondary plungers, ensuring that they are the correct way round. Place the dished washer with the dome against the underside of the valve seat. Hold it in position with the valve spacers ensuring that the legs face towards the valve seal.
23 Refit the plunger return spring centrally on the spacer, insert the thimble into the spring and depress until the valve stem engages in the keyhole of the thimble.
24 Insert the reduced end of the plunger into the thimble, until the thimble engages under the shoulder of the plunger, and press home the thimble leaf. Refit the intermediate spring between the primary and secondary plungers.
25 Check that the master cylinder bore is clean and smear with clean brake fluid. With the complete assembly suitably lubricated with brake fluid, carefully insert the assembly into the bore. Ease the lips of the plunger seals carefully into the bore. Push the assembly fully home.
26 Refit the tipping valve assembly and seal into the cylinder and tighten the securing nut. Refit the fluid reservoir and tighten the two retaining screws.
27 The master cylinder can now be refitted to the vehicle as described in Section 9.

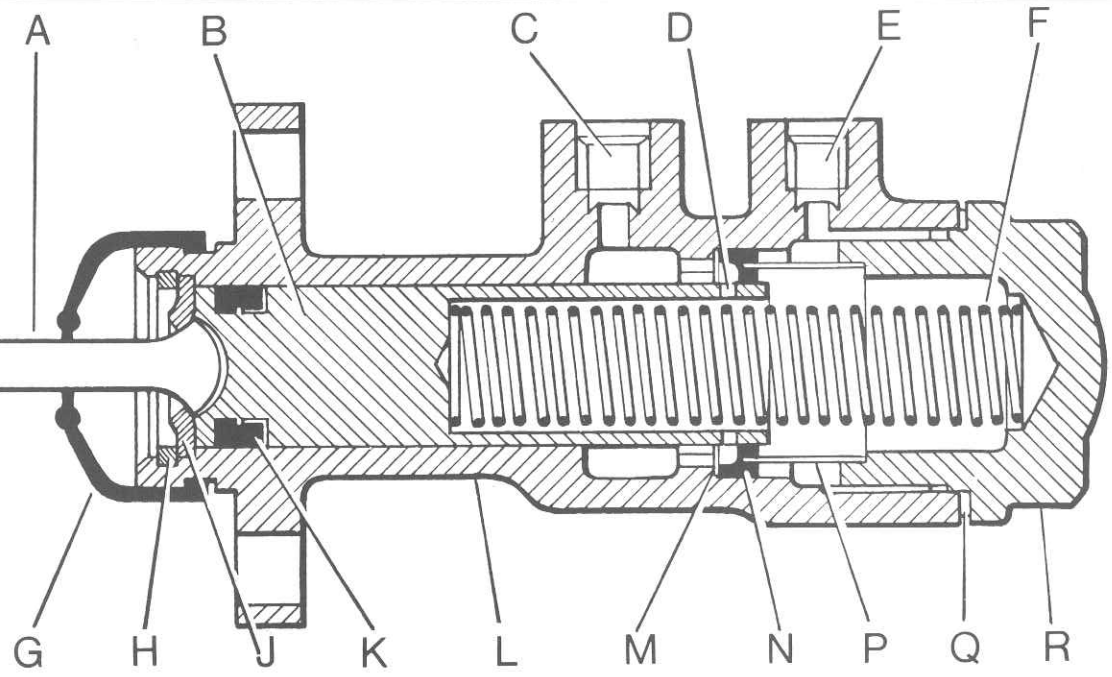


Fig. 9.27. Sectional view of CB type master cylinder

A Pushrod
B Piston
C Inlet from reservoir
D Inlet ports
E Outlet to wheel cylinders
F Piston spring
G Dust cover
H Circlip
J Retaining washer
K End seal
L Cylinder
M Shim
N Recuperating seal
P Seal support
Q Gasket
R End cap

