ENGINE

DESCRIPTION

GENERAL

The designation of the engine in the P 1800 is B 18 B. It is a four-cylinder, water-cooled, overhead-valve engine with twin horizontal carburetors.

There are separate inlet and exhaust ports in the cylinder head, one for each valve. The crankshaft is carried in five bearings.

The outputs are thus as follows:

B 18 B 100 b.h.p./5500 r.p.m. (SAE) early prod.
108 b.h.p./5800 r.p.m. (SAE) late prod.

For other detailed information, see the specifications on page 1:41.

CYLINDER BLOCK

The cylinder block (29, Illustration 1-A) is made in one unit of special cast iron. The cylinder bores which are surrounded by cooling water jackets, are machined directly in the block. The oil channels in the block are arranged in such a way that the oil cleaner, which is of the fullflow type, is connected directly to the oil cooler on one side of the block.

CYLINDER HEAD WITH VALVES

The cylinder head (23), which is attached to the top of the block by means of bolts, covers the upper part of the cylinders and forms the combustion chambers. The cylinder head also contains the inlet and exhaust ports as well as cooling water jackets. The valves (4 and 8, Illustration 1-A) in the cylinder head are of the overhead type and are made of special steel, being carried in replaceable guides.

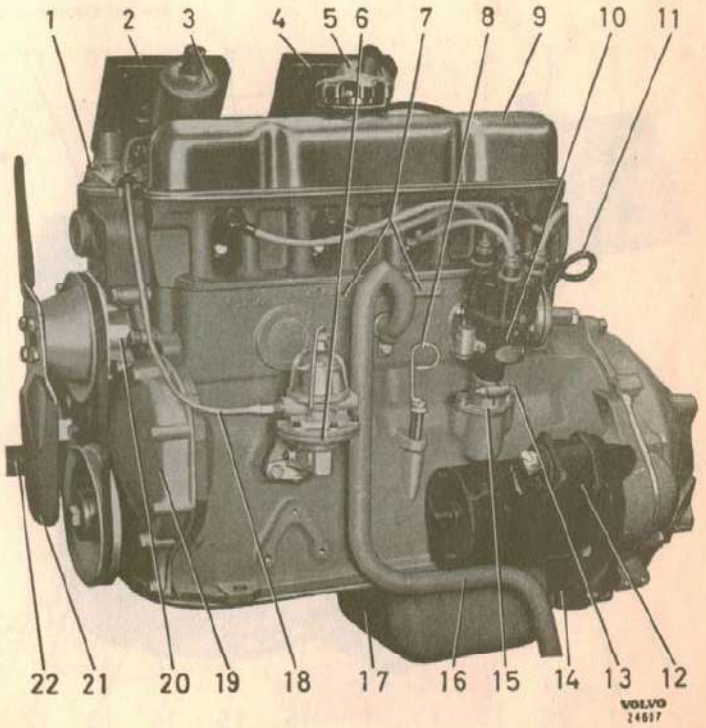
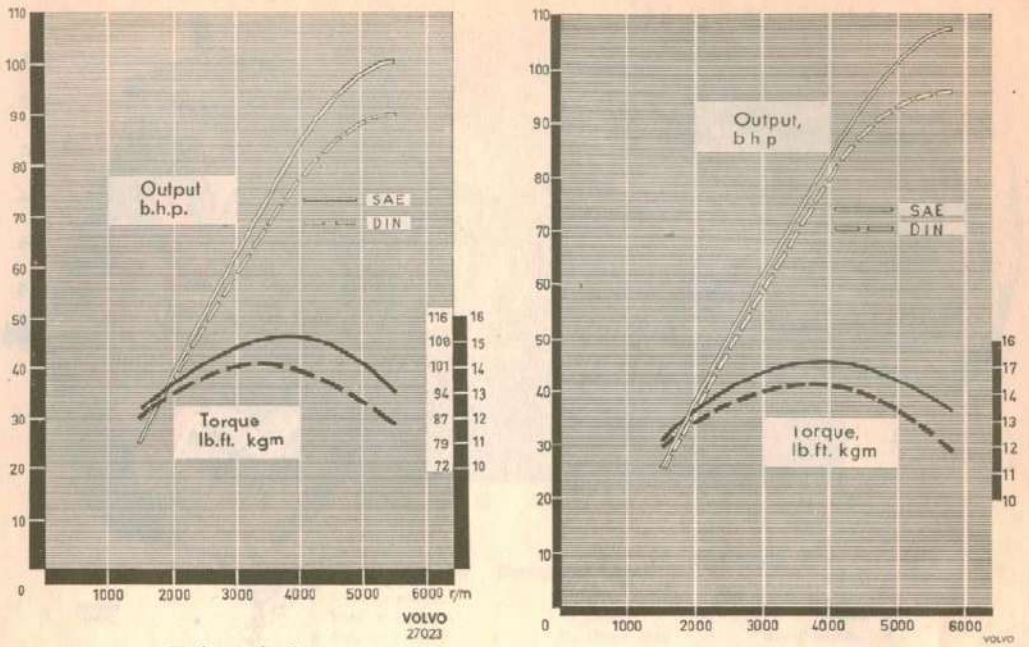


Fig. 1-1. The engine (left side)

1. Water outlet pipe
2. Front air cleaner
3. Front carburetor
4. Rear air cleaner
5. Rear carburetor
6. Fuel pump
7. Engine serial number
8. Oil dipstick
9. Rocker arm cover
10. Distributor
11. Vacuum line
12. Starter motor
13. Lock screw
14. Cover plate
15. Retainer
16. Breather pipe
17. Oil pan
18. Fuel pipe
19. Timing gear casing
20. Water pump
21. Fan
22. Water inlet pipe

CONTENTS

Part 1. Engine



Early production

Late production

Fig. 1-3. Output and torque curves. Engine B 18 B

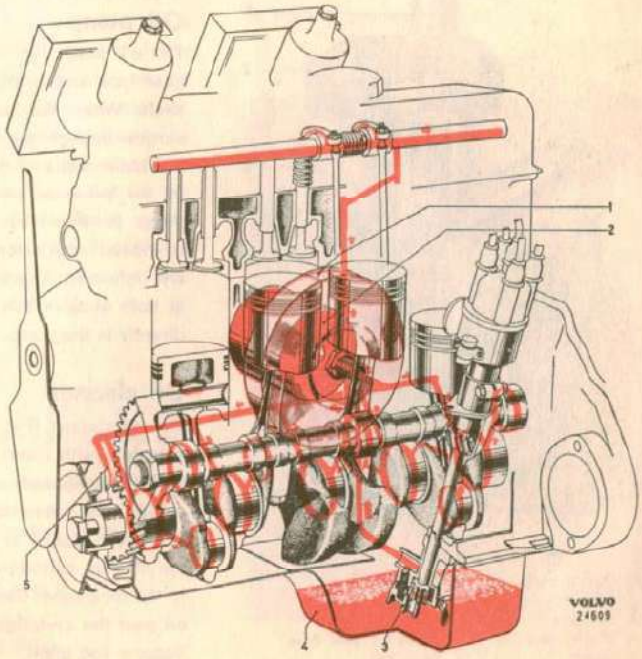


Fig. 1-4. The lubricating system

1. Oil cooler
2. Oil cleaner
3. Oil pump
4. Oil pan
5. Nozzle

CRANKSHAFT WITH BEARINGS

The crankshaft (44) is of forged steel and has ground and surface-hardened crankpins. It is carried in five main bearings, the rear of which also functions as an axial guide bearing. There are drillings through the crankshaft for the lubricating oil.

The bearing shells, which are replaceable, consist of steel-backed, indium-plated, lead-bronze bearing metal.

CAMSHAFT WITH VALVE LIFTERS

The camshaft (45) is made of special-alloy castiron and has surface-hardened cams. The camshaft is driven from the crankshaft by means of gears with a ratio of 1:2. Axial guidance is obtained by means of an axial washer on the front end of the shaft. The axial clearance is determined by a shim behind the camshaft gear.

The valve lifters (27) are influenced directly by the camshaft. They are located in ground holes in the block above the camshaft and transfer the movement to the valves through push rods and rocker arms. There are no inspection covers for the valve lifters since the valve lifters are accessible from the top after the cylinder head has been removed.

CONNECTING RODS, PISTONS AND PISTON RINGS

The connecting rods (48) are of drop-forged steel and are fitted at the top with finely-finished bushings which act as bearings for the piston pins. The connecting rod bearings on the crankshaft consist of precision-manufactured, replaceable bearing shells. The pistons (46) are made of light-alloy and each has two compression rings and one oil scraper ring. The upper compression ring on each piston is chromed to reduce cylinder wear.

The piston pins (50) are fully-floating in both the pistons and connecting rods. The axial movement of the piston pins is limited by the circlips in the piston pin holes.

LUBRICATING SYSTEM

The engine is lubricated by oil under pressure, see Fig. 1–4. The pressure is produced by a gear pump, driven from the camshaft and located under the crankshaft in the oil pan. The gears in the pump force the oil past the relief valve which is also located in the pump and then through the oil cooler, oil cleaner and so out through the drillings to the various lubricating points. All the oil which is forced out to the lubricating points thus first passes through the oil cleaner.

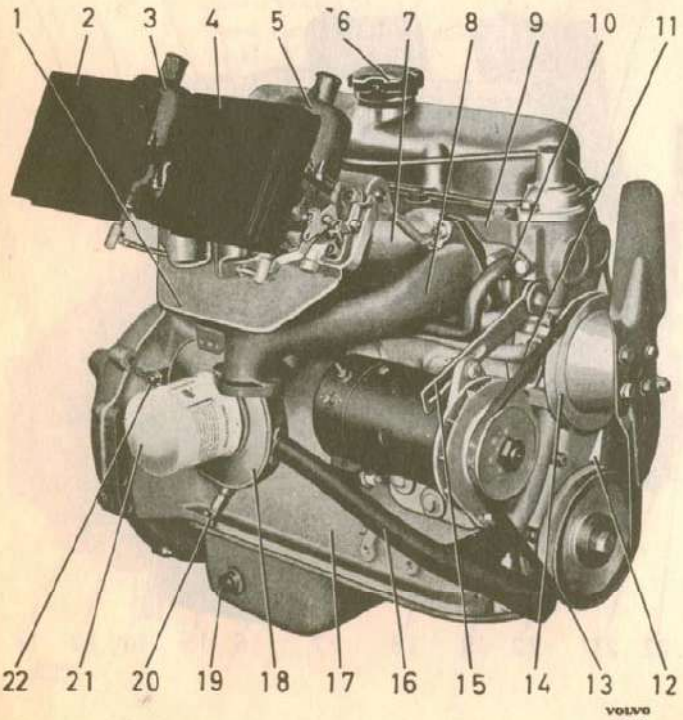


Fig. 1-2. The engine (right side)

1. Shield plate
2. Rear air cleaner
3. Rear carburetor
4. Front air cleaner
5. Front carburetor
6. Oil filler cap
7. Inlet manifold
8. Exhaust manifold
9. Cylinder head
10. Water pipe (to oil cooler)
11. Water pipe (from heater)
12. Setting marks
13. Pulley
14. Pulley
15. Belt tensioner
16. Water pipe
17. Cylinder block
18. Oil cooler
19. Plug for oil temperature gauge
20. Drain cock for water
21. Oil cleaner
22. Drain cock for water

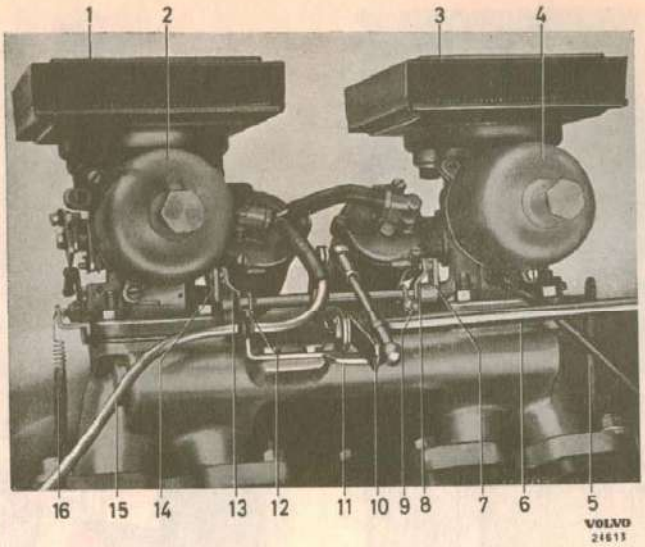


Fig. 1-8. Carburetor layout

1. Front air cleaner
2. Front carburetor
3. Rear air cleaner
4. Rear carburetor
5. Return spring
6. Control shaft
7. Lever on throttle spindle
8. Lever on intermediary shaft
9. Lock screw
10. Lever
11. Check stop
12. Lock screw
13. Lever on intermediary shaft
14. Lever on throttle spindle
15. Fuel pipe
16. Return spring

Oil cooler

The oil cooler (Fig. 1-8) is fitted between the oil cleaner and the cylinder block and consists of an inner part for the oil which is surrounded by a cooling jacket. The engine cooling water is taken through the cooling jacket. When the oil passes through the cooler on its way to the oil cleaner, part of the heat from the oil is conducted away by the cooling water. The cooling water cannot go the nearest way from the inlet (1) to the outlet (6) but is forced to circulate round the oil cooler by means of the stop plates (5). The oil is pressed through the pairs of disks one after the other due to the stop plates (4) and then passes out finally to the oil cleaner.

IGNITION SYSTEM

The distributor (25, Illustration 1-A) which is driven through a bevel gear from the camshaft is fitted with both centrifugal and vacuum governors. The direction of rotation is anti-clockwise and the order of firing is 1-3-4-2. See also Part 10.

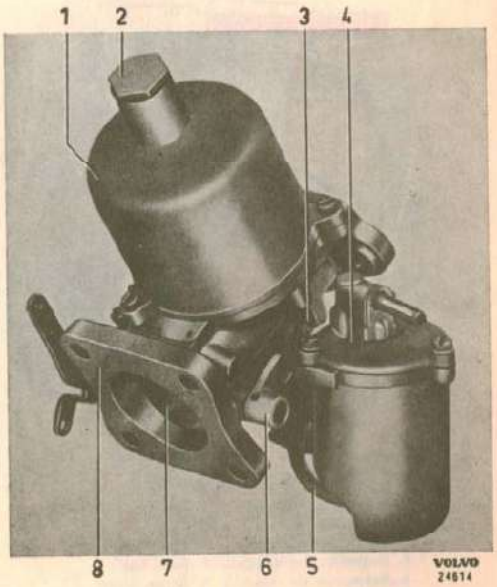


Fig. 1-9. Carburetor viewed from the left

1. Suction chamber
2. Screw for damping plunger
3. Lift pin
5. Fuel line
4. Float bowl cover
6. Lever
7. Throttle
8. Connecting flange

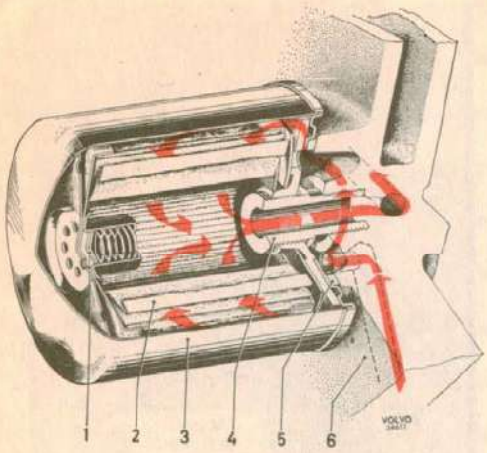


Fig. 1-5. Oil cleaner

1. Relief valve
2. Cartridge
3. Housing (cannot be disassembled)
4. Nipple (see also 10, Fig. 1-6)
5. Gasket
6. Cylinder block

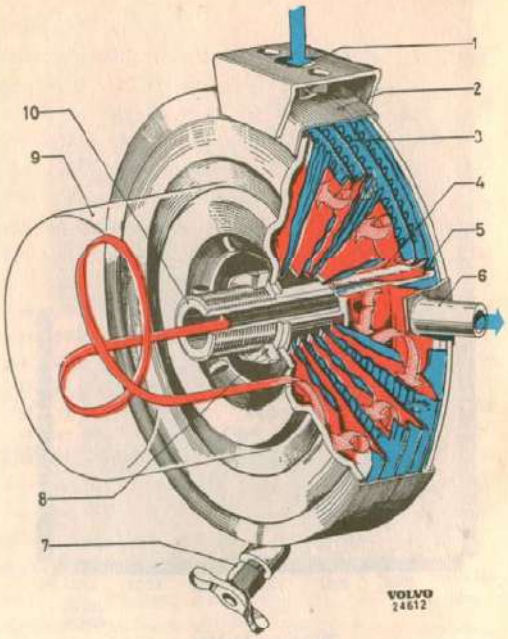


Fig. 1-6. Oil cooler

1. Cooling water inlet
2. Housing
3. Disks
4. Stop for oil
5. Stop for cooling water
6. Cooling water outlet
7. Drain cock for cooling water
8. Nut
9. Oil cleaner
10. Nipple

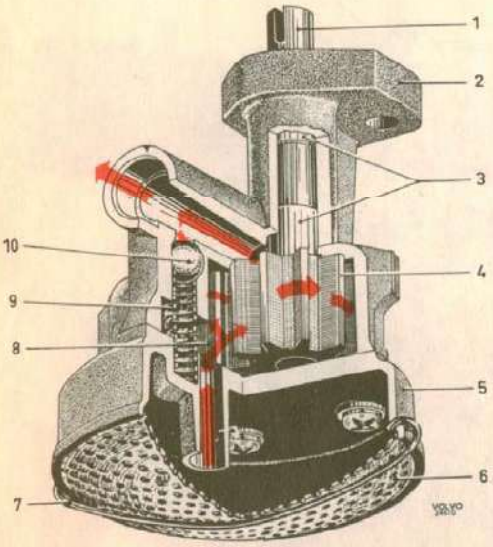


Fig. 1-7. Oil pump

1. Driving shaft
2. Pump housing
3. Bushings
4. Driving gear
5. Cover
6. Strainer
7. Bail
8. Driven gear
9. Spring for relief valve
10. Valve ball

Oil pump

The oil pump, Fig. 1-7 (41, Illustration 1-A) is of the gear type and is driven through gears from the camshaft. When the pump gears start rotating, oil is carried through the spaces between the teeth along the inner walls of the pump from the suction side to the pressure side. The pressure pipe from the pump to the block has no screw unions and is tensioned in position when the pump attaching bolts are tightened. There are seal rings of special rubber at both ends of this pipe. The relief valve is located directly in the pump.

Oil cleaner

The oil cleaner (Fig. 1-5) is manufactured in one unit complete with insert cartridge. The cleaner is of the fullflow type and is bolted directly onto the oil cooler. The oil which is forced out to the various lubricating points on the engine first passes through the cleaner cartridge which is made of special paper. In the oil cleaner there is a relief valve which releases oil past the cartridge if the resistance to flow should become too great.

