Chapter G

Hydraulic systems

This chapter is in two parts. Part I covers cars fitted with hydraulic systems using Castrol RR363 brake fluid. Part II covers cars fitted with systems using hydraulic system mineral oil (LHM).

Care should be taken before commencing work on a car hydraulic system to determine the type of system fitted.

Part I - Castrol RR363 brake fluid
Applicable to Silver Shadow II, Bentley T2 Silver Wraith II, Corniche and Camargue cars prior to car serial number 50 000

Part II - Hydraulic system mineral oil (LHM)
Applicable to Corniche and Camargue cars from serial number 50 001

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Chapter G Part I

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Chapter G

Part I
Hydraulic systems
Castrol RR363 brake fluid

Applicable to Silver Shadow II, Bentley T2, Silver Wraith II, Corniche and Camargue cars prior to serial number 50 000

Section

G1 Introduction
G2 Special precautions
G3 Hydraulic system pipework
G4 Bleeding the hydraulic systems
G5 Hydraulic fluid reservoir
G6 Hydraulic pumps
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G8 Deceleration conscious pressure limiting valve
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G16 Parking brake linkage
G17 Fault diagnosis

Castrol
RR363
Brake Fluid

Section G1

Introduction

Chapter G Part 1 covers the components for the two independently power operated braking systems the height control system and the mechanically operated parking brake, fitted to Silver Shadow II Bentley T2, Silver Wraith, Corniche and Camargue cars with serial numbers prior to 50 000.

These cars use conventional synthetic brake fluid in the hydraulic systems i.e. Castrol RR 363 Brake fluid.

The braking systems consist of two independent circuits, 'System 1' operating the front road wheels front brake calipers and the upper cylinders of the rear road wheel brake calipers, 'System 2' operating the front road wheels rear brake calipers and the lower cylinders of the rear road wheel brake calipers. All wheels are fitted with disc brakes.

Pressure for the system is supplied by two hydraulic accumulators which are charged by engine operated hydraulic pumps. The hydraulic pump situated in front of the engine air inlet manifold supplies fluid to the accumulator on the right-hand side of the engine (No1 System) and the hydraulic pump situated at the rear of the engine supplies fluid to the accumulator situated on the left-hand side of the engine (No.2 System). This accumulator also supplies pressurised fluid to the height control system. This system is operated by two height control valves situated on the rear suspension crossmember. These valves control the amount of pressurised fluid passed to the hydraulic rams, positioned on top of each rear road spring.

The mechanical parking brake is hand operated on right-hand drive cars. On left-hand drive cars the parking brake is applied by a foot operated pedal and released by a hand lever. Both types of brake operate two additional brake pads onto each rear brake disc.

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Section G2

Special precautions

Important

The hydraulic systems operate at high pressure. Before attempting any work on the hydraulic systems of the car service personnel must note carefully the contents of this section and be fully conversant with the precautions required to ensure adequate safety and correct system operation.

Before any work except specified tests, is carried out on the hydraulic systems, depressurisation of the systems must be carried out.

With the exception of bleed screws; pipes and components must never be removed when the systems are in a pressurised state.

Depressurising a system

Method 1

Switch on the ignition and pump the brake pedal 50 or 60 times until the warning panels marked 1 BRAKE PRESSURE and 2 BRAKE PRESSURE on the instrument facia are illuminated. Switch off the ignition.

On cars destined for Australia, Canada and the USA it will be necessary to pump the brake pedal an extra 30 times after the warning panels have illuminated to ensure complete depressurisation of the systems.

Method 2

With the ignition switched off, place a length of bleed tube over the bleed screw in the accumulator valve body; hold the free end in a clean container.

Open the bleed screw slightly and bleed until fluid no longer flows from the accumulator. The bleed screw should only be opened fractionally otherwise accumulator pressure will force the tube off the bleed screw.

Close the bleed screw, remove the tube and repeat the operation for the other accumulator.

Depressurise the height control rams by placing a bleed tube on each ram bleed screw in turn, opening the bleed screws and allowing the fluid to bleed into a clean container.

Bleeding the hydraulic systems

It is recommended that the gear change thermal cut-out is removed from the fuseboard beneath the facia, to isolate the electric gear change whilst the systems are bled.

Hydraulic fluid

It is important that only the approved fluid should be used (see Chapter D Lubricants). Under no circumstances should a mineral oil be substituted for the genuine fluid.

It must be noted that brake fluid is hygroscopic, i.e. the fluid will absorb and chemically combine with water from the atmosphere.

Brake fluid which is contaminated by water will boil at a much lower temperature than fluid with no water content.

If the fluid is contaminated and the car is braked excessively or very hard from high speeds, there will be a tendency for the heat generated by the brakes to boil the fluid, which could result in vaporisation of the brake fluid causing a delay in braking response to brake pedal actuation.

This situation can be dangerous in that although full braking will ultimately be available, an excessive delay can be misinterpreted as ineffective brakes and so confuse the driver into otherwise unwarranted actions.

To eliminate possible contamination of the brake fluid it is essential that the fluid is exposed to the atmosphere for the absolute minimum of time. It should always be stored in and used direct from small sealed containers. When the systems are replenished, the two reservoir covers and the container cover must be replaced immediately.

Cleanliness

For the correct functioning of the hydraulic systems meticulous care should be taken to ensure complete cleanliness at all times.

Since both the braking system and the height control system employ components which have very fine manufacturing limits, the ingress of even very fine particles of foreign matter could have very serious effects on the operation of the systems.

Care must therefore be taken to ensure that at all times only clean fluid of the specified type (refer to Chapter D) is used in the systems and that any overhauled units or components have not been exposed to contamination before they are fitted to the car.

Contact with mineral based oils must be avoided at all times as these oils have a detrimental effect on the rubber seals used in the hydraulic systems.

Removing components

Prior to disconnecting any pipes or removing hydraulic components from the car, the area around

the pipes and components should be thoroughly cleaned. Particular attention should be given to the localised areas around the pipe unions and their corresponding ports.

Whenever units, pipes or components are disconnected from the hydraulic systems all open ports and pipe ends must be blanked off immediately to avoid contamination of the systems.

It is stressed that the clean condition of any blanks used is equally as important as the clean condition of the components they seal.

The size and type of each blank is as follows:

Male	3/8 in. U.N.F.
Female	3/8 in. U.N.F.
Male	7/16 in. U.N.F.

There are two types of female push-on blanking cap.

Quantities of blanks may be obtained, on request, from the Parts Department at Crewe.

In addition, special pressure blanks are available, capable of withstanding full hydraulic system pressure, for use during testing and fault diagnosis procedures where it may be necessary to blank off a pipe or component and then charge the systems.

Note
Masking tape and/or cork bungs do not constitute blanks.

The Part Numbers of the pressure blanks listed in the Tools Catalogue are as follows:

RH 7310	Male	3/8 in. U.N.F.
RH 7809	Female	3/8 in. U.N.F.

When used, these blanks must be torque tightened to the figures quoted for the pipe unions which they replace.

Cleaning components
Components which have been removed should be thoroughly cleaned before replacement.

Blow dry compressed air through all pipes. Rubber pipes, sealing rings and other components should be washed in methylated spirits and then dried with dry compressed air.

Cloths, even the lint free type, should never be used to clean hydraulic components or sealing rings.

Methylated spirits is the only recommended cleanser; trichlorethylene, paraffin or petrol must never be used to clean hydraulic components.

Note
When rubber seals are washed in methylated spirits, they must not be allowed to soak, as prolonged immersion in spirit could have a detrimental effect.

Hydraulic system - General maintenance
When the hydraulic reservoir and systems are drained completely always fill with fresh clean fluid of the specified type. Refer to Chapter D for the fluid specification.

This procedure will require a complete bleeding operation to be performed afterwards to remove all air from the systems.

Servicing rubber components
In the interest of safety, the rubber components used in the hydraulic systems have been allotted specific 'life' mileages at the completion of which, or at the nearest service, it is recommended that the components are renewed. (Reference should be made to Service Schedule Manual publication number T.S.D. 4117 for this information.)

Seals, other than dust covers, used in the hydraulic systems should only be lubricated with clean brake fluid of the approved type.

Hydraulic accumulator spheres
The hydraulic accumulator spheres are charged on one side of the diaphragm with nitrogen gas (see Chapter G6) through a one-way charging valve, the valve being situated in the lower end of the sphere.

Replacement spheres are supplied in an uncharged state and therefore must be charged by the Franchise holder before being used to replace existing faulty spheres.

Exchange spheres are supplied complete with charging valve cap; a warning plate and locking washer are supplied loose. A label is attached which reads 'Uncharged - Remove label on charging and attach warning plate'.

It is of the utmost importance that, when the sphere is charged, the warning plate is fitted below the charging valve cap (see Fig. G10).

Spheres must never be transported in a charged state, they must always be discharged before despatch.

Service Personnel are advised that spare accumulator spheres should be charged and leak tested immediately on receipt and then stored in a charged condition.

This ensures that the storage period is utilised as a time/leakage test so that when a sphere is removed from store and the pressure of the nitrogen is tested after fitting, it can be seen whether the sphere is still fully charged with nitrogen.

Spheres which have been correctly charged and successfully leak tested before storage and then show a loss of pressure in excess of 1,75 kg/sq.cm. (25 lb/sq.in.) when tested prior to fitting, must be rejected. The sphere should be recharged and leak tested again to determine the cause of leakage. If the leak persists, the sphere should be discharged and dismantled and the diaphragm checked and renewed if necessary (refer to Section G6).

Fitting replacement units
Replacement hydraulic units are tested and blanked off before being despatched from the factory.

It is advisable, when fitting a replacement unit, that when the unit has been placed in position and the blanks removed, the fluid in the unit is allowed

to drain before the pipes are connected.

When drained, the pipes should be connected and the appropriate bleeding operations carried out.

Note

The fluid should not be blown out; allowing it to drain is sufficient.

Storage and transportation

The care taken to prevent contamination of components during storage or transportation is extremely important.

Replacement parts, pipes and units must be correctly and securely sealed with the recommended blank which should not be removed until immediately prior to fitting. The replacement parts must also be adequately protected from dust or damage.

Sealing rings and rubber pipes in store should be protected from dust, light and heat.

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Section G3

Hydraulic system pipework

Except in certain cases where flexible hoses are used to accomodate movement between two units the fluid for the systems is carried in bundy tubing.

The pipework, with the exception of the flexible hoses, is almost entirely 4,76 mm. (0.186 in.) diameter bundy tubing. The only exceptions are the ends of the return pipes from the hydraulic accumulators to the reservoir which are 6,35 mm. (0.250 in.) diameter. The metal sections of the feed pipes from the reservoir to the hydraulic pumps and the pressure feed pipe from the hydraulic pump to the accumulator are 9,52 mm. (0.375 in.) diameter.

To enable pipe identification neoprene sleeves are fitted to each end of the metal pipes, except for the short bridge pipe fitted to each rear caliper. A chart quoting the pipe colours and functions is given on Page G3 - 2. This chart should be consulted to determine the function of each pipe i.e. high pressure, low pressure and system.

Generally, pipework connections are effected by flared pipe ends and unions, either male or female as necessary. Conical seats are machined in the components or junctions to seat the flares and provide effective joints. In certain flexible pipe joints face seals and copper washers are employed.

If hydraulic pipes are disturbed the following points should be noted.

The area around the pipe union and pipe end should be thoroughly cleaned before the union is unscrewed.

Pipe ends should always be blanked off immediately after removal and the blanks should not be removed until immediately before fitting.

Whenever pipes are removed, the flares should be inspected for serviceability and pipes showing signs of damage, cracking or collapse must be renewed.

Before fitting, pipes and unions should be cleaned thoroughly using methylated spirits, then blown through with clean dry compressed air. Particular attention should be paid to the union and the exterior of the pipe immediately behind the flare.

When fitting pipes, do not overtighten unions as this could cause damage to pipe flares. In the case of face seals new copper washers must be fitted each time a pipe is refitted.

If when a pipe is removed the coloured sleeves are in poor condition they should be renewed. This is best achieved by expanding a new correctly coloured, rubber sleeve sufficiently to clear the union using a small three pronged expanding hand tool (e.g. Penguin pliers).

Identification sleeves are not fitted to the flexible hoses but the sleeves on the connecting pipes at either end may be used to identify the flexible pipe and its function.

The flexible and metal pipes can be readily identified by means of the colour coding and component location layout (see Figs. G1 and G2) and the function chart shown on Page G3 - 2.

Note

The two high pressure pipes from the hydraulic pumps to the hydraulic accumulators and the feeds from the reservoir to the hydraulic pumps are not marked and do not connect to any other marked pipes. Since these pipes are the only ones without means of identification confusion should not arise.

Extreme caution should be taken when fitting or renewing flexible pipes to ensure that the correct type of pipe is fitted, in the correct place and in accordance with the colour coding.

In the interest of safety, the flexible pipes fitted to the hydraulic systems have been allotted specific 'life' mileages at the completion of which or at the Service nearest to this mileage it is recommended that the flexible pipes are renewed.

For recommended 'life' mileages reference should be made to the Service Schedule Manual publication number T.S.D. 4117.

When removing ridged or flexible pipes, the positions of all clipping points and pipe routing should be noted to ensure that, when fitted, no chafing or vibration of the pipes can occur. Always ensure that the flexible hoses and ridged pipes are routed to clear other components and that clearance is maintained during the full range of steering and suspension movement.

It should be noted that the 4,76 mm. (0.186 in.) diameter pipes are not available as spares and in the event of a replacement being required it is recommended that they are produced using 'Armco' 25 microns zinc plated, fully chromate passivated bundy tubing. Care should be taken to avoid sharp bends when producing replacement pipes as this will cause the plating to fracture.

Note

The pipe connection tappings on the front wheel calipers are metric threads and only unions of the correct thread should be fitted to the caliper end of the pipes.

All pipes must be thoroughly cleaned using methylated spirit and dried using clean compressed

air. The ends should then be blanked until immediately before fitting.

All replacement pipes should be protected with a coating of underseal after fitting and leak checks have been carried out.

Non-standard torque figures are specified for certain pipe unions and fittings. These figures are given in Chapter P which also quotes all standard and non-standard torque figures. These figures must be adhered to at all times to avoid overtightening and possible damage.

Pipework colour coding

Colour	Function	System and location
Red	High pressure	**No.1 Braking system,** pipes from the front hydraulic pump to the right-hand accumulator and from the right-hand accumulator to the upper brake distribution valve.
Orange	High pressure	**No.2 Braking and height control system,** pipes from the rear hydraulic pump to the left-hand accumulator and from the left-hand accumulator to the lower distribution valve. Also from the left-hand accumulator to the height control solenoid valve and the height control valves.
Black	Low pressure	**No.1 Braking system,** return pipe from the upper brake distribution valve to the fluid reservoir.
White	Low pressure	**No.2 Braking and height control system,** return pipes from the lower brake distribution valve to the fluid reservoir; return from the height control valves to the reservoir. Also the height control solenoid to the reservoir.
Blue	High pressure	**No.1 Braking system,** pipes from the upper brake distribution valve to the front calipers on the front wheels and the upper cylinders on the rear wheel calipers.
Mauve	High pressure	**No.2 Braking and height control system,** pipes from the lower brake distribution valve to the rear calipers on the front wheels and the lower cylinder on the rear wheel calipers.
Yellow	High pressure	**No.2 Braking and height control system,** pipes carrying signal pressure from the solenoid valve to the height control valves.
Brown	High pressure	**No.2 Braking and height control system,** pipes from the height control valves to the height control rams.
Pink	High pressure	**No.2 Braking and height control system,** pipes from height control rams to remote bleed screws on the body sill adjacent to the right-hand rear wheel.

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Section G4

Bleeding the hydraulic systems

Introduction

In order to obtain optimum performance of the hydraulic systems it is essential that they are free of air at all times. The two hydraulic systems are re-circulatory and therefore, if air is allowed to enter them at any point it will reduce efficiency.

Bleed screws are provided on the side of the accumulators, on the left-hand pressure switch, on each pair of brake calipers, on each height control ram and on the deceleration conscious pressure limiting valve. The bleed screws for the height control rams are positioned on the inner side of the right-hand body sill just forward of the rear wheel arch (see Fig. G3).

The accumulators are situated on each side of the engine. The accumulator for the number one system is situated on the 'A' bank side of the engine; the accumulator for the number two system is situated on the 'B' bank side of the engine. The pressure switches are mounted on each valance adjacent to its respective accumulator.

The front compartment of the hydraulic reservoir supplies fluid for the number one braking system. From the reservoir fluid is supplied to the front brake pump which in turn supplies hydraulic fluid under pressure to the right-hand accumulator, the upper distribution valve, the deceleration conscious pressure limiting valve, the front calipers of the front brakes and the upper cylinders of the rear brake calipers.

The rear compartment of the hydraulic reservoir supplies fluid for the number two braking system. From the reservoir fluid is supplied to the rear brake pump which in turn supplies fluid under pressure to the left-hand accumulator, the lower distribution valve, the rear calipers of the front brakes, the lower cylinders of the rear brakes and the height control rams.

If a rectification has been carried out between the brake pumps and the distribution valves, it will be necessary to bleed at all the bleed points in that particular circuit.

If a rectification has been carried out between the distribution valves and the brake calipers, it should only be necessary to bleed at the bleed points between the distribution valve and the brake calipers in the faulty circuit. However if in any doubt it is advisable to bleed the complete system.

Care must be taken when bleeding at the brake pressure switch not to allow brake fluid to come into contact with the paintwork, as serious damage would result. As the pressure switch is located in close proximity to the engine cooling fan and various driven belts, bleeding of the switch should only be carried out with the engine switched off.

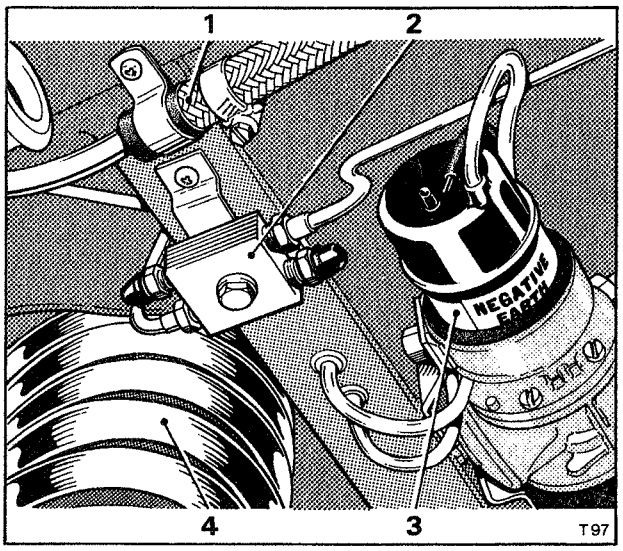

Fig. G3 Rear height control ram bleed screw location

1 Fuel pipe
2 Bleed screws
3 Fuel pump
4 Right-hand rear road spring

The power brake circuits should be bled at low pressure ensuring that the system is depressurised and the fluid levels in the reservoirs are kept above the minimum marks at all stages of the bleeding operation.

To obtain low pressure bleeding the system(s) must remain open at all times. Also throughout the bleeding operation, the brake pressure warning panel(s) 1 BRAKE PRESSURE and/or 2 BRAKE PRESSURE should be illuminated. Only when bleeding the height control rams and the pressure switch should the systems be fully pressurised and the warning panel lamps extinguished.

When bleeding the height control rams the interior of the car should be weighted to compress the suspension sufficiently for the height control valves to actuate and allow pressurised fluid through to the rams and bleed screws. The engine should be allowed to run for four minutes to ensure that the system is fully charged. Bleed both of the rams until all the air bubbles cease then allow fifteen seconds to elapse before fully tightening each bleed screw.

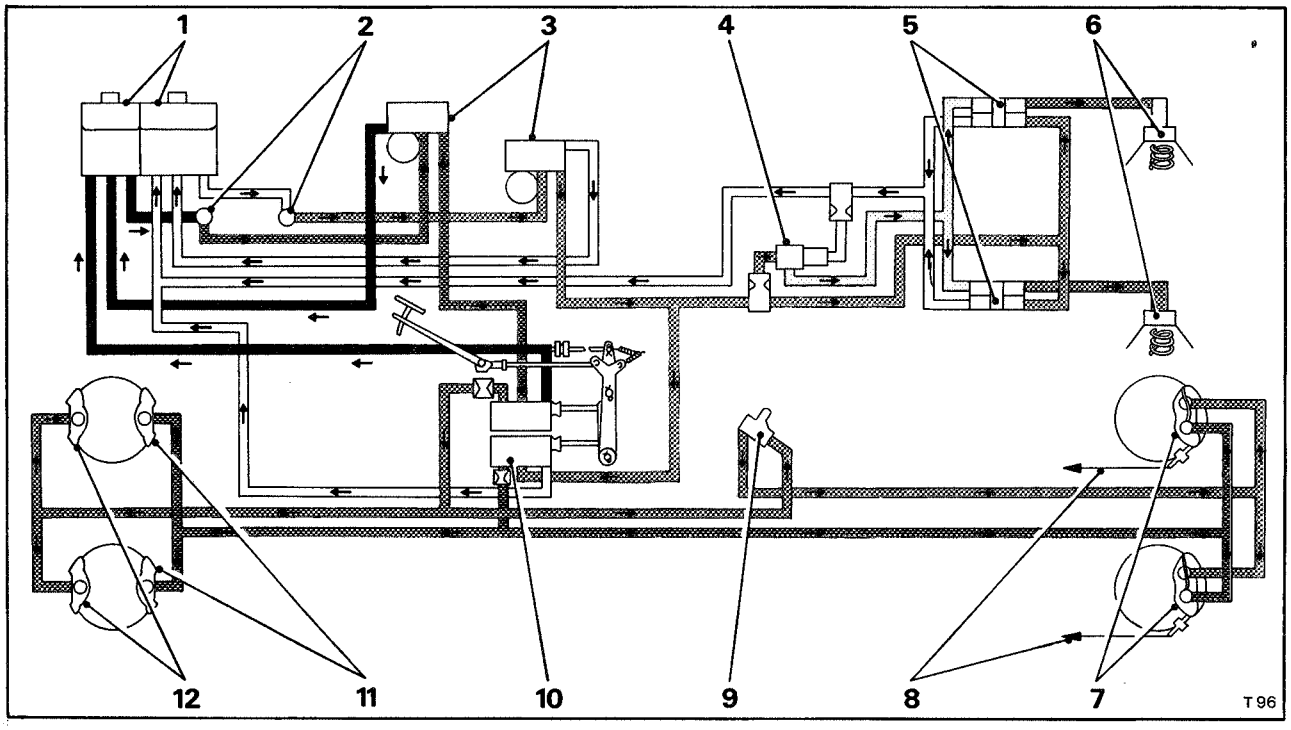

Fig. G4 Diagram of the hydraulic systems

No.1 Braking system
- High pressure
- Brake line pressure
- Low pressure
- Restrictors

No.2 Braking and levelling system
- High pressure
- Brake line pressure
- Low pressure
- Intermediate pressure
- High/low (solenoid signal pressure

1 Fluid reservoirs
2 Hydraulic pumps
3 Hydraulic accumulators
4 Solenoid valve
5 Height control valves
6 Height control rams
7 Rear wheel brake calipers
8 Parking brake cables
9 Deceleration conscious pressure limiting valve
10 Brake distribution valves
11 Rear brake calipers - front wheels
12 Front brake calipers - front wheels

Bleeding the systems

The following information is a comprehensive bleeding operation which should be carried out to ensure removal of air from the complete hydraulic systems but, as previously stated, each system can be bled separately at all points downstream of any replacements or pipe disconnections. A planned bleeding chart is given at the end of this section but if any doubt exists, it is advisable to bleed the complete system concerned.

Whilst bleeding is being carried out it is essential that the fluid level of the two reservoir compartments is kept to at least the topping-up level mark on the sight glasses using clean approved fluid (refer to Chapter D Lubricants).

All bleed screws should be torque tightened in accordance with the figure quoted in Chapter P.

When bleeding the hydraulic systems attach a length of rubber tube to each bleed screw prior to the bleed screw being opened, immerse the free end of the tube in approximately 2,5 cm. (1 in.) of brake fluid contained in a clean bottle.

With the gear selector in the 'P' park position and the parking brake applied, remove the gear-change thermal cut-out from the fuseboard below the facia.

Bleed the complete systems in the following sequence (refer to Fig. G5).

Depressurise the hydraulic systems.

Open bleed screws at points A, B and C.

Depress brake pedal. Start and run engine at between 750 r.p.m. and 800 r.p.m.

Ensure facia warning panels 1 BRAKE PRESSURE and 2 BRAKE PRESSURE are illuminated.

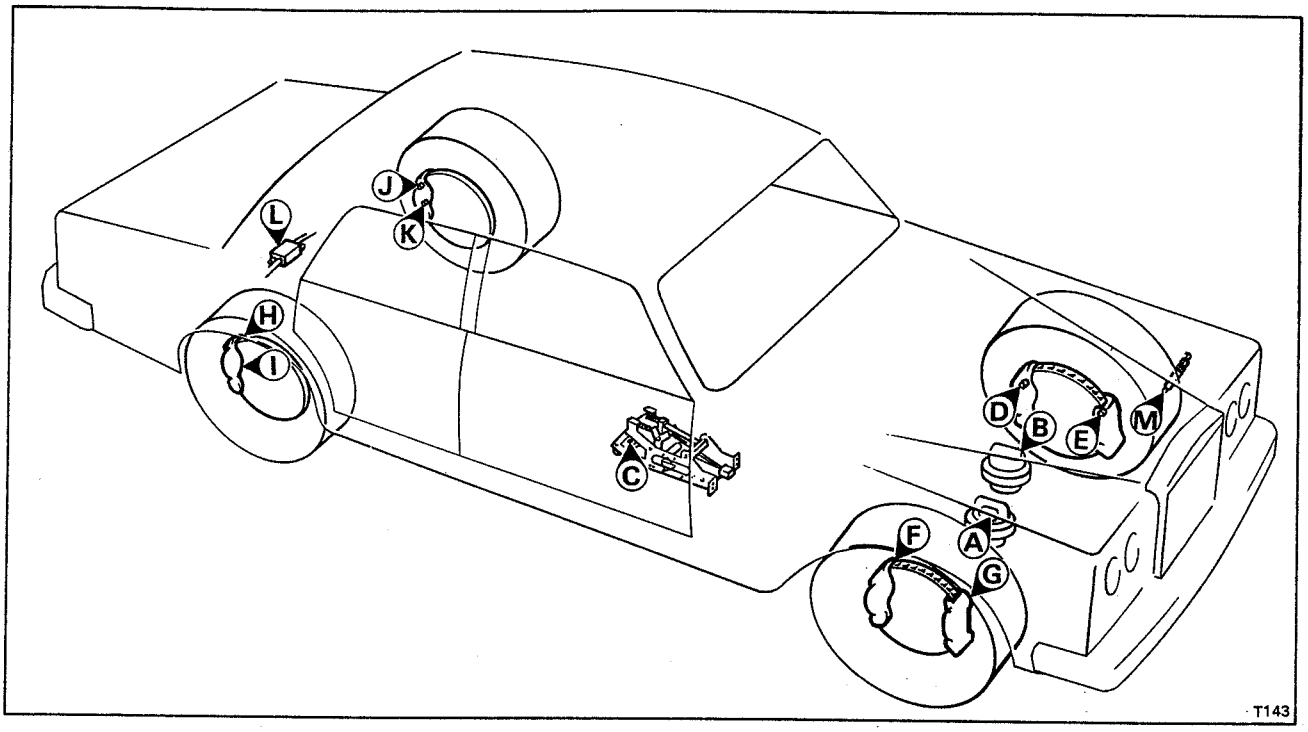

Fig. G5 Hydraulic system bleed point locations

A 'A' Bank accumulator
B 'B' Bank accumulator
C Pressure limiting valve
D Rear caliper left-hand front wheel
E Front caliper left-hand front wheel
F Rear caliper right-hand front wheel
G Front caliper right-hand front wheel
H Right-hand rear caliper (upper cylinder)
I Right-hand rear caliper (lower cylinder)
J Left-hand rear caliper (upper cylinder)
K Left-hand rear caliper (lower cylinder)
L Height control rams (underside rear floor)
M Pressure switch (left-hand valance)

Allow points A, B and C to bleed until air free.
Open bleed screws at points D and E; allow bleeding to start.
Close bleed screws at points A, B and C.
Bleed at points D and E until air free.
Open bleed screws at points F and G; allow bleeding to start.
Close bleed screws at points D and E.
Bleed at points F and G until air free.
Open bleed screws at points H and I; allow bleeding to start.
Close bleed screws at points F and G.
Bleed at points H and I until air free.
Open bleed screws J and K; allow bleeding to start.
Close bleed screws at points H and I.
Bleed at points J and K until air free.
Close bleed screws at points J and K.
Release brake pedal.
Add weight to rear of car to actuate levelling valves.
Allow systems to pressurise (facia warning panels extinguished).
Open bleed screws at point L; bleed until air free.
Close bleed screws at point L.
Switch off engine.
Open bleed screw at point M; bleed until air free.
Close bleed screw at point M.
Check fluid levels in reservoir, top up as necessary.
Fit rubber dust covers to each bleed screw.

Note

System 1 BRAKE PRESSURE bleed points A,C,E,G, H and J.
System 2 BRAKE PRESSURE bleed points B,D,F,I, K,L and M.

When bleeding the height control rams and the pressure switch extra care should be taken when slackening the bleed screws as the system will be operating at full pressure.

Sectional bleed requirements

Red pipe line

Any pipe disturbed between the hydraulic reservoir front compartment, front hydraulic pump, right-hand accumulator and upper distribution valve (No. 1 system).

