# hydraulic servo unit MK 2A



**hydraulic servo units**

## Introduction

The Mk 2A Hydraulic Servo unit and Powerstop has been completely superseded by the Mk 2B unit. To save space therefore this manual page does not describe and illustrate how the unit works, but does provide the necessary Servicing, Testing and Fault Finding information.

## Servicing

After 64,000 km (40,000 miles) or three years, whichever is reached first, the Mk 2A unit should be replaced by a new guaranteed Mk 2B unit. Alternatively, it should be completely dismantled and examined to see that the internal working surfaces are in perfect condition. Provided the parts are in perfect condition, new seals and gaskets can be fitted from the relevant Girling Service Kit: the unit will then be satisfactory for a further period of service. Where doubt exists concerning the condition of the parts, the unit should be scrapped and a new guaranteed Mk 2B unit should be fitted.

The vacuum pipe and filter element should be renewed when the unit is replaced or overhauled. In between service periods, the filter element should be changed whenever new brake shoes or pads are fitted.

### Dismantling & Reassembly

A fitting instruction provided in the relevant Girling Service Kit gives full details of the correct procedure for dismantling and reassembling Mk 2A units.

### Replacing a Mk 2A Unit

When replacing a Mk 2A unit with a Mk 2B unit, as the illustration shows, the two units are slightly different in shape and therefore minor modifications may be necessary on some installations. The changes fall into two categories:-

1. **Vacuum Connections**
The vacuum hose connection on Mk 2B units is in the vacuum shell and not, as with Mk 2A in the hydraulic body. It is therefore expected that the vacuum hose will need to be longer. A longer length of hose than the one originally fitted should therefore be obtained from your Girling distributor.

   NEVER FIT HOSES MADE FROM SPURIOUS MATERIALS. USE ONLY THE RECOMMENDED PARTS.

   In cases where banjo unions having a metal vacuum supply pipe are used, the pipe should be cut and a suitable length of vacuum pipe installed.

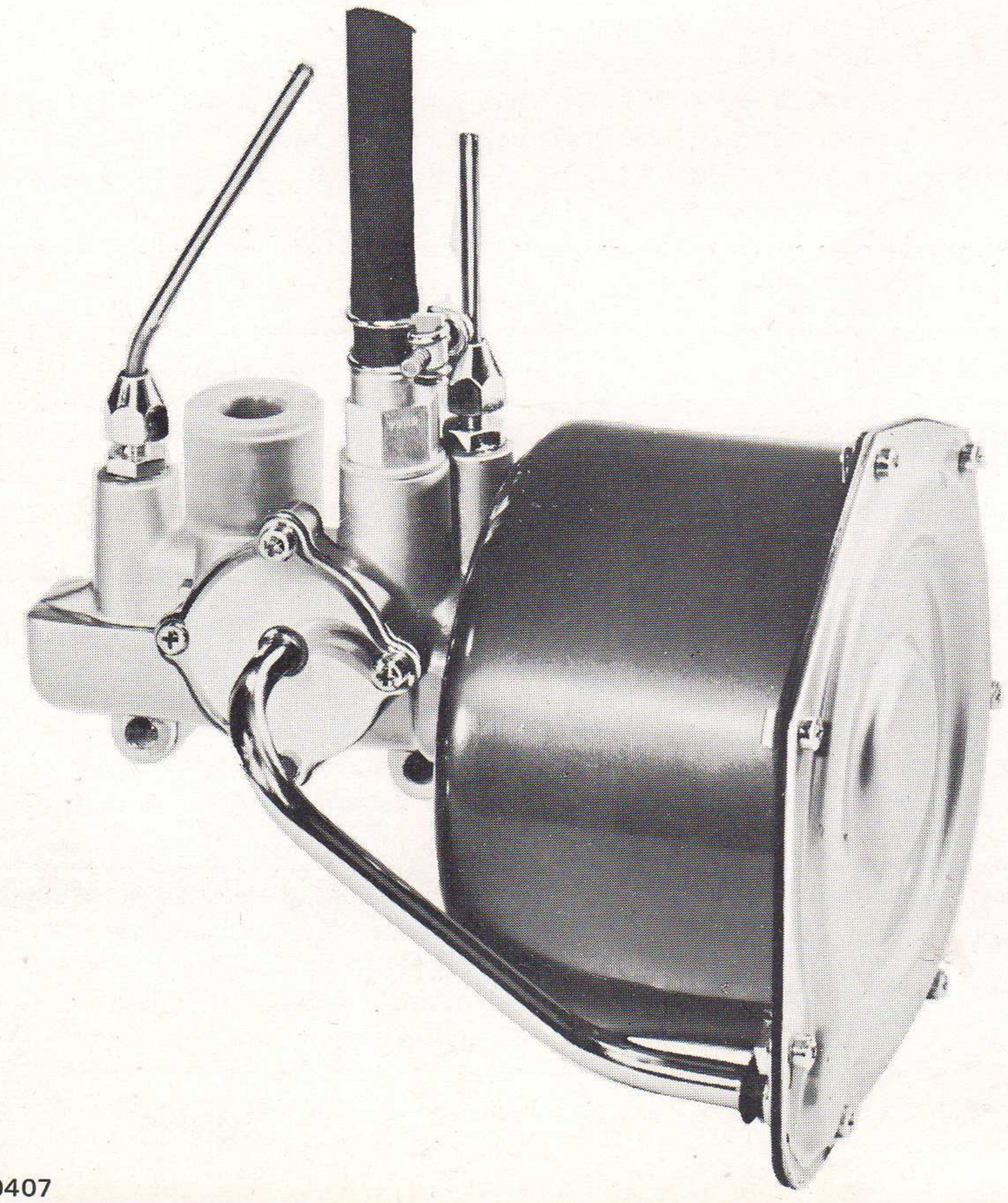
   It is important to note that most Mk 2B units are fitted with a non-return valve. However, where vacuum tanks are part of the installation, it is ESSENTIAL that another non-return valve is fitted between the tank and the engine.

   IMPORTANT: THE MK 2B NON-RETURN VALVE IS WHITE IN COLOUR. SOME UNITS INCORPORATE A SLAVE ADAPTOR COLOURED RED WHICH MUST BE REPLACED BY A WHITE NON-RETURN VALVE.

2. **Vacuum Shell Clearance**
Because the crimp band makes the Mk 2B unit slightly bigger overall, modifications may be necessary on some installations. In some cases, the fitting of spacers between the unit and brackets, would make alterations to the brackets unnecessary.

In conclusion, any installation changes will be relatively simple and difficulties are not expected, but where doubt exists, contact Girling Technical Service Department.

**1 MK 2A SERVO UNIT**



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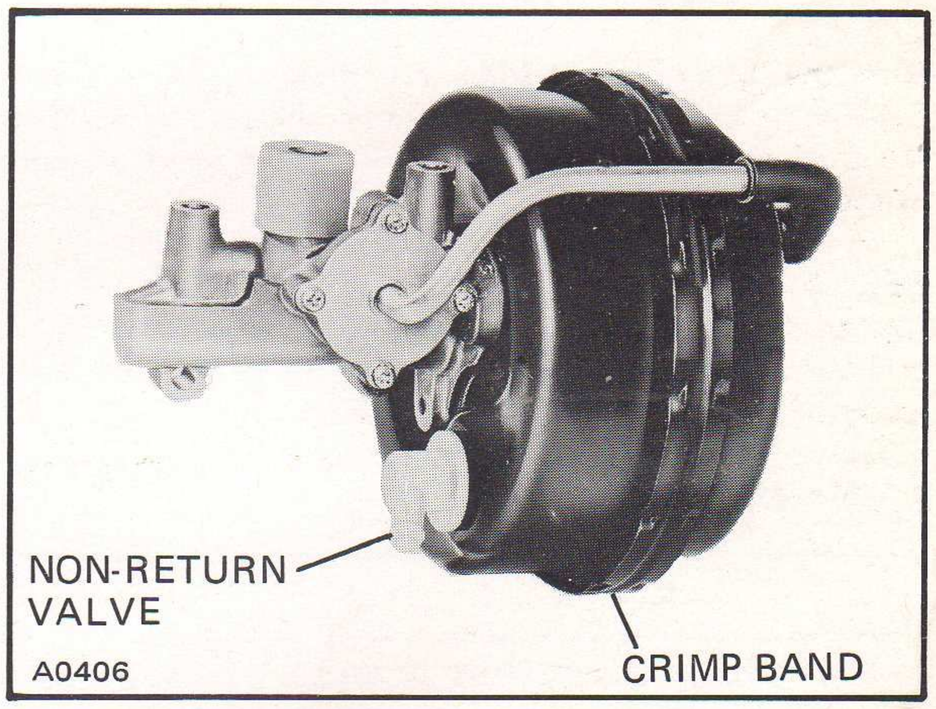


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## Testing

The use of these tests will assist in diagnoses and will provide assurance after servicing, but the tests are not exhaustive and obviously cannot equal the quality of testing which is done in the factory by the specially designed equipment. If a Servo Unit gives cause for doubt it is always best to replace it by a factory-tested unit whenever possible.

It is assumed that any faults connected with the brake system, such as contamination, lack of adjustment, air in the system, fluid leaks, etc., have been recognised and eliminated.

**TEST 1**

Fit the completed unit to the mounting brackets and, before connecting the pipes, fit a bleedscrew in the hydraulic outlet port and an adaptor shown in Fig. 2, into the hydraulic inlet port. Connect the Vacuum hose to the adaptor and remove the filter element. While the engine is "ticking over" place fingers over the air inlet and vacuum ports to determine if there is any suction at either orifice. If suction can be detected it indicates that the bores are scored or the components incorrectly assembled.

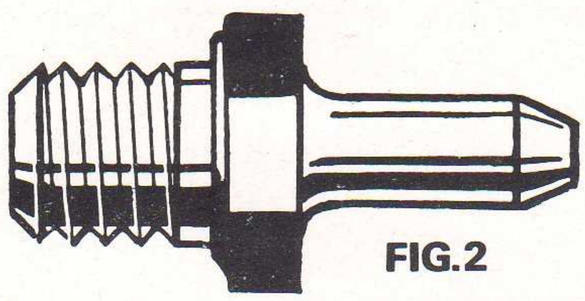

FIG.2

**TEST 2**

Connect up the hydraulic and vacuum pipes and bleed the system. Run the engine and, while the brake is being applied, it should be possible to hear the hiss of the air inlet and, with a hand on the vacuum cylinder, feel the movement of the unit working.

**TEST 3**

Run the engine for half-a-minute, switch off and leave for two minutes. Apply the brake and the Servo unit should operate and the operation should be detected as detailed in test 2.

**TEST 4**

Run the engine and apply the brake hard, and hold it for fifteen to twenty seconds. There should be no perceptible creep of the pedal. If there is it indicates leaks or scored bores in the components.

**TEST 5**

Jack up the front wheels and with the engine running apply the brake and release. The wheels should be free to move half-a-second after the release of the pedal.

Tests 2 to 5 can be used to test a suspect Servo unit before it is removed from the car.
If the result is unsatisfactory on:–

**TEST 2**

It means the unit is not working at all which could be caused by a lack of vacuum, possibly a faulty non-return valve, or a fault within the unit.

**TEST 3**

It indicates leaking gaskets, air valve or rubber grommet. To test non-return valve and grommet, run the engine for half-a-minute, clamp the vacuum hose, switch off engine and leave for two minutes. Apply the brake and the Servo unit should operate and the operation should be detected as detailed in test 2. If satisfactory the non-return valve is faulty. To test for a leaking air valve remove clamp from vacuum hose, run the engine and place the finger over the air inlet. If the suction is only slight the air valve is satisfactory and the leak is elsewhere.

**TEST 4**

The source of trouble can only be found by elimination. Check for leaks. If no leak of hydraulic fluid is evident clamp each hose successively and repeat test each time. Finally plug the master cylinder outlet and test. If creeping of the pedal is evident when the hoses are clamped and the pedal is solid when the master cylinder outlet is plugged, the Servo Unit is faulty.

**TEST 5**

If the brakes remain on, disconnect the vacuum pipe, operate the brakes to eliminate all vacuum in the Servo Unit and make the test again. If the brakes remain on, the fault is not in the Servo Unit. If the brakes now release normally, the fault is in the Servo Unit and the vacuum piston alignment is suspect. See kit fitting instructions.

## Fault Finding

| FAULT | CAUSE | ACTION |
|---|---|---|
| Hard Pedal — apparent lack of assistance with engine running. | Lack of vacuum. Restricted hose. Blocked air inlet. Rubber grommet swollen. Faulty output piston. Major fault in unit. | Check vacuum connections. Check hose and replace if necessary — fit parts from Service Kit — examine filter and air inlet — fit new unit. |
| Brakes hanging on. | Misaligned vacuum piston (after servicing unit). Swollen rubber grommet or swollen backing ring. | Check as Test No. 5. Replace parts as necessary. |
| Slow action of Servo Unit. | Swollen rubber grommet. Blocked filter or restricted air inlet. | Check and replace as necessary. Tighten vacuum connections. Replace hose. |
| Lack of assistance on heavy braking. Servo operating only when engine is running. Poor slow running of engine. | Air leak in servo low vacuum. Air leaks in gaskets or air valve. Vacuum hoses or faulty non-return valve. | Check for vacuum leaks, if unsuccessful, dismantle and replace all parts in Service Kit. Tighten vacuum connections. Replace vacuum hose or replace non-return valve. |
| Loss of fluid. | Failure of a seal or seals in unit or scored bores. | Replace unit or fit a Service Kit of seals and gaskets. |

# hydraulic servo unit MK IIB 6A 2a

**hydraulic servo units**

## Introduction

The Girling Hydraulic Servo Unit takes wasted power from the engine and uses it to boost the hydraulic pressure in the brake system. On many vehicles the unit is fitted as original equipment, but not all cars have power assisted brakes and a unit called the Powerstop was therefore introduced by Girling to offer any car owner the luxury of ample power at the brake pedal. Obviously, the same boost ratio would not suit all vehicles, and both the Hydraulic Servo Unit and the Powerstop are available with boost ratios to accommodate the various installations. The Hydraulic Servo Unit and Powerstop have been established now for many years and sold world-wide by Girling.

This manual page deals with the Mk 11B Hydraulic Servo Unit and Powerstop, which superseded the Mk 11A. The external differences between the two units can be seen from the illustration (Fig. 1). Internally the basic design is unchanged but small improvements have been made and these are (1) operational 'clonk' has been eliminated by the anti-knock output piston, (2) the vacuum piston has been replaced by a diaphragm and; (3) the vacuum connection is now in the vacuum chamber and not the hydraulic body. The design of the vacuum chamber and the retaining band, which holds the two halves of the shell together, makes the outside shape slightly different but, with few exceptions it is expected the Mk 11B unit will eventually replace the Mk 11A in service.

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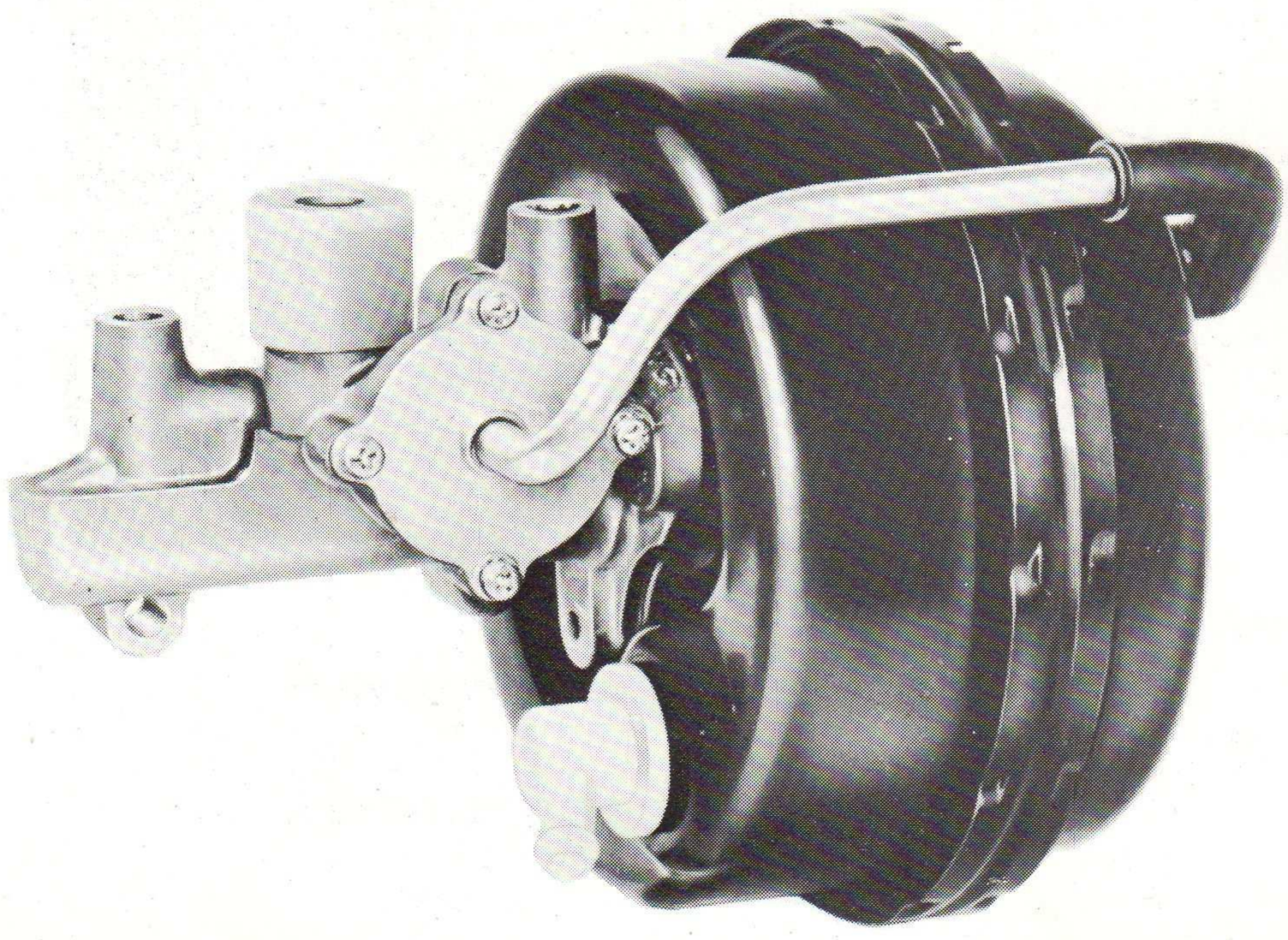
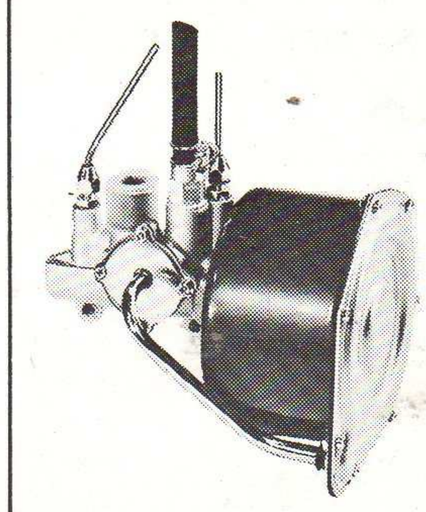


MK IIA SERVO UNIT



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## How it works

The unit is installed in the hydraulic system between the master cylinder and the wheel cylinders, with the outlet pipe from the master cylinder connected to the Servo hydraulic inlet and the Servo hydraulic outlet connected to the wheel cylinders. The force required to augment the drivers effort is obtained by admitting atmospheric pressure to one side of a diaphragm in a vacuum cylinder.

The pressure difference thus obtained across the diaphragm produces a thrust load which is used to increase the hydraulic pressure available at the wheel cylinders.

In the Girling Servo Unit, and the 'Powerstop', the diaphragm in the vacuum cylinder is normally subjected to vacuum on both sides and this principle is known as a 'suspended vacuum' system.

This method induces a more rapid response than the 'direct' or 'non-suspended' vacuum type of cylinder, in which the piston or diaphragm is normally subjected to atmospheric pressure on both sides and the vacuum is introduced to one side when a pressure difference is required.

When air is admitted to the vacuum cylinder by the control valve, the diaphragm drives the piston rod and plunger down the hydraulic cylinder, providing a considerable increase in pressure of fluid to the wheel cylinders.

The control valve, operated by the fluid from the master cylinder and output pressure in opposition, exercises a precise control over the pressure increase and the brakes are operated exactly in proportion to the effort applied to the pedal.

Fig. 2 shows diagrammatically the unit in the 'at rest' position with no pressure in the hydraulic system. The valve is open to the vacuum tank or inlet manifold and the vacuum on both sides of the diaphragm is equal.

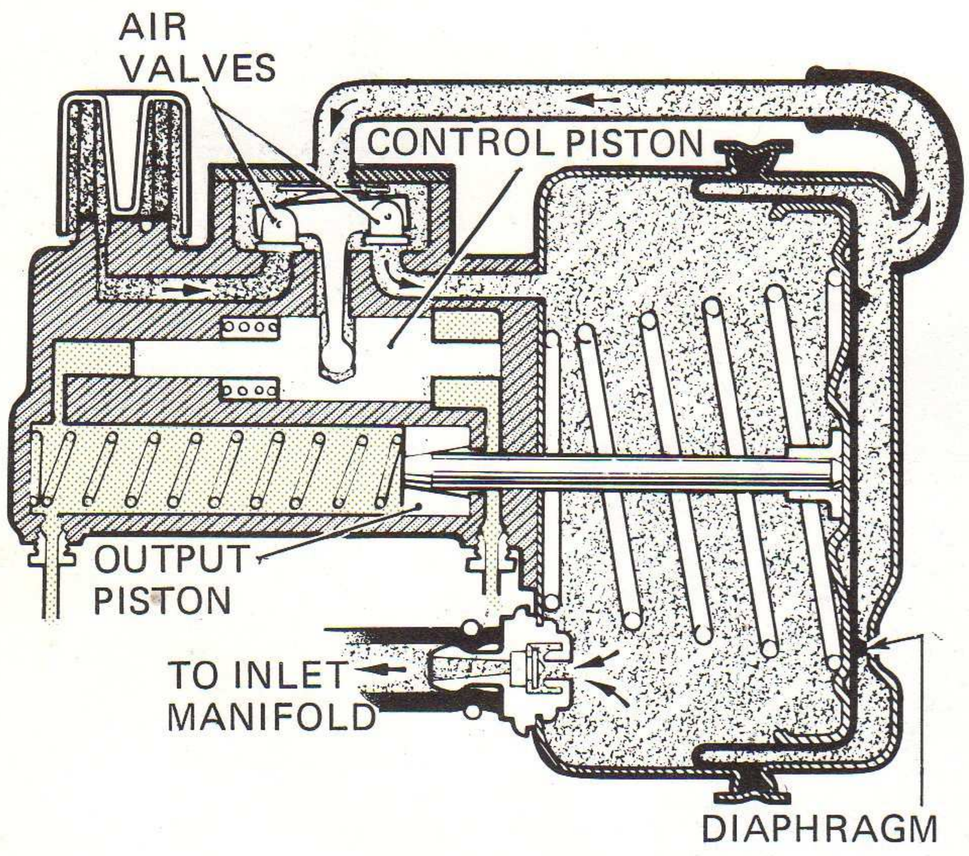
When the foot pedal is applied, hydraulic pressure is exerted throughout the whole system and equally on both ends of the composite valve control piston. As one end of the piston is larger than the other, an equal pressure pounds per square inch at both ends causes a proportionally greater thrust to be exerted on the large end and the piston moves (to the left as drawn), and the 'T' shaped lever opens the valve to the atmosphere. The air admitted to the right hand end of the vacuum cylinder drives the diaphragm to the left, and the piston rod pushes the output piston down the bore. There is no noise during operation because the output piston is kept in contact with the piston rod.

The piston sleeve (see inset Fig. 5) remains stationary during the initial movement and allows the ball to drop and seal off the fluid port in the piston. As the movement is continued the piston applies pressure on the fluid proceeding to the wheel cylinders and to the small end of the valve-control piston (see Fig. 3).

This movement of the output piston continues until the thrust on the small end of the control piston, by the high fluid pressure, overcomes the thrust by the low pressure fluid on the large end. The valve control piston is thus moved back, closing the air valve.

At this point both valves are closed as shown on Fig. 4, and the brakes are being held on. If the foot pedal is released, the fluid pressure is reduced at the large end of the control piston, which moves to the right, the valve rocker opens the vacuum valve, air is drawn out of the cylinder, the diaphragm

**2** BRAKE OFF




ATMOSPHERE

VACUUM

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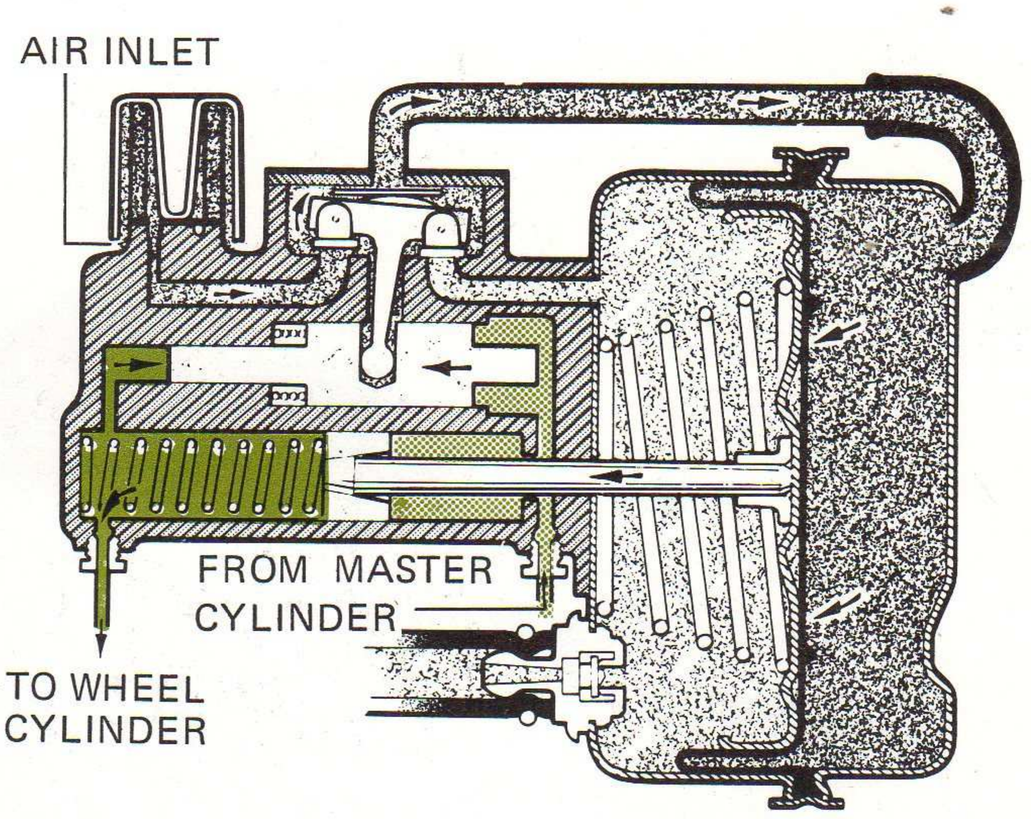
**3** BRAKE APPLIED




FLUID

LOW PRESSURE FLUID

HIGH PRESSURE FLUID

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## hydraulic servo units

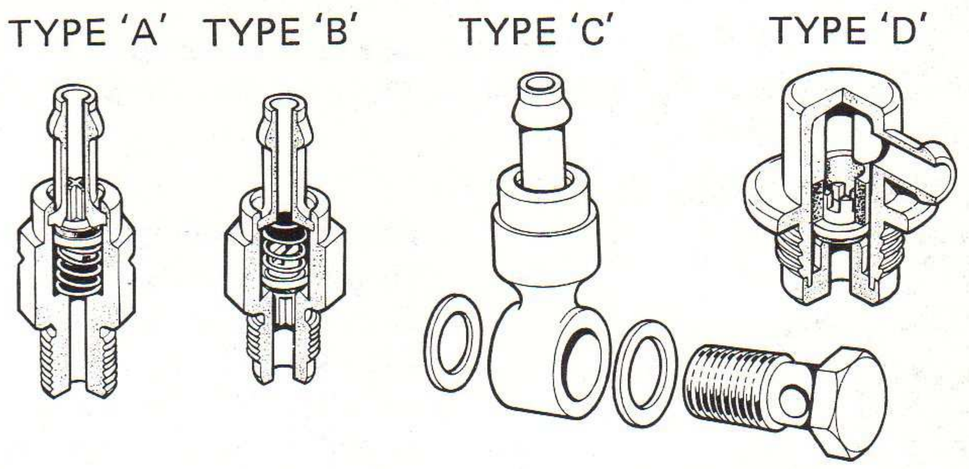
returns and with it the output piston, relieving the pressure to the wheel cylinders as shown on Fig. 5. The piston sleeve lifts the ball and allows the fluid to move unrestricted between the supply tank and wheel cylinders.

If the force on the pedal is increased after arriving at the position shown on Fig. 4, the valve gear operates to give additional assistance from the diaphragm until the thrust on each end of the control piston is balanced or until the limit of available vacuum is reached. Conversely, if the foot pedal force is reduced the valve gear operates to reduce the pressure at the brake cylinders until again, a state of balance of the control piston is reached. The difference in area between the two opposed ends of the control piston determines the proportion of assistance provided by the unit. If, for example, the large end is twice the area of the small end, the hydraulic pressure output is built up to twice that of the input from the master cylinder before the control piston moves back to close the air valve. Such a unit therefore would have an output of twice the pressure of the input, throughout the range of the unit.

In this way, the pressure in the wheel cylinders varies in proportion to the effort at the pedal, and full and precise control of the brakes is always at the command of the driver. Some units have an input to output boost ratio of 2¾ to 1, some have a boost ratio of 2 to 1, and the Powerstop (type 5156) has a boost ratio of 1½ to 1.

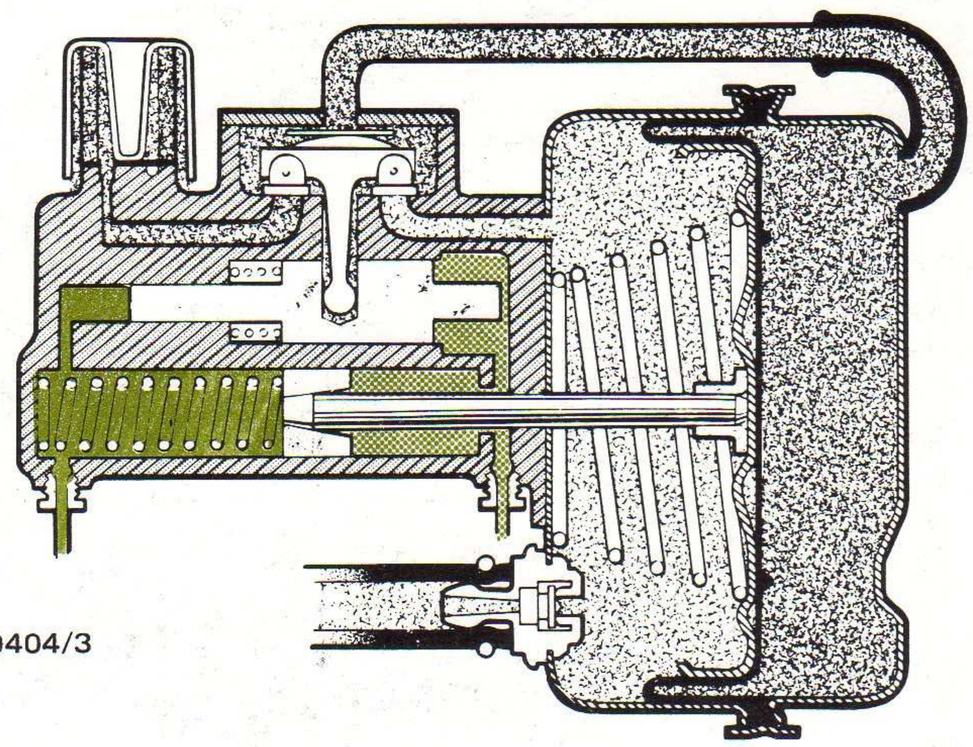
Between the engine inlet manifold and the vacuum reserve tank, or, if a tank is not fitted, between the manifold and the servo unit, is a non-return valve. This valve retains vacuum in the tank or servo unit so that power operation of the brakes is possible for a limited period, should a vacuum failure occur. Fig. 6 shows the types of non-return valves in use: Type 'A' screws directly into the engine manifold; Types 'B' and 'C' are usually fitted in the servo body of Mk 11A units; and Type 'D' which is a push fit in the rear shell of the unit and may have a straight or right angled nozzle. Type 'D' is white in colour so that it can be distinguished from the slave adaptor coloured red. If a red slave adaptor is fitted in the rear shell instead of a white type 'D' non-return valve, a non-return valve must be fitted at some other point in the vacuum line.

**6**




Type 'A' works in the opposite way to types 'B', 'C' and 'D' as the half ball, or plate valve, is in the opposite end of the valve body. The illustration shows the arrangement of the internal parts of types 'A' and 'B', and also shows the 'V' cuts in the hexagon body which identify type 'A'.

**4** BRAKE HELD ON



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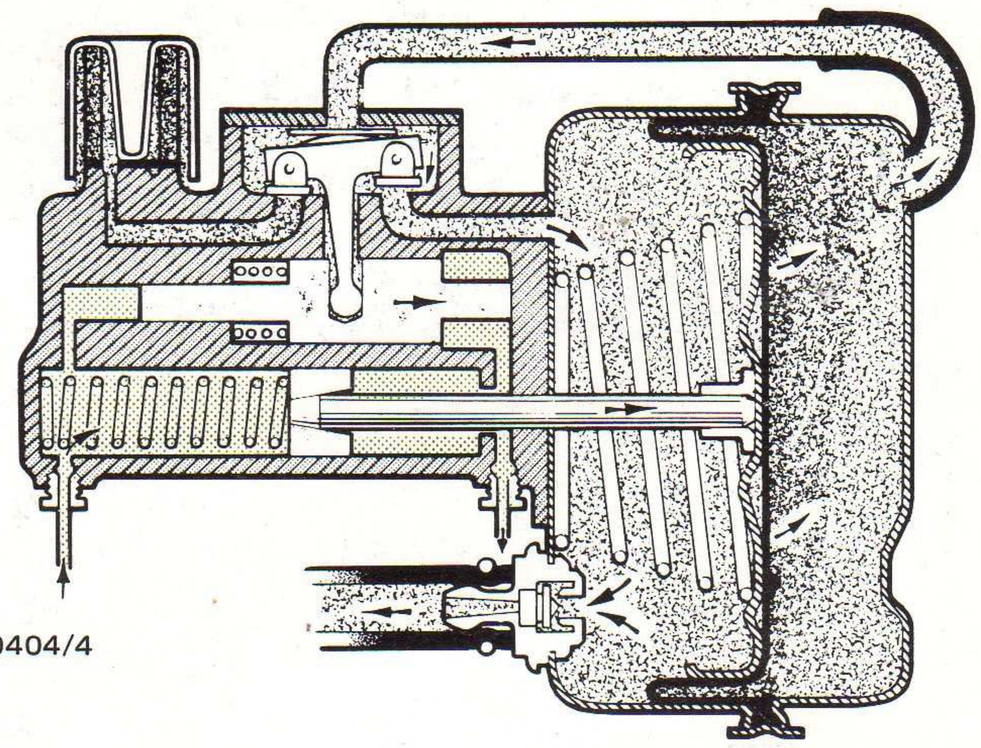
**5** BRAKE RELEASED



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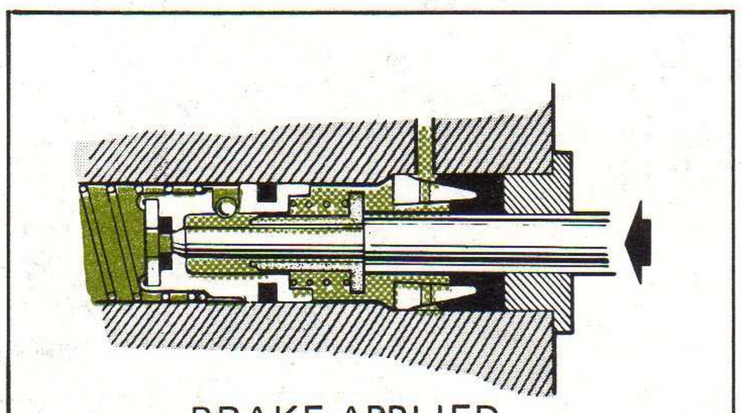


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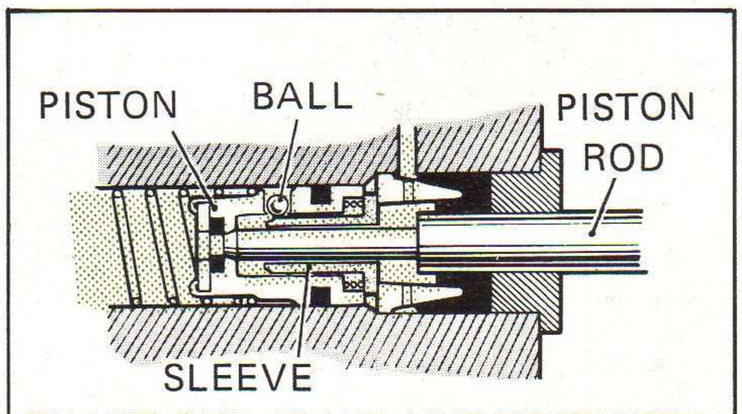


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# hydraulic servo unit MK IIB



## Servicing

After 40,000 miles (64,000 km) or three years, whichever is reached first, the Servo or Powerstop should be replaced by a new guaranteed unit, alternatively, it should be completely overhauled and the diaphragm, seals and gaskets changed using the parts from the relevant Girling Service Kit. Provided the internal working surfaces are in perfect condition, the unit will be satisfactory for a further period of service, but where doubt exists concerning the condition of the parts, a new guaranteed unit should be fitted.