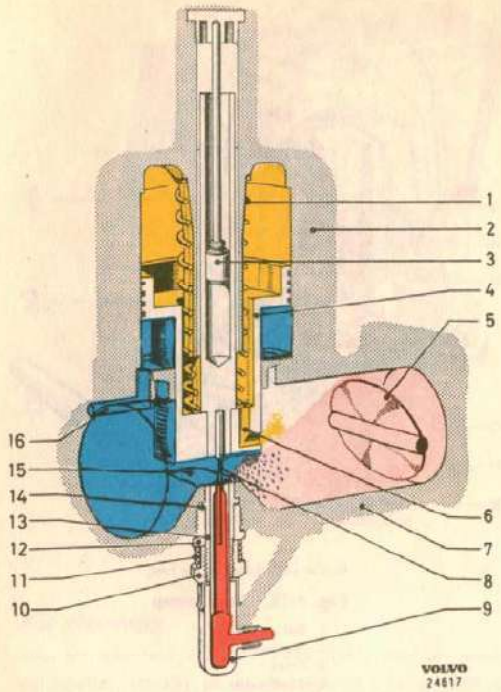


Fig. 1-13. Function of carburetor

Blue = atmospheric pressure
Yellow = vacuum
Red = fuel
Light red = fuel-air mixture

1. Spring
2. Suction chamber
3. Damping plunger
4. Piston in suction chamber
5. Throttle
6. Channel
7. Housing
8. Fuel needle
9. Jet
10. Adjuster nut
11. Lock spring
12. Lock nut
13. Jet sleeve
14. Washer
15. Bridge
16. Channel

by the float is fitted in the cover. Fuel is taken to the lower end of the jet through a flexible hose from the lower part of the float bowl (8, Fig. 1-11).

Cold Starting

When starting a cold engine, the fuel-air mixture can be made richer by lowering the jet, Fig. 1-12. The jet is influenced through a link system from the choke control on the instrument panel. Since the fuel needle is tapered, the fuel flow area is increased when the jet is lowered.

When the choke control is pulled out, the outer end of the lever (3) is pressed downwards and this influences the jet so that it is pushed down. The rapid idling screw is also influenced by the cam on the lever (2, Fig. 1-15) and the throttle opening is somewhat increased.

Operation

The stream of air which passes through the carburetor while it is operating increases in speed when it passes the constriction which is called the bridge (15). See Fig. 1-13.

Fuel is supplied to the air stream through the jet which terminates at the bridge.

The vertical position of the piston in the suction chamber is determined by the difference in pressure between the degree of vacuum in the carburetor and atmospheric pressure – the space above the piston is connected with the space between the throttle and the bridge – while the underside of the piston is influenced by atmospheric pressure. When loading increases, the degree of vacuum increases whereby the piston and the tapered fuel needle rise and permit an increased amount of fuel-air mixture to pass into the cylinders.

The amount of fuel and air supplied to the cylinders is thus dependent on the degree of vacuum in the throat of the carburetor and the carburetors thus work continuously over the whole range.

In order to prevent the piston in the suction chamber from moving too quickly, there is a damping plunger which runs in an oil-filled cylinder.

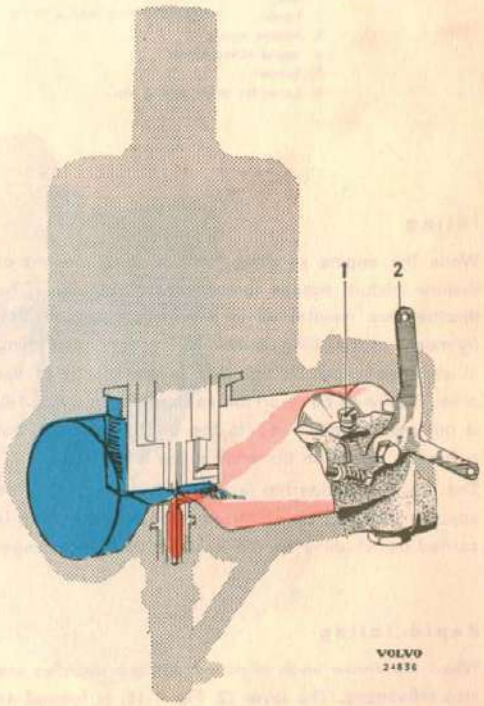


Fig. 1-14. Carburetor, idling

1. Idling screw
2. Lever for return spring

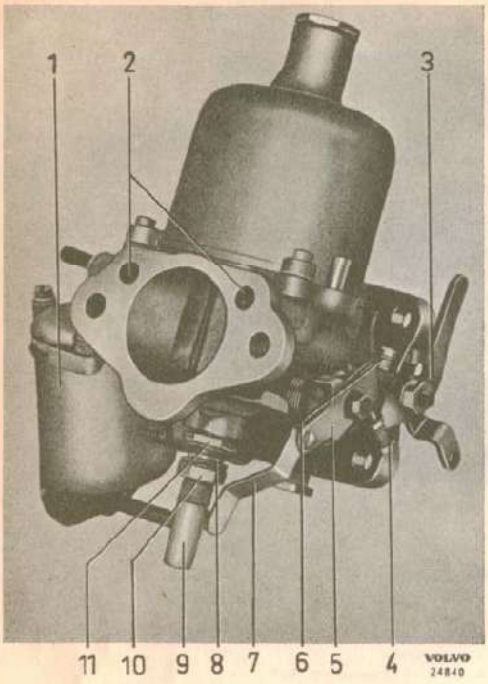


Fig. 1-10. Carburetor viewed from the right

1. Float bowl
2. Ventilation hole
3. Lever
4. Rapid idling screw
5. Lever
6. Idling screw
7. Link for jet
8. Spring
9. Jet
10. Adjuster nut.
11. Locknut

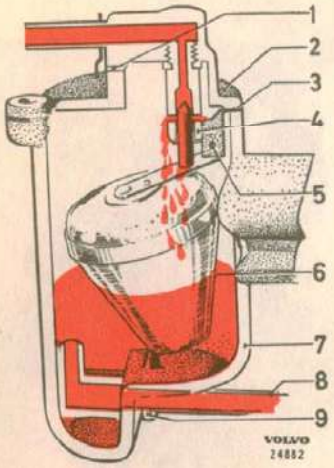


Fig. 1-11. Float system

1. Ventilation hole with protective washer
2. Float bowl cover
3. Gasket
4. Valve
5. Pin
6. Float
7. Float bowl
8. Fuel line
9. Screw union

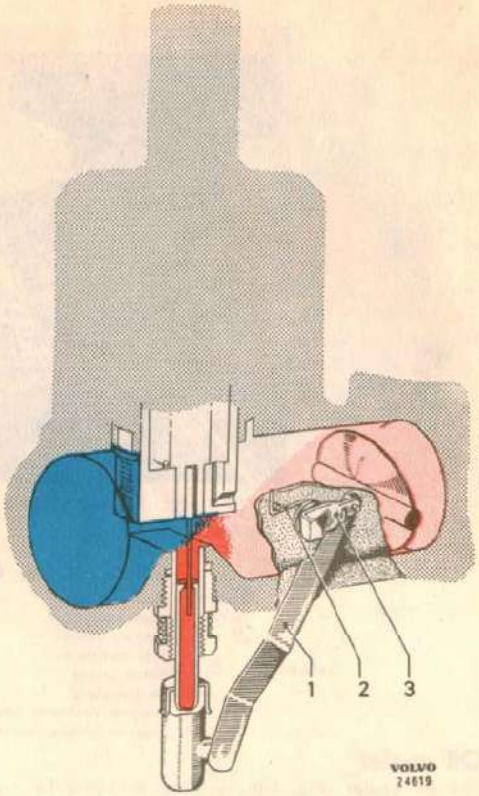


Fig. 1-12. Cold starting

1. Link
2. Return spring
3. Lever

FUEL SYSTEM

The fuel is sucked by a diaphragm type pump from the fuel tank through a filter and is then forced up to the float chambers in the carburetors. There are twin carburetors of the horizontal type. See Fig. 1-8, 1-9 and 1-10.

Carburetors

The twin carburetors, SU-HS 6 (2, Illustration 1-A) are of the horizontal type. Movement of the accelerator pedal is transmitted to the throttles on the carburetors by means of the shaft between the carburetors which is flexibly carried in the carburetor levers. For starting in cold weather, the fuel-air mixture is made richer by lowering the jets. This also causes rapid idling to occur. The various functions of the carburetors are as follows:

Float

The float bowl is screwed to the carburetor housing. See Fig. 1-10. The valve, which is opened or closed

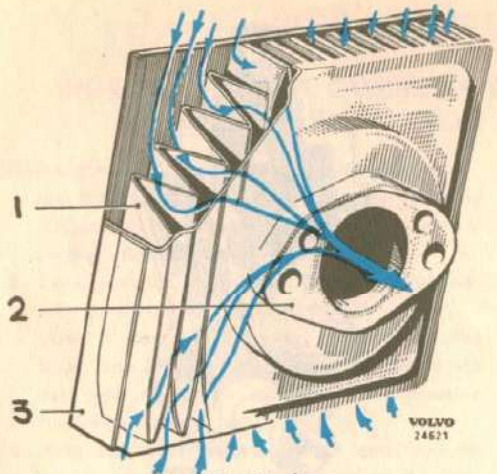


Fig. 1-17. Air cleaner

1. Cartridge (special paper), cannot be removed
2. Gasket
3. Housing

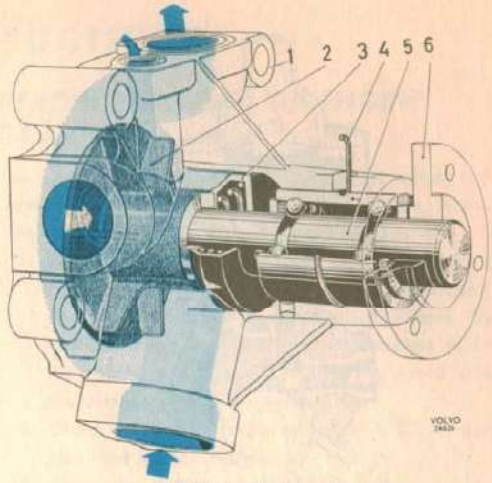


Fig. 1-18. Water pump

1. Housing
2. Impeller wheel
3. Seal
4. Lock spring
5. Shaft with ball bearing (1 unit)
6. Hub

Air cleaners

The air cleaners (1, Illustration 1-A), one on each carburetor, consist of a sheet-metal casing with a cartridge made of special paper. Dust and other impurities in the air are trapped when the air passes through the cleaners (see Fig. 1-17). The air cleaners require no maintainance and may not be oiled in. The complete air cleaners are replaced by new units after a certain mileage.

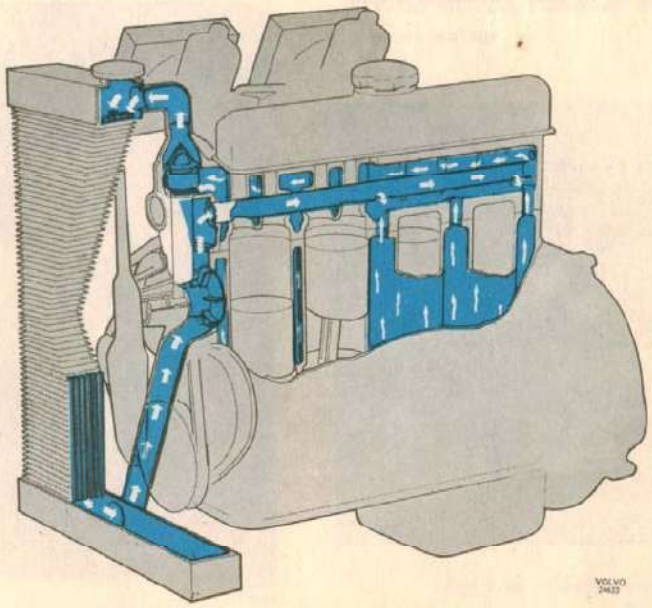


Fig. 1-19. Cooling system

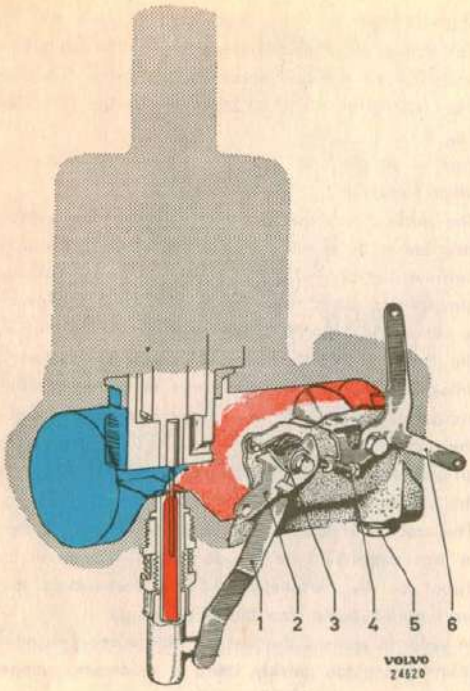
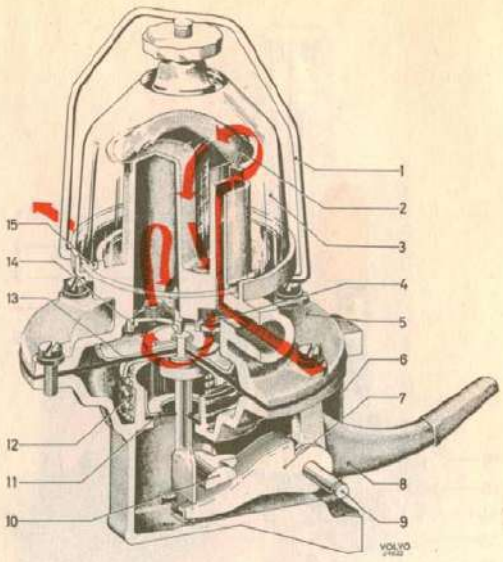


Fig. 1-15. Carburetor, rapid idling

1. Link
2. Lever
3. Return spring
4. Rapid idling screw
5. Screw
6. Lever for return spring etc.



Red = path followed by fuel

Fig. 1-16. Fuel pump

1. Bail
2. Strainer
3. Bowl
4. Inlet valve
5. Upper pump housing
6. Lower pump housing
7. Inner lever
8. Outer lever
9. Shaft
10. Check stop
11. Seal
12. Spring
13. Diaphragm
14. Outlet valve
15. Gasket

Idling

While the engine is idling, only a small amount of fuel-air mixture passes through the carburetors. The throttles are maintained in a slightly open position by means of the idling screws, (1, Fig. 1-14). The idling of each carburetor is adjusted independently of the other. The shaft between the carburetors, see Fig. 1-8, is not permanently fixed to the throttle spindles but is flexibly carried in the ends of the levers.

The fuel/air relationship is adjusted by means of the adjuster nuts (10, Fig. 1-13) on the jets and setting is carried out at idling for the whole of the speed range.

Rapid idling

When the choke knob is pulled out, the throttles are also influenced. The lever (2, Fig. 1-15) is formed as a cam at one end and this cam presses against the rapid idling screw (4) whereby the throttles are opened.

This means that the engine runs at a higher idling speed during the time the choke knob is pulled out.

Fuel pump

The fuel pump is of the diaphragm type and is driven by a cam on the camshaft. The pump is fitted with a disengaging device whereby it ceases to operate when there is a sufficiently high pressure in the float bowls. The design of the pump is shown in Fig. 1-16. The red arrows show the path followed by the fuel.

Fig. 1-20. Circulation of cooling water with thermostat closed

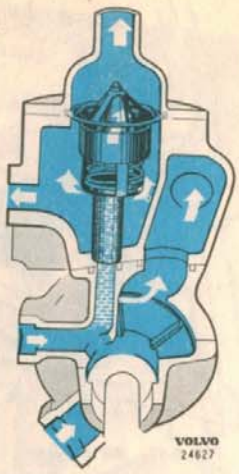


Fig. 1-21. Circulation of cooling water with thermostat open

COOLING SYSTEM

The cooling system, Fig. 1-19, is of the pressure type and is fitted with a circulating pump (Fig. 1-18).

While the engine is cold the cooling water only circulates through the engine itself through a by-pass (Fig. 1-20). When the engine warms up, the thermostat starts to open the outlet to the radiator (Fig. 1-21) whereby the spring-loaded plate on the underside of the thermostat closes the by-pass. Circulation is then regulated by the thermostat so that the engine operating temperature is maintained within the correct limits. A distribution tube in the cylinder head ensures that there is equal distribution of the cooling water though the warmest parts of the cylinder head. The cooling water round the walls of the cylinders circulates by the thermo-siphon principle.

WORK THAT CAN BE CARRIED OUT WITHOUT REMOVING THE ENGINE FROM THE CAR

Measuring the compression pressure

1. Run the engine until it obtains normal operating temperature. Check that the air cleaners are not blocked. Replace them if necessary.
2. Remove all the spark plugs. Depress the accelerator pedal and place a weight on it.
3. Insert a compression tester in the spark plug holes, one after the other, and turn the engine over with the starter motor until the pressure reaches a maximum value.
4. Note the pressure obtained on each cylinder unless the compression tester is of the self-registering type.
5. If low or uneven values are obtained, repeat the compression test after pouring a small quantity of thick oil into each cylinder. If the pressure is low in one of the cylinders, both with and without oil, this is a symptom of leaking valves. If the pressure is higher when the oil has been added, it is probable that the piston rings are worn.

Tuning up the engine

The engine should be tuned up at regular intervals if it is to produce the best results. Tuning up consists of adjusting all settings to the correct value and remedying small defect such as, for example, dirt in the sludge trap, deposits on the spark plugs, etc.

1. Run the engine warm and check (adjust if necessary) the dwell angle (contact breaker gap). Replace burnt contact breaker points. Check the ignition timing setting with a stroboscope while the engine is running at rapid idling speed with the vacuum governor disconnected.
2. Check the distributor gap and clean it. Check and clean the ignition cables.
3. Check the state of charge of the battery and the battery connections.
4. Clean the fuel pump sludge trap. Remove the float bowl covers from the carburetors and blow the housing clean. Remove and clean the plungers of the suction chambers and clean the chambers in white spirit. Re-assemble.
5. Check the air cleaners and replace if necessary.
6. Check the tightening torque of the cylinder head and the tightening of the inlet and exhaust manifolds. Check that there are no air leaks.
7. Remove and adjust the spark plugs or fit new spark plugs.
8. Check the compression on all the cylinders.
9. Adjust the valve clearances. Check that there is no oil leakage.

