

Chapter 9

Hydraulic system

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Degrees of difficulty

Easy , suitable for novice with little experience		Fairly easy , suitable for beginner with some experience		Fairly difficult , suitable for competent DIY mechanic		Difficult , suitable for experienced DIY mechanic		Very difficult , suitable for expert DIY or professional	
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Specifications

High pressure pump

Type	Five piston volumetric
Operating speed	Half engine speed
Output (per pump cycle)	4 cc

Pressure regulator

Cut-out pressure	170 ± 5 bar
Cut-in pressure	145 ± 5 bar

Accumulator

Capacity	0.40 litre (0.70 Imp pint)
Calibration pressure	62 + 2 bar - 32 bar

Security valve

Slide valve return spring calibration pressures:	
Isolation pressure (min)	80 bar
Suspension supply pressure (min)	100 bar

Torque wrench settings

	Nm	lbf ft
Hydraulic pipe unions:		
3.5 and 4.5 mm diameter pipes	8 to 9	6 to 7
6.0 mm diameter pipes	9 to 11	7 to 8

1 General information and precautions

General information

The hydropneumatic suspension and the braking system are both pressurised by a common hydraulic system (see illustrations).

Fluid is drawn from a reservoir which is mounted on the right-hand wing valance and delivered under pressure to a pressure regulator which is mounted on the engine crankcase. The system is pressurised by a belt-driven pump, which is mounted on the engine and driven by the crankshaft pulley.

From the pressure regulator, fluid passes to the security valve which has pipe connections running to the compensator control valve and the front and rear suspension height corrector units.

Fluid from the suspension height corrector units (one at the front and one at the rear) flows to the suspension unit cylinders. From the suspension cylinders the low pressure return fluid is returned through pipelines to the hydraulic reservoir.

The height correctors maintain the hydropneumatic suspension at the manually selected height by admitting fluid to, and releasing fluid from, the suspension cylinders according to the movement of the front and rear anti-roll bars to which they are connected.

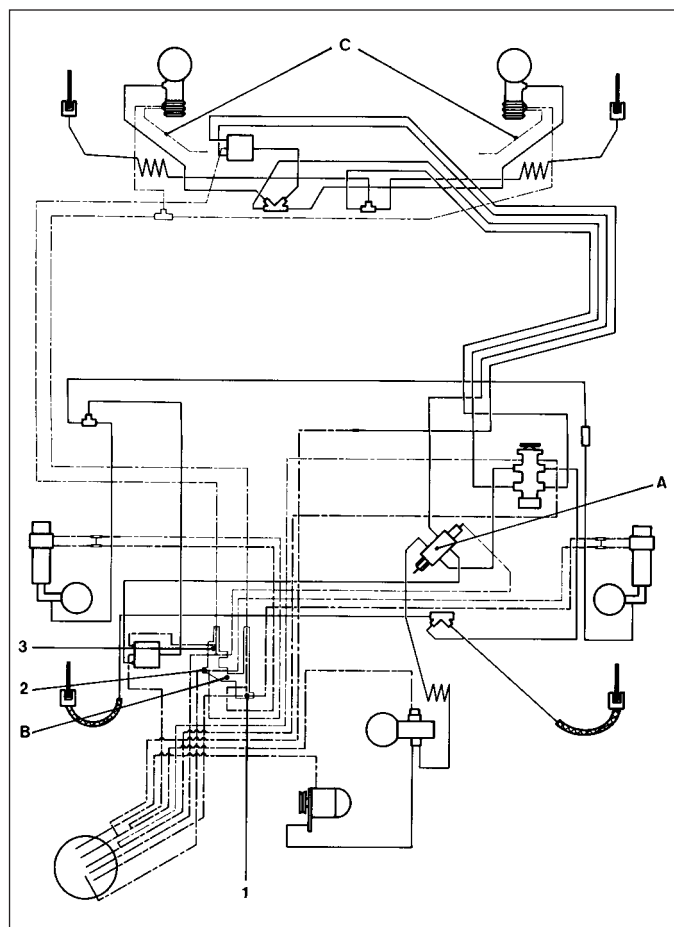
Four height positions can be selected by the manual height control within the vehicle. They are as follows:

- a) *Lever set at second setting position from the front - Normal driving position.*
- b) *Lever set at most forward setting position - Minimum height setting for use during repair and overhaul procedures on the vehicle. Should not be used for normal driving.*

c) *Lever set at third setting position from the front - Raises vehicle ride height to intermediate setting. For use when traversing rough road conditions.*

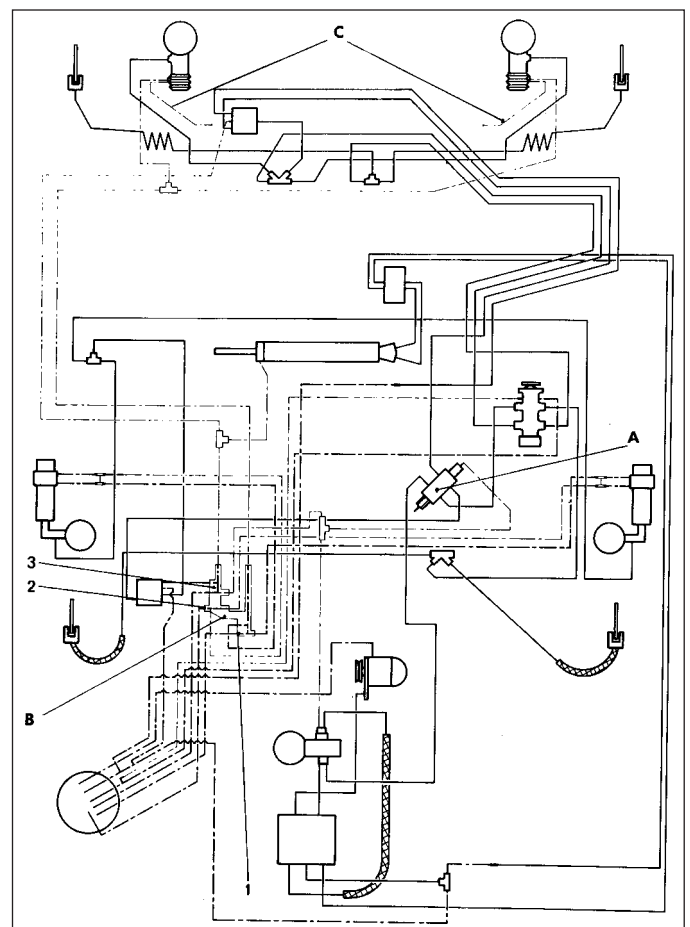
d) *Lever set at fourth setting position (ie. lever moved fully back) - Raises vehicle to maximum height setting. Primary use is to assist when changing roadwheels. Should not be selected when driving except under exceptional conditions such as negotiating undulating surfaces, then only for short distances and at very low speeds.*

Hydraulic pressure for the braking system is supplied from the compensator control valve with separate front and rear circuits. The front circuit is supplied direct from the compensator control valve, whilst the rear brake circuits operate in conjunction with the hydraulic circuits to the rear suspension. This arrangement results in the braking effort being biased in favour of the front brakes and at the same time regulates the braking effort on the



1.1a Hydraulic system circuit diagram - manual steering models

- A Security valve
- B Return pipes to reservoir (see 1 to 3)
- C Rear suspension vent line
- 1 Overflow return - front and rear suspension cylinders
- 2 Vent pipe - front suspension cylinders
- 3 Leakage from front and rear height correctors and security valve



1.1b Hydraulic system circuit diagram - power steering models

- A Security valve
- B Return pipes to reservoir (see 1 to 3)
- C Rear suspension vent line
- 1 Overflow return - front and rear suspension cylinders
- 2 Vent pipe - front suspension cylinders
- 3 Leakage from front and rear height correctors and security valve

rear wheels according to the load on the rear suspension. The heavier the load, the greater the pressure in the rear suspension, thus more braking effort.

Hydraulic pressure is released from the system by slackening the bleed screw on the pressure regulator. This allows the pressure fluid to bleed off to the reservoir.

