Bleeding the hydraulic systems

WARNING

Do not use equipment that has been used on cars utilizing synthetic brake fluid i.e. RR363, when carrying out bleeding operations on cars using hydraulic system mineral oil (LHM). Failure to observe this warning will result in contamination of the hydraulic systems, necessitating extensive and expensive rectification.

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 recirculatory and therefore, if air is allowed to enter them at any point it will reduce the efficiency.

Bleed screws are provided on the side of the accumulators, on the brake calipers, on the suspension struts, and on the deceleration conscious pressure limiting valve.

On 1989 model year cars, bleed screws are also incorporated at the pressure switches.

The accumulator bleed screws are an integral part of the valve housing and do not require the connection of a bleed pipe during the bleeding operation. The bleed screw for the suspension struts is situated on the right-hand sill forward of the rear road spring.

The accumulators are situated on the front right-hand ('A' bank) side of the engine except for the Bentley Turbo R, where the accumulators are mounted on the left-hand ('B' bank) side of the engine (see fig. G5-2). The accumulator for the number one system is vertically mounted and the number two system accumulator horizontally mounted.

The two hydraulic system mineral oil reservoirs are situated on the left-hand side of the engine compartment.

Anti-lock braking systems

The inboard hydraulic reservoir supplies hydraulic system mineral oil for the number one system. From the reservoir, mineral oil is supplied to the front brake pump, which in turn supplies hydraulic system mineral oil under pressure to the vertically mounted accumulator, upper distribution valve, and the rear brakes and levelling.

The outboard reservoir supplies hydraulic system mineral oil for the number two system. From the reservoir, mineral oil is supplied to the rear brake pump which in turn supplies hydraulic system mineral oil under pressure to the horizontally mounted accumulator, the lower distribution valve, and front brakes.

Non anti-lock braking systems

The inboard hydraulic reservoir supplies hydraulic system mineral oil for the number one system. From the reservoir, mineral oil is supplied to the front brake pump, which in turn supplies hydraulic system mineral oil under pressure to the vertically mounted accumulator, the upper distribution valve, the front brake calipers on the front wheels, the upper cylinders of the rear brake calipers, and the rear suspension struts.

The outboard reservoir supplies hydraulic system mineral oil for the number two system. From the reservoir, mineral oil is supplied to the rear brake pump which in turn supplies hydraulic system mineral oil under pressure to the horizontally mounted accumulator, the lower distribution valve, the rear brake calipers on the front wheels and the lower cylinders of the rear brake calipers.

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

However, 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 calipers in the faulty circuit.

Whenever in doubt it is advisable to bleed the complete system.

The power brake circuits should be bled at low pressure, ensuring that the systems are depressurized and the mineral oil levels in the reservoirs are kept up to the black line on the sight glass, at all stages of the bleeding operation.

To obtain low pressure bleeding of the system(s), depress the brake pedal and open the relevant bleed screw before starting the engine and running it at 1000 rev/min. This ensures the accumulator remains at low pressure. Throughout the bleeding operation, the brake pressure warning panels should be illuminated (see Section G2). Only when bleeding the suspension struts should the systems be fully pressurized and the warning panel lamps extinguished.

When bleeding the suspension struts, the interior of the car should be weighted to compress the suspension sufficiently for the levelling valve to actuate, thus allowing pressurized mineral oil to flow to the suspension struts and bleed screw. The engine should be allowed to run for four minutes prior to bleeding, to ensure the systems are fully charged. Bleed the suspension struts until all the bubbles have been expelled then allow fifteen seconds to elapse before fully tightening the bleed screw.

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. However, as previously stated, each system can be bled separately at all points downstream of any replacements or pipe disconnections (refer to Sectional bleed requirements). However, if any doubt exists, it is advisable to bleed the complete system concerned.

Whilst bleeding is being carried out, it is essential that the mineral oil level in the two reservoirs is kept to the black line on the level indicator sight glass, using clean hydraulic system mineral oil. Reference should be made to Chapter D for approved types.

All bleed screws should be torque tightened in accordance with the figures quoted in Section G22.

When bleeding the hydraulic systems ensure that only equipment suitable for hydraulic system mineral oil is used. See **Warning** on page G5-1.