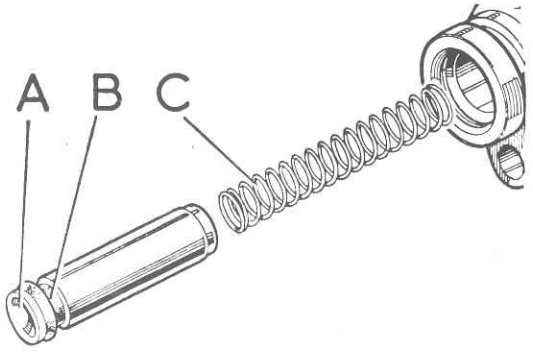


Fig. 9.28. Removing the piston and spring from master cylinder (CB type)

A Seal
B Piston
C Spring

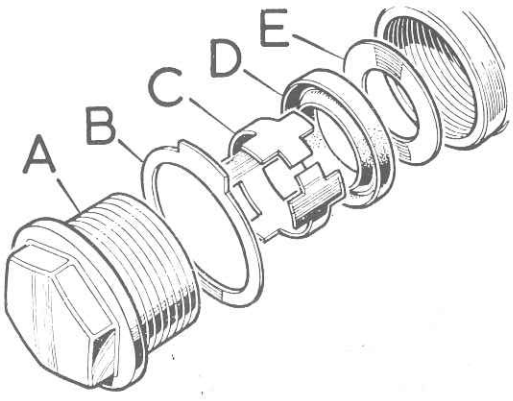


Fig. 9.29. End cap assembly (CB type)