The vacuum pipe and filter element should be renewed when the unit is replaced or overhauled. In between service periods, the filter element should be changed whenever new brake shoes or new disc brake pads are fitted.

Listed below are the kits available to service the unit; the relevant parts contained in each kit can be seen on the illustration (Fig. 7).

MAJOR OVERHAUL KIT

Rubber Sleeve
Plug
Diaphragm
Body Gasket
Copper Washers (three)
Plug Seal
Control Piston Seal (primary)
Control Piston Seal (secondary)
Piston Rod Gland Seal
Output Piston Seal
Output Piston Assembly
Clamping Ring
Valve Chest Cover Gasket
Grommet (non-return valve)
Girling Grease No. 64949009

FILTER KIT

Filter Element
Filter Base Washer

NON-RETURN VALVE KIT

Non-return Valve
Grommet
Girling Grease No. 64949009.

**KEY**

1. CONTROL SEAL (SECONDARY)
2. CONTROL PISTON
3. CONTROL SEAL (PRIMARY)
4. SPRING ABUTMENT
5. SPRING
6. RETAINER
7. CIRCLIP
8. PLUG
9. PLUG SEAL
10. BUSH
11. PISTON ROD GLAND SEAL
12. SPACER
13. SLEEVE
14. PISTON SLEEVE SPRING
15. OUTPUT PISTON SEAL
16. ANTI-KNOCK OUTPUT PISTON
17. BALL
18. OUTPUT PISTON SPRING
19. PISTON STOP
20. COVER
21. FILTER ELEMENT
22. FILTER BASE WASHER
23. BODY GASKET
24. REAR SHELL
25. DIAPHRAGM RETURN SPRING
26. COVER GASKET (VALVE CHEST)
27. 'T' LEVER VALVE ASSEMBLY
28. ANTI-KNOCK OUTPUT PISTON ASSEMBLY
29. SERVICE CLAMPING RING
30. DIAPHRAGM PLATE & PISTON ROD ASSEMBLY
31. DIAPHRAGM
32. CLAMPING RING
33. FRONT SHELL
34. RUBBER SLEEVE
35. PLUG
36. VACUUM PIPE
37. ABUTMENT WASHER
38. (COPPER) WASHER
39. CLAMPING PLATE
40. GROMMET
41. NON-RETURN VALVE/ ADAPTOR
42. HYDRAULIC BODY
43. VALVE
44. VALVE SPRING
45. 'T' LEVER
46. SPRING PLATE
47. LEVER GUIDE
48. SPRING CLIP

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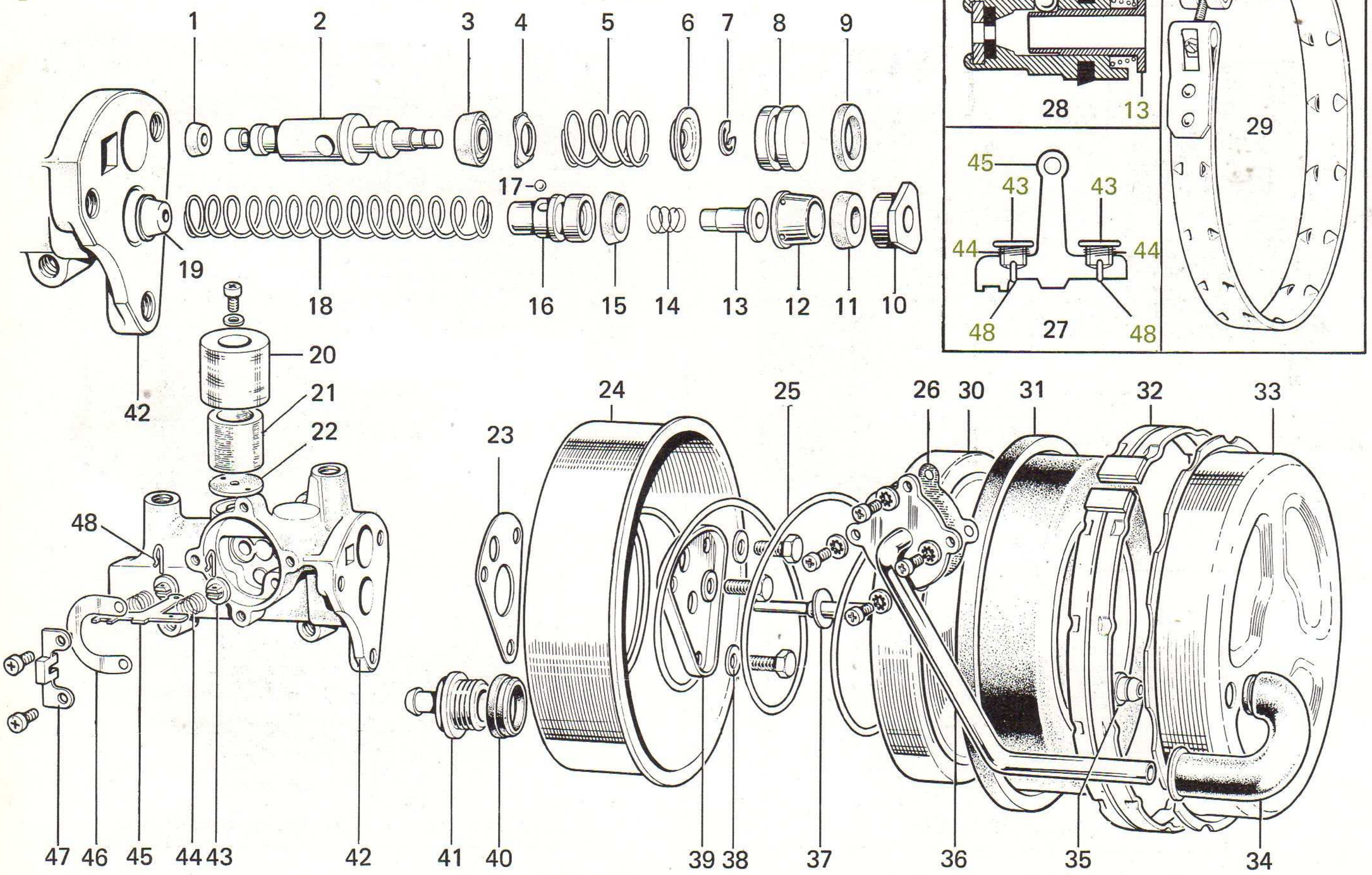


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## hydraulic servo units

### Dismantling

A support plate is required (Fig. 8) to dismantle and re-assemble the unit. If the unit is held in the vice by one of the body mounting lugs, damage to the lug may occur necessitating a new unit.

Bolt the support plate to the body and clamp the plate in the vice so that the small plate welded to the clamping ring is uppermost (refer to Fig. 9). On some units the plate may be in a diametrically opposed position on the clamping ring and the unit would therefore be in an inverted position to that shown on the illustration. Before commencing to dismantle the unit, scribe a line across the two halves of the shell adjacent to the small plate, thus enabling the shells to be re-assembled in the same relative positions.

Connect one end of a vacuum hose to the non-return valve/adaptor and the other to the engine inlet manifold. Start the engine, the vacuum will draw the two halves of the shell together. Cover or blank off the hydraulic ports to prevent the entry of filings and saw through the centre of the plate (Fig. 9) taking care not to damage the shells.

Lever the clamping ring from the shell with a screwdriver (Fig.10) and remove. To allow air to enter the unit and break the vacuum lock, loosen and remove the setscrews securing the valve chest cover. It is important to press firmly with the body against the front shell whilst using the hands to remove the setscrews with a Phillips screwdriver, otherwise the diaphragm return spring may cause the two shells to fly apart. Remove the front shell and spring (Fig. 11). Switch off the engine and remove the vacuum hose from the non-return valve/adaptor. Pull the vacuum pipe from the rubber sleeve. Lever the sleeve from the front shell with a flat screwdriver (Fig. 12), but first remove the support plug from the sleeve by inserting a Phillips screwdriver down the centre and levering it out.

Re-position the unit in vice (Fig. 13) and unscrew the three bolts retaining the rear shell to the body. Remove the clamping plate with care as the output piston spring may eject the parts from the bore. If the parts are not ejected, withdraw the bush and hook out the piston rod gland seal when the output piston spring will then eject the anti-knock output piston, piston sleeve spring and ball; but provided care is used these parts will be caught in the rear shell..

Remove the rear shell and lever out the non-return valve by inserting a large screwdriver between the rubber grommet and valve. Remove the grommet and body gasket.

Unscrew the setscrews and remove the lever guide and spring plate from the valve chest (Fig. 14). Before the 'T' lever valve

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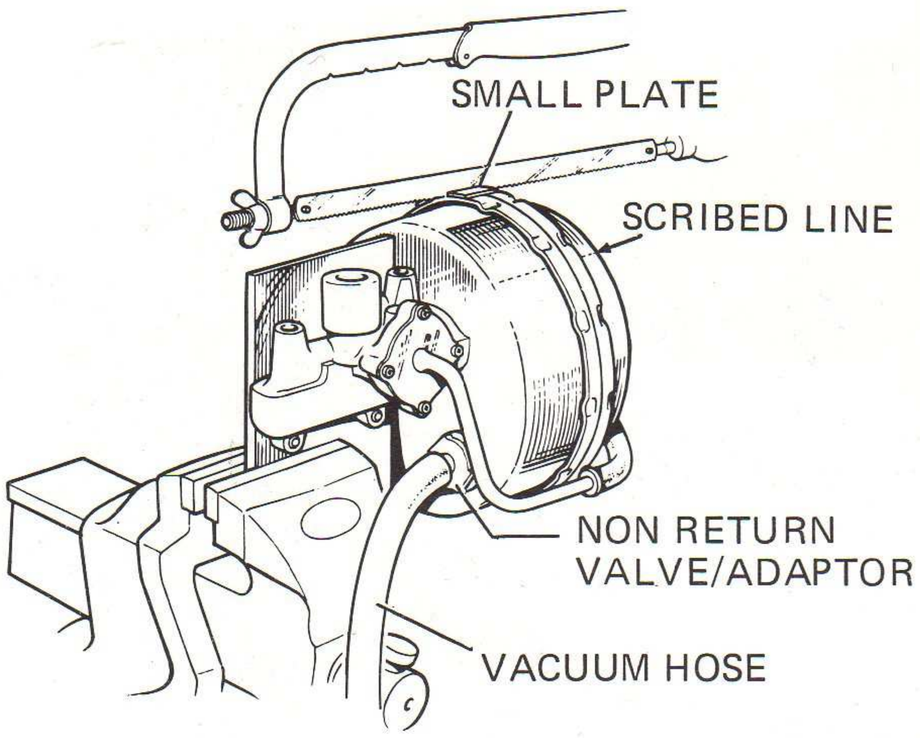


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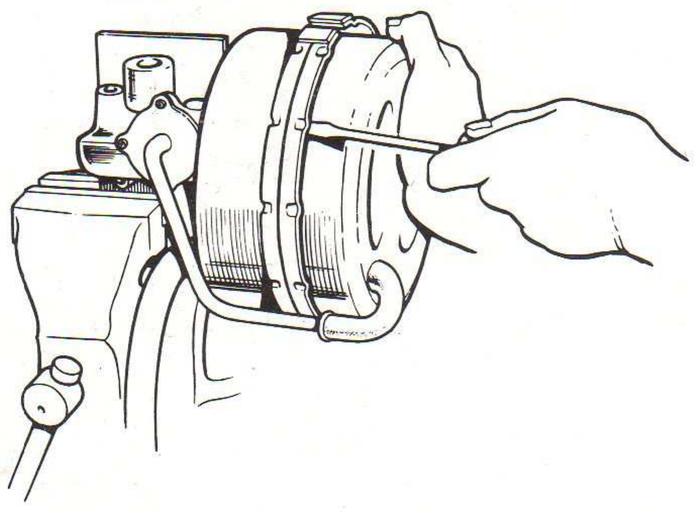

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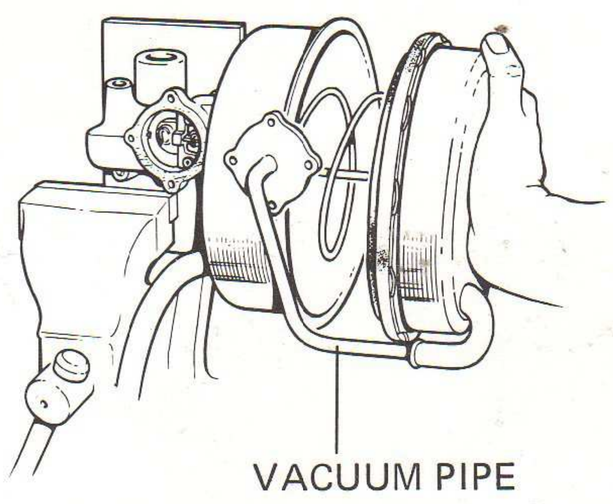


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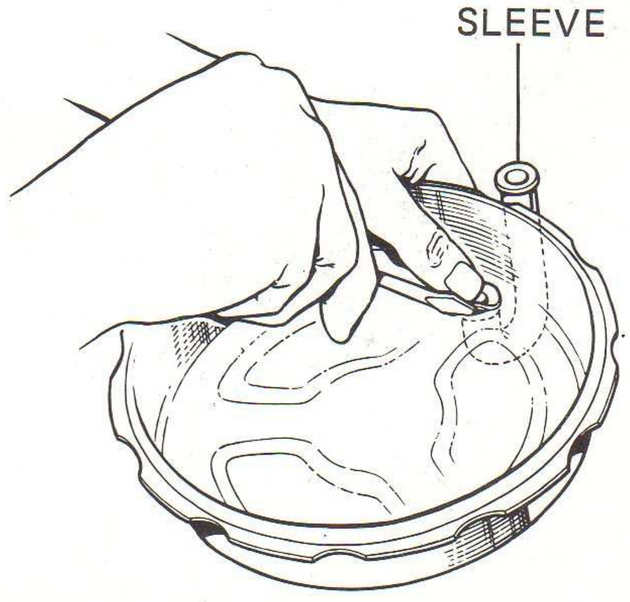


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can be withdrawn, it is usually necessary to depress the plug in the body.

Insert a suitable bent rod into the hole in the control piston and lever the piston along to push out the plug (Fig. 15). Remove the control piston from the bore and compress the spring to remove the circlip, retainer and spring abutment. Remove the seals from the plug and control piston.

Unscrew the setscrew and remove the air filter and associated parts (Fig. 16).

## Cleaning

Scrupulous cleanliness is now essential. Wash the hands before proceeding, and lay out a clean sheet of paper on which to place the parts. The Girling Service Kit contains all the parts necessary for a normal service overhaul and indicates which used parts should be discarded.

Do not handle the new diaphragm more than is absolutely necessary and keep it clean and dry at all times.

Clean the remaining parts thoroughly with Girling Cleaning Fluid, or clean Castrol-Girling Brake Fluid and place them on the sheet of paper and allow to dry. Examine each part to see it is undamaged and in good working order. Special attention should be given to the pistons and piston bores in the hydraulic body, there should be no signs of corrosion, pitting, scoring or ridges.

## Assembling

Lubricate the control piston, piston seals and bore with clean, unused Castrol-Girling Brake Fluid. Fit the seals to the piston so that the lips face away from the centre hole. Fit the spring abutment, spring, retainer and circlip to the piston, and insert into the bore; the piston centre hole should align with the valve chest. Fit the seal to the plug and press into the body.

Insert the rocking 'T' lever into the valve chest. The round end of the lever should fit in the hole in the control piston, if necessary press in the plug to locate lever in the piston. Place the spring plate and lever guide in position on the lever, ensuring the slot in the spring plate engages the lug above one of the lever valves, secure with setscrews.

Position the body in the vice as shown on Fig. 14 and lubricate the output piston bore and seal with clean, unused Castrol-Girling Brake Fluid. Fit the seal to the anti-knock piston so that the seal lips face the reduced end of the piston. Refer to Fig. 17 and with the rear shell in position on the body, fit the anti-knock piston and associated parts into the bore. Care must be taken to ensure the ball remains in the piston and does not drop down the bore. Until the clamping plate is fitted, the parts must be retained in the bore by hand pressure (Fig. 18). Position the plate and secure with bolts and washers. Remove the unit from the vice.

Fit the non-return valve/adaptor grommet (Fig. 19) to the rear shell. Lubricate the ribs of the non-return valve/adaptor with Girling Grease No. 64949009 and push fully home in the grommet.

Fit the rubber sleeve to the front shell (Fig. 20) lubricate the plug with Girling Grease No. 64949009 and insert as shown.

Fit the new diaphragm to the vacuum piston and place in the front shell. Position the return spring, with large diameter

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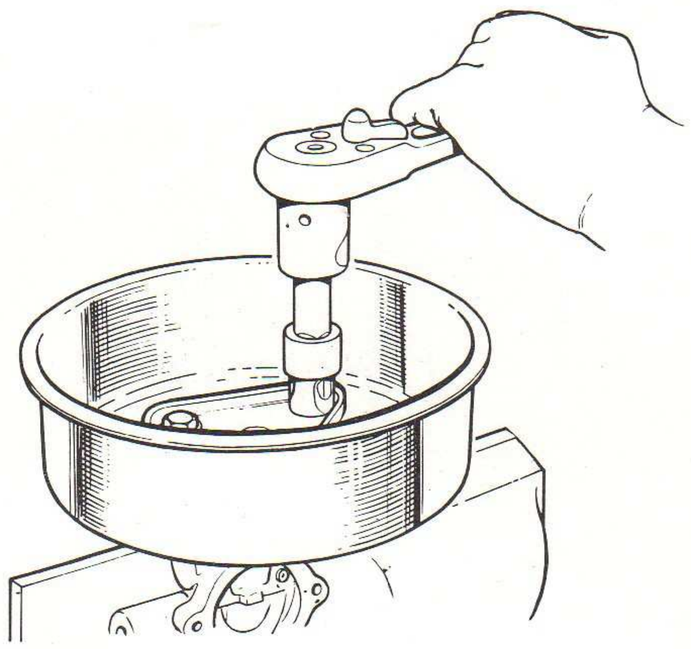

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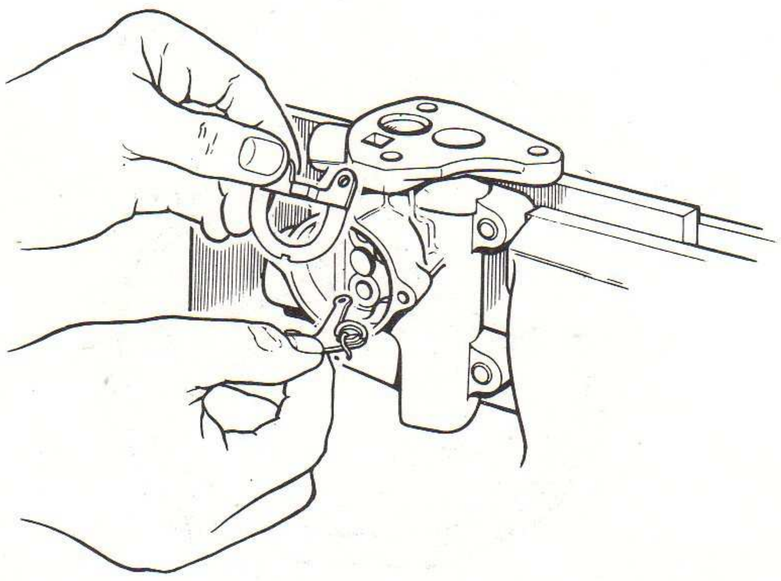

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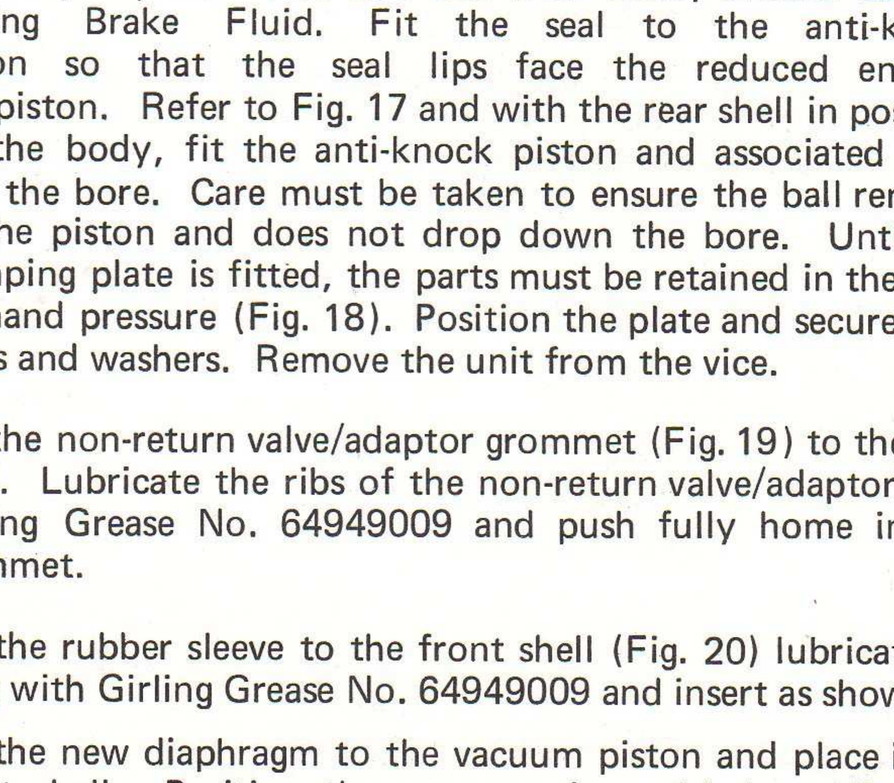


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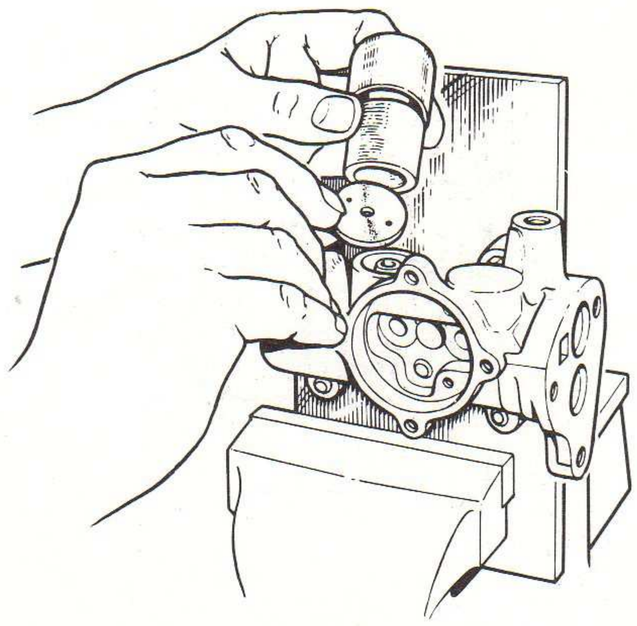


A 0093/7

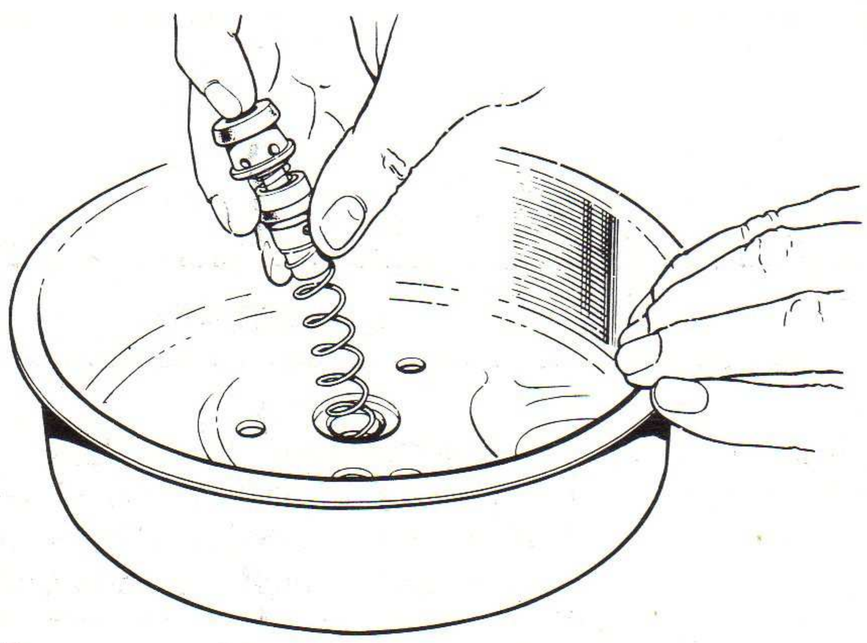
## hydraulic servo units

leading on the diaphragm plate. Re-position the unit in the vice in the manner shown on (Fig. 9) and place the new retaining band, with bolt and nut, loosely in position on the rear shell. Refit the vacuum hose to the non-return valve/ adaptor. Fit the gasket and vacuum pipe to the valve chest and secure with the four setscrews and washers.

Switch on the engine and offer the front shell, complete with vacuum piston and diaphragm, to the rear shell so that the scribed lines are in alignment. When the elbow grommet is pushed onto the vacuum pipe the vacuum should hold the two halves of the unit together. The retaining band must be positioned so that the securing bolt and raised legs will not prevent the unit being re-fitted on the vehicle in its original position. Also ensure the small convex 'V' pressings engage the level sections on the front shell rim.

Position the clamping ring on the shells and slowly tighten the bolt whilst tapping each side of the ring with a hammer to ensure the small 'V' pressings are in position on the edge of the shells and pressing them together. When the bolt cannot be tightened further; bend up the lockwasher, fit the filter element and test for leaks (see Testing Page 6a 2h).

17



A 0408/2

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A 0408/3

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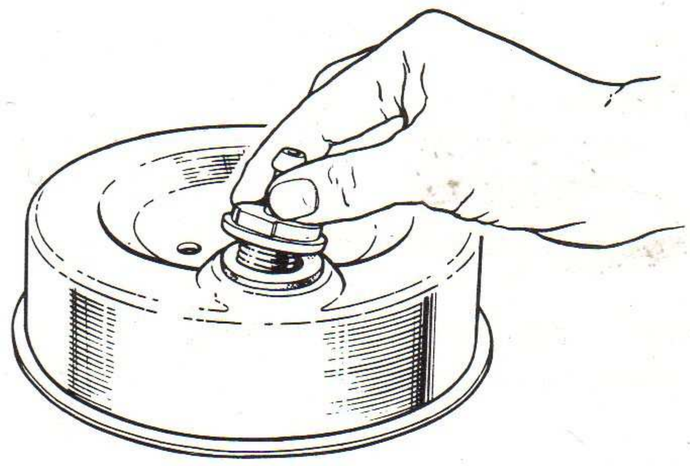

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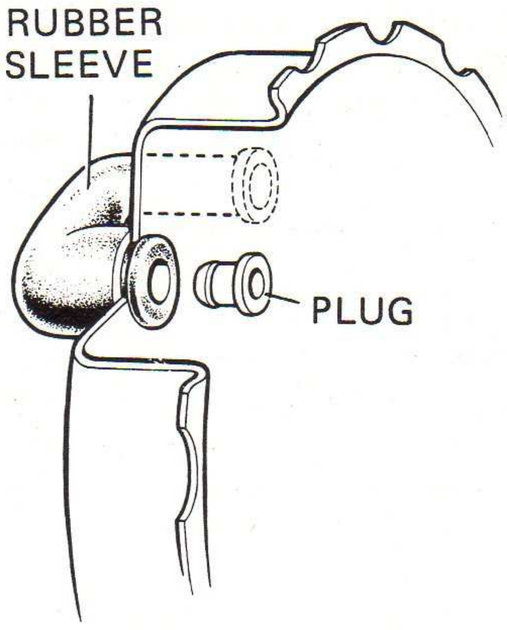



A 0108/1

## Testing

The use of these tests will assist in diagnosis and will provide assurance after servicing, but the tests are not exhaustive and obviously cannot equal the quality of testing which is done in the factory by the specially designed equipment. If a Servo Unit gives cause for doubt it is always best to replace it by a factory-tested unit whenever possible.

It is assumed that any faults connected with the brake system, such as contamination, lack of adjustment, air in the system, fluid leaks etc., have been recognised and eliminated.

---

**TEST 1**

Connect up the hydraulic and vacuum pipes and bleed the system refer to Section 1, Page 1D1).

Start the engine and as the brake is applied, it should be possible to hear the 'hiss' of the air inlet and, with a hand on the centre of the front shell, feel the movement of the unit working. With the brakes held on there should be no 'hiss' from the air inlet

**Unsatisfactory result on TEST 1**

It means the unit is not working at all which could be caused by a lack of vacuum, possibly a faulty non-return valve, or a fault within the unit.

---

**TEST 2**

Run the engine for half a minute, switch off and leave for two minutes. Apply the brake and the Servo Unit should operate and the operation should be detected as described in Test 1.

**Unsatisfactory result on TEST 2**

It indicates leaking gaskets, air valve or rubber grommet. Run the engine, clamp the vacuum hose and repeat test. If satisfactory the non-return valve is faulty. To test for a leaking air valve run the engine and place the finger over the air inlet. If the suction is only slight the air valve is satisfactory and the leak is elsewhere.

---

**TEST 3**

Run the engine and apply the brake hard, and hold it for fifteen to twenty seconds. There should be no perceptible creep of the pedal. If there is, it indicates leaks or scored bores in the components. If the pedal pushes back the hydraulic connections may be reversed or there is a fault in the unit.

**Unsatisfactory result on TEST 3**

The source of the trouble can only be found by elimination. Check for leaks. If no leak of hydraulic fluid is evident clamp each hose successively and repeat test each time. Finally plug the master cylinder outlet and test. If creeping of the pedal is evident when the hoses are clamped and the pedal is solid when the master cylinder outlet is plugged, the Servo Unit is faulty.

These tests can be used to test a suspect Servo Unit before it is removed from the car.

## Fault Finding

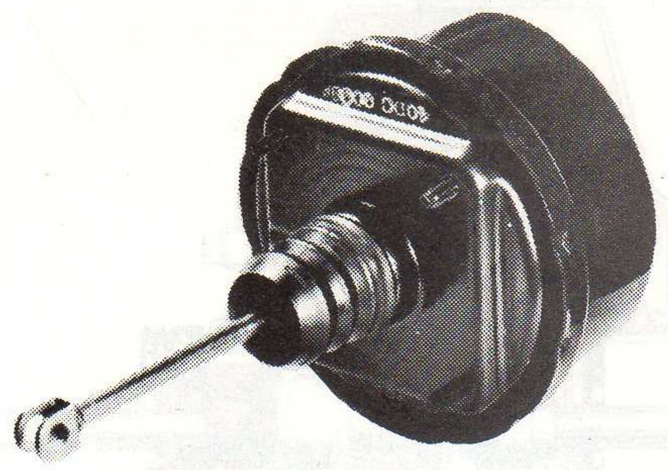
| FAULT | CAUSE | ACTION |
|---|---|---|
| Hard pedal — apparent lack of assistance with engine running. | Lack of vacuum. Restricted hose. Blocked air inlet. Faulty output piston. Major fault in unit. | Check vacuum connections. Check hose and replace if necessary — fit parts from Service Kit — examine filter and air inlet — fit new unit. |
| Slow action of servo unit. | Blocked filter or restricted air inlet. Faulty vacuum hose or connections. | Change filter. Tighten vacuum connections. Replace hose. |
| Lack of assistance on heavy braking. Servo operating only when engine is running. Poor slow running of engine. | Air leak in servo low vacuum. Air leaks in gaskets, non-return valve grommet, rubber sleeve, diaphragm or air valve. Vacuum hoses or faulty non-return valve. | Check for vacuum leaks, if unsuccessful, dismantle and replace all parts in Service Kit. Tighten vacuum connections. Replace vacuum hose or replace non-return valve. |
| Loss of fluid. | Failure of a seal or seals in unit or scored bores. | Replace unit or fit a Service Kit of seals and gaskets. |
| Pedal pushes back. | Hydraulic inlet and outlet pipe wrongly connected, or fault in unit. | Re-connect pipes or dismantle unit. |

# Girling supervac



**mechanical servo units**

1



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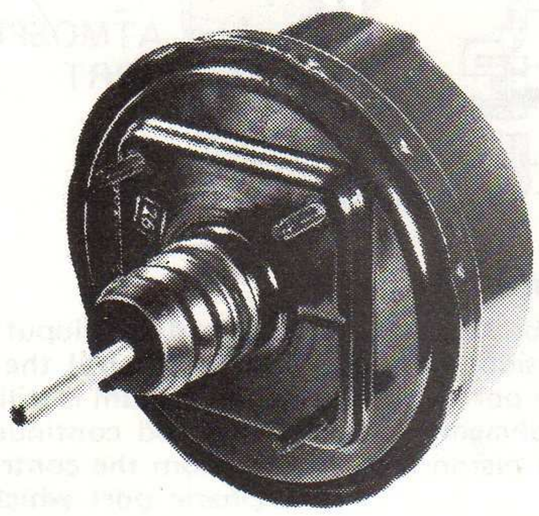


A 0383/4

## Introduction

The Girling Supervac is a mechanical servo unit designed to provide controlled power assistance to the effort applied by the driver's foot to the brake pedal.

Power supplied by the unit is obtained from vacuum created in the engine inlet manifold. The vacuum is applied to both sides of a diaphragm and by admitting atmospheric pressure to one side of the diaphragm, the power is obtained.

Mounted between the brake pedal and the master cylinder, the unit is connected to these parts by push rods. Should a vacuum failure occur, the two push rods act as a single rod and the brakes will therefore work in the conventional manner; but more effort will be required on the brake pedal.

There are four basic Supervac units in service. These are the Type 28 (Fig. 1); Type 38 (Fig. 2); Type 50 (Fig. 3) and the Tandem Supervac — which is fully described and illustrated on page 6B3. The major difference between the types 28, 38 and 50 is the size of the vacuum pots. These details and the boost ratio of the units are listed below.

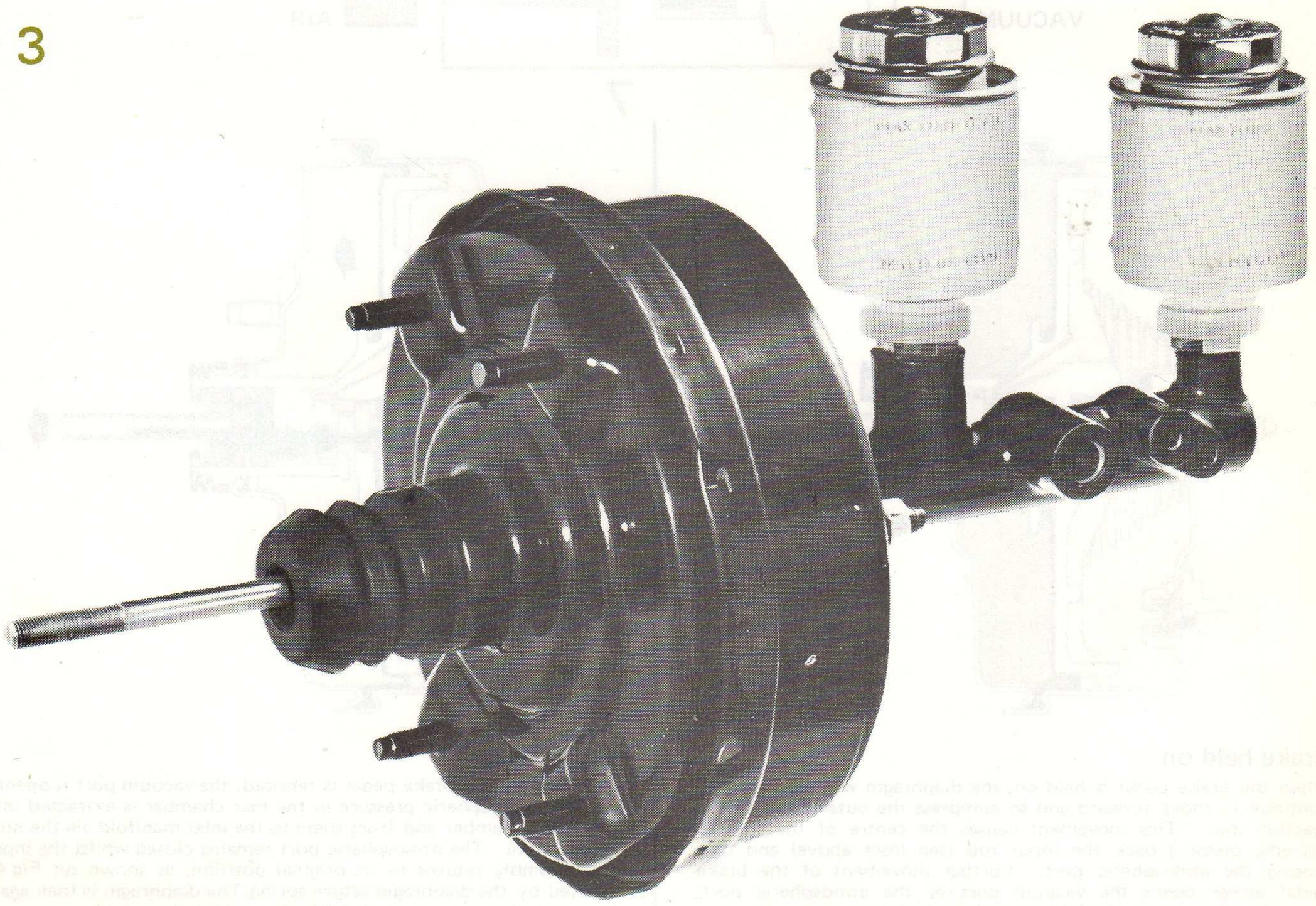
TYPE 28 Boost ratio 2.2:1 Dia. of Vacuum Pot 6½" (165 mm)
TYPE 38 Boost ratio 2.2:1 Dia. of Vacuum Pot 7½" (190 mm)
TYPE 50 Boost ratio 3.02:1* Dia. of Vacuum Pot 8½" (216 mm)

*A few units were manufactured with a boost ratio of 2.2:1

The type 28 and 38 have the same boost ratio of 2.2:1, but the type 38 has a larger vacuum pot so that the unit provides power assistance over a greater range. There are straight and angled non-return valves for all three types and the design of the push rod - which is attached to the brake pedal - is varied to suit the vehicle manufacturer's installation.

