



Land Rover
Range Rover

Workshop Bulletin

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RANGE ROVER

LUCAS GIRLING-TYPE 115 SERVO AND MASTER CYLINDER ASSEMBLY

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INTRODUCTION **01**

RANGE ROVER

1987 MODEL YEAR IMPROVEMENTS

INTRODUCTION

As part of the 1987 model year programme Land Rover Ltd are continually looking at ways to improve the quality and characteristics of its products, the introduction of the following components to Range Rover will improve the brake system and also reduce service costs.

The braking system is updated with the introduction of a new type-115 Lucas Girling servo and master cylinder assembly which gives improved brake pedal feel and response by reducing brake pedal effort. The effectiveness of the braking system is now controlled by brake pedal travel.

04 GENERAL SPECIFICATION DATA

BRAKING SYSTEM

Servo/master cylinder

Manufacturer	Lucas Girling
Servo type	LSC 115
Boost ratio	5.6:1
Master cylinder type	25.4mm AS/AS (steel tube construction)
Fluid displacement - Primary	5.16 cm ³
- Secondary	9.17 cm ³
Nominal split	36/64
Unit weight	3.75 Kg
Maximum bleed pressure	2,76 bar (40 lbf/in ²)

06 TORQUE WRENCH SETTINGS

BRAKING SYSTEM

	Nm	lbf ft
Servo assembly to pedal box	22 to 25	16 to 19
Brake pipes to master cylinder	9 to 11	7 to 8
Master cylinder to servo	21 to 29	15 to 22

09 LUBRICANTS, FLUIDS AND CAPACITIES

COMPONENT	SPECIFICATION	AMBIENT TEMPERATURE									
		°C									
		-30	-20	-10	0	10	20	30	40	50	
		°F									
		-22	-4	+14	+32	50	68	86	104	122	
Brake Reservoir	Brake fluid must have a minimum boiling point of 260°C (500°F) and comply with FMVSS/116/DOT4.										

Approved fluids

Castrol/Girling
Automotive Products

K624 DOT4
429S Super DOT4

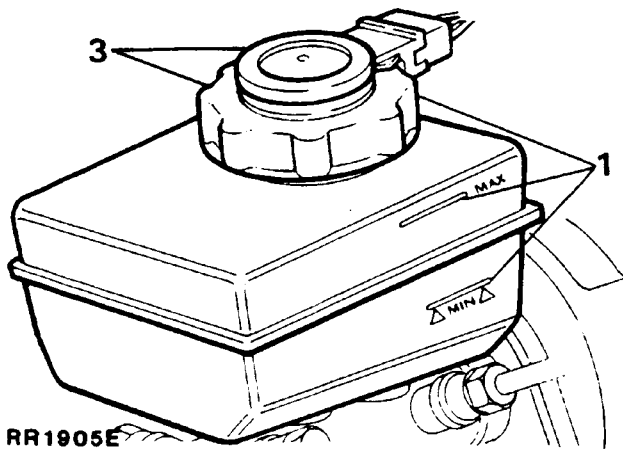
MAINTENANCE SCHEDULE

The fitting of the new Servo and master cylinder does not necessitate the issue of additional Maintenance Schedules, therefore existing schedules should be used and the service intervals adhered to.

CHECK AND TOP UP BRAKE FLUID RESERVOIR

1. Visually check the brake fluid level against the 'MIN' and 'MAX' level markings on the side of the reservoir.
2. If necessary top up with the recommended grade of fluid (refer to section 09 lubricants fluids and capacities) **DO NOT OVERFILL.**
3. Release the cap with combined fluid level switch by rotating anti-clockwise. Withdraw the cap and switch, top up the reservoir.

CAUTION : When topping up the reservoir care should be taken to ensure that the brake fluid does not come into contact with any of the vehicle paintwork. Should this occur, wash the affected area **IMMEDIATELY** with copious amounts of water.



BRAKE SYSTEM**Description**

The hydraulic braking system fitted to Range Rovers is the dual line type, incorporating primary and secondary hydraulic circuits.

NOTE: References made to primary or secondary do not imply main service brakes or emergency brakes but denote hydraulic line identification.

The brake pedal is connected to a vacuum assisted mechanical servo which in turn operates a tandem master cylinder. The front disc brake calipers each house four pistons, the upper pistons are fed by the primary hydraulic circuit, the lower pistons by the secondary hydraulic circuit. The rear disc brake calipers each house two pistons, these are fed by the secondary hydraulic circuit via a pressure reducing valve.

A brake fluid level switch is incorporated into the reservoir cap assembly, the switch having detected either low or sudden fluid loss will immediately illuminate a warning light in the instrument binnacle

The brake fluid reservoir is divided, the section closest to the servo feeds the primary circuit and the section furthest away from the servo feeds the secondary circuit. Under normal operating conditions both the primary and secondary circuits operate simultaneously on brake pedal application. In the event of a failure in the primary circuit the secondary circuit will still function and operate front and rear calipers. Alternatively, if the secondary circuit fails the primary circuit will still function and operate the upper pistons in the front calipers, allowances should be made and vehicle speed adjusted accordingly to allow for the lack of full braking efficiency.

If the servo should fail, both hydraulic circuits will still function but would require greater pedal effort due to the lack of vacuum assistance.

The hand operated transmission brake acts on a brake drum at the rear of the transfer gearbox and is completely independent of the hydraulic circuits.

Brake pad wear sensors are incorporated in the front and rear right hand side inboard brake pads. The sensor will illuminate a brake pad wear warning light in the instrument binnacle, when pad thickness has been reduced to approximately 3mm (0.118 in)

CAUTION: THOROUGHLY CLEAN ALL BRAKE CALIPERS, PIPES AND FITTINGS BEFORE COMMENCING WORK ON ANY PART OF THE BRAKE SYSTEM. FAILURE TO DO SO COULD CAUSE FOREIGN MATTER TO ENTER THE SYSTEM AND CAUSE DAMAGE TO SEALS AND PISTONS WHICH WILL SERIOUSLY IMPAIR THE EFFICIENCY OF THE BRAKE SYSTEM.

To ensure the brake system efficiency is not impaired the following warnings must be adhered to :-

DO NOT use any petroleum (gasoline) based cleaning fluids or any proprietary fluids containing petroleum (gasoline). The preferred fluids are clear methylated spirits or industrial alcohol.

DO NOT use brake fluid previously bled from the system.

DO NOT use old or stored brake fluid.

ENSURE that only new fluid is used and that it is taken from a sealed container.

DO NOT flush the brake system with any fluid other than the recommended brake fluid.