Anti-lock braking systems (see figs. G5-1 and G5-2) Attach a length of bleed tube to each bleed screw prior to the bleed screw being opened. Immerse the free end of the tube in approximately 25 mm (1 in) of hydraulic system mineral oil contained in a clean bottle.

Bleed tube attachment is not necessary when bleeding the accumulators, as bleeding is effected internally through the accumulator valve housing, the mineral oil being allowed to flow back to its respective reservoir when the bleed screw is released approximately one revolution (see Section G9).

With the gear selector in the park position and the parking brake applied the following sequence of operations should be carried out, after first noting the following.

System 1 bleed points are A, C, F, H, G, I, and J (plus L for 1989 model year cars).

System 2 bleed points are B, D, and E (plus K for 1989 model year cars).

When bleeding the suspension struts extra care should be taken when slackening the bleed screw as the system will be operating at full pressure.

Any hydraulic system mineral oil that has been spilt onto the tyres must be removed. The use of a soap solution and a final rinse with clean water is recommended for this purpose.

Under no circumstances should hydraulic system

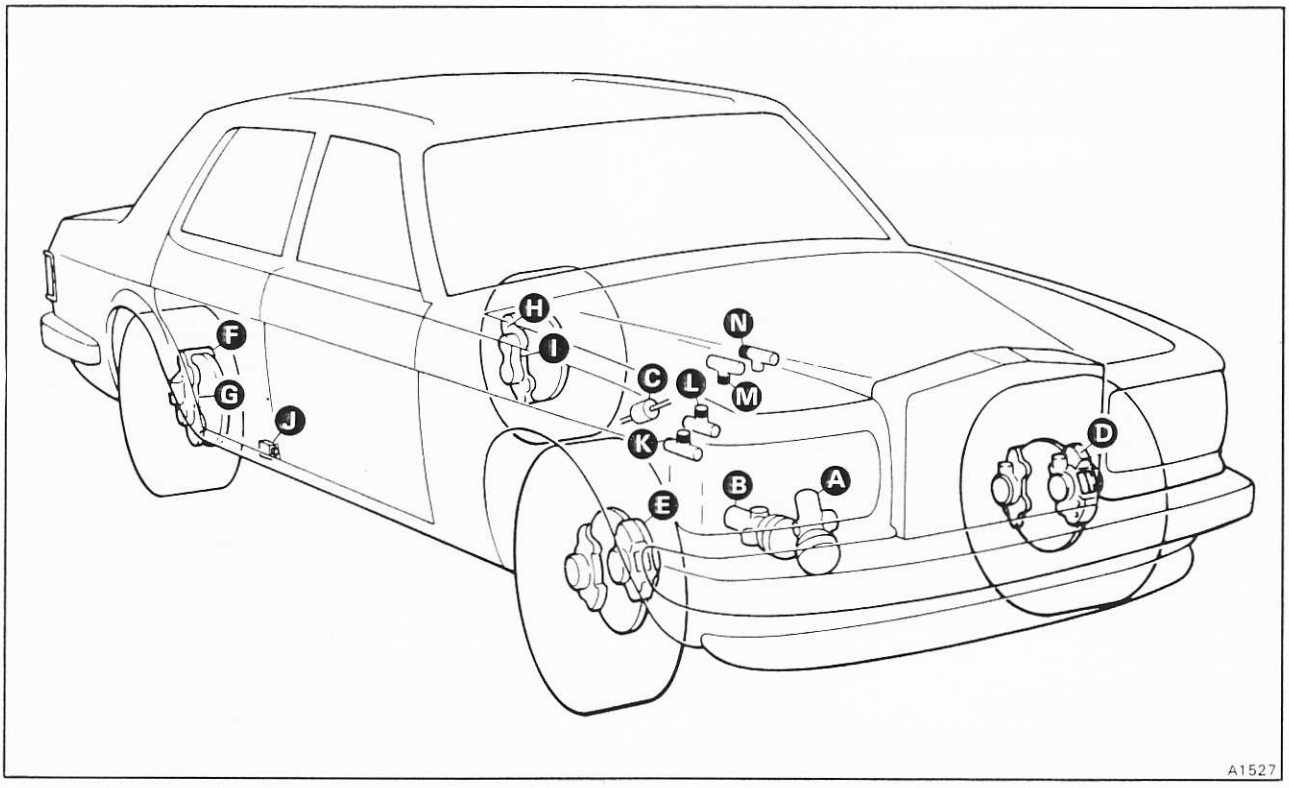

Fig. G5-1 Anti-lock braking system bleed points and accumulator test service points (Non-turbocharged cars)

