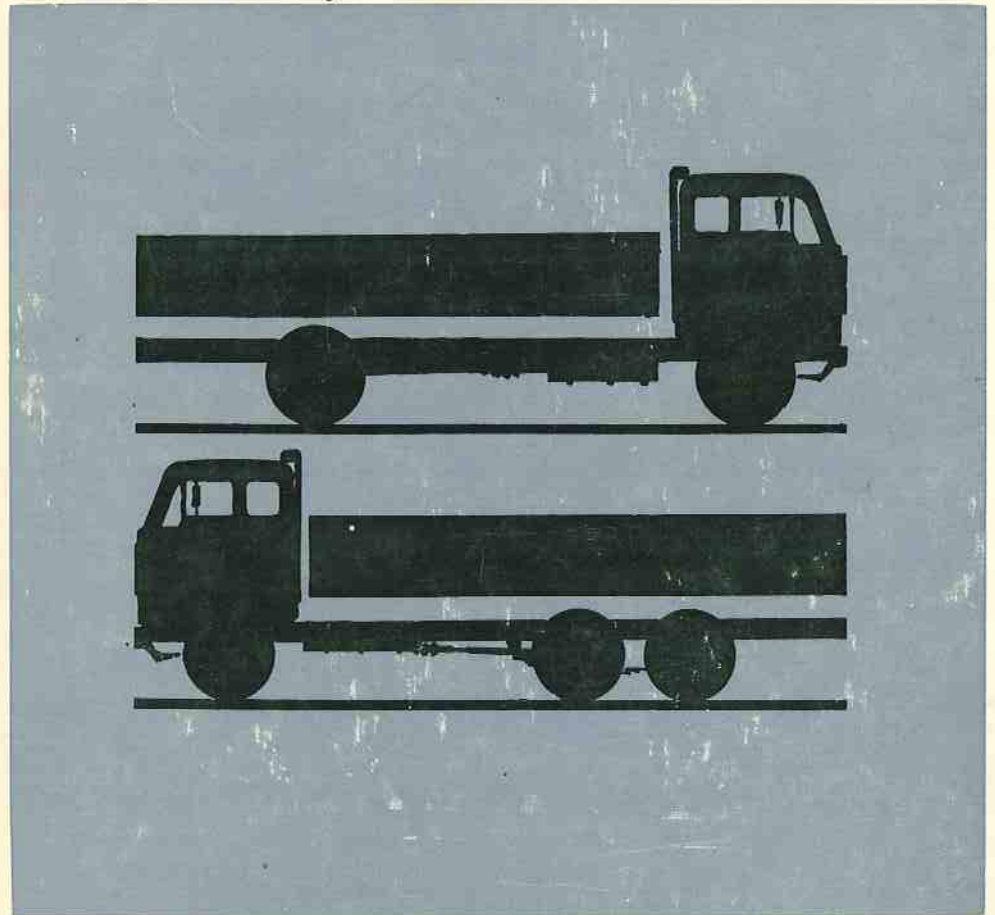


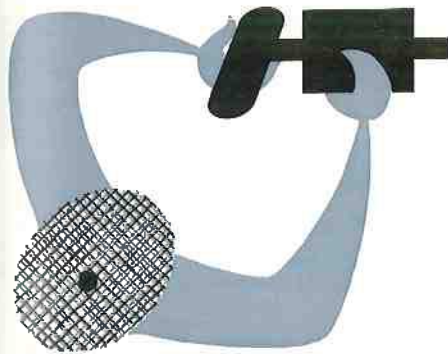
VOLVO

INSTRUCTION BOOK

F88

G88





MAINTENANCE

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 in the way of servicing and maintenance, we have listed the various servicing procedures in the maintenance schedule on the following two pages. The schedule is set out in accordance with three types of driving: local traffic, short-distance traffic and long-distance traffic.

Knowing what type of driving your vehicle is to be used for 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 schedule with (○). Work which can be done by the owner or driver is indicated with (●).

The various points in the maintenance schedule are numbered consecutively, and refer to the more detailed descriptions on the pages following the maintenance schedule.

This chapter also includes technical descriptions of the truck components.

MAINTENANCE SCHEDULE		To be carried out after every:						Remarks
Action		Local traffic		Short-distance traffic		Long-distance traffic		
		km	miles	km	miles	km	miles	
ENGINE								
1. Compression test	○	10 000	6000	20 000	12 500	40 000	25 000	
2. Check valve clearance	○	20 000	12 500	40 000	25 000	80 000	50 000	
Lubricating system								
3. Check oil level	●	Every day						
4. Change oil	●	5000 ¹⁾	3000 ¹⁾	5000 ¹⁾	3000 ¹⁾	5000 ¹⁾	3000 ¹⁾	
5. Change oil filter	●	10 000 ²⁾	6000 ²⁾	10 000 ²⁾	6000 ²⁾	10 000 ²⁾	6000 ²⁾	
Fuel system								
6. Clean pre-filter	●	5000	3000	10 000	6000	20 000	12 500	
7. Change fine filters	●	See page 50						
8. Check injection pump and injectors	○	10 000	6000	20 000	12 500	40 000	25 000	
9. Overhaul injection pump	○	160 000	100 000	160 000	100 000	160 000	100 000	
10. Clean strainer in fuel tank, drain condensation water	●	20 000	12 500	40 000	25 000	80 000	50 000	
11. Change paper element of air cleaner	●	See page 53						
Cooling system								
12. Check coolant level	●	Every day						
13. Change coolant, check hose connections	●	Every spring and autumn						
14. Check V-belts	●	5000	3000	5000	3000	10 000	6000	
Turbo-compressor								
15. Check air line for leakage	●	5000	3000	10 000	6000	20 000	12 500	
16. Check exhaust pipe for leakage	●	5000	3000	10 000	6000	20 000	12 500	
17. Check oil supply line and return line for leakage	●	5000	3000	10 000	6000	20 000	12 500	
18. Check oil flow	○	10 000	6000	20 000	12 500	40 000	25 000	
19. Check boost pressure	○	10 000	6000	20 000	12 500	40 000	25 000	
20. Change turbo-compressor	○	160 000	100 000	160 000	100 000	160 000	100 000	See page 64.
ELECTRICAL SYSTEM								
21. Check electrolyte level in batteries	●	2500	1500	2500	1500	2500	1500	
22. Check charging condition of batteries	●	5000	3000	10 000	6000	20 000	12 500	
23. Check alternator brushes	○	See page 87						
24. Check headlight adjustment	○	10 000	6000	20 000	12 500	40 000	25 000	
CLUTCH								
25. Check fluid level in container	●	5000	3000	5000	3000	5000	3000	
26. Check clutch lever clearance	○	5000	3000	5000	3000	10 000	6000	

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 (1600 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).

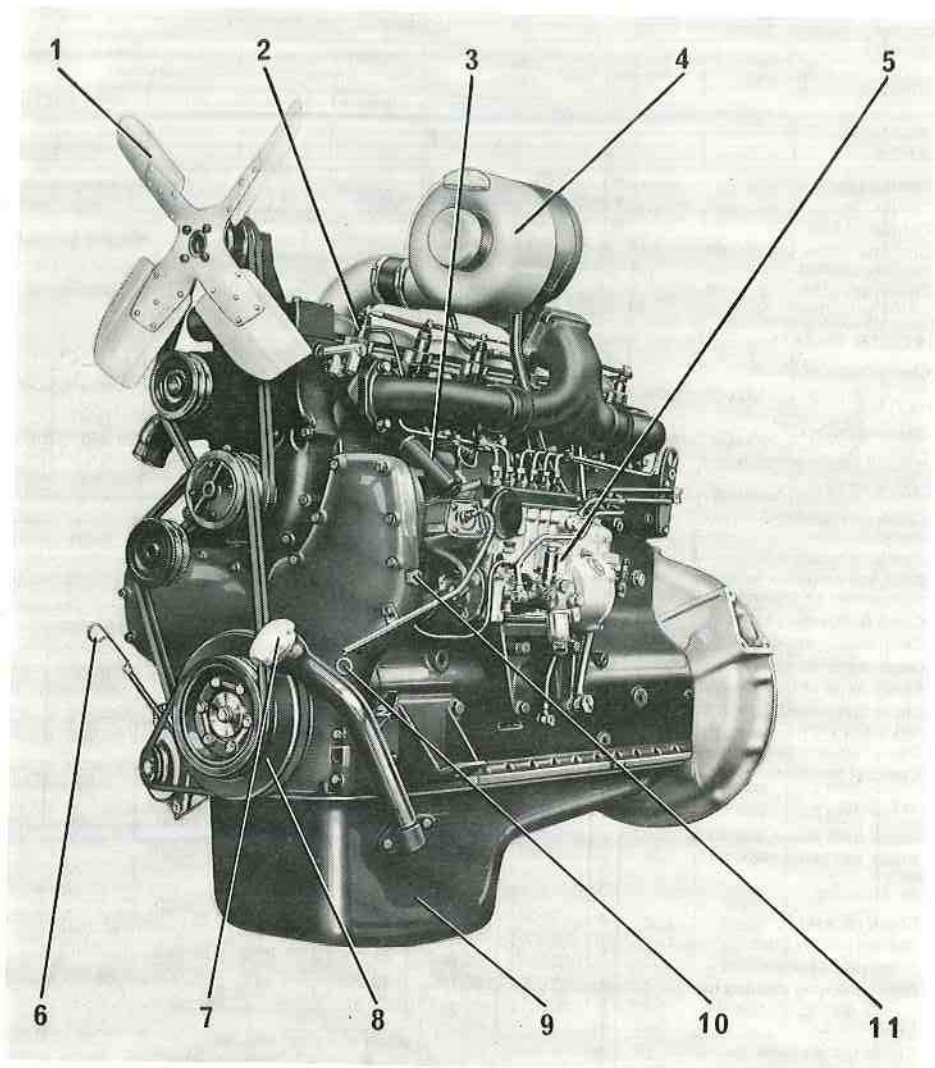
3) The oil should be changed at least once a year even when mileage is less than 40 000 km (25 000 miles) annually.

4) After the first 10 000 km (6000 miles) as well as when running-in.

MAINTENANCE SCHEDULE		To be carried out after every:						Remarks
Action		Local traffic		Short-distance traffic		Long-distance traffic		
		km	miles	km	miles	km	miles	
GEARBOX								
27. Check oil level	●	2500	1500	2500	1500	2500	1500	
28. Change the oil	●	40 000 ³⁾	25 000 ³⁾	40 000 ³⁾	25 000 ³⁾	40 000 ³⁾	25 000 ³⁾	
29. Change oil filter	●	80 000 ²⁾	50 000 ²⁾	80 000 ²⁾	50 000 ²⁾	80 000 ²⁾	50 000 ²⁾	
30. Lubricate valves and cylinder of auxiliary gearbox	○	Once a year						
31. Check gear-changing point, SR 61 overdrive	○	5000	3000	5000	3000	10 000	6000	
PROPELLER SHAFTS								
32. Check propeller shafts	○	5000	3000	10 000	6000	20 000	12 500	
REAR AXLE								
33. Check oil level	●	2500	1500	2500	1500	2500	1500	
34. Change the oil	●	40 000 ³⁾	25 000 ³⁾	40 000 ³⁾	25 000 ³⁾	40 000 ³⁾	25 000 ³⁾	
BRAKE SYSTEM								
35. Check pressure regulator and warning lamps	●	Every day						
36. Check for leakage	●	5000	3000	5000	3000	10 000	6000	
37. Drain condensation water in compressed air reservoirs	●	Once a week						See page 87
38. Check fluid level in anti-freeze device	●	Once a week						See page 88
39. Clean anti-freeze device filter	●	5000	3000	10 000	6000	20 000	12 500	
40. Clean compressor filter	●	5000	3000	5000	3000	10 000	6000	
41. Check travel of brake cylinders	○	5000	3000	5000	3000	10 000	6000	
42. Check brake bands, brake drums and brake cams	○	10 000	6000	20 000	12 500	40 000	25 000	
43. Check function of brake system	○	20 000	12 500	40 000	25 000	80 000	50 000	
44. Overhaul compressor	○	Every other year						
FRONT END								
45. Check front wheel alignment	○	5000	3000	10 000	6000	20 000	12 500	
46. Check ball joints, rods, etc.	○	8000	3000	5000	3000	10 000	6000	
Power steering								
47. Check oil level	●	2500	1500	2500	1500	2500	1500	
48. Change oil and filter	○	40 000 ⁴⁾	25 000	40 000 ⁴⁾	25 000 ⁴⁾	80 000	50 000	
49. Overhaul power steering	○	40 000	25 000	40 000	25 000	80 000	50 000	
50. Reconditioning steering gear	○	240 000	150 000	240 000	150 000	240 000	150 000	
WHEELS								
51. Check tyre pressure	●	When filling up with fuel						
52. Check-tighten wheel nuts	●	5000	3000	5000	3000	10 000	6000	
BODY								
53. Lubricate body	●	5000	3000	5000	3000	10 000	6000	
CHASSIS								
54. Lubricate chassis	●	See lubricating chart						

Note. The operation numbers in the table refer to the detailed descriptions with the corresponding numbers on the following pages.