On power steering models, a flow distributor is fitted between the HP pump and the pressure regulator unit. The purpose of the flow distributor is to control the hydraulic pressure between the steering circuit and the suspension/brake circuits.

Precautions

Cleanliness is of the utmost importance when working on the hydraulic system and its components. Clean all adjacent areas before disconnecting components. After removal, blank off all orifices and ensure that components and pipes do not get contaminated.

Use only LHM mineral hydraulic fluid in the hydraulic system. The use of any other fluid will ruin the rubber rings and seals. LHM fluid is green in colour. Keep the fluid, carefully sealed, in its original container.

Use only genuine spare parts. Components are identified by painting or marking in green. All rubber parts are identified by their white or green colour and are of a special quality for use with LHM fluid.

Before starting work on the hydraulic system, the pressure must be released as follows:

- a) Switch the engine off.
- b) Place the manual height control lever in the "low" (minimum) height position.
- c) Loosen the pressure regulator release screw one and a half turns then wait for the vehicle to reach the low position.
- d) Only undo the regulator release screw by the specified amount, do not remove it (see illustration).

Although the maximum height setting is a useful aid when undertaking inspection and repair tasks on the vehicle, it is essential that the vehicle is supported on safety stands when carrying out any service or repairs from underneath.



1.13 Pressure regulator unit (BX 16) showing pressure release screw (arrowed)

2 System pressure checks



1 In order to carry out pressure checks on the hydraulic system, a pressure gauge capable of measuring pressure from 0 to 250 bar will be required. A suitable length of high pressure line will also be needed for attachment between the gauge and the operational pipe union on the pressure regulator. A gauge used to check injection pressure on diesel engines may be suitable.

2 Before making any checks, ensure that the hydraulic reservoir filters are clean and also that the fluid level in the reservoir is correct.

3 Release system pressure by loosening the bleed screw on the pressure regulator 1 to 1.5 turns.

4 Disconnect the operational pipe from the pressure regulator by unscrewing the union nut. Move the pipe to one side and plug it to prevent the ingress of dirt.

5 Screw the pressure gauge pipe into the operational pipe port in the pressure regulator. Make the following checks in the order given.

Main accumulator pressure check

6 Tighten the pressure regulator bleed screw.

7 Disconnect the distributor-to-coil leads.

8 Get an assistant to turn the engine over on the starter motor. As the starter motor is operated, check the pressure gauge needle reading. The pressure should gradually rise then stabilise within the calibration pressure readings given in *Specifications*.

9 If the pressure is not within the specified limits, the main accumulator is faulty.

10 Reconnect the ignition lead on completing this test.

Pressure regulator check

11 Loosen the bleed screw on the pressure regulator by 1 to 1.5 turns.

12 Start the engine and run it at an increased idle speed, then retighten the pressure regulator bleed screw and observe the increase in pressure. When the pressure gauge needle stabilises, the cut-out pressure

is reached and this should be within the pressure range specified.

13 Allow the engine to run at idle speed for a short period to allow the pressure to stabilise. Switch off the engine and note the drop in pressure over a period of three minutes. If this exceeds 10 bar the regulator is faulty.

14 Start the engine again and run it at an increased idle speed. When the cut-in occurs, loosen the pressure regulator bleed screw 1 to 1.5 turns. The pressure reading should gradually fall then rise as the HP pump becomes operational. The minimum pressure reading taken should correspond to the cut-in pressure specified.

15 If the cut-out or cut-in pressure readings taken are incorrect, then the regulator is faulty.

16 On completion, switch off the engine, release the system pressure and detach the pressure gauge. Remove the plug from the operational pipe and reconnect it to the pressure regulator unit.

3 Hydraulic pipes - removal and refitting



Note: Use only LHM mineral hydraulic fluid in the hydraulic system

Removal

1 If at any time it is necessary to disconnect or remove any hydraulic pipeline in the suspension or braking circuits, it is essential that the system pressure is first released. See "Precautions".

