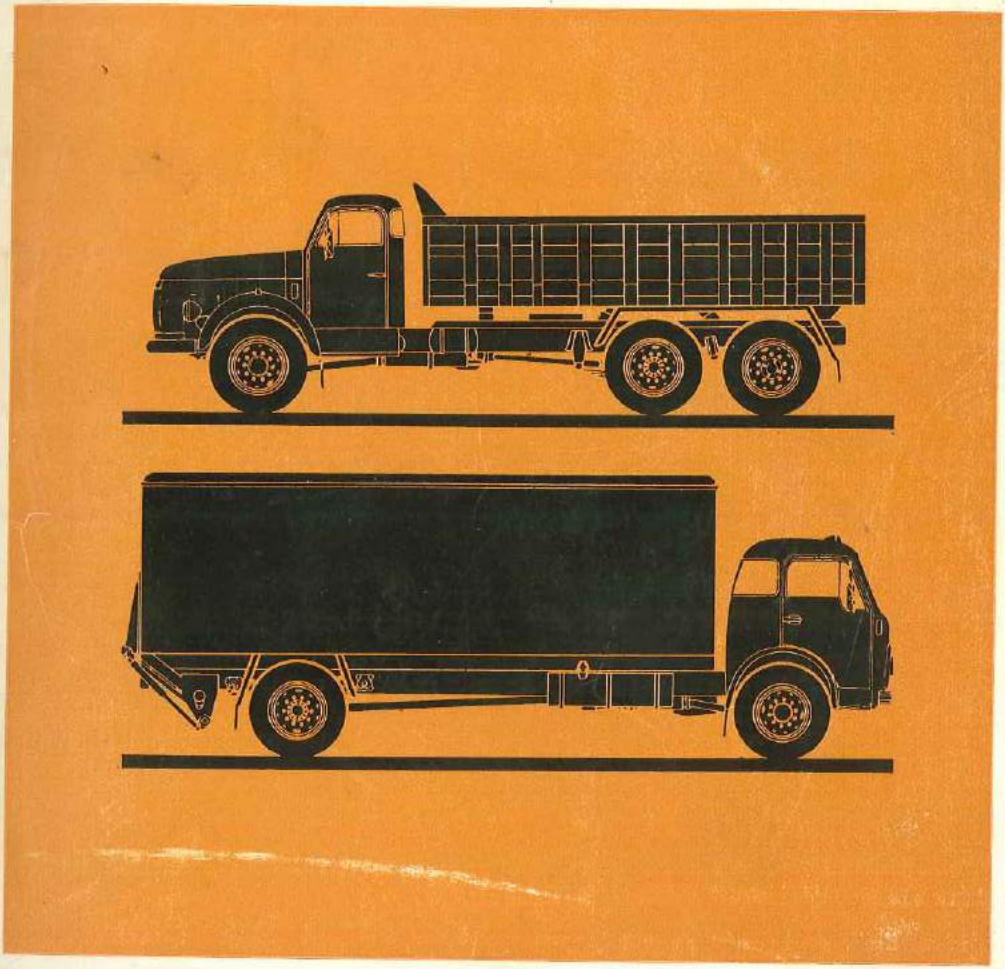
VOLVO

INSTRUCTION BOOK

86-SERIES



MAINTENANCE

General

Regular maintenance is essential in order to obtain the most profitable use from your vehicle, and even apparently minor faults should be corrected as soon as possible.

To give you a clear idea of what the vehicle requires tenance scheme on the following two pages. The scheme is set out in accordance with three types of driving: local traffic, short-distance traffic and long-distance traffic.

Decide from the beginning the type of driving for which your vehicle is to be used and then follow the appropriate action as indicated in the schedule.

Operations which require the attention of skilled mechanics and the use of special tools, and which must therefore be entrusted to an authorised Volvo workshop, are marked in the scheme with (o). Work which can be done by the owner or driver is indicated with (●).

The various points in the maintenance scheme are numbered consecutively, these numbers referring to the more detailed descriptions on the pages following the maintenance scheme. The respective intervals for local, short-distance and long-distance traffic are shown after each heading.

MAINTENANCE SCHEME

Action		To be carried out after every: Local traffic km	Local traffic miles	Short-distance traffic km	Short-distance traffic miles	Long-distance traffic km	Long-distance traffic miles	Remarks
ENGINE								
1. Compression test	O	10 000	6 000	20 000	12 500	40 000	25 000	
2. Check valve clearance	O	20 000	12 500	40 000	25 000	80 000	50 000	
Lubricating system								
3. Check oil level	●	Every day						
4. Change oil	●	5 000[1]	3 000[1]	5 000[1]	3 000[1]	5 000[1]	3 000[1]	
5. Change oil filter	●	10 000[2]	6 000[2]	10 000[2]	6 000[2]	10 000[2]	6 000[2]	
Fuel system								
6. Change fuel filters	●	40 000	25 000	80 000	50 000	80 000	50 000	
7. Check injection pump and injectors	O	10 000	6 000	20 000	12 500	40 000	25 000	
8. Overhaul injection pump	O	160 000	100 000	160 000	100 000	160 000	100 000	
9. Clean strainer in fuel tank, drain condensation water	●	Once a year						
10. Change paper element of air cleaner	●	See page 54						
11. Clean oil bath air cleaner	O	10 000	6 000	10 000	3 000	10 000	6 000	
Cooling system								
12. Check coolant level	●	Every day						
13. Change coolant, check hose connections	●	Every spring and autumn						
14. Check V-belts	●	5 000	3 000	5 000	6 000	10 000	6 000	
Turbo-compressor								
15. Check air line for leakage	●	5 000	3 000	10 000	6 000	20 000	12 500	
16. Check exhaust pipe for leakage	●	5 000	3 000	10 000	6 000	20 000	12 500	
17. Check oil supply line and return line for leakage	●	5 000	3 000	10 000	6 000	20 000	12 500	
18. Clean oil flow filter	●	10 000	6 000	20 000	12 500	40 000	25 000	
19. Check oil flow filter	O	10 000	6 000	20 000	12 500	40 000	25 000	
20. Change turbo-compressor	O	160 000	100 000	160 000	100 000	160 000	100 000	See page 64
ELECTRICAL SYSTEM								
21 Check electrolyte level in batteries	●	Every other week						
22. Check charging condition of batteries	●	5 000	3 000	10 000	6 000	20 000	12 500	
23. Dynamo, check brushes and charging	O	40 000	25 000	40 000	25 000	40 000	25 000	
24. Check headlight adjustment	O	10 000	6 000	20 000	12 500	40 000	25 000	
CLUTCH								
25. Check fluid level in container (F 86)	●	5 000	3 000	5 000	3 000	5 000	3 000	
26. Check clutch lever clearance	O	5 000	3 000	5 000	3 000	10 000	6 000	

[1]) During the running-in period, also after the first 1000 km (600 miles) and in connection with the cost-free inspection after 2500 km (1500 miles).
After this the oil should be changed in accordance with the above-mentioned intervals, but in any case at least every six months.