ENGINE



TD 100 A engine

- 1 Fan (thermostat-controlled or fixed)
- 2 Injector
- 3 Servo pump
- 4 Turbo-compressor
- 5 Fuel injection pump

- 6 Oil dipstick
- 7 Oil filler
- 8 Vibration damper
- 9 Sump
- 10 Cold starting control
- 11 Tachometer sensor

General

TECHNICAL DESCRIPTION

The D 100 B and TD 100 A are six-cylinder, in-line fourstroke direct-injection Diesel engines with overhead valves. The engines are equipped with wet-type, easily replaceable cylinder liners and separate, interchangeable cylinder heads.

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

The main and big-end bearings are replaceable and consist of indium-plated, lead-lined bearing shells. The camshaft, injection pump, oil pump, compressor and servo pump are driven by means of auxiliary drive gears from the crankshaft.

The fan, coolant pump and alternator are driven by means of V-belts from the crankshaft pulley.

The TD 100 A is a turbo-compressor supercharged version of the D 100. The pistons, fuel injection pump, camshaft, exhaust manifold, silencer and exhaust pipe are therefore of modified design.

1 COMPRESSION TEST

In order to obtain an idea of the general condition of the engine, a compression test can be carried out.

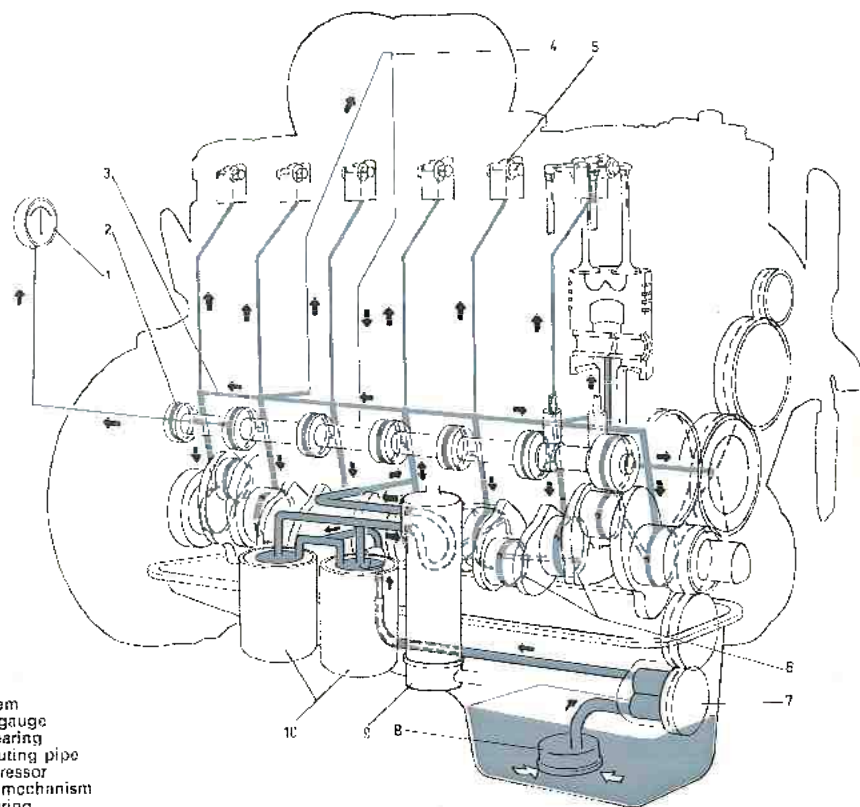
The test should be done with a warm engine. Remove the injectors and test the cylinders in turn. NOTE. The stop control must be fully out. The compression pressure should be about 26 kp/cm² (370 lb/sq.in.) at a speed of 220 r.p.m. for the D 100 B and at 230 r.p.m. for the TD 100 A.

2 CHECKING THE VALVE CLEARANCE

The valve clearance should be checked at regular intervals. Insufficient valve clearance can lead to burnt valves.

The valve clearance should be adjusted with the engine cold and should be 0.40 mm (0.016") for the inlet valves and 0.70 mm (0.028") for the exhaust valves. Since the pistons are made with the combustion chamber in the crown, the distance between the pistons and valves is so small that on no account must valve adjustment be carried out with the engine running, as otherwise the valves can strike the piston. Pull out the stop control and turn the engine round by using the starter motor. Turn the engine round to the end of the compression stroke for No. 1 cylinder, i.e. with the piston in No. 1 cylinder at top dead centre, and then measure the clearance on the following rocker arms: 1, 2, 4, 5, 8 and 9. Then turn the engine round one complete turn and measure the clearance on rocker arms 3, 6, 7, 10, 11 and 12.

Engine lubricating system



- Lubricating system
- 1 Oil pressure gauge
 - 2 Camshaft bearing
 - 3 Main distributing pipe
 - 4 Turbo-compressor
 - 5 Rocker arm mechanism
 - 6 Big-end bearing
 - 7 Oil pump
 - 8 Oil strainer
 - 9 Oil cooler
 - 10 Oil filter

TECHNICAL DESCRIPTION

The engine has a complete force-feed lubricating system. The oil pressure is provided by a gear pump (7), which is driven from the crankshaft gear through an intermediate gear.

The oil pump sucks the oil from the sump through a metal gauze strainer (8) and feeds it to the oil filter elements (10).

The relief valve limits the oil pressure and thus prevents it from reaching excessively high values.

The TD 100 A is fitted with an oil cooler.

The function of the oil cooler is to decrease oil temperature, particularly under heavy loading. The oil cooler is connected to the oil filter housing.

From the oil filter housing the oil goes to a main distributing pipe from which galleries lead to the main bearings and through drillings in the crankshaft to the big-end bearings. Oil is forced up to the gudgeon pins and bushings through a channel in each connecting rod.

The air compressor, turbo-compressor and injection pump have force-feed lubrication from outlets on the main distributing pipe.

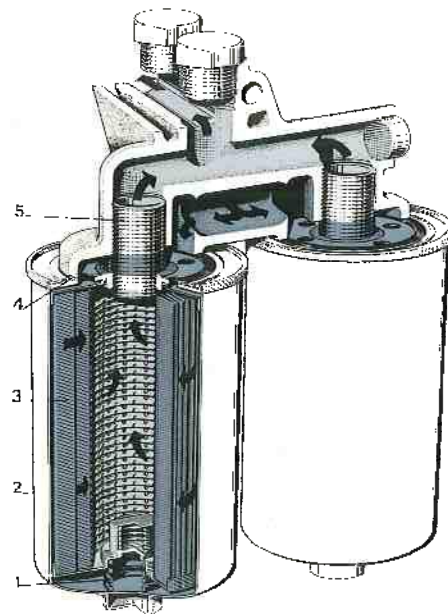
Oil filter

The oil filter is of the full-flow type, i.e. all the oil passes through the filter on its way to the lubricating points.

The filter consists of a housing in which two filter cartridges are fitted.

The filter elements consist of special filter paper which is folded in such a way as to give a large effective filtering surface.

At the bottom of the filter cartridges there is an overflow valve which allows the oil to by-pass the filter if the pressure drop through the elements should be too large. The filter cartridges are of the disposable type and are therefore changed complete. Note. Always change both cartridges at the same time.



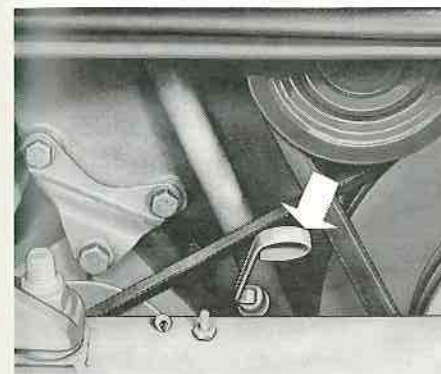
Oil filter
 1 Relief valve
 2 Filter cartridge
 3 Filter unit
 4 Rubber seal
 5 Bushing

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 quality		Viscosity ¹⁾		
	Normal operating conditions	Severe operating conditions	Below -10° C (14° F) ²⁾	-10° to 20° C (14° to 70° F)	Above 20° C (70° F)
D 100 B	For Service DM	For Service DS	SAE 10 W	SAE 20/20W ³⁾	SAE 30
TD 100 A	For Service DS		or SAE 10 W-20	or SAE 20 W-30	

¹⁾ The temperature values refer to continuous air temperatures.
²⁾ Or when cold-starting difficulties can be expected.
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.



3 CHECKING OIL LEVEL

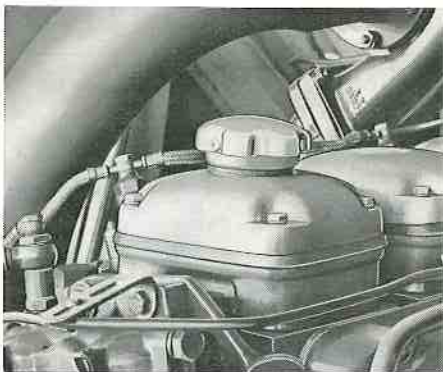
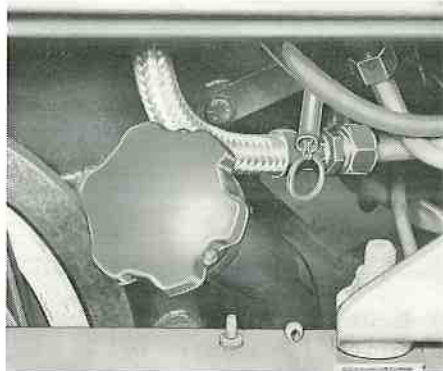
Check the oil level every day before starting the engine and when filling up with fuel. The oil level is checked with the dipstick which is placed behind the service opening on the front of the cab. The level should be maintained between the two marks on the dipstick. The distance between the dipstick markings corresponds to about 8 litres (1.8 Imp. galls. = 2.1 US gallons). **On no account must it fall below the lower mark.** The level should not be above the upper mark either. Top up with new oil of the same quality that is already in the engine when necessary.

4 CHANGING THE OIL

During the running-in period the oil must be changed after the first 1000 km (600 miles) and again in connection with the cost-free inspection after 2500 km (1500 miles). After this the oil must be changed every 5000 km (3000 miles), but in any case at least once every six months. The drain plug is fitted at the bottom of the sump. Drain the oil immediately after running when it is still warm.

Oil can either be filled through the filling hole behind the service opening or through the filling hole on the rear rocker arm casing.

Oil change quantity: approx. 18 litres (4.0 Imp. galls. – 4.7 US galls), excluding oil filter.
including oil filter and oil cooler, approx. 20 litres (4.4 Imp. galls. – 5.3 US galls.)