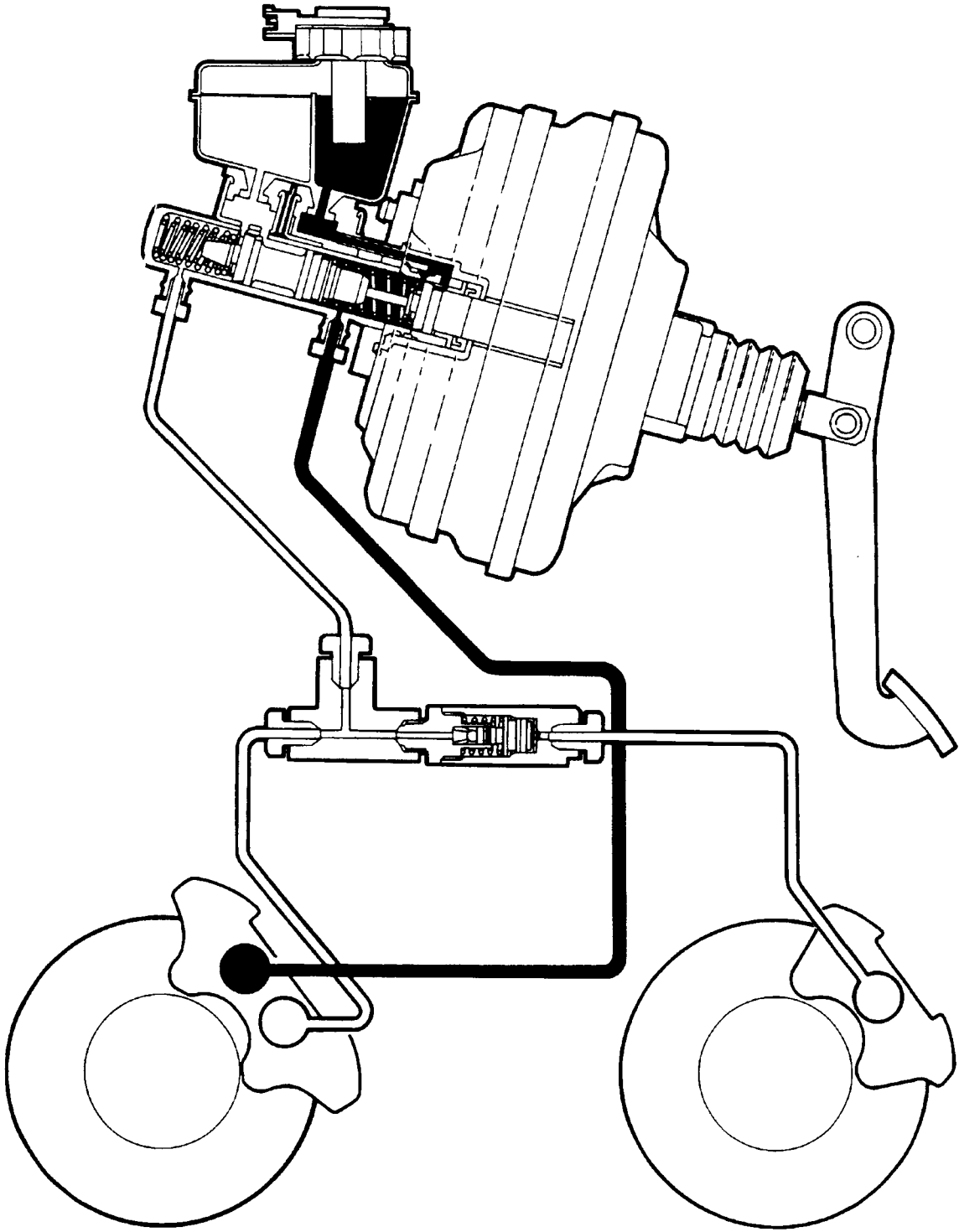
The brake system should be drained and flushed at the recommended service intervals.

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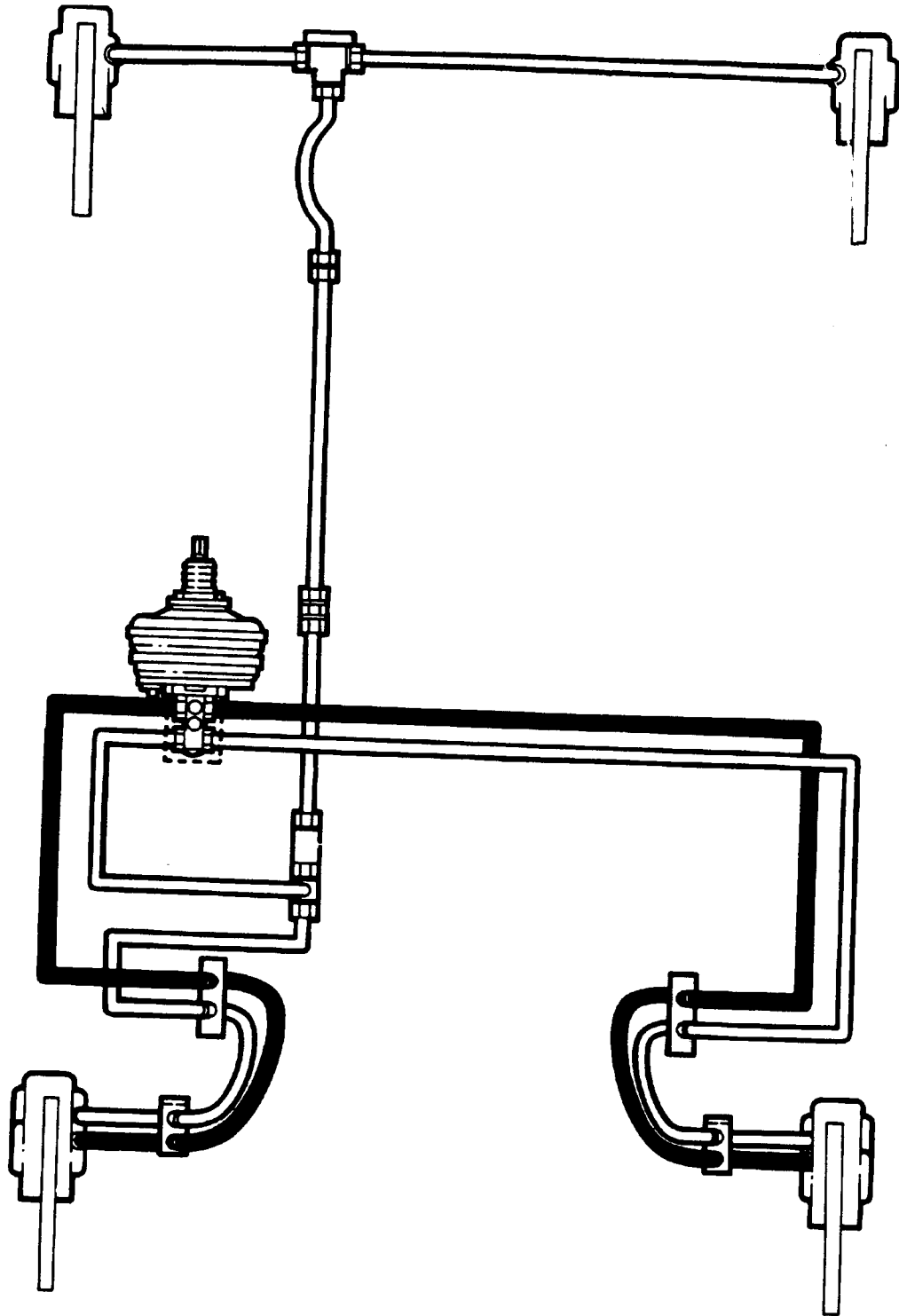