2 Before disconnecting the pipe concerned, thoroughly clean the union external surfaces.

3 If a complete pipe section is to be replaced, release the pipe from the retaining clips and/or clamps and bushings. Avoid distorting or damaging the pipe as it is withdrawn (see illustrations).

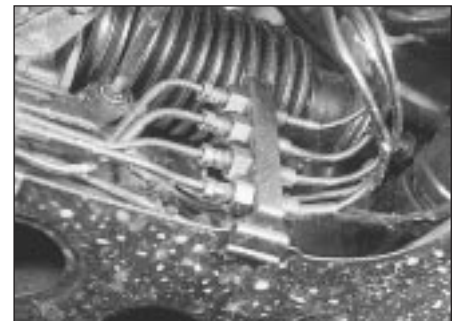
4 If the pipe is not being replaced immediately, plug the union connections to prevent the ingress of dirt into the system.

Refitting

5 To ensure that a perfect seal exists when

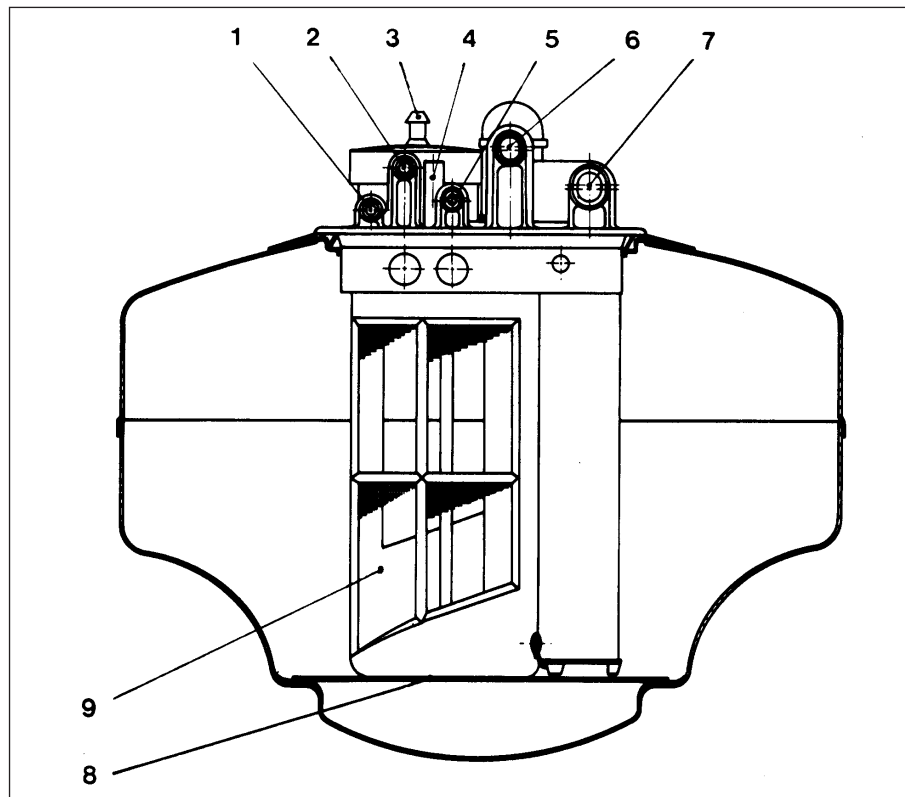


3.3a Hydraulic pipes and retaining clips which keep them correctly located



3.3b Hydraulic pipes and union connections - also secured by a clamp for security

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3.3c Hydraulic system reservoir connections

- | | | |
|---|---|--|
| 1 Front and rear suspension cylinders overflow return | 4 Vent pipe - front suspension cylinders | 6 Operational return from pressure regulator and height correctors |
| 2 Security valve and front/rear height correctors | 5 Operational return/overflow return from brake control valve | 7 HP pump suction hose |
| 3 Breather | | 8 Deflector |
| | | 9 Filter |

hydraulic pipe joints are assembled, the following procedure must be carried out.