5 CHANGING THE OIL FILTER

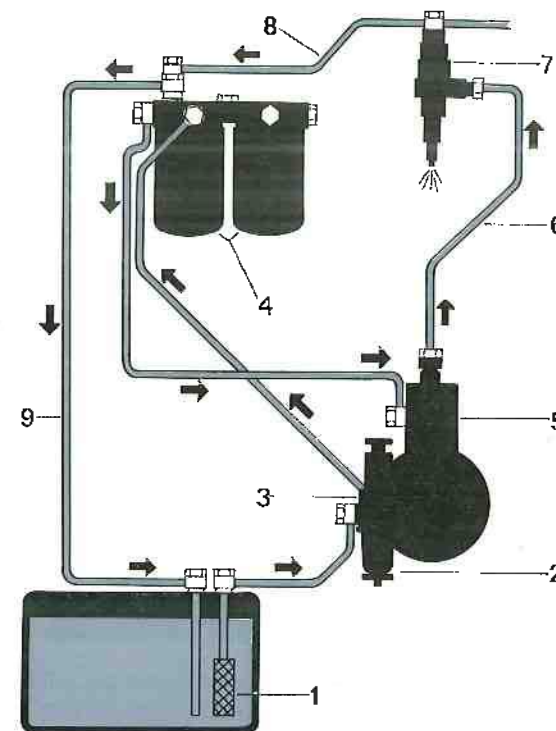
Both the filter cartridges of the oil filter must be changed after 10 000 km (6000 miles) regardless of the type of operation. During the running-in period, however, they must be changed after the first 5000 km (3000 miles).

N.B. The filter cartridges must not be cleaned – the only permissible action being to replace them completely. Always change both cartridges at the same time.

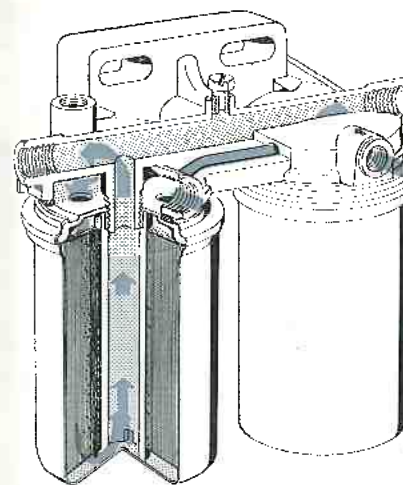
The cartridges are replaced as follows:

- 1 Clean the outside of the oil filter so that no dirt can enter when the new cartridges are fitted.
- 2 Loosen the filter cartridges with a spanner and throw them away.
- 3 Moisten the sealing washers of the new filter cartridges with oil. Screw in the cartridges by hand until the sealing washers make contact with the sealing surfaces. Then screw them in a further 1/2 to 3/4 of a turn.
- 4 Fill up the engine with oil and start it. Check that there is no leakage.

Engine fuel system



- Fuel system
- 1 Tank filter
 - 2 Pre-filter
 - 3 Feed pump
 - 4 Fine filters
 - 5 Injection pump
 - 6 Delivery line
 - 7 Injector
 - 8 Leak-off oil line
 - 9 Return line



Fine filters

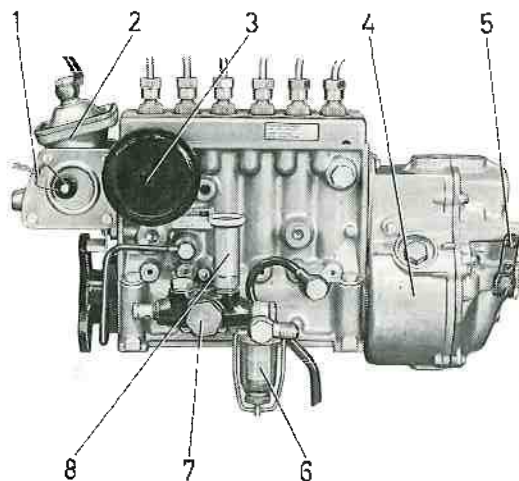
TECHNICAL DESCRIPTION

The fuel is sucked through a strainer (1) in the fuel tank and passes to the pre-filter (2) and feed pump (3), from where it is fed through the parallel-connected fine filters (4) to the injection pump. Special pump elements in the injection pump – one for each cylinder – then force the fuel through the delivery pipes to the injectors, which spray the fuel in finely atomized form into the engine cylinders. As a further safeguard, the injectors are provided with rod filters.

Injection pump

The fuel supply is controlled by a centrifugal governor. The injection pump control rod and injected quantities are influenced mechanically by speed-sensing weights in the governor.

The injection pump on the turbo-supercharger is also provided with a pressure-dependent full-load stop (smoke limiter) which regulates the amount of fuel in relation to the pressure existing in the induction manifold.



Injection pump TD 100 A
 1 Cold-starting device
 2 Pressure-dependent full-load stop (smoke limiter)
 3 Pressure compensator
 4 Centrifugal governor
 5 Throttle lever
 6 Pre-filter
 7 Feed pump
 8 Hand primer

FUEL

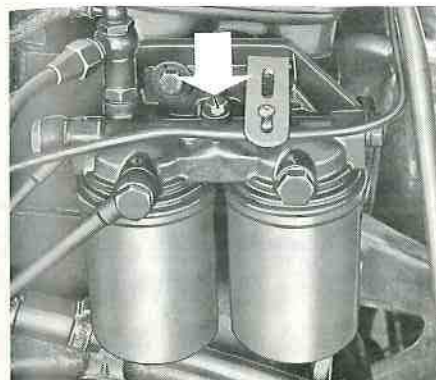
Use one of the special Diesel fuel oils for high-speed engines supplied by a well-known oil company. Never use inferior quality fuel oils, since these can cause functional troubles in the injection pump and injectors. During winter when the air temperature is very low, use one of the special winter fuels supplied by the well-known oil companies. Winter fuels are more volatile and reduce the risk of wax precipitation in the fuel system.

Note. The addition of alcohol to the fuel is not recommended. Even small quantities (more than 1/2%) can damage the fuel system. Instead, try to keep the tank as full as possible to avoid condensation.

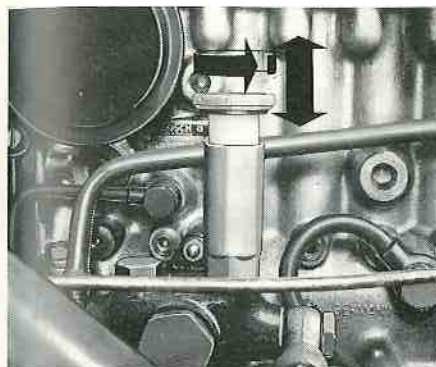
If you fill up with fuel at a filling station, always make sure that it is clean round the filling hole. If you fill up from your own storage tank or drums, be careful to filter the fuel well and make sure that all vessels used for filling are thoroughly clean.

REMEMBER

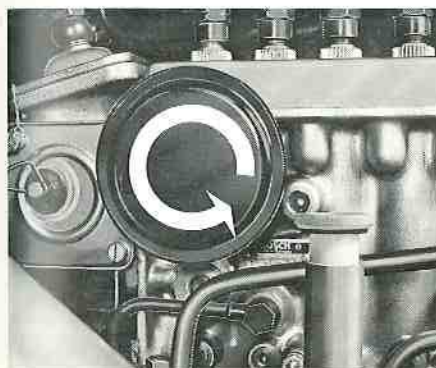
Always observe the utmost cleanliness when working on the Diesel engine in order to avoid unnecessary functional troubles and unnecessary wear. The lead seals must not be broken by any unauthorised person. If the seals are broken by anyone other than an authorised mechanic, all guarantees cease to be valid.



Venting valve for fine filters



Hand priming pump



Pressure compensator

VENTING THE FUEL SYSTEM

The fuel system should be vented when:

- The engine is new or has been reconditioned.
- The fuel system has been serviced, for example, after cleaning or changing filters.
- The engine has not been in use for some length of time.
- The fuel tank has been run empty.

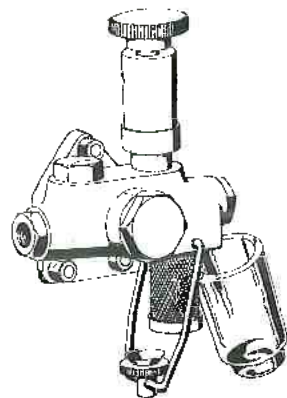
Vent the system as follows:

- 1 Open the venting valve on the fine filters.
- 2 Turn the handle on the feed pump anti-clockwise. Then prime the system with fuel by operating the pump handle. When fuel free from air bubbles begins to run out, close the filter fine venting valves while the fuel is running out.
- 3 Loosen the pressure compensator with a spanner and turn it one turn to the left and continue pumping with the hand priming pump until fuel free from air bubbles also runs out here, and then tighten it up again while the fuel is running out. Turn back the handle on the feed pump.

6 CLEANING THE PRE-FILTER

The pre-filter consists of a fine-mesh plastic gauze which separates impurities from the fuel before it is sucked into the feed pump.

- 1 Loosen the clamping nut, move the clamp aside and lift off the filter body. Take out the filter element.
- 2 Clean the filter element, body and casing with clean white spirit.
- 3 Make sure that the sealing washers on the filter body and fuel pipe banjo screw are undamaged. Assemble the parts.
- 4 Vent the fuel system.



7 CHANGING THE FINE FILTERS

The purpose of the fine filters is to remove any impurities which may have passed through the pre-filter. The filter cartridges are of the expendable type and are replaced completely. Note. Change both cartridges at the same time.

The filter cartridges are changed in the following way:

- 1 Clean the outside of the filter housing to prevent dirt from getting in when the new filters are fitted.
- 2 Loosen the filter cartridges. Use a special tool or stick a screwdriver through the cartridge and then twist.
- 3 Screw on the new cartridges by hand until the gaskets contact the sealing surfaces. Then tighten half a turn.
- 4 Vent the fuel system.

The fine filter cartridges should be replaced as soon as feed pressure after the filters is less than 0.5 kp/cm² (7 lb./sq.in.). NOTE. This applies on condition that the pre-filter is not blocked and that the feed pump has been adjusted. A running interval of 30 000–50 000 km (20 000–30 000 miles) can be considered normal between filter replacements.

Feed pressure should be checked after every 20 000 km (12 000 miles).

The pre-filter should also be cleaned at the same time as the fine filters are replaced.

8 CHECKING INJECTION PUMP

In order for the injection pump to operate as economically and effectively as possible, it is important that the vehicle should be taken to an authorised workshop for checking in accordance with the intervals show in the maintenance schedule.

In this connection the pump coupling bolts should be examined and the injection timing angle of the pump checked and adjusted if necessary. The injectors should be checked for spray pattern and opening pressure and adjusted if necessary. Idling should also be checked and adjusted if necessary.

It is most important that adjustment of the injection pump is carried out correctly. Volvo has therefore prepared special Diesel Test Standards, which should be followed when adjusting the injection pump. Faulty adjustment can lead to a smoky exhaust, irregular operation and severe stresses on the engine. If the engine is equipped with a turbo-compressor, faulty adjustment can have even more serious consequences due to the fact that the engine has a continuous surplus supply of air. This means that an increased amount of fuel cannot be noticed through the exhaust gases, while the stresses on the engine considerably increase.

N.B. The injection pump may only be adjusted and sealed by authorised mechanics.

9 OVERHAULING INJECTION PUMP

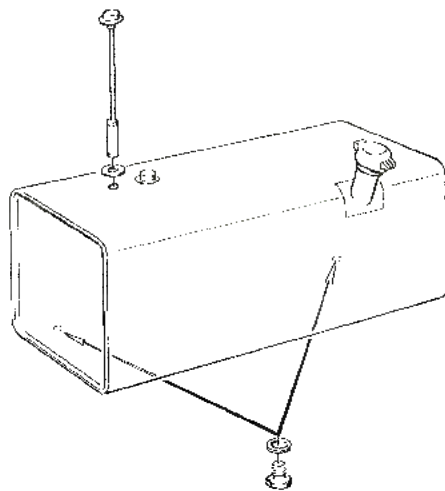
After every 160 000 km (100 000 miles) the vehicle should be taken to an authorised workshop for removal and overhaul of the injection pump.