Bleed the complete system: right-hand accumulator, deceleration conscious pressure limiting valve, front calipers on the front wheels, upper cylinder on the rear wheels.

Orange pipe line

Any pipe disturbed between the hydraulic reservoir rear compartment, rear hydraulic pump, left-hand accumulator, lower distribution valve and height control valves (No. 2 system).

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Bleed the complete system: left-hand accumulator, rear calipers on the front wheels, lower cylinder on the rear wheels, height control rams and pressure switch.

Blue pipe line
Any pipe disturbed between the upper brake distribution valve and front calipers on the front wheels and the upper cylinders on the rear wheel calipers.

Bleed the deceleration conscious pressure limiting valve, the front calipers on the front wheels and the upper cylinder on the rear wheel calipers.

Mauve pipe line
Any pipe disturbed between the lower brake distribution valve and rear calipers on the front wheel and lower cylinder on the rear wheel calipers.

Bleed the rear calipers on the front wheels and the lower cylinders on the rear wheel calipers.

Brown pipe line
Any pipe disturbed between the height control valves and the height control rams.

Bleed the height control rams.

After bleeding, the systems must be fully charged and the reservoir compartments topped-up in accordance with the instructions given on the sight glass instruction plate.

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Section G6

Hydraulic pumps

Before commencing any operations on the hydraulic pumps the car wings should be suitable protected with wing covers.

Hydraulic pump housing sealing rings - To renew
If brake fluid leakage occurs from a brake pump housing it is possible to renew the two sealing rings with the pump(s) in position using the following procedure.
1. Depressurise the hydraulic systems as described in Section G2.
2. Ensure that the pump(s) and the surrounding area is thoroughly clean.
3. Compress the rubber hose section of the hydraulic pump low pressure inlet pipe to prevent fluid flow. Remove the hose at the centre connection worm-drive clip. Suitably blank the hose end or allow the fluid to drain into a clean container.

Note
When work is being carried out on the rear hydraulic pump the ignition distributor should be removed as described in Chapter M.

On cars fitted with an exhaust emission control system the three way connector and check valve must be removed from above the front hydraulic pump (see Section U2).
4. Disconnect the high pressure outlet and low pressure inlet pipes from the hydraulic pump.
5. Remove the circlip from the top of the pump and draw the outer housing upwards and off the pump.
6. Discard the two old sealing rings; fit new ones lubricated with clean brake fluid of the approved type.
7. Fit the pump outer housing, aligning the port with the inlet pipe. Press the housing firmly into position then fit the circlip.
8. Prime the pump with approved brake fluid, connect the low pressure feed and high pressure outlet pipes to the pump, also connect the low pressure hose from the reservoir.
9. Top-up the reservoir with approved fluid (see Chapter D) and bleed the hydraulic systems as described in Section G4.

Hydraulic pumps - To remove
1. Carry out Operations 1 to 5 inclusive of Hydraulic pump housing sealing rings - To renew.
2. Using special box spanner (RH 8428) unscrew and remove the pump from its pedestal on the tappet chest cover; blank off the pedestal against the ingress of dirt.

Note
The pump cannot be removed using the top adapter as a spannering point.

Hydraulic pump - To dismantle
When two pumps are being dismantled the components from each pump must not be interchanged.
1. Remove the adapter from the top of the pump and withdraw the non-return valve assembly from the bore.

Gentle use of a small screwdriver may be necessary to assist removal of the chamfered washer; if the washer has spread it should be discarded and a new one fitted on assembly.
2. Remove the inlet valve ring, spacer ring and conical valve spring.
3. From the lower end of the pump remove the circlip and withdraw the plunger and spring collar; collect the spring.

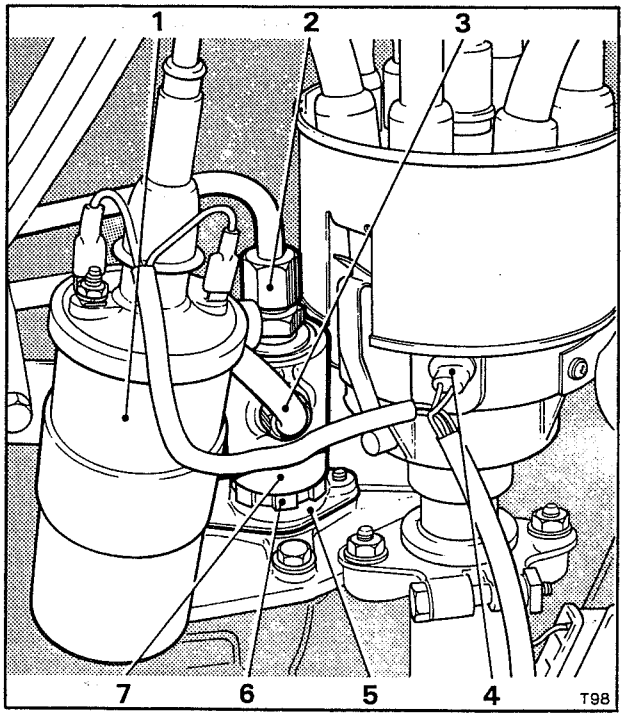

Fig. G8 Rear hydraulic pump
1 Ignition coil
2 High pressure outlet pipe
3 Low pressure inlet pipe
4 Ignition distributor
5 Pump mounting pedestal
6 Hydraulic pump spanner point
7 Pump outer housing

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4. Carefully withdraw the plunger barrel from the pump body.

Note

The barrel and plunger are a matched ground component and pieces are not interchangeable with pieces from other assemblies.

5. Remove and discard the three 'O' rings from the pump body.

6. To dismantle the non-return valve assembly, remove the circlip, push out the valve from the outer body and collect the spring, end stop and valve.

Hydraulic pump components - To clean and inspect

Important

Ensure that all components are absolutely clean.

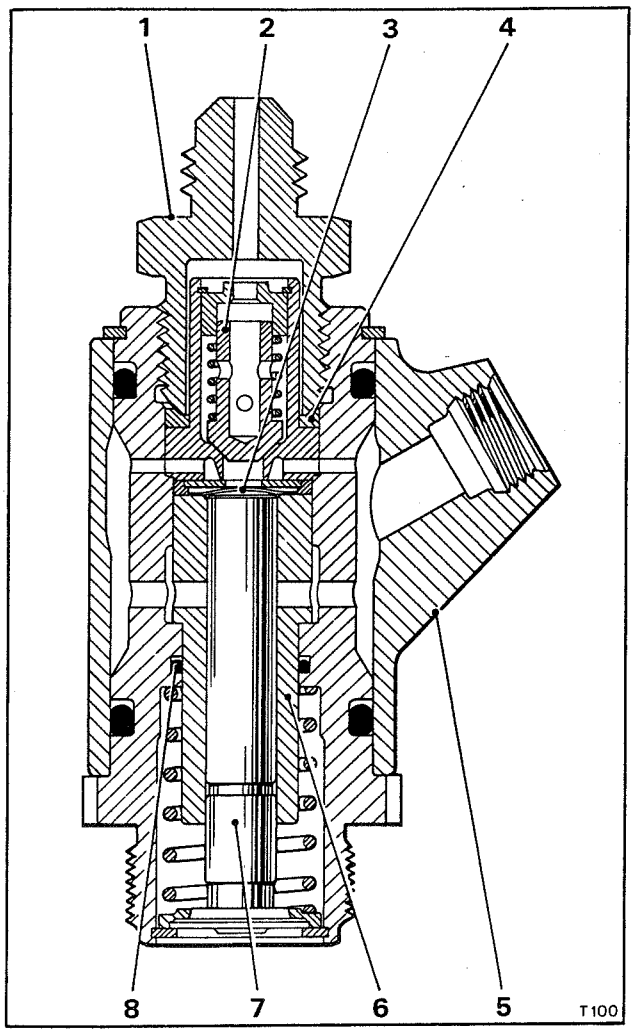

Fig. G9 Hydraulic pump - Sectional view

1 Adapter - high pressure outlet
2 Non-return valve
3 Inlet valve
4 Chamfered ring
5 Outer housing
6 Pump barrel
7 Plunger
8 Sealing ring

Tapped holes require special attention to ensure that they are free from foreign matter and slivers of thread which might break off during assembly and become entrapped in the hydraulic system. One method of achieving this is to screw slave adapters or setscrews down the threads before thoroughly cleaning the components in methylated spirits and drying with dry compressed air, **not cloth.**

It is important that the seating of the valves is correct and that the finely machined barrel and plunger are not scored or damaged.

Under normal circumstances after a thorough cleaning, and the introduction of a new set of sealing rings, the only parts that might need renewal are the small coil springs.

Hydraulic pump - To assemble

When assembling a hydraulic brake pump reference should be made to Figure G9.

1. Lubricate all parts including sealing rings with approved brake fluid (see Chapter D) prior to fitting in their respective positions.
2. Fit the small 'O' ring into position in the centre bore of the pump body.
3. Insert the plunger barrel into the pump body, pressing it through the sealing ring until it abuts the shoulder.
4. Insert and locate the spacer; fit the valve spring (crowned face towards inlet valve) and the inlet valve into position adjacent to the barrel head. Ensure that the seating face of the valve is free from damage marks otherwise the efficiency of the pump will be reduced.
5. Assemble the non-return valve, reversing the procedure given for its dismantling. Ensure that the valve is fully seated and the circlip correctly located in its groove. The end stop should be drawn upward to abut the circlip.
6. Fit the non-return valve assembly larger diameter leading into the pump body bore to abut the inlet valve ring.
7. Fit the chamfered sealing ring, small bore diameter leading into the pump body bore, to abut the shoulder of the non-return valve.
8. Fit the adapter to the top of the pump body, torque tightening to the figures quoted in Chapter P. Blank off the union.
9. Fit the coil spring into the lower end of the pump body.
10. Fit the spring collar to the barrel plunger and carefully insert the plunger into the bore of the barrel.
11. Depress the plunger against the spring sufficiently to enable the circlip to be fitted in its location.
12. Fit the two 'O' rings to the outside of the pump body. The pump is now ready for fitting to the engine.

Hydraulic pump - To fit and set

Prior to fitting the pump to the engine tappet cover flange, ensure that the shim washer fitted between the pump mounting flange and tappet cover is of the

correct thickness. For checking procedure refer to Chapter E Engine.

To fit the hydraulic pump, reverse the procedure for removal noting the following points.

1. The hydraulic pump and pipe connections should be torque tightened in accordance with the figures quoted in Chapter P. The pump should only be tightened using special box spanner (RH 8428), the top adapter should never be used as a spannering point.
2. Bleed the hydraulic systems as described in Section G4. Check all disturbed pipe connections for leaks.

Hydraulic pumps - To test (on the car)

1. Depressurise the system as described in Section G2.
2. Place a length of bleed tube onto the bleed screw of the accumulator pressurised by the pump to be tested; place and secure the other end of the tube in a clean measuring vessel, then open the bleed screw.
3. Ensure the appropriate reservoir compartment is full and start the engine.
4. Fluid should flow from the bleed tube in a series of spurts, coinciding with each revolution of the camshaft. The rate of flow should be approximately 250 ml. or just under ½ pint per minute at an engine speed of 1 000 r.p.m.
5. If fluid does not flow or the pumped quantity is below requirements the pump should be removed and overhauled.

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Section G7

Hydraulic accumulators

The hydraulic accumulators are mounted on the sides of 'A' bank (No.1 Hydraulic system) and 'B' bank (No.2 Hydraulic system) of the engine crankcase. Each accumulator consists of a sphere containing high pressure nitrogen gas with a control valve assembly mounted to the top of the sphere (see Fig. G12).

Hydraulic accumulator - To remove

The hydraulic accumulator must be removed from underneath the car.

1. Depressurise the hydraulic systems as described in Section G2.
2. Unscrew the worm drive clip on the fluid return hose, (see Figs.G10 and G11) clamp the hose to prevent fluid flow and withdraw it off the connecting pipe. Blank off the hose to prevent loss of fluid.
3. Disconnect the high pressure inlet and outlet pipes from the accumulator and blank off both pipes and connections.
4. Remove the setscrews and nut securing the retaining plate to the engine sump flange and the accumulator, collect the distance pieces and remove the plate.
5. Support the accumulator, remove the setscrews securing the accumulator to the engine crankcase, collect the distance pieces, then carefully remove the accumulator from the engine.

Hydraulic accumulator sphere and valve housing - To separate

1. Slacken the charging valve cap and allow any gas that may be escaping from the sphere to be discharged.
2. Remove the cap and discard the sealing ring. Collect the warning plate and sealing washer.
3. Unscrew the sphere from the valve housing.

Note

When using the hexagon machined on the sphere adjacent to the charging valve for spannering it is important that both halves of the sphere rotate as a unit when being unscrewed from the valve housing.

In the unlikely event of the lower half unscrewing from the upper half the operation must be stopped and the large hexagon on the upper half of the sphere used to separate the sphere from the valve housing. **Under no circumstances should the halves of the sphere be allowed to become separated with the sphere in a charged state.**

Hydraulic accumulator sphere - To discharge and dismantle

1. Carefully remove the valve cap and collect the sealing washers if not previously removed.
2. Depressurise the sphere by fitting the discharging adapter (RH 8235) to the base of the sphere and carefully screwing the adapter onto the sphere sufficiently to lift the one way valve from its seat.

This allows the nitrogen gas to escape slowly. It is not advisable to open the valve too wide or too quickly in order to quickly discharge the nitrogen gas from the sphere.

When the sphere is completely discharged remove the adapter.

3. Secure the sphere in holding tool (RH 8145) and using special pin spanner (RH 8144), remove the clamping ring in order to separate the halves of the sphere.

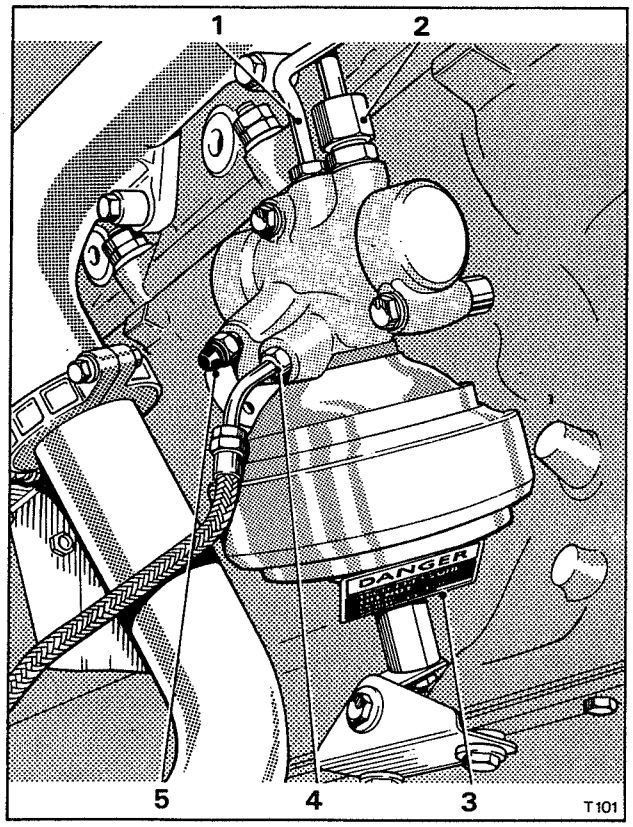

Fig. G10 Front hydraulic accumulator

1 Low pressure return to reservoir
2 High pressure inlet from pump
3 Warning plate
4 High pressure outlet to upper distribution valve
5 Bleed screw

4. Remove and discard the diaphragm.
5. In order to dismantle the one-way valve at the base of the sphere lower half, remove the circlip, washer, small spring and valve ball.

Hydraulic accumulator sphere - To assemble
Assemble the sphere by reversing the dismantling procedure noting the following points.
1. Examine the one-way valve seating and return spring. Renew the return spring if necessary.
2. Lightly tap a new steel ball onto the valve seat, then fit the spring, washer and circlip. The washer counterbore being the seating location for the spring.
3. Lightly smear the buttress threads of the clamping ring with Molytone 'C' grease or its equivalent.
4. Lay the new diaphragm in the upper half of the sphere after first wetting the uppermost face with recommended brake fluid, then fit the sphere lower half and clamping ring.

When tightening the sphere clamping ring, use a suitable torque spanner attached to special pin spanner (RH 8144) and torque tighten to the figure quoted in Chapter P.

It is essential that when tightening, the lower half of the sphere is not allowed to rotate otherwise damage to the diaphragm may result.

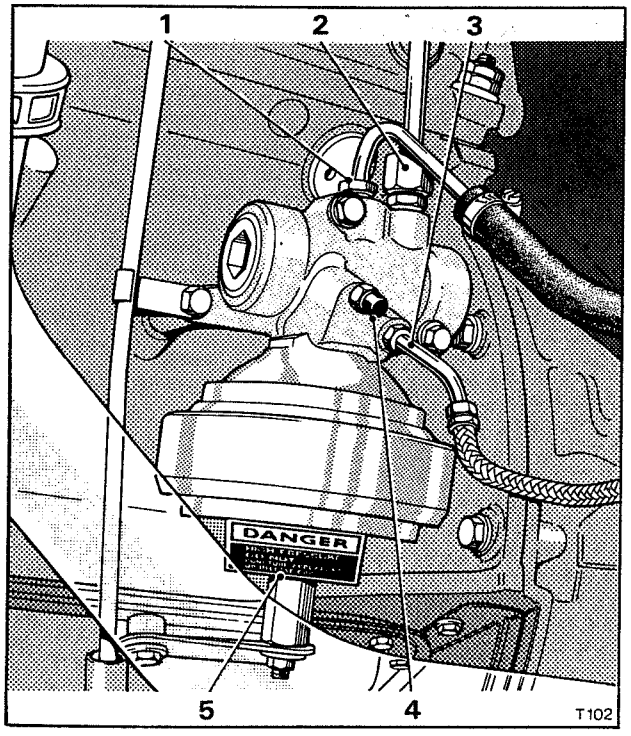

Fig. G11 Rear hydraulic accumulator
1 Low pressure return to reservoir
2 High pressure inlet from pump
3 High pressure outlet to lower distribution valve and levelling valves
4 Bleed screw
5 Warning plate

Hydraulic accumulator sphere - To charge
It should be noted that the utmost care must be taken when charging the accumulator spheres and consequently the accumulator should always be removed from the engine.

In order to control the flow of nitrogen gas from the cylinder a gauge and regulator capable of regulating to a pressure of 105 kg/sq.cm. (1500 lb/sq.in.) should be used. Connecting hoses and end fittings must be capable of withstanding a gas pressure of 281,23 kg/sq.cm. (4000 lb/sq.in.)

Before commencing to charge the accumulator sphere it should be placed in a section of the workshop away from other personnel, then surrounded by a safety shield consisting of a quantity of sand filled bags.

1. Before fitting the regulator to the nitrogen cylinder the cylinder control valve should be opened fractionally in order that the nitrogen discharged will remove any dust or grit which may be present on the cylinder valve seating.
2. Fit the regulator and high pressure connecting pipes to the nitrogen cylinder.
3. Fit the charging adapter (RH 7808) to the one-way valve at the base of the sphere.
4. Open the regulator valve sufficiently to discharge any dust and grit from the high pressure pipes.
5. Connect the high pressure pipe to the valve adapter.
6. Open the nitrogen cylinder control valve. Slowly open the regulator valve and allow the gas pressure to build up until the gauge shows a reading of 70,3 kg/sq.cm. (1 000 lb/sq.in.).
7. Close the nitrogen cylinder valve and observe the gauge; if the gauge reading does not remain steady at 70,3 kg/sq.cm. (1 000 lb/sq.in.) there is a leak either from the sphere or from the high pressure pipe connection.
8. If the pressure is maintained, remove the connecting pipe and charging adapter from the sphere.
9. Fit the warning plate, washer and charging valve cap together with a new sealing ring. Torque tighten the cap to the figure quoted in Chapter P.

Note
The valve cap should be fitted as quickly as possible after charging the sphere to provide a secondary seal as the ball valve alone may not be a completely effective seal.

10. With the fluid ports in the upper half of the sphere suitably blanked, immerse the lower half of the sphere in water until the level is above the clamping ring and check for leakage around the clamping ring and valve cap. If leakage is evident from around the clamping ring then the diaphragm is faulty, presumed damaged on assembly and must be renewed.

If leakage is observed from the charging valve cap the 'O' ring should be renewed, but the sphere must be re-charged to 70,31 kg/sq.cm. (1 000 lb/sq.in.) before the cap is refitted. The submerge test

must then be carried out again.
11. After a successful submerged test, the sphere should be thoroughly dried with dry compressed air, particular attention should be paid to the fluid ports which should be blanked off while awaiting fitting to the valve assembly.
12. A check of the accumulator pressure may be taken when the accumulator is fitted to the engine by using the hydraulic system pressure gauge rig (RH 7938) as described under the heading, Hydraulic accumulator - To test.

Hydraulic accumulator valve housing - To dismantle
1. Separate the hydraulic accumulator sphere from the valve housing as described earlier.
2. Remove the end plug from the valve housing, by using a 25,4 mm. A/F (1.00 in. A/F) Allen key or a length of hexagon bar inserted into the plug, then slacken with a suitable spanner.
3. Using a 0.250 in. U.N.F. setscrew screwed into the threaded hole of the valve sealing plug, withdraw the plug from the valve housing and discard the sealing ring.
4. Remove the sealing disc, non-return valve and the return spring from the smaller bore of the bobbin (see Fig. G12).
5. Remove the valve bobbin by gently tapping the valve housing on a piece of wood. Remove and discard the three sealing rings leaving the P.T.F.E. seal in position.
6. Remove the piston from the centre bore of the bobbin, remove and discard the combined Fluon and rubber sealing ring.
7. Remove the regulator valve, spring and adjusting washers from the valve housing.

Hydraulic accumulator valve - To inspect
1. Thoroughly wash all the components, including the valve housing in methylated spirits. Dry, using clean compressed air. Never use cloths to dry components.
2. Inspect the ball seat in the bobbin and the ball of the regulator valve for wear and ingrained dirt. Any dirt should be removed and the parts washed again in methylated spirits. Worn parts should be renewed.
3. Burnish the ball seat of the bobbin, by holding the ball on to the seat and rotating the regulator valve by hand or lightly tap a 3,96 mm. (0.156 in.) diameter ball onto the ball seat, to form a leakproof spherical seat on the bobbin.
4. Inspect all parts, renewing those which may be worn or damaged.

Hydraulic accumulator valve housing - To assemble
Assemble the valve by reversing the procedure for dismantling noting the following points.
1. Lubricate all internal parts with clean brake fluid of the approved type (see Chapter D).
2. Fit new sealing rings to the bobbin, piston and sealing plug.
The anti-extrusion washer must be fitted to the flanged side of the end 'O' ring groove on the bobbin (see Fig. G12).
3. It may be necessary to lightly tap the piston into the bore of the bobbin due to the interference fit of the new seal. This trims the seal and any particles produced must be removed. The piston must then be extracted from the bore, cleaned and fitted again using only finger pressure.
4. After assembling the non-return valve, spring, sealing disc and end plug into the bobbin, check that the non-return valve operates freely in its bore and is returned to its seat by the spring load.
5. Torque tighten the end plug and pipe adapters in accordance with the torque figures quoted in Chapter P.

Hydraulic accumulator sphere and valve housing - To fit
1. Fit a new 'O' ring to the top of the accumulator sphere and screw the sphere into the valve housing. Using the hexagon at the top of the sphere, torque tighten the sphere to the valve housing to the torque figure quoted in Chapter P.
Note
Do not use the charging valve cap as a spannering point.
2. Fit the accumulator to the engine reversing the procedure given for removal. Blanks should only be removed immediately prior to connecting the pipes.
3. All setscrews and pipe connections must be torque tightened in accordance with the figures quoted in Chapter P.
4. After fitting, top-up the fluid reservoir and test the accumulator(s) as described in Hydraulic accumulator - To test. With the engine running all joints and unions which have been disturbed must be leak free prior to tests being carried out.
5. Bleed the system(s) as described in Section G4.

Hydraulic accumulators - To test
1. Depressurise the systems as described in Section G2.
2. Remove the bleed screw from the accumulator. Connect a length of high pressure pipe, fitted with a bleed screw connection and a zero kg/sq.cm. to 210 kg/sq.cm. (zero lb/sq.in. to 3 000 lb/sq.in.) pressure gauge (RH 7938) to the bleed screw outlet of the accumulator.
3. Start the engine. The gauge needle should immediately jump to 70,31 kg/sq.cm. (1 000 lb/sq.in.) which is the nitrogen pressure in the accumulator sphere; then rise slowly to between 168 kg/sq.cm. and 182 kg/sq.cm. (2 400 lb/sq.in. and 2 600 lb/sq.in.). At this pressure the accumulator control valve should operate and the pump should cease to charge the accumulator.
4. After the cut off pressure has been reached note the pressure to which the gauge settles. This settling takes up to one minute and the pressure should not be more than 10,5 kg/sq.cm. (150 lb/sq.in.) below the cut off pressure. The pressure should then remain steady unless the brake pedal

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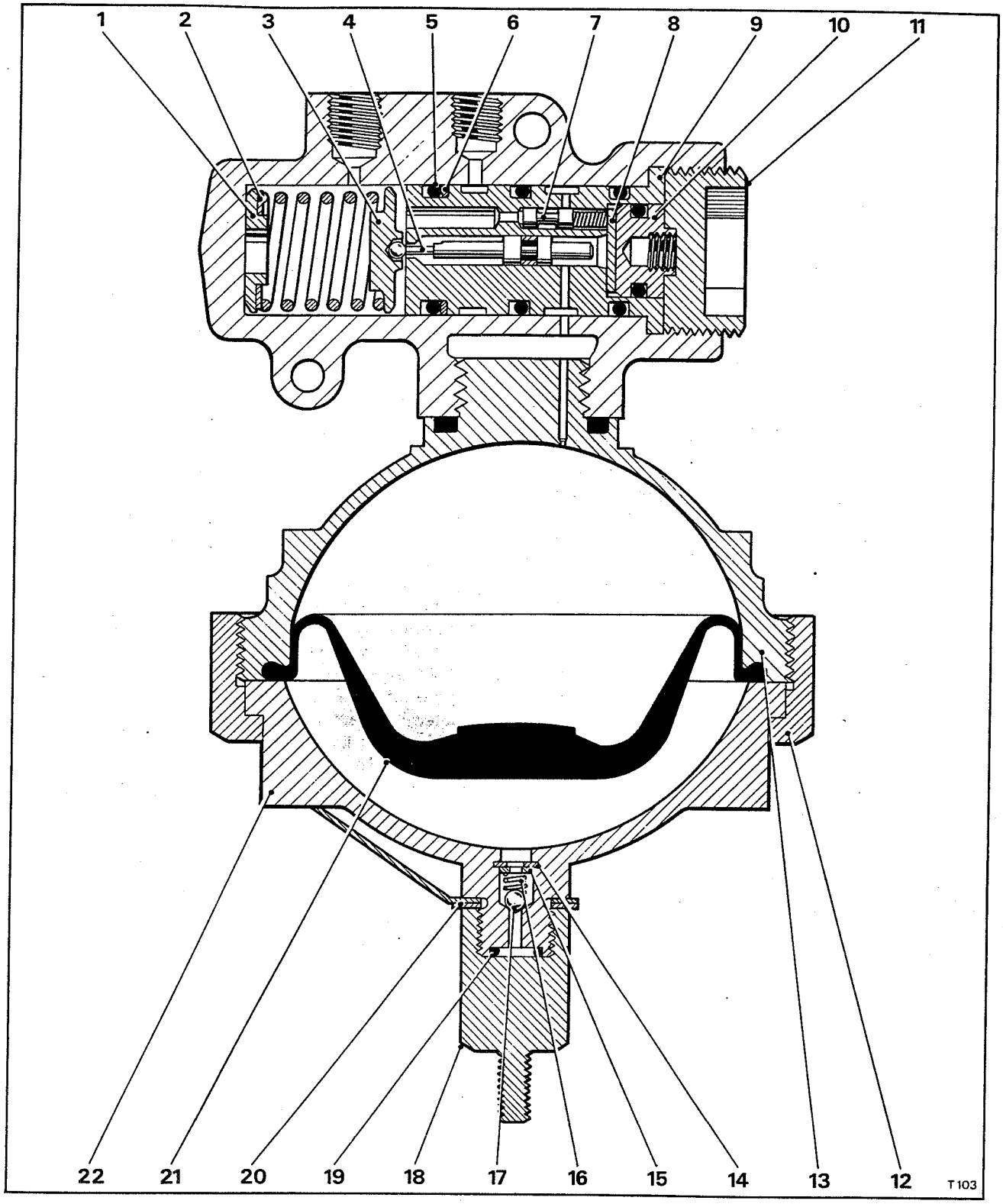

Fig. G12 Hydraulic accumulator

1 Seating washer
2 Adjusting washer(s)
3 Regulator valve
4 Piston and sealing ring
5 Bobbin sealing rings
6 Fluon washer
7 Non-return valve
8 Sealing disc
9 Valve bobbin
10 Valve sealing plug
11 End plug
12 Clamping ring
13 Sphere upper half
14 Circlip
15 Washer
16 Spring
17 Ball
18 Charging valve cap
19 Sealing ring
20 Washer and warning plate
21 Diaphragm
22 Sphere lower half

is operated, the height control is actuated or the accumulator bleed screw opened.

5. Fit a bleed pipe to the gauge connecting pipe bleed screw, open the bleed screw, thus allowing the pressure gauge reading to fall. When the pressure has fallen to between 126,55 kg/sq.cm. and 133,58 kg/sq.cm. (1,850 lb/sq.in. and 1 900 lb/sq.in.) the accumulator control valve should allow the pump to cut in again and charge the accumulator back to 175,77 kg/sq.cm. (2 500 lb/sq.in.).