A End cap
B Gasket for end cap
C Support for seal
D Recuperating seal
E Shim

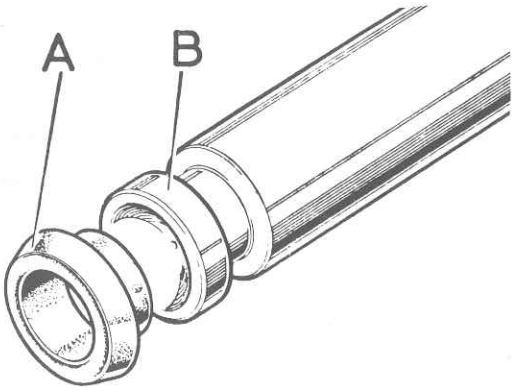


Fig. 9.30. Correct location of piston seal

A Seal *B Piston*

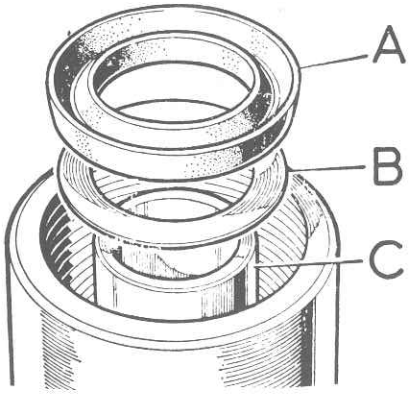


Fig. 9.31. Correct location of recuperating seal

A Seal *C Piston*
B Shim

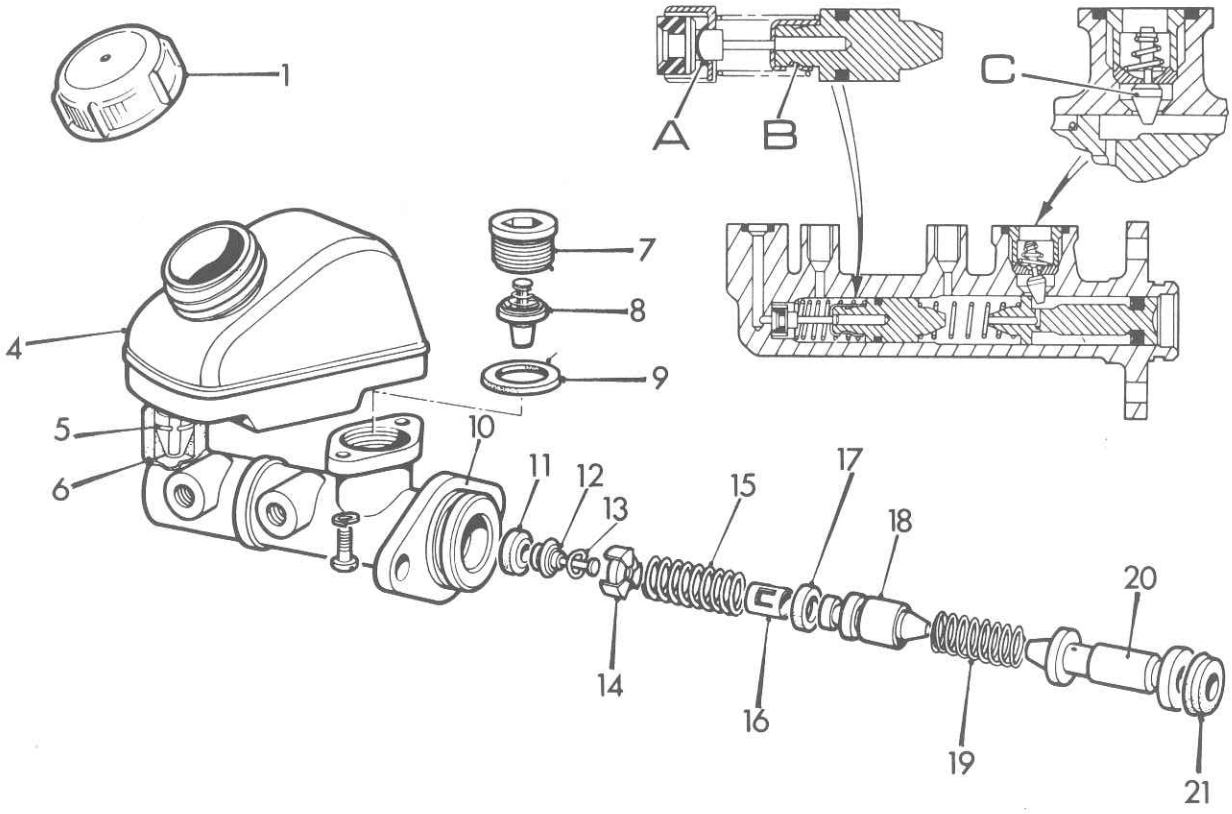


Fig. 9.32. Dual master cylinder components

1 Filler cap
4 Reservoir - dual
5 Circlip - internal
6 Seal
7 Securing nut
8 Tipping valve
9 Face seal
10 Cylinder body
11 Valve seal
12 Valve stem
13 Spring washer - curved
14 Valve spacer
15 Secondary spring
16 Spring retainer
17 Seal
18 Secondary plunger
19 Intermediate spring (black)
20 Primary plunger
21 Gland seal

A Correct assembly of spring washer in centre valve
B Leaf of spring retainer

C As the brakes are applied the primary plunger moves down the cylinder and allows the tipping valve (C) to close the primary supply port. The assembly shows the unit in the off position

11 Servo unit - description

The vacuum servo unit is fitted into the brake hydraulic circuit in series with the master cylinder to provide assistance to the driver when the brake pedal is depressed. This reduces the effort required by the driver to operate the brakes under all braking conditions.
The unit operates by vacuum obtained from the induction manifold and comprises, basically, a booster diaphragm, control rod, slave cylinder and non-return valve.

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

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

Under normal operation conditions the vacuum servo unit is very reliable and does not require overhaul except at very high mileage. In this case it is necessary to obtain a service exchange unit, rather than attempt to repair the orginal unit.

12 Servo unit - removal and refitting

1 Refer to Section 9 and remove the master cylinder from the servo unit.
2 Slacken the clip and disconnect the vacuum hose from the servo unit non-return valve.
3 Remove the screws securing the switch plate to the top of the pedal box and lift off the switch and plate (see Fig. 9.34).
4 Prise out the rubber plugs either side of the pedal box. Remove the split pin and withdraw the clevis pin securing the servo rod to the brake pedal.
5 Remove the four nuts and washers securing the servo unit to the pedal box and lift away the complete servo unit.
6 Refitting the servo unit is the reverse sequence to removal. It will be necessary to bleed the brakes as described in Section 18.

13 Servo unit non-return valve - removal and refitting

1 The servo unit should not be completely dismantled so if it develops an internal fault it should be renewed. Even if the unit is dismantled there would probably be extreme difficulty in obtaining spare parts. The only two service operations that may be carried out are renewing the non-return valve (this Section) and the air filter (Section 14).
2 To renew the non-return valve first detach the vacuum hose from the valve union.
3 Note the angle of the valve union and then insert a wide blade screwdriver between the valve and grommet. Pull on the valve whilst twisting the screwdriver to release it from the body.
4 Recover the grommet.
5 Refitting the grommet and valve is the reverse sequence to removal. Lubricate the ribs of the valve with a little rubber grease.