10 DRAINING CONDENSATION WATER AND CLEANING STRAINER IN FUEL TANK

Once a year, preferably during the autumn, the bottom plug of the fuel tank should be removed in order to drain out any sludge and condensation water.

At the same time the fuel tank strainer should also be cleaned, which is done as follows:

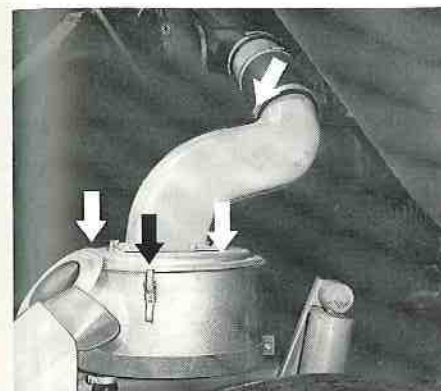
- 1 Disconnect the fuel lines.
- 2 Loosen the five screws on the flange.
- 3 Lift up the strainer, clean it and refit the parts.
- 4 Vent the fuel system.



AIR CLEANER

When operating in long-distance traffic, the filter should normally be replaced after 60 000–70 000 km (37 000–44 000 miles) operation. If the vehicle is used under dusty road conditions (for example in certain types of building construction work) the filter must be changed more often.

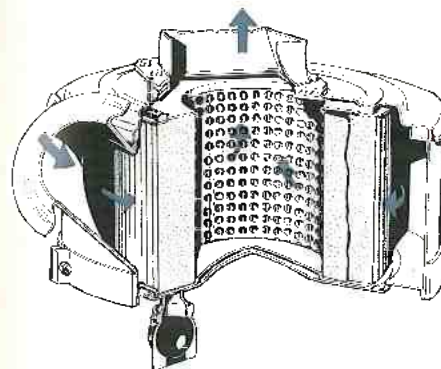
One indication that the filter is blocked can be that engine output is lower and that the exhaust gases become smoky.



Cleaning the air cleaner

Replacing the filter cartridge

- 1 Tilt the cab forward.
- 2 Remove the cover from the air cleaner housing together with the connecting pipe.
- 3 Lift out the cartridge.
- 4 Clean the air cleaner housing internally. Check the gaskets and the rubber valve in the bottom of the air cleaner housing. Replace if necessary. If the housing needs to be removed, it is advisable to mark up before loosening the tensioning band. If the complete air cleaner is to be removed, when fitting make sure that the cleaner housing is pressed down against the bottom of the bracket when it is tightened by means of the tensioning band.
- 5 Replace the filter cartridge.
- 6 Re-fit the cover. Make sure that the filter cartridge is clamped in position.
- 7 Check that the sealing collar (rubber bellows) on the air intake is centred in relation to the cleaner housing connector flange and that the draining hole in the sealing collar points downwards. Then adjust if required. When the cab is lowered and secured in position again, the sealing collar should be compressed by about 5 mm (0.2 in.).

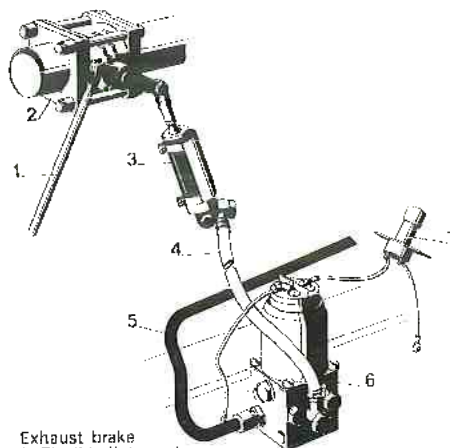


Exhaust brake

The exhaust brake consists of a flap housing fitted in the exhaust pipe of the engine. When the foot contact for the exhaust brake is pressed down, fuel injection is cut off and at the same time the flap in the exhaust pipe closes off the exhaust gas flow. This forms a cushion of air between the flap and pistons in the engine during the exhaust stroke. This cushion of air creates back-pressure on the pistons and produces a braking effect which doubles the ordinary braking effect of the engine.

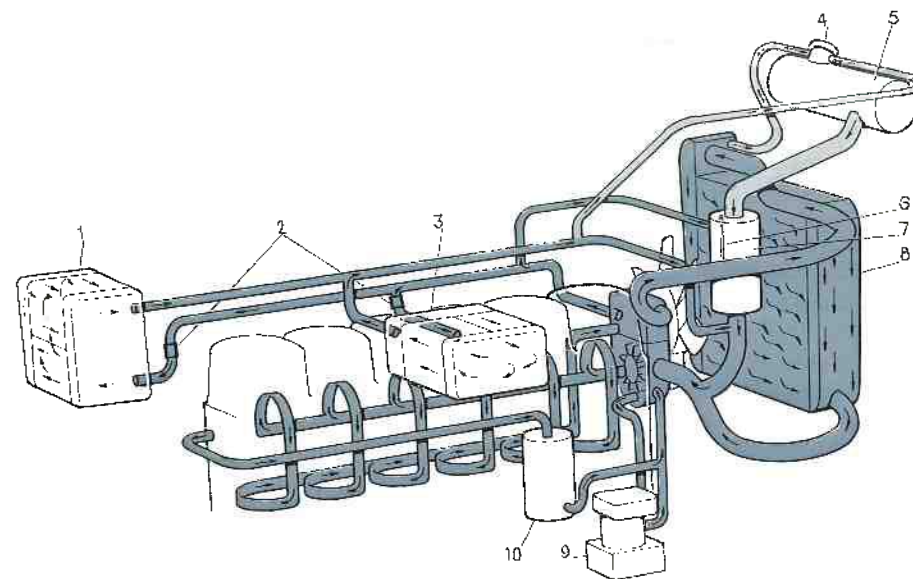
The exhaust brake is controlled by an electrical foot contact (7) which, through a solenoid valve (6), operates a compressed air cylinder (3). This operates the exhaust brake flap through a system of rods and levers. Before the flap closes completely, fuel injection ceases due to the action of a flexible link rod from the exhaust flap lever on the stop lever of the injection pump.

The exhaust brake normally requires no maintenance. The only thing to think about is to use it every day (to avoid it sticking through carbon deposits).



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

Engine cooling system



- Cooling system, full circulation
 1 Left hand heater
 2 Heater control valve
 3 Right hand heater
 4 Filler cap (pressure type)
 5 Expansion tank
 6 Level indicator
 7 Air deflector tank
 8 Cross-flow cooler
 9 Compressor
 10 Oil cooler

TECHNICAL DESCRIPTION

The engine is water-cooled with a pressurized system. Coolant circulation is provided by a centrifugal pump which is driven by V-belts from the crankshaft belt pulley.

The pump feeds the coolant into a distribution channel in the left side of the cylinder block from where it passes through channels directly up to the cylinder heads where flow is directed at the injector sleeves and exhaust valve seats. From there it passes to the cylinder liners.

At the front end of the cylinder block the coolant then goes up to the thermostat housing where coolant temperature is controlled by three wax thermostats.

During the warming-up period, the coolant only circulates in the engine itself through a by-pass directly to the pump, i.e. not through the radiator.

When the correct operating temperature has been reached, the thermostats control the amount of coolant which passes out to the radiator, thereby always maintaining the optimum operating temperature.

In the radiator the coolant passes through a system of tubes which are cooled by the outside air which is drawn through by means of a fan.

The cooling system includes an air separation tank and an expansion tank. The air separation tank eliminates air which collects or has got into the cooling system. Air collects in the expansion tank and is evacuated through the filler hole. On the upper part of the air separation tank, there is a level indicator which actuates a warning lamp on the dashboard to inform the driver if the cooling water level is too high for some reason. **The radiator must not be screened off in any way since this can cause overheating and engine damage.**

Thermostatically controlled fan

The fan has a hydraulic drive system which is variably controlled by a thermostat.

On the fan shaft there is a fixed drive plate in the fan connector housing. Hydraulic fluid transfers power from the drive plate to the fan. The more fluid, the more power transferred, i.e. degree of engagement.

In the connector housing there is a hydraulic fluid tank. Depending on the air temperature, the thermostat regulates the amount of fluid between the drive plate and the tank.

When the engine is started from cold the fan will first run fast due to the fluid round the drive plate but as the fluid is transferred to the tank the fan rotates more slowly until minimum speed is obtained, i.e. about 25% of the speed of the fan shaft.

As the engine temperature increases, so the fan will be engaged more and more until a maximum speed of about 95% of that of the fan shaft is reached.

If the warning lamp for the cooling system should light up while the engine is running and it is found that



there is a fault on the fan, it is possible to lock the fan so that it is driven mechanically. This is done as follows:

- 1 Loosen the two screws which hold the ratchet pawls. The screws are situated on the rear of the fan clutch housing.
- 2 Turn the fan round so that the ratchet pawls come in line with the corresponding notches in the drive shaft.
- 3 Push in the ratchet pawls and tighten up the screws.

The fan is now driven mechanically. However, it is necessary to take the vehicle to a workshop for overhaul of the fan as soon as possible.

The fan can suffer bearing damage if it is run too long in a locked position.



12 CHECKING THE COOLANT LEVEL

Check the coolant level every day before starting the engine and each time you fill the tank with fuel.

The level should be up to the metal marker in the filler opening. If the level has gone down more than 2–3 cm (about 1") below the metal marker, coolant should be added up to the marker. The cooling system is automatically air-vented.

When topping-up, always use the same mixture as that already in the system.

13 COOLANTS, CHANGING COOLANT, CHECKING HOSE CONNECTIONS

At the factory the cooling system is filled with approved Volvo anti-freeze fluid for frost protection down to -25°C (-13°F).

This coolant can be used during the first winter season. **After this, the coolant must 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 oz.) which are sufficient for 8–10 litres (about 2 Imp. galls. = 2.4 US galls.) of water. This means that 5–6 bags are necessary for the F 88/G 88. The agent should be dissolved in water before filling into the cooling system.

N.B. When topping-up during the summer season, water with the same proportion of anti-rust agent that is 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 fluid is recommended. Change in good time before the winter season. 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 whole winter season. The glycol added should therefore amount to at least 40%. This gives frost protection down to -25°C (-13°F).

N.B. When topping-up during winter, use water with a mixture of glycol amounting to not less than 40%.

For lower temperatures, larger proportions of glycol are required as shown in the table below.

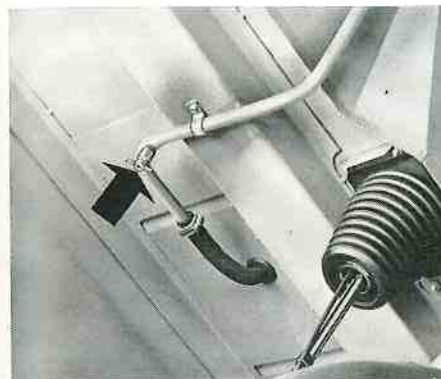
Capacity of cooling system	Necessary amount of glycol in litres (Imp. galls./US galls.) for frost protection down to:			
	-25° (-13°F)	-30°C (-22°F)	-40°C (-40°F)	-56°C^* (-69°F)
approx 47 litres (10.3 Imp. galls. = 12.4 US galls)	19 (4.3/5)	21 (4.6/5.5)	25 (5.5/6.6)	28 (6.1/7.4)

* -56°C (-69°F) is the maximum amount of frost protection which can be provided. To increase the glycol content above this only impairs the frost protection.

Draining the cooling system

In order to drain the cooling system completely, all the draining points should be opened. The radiator filler cap should also be removed while draining is being carried out.