The Supervac unit is usually a part of the original brake equipment and each installation is approved by Girling engineers.

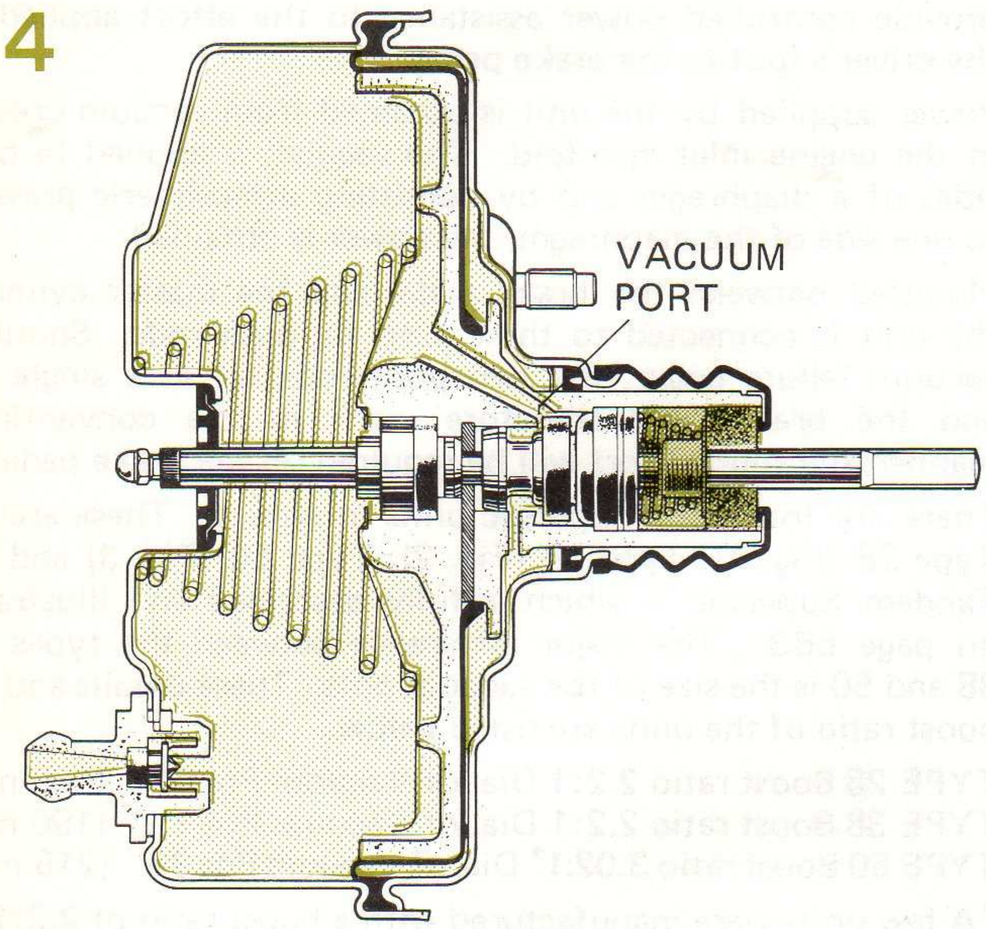
3



A 0387

## How it works

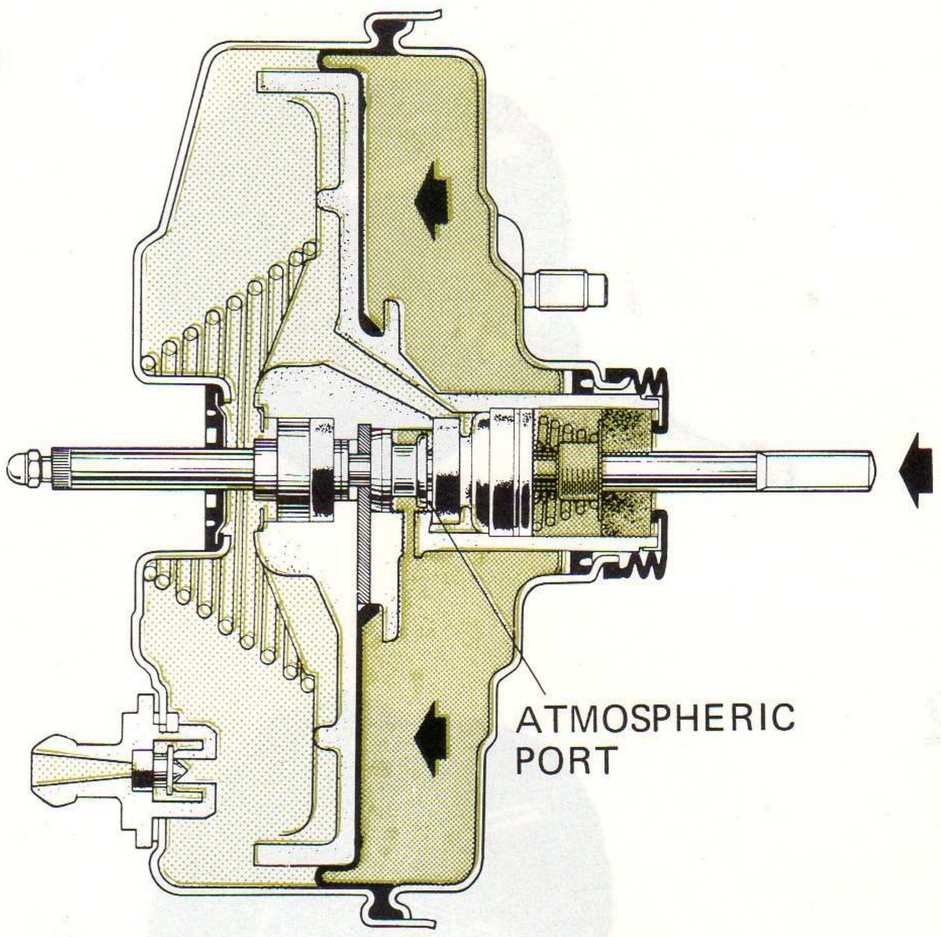
4




### Brake off

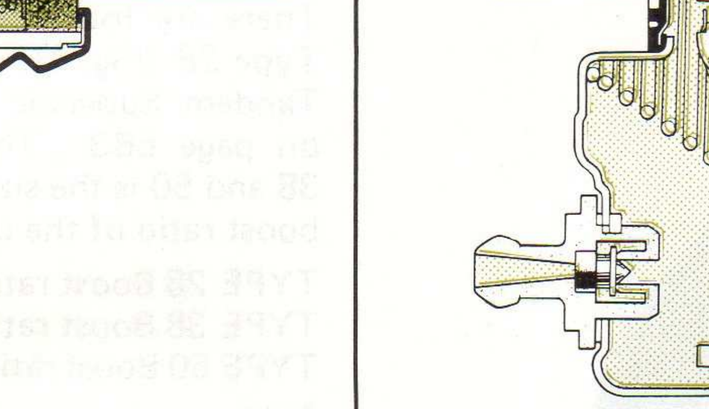
The diaphragm is fully recuperated and is held against the rear shell by the diaphragm return spring. The input rod assembly is also fully recuperated by the brake pedal return spring within the diaphragm plate, as far as the stop key, or valve return plate will allow. With the input rod in this position the vacuum port is open and there is a vacuum each side of the diaphragm.

5



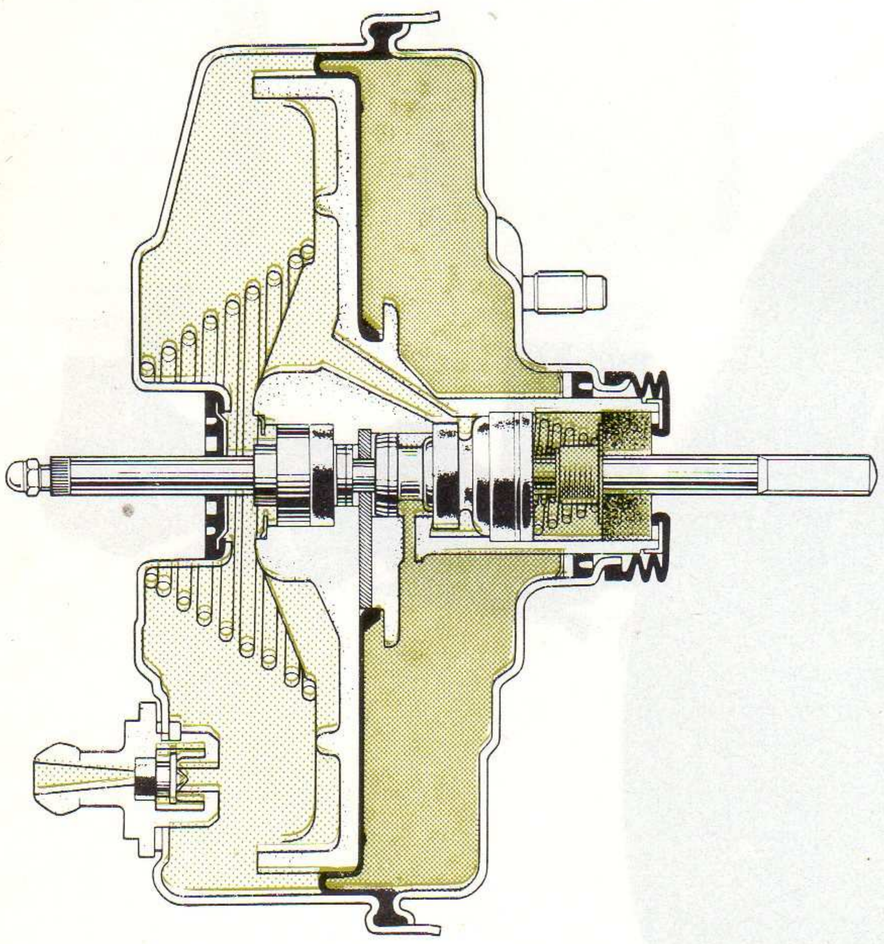

### Brake applied

When the brake pedal is depressed, the input rod assembly moves forward inside the diaphragm plate until the control valve closes the vacuum port; at this juncture vacuum is still present on each side of the diaphragm. As the input rod continues to move forward, the control piston moves away from the control valve, opening the atmospheric port which is formed between these two parts. Atmospheric pressure then enters the rear shell behind the diaphragm and assists the input rod in pushing the diaphragm plate forwards and thus the output rod actuates the master cylinder plunger.



VACUUM AIR

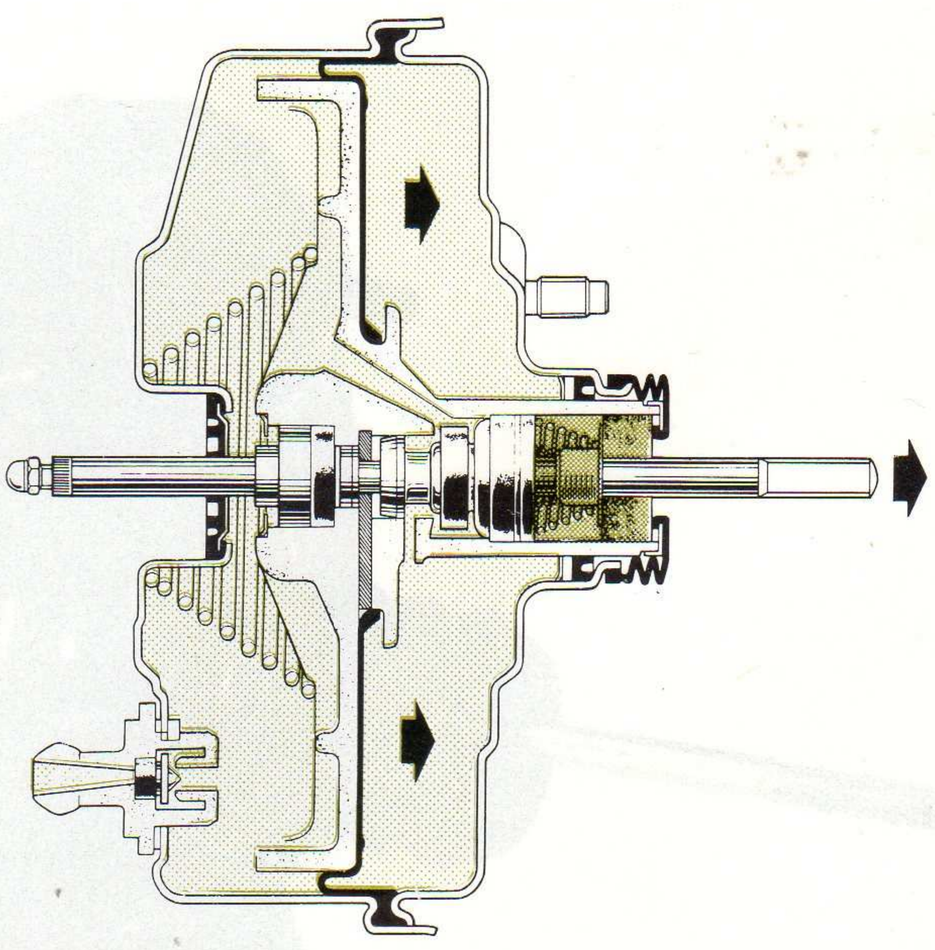
6



### Brake held on

When the brake pedal is held on, the diaphragm will momentarily continue to move forward and so compress the outer edges of the reaction disc. This movement causes the centre of the disc to extrude, pressing back the input rod (see inset above) and thus closing the atmospheric port. Further movement of the brake pedal either opens the vacuum port or the atmospheric port, depending on whether the brake pedal is released or depressed.

7



### Brake released

Immediately the brake pedal is released, the vacuum port is opened and the atmospheric pressure in the rear chamber is extracted into the front chamber and from there to the inlet manifold via the non-return valve. The atmospheric port remains closed whilst the input rod assembly returns to its original position, as shown on Fig 4, assisted by the diaphragm return spring. The diaphragm is then again 'suspended' in vacuum until the brake pedal is depressed.

# Girling supervac



## Servicing (Fig. 8)

The parts available to service the unit are; filters, a non-return valve kit and a service kit. Servicing of the internal parts is not recommended and if a major fault is apparent, a new complete guaranteed unit should be fitted.

The air filters should be changed every 40,000 miles (64,000 km) or three years, when the hydraulic cylinders and hoses are replaced. If dusty conditions prevail, the filters should be changed more frequently.

The output rod is now retained internally and cannot be extracted. If the rod or the domed screw on the rod end is damaged the Supervac Unit must be replaced complete.

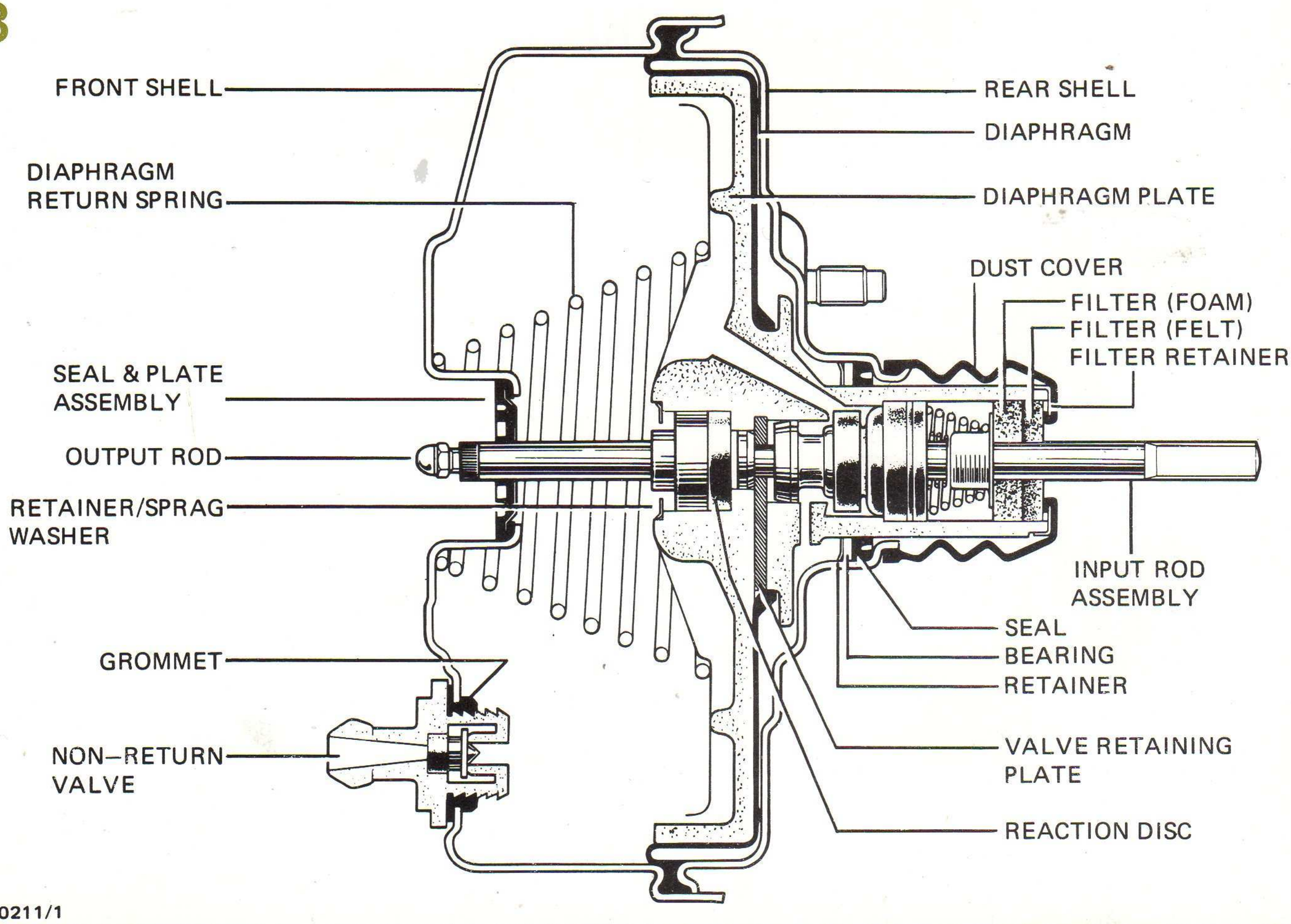
NO ATTEMPT SHOULD BE MADE TO ADJUST THE DOMED SCREW, THIS IS CORRECTLY SET AT THE PRODUCTION FACTORY AND SHOULD NEVER BE DISTURBED.

The contents of the kits are as follows:

| SERVICE KIT | NON-RETURN VALVE KIT |
|---|---|
| Dust Cover | Non-Return Valve |
| Filter Retainer | Grommet |
| Filter (Foam) | BMS Grease No. 64949086* |
| Filter (Felt) | |
| Seal & Plate Assembly or 'O' ring | |
| Master Cylinder Seal (some Ford installations) | |
| BMS Grease No. 64949086 | |

*Not included with bayonet type non-return valves as the 'O' ring must not be lubricated.

8




A 0211/1

## Replacing the Filter (Fig. 9)

Pull back the dust cover and filter retainer, hook out the filters and cut as shown on the illustration to remove from the input rod.

Cut the new filters, press into the neck of the valve body as shown and refit the filter retainer and dust cover.
If the dust cover is damaged, fit a new one from a Service Kit.

## Replacing the Non-Return Valve (Fig. 10)

NOTE: Two different methods of fitting the valve have been used. The earlier one with a bayonet type fixing is not interchangeable with the later valve which is pushed into position.

Straight and angled nozzles are used on both types of valves. The angled valves are 'handed', therefore, note the angle of the valve nozzle in relation to the front shell so that the new valve can be fitted in the same position.

With the bayonet type a suitable spanner is required and the valve must be pressed down as shown whilst the valve is turned one third of a turn to release the fixing lugs. Fit the new 'O' ring to the new non-return valve but do not lubricate

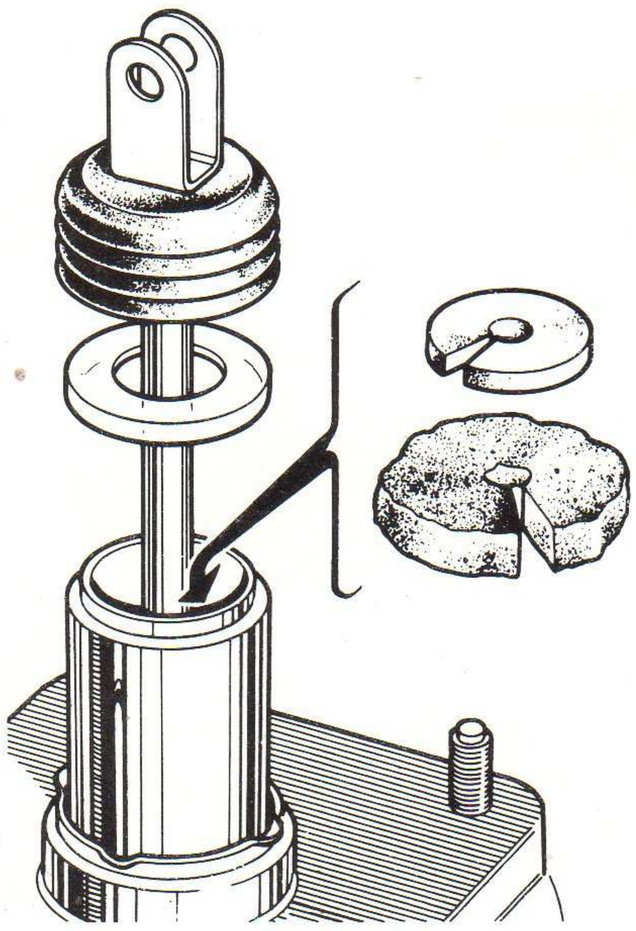
Place the valve in position on the front shell and press on the valve to compress the 'O' ring, then with the spanner turn the valve one third of a turn to engage the fixing lugs.

With the push-in type, remove the valve by pulling on the nozzle whilst exerting a side load. If the nozzle is straight it is easier to remove the valve if the hose is left clipped on. Alternatively, insert a flat bladed screwdriver (as shown) between the rubber grommet and the valve flange and (taking care not to damage the unit) lever the valve from the front shell. When removing the grommet ensure it does not drop into the vacuum chamber.

Fit the new grommet.

Lubricate the ribs of the new non-return valve with BMS Grease Number 64949086 and push fully into the grommet.

9



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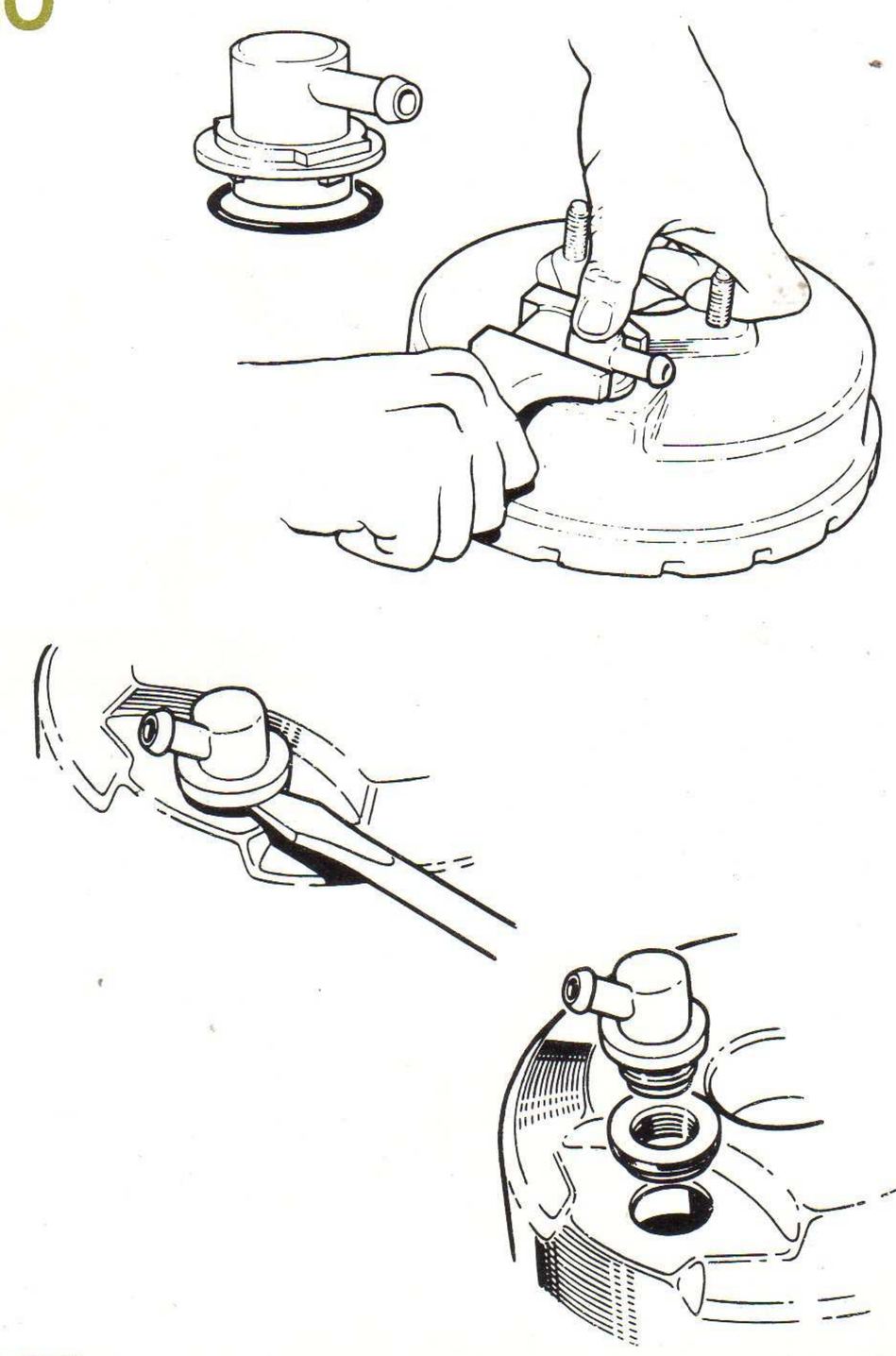
10



A 0205

## Fitting the parts from a Service Kit (Fig. 11)

To fit the new dust cover it is necessary to remove the unit from the vehicle and this should be done in accordance with the vehicle manufacturer's instructions.

Remove the dust cover and hook out the filters; cut the filters as shown to remove from the input rod. Cut the new filters and press into the valve body in the order shown on the illustration. Ensure the exterior of the valve body neck is clean and lubricate with BMS Grease Number 64949086. Fit the new dust cover.

Figs. 11a, 11b and 12 show the three methods of sealing the front shell.

Fig. 11a: Remove the seal and plate assembly from the front shell recess by gripping the centre rib with a pair of pointed nosed pliers. Wipe clean the output rod and recess wall and lubricate them and the new seal and plate assembly with BMS Grease Number 64949086. With plate side leading, fit the new seal and plate assembly over the rod and into the recess.

Fig. 11b: If in addition to the seal and plate assembly, a square section seal is fitted between the master cylinder and the Supervac, use the replacement seal provided in the relevant Girling Service Kit. DO NOT FIT THE SEAL UNLESS THE MASTER CYLINDER FLANGE INCORPORATES THE SEAL GROOVE AS SHOWN ON THE ILLUSTRATION BELOW.

Fig. 12: If the master cylinder is the 'OVERHUNG' A.S.A.S. TYPE, wipe clean the front mating face of the Supervac, but before fitting the master cylinder, examine the breather hole and the exposed section of the plunger. The breather hole must be kept clear, if allowed to become blocked by dirt or grease etc., this could affect the master cylinder and the Supervac.

A BRAKE FAILURE CAN RESULT FROM ANY ATTEMPT TO CLEAN THE BORE WITH WIRE OR COMPRESSED AIR.

Where necessary, remove the internal parts (refer to Section 5, Page 5A6) clean out the breather hole and wash the cylinder thoroughly with Girling Cleaning Fluid or unused Castrol-Girling Brake Fluid.

NOTE: Every 40,000 miles (64,000 km) or a period of three years, whichever occurs first, master cylinders fitted to Private Cars and Light Commercial Vehicles should be replaced by new guaranteed units. However, the cylinder can be overhauled at this juncture and new seals fitted from the appropriate Girling Service Kit, but only if the cylinder bore is in perfect condition.

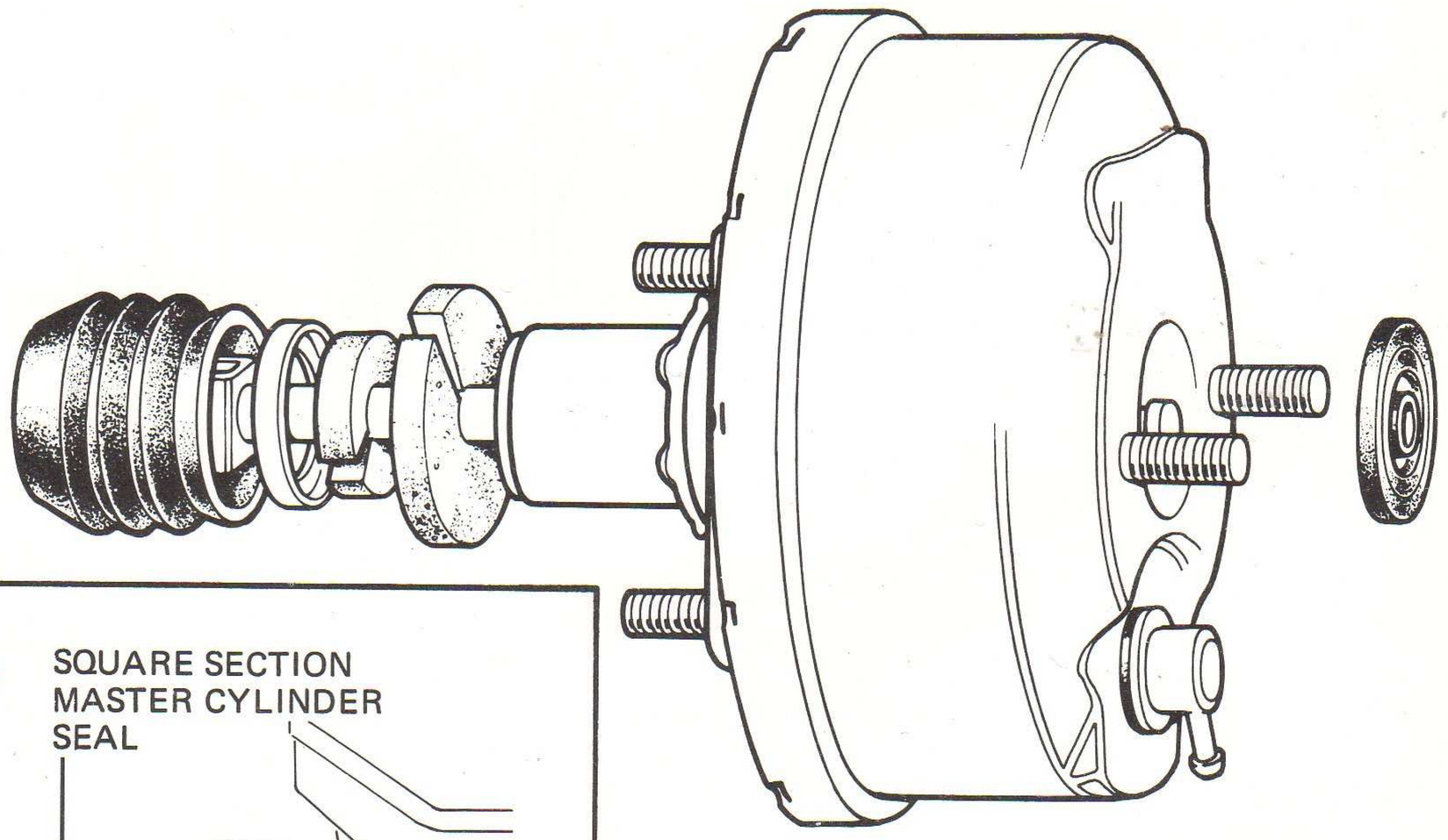
Examine the cylinder bore and the plungers for visible score marks, ridges and corrosion. Check the plunger seals for swelling, hardness or damage to the sealing edges.

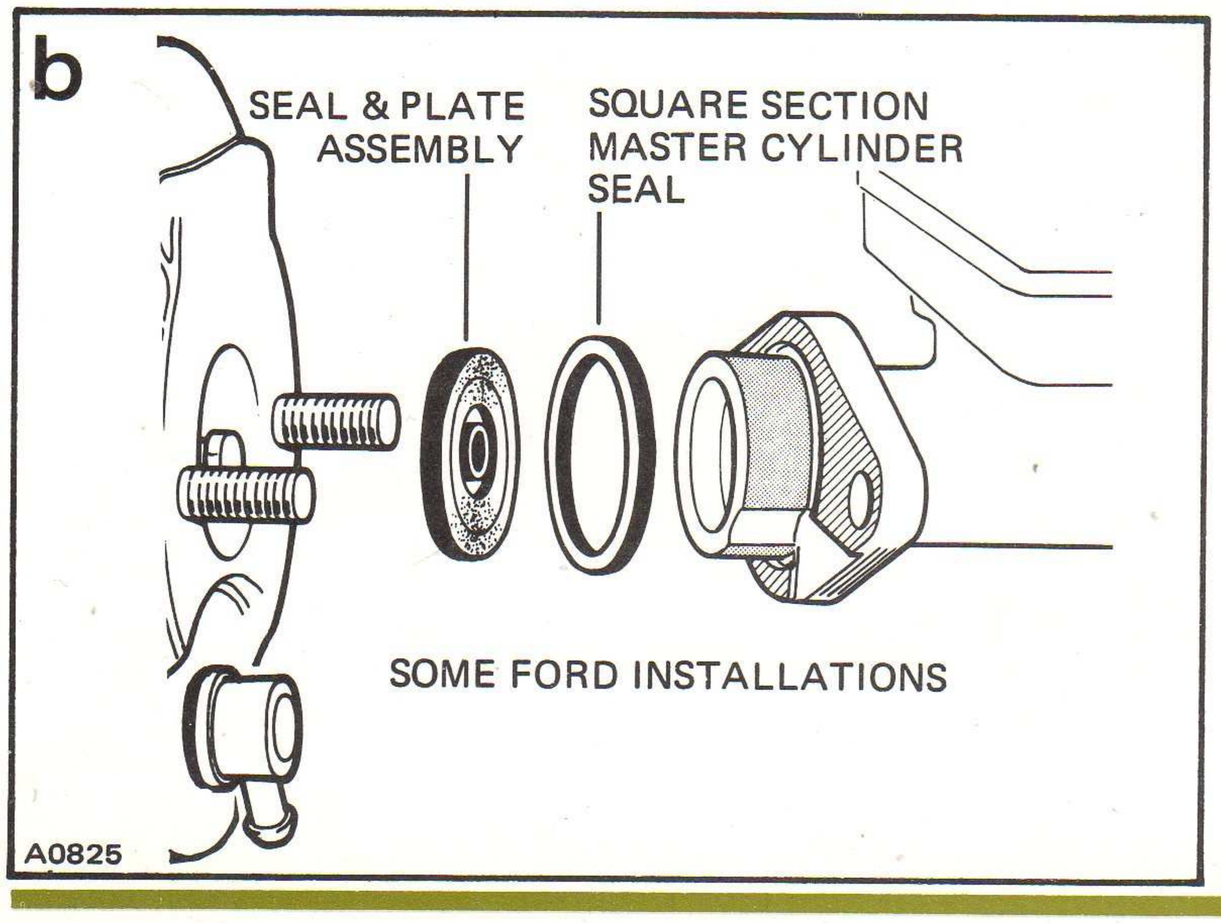
Provided the parts are in perfect condition the master cylinder can be reassembled, but where doubt exists, fit a new guaranteed master cylinder.

The exposed part of the primary plunger must be lubricated, but use only the special BMS Grease Number 64949086. Depress the plunger by hand several times and lubricate again if necessary.

Finally, position the 'O' ring on the master cylinder and bolt the cylinder onto the Supervac.