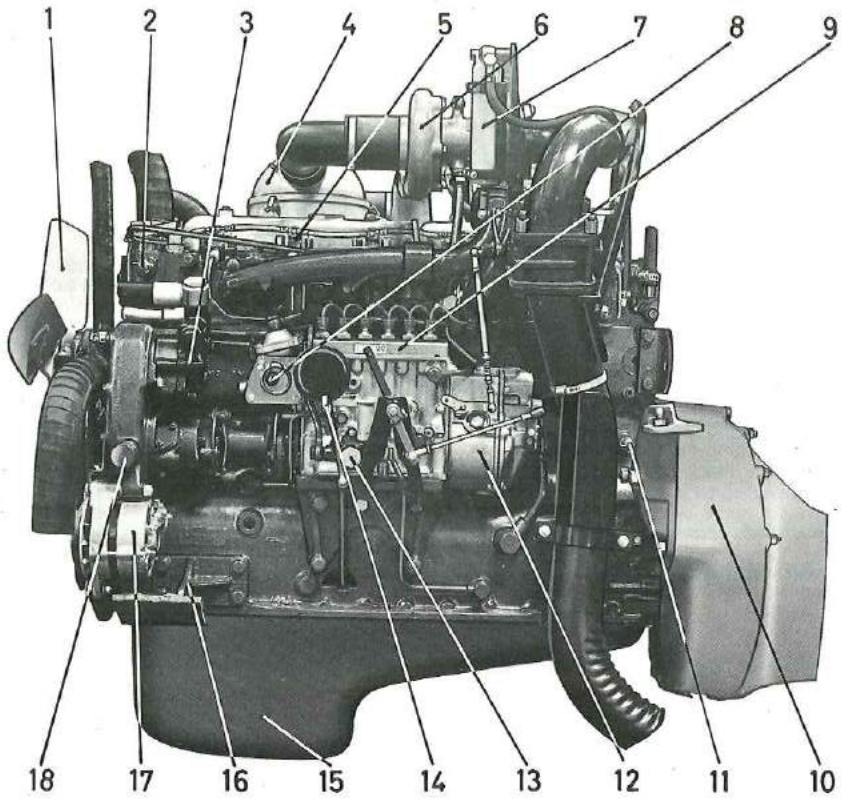
[2]) During the running-in period after the first 5000 km (3000 miles).

MAINTENANCE SCHEME

Action		To be carried out after every: Local traffic km	Local traffic miles	Short-distance traffic km	Short-distance traffic miles	Long-distance traffic km	Long-distance traffic miles	Remarks
GEARBOX								
27. Check oil level	●	2 500	1 500	2 500	1 500	2 500	1 500	
28. Change the oil	●	40 000[2]	25 000[2]	40 000[2]	25 000[2]	40 000[2]	25 000[2]	
29. Lubricate valves and cylinder of auxiliary gearbox	O	Once a year						
Change oil filter	O	80 000[2]	50 000[2]	80 000[2]	50 000[2]	80 000[2]	50 000[2]	
PROPELLER SHAFTS								
31. Check propeller shafts	O	5 000	3 000	10 000	5 000	20 000	12 500	
REAR AXLE								
32. Check oil level	●	2 500	1 500	2 500	1 500	2 500	1 500	
33. Change the oil	●	40 000[2]	25 000[2]	40 000[2]	25 000[2]	40 000[2]	25 000[2]	
BRAKE SYSTEM								
34. Check pressure regulator and warning lamps	●	Every day						
35. Check for leakage	●	5 000	3 000	5 000	3 000	10 000	6 000	
36. Drain condensation water in compressed air reservoirs	●	Once a week						
37. Check fluid level in anti-freeze device		Once a week						
38. Clean compressor filter	●	5 000	3 000	10 000	6 000	20 000	12 500	
39. Clean compressor filter	●	5 000	3 000	5 000	3 000	10 000	6 000	
40. Check travel of brake cylinders	O	5 000	3 000	5 000	3 000	10 000	6 000	
41. Check brake bands, brake drums and brake cams	O	10 000	6 000	20 000	12 500	40 000	25 000	
42. Check brake lines	●	10 000	6 000	20 000	12 500	40 000	25 000	
43. Check function of brake system	O	20 000	12 500	40 000	25 000	80 000	50 000	
44. Overhaul compressor	O	Every other year						
FRONT END								
45. Check front wheel alignment	O	5 000	3 000	10 000	6 000	20 000	12 500	
46. Check joints, rods, etc.	O	5 000	3 000	5 000	3 000	10 000	6 000	
Steering box F 86, FB 86[3])								
47. Check oil level	●	5 000	3 000	5 000	3 000	5 000	3 000	
Power steering								
48. Check oil level	●	2 500	1 500	2 500	1 500	2 500	1 500	
49. Change oil and filter	O	40 000[4])	25 000[4])	40 000[4])	25 000[4])	80 000[4])	50 000[4])	
50. Overhaul power steering gear	O	40 000	12 500	40 000	25 000	80 000	50 000	
51. Reconditioning steering gear	O	240 000	150 000	240 000	150 000	240 000	150 000	
52. Check tyre pressure	●	When filling up with fuel						
53. Check-tighten wheel nuts	●	5 000	3 000	5 000	3 000	10 000	6 000	
BODY								
54. Lubricate body	●	5 000	3 000	5 000	3 000	10 000	6 000	
CHASSIS								
55. Lubricate chassis	●	See lubricating chart						

[2]) During running-in after the first 5 000 km (3 000 miles).
[3]) Also N 86, NB 86 without servo steering.
[4]) First oil change after 10 000 km (6 000 miles).

MOTOR



TD 70 B engine (N 86, NB 86)

1 Fan
2 Drain cock, cooling system
3 Servo pump
4 Air cleaner
5 Injector
6 Turbo-compressor
7 Compressed-air cylinder, exhaust brake
8 Cold start control
9 Fuel injection pump
10 Timing gear casing
11 Drain cock, cooling system
12 Centrifugal governor
13 Feed pump
14 Oil dipstick
15 Sump
16 Engine mounting
17 Alternator
18 Rev. counter sender

General

Technical description

The N, NB 86 and F, FB 86 trucks are supplied with two alternative engines: D 70 B or TD 70 B. Both these engines are six-cylinder, four-stroke diesel units with overhead valves. They have wet, easily replaceable cylinder liners and two cylinder heads, which are mutually interchangeable.

The crankshaft is drop-forged, statically and dynamically balanced and carried in seven main bearings. A vibration damper is fitted on the front end of the crankshaft.

Gear-driven from the crankshaft are the camshaft, fuel injection pump, oil pump, air compressor and servo pump.

The fan, coolant pump and alternator are driven by vee-belts from pulleys on the crankshaft. However, the fan on the F 86 is mounted directly to the crankshaft.

The TD 70 B engine differs from the D 70 B unit in that it has a turbo-compressor. In consequence, the pistons, injectors, fuel injection pump, camshaft, valves, exhaust manifold, silencer and exhaust pipe are of a different design or are made of another material.

1 Compression test

The simplest and most reliable way to get an idea of the state of the engine is to carry out a compression test. This test shows the compression in the cylinders. If the pressure is faulty, this may be due to leaking piston rings, valves or cylinder head gaskets.

The test should be carried out with a warm engine. Unscrew the injectors and test the cylinders one by one. Note that before doing this the stop control must be pulled out fully. At approx. 180 r.p.m. the compression pressure should be:
for the D 70 B engine approx. 28 kp/cm² (398 p.s.i.)
for the TD 70 B engine approx. 26 kp/cm²' (370 p.s.i.).
A deviation of 10 % less than these figures can be considered to be acceptable.