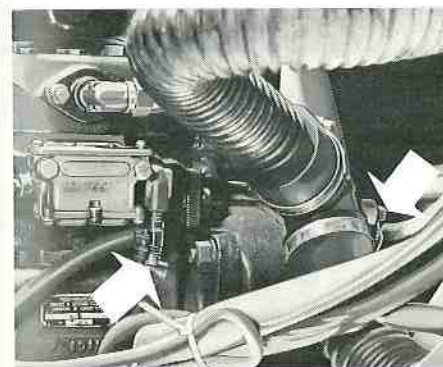
Draining points



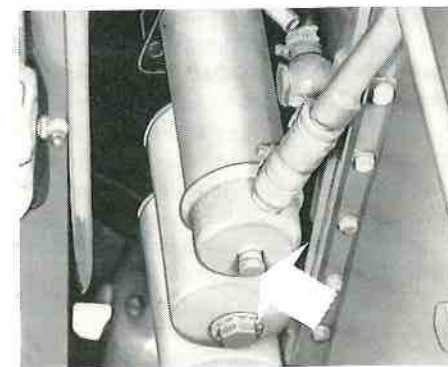
Pipe to heater (under cab) (cock)



Right-hand side of engine block (cock)



Tubular connection between engine and radiator (plug). Compressor (cock).



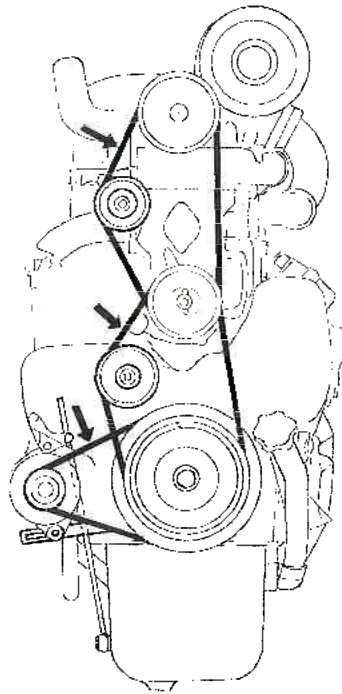
Oil cooler (plug)

Filling an empty cooling system with coolant

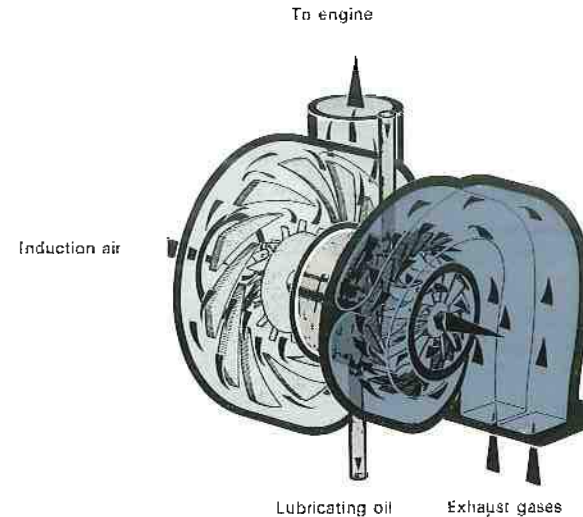
Coolant is added through the filler opening on the front end of the vehicle. The engine should be standing still and the heating control should be on Hot. Coolant is filled up to the level of marker in the filler opening. The cooling system is automatically air-vented. **Note.** The filler cap should be removed completely (also the threaded connector section on the cap). The coolant level should be checked again when the engine has been run warm. Coolant capacity is 47 litres (10.3 Imp. galls. - 12.4 US galls.)

14 CHECKING THE DRIVE BELTS

The tension of all the drive belts on the engine should be checked at the specified intervals. **This check is very important since the tension of the water pump drive belts is vital for the proper function of the cooling system.** Insufficient tension on the belts can lead to slipping, particularly during wet weather, thus impairing the function of the cooling system. The belts are tensioned by means of a tensioning roller. When correctly tensioned, it should be possible to press in the belts about 10 mm (3/8") in the middle. N.B. Always replace the belts in pairs.



Turbo-compressor



TECHNICAL DESCRIPTION

The turbo-compressor consists of a turbine rotor and compressor rotor with a bearing housing between them. The turbine and compressor rotors are joined by means of a shaft which is journaled in the bearing housing by means of floating plain bearings. Lubrication of the bearings and cooling of the bearing housing is done with oil from the force-feed lubrication system of the engine. The turbo-compressor is mounted directly on the exhaust manifold. When the exhaust gases meet the blades on the turbine rotor, both this and the compressor rotor which is fitted on the same shaft are brought into rotation. When the compressor rotor rotates it sucks in fresh air which is compressed and supplied to the engine cylinders through the induction manifold. The maximum rotational speed is about 70 000 r.p.m. The boost pressure thereby provided by the compressor is about 0.7 - 0.9 kp/cm² (10 - 13 lb/sq.in.). If it is suspected that the turbo-compressor is not functioning properly, which can 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. The turbo-compressor normally stops rotating after the engine has stopped, so that the noise that 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 turbo-compressor.
- 2 **Make quite sure that the compressor rotor is stationary and only after this feel with the hand whether the rotor turns stiffly.** If so, the turbo-compressor must be examined and changed if necessary.

If absolutely necessary, the vehicle can be run for a short distance with a damaged turbo-compressor providing that the engine loading is considerably less than normal.

If any of the following symptoms are noticed, the vehicle should be immediately taken to a Volvo workshop for investigation and correction of the fault, otherwise there is a risk of the unit being damaged to such an extent that reconditioning is impossible, which means that the replacement cost will be much more expensive than would normally be the case. The following symptoms indicate faults in the turbo-compressor:

- 1 Noise from the turbo-compressor (vibration).
- 2 Smoky exhaust.
- 3 Engine does not reach full speed.
- 4 Engine runs unevenly.

The turbo-compressor must only be dismantled by an authorised workshop.

No alterations are permitted on 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. Tighten up any loose hose clips or replace the air line if necessary. Also check the sealing collar on the air cleaner.

16 CHECKING THE EXHAUST MANIFOLD FOR LEAKAGE

Good sealing on the exhaust system from the manifold to the Turbo-compressor is of vital significance for the function of the compressor.

For the function of the exhaust brake it is also important that the exhaust system from the compressor to the exhaust brake is free from leaks so that full braking effect is obtained. 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 tight. 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.

18, 19 CHECKING THE OIL FLOW, BOOST PRESSURE AND BEARING WEAR

These checks should be carried out by an authorised workshop.

The oil flow to the rotor shaft bearings is of vital importance and must reach a certain quantity in order for the turbo-compressor to function satisfactorily. The boost pressure is measured with a pressure gauge which is connected to an outlet on the induction manifold. Measuring should be done with the engine on full loading and at full throttle the pressure gauge being read off continuously as engine speed slowly increases to 2000 r.p.m., at which point the boost pressure should amount to 0.7–0.8 kp/cm² = 10–11 lb/sq.in. The bearing wear is checked by measuring the end float and radial clearance of the shaft. These clearances must not be excessive, otherwise there is a risk of damage to the turbo-compressor.

20 EXCHANGING THE TURBO-COMPRESSOR

After every 160 000 km (100 000 miles) the turbo-compressor should be exchanged with a reconditioned unit. If it is run for a longer period than this there is a risk that the unit can be damaged to such an extent that reconditioning is impossible. Note that a unit which can be reconditioned can be exchanged for a fixed replacement price, whereas a unit which has been damaged to such an extent that it cannot be reconditioned will cost about twice as much to replace.

ELECTRICAL SYSTEM**TECHNICAL DESCRIPTION**

The electrical system of the vehicle is designed for a voltage of 24 V. The current is supplied by two 12 V series-connected batteries and an alternator with voltage control. The system is of the single-pole type, where the chassis and engine frame act as conductors. The negative terminal of the battery is earthed.

ALTERNATOR

The following should be noted when carrying out work on the electrical system:

- 1 When removing or fitting batteries, make sure that the new batteries are connected with the correct polarity.
- 2 If extra batteries are used for starting they must be correctly connected up to prevent the rectifiers from being damaged.
The negative cable from the battery being used to help starting must be connected to the truck battery minus terminal and the plus cable from the battery being used to help connected to the truck battery plus terminal.
- 3 If a rapid-action charger is used to charge up the batteries, the truck battery cables must be disconnected.
A rapid-action charger may be used to assist starting. However, the rapid-action charger must be switched off when attaching and removing the cables from the charger.
- 4 The charging circuit cables must never be earthed. This can damage the alternator and charging regulator.
- 5 Never operate the alternator with the main circuit open. Neither the battery nor the alternator and regulator cables may be disconnected while the engine is running.
- 6 Never try to polarize the alternator. No polarization is necessary.
- 7 When removing from the vehicle or when carrying out other work on the alternator or regulator, always first disconnect the battery earth cable.
- 8 When carrying out welding on trucks using an alternating current generator, first disconnect the battery earth cable and then disconnect all the cables to the alternator, the over-voltage protector and the charging regulator. Make sure that the loose cable ends do not come into contact with the truck frame or chassis. Insulate well if necessary.
The welding set must always be connected as close to the welding point as possible.

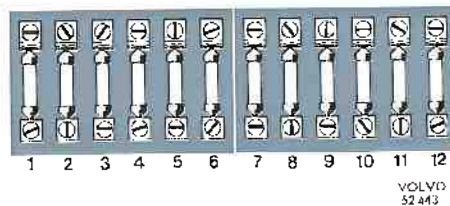
9 Permanent connections must be used in all testing of alternating current equipment. Crocodile clips must not be used since they have a certain tendency to loosen. A cable which loosens can imply that both the alternator and the regulator are ruined. Whenever test instruments are connected up, the battery must be disconnected.

FUSES

All the fuses are grouped under the storage compartment between the driving seat and passenger seat. The fuses are accessible by removing the two screws and lifting off the storage compartment. The fuse for extra lighting is rated at 25 A and the others at 8 A.

Changing the fuses

Always use the correct type of fuse. If any fuse should blow out repeatedly, do not fit one with a higher rating. Instead take the vehicle to the workshop for overhaul of the electrical system.



- Fuses
- 1 Foglight. Spotlight (25 A)
 - 2 Inspection lamp. Roof light. Brake stoplights
 - 3 Horn. Warning lamps. Stage relay. Full/dipped headlights.
 - 4 Starter button. Differential lock
 - 5 Exhaust brake. Heater.
 - 6 Fuel gauge. Direction indicators. Control lamp - oil pressure. Control lamp - overdrive (SR 61). Control lamp - running brakes.
 - 7 Full headlights, right. Control lamp - headlights.
 - 8 Full headlights, left
 - 9 Dipped headlights, right
 - 10 Dipped headlights, left
 - 11 Parking lights, right
 - 12 Parking lights, left. Headlight switch

21 CHECKING ELECTROLYTE LEVEL IN BATTERIES

Check the electrolyte level in all the cells. The electrolyte should come up to about 10 mm (3/8") above the cell plates. If the level is too low, top up with distilled water. Do not fill up with too much water, otherwise the electrolyte can splash over.

22 CHECKING THE CHARGING CONDITION

The charging condition of the batteries should be checked with a hydrometer. In a fully charged battery the specific gravity of the electrolyte is 1.28. If the battery is discharged, or if the specific gravity of the electrolyte is lower than 1.21, the battery should be removed for recharging. Normally, however, the engine alternator should keep the batteries in a fully charged condition.

It is particularly important during the winter to check the charging condition of the batteries regularly, since a discharged battery is liable to damage caused by frost.

When checking the state of charge of the batteries, also check that they are properly secured and that the cable terminals and pole bolts are well greased.

23 ALTERNATOR. CHECKING WEAR OF BRUSHES

This check should be done at an authorised workshop at intervals of 40 000 km (25 000 miles).

24 CHECKING HEADLIGHT ADJUSTMENT

It is important from a traffic safety point of view that the headlight adjustment is checked regularly.

CHANGING BULBS

N.B. When changing a bulb, never take hold of the bulb glass with the fingers. Any grease or oil on the glass can be vapourized by the heat from the bulb, thus causing damage to the reflector. This applies particularly to the headlight bulbs.