If the above requirements are met the accumulator is operating correctly.

6. If, on first starting the engine, the pressure gauge needle fluctuates violently, rapidly climbs to 175,77 kg/sq.cm. (2 500 lb/sq.in.) and then immediately falls to zero when the brake pedal is depressed, this indicates a complete loss of nitrogen pressure from the accumulator sphere.

This could be caused by a leaking charging cap or a failure of the diaphragm in the sphere.

7. If when the engine is started, the gauge needle jumps to a pressure less than the accumulator nitrogen pressure of 70,31 kg/sq.cm. (1 000 lb/sq.in.) this indicates a partial loss of nitrogen pressure from the sphere. When the above condition exists the sphere must be further charged.

If, on starting the engine, the pressure gauge correctly jumps to 70,31 kg/sq.cm. (1 000 lb/sq.in.) but then fails to attain between 168 kg/sq.cm. and 182 kg/sq.cm. (2 400 lb/sq.in. and 2 600 lb/sq.in.) this could be due to the accumulator controlling at a low pressure or leakage. Should the gauge needle rise to a pressure below 168 kg/sq.cm. (2 400 lb/sq.in.) and then remain steady the accumulator valve is controlling at too low a pressure. If leakage is suspected the valve assembly should be overhauled or renewed. To adjust the accumulator controlling pressure, partly dismantle the valve housing assembly; fit sufficient adjusting washers behind the regulating spring to obtain a pressure of between 168 kg/sq.cm. and 182 kg/sq.cm. (2 400 lb/sq.in. and 2 600 lb/sq.in.). Adjusting washers are available in a range from between 0,127 mm. and 1,22 mm. (0.005 in. and 0.045 in.). If the regulator spring is renewed, fully compress the new spring several times before fitting. in order to reduce initial spring pressure variation.

If observation of the gauge shows that the pump is still pumping (needle fluctuating with the pump pulses) without giving a rise in pressure then there is a leak equal to the pump flow at that pressure. Pump 'cut out' indicated by the change of audible note of the pump can be heard if the end of the engine dipstick is placed on top of the pump and used as a hearing aid.

To verify an accumulator internal leak, depressurise the systems, remove the hose connection and blank off the high pressure outlet from the accumulator. Repeat the test. If the symptoms persist then the accumulator valve body has an internal leak and the valve assembly should be overhauled. If however, the gauge now behaves correctly and the pumps can be heard to 'cut-out' the leakage is occuring downstream and further checks will be necessary in order to isolate the faulty item.

The component isolating procedure necessary to locate the fault consists of depressurising the systems then removing or blanking off the pressure feed to the various components in turn and repeating the test procedure.

The pressure feeds to the components can be readily identified from the colour coding chart (see Section G3) and the symptoms for determining whether units are functioning correctly are given under the applicable test procedures within the respective sections.

Note

When a unit has been blanked off, before removing the blank the systems must be depressurised either by continuous system operation with the engine switched off or by bleeding the appropriate accumulator until it is depressurised.

If when the engine is started, the gauge works correctly and the accumulator controls at between 168 kg/sq.cm. and 182 kg/sq.cm. (2 400 lb/sq.in. and 2 600 lb/sq.in.) but then the pressure drops steadily without brake or height control actuation, until the accumulator allows the pump to cut in again at between 130 kg/sq.cm. and 133,6 kg/sq.cm. (1 850 lb/sq.in. and 1 900 lb/sq.in.) a leak in the system is indicated and the component checking procedure should be carried out to determine the location.

After tests have been carried out involving blanking off components all blanks should be removed and components reconnected. The systems should then be bled in accordance with the information given in Section G4.

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Section G8

Deceleration conscious pressure limiting valve

Introduction

The pressure limiting valve is non-adjustable and should not require servicing other than renewing the valve seals at the recommended mileage. Refer to Service Schedule Manual publication number T.S.D. 4117 for this information.

If a valve is found to be faulty, usually indicated by premature rear brake locking, it should be removed from the car and overhauled.

Pressure limiting valve - To remove

1. Place the car on a ramp and remove the undershield protecting the brake actuation linkage.
2. Depressurise the hydraulic systems as described in Section G2.
3. Disconnect the two pipes from the pressure limiting valve; blank off the pipe ends and valve ports.
4. Remove the split pins and nuts from the two valve mounting bolts; withdraw the bolts and remove the valve and distance pieces.

On left-hand drive cars the angular end plate must be removed to enable the valve and distance pieces to be removed from the mounting bolts.

Pressure limiting valve seals - To renew (see Fig. G13)

1. Remove the pressure limiting valve as described previously.
2. Remove the end plug and sealing washer from the valve body. Invert the valve and remove the spacer and ball.
3. Remove the insert and rubber seal from the bottom of the valve bore. Fit a new seal on the insert.
4. Fit the insert and seal, then the ball, spacer and end plug. Ensure that a new seal is fitted to the end plug.
5. Torque tighten the end plug to the figure quoted in Chapter P.

Pressure limiting valve - To fit

To fit the pressure limiting valve reverse the procedure given for removal noting the following.

1. All nuts must be torque tightened in accordance with the figures quoted in Chapter P prior to the split pins being fitted.
2. On completion the hydraulic systems must be bled as described in Section G4.

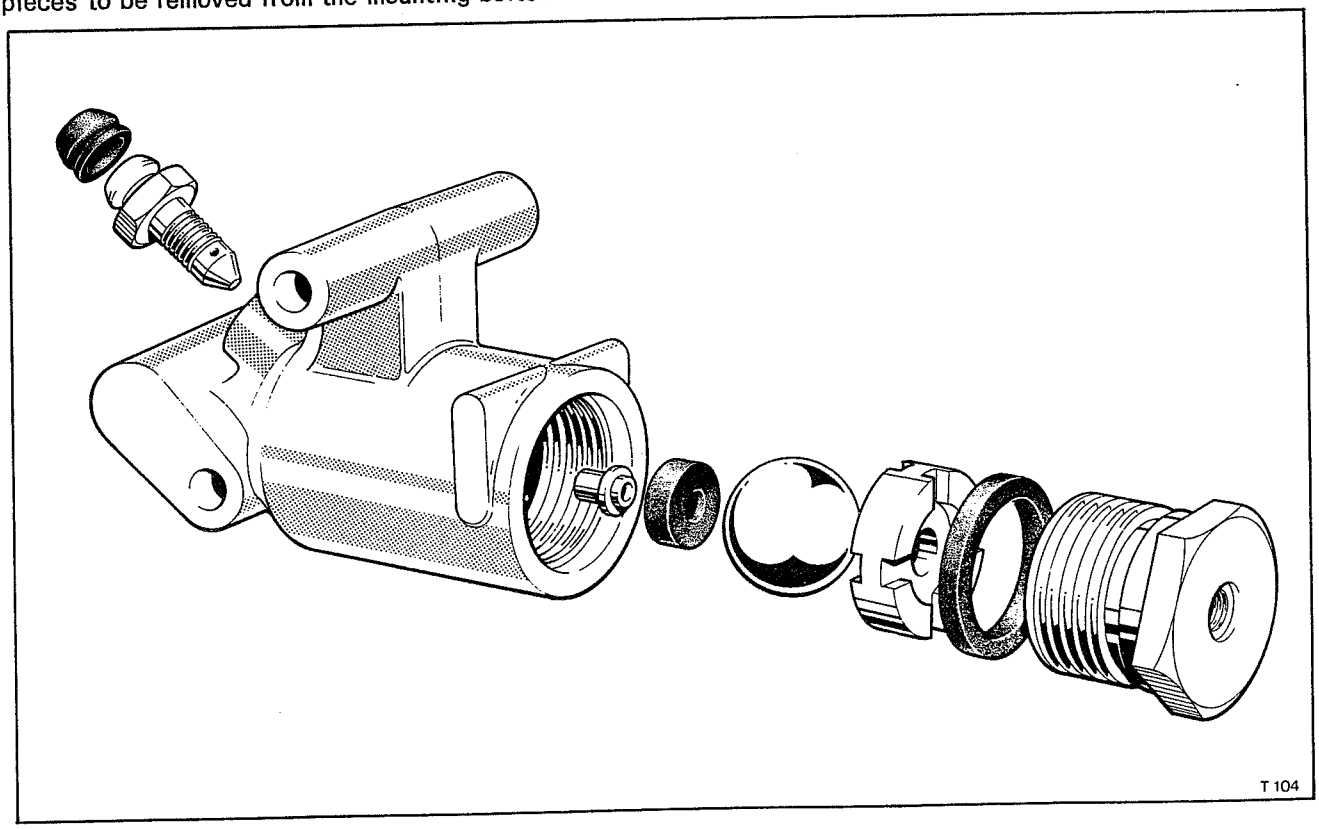

Fig. G13 Deceleration conscious pressure limiting valve

Section G9

Brake distribution valves

Introduction

The brake distribution valves are situated one above the other within the brake actuation linkage assembly and are operated through linkage and a balance lever arrangement when the foot brake is applied (see Fig. G15).

The distribution valves are identical in operation but are not interchangeable due to differing mounting points and pipe arrangements. Corresponding valves on right-hand and left-hand drive cars are identical.

Complete distribution valve assemblies are available as service exchange units. Only the rubber end cover, return spring and end plug sealing washer are available as separate items. The remaining working parts are subject to very fine limits and are therefore selectively assembled by the manufacturer.

Note
The design of the valve is such that to provide adequate lubrication to the 0,0025 mm. (0.0001 in.) clearance between the operating valve and its bore a small fluid 'leak-off' is permitted. This leakage is visible and takes the form of a small droplet of fluid hanging from the valve base. This is normal.

When deciding whether a valve is leaking excessively, in order to warrant renewal or overhaul; if the fluid 'leak-off' does not impair the braking efficiency of the car or cause a noticeable drop in fluid level in the reservoir, then the valves should be regarded as satisfactory.

Brake distribution valves - To test (on the car)

1. Place the car on a ramp. Isolate the gearchange selector and depressurise the systems as described in Section G2.
2. Remove the undershield from around the brake actuation linkage.
3. Connect a zero kg/sq.cm. to 210 kg/sq.cm. (zero lb/sq.in. to 3 000 lb/sq.in.) pressure gauge with a length of high pressure pipe attached, into the high pressure outlet port of the distribution valve (blue or mauve pipe) or into any convenient junction between the valve and the brake calipers it supplies. The brake caliper bleed screw ports may be used if desired.
4. Start the engine then depress the brake pedal. The brake line pressure shown on the gauge should be proportional to the load applied to the pedal provided the accummulators are fully charged. For a 20,4 kg. (45 lb.) load on the pedal, the line pressure should be approximately 70,31 kg/sq.cm. (1 000 lb/sq.in.), It should also be possible to achieve a line pressure of 140,62 kg/sq.cm. (2 000 lb/sq.in.) for a pedal pressure of approximately 34,0 kg. (75 lb.).

When the brake pedal load is varied continuously, the brake line pressure should vary accordingly, without any marked lag or jerkiness.

If the above effort/pressures are not obtainable or actuation shows marked lag or jerkiness on the gauge, the distribution valve may be considered faulty and must be overhauled or renewed.

5. If a system internal leakage investigation, as described under Hydraulic accumulator - To test, show a distribution valve to be the cause of a loss of accumulator pressure the actual leakage can be checked as follows.
6. Disconnect the low pressure return line from the distribution valve port (black or white pipe). Blank the end of the pipe to prevent drainage of the reservoir.
7. Insert a union and a length of pipe into the distribution valve low pressure return port and place the open end of the pipe into a clean container.
8. Start the engine but do not depress the brake pedal.
9. Top-up the reservoir continuously to prevent the hydraulic fluid from falling below the 'minimum' level mark.

For the valve to be acceptable the fluid leakage should not exceed 25 ml. per half hour with the valve in the 'off' position (ie. brake pedal not applied) or 50 ml. per minute with the brake pedal depressed and held steady under a load of 20,41 kg. (45 lb.) which is equivalent to a brake line pressure of 70,31 kg/sq.cm. (1 000 lb/sq.in.). If the valve leakage exceeds these figures it must be overhauled or renewed.

Brake distribution valves - To remove

1. Place the car on a ramp and depressurise the hydraulic systems as described in Section G2.
2. Remove the undershield from around the brake actuation linkage.
3. Remove the pipes from each valve. Blank off the pipe ends and valve ports.
4. Unlock and remove the securing bolts from each valve, draw the rubber boot seal off the valve. Taking care not to bend the valve actuation push rod, move each valve forward and downward, out of the actuation linkage assembly.

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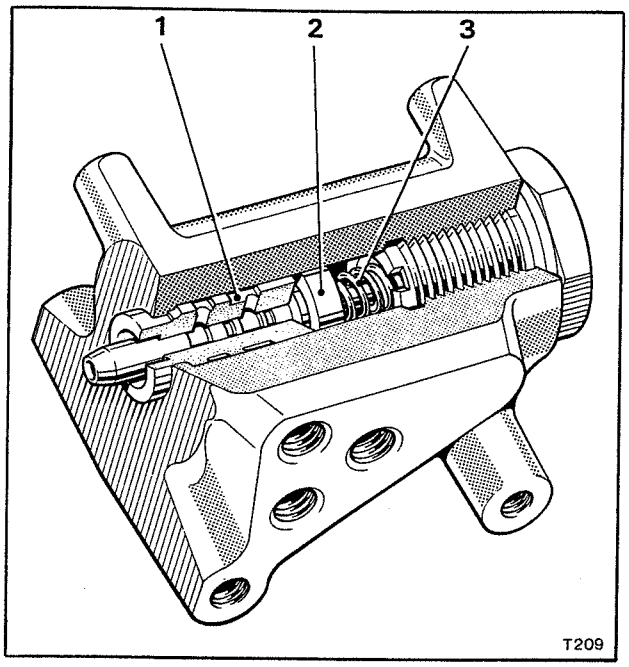

Fig. G14 Distribution valve
1 Valve insert
2 Valve stem
3 Return spring

Brake distribution valve - To dismantle (see Fig. G14)
1. Remove the end plug and sealing washer; collect the return spring.
2. Carefully remove the valve stem. Extreme care should be taken to ensure that the valve stem and its operating bore do not become scratched or damaged.
3. Carefully wash all parts in methylated spirits and dry with clean, dry compressed air.

Brake distrubition valve - To inspect
1. Carefully examine the fine limit bore of the valve insert and the outside diameter of the valve stem. Each surface should be smooth and free from scratches.
2. Lubricate the bore of the valve insert and the valve stem with clean brake fluid. Carefully fit the valve stem into the valve insert bore and check for any axial wear. There should only be sufficient clearance to allow the valve stem to slide freely in the bore, the stem and bore having a clearance of 0,0025 mm. (0.0001 in.).
3. Wash the parts in methylated spirits and dry with clean, dry compressed air.

Brake distribution valves - To assemble
1. Lubricate the bore of the valve insert and the valve stem with approved brake fluid (see Chapter D).
2. Carefully insert the valve stem into the valve insert bore until fully seated. Fit a new return spring.
3. Fit a new sealing washer to the end plug. Fit and torque tighten the plug to the figure quoted in Chapter P.
4. Ensure that the inward and return movement of the valve stem is smooth and does not bind or stick at any point along its travel.

Brake distribution valves - To fit
Fit the distribution valves by reversing the procedure given for removal noting the following points.
1. If a replacement valve is being fitted, remove one of the blanking plugs and allow any fluid to drain from the valve. Re-fit the plug.
2. Torque tighten the mounting bolts and pipe connections in accordance with the figures quoted in Chapter P. Lock the securing bolt tab washers.
3. On completion the hydraulic systems must be bled as described in Section G4.

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Section G10

Brake actuation linkage assembly

Introduction

The brake actuation linkage assembly is mounted just rearward of the toe-board. On right-hand drive cars the assembly is positioned just inboard of the body sill. On left-hand drive cars the assembly is fitted adjacent to the inner side of the body longeron.

The assembly houses the distribution valves, deceleration conscious pressure limiting valve and the stop lamp switch; the assembly being the same for both right and left-hand drive cars.

Brake actuation linkage assembly - To remove

1. Place the car on a ramp; depressurise the hydraulic systems as described in Section G2.
2. Disconnect the battery.
3. Remove the undershield from around the linkage assembly.
4. Disconnect the Lucar connections, then remove the brake stop lamp switch and mounting bracket.
5. Remove the brake pedal pinch bolt from the upper end of the brake pedal lever and ease the pedal stem out of the lever. Collect the rubber seal.
6. Disconnect the pipes from the distribution valves and deceleration conscious pressure limiting valve. Blank off all exposed pipe ends and valve ports.

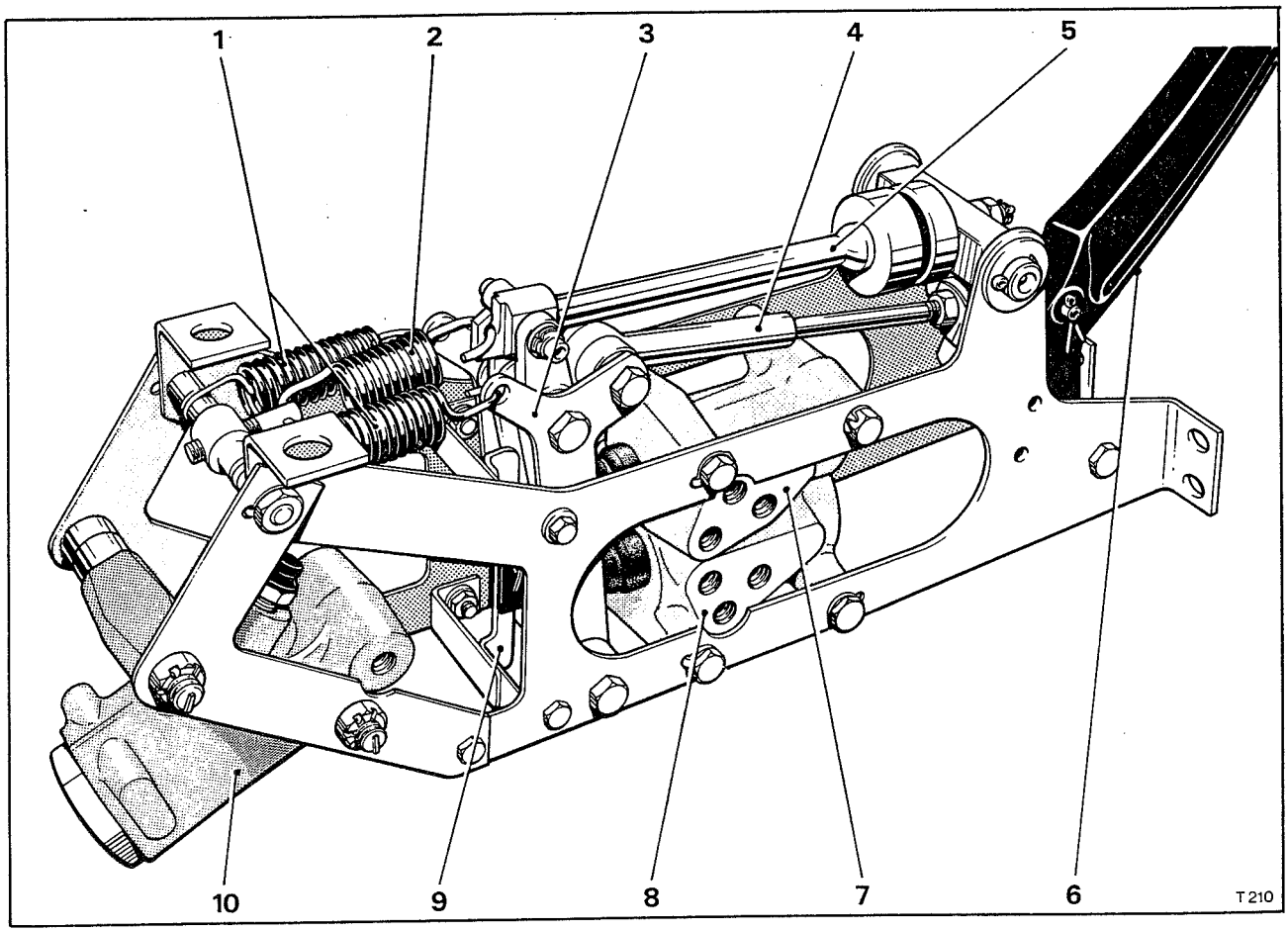

Fig. G15 Brake actuation linkage assembly

1 Return springs
2 Pedal 'feel' spring
3 Balance lever assembly
4 Brake actuation rod
5 Pedal 'feel' rod
6 Brake pedal lever
7 Upper distribution valve (System 1)
8 Lower distribution valve (System 2)
9 'Off' stop bracket
10 Deceleration conscious pressure limiting valve

7. On right-hand drive cars disconnect the petrol pipe clip from the linkage side mounting bracket.
8. Remove the setscrews (right-hand drive cars) or bolt and nuts (left-hand drive cars) securing the linkage assembly side plates at the forward end. Support the linkage assembly and remove the two rear securing setscrews. Lower the assembly from the car.

On left-hand drive cars, the brake pedal lever must be withdrawn from the rubber sealing boot when lowering the actuation linkage from the car.

Important

Under no circumstances should the brake actuation assembly be allowed to hang from the brake pedal, supported by the actuation rod,as this may result in the rod being bent.

Brake actuation linkage - To dismantle

Prior to dismantling the linkage note should be taken of the relative positions of the distance pieces and bolt directions (see Figs. G15 and G16.).
1. Remove the brake actuation linkage from the car as described previously.
2. Remove the split pin and clevis pin from the operating rod pivot on the brake pedal lever.
3. Remove the three springs from the rear of the linkage.

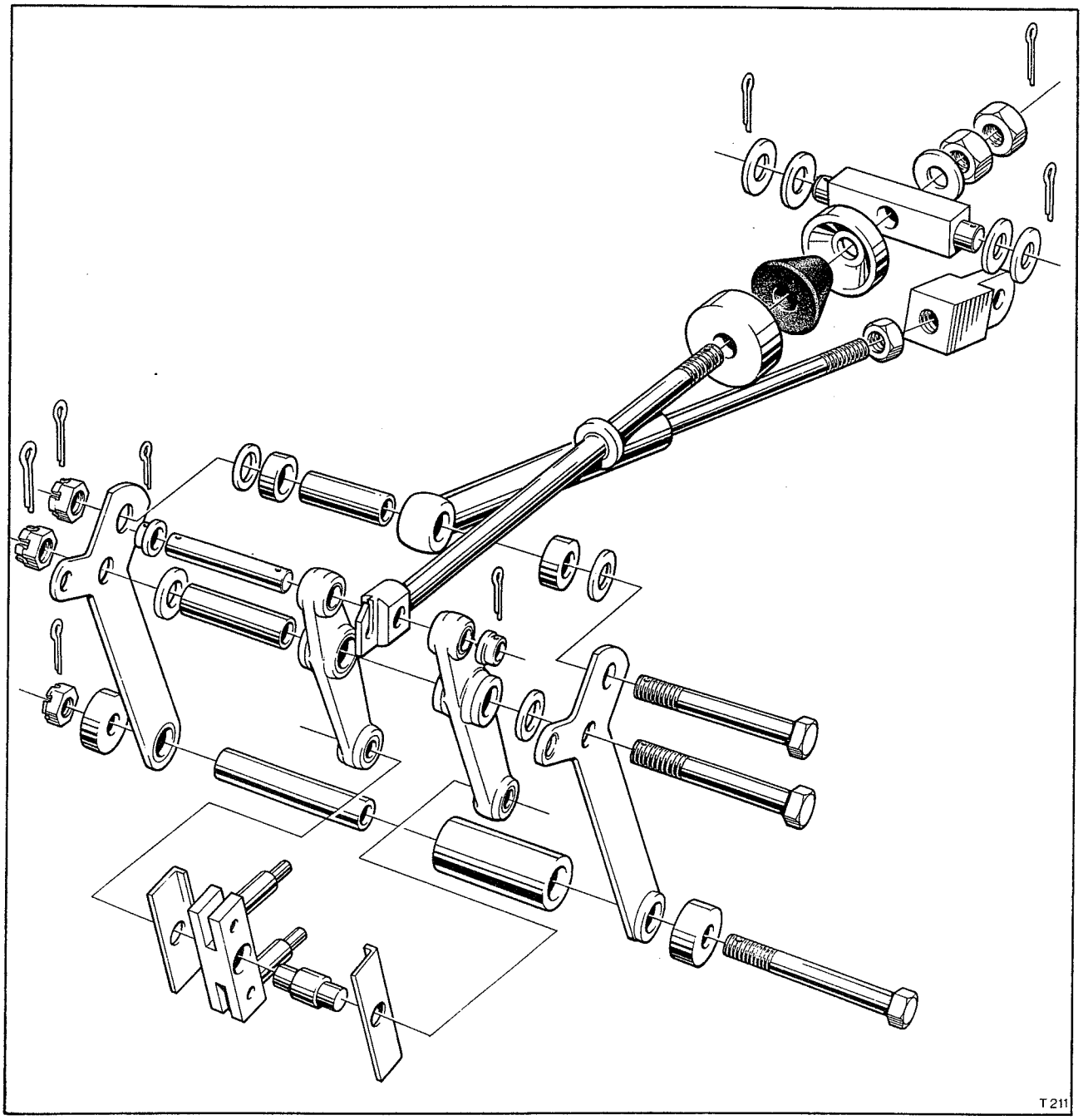

Fig. G16 Brake actuation linkage balance lever assembly

4. Remove the split pin and nuts from the end of the pedal 'feel' rod.
5. Remove the 'off' stop bracket from behind the balance levers.
6. Remove the pivot bolt from the lower end of the balance levers. Ease the levers rearward and carefully withdraw the balance lever push rods from the distribution valves. Remove the distance pieces and pivot tube from the lower end of the balance levers.
7. Lift the levers clear of the side plates and withdraw the 'feel' rod from its retaining bar. Collect the conical rubber and abutment cups.
8. Remove the split pin from one side of the 'feel' rod pivot pin; withdraw the pin and collect the collar.
9. Remove the two bolts retaining the pivot arms to the balance levers. Noting their positions collect the washers, distance pieces and pivot tubes.
10. Remove the balance levers from each side of the distribution valve push rod equalising block, collect the pin retaining plates.

Note
The levers and pivot pins are clearance fits and are easily removed.

Brake linkage assembly bushes and pivot pins - To renew
1. Remove and dismantle the brake linkage as described previously.
2. Carefully press the bushes requiring renewal out of their locations and fit new bushes. The bush bores are machined to final size, therefore no reaming or boring is necessary.
3. Any pivot pins that are worn or damaged must be renewed.

Brake actuation linkage - To assemble
Assemble the linkage by reversing the dismantling procedure noting the following points.
1. Clean all components prior to assembly. Lightly lubricate the linkage pivots, the protruding parts of the distribution valve stems and the push rod location bores with Molytone 'C' grease.
2. All bolts and nuts must be torque tightened to the figures quoted in Chapter P before split pins are fitted and tab washers secured.
3. The linkage should operate freely when located between the assembly side mounting plates. All levers must be absolutely free to move with negligible friction on their pivots. Distance tubes must be similarly free in the Oilite bushes.

Note
All bolts should be fitted in the directions shown in Figure G15 in order that certain individual items may be removed without removing the complete assembly from the car.

Brake actuation linkage - To adjust
Adjustment of the actuation linkage should be carried out in the following sequence.
(a) Distribution valve push rod clearance.
(b) Rubber 'feel' cone setting.
(c) Main 'feel' spring setting.
(d) Brake pedal height setting.

Note
Adjustments 'a', 'b' and 'c' can be carried out with

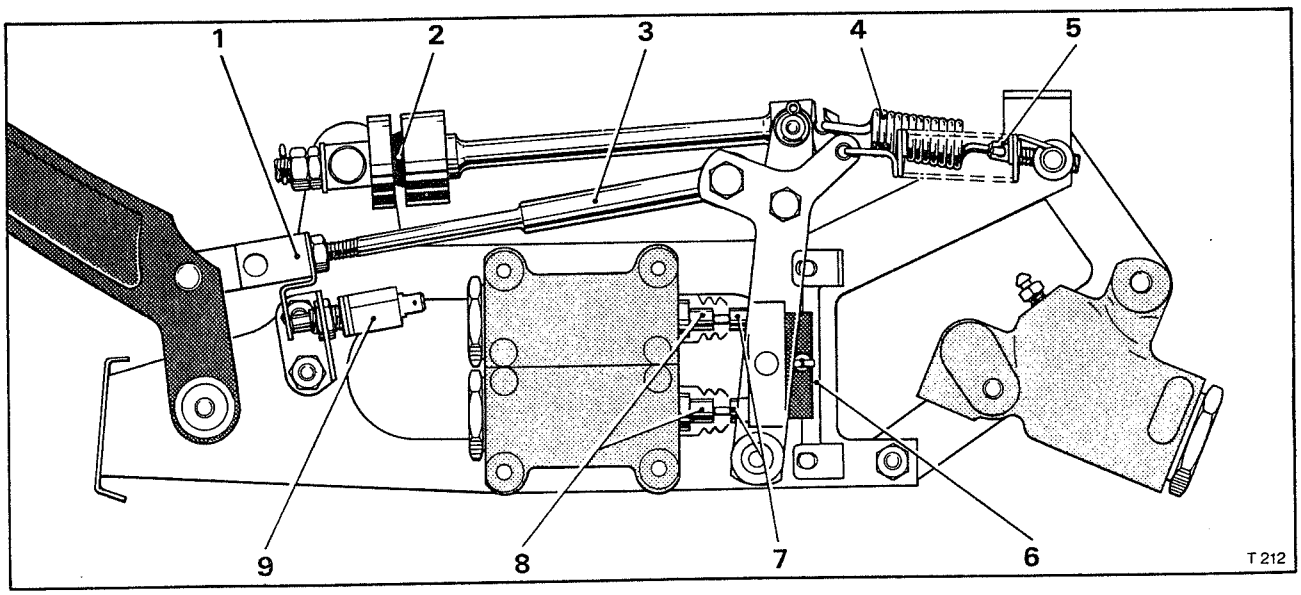

Fig. G17 Brake actuation linkage adjustment points
1 Brake pedal lever adjustment block
2 Rubber 'feel' cone
3 Brake actuation operating rod
4 Main 'feel' spring
5 'Feel' spring adjustment screw
6 Off stop bracket
7 Balance lever push rods
8 Distribution valve stems
9 Brake stop lamp switch

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the actuation linkage assembly removed from the car.