- A Accumulator (No. 1 system)
- B Accumulator (No. 2 system)
- C Deceleration conscious pressure limiting valve
- D Front caliper left-hand front wheel
- E Front caliper right-hand front wheel
- F Right-hand rear caliper (upper cylinder)
- G Right-hand rear caliper (lower cylinder)
- H Left-hand rear caliper (upper cylinder)
- I Left-hand rear caliper (lower cylinder)
- J Rear suspension struts (right-hand side inner sill forward of rear road spring)
- K High pressure (pressure switch) (orange line No. 2 system)
- L High pressure (pressure switch) (red line No. 1 system)
- M High pressure (red line No. 1 system) right-hand drive cars
- N High pressure (orange line No. 2 system) left-hand drive cars

mineral oil be allowed to remain on the tyres for prolonged periods as this will cause tyre damage.

1. Remove fuse A6 from fuse panel F2 on the main fuseboard.
2. Depressurize the hydraulic systems as described in Section G3. Complete depressurization of the suspension struts is not necessary.
3. Open the accumulator bleed screws, points A and B.
4. Start and run the engine at 1500 rev/min for one minute. Ensure that the facia warning panels are illuminated (see Section G2).
5. Switch off the engine.
6. Close the accumulator bleed screws, points A and B.
7. Open the bleed screws at points C, D, and E (plus K and L for 1989 model year cars).
8. Depress the footbrake pedal.
9. Start and run the engine at 1000 rev/min.
10. Allow points C, D, and E (plus K and L, if applicable) to bleed until air free.
11. Open bleed screws F and G, allow bleeding to start.
12. Close the bleed screws at points C, D, and E (plus K and L, if applicable).
13. Bleed at points F and G until air free.
14. Open bleed screws at points H and I, allow bleeding to start. Close the bleed screws at points F and G.
15. Bleed at points H and I until air free.
16. Close the bleed screws at points H and I.
17. Release the footbrake pedal.
18. Add weight to the rear of the car to actuate the levelling valve.
19. Allow the systems to pressurize (facia warning panels extinguished).
20. Open the bleed screw at point J, bleed until air free.
21. Close the bleed screw at point J.
22. Check the hydraulic system mineral oil levels in the reservoirs and top-up as necessary.
23. Switch off the engine.
24. Fit a rubber dust cover to each bleed screw, and replace the fuse in the fuseboard.

Sectional bleed requirements

Red pipe line (No. 1 system)