14 Servo unit filter - removal and refitting

1 Carefully pull back the dust cover and then ease the filter retainer from the servo neck.
2 Using a small screwdriver ease out the filter. Cut it in half and lift away.
3 Cut a new filter diagonally to the centre hole, fit it over the pushrod and carefully ease it into the housing.
4 Refit the filter retainer and dust cover.

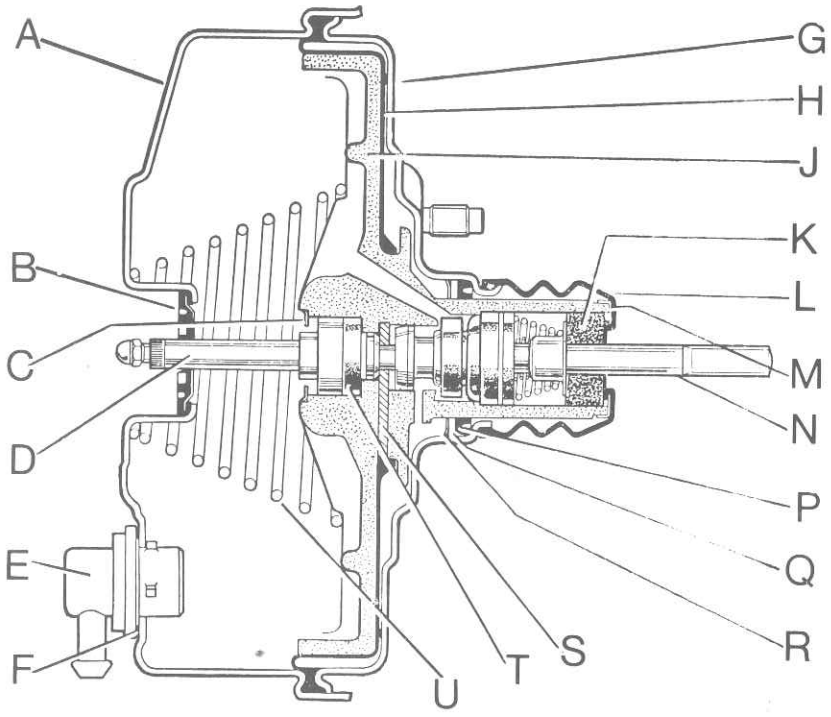


Fig. 9.33. Sectional view of servo unit

A Front shell
B Seal and plate assembly
C Retainer sprag washer
D Hydraulic pushrod
E Non-return valve
F 'O' ring
G Rear shell
H Diaphragm
J Diaphragm plate
K Filter
L Dust cover
M End cap
N Valve operating rod assembly
P Seal
Q Bearing
R Retainer
S Valve retaining plate
T Reaction disc
U Diaphragm return spring

15 Brake failure valve (dual braking system only) - removal, inspection and refitting

1 On vehicles fitted with the dual braking system (Series III models) a brake failure valve and switch is located inside the engine compartment on the RH side chassis member. The unit is basically a two-way shuttle valve through which the front and rear brake lines pass.
2 In the event of a leakage in either the front or rear braking system, the faulty system is cut off but hydraulic braking pressure is maintained in the remaining system. At the same time, the switch on the valve is actuated by the movement of the piston and the brake warning light on the instrument panel will illuminate.
3 To test the valve switch, remove the wire from the switch terminal and earth it against the valve body, with the ignition switched on. The brake warning lamp will illuminate.
4 To remove the valve unit, disconnect the five hydraulic pipe unions, detach the switch wire and remove the single retaining bolt. Lift the unit away from the chassis member.
5 Referring to Fig. 9.36, remove the switch and ball, and the two end plugs.
Using a soft drift, carefully push out the two-part piston.
6 Examine the piston and valve bore for signs of scoring and if evident, renew the affected component.
7 Dip some new seals in brake fluid and fit them to the piston using the fingers only.
8 Fit the pistons back into the valve bore ensuring they are the correct way round.
9 Refit the ball and switch ensuring the ball is located in the piston groove.
10 Screw on the end cap and union and tighten them. Refit the valve unit to the vehicle using the reverse procedure to removal.
11 Bleed the brake system as described in Section 18.
12 The valve must now be reset. First apply the brake pedal hard and the warning light should go out, and stay out, even when the brake pedal is released.
13 Should the light not go out, the pressure in the system is unbalanced and the valve or the switch should be checked for correct operation.
14 If the brake failure warning light is off, check that the bulb is in order. Press the test-push and the light should glow.
15 Apply pressure to the brake pedal. The warning light will remain off if the hydraulic system is functioning satisfactorily and will come on to indicate hydraulic failure in one side of the system.