Distribution valve push rods - To set (see Fig. G17)

1. Slacken and unscrew the brake 'feel' rod adjusting nuts until clearance is obtained between the feel rod mounting block and the rubber cone seat.
2. Remove the 'feel' and return springs.
3. Slacken the four bolts securing the 'off' stop bracket to the actuation linkage side plate.
4. Slide the 'off' stop bracket forward on the elongated holes until a clearance of up to 0,254 m.m. (0.010 in.) is obtained between the balance lever push rods and the distribution valve stems; with no preload being applied to the valve stems. Ensure that the setting is equal on each valve, then tighten the bracket securing bolts.

Note

It will be necessary to draw back the two rubber dust covers on the distribution valves in order to check the push rod to distribution valve stem clearance.

Rubber 'feel' cone - To set (see Fig. G17)

1. Fit the two return springs to the linkage assembly. At this point the two abutment cups and the rubber 'feel' cone should be loose and free to slide on the shaft.
2. Tighten the adjusting nut until the clearance between the abutment cups and the rubber cone has been removed, without a preload being applied to the rubber cone.
3. Securely tighten the lock-nut onto the adjusting nut, then depress and release the brake pedal several times to ensure that the cone is seated correctly. Recheck the cone setting. Ensure that a security split pin is fitted to the end of the shaft.

Main 'feel' spring - To set (see Fig. G17)

1. Ensure that the actuation assembly remains in the 'off' position.
2. Fit one end of the 'feel' spring into the adjusting screw fitted in the centre of the spring anchor rod.
3. Rotate the spring and screw half a turn at a time in the direction required until the spring can be fitted into the 'feel' rod hook, with no clearance between the spring and hook, ensure that there is no spring preload.

Note

It is necessary to stretch the spring over the hook to obtain the correct position where clearance is determined.

4. Remove the spring from the hook and rotate the spring and screw 1½ turns clockwise, when viewed from the brake pedal end of the assembly (ie. effectively tensioning the spring). Fit the spring onto the hook.

Note

It is essential to follow both of the previous setting instructions accurately as deviations will completely alter the subjective feel and accepability of brake control.

Clearance between the rubber 'feel' cone and its abutments will cause a spongy, long travel pedal feel at low decelerations; any preload on this rubber will cause jerky initial braking under these conditions.

Inadequate preload on the rear tension spring will produce unwanted free travel at the pedal followed by jerky initial braking; too much preload on this spring will give jerky initial braking followed by a period of 'spongy' pedal travel.

Brake pedal height setting (see Figs. G18 and G19)

This setting can only be carried out with the actuation linkage assembly fitted to the car.

1. Locate the setting gauge into the brake pedal stem hole in the end of the pedal lever (see Fig. G18). Raise the pedal lever until the gauge touches the underside of the toe-board seal housing.
2. Adjust the block on the lever operating rod until the hole in the block aligns with the hole in the pedal lever.

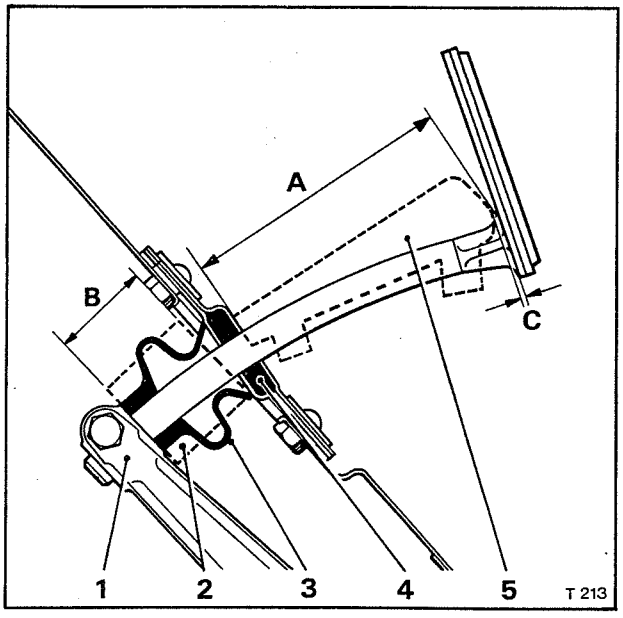

Fig. G18 Brake pedal height settings

1 Brake lever
2 Brake lever setting gauge
3 Rubber seal
4 Toe-board seal and housing
5 Pedal height checking template
A 99,06 mm. to 98,30 mm. (3.90 in. to 3.870 in.)
B 38,10 mm. to 37,97 mm. (1.50 in. to 1.495 in.)
C 0,38 mm. to 5,08 mm. (0.015 in. to 0.20 in.)

Note
Shortening the rod length reduces the gap between the pedal lever and seal plate, half a revolution of the block being equal to approximately 3,17 mm. (0.125 in.) of pedal lever movement.

3. Remove the setting gauge from the brake lever. Connect the rod to the lever by inserting the clevis pin. Fit the split pin.
4. Fit the rubber seal between the brake pedal lever and toe-board seal plate.

On left-hand drive cars slide the convoluted rubber seal over and down the brake pedal lever; fit the two retaining screws and washers. Ensure that the seal does not prevent the lever and linkage returning to the fully 'off' position.

5. Insert the brake pedal through the toe-board felt and rubber seals into the hole in the brake pedal lever.
6. Fit and tighten the pinch bolt to secure the brake pedal lever.
7. Check that the rubber seal does not prevent the actuation linkage returning to the 'off' position and that the brake pedal does not foul the seal housing at any point along its travel.
8. Fit the brake stop lamp switch and adjust the setting as described under Brake stop lamps switch - To adjust.

Brake pedal height - To check
1. Place the checking template as shown in Figure G18 between the underside of the brake pedal and the upper surface of the pedal seal housing with the two lugs of the gauge located under the pedal stem. Rest the flat base of the template on the seal housing. Ensure that both carpet and underlay are removed from the housing surface.
2. If the clearance between the top of the template and the underside of the pedal is less than 0.38 mm. (0.015 in.) or more than 5,08 mm. (0.20 in.) adjust the length of the pedal lever rod as described in Brake pedal height setting.

Brake pedal lever - To remove
1. Place the car on a ramp and remove the undershield from around the brake actuation linkage.
2. Disconnect the battery.
3. Disconnect the Lucar connections and remove the stop lamp switch.
4. Remove the brake pedal stem pinch bolt from the top of the pedal lever and withdraw the stem out of the lever. Collect the rubber seal from the pedal stem.
5. Remove the split pin and clevis pin from the operating rod pivot on the pedal lever.
6. Remove the bolt and nut from the pedal lever pivot. Remove the lever and collect the pivot tube. On left-hand cars it is necessary to withdraw the lever from the convoluted rubber seal during final removal.

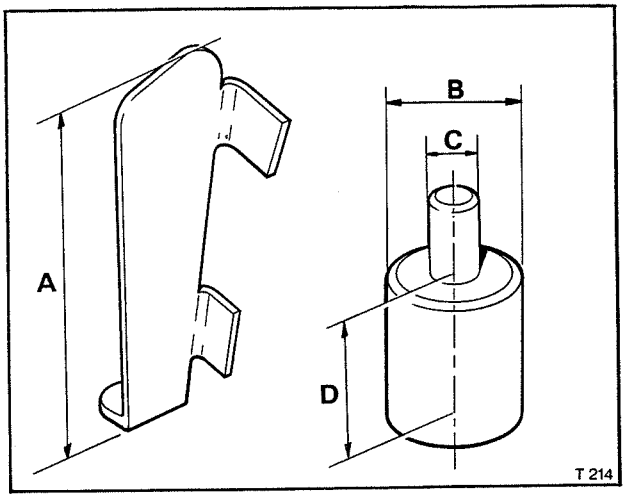

Fig. G19 Brake pedal setting gauge and checking template

A 99,06 mm. to 98,30 mm. (3.90 in. to 3.870 in.)
B 34,92 mm. to 34,29 mm. (1.375 in. to 1.350 in.)
C 12,50 mm. to 12,44 mm. (0.492 in. to 0.490 in.)
D 38,10 mm. to 37,97 mm. (1.50 in. to 1.495 in.)

Brake pedal lever - To fit
To fit the brake pedal lever reverse the procedure given for removal noting the following points.
1. All nuts must be torque tightened to the figures quoted in Chapter P.
2. The pedal lever and the stop lamp switch must be checked for correct operation and adjusted if necessary as described under the appropriate headings in this section.

Brake stop lamp switch - To adjust
With all other adjustments to the brake actuation linkage and brake pedal completed, set the brake stop lamp switch as follows.
1. Slacken the nuts retaining the stop lamp switch to the switch mounting bracket.
2. Switch on the ignition.
3. Adjust the switch position until the stop lamps are illuminated during the initial movement of the footbrake pedal; between 3,2 mm. and 9,5 mm. (0.125 in. and 0.375 in.) of brake travel.
4. Tighten the retaining nuts and again check the stop lamps for operation.
5. Switch off the ignition.

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Section G11

Solenoid and Restrictor valves

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Introduction

The height control solenoid valve and both the high pressure and low pressure restrictor valves are situated on the rear face of the rear suspension crossmember.

A complete solenoid valve can be obtained as a service exchange item or the valve dismantled and overhauled as follows.

Solenoid valve - To remove

1. Depressurise the hydraulic systems as described in Section G2.
2. Disconnect the battery.
3. Remove the Lucar connections from the solenoid valve.
4. Disconnect the three hydraulic pipes and blank off the pipe ends and solenoid valve ports.
5. Remove the two setscrews securing the solenoid valve to the rear suspension crossmember. Remove the solenoid valve.

Solenoid valve - To dismantle (refer to Fig. G20)

1. Remove the retaining clips from the protective rubber cover. Remove the cover to expose the solenoid end face.
2. Unlock the tab washer and remove the nut; discard the tabwasher.
3. Remove the flux plate, carefully withdrawing the two cables from the plate.
4. Note the position of the sealing ring situated immediately behind the flux plate to facilitate assembly (see Fig. G22). Remove and discard the sealing ring.
5. Carefully withdraw the coil from the housing.
6. Remove the spacer.
7. Remove the housing from the solenoid body; remove and discard the sealing ring.
8. From the opposite end of the solenoid valve, remove the lock-nuts then unscrew and remove the valve seat. Remove and discard the sealing ring.
9. Remove the bobbin assembly from the main bore of the solenoid valve. Collect the shims which are situated between the faces of the bobbin and cone valve.
10. Remove the cone valve body from the main bore of the solenoid valve; remove and discard the sealing ring.
11. Remove the cone valve from the body and collect the return spring.
12. Wash all non-electrical parts in methylated spirits and dry with clean dry compressed air, not cloth. Wipe clean the electrical components.
13. Inspect the components for any signs of wear and damage, renew as necessary. Check that the two valves are seating correctly.
14. Check the insulation resistance of the coil. The resistance between either lead and the coil measured at 250 volts DC must not be less than 2 megohms. Renew the coil if necessary.

Note
If leakage is suspected from the joint seal between the solenoid body and extension, the sub-assembly should be renewed. No attempt should be made to correct the fault.

Solenoid valve - To assemble (refer to Figs. G21 and G22)

Assemble the solenoid valve by reversing the dismantling procedure noting the following points.

1. It is essential that all parts are thoroughly cleaned before assembly.
2. Fit the sealing ring to the main valve body. Lightly lubricate the sealing ring with Molytone 'C' grease then slide the outer casing into position.
3. Lubricate the non-electrical components and sealing rings with approved brake fluid (see Chapter D). Note the position of the sealing ring situated between the coil and the flux plate. This ring must be left dry, then cut and suitably positioned to clear the electrical wiring (see Fig. G22).
4. Assemble the bobbin, cone valve and cone valve body without the return spring. Selectively fit shims to point Y shown in Figure G21 until a gap of between 0,20 mm. and 0,28 mm. (0.008 in. and 0.011 in.) is obtained at point Z with the cone valve fully seated. Carefully remove the cone valve body and fit the cone valve return spring prior to fitting the assembly into the main body bore.
5. Set the gap X between the opposing faces of the valve and bobbin assembly and the valve seat to between 0,508 mm. and 0,635 mm. (0.020 in. and 0.025 in.). To obtain this setting, energise the solenoid; push the valve seat fitted with a new sealing ring into the bore of the body assembly; screw in the adjusting sleeve until the valve seat touches the nylon seat of the bobbin.

Checking with a dial test indicator or depth micrometer screw out the adjusting sleeve between 0,508 mm. and 0,635 mm. (0.020 in. and 0.025 in.). Fit and tighten the large lock-nut ensuring that the adjusting sleeve is not rotated.

De-energise the solenoid. This pushes the valve seat against its stop on the adjusting screw. Fit

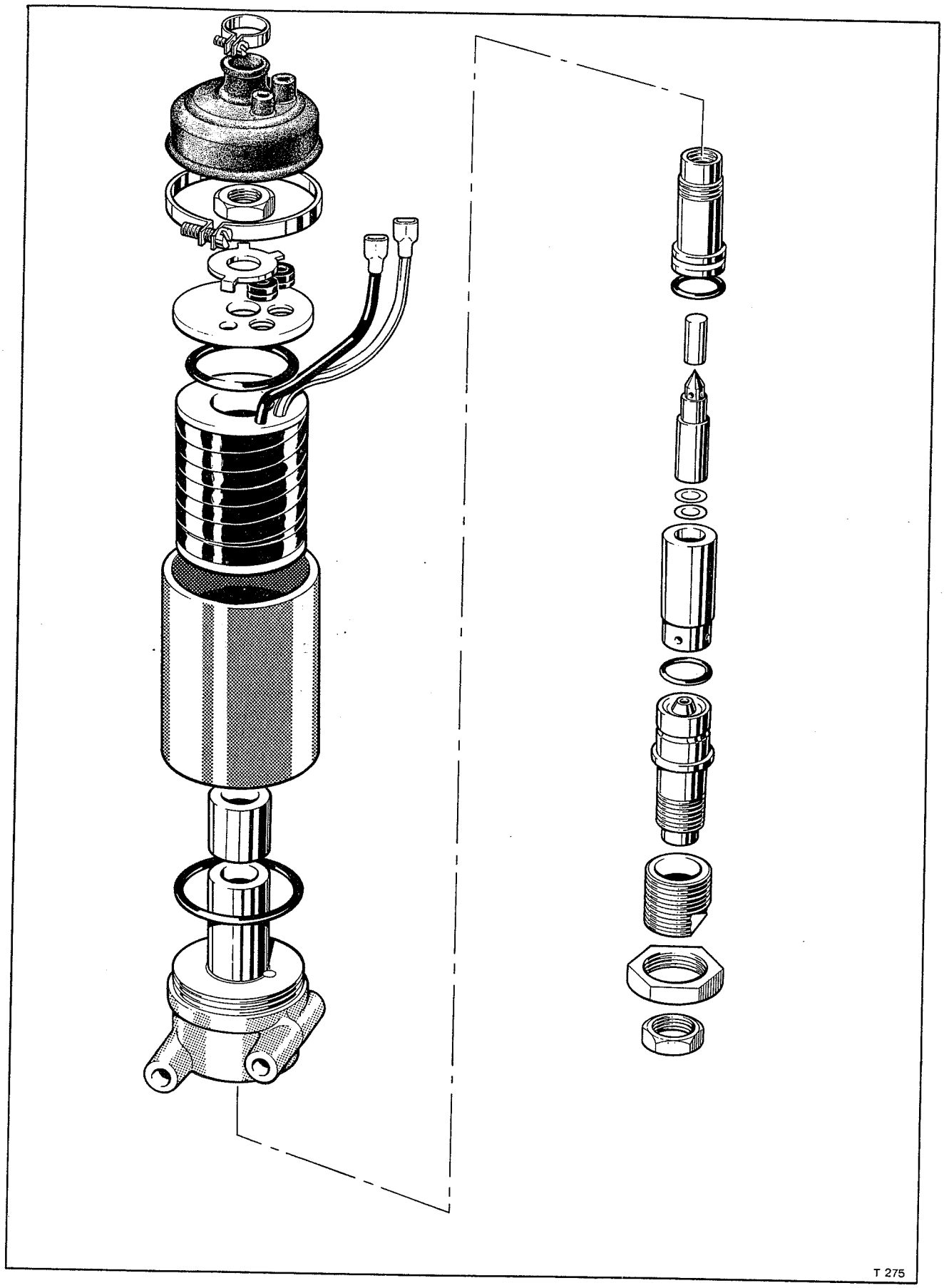

Fig. G20 Height control solenoid valve

and tighten the lock-nut to the valve seat. To avoid damage to the sealing ring ensure that the valve seat does not rotate in the housing.

Note

It is important all the lock-nuts are tightened in the above order and in accordance with the torque figures quoted in Chapter P.

6. Ensure that the solenoid protective rubber cover is clean and in good condition before fitting, renew if necessary.
7. Fit blanking plugs to each port of the valve until the valve is fitted to the car.

Solenoid valve - To fit

Fit the solenoid valve by reversing the procedure given for its removal noting the following points.

1. Torque tighten the setscrews and pipe connections in accordance with the figures quoted in Chapter P.
2. After fitting, bleed the hydraulic system as described in Section G4.

Solenoid valve - To test

If either 'slow' or 'fast' height control is not available the solenoid valve may be checked for correct operation on the car as follows.

1. Run the engine to fully charge the hydraulic systems. Stop the engine but leave the ignition switched on.
2. Disconnect one of the electrical connections from the solenoid valve. This disconnection should cause a light audible click from the solenoid valve. If this is not apparent the valve or electrical circuit is faulty.

If during this valve disconnection test a 'hissing' noise is evident when the electrical

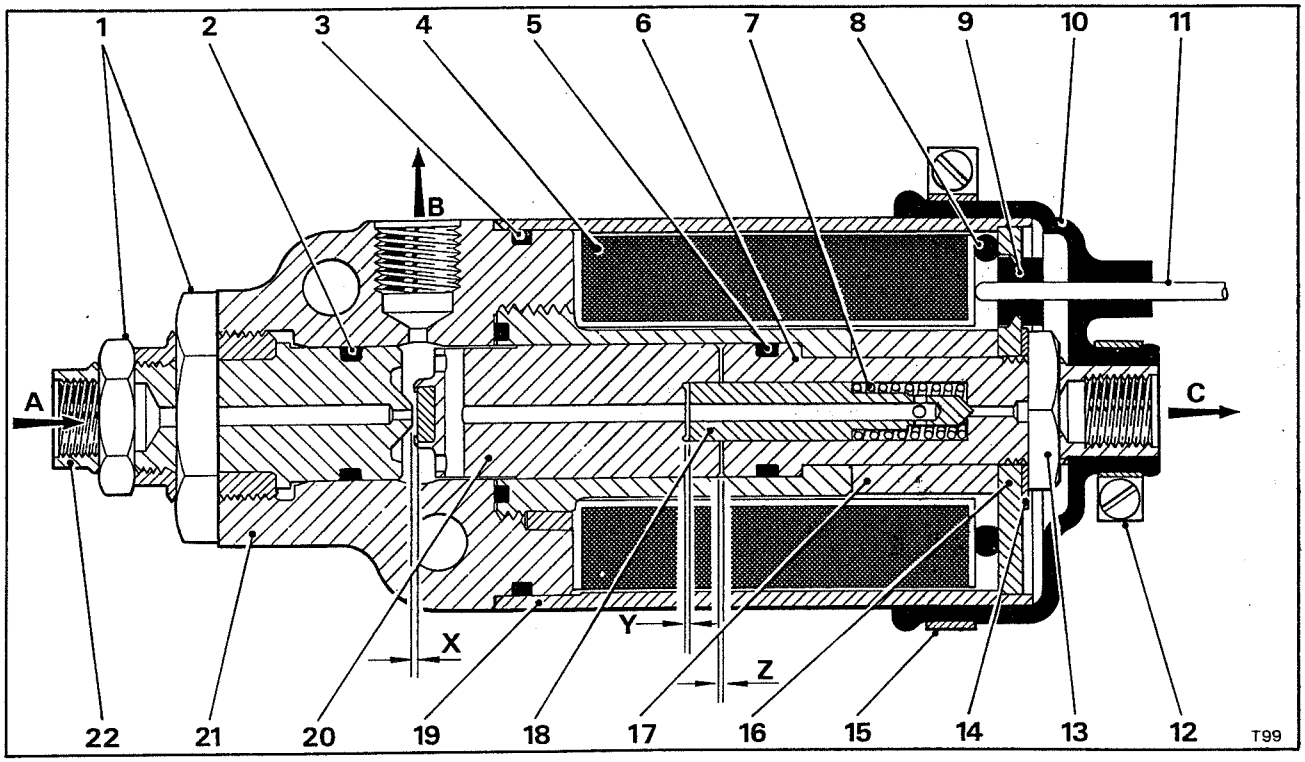

Fig. G21 Height control solenoid valve

1 Locknuts
2 Valve seat sealing ring
3 Coil housing sealing ring
4 Coil
5 Cone valve body sealing ring
6 Cone valve body
7 Return spring
8 Sealing ring (see Fig. 22)
9 Grommet
10 Protective cover
11 Lucar connector lead
12 Retaining clip
13 Lock nut
14 Tabwasher
15 Retaining clip
16 Flux plate
17 Spacer
18 Cone valve
19 Coil housing
20 Bobbin
21 Body and extension assembly
22 Valve seat
A High pressure inlet
B Connection to height control valves
C Low pressure return to reservoir
X Gap 0,50 mm. to 0,63 mm. (0.020 in. to 0.025 in.)
Y Shims - suitable thickness to obtain gap Z
Z 0,20 mm. to 0,28 mm. (0.008 in. to 0.011 in.)

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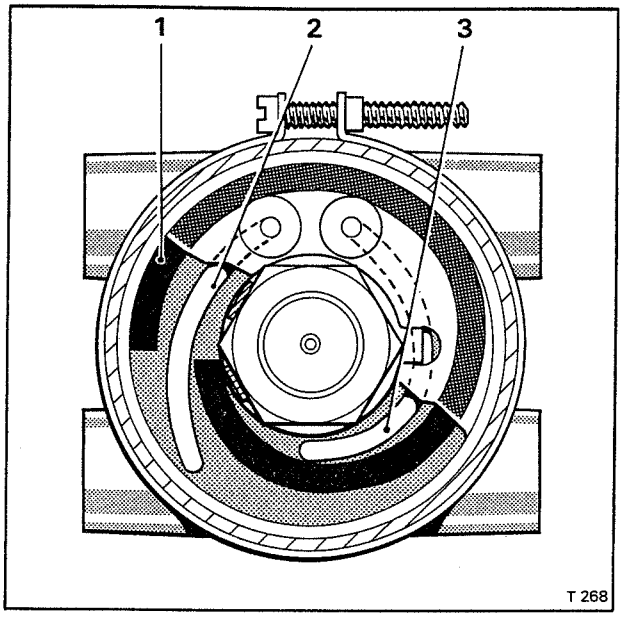

Fig. G22 Height control solenoid valve sealing ring position
1 Sealing ring (cut and positioned)
2 Lucar connector lead
3 Lucar connector lead

connection is disconnected a faulty high pressure valve seat is indicated and the solenoid valve must be overhauled or renewed.

3. Check the electrical circuit by removing the two electrical connections from the solenoid valve and connecting a jumper lead and lamp across the two leads. When the ignition is switched on the lamp should illuminate if the electrical circuit is operating correctly.

4. Remove the jumper lead and lamp and connect it between the solenoid valve terminal and one of the disconnected wires; connect the other wire to the solenoid. If the lamp illuminates when the ignition is switched on, the windings are sound. If the windings are faulty the solenoid valve must be overhauled or renewed.

5. If it has been determined that the solenoid valve is operating correctly but 'fast' height control is still not operating, the solenoid valve restrictors should be checked for blockage as described under Solenoid valve restrictor - To dismantle.

If however it is evident that a leak is occuring in the system, to determine whether the solenoid valve is the cause proceed as follows.

6. Depressurise the systems.

7. Disconnect the solenoid return pipe from the solenoid valve (white line) and blank off the pipe. Insert a union and a length of pipe into the solenoid port and place the open end of the pipe into a clean container.

8. With the solenoid valve electrical leads disconnected (solenoid de-energised) start the engine and charge the hydraulic systems. The valve should hold the pressure internally with no leakage from the return pipe port.

9. Connect the electrical leads to the solenoid valve (solenoid energised) and again check that the valve holds internal pressure. A maximum leakage of 10 ml. from the return pipe port is permissible.

10. If the solenoid is then de-energised, with pressure applied to the inlet port, fluid should flow from the return port for a few seconds then cease. It should be noted however that if fluid does not flow from the port, the cause may be due to there being an easier fluid leak path elsewhere in the system or that the restrictor valves are blocked.

Solenoid valve restrictor - To remove

The two solenoid valve restrictors are incorporated into the high pressure (orange) pipe line and low pressure (white) pipe line respectively. They are both mounted on the rear suspension crossmember.

1. Depressurise the systems as described in Section G2.
2. Disconnect the hydraulic pipes from the restrictor and blank off the pipe ends.
3. Remove the setscrew securing the restrictor to the crossmember. Remove the restrictor.

Solenoid valve restrictor - To dismantle (refer to Fig. G23)

1. Remove the union plug from the restrictor body.
2. Invert the restrictor valve body and collect the sealing ring, restrictor plate, restrictor roller and end plates.
3. Thoroughly clean all components with methylated spirits and dry with clean compressed air.

Solenoid valve restrictor - To assemble

Assemble the restrictor by reversing the dismantling procedure noting the following points.

1. All parts must be thoroughly cleaned before assembly.

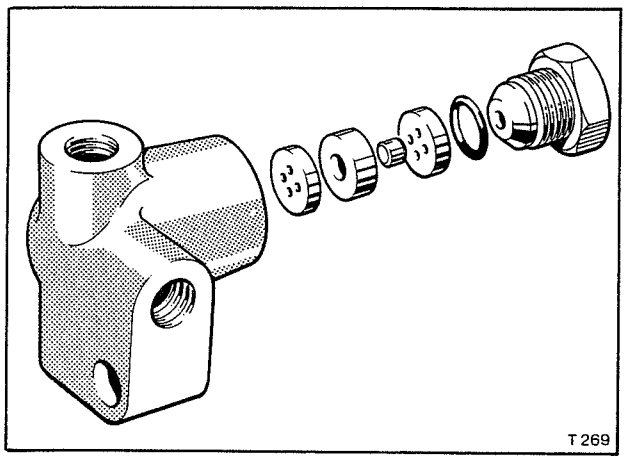

Fig. G23 Solenoid restrictor valve (high and low pressure pipe lines)

2. Ensure that the restrictor roller moves freely in the restrictor plate bore prior to fitting into the valve body.
3. Lightly smear the threads of the union plug with Molytone 'C' grease prior to fitting.
4. Torque tighten the union plug in accordance with the figure quoted in Chapter P.

Solenoid restrictor valve - To fit

Fit the solenoid restrictor valve by reversing the procedure given for removal noting the following points.

1. Torque tighten the valve securing setscrew and pipe connections in accordance with the figures quoted in Chapter P.
2. After fitting, bleed the hydraulic system as described in Section G4.

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Section G12

Height control valves

Introduction

The height control valves are situated on the outer ends of the rear suspension crossmember and are operated by pivoting links attached to each trailing arm.

Due to the valves containing fine limits and machine matched parts, only certain components are available as individual items. Service replacements for the complete assembly are available if required. Details of the available items are shown in the current parts list.

Height control valves - To remove

1. Place the car on a ramp and depressurise the hydraulic systems as described in Section G2.
2. Remove the flexible and steel pipes from the rear of the height control valve.

Note

All pipe ends, valve ports and junction block ports must have blanks fitted as they are disconnected.

3. **Left-hand height control valve.** Disconnect the two pipes entering the front of the valve at the two three-way junction connectors mounted on the rear face of the rear suspension crossmember (see Fig. G24).

Right-hand height control valve. Disconnect the two pipes entering the front of the valve at the four-way junction connector mounted on the side of the height control valve mounting bracket (see Fig. G25).

4. Slacken the lock-nut and unscrew the adjusting screw from the bottom ball joint of the valve actuation link; disengage the joint.
5. Remove the valve mounting bolts and nuts. Remove the valve, actuation rod and two pipes as a complete assembly.

Height control valves - To dismantle (see Fig. G26)

1. Correlate the position of the operating arm relative to the operating shaft to facilitate assembly. Remove the clamping bolt and operating arm from the shaft.
2. Remove the ram supply adapter complete with washer, sealing ring, nylon valve stop and return spring from the valve; discard the sealing ring.
3. Remove the inlet adapter complete with washer and sealing ring; discard the sealing ring.
4. Remove the return spring and inlet valve from the bore.
5. Remove the nuts and washers securing the halves of the valve together. Carefully separate the halves and discard the sealing rings.
6. Collect the exposed plunger return spring and withdraw the sleeve valve from its bore.