11a






A 0388

# Girling supervac



## Testing

The use of these tests will assist in diagnosis and provide assurance after servicing, but they cannot equal the quality of testing done at the Production Factory on specially designed equipment. If a unit gives cause for doubt, it is always best to replace it by a factory tested unit whenever possible.

It is assumed that any faults connected with the braking system such as contamination, lack of adjustment, air in the system or fluid leaks etc., have been recognised and eliminated.

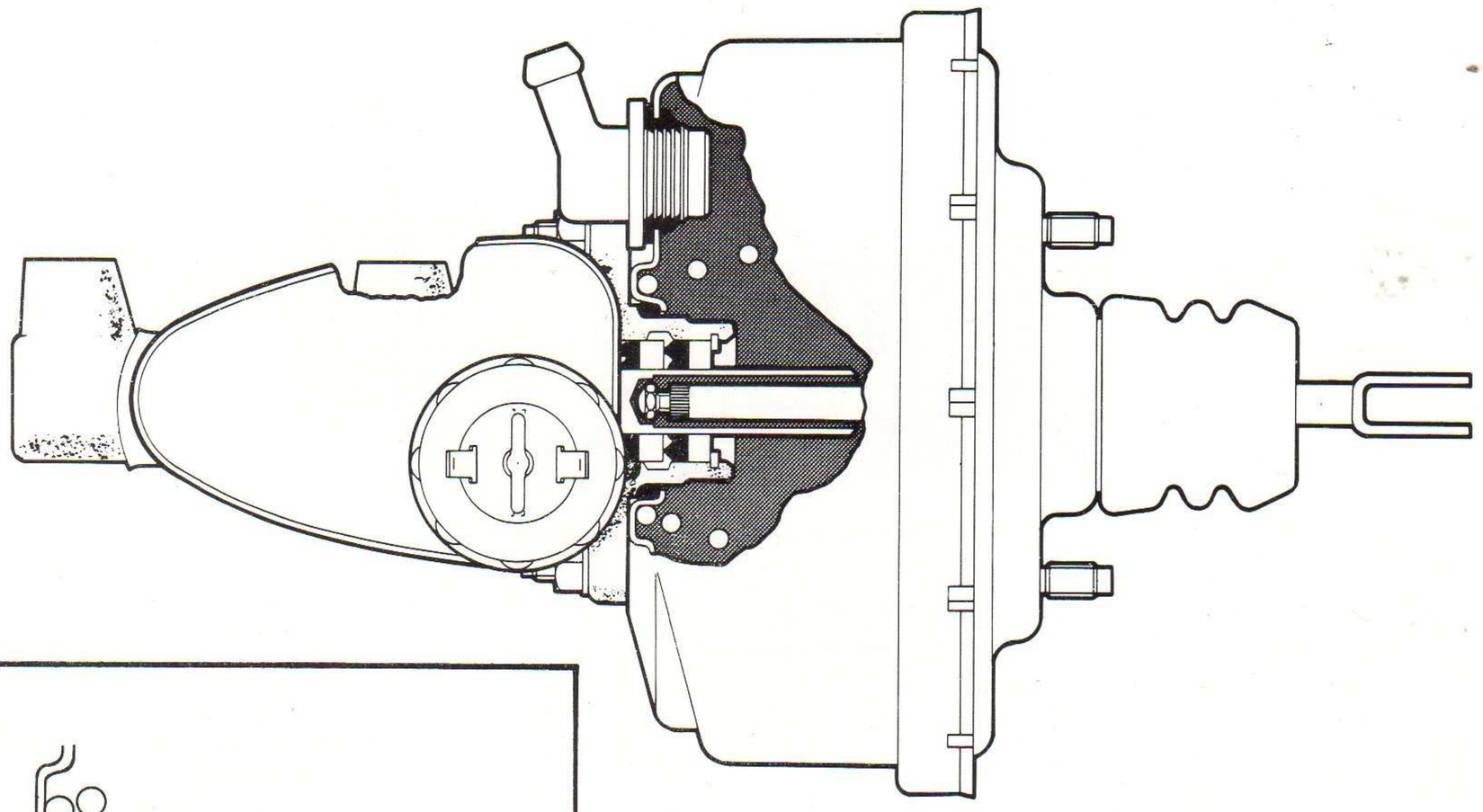
1. With the front of the car jacked-up, confirm one of the front wheels turns easily. Start the engine, allow vacuum to build up in the unit, and apply the brake pedal several times. It should be possible to turn the wheel amost immediately the pedal is released. If the brakes bind, suspect a major fault in the unit.
2. With engine running apply the brake pedal several times and check the operation of the pedal. If the response is sluggish, the vacuum hose may be faulty or the air filter may require changing.
3. Allow vacuum to build up in unit, stop engine and try brake action. Two or more applications should be power assisted as indicated by the effort required on the pedal. If the pedal action is not power assisted, the non-return valve may be faulty or there is a leak in the vacuum system.
4. Stop engine and press brake pedal several times to deplete all vacuum reserve in the system. Press brake and hold light foot pressure on pedal and start car engine. If the unit is working the pedal will fall away under foot pressure and less pressure is required to hold pedal in applied position.
5. Road test vehicle.

## Fault Finding

Listed below are some possible causes of hard pedal or apparent lack of power assistance.

| CAUSE | ACTION |
|---|---|
| Restricted air filter | Fit new filters. |
| Faulty vacuum hose | Check for kinking, loose connections or faulty hose. Fit new hose. |
| Faulty non-return valve | Fit new valve and grommet. |
| Vacuum leak from unit | Check for obvious leaks, fit new parts from Service kit or fit new unit. |
| Major fault in unit, refer to testing. | Fit new unit. |
| Brake Fluid in unit. | Fit new unit and a new 'Overhung' A.S.A.S. master cylinder. |

12a



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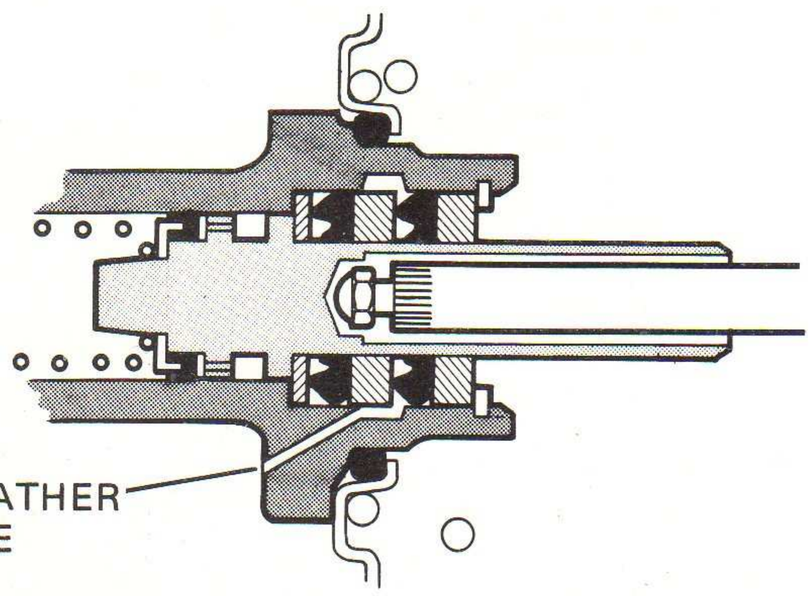



A0743

A0824

# Girling F.D. servo (flexing diaphragm)



## Introduction

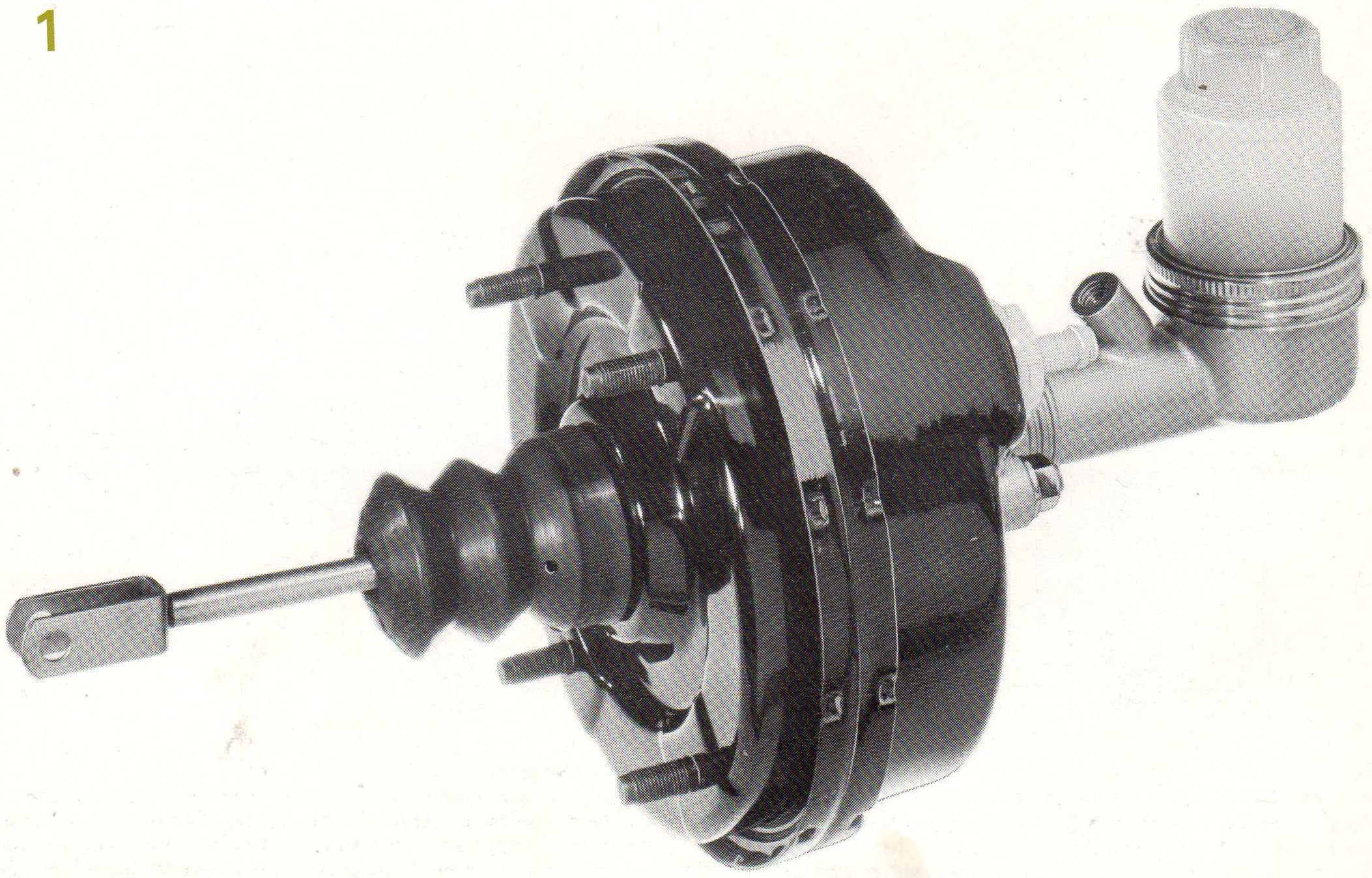
The Girling F.D. Servo (Fig. 1) is a mechanical servo unit designed to provide controlled power assistance to the effort applied by the driver's foot to the brake pedal.

Power supplied by the unit is obtained from vacuum created in the engine inlet manifold. The vacuum is applied to both sides of a diaphragm and by admitting atmospheric pressure to one side of the diaphragm, the power is obtained.

Mounted between the brake pedal and the master cylinder, the unit is connected to these parts by push rods. Should a vacuum failure occur, the two push rods act as a single rod and the brakes will therefore work in the conventional manner; but more effort will be required on the brake pedal.

The F.D. Servo unit is usually a part of the original brake equipment and each installation is approved by Girling engineers.

1



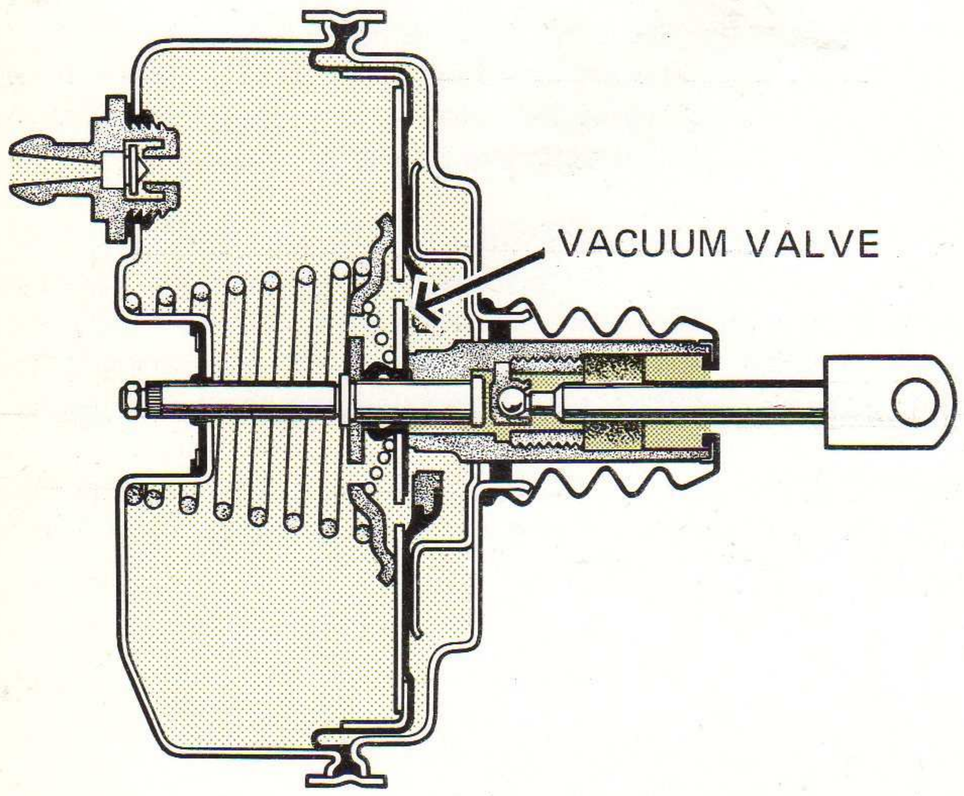
A 0382

# Girling F.D. servo (flexing diaphragm)



## How it works

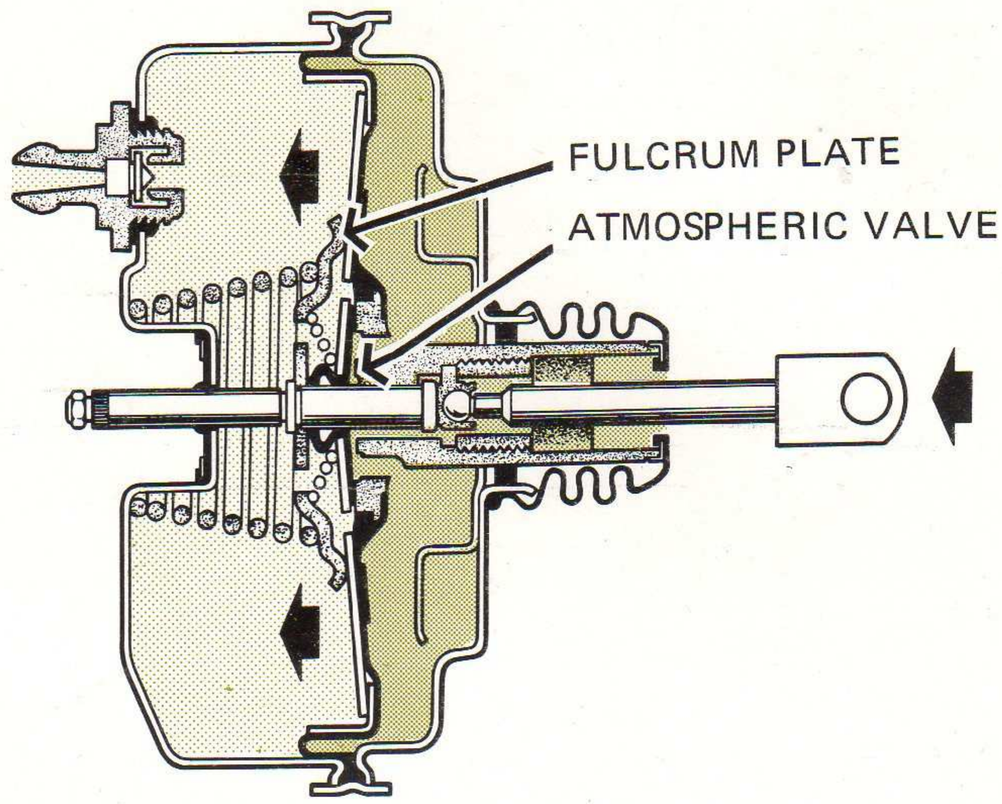
2




### Brake off

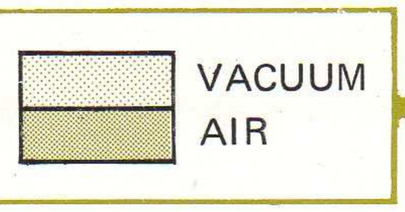
The diaphragm is fully recuperated and held against the rear shell by the diaphragm return spring. The input rod is also fully recuperated by the brake pedal return spring and with the rod in this position the vacuum valve is open and there is vacuum each side of the diaphragm.

3




### Brake applied

When the brake pedal is depressed the input rod and valve body move forward, the diaphragm fingers pivot on the fulcrum plate, closing the vacuum valve and opening the air valve. Atmospheric pressure then enters the rear shell behind the diaphragm and assists the input rod in pushing the diaphragm and output rod forward, thereby actuating the master cylinder plunger.

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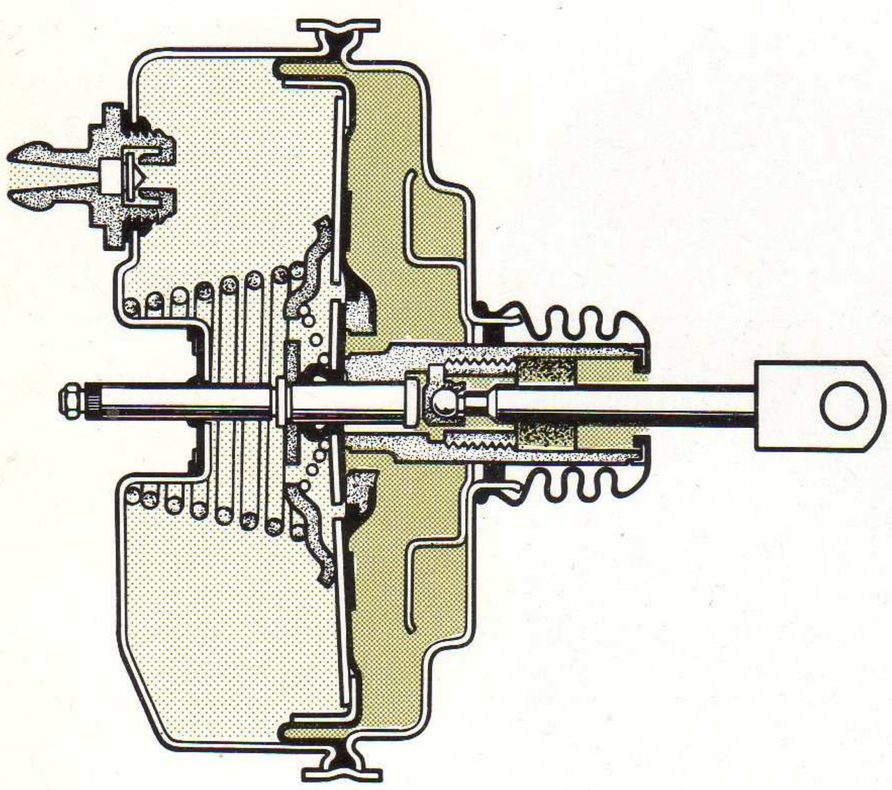
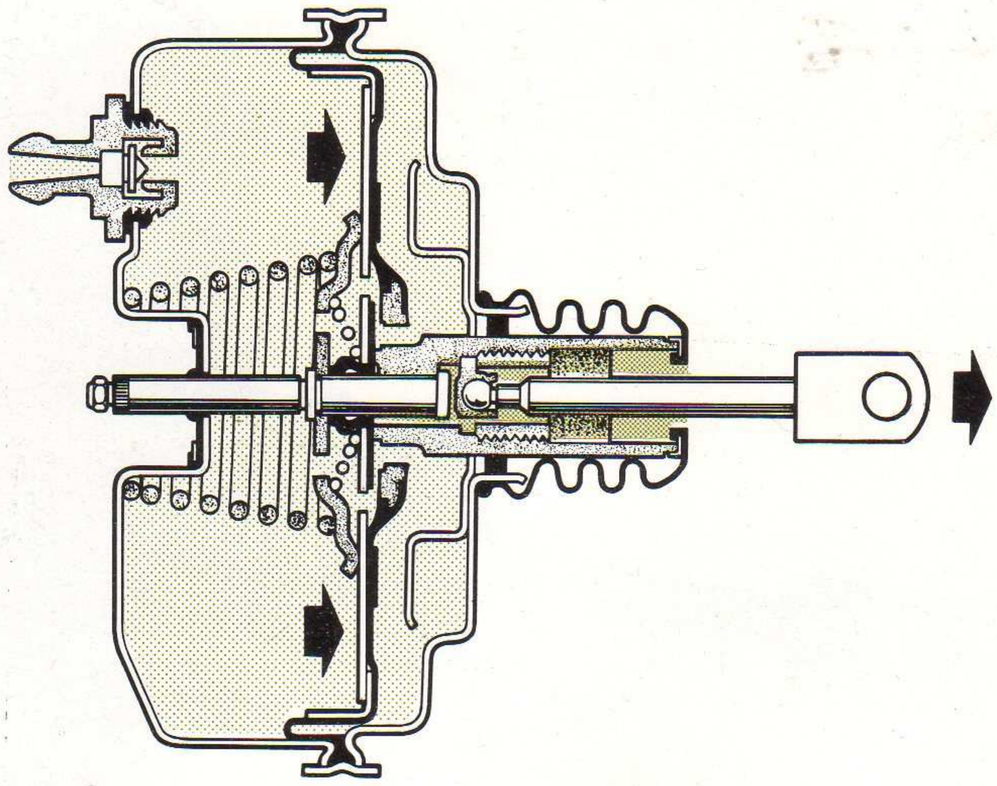


### Brake held on

When the brake pedal is held on, the diaphragm will momentary continue to move forward and this movement causes the valve fingers to pivot on the fulcrum plate and close the atmospheric valve. Further movement of the brake pedal either opens the vacuum valve or the atmospheric valve, depending on whether the brake pedal is released or depressed.

5



### Brake released

Immediately the brake pedal is released, the vacuum valve is opened and the atmospheric pressure in the rear chamber is extracted into the front chamber and from there to the inlet manifold, via the non-return valve. The atmospheric port remains closed whilst the valve body and input rod return to their original position (as shown on Fig. 2) assisted by the diaphragm return spring. The diaphragm is then again suspended in vacuum until the brake pedal is depressed.

# Girling F.D. servo (flexing diaphragm)

6B 2c

## Servicing (Fig.6)

The parts available to service the unit are; filters, a non-return valve kit and a service kit. Servicing of the internal parts is not recommended and if a major fault is apparent, a new complete guaranteed unit should be fitted.

The air filters should be changed every 40,000 miles (64,000 km) or three years, when the hydraulic cylinders and hoses are replaced. If dusty conditions prevail, the filters should be changed more frequently.

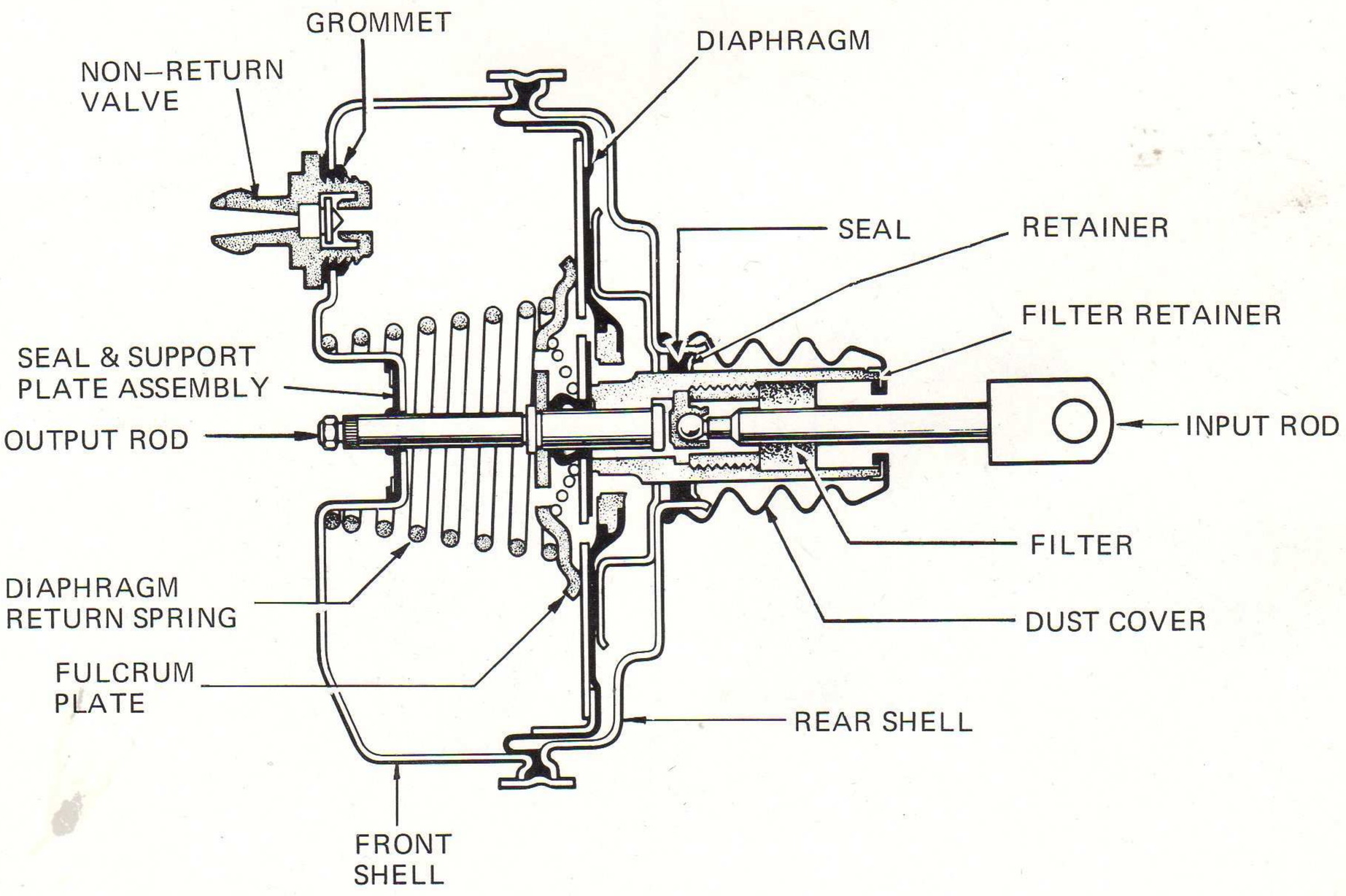
The output rod which operates the master cylinder plunger is retained internally and cannot be extracted. If the rod or the domed screw on the rod end is damaged, the Servo Unit must be replaced complete.

NO ATTEMPT SHOULD BE MADE TO ADJUST THE DOMED SCREW, THIS IS CORRECTLY SET AT THE PRODUCTION FACTORY AND SHOULD NEVER BE DISTURBED.

The contents of the kits are as follows:

| SERVICE KIT | NON-RETURN VALVE KIT |
|---|---|
| Seal & Support Plate Assy | Non-Return Valve |
| Seal (Rear Shell) | Grommet |
| Retainer (Rear Shell) | Grease No. 64949009 |
| Dust Cover | |
| Filter | |
| Filter Retainer | |
| Grease No. 64949008 | |

6




A 0204

# Girling F.D. servo (flexing diaphragm)

## Replacing the Filter (Fig. 7)

Pull back the dust cover, lift the filter retainer off the valve body and hook out the filter; cut the filter as shown on the illustration to remove from the input rod.

Cut new filter, press into neck of valve body and refit filter retainer and dust cover. If the dust cover is damaged, fit a new one from a Service Kit.

## Replacing the Non-Return Valve (Fig. 8)

Some valves have angled nozzles which are 'handed', therefore if fitted, note the angle of the valve nozzle in relation to the front shell so that the new valve can be fitted in the same position.

Remove the valve by pulling on the nozzle whilst exerting a side load. If the nozzle is straight it is easier to remove the valve if the hose is left clipped on. Alternatively, insert a flat bladed screwdriver (as shown Fig. 8) between the rubber grommet and the valve flange and (taking care not to damage the unit) lever the valve from the front shell.

When removing the grommet ensure it does not drop into the vacuum chamber.

Fit the new grommet.

Lubricate the ribs of the new non-return valve with grease number 64949009 and push fully into the grommet.

## Fitting the Parts from a Service Kit (Fig. 9)

To fit the new dust cover it is necessary to remove the unit from the vehicle and this should be done in accordance with the vehicle manufacturer's instructions.

Remove the seal and support plate assembly from the front shell recess by inserting a screwdriver under the metal part and levering the assembly from the recess.

Wipe clean the output rod and recess wall and lubricate them and the new seal assembly with grease number 64949008. With rubber side leading, fit the new seal assembly over the rod and into the recess.

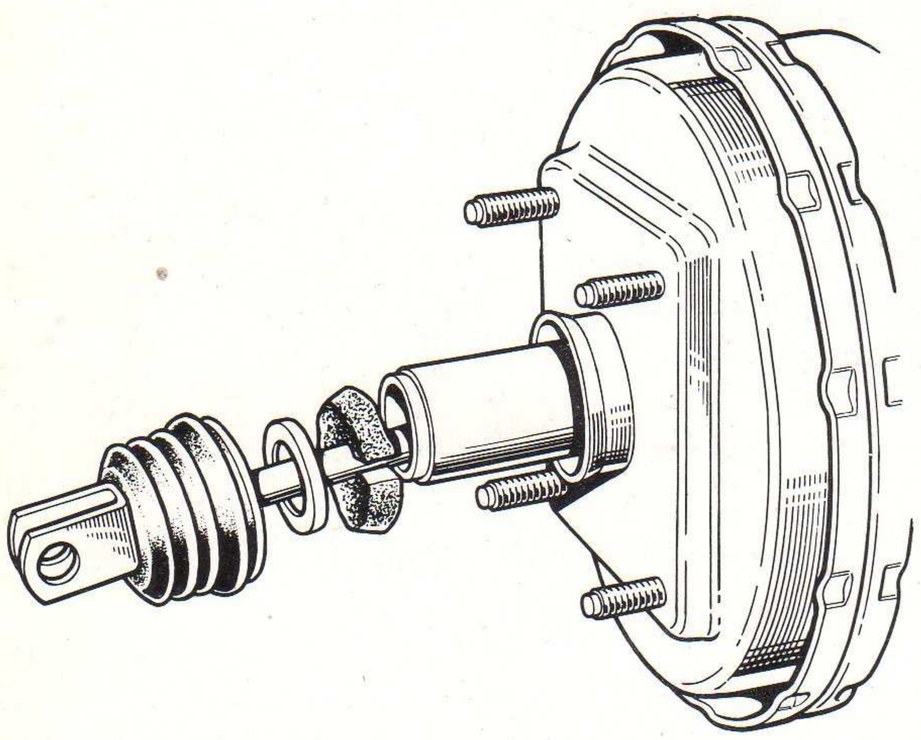
Remove the dust cover, lift the filter retainer off the valve body neck and hook out the filter; cut filter as shown to remove from the input rod. Cut the new filter, press into the valve body and refit the filter retainer.

Lever out the retainer from the rear shell and remove the seal; TAKE CARE NOT TO SCRATCH OR DAMAGE THE VALVE BODY NECK.

Lubricate the new seal, valve body neck and sealing areas of the new dust cover with grease number 64949008.

Fit the new seal, flat back leading, and new retainer, press retainer firmly into position. Fit the new dust cover.

7



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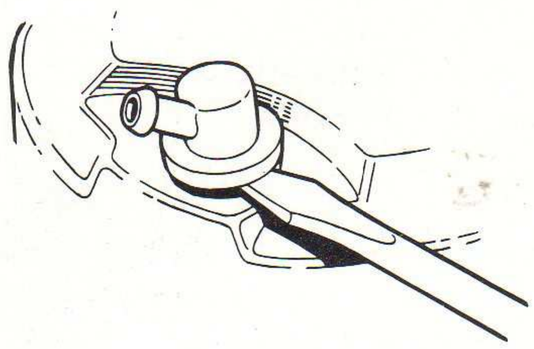
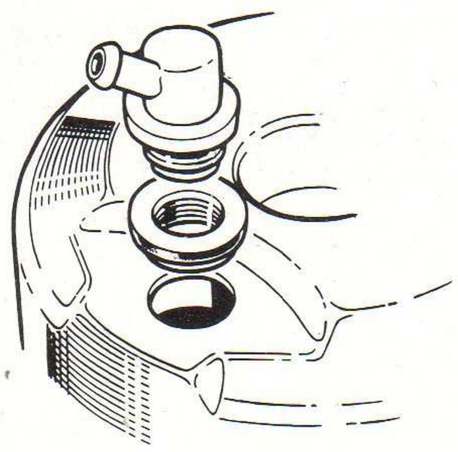




# Girling F.D. servo (flexing diaphragm)



## Testing

The use of these tests will assist in diagnosis and provide assurance after servicing, but they cannot equal the quality of testing done at the Production Factory on specially designed equipment. If a unit gives cause for doubt, it is always best to replace it by a factory tested unit whenever possible.
It is assumed that any faults connected with the braking system such as contamination, lack of adjustment, air in the system or fluid leaks etc, have been recognised and eliminated.

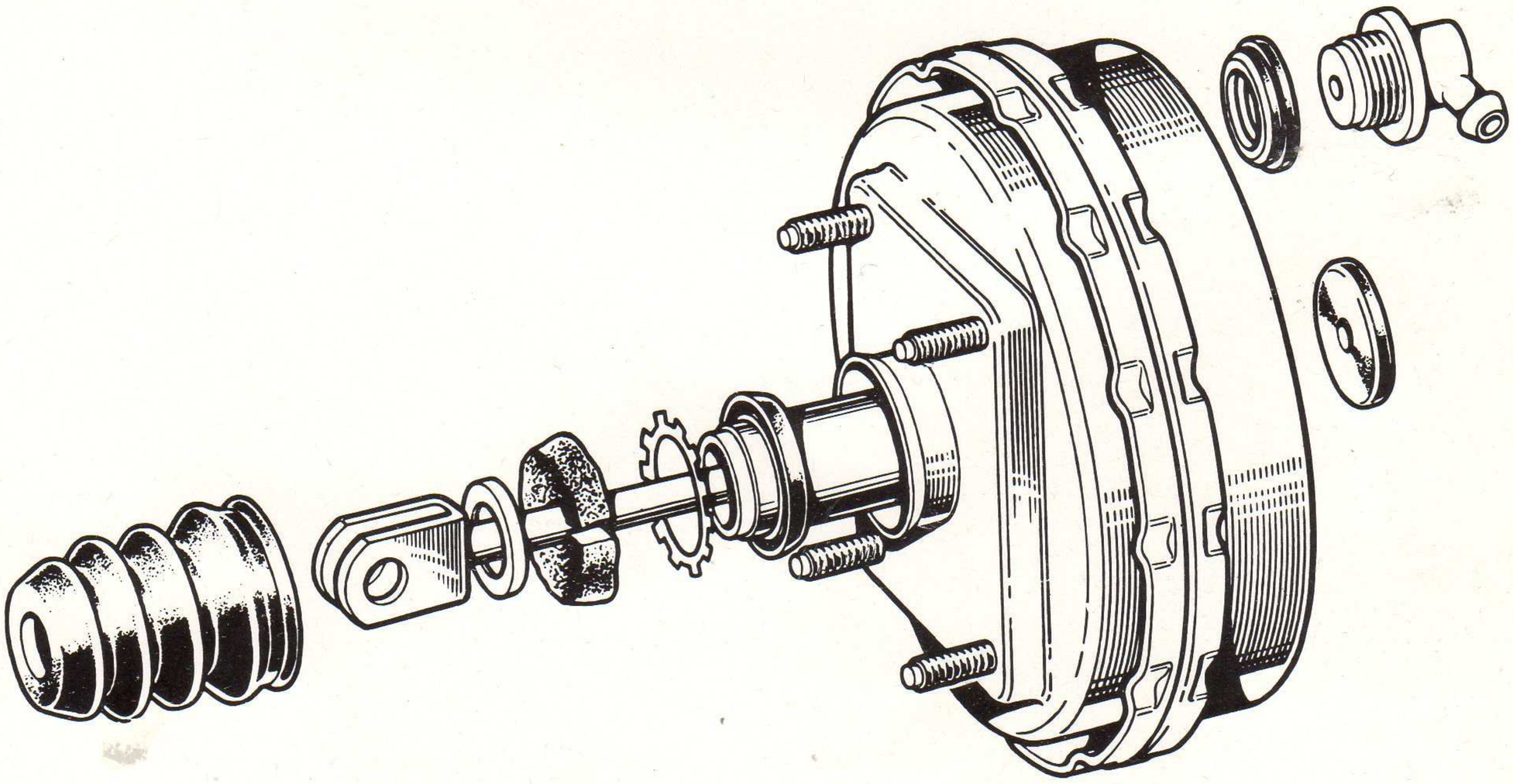
1. With the front of the car jacked up, confirm one of the front wheels turns easily. Start the engine, allow vacuum to build up in the unit, and apply the brake pedal several times. It should be possible to turn the wheel almost immediately the pedal is released. If the brakes bind, suspect a major fault in the unit.
2. With engine running apply the brake pedal several times and check the operation of the pedal. If the response is sluggish, the vacuum hose may be faulty or the air filter may require changing.
3. Allow vacuum to build up in unit, stop engine and try brake action. Two or more applications should be power assisted as indicated by the effort required on the pedal. If the pedal action is not power assisted, the non-return valve may be faulty or there is a leak in the vacuum system.
4. Stop engine and press brake pedal several times to deplete all vacuum reserve in the system. Press brake and hold light foot pressure on pedal and start car engine. If the unit is working the pedal will fall away under foot pressure and less pressure is required to hold pedal in applied position.
5. Road test vehicle.