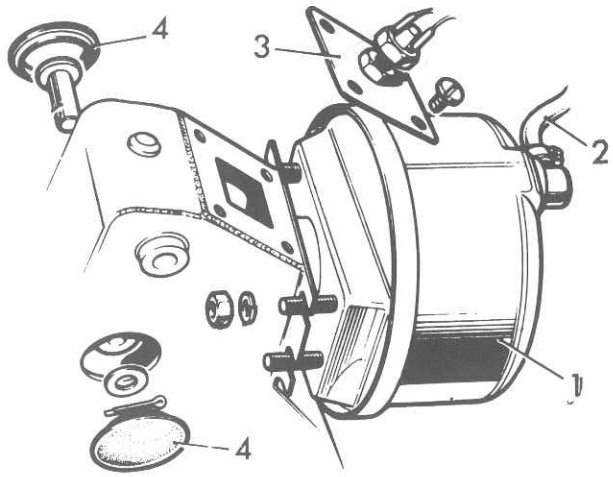


Fig. 9.34. Removing the servo unit

1 *Servo unit*
2 *Vacuum pipe*
3 *Brake switch*
4 *Rubber plugs*

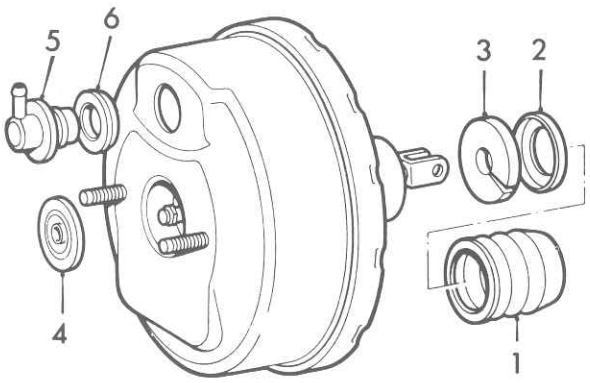


Fig. 9.35. Servo unit components

1 *Rubber dust cover*
2 *Retainer*
3 *Filter*
4 *Grommet*
5 *Non-return valve*
6 *Grommet*