Any pipe disturbed between the inboard hydraulic

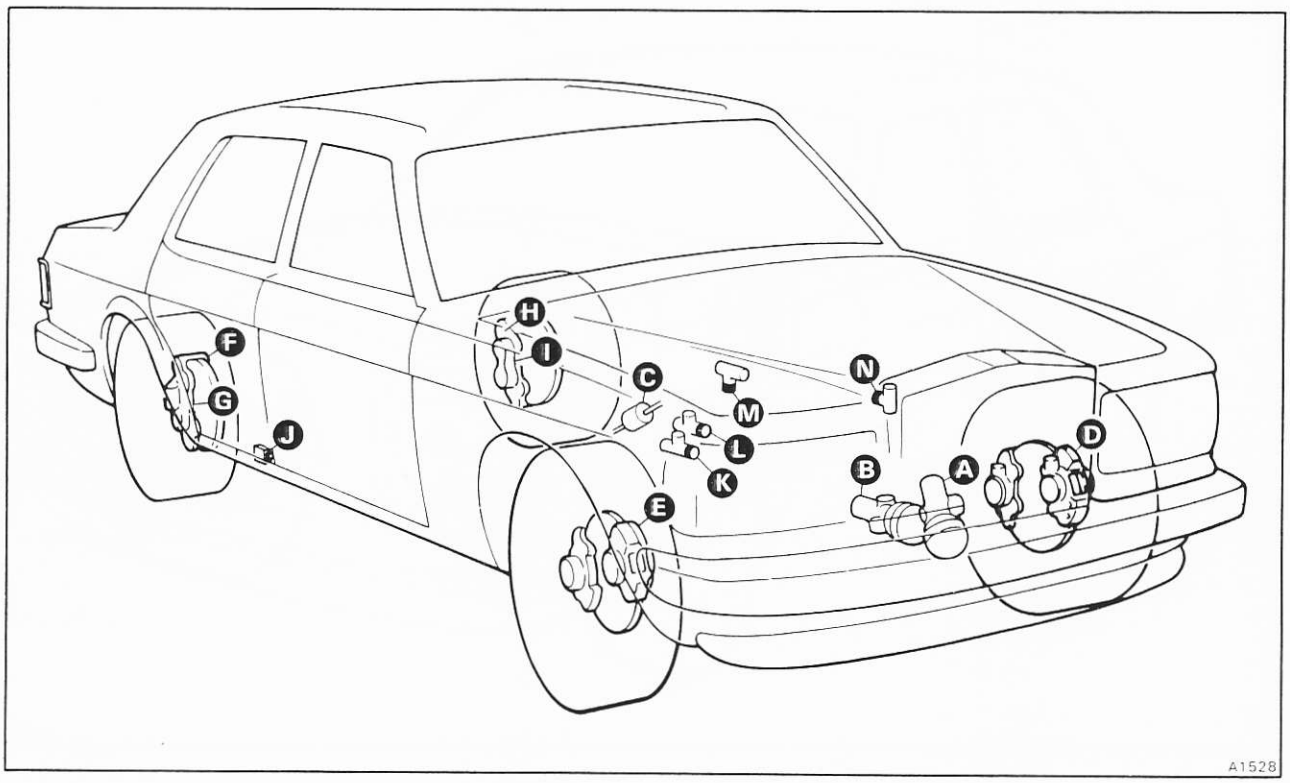

Fig. G5-2 Anti-lock braking system bleed points and accumulator test service points (Turbocharged cars)

- A Accumulator (No. 1 system)
- B Accumulator (No. 2 system)
- C Deceleration conscious pressure limiting valve
- D Front caliper left-hand front wheel
- E Front caliper right-hand front wheel
- F Right-hand rear caliper (upper cylinder)
- G Right-hand rear caliper (lower cylinder)
- H Left-hand rear caliper (upper cylinder)
- I Left-hand rear caliper (lower cylinder)
- J Rear suspension struts (right-hand side inner sill forward of rear road spring)
- K High pressure (pressure switch) (orange line No. 2 system)
- L High pressure (pressure switch) (red line No. 1 system)
- M High pressure (red line No. 1 system) right-hand drive cars
- N High pressure (orange line No. 2 system) right-hand drive cars

reservoir, front hydraulic pump, accumulator (vertically mounted), upper distribution valve, and rear suspension struts.

Bleed the complete system i.e. accumulator, deceleration conscious pressure limiting valve, the upper cylinders on the rear wheel calipers, and the rear suspension struts.

Orange pipe line (No. 2 system)
Any pipe disturbed between the outboard hydraulic reservoir, rear hydraulic pump, accumulator (horizontally mounted), and lower distribution valve.

Bleed the complete system i.e. accumulator and the front brake calipers.

Blue pipe line (No. 1 system)
Any pipe disturbed between the upper brake distribution valve, modulator, and the rear wheel calipers.

Bleed the deceleration conscious pressure limiting valve, and all the cylinders on the rear wheel calipers.

Mauve pipe line (No. 2 system)
Any pipe disturbed between the lower brake distribution valve, modulator, and front brakes.

Bleed the front brake calipers.

Checking the levels in the hydraulic reservoirs
After bleeding, the following procedure should be used when checking the levels in the hydraulic reservoirs.