## Fault Finding

Listed below are some possible causes of hard pedal or apparent lack of power assistance.

| CAUSE | ACTION |
|---|---|
| Restricted air filter | Fit new filters |
| Faulty vacuum hose | Check for kinking, loose connections or faulty hose. Fit new hose. |
| Faulty non-return valve | Fit new valve and grommet. |
| Vacuum leak from unit | Check for obvious leaks, fit new parts from Service Kit or fit new unit. |
| Major fault in unit, refer to testing. | Fit new unit. |





A 0205

# Girling tandem supervac (type 100)

6B 3a

## Introduction

The Tandem Supervac (Fig. 1) is a mechanical servo unit designed to provide adequate controlled assistance to the brake systems of the larger and more powerful vehicles.

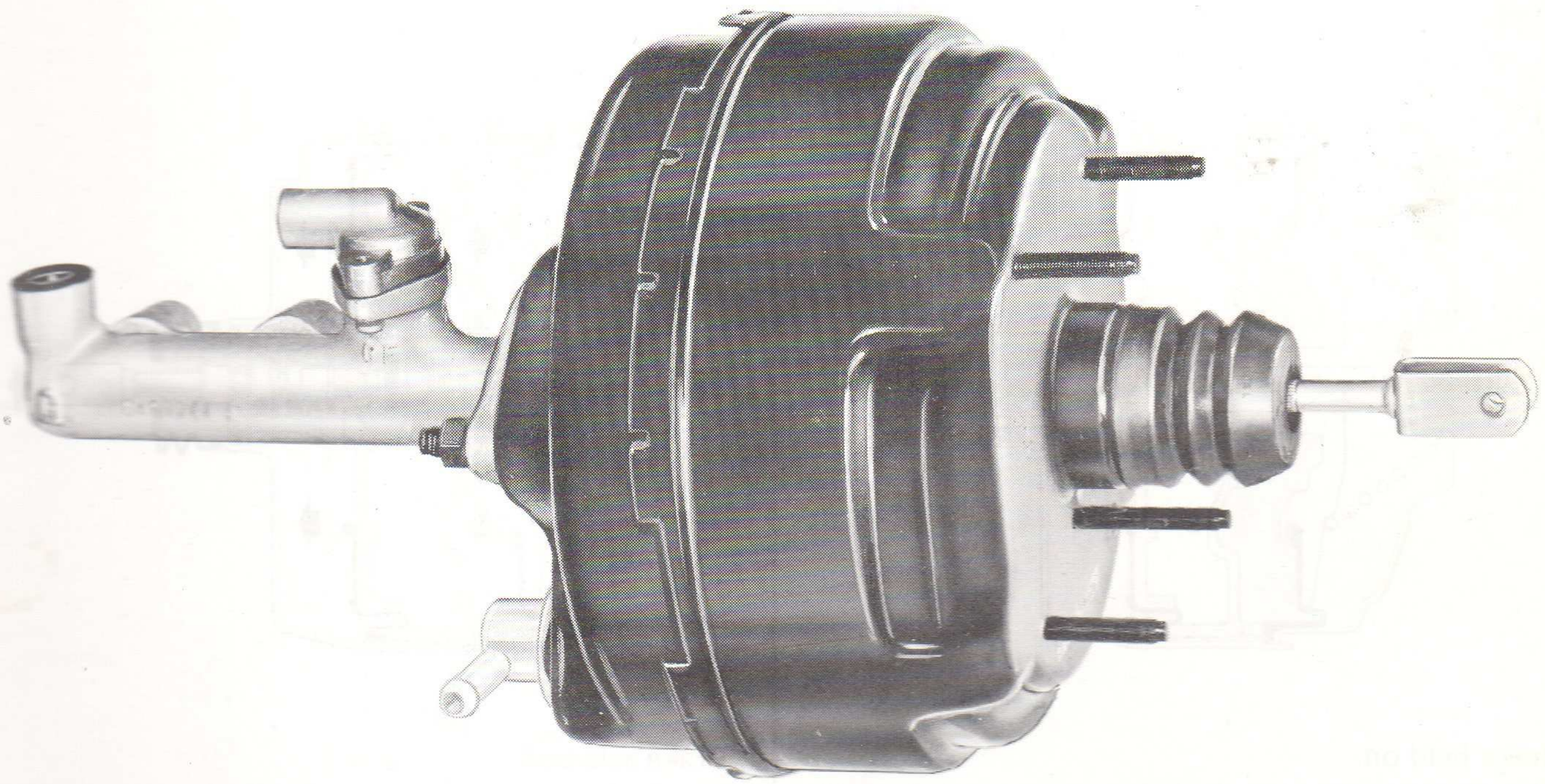
Power supplied by the unit is obtained from vacuum created in the engine inlet manifold. The vacuum is applied to both sides of twin diaphragms and by admitting atmospheric pressure to one side of the diaphragms, the power is obtained.

Mounted between the brake pedal and the master cylinder, the unit is connected to these parts by push rods. Should a vacuum failure occur, the two push rods act as a single rod and the brakes will therefore work in the conventional manner; but more effort will be required on the brake pedal.

There are straight and angled non-return valves and the design of the push rod — which is attached to the brake pedal — is varied to suit the vehicle manufacturer's installation.

The Tandem Supervac unit is usually a part of the original brake equipment and each installation is approved by Girling engineers.

1



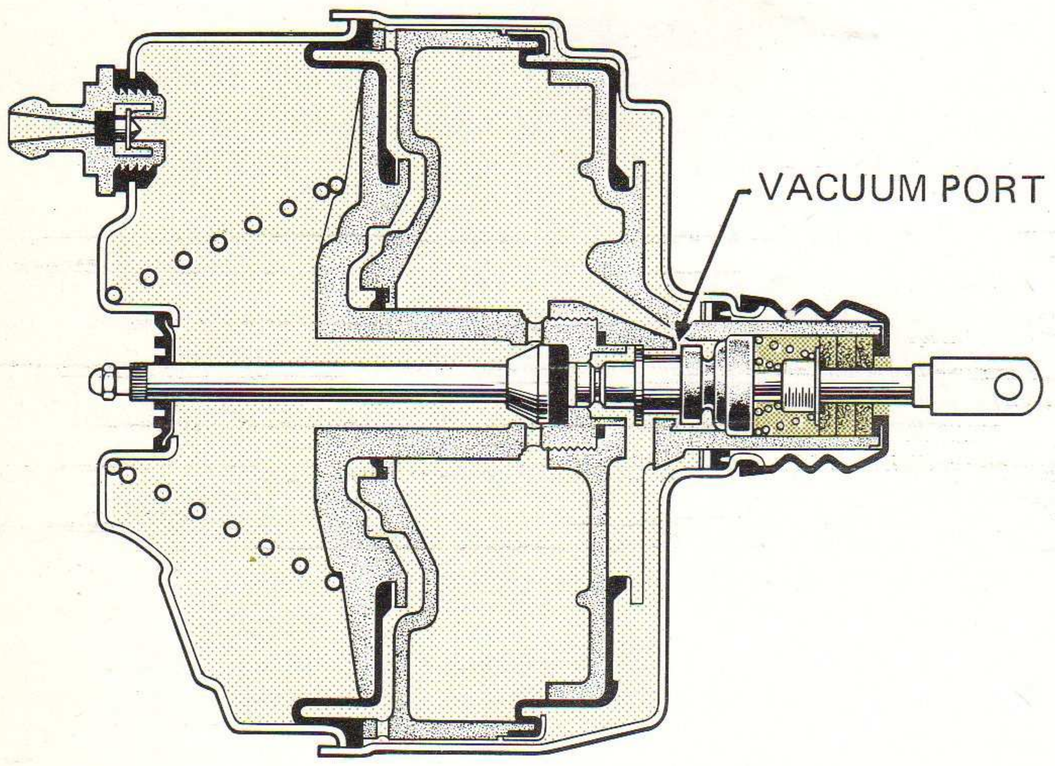
A 0382

# Girling tandem supervac (type 100)



## How it works

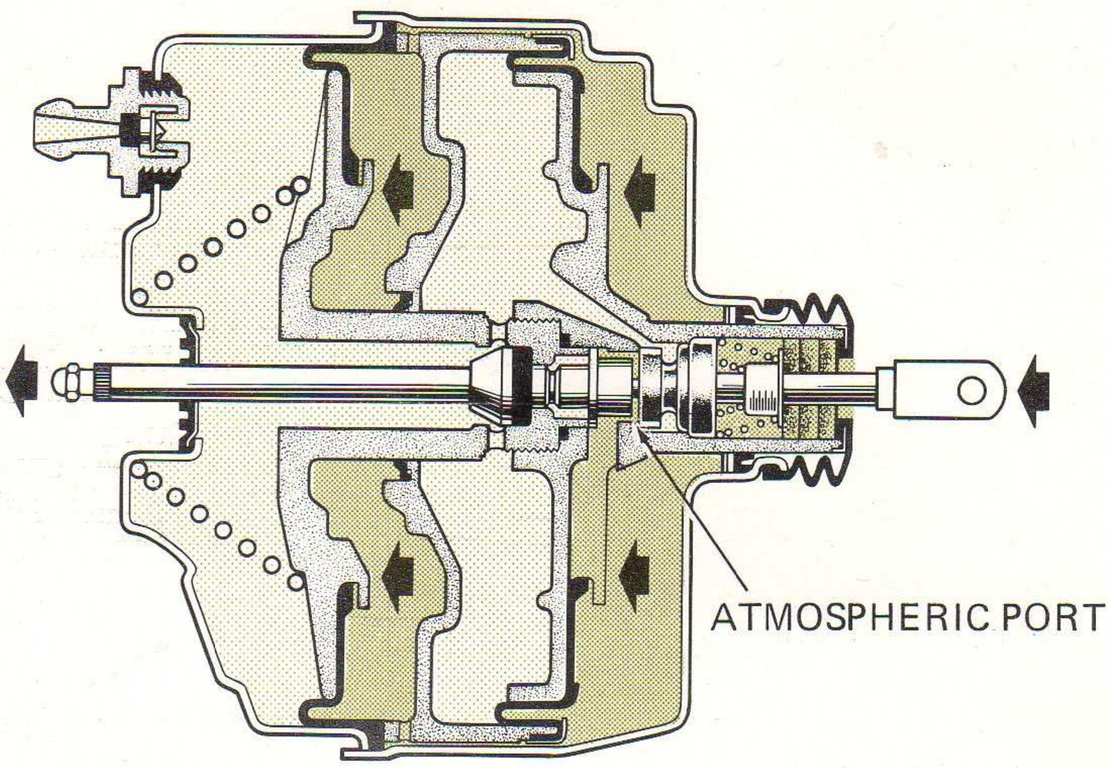
2




### Brake off

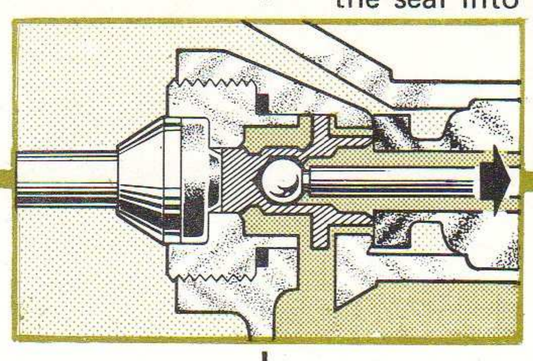
The twin diaphragms are fully recuperated and held against the stop faces by the diaphragm return spring. The input rod assembly is also fully retracted by the brake pedal return spring, within the diaphragm plate, as far as the valve control piston will allow. With the input rod in this position the vacuum port is open and there is a vacuum each side of both diaphragms.

3



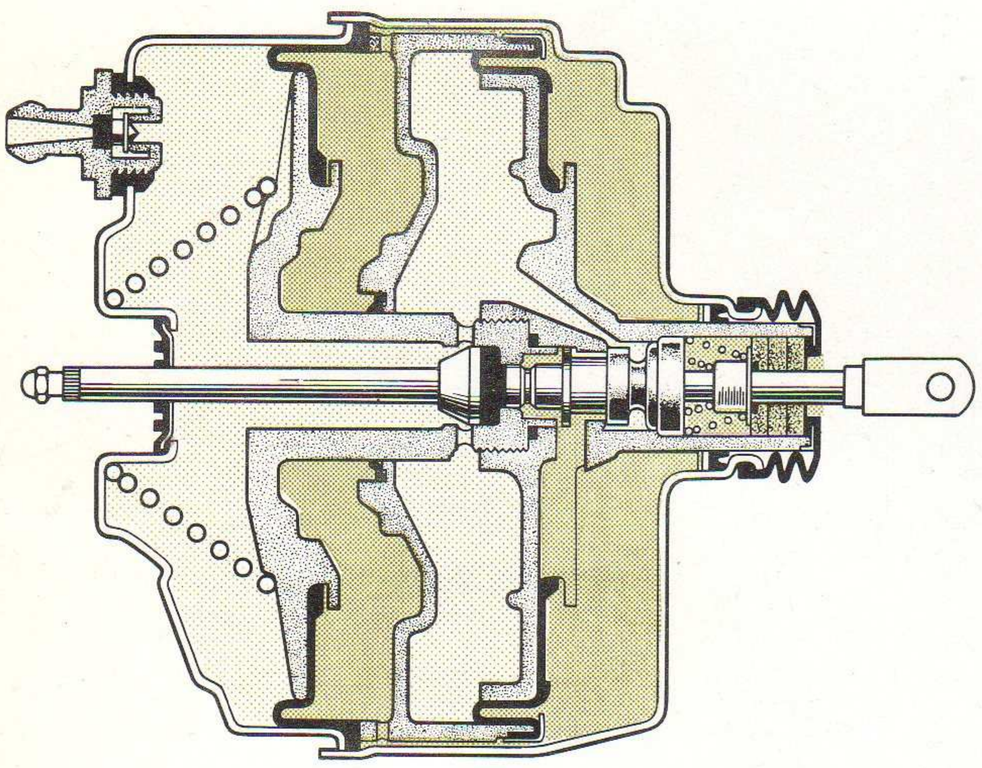

### Brake being applied

When the brake pedal is depressed, the input rod moves forward and the rubber valve seal closes the vacuum port, isolating the chambers behind the diaphragms from the vacuum source. The input rod continues to move forward through the now stationary valve seal opening the air valve. This allows air to pass through the centre of the seal into the chambers behind the two diaphragms. The driving force provided by the air acting on the diaphragms and the drivers foot on the brake pedal moves the output rod forward, operating the master cylinder.



VACUUM AIR

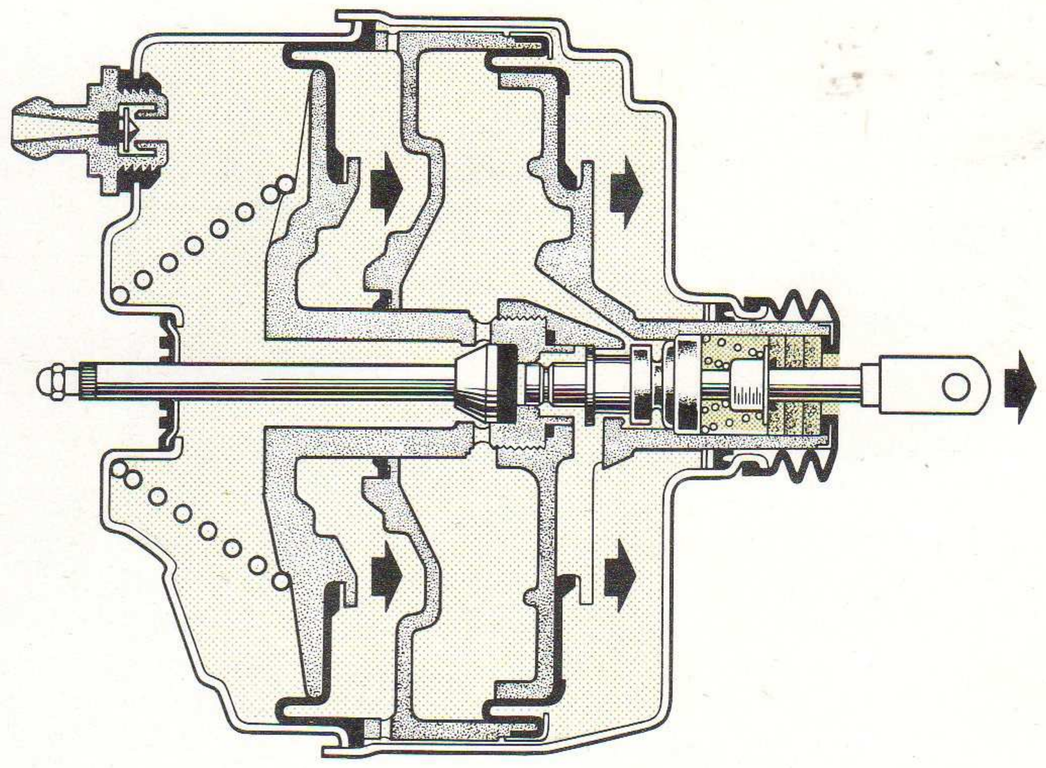
4



### Brake held on

When the brake pedal is held on, the front and rear diaphragms will momentarily continue to move forward and so compress the outer edges of the reaction disc. This compression causes the centre of the disc to extrude, pressing back the input rod (see inset above) and thus closing the atmospheric port. Further movement of the brake pedal either opens the vacuum or atmospheric port, depending on whether the brake pedal is released or depressed.

5



### Brake released

Immediately the brake pedal is released, the vacuum port is opened and the atmospheric pressure in the unit is extracted to the inlet manifold via the non-return valve. The atmospheric port remains closed whilst the input rod assembly returns to its original position (as shown on Fig. 2) assisted by the diaphragm return spring. The twin diaphragms are then suspended in vacuum until the brake pedal is depressed.

# Girling tandem supervac (type 100)

6B 3c

## Servicing (Fig. 6)

The parts available to service the unit are:— filters, a non-return valve kit and a service kit. Servicing of the internal parts is not recommended and if a major fault is apparent, a new complete guaranteed unit should be fitted.

The air filters should be changed every 40,000 miles (64,000 km) or three years, when the hydraulic cylinders and hoses are replaced. If dusty conditions prevail, the filters should be changed more frequently.

The output rod is not serviceable and it is quite unnecessary to alter the height of the output rod in service.

NO ATTEMPT SHOULD BE MADE TO ADJUST THE DOMED SCREW, THIS IS CORRECTLY SET AT THE PRODUCTION FACTORY AND SHOULD NEVER BE DISTURBED.

The contents of the kits are as follows:—

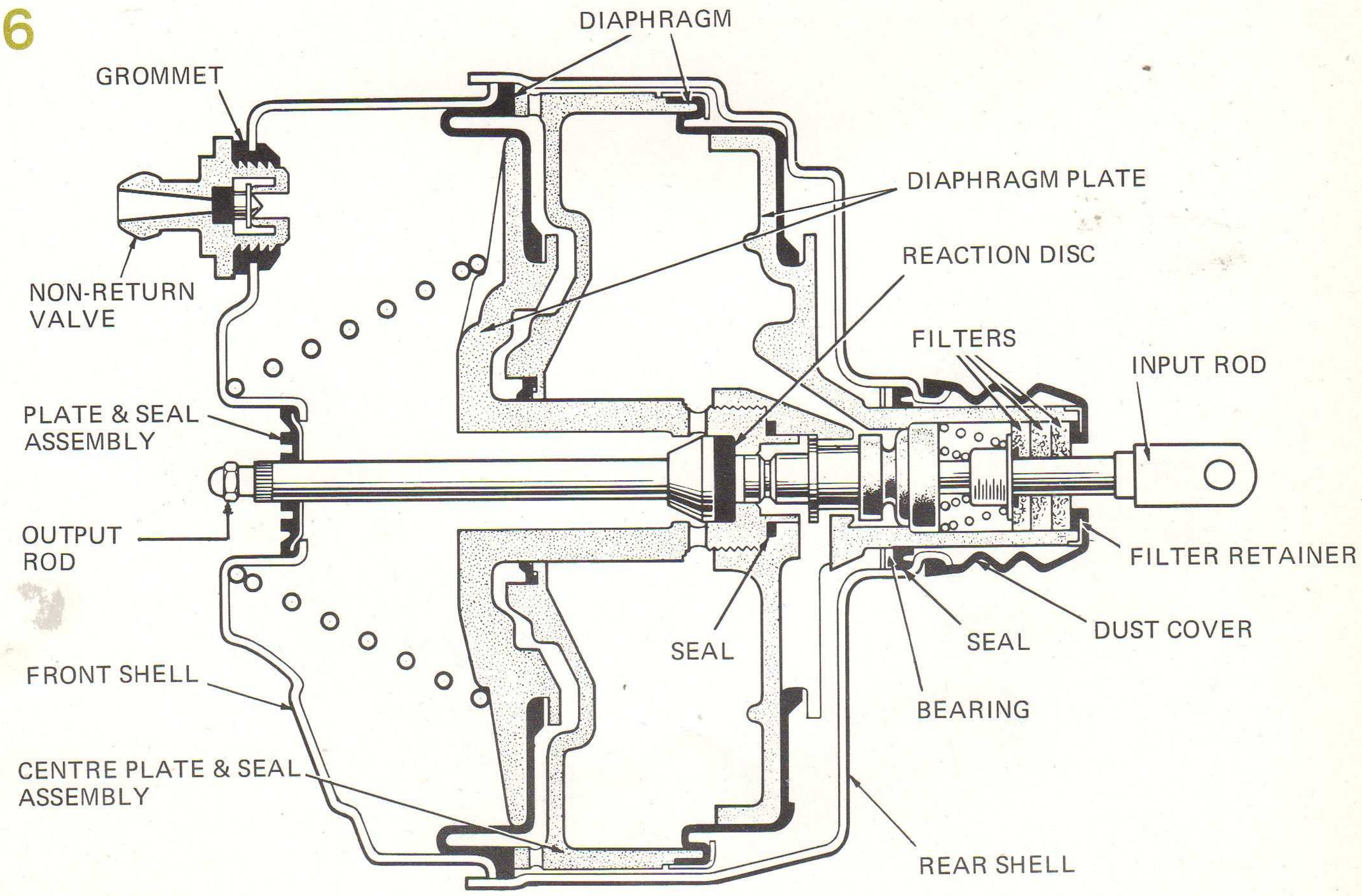
SERVICE KIT

Dust Cover
Filter (Foam)
Filter (Felt) 2 off
Filter Retainer
Plate and Seal Assembly
Grease No. 64949008

NON RETURN VALVE KIT

Non-Return Valve
Grommet
Grease No. 64949009

6




A 0134

# Girling tandem supervac (type 100)



## Replacing the Filters (Fig. 7)

The filters cannot be replaced on some installations unless the pedal box is removed from the vehicle and this should be done in accordance with the vehicle manufacturer's instructions Provided the unit is accessible therefore, proceed as follows:—
Pull back the dust cover and filter retainer; hook out the filters and cut to remove from the input rod. If damaged, the dust cover should be replaced.
Cut the new filters and press into the neck of the diaphragm plate as indicated on the illustration.
Refit the filter retainer and dust cover.

## Replacing the Non-Return Valve (Fig. 8)

Some valves have angled nozzles which are 'handed', therefore if fitted, note the angle of the valve nozzle in relation to the front shell so that the new valve can be fitted in the same position.
Remove the valve by pulling on the nozzle whilst exerting a side load. If the nozzle is straight it is easier to remove the valve if the hose is left clipped on. Alternatively, insert a flat bladed screwdriver (as shown) between the rubber grommet and the valve flange and (taking care not to damage the unit) lever the valve from the front shell.
When removing the grommet ensure it does not drop into the vacuum chamber.
Fit the new grommet.
Lubricate the ribs of the new non-return valve with grease number 64949009 and push fully into the grommet.

## Fitting the Parts from a Service Kit (Fig. 9)

To fit the new dust cover it is necessary to remove the unit from the vehicle and this should be done in accordance with the vehicle manufacturer's instructions.
Remove the seal and plate assembly from the front shell recess by gripping the centre rib with a pair of pointed nosed pliers.
Wipe clean the recess and the output rod and lubricate them and the new seal assembly with grease number 64949008.
With plate side leading, fit the new seal assembly over the output rod and into the recess.
Remove the dust cover, filter retainer and filters. Wipe clean the exterior of the diaphragm plate neck and lubricate with grease number 64949008. Also lubricate the sealing areas of the new dust cover with this grease.
Cut the new filters and press into the neck of the diaphragm plate as indicated on the illustration. Refit the filter retainer and fit the new dust cover. Refit unit to vehicle in accordance with the vehicle manufacturer's instructions.

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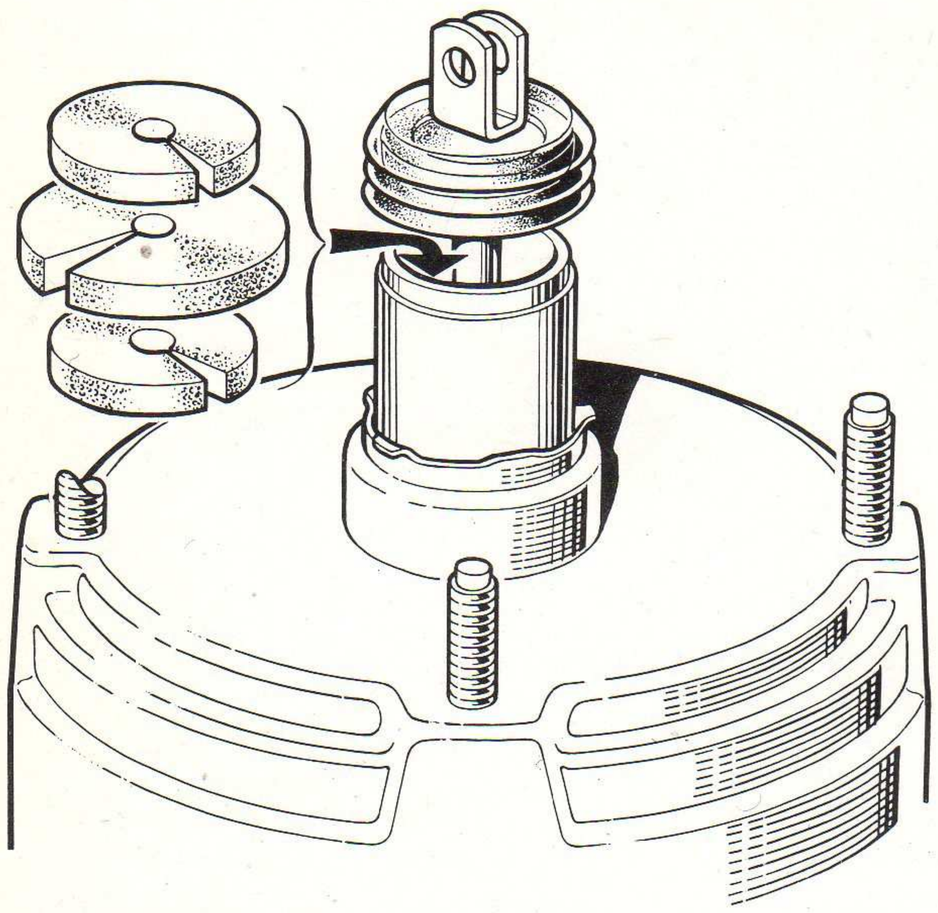

A 0196

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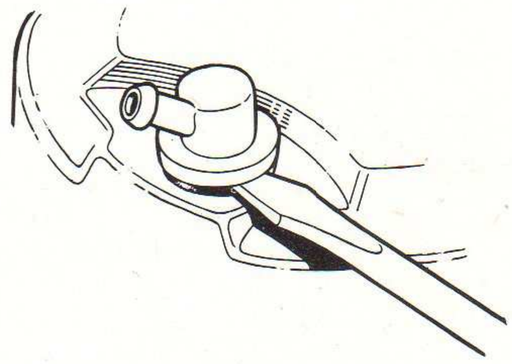
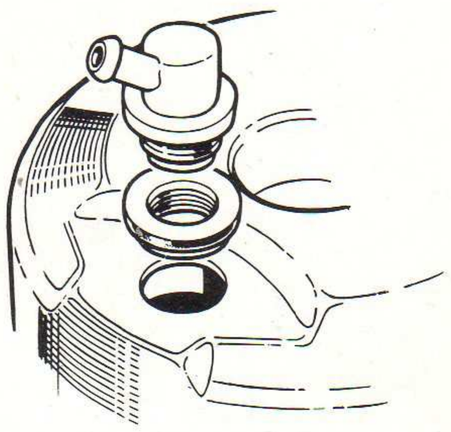




A 0205

# Girling tandem supervac (type 100)

6B 3e

## Testing

The use of these tests will assist in diagnosis and provide assurance after servicing, but they cannot equal the quality of testing done at the Production Factory on specially designed equipment. If a unit gives cause for doubt, it is always best to replace it by a factory tested unit whenever possible.

It is assumed that any faults connected with the braking system such as contamination, lack of adjustment, air in the system or fluid leaks etc, have been recognised and eliminated.

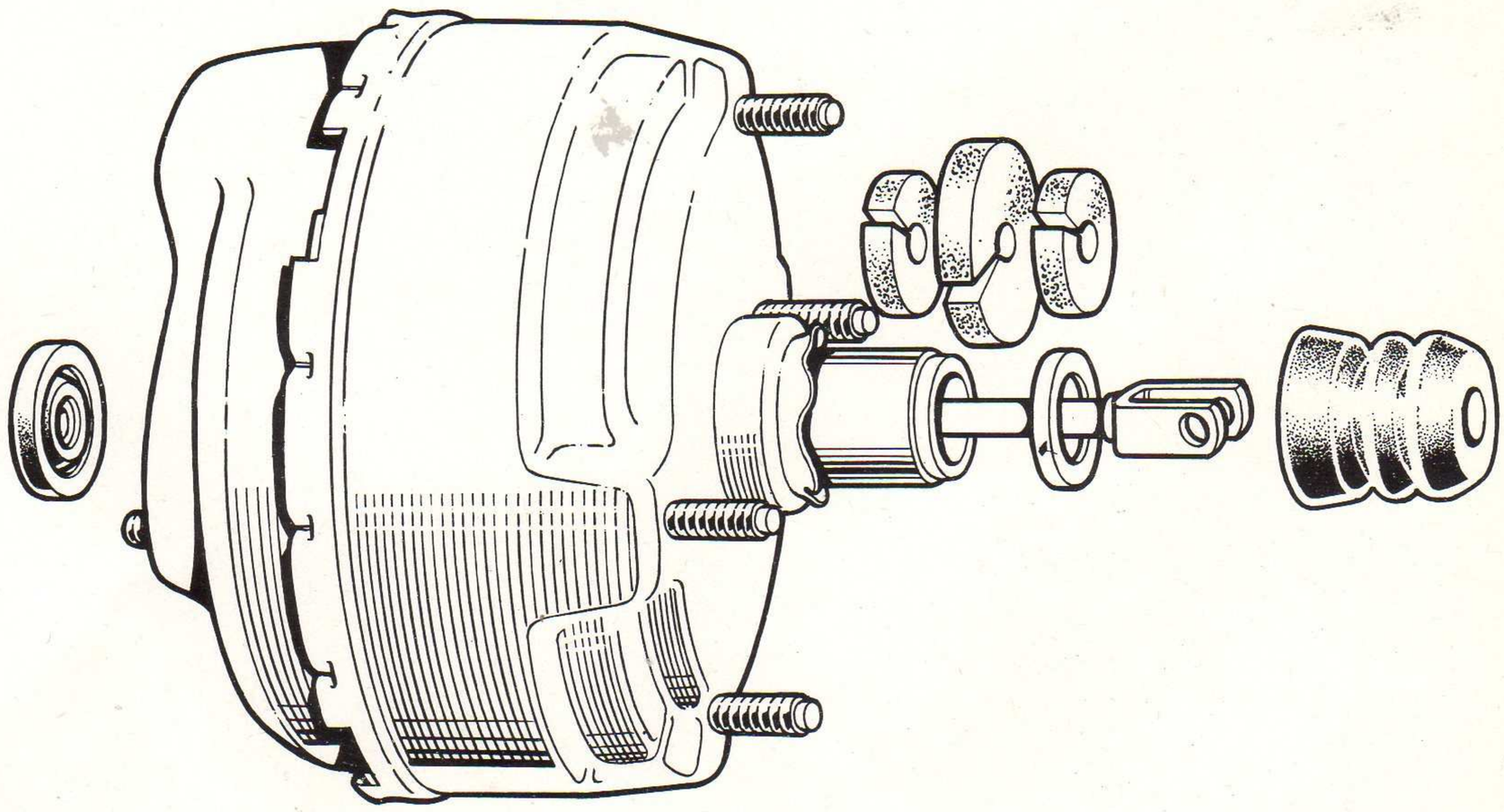
1. With the front of the car jacked up, confirm one of the front wheels turns easily. Start the engine, allow vacuum to build up in the unit, and apply the brake pedal several times. It should be possible to turn the wheel almost immediately the pedal is released. If the brakes bind, suspect a major fault in the unit.
2. With engine running apply the brake pedal several times and check the operation of the pedal. If the response is sluggish, the vacuum hose may be faulty or the air filter may require changing.
3. Allow vacuum to build up in unit, stop engine and try brake action. Two or more applications should be power assisted as indicated by the effort required on the pedal. If the pedal action is not power assisted, the non-return valve may be faulty or there is a leak in the vacuum system.
4. Stop engine and press brake pedal several times to deplete all vacuum reserve in the system. Press brake and hold light foot pressure on pedal and start car engine. If the unit is working the pedal will fall away under foot pressure and less pressure is required to hold pedal in applied position.
5. Road test vehicle.

## Fault Finding

Listed below are some possible causes of hard pedal or apparent lack of power assistance.

| CAUSE | ACTION |
|---|---|
| Restricted air filter | Fit new filters. |
| Faulty vacuum hose | Check for kinking, loose connections or faulty hose.<br>Fit new hose. |
| Faulty non-return valve | Fit new valve and grommet. |
| Vacuum leak from unit | Check for obvious leaks, fit new parts from Service Kit or fit new unit. |
| Major fault in unit, refer to testing. | Fit new unit. |





A 0196/1

# Girling servac



## Introduction

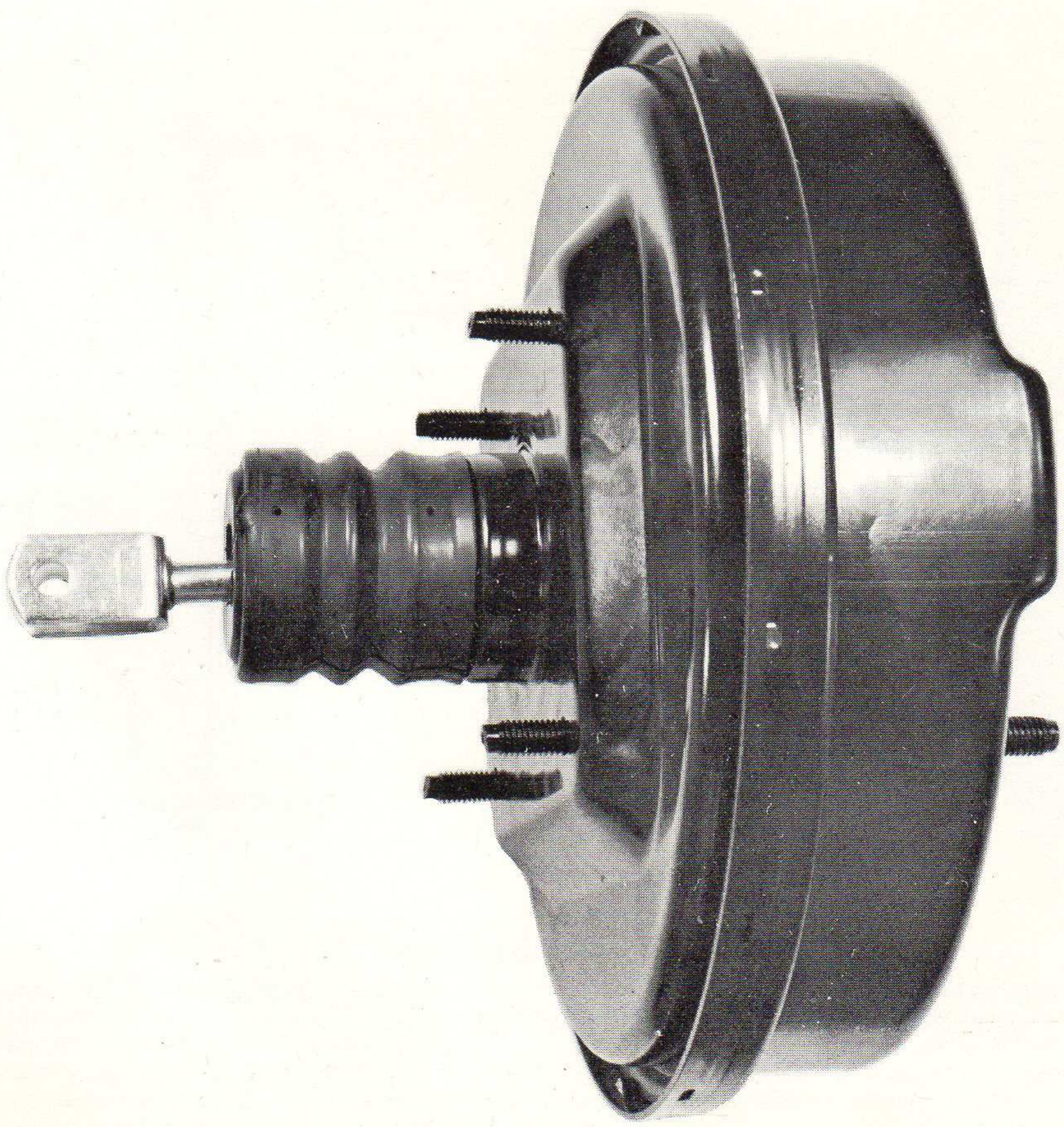
The Girling Servac (Fig. 1) is a mechanical servo unit designed to provide controlled power assistance to the effort applied by the driver's foot to the brake pedal.