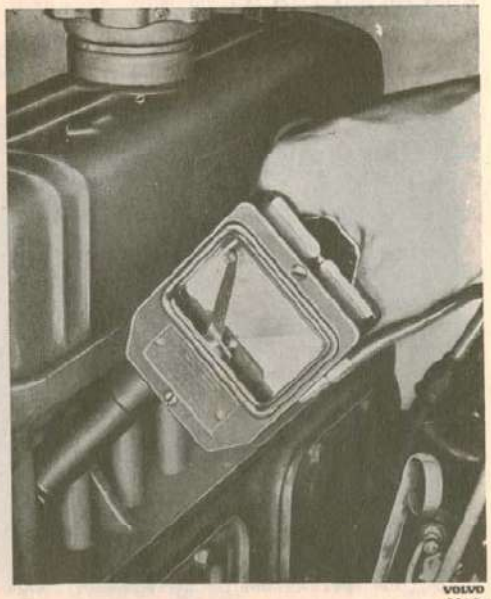


Fig. 1-22. Testing compression

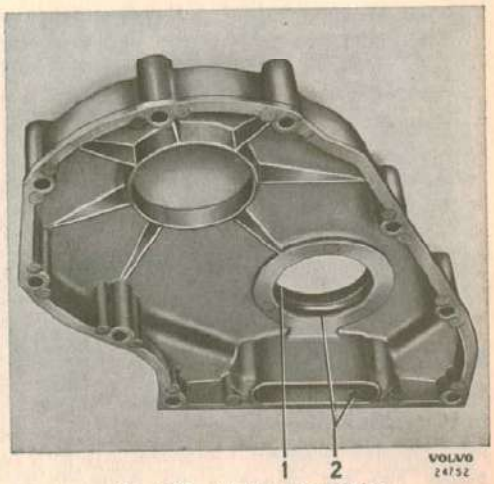


Fig. 1-23. Timing gear casing

1. Seal ring 2. Drain holes

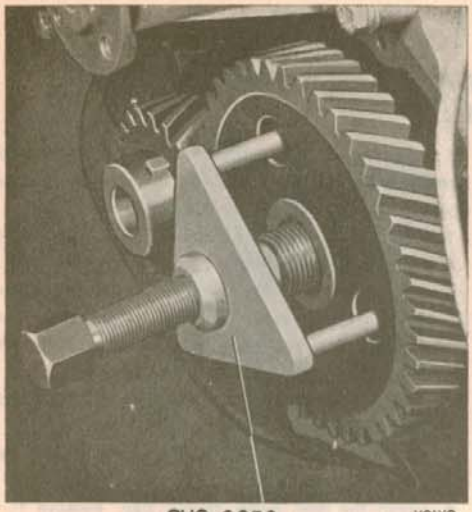


Fig. 1-24. Removing the camshaft gear

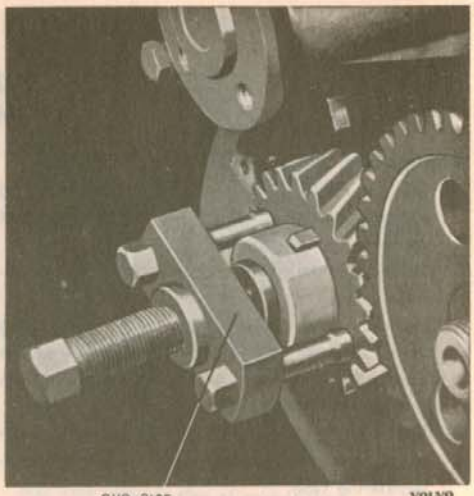


Fig. 1-25. Removing the crankshaft gear

10. Check and adjust when necessary the carburetor settings, see under the heading "Carburetor settings after assembly".

Replacing the cooling water pump

1. Drain off the cooling water.
2. Release the tension on the fan belt. Loosen both the water pipes.
3. Remove the fan and pulley, remove the pump.
4. Fitting is carried out in the reverse order but make sure that the seal rings on the top of the pump are correctly located. Also press the pump upwards against the extension of the cylinder head, for example, with two robust screwdrivers in front of and below the screw union so that the seal between the pump and the cylinder head is good.
5. Make sure that the seal rings on the water pipe are in good condition and push the pipes carefully in when attaching.
6. Fill up with cooling water. Test-run the engine and check that there is no leakage.

Replacing the carburetors

To replace one of the carburetors, both the carburetors must be removed and the attaching screws pulled off simultaneously. The intermediary shaft is pushed into and carried in the throttle levers. When fitting, put the intermediary shaft in position between the carburetors and then fit both carburetors at the same time. See also under the heading "Fuel system".

Replacing the oil cooler

To replace the oil cooler follow the instructions on page 1-24.

Replacing the oil cleaner

When replacing the oil cleaner, this being normally carried out after every 10 000 km (6000 miles), follow the instructions on page 24.

Replacing the timing gear casing

1. Release fan belt tension.
2. Remove the fan and the pulley on the water pump.
3. Remove the crankshaft pulley bolt. Remove the pulley.
4. Remove the timing gear casing. Loosen a couple of extra bolts for the oil pan and be careful to ensure that the oil pan gasket is not damaged.
5. Make sure that the drain holes (see Fig. 1-23) are not blocked in the new casing that is to be fitted.
6. Oil in the seal ring lightly and fit a new gasket.
7. Assemble the parts. Make sure that the casing is correctly centered. Tension the fan belt in accordance with the instructions on page 1-36.
   See the specifications for the tightening torque for the pulley bolt.

Replacing the timing gears

1. Drain off the cooling water and remove the hood and radiator.
2. Carry out the work described in points 1-4 in the previous section.
3. Remove the camshaft nut and pull off the camshaft gear by using tool SVO 2250, Fig. 1-24.
   The sleeve on the crankshaft is forced out with the help of a medium-sized sharp-ground screwdriver. The crankshaft gear is pulled off by using tool SVO 2405, Fig. 1-25.
4. Fit the crankshaft gear with SVO 2407. Fig. 1-26. Fit the camshaft gear with tool SVO 2408, Fig. 1-27. Do not push the shaft in so that the seal washer at the rear end of the camshaft is forced out. Check that the gears have the correct relationship according to the markings shown in Fig. 1-29. There are flats on tool SVO 2407 to turn the crankshaft.
5. Measure the tooth flank clearance, Fig. 1-28. Also measure the shaft end play, this being determined by the shim behind the camshaft gear. See the specifications for the measurement value. Fit the sleeve on the crankshaft.
6. Refit the other parts.

Valve-grinding and decarbonizing

1. Drain off the cooling water.
2. Disassemble the throttle control by loosening the ball joints, cotter pin and bracket on the inlet manifold. Loosen the choke control.

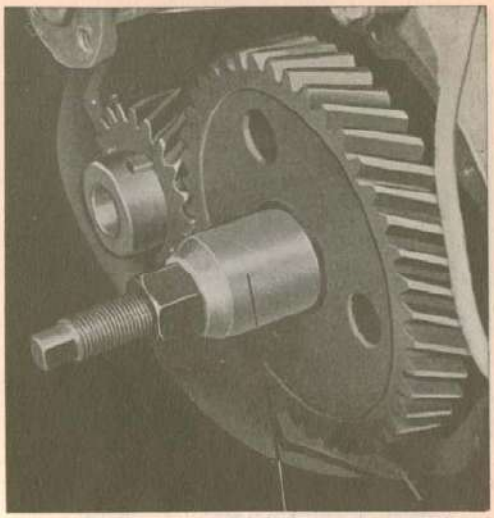


Fig. 1-27. Fitting the camshaft gear

3. Remove the carburetor. Both carburetors must be loosened and removed simultaneously since the intermediary shaft is carried and guided in the carburetor lever.
4. Disconnect the exhaust pipe from the exhaust manifold, disconnect the water hoses to the radiator and disconnect the other connections to the cylinder head.
5. Remove the rocker arm, rocker arm shaft and push rods.
6. Remove the cylinder head bolts, loosen the water

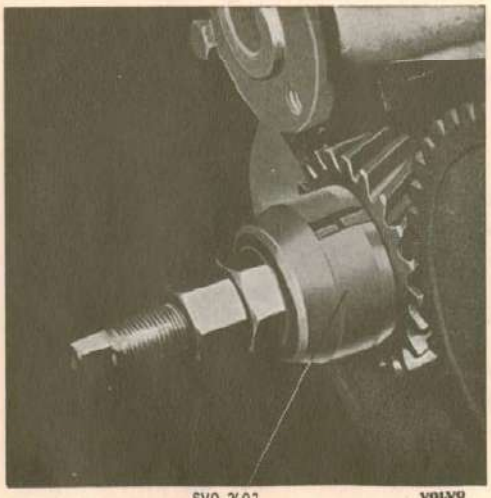


Fig. 1-26. Fitting the crankshaft gear

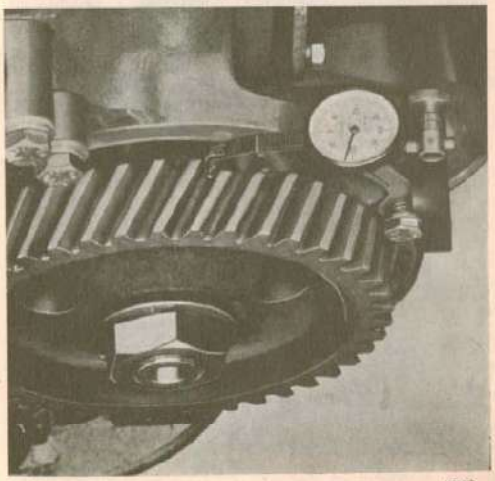


Fig. 1-28. Measuring tooth flank clearance

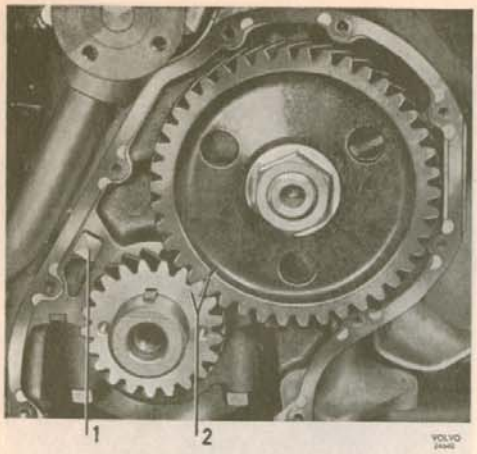


Fig. 1-29. Timing gear setting
1. Jet for lubrication of gears 2. Markings

pipe at the thermostat housing, loosen the attachment at the rear exhaust manifold bolt. Loosen the generator tensioner. Lift off the cylinder head.

7. Clean the piston crowns, combustion chambers, inlet and exhaust ports thoroughly. Do not use emery cloth since small particles can get between the pistons and the cylinder walls and cause damage.
8. Recondition the valve system according to the description under the heading "Cylinder head with valves".
9. Fit the valves. Fit a new cylinder head gasket and new seals for the water pump. Fit the cylinder head. See the specifications for the tightening order and tightening torque. Fit the other parts. Fill up with cooling water.
10. Adjust the valve clearances. Run the engine for a short while. Re-tighten the cylinder head and re-adjust the valve clearances.

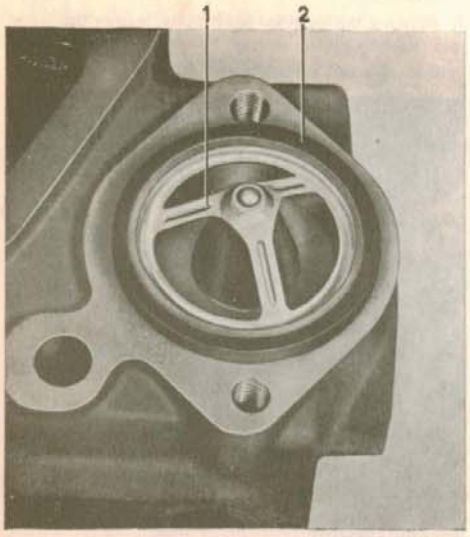


Fig. 1-30. Thermostat
1. Thermostat 2. Gasket

Replacing the thermostat

1. Drain off part of the cooling water.
2. Remove the bolts for the outlet pipe over the thermostat and turn up the pipe.
3. Replace the thermostat (1, Fig. 1-30). Use a new gasket.
4. Screw the pipe into position. Fill up with cooling water and check for leakage.

REMOVING THE ENGINE

1. Jack up the car about 30 cm (12") over the floor and fit trestles under it.
   Drain off the cooling water and engine oil. Remove the positive pole from the battery.
2. Remove the hood and the radiator. Be careful not to damage the finish on the hood.
3. Remove the throttle control joints at the front and rear of the shaft between the engine and the body. Remove the cotter pin and washer and then pull out the shaft. Disconnect the vacuum tube at the front end of the inlet manifold and

Fig. 1-31. Lifting out the engine

Fig. 1-32. Measuring clearance

disconnect the water pipe on the right-hand side of the thermostat housing.

Disconnect all connections round the rest of the engine. Remove the throttle control shaft behind the flywheel housing.

4. Loosen the exhaust pipe at the exhaust manifold and the attachment on the flywheel housing. Remove the nuts for the engine mounting blocks.
5. Remove the gearshift lever. Remove the control for the clutch and the cables for the overdrive.
6. Disconnect the forward propeller shaft joint. Place a jack under the transmission and raise the jack slightly. Remove the support cross-member.
7. Fit lifting tool SVO 2425 to the engine. Tighten the bolt on the tool in the hole at the front end of the cylinder head, locate the hooks under the manifold front and rear. See Fig. 1-31.
8. Lift the front end of the engine an inch or so to clear the engine mounting blocks. Lower the transmission but not more than necessary and pull the engine forwards at the same time as the front end is lifted. Lift out the engine by gradually raising the front end and lowering the rear end.

DISASSEMBLING THE ENGINE

After the engine has been lifted out of of the car, disassembly is carried out as shown below. (See under the headings concerned for the separate components).

1. Place the engine in a suitable stand. Check that the oil has been drained off.
2. Remove the starter motor and the cover plate on the lower front edge of the flywheel housing together with the transmission and then remove the clutch and flywheel.
3. Remove the rear sealing flange, the generator, the water pump and distributor, the rocker arm

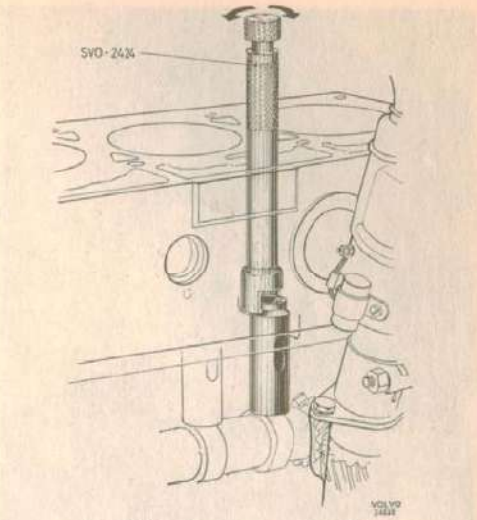


Fig. 1-33. Removing a valve lifter

cover, the rocker arms and the cylinder head. Remove the oil cleaner and oil cooler.

Remove the valve lifters with tool SVO 2424, see Fig. 1-33.

4. Remove the timing gear casing and the timing gears. See under the heading "Replacement of timing gears" for the tools concerned. Remove the camshaft.
5. Stand up the engine on its rear end on a bench. Place three wooden blocks under so that the crankshaft can rotate freely.

   Remove the oil pan, oil pump and connecting rods with pistons. Replace the bearing caps on their respective connecting rods.
6. Lay the engine with the bottom upwards and remove the crankshaft. Replace the bearing caps in their correct positions.

CLEANING

All the engine parts should be carefully cleaned after the engine has been disassembled. Parts made of steel or cast iron can be cleaned in a de-greasing tank with a lye solution. Light-alloy parts can easily be damaged by the lye and should therefore preferably be cleaned in white spirit. Never clean pistons and bearing shells in lye. Rinse the parts with warm water and blow them dry with compressed air after washing. Clean out the oil drillings particularly thoroughly. Clean them through by using a special brush and then blow them out with compressed air.

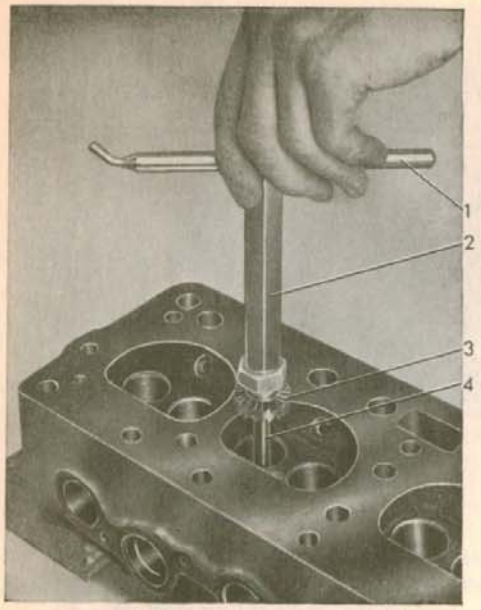


Fig. 1-34. Reaming a valve seat

All the seal plugs at the ends of the drillings in the cylinder block must be removed while cleaning is going on.

CYLINDER HEAD WITH VALVES

Disassembly

1. Remove the rubber seal. Remove the valve springs by first compressing them with a valve spring tool and then removing the valve keys and releasing the tool. Place the valves in order in a special stand.
2. Measure the clearance between the valve spindle and the valve guides as shown in Fig. 1-32. With a new valve this clearance should not exceed 0.15 mm (0.006"). Also check that the valves are not too worn. See under the headings "Valve system" and "Wear tolerances" in the specifications.

Fig. 1-35. Valve seat width
A = 1.5 mm (0.060")

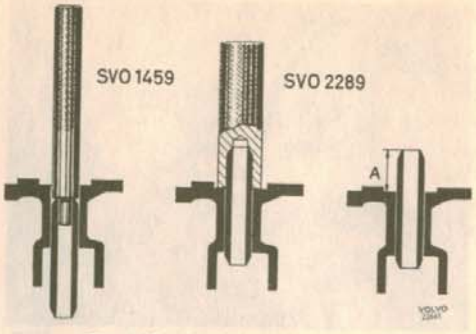


Fig. 1-36. Replacing valve guides
A = 21 mm (0.827")

Cleaning

Clean the valves, combustion chambers and channels with rotating brushes to remove soot and combustion residues.

Grinding the valves and valve seats

1. Grind the valves in a valve-refacing machine after they have been cleaned. If the valves are very worn, fit new valves.
2. Grind the valve seats. Use an electrically driven valve-seat grinder or a hand reamer. A pilot spindle must first be fitted accurately before the work is started and worn valve guides should be replaced with new guides.
   Grind the seat until satisfactory sealing is obtained. The angle is 45° and the width of the valve seat should be 1.5 mm (0.060"), see "A", Fig. 1-35.
   If the valve seat width is too wide after grinding, it can be reduced from the inside with a grinding stone with an angle of 70° and from the outside with a 20° grinding stone.
3. Smear the valve seat surfaces with a thin layer of fine grinding compound and lap in the valves against their seats.
   Then clean the valves and seats and check for leakage.

Fig. 1-37. Spring testing

Replacing valve guides

1. Press out the old guides with the help of tool SVO 1459.
2. Press in the new guides by using tool SVO 2289, which presses them in to the correct depth. See Fig. 1-36.
3. Ream the new guides to the correct diameter with a suitable reamer so that the correct clearance is obtained, see the specifications.