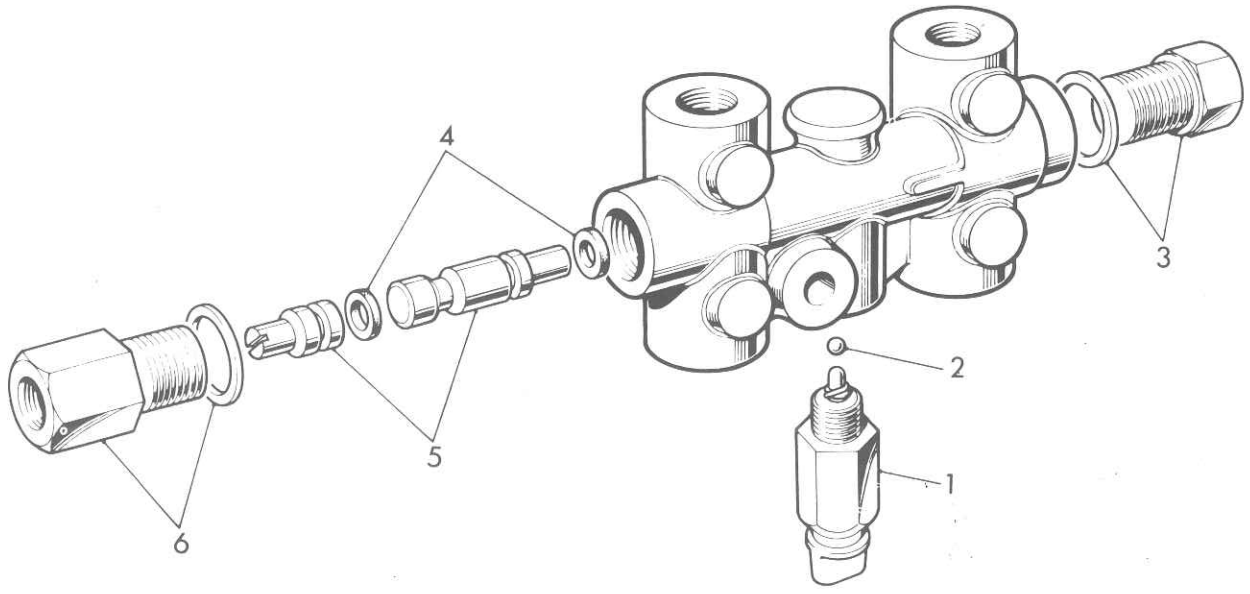


Fig. 9.36. Brake failure valve (dual braking system)

1 *Switch*
2 *Switch ball*
3 *End plug and gasket*
4 *Seals*
5 *Pistons*
6 *End union and gasket*

16 Brake pedal - removal and refitting

1 Referring to Section 9, paragraphs 3 to 9 inclusive, remove the complete brake pedal and bracket.
2 Using a suitable punch, drive out the pin securing the pedal shaft to the bracket. Remove the shaft and withdraw the pedal complete with bushes and trunnion (see Fig. 9.37).
3 Examine the bushes and shaft for wear and renew if necessary. Note that new bushes must be reamed to 0.750 in (15.875 mm) before fitting.
4 Grease the pedal shaft and bushes and refit using the reverse procedure to removal.
5 Bleed the brake system and adjust the pedal height and pushrod free-play to the dimensions shown in Fig. 9.38.

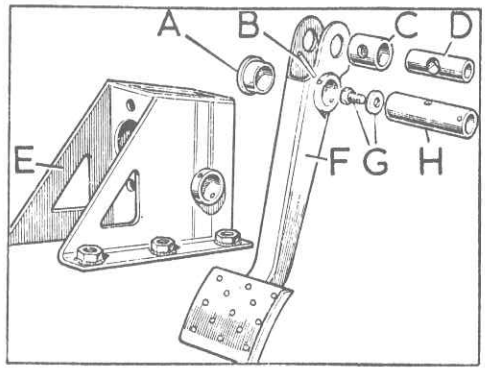


Fig. 9.37. Brake pedal assembly

A Bush for pedal
B Pin for pedal shaft
C Distance piece
D Trunnion for pedal
E Bracket for brake pedal
F Brake pedal
G Oil plug and washer
H Shaft for pedal

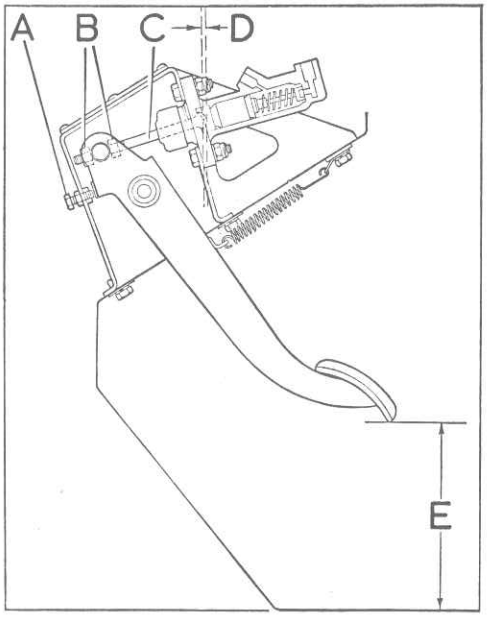


Fig. 9.38. Setting the brake pedal height

A Pedal stop
B Locknuts for master cylinder pushrod
C Master cylinder pushrod
D 1/16 in (1.5 mm)
E Pedal height 6¼ in (158 mm)