Power supplied by the unit is obtained from vacuum created in the engine inlet manifold. The vacuum is applied to both sides of a flexing diaphragm and by admitting atmospheric pressure to one side of the diaphragm, the power is obtained.

Mounted between the brake pedal and the master cylinder, the unit is connected to these parts by push rods. Should a vacuum failure occur, the two push rods act as a single rod and the brakes will therefore work in the conventional manner; but more effort will be required on the brake pedal.

The design of the push rod attached to the brake pedal is varied to suit the vehicle manufacturer's installation and the Servac is usually part of the original brake equipment with each installation being approved by Girling engineers.

1



A0727

## Servicing (Fig.6)

The parts available to service the unit are; filters, a non-return valve kit and a service kit. Servicing of the internal parts is not recommended and if a major fault is apparent, a new complete guaranteed unit should be fitted.

The air filters should be changed every 40,000 miles (64,000km) or three years, when the hydraulic cylinders and hoses are replaced. If dusty conditions prevail, the filters should be changed more frequently.

The output rod which actuates the master cylinder is retained internally and cannot be extracted. If the rod or the domed screw on the rod end is damaged, the servo unit must be replaced complete.

NO ATTEMPT SHOULD BE MADE TO ADJUST THE DOMED SCREW, THIS IS CORRECTLY SET AT THE PRODUCTION FACTORY AND SHOULD NEVER BE DISTURBED.

The contents of the kits are as follows:-

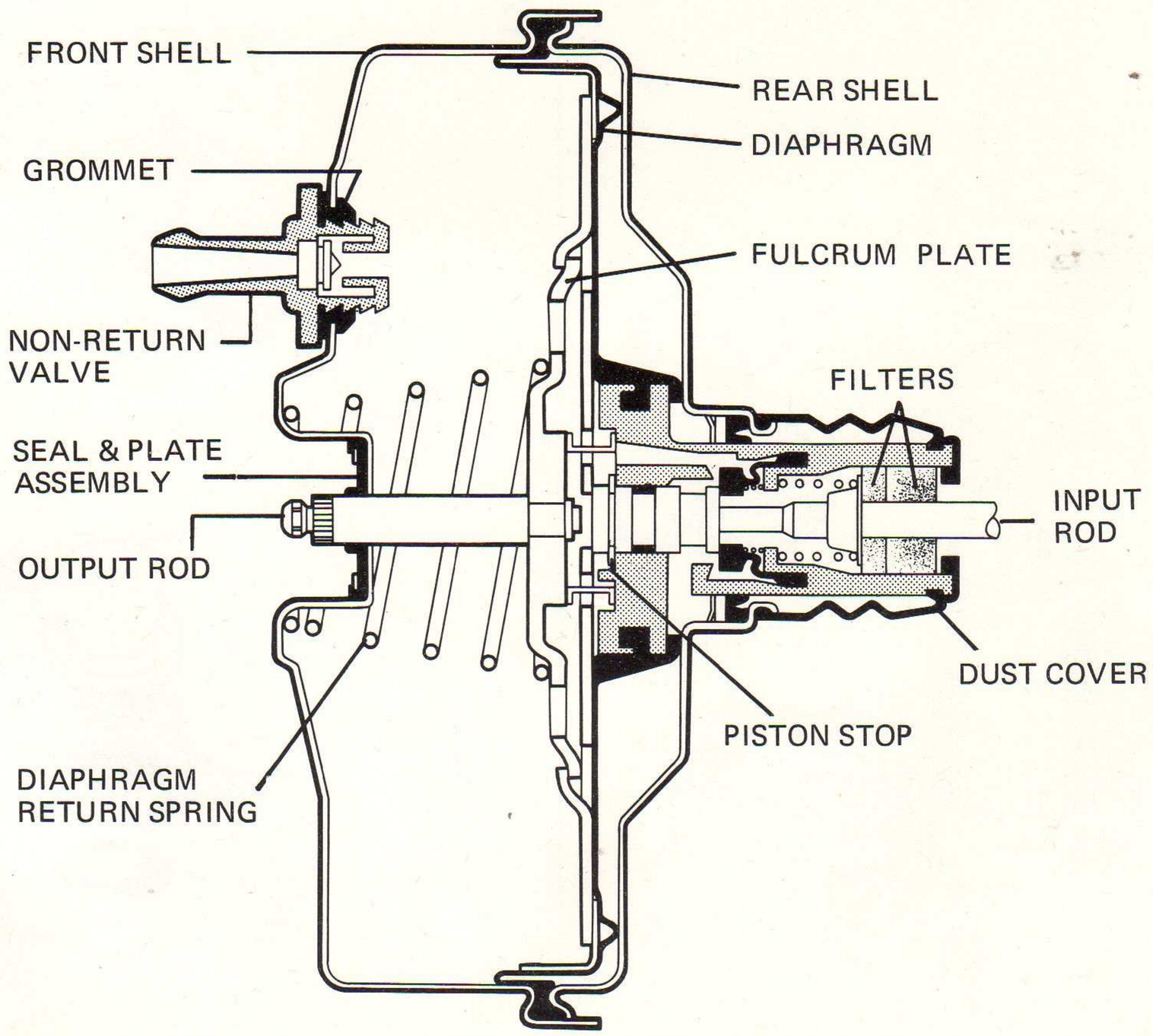
SERVICE KIT

Dust Cover
Filter (Foam)
Seal & Plate Assembly
or '0' ring
BMS Grease No. 64949086

NON-RETURN VALVE KIT

Non-Return Valve
Grommet
BMS Grease No. 64949086

6




A0643

## Replacing the Filter (Fig. 7)

Pull back the dust cover, hook out the filters and cut as shown on the illstration to remove from the input rod.

Cut the new filters, press into the neck of the valve body as shown and refit the dust cover.

If the dust cover is damaged fit a new one from a Girling Service Kit.

## Replacing the Non-Return Valve (Fig. 8)

Some valves have angled nozzles which are 'handed' and it is important to note the angle of the valve nozzle in relation to the front shell so that the new valve can be fitted in the same position.

Remove the valve by pulling on the nozzle whilst exerting a side load. If the nozzle is straight it is easier to remove the valve if the hose is left clipped on. Alternatively, insert a flat bladed screwdriver (as shown on Fig. 8) between the rubber grommet and the valve flange and (taking care not to damage the unit) lever the valve from the front shell.

When removing the grommet ensure it does not drop into the vacuum chamber.

Fit the new grommet.

Lubricate the ribs of the new non-return valve with BMS grease number 64949086 and push fully into the grommet.

## Fitting the Parts from a Service Kit (Fig. 9)

To fit the new dust cover it is necessary to remove the unit from the vehicle and this should be done in accordance with the vehicle manufacturer's instructions.

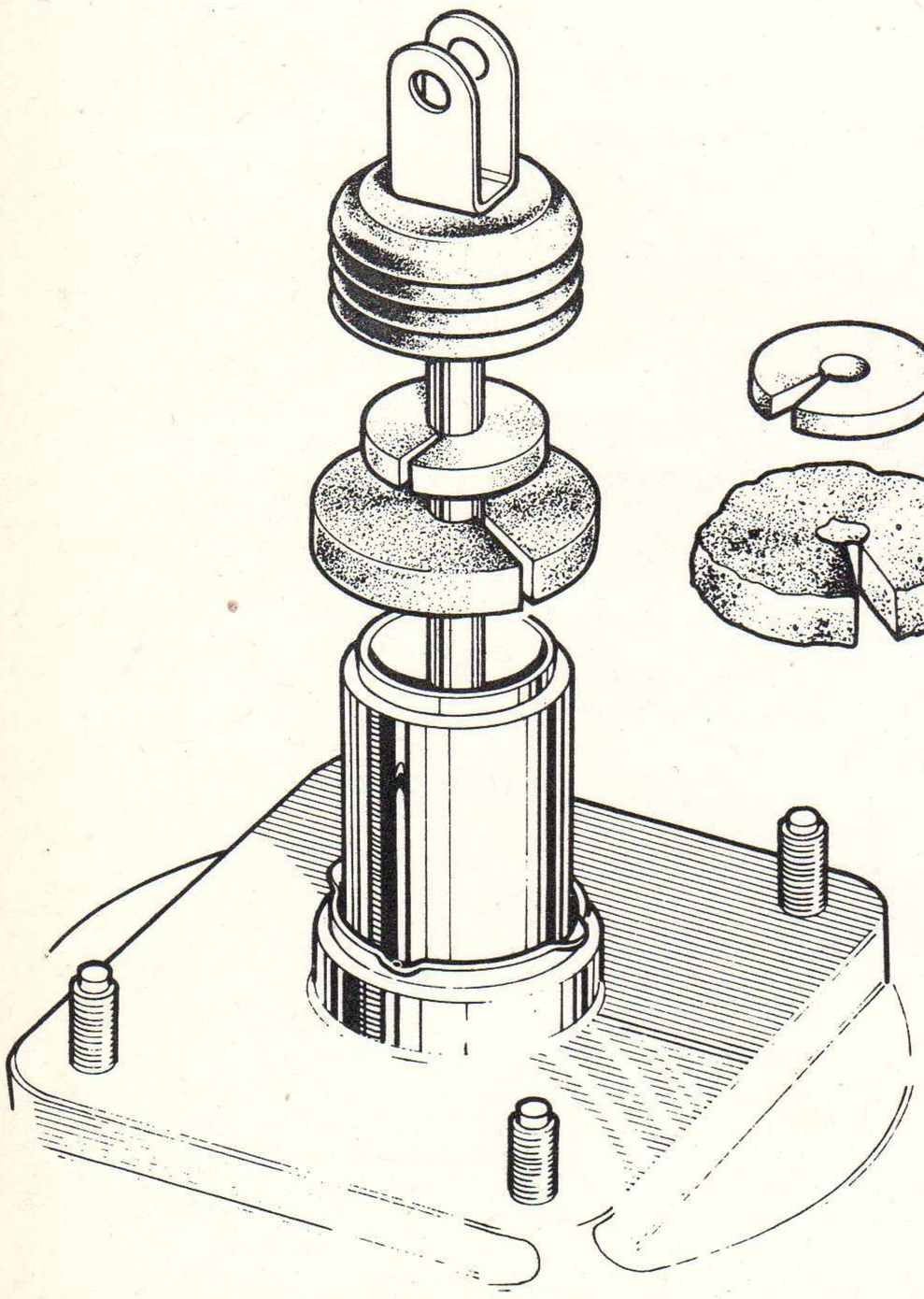
Remove the dust cover and hook out the filters; cut the filters as shown to remove from the input rod. Cut the new filters and press into the valve body in the order shown on the illustration. Ensure the exterior of the valve body neck is clean and lubricate with BMS grease number 64949086. Fit the new dust cover.

Figs. 9a and 9b show the two methods of sealing the front shell.

Fig. 9a: Remove the seal and plate assembly by inserting a flat bladed screwdriver under the metal plate and levering the assembly from the recess. Wipe clean the output rod and recess wall and lubricate these parts and the new seal and plate assembly with BMS grease number 64949086. With rubber side leading, fit the new seal and plate assembly over the rod and into the recess.

Fig. 9b: If an 'O' ring is fitted this is usually removed when the master cylinder is unbolted from the servo. Wipe clean the servo face. Before fitting the new 'O' ring from the kit examine the exposed part of the master cylinder plunger. If in a dry condition, clean with Girling Cleaning Fluid or unused Castrol-Girling Brake Fluid. The plunger must be lubricated, but use only the special BMS grease number 64949086.
Depress the plunger by hand several times and lubricate again if necessary. Position the new 'O' ring on the master cylinder and bolt the cylinder onto the Servac.

7



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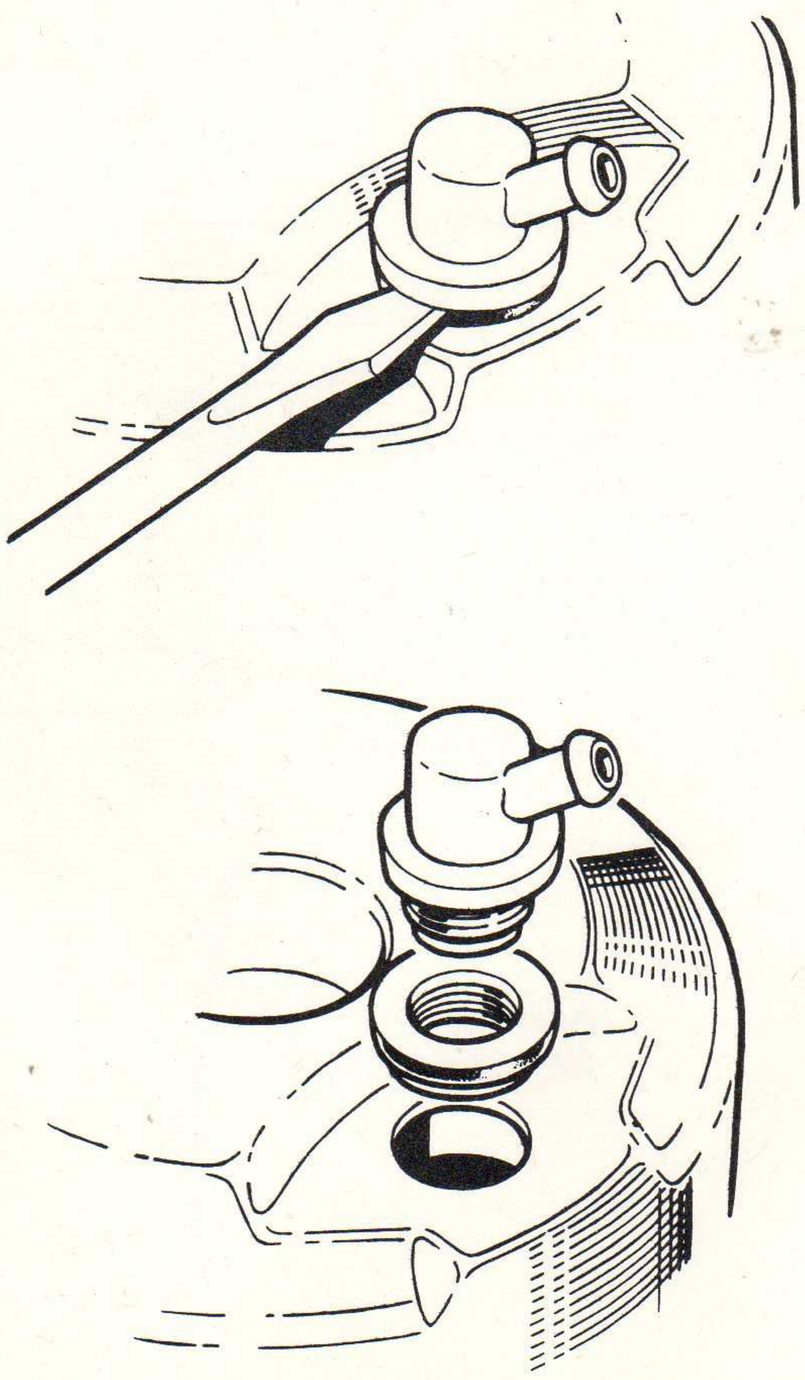


A0205

**mechanical servo units**

## Testing

The use of these tests will assist in diagnosis and provide assurance after servicing, but they cannot equal the quality of testing done at the Production Factory on specially designed equipment. If a unit gives cause for doubt, it is always best to replace it with a factory tested unit whenever possible.

It is assumed that any faults connected with the braking system such as contamination, lack of adjustment, air in the system, or fluid leaks etc., have been recognised and eliminated.

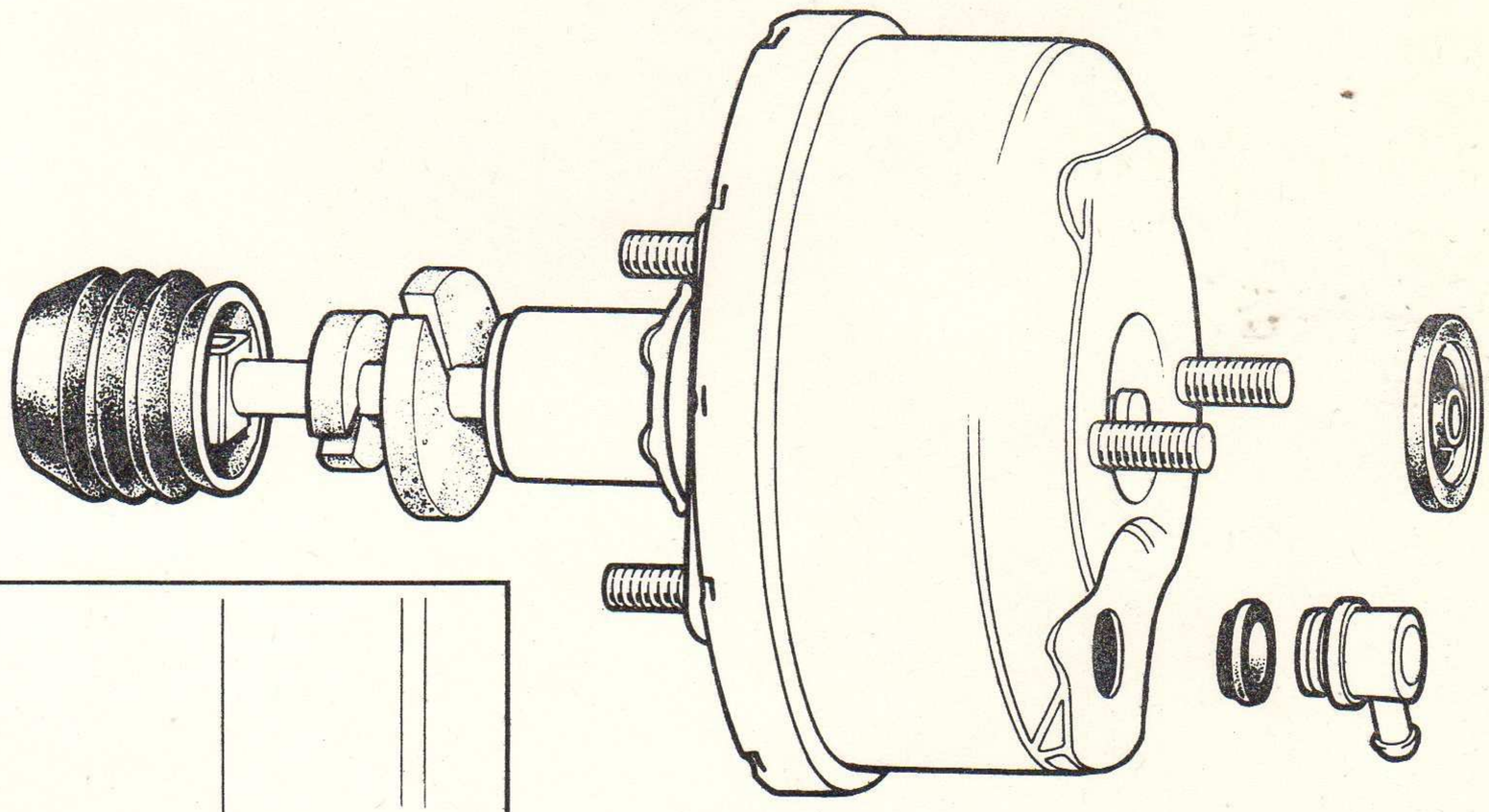
1. With the front of the car jacked up, confirm one of the front wheels turns easily. Start the engine, allow vacuum to build up in the unit, and apply the brake pedal several times. It should be possible to turn wheel almost immediately the pedal is released. If the brakes bind, suspect a major fault in the unit.
2. With engine running apply the brake pedal several times and check the operation of the pedal. If the response is sluggish, the vacuum hose may be faulty or the air filter may require changing.
3. Allow vacuum to build up in the unit, stop engine and try brake action. Two or more applications should be power assisted as indicated by the effort required on the pedal. If the pedal action is not power assisted, the non-return valve may be faulty or there is a leak in the vacuum system.
4. Stop engine and press brake pedal several times to deplete all vacuum reserve in the system. Press brake and hold light foot pressure on pedal and start car engine. If the unit is working the pedal will fall away under foot pressure and less pressure is required to hold pedal in applied position.
5. Road test vehicle.

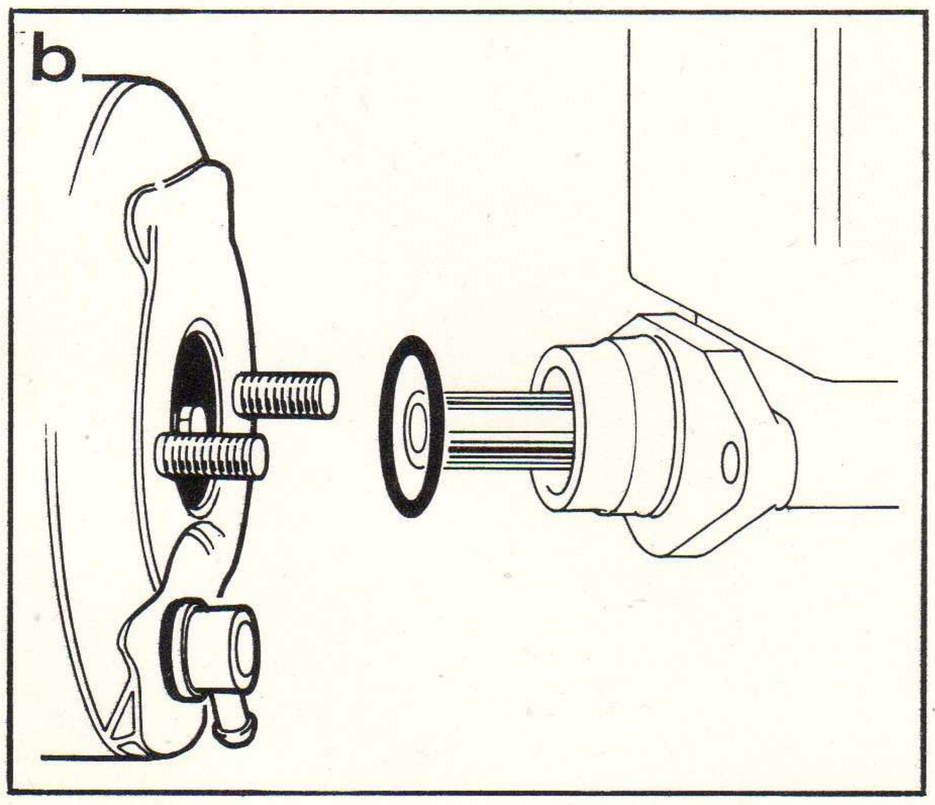
## Fault Finding

Listed below are some possible causes of hard pedal or apparent lack of power assistance.

| CAUSE | ACTION |
|---|---|
| Restricted air filter | Fit new filters. |
| Faulty Vacuum Hose. | Check for kinking, loose connections or faulty hose. Fit new hose. |
| Faulty non-return valve. | Fit new valve and grommet. |
| Vacuum leak from unit. | Check for obvious leaks, fit new parts from Service Kit or fit new unit. |
| Major fault in unit, refer to testing. | Fit new unit. |

9a



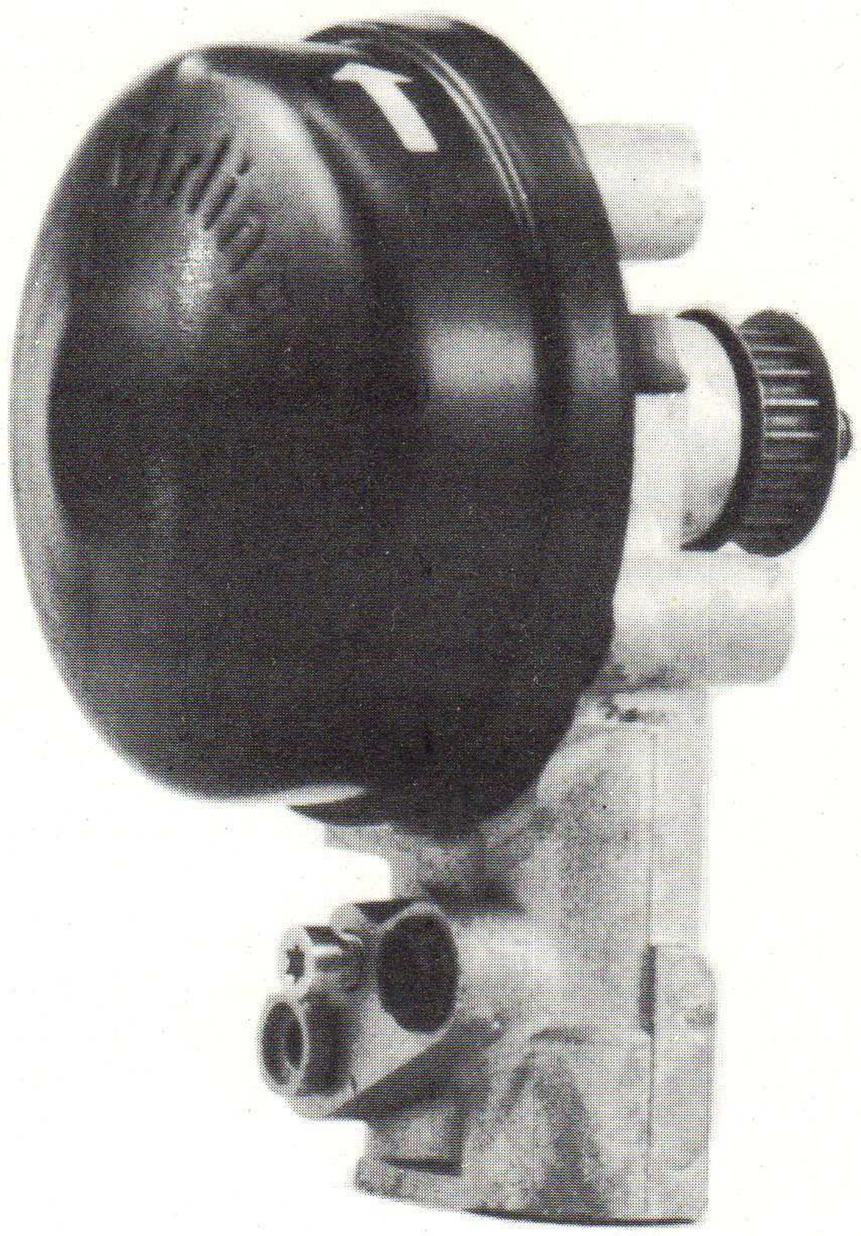



A0740

# S.C.S.
# (stop control system)



**1**



A2194

## Introduction

Lucas Girling SCS is a sophisticated hydromechanical anti-lock braking system for use on small and medium sized front wheel drive cars which are typically equipped with an "X-split" braking system (see "SCS and X-split" braking systems 8A3b).

S.C.S. offers these major safety advantages:-

* The car retains directional stability under normal or emergency braking on road surfaces which may have differing adhesion levels, even when these differ from front to rear or left to right on the vehicle.

* Steering control is retained even when braking hard through a bend. However, no type of anti-lock braking system, (mechanical or electronic), can prevent loss of sideways (lateral) control caused by attempting to corner too fast for the vehicles handling capabilities.

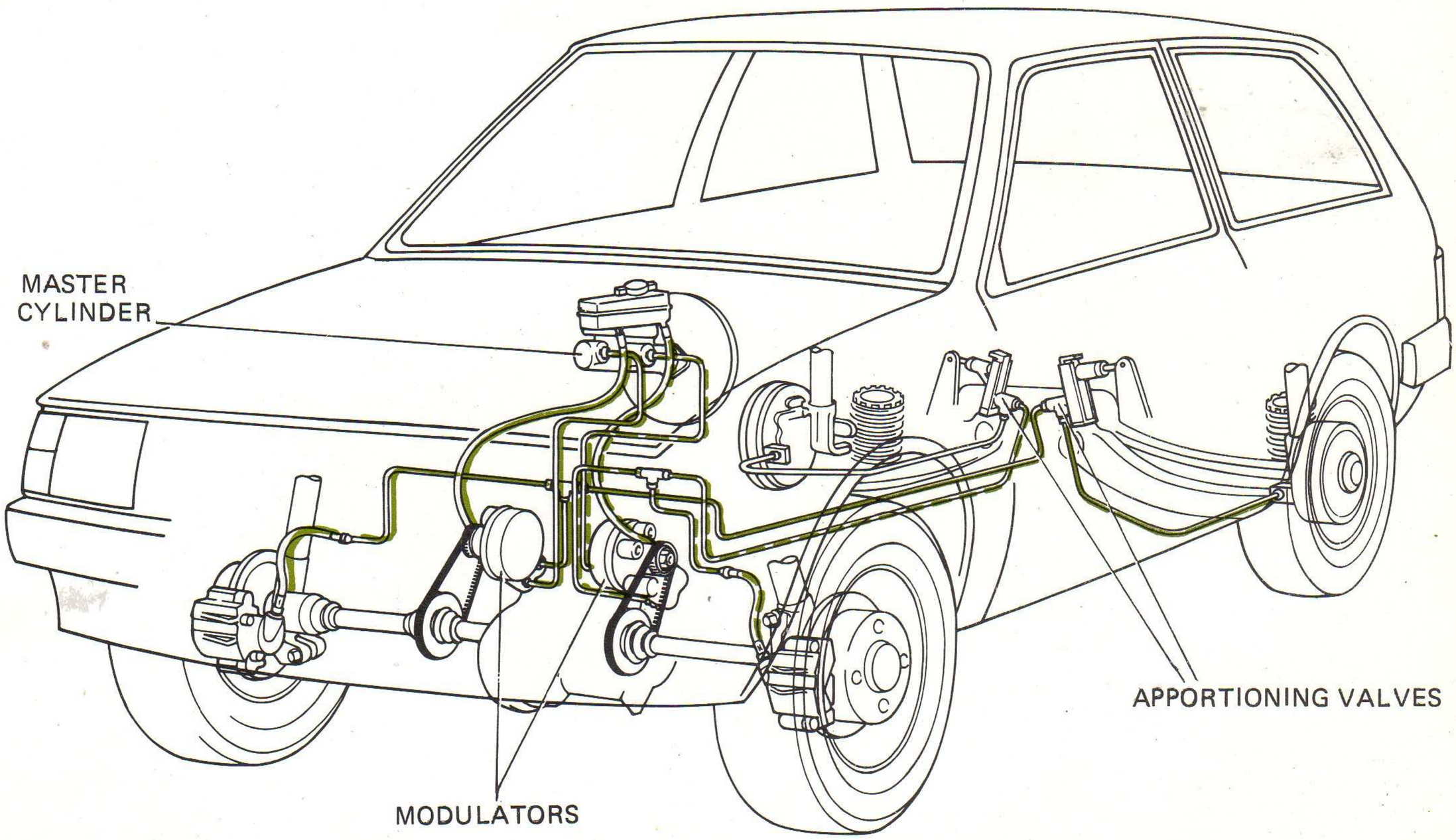
* Maximises the drivers skill and confidence in meeting emergency braking situations.

## How the system works

The operation and maintenance of S.C.S. are relatively simple. The system (Fig. 2) consists of two major components which are the modulator units (Fig. 1). These are driven from the drive shafts by toothed belts on either side of the transmission. No other source of energy is therefore necessary to power the anti-lock.

Each modulator unit consists of an integrated sensor, pump and the brake pressure modulator itself. The modulator not only controls the adjacent front wheel, but also through an apportioning valve (Fig. 3) the diagonally opposite rear wheel.

**2**




A2058

The sensor determines when the front wheel is approaching a predetermined threshold. In response to this the modulator reduces the pressure in the respective brake circuit. When the wheel speeds up again, the pump raises that pressure in order to bring the braking force back to a maximum level. This compensation takes place many times per second to avoid the wheel locking, thereby maintaining the deceleration of the vehicle and providing control and stability.

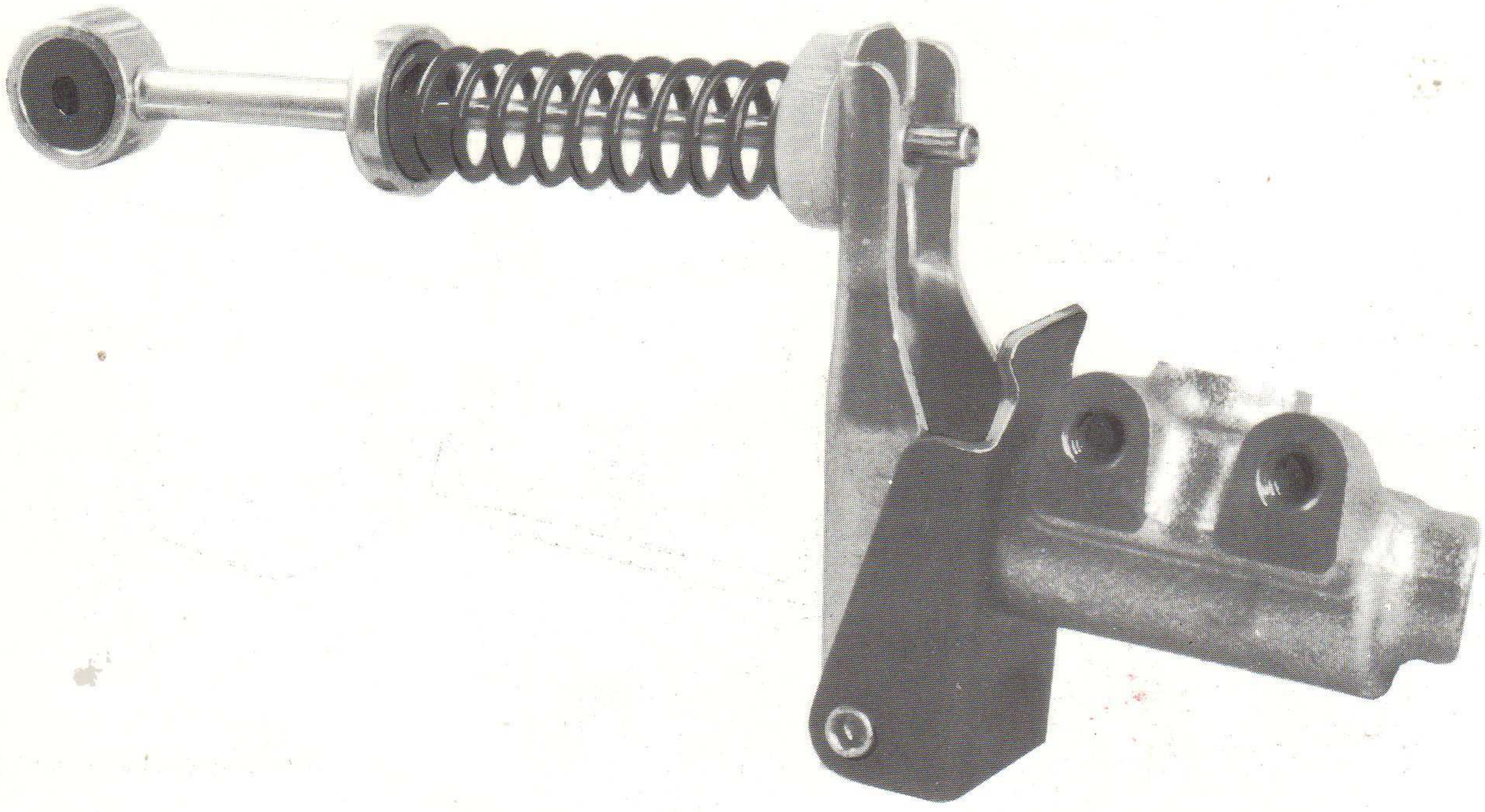
A car equipped with S.C.S. remains stable with full steering control even under "panic braking" conditions that would cause a normally braked vehicle to skid or spin. The system responds quickly and effectively to changes in tyre-to-road adhesion.

## S.C.S. and 'X' (diagonal) split braking systems

With most modern front wheel drive cars having a dynamic weight distribution that requires nearly all of the braking effort to be at the front wheels, diagonal split brake circuits have been adopted in order to satisfy partial system failure performance requirements.