2 Checking valve clearances

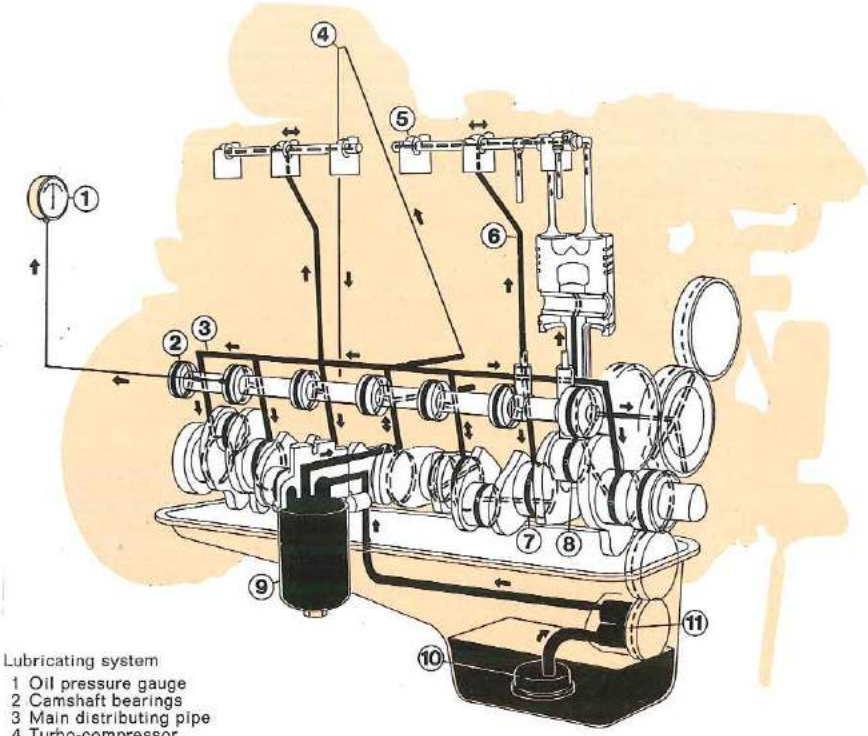
The engine valve clearances should be checked regularly. Too small a clearance can result in burnt valves. On the other hand, an excessive clearance can impair the air flow in the cylinders and lower the engine output.

The valve clearance should be adjusted with the engine cold and should be:

	inlet	exhaust
D 70 B engine	0.40 mm (0.016")	0.45 mm (0.018")
TD 70 B engine	0.40 mm (0.016")	0.55 mm (0.022")

Because the pistons are designed with the combustion chambers in the piston heads, the distance between piston and valve is so small that the valve **must not be adjusted while the engine is running,** as otherwise the valves would go against the piston. Pull out the stop control and turn over the engine with the help of the starter motor or possibly with a screwdriver against the flywheel ring gear. Turn the engine to the end of the compression stroke for No. 1 cylinder, that is, with the piston of this cylinder at T.D.C. Then measure the clearance on the following rocker arms: 1, 2, 4, 5, 7 and 9. Next turn the engine over one revolution, and measure the clearance on the following rocker arms: 3, 6, 8, 10, 11 and 12.

Engine lubricating system



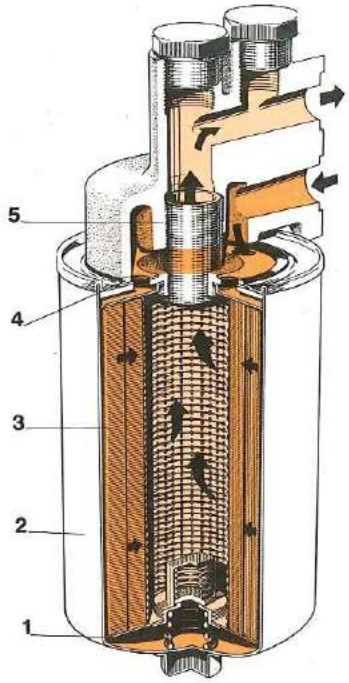
Lubricating system
1 Oil pressure gauge
2 Camshaft bearings
3 Main distributing pipe
4 Turbo-compressor
5 Rocker arm mechanism
6 Lubricating oil drilling to rocker arm mechanism
7 Main bearings
8 Big-end bearings
9 Lubricating oil filter
10 Oil strainer
11 Oil pump

Technical description

The engine has a complete pressure lubricating system. Oil pressure is produced by a pump (11), which is gear-driven from the crankshaft drive via an intermediate gear. Oil is sucked up from the sump through a wire-mesh strainer (10) to the oil pump which, through a relief valve, conveys the oil under pressure to the lubricating oil filter (9).

The function of the relief valve is to limit the oil pressure and prevent it from reaching excessive values.
From the lubricating oil filter the oil passes to a main distributing pipe from which branches lead to the main bearing and to the big-end bearings through oilways drilled in the crankshaft.
The oil is forced up through a drilling in the connecting rods to the gudgeon pins and bushes. The rocker arms are lubricated with oil which is fed from the main oilway through oilways in the cylinder block and cylinder heads.
The timing gears are shot-lubricated from the trunnion bearing of the intermediate gear which is linked to the main oilway by means of drillings.
Of the engine auxiliary units, the air compressor, turbo-compressor and fuel injection pump are pressure-lubricated from outlets on the main distributing pipe.

Lubricating oil filter
1 Overflow valve
2 Filter cartridge
3 Filter element
4 Rubber seal
5 Bush



Lubricating oil filter

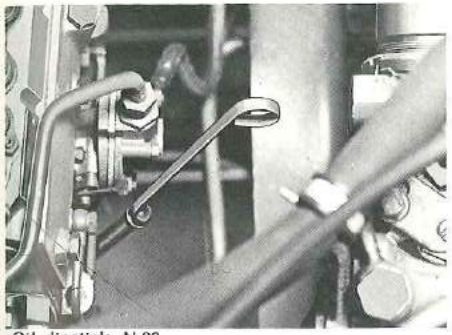
The lubricating oil filter is of the full-flow type, that is, all oil passes through this filter on its way to the lubricating points.
The filter consists of a housing in which a filter cartridge is screwed securely.
The filter elements of the lubricating oil filter consist of special filter paper folded inorder to provide a large effective filter area.
An overflow valve is located at the bottom of the filter cartridge. Its function is to release oil passed the filter if the drop in pressure through the filter should exceed 1.2±0.2 kp/cm² (17±3 p.s.i.). The filter cartridge is of the "throw-away" type and is thus replaced in its entirety.

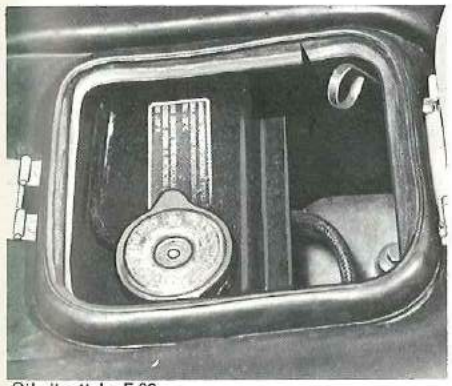
Lubricating oil

For engine lubrication, always use oil of a well-known make corresponding to the grades shown in the table below.

Engine type	Oil grade		Viscosity [1]		
	Normal operating conditions	Severe operating conditions	Below —10° C (14° F)[2]	—10° to +20° C (14° to 68° F)	Above +20° C (68° F)
D 70 B	For Service DM	For Service DS	SAE 10 W	SAE 20 W/20[3] alternatively	SAE 30
TD 70 B	For Service DS		SAE 10 W/20	SAE 20 W/30	

[1] The temperature values refer to continuous air temperatures.
[2] Or when cold-starting difficulties can be anticipated.
[3] For vehicles used in very heavy work, for example, long-distance running with large gross vehicle weights, SAE 20/20 W is also recommended at lower temperatures providing that this does not lead to cold-starting difficulties.