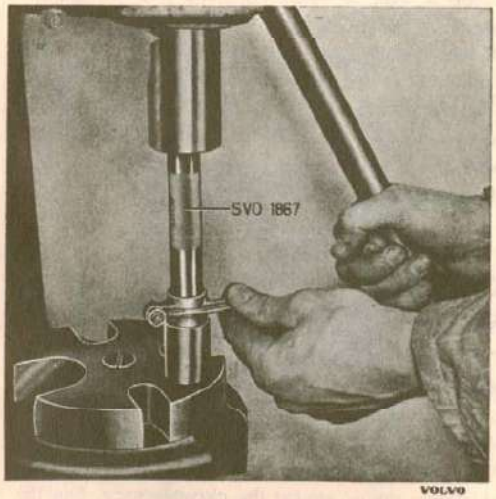


Fig. 1-38. Replacing a rocker arm bushing

Fig. 1-39. Reaming a new bushing

Assembling

1. Check that the parts are in good condition and clean. Check that the springs hold the values shown in the specifications. See also Fig. 1-37.
2. Fit the valves in position. Fit the lower rubber washer, steel washer, valve spring, upper washer and valve cotter. Finally fit the rubber ring.

Replacing the rocker arm bushings and grinding the rocker arms

1. If wear is as much as 0.1 (0.004"), replace the rocker arm bushings. Use tool SVO 1867 to press out and press in the bushings. Then ream the bushings with a suitable reamer to an accurate fit on the shaft. The hole in the bushing should index with the hole in the rocker arm.
2. If necessary grind the thrust surface against the valve in a special machine.

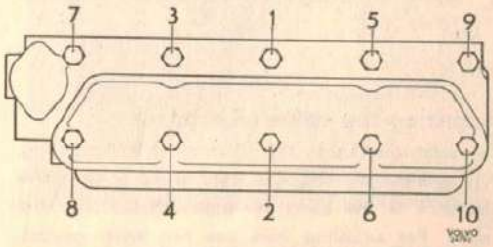


Fig. 1-40. Order of tightening for cylinder head bolts

Fig. 1-41. Adjusting valve clearance

Fitting the cylinder head

1. Check that the cylinder head, cylinder block, pistons and cylinder bores are clean.
2. Check that the oil drillings to the rocker arm mechanism on the valve lifter side in the center of the block are clean. In the cylinder head, the oil goes up through the screw hole between the screw and the wall of the hole and then out through a diagonal drilling to the attaching screw for the rocker arm shaft and then up in the shaft.
3. Fit a new cylinder head gasket. Fit the cylinder head. Tighten the bolts in the right order and to the correct tightening torque. See Fig. 1-40 and the specifications.
4. Fit the rocker arm mechanism. Adjust the valve clearances. Fit the remaining parts.
5. Drive the car for a short distance. Retighten the cylinder head bolts and adjust the valve clearances.

Adjusting the valve clearances

The valve clearances are adjusted as shown in Fig. 1-41, whether the engine is cold or warm. The valve clearance is the same for both exhaust and inlet valves. For adjusting work use two feeler gauges, one 0.50 mm (0.02") and the other 0.55 mm (0.022").

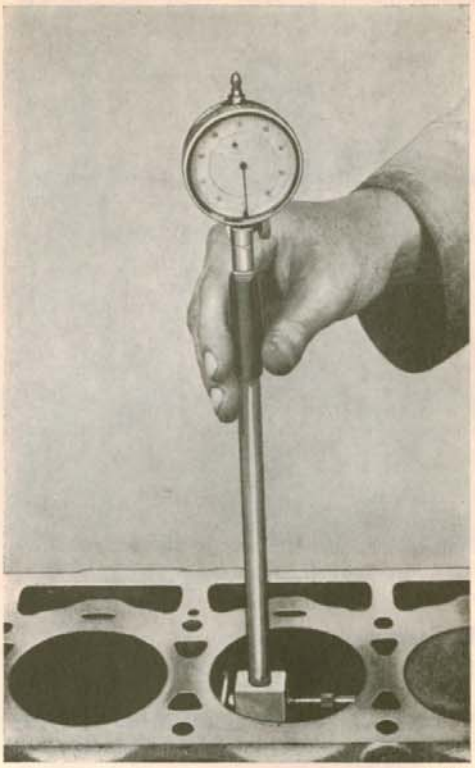


Fig. 1-42. Measuring the cylinder bore

The clearance is adjusted so that the 0.50 mm (0.02") gauge is easy to insert while the 0.55 mm (0.022") gauge will not go in.

If the engine has been diassembled, the valve clearances should be roughly adjusted before starting. The engine should then be turned over by hand by turning the fan. The spark plugs should be removed while this is done so that compression does not make the engine difficult to turn over.

CYLINDER BLOCK

Measuring the cylinder bores

The cylinder bores are measured by using a special gauge as shown in Fig. 1-42. There is a letter stamped on each cylinder bore showing its dimensions (only standard model), see specifications. See also Fig. 1-52. Carry out measurements at various depths and at various points around the circumference. See the specifications for the dimensions.

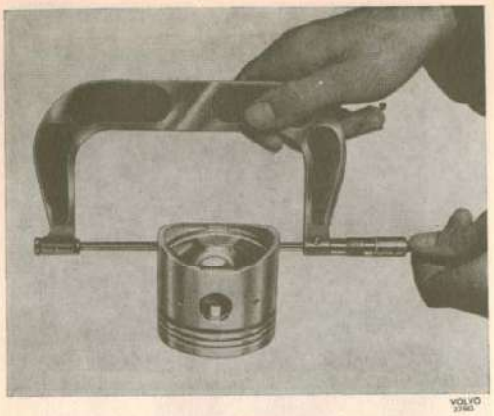


Fig. 1-43. Measuring a piston

Reboring the cylinders

The cylinders are rebored in a special machine and then they are honed to obtain a fine surface texture. The complete cylinder block should be washed before assembly in a de-greasing tank to remove all metallic residue and impurities.

See the specifications for the dimensions. See also the text under the heading. "Fit of pistons in cylinder bores".

PISTONS, PISTON RINGS, PISTON PINS

Measuring the pistons

The pistons are measured by means of a micrometer at right angles to the piston pin hole, 12.5 mm (0.490") from the lower edge, see Fig. 1-43. See the specifications for the dimensions.

Fit of pistons in cylinder bores

The fit of the pistons in the cylinder bores is checked without the pistons pins fitted. The clearance at right angles to the piston pin hole is measured with a feeler gauge 1/2" wide and 0.04 mm (0.0016") thick attached to a spring balance. The pull required should be 0.5–2 kg (1–4 1/2 lb.). This test should be repeated on several different diameters and at different depths.

The standard bore cylinders have a letter stamped on which shows the dimension and the piston in this particular cylinder should be marked with the same letter.

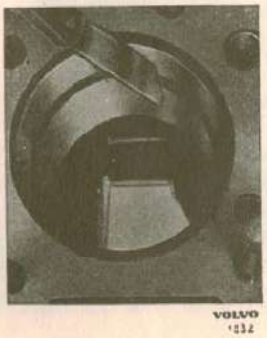


Fig. 1-44. Measuring the piston ring gap

Fig. 1-45. Piston ring clearance in groove

Piston ring fit

In a new or rebored cylinder

1. Push down the piston rings one after the other in the cylinder bore. Use a piston upside down so that the rings come into their correct position.
2. Measure the ring gap with a feeler gauge, Fig. 1-44. The gap should be 0.25–0.50 mm (0.01–

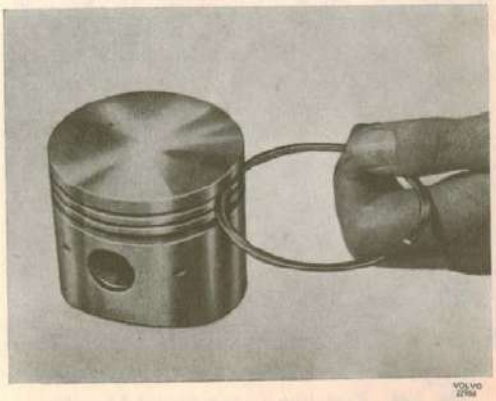


Fig. 1-46. Rolling the piston ring in the groove

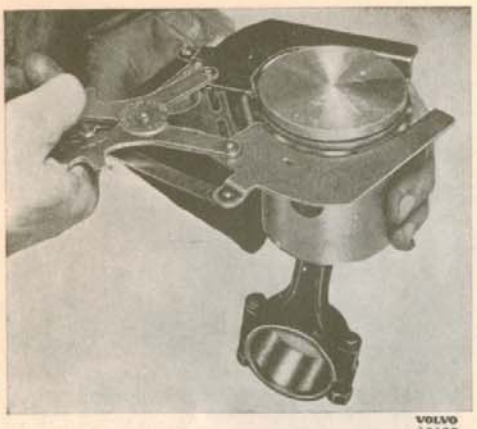


Fig. 1-47. Fitting the piston rings

0.020"). If necessary widen the gap by using a special file.

3. Check the piston rings in their respective ring grooves by rolling them in the groove, Fig. 1-46. Also measure the clearance at several points, Fig. 1-45. See the specifications for the dimenslons.

In a worn cylinder bore

When checking the fit of the rings in a worn cylinder bore, the rings must be tested at bottom dead center since it is there that the cylinder has the smallest bore.

Piston pins

The piston pins are available in three oversizes: 0.05 mm (0.002"), 0.10 mm (0.0040") and 0.20 mm (0.008")

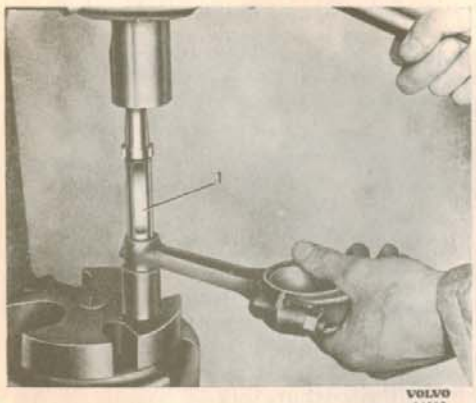


Fig. 1-48. Replacing a connecting rod bushing
1 = SVO 1867

Fig. 1-49. Piston pin fit

larger than the standard diameter 22.00 mm (0.866"). If the piston pin hole in the piston is worn so much that it is necessary to fit an oversize, first ream up the hole to the correct dimension. Use a reamer fitted

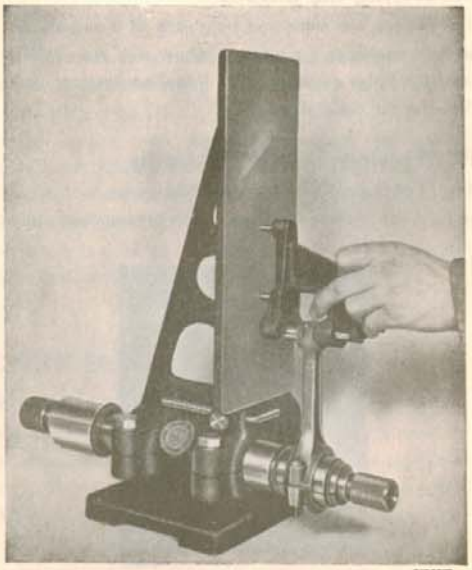


Fig. 1-50. Checking connecting rod alignment

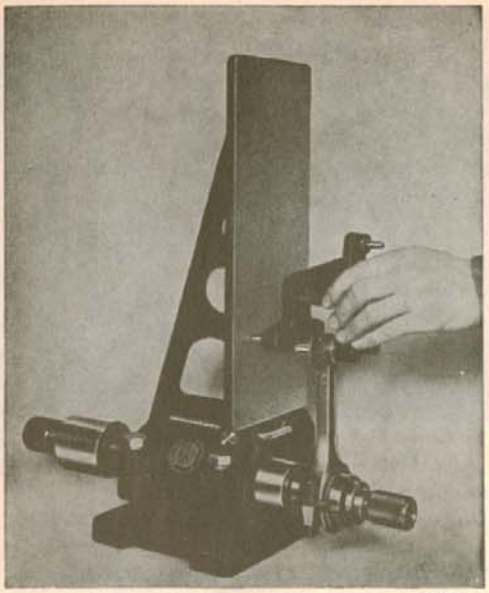


Fig. 1-51. Checking connecting rod alignment

with a guide and remove only a small quantity of material at a time.

The fit is correct when the piston pins can be pushed through the hole by hand and only light resistance felt.

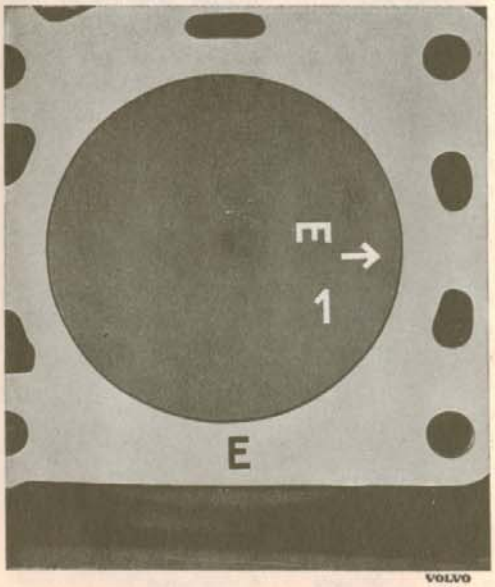


Fig. 1-52. Markings on piston and cylinder block

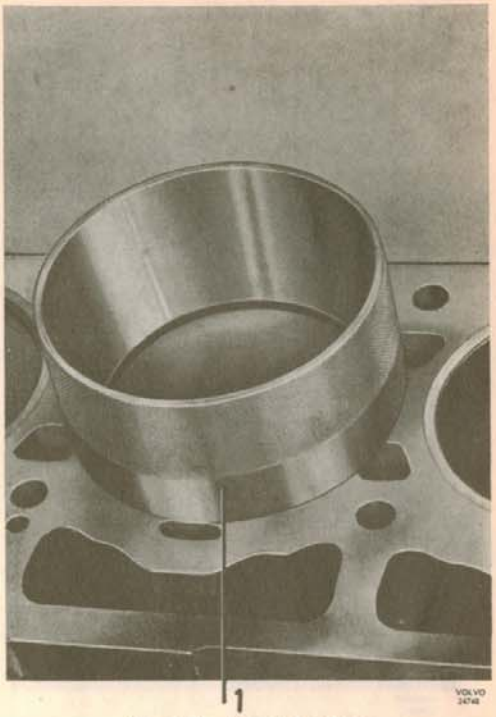


Fig. 1-53. Fitting a piston

1. Piston-inserting tool SVO 2176

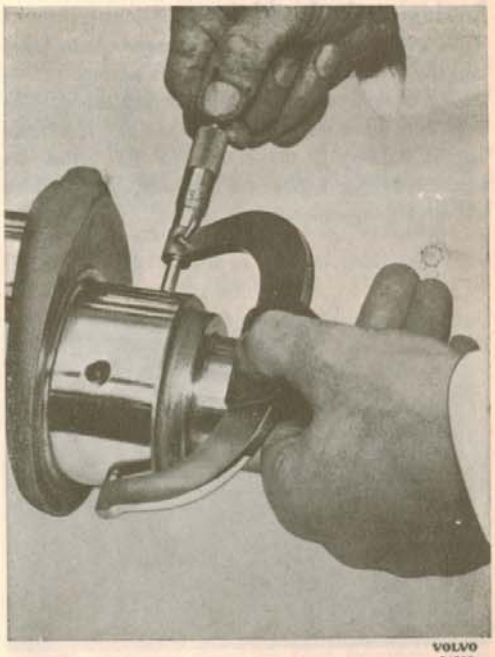


Fig. 1-54. Measuring the crankshaft

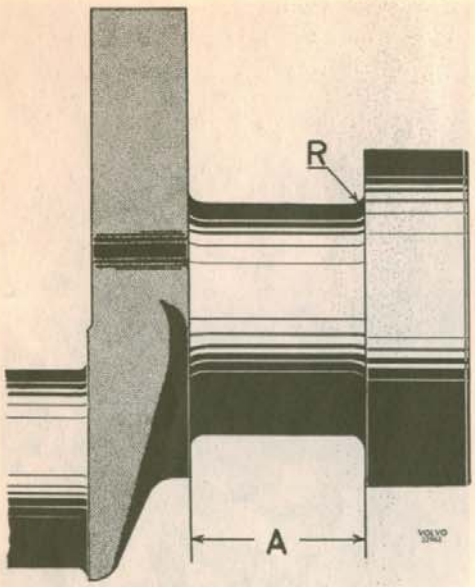


Fig. 1-55. Bearing journal
(R) for all bearing journals 2.0–2.5 mm (0.079"–0.098")
(A) width, dependent on size of journal

CONNECTING RODS

Replacing the bushings

If the old bushing is worn, it is pressed out by using tool SVO 1867 and a new bushing is pressed in with the same tool. Make sure that the lubricating holes index with the holes in the connecting rod. Then ream up the bushing to the correct fit. The piston pin should then slide through the hole with some pressure but without any noticeable looseness.

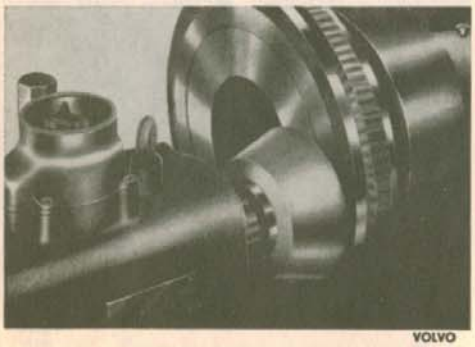


Fig. 1-56. Grinding the flywheel

Alignment

Check the connecting rods before fitting concerning alignment to make sure that they are straight, free from twist or S-distortion. If necessary, straighten them. See Fig. 1-50 and 1-51.
Always fit new nuts and bolts when reconditioning is carried out.

Assembling and fitting pistons and connecting rods

When assembling make sure that the pistons are turned the right way with the arrow on the top of the pistons facing the front of the engine, see Fig. 1-52. The number marking on the connecting rods should be turned to face away from the camshaft side. The piston pins are then fitted, the circlips placed in position and the piston rings fitted.
Use a piston ring tool for the rings. The compression rings are marked "TOP" and the upper ring is chromed. Place the bearing shells in position.
Turn the rings so that the ring gaps are not immediately under each other, then lubricate the piston and bearing surfaces.
Use the piston inserting tool SVO 2176, Fig. 1-53 when fitting the piston in the bore. Tighten the connecting rod bolts with a torque wrench, see the specifications for the tightening torques.