PRIMARY HYDRAULIC CIRCUIT

SECONDARY HYDRAULIC CIRCUIT



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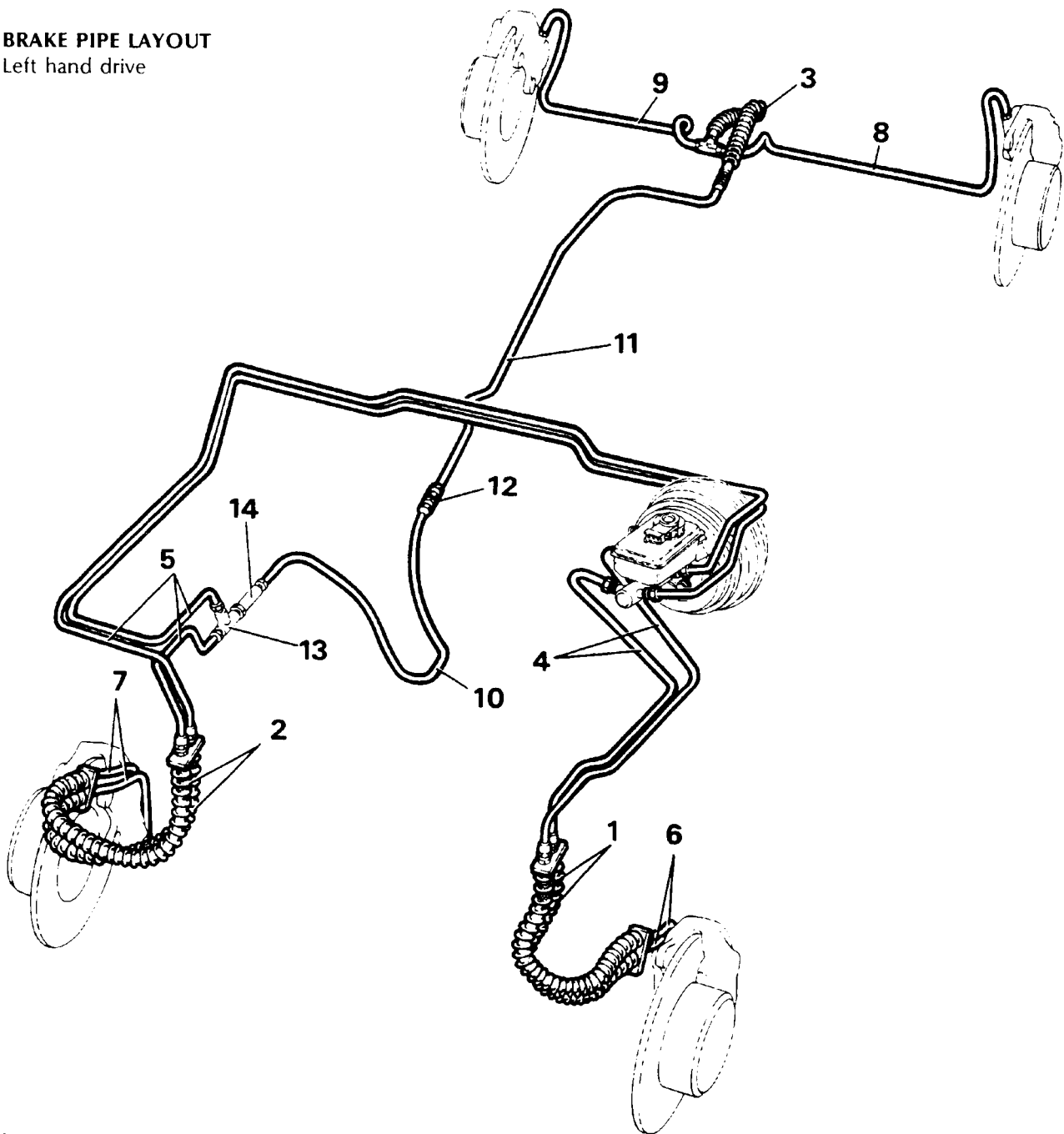


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Right hand drive brake circuit illustrated, left hand drive circuit is a mirror image of the right hand drive circuit.

BRAKE PIPE LAYOUT

Left hand drive



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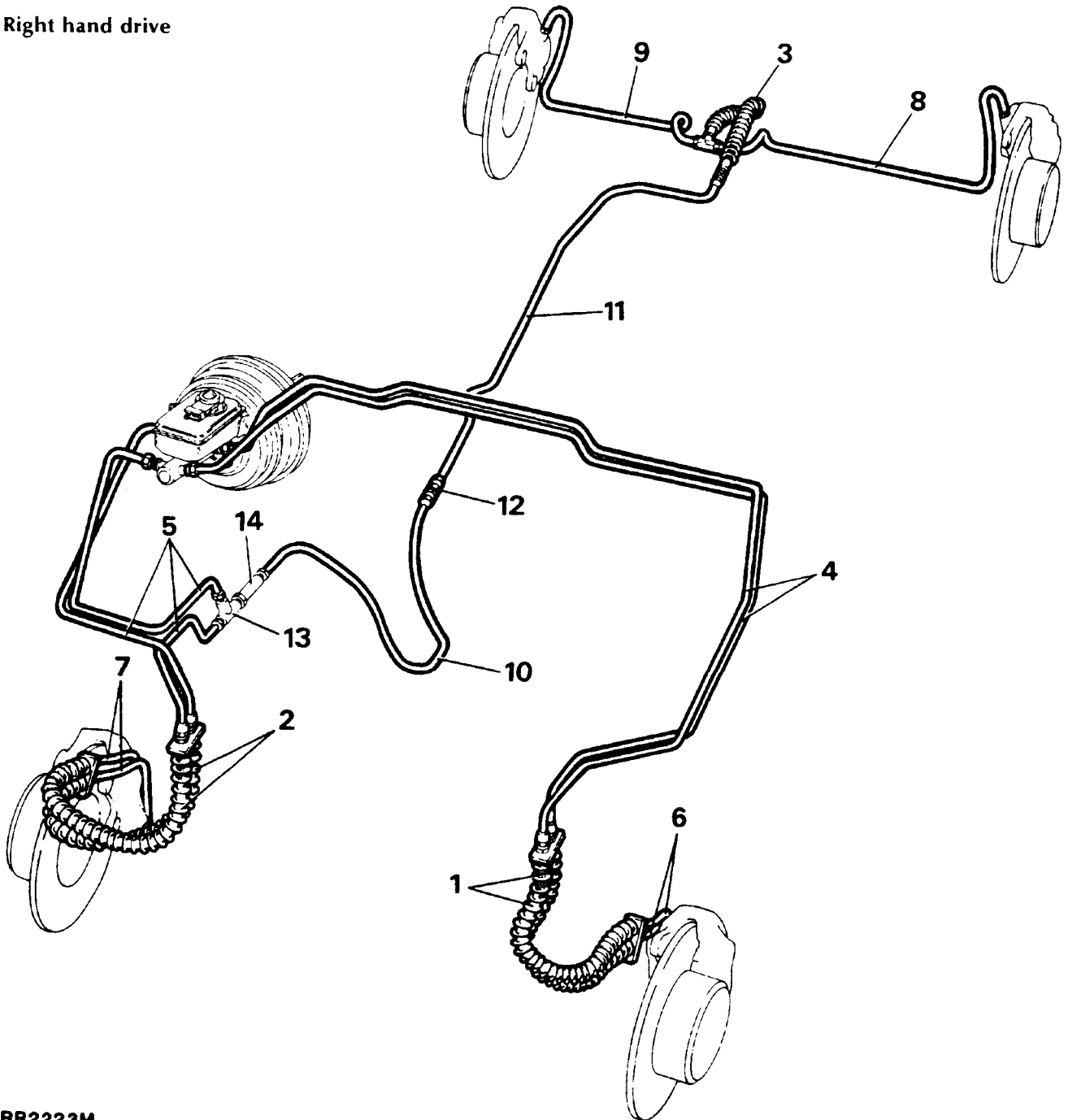
HOSES