Oil dipstick, N 86


Oil dipstick, F 86

3 **Checking oil level**

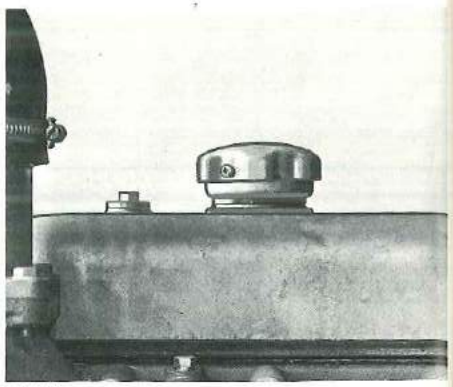
Check the oil level every day before starting the engine and when filling up with fuel. On the **N 86, NB 86** the dipstick is located on the left-hand side of the engine.
On the **F 86, FB 86** the dipstick is accessible through the opening between the driver's seat and the passenger's seat. The oil level should be between the marks on the dipstick.
Under no circumstances whatsoever may it go below the lower mark.
If necessary, top up with oil of the same grade already used in the engine.

4 Changing oil

During the running-in period, the oil should be changed even after the first 1 000 km (600 miles) and also in connection with the free inspection after 2 500 km (1 500 miles). Subsequent changes should take place after every 5 000 km (3 000 miles) or at least every six months. The drain plug is located in the bottom of the sump. Drain the oil immediately after driving while it is still warm.

Oil capacity:
approx. 13 litres (2.9 Imp. galls. = 3.4 US galls.)
incl. oil cleaner, approx. 14 litres
(3.0 Imp. galls. = 3.7 US galls.)

For each oil change, release the drain plugs of the fuel filters in order to drain off any water which may have collected.



Oil filler cap

5 Changing lubricating oil filter

The filter cartridge of the lubricating oil filter should be replaced every 10 000 km (6 000 miles) irrespective of the type of driving involved.

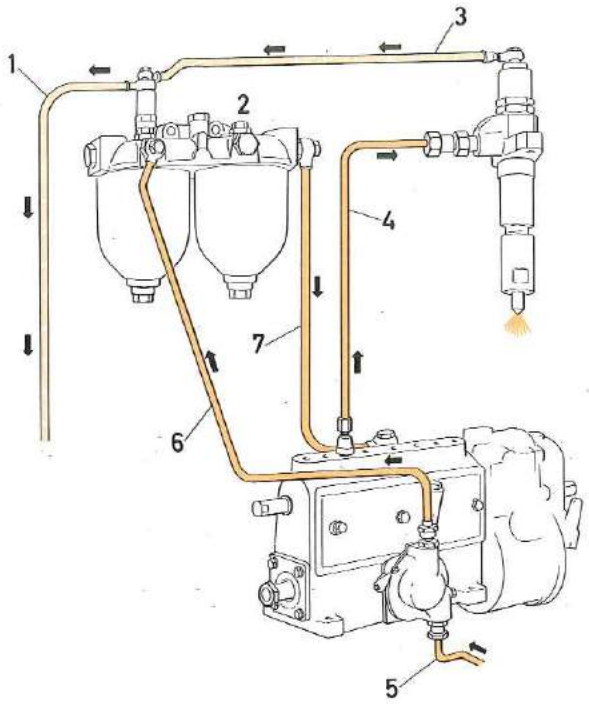
During the running-in, it should also be changed after the first 5 000 km (3 000 miles).

NOTE. The filter must not be cleaned. The only servicing involved is replacement.

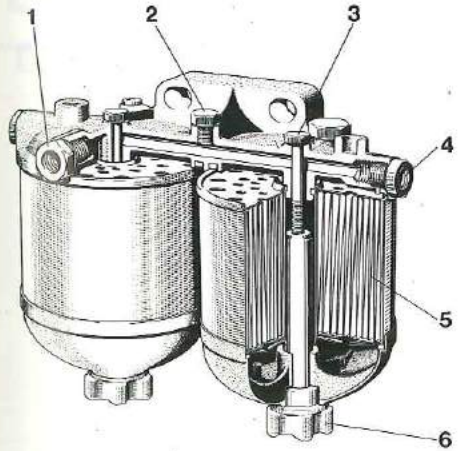
The filter cartridge is changed as follows:

1 Clean the outside of the lubricating oil filter, making sure that dirt does not get in when the new filter is fitted.
2 Remove the filter cartridge with a spanner and scrap it.
3 Moist the new filter cartridge seal with oil. Screw the cartridge on by hand. Make sure the seal makes good contact with the sealing surface. Then turn the cartridge a further 1/2—3/4 turn by hand.
4 Fill the engine with oil and start it. Check to make sure there is no leakage.

Engine fuel system



Fuel system
1 Leak-off line
2 Fuel filter
3 Leak-off oil line
4 Delivery line
5 Feed pump
6 Line between feed pump—filter
7 Line between filter—injection pump



Fuel filters, D 70 B
1 Inlet union
2 Venting screw
3 Attaching bolt
4 Union, outlet
5 Filter insert
6 Drain plug

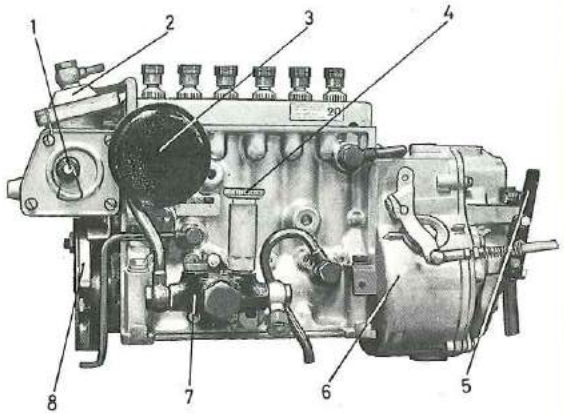
Technical description

Fuel is sucked through a strainer in the fuel tank to the feed pump (5) from where it is forced under pressure through the parallel-connected fuel filters (2) to the fuel injection pump. Special pump elements in the injection pump — one for each cylinder — then force the fuel through the delivery pipes (4) to the injectors.

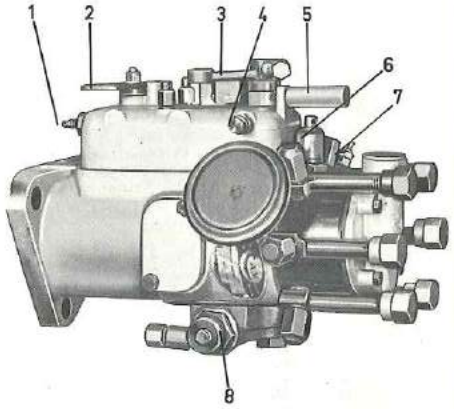
Fuel injection pump

The purpose of the injection pump is to regulate the supply of fuel by means of a centrifugal governor. In addition, the TD 70 B engine has a pressure dependent full load stop (smoke eliminator), which controls the fuel supply in relation to pressure in the intake manifold.