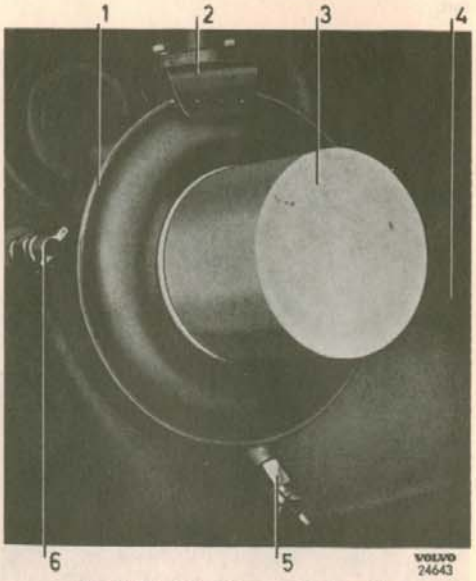


Fig. 1-57. Oil cleaner and oil cooler

1. Oil cooler
2. Water inlet
3. Oil cleaner
4. Water outlet
5. Drain cock for water
6. Drain cock for water

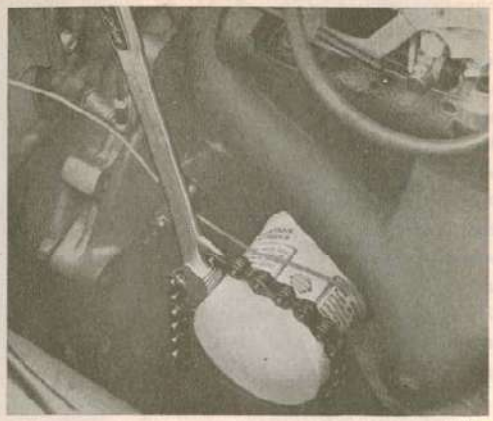


Fig. 1-58. Removing the oil cleaner

CRANKSHAFT

After cleaning the crankshaft, measure its journals with a micrometer. This measurement should be carried out at several points round the circumference and along the width. Out-of-roundness on the main bearing journals should not exceed 0.05 mm (0.002") and on the connecting rod bearing journals, 0.07 mm (0.003"). Taper should not be greater than 0.05 mm (0.002") for any of the journals. See Fig. 1-54.

If the measurement values obtained are in the neighborhood of or exceed the wear tolerances given above, the crankshaft should be ground to undersize. Suitable bearing shells are available in five undersizes. See the specifications for the dimensions. Check that the crankshaft is straight to within 0.05 mm (0.002") by using a dial indicator. Lay the crankshaft in two vee blocks and adjust a dial indicator against the center bearing journal. Then rotate the crankshaft. If necessary straighten the crankshaft in a press.

Grinding the crankshaft

Before the crankshaft is ground, its straightness should be checked as detailed above. Grinding is carried out in a special machine whereby the main and connecting rod bearing journals are ground to identical dimensions. These dimensions, which are given in the specifications, must be carefully followed to ensure that the correct bearing clearance is obtained with the precision bearing shells.

Scraping of the bearing shells or filing of the bearing caps is absolutely forbidden.

The fillet radius at the ends of the bearing journals should be 2.0–2.5 mm (0.079–0.098") for all the journals, see Fig. 1-55. The width (A) for the guide bearing is dependent on the size of the journal and should be ground to obtain the correct measurements. After grinding, the oil drilling openings should be carefully bevelled and all the bearing journals lapped with fine grinding compound to get the best surface texture. The crankshaft should then be washed. All the oil drillings should be cleaned particularly carefully to remove any traces of filings.

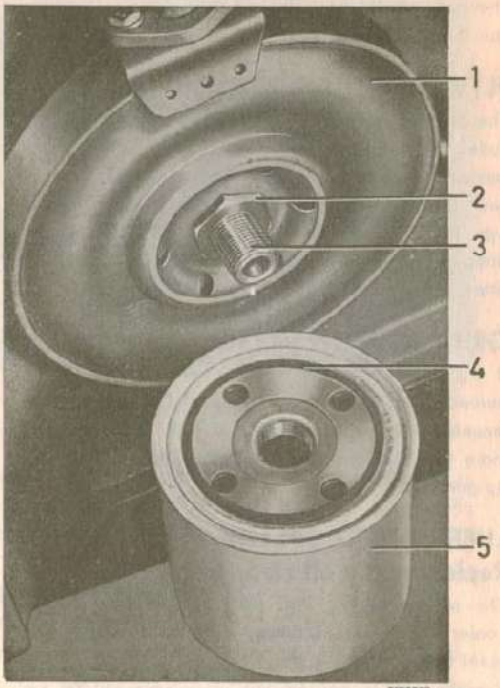


Fig. 1-59. Oil cleaner ready for fitting

1. Cooler
2. Nut
3. Nipple
4. Gasket
5. Cleaner

Main bearings and connecting rod bearings

Apart from the standard size, bearing shells are available in undersizes of 0.10", 0.020", 0.030", 0.040" and 0.050". The rear bearing shells are fitted with flanges and have a larger width relative to their size. If the crankshaft has been ground to the correct dimensions, the correct bearing clearance is obtained when the corresponding bearing shells are fitted. The bearing shells may not be scraped and the bearing caps may never be filed to obtain closer bearing clearance.

The bolts should be tightened with a torque wrench, see the specifications for tightening torque.

FLYWHEEL PILOT BEARING

The pilot bearing lock ring is removed, the bearing pulled out with tool SVO 4090 and checked after washing in white spirit. If the bearing is worn, fit a new bearing. Before re-fitting, pack the bearing with heat-resistant bearing grease. The bearing is fitted with tool SVO 1426 and the lock ring is then fitted.

GRINDING THE FLYWHEEL

If the wearing surface of the flywheel is uneven or burned, the surface can be ground flat in a saddle-mounted grinding machine. Fig. 1-56. Never remove more than 0.75 mm (0.030") of the original thickness by grinding.

LUBRICATING SYSTEM

Replacing the oil cleaner

The oil cleaner (3, Fig. 1-57) is bolted to the oil cooler in one unit together with the cartridge and relief valve.

Replacement is carried out after every 10 000 km (6000 miles) when the old oil cleaner is thrown away. In the case of a new or reconditioned engine, the oil cleaner is also changed for the first time after 5000 km (3000 miles) driving.

1. Remove the old oil cleaner with the help of a tool, as shown in Fig. 1-58.
2. Smear oil onto the rubber gasket on the new cleaner (4, Fig. 1-59) and make sure that the contact surface for the oil cleaner is free from dirt. If it is smeared with oil the gasket will slide better onto the sealing surface. Screw on the cleaner by hand until it just touches the oil cooler.
3. Tighten the oil cleaner a further half-turn but absolutely no more. Start the engine and check that the joints are not leaking. Top up with oil if necessary.

Oil pump with release valve

After the pump has been disassembled and cleaned, check that all the parts are in good condition. Check the spring for the relief valve (2, Fig. 1-60), see the specifications for the test standards.

Check that the tooth flank clearance is 0.15–0.35 mm (0.006–0.014"), see Fig. 1-61.

Measure the axial clearance, 0.02–0.10 mm (0.008–0.004"), see Fig. 1-62.

Fit a new cover or check that the old cover is not noticeably worn. A worn cover can be ground level. If the bushings or the shaft are worn, fit new units. Remember that the hole for the tubular pin in the driving gear may not be drilled right through since this would short-circuit the suction and pressure sides. The new bushings should be reamed after being pressed in. Use a reamer fitted with a guide.

Check that the seal rings on the ends of the pressure pipe are in good condition or fit new seals. The pressure pipe must be clamped in the holes properly, first in the oil pump and then the oil pump and the pipe together against the block. The pipe connecting flange should be flat against the block before being tightened.

Oil drillings

All the oil drillings must be cleaned particularly carefully to avoid damage to the bearings, bearing journals and other parts.

Before cleaning the cylinder block channels, remove the seal plugs and fit new plugs after cleaning them and blowing them dry.

Replacing the oil cooler

1. Drain off the engine cooling water.
2. Loosen the cooling water connections at the oil cooler. Remove the oil cleaner, see Fig. 1-58.
3. Remove the nut (2, Fig. 1-59) on the nipple for the oil cooler and pull out the cooler.
4. Fit the oil cooler in the reverse order. The O-ring against the block must be replaced if necessary and, should it be replaced, a new ring should be glued in the groove on the oil cooler before the oil cooler is fitted. Smear the groove with a thin layer of glue, resistant to oil at temperatures up to 140° C = 285° F (for example, Pliobond 20). Check during fitting that the oil cooler is in good top contact with the block all round when the nut has been tightened to a torque of 1 kgm (7 lb.ft.). The nut is finally tightened to a torque of 3–3.5 kgm (21–25 lb.ft).
5. Fit the oil cleaner, see under the heading "Replacing the oil cleaner".
6. Fill up with cooling water and engine oil if necessary.
7. Start the engine and check that there is no leakage.
8. If the nipple (3, Fig. 1-59) is replaced, the new nipple should be tightened to a torque of 4.5–5.5 kgm (32–40 lb.ft.).

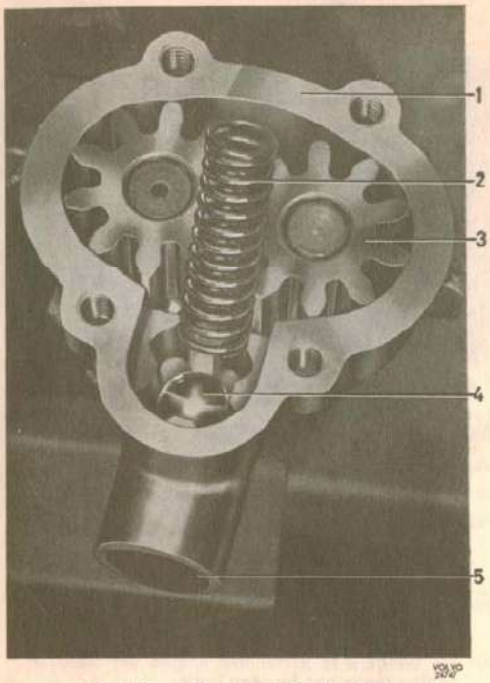


Fig. 1-60. Oil pump with relief valve

1. Pump housing
2. Spring for relief valve
3. Gear
4. Valve ball
5. Hole for oil pipe

IGNITION SYSTEM

Fitting the distributor drive gear

When the engine is at TDC for ignition on number 1 cylinder, the drive gear for the oil pump and distributor is fitted. The small part of the groove is

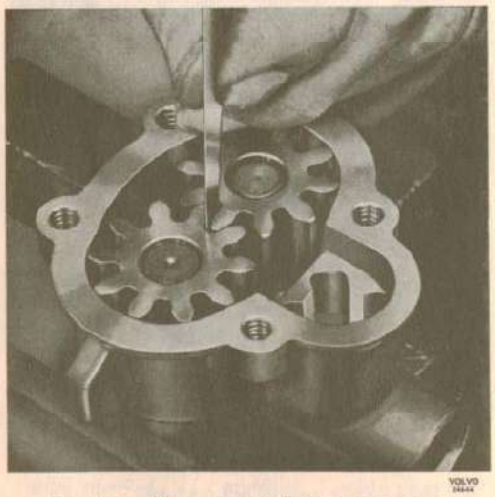


Fig. 1-61. Measuring tooth flank clearance

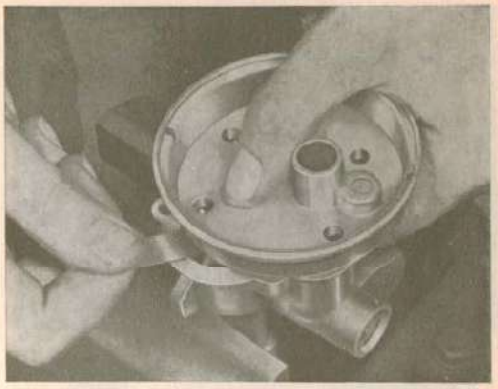


Fig. 1-62. Measuring axial clearance

turned diagonally upwards and to the rear, and the groove is placed at an angle of about 35° to the longitudinal axis of the engine, see A, Fig. 1-64.

Ignition timing setting

Basic setting

The basic setting when fitting the distributor on the engine is 5° before TDC (97 octane fuel). This setting is, however, only a rough setting which should be adjusted with a stroboscope before the car is driven.

1. Check that the engine is in the position for firing on cylinder number 1 and that the distributor drive gear is correctly fitted according to the description in the previous paragraph.
2. Turn the engine over so that the pointer at the front (Fig. 1-65) is opposite 5° before TDC. Fit the distributor but do not tighten it in position.
3. Connect up a small bulb (max. 2 W) as shown in Fig. 1-66 and connect up the current. Turn the distributor housing slowly in an anti-clockwise

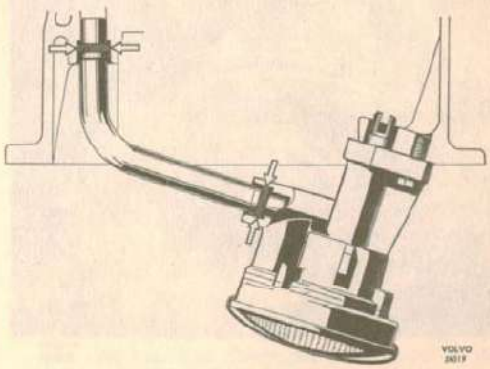


Fig. 1-63. Sealing rings on pressure pipe

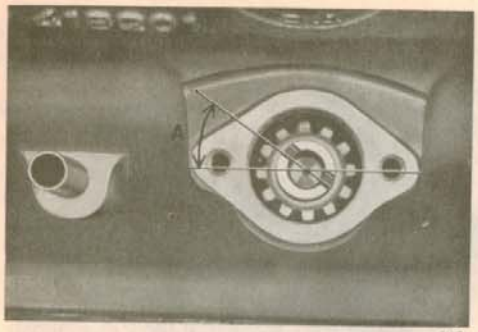


Fig. 1-64. The position of the distributor drive gear
A = 35°

direction past the contact breaker opening point for cylinder number 1, and then back again in a clockwise direction until the lamp just lights up. Tighten the distributor in this position. Make sure that the rotor is opposite the contact in the distributor cap which leads to number 1 cylinder, Fig. 1-68.

4. Fit the distributor cap and cables in order as shown in Fig. 1-68. The rotor rotates in an anti-clockwise direction.

Fine adjustment

Ignition timing setting should be carried out while the engine is running with the help of a control lamp (stroboscope) after the distributor has been removed, or otherwise when required. The basic setting as described above applies for assembly but the final adjustment is carried out while the engine is running.

1. Disconnect the vacuum governor by loosening its pipe at the distributor.

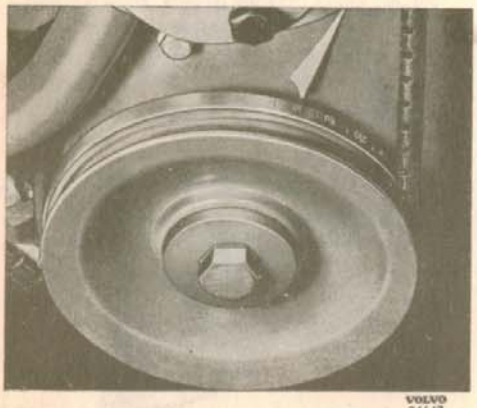


Fig. 1-65. Graduations for timing setting

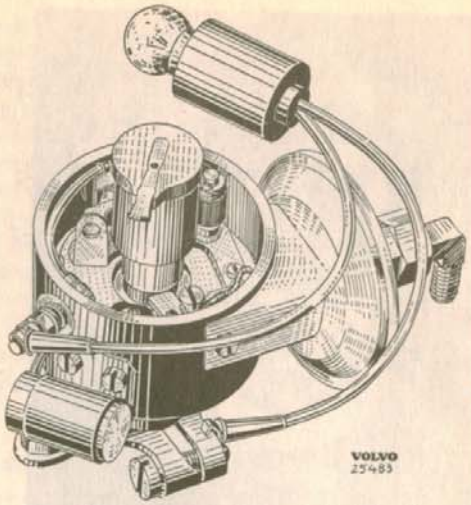


Fig. 1-66. Lamp connected up for basic ignition timing setting

2. Mark the crankshaft belt pulley with chalk within the graduations applying for the timing setting concerned. This facilitates adjustment since the setting range can be seen better.
With 100 h.p. (SAE) B 18 B engines using 97 octane (Research Method) fuel, the setting should be 17–19° before T. D. C. This setting also

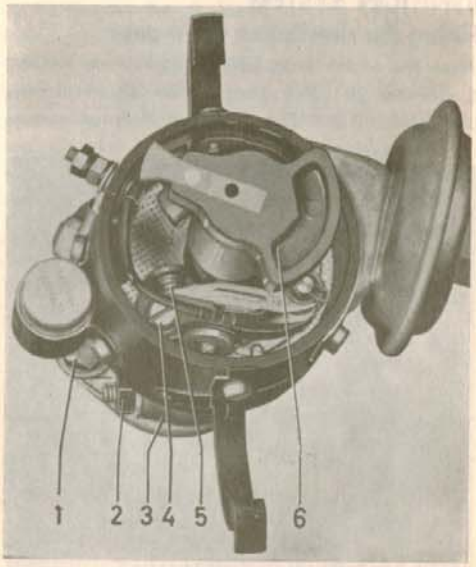


Fig. 1-67. Attachment of distributor

1. Screw for retainer
2. Clamp screw
3. Retainer
4. Lock screw
5. Breaker points
6. Rotor

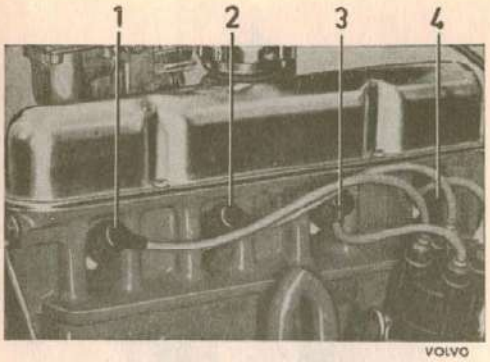


Fig. 1-68. Numbering of cables

applies for 108 h.p. (SAE) B 18 B engines using 100 octane (Research Method) fuel. If the latter engine type should be run on 97 octane (Research Method) fuel, the timing setting should be 14–19° before T. D. C.

3. Connect the lamp with the high tension cable to the spark plug in number 1 cylinder and the other two cables to the battery. See Fig. 1-69.
4. Start the engine and run it at a speed of 1500 r.p.m.
   Aim the lamp at the scale on the pulley and check that igniton occurs opposite the chalked mark mentioned in point 2 above.
   Keep your fingers away from the fan.