1. Front left hand flexible hoses.
2. Front right hand flexible hoses.
3. Intermediate flexible hose.

PIPES

- | | |
|--|---|
| <ol style="list-style-type: none"> 4. Feed to front left hand hose connector. 5. Feed to front right hand hose connector. 6. Feed to front left hand caliper. 7. Feed to front right hand caliper. 8. Feed to rear left hand caliper. | <ol style="list-style-type: none"> 9. Feed to rear right hand caliper. 10. Feed to two way connector. 11. Feed to intermediate hose. 12. Two way connector. 13. Three way connector. 14. Pressure reducing valve. |
|--|---|

Right hand drive



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WARNING: Some components on the vehicle such as gaskets and friction surfaces (brake linings, clutch discs, or automatic transmission brake bands), may contain asbestos. Inhaling asbestos dust is dangerous to your health and the following essential precautions must be observed :-

- * Work out of doors or in a well ventilated area and wear a protective mask.

- * Dust found on the vehicle or produced during work on the vehicle should be removed by vacuuming or by using a well dampened cloth and not by blowing.
- * Dust waste should be dampened, placed in a sealed container and marked to ensure safe disposal.
- * If any cutting, drilling etc, is attempted on materials containing asbestos the item should be dampened and only hand tools or low speed power tools used.

Bleed

The hydraulic system comprises two completely independent circuits. The rear calipers and the lower pistons in the front calipers form the secondary circuit, while the upper pistons in the front calipers form the primary circuit. The following procedure covers bleeding the complete system, but it is permissible to bleed one circuit only if disconnections are limited to that circuit.

Bleeding will be assisted if the engine is run or a vacuum supply is connected to the servo.

WARNING: IF THE ENGINE IS RUNNING DURING THE BRAKE BLEEDING PROCESS ENSURE THAT NEUTRAL GEAR IS SELECTED AND THAT THE HANDBRAKE IS APPLIED.

When bleeding any part of the secondary circuit, almost full brake pedal travel is available. When bleeding the primary circuit only, brake pedal travel will be restricted to approximately half.

NOTE: When bleeding the system commence with the caliper furthest from the master cylinder and bleed from the screw on the same side as the fluid inlet pipes, then close the screw and bleed from the screw on the opposite side of the same caliper. Tighten the bleed screws to the correct torque. See section 06

Bleeding

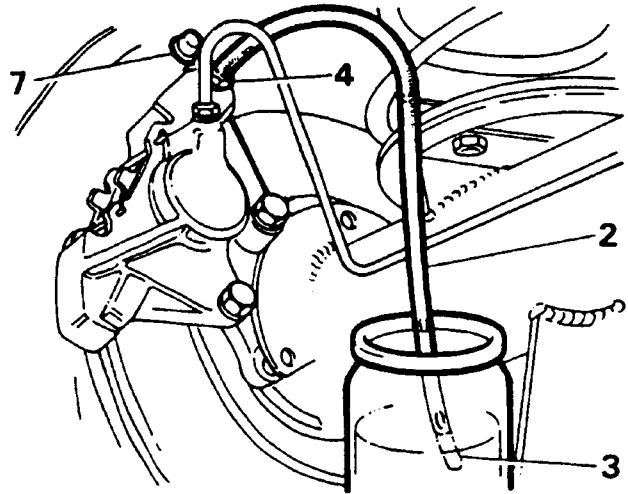
1. Fill the fluid reservoir with the correct fluid, see section 09 lubricants and fluids.

NOTE: The correct fluid level must be maintained throughout the procedure of bleeding.

2. Connect a bleed tube to the bleed screw on the rear caliper furthest from the master cylinder.
3. Submerge the free end of the bleed tube in a container of clean brake fluid.
4. Slacken the bleed screw 1/2-3/4 turn.
5. Operate the brake pedal fully and allow to return.

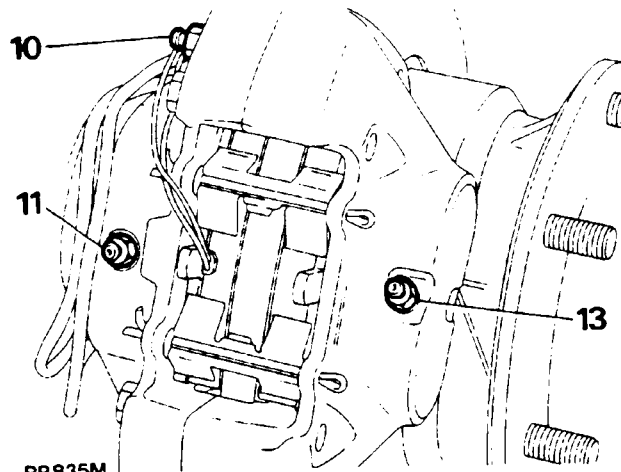
NOTE: Allow at least five seconds to elapse with the foot right off the pedal to ensure that the pistons fully return before operating the pedal again.

6. Repeat 5 until fluid clear of air bubbles appears in the container, then keeping the pedal fully depressed, tighten the bleed screw.
7. Remove the bleed tube and replace the dust cap on the bleed screw.



RR1946E

8. Repeat 1 to 7 for the other rear caliper.
9. Remove the front wheel on the side furthest from the master cylinder.
10. Connect a bleed tube to the primary bleed screw on the front caliper furthest from the master cylinder.
11. Connect a bleed tube to the secondary bleed screw on the same side of the caliper as the primary screw.