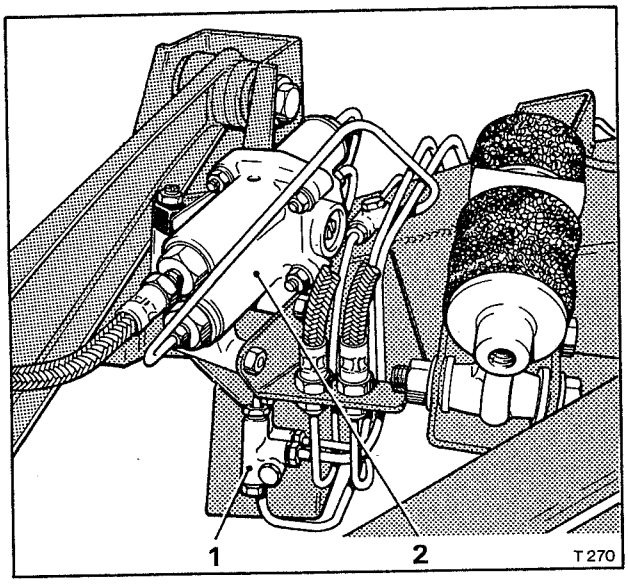

Fig. G24 Left-hand height control valve in position
1 Three-way connectors
2 Height control valve

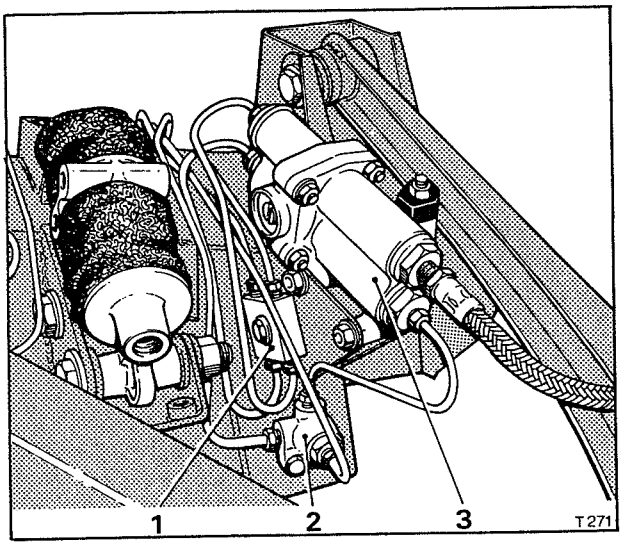

Fig. G25 Right-hand height control valve in position
1 Four-way junction connector
2 High pressure restrictor
3 Height control valve

7. Carefully remove the restrictor valve assembly from the upper bore and collect the spring seating from inside the upper bore of the housing.
8. Remove the solenoid line adapter complete with

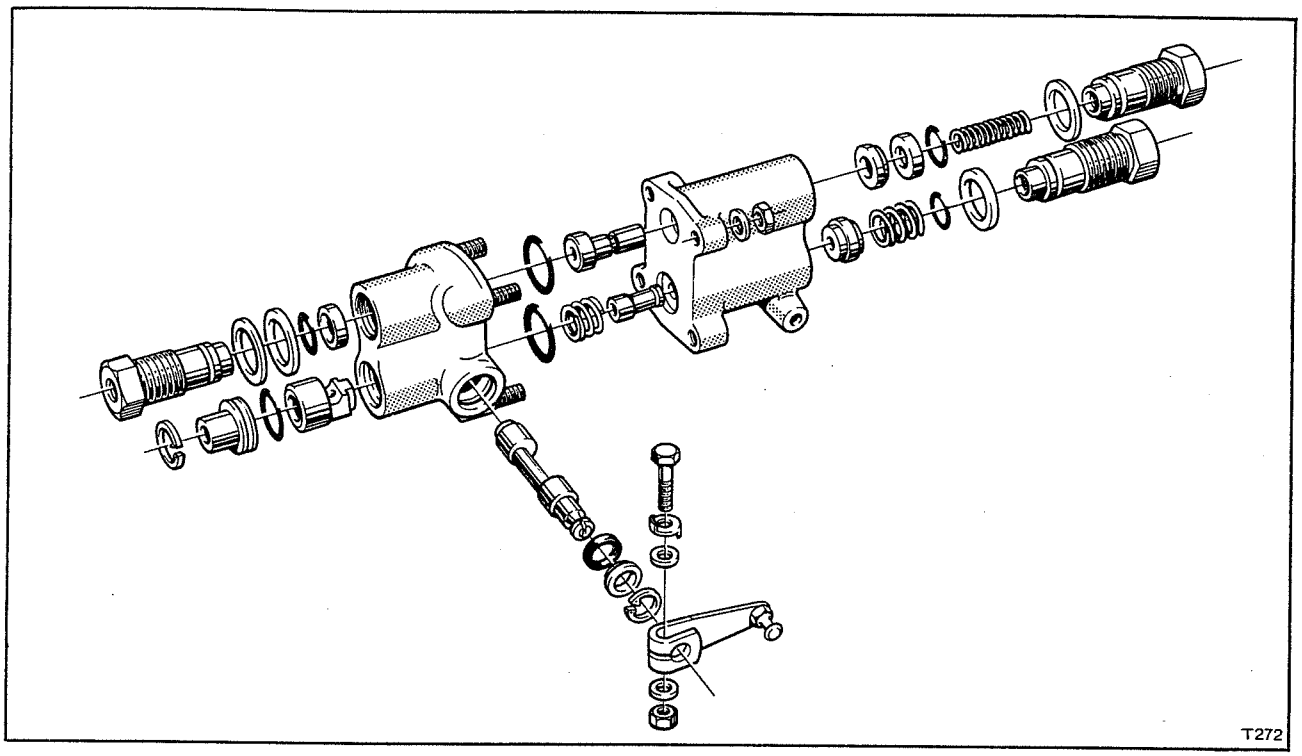

Fig. G26 Height control valve (left-hand shown)

washer, adjusting washers (when fitted) and nylon valve stop; discard the sealing ring.
9. Remove the circlip retaining the fluid return adapter; remove the adapter and discard the sealing ring.
10. Rotate the operating shaft to allow the shaft eccentric to clear the plunger groove; push the plunger out of its bore.
11. Remove the circlips retaining the operating shaft in its bore, remove the stepped washers and press out the shaft. Remove and discard the sealing rings.
12. Thoroughly clean all parts of the valve assembly with methylated spirits and dry with clean compressed air.
13. Inspect all parts for wear and damage. Ensure that the sleeve valve and restrictor valve operate smoothly in their bores without excess radial clearance. Also ensure that the end face of the sleeve valve and the adjacent valve and plunger faces are smooth and free from burrs and damage.

Height control valve - To assemble (see Fig. G27)
Ensure that all parts to be used in the assembly are scrupulously clean.
1. Insert the operating shaft into position in the housing bearing bores; smear the bearings with Molytone 'C' grease. Note that the position of the shaft determines whether the valve assembly is for use on the right-hand or left-hand side of the car.
2. Fit a seal lightly smeared with Molytone 'C' grease to one end of the operating shaft. Ease the seal into its recess using a thin blunt instrument, taking care not to cut the seal.
3. Fit a seal retaining washer over the shaft and locate it in its recess. Pushing gently on the washer, fit the circlip.
4. Fit a seal, retaining washer and circlip to the opposite end of the shaft by repeating Operations 2 and 3.
5. Lightly smear the outside bearing surface and tranverse slot of the plunger with Molytone 'C' grease. Insert the plunger into its bore ensuring that it moves freely. Allow the nose of the plunger to pass the operating shaft then rotate the shaft 180° to locate the plunger into position. Leave the plunger in this position.
6. Fit a sealing ring lubricated with brake fluid onto the fluid return adapter. Insert the adapter into the bore behind the plunger then fit the retaining circlip.
7. Fit a sealing ring lubricated with brake fluid onto the threaded adapter removed from the solenoid connection of the valve body; ensuring that the nylon valve stop is in position. Lubricate the adapter threads with Molytone 'C' grease.
8. Fit the large washer and any adjusting washers that were previously fitted onto the adapter then fit and tighten the adapter into the casing.
9. Lubricate the restrictor valve and sleeve valve with recommended brake fluid (see Chapter D), and insert them into their respective bores ensuring that they move freely.
10. Fit a sealing ring into each groove in the centre joint face of the valve casing and fit the return

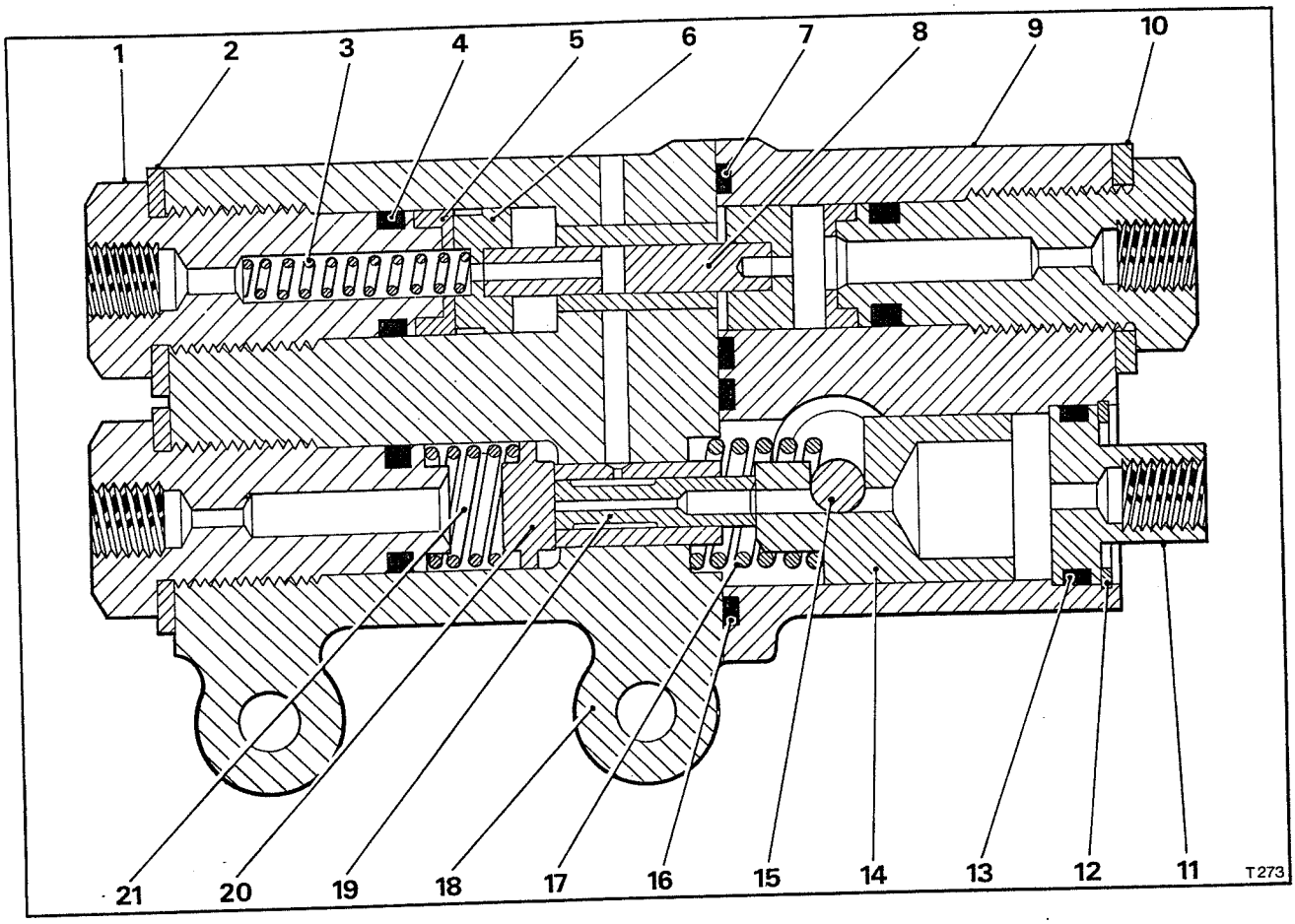

Fig. G27 Height control valve

1 Adapter (3)
2 Washer (3)
3 Return spring
4 Sealing ring (3)
5 Nylon valve stop (2)
6 Return spring seat
7 Sealing ring
8 Sleeve valve
9 Housing
10 Washer (plus adjusting washers if fitted)
11 Fluid return adapter
12 Circlip
13 Sealing ring
14 Plunger
15 Operating shaft
16 Sealing ring
17 Spring
18 Housing
19 Restrictor valve
20 Inlet valve
21 Spring

spring over the nose of the plunger.

11. Carefully secure the valve housing and casing together using the four nuts and washers.

12. Fit a sealing ring lubricated with brake fluid to the two remaining adapters then lightly smear the threads with Molytone 'C' grease. One adapter should be fitted with a nylon valve stop.

13. Carefully insert a straight length of clean 1,59 mm. (0.062 in.) diameter wire approximately 15 cm. (6 in.) long through the adapter fitted with the nylon stop. Thread the return spring onto the wire and into the adapter bore. Locate the spring seat on the wire to abut the spring.

14. Locate the large washer on the adapter then carefully locate the end of the wire in the restrictor valve bore. Slide the parts down the wire into their correct positions then screw and tighten the adapter into position in the housing and withdraw the wire.

15. Fit the nylon inlet/exhaust valve in the following manner. Rest the valve on a short length of clean aluminium bar of approximately 12,7 mm. (0.50 in.) diameter. Invert the height control valve assembly and feed the bar and valve carefully into the housing bore. Upturn the valve assembly and withdraw the bar.

16. Fit the return spring, locate the large washer on the adapter then fit and tighten the adapter into the bore.

17. Fit blanking plugs to the exposed ports of the valve to prevent the ingress of dirt.

18. Fit the operating lever onto the operating shaft; align the correlation marks made prior to removal and fit the clamping bolt. Torque tighten the bolt to the figure quoted in Chapter P.

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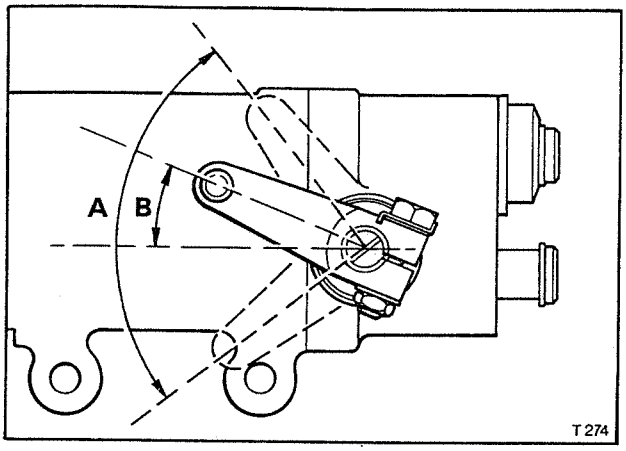

Fig. G28 Height control valve operating arm position and range

- A Approximate operating range without internal disengagement
- B 22° to 20° from horizontal position (see Operation 18 of Height control valve - To assemble.)

If the operating lever and shaft have not been correlated the correct position for the operating lever on the shaft should be determined as follows.

Fit the operating arm onto the shaft but do not tighten the clamping bolt.

Using a length of rod approximately 2,54 mm. (0.10 in.) diameter inserted through the inlet port adapter, push and retain the nylon inlet valve on its seat.

Carefully rotate the operating shaft in a clockwise direction until internal contact between the plunger and sleeve valve is felt.

Position the operating arm as shown in Figure G28 and tighten the clamp bolt.

Note

The operating shaft should only be rotated within the range shown in Figure G28. Further rotation will cause the shaft to disengage from the plunger. If disengagement occurs a thin rod should be inserted through the return port adapter and the plunger carefully pushed down the bore while the operating shaft is slowly rotated to re-engage in the plunger.

Height control valve - To fit

To fit a height control valve, reverse the procedure given for its removal, noting the following points.

1. The operating link joints must be lubricated with Rocol MTS 1000 grease or equivalent and then adjusted to give complete freedom of movement without free play.
2. All setscrews, nuts and pipe connections should be torque tightened in accordance with the figures quoted in Chapter P.
3. After fitting a height control valve, the hydraulic system must be bled as described in Section G4 and the height control valves 'set' to give the correct car levelled height.

Levelled height - To set

If the height control valves are removed from the car, on their replacement the levelled height must be checked and adjusted as necessary.

Note

Before any attempt is made to set the levelled height it is important that the car suspension height is correct. For details of the checking procedure reference should be made to Chapter H.

1. Weight the car with four occupants, or weights to a total of approximately 272 kg. (600 lb.) equally disposed between the front and rear seats. The fuel tank should contain 45 litres (10 Imp. gal. 12 US gal.) of fuel and all accessories, spare wheel and tools must be fitted in their respective locations.
2. Ensure the gearchange selector is in the 'P' Park position then remove the gearchange thermal cut-out from the fuse board.
3. Start the engine and allow the system to fully pressurise.
4. Check the levelled height by measuring the height 'A' (see Fig. G29) from the level surface on which the car stands, to the centre line of the rearmost bottom bolt which secures the forged bracket of the rear suspension crossmember to the body sill. Measure height 'B' from the level surface to the centre line of the rearmost bottom bolt which secures the rear hub assembly to the trailing arm. The difference between these two heights should be between 19,05 mm. and 25,4 mm. (0.750 in. and 1.0 in.). The maximum permissible difference in height between each side of the car being 4,76 mm. (0.187 in.).

On cars destined for USA and Canada with the exception of the Camargue a 12,50 mm. (0.50 in.) thick aluminium ring and second flexible seating washer are fitted to meet the statutory condition of car height.

In this case the difference between dimensions 'A' and 'B' should be between 3,80 mm. and 10,16 mm. (0.150 in. and 0.40 in.).

It is necessary to take two measurements at each point. Before taking the first measurement the

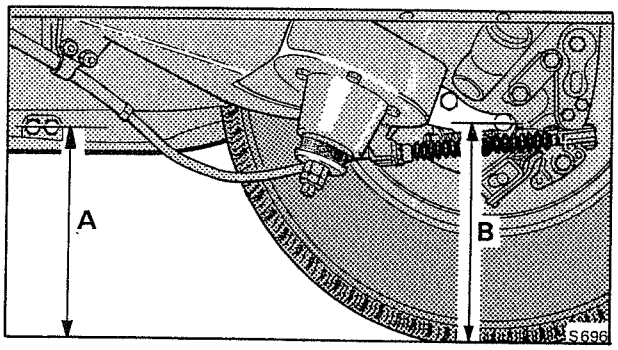

Fig. G29 Levelled height setting measurement positions

- A Ground to centre line of body bracket setscrew
- B Ground to centre line of axle yoke setscrew

car should be lifted approximately 5,08 cm. (2.0 in.) above its static position, then lowered gently and the measurements noted. The car should then be depressed approximately 5,08 mm. (2.0 in.) below its static position and allowed to rise before the second measurements are taken.

The average of the two measurements taken at points 'A' and 'B' should then be used when calculating the levelled height.

5. The levelled height is adjusted by altering the position of the control link bottom ball pivot in the elongated attachment hole on the trailing arm. Raising the ball pivot will increase the car levelled height, lowering the ball pivot will decrease the height.

It should be noted that although only one levelling valve may have been disconnected, both sides of the car must be checked for correct levelled height setting, as alteration to one side will affect the other.

Height control valves - To test (on the car)

The height control valves can be isolated and checked for operation on the car as follows.

1. Depressurise the hydraulic systems as described in Section G2 and isolate the gear-change by removing the thermal cut-out.
2. Remove the feed pipe (orange line) from one of the height control valves at the three-way junction on the rear crossmember and blank off the pipe end. Fit a blank capable of withstanding full hydraulic pressure to the three-way junction.
3. Start and run the engine at approximately 1000 r.p.m. If the height control valve on the opposite side of the car to the isolated valve was not operating before but now operates correctly then the isolated valve or its associated height control ram is faulty.
4. Stop the engine, depressurise the systems and reconnect the height control valve feed.
5. A further check can be made by removing the height control valve return pipe (white line) from the junction on the rear suspension crossmember. Blank off the junction and insert the end of the pipe into a clean container.
6. Disconnect the height control valve operating arm and link from its pivot on the suspension then push the operating arm upwards. Run the engine at approximately 1000 r.p.m.

Fluid should not flow from the pipe, if it does, the height control valve is faulty and should be overhauled or renewed.

7. Pull the control lever down so as to lower the car levelled height.

Fluid contained in the ram(s) should now flow into the container and then stop when the ram(s) are completely exhausted. If the flow does not stop then the height control valve has a faulty valve seat.

8. If the valve is working correctly, depressurise the systems and reconnect the height control valve return pipe.

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Section G13

Height control rams

Introduction

The height control rams are situated above each rear road spring. With the exception of Corniche Convertible cars access to the rams is through the luggage compartment of the car.

On Corniche Convertible cars the rams are removed down the road spring aperture, necessitating the removal of the rear road spring.

Height control ram - To remove
Silver Shadow II, Bentley T2, Silver Wraith II, Corniche Saloon and Camargue

1. Depressurise the hydraulic systems as described in Section G2.
2. Attach bleed tubes to the height control ram bleed screws; open the bleed screws and allow any remaining fluid to drain into a clean container.
3. **Cars destined for countries other than U.S.A. and Canada**
Remove the trim from the forward panel and corners of the luggage compartment.
Cars destined for U.S.A. and Canada
Remove the screws retaining the sealing panel at the forward end of the luggage compartment. Remove the panel to expose the fuel tank.
Remove the fuel tank as described in Chapter K.
4. Disconnect the hydraulic pipes from the top of the ram body and blank off each pipe and port.
5. Unscrew the three ram retaining setscrews equal amounts to allow the road spring connector tube to lift under road spring pressure until it abuts the underside of the spring pot. When this is achieved, remove the setscrews completely.
6. Ease the ram housing upwards to gain access to the ram piston slots, then using the hook wrench (RH 8051) unscrew the ram piston from the connector tube. Remove the ram from the car.

Height control ram - To remove
Convertible cars

1. Depressurise the hydraulic systems as described in Section G2.
2. Attach bleed tubes to the height control ram bleed screws; open the bleed screws and allow any remaining fluid to drain into a clean container.
3. Remove the rear seat cushions, backrest and trims to expose the ram securing setscrews on the base of the hood stowage compartment (see Chapter S).
4. Using special peg spanner and extension bar (RH 8048) inserted through the centre of the road-spring unlock, but do not unscrew fully the ram piston from the connector tube.

Note
When unlocking the ram piston from the connector tube the spanner must be turned clockwise.

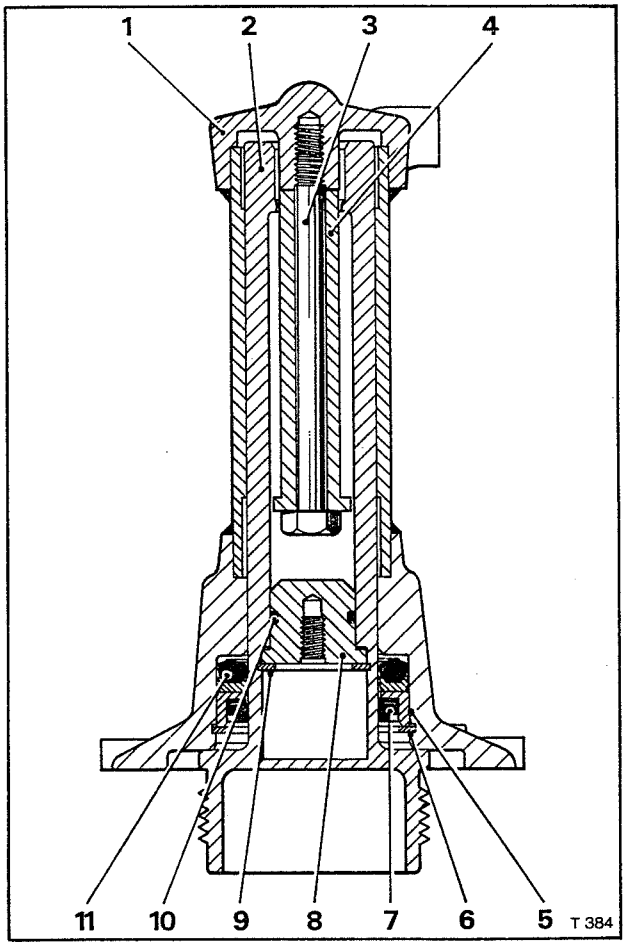

Fig. G30 Height control ram
Silver Shadow II, Bentley T2, Silver Wraith II, Corniche Saloon and Camargue

1 Housing
2 Piston
3 Travel limiting stop setscrew
4 Travel limiting stop
5 Seal housing
6 Circlip
7 Wiper seal
8 Sealing plug
9 Circlip
10 Sealing ring
11 Main seal

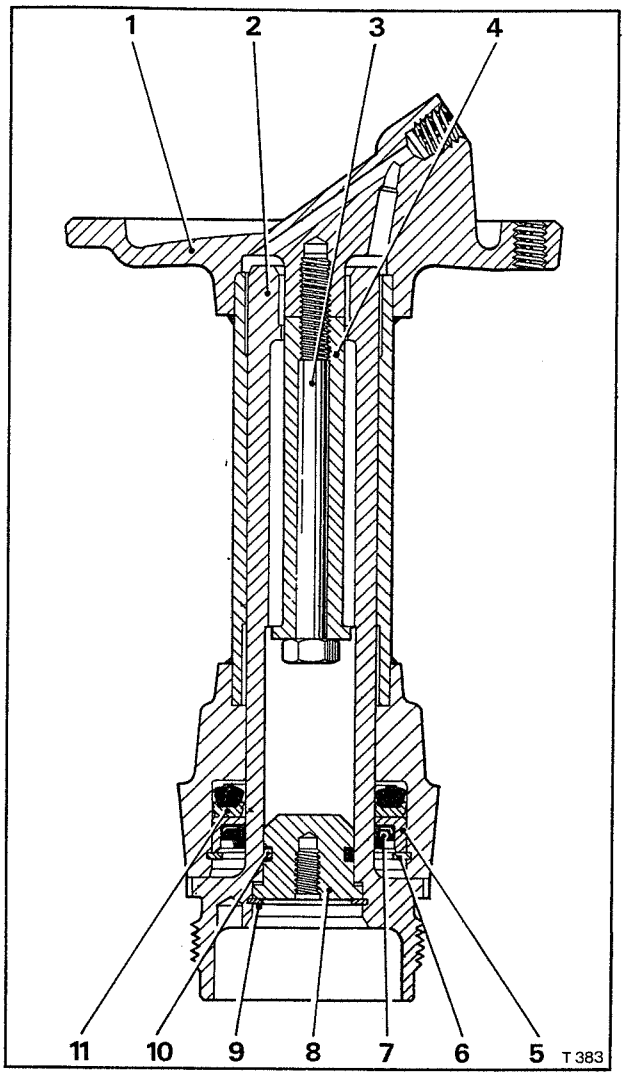

Fig. G31 Height control ram
Convertible cars

1 Housing
2 Piston
3 Travel limiting stop setscrew
4 Travel limiting stop
5 Seal housing
6 Circlip
7 Wiper seal
8 Sealing plug
9 Circlip
10 Sealing ring
11 Main seal

An alternative method is to proceed with Operation 5 onwards and separate the ram piston and connector tube on the workbench.

5. Remove the ram securing setscrews from the base of the hood stowage compartment.

6. Remove the road spring, connector tube and ram assembly from the car as described in Chapter H.

7. Separate the ram assembly from the connector tube by unscrewing the ram piston from the connector tube.

Height control ram - To dismantle (see Figs. G30 and G31)

1. Remove the circlip retaining the sealing plug in the piston bore.

2. Withdraw the sealing plug from the piston bore. Discard the sealing ring.

A 0.250 in. UNF threaded hole is provided in the end of the plug to facilitate removal.

3. Using a suitable spanner unscrew the travel limiting stop setscrew. Withdraw the ram piston from the housing and collect the travel limiting stop and setscrew.

4. Remove the seal retaining circlip from the ram housing then extract the wiper seal, seal housing and main seal.

5. Thoroughly clean and inspect all items for wear and damage. Any score marks should be removed from the piston by use of a fine grade emery cloth prior to final cleaning.

Height control ram - To assemble

1. Lubricate a new main seal with recommended brake fluid (see Chapter D) and insert it into position in the ram housing as shown in Figure G32.

2. Lubricate a new wiper seal with brake fluid and gently push it into place in the seal housing.

3. Insert the wiper seal and housing into position in the ram housing. Ensure that the flat face of the housing abuts the main seal. Fit the seal retaining circlip.

4. Slide the piston into the ram housing taking care not to damage the seal lips.

5. Fit the setscrew and travel limiting stop and torque tighten the setscrew to the figure quoted in Chapter P.

6. Smear the new piston blanking plug seal with Molytone 'C' grease or equivalent and fit it onto the plug.

7. Press the blanking plug into position in the ram piston and fit the retaining circlip.

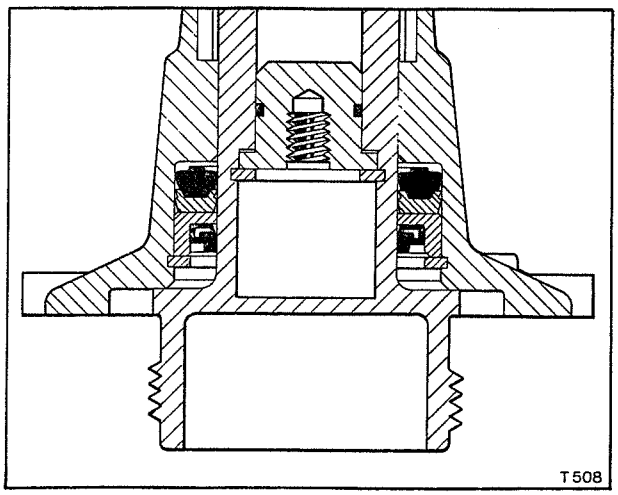

Fig. G32 Height control ram seals

Height control ram - To fit

Fit the height control ram by reversing the procedure for removal noting the following points.