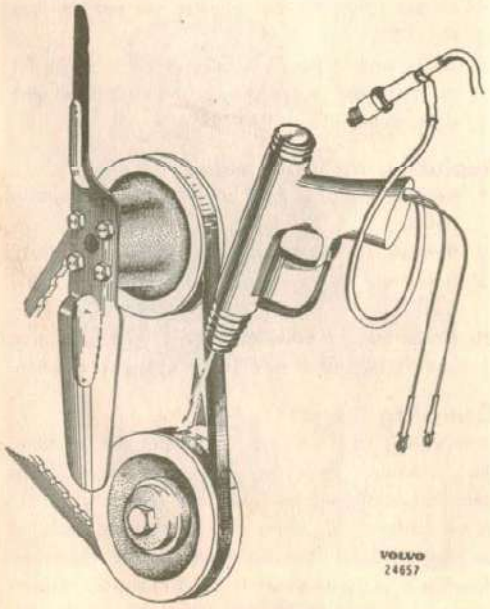


Fig. 1-69. Checking the ignition setting while the engine is running

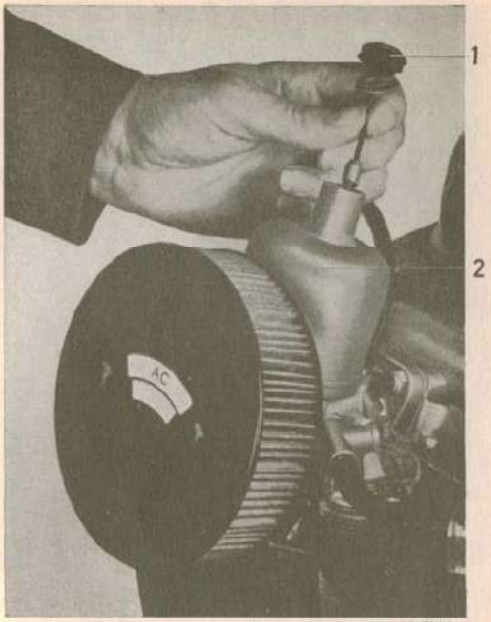


Fig. 1-70. Removing the damping plungers to fill oil in the damping cylinders

5. Adjust the setting if so required by turning the distributor after loosening its clamp screw.
6. Screw the distributor firmly into position and tighten up the vacuum pipe.

FUEL SYSTEM

Carburetors

Each time the car is given all-round lubrication, the oil level in the carburetor damping cylinders should be checked. If necessary top up with engine oil (SAE 20 but not multi-grade oil). See Fig. 1-70.
Do not add much oil, only the center spindle itself should be filled and not the part above this.

Removing the carburetors

(The carburetors should not be removed before this is absolutely necessary.)
Both the carburetors must be removed at the same time from the inlet manifold since the intermediary shaft is carried in the levers on the throttle spindles.

1. Remove the air cleaners, fuel pipes, vacuum pipe and controls from the carburetors.
2. Unscrew all the nuts retaining the carburetors on the inlet manifold.
3. Take off both the carburetors simultaneously from the inlet manifold. Cover the inlet holes in the manifold with masking tape.

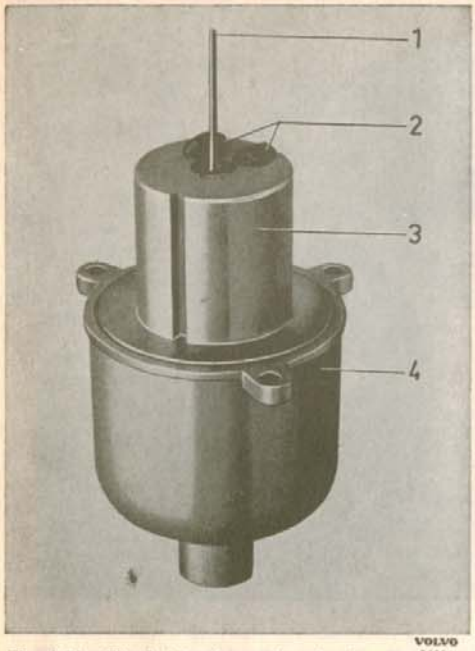


Fig. 1-71. Fit of piston in suction chamber
1. Fuel needle 2. Plugs 3. Vacuum piston 4. Suction chamber

Disassembling the carburetors

1. Remove the damping plungers and suction chamber with piston.
2. Unscrew the float bowl cover and lift it up. Then remove the housing.
3. Loosen the screws retaining the levers for the choke and rapid idling controls, pull these off and remove the jet.
   Remove the adjuster nut, the locknut and the jet sleeve.
4. Wash all the component parts in white spirit and blow dry with compressed air.
   The air cleaners must not be washed since they have paper inserts.

Inspection and assembly of carburetors

Check before assembling that all the parts are in good condition. The fit of the piston in the suction chamber is of high precision and its character may not be altered by means of filing or scraping. Small uneven points can be polished finely with fine grade emery cloth.

The fit can be tested by plugging the air holes in the piston, placing it in the suction chamber and holding the parts upside down. The damping plunger should be fitted but not filled with oil. The spring for the suction chamber piston should not be fitted. The piston should normally sink to the bottom from the position shown in Fig. 1-71 in 5-7 seconds.

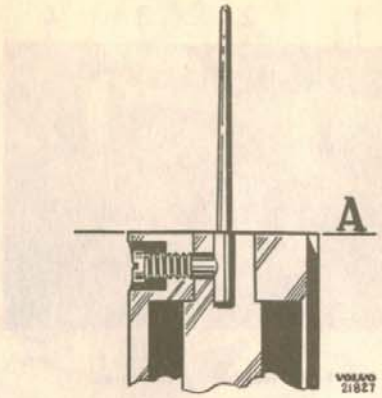


Fig. 1-72. Attachment of fuel needle
A = attaching level

1. Fit the fuel needle as shown in Fig. 1-72. Only the tapered part of the needle should be above the piston.
2. Fit the spring, washer and piston in the suction chamber and screw the suction chamber into the carburetor housing.
3. Fit the jet sleeve, locknut and adjusting nut, see Fig. 1-76. Slide in the jet and center it. See "Centering the jet".
4. Fit the spring for the adjuster nut and jet. See Fig. 1-73.
5. Check and fit the float valve (see Fig. 1-74). Fit the float and cover. Attach the float bowl and pipes to the jet.

Replacing the float valve

1. Remove the float bowl cover and turn it upside down.
2. Remove the float lever pin. Remove the float.
3. Screw out the valve and fit a new valve. Fit the float.
4. Check that the cover gasket is in good condition and fit the cover and screw tightly in position.

Centering the jet

It is usually only necessary to center the jet when the carburetors have been disassembled, or when parts influencing the jet have been replaced.

When centering is carried out, the carburetor should be disassembled. The carburetor in question is laid down on a bench as shown in Fig. 1-77 and the vacuum plunger is moved backwards and forwards with one finger towards the throttle flap by using light pressure.

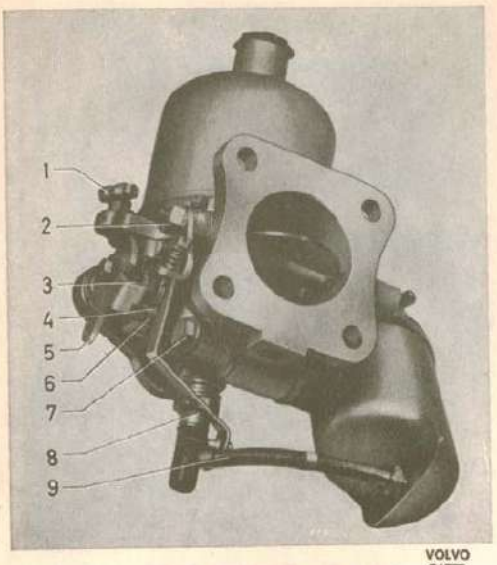


Fig. 1-73. Levers and springs

1. Attachment for choke control sleeve
2. Throttle spindle
3. Return spring
4. Return spring
5. Lever for rapid idling, etc.
6. Lever to lower jet
7. Screw for float bowl
8. Link to lower jet
9. Fuel line

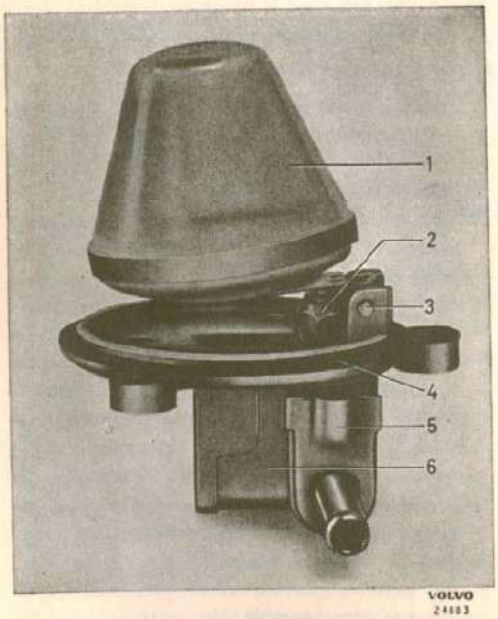


Fig. 1-74. Float

1. Float with arm
2. Float valve
3. Pin
4. Gasket
5. Air-venting washer
6. Cover

Fig. 1-75. Fitting the float bowl

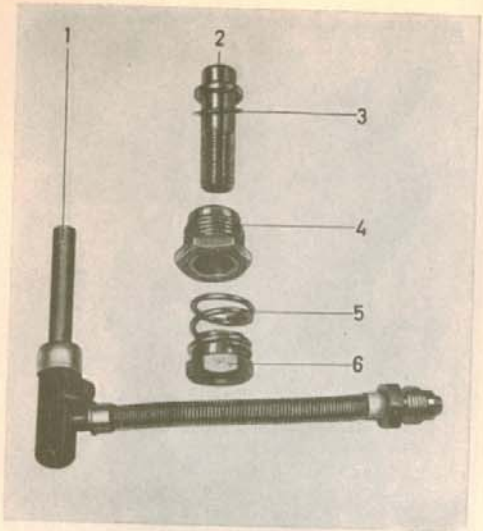
1. Cover
2. Gasket
3. Valve
4. Arm
5. Housing

This centers the jet correctly in relation to the position assumed by the vacuum plunger while the engine is running. The plunger is then pressed over towards the throttle flap due to the vacuum prevailing between the plunger and the throttle flap.

1. Remove the jet by removing the screw on the lower end of the link and the fuel line nipple.
2. Remove the adjuster nut (6) and the spring (5), Fig. 1-76. Loosen the locknut so that the sleeve can be moved.
3. Push the jet into position. Note that the fuel line of the jet should be at the same angle as it is when fitted. See Fig. 1-77.
4. Push up the jet against the jet sleeve and, at the same time, move the vacuum plunger backwards and forwards right down to the bridge by exerting light pressure against the trottle flap. Center the jet sleeve so that it does not prevent movement. Tight the lock nut (2) and then check that the plunger runs easily down to its loose position when the jet is held in the upper position as described in point 3 above.
5. Fit the parts which have been taken out. Make sure that the fuel line is not twisted when it is being attached to the float bowl.

Fitting the carburetors

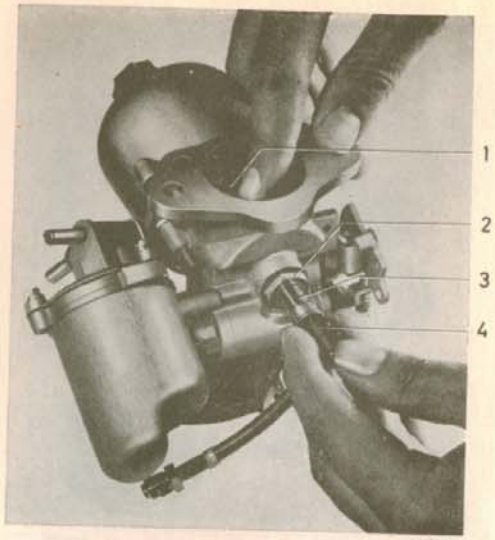
1. Remove the protective material over the inlet channels. Fit new gaskets.



VOLVO 26771

Fig. 1-76. The jet, disassembled

1. Jet with fuel line, complete
2. Jet sleeve
3. Washer
4. Locknut
5. Spring
6. Adjuster nut



VOLVO 26770

Fig. 1-77. Centering the jet

1. Lower part of vacuum plunger
2. Lock nut
3. Jet sleeve for jet

2. Move the intermediary shaft into its position between the carburetors, see Fig. 1-78. Make sure that the protective plate is in good condition and that the sealing surfaces are clean.
3. Fit the carburetors at the same time, with the intermediate shaft in position. Tighten the nuts and connect up the controls and lines.
4. Carry out necessary adjustment of carburetor settings, see "Carburetor settings after fitting".
5. Fit the air cleaners but make sure that the gaskets come into their correct positions. Fill up with SAE 20 engine oil (not multi-grade oil) in the damping cylinders if necessary.

Carburetor settings, after fitting (synchronization)

After the engine has been installed in the car and the carburetors have been fitted, they are adjusted in accordance with the following instructions. Check that oil and water has been added before the engine is started. If settings are carried out carefully, subsequent adjustment is very rarely needed.

At certain intervals, for example when changing the air cleaners, it is advisable to remove and thoroughly clean the suction chambers and vacuum plungers.

The float bowls should be cleaned at the same time. This can easily be carried out after the float bowl covers have been removed.

Synchronizing of the carburetors implies adjustment of the clearance on the intermediary shaft, adjustment of fuel/air mixture and idling as well as adjustment of the choke control and rapid idling.

Adjusting the clearance on the intermediary shaft

1. Insert a feeler gauge 0.5 mm thick at (A), Fig. 1-78, between the lever and its check stop. Screw out the idling screws (2, Fig. 1-79) so that the throttle flaps are completely closed.
2. Loosen the nuts (3 and 9, Fig. 1-78) and push the outer end of the levers (2, 8) on the intermediary shaft carefully downwards, so that the pins just contact the lower tooth on the throttle spindle levers, (1, 10). Note. Do not press so hard that the throttle flap is influenced. Only the clearance downwards at the pins should be eliminated. Tighten the nuts (3, 9) in this position. Note when tightening that the shaft end play is distributed equally in both directions and that there is a small axial clearance between the levers on the intermediary shaft and the throttle spindle levers.
3. Remove the feeler gauge. Then check by lifting the lever at "A" that both throttle flaps are influenced simultaneously. Also make sure that the intermediary shaft is free and can be moved slightly backwards and forwards. It must not be

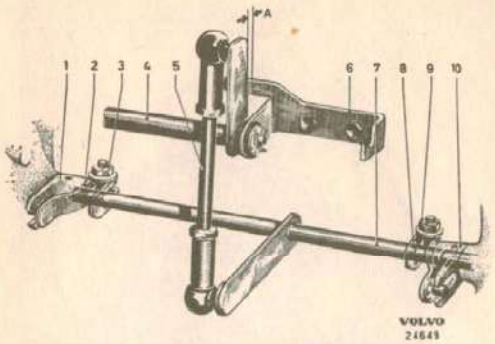


Fig. 1-78. Intermediary shaft and levers

A = clearance between stop and lever

1. Lever on throttle spindle
2. Lever on intermediary shaft
3. Locknut
4. Control shaft
5. Link
6. Bracket
7. Intermediary shaft
8. Lever on intermediary shaft
9. Locknut
10. Lever on throttle spindle

clamped by the levers (2, 8) being fitted too near the carburetors.

Adjustment of fuel/air mixture and idling

1. Roughly adjust the height of the jet by first screwing up adjuster nut (7, Fig. 1-79) to its upper position and then screwing it back one and a half turns. Adjust both carburetors in a similar way.
2. Turn the idling screws (2) so that they just touch the throttle levers while the throttle is closed. Then screw them down one half turn.
3. Top up with oil in the carburetor damping cylinders. Use SAE 20 engine oil, but not multi-grade oil. Only fill the center spindle of the vacuum plunger, not the part above this.
4. Start the engine. Adjust idling speed to 600–800 r.p.m. (B 18 B), 500–700 r.p.m. (B 18 D). Use the idling screws (2). Turn the screws so that the induction sound is equally strong on each carburetor. Run the engine warm.
5. Adjust the height of the jets (and thereby the fuel/air relationship) thoroughly, by turning the adjuster nut (7). The best position has been reached when the highest engine speed is obtained without altering the idling screw. When adjusting, screw the adjuster nut first slowly downwards (richer mixture) until the engine starts to run roughly and then slightly upwards (leaner mixture) so that the engine runs easily. Adjust the carburetors one at a time.

Fig. 1-79. Controls

1. Attachment for sleeve, choke control
2. Idling screw
3. Rapid idling screw
4. Lever
5. Lock screw for choke control
6. Locknut
7. Adjuster nut
8. Jet

6. Check and adjust idling speed with the idling screws. Remember to alter the setting equally on both carburetors.
7. Check that the fuel/air mixture is correct on both carburetors. First lift the plunger in one of the carburetors by using the pin beside the air intake and then do the same thing on the other carburetor. The engine should run equally unevenly in both cases. Engine speed should also fall off by about 200 r.p.m.

   If the engine should stall when one of the carburetor plungers is lifted, this usually depends on the fact that the mixture in the other carburetor is too lean. If the speed of the engine increases, the fuel/air mixture in the other carburetor is too rich. Adjust the settings carefully in both the last-mentioned cases.

Adjusting the choke control and rapid idling

The rapid idling adjustment described below is a normal setting. The setting can also be varied to suit varying requirements and temperatures. In the case of extremely cold weather, it may be advisable to adjust the rapid idling screw so that it comes into contact with the idling cam earlier than in the setting described below.

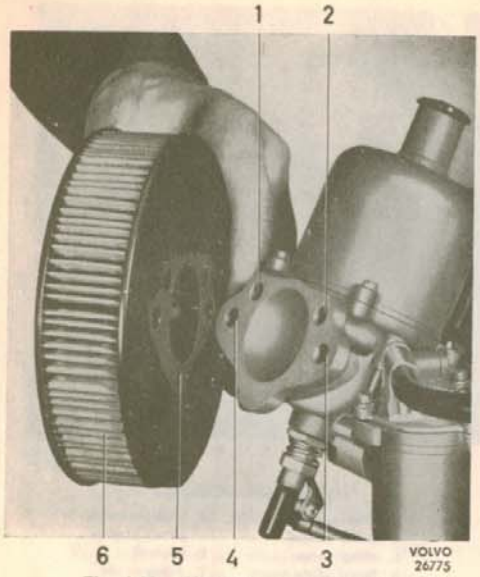


Fig. 1-80. Changing an air cleaner

1. Ventilation hole
2. Ventilation hole
3. Screw hole
4. Screw hole
5. Gasket
6. Air cleaner

Fig. 1-81. Replacing the diaphragm

1. Lever
2. Diaphragm
3. Washer

Adjusting must always be carried out so that both carburetors are influenced to exactly the same amount by the controls.

1. Pull out the choke control on the instrument panel 15 mm (3/4").
2. Loosen the screw (5, Fig. 1-79) for the control cable. Lift the lever so much that the jet just starts to go down.
3. Adjust the rapid idling screw (3) so that it just touches the rapid idling cam on the lever (4) when the jet starts to be influenced as described above. Tighten the lock screw for the control cable in this position.
4. Carefully adjust the other carburetor in the same way.
5. Check by pulling out the control that both carburetors are influenced to exactly the same extent. This is easiest to do if the control is pulled out about 20 mm (25/32") and then watching the degree to which the jets go down.
   Adjust the settings if the jets do not go down by an equal amount.

Accelerator pedal adjustment

The length of the vertical push-rod from the control on the body should be adjusted so that there is a clearance of 1 mm (0.04") between the lug on the throttle lever and the full throttle stop on the carburetor when the accelerator pedal is fully depressed. This means that when the accelerator pedal is fully depressed the loading exerted by the driver's foot will be taken up by the toe-plate without unnecessary loading of the carburetor linkage.