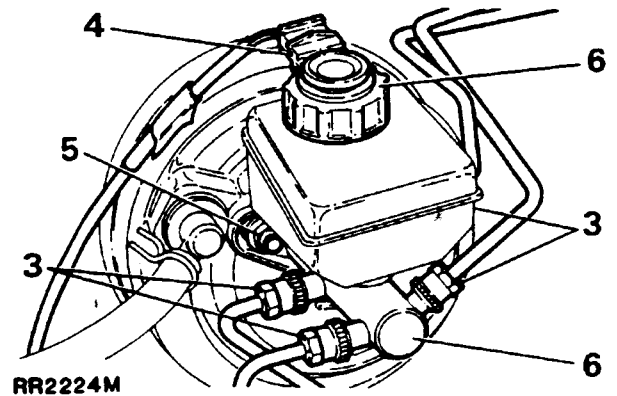
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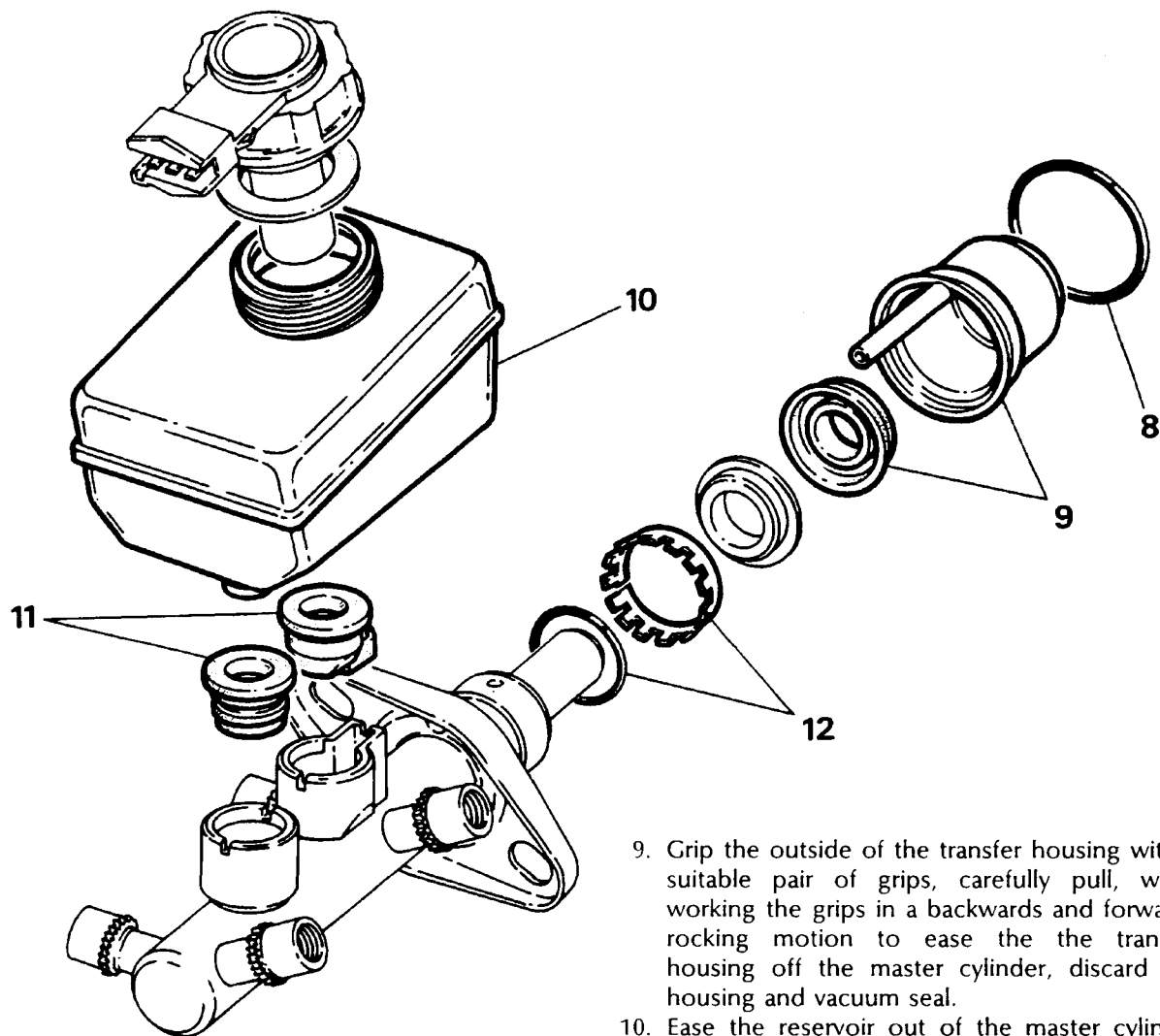
12. Repeat 3 to 7 for the front caliper, bleeding from the two screws simultaneously.
13. Connect a bleed tube to the other screw on the front caliper furthest from the master cylinder.
14. Repeat 3 to 7 for the second secondary screw on the front caliper.
15. Refit the front wheel.
16. Repeat 9 to 15 for the front caliper nearest the master cylinder.

MASTER CYLINDER- Lucas Girling -Type 25.4mm AS/AS**Remove, overhaul and refit****Removing**

1. Disconnect the battery negative terminal.
2. Place a suitable container under the master cylinder to catch any brake fluid which may seep from the cylinder when the brake pipes are disconnected from the outlet ports.
3. Thoroughly clean the immediate area around all outlet ports. Remove each of the brake pipes from the master cylinder in turn, sealing each pipe and outlet port with suitable plugs as they are disconnected, to prevent ingress of foreign matter and excessive fluid loss.
4. Disconnect the electrical plug from the low fluid switch located on the reservoir cap.
5. Remove the two nuts securing the master cylinder to the servo unit remove also the spring and plain washers.
6. Detach the the master cylinder from the servo, remove the reservoir cap and drain the brake fluid into a suitable container.



WARNING: Do not use brake fluid previously drained or bled from the system. Carefully dispose of unwanted fluid, if stored in a sealed container, ensure that the container is marked USED BRAKE FLUID.



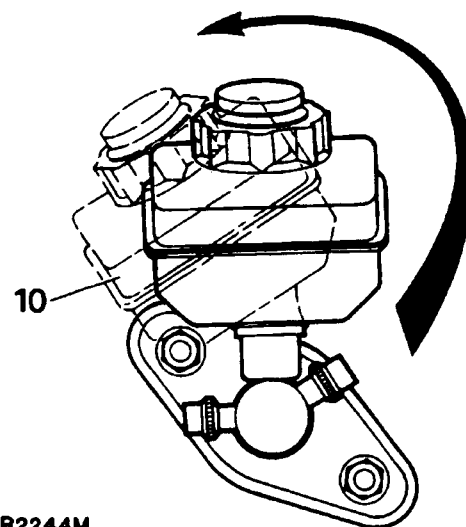
RR2237M

9. Grip the outside of the transfer housing with a suitable pair of grips, carefully pull, while working the grips in a backwards and forwards rocking motion to ease the the transfer housing off the master cylinder, discard the housing and vacuum seal.
10. Ease the reservoir out of the master cylinder taking care to ensure that the two outlet ports on the bottom of the reservoir do not become damaged during this process.