1. Switch on the ignition.
2. Depressurize the system by using the bleed screws on both hydraulic accumulators until both brake pressure warning panels are illuminated.
3. Start the engine and allow to run at idle speed.
4. Allow the height to stabilize, then run the engine for a further four minutes.
5. Check the levels in each reservoir, adjust to the black line. **Do not overfill the reservoirs.**
6. Switch off the engine.
7. Replace the filler blanking plugs.

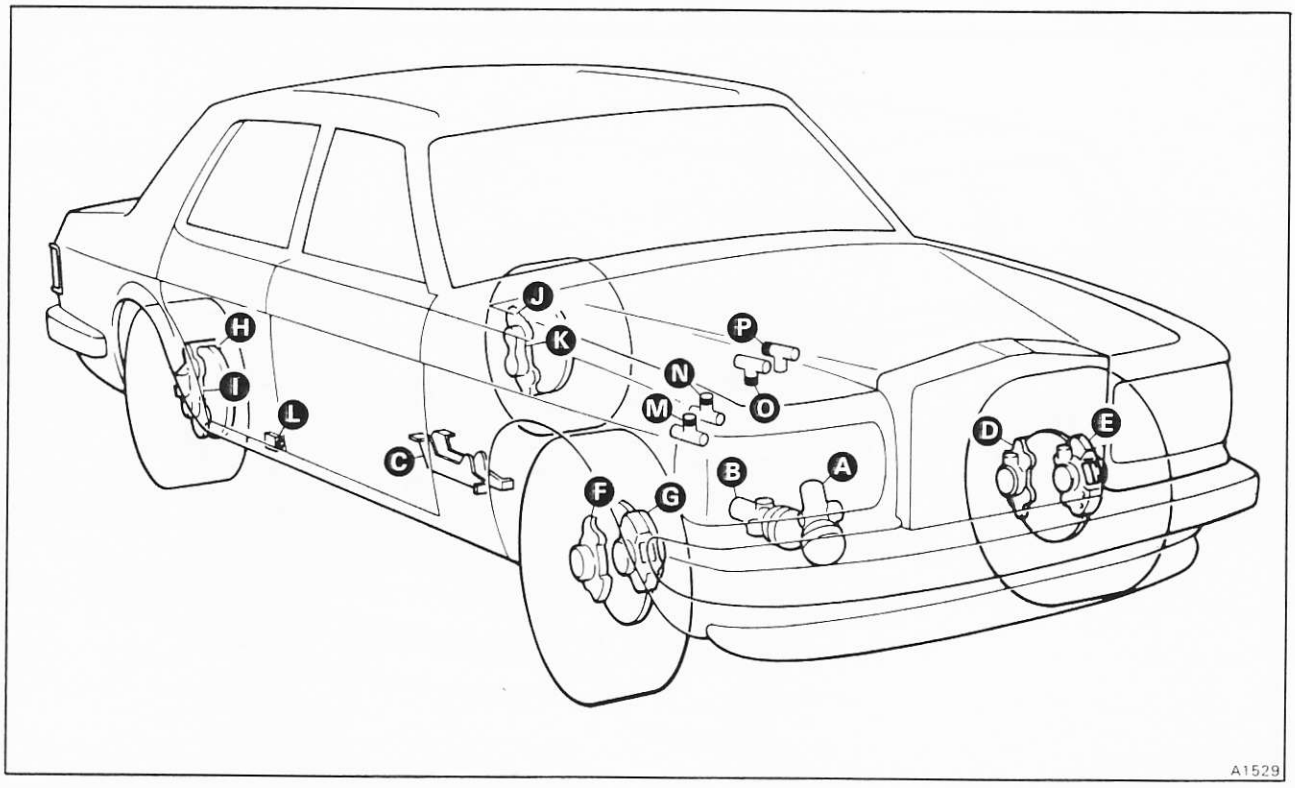

Fig. G5-3 Non anti-lock braking system bleed points and accumulator test service points

A Accumulator (No. 1 system)
B Accumulator (No. 2 system)
C Deceleration conscious 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 Rear suspension struts (right-hand side inner sill forward of rear road spring)
M High pressure (orange line No. 2 system) right-hand drive cars
N High pressure (red line No. 1 system) left-hand drive cars
O High pressure (red line No. 1 system) right-hand drive cars
P High pressure (orange line No. 2 system) left-hand drive cars

Non anti-lock braking systems (see fig. G5-3)
Attach a length of bleed tube to each bleed screw prior to the bleed screw being opened. Immerse the free end of the tube in approximately 25 mm (1 in) of hydraulic system mineral oil contained in a clean bottle.