6 Clean the component port, hydraulic pipe, union nut and sealing rubber and lightly lubricate them with LHM fluid.

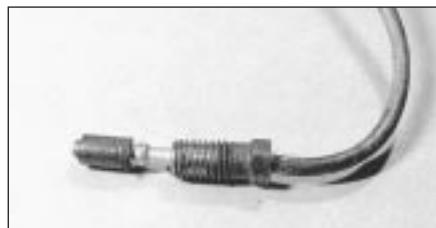
7 Slide the sealing rubber onto the end of the pipe until the pipe protrudes from it (see illustration).

8 Insert the pipe into the component so that the pipe end enters the central hole of the component port. The sealing rubber must enter its location hole fully. Check that the visible part of the pipe is located centrally in the component port (see illustration).

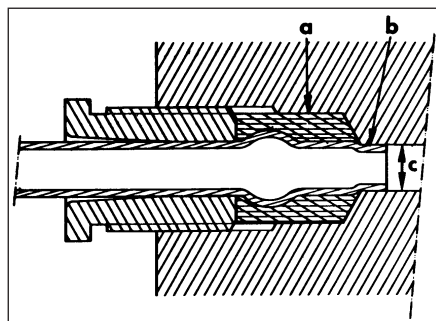
9 Screw in the union nut by hand whilst keeping the hydraulic pipe stationary, then tighten it to the specified torque.

10 The pipe union is designed to provide increased sealing with increased fluid pressure. Tightening the nut more than the specified amount will not improve the seal and may easily damage the pipe.

11 On completion, check that the hydraulic system pipes do not touch each other or any other component which may stress or chafe the pipes.



3.7 Hydraulic pipe union and sealing rubber



3.8 Cross-section through a hydraulic pipe joint
a Sealing rubber b Pipe c Union bore

4 Pressure regulator unit - removal and refitting



Removal

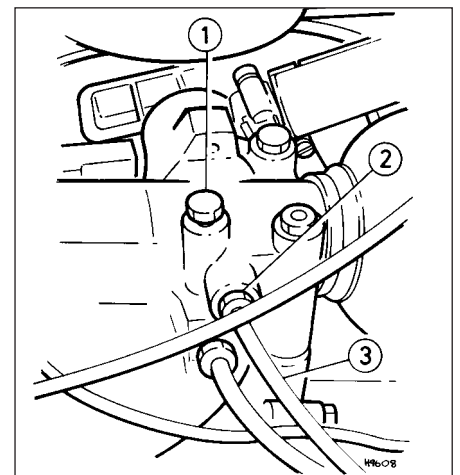
1 Release the system pressure by loosening the pressure bleed screw by 1 to 1.5 turns on the pressure regulator unit (see illustration). Allow the vehicle to drop to its fully lowered position.

2 Wipe clean the pressure regulator unit and the pipe connections in particular.

3 Loosen the retaining clip and detach the return pipe hose from the regulator. Plug the hose and position it out of the way.

4 Undo the union nuts and detach the two rigid pipes from the pressure regulator. Plug them to prevent the ingress of dirt (see illustration).

5 Undo the two retaining bolts and the support bracket nut. Support the regulator unit as the bolts and nuts are removed and withdraw the regulator unit. Note the position of the hose location wire under the lower bolt head.



4.1 Pressure regulator

- 1 Pressure release (bleed) screw
- 2 Union connector - operational pipe to pressure regulator
- 3 Operational pipe



4.4 Disconnecting the rigid pipes from the pressure regulator. Note the plug inserted into the vacated port (arrowed)



5.3 HP pump showing the supply and output pipe connections



5.4 Detach the output pipe. Pump retaining bolts arrowed



6.2 HP pump drivebelt jockey wheel mounting and adjuster bolts (arrowed) - BX 16

Refitting

6 Refitting is a reversal of the removal procedure. Ensure that the connecting pipe connections are thoroughly clean before connecting them.

7 On completion, top-up the hydraulic fluid level in the reservoir and prime the HP pump.

5 High pressure (HP) pump - removal and refitting



Removal

1 Release the pressure in the hydraulic system as described in "Precautions".

2 Wipe clean the pump and its pipe connections.

3 Disconnect the pump supply pipe from the inlet port and drain the fluid into a suitable container. If a roll type clip is fitted, remove it and obtain a screw type (worm drive) clip (see illustration).