Overhaul

WARNING: Use only clear methylated spirits or unused brake fluid to clean any part of the brake system. DO NOT use petrol, paraffin or other mineral based fluids.

7. Before commencing the overhaul procedure thoroughly clean the master cylinder and inspect the outer surfaces for damage and condition, renew the complete assembly if necessary.
8. Using two slave spacers, one either side of the master cylinder flange, clamp the flange in a suitable engineers vice. Remove the water ingress 'O' ring seal from the master cylinder to servo flange and discard.

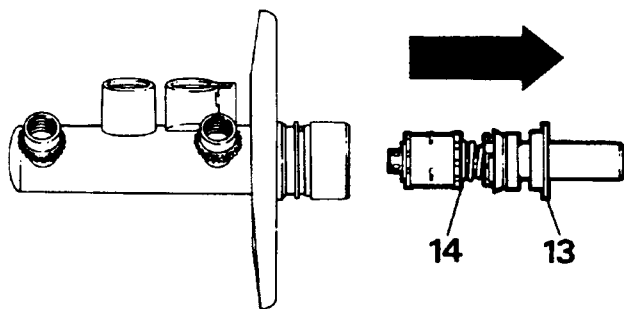


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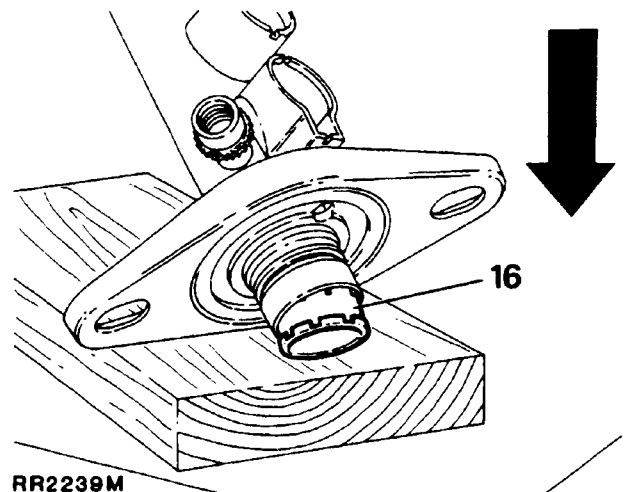
11. Withdraw the two reservoir seals from the master cylinder inlet ports, the seals are different and should be noted for assembly, discard both of the seals.
12. Remove the retaining ring and 'O' ring seal from the machined outer surface of the master cylinder, discard both the seal and retaining ring.
13. Remove the guide ring from the mouth of the master cylinder which supports the primary plunger assembly and place to one side, this component is not part of the master cylinder service kit and is to be refitted on assembly of the unit.
14. Pull the primary plunger assembly out of the master cylinder.

NOTE: The primary plunger assembly cannot be stripped down any further and is serviced as a complete unit. Discard the assembly.



RR2238M

15. The secondary plunger assembly will remain at the bottom of the master cylinder bore, the plunger can be easily expelled by tapping the assembly on a piece of wood until the plunger appears at the cylinder mouth, carefully pull the plunger out of the master cylinder.
16. If the swirl tube was not expelled at the same time as the secondary plunger, repeat the above operation to expel it from the bottom of the master cylinder bore and discard.



RR2239M

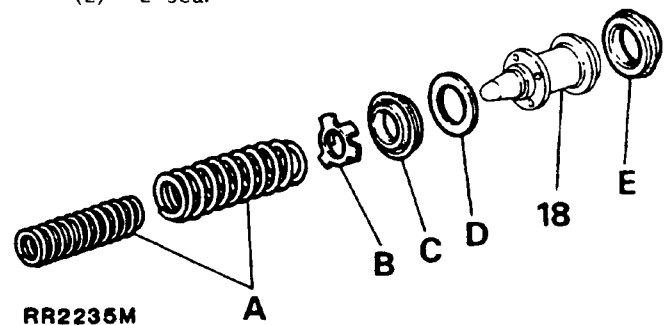
17. Clean all parts with Girling cleaning fluid or unused brake fluid and place the cleaned parts onto a sheet of clean paper. Inspect the cylinder bores and plungers for signs of corrosion, ridges and score marks. Provided the working surfaces are in perfect condition, new seals from a Girling Service Kit may be used.

Renewing secondary plunger seals

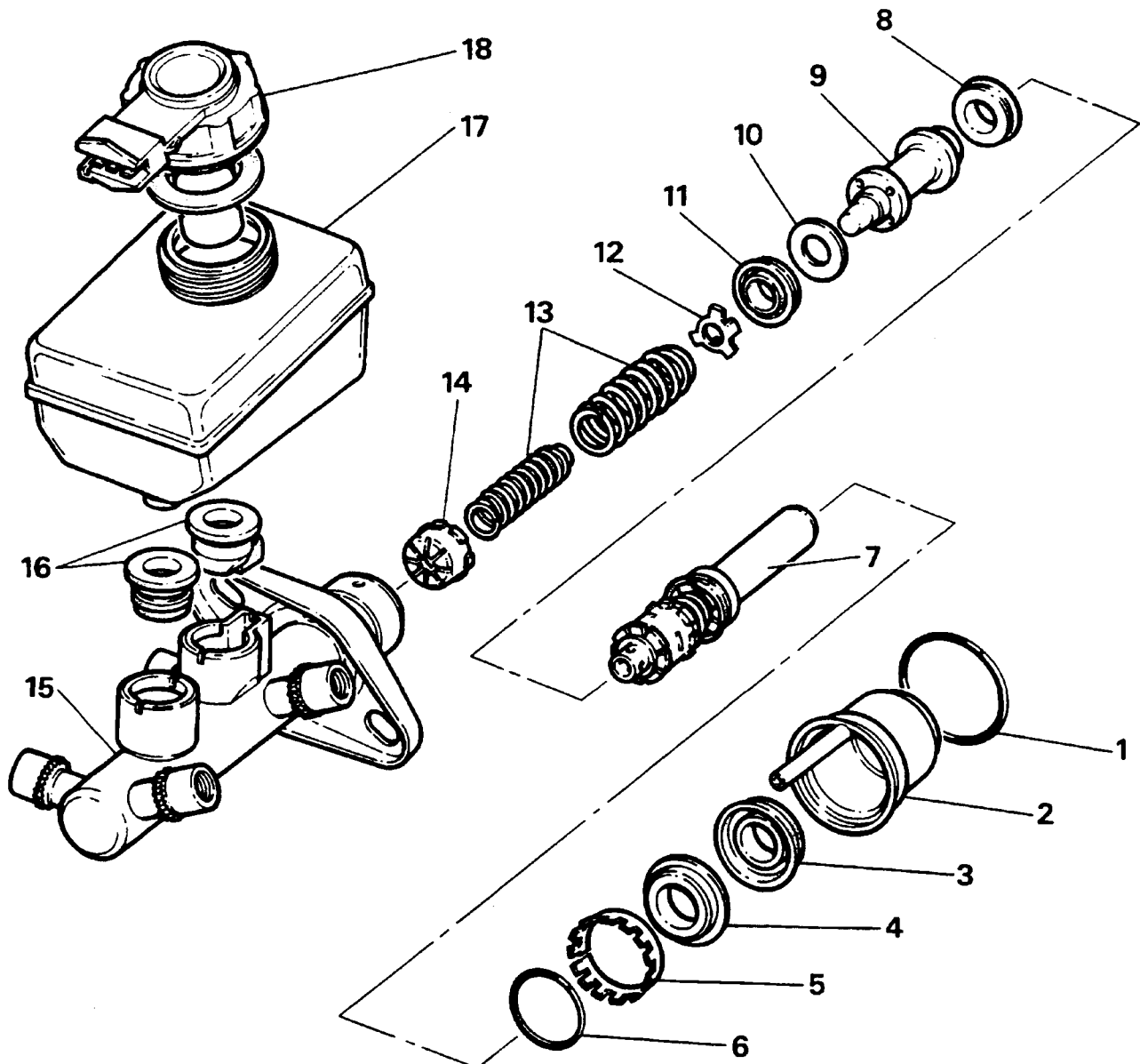
18. Remove from the following components from the secondary plunger and discard:

NOTE: A small screwdriver with the end rounded off and polished is required to remove the 'L' seal. DO NOT damage the secondary plunger.

- (A) Springs
- (B) Seal retainer
- (C) Recuperating seal
- (D) Washer
- (E) 'L' seal



RR2235M



RR2234M

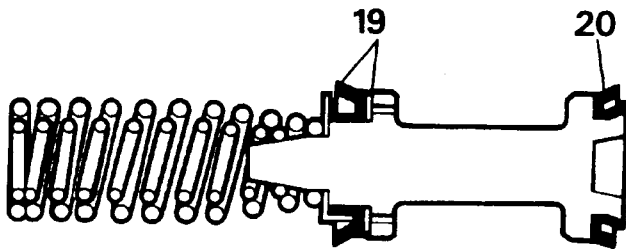
KEY TO MASTER CYLINDER

- | | |
|-----------------------------|------------------------------------|
| 1. Water ingress seal | 10. Washer |
| 2. Transfer housing | 11. Recuperating seal |
| 3. Vacuum seal | 12. Seal retainer |
| 4. Guide ring | 13. Springs (2 off) |
| 5. Retaining ring | 14. Swirl tube |
| 6. 'O' ring seal | 15. Master cylinder body |
| 7. Primary plunger assembly | 16. Reservoir seals |
| 8. 'L' seal | 17. Reservoir |
| 9. Secondary plunger | 18. Low fluid level switch and cap |

NOTE: Thoroughly check that no debris of any description is lodged in any of the fluid passageways and drillings. If debris is found, carefully remove, re-clean the cylinder and re-check.

Continued

19. Coat the new seals in unused brake fluid and firstly fit the 'L' seal to the plunger.
20. Fit the washer followed by the recuperating seal. Fit the seal retainer and springs, ensure the springs are correctly seated.

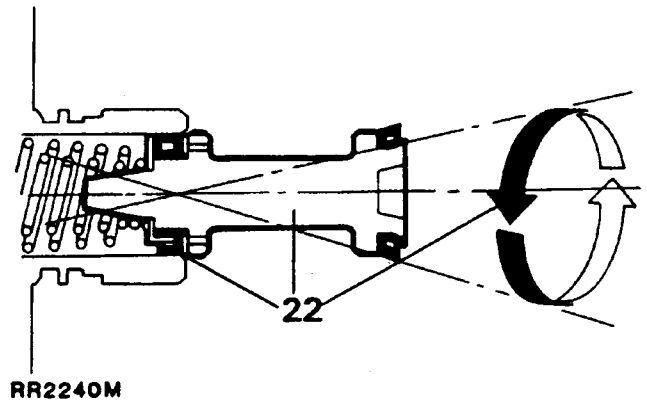


RR2236M

ASSEMBLING THE MASTER CYLINDER

CAUTION: It is important that the following instructions are carried out precisely, otherwise damage could be caused to the new seals when inserting the plungers into the cylinder bore. Generous amounts of new brake fluid should be used to lubricate the the parts during assembly. Never use old fluid or any other form of cleaning and lubricating material. Cleanliness throughout is essential.

21. Fit the new swirl tube to the bottom of the cylinder bore.
22. Lubricate the secondary plunger and cylinder bore. Offer the plunger assembly to the cylinder bore. Offer the plunger assembly to the cylinder bore until the recuperation seal is resting centrally in the mouth of the bore. Gently introduce the plunger with a circular rocking motion, as illustrated. Ensuring that the seal does not become trapped, ease the seal into the bore and slowly push the plunger down the bore in one continuous movement.



RR2240M

23. Fit the primary plunger assembly using the same method as for the secondary plunger, push the plunger down the bore.
24. Fit the original guide ring to support the primary plunger.
25. Coat a new 'O' ring with brake fluid and fit to its respective groove on the outer location surface of the master cylinder.

NOTE: The 'O' ring should not be rolled down the outer location surface of the master cylinder but should be slightly stretched and eased down the cylinder and into its groove. **DO NOT OVER STRETCH THE SEAL.**

26. Fit a new retaining ring on the outer surface of the master cylinder ensuring that the serrations of the ring are facing the mounting flange.
27. Fit the two new reservoir seals in their respective ports.
28. Fit a new vacuum seal to either the primary plunger or to the bottom of the transfer housing bore, open face of the seal towards the primary plunger guide ring.
29. Lubricate the vacuum seal with brake fluid, fit the transfer housing to the master cylinder, push the housing fully upto the cylinder mounting flange, **DO NOT ADJUST THE TRANSFER HOUSING AFTER FITTING.**
30. Lubricate a new water ingress seal with brake fluid, slightly stretch the seal and ease it down the housing until the seal is in the correct position between the housing and flange.
31. Roll the reservoir into the top of the master cylinder. (Reverse the operation described in instruction 10 illustration RR2244M).

32. Fit the master cylinder to the servo fit the plain and spring washers and secure in position with the two nuts. Tighten to the specified Torque- see section 06.
33. Fit the brake pipes to the master cylinder and tighten to the specified Torque- see section 06
34. Top-up the master cylinder with the correct grade of brake fluid (see section 09) bleed the brake systems.

WARNING: Do not use brake fluid previously drained or bled from the system. Carefully dispose of unwanted fluid, if stored in a sealed container, ensure that the container is marked USED BRAKE FLUID.