17 Hydraulic pipes and hoses - general

1 Carefully examine all brake pipes/hoses, pipe hose connections and unions, periodically.
2 First examine for signs of leakage where the pipe unions occur. Then examine the flexible hoses for signs of chafing and fraying and, of course, leakage. This is only a preliminary part of the flexible hose inspection, as exterior condition does not necessarily indicate the interior condition, which will be considered later.
3 The steel pipes must be examined carefully and methodically. They must be cleaned off and examined for any signs of dents, corrosion or other damage and corrosion should be scraped off and, if the depth of pitting is significant, the pipes will need renewal. This is particularly likely in those areas underneath the vehicle body where the pipes are exposed and unprotected.
4 If any section of pipe is to be taken off, first wipe and then remove the fluid reservoir cap and place a piece of polythene over the reservoir neck. Refit the cap, this will stop syphoning during subsequent operations.
5 Rigid pipe removal is usually quite straightforward. The unions at each end are undone, the pipe and union pulled out, and the centre sections of the pipe removed from the body clips. Where the pipes are exposed to the full force of road and weather they can sometimes be very tight. As one can only use an open ended spanner and the unions are not large, burring of the flats is not uncommon when attempting to undo them. For this reason a self-locking grip wrench (mole) is often the only way to remove a stubborn union.
6 To remove a flexible hose, wipe the unions and bracket free from dust and undo the union nut from the metal pipe end.
7 Detach the hose from the bracket, be it either a clip or locknut.
8 The flexible hose may now be unscrewed from its attachment.
9 With the flexible hose removed, examine the internal bore. If it is blown through first, it should be possible to see through it. Any specks of rubber which come out, or signs of restriction in the bore, mean that the rubber lining is breaking up and the pipe must be renewed.
10 Rigid pipes which need renewing can usually be purchased at any garage where they have the pipe, unions and special tools to make them up. All they need to know is the total length of the pipe, the type of flare at each end with the union, and the length and thread of the union.
11 Refitment of the pipe is a straightforward reversal of the removal procedure. If the rigid pipes have been made up it is best to get all the 'sets' (bends) in them before trying to install them. Also, if there are any acute bends, ask your supplier to put these in for you on a special tube bender, otherwise you may kink the pipe and thereby decrease the bore area and fluid flow.
12 With the pipes refitted, remove the polythene from the reservoir cap and bleed the system as described in Section 18.

18 Bleeding the hydraulic system

Whenever the brake hydraulic system has been overhauled, partially renewed, or the level in the reservoir becomes too low, air will have entered the system necessitating bleeding. During the operation, the level of hydraulic fluid in the reservoir should not be allowed to fall below half full, otherwise air will be drawn into the system again.
1 Obtain a clean and dry glass jar, plastic tubing at least 15 inches (40 cm) long and of suitable diameter to fit tightly over the bleed screw, and a supply of hydraulic fluid.
2 Fill the master cylinder reservoir and the bottom inch of the jar with hydraulic fluid. Take extreme care that no fluid is allowed to come into contact with the paintwork as it acts as a solvent and will damage the finish.
3 **Single master cylinder type system:** Start bleeding at the front bleed screw which is furthest from the master cylinder and finish at the rear brake nearest to the master cylinder. The correct sequence is as follows: Front left, front right, rear left and rear right.
4 **Tandem master cylinder type system:** Bleed the system supplied by the secondary master cylinder chamber first. Commence bleeding at the front bleed screw and then bleed the diagonally opposite rear brake. The correct sequence is as follows: Front right, rear left, front left and rear right.
5 **All models:** Having decided the procedure open the first bleed screw about three quarters of a turn. Place one end of the bleed tube over the bleed nipple and submerge the other end of the tube in the fluid in the jar. **Note:** The end of the tube must remain submerged, throughout the bleeding operation.
6 An assistant should now pump the brake pedal by first depressing it one full stroke followed by three short but rapid strokes and

allowing the pedal to return of its own accord. Check the fluid level in the reservoir. Carefully watch the flow of fluid into the glass jar and, when air bubbles cease to emerge with the fluid during the next down stroke, tighten the bleed screw. Remove the plastic bleed tube and tighten the bleed screw. Do not overtighten. Refit the rubber dust cap supplied. Top up the fluid in the reservoir.