Air cleaners

The only normal service procedure is to replace both the air cleaners after every 20 000 km (12 000 miles). The old air cleaners should be thrown away.

If the car is driven on dusty roads and in districts with particularly contaminated air, the cleaners should be changed more often, approx. after 10 000 km (6000 miles).

No cleaning of any sort should be carried out between these changes.

1. Remove the air cleaners by unscrewing the attaching screws.
2. Make sure that the gaskets are turned the right way, see Fig. 1-80, and fit the new air cleaners.

If the gasket is fitted wrongly, the ventilation holes for the suction chamber pistons are blocked and the carburetors cannot function properly. The car should not be driven without air cleaners fitted since the carburetors are dependent on the resistance to air flow through the carburetor cartridges.

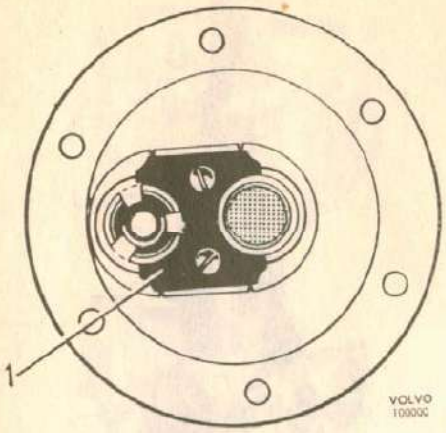


Fig. 1-82. Fuel pump early prod.
1. Retainer

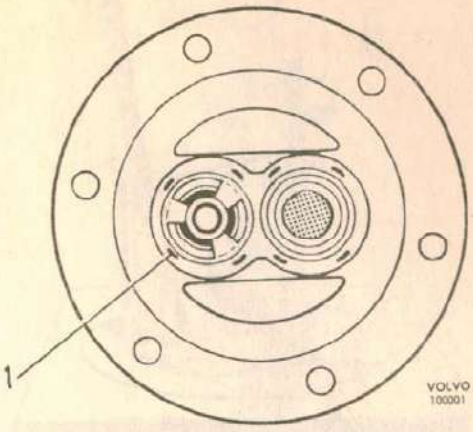


Fig. 1-84. Fuel pump late prod.
1. Upset material

Repairing the fuel pump

Before the pump is removed, it should be checked for pressure and capacity. If the values do not agree with those given in the specifications, the pump should be removed for repair, which most frequently involves replacing the diaphragm and/or valves.

Replacing the diaphragm

1. Dismantle the pump.
2. Hold the pump as shown in Fig. 1-81. Remove the old diaphragm by pressing it down and turning it a quarter of a turn.
3. Fit the new diaphragm by pressing down the rod and turning it a quarter of a turn.

Replacing the valves

Early production

1. Remove the screws which hold the upper and lower parts of the pump together.
2. Remove the valve retainer (1, Fig 1-82) and remove the valves and gasket.
3. Clean the valve recesses so that the valves come in the correct position when fitting.
4. Fit on a new gasket and new valves and screw up the retainer again.

Late production

1. Dismantle the pump.
2. Remove the old valves with a screwdriver or some other suitable tool.
3. Clean the valve recesses so that the new valves can be fitted correctly.
4. Place the new gaskets and valves in position.
5. Press down the valves to the correct position. A tube as shown in the figure 1-83 can be used for this.
6. Upset the material round each valve in four places, see Fig. 1-84, with a punch as shown in the figure 1-85.

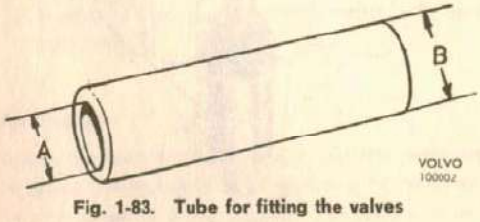


Fig. 1-83. Tube for fitting the valves

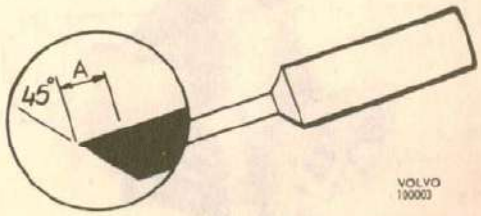


Fig. 1-85. Punch
A = 2.5 mm (3/32")

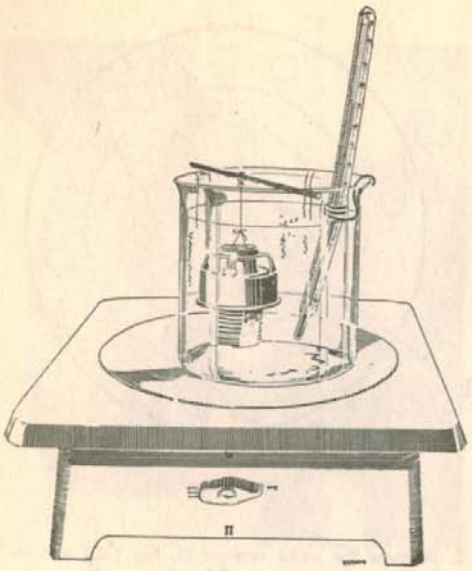


Fig. 1-86. Testing the thermostat

After the necessary repairs have been carried out to the fuel pump, it is assembled and tested and then fitted to the vehicle. Make sure that the lever comes in the correct position above the cam.

COOLING SYSTEM

During the cold season ethylene glycol should be mixed with the cooling water together with anti-corrosion agent in order to prevent the cooling system from freezing. See the specifications for the amounts required. Always use clean water (preferably rain water) together with anti-corrosion additive.
NOTE. The water pump is made of light-alloy.

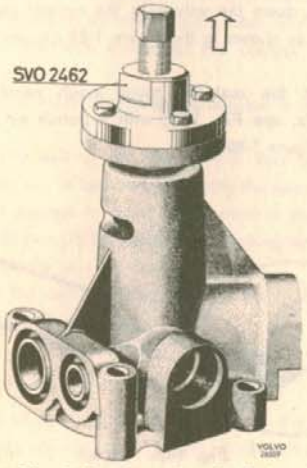


Fig. 1-87. Removing the hub

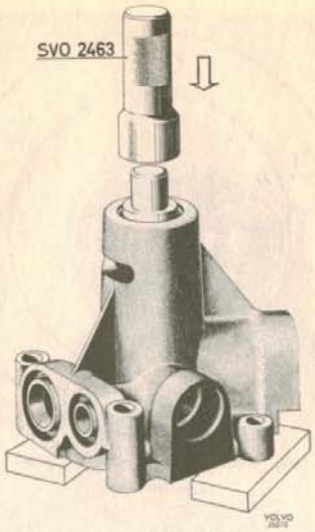


Fig. 1-88. Removing the shaft and impeller

Thermostat

The thermostat can be tested after it has been removed in a vessel full of water which is heated up. See Fig. 1-86.
The thermostat should open and close at the temperatures shown in the specifications.

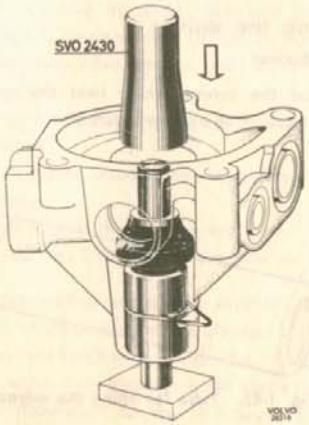


Fig. 1-89. Fitting the seal ring

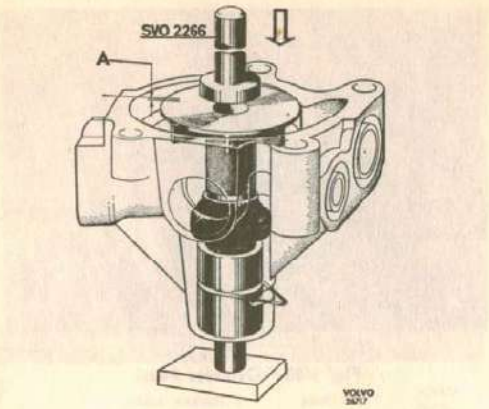


Fig. 1-90. Fitting the impeller
A = 0–0.016" (0–0.4 mm)

Reject a faulty thermostat. Use a new gasket when reassembling.

Water pump, reconditioning

Disassembly and inspection

1. Pull out the lock spring.
2. Fit puller SVO 2462 on the hub with the bolts for the pulley and pull off the hub. See Fig. 1-87.
3. Place the pump in a press. Fit tool SVO 2463 on the bearing outer race and press out the shaft, bearing and impeller. Fig. 1-88.
4. Inspect the impeller and the bearing. If the bearing is worn and feels loose or if it chafes, reject the shaft and bearing. (The shaft and bearing cannot be disassembled). If the bearing can still be used, it should not be warmed up or washed in fluid since the lubricant in it will then be ruined. If the impeller is removed it should be replaced by a new unit since there is almost always damage and excessive clearance. The seal ring should always be replaced by a new unit.
5. When disassembling the shaft and impeller, these units are separated by pressing the seal ring down and sliding the washer SVO 2429 in under the impeller. Then press out the shaft with tool SVO 2266.

Assembly

Check carefully before assembly that the parts are in good condition. The impeller sealing surface must be even and free from scratches. The bearing should run easily without chafing and should not be loose.

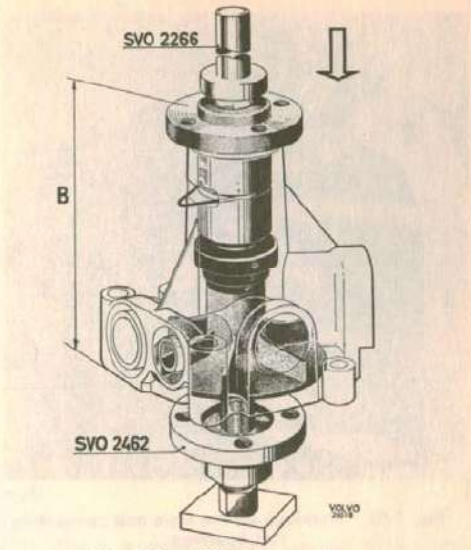


Fig. 1-91. Fitting the pulley
B = 4.134" ± 0.008" (105 ± 0.2 mm)

Replace damaged parts with new parts. The seal ring should always be replaced with a new unit.

1. Press down the shaft and the bearing in the housing by using tool SVO 2463 in a similar way to that shown in Fig. 1-88 so far that the lock wire can be inserted into its groove. Fit the lock wire.
2. Fit the seal ring with tool SVO 2430 as shown in Fig. 1-89. Smear the sealing surface against the impeller with molybdenum disulphide which has been stirred up in methylated spirit.
3. Press down the impeller with tool SVO 2266 so far that the impeller is level with or up to 0.016" (0.4 mm) below the pump housing surface. The lower end of the shaft should rest against a counterhold. See Fig. 1-90.
4. Turn the pump. Apply a counterhold under the end of the shaft in the impeller hole and press on the hub with tool SVO 2266. As counterhold use,

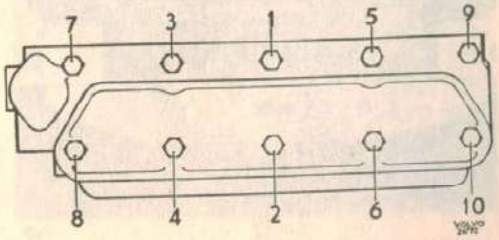


Fig. 1-92. The correct order to tighten the cylinder head bolts

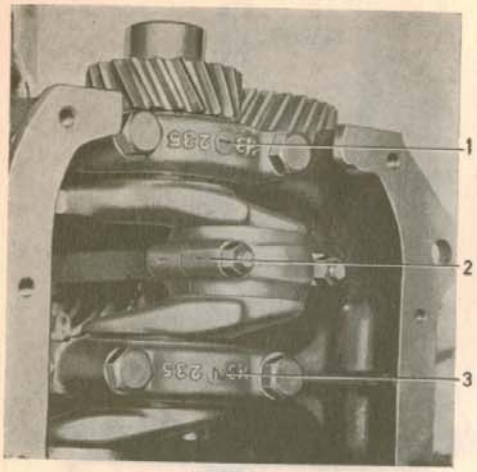


Fig. 1-93. Markings on the main and connecting rod bearings

1. Main bearing number 1 2. Connecting rod bearing number 1 3. Main bearing number 2

for example, puller SVO 2462 with the center bolt screwed in so that it supports against the shaft. Press carefully so far that the dimension B as shown in Fig. 1-91 is 4.134±0.008" (105±0.2 mm).

5. Check that the pump can be turned by hand without excessively large resistance and that there is no chafing.

ASSEMBLING THE ENGINE

When assembling the engine follow the instructions for the parts concerned. The order of working will be in the reverse way to that carried out when disassembling. Check the marking on the bearings as shown in Fig. 1-93. The main bearings are marked 1–5, the connecting rod bearings 1–4, starting from the front.

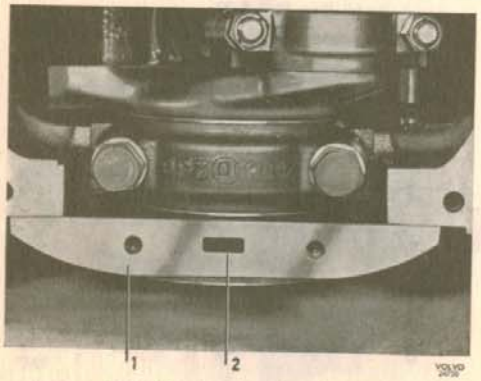


Fig. 1-94. Rear sealing flange

1. Flange 2. Drain hole

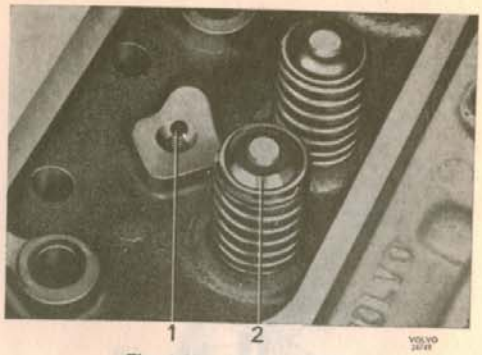


Fig. 1-95. Cylinder head

1. Oil hole 2. Rubber washer

Check that all component parts are clean and lubricate bearing surfaces with oil before assembling. Always use new gaskets and washers, cotter pins and lock washers. Shellac should not be used as sealing agent since it dries out and flakes off with the resultant risk that oil channels can be partially blocked.

Seals on the ends of the pressure pipes on the oil pump, as well as the pipes on and above the water pump, should be made of rubber. Make sure that these are in their correct positions and that the pipes are pressed in properly.

Make sure that the drain hole in the timing gear casing and the rear sealing flange (2, Fig. 1-94) are open and that the seals are in good condition. Make sure also that the timing gear casing and flange are well centered.

Fit new connecting rod nuts and bolts when reconditioning.

The cylinder head bolts must be tightened in a special order as shown in Fig. 1-92 in order to avoid unnecessary stresses. Check that the oil hole (1, Fig. 1-95) for the lubrication of the rocker arms is not blocked. The support bearing (5, Fig. 1-96) should be lubricated before fitting with heat-resistant bearing grease. The bearing is maintained in position by a lock ring (4).

The most important nuts and bolts should be tightened with a torque wrench, see the specifications for the correct tightening torque.

The fan belt should be tensioned so that the pulley starts to slip under a force of 6.5–8.5 kg (14 1/2–19 lb.) applied 150 mm (6") from the hub center.

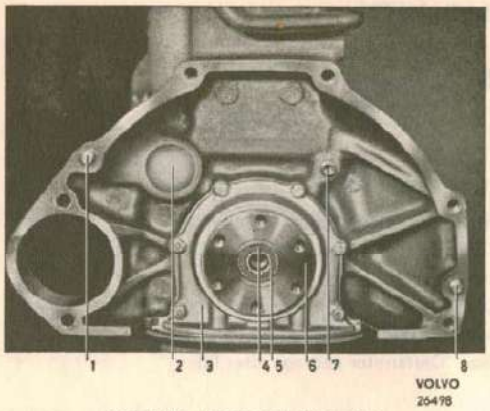


Fig. 1-96. Rear end of engine

A = 14.5 mm (9/16")
B = 19 mm (3/4")
1. Guide pin
2. Seal washer
3. Sealing flange
4. Lock ring
5. Support bearing
6. Crankshaft
7. Plug
8. Guide pin

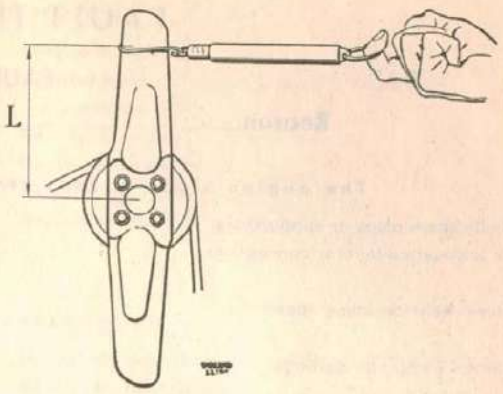


Fig. 1-97. Fan belt tension

L = 150 mm (6")
Force applied = 8.5–8.5 kg (14 1/2–19 lb.)

Exert pressure in the direction of rotation of the engine and use a spring balance as shown in Fig. 1-97.

FITTING THE ENGINE IN THE CAR

Use the lifting tool SVO 2425 when fitting the engine in the car. The order of operations will be the reverse to that used when removing, see under heading "Removing the engine".

After all the component parts have been fitted, fill up with cooling water and oil.

Make sure that all the controls have been correctly connected, see the sections concerned.

When the fan blades are vertical, the clearance to the radiator straight up should be at least 15 mm (0.59"). The clearance between the fan blades and the radiator straight forward where it is nearest should not be less than 11 mm (0.43").

Adjustment can be carried out by means of washers on the radiator mountings.

RUNNING IN

An engine that has been reconditioned either partly or completely must always be driven carefully during the first period, the running-in period. Do not run the engine at excessively high speeds but avoid running at very low speeds under loading.

Change the engine oil at closer intervals than usual. See the sections concerned in the instruction book.

If an engine test bench is available, it is a great advantage to run the engine in this if extensive reconditioning has been carried out.