Fuel injection pump TD 70 B



1 Control for cold start
2 Pressure dependent full load stop (smoke eliminator)
3 Pressure equalizer
4 Hand primer
5 Throttle arm
6 Centrifugal governor
7 Feed pump
8 Pump coupling



Fuel injection pump D 708 (distributor pump)

1 Overrun stop
2 Stopper
3 Throttle arm
4 Bleeder screw
5 Full-speed stop
6 Cold start
7 Full-load adjusting screw
8 Automatic advance mechanism

Fuel

Use the special diesel fuel oils for rapid engines which are supplied by well-known oil companies. Never use fuel oils of poor quality since these can easily cause damage to the fuel injection pump and injectors.
During wintertime where low outer temperatures are to be encountered, the special winter fuels supplied by well-known oil companies should be used. Winter fuels are more volatile and reduce the risk of wax in the fuel system.

NOTE. Mixing methylated spirits, etc., with the diesel fuel is **not** recommended since a small a quantity as just over 1/2% can cause damage to the fuel system. Instead try to keep the fuel tank as well-filled as possible in order to avoid condensation water forming.
If you fill up with fuel at a filling station, always make sure that it is clean round the filling hole. If you fill up from your own storage tank or drum, be careful to filter the fuel well and make sure that all vessels used for filling are thoroughly clean.
Always observe the utmost cleanliness when working on a diesel engine in order to avoid unnecessary functional troubles and unnecessary wear.
The lead seals must not be broken by any unauthorized person. If the seals are broken by anyone other than an authorized mechanic, all guarantees cease to remain valid.

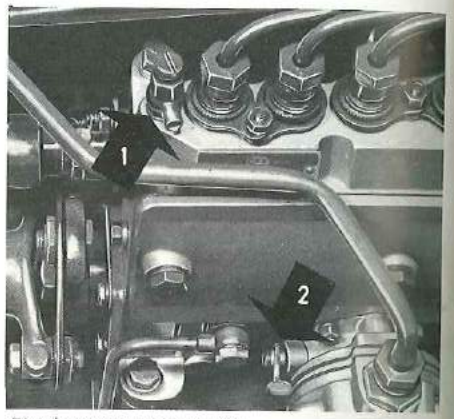
Bleed the fuel system

Bleed the fuel system if:
the engine is new or reconditioned
the engine fuel system has been serviced, e.g., after cleaning or replacing filter
the engine has been idle for some time
the tank has been driven empty of fuel
Bleed the system as follows:

Bleeder screw, fuel filter

Aspirated engine with injection pump CAV NNL (in-line pump)

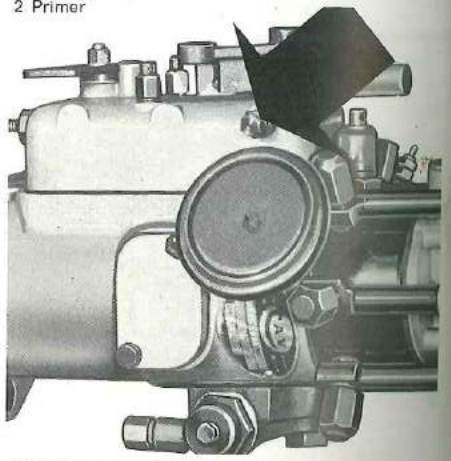
1 Open the bleeder valve on the fuel filter.
2 Fill the fuel system with fuel by priming with the feed pump primer. When fuel free from air bubbles starts flowing out, shut the valve **while** the fuel is running out.
3 Open the front bleeder screw on the injection pump and continue priming until fuel free from bubbles flows out also here, then close the bleeder screw while the fuel is running out.



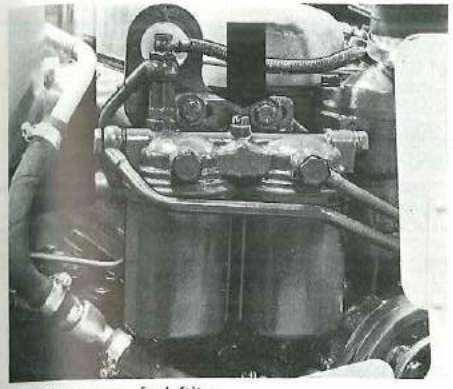
Bleeder screw, in-line pump
1 In-line pump
2 Primer

Aspirated engine with injection pump CAV DPA (distributor pump)

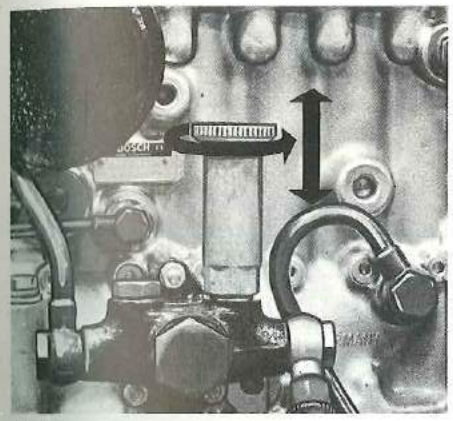
1 Open the bleeder screws on the fuel filters and injection pump and slacken the delivery pipe connections at the injectors.
2 With the feed pump primer, pump until fuel free from air flows out the filter. Then close the filter bleeder screw.
3 Continue priming until fuel free from air comes out at the bleeder screw on the injection pump. Then close the screw.
4 Place the stop lever in operating position and the throttle arm at full throttle and turn over the engine with the starter motor until fuel free from air comes out with each injection. Tighten the delivery pipe nuts well.



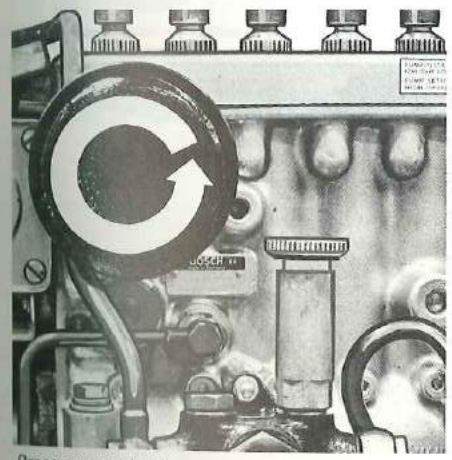
Bleeder screw, distributor pump



Bleeder screw, fuel filter



Hand pump



Pressure equalizer

TD 70 B engine

1 Open the bleeder valve on the fuel filters.

2 Turn the handle on the feed pump anti-clockwise. Then fill the fuel system with fuel by pumping with the handle. When fuel free from air bubbles starts flowing out, close the bleeder valves of the fine filters.

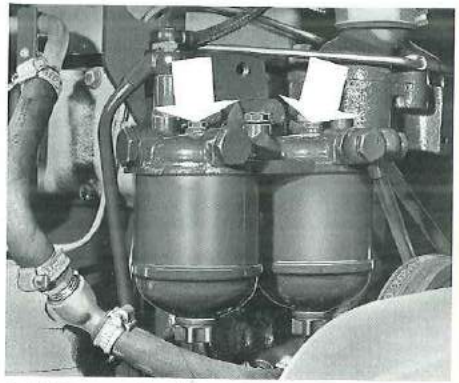
3 Release the pressure equalizer with a spanner and turn it one turn to the left and continue pumping with the primer until fuel free from air bubbles flows out also here. Then tighten up the equalizer.
Turn back the handle on the feed pump.

6 Changing fuel filters

The function of the fuel filters is to clean the fuel of impurities.
The filter inserts consist of a spiral-wound paper filter.