7 Continue bleeding the hydraulic system until all four units have been bled.

8 Sometimes it may be found that the bleed operation for one or more cylinders is taking a considerable time. The cause is probably air being drawn past the bleed screw threads when the screw is loose. To counteract this condition, it is recommended that at the end of each downward stroke the bleed screw be tightened to stop air being drawn past the threads.

9 If, after the bleed operation has been completed, the brake pedal operation still feels spongy, this is an indication that there is still air in the system, or that the master cylinder is faulty.

10 **Brake failure valve (dual line systems only).** Should it be noticed that during the bleed operation and with the ignition switched on the warning light glows, the bleed operation must be continued until all traces of air are removed. Ascertain which wheel caused the light to glow and then attach a tube to the bleed screw at the opposite end of the vehicle and open the bleed screw. Slowly depress the brake pedal and, when the light goes out, release the pedal and tighten the bleed screw.

11 Check and top up the reservoir fluid level with fresh hydraulic fluid. Never re-use old brake fluid. Finally, check the drum brake adjustment.

19 Fault finding - braking system

Before diagnosing faults from the following chart, check that any braking irregularities are not caused by:

1 Uneven and incorrect tyre pressures.
2 Incorrect 'mix' of radial and cross-ply tyres.
3 Wear in the steering mechanism.
4 Defects in the suspension and dampers.
5 Misalignment of the body frame.

Symptoms	Reason/s	Remedy
Pedal travels a long way before the brakes operate	Brake shoes set too far from the drums	Adjust the brake.
Stopping ability poor, even though pedal pressure is firm	Linings and/or drums badly worn or scored	Dismantle, inspect and renew as required.
	Failure of one circuit, dual hydraulic system	Check both circuits for hydraulic leaks and repair.
	One or more wheel hydraulic cylinders seized, resulting in some brake shoes not pressing against the drums	Dismantle and inspect wheel cylinders. Renew as necessary.
	Brake linings contaminated with oil	Renew linings and repair source of oil contamination.
	Wrong type of linings fitted (too hard)	Verify type of material which is correct for the vehicle, and fit it.
	Brake shoes wrongly assembled	Check for correct assembly.
	Servo unit not functioning (if fitted)	Check and repair as necessary.
Vehicle veers to one side when the brakes are applied	Brake linings on one side are contaminated with oil	Renew linings and stop oil leak.
	Hydraulic wheel cylinder(s) on one side partially or fully seized	Inspect wheel cylinders for correct operation and renew as necessary.
	A mixture of lining materials fitted between sides	Standardise on type of lining fitted.
	Unequal wear between sides caused by partially seized wheel cylinders	Check wheel cylinders and renew linings and drums as required.
Pedal feels spongy when the brakes are applied	Air is present in the hydraulic system	Bleed the hydraulic system and check for any signs of leakage.
Pedal feels springy when the brakes are applied	Brake linings not bedded into the drums (after fitting new ones)	Allow time for new linings to bed in after which it will certainly be necessary to adjust the shoes to the drums as pedal travel will have increased.
	Master cylinder or brake backplate mounting bolts loose	Retighten mounting bolts.
	Severe wear in brake drums causing distortion when brakes are applied	Renew drums and linings.
Pedal travels right down with little or no resistance and brakes are virtually non-operative. (With dual braking systems this would be extraordinary as both systems would have to fail at the same time).	Leak in hydraulic systems resulting in lack of pressure for operating wheel cylinders	Examine the whole of the hydraulic system and locate and repair source of leaks. Test after repairing each and every leak source.
	If no signs of leakage are apparent all the master cylinder internal seals are failing to sustain pressure	Overhaul master cylinder. If indications are that seals have failed for reasons other than wear all the wheel cylinder seals should be checked also and the system completely replenished with the correct fluid.
Binding, juddering, overheating	One or a combination of causes given in the foregoing sections	Complete and systematic inspection of the whole braking system.