1. All nuts and setscrews should be torque tightened in accordance with the figures quoted in Chapter P.
2. After fitting the height control ram, bleed the height control system as described in Section G4.
3. Check the ram and all the disturbed pipe connections for leaks prior to fitting the body trims.

Height control ram - To test (on the car)

The only likely failures on a height control ram are seal failures. If a ram piston blanking plug seal or main piston seal fail this will be visually evident as hydraulic fluid will be seen running down the damper casing or road spring.

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Section G14

Pressure switches

Introduction

The accumulator pressure switches are situated in the engine compartment on the right-hand longeron (No. 1 system accumulator) and the left-hand longeron (No. 2 system accumulator).

The pressure switches are operated by the pressurised fluid in the hydraulic systems and will illuminate the warning panel(s) situated on the interior facia if the pressure in the hydraulic system(s) falls below a safe working pressure. It is important therefore that the warning panel lamps are not operated due to a faulty switch.

In the event of a pressure switch failure the pressure switch should be renewed.

Pressure switch - To test

1. The hydraulic pressure switches are designed to 'fail safe' i.e. if a pressure switch fails it will operate the facia panel warning lamps.
2. The warning lamp bulbs can be checked for correct operation by moving the gear range selector lever to the 'D' drive position and turning the ignition key against the spring pressure to the 'start' position. This operation should result in all of the panels in the warning cluster situated on the facia being illuminated.

Important

Ensure that both the parking brake and foot brake are firmly applied when carrying out this operation.

3. The easiest method of testing a hydraulic pressure switch is by substitution. If this is not possible the following procedure should be carried out.
4. Depressurise the hydraulic systems as described in Section G2.
5. Remove the bleed screw from the three-way adapter on the left-hand pressure switch and connect a zero kg/sq.cm. to 210 kg/sq.cm. (zero lb/sq.in. to 3 000 lb/sq.in.) pressure gauge fitted with a connecting pipe and bleed screw into the adapter.
6. Connect a battery and test lamp in series to the pressure switch as shown in Figure G34. The test lamp should illuminate, confirming that the switch contacts are made, denoting no brake fluid pressure.
7. Start and run the engine at approximately 800 r.p.m. and observe the pressure gauge. The test lamp should extinguish at a pressure not exceeding 45,70 kg/sq.cm. (650 lb/sq.in.). Switch off the ignition and using a bleed tube attached to the gauge feed pipe bleed screw slowly bleed off the fluid into a clean container thus allowing the hydraulic pressure to fall. Observe the pressure at which the test lamp illuminates, this pressure should not be less than 17,58 kg/sq.cm. (250 lb/sq.in.).

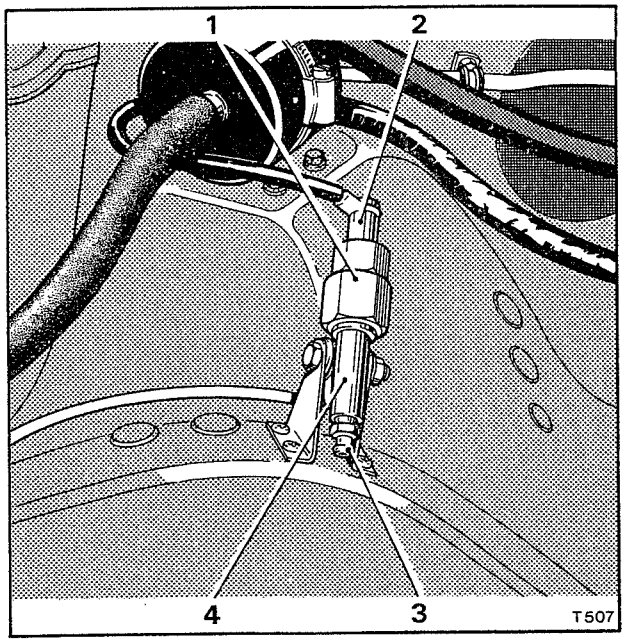

Fig. G33 Pressure switch (left-hand longeron)
1 Pressure switch
2 Electrical connection
3 Bleed screw
4 Three-way adapter

Note

On cars destined for use in Australia, Canada and the U.S.A. higher rated pressure switches are fitted. The operating pressures for these switches are as follows:

84,39 kg/sq.cm. (1 200 lb/sq.in.) test lamp extinguished.

63,28 kg/sq.cm. (900 lb/sq.in.) test lamp illuminated.

8. In order to test the pressure switch fitted to the right-hand longeron (No. 1 system) the pressure switch should be exchanged with the left-hand (No. 2 system) pressure switch and Operations 5 to 7 inclusive repeated.
9. When tests and rectifications have been completed the systems must be bled as described in Section G4.

Pressure switch - To renew

1. Depressurise the hydraulic systems as described in Section G2.

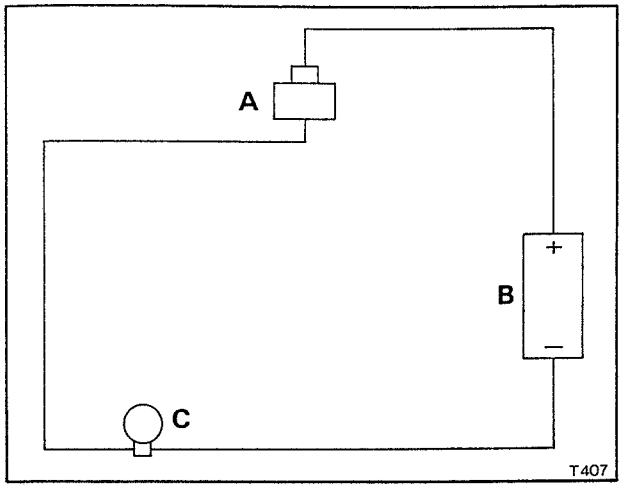

Fig. G34 Pressure switch test circuit
A Pressure switch
B Battery
C Test lamp

2. Disconnect the electrical connection from the top of the pressure switch. Unscrew the pressure switch from the three-way adapter; discard the two aluminium sealing washers.
3. Screw a new pressure switch into the three-way adapter, fitting a new sealing washer to each side of the distance washer on the switch connection. Torque tighten the switch to the figure quoted in Chapter P.
4. Fit the electrical connection to the pressure switch contact pin.
5. When fitting is completed bleed the hydraulic system as described in Section G4.

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Section G15

Front and rear disc brakes

Introduction

Disc brakes are fitted to all four wheels; each front wheel being fitted with two twin cylinder calipers and each rear wheel with a large four cylinder caliper.

The calipers are divided between the two hydraulic systems, providing an integrated braking system in which each system can operate independently in the event of system failure.

Bleed screws are fitted to the inner faces of each caliper to facilitate bleeding of the two systems.

The rear brake calipers have the mechanically operated parking brake pads situated beneath them. On application of the parking brake the wedge shaped brake pads act on each side of the rear brake disc (refer to Section G16 for details).

Inspection of all brake pads must be carried out at the specified service intervals; for details reference should be made to the Service Schedule Manual publication number T.S.D. 4117.

In order to obtain maximum efficiency and safety from the braking systems it is important that only replacement disc pads of approved design and material specification are fitted.

It is important when changing brake pads that the friction material of the new pads is of the same type and grade as that fitted to the other brake calipers; otherwise it will be necessary to renew all the brake pads.

Brake pads of different specification or different manufacturers vary in their friction, wear and operating characteristics and if mixed could have an adverse effect on braking performance.

The brake pads must be renewed when the brake pad linings are worn to within 3,18 mm. (0.125 in.) of the back plate.

After fitting new brake pads an initial running-in period of between 1100 kilometres and 1300 kilometres (700 miles and 800 miles) should be observed.

During this initial running-in period, the brakes should not be applied harshly or for prolonged periods from high speeds except in an emergency. The force with which the brakes are applied may be progressively increased towards the end of the running-in period.

Note
If the brakes are to be relined with pads which have different recommended linings from those previously fitted the disc faces should be cleaned prior to fitting the new pads. All traces of the old pad material should be removed by hand rotating the disc whilst applying fine emery cloth to the disc faces. Do not emery the disc radially. **It is again stressed that the same type and grade of pad linings must be fitted to all six brake calipers.**

Front wheel brake pads - To renew

1. Depressurise the hydraulic system as described in Section G2.

Note
This operation is not essential for brake pad renewal but is recommended as a safety precaution in the event of the brake pedal being accidentally depressed whilst the brake pads are removed.

2. Slacken but do not remove the front road wheel retaining nuts.
3. Securely chock the rear road wheels, then jack up the front of the car. Support the car with stands and sill blocks.
4. Remove the front road wheels.
5. Remove the spring clips from the two brake pad retaining pins (see Fig. G35) and withdraw the pins.
6. Using extractor tool (RH 8928) withdraw the brake pads from the caliper.
7. Prior to fitting the new brake pads, inspect the caliper piston dust seals for signs of damage or heat hardening and renew as necessary.
8. Carefully press the caliper pistons back into their bores, taking care not to damage or trap the piston seals. Ensure that the seal retaining clips are correctly located.
9. Fit the new pads by reversing the removal procedure, ensuring that the spring clips are correctly located in the pad retaining pins.

On later cars a 'M' shaped anti-rattle spring is fitted onto the brake pad retaining pin, on the leading side of the caliper pad i.e. upper pin on the front wheel, front brake caliper and lower pin on the front wheel, rear brake caliper (see Fig. G36). One spring only is fitted to each brake caliper.

The brake pads differ from those fitted to the earlier type of brake caliper in that an additional hole is incorporated to accommodate the 'M' spring.

Always ensure that the 'M' spring is fitted correctly as follows.

1. Fit the brake pads into the caliper and insert the trailing, pad retaining pin. Secure the pin with the retaining clip.
2. Locate the ends of the 'M' spring into the central holes of the brake pad back plate.

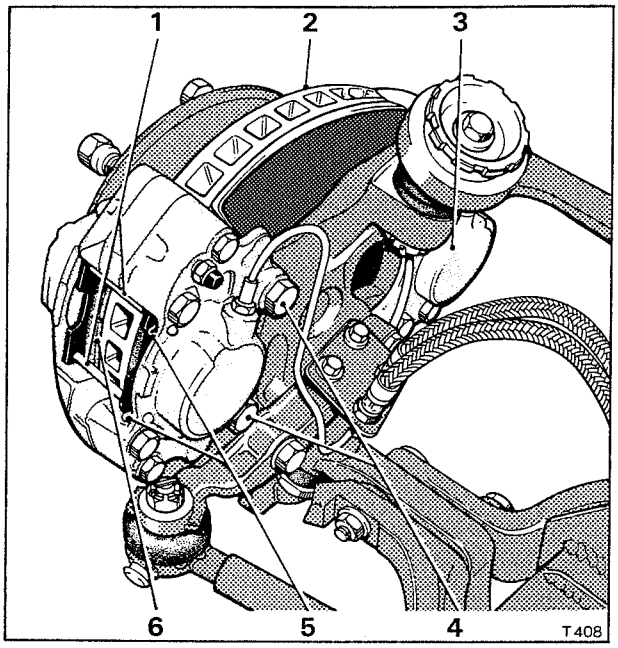

Fig. G35 Front wheel brake calipers
1 Brake pad retaining pins
2 Brake disc
3 Rear caliper
4 Caliper retaining bolts
5 Spring clips
6 Brake pad

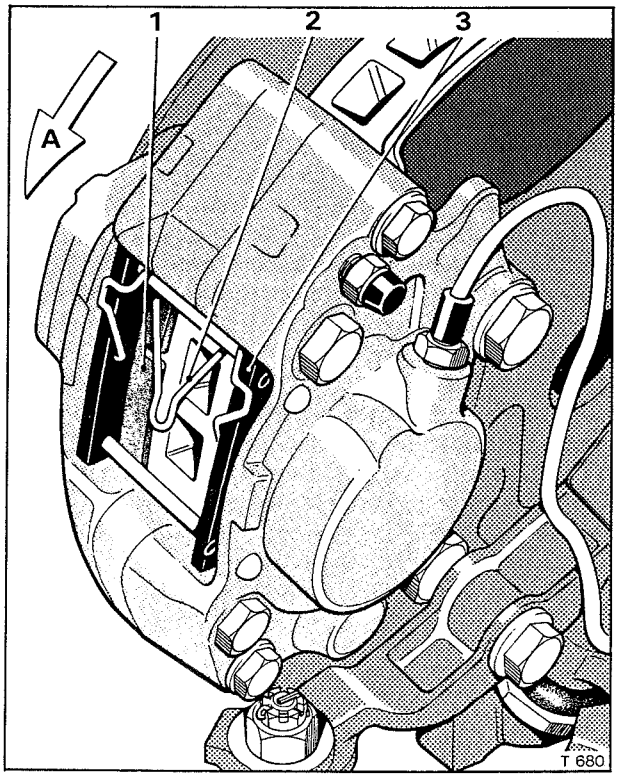

Fig. G36 Front wheel brake caliper 'M' spring type
1 Brake pad
2 'M' spring
3 Brake pad backing plate
A Direction of forward rotation of brake disc

3. Ease the spring into position and secure with the leading pad retaining pin. Fit the pin retaining clip.
4. Ensure that the centre of the 'M' spring points in the same direction as the forward rotation of the brake disc.

Note
When fitting the 'M' spring the 'ears' of the spring must rest on the edge of the brake pad backing plate, with the bends at the top of the 'M' figuration butting against the caliper body.

Do not compress the two bends of the spring more than the normal gap between the two brake pads otherwise the spring may become permanently set.

Due to inherent distortion during pad wear new 'M' springs must be fitted whenever replacement brake pads are fitted.

Rear wheel brake pads - To renew
1. Depressurise the hydraulic system as described in Section G2.

Note
This operation is not essential for brake pad renewal but is recommended as a safety precaution in the event of the brake pedal being accidentally depressed whilst the brake pads are removed.

2. Securely chock the front road wheels, then jack up the rear of the car as necessary. Support the car with stands and sill blocks.
3. Remove the rear road wheels.
4. Remove the spring clips from the two brake pad retaining pins (see Fig. G38) and withdraw the pins. Collect the anti-rattle spring clip from the rear of each brake pad.
5. Withdraw the brake pads from the caliper using the extractor tool (RH 8929).
6. Prior to fitting the new pads, inspect the caliper piston dust seals for signs of damage or heat hardening and renew as necessary.
7. Carefully press the caliper pistons back into their bores, taking care not to damage or trap the seal. Ensure that the seal retaining clips are correctly located.
8. Fit the new pads by reversing the removal procedure, ensuring that the anti-rattle spring clips and pad retaining pin clips are correctly located (see Fig. G38).

Front brake caliper - To remove (refer to Fig. G35)
1. Depressurise the hydraulic systems as described in Section G2.
2. Securely chock the rear road wheels.
3. Remove the wheel disc, (see Section R1) then slacken but do not remove the wheel retaining nuts.
4. Raise the front of the car on a hydraulic jack. Securely support the car on stands and sill blocks.
5. Remove the road wheel.
6. Disconnect the caliper feed pipe and blank off the pipe end and caliper port against the ingress of dirt.

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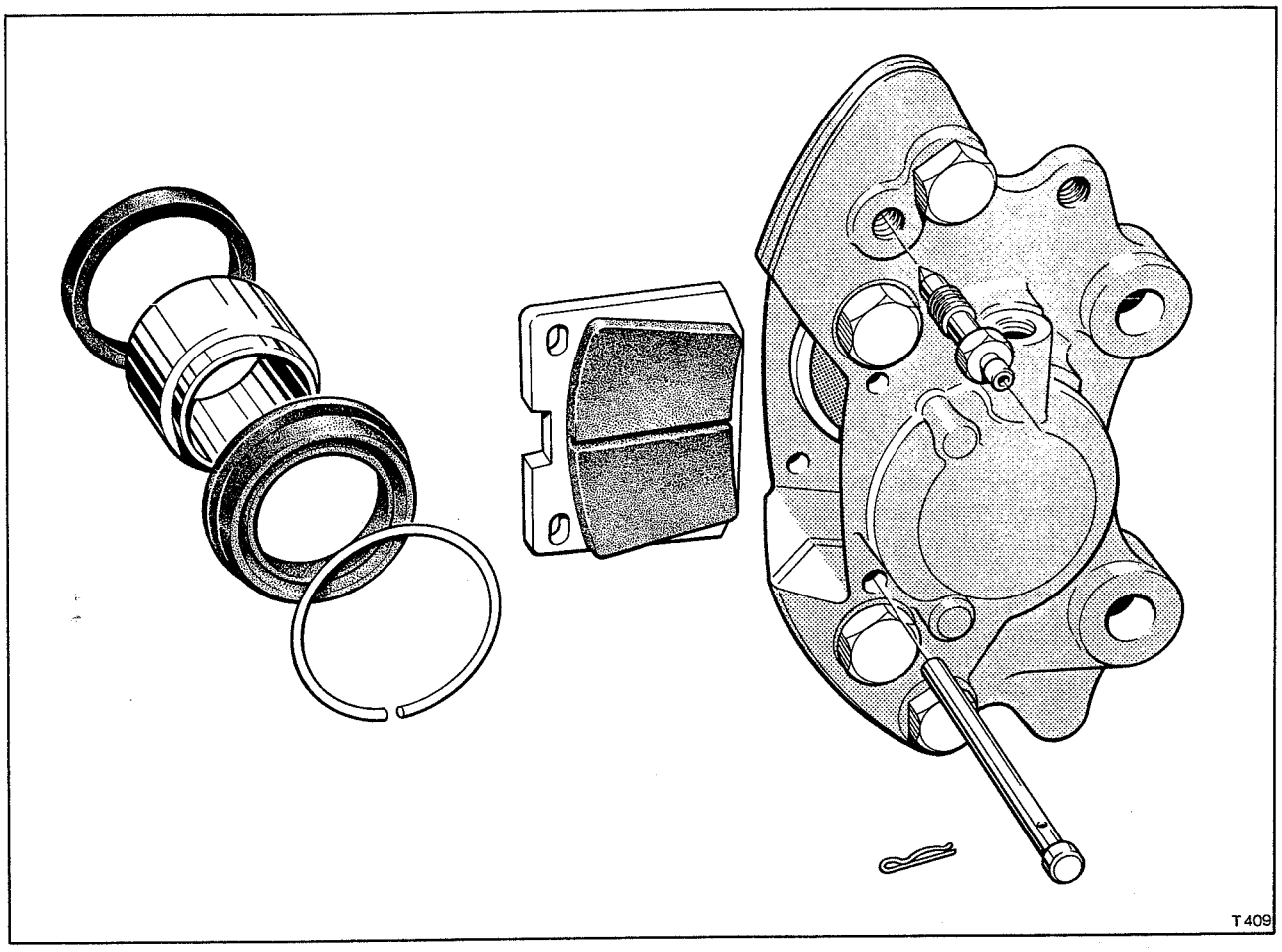

Fig. G37 Front wheel brake caliper

7. Remove the fitted bolts which secure the caliper to the axle yoke. Remove the caliper from the car.
8. It is recommended that a distance piece is fitted between the caliper pads after removal to prevent the pistons from easing out of their bores.

Rear brake caliper - To remove (refer to Fig. G38)
1. Depressurise the hydraulic systems as described in Section G2.
2. Securely chock the front wheels of the car.
3. Remove the wheel disc (see Section R1) then slacken but do not remove the wheel retaining nuts.
4. Raise the rear of the car on a hydraulic jack. Securely support the car on stands and sill blocks. Do not allow the full load of the suspension to hang on the rebound straps.
5. Remove the road wheel.
6. Disconnect the two caliper feed pipes from the caliper and blank off the pipe ends and caliper ports against the ingress of dirt.
7. Remove the split pin and clevis pin from the twin links on the parking brake caliper linkage. Collect the waved anti-rattle washer.
8. Remove the fitted bolts securing the caliper to the hub yoke. Remove the caliper from the car.
9. Fit a distance piece between the caliper pads to prevent the pistons easing out of their bores.

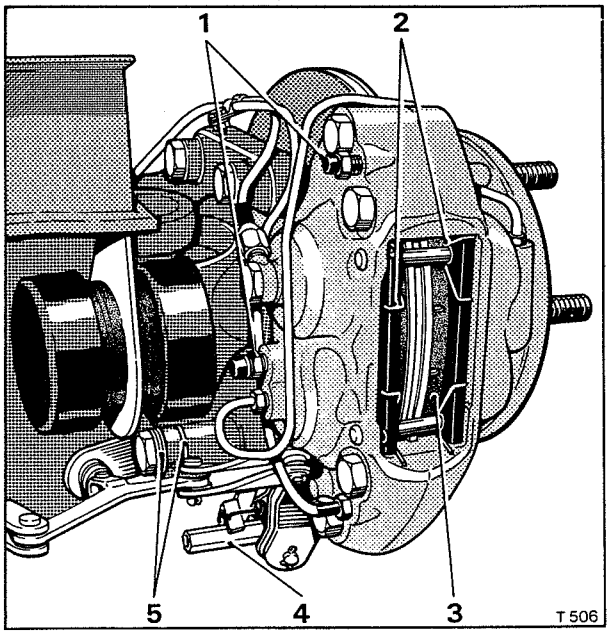

Fig. G38 Rear wheel brake caliper
1 Bleed screws
2 Anti-rattle spring clips
3 Brake pad
4 Parking brake adjuster
5 Parking brake lever adjustment washers

Brake caliper piston seals - To renew
The brake caliper seals should be renewed at the intervals specified in the Service Schedule Manual publication number T.S.D. 4117.
1. Depressurise the hydraulic systems as described in Section G2.
2. Remove the brake caliper from the car and remove the brake pads as described previously.
3. Remove the spring clip retaining the caliper piston dust seal; remove the dust seal.
4. Ease the piston from its bore taking care not to damage the piston.
5. Remove the piston seal from the caliper bore.
6. Clean the caliper bore and piston with methylated spirits and dry thoroughly using dry compressed air.
7. Immerse the new piston seal in approved brake fluid (refer to Chapter D), then carefully insert it into the groove in the caliper bore, ensuring it is correctly seated.
8. Lubricate the piston outside diameter with a small quantity of approved brake fluid, then carefully fit the piston.
9. Fit a new dust seal around the piston top and over the caliper bore flange. Fit the spring ring taking care not to 'pinch' the seal with the ends of the ring.

Brake calipers - To fit
Fit the brake calipers by reversing the respective removal procedure noting the following points.
1. All setscrews and pipe connections must be torque tightened in accordance with the figures quoted in Chapter P.
2. Ensure that a minimum clearance of 8,00 mm. (0.312 in.) is maintained between the caliper bridge pipe and the brake disc when fitting rear brake calipers.
3. When fitting is completed bleed the hydraulic systems as described in Section G4.

Note
The supply pipe connection ports on the front wheel brake calipers are a metric threaded fitting and only pipes fitted with the correct metric pipe nuts should be used.

Brake disc - To remove
1. Depressurise the hydraulic systems as

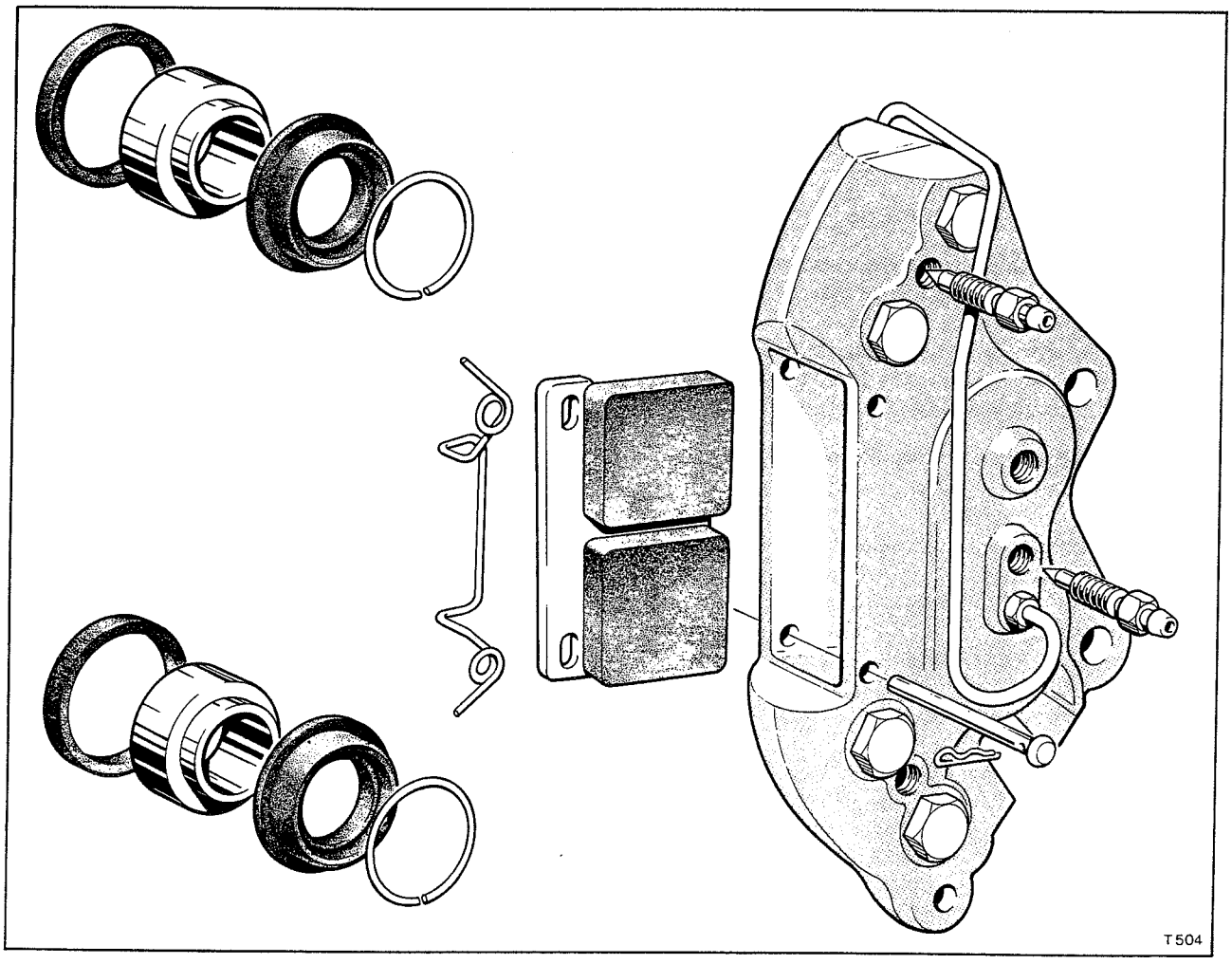

Fig. G39 Rear wheel brake caliper

described in Section G2.
2. Remove the front or rear hub as necessary, following the procedure described in Chapter J Rear hubs or Chapter H Front hubs.
3. To remove a front brake disc remove the set-screws securing the disc to the hub.
4. To remove a rear brake disc dismantle the rear hub as described in Chapter J then unscrew the disc retaining setscrews.

Brake disc - To fit
Fit the brake disc by reversing the procedure for removal noting the following points.
1. All setscrews must be torque tightened in accordance with the figures quoted in Chapter P.
2. The hubs must be assembled and fitted as described in their respective Chapter H or J.
3. On completion the hydraulic systems must be bled as described in Section G4.

Note
New brake discs are treated with a protective film. When a new disc has been fitted the brakes should be gently applied until the protective film has been removed from the working surface of the disc by the first few brake applications.

If only one front brake disc has been replaced the car will gently pull to the side opposite the new disc until the protective film has been removed.

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Section G16

Parking brake linkage

Introduction

The parking brake is operated by a hand pulled mechanism on right-hand drive cars and by a foot pedal application with a hand pull release on left-hand drive cars. Both types of mechanism operate a caliper lever arrangement fitted beneath the two rear hydraulic brake calipers. These levers apply a wedge shaped friction pad to each side of the brake disc.

The parking brake pads should be manually adjusted at the intervals specified in the Service Schedule Manual publication T.S.D. 4117.

Hand operated ratchet assembly - To remove
Right-hand drive cars

1. Place the car on a ramp and securely chock the road wheels. Release the parking brake to the 'off' position.
2. At the intermediate linkage on the underside of the body, unhook the parking brake return spring from the operating lever. Remove the clevis pin attaching the front parking brake cable to the end of the lever (see Fig. G40).
3. Remove the trim retaining screw from the centre panel of the parking brake handle aperture.
4. Remove the Lucar connectors from the micro-switch mounted on the lower end of the ratchet assembly cover tube.
5. Remove the setscrews securing the upper support bracket to the facia structure.
6. Remove the setscrew securing the lower support bracket.
7. Ease the complete ratchet assembly downwards, from beneath the facia.
8. Draw the ratchet assembly away from the toeboard and disconnect the cable from the retaining piece bolted to the bottom of the operating rod; remove the assembly.

Hand operated ratchet assembly - To dismantle

1. Remove the ratchet assembly from the car as described previously.
2. Remove the cable retainer from the lower end of the operating rod. Refit the screw into the operating rod to retain the coil spring and end fittings.
3. Remove the cheese headed screw and washer from behind the cover tube locking nut.
4. Unscrew the locking nut from behind the upper support bracket.
5. Withdraw the operating rod and roller assembly from the cover tube.