Brake apportioning valves are incorporated to ensure that the legislative requirement of front wheels always locking before the rears for all conditions of loading is met. Therefore an anti-lock system that senses front wheel speeds only can be installed (Fig. 1).

3



A2195

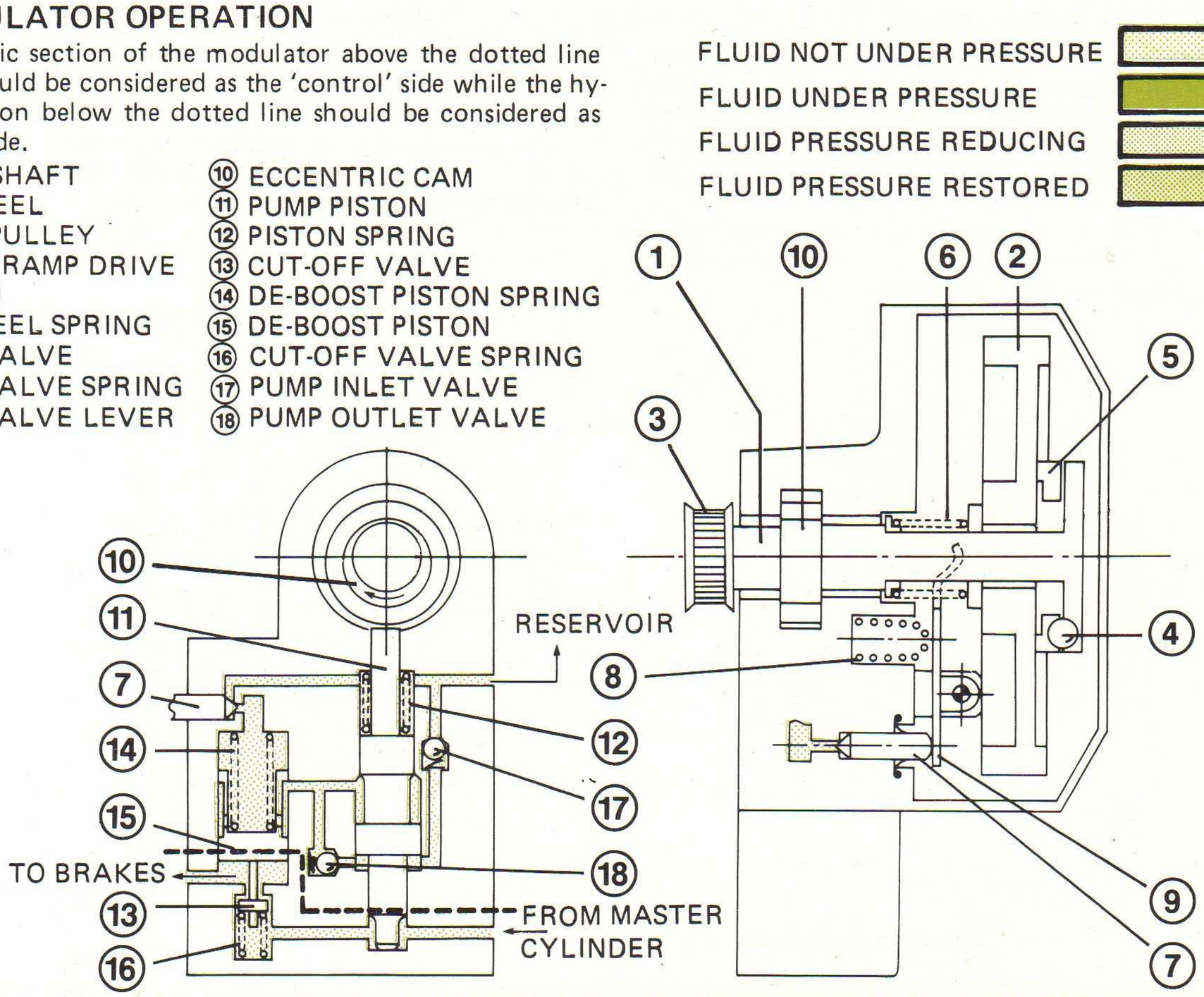
# S.C.S. (stop control system)



## 4 MODULATOR OPERATION

The hydraulic section of the modulator above the dotted line in Fig. 4 should be considered as the 'control' side while the hydraulic section below the dotted line should be considered as the brake side.

① DRIVE SHAFT
② FLYWHEEL
③ DRIVE PULLEY
④ BALL & RAMP DRIVE
⑤ CLUTCH
⑥ FLYWHEEL SPRING
⑦ DUMP VALVE
⑧ DUMP VALVE SPRING
⑨ DUMP VALVE LEVER
⑩ ECCENTRIC CAM
⑪ PUMP PISTON
⑫ PISTON SPRING
⑬ CUT-OFF VALVE
⑭ DE-BOOST PISTON SPRING
⑮ DE-BOOST PISTON
⑯ CUT-OFF VALVE SPRING
⑰ PUMP INLET VALVE
⑱ PUMP OUTLET VALVE

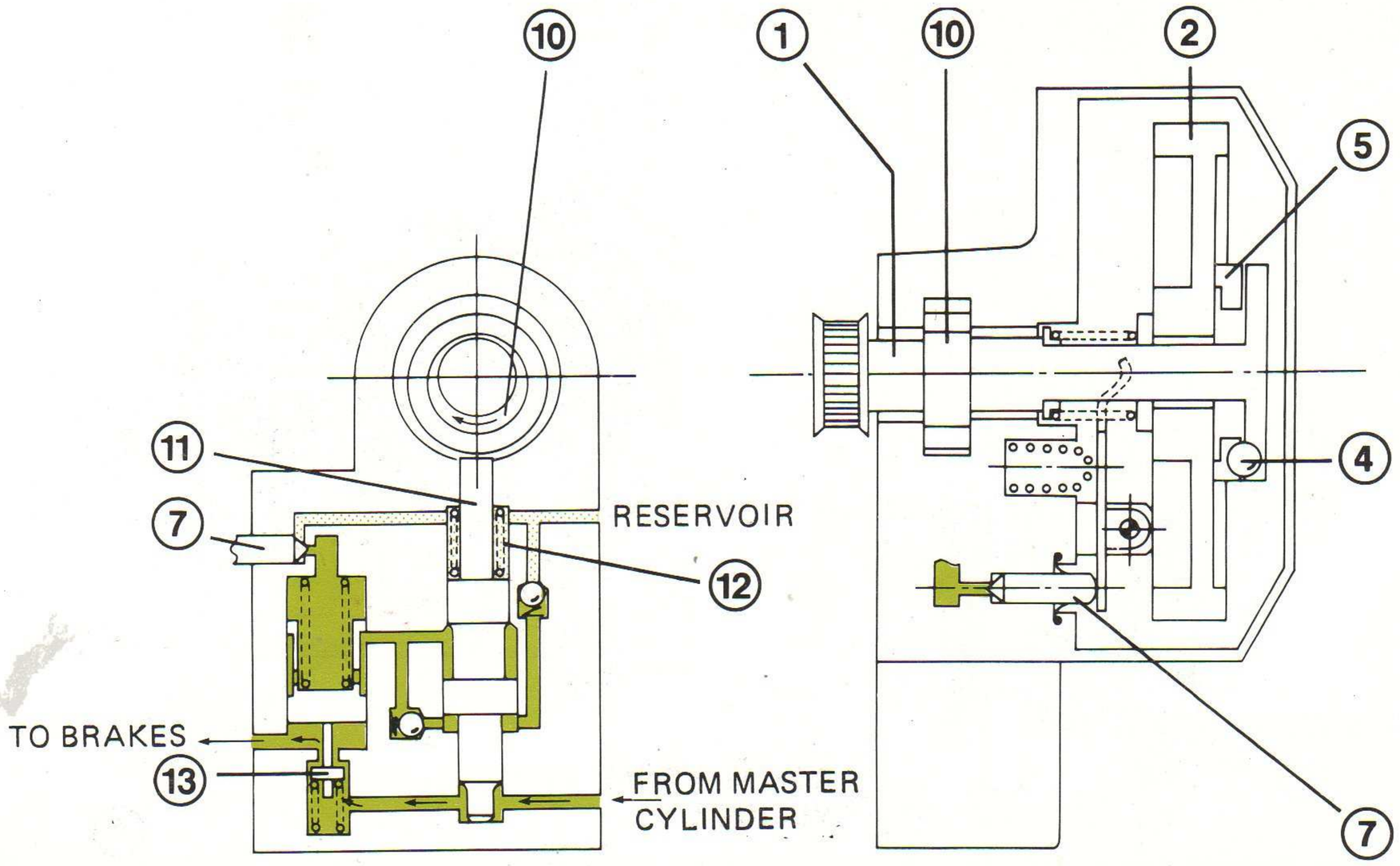



A2040

## 5 FOOTBRAKE APPLIED - NORMAL BRAKING, NO S.C.S. OPERATION REQUIRED

During normal braking, the fluid pressure generated in the master cylinder is connected to the road wheel brakes through the open cut-off valve (13). The dump valve (7) is closed. The shaft (1), which rotates at a multiple of wheel speed, drives the flywheel (2) through the ball and ramp (4) and clutch (5). The pump piston (11) is held out of engagement with the rotating cam (10) by a spring (12) and a pressure balance condition on the pump piston.

In this condition the brake system operates in a conventional manner.



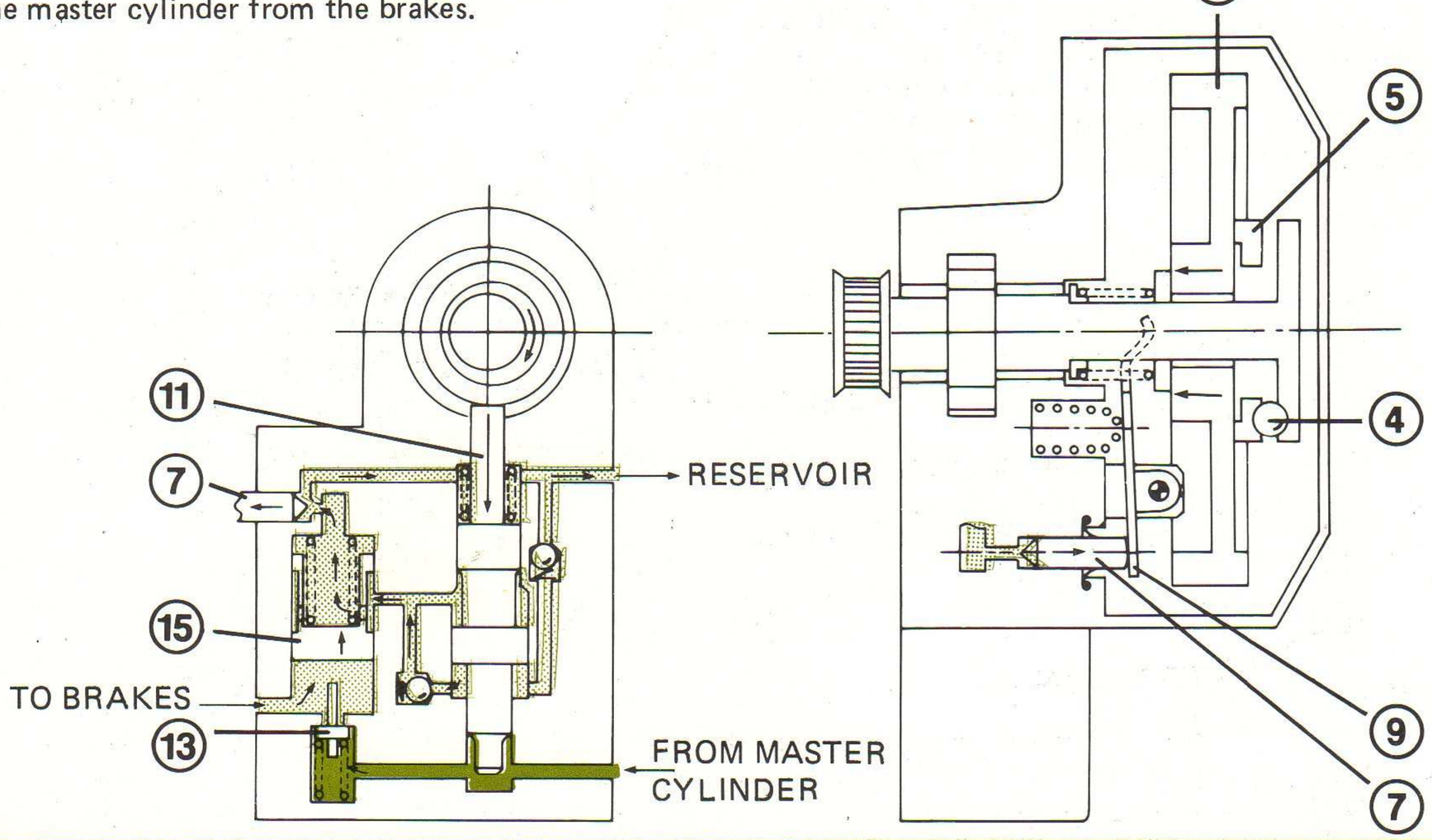

A2041

## 6 FOOTBRAKE APPLIED POTENTIAL FRONT WHEEL LOCK SENSED, BRAKE PRESSURE REDUCED

If the deceleration of the front wheel, and therefore the drive shaft, exceeds a pre-determined maximum value, then the flywheel (2), through its inertia, overruns the ball and ramp (4). The resulting axial movement then opens the dump valve (7) through the lever (9), thus connecting the de-boost piston (15) to the tank.

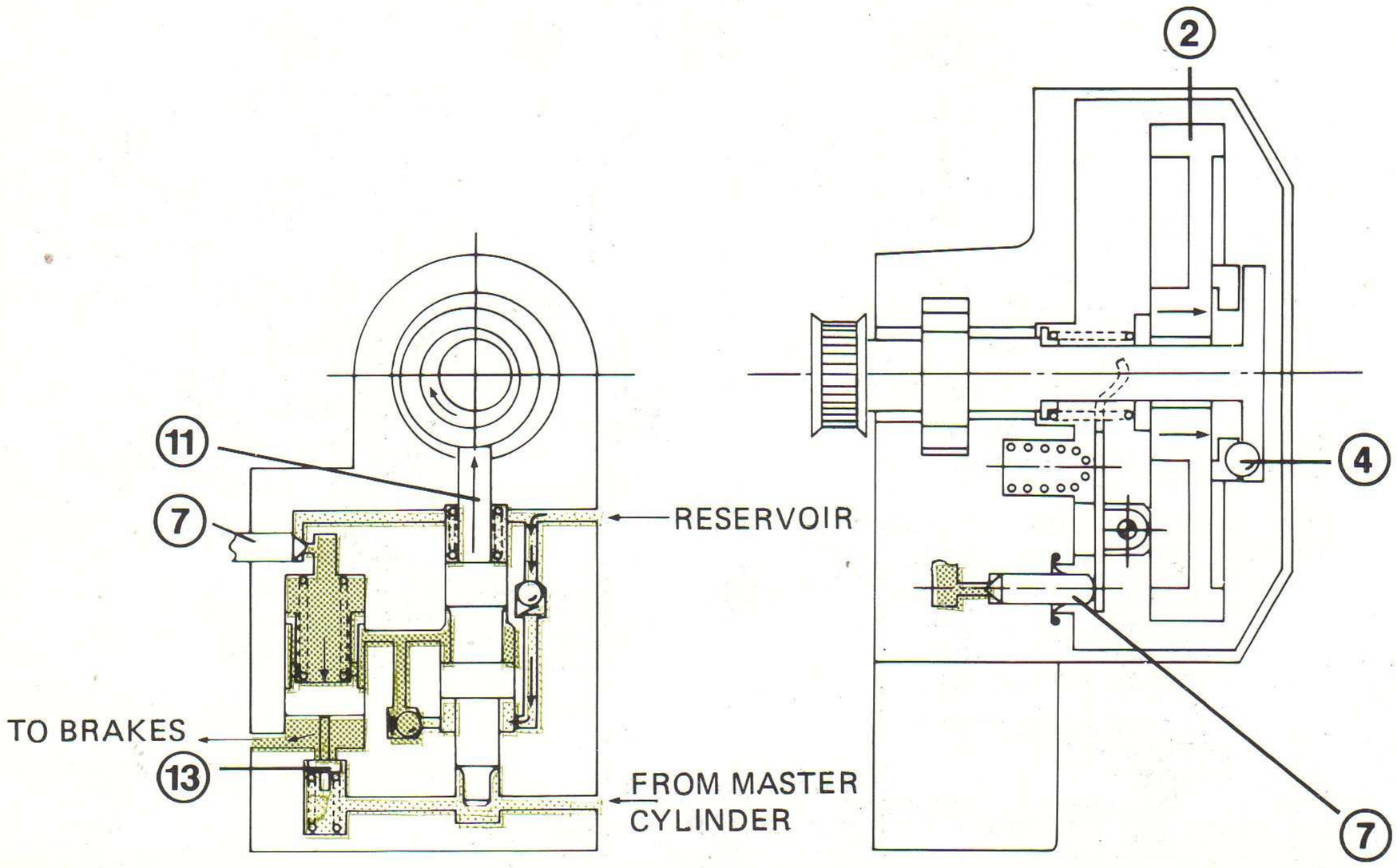
This causes the de-boost piston (15) to move, which relieves the brake line pressure and also closes the cut-off valve (13) isolating the master cylinder from the brakes.

At the same time the reduced pressure in the control chamber allows the line pressure from the master cylinder to push the pump piston (11) against the rotating cam, but at this stage, no pressure can be generated as the dump valve (7) is open to the tank. The flywheel is then decelerated at a controlled rate through the braking effect of the clutch (5).




## 7 FOOTBRAKE APPLIED - WHEEL LOCK AVERTED, BRAKE PRESSURE INCREASED

The pressure reduction in the brake line resulting from the previous phase releases the brakes and allows the wheel to accelerate to the speed of the still decelerating flywheel (2). At that point the ball and ramp (4) runs back into its "start" position and the dump valve (7) closes which allows the pump piston (11) (which is still in contact with the cam) to develop pressure and the clutch to accelerate the flywheel (2) at a controlled rate. Through this process the brake pressure is increased until either the maximum deceleration value is reached again and the pressure reduction sequence is repeated or the master cylinder pressure is restored without wheel lock. In the latter case the cut-off valve (13) re-opens, the pump piston (11) is disengaged, and the system is back in a "normal braking" condition (Fig. 5).



# S.C.S.
# (stop control system)



## S.C.S. and the driver

During normal braking, when S.C.S. is not called upon to operate, the driver will not perceive any difference between an S.C.S. equipped car and a non S.C.S. equipped vehicle.

When the S.C.S. is activated, there may be a slight pedal "flutter" discernable on those vehicles where the brake pedal is connected directly to the servo/master cylinder. On vehicles equipped with a torque tube/cross shaft fitted across the bulkhead and linking the brake pedal to a remote servo/master cylinder, the "flutter"is unlikely to be felt. This is due to the damping effect of the installation.

If "flutter" is experienced during normal braking as well as during S.C.S. operation the braking surface of the discs should be checked for uniform thickness around their diameters (as little as 0.0005" variation in thickness can be responsible for complaints of "flutter" or "vibration"). If doubt exists the S.C.S. can be checked on a ramp by a competent mechanic using a simple procedure(Pages 8A3k-l).

Brake fluid is supplied to the control side of the modulators from the same reservoir body as that supplying the normal brake system (Fig. 8). There is a single filler cap although the reservoir is split into separate independent compartments. This "control" fluid is returned to the same compartment from whence it was supplied through the common supply/return hose. It is therefore only necessary to keep the reservoir properly filled with the recommended Castrol-Girling Universal Brake Fluid. If loss of fluid occurs for whatever reason in any compartment, sufficient fluid will remain in the other compartments for them to continue to supply those parts of the system to which they are linked.

The usual warning light on the dashboard will give an indication of fluid loss in any part of the system. A second light will illuminate in the unlikely event of a drive belt breakage.

## Brake lining material (Important)

The S.C.S. system has been designed and developed to give optimum performance when used with brake linings and pads, tyres and suspension struts originally fitted by the vehicle manufacturer. Replacement of these items should only be with a type specifically approved by the vehicle manufacturer. Vehicle handling and braking response may be adversely affected by the fitment of unapproved replacement items.

## S.C.S. Servicing

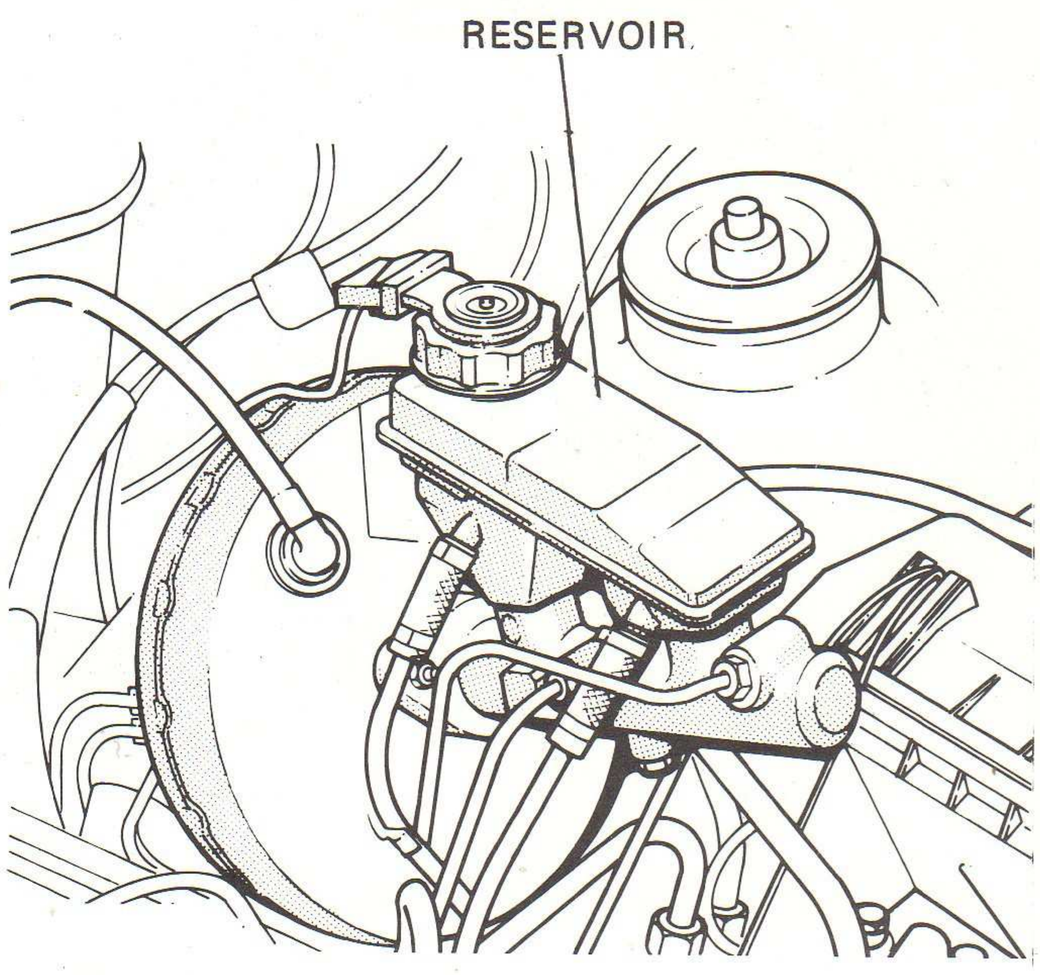
The servicing of the stop control system is currently by unit replacement only. The modulator units (left and right hand), drive belts and brake apportioning valves (left and right hand) are all available as separate items. No kits are available for the modulator or valve overhaul.

NOTE: Arrows on the cover of the modulator (Fig. 1). show the direction of the flywheel rotation. When installed the arrows must point in the direction of forward wheel rotation.

It is important that the toothed drive belt is in good condition and the tension is correctly set. When correctly set it should be possible to deflect the belt 5mm without excessive force (Fig. 9). The belt is tensioned in a similar manner to tensioning an alternator belt. To tension the belt, the belt shield must be removed.

NOTE: Care must be taken when replacing the shield to locate the belt warning light lever correctly.

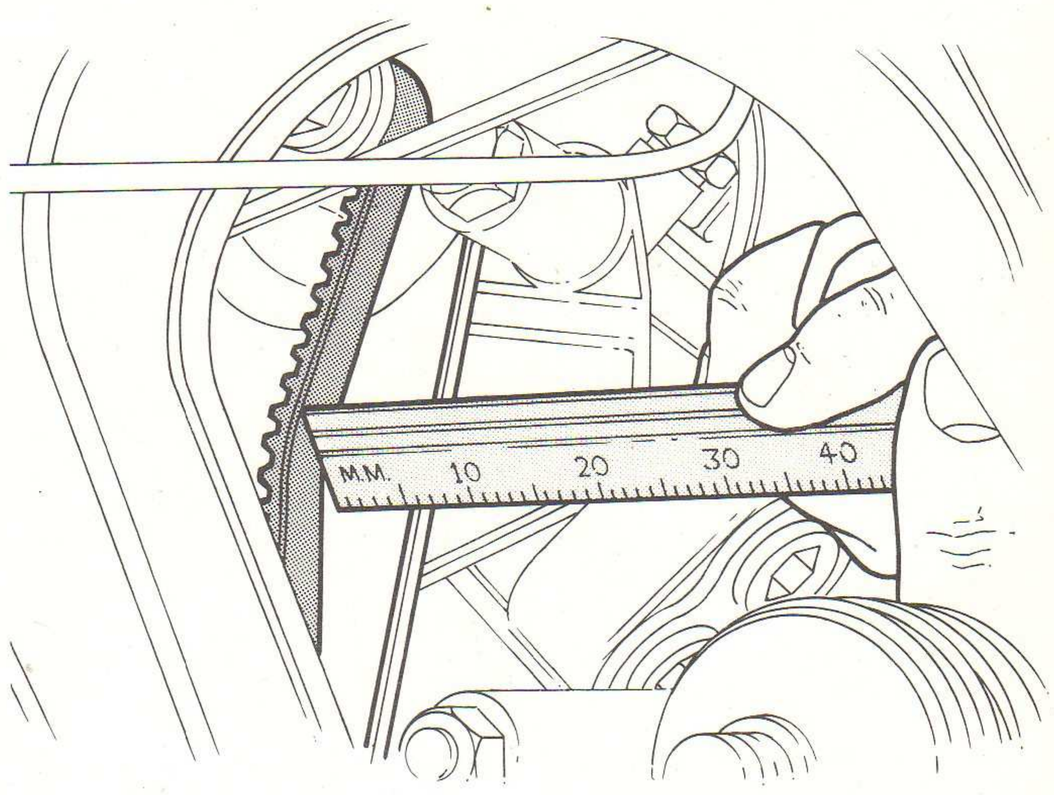
**8**




A2192/2

**9**

CHECKING MODULATOR
DRIVE BELT TENSION




A2075

# S.C.S. (stop control system)

The correct setting of the apportioning valve is critical to the brake system operation - refer to the section headed "Valve Removal replacement and setting procedure".

## Bleed procedure for cars fitted with S.C.S. - 2 man operation

IMPORTANT: TO ENSURE THE MOST EFFECTIVE OPERATION OF THE STOP CONTROL SYSTEM, IT IS ESSENTIAL THAT THE MODULATORS (FIG. 1) ARE COMPLETELY FREE OF AIR BUBBLES. THE FOLLOWING INSTRUCTIONS MUST BE FOLLOWED EXACTLY AND NO SHORT CUTS ATTEMPTED.

Access to the modulators will vary according to the application. This may cause some difficulty in locating the positions of the auto-bleed plunger and the by pass valve on each modulator (Fig. 11). The units can generally be most easily reached from the engine compartment (Fig. 10).

There are three possible situations in which bleeding the brakes will become necessary:-

1. When a modulator has been replaced, or if the fluid head in the return hose has been lost, use the full bleed sequence which must the modulator.

2. In any condition where the master cylinder reservoir has been emptied-providing that the fluid head in the return hose has not been lost, use the partial bleed sequence (i.e. bleed the conventional system only).

3. After the replacement of any component in the system after the modulator (e.g. caliper, wheel cylinder, valve), use the partial bleed sequence (i.e. bleed conventional system only).

NOTE: Pressure bleeding equipment using pressures in excess of 110 psi (7.5 Bar) must not be used as damage to the fluid reservoir will result.

Exhaust the servo unit before commencing the bleed operation.

## Procedure for full bleed sequence

The modulators may be individually or, both,simultaneously bled.

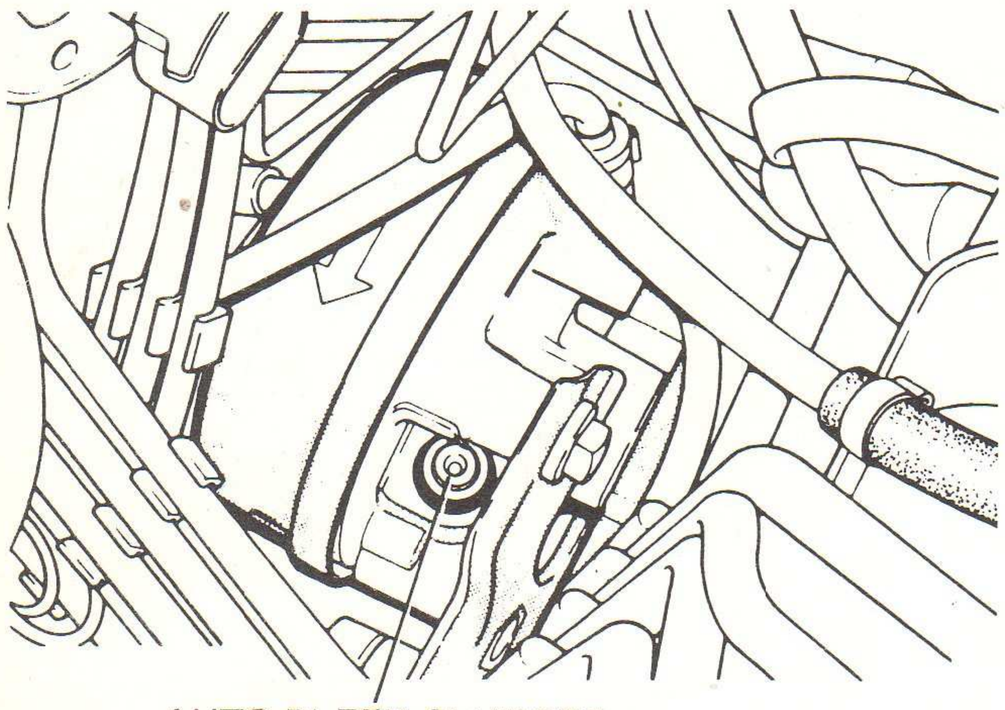
IMPORTANT: THE "CONTROL" CIRCUIT OF THE MODULATORS (FIG.5) MUST BE BLED PRIOR TO BLEEDING THE NORMAL SYSTEM OTHERWISE IT WILL NOT BE POSSIBLE TO BLEED THE NORMAL SYSTEM.

NOTE: The conventional concept of bleeding does not apply to the "control" circuit, in that no brake fluid is expelled to the atmosphere. The by-pass valve (Fig. 12) and the auto-bleed plunger (Fig. 11) open internal bleed paths and fluid should not be emitted from either item.

1. Ensure all the bleed screws at the brakes are closed.

2. Top up the master cylinder reservoir to the 'max' level.

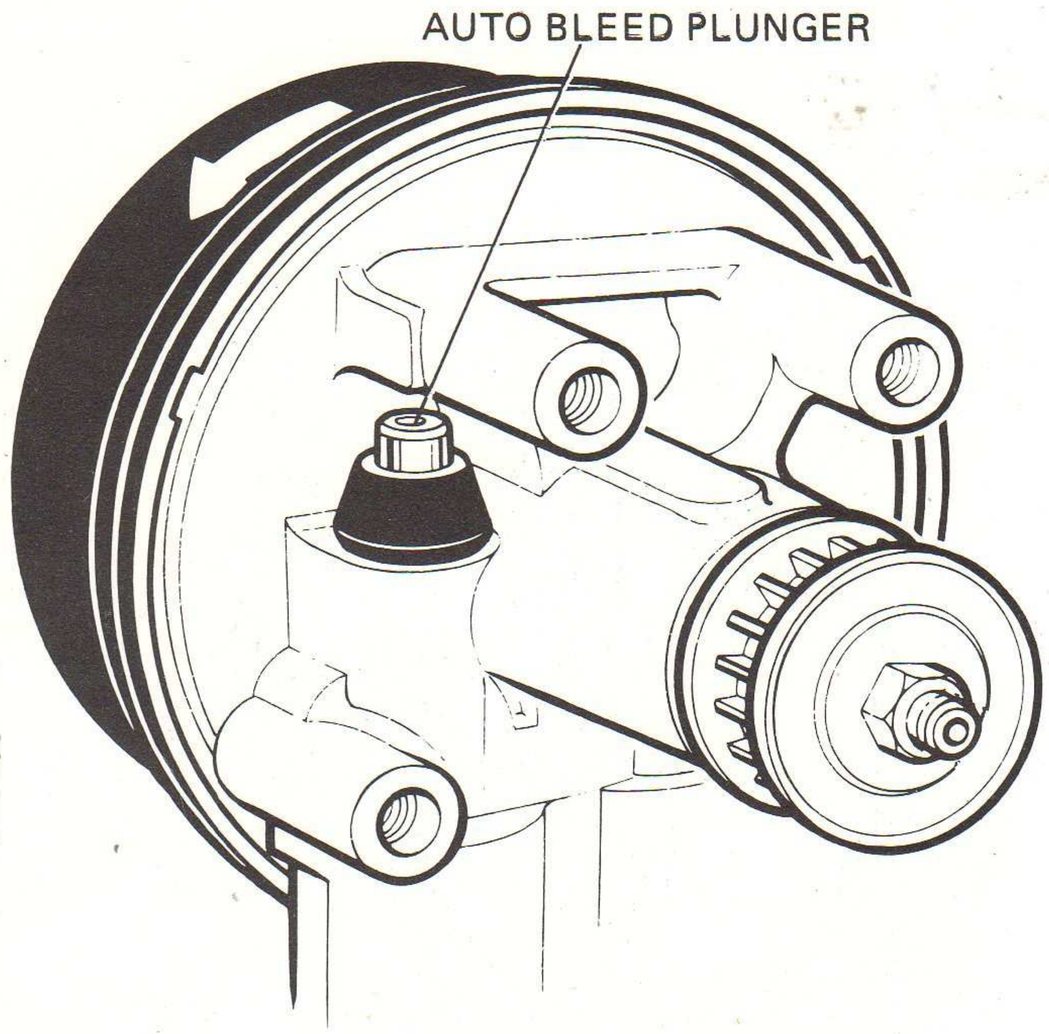
10



AUTO BLEED PLUNGER

A2120

11




A2119

3. Using a T30 Torx bit, open the by-pass valve between 1 and 1½ turns (Fig. 12).

4. Fully depress the auto bleed plunger until the circlip contacts the body (depress both plungers if the two modulators are being bled simultaneously) and hold depressed for the duration of the "control" circuit bleeding.

NOTE: When the auto bleed plunger is fully depressed the rubber dust cover is displaced so that it is proud of the modulator housing. Run a finger along the side of the modulator (Fig. 13) to check the position of the dust cover (and therefore check that the auto bleed plunger is fully depressed).

5. Steadily depress and release the brake pedal fully at least 30 times after which the fluid should be returning to the reservoir free from air bubbles. Continue to operate the pedal if necessary until air free fluid is observed. As the fluid in the control circuit is re-circulated back to the reservoir during this process, there is no need to keep topping up the reservoir.

6. Release the auto bleed plunger(s).

7. Close the by-pass valve and tighten to a torque of 6-10Nm (4½ - 7½ lbf.ft).

8. Depress and release the brake pedal.

9. Check that the auto bleed plunger is fully out (Fig. 11).

IMPORTANT: IF THE PLUNGER HAS NOT FULLY RETURNED THEN PULL IT OUT MANUALLY.

10. Bleed the conventional brake system as advised by the vehicle manufacturer. Keep the reservoir topped up.

Bleed the braking system in the conventional manner, starting with the right hand front-left hand front, right hand rear and then left hand rear.

Ensure that the reservoir is kept topped up throughout the bleeding procedure.

NOTE: The rear wheel cylinders can only be bled with the full vehicle weight on the road wheels. It is unacceptable to have any of the vehicle body weight supported as the rear reducing valves will not allow a sufficient flow of fluid to pass.

After completing the bleed procedure the diagnostic check must be carried out to ensure the S.C.S. is operating correctly and the modulator control circuits are free from air.