The fuel filters on the D 70 B engine are changed as follows:

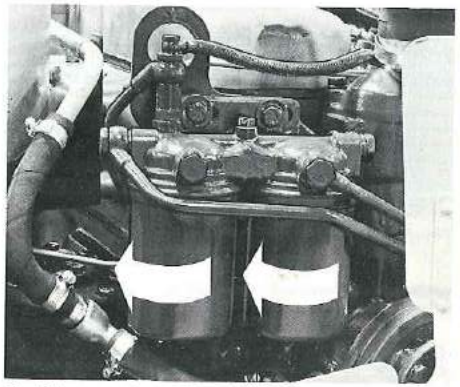
1 **Thoroughly** clean the outside of the filters and connected lines, preferably using compressed air.
2 Remove the containers with their filter insert.
3 Clean the inside of the containers. They should preferably be blown dry with compressed air.
4 Fit the new inserts. Inserts are always replaced since they cannot be cleaned.
5 Make sure the fuel system is well bled.



Fuel filters, aspirated engine

The fuel filters on the turbo-engine (TD 70 B) are changed as follows:

1 Clean round the outside of the filter body to prevent dirt from getting in when the new filters are being fitted.
2 Unscrew the filter cartridges. This should be done with a special tool but can also be done by sticking a screwdriver through the cartridge and turning it.
3 Screw on the new cartridges by hand until the cartridge seal makes contact with the sealing surface. Then continue turning a further 1/2 turn.
4 Bleed the fuel system.



Fuel filters, turbo-engine

7 Checking the fuel injection pump

If the fuel injection pump is to operate as economically and effectively as possible, it is important that it is checked by an authorized workshop.
This check should cover the pump coupling bolts, and of course the pump itself. If necessary, the injection angle should be adjusted. The injectors should be checked concerning spray pattern and the opening pressure adjusted if necessary. Idling and maximum speeds should also be checked and eventually adjusted.
It is extremely important that the fuel injection pump is adjusted properly. For this reason, Volvo has issued diesel test standards which should be followed when adjusting the pump. Incorrect adjustment very often leads to excessively smoky exhaust gases, interruptions in operation and large stresses in the engine. If the engine is fitted with a turbo-compressor, a faulty adjustment can have even graver consequences due to the fact that the turbo-engine will still have surplus air. As a result, an increased amount of fuel will not be seen in the exhaust gas, but the stresses in the engine on the other hand will rise considerably.

NOTE. Adjustment and lead-sealing of the fuel injection pump may only be carried out by authorized mechanics.

8 Overhauling fuel injection pump

After every 160 000 km (100 000 miles) the vehicle should be left with an authorized workshop for removal and overhaul of the fuel injection pump.

9 Draining condensation water and cleaning strainer in fuel tank

At least once a year, suitably in the autumn, the bottom plug of the fuel tank should be removed to enable any dirt and condensation water to run out. The fuel tank strainer should be cleaned at the same time.

On the N 86, NB 86, the strainer can be reached by removing a cover under the passenger's seat. The strainer is cleaned as follows:

1 Disconnect the fuel lines.
2 Unscrew the five bolts on the flange.
3 Take up the strainer, clean it, put it back and re-fit bolts and lines.
4 Bleed the fuel system.

10 Replacing air cleaner with paper filter

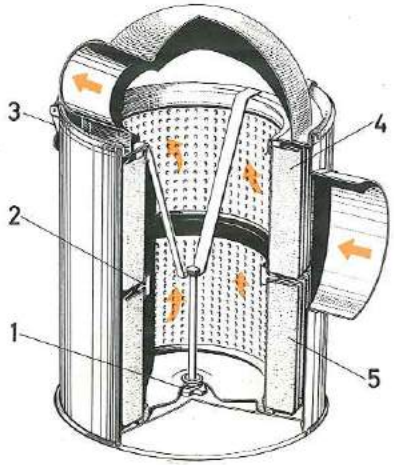
The paper filter in the air cleaner on trucks fitted with a pressure-drop indicator should be changed when the indicator window has become completely red. On the N 86, NB 86 the indicator is located on the cowl in the engine compartment. On the F 86, FB 86 it is placed at the lower edge of the dashboard.

On trucks which do not have a pressure-drop indicator, the filter should normally be changed after 60 000—70 000 km (36 000—42 000 miles). If the truck operates under dusty conditions, where the dust consists of fine particles, the filter may become blocked much sooner.

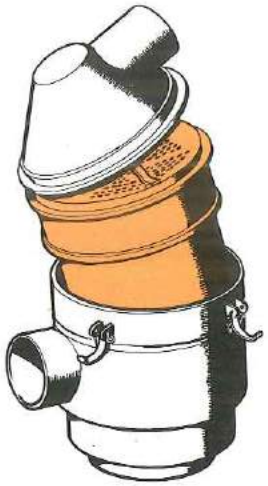
The paper inserts are changed as follows:

1 Disconnect the elbow which is connected to the air cleaner cover.
2 Slacken the clamps. Lift up the upper section. Take out the inserts.
3 Clean the air cleaner. Fit new filter inserts. Make sure that the seals are fitted properly and that the inserts are secured well by the clamps. Put back the cleaner cover.
4 Re-fit the elbow and re-set the pressure-drop indicator by pushing in the button at the bottom.
5 Check well to make sure that there is no leakage in the connection between the air cleaner and the intake manifold.

The paper inserts are not to be washed or moistened — replacement by new ones is the only servicing required here.



Air cleaner
1 Nut
2 Rubber ring
3 Clip
4 Cleaner element
5 Cleaner element

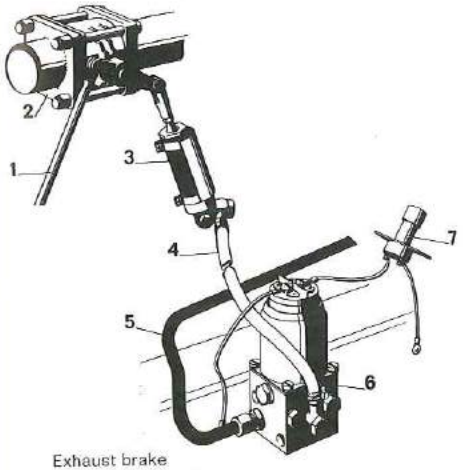


11 Oil-bath air cleaner

The oil-bath air cleaner should be cleaned every 10 000 km (6 000 miles). The oil is changed and the filter cleaned as follows:

1 Remove the air cleaner complete.
2 Take the air cleaner apart and empty out the oil.
3 Clean all parts in white spirit. Allow the spirit to run off the insert before fitting it.
4 Fill with oil of the same type used in the engine. Fill up to just over the level edge.
5 Put the air cleaner together and re-fit it.

When changing the paper insert or cleaning the oil-bath air cleaner, great care must be take to ensure that no impurities get into the engine intake manifold.