FAULT TRACING

FAULTS

Reason	Remedy
The engine stops or runs very unevenly at idling speed	
Faulty spark plugs or suppressors.	Replace spark plugs and suppressors.
Air leaks at carburetor connections.	Check the tightness of the connections. Replace damaged gaskets.
Excessively low idling speed.	Increase the idling speed and check that the air intake sound is equally strong on both carburetors.
Uneven carburetor settings.	See "Carburetor settings after fitting".
The engine jerks (or coughs) during acceleration	
Dirty insulators on the spark plugs.	Clean the insulators.
Faulty spark plugs.	Check or replace spark plugs.
Dirty, faulty or moist distributor cap.	Remove and clean or replace the distributor cap.
Faulty or moist cables.	Check, clean or replace cables. See also Part 10.
Too little oil or too thin oil in the carburetor damping cylinders.	Fill with oil of the right grade and viscosity.
Dirt in the carburetors.	Remove the float bowl covers and clean the bowls.
Excessively lean fuel/air mixture.	Check the carburetor settings.
Faulty fuel pump supplying too little fuel.	Check the pressure and capacity of the fuel pump.
Weak engine output	
Air cleaners blocked.	Fit new air cleaners.
Poor quality fuel, too low octane value.	Check the fuel grade, use the correct fuel.
Faulty ignition timing setting.	Adjust the ignition timing setting during rapid idling with a stroboscope. See "Ignition timing setting".
Faulty and uneven adjustment of carburetors.	Check and adjust the carburetor setting. See "Carburetor setting after fitting".
Faulty valve clearances.	Check and adjust valve clearances.
Low compression on one cylinder.	Measure compression pressure. In the case of low values, remove the cylinder head for close investigation of engine.
Chafing piston.	Remove cylinder head for investigation.
Chafing wheel bearings or faultily adjusted brakes.	See Part 7.
Knocking from valve mechanism	
Excessively large valve clearances.	Adjust valve clearances.
Worn or damaged parts in valve mechanism.	Recondition or replace parts where required.
Heavy regular knocking sound, worse during loading	
Worn main and connecting rod bearings or worn pistons and piston pins.	Localise sound by short-circuiting spark plugs, one after the other. Then disassemble where necessary for an examination of bearings and pistons.

Oil pressure too low

Blocked oil cleaner.	Change air cleaner.
Faulty pressure gauge or piping.	Determine pressure with control gauge. Replace faulty gauge or pipe.
Faulty spring for release valve and/or worn pump.	Remove oil pump. Check spring and pump.
One or more bearings worn.	Examine and replace bearing shell.
Excessive wear in general.	Replace or recondition engine.

Excessive oil consumption

Hard driving.	No remedy necessary. Oil consumption can increase during very hard driving.
Leakage at joints.	Tighten bolts, replace damaged or poor gaskets at various points in engine.
Oil level too high.	Do not top up with oil until the level is almost down to the lower mark on the dipstick.
Worn valve guides.	Recondition valve system.
Worn piston rings.	Replace piston rings.

Fuel consumption excessive

Hard driving.	No remedy necessary. Normal during hard driving.
Blocked air cleaners.	Replace air cleaners.
Carburetors flooding.	Check or replace float valves. Also check pump pressure.
Faulty carburetor settings, fuel/air mixture too rich.	Adjust settings.
Poor suppressors on spark plugs, faulty contact on breaker points.	Replace spark plug suppressors. Adjust distributor.
Faulty cam dwell and ignition setting.	Adjust cam dwell and ignition setting. Use stroboscope for ignition settings.

Engine runs abnormally warm

Not enough cooling water.	Top up with cooling water.
Faulty gauge.	Check or replace gauge.
Fuel with excessively low octane rating (knocking).	Use fuel with correct octane rating.
Faulty thermostat.	Replace thermostat.
Faulty ignition setting.	Adjust ignition setting.
Faulty carburetor setting, (fuel/air mixture too lean).	Adjust carburetor settings.
Blocked cooling system.	Clean cooling system.
Fan belt insufficiently tensioned.	Adjust tension.

Cooling water losses

Hose junctions leaking.	Check or replace hoses and clips.
Faulty radiator cap.	Replace radiator cap.
Faulty cylinder head gasket, (oil in cooling water).	Replace cylinder head gasket.

TOOLS

The following special tools are needed for work on the engine.

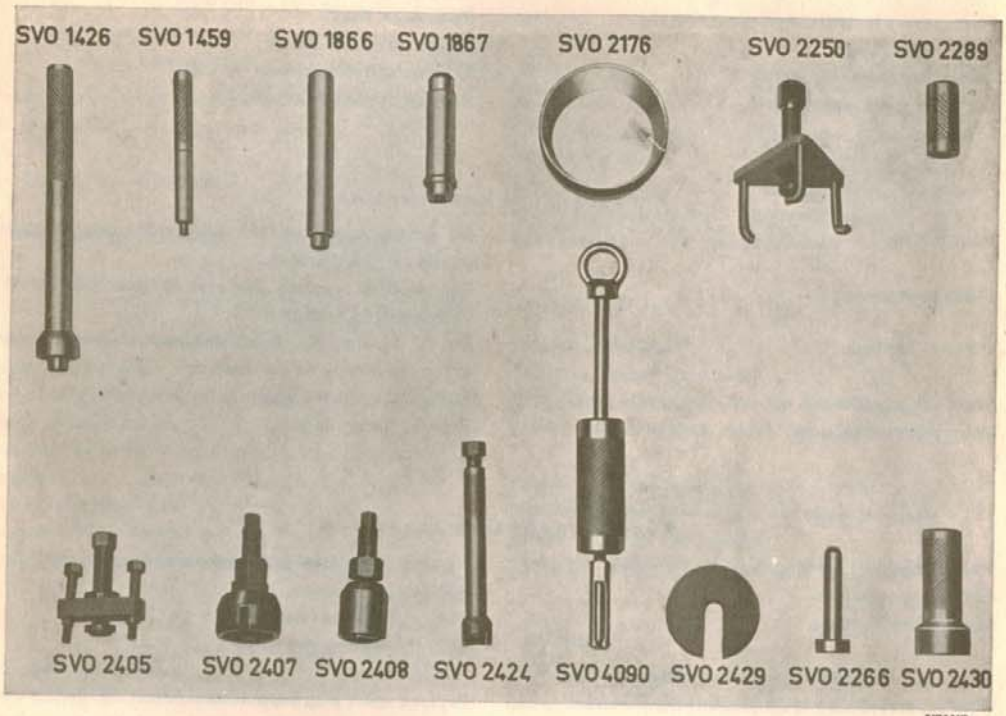


Fig. 1-98. Tools for engine

SVO 1426	Tool for removing pilot bearing
SVO 1459	Tool for removing valve guides
SVO 1866	Tool for removing and fitting piston pins
SVO 1867	Tool for removing and fitting bushings in rocker arms and connecting rods
SVO 2176	Tool for fitting piston rings (standard size)
SVO 2250	Puller for camshaft gear
SVO 2289	Tool for fitting valve guides
SVO 2405	Puller for crankshaft gear
SVO 2407	Press tool for fitting crankshaft gear
SVO 2408	Press tool for fitting camshaft gear
SVO 2424	Grip tool for removing and fitting valve lifters
SVO 4090	Puller for pilot bearing
SVO 2429	Press washer for removing impeller, water pump
SVO 2266	Tool for removing and fitting hub and impeller, water pump
SVO 2430	Tool for fitting seal, water pump

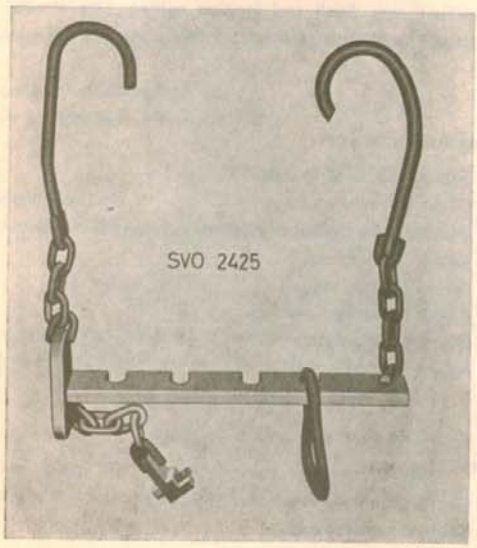


Fig. 1-99. Lifting tool for engine, SVO 2425

SPECIFICATIONS

GENERAL

Type designation	**B 18 B**
Output, b.h.p. at r.p.m. (SAE)	100/5500 (early prod.)
(DIN)	90/5500 (early prod.)
(SAE)	108/5800 (late prod.)
(DIN)	96/5600 (late prod.)
Max torque, kgm (lb.ft.) at r.p.m. (SAE)	15 (108)/4000 (early prod.)
(DIN)	14.5 (105)/3500 (early prod.)
(SAE)	15.2 (110)/4000 (late prod.)
(DIN)	14.3 (103)/3800 (late prod.)
Compression pressure (warm engine) when turned over with starter motor 200 r.p.m., kg/cm²	13–14
lb.sq.in.	184–200
Compression ratio	9.5:1 (early prod.)
	10.0:1 (late prod.)
Number of cylinders	4
Bore	84.14 mm (3.313")
Stroke	80 mm (3.15")
Displacement	1.78 liters (108.6 cu.in.)

CYLINDER BLOCK

Material	Special-alloy cast iron
Bore, standard	84.14 mm (3.313")
„ 0.020" oversize	84.65 mm (3.333")
„ 0.030" „	84.90 mm (3.343")
„ 0.040" „	85.16 mm (3.353")
„ 0.050" „	85.41 mm (3.363")

PISTONS

Material	Light-alloy
Weight	425±5 gm (15±0.18 oz.)
Permissible weight difference between pistons in same engine	10 gm (0.35 oz.)
Overall height	83.5 mm (3.29")
Height from piston pin center to piston crown	46 mm (1.81")
Piston clearance	0.03–0.05 mm (0.0012"–0.0020")
Diameter at right angles to piston pin at a point 12.5 mm (0.49") from lower edge of piston:	
Standard Class C	84.085 mm (3.314")
„ „ D	84.095 mm (3.3106")
„ „ E	84.145 mm (3.3112")
0.020" oversize	84.605±0.01 mm (3.3309±0.0004")
0.030" „	84.855±0.01 mm (3.3407±0.0004")
0.040" „	85.115±0.01 mm (3.3509±0.0004")
0.050" „	85.365±0.01 mm (3.3608±0.0004")

PISTON RINGS

Piston ring gap measured in ring opening	0.25–0.50 mm (0.001"–0.002")
Oversizes for piston rings	0.020" 0.040"
	0.030" 0.050"

Compression rings

Marked "TOP". Upper ring chromed	
Number of compression rings on each piston	2
Height	1.98 mm (0.078")
Piston ring clearance in groove	0.054–0.092 mm (0.021–0.0036")

Oil control rings

Number of oil control rings on each piston	1
Height	4.76 mm (0.187")
Piston ring clearance in groove	0.044–0.072 mm (0.0017–0.0028")

PISTON PINS

Fully floating. Circlips at both ends in piston

Fit:	
In connecting rod	Light push fit (accurate running fit)
In piston	Push fit (slide fit)
Diameter, standard	22.00 mm (0.866")
„ 0.05 oversize	22.05 mm (0.868")
„ 0.10 „	22.10 mm (0.870")
„ 0.20 „	22.20 mm (0.874")

CYLINDER HEAD

Height, measured from cylinder head contact surface to bolt head level	87 mm (3.42")
Distance from upper surface of cylinder head to upper end of overflow pipe (pipe located under thermostat)	33 mm (1.38")

CRANKSHAFT

Crankshaft axial clearance	0.017–0.108 mm (0.0007–0.0042")
Main bearings, radial clearance	0.038–0.089 mm (0.0015–0.0035")
Connecting rod bearings, radial clearance	0.039–0.081 mm (0.0015–0.0032")

Main bearings

Main bearing journals

Diameter, standard	63.441–63.454 mm (2.4977–2.4982")
„ undersize 0.010"	63.187–63.200 mm (2.4877–2.4882")
„ „ 0.020"	62.933–62.946 mm (2.4777–2.4782")
„ „ 0.030"	62.679–62.692 mm (2.4677–2.4682")
„ „ 0.040"	62.425–62.438 mm (2.4577–2.4582")
„ „ 0.050"	62.171–62.184 mm (2.4477–2.4482")
Width on crankshaft for flange bearing shell	
Standard	38.930–38.970 mm (1.5327–1.5343")
Oversize 1 (undersize shell 0.010")	39.031–39.072 mm (1.5366–1.5383")
„ 2 („ „ 0.020")	39.133–39.173 mm (1.5407–1.5422")
„ 3 („ „ 0.030")	39.235–39.275 mm (1.5447–1.5463")
„ 4 („ „ 0.040")	39.336–39.376 mm (1.5487–1.5502")
„ 5 („ „ 0.050")	39.438–39.478 mm (1.5527–1.5542")

Main bearing shells

Thickness, standard	1.979–1.985 mm (0.0779–0.0781")
undersize 0.010"	2.106–2.112 mm (0.0829–0.0831")
„ 0.020"	2.233–2.239 mm (0.0879–0.0881")
„ 0.030"	2.360–2.366 mm (0.0929–0.0931")
„ 0.040"	2.487–2.493 mm (0.0979–0.0981")
„ 0.050"	2.614–2.620 mm (0.1029–0.1031")

Connecting rod bearings

Connecting rod bearing journals

Bearing recess width	31.950–32.050 mm (1.2579–1.2620")
Diameter, standard	54.089–54.102 mm (2.1295–2.1300")
„ undersize 0.010"	53.835–53.848 mm (2.1195–2.1200")
„ „ 0.020"	53.581–53.594 mm (2.1095–2.1100")
„ „ 0.030"	53.327–53.340 mm (2.0995–2.1000")
„ „ 0.040"	53.073–53.086 mm (2.0895–2.0900")
„ „ 0.050"	52.819–52.832 mm (2.0795–2.0800")

Connecting rod bearing shells

Thickness, standard	1.833–1.841 mm (0.0722–0.0725")
undersize 0.010"	1.960–1.968 mm (0.0772–0.0775")
„ 0.020"	2.087–2.095 mm (0.0822–0.0825")
„ 0.030"	2.214–2.222 mm (0.0872–0.0875")
„ 0.040"	2.341–2.349 mm (0.0922–0.0925")
„ 0.050"	2.468–2.476 mm (0.0972–0.0975")

CONNECTING RODS

Axial clearance at crankshaft	0.15–0.35 mm (0.006–0.014")
Length, center–center	145±0.1 mm (5.709±0.004")
Maximum permissible weight difference between connecting rods in same engine	6 gm (0.21 oz.)

FLYWHEEL

Permissible runout. max.	0.20 mm (0.008")
Ring gear (bevel facing forward)	142 teeth

FLYWHEEL HOUSING

Max. tolerance, rear face	0.05 mm/100 mm diam. (0.002"/4" diam.)
Max. tolerance, rear guide	0.15 mm (0.006")

CAMSHAFT

Number of bearings	3
Front bearing journal, diameter	46.975–47.000 mm (1.8494–1.8503")
Center bearing journal, diameter	42.975–43.000 mm (1.8494–1.8503")
Rear bearing journal, diameter	36.975–37.000 mm (1.4557–1.4567")
Radial clearance	0.020– 0.075 mm (0.0008–0.0030")
Axial clearance	0.020– 0.060 mm (0.0008–0.0024")
Valve clearance for check of camshaft setting (cold engine)	1.15 mm (0.006")
B 18 B engine (100 b.h.p. SAE)	1.15 mm (0.045")
B 18 B engine (108 b.h.p. SAE)	1.45 mm (0.057")
The inlet valve should then open at	0° (TDC)

CAMSHAFT BEARING

Front bearing, diameter	47.020–47.050 mm (1.8512–1.8524")
Center bearing, diameter	43.025–43.050 mm (1.6939–1.6949")
Rear bearing, diameter	37.020–37.045 mm (1.4575–1.4585")

TIMING GEARS

Crankshaft gear, number of teeth	21
Camshaft gear (fiber), number of teeth	42
Tooth flank clearance	0.04–0.08 mm (0.0016–0.0032")

VALVES

Inlet

Valve disk diameter	40 mm (1.575")
Stem diameter	8.685–8.700 mm (0.3413–0.3465")
Valve seat angle	44.5°
Cylinder head seat angle	45°
Seat width in cylinder head	1.5 mm (0.060")
Clearance, warm or cold engine	0.50 mm (0.020")

Exhaust

Disk diameter	35 mm (1.50")
Stem diameter	8.645–8.660 mm (0.3403–0.3409")
Valve seat angle	44.5°
Cylinder head seat angle	45°
Seat width in cylinder head	1.5 mm (0.060")
Clearance, warm or cold engine	0.50 mm (0.020")

VALVE GUIDES

Length	63 mm (2.48")
Inner diameter	8.725–8.740 mm (0.3435–0.3441")
Height above cylinder head upper surface	21 mm (0.83")
Clearance, valve stem-guide, inlet valves	0.025–0.055 mm (0.0010–0.0021")
" " " " exhaust valves	0.065–0.095 mm (0.0025–0.0037")

VALVE SPRINGS

Length, unloaded	45 mm (1.77")
" with a loading of 25.5±2 kg (56±4 1/2 lb.)	39 mm (1.54")
" with a loading of 66±3.5 kg (145±8 lb.)	30.5 mm (1.20")

LUBRICATING SYSTEM

Oil capacity, including oil cleaner	3.75 liters (8 US pints = 6 1/2 Imp. pints)
Oil capacity, excluding oil cleaner	3.25 liters (7 US pints = 5 3/4 Imp. pints)
Oil pressure at 2000 r.p.m. (with new oil cleaner)	3.5–6.0 kg/cm² (50–85 lb./sq.in.)
Lubricant	Engine oil "Service MS"
" viscosity below 0° C (32° F)	SAE 10 W
" " between 0° and +30° C (32° and +90° F)	SAE 20
" " over +30° C (90° F)	SAE 30
	or multi-grade oil SAE 10 W–30

Lubricating oil cleaner

Type	Fullflow oil cleaner
Make	Wix

Lubricating oil pump

Lubricating oil pump, type	Gear pump
" " " number of teeth on each gear	10
" " " axial clearance	0.02–0.10 mm (0.0008–0.0040")
" " " radial clearance	0.08–0.14 mm (0.0032–0.0055")
" " " tooth flank clearance	0.15–0.35 mm (0.0060–0.0140")

Relief valve spring (in oil pump)

Length, unloaded	31 mm (1.22")
" , with a loading of 4.0±0.2 kg (9±1/2 lb.)	27.5 mm (1.08")
" , " " " " 9.5±0.3 kg (21±3/4 lb.)	22.5 mm (0.089")

FUEL SYSTEM

Fuel pump

Fuel pump, type	AC diaphragm pump UG
Fuel pressure	min. 0.11 kg/cm² (1.5 lb/sq.in.) max. 0.18 kg/cm² (2.5 lb./sq.in.)

Carburetors

Type	Horizontal carburetors
Make and designation	SU-HS 6
Number of carburetors	2
Size (air intake diameter)	44.5 mm (1 3/4")
Fuel needle, designation	TZ or ZH
Idling speed	600–800 r.p.m.
Oil for damping cylinders	SAE 20, engine oil (not multi-grade)

IGNITION SYSTEM

Voltage	12 volts
Order of firing	1-3-4-2
Ignition timing setting with stroboscope at 1500 r.p.m. Octane number by Research Method.	
Engine B 18 B (100 b.h.p. SAE), 97 octane	17–19° before TDC
Engine B 18 B (108 b.h.p. SAE), 97 octane	14–19° before TDC
100 octane	17–19° before TDC
Spark plugs