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.

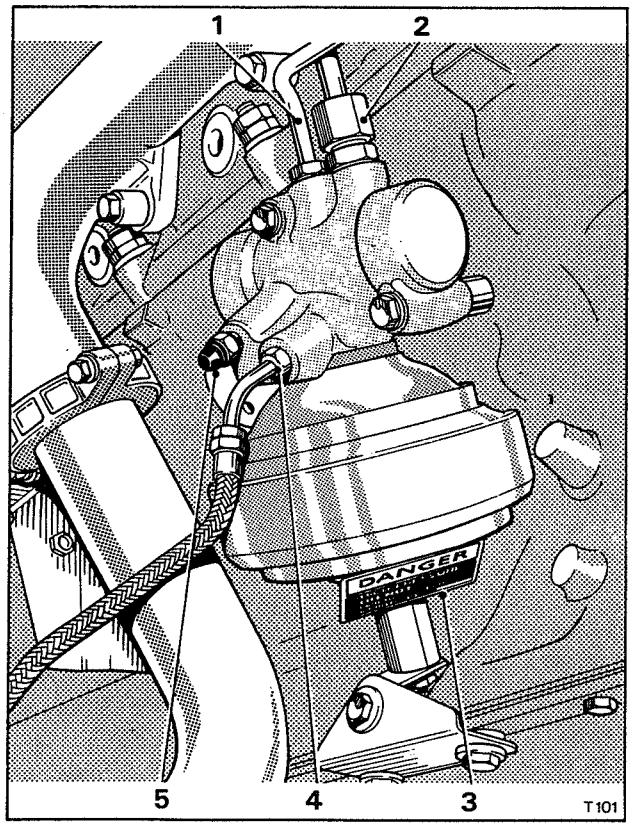

Fig. G10 Front hydraulic accumulator

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.

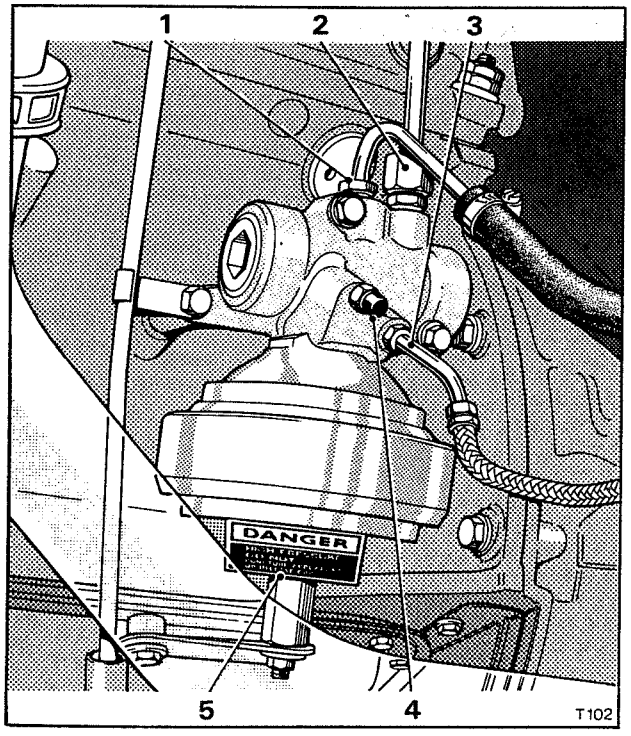

Fig. G11 Rear hydraulic accumulator
1 Low pressure return to reservoir
2 High pressure inlet from pump
3 High pressure outlet to lower distribution valve and levelling valves
4 Bleed screw
5 Warning plate

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

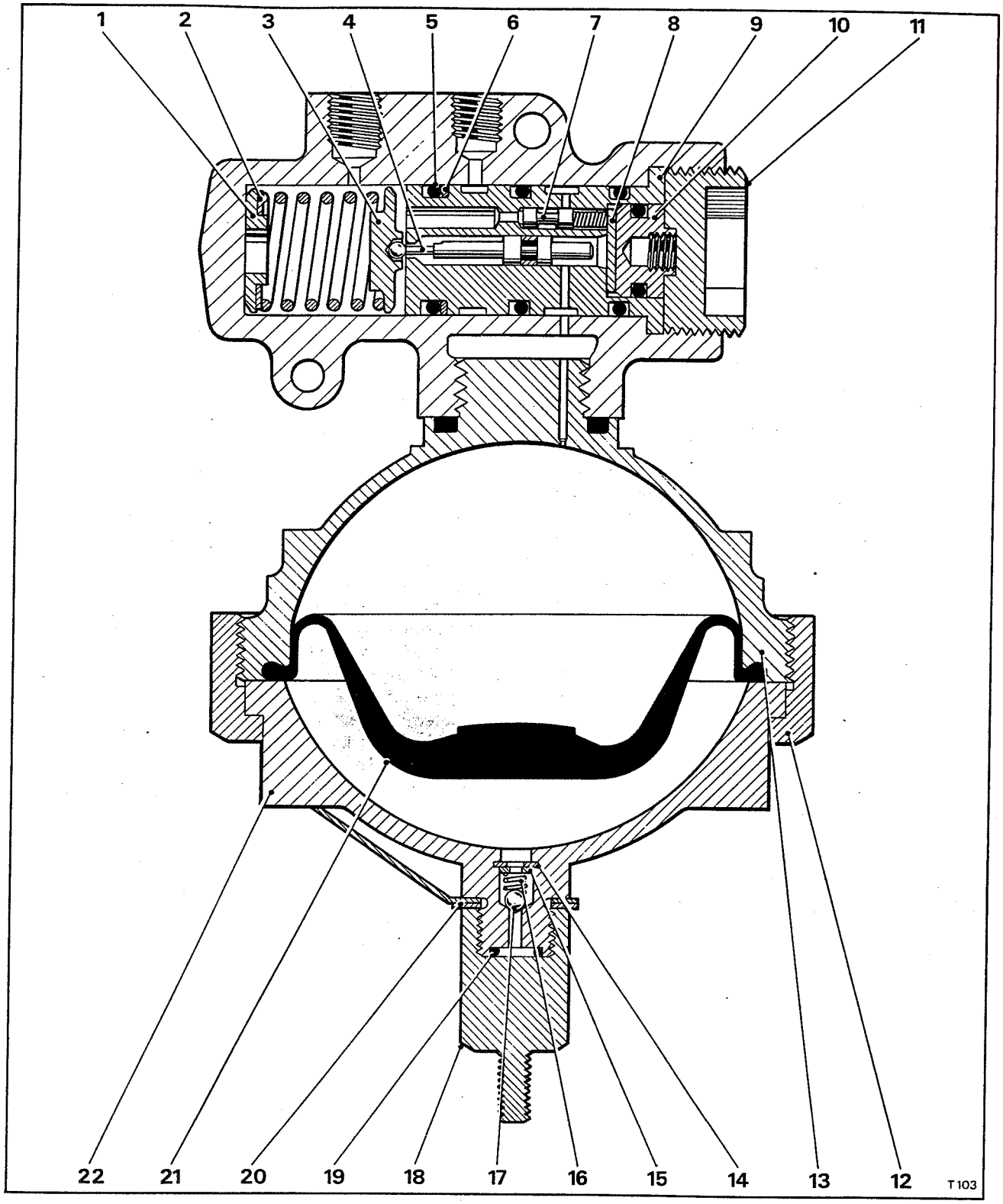

Fig. G12 Hydraulic accumulator

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.