Switches

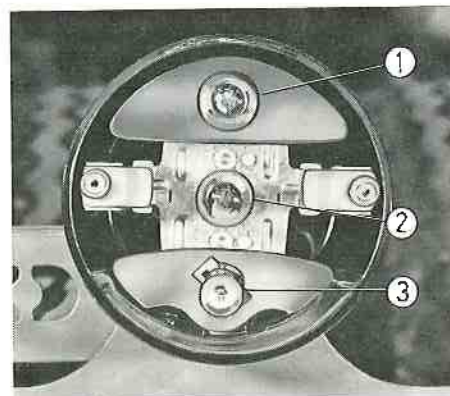
When changing bulbs, unscrew the upper part of the switch and the bulb is then accessible for replacement.

Flashers

- 1 Loosen the Philips screw and remove the lamp glass.
- 2 The bulb is now accessible for replacement. Press in the bulb slightly and then turn anti-clockwise.

Rear lamps

- 1 Loosen the two screws and remove the glass.
- 2 The bulbs are now accessible for replacement.



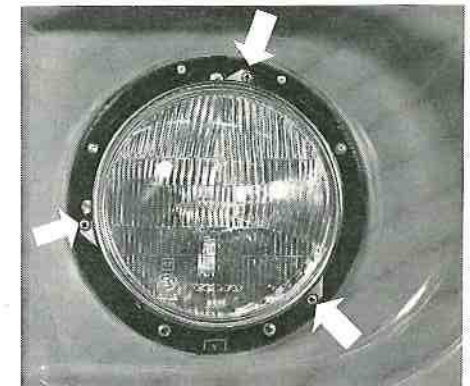
Rear lamp
 1 Bulb for brake light
 2 Bulb for direction indicator
 3 Bulb for tail lamp

Headlights

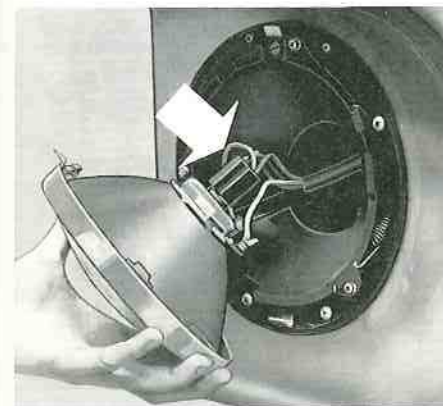
- 1 Unscrew the screw at the bottom of the headlight rim. Lift off the rim by pulling out the lower part and then lifting outwards and upwards.
- 2 Loosen the Philip screws for the retaining ring for the headlight insert a few turns. Turn the retainer until the hooks release from the screws and then lift out the retainer and insert with bulb holder.
- 3 Disconnect the bulb holder contact by pulling it straight out. Press in the bulb holder slightly and then turn it anti-clockwise.
- 4 The bulb is now accessible for replacement. Do not touch the new bulb with the fingers.



1

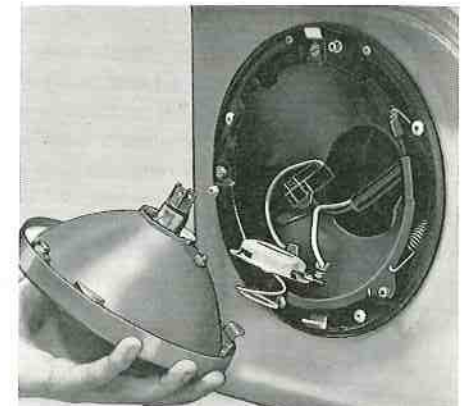


2



3

VOLVO
57446



4

VOLVO
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POWER TRANSMISSION

Clutch

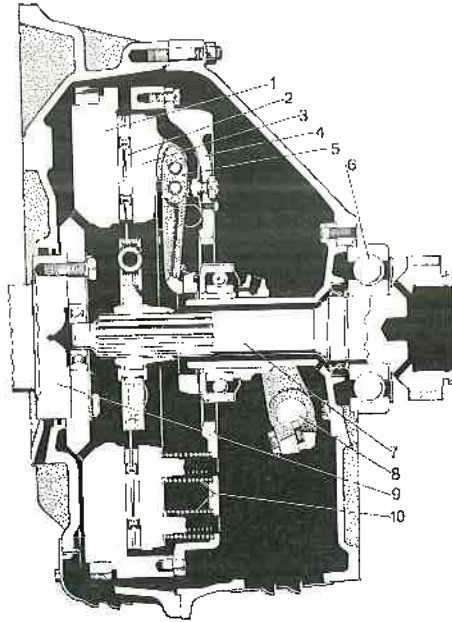
TECHNICAL DESCRIPTION

Single plate clutch

- | | |
|-------------------|------------------------------|
| 1 Flywheel | 6 Bearing |
| 2 Disc | 7 Clutch shaft (input shaft) |
| 3 Pressure plate | 8 Throw-out shaft |
| 4 Attaching plate | 9 Crankshaft |
| 5 Lever | 10 Clutch springs |

The attaching plate (4) is bolted to the engine flywheel (1) and makes up the retainer for the other clutch parts. The pressure plate (3) is located between the attaching plate and discs (2) and transfers pressure from the springs (10) to the discs.

When the clutch pedal is depressed the throw-out shaft (8) turns and the throw-out bearing is moved forward against the thrust washer. The thrust washer, in its turn, influences the clutch levers so that the pressure plate is pulled back and pressure on the disc ceases. In its engaged position, the pressure plate is held against the discs by the springs.

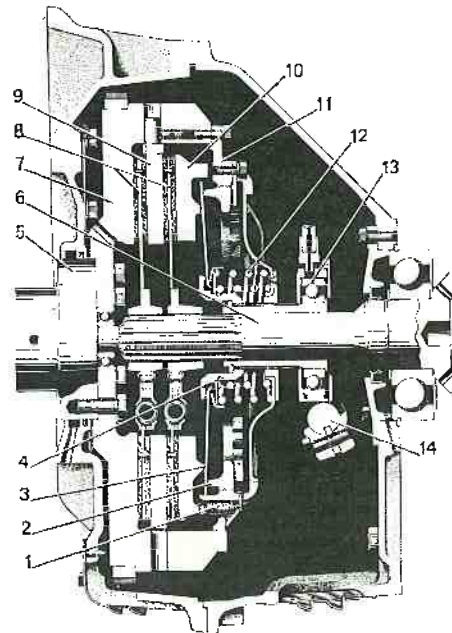


Double plate clutch

- | | |
|------------------------------|------------------------------------|
| 1 Return spring | 9 Intermediate pressure plate |
| 2 Adjustor ring | 10 Pressure plate |
| 3 Lever | 11 Retainer |
| 4 Lever centre | 12 Clutch springs, inner and outer |
| 5 Crankshaft | 13 Throw-out bearing |
| 6 Clutch shaft (input shaft) | 14 Throw-out shaft |
| 7 Flywheel | |
| 8 Discs | |

The double plate clutch has double discs (8) and pressure plates (9, 10). Spring pressure is provided by 2 centrally located springs (12) and transferred to the pressure plates and discs through a lever disc consisting of a large number of levers.

When the clutch pedal is depressed, the throw-out bearing (13) and throw-out sleeve are drawn by the control system rearwards together with the lever centre (4) which is connected to the throw-out sleeve by means of splines. The inner end of the lever is drawn back and force exerted on the pressure plate ceases. Through the 4 return springs (1), the pressure plate is released from the rear disc and the clutch is thereby disengaged.



25 CHECKING FLUID LEVEL IN CLUTCH FLUID CONTAINER

The clutch fluid container is placed above the clutch pedal and is provided with an inspection window. To read off the level, first unscrew the casing in front of the container. The level should reach up to the middle of the inspection window. Check the level after every 5000 km (3000 miles).

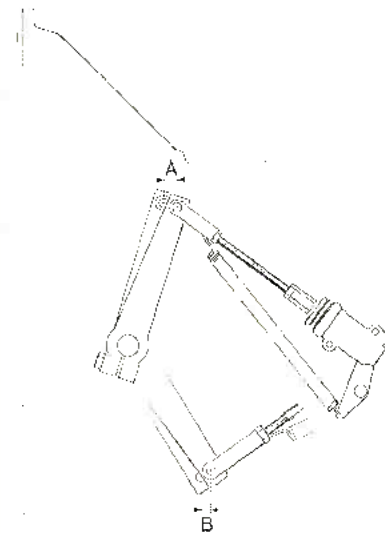
Top up when necessary with brake fluid which fulfils the requirements of SAE 70 R 3.

26 CHECKING CLUTCH LEVER TRAVEL

In order to make sure that the clutch does not slip the clutch release lever travel should be checked regularly and adjusted if necessary. This check is most important since the hydraulic control makes it impossible to tell exactly when adjustment is necessary.

Single-disc clutch

The clutch release lever free play (A) should be 5-7 mm (0.20-0.28"). The play is adjusted by loosening the nut and altering the effective length of the push rod.



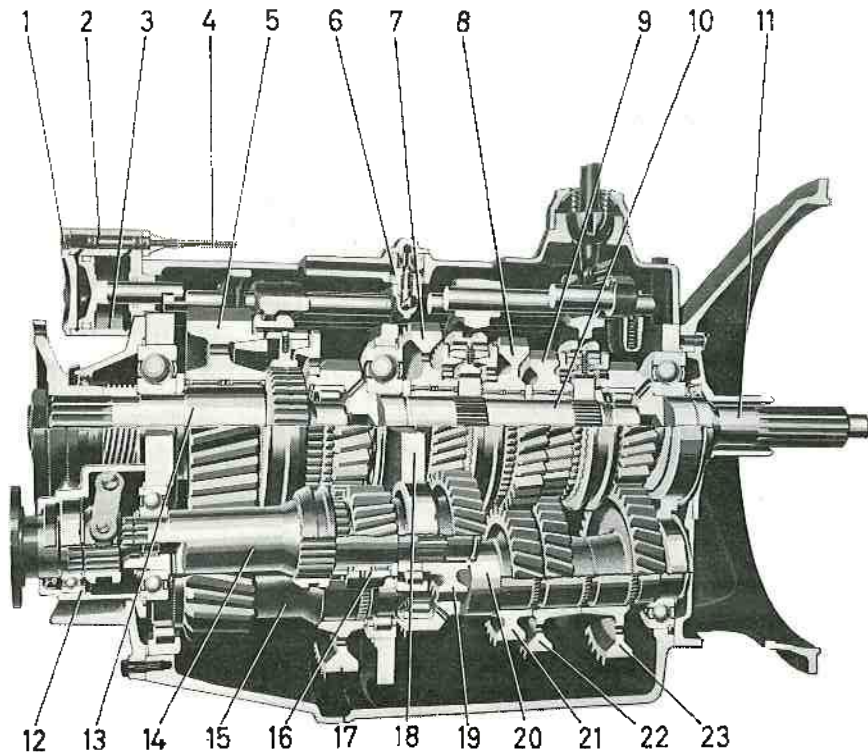
Clutch release lever free play
A With single plate
B With double plate

Double disc clutch

To adjust clutch release lever free play, the clutch must be adjusted so that there is 15 mm (0.59") between the throw-out bearing and the clutch cover. Clutch lever free play should then be 5-7 mm (0.20-0.28").

NOTE. When free play has decreased to about 2 mm (0.08"), adjust the adjuster ring in the retainer so that the clearance throw-out bearing - retainer hub is 15 mm (0.59").