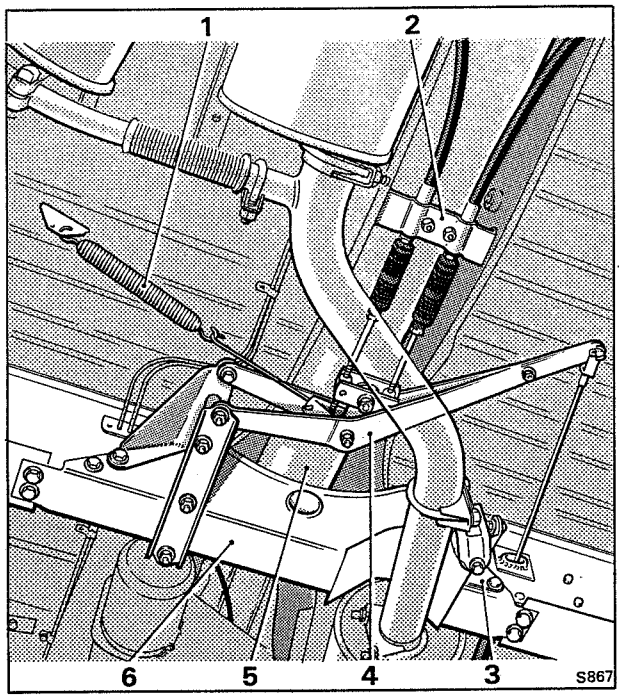

Fig. G40 Parking brake intermediate linkage (Right-hand drive cars)

1 Return spring
2 Abutment bracket-rear brake cables
3 Exhaust mount
4 Operating lever
5 Propeller shaft
6 Centre body member

Note
The roller assembly can be extracted from the cover tube by pulling the assembly to the top of the tube then tilting the tube and carefully manipulating first one roller then the other roller out of the slots.

6. Remove the retaining screw from the lower end of the operating rod. Slide the coil spring, stop plate, roller assembly and distance piece off the operating rod.
7. Remove the operating rod from the upper housing and separate the housing and ratchet components.
8. All the components should be inspected for signs of wear and damage, paying particular attention to the bushes, ratchet assembly and springs. New parts should be fitted as necessary.

Hand operated ratchet assembly - To assemble
Assemble the ratchet assembly by reversing the

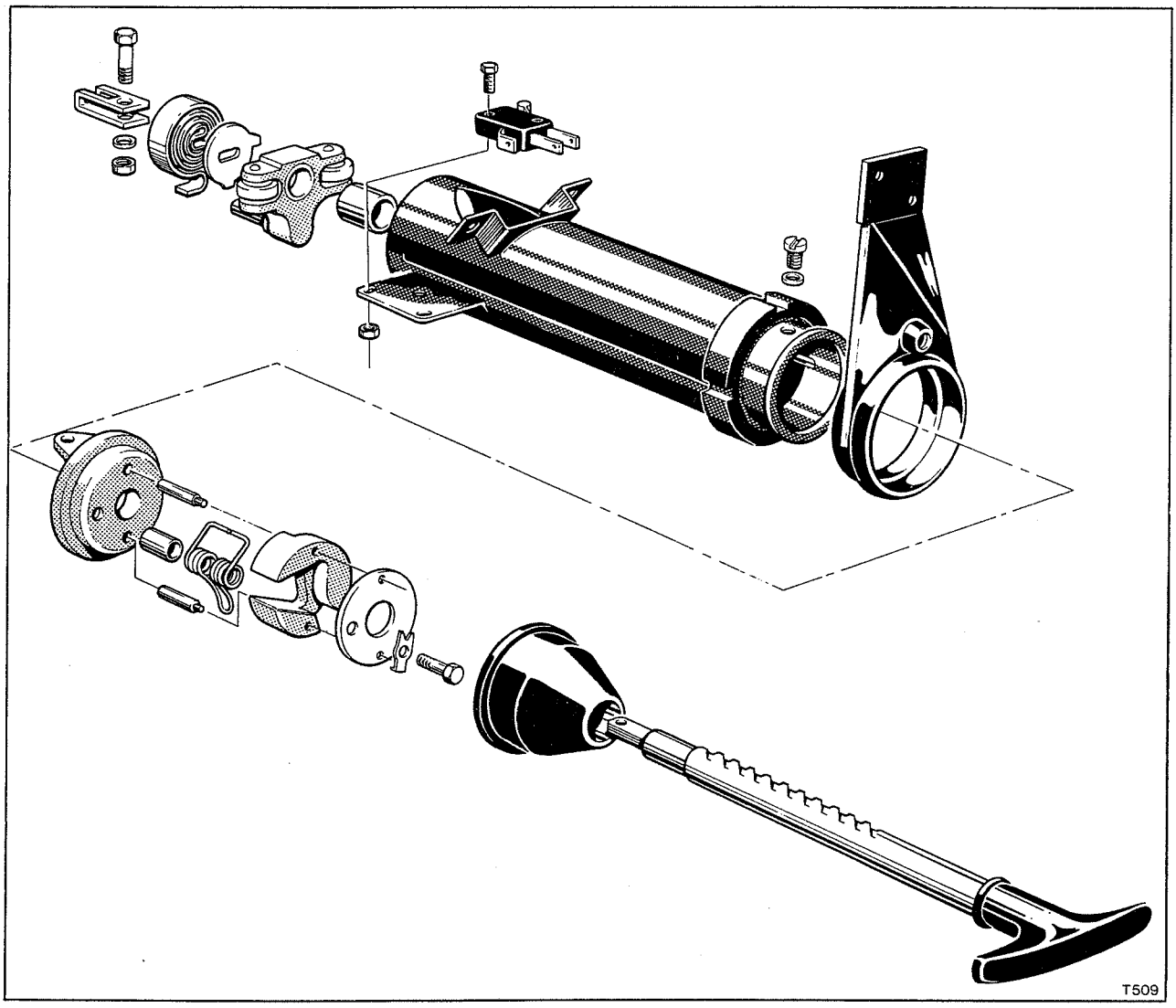

Fig. G41 Parking brake ratchet assembly (Right-hand drive cars)

procedure given for dismantling noting the following points.

1. The hand operating rod is spring loaded and must turn in a clockwise direction from the horizontal position to release the ratchet mechanism. For correct operation ensure that the coil spring and stop plate fitted below the roller assembly are as shown in Figure G41.
2. Lightly lubricate the ratchet pawls and roller mechanism using Retinax 'A' grease or equivalent.
3. Care must be taken when entering the rollers and operating rod into the cover tube slots. The tube should be held at an angle to the control rod. Enter one roller into the tube, then carefully manipulate the other roller into position.
4. The cable retainer should be fitted after the control rod and roller assembly has been fitted into the cover tube.
5. Adjust the micro-switch so that on the initial movement of the parking brake the facia warning panel marked PARKING BRAKE illuminates.

Hand operated ratchet assembly - To fit

Fit the ratchet assembly by reversing the procedure given for removal noting the following points.

1. All setscrews should be torque tightened in accordance with the figures quoted in Chapter P.
2. Care should be taken to ensure the brake cable end is located correctly in the connector link.
3. Ensure that the brake cable is correctly positioned in the guide pulleys.
4. Check the operation of the mechanism to ensure free movement of the ratchet assembly and brake cable.

Foot operated parking brake mechanism - To remove
Left-hand drive cars

1. Place the car on a ramp and securely chock the road wheels. Release the parking brake to the 'off' position.
2. At the intermediate linkage on the underside of the body, unhook the parking brake return spring

from the operating lever. Remove the clevis pin attaching the front brake cable to the lever (see Fig. G42)

3. Remove the knee roll trim from the parking brake area as described in Chapter S in order to gain access to the four setscrews which retain the foot pedal mechanism.

4. Disconnect the Lucar connections from the micro-switch.

5. Disconnect the brake cable from the retaining piece on the actuation lever.

6. Remove the four pedal mechanism retaining setscrews and lower the mechanism from beneath the facia.

Foot operated parking brake mechanism - To dismantle

1. Remove the foot operated parking brake mechanism as described previously.

2. Remove the spring plate and release lever return springs.

3. Dismantle the parking brake foot mechanism by removing the pivot bolts from the foot pedal lever, sprag plate, release actuator and hand release lever. Remove these items from the mounting bracket frame; collect the distance tube from each pivot.

4. Separate the release actuator from the intermediate lever by removing the clamping setscrew, collect the distance piece.

5. Inspect all items for wear and damage; renew parts as necessary.

Foot operated parking brake mechanism - To assemble (see Fig. G43)

Assembly the parking brake mechanism by reversing the procedure given for dismantling noting the following points.

1. The inside of the sprag plate hole should be sparingly smeared with Retinax 'A' grease or equivalent.

Note

The sprag rod must be clean, dry and free of lubricant.

2. The sprag plate pivot bolt should be fitted with the bolt head on the left-hand side of the frame. All other bolts should be fitted from the right-hand side of the frame.

3. Adjust the mechanism as described under Foot operated parking brake - To adjust.

4. All setscrews should be torque tightened to the figures quoted in Chapter P.

Foot operated parking brake - To adjust (see Fig. G44)

1. Slacken the setscrew securing the intermediate lever to the actuator.

2. Slowly depress the pedal from the 'off' position. The sprag plate will rise from its 'off' position for approximately one third of the sprag rod's length,

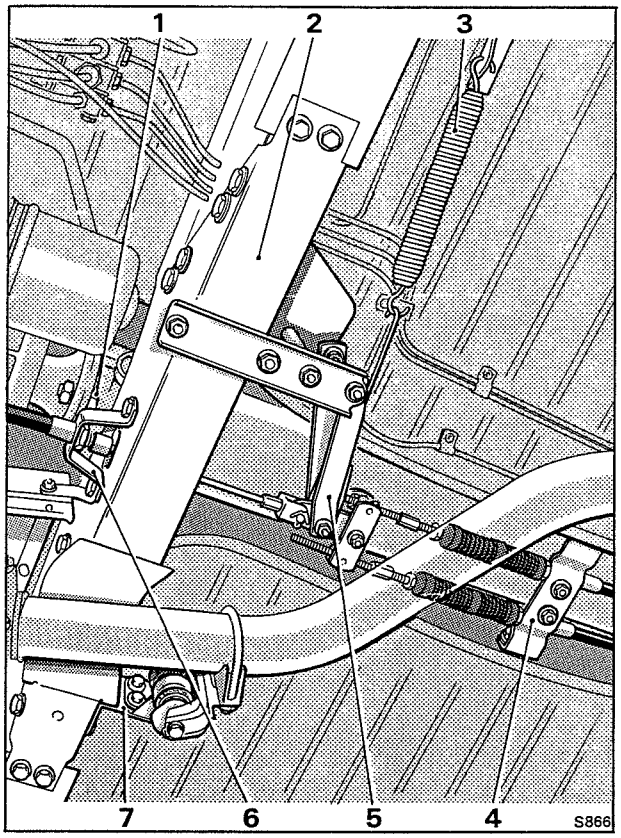

Fig. G42 Parking brake intermediate linkage (Left-hand drive cars)

1 Propeller shaft
2 Centre body member
3 Return spring
4 Abutment bracket-rear brake cables
5 Operating lever
6 Mounting bracket-front brake cable
7 Exhaust mount

then lower for the remainder of pedal travel. With the sprag plate in its highest position adjust the actuator to obtain a clearance of 0,127 mm. to 0,254 mm. (0.005 in. to 0.010 in.) between the actuator pawl and the sprag plate. Tighten the setscrew securing the intermediate lever to the actuator.

3. With the sprag rod approximately 3,17 mm. (0.125 in.) away from its rubber off stop, set the warning lamp micro-switch so that it operates i.e. the point where the switch gives an audible click. Check that the switch roller assembly is not trapped between the switch body and roller ramp when the sprag rod is against the 'off' stop.

Note

Operations 1 to 3 inclusive can be carried out with the parking brake mechanism removed from the car.

4. Release the parking brake caliper adjusters at the rear wheels to enable the parking brake pedal to be fully depressed to the floor. Check the release handle travel; there should be a minimum of 12,70 mm. (0.50 in.) extra travel (measured at the

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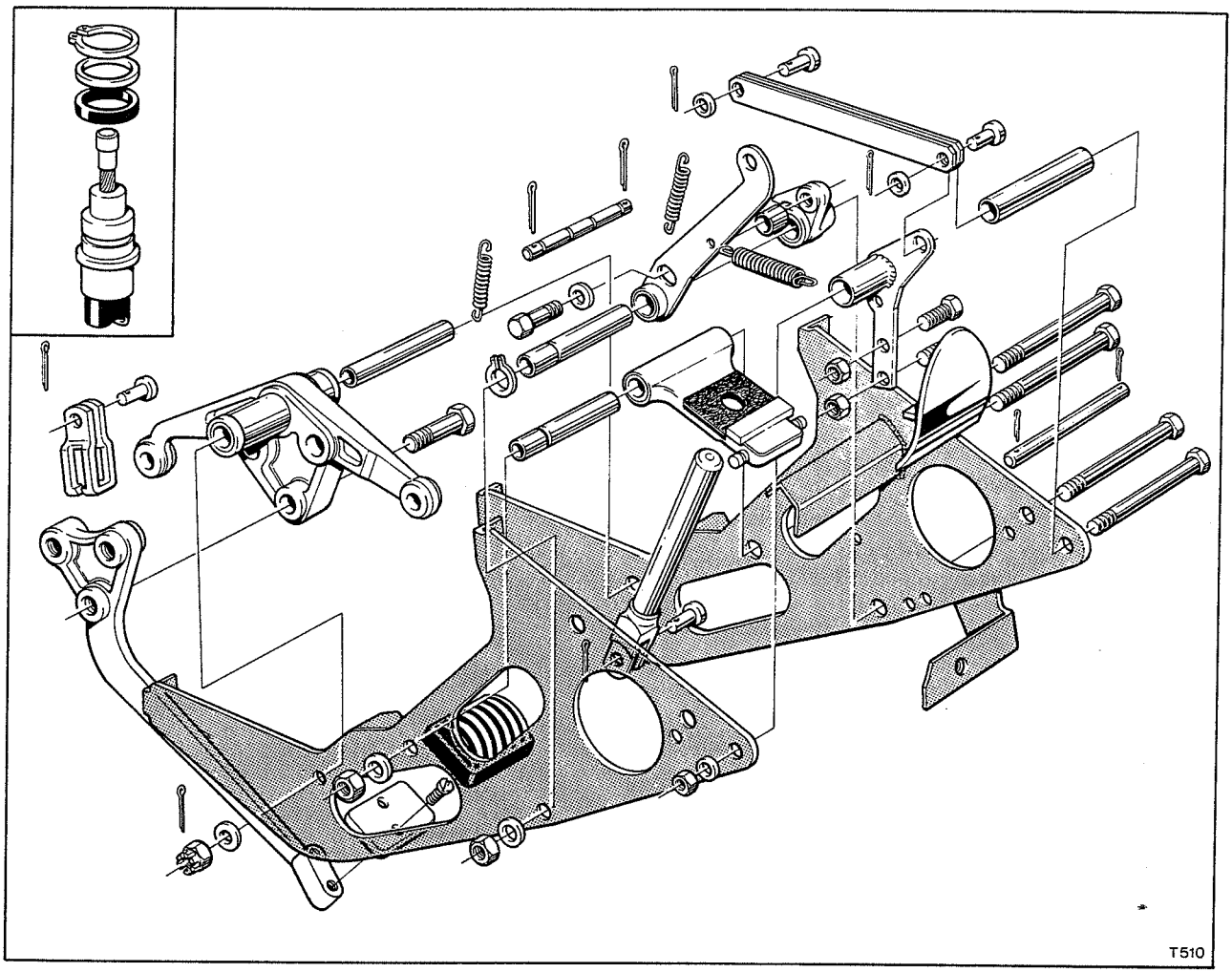

Fig. G43 Foot operated parking brake and cable connection

end of the release handle) after the point of release of the mechanism. If the handle travel is incorrect the clearance between the actuator pawl and the sprag plate should be checked as described previously in Operation 2.
5. Adjust the parking brake cables and pads as described in their relevant sections.
6. Apply the parking brake. The foot pedal should remain in the 'on' position without slipping until the mechanism is released. If slipping occurs inspect the sprag rod and sprag plate for signs of wear and replace as necessary.
7. Check that the facia warning lamp marked PARKING BRAKE is extinguished when the brake is released to the 'off' position.

Foot operated parking brake - To fit
Fit the foot operated parking brake by reversing the procedure for removal noting the following points.
1. All setscrews should be torque tightened in accordance with the figures quoted in Chapter P.
2. Care should be taken to ensure the brake cable end is located correctly in the connector link.
3. Check the operation of the parking brake as described in Foot operated parking brake - To adjust.

Parking brake front cable - To remove
Right-hand drive cars
1. Remove the hand operated ratchet assembly as described under Hand operated ratchet assembly - To remove.
2. Remove the circlip retaining the rubber seal to the brake cable on the interior side of the toeboard. Remove the seal from the cable.
3. Remove the two setscrews retaining the felt seal housing to the engine side of the toeboard. Withdraw the cable from the housing and felt seal.
4. Remove the two brake cable guide pulleys; collect the distance tube from the centre of each pulley (see Fig. G45).
5. Remove the nuts and bolts retaining the brake cable outer cover to their mountings on the underside of the body. Also remove the clips retaining the cable in position along the body.
6. Carefully withdraw the brake cable from

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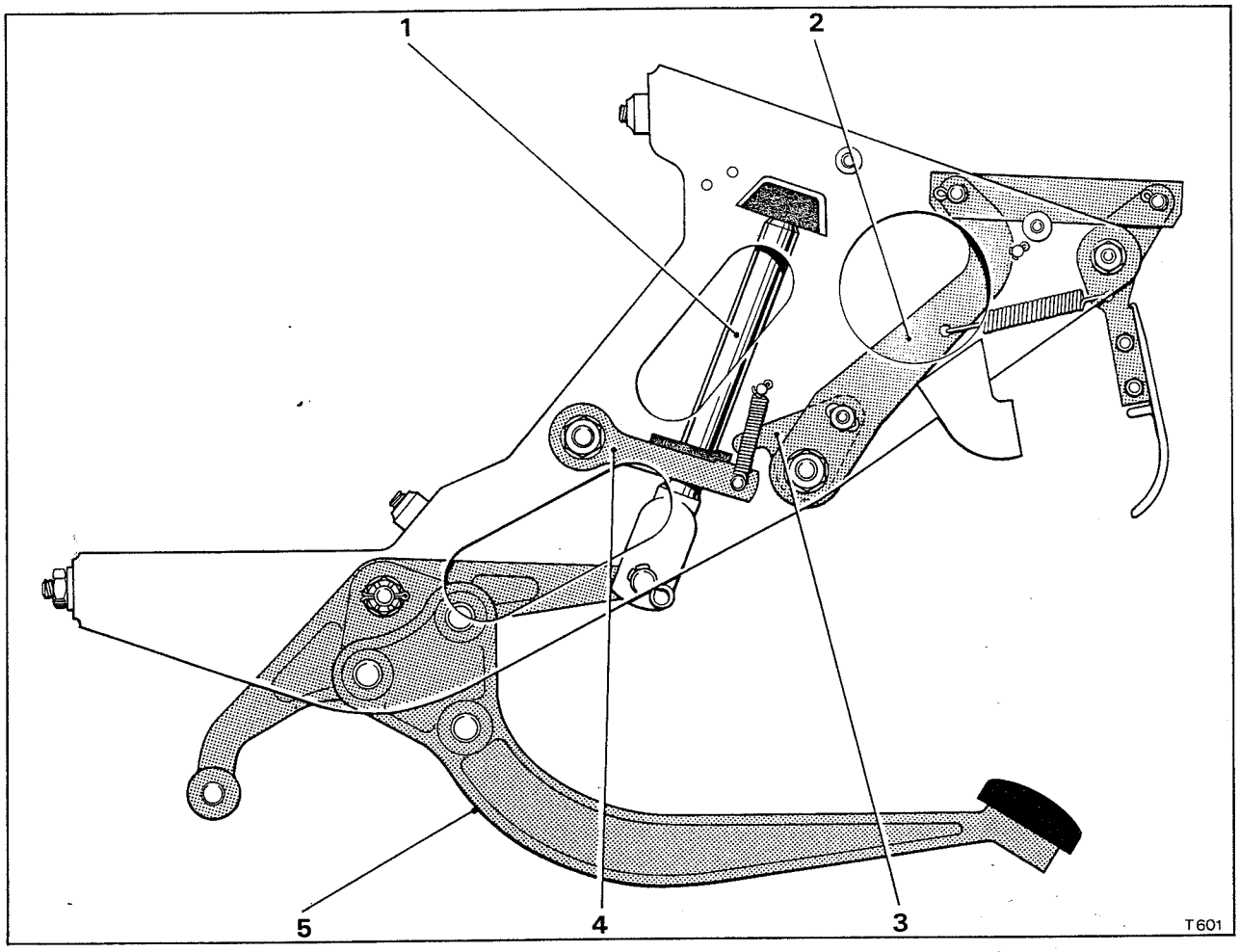

Fig. G44 Foot operated parking brake components

1 Sprag rod
2 Intermediate lever
3 Actuator
4 Sprag plate
5 Foot pedal

behind the exhaust pipe heatshield and remove it from the car.

Parking brake front cable - To fit
Right-hand drive cars

Fit the parking brake front cable by reversing the procedure given for removal noting the following points.

1. All setscrews and nuts should be torque tightened in accordance with the figures quoted in Chapter P.
2. Lubricate the guide pulley pivots with Molytone 265 grease and the pulley grooves with Midland Silicones MS44 grease.

Note

Use of any other grease on the pulley grooves could have a harmful effect on the inner cable low friction coating.

3. Ensure that the guide pulley cable retainers are correctly located in the pulley mounting brackets.
4. Check for freedom of movement during the application and release of the parking brake. The parking brake should operate freely without roughness or binding throughout its operation.
5. Adjust the parking brake cables and calipers as described under Parking brake cables and calipers - To adjust.

Parking brake front cable - To remove
Left-hand drive cars

1. Carry out Operations 1 and 2 of Foot operated parking brake mechanism - To remove.
2. Disconnect the front end of the brake cable from the retaining piece on the actuation lever of the foot pedal mechanism.
3. Remove the circlip retaining the outer cable to the car floor below the foot pedal mechanism. Withdraw the front end of the brake cable from the car floor; collect the washer and rubber seal.
4. Disconnect the rear end of the outer cable from the support bracket on the centre crossmember of the body.
5. Disconnect the clip securing the cable to the bracket on the transmission sump. Remove the brake cable from the car.

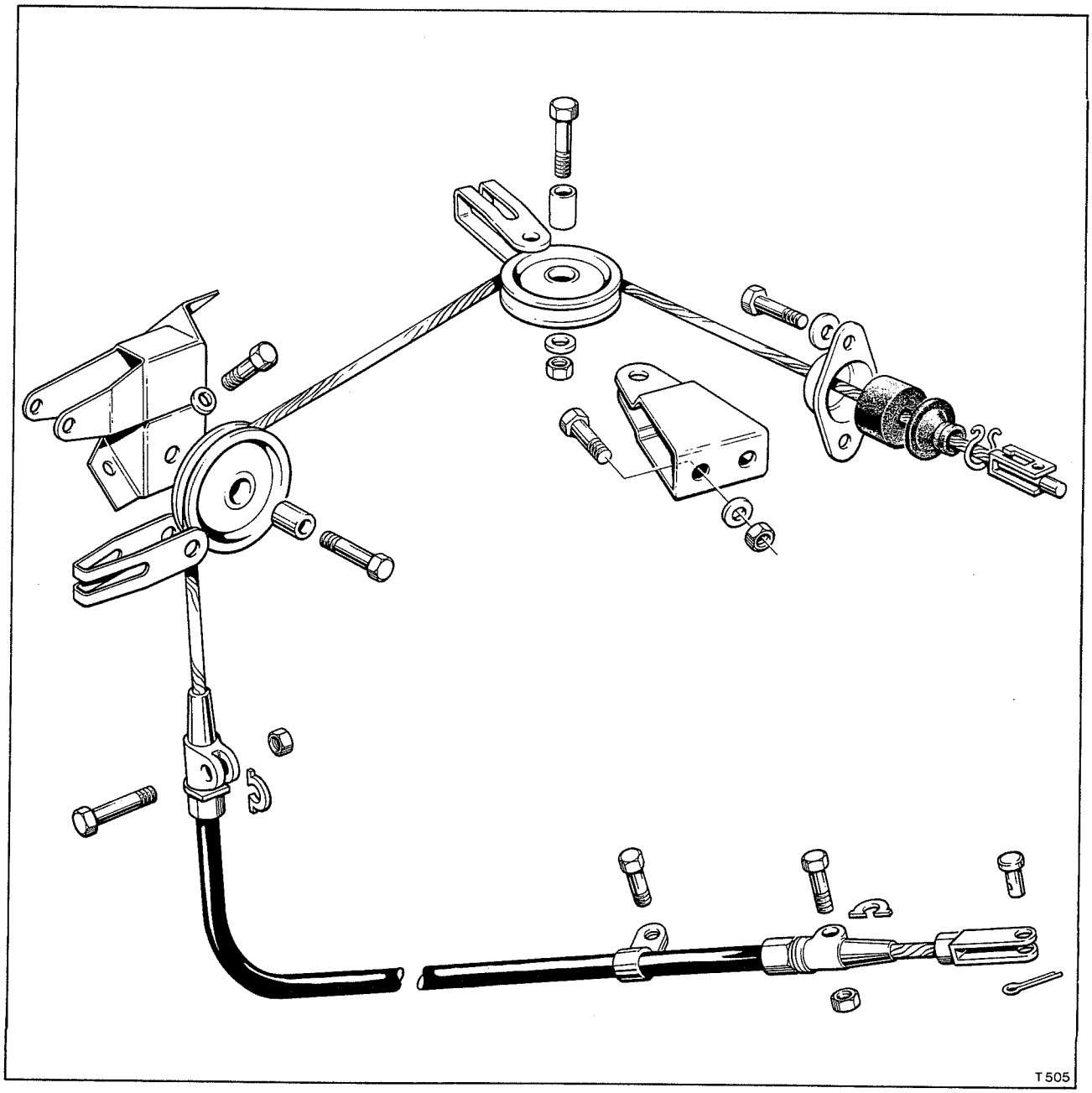

Fig. G45 Parking brake front cable and pulleys (Right-hand drive cars)

Parking brake front cable - To fit
Left-hand drive cars
Fit the front cable by reversing the procedure given for removal noting the following points.
1. All setscrews and nuts should be torque tightened in accordance with the figures quoted in Chapter P.
2. Lubricate the clevis pin with Molytone 265 grease prior to fitting.
3. Check for freedom of operation during the application and release of the parking brake. The parking brake should operate freely without roughness or binding throughout its operation.
4. Adjust the parking brake cables and calipers (see Parking brake cables and calipers - To adjust).

Parking brake rear cables - To remove
Although the parking brake intermediate linkages, situated on the centre body crossmember are different for right-hand and left-hand drive cars, the rear brake cable arrangements are identical.
1. Disconnect the rear cables at the equaliser fitted to the intermediate linkage on the centre body crossmember.
2. Disconnect the rear end of each cable from the parking brake caliper mechanism.
3. Remove the two centre bolts from the abutment bracket at the front end of the cables; collect the top clamping plate.
4. Disconnect the cable support clips from each cable; remove the cables from the car.

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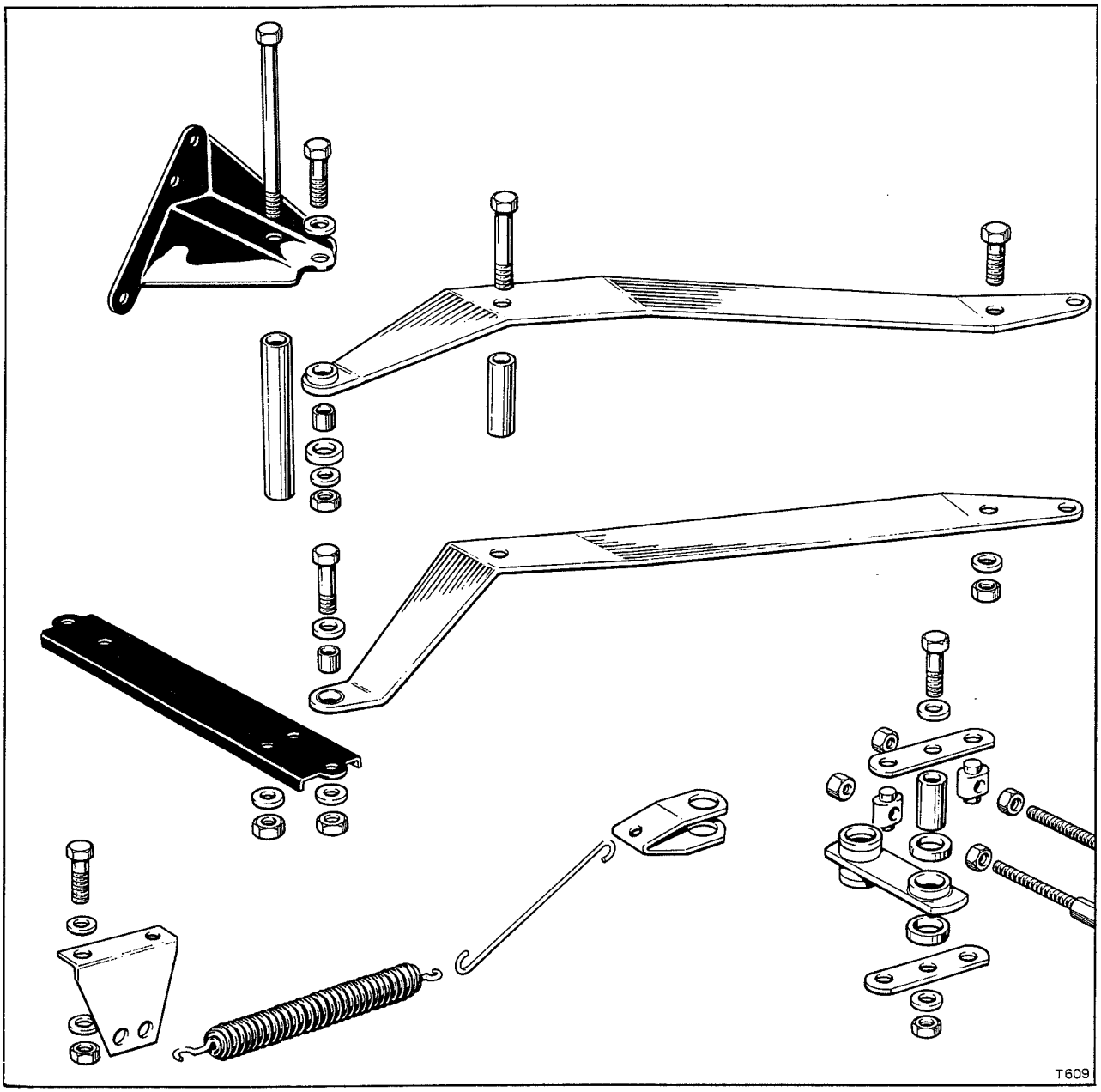

Fig. G46 Parking brake intermediate linkage (Right-hand drive cars)

Parking brake rear cables - To fit

Fit the parking brake rear cables by reversing the procedure given for removal noting the following points.