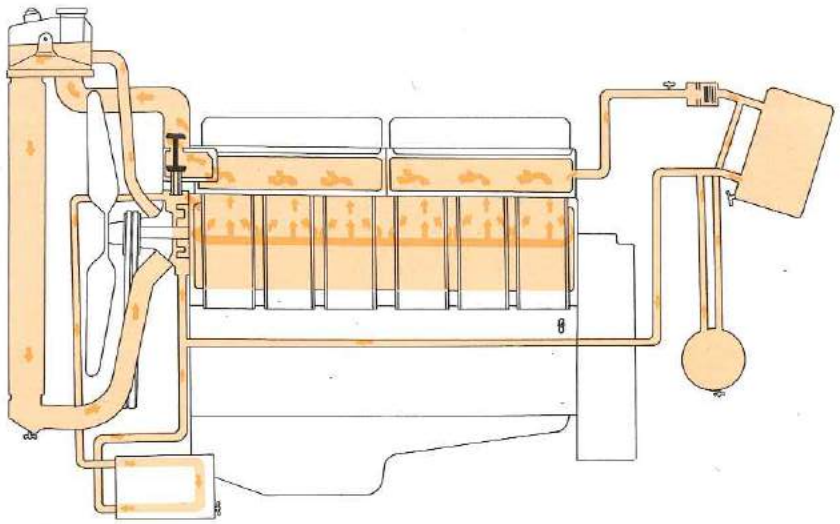


Exhaust brake
1 Sprung link rod
2 Shutter housing
3 Compressed air cylinder
4 Line solenoid valve—compressed air cylinder
5 Line, compressed air reservoir—solenoid valve
6 Solenoid valve
7 Foot contact

Exhaust brake

The exhaust brake consists of a shutter housing mounted in the exhaust pipe of the engine. When the foot contact for the exhaust brake is depressed, fuel injection is cut off and at the same time the shutter in the exhaust pipe closes off the exhaust gas flow. This forms a cushion of air between the shuter and pistons in the engine during the exhaust stroke. The air cushion creates back-pressure on the pistons and produces a braking effect which doubles the ordinary braking effect of the engine. The exhaust brake is controlled by an electrically operated foot contact (7) which, through a solenoid valve (6), operates a compressed air cylinder (3). This operates the exhaust brake shutter through a system of rods and levers. Before the shutter closes completely, fuel injection ceases due to the action of a flexible link rod from the exhaust shuter lever on the stop lever of the injection pump.

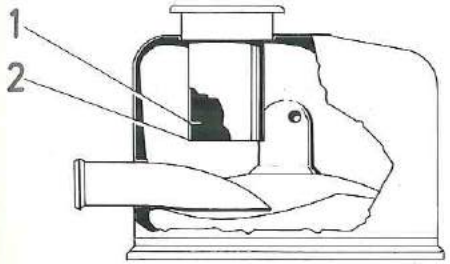
Engine cooling system



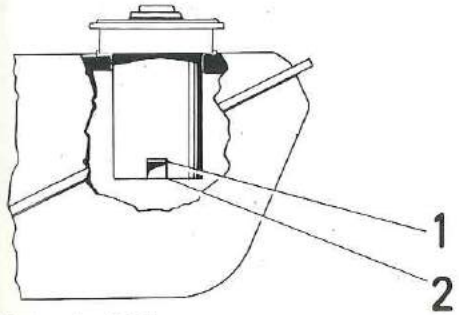
Technical description

The engine is water-cooled with a pressurized system. Coolant circulation is provided by a centrifugal pump driven by vee-belts from the crankshaft belt pulley.
This pump draws the coolant from the lower part of the radiator and feeds it into the cylinder block where it circulates round the cylinder liners and flows up through calibrated holes to the cylinder heads. From the front end of the cylinder block the coolant then goes out via thermostats to the radiator cells where it is cooled. During the warming-up period, the coolant only circulates in the engine cells. The thermostats conduct the coolant through a by-pass directed to the pump, i.e., not through the radiator.

Once the correct operating temperature has been reached, the thermostats regulate the amount of coolant passing out to the radiator, thereby always maintaining the optimum operating temperature.
The radiator must not be screened off in any way, as this can lead to overheating with resultant damage to the engine. The coolant passes through a system of tubes in the radiator. These tubes are cooled by outside air which is drawn through them by means of a fan.



Coolant level, N 86
1 Upper level
2 Lower level



Coolant level, F 86
1 Upper level
2 Lower level

12 Checking coolant level

Check the coolant level every day before starting the engine and each time when filling up with fuel. **When the engine is cold, the level should reach the plate tab in the radiator filler opening.** On the F 86, FB 86, this opening is accessible through the cover between the driver's and passenger's seats.
The level may be somewhat higher when the engine is warm. But it must not be approx. 10 mm (3/8") below the tab. Top up with coolant to the tab if it has.
Do not fill with too much coolant otherwise this will be lost during driving since the coolant level rises. On the other hand, too little coolant can impair the circulation and might risk damage to the engine.
If the level has fallen so low that it cannot be seen through the radiator filler opening, the system must be vented when topping-up.
The system should always be topped-up with the same mixture of coolant already in it.
Repeated topping-up indicates leakage, which must be attended to.

13 **Coolants, changing coolant, checking hose connections**

The cooling system is filled at the factory with approved Volvo anti-freeze which will cater for temperatures down to —25° C (—13° F).

This coolant can be used during the first winter season. **After this, the coolant should be changed every spring and autumn.** When changing the coolant, the whole system should be flushed clean with water and **hoses and connections checked for leakage.**

During summer, water with anti-rust agent should be used. The anti-rust agent supplied by Volvo is packed in bags of 113 grammes (4 ozs.) sufficient for 8—10 litres (about 2 Imp. galls. = 2.4 US galls.) of water. This means that about 3 bags are necessary for the N 86, NB 86 and F 86, FB 86. The agent should be dissolved in water **before** filling into the cooling system.

NOTE. When topping-up during the summer season, water with the same proportion of anti-rust already in the radiator should be used in order to safeguard the anti-rust protection.

During winter, water with glycol should be used.

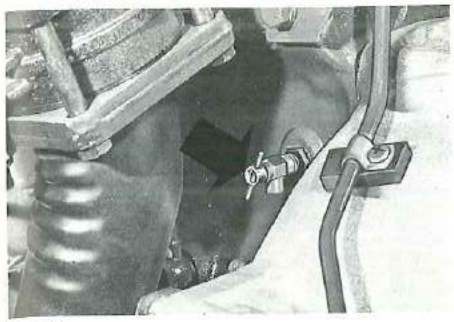
For this purpose, approved Volvo anti-freeze is recommended. Change in good time before the winter season starts. It has been found from experience that weak glycol mixtures are very unfavourable from an anti-rust point of view. The anti-rust additive in the glycol will not last throughout the entire winter season. Therefore, the glycol added should amount to at least 40%. This will provide protection against frost down to —25° C (—13° F).

NOTE. When topping-up during winter, add not less than 40 % glycol.

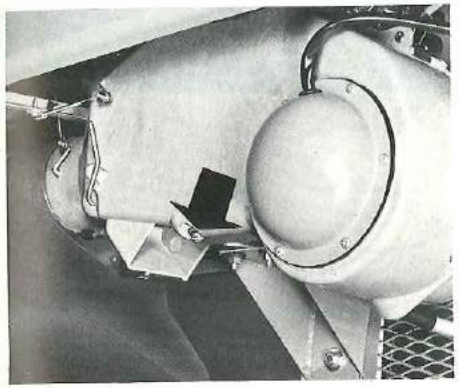
The following table shows the amount of glycol required for low temperatures.

Capacity of cooling system	Necessary amount of glycol in litres (Imp. galls. = US galls.) for frost protection down to:			
	—25° C (—13° F)	—30° C (—22° F)	—40° C (—40° F)	—56° C* (—69° F)
N 86, NB 86: 30.5 litres (6.7 Imp. galls. = 8.0 US galls.) F 86, FB 86: 30 litres (6.6 Imp. galls. = 7.9 US galls.)	approx. 12 (2.6 = 3.2)	13.5 (3.0 = 3.4)	16 (3.5 = 4.2)	18 (4.0 = 4.8)

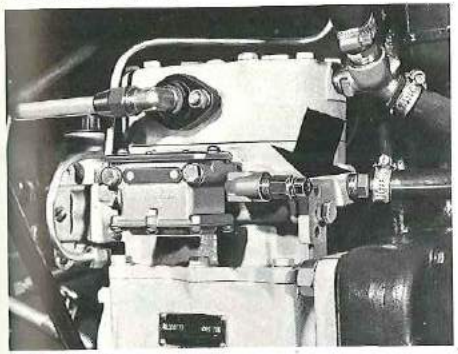
* The glycol quantity indicated for —56° C (—69° F) is the **maximum** amount of frost protection which can be provided. To increase the glycol content above this would only impair the frost protection.