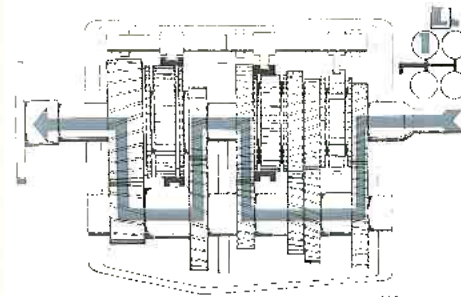
Gearbox



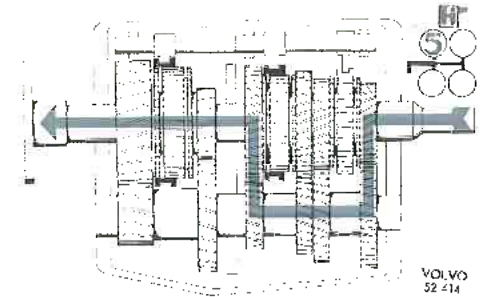
- R 60 gearbox
- 1 Air filter
 - 2 Valve
 - 3 Control cylinder
 - 4 Control cable
 - 5 Gear wheel, low ratio
 - 6 Check valve
 - 7 Gear wheel, 1st speed
 - 8 Gear wheel, 2nd speed
 - 9 Gear wheel, 3rd speed
 - 10 Mainshaft
 - 11 Input shaft
 - 12 Rear-mounted power take-off
 - 13 Output shaft
 - 14 Reverse shaft
 - 15 Countershaft II
 - 16 Idler gear
 - 17 Drive gear, countershaft II
 - 18 Partition wall
 - 19 Drive gear, reverse shaft
 - 20 Intermediate gear I
 - 21 Gear wheel, 2nd speed
 - 22 Gear wheel, 3rd speed
 - 23 Drive gear for countershaft I

TECHNICAL DESCRIPTION, R 60 (8-SPEED)

The R 60 gearbox is an 8-speed unit consisting of two sections, a 4-speed front section (basic section) which is controlled with the gear lever and a 2-speed rear section which is controlled pneumatically by means of a selector switch on the gear lever. These two sections combined give 8 forward speeds and two reverse. All forward speeds are synchromesh, whereas the reverse speeds are unsynsynchronized. This means that changing between low and high ratio cannot be done while reversing.



Low ratio
Speeds 1-4 are obtained with the range gearbox in the low ratio position. The power is transmitted in the usual way through the main gearbox but then passes through the gear wheels in the range unit.



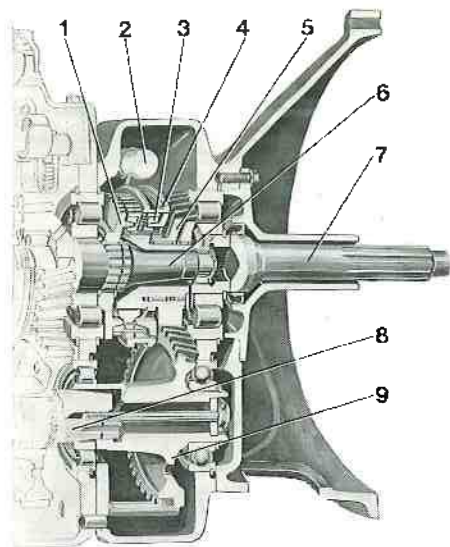
High ratio
Speeds 5-8 are obtained with the range gearbox in the high ratio position. The power is transmitted through the main gearbox in the same way as in low ratio but then passes direct from the mainshaft to the output shaft.

The compressed air operated auxiliary unit is only used once when changing through the whole gear register (between 4th and 5th speeds).

On the R 60 gearbox it is possible to fit a side-mounted power take-off and two types of rear-mounted power take-off. The side-mounted power take-off is fitted on the right-hand side of the gearbox and is driven from the front gear wheel of the reverse gear. The rear-mounted power take-off is fitted on the rear end of the gearbox. The low-speed power take-off is driven through a dog clutch on the rear end of the reverse shaft. The high-speed power take-off is driven through a dog clutch and gear on the rear end of the reverse shaft. Engagement is done by means of a switch on the instrument panel. This operates a solenoid valve which regulates the air supply to a control cylinder fitted on the gearbox, which in turn controls the power take-off.

See page 111 for data concerning power take-offs.

TECHNICAL DESCRIPTION, SR 61 (16-SPEED)



- 1 Clutch ring
- 2 Shift yoke
- 3 Synchronizing cone
- 4 Coupling sleeve
- 5 Idler gear
- 6 Input shaft, basic gearbox
- 7 Input shaft, overdrive gearbox
- 8 Idler shaft
- 9 Countershaft

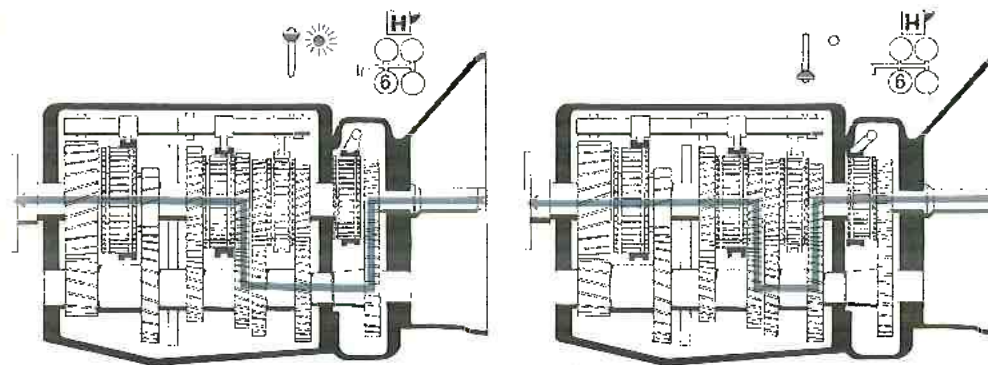
The type SR 61 gearbox consists in principle of an R 60 gearbox (8-speed) fitted with an overdrive supplement (splitter) which provides two gear ratios on each of the eight gears in the main gearbox. This provides a total of 16 ratios.

The overdrive gearbox is attached between the clutch housing and the main gearbox housing.

The overdrive supplement consists of a gear system with compressed air operated synchronization.

Gear-changing is carried out by using compressed air. The pre-selector control influences a control valve on the operating cylinder. Gear-changing does not start, however, until the clutch pedal has been pressed down and the blocking valve thereby admits compressed air.

The use of the overdrive supplement provides two alternative ratios for the power take-offs.



Overdrive position
When overdrive is engaged, the power goes through the gear system and then to the main gearbox. This provides half a stage changing-up of each gear in the main gearbox.

Direct gear position
When direct gear is engaged, the power goes directly to the main gearbox input shaft.

LUBRICATION (R 60 and SR 61)

Oil as recommended below should be used for lubricating the gearbox:

Alternative 1 Gear oil without film strengthening additive.

Hypoid oils (HYP or EP) or Multipurpose oils (MP) must not be used, since these oils can attack the bronze parts and oil seals and cause synchronizing difficulties and oil leakage.

Alternative 2 Engine oil
Gear oil and engine oil can be mixed without causing any difficulties.

The viscosity should be chosen as shown in the table below:

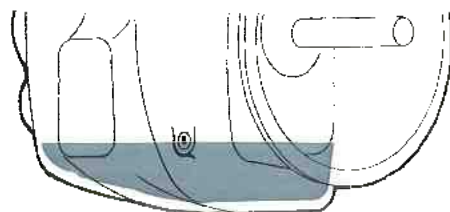
Lubricant type	Viscosity ¹⁾		
	Below -10° C (14° F)	-10° C to 30° C (14 to 86° F)	Above 30° C (86° F)
Gear oil	SAE 80	SAE 90 ³⁾	SAE 140
or Engine oil	Not lighter than SAE 40 all the year round ²⁾ .		—

¹⁾ The temperature values refer to continuous air temperatures.
²⁾ Multigrade oil should not be used.
³⁾ If the truck is used for very hard driving or prolonged driving at altitudes more than 2000 metres (6500 ft.) above sea-level, oil with a viscosity of SAE 140 should be used

27 CHECKING OIL LEVEL IN GEARBOX

To check the oil level, screw out the level plug on the right-hand side of the gearbox. (2 plugs on SR 61). The oil should come level with the hole.

If necessary, top up with oil of the same type that is already in the gearbox.



Level R 60

VOLVO
52416

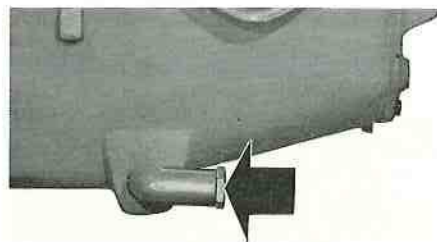
28 CHANGING OIL IN GEARBOX

The oil must be changed after every 40 000 km (25 000 miles). Even in the case of vehicles which are operated less than 40 000 km (25 000 miles) per year, the oil must be changed at least once per year. During the running-in period the oil should also be changed after the first 5 000 km (3000 miles) and the gearbox should be flushed with the same type of oil which is later added. The oil is drained off through the drain plug.

On the SR 61 there are two drain plugs on the right-hand side.

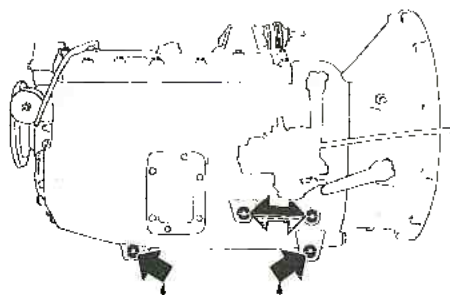
Topping-up of the R 60 can be carried out through the level hole or through a filler hole on the top of the gearbox. The oil capacity is 9.5 litres (2.1 imp. galls. = 2.5 US galls.).

On the SR 61 the oil capacity is 11.5 litres (2.5 imp. galls. = 3.0 US galls.). Of this about 1.5 litres (1 1/2 quarts) is to be filled through the front level hole and the rest through the rear level hole.



Drain plug R 60

VOLVO
52420



Level and drain plugs SR 61

29 CHANGING THE GEARBOX FILTER

The filter is to be changed in connection with every other oil change. During the running-in period, the filter should be changed also after the first 5000 km (3000 miles) in connection with the first oil change in the gearbox. Changing is carried out as follows:

- 1 Remove the cover.
- 2 Take out the filter and clean the filter cavity in the gearbox using white spirit.
- 3 Fit a new oil filter.
- 4 Fit the cover with a new gasket.



30 LUBRICATING VALVES AND CYLINDER OF RANGE GEARBOX

The valves and cylinder for the range gearbox should be lubricated with ball bearing grease at least once a year, which is necessary to prevent the O-rings from binding or wearing, thus causing air leakage. Insufficient range gearbox lubrication can result in failure to change over between LOW and HIGH or slow operation. (Change the O-rings when the gearbox is being repaired).

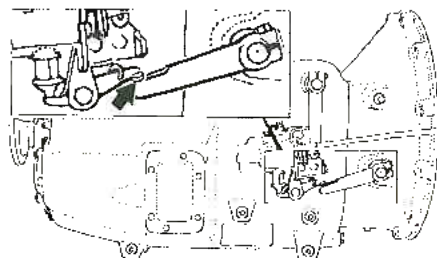
In order to prevent condensation water from collecting in the valves and cylinders, make sure to drain off the water in the compressed air system.

31 CHECKING THE GEAR-CHANGING POINT, SR 61 OVERDRIVE

Gear-changing in the overdrive supplement must not occur until the engine is completely declutched. For this reason a control must be carried out and adjustment if possible of the clearance between the levers to the blocking valve (on the right-hand side of the gearbox) in connection with a check of the declutching lever clearance. The clearance between the levers must be 8–10 mm (0.31–0.39").

The following check should then be carried out:

- 1 Start the engine and allow to run at idling speed with the gear lever in the neutral position.
- 2 Engage direct gear and then pre-select to the overdrive position.
- 3 Slowly press down the clutch pedal until the green lamp starts to light up.
- 4 Hold the clutch pedal in this position and engage reverse.
 - a) If reverse gear clashes, overdrive engagement is too early and the clearance must be increased.
 - b) If overdrive does not engage in spite of the fact the clutch pedal is depressed the whole way, the clearance is too large and must be decreased.