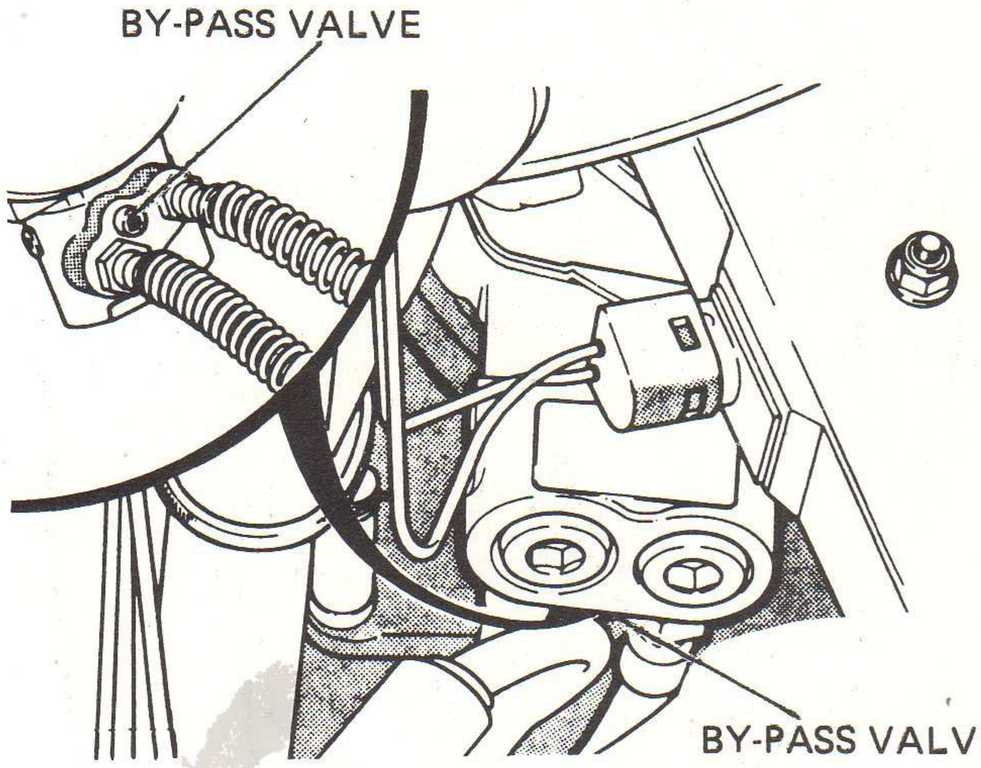
## Procedure for partial bleed sequence

Bleed the conventional brake system as advised by the vehicle manufacturer.
Keep the reservoir topped up.

NOTE: The rear wheel cylinders can only be bled with the full vehicle weight on the road wheels. It is not acceptable to have any of the vehicle body weight supported as the rear reducing valve will not allow a sufficient flow of fluid to pass.

**12**

BY-PASS VALVE

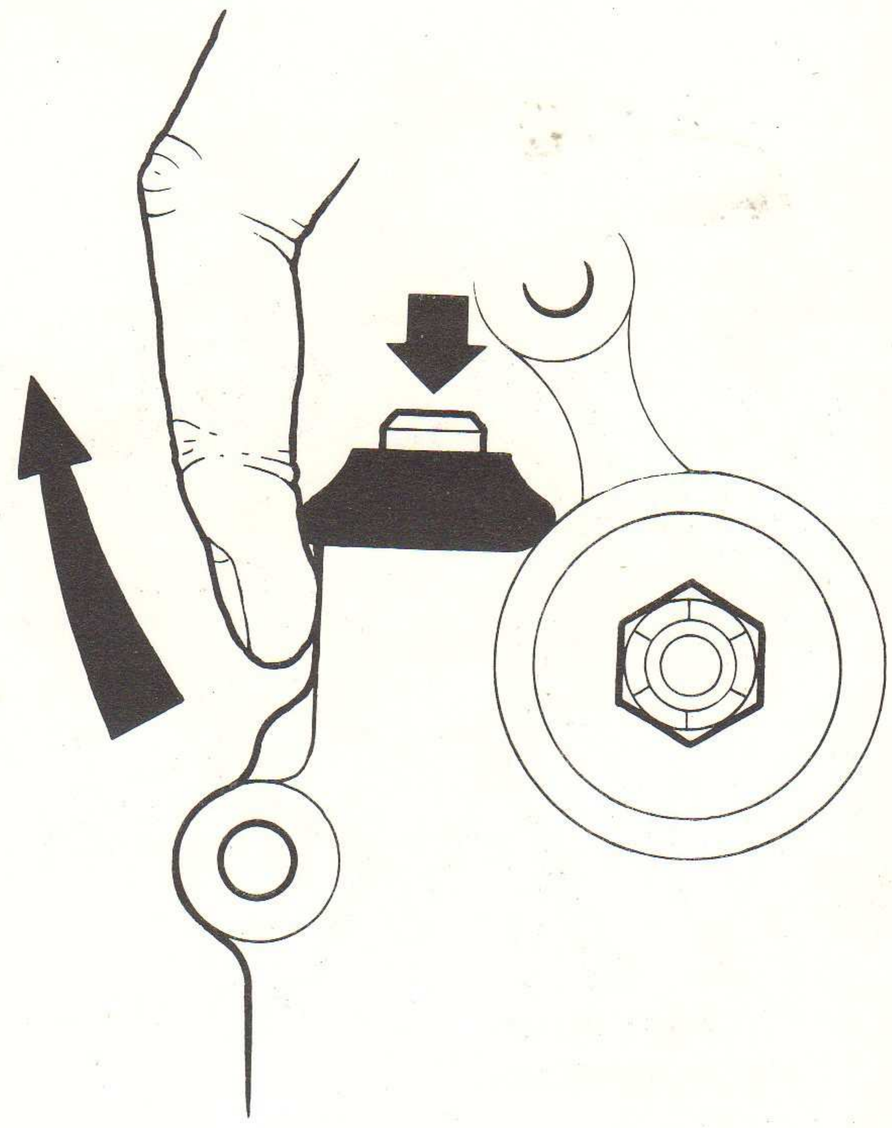


BY-PASS VALVE

A2120

**13**

CHECKING THAT THE AUTO-BLEED PLUNGER IS FULLY DEPRESSED



A2183

## Valve Removal, replacement and setting procedure

The setting procedure is a two man operation and the vehicle should be at kerbside weight with ½ a tank of fuel.

IMPORTANT: If a valve is incorrectly set it will affect the performance of the normal brake system and reduce the efficiency of the S.C.S.

## Removal

1. Raise the vehicle on a ramp, ensuring that the full vehicle weight is on the road wheels.

NOTE: On some models it may be necessary to lower the fuel pump assembly when servicing the right hand side valve. If so remove the nut and bolt (Fig.14) securing the fuel pump.

2. Disconnect all the hydraulic pipes from the valve. Blank off the ports and pipes.

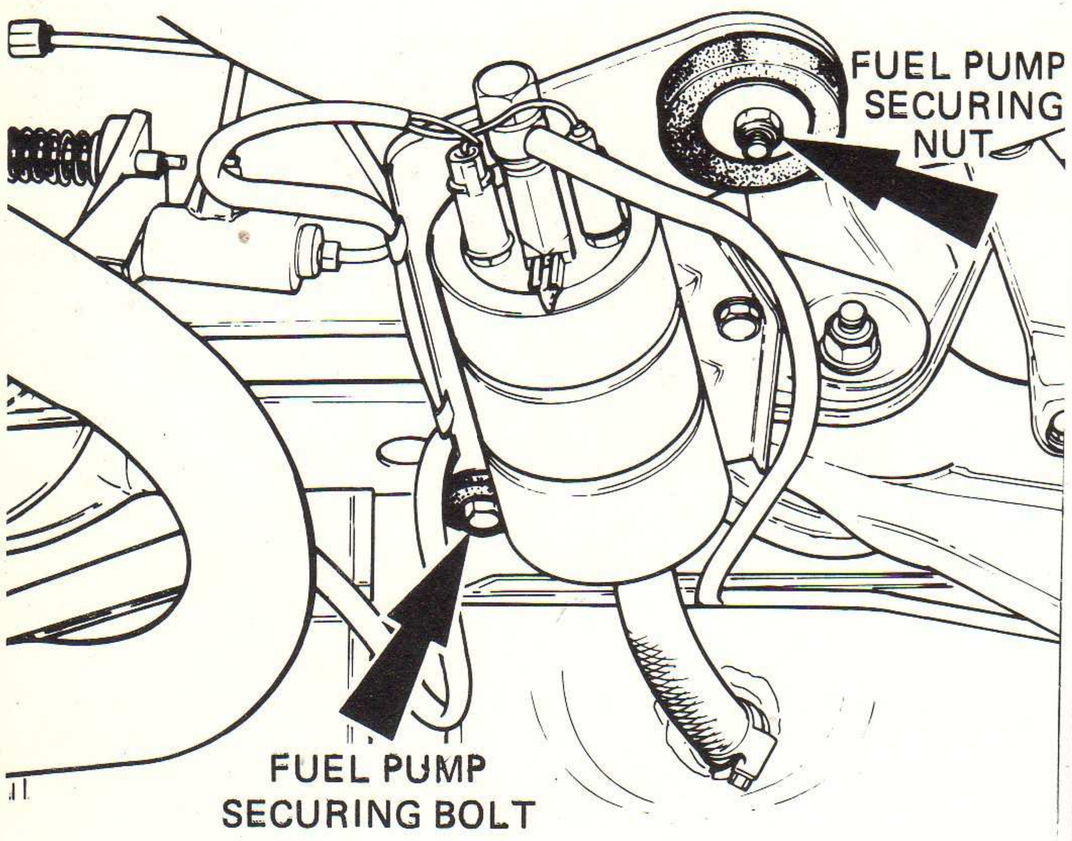
3. Remove the two nuts and the stud plate from the adjusting bracket (Fig. 15).

4. Remove the suspension lower arm inner pivot nuts (Fig. 15) and ease off the valve mounting bracket and adjusting bracket together.

5. Remove the two bolts holding the valve to the valve mounting bracket. Remove the valve and adjusting bracket assembly.

6. Lever the push rod and spring off the adjusting bracket spigot (Fig. 16). Lubrication of the rubber bush will help with removal.

**14**

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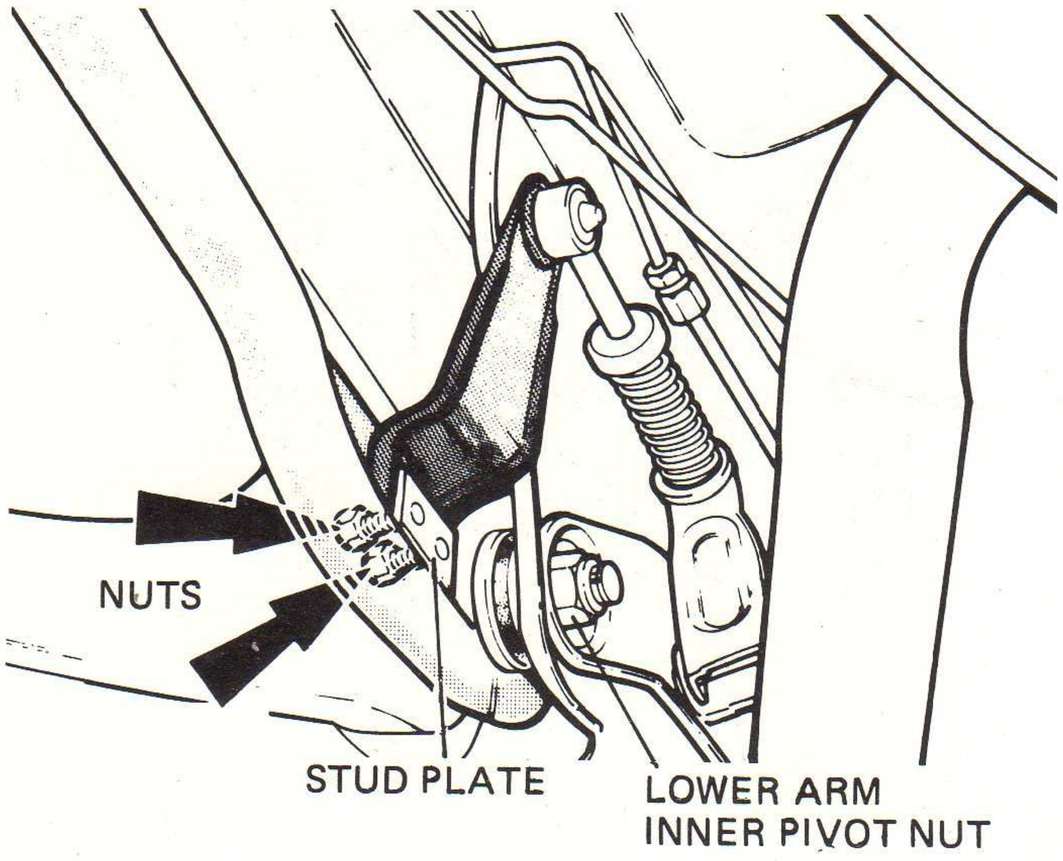
**15**




A2196

# S.C.S.
# (stop control system)



## Replacement

1. Fit the new valve's push rod onto the adjusting bracket spigot. They can be carefully pressed together in a vice using a suitable socket as a spacer. Lubrication of the rubber bush will help assembly.

2. Fit the valve to the mounting bracket. Tighten the bolts to a torque of 21 to 28 Nm (15 to 21 lbf.ft).

3. Refit the mounting bracket and valve assemblies to the lower arm inner pivot bolts (Fig. 15). Fit the nuts and tighten to a torque of 70 to 80 Nm (52 to 60 lbf.ft)

4. Reconnect the hydraulic lines and tighten the pipe nuts to a torque of 9 to 11 Nm (7 to 8 lbf.ft).

5. Secure the adjusting bracket to the lower arm. Tighten the nuts so that the bracket is firm, but still able to pivot.

NOTE: When setting the valve the vehicle must have its normal weight (e.g. spare wheel, tools etc.) on all four wheels. The petrol tank must be half full.

IMPORTANT: NEW SERVICE VALVES ARE FITTED WITH RED 7.5 MM NYLON SETTING SPACERS. AFTER FITTING AND SETTING THE VALVE THESE SPACERS MUST BE REMOVED. IF NEW ROAD SPRINGS HAVE BEEN FITTED THEN A SPECIAL 6MM SETTING GAUGE WILL HAVE TO BE MADE (SEE "SETTING GAUGE" SECTION FOR DETAILS). FAILURE TO USE THE CORRECT GAUGE WILL RESULT IN INCORRECT BRAKE PERFORMANCE AND VEHICLE HANDLING RESPONSE.

1. If the 7.5mm spacer, already fitted to the new valve, is not being used then fit the 6mm setting gauge between the lever and the spring ferrule (Fig. 17).

2. Hold the valve lever hard against the plunger, ensuring that the valve internals are fully compressed (Fig. 17).Do not use the spring loaded push rod to achieve this.

3. With the valve loaded as in Step 2, tighten the two nuts on the adjusting bracket to a torque of 21 to 28 Nm (15 to 21 lbf.ft).

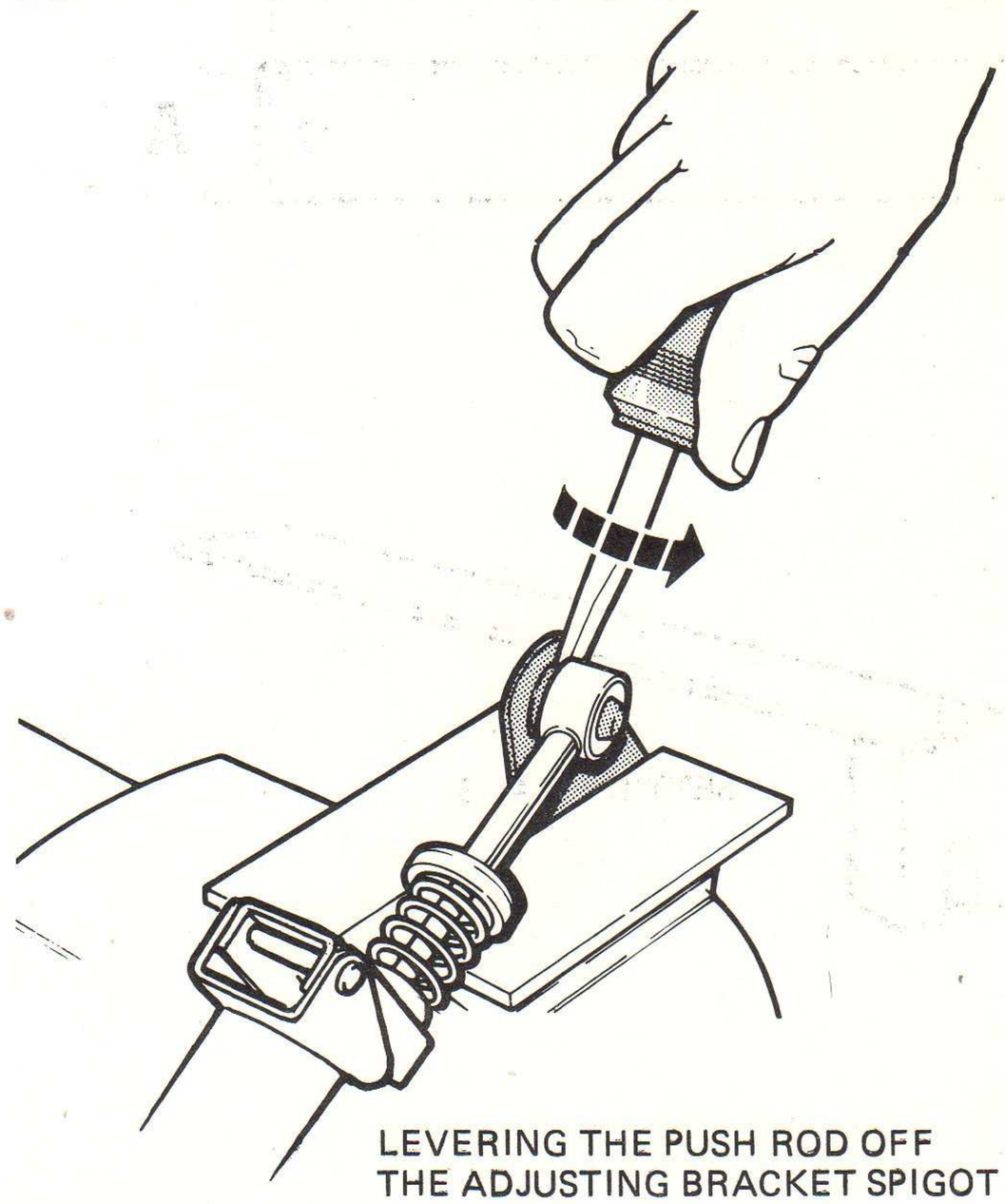
4. Remove the 6mm setting gauge or the 7.5 mm spacer. The gauge must be able to slide in and out of the gap in a similar manner to that of feeler gauges.

5. Refit the fuel pump and secure.

6. Bleed the rear brakes (ensure that the vehicle weight is on the wheels).

7. Lower the vehicle, test the brakes and road test.

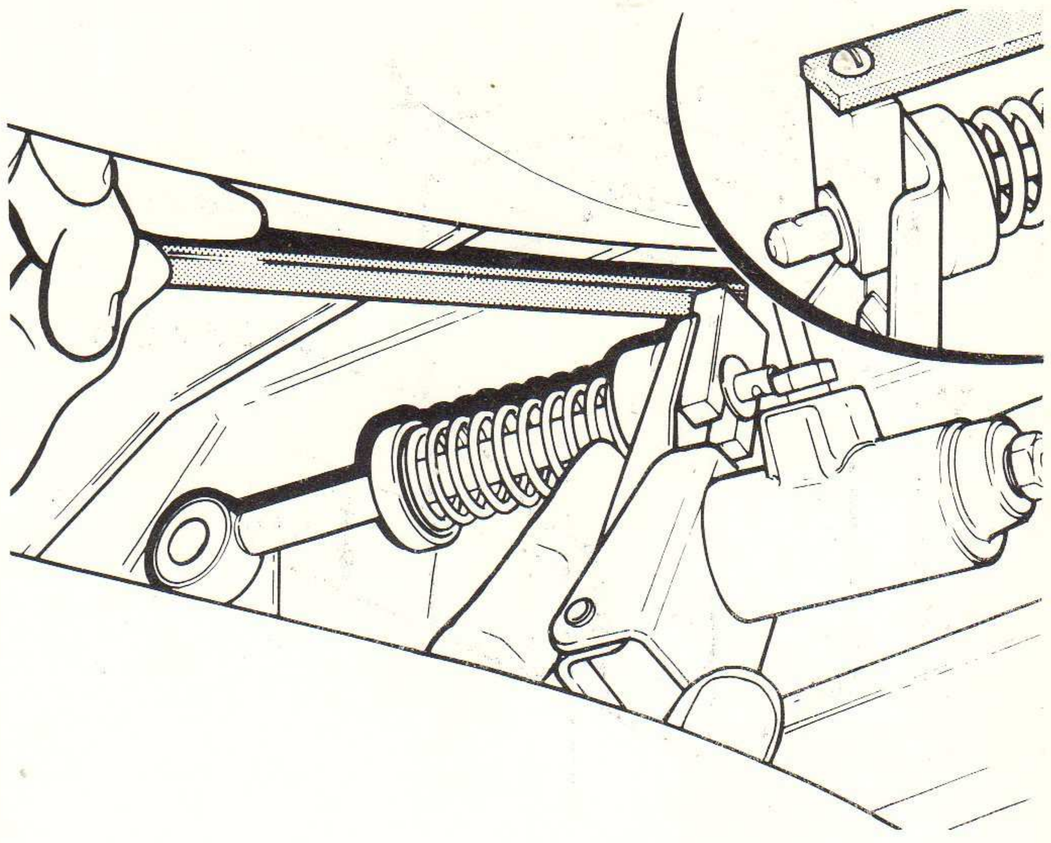
**16**



LEVERING THE PUSH ROD OFF THE ADJUSTING BRACKET SPIGOT

A2192/5

**17**



A2192/3

## Setting Gauge

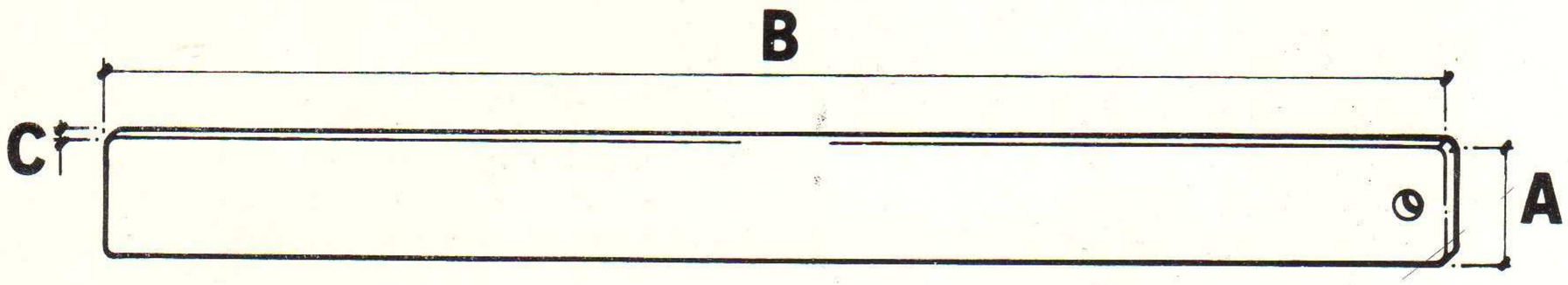
When fitting a new valve or refitting the existing valve to a vehicle which has had new road springs fitted a 6 mm setting gauge must be used and can be made as follows:

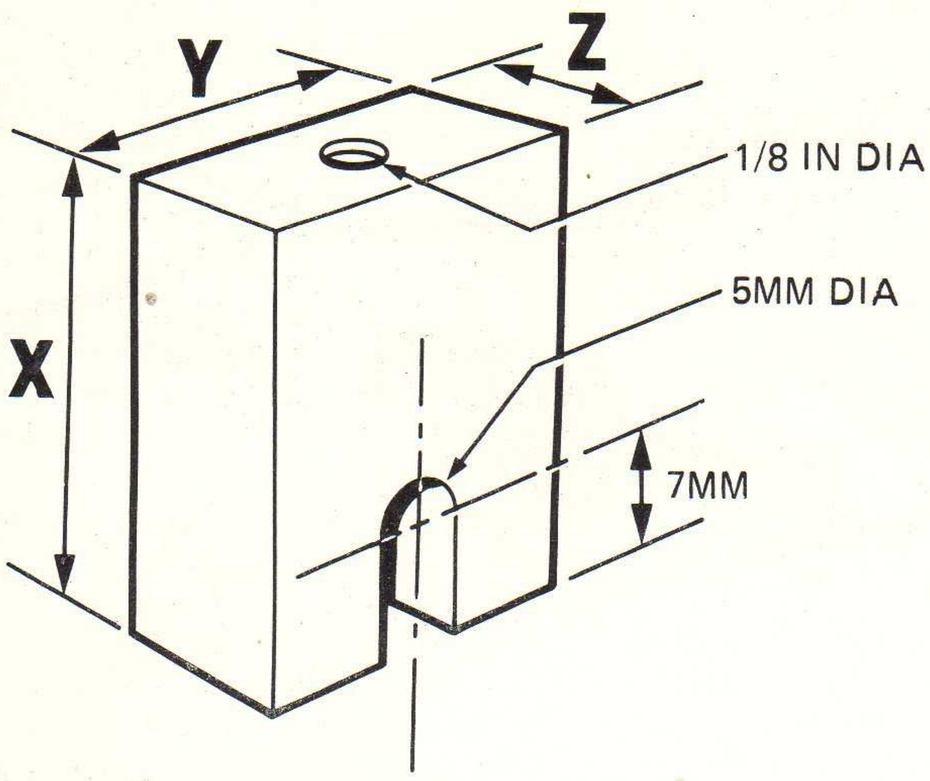
Materials: Steel Block X = 30 mm
Y = 15 mm
Z = 6 mm

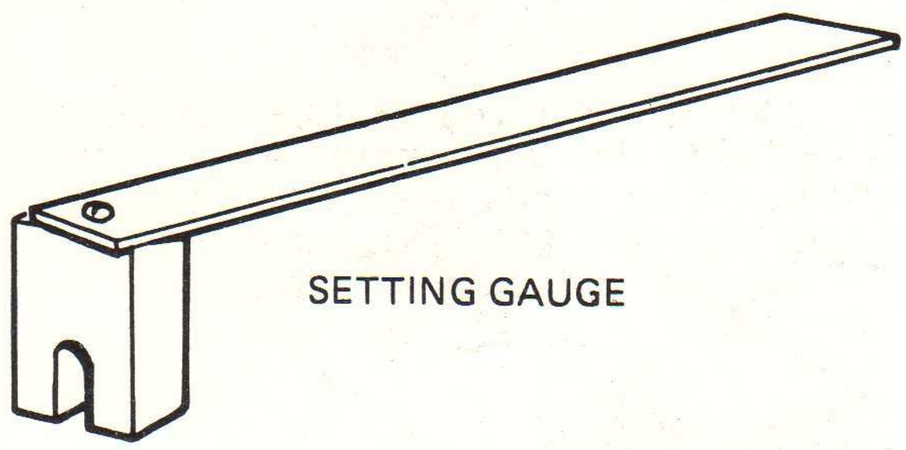
Steel Strip A = 10 mm
B = 150 mm
C = 3 mm

1. Drill a 5mm hole in the steel block.
2. Make two saw cuts joining the hole. Remove the metal leaving a slot (Fig. 18).
3. In the opposite end to the slot, drill and tap a 1/8in. hole (Fig. 18).
4. Drill a 1/8 in. clearance hole 3/16 in. from the end of the steel strip (Fig. 18).
5. Apply loctite to a 1/8 in. screw and fasten the block to the steel strip. Tighten the screw sufficiently to just allow the block to rotate.

18




A2129

# S.C.S. (stop control system)



system information

## SERVICE DIAGNOSTIC PROCEDURE

WARNING: IF THE VEHICLE HAS A STANDARD DIFFERENTIAL THEN FOLLOW STEPS 1 TO 19. IF THE VEHICLE HAS A LIMITED SLIP DIFFERENTIAL FOLLOW STEPS 1 TO 5, THEN STEPS 20 TO 35 OVERLEAF, OTHERWISE DAMAGE MAY OCCUR.

## ALL VEHICLES

IMPORTANT: EXAMINE THE CONDITION AND TENSION OF THE DRIVE BELT PRIOR TO CONDUCTING THE CHECK. (REFER TO VEHICLE MANUFACTURERS SERVICE MANUAL).

NOTE: Remember, the vehicle utilises a diagonal (x) split braking system. If there is a system fault it should show up on the diagonally opposed wheels.

1. Jack up and support the car on its suspension using a wheel free ramp or axle stands. (The wheels must be clear of the ground and the vehicle safely supported). The suspension and drive shafts must not hang free. Check for fluid leakage from any point of the brake system.

2. Release the handbrake and ensure that all wheels can be rotated. If excessive brake drag is apparent inspect the basic brake system.

3. Start the engine, apply the brake pedal and hold the steering wheel firmly.

4. Attempt to rotate all of the road wheels for a minimum of 15 secs each. This is best achieved by briefly trying each wheel in turn and then moving around the car a second time trying the wheels - approximately 15 seconds will have elapsed between leaving a wheel and returning to it for the second time. They should be locked and remain locked. If either wheel is not locked or it releases within that time, there is a problem with the basic brake system or there is a leak at, or in the modulator.

5. Release the brakes and switch off the engine.

## STANDARD DIFFERENTIAL VEHICLES

### Test 1 - Anti-Lock Operation (Steps 6 to 12)

6. Start the engine and hold the steering wheel firmly.

7. Engage third gear, slowly release the clutch and run the engine until approximately 20 m.p.h. is shown on the speedometer.

IMPORTANT: BOTH ROAD WHEELS MUST BE TURNING AT APPROXIMATELY THE SAME R.P.M. IF THIS CONDITION CANNOT BE ACHIEVED THEN IT WILL BE NECESSARY TO PROCEED BY UTILISING AN ALTERNATIVE METHOD EXPLAINED IN STEPS a TO e BELOW. OTHERWISE PROCEED TO STAGE 8.

a. Switch off the engine.
b. Apply the footbrake and using only the Lucas Girling Hose Clamp (Part No. 64947017) clamp off the hose leading to the nearside front wheel. Do not use any alternative clamp otherwise hose damage will occur.
c. Ensure the steering wheel is returned to the straight ahead position and release the footbrake.
d. Re-start the engine and hold the steering wheel firmly.
e. Engage second gear, slowly release the clutch and run the engine until approximately 10 mph is shown on the speedometer.

8. Rapidly disengage the clutch and apply the brakes hard. KEEP THE FOOTBRAKE APPLIED and return the gear lever to neutral.

9. SWITCH THE ENGINE OFF, release the clutch pedal but KEEP THE FOOTBRAKE APPLIED throughout stages 10 and 11.

10. Rotate the offside front wheel in a forward direction against the brake drag until it locks. This may be possible for up to one complete turn dependant upon the point at which the dump valve operated. The effort involved will increase greatly as the wheel is turned. This action will confirm that the anti-lock has operated the dump (brake release) stage and that, as the wheel turned and locked, the pump has operated to re-apply the brakes. If the wheel cannot be turned at all, of if the wheel can be turned beyond 1 revolution then the modulator is not operating correctly.

11. Repeat step 10 on the nearside front wheel. If the hose clamp had to be used it will be necessary to repeat steps 4a and 4b (but this time clamping off the offside front wheel) through to step10, (rotating the nearside front wheel).

12. Fully release the brake pedal (remove the hose clamp where applicable).

IMPORTANT: IF A MODULATOR IS SUSPECT, ALWAYS ENSURE THAT IT IS PROPERLY BLED BEFORE REMOVING IT. FOLLOW THE RECOMMENDED MODULATOR BLEED PROCEDURE IF NECESSARY AND RE-TEST. ONLY THEN SHOULD A NEW MODULATOR BE FITTED, FULLY BLED AND THE SYSTEM RE-TESTED.

### Test 2 -Anti-Lock Low Speed Cut Out(Steps 13 to 17)

13. Repeat stages 6 and 7 at an indicated speed of 5 mph on the speedometer (DO NOT EXCEED THIS FIGURE). Both road wheels, must be rotating at approximately the same R.P.M. IT WILL BE NECESSARY TO CLAMP OFF THE HOSES IF THE WHEEL SPEEDS DIFFER GREATLY, as with this test the speedometer indicated speed is critical.

NOTE: With one hose clamped, an indicated speed not in excess of 2½ m.p.h. must be achieved and each front wheel must be tested individually.
Use the tool and procedure recommended in steps 7a-7d.

14. Rapidly disengage the clutch and apply the brakes hard. KEEP THE FOOTBRAKE APPLIED and return the gear lever to neutral.

15. SWITCH THE ENGINE OFF, release the clutch pedal but KEEP THE FOOTBRAKE APPLIED.

16. Attempt to rotate first one front wheel and then the other in a forward direction. It should not be possible to rotate either wheel. This confirms that the low speed cut-out has operated. If either wheel can be rotated repeat the check ensuring that 4 mph (2 mph if clamped) is not exceeded. If either wheel can still be rotated this confirms that the appropriate modulator is not operating correctly.

17. Release the footbrake. (Remove the hose clamp where applicable).

IMPORTANT: IF A MODULATOR IS SUSPECT, ALWAYS ENSURE THAT IT IS PROPERLY BLED BEFORE REMOVING IT. FOLLOW THE RECOMMENDED MODULATOR BLEED PROCEDURE IF NECESSARY AND RE-TEST. ONLY THEN SHOULD A NEW MODULATOR BE FITTED, FULLY BLED AND THE SYSTEM RE-TESTED.

18. Apply the handbrake.

19. Lower the vehicle to the ground.

NOTE: It is not practical without special equipment to accurately assess the system function over a range of speed and applications. Whilst under warranty, no attempt should be made to dismantle the modulator. If it is suspect, return the unit with all ports plugged, to the vehicle manufacturers Service Dept. where applicable, or through the Lucas Girling Distributor from where it was purchased.

## LIMITED SLIP DIFFERENTIAL VEHICLES

### Test 1 - Anti-Lock Operation (Steps 20 to 26)

20. DO NOT APPLY BRAKE PEDAL. Using only the Lucas Girling Hose Clamp (Part No. 64947017) clamp off the hose leading to the nearside front wheel. Do not use any alternative clamp otherwise hose damage will occur.

21. Ensure the steering wheel is returned to the straight ahead position.

22. Start the engine and hold the steering wheel firmly.

23. Engage third gear, slowly release the clutch and run the engine until approximately 20 m.p.h. is shown on the speedometer.

24. Rapidly disengage the clutch and apply the brakes hard. KEEP THE FOOTBRAKE APPLIED and return the gear lever to neutral.

25. SWITCH THE ENGINE OFF, release the clutch pedal but KEEP THE FOOTBRAKE APPLIED throughout stage 26.

26. Rotate the offside front wheel in a FORWARD direction against the brake drag until it locks. This may be possible for up to one complete turn dependant upon the point at which the dump valve operated. The effort involved will increase greatly as the wheel is turned. This action will confirm that the anti-lock has operated the dump (brake release) stage and that, as the wheel turned and locked, the pump has operated to re-apply the brakes. If the wheel cannot be turned at all, or if the wheel can be turned beyond 1 revolution then the modulator is not operating correctly.

IMPORTANT: IF A MODULATOR IS SUSPECT, ALWAYS ENSURE THAT IT IS PROPERLY BLED BEFORE REMOVING IT. FOLLOW THE RECOMMENDED MODULATOR BLEED PROCEDURE IF NECESSARY AND RE-TEST. ONLY THEN SHOULD A NEW MODULATOR BE FITTED, FULLY BLED AND THE SYSTEM RE-TESTED.

### Test 2 -Anti-Lock Low Speed Cut Out(Steps 27 to 29)

27. Repeat steps 22 to 25 using 1st gear at an indicated speed of 5 mph on the speedometer (DO NOT EXCEED THIS FIGURE).

28. Attempt to rotate offside front wheel in a forward direction. It should not be possible to rotate the wheel. This confirms that the low speed cutout has operated. If the wheel can be rotated repeat the check ensuring that 4 mph on the speedometer is not exceeded. If the wheel can still be rotated this confirms that the offside modulator is not operating correctly.

IMPORTANT: IF A MODULATOR IS SUSPECT, ALWAYS ENSURE THAT IT IS PROPERLY BLED BEFORE REMOVING IT. FOLLOW THE RECOMMENDED MODULATOR BLEED PROCEDURE IF NECESSARY AND RE-TEST. ONLY THEN SHOULD A NEW MODULATOR BE FITTED, FULLY BLED AND THE SYSTEM RE-TESTED.

29. Release the footbrake.

30. Remove the hose clamp.

### Test 3 - Anti-Lock Operation (Step 31)

31. Repeat steps 20 to 26 on the nearside front wheel. (this time clamping off the offside front wheel and rotating the nearside front wheel).

IMPORTANT: IF A MODULATOR IS SUSPECT, ALWAYS ENSURE THAT IT IS PROPERLY BLED BEFORE REMOVING IT. FOLLOW THE RECOMMENDED MODULATOR BLEED PROCEDURE IF NECESSARY AND RE-TEST. ONLY THEN SHOULD A NEW MODULATOR BE FITTED, FULLY BLED AND THE SYSTEM RE-TESTED.

### Test 4 -Anti-Lock Low Speed Cut Out(Steps 32 to 35)

32. Repeat steps 27 to 29 (attempt to rotate the nearside front wheel).

33. Remove the hose clamp.

34. Apply the handbrake.

35. Lower the vehicle to the ground.

NOTE: It is not practical without special equipment to accurately assess the system function over a range of speed and applications. Whilst under warranty no attempt should be made to dismantle the modulator. If it is suspect, return the unit with all ports plugged, to the vehicle manufacturers Service Dept. where applicable, or through the Lucas Girling Distributor from where it was purchased.