Bleed tube attachment is not necessary when bleeding the accumulators, as bleeding is effected internally through the accumulator valve housing, the mineral oil being allowed to flow back to its respective reservoir when the bleed screw is released approximately one revolution (see Section G9).

With the gear selector in the park position and the parking brake applied the following sequence of operations should be carried out, after first noting the following.

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

When bleeding the suspension struts extra care should be taken when slackening the bleed screw as the system will be operating at full pressure.

Any hydraulic system mineral oil that has been spilt onto the tyres must be removed. The use of a soap solution and a final rinse with clean water is recommended for this purpose.

Under no circumstances should hydraulic system mineral oil be allowed to remain on the tyres for prolonged periods as this will cause tyre damage.

1. Remove fuse A6 from fuse panel F2 on the main fuseboard.
2. Depressurize the hydraulic systems as described in Section G3. Complete depressurization of the suspension struts is not necessary.
3. Open the accumulator bleed screws, points A and B.
4. Start and run the engine at 1500 rev/min for one minute. Ensure that the facia warning panels are illuminated (see Section G2).
5. Switch off the engine.
6. Close the accumulator bleed screws, points A and B.
7. Open the bleed screws at points C, D, and E.
8. Depress the footbrake pedal.
9. Start and run the engine at 1000 rev/min.
10. Allow points C, D, and E to bleed until air free.
11. Open bleed screws F and G, allow bleeding to start.
12. Close the bleed screws at points C, D, and E.
13. Bleed at points F and G until air free.
14. Open the bleed screws at points H and I, allow bleeding to start. Close the bleed screws at points F and G.
15. Bleed at points H and I until air free.
16. Open bleed screws J and K, allow bleeding to start.
17. Close the bleed screws at points H and I.
18. Bleed at points J and K until air free.
19. Close the bleed screws at points J and K.
20. Release the footbrake pedal.
21. Add weight to the rear of the car to actuate the levelling valve.
22. Allow the systems to pressurize (facia warning panels extinguished).
23. Open the bleed screw at point L, bleed until air free.
24. Close the bleed screw at point L.
25. Check the hydraulic system mineral oil levels in the reservoirs and top-up as necessary.
26. Switch off the engine.
27. Fit a rubber dust cover to each bleed screw, and replace the fuse in the fuseboard.

Sectional bleed requirements

Red pipe line (No. 1 system)
Any pipe disturbed between the inboard hydraulic reservoir, front hydraulic pump, accumulator (vertically mounted), upper distribution valve, and rear suspension struts.

Bleed the complete system i.e. accumulator, deceleration conscious pressure limiting valve, front calipers on the front wheels, upper cylinders on the rear wheel calipers, and the rear suspension struts.

Orange pipe line (No. 2 system)
Any pipe disturbed between the outboard hydraulic reservoir, rear hydraulic pump, accumulator (horizontally mounted), and lower distribution valve.

Bleed the complete system i.e. accumulator, rear brake calipers on the front wheels, and the lower cylinders on the rear wheel calipers.

Blue pipe line (No. 1 system)
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 cylinders on the rear wheel calipers.

Mauve pipe line (No. 2 system)
Any pipe disturbed between the lower brake distribution valve and rear calipers on the front wheels and lower cylinders on the rear wheel calipers.

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

Checking the levels in the hydraulic reservoirs
After bleeding, the following procedure should be used when checking the levels in the hydraulic reservoirs.

1. Switch on the ignition.
2. Depressurize the system by using the bleed screws on both hydraulic accumulators until both brake pressure warning panels are illuminated.
3. Start the engine and allow to run at idle speed.
4. Allow the height to stabilize, then run the engine for a further four minutes.
5. Check the levels in each reservoir, adjust to the black line. **Do not overfill the reservoirs.**
6. Switch off the engine.
7. Replace the filler blanking plugs.