Engine



Heater element (F 86)



Compressor

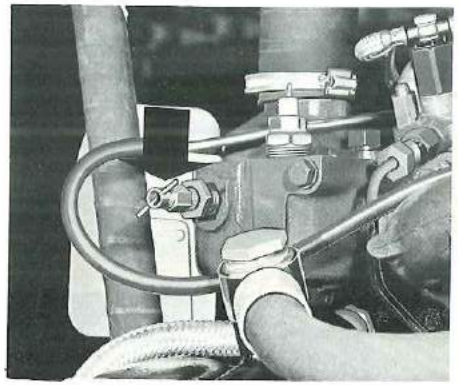
Draining cooling system

There are four drain cocks for draining the cooling system: one on the left-hand side of the cylinder block at the rear, one at the bottom, left, on the radiator, one on the heater element and one on the compressor.

The filler cap should always be removed when draining the cooling system. This will prevent a vacuum from arising which could prevent the fluid from flowing out.

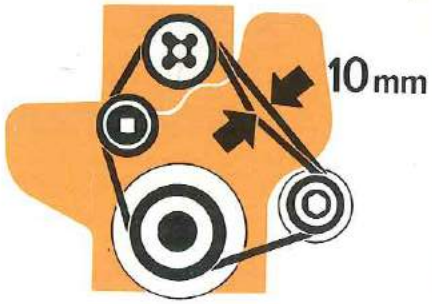
Filling empty cooling system with coolant

When filling an empty system with coolant it is very important to ensure that all air in the cooling system is evacuated. For this reason, the N 86, NB 86 and F 86, FB 86 are fitted with special venting cocks.
An empty system is filled with coolant as follows: Set the heater control to "Warm". Open the venting cock on the thermostat housing. Fill with coolant. When about 0.5 litre (1 pint) coolant has run out through the venting cock, close it. Then fill with coolant (cab down) until the level rises to the tab in the filler opening.
NOTE. The engine must not be started until venting has taken place. After running the engine warm, check the coolant level once again.

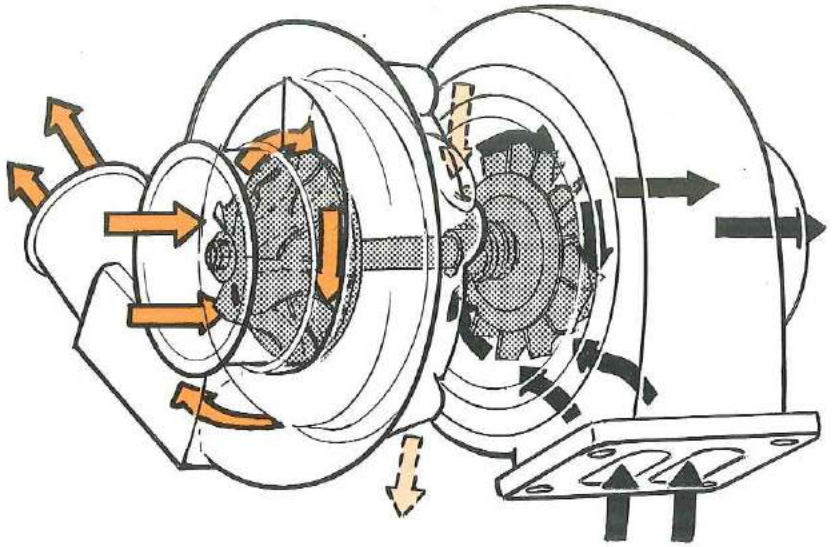


14 Checking drive belts

All the drive belts on the engine should be checked for proper tension. **This check is very important since the tension of the water pump drive belts is vital for the proper function of the cooling system.** Wear, grease or oil can cause the belts to slip. Poorly tensioned belts can also slip in very wet weather.
The belts are tensioned by means of the idler pulley. When properly tensioned, it should be possible to press in the belts about 10 mm (3/8") midway.
NOTE. Always replace both belts even if only one needs to be changed.



Turbo-compressor



Technical description

The turbo-compressor consists of a turbo section and a compressor section between which a bearing housing is located. A shaft, which is journalled in the bearing housing by means of two ball bearings, carries and links the turbine and compressor wheels. Lubrication of the bearings and cooling of the bearing housing are done with oil from the force-feed lubrication system of the engine. The turbo-compressor is mounted directly on the exhaust manifold. When exhaust gases meet the turbine rotor blades, both this rotor and the compressor rotor, which is fitted on the same shaft, start rotating. The compressor rotor then sucks in fresh air which is compressed and supplied to the engine cylinders through the induction manifold.
Maximum rotational speed is about 80 000 r.p.m. The boost pressure thereby provided by the compressor is about 0.8—0.9 kp/cm² (11.4—12.8 p.s.i.).

If it is suspected that the turbo-compressor is not functioning properly, which may be the case if the engine does not produce full output or if the exhaust is very smoky, carry out the following checks:

1 Stop the engine and listen to the turbo-compressor. Normally it stops rotating after the engine has stopped, so that the noise it makes when slowing down should continue to be heard after the engine has stopped. If this noise cannot be heard, remove the pipe between the air cleaner and the turbo-compressor.

2 **Make absolutely sure that the compressor rotor is stationary and only after this feel with the rotor turns stiffly.** If it is stiff, the turbo-compressor must be examined and changed if necessary.

If absolutely necessary, the vehicle can be driven with the turbo-compressor damaged for a short distance providing that the engine loading is considerably less than normal. If any of the symptoms listed below are noticed, the vehicle should be immediately taken to a Volvo workshop for investigation and correction of the fault, otherwise there is risk of the unit being damaged to such an extent that the turbo-compressor cannot be reconditioned, this involving replacement costs which would be greatly in excess of what normally would be necessary. Examples of faulty symptoms:
1 Noise from the turbo-compressor (vibrations)
2 Smoky exhaust
3 Engine does not reach full speed
4 Engine runs unevenly

The turbo-compressor may only be dismantled by an authorized workshop.
No alterations are permitted to the air inlet lines or exhaust pipe and silencer.

15 Checking air line for leakage

The air line from the air cleaner to the turbo-compressor and from the turbo-compressor to the engine should be checked for leakage. Leakage is indicated if there is a whistling or hissing noise when the engine is running. Tighten up any loose hose clips or replace the air line if necessary.

16 Checking exhaust manifold for leakage

It is most important for the function of the turbo-compressor that there is no leakage between the exhaust manifold and turbo-compressor. This can easily be checked with the engine running by watching to see whether there is any exhaust smoke round the manifold, particularly at the joints and connections. To help you with this check, run the engine at high speed with the hand throttle control. It is also important for the function of the exhaust brake that there is no leakage between the compressor and exhaust brake. Any leakage on the exhaust line should be repaired immediately.

17 Checking oil supply line and return line for leakage

The supply and return lines for the lubricating oil must be well tightened. A leaking pipe can usually be discovered at an early stage if the compressor and parts connected to it are kept clean, but a routine check of all pipe connections is, however, necessary. A leaking pipe or connection must be replaced immediately in order not to endanger the function of the compressor.