4 Unscrew the high pressure output pipe from the pump (see illustration).

5 Loosen the drivebelt tension and disengage the drivebelt from the pump pulley.

6 Undo the two retaining bolts and withdraw the pump.

Refitting

7 Refitting is a reversal of the removal procedure. Adjust the drivebelt tension.

8 With the pump refitted and the hoses connected, prime the pump.



7.1 Security valve location

6 High pressure (HP) pump drivebelt - removal, refitting and adjustment



Removal

1 On BX 16 and BX 19 models, remove the alternator drivebelt.

2 Loosen the HP pump drivebelt jockey wheel mounting and adjuster bolts then pivot the jockey wheel inwards towards the engine to release the drivebelt tension (see illustration).

3 Remove the drivebelt from the HP pump and associate pulleys.

Refitting

4 Refit in the reverse order to removal.

Adjustment

5 With the belt fitted on the pulleys, set the tension by pivoting the jockey pulley outwards as much as possible by hand to take up any play in the belt on its longest run between pulleys. If any form of leverage is employed to achieve this tension great care must be taken not to damage any fittings. Tighten the jockey

pulley mounting/adjuster bolt to set the tension.

6 With the jockey wheel position set, the belt tension must be felt to be taut under a reasonable thumb pressure at the midway point between the pulleys on its longest run. Note however, that the belt tension must not be tightened excessively or the belt life will be shortened and damage to the pulleys and their drive bearings could result. Recheck the tension of a new belt after a nominal mileage has been covered.

7 On BX 16 and BX 19 models, refit the alternator drivebelt and adjust its tension.

7 Security valve - removal and refitting

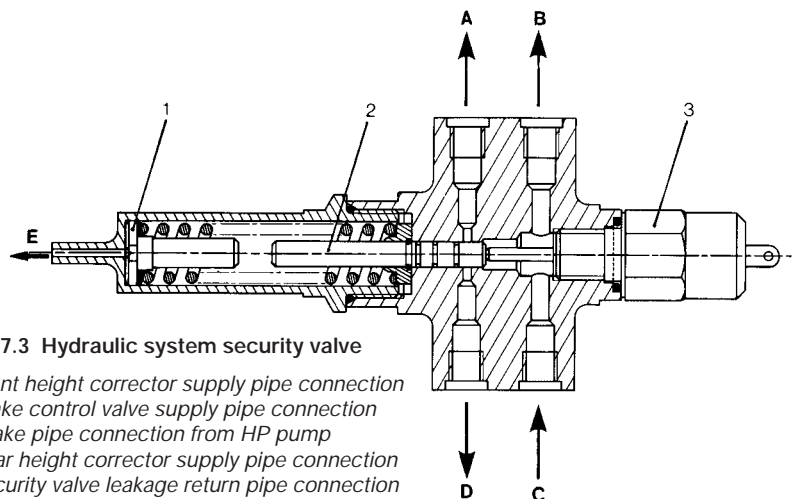


Removal

1 The security valve is located on the lower left-hand side of the front subframe, behind the steering gear (see illustration).

2 Loosen the pressure regulator bleed screw.

3 Disconnect the rubber overflow return pipe from the end of the valve (see illustration).



7.3 Hydraulic system security valve

- A Front height corrector supply pipe connection
- B Brake control valve supply pipe connection
- C Intake pipe connection from HP pump
- D Rear height corrector supply pipe connection
- E Security valve leakage return pipe connection
- 1 Adjustment shims
- 2 Slide valve
- 3 Fault detector (pressure) switch

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4 Unscrew the union nuts securing the inlet and outlet pipes to the security valve, making a careful note of their location.

5 Disconnect the supply wire from the pressure switch terminal.

6 Unscrew and remove the mounting bolt and withdraw the valve. Where a brake limiter is fitted, this is also detached at the same time.

Refitting

7 Refitting is a reversal of removal. With the pipes and wire connected, tighten the pressure regulator bleed screw.