1. All setscrews and nuts should be torque tightened in accordance with the figures quoted in Chapter P.
2. Lubricate the clevis pins and cable adjustment threads with Molytone 265 grease prior to fitting.
3. Check for freedom of operation during the application and release of the parking brake. The parking brake should operate freely without roughness or binding throughout its operation.
4. Ensure that the cables are held correctly by the cable support clips. The front clip on each cable can be adjusted on elongated holes and should hold the cable firmly in position, whilst the clips on the trailing arms should allow the nylon covered section of the cable to slide freely through them.
5. Adjust the cables as described under Parking brake cables and calipers - To adjust.

Parking brake cables and calipers - To adjust

Before any adjustments are made to the parking brake rear cables the calipers on each rear wheel should be set as follows

1. Remove the clevis pin connecting the brake cable to the caliper lever. The position of the clevis

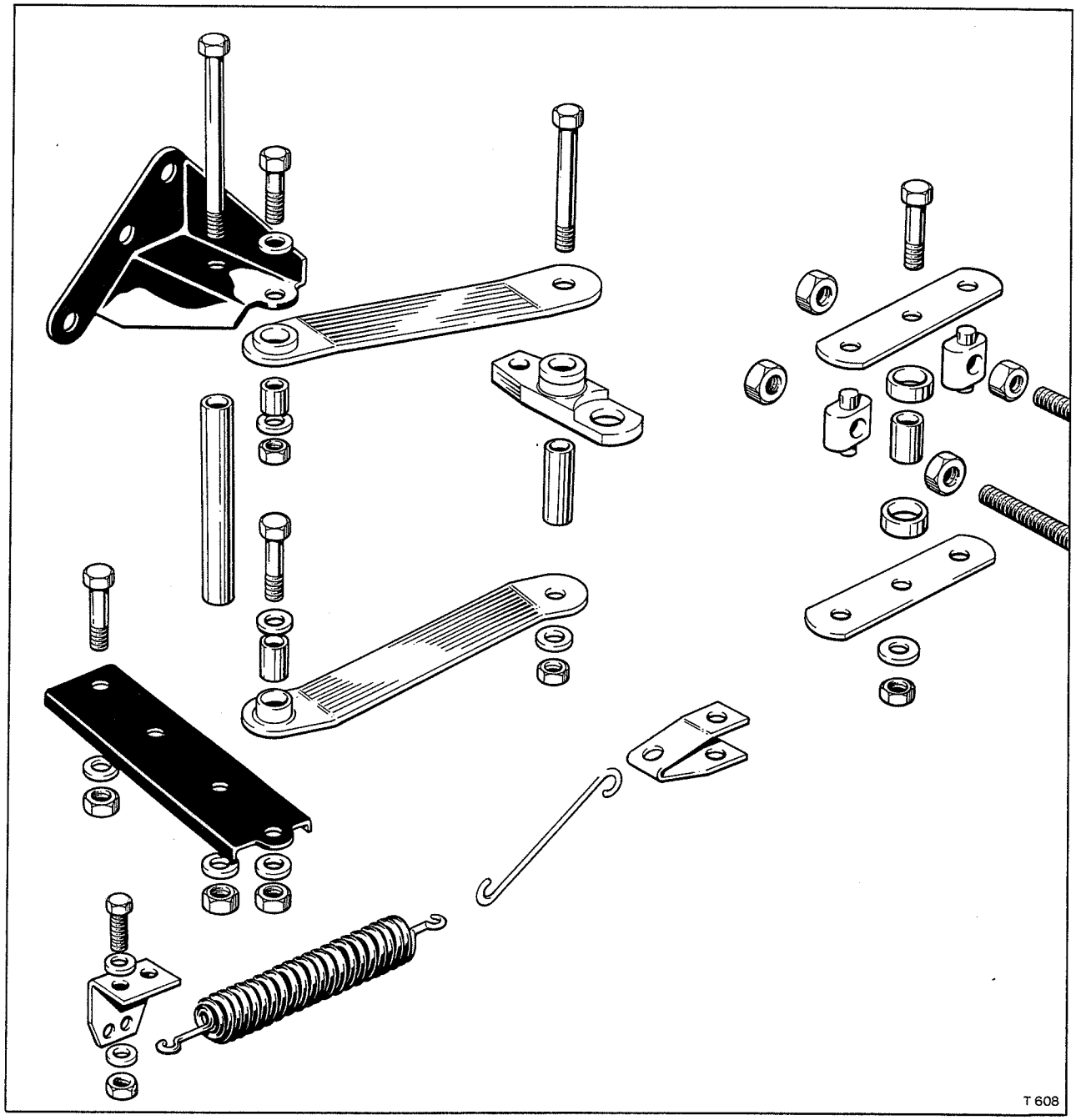

Fig. G47 Parking brake intermediate linkage (Left-hand drive cars)

pin hole in the lever must be set by correctly positioning the washers situated on the lower rear hub mounting bolts (see Fig. G38). Five washers must always be fitted to each bolt. One washer must always be fitted beneath the bolt head; the remaining four should be fitted either between the pivot bracket and trailing arm or directly below the bolt head, depending on the adjustment required. The adjustment is correct when there is a clearance of approximately 4,80 mm. (0.187 in.) between the washer on the spring guide rod and the spring abutment bracket with the caliper in the fully 'off' position.

2. Connect the rear brake cable to the caliper lever.
3. Ensure that the parking brake is in the fully 'off' position. Adjust the rear cables at the equaliser on the intermediate linkage until the caliper 'off stops' are just clear of the caliper. Measure the gap beneath each 'off stop' and lengthen the cables at the adjusters by this amount.

Note
The cables must be adjusted so that the equaliser transverse link, lies at right angles to the centre line of the car with the parking brake in the 'off' position.

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4. Raise each rear wheel in turn so that it is free to rotate. Turn the caliper adjuster clockwise until the parking brake pads grip the brake disc. At this point it should only just be possible to rotate the wheel by hand. Turn the adjuster anti-clockwise a quarter turn (three clicks on the nut) to obtain minimum clearance between the pads and disc.
5. Ensure that the centralising straps are forcing the pads away from the disc when the handbrake is in the 'off' position. If not, remove the retaining bolt securing the straps; bend the straps outwards then re-assemble.
6. When new brake pads have been fitted carry out the pad bedding operation as described under Parking brake pads - To 'bed-in'.

Parking brake pads - To renew (see Fig. G49)
The parking brake pads should be inspected at the recommended intervals (see Service Schedule Manual publication T.S.D. 4117). The pads must be renewed when the friction material has worn to within 3,18 mm. (0.125 in.) of the pad back plates.
1. Securely chock the front wheels.
2. Raise the rear of the car and place sill blocks under the rear end of the body sills. Support the trailing arms; do not allow the suspension rebound straps to support the full suspension load.
3. Remove the rear wheel trims and the rear wheels.
4. Release the parking brake to the 'off' position.
5. Disconnect the twin links from the caliper lever. Collect the waved washer.
6. Unscrew and remove the caliper adjuster. Collect the adjuster clicker plate.
7. Unhook the pad retention springs from each brake pad; noting that the larger spring is fitted to the inner parking brake pad.
8. Lift out the parking brake pads from the caliper and remove the retention springs.
9. Fit the springs to the new pads, then locate the pads in position. Hook the springs onto the caliper levers.
10. Complete the assembly by reversing the removal procedure and adjusting the calipers and cables as described under Parking brake cables and calipers - To adjust.

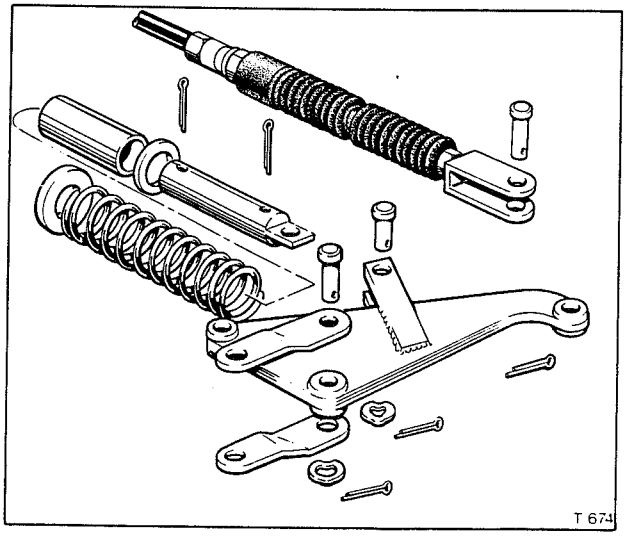

Fig. G48 Operating lever and guide rod - Parking brake caliper

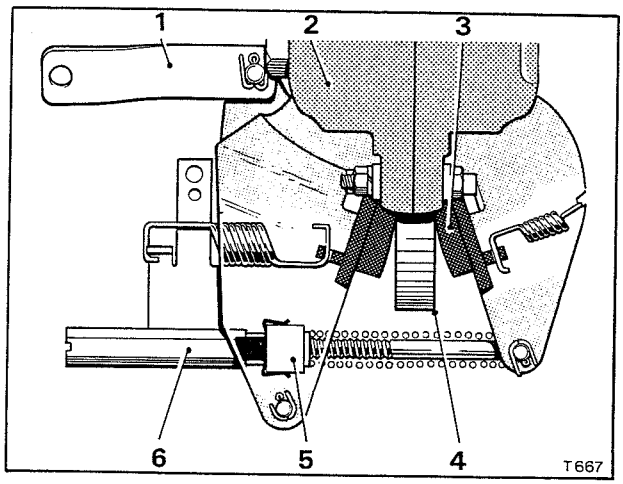

Fig. G49 Parking brake caliper
1 Twin connecting links
2 Rear brake caliper
3 Parking brake pads
4 Brake disc
5 Adjuster clicker block
6 Adjuster

Parking brake pads - To 'bed-in'
When new parking brake pads are fitted to the car the following 'bedding-in' procedure should be carried out.
1. Drive the car at 48 k.p.h. (30 m.p.h.) and apply the parking brake to bring the car to rest. The parking brake should be applied in such a way that the retardation of the car is constant without locking the wheels. This operation should be carried out nine times, allowing at least one minute to elapse between applications to prevent overheating.
2. Re-adjust the parking brake calipers as described under Parking brake cables and calipers - To adjust.

Section G17

Brake and height control hydraulic systems

Systematic check sequence chart

Facia warning lamps 1 BRAKE PRESSURE and/or 2 BRAKE PRESSURE illuminated (Intermittently or continuously)

Sheet 1 of 2

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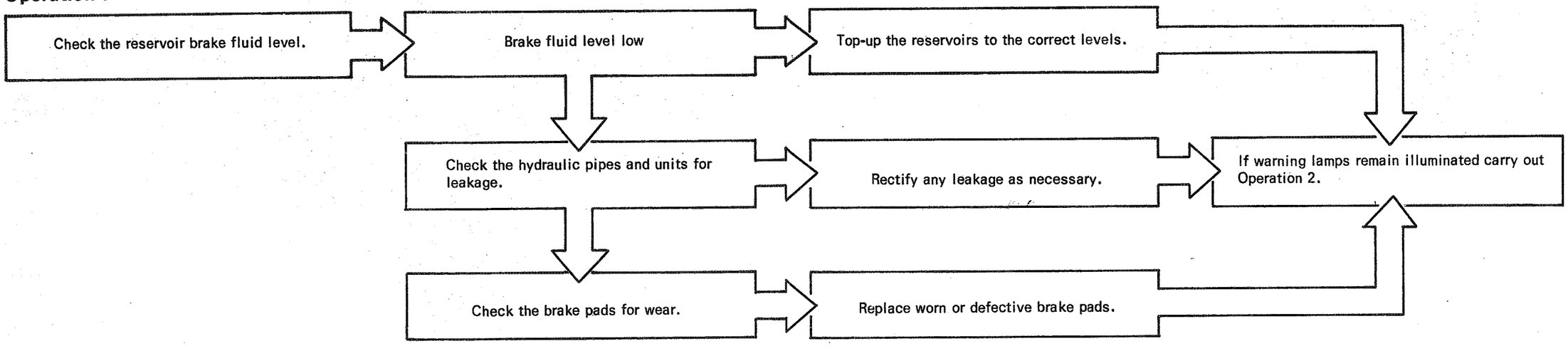
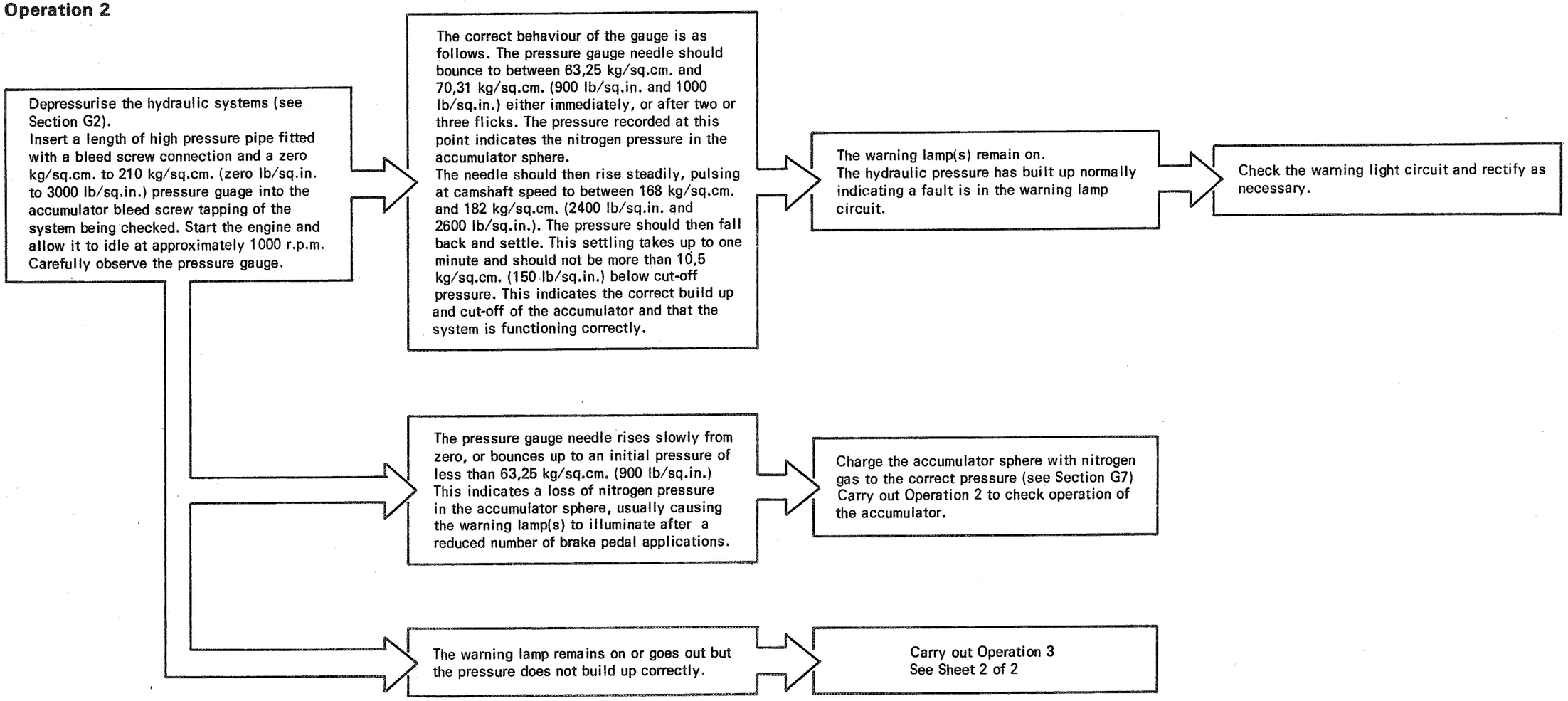
Operation 1



Operation 2



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Operation 3

Depressurise the systems. Remove the pressure gauge and pipe from the bleed screw tapping and insert it into the accumulator pressure outlet after first removing the flexible pipe. Refit the bleed screw.
Start the engine and observe the pressure gauge.
This action separates the accumulator from the rest of the system and allows the accumulator and hydraulic pump to be checked thoroughly.

- Pressure does not build up at all.
  This indicates that the hydraulic pump is not functioning correctly because either the pump is air locked or there is dirt under the pump main delivery valve seat.
  - Stop the engine.
    Connect a bleed tube to the bleed screw on the accumulator. Open the bleed screw. Run the engine to see if brake fluid flows from the bleed tube.
    - Brake fluid does not flow.
      Check that the hydraulic pump is not air locked.
      Brake fluid flows.
      Close the bleed screw and check again. If pressure still does not build up the pump is faulty.
      Overhaul the hydraulic pump (see Section G6).
      Bleed and re-test the system.
- Pressure builds up to between 21,1 kg/sq.cm. and 84,4 kg/sq.cm. (300 lb/sq.in. and 1200 lb/sq.in.) but will not increase further.
  - Stop the engine.
    Remove the accumulator to reservoir return hose from the accumulator stub pipe; blank off the hose to prevent the reservoir from draining. Connect a bleed pipe to the accumulator stub pipe. Run the engine and check for brake fluid flow from the bleed pipe.
    - Brake fluid flows before the pressure has built up to between 168 kg/sq.cm. and 182 kg/sq.cm. (2400 lb/sq.in. and 2600 lb/sq.in.
      The main charging valve is faulty or an internal leak is occuring.
      Overhaul the accumulator valve assembly as described in Section G7.
      Bleed and re-test the system.
    - Brake fluid does not flow and pressure does not build up.
      Overhaul the accumulator valve and check cut-off valve setting as described in Section G7.
      Bleed and re-test the system.
- Pressure builds up and cuts off correctly.
  - Carry out Operation 4.

Operation 4

De-pressurise the system and refit the pressure gauge into the bleed valve tapping. Reconnect the pressure outlet flexible pipe and confirm fault exists as at Operation 3.

- Blank off the feed to the relevant distribution valve.
  Carry out Operation 2.
  - If pressure now builds up normally overhaul the distribution valve as described in Section G9.
    Bleed and re-test the system.

Operation 5

Only applicable when warning lamp marked 2 BRAKE PRESSURE is illuminated.
Blank off in turn the feed (orange pipe) to each of the following units in turn. 1. Right-hand height control valve. 2. Left-hand height control valve. 3. Solenoid valve.
After blanking off each valve, run the engine and observe the gauge. If the pressure is normal after blanking off one of the valves that valve is faulty.
The main valve in the height control valves can leak and allow fluid to flow back to the reservoir thus preventing pressure build up.
By blanking off individual valves the faulty valve can be isolated from the system.

- Pressure not available by blanking off the height control valves.
  - Blank off the lower brake distribution valve feed.
    If pressure is corrected. Overhaul the distribution valve.
    Bleed and re-test the system.
- Pressure available after blanking off the height control valves.
  - Flush clean the height control valve by holding the valve wide open and fast running the engine.
    If the fault still exists overhaul the faulty valve as described in Section G12.
    Bleed and re-test the system.

Section G17

Brake and height control hydraulic systems

Systematic check sequence chart

Facia warning lamps 1 BRAKE PRESSURE and/or 2 BRAKE PRESSURE illuminated (Intermittently or continuously)

Sheet 2 of 2

Hydraulic system colour coding and component location

Left-hand drive cars

Figure G2

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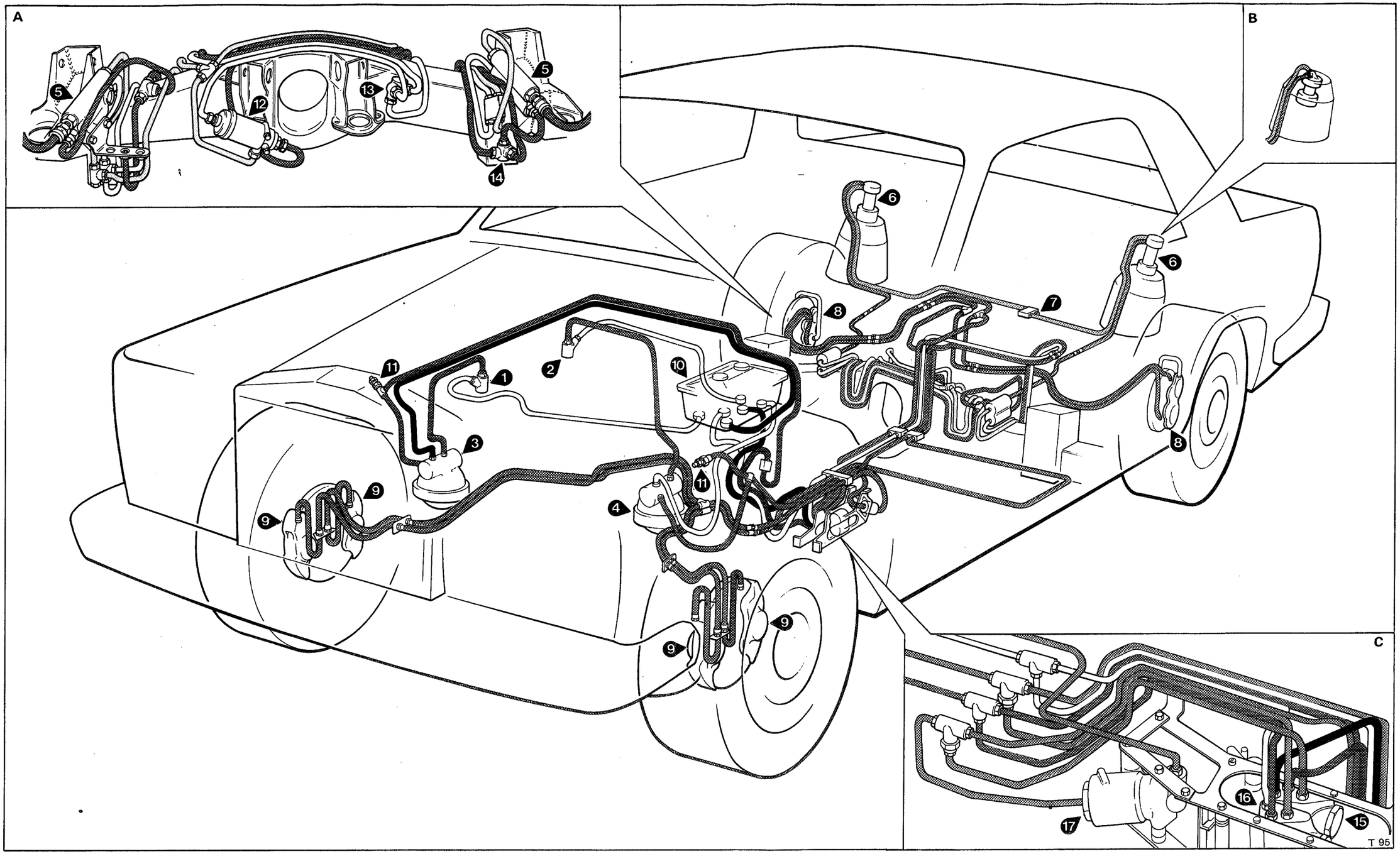

Fig. G2 Hydraulic system colour coding and component location (Left-hand drive cars)

1 Hydraulic pump (No. 1 system)
2 Hydraulic pump (No. 2 system)
3 Hydraulic accumulator (No. 1 system)
4 Hydraulic accumulator (No. 2 system)
5 Height control valves
6 Height control rams
7 Height control ram bleed screws
8 Four cylinder disc brake caliper
9 Twin cylinder disc brake caliper
10 Hydraulic fluid reservoirs
11 Pressure switches
12 Solenoid valve
13 Low pressure line restrictor
14 High pressure line restrictor
15 Distribution valve (No. 1 system)
16 Distribution valve (No. 2 system)
17 Deceleration conscious pressure limiting valve
A Rear sub frame rear view
B Height control ram connections – Corniche Convertible cars
C Distribution valve port connections

Hydraulic system colour coding and component location

Right-hand drive cars

Figure G1

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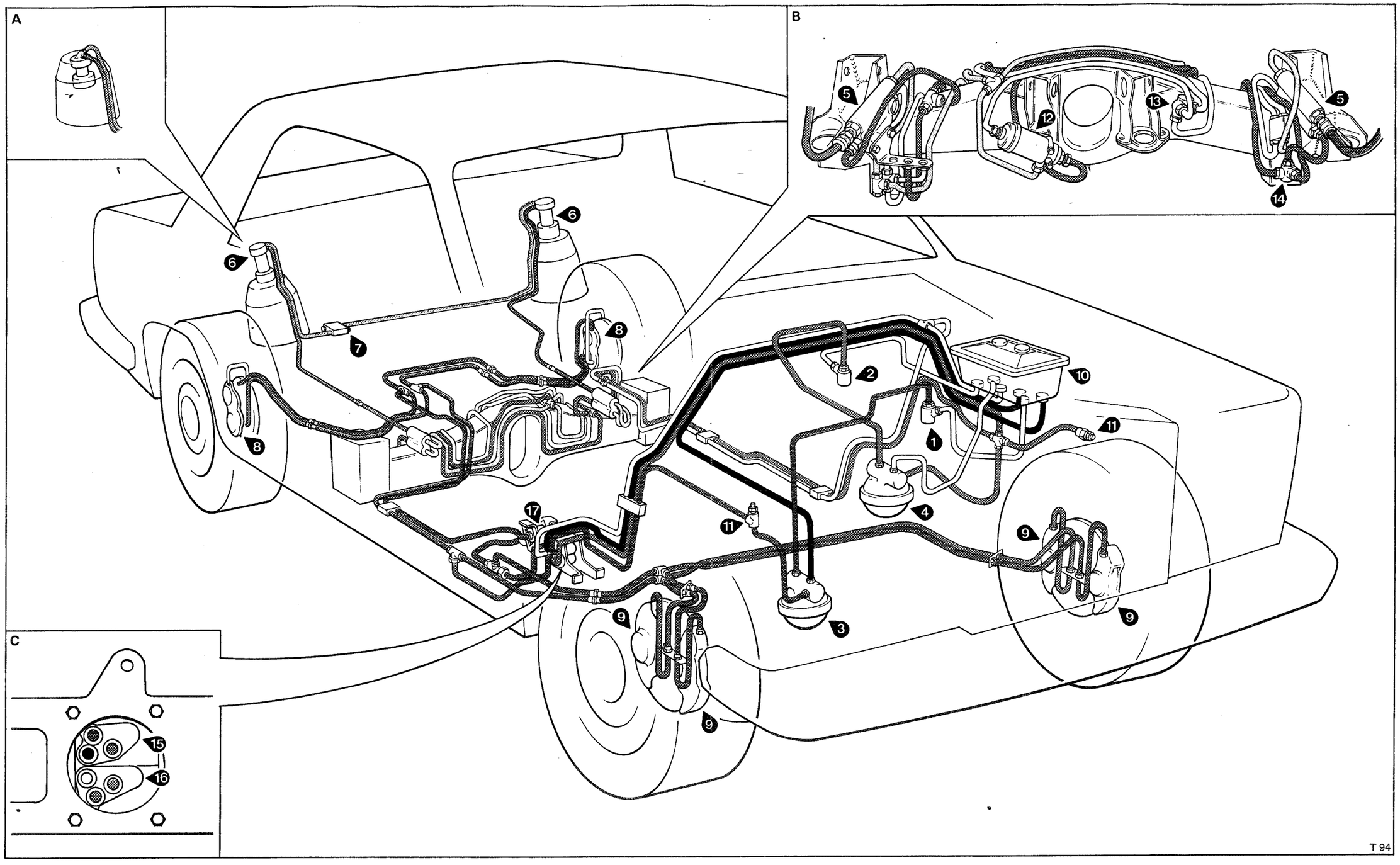

Fig. G1 Hydraulic system colour coding and component location (Right-hand drive cars)

1 Hydraulic pump (No. 1 system)
2 Hydraulic pump (No. 2 system)
3 Hydraulic accumulator (No. 1 system)
4 Hydraulic accumulator (No. 2 system)
5 Height control valves
6 Height control rams
7 Height control ram bleed screws
8 Four cylinder disc brake caliper
9 Twin cylinder disc brake caliper
10 Hydraulic fluid reservoirs
11 Pressure switches
12 Solenoid valve
13 Low pressure line restrictor
14 High pressure line restrictor
15 Distribution valve (No. 1 system)
16 Distribution valve (No. 2 system)
17 Deceleration conscious pressure limiting valve
A Height control ram connections – Corniche Convertible cars
B Rear sub frame rear view
C Distribution valve ports