35. Fit the cap with combined low level fluid switch and refit the electrical plug. Re-connect the battery.

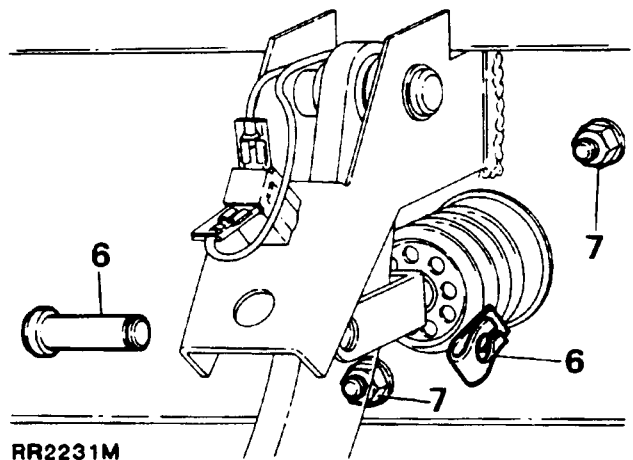
SERVO ASSEMBLY

Remove and refit

NOTE: Other than replacing the filter, non-return valve and gromet the servo is not a serviceable component, in the event of failure or damage fit a new unit.

Removing

1. Disconnect the battery negative terminal.
2. Disconnect the electrical plug to the low fluid level switch.
3. Thoroughly clean the immediate area around all master cylinder outlet ports. Remove each of the brake pipes from the master cylinder in turn, sealing each pipe and outlet port as they are disconnected with suitable plugs, to prevent ingress of foreign matter and excessive fluid loss.
4. Disconnect the vacuum supply hose to the servo.
5. From inside the vehicle remove the lower fascia panel to gain access to the spring clip securing the servo push rod to the brake pedal assembly.
6. Release the spring clip and remove the clevis pin securing the servo push rod to the brake pedal.
7. Remove the two nuts and plain washers securing the servo to the bulkhead pedal box.

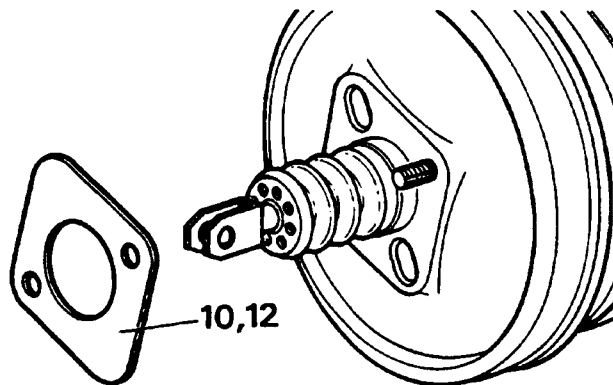


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8. From within the engine compartment withdraw the servo and master cylinder assembly.
9. Remove the cap from the reservoir and drain the brake fluid into a suitable container if the master cylinder can be kept horizontal it will not be necessary to drain the fluid.

WARNING: Do not use brake fluid previously drained or bled from the system. Carefully dispose of unwanted fluid, if stored in a sealed container, ensure that the container is marked USED BRAKE FLUID.

10. Detach the spacer from the pedal box mounting face of the servo, it is important that the spacer is fitted to the mounting face of the new servo to ensure that stringent pedal to servo operating dimensions are maintained.



RR2233M

11. If a new servo is being fitted it will be necessary to remove the master cylinder from the existing servo and refitted to the new unit.

Refitting

12. Fit the spacer previously removed from the old servo, to the new servo.
13. Fit the servo to the pedal box assembly.
14. From inside the vehicle lightly grease the brake pedal around the area that the servo push rod pivots.
15. Fit the push rod to the brake pedal and secure in position with the clevis pin and clip.

16. Fit the plain washers and secure the servo with the two nuts. Tighten the nuts to the specified torque-see section 06.
17. Refit the lower fascia panel.
18. Fit the master cylinder to the servo, refit the plain and spring washers and secure the master cylinder to the servo with the two nuts. Tighten the nuts to the specified torque-see section 06.
19. Remove the sealing plugs, fitted to the master cylinder outlet ports during the removal procedure and refit the brake pipes to their respective ports. Tighten the brake pipes to the correct torque-see section 06.
20. Refit the vacuum supply hose.
21. Fill the master cylinder to between the 'MAX' and 'MIN' level markings with the correct grade of brake fluid-see section 09.
22. Bleed the brake systems.

PEDAL ASSEMBLY**Remove, overhaul and refit****Remove**

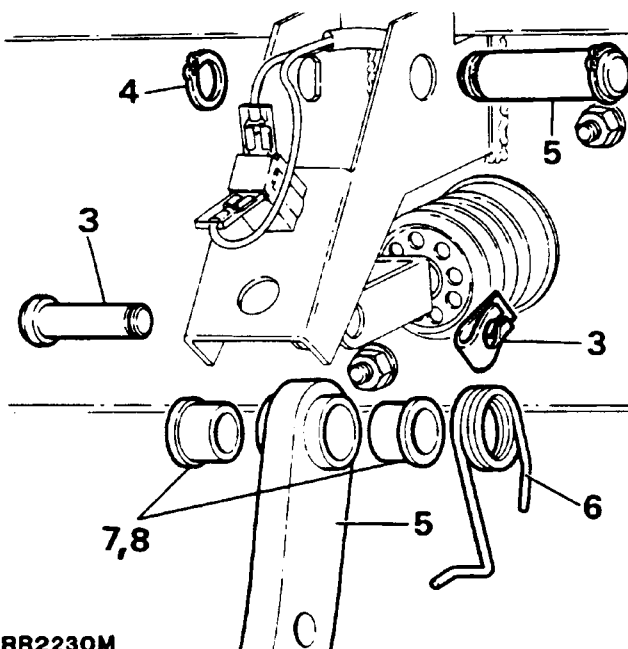
1. Disconnect the battery negative terminal.
2. From inside the vehicle remove the lower fascia panel to gain access to the pedal assembly.
3. Release the spring clip and remove the clevis pin securing the servo push rod to the brake pedal.
4. Remove the circlip from the 'D' shaped end of the pedal shaft.
5. Remove the pedal shaft from the pedal assembly and withdraw the pedal from the pedal box.
6. Remove the return spring from the pedal.

Overhaul

7. Remove the bushes from the pedal pivot tube.
8. Press new bushes into the pedal pivot tube. If necessary ream out the bushes to 15.87mm plus 0.05mm (.625 in plus .002in).
9. Lightly grease the bushes.

Refitting

10. Fit the return spring to the pedal.
11. Fit the pedal to the pedal box assembly and refit the pedal shaft. Secure the pedal assembly in position with the circlip.
12. Lightly grease the servo push rod and secure in position with the clevis pin and clip.
13. Refit the lower fascia panel and reconnect the battery.



RR2230M