Adjustment is carried out by loosening the lock nut in the clutch shaft lever and then turning the lever to the correct clearance. (The lock nut is to be tightened to a torque of 5–6 kpm (36–43 lb.ft.).

A gear-changing control should be carried out again after adjustment.

Propeller shaft

TECHNICAL DESCRIPTION

Vehicles with the shortest wheelbases are equipped with a one-piece propeller shaft. At the rear end there is a slip joint which allows for the alterations in length of the propeller shaft caused by the movement of the rear axle. On vehicles with longer wheelbases the propeller shaft is of the two-piece type. The front section is suspended in a support bearing which consists of two ball bearings pressed into a bearing sleeve. The bearing sleeve is provided with a vulcanized rubber ring. The rear section is provided with a slip joint.

32 CHECKING PROPELLER SHAFT

Check the universal joints and support bearing for play regularly. Also check that the propeller shaft bolted joints are tightened to the correct torque.

N.B. Care should be taken not to step on the propeller shaft while working on the vehicle as it can easily be deformed.

Rear axle

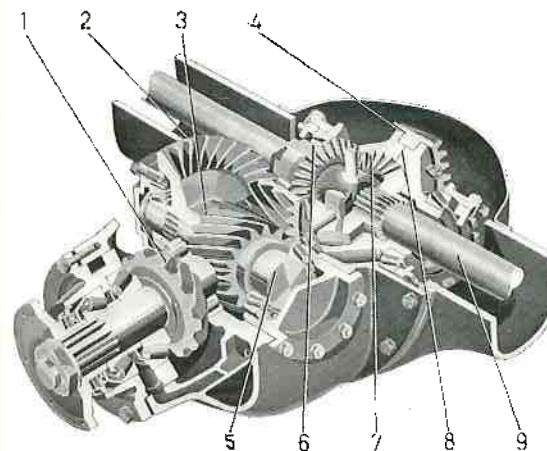
TECHNICAL DESCRIPTION

Several different rear axle alternatives are available for F 88 and G 88 trucks: Double reduction, single reduction with hub reduction and four-wheel drive bogie (with single reduction or single reduction with hub reduction).

All these units are of the hypoid type.

Double reduction, type 181

There are two reduction steps in the double reduction rear axle. The first reduction takes place between the pinion (1) and crown wheel (2). The pinion is journalled in two taper and one cylindrical roller bearing. The second reduction step takes place in the spur gear drive. The intermediate shaft with the small spur gear (3) and pressed-on crown wheel is journalled in the rear axle housing by means of two taper roller bearings. The large spur gear (4) is attached with bolts between the two differential carrier halves. The differential carrier is journalled in the rear axle housing by means of taper roller bearings. The differential is of conventional type.



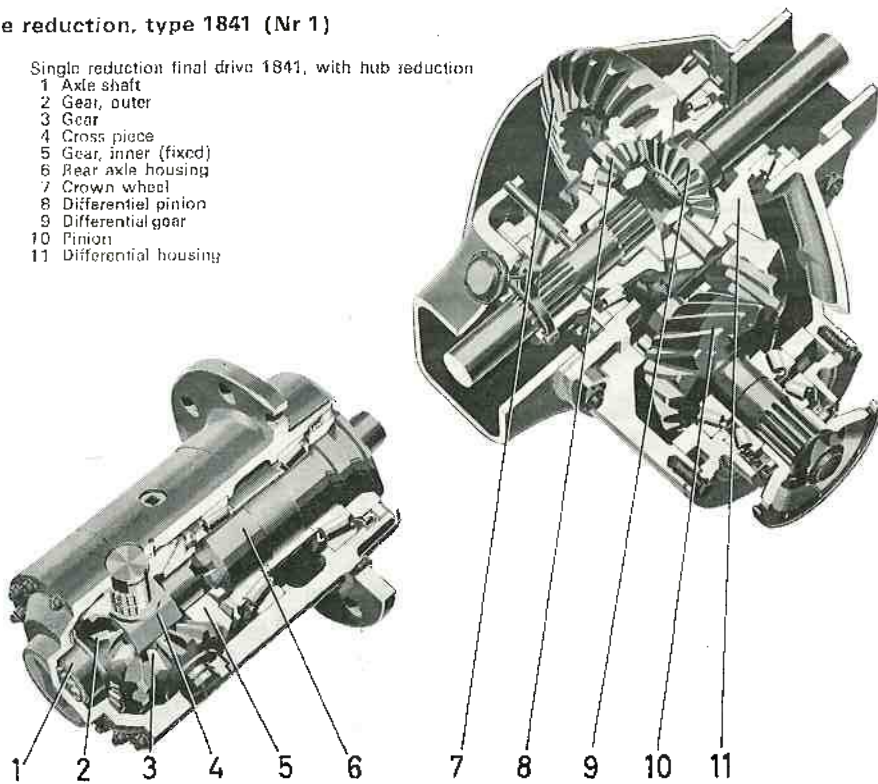
VOLVO
52 418

- Double reduction, 181
1. Pinion
 2. Crown wheel
 3. Spur gear, small
 4. Spur gear, large
 5. Intermediate shaft
 6. Differential gear
 7. Differential pinion
 8. Differential carrier
 9. Axle shaft

Single reduction, type 1841 (Nr 1)

Single reduction final drive 1841, with hub reduction

- 1 Axle shaft
- 2 Gear, outer
- 3 Gear
- 4 Cross piece
- 5 Gear, inner (fixed)
- 6 Rear axle housing
- 7 Crown wheel
- 8 Differential pinion
- 9 Differential gear
- 10 Pinion
- 11 Differential housing



In this case also, reduction takes place in two steps. The first step occurs in the final drive, which is of the conventional single reduction type.

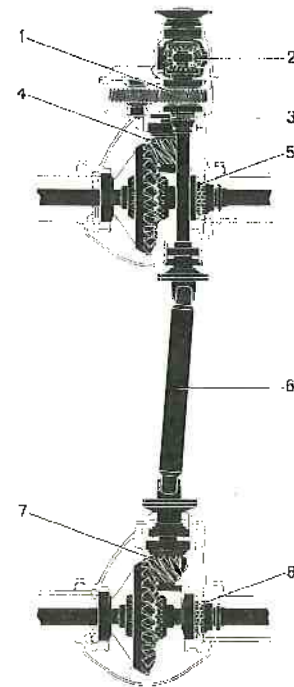
As in the case of the double reduction unit, the pinion is journalled in the three bearings. The differential carrier (11) consists of two halves, to one of which the crown wheel is bolted. The differential carrier is journalled in the rear axle housing by means of two taper roller bearings.

The second reduction step consists of hub reduction units of the bevel planetary gear type fitted in the wheel hubs.

The hub reduction functions as follows: The drive is transmitted to the outer gear wheel (2) which is fixed

on the axle shaft. This gear wheel causes the planet gears (3) on the cross piece (4) to rotate, at the same time causing them to roll in mesh with the fixed inner gear wheel (5). The cross piece and hub will thus rotate at half the speed of the axle shaft. This means that the transmission torque, and thereby the tractive effort, is doubled.

The wheel hub is journalled in two taper roller bearings.



Final drives 6x4

The four-wheel drive bogie versions are fitted with either a single reduction gear or a single reduction gear with hub reduction.

On the 6x4 vehicles both the rear axles are of the driving type. On the forward rear axle there is a transfer box with differential which distributes the tractive effort between the leading and trailing tandem axles.

- 1 Transfer box
- 2 Transfer box differential (differential between axles)
- 3 Transfer box differential lock (differential lock between axles)
- 4 Single reduction, leading tandem axle
- 5 Differential lock, leading tandem axle
- 6 Propeller shaft
- 7 Single reduction, trailing tandem axle
- 8 Differential lock, trailing tandem axle

DIFFERENTIAL LOCK

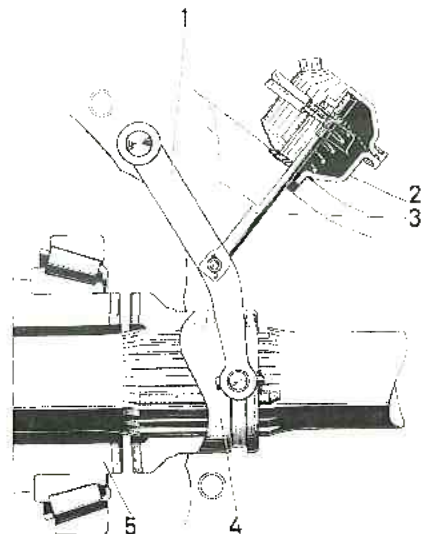
The differential lock is controlled by means of a switch on the instrument panel. This operates a solenoid valve which admits compressed air to a control cylinder on the rear axle casing.

The compressed air influences the control cylinder (2) in such a way that the selector rod (3) is pressed down. This causes the selector fork (1) to move the carrier (4) against the differential carrier (5). In this way the differential carrier is locked to one of the axle shafts so that power can be transmitted to the wheel which has ground adhesion.

N.B. The differential lock must only be used on slippery surfaces.

The 6 x 4 trucks are fitted with three differential locks, one on each rear axle and one in the transfer box.

The differential locks in the rear axles are regulated by means of the same switch on the dashboard. The transfer box differential lock, which is used to lock between the rear axles, is controlled by means of a separate switch.



Differential lock
 1 Selector fork
 2 Control cylinder
 3 Selector rod
 4 Carrier
 5 Differential carrier

LUBRICANTS

Final drive oil of the MIL-L-2105 B type is to be used in the final drive.

The viscosity is selected from the following table:

Lubricant type	Viscosity ¹⁾		
	Below -10° C (14° F)	-10° to 30° C (14 to 86° F)	Above 30° C (86° F)
Final drive oil MIL-L-2105 B	SAE 80	SAE 90 ²⁾	SAE 140

¹⁾ The temperature values refer to continuous air temperatures.
²⁾ If the truck is used for prolonged driving at altitudes of more than 2000 metres (6500 ft.) above sea-level, oil with a viscosity of SAE 140 should be used.

33 CHECKING OIL LEVEL IN REAR AXLE

Check the oil level after every 2500 km (1500 miles). To check the oil level, screw out the combined level and filling plug on the rear axle casing. The oil level should reach up to the hole.

If necessary, top up with oil of the same type that is already in the rear axle. When topping up oil in a rear axle with hub reduction, this is done through the filling hole in the rear axle casing. Fill up until the oil comes level with the hole, wait for 5-10 minutes and top up with more oil if necessary.

N.B. Also check that the rear axle breather valve is not blocked. This is important to avoid oil leakage due to excess pressure in the rear axle.



Hub reduction unit, draining and filling plug

34 CHANGING OIL IN REAR AXLE

The oil must be changed after every 40 000 km (25 000 miles). The oil is to be changed at least once every year even in the case of trucks with a mileage less than 40 000 km (25 000 miles).

During the running-in period the oil should also be changed after the first 5000 km (3000 miles), when the rear axle should be flushed with the same type of oil that is to be used.

The old oil is drained through the bottom plug in the rear axle casing.

N.B. When changing the oil in a rear axle with hub reduction, the hubs should be emptied separately. This is done by turning the wheel so that the combined filling and drain plug faces downwards. Then screw out the plug.

When filling up with new oil, 1.5 litres (2.6 Imp. pints = 3.1 US pints) should first be added to each hub, after which the plug is screwed in. Then fill up with oil until it comes level with the filling hole in the rear axle casing.

(If the transfer gear of a 6 x 4 has been disassembled for some reason, when filling up with oil, add about 1 litre (1 quart) through the filler hole on the top of the transfer box.)

Type of final drive	Oil capacity, litres (Imp. galls/US galls)
Double reduction	13 (2.7/3.2)
Single reduction with hub reduction	28 (6.4/7.7)
6 x 4 Front tandem drive	
Single reduction	20 (4.4/5.3)
Single reduction/hub reduction	29 (6.6/7.9)
Rear tandem drive, single reduction	9.5 (2.0/2.5)
Single reduction/hub reduction	28 (6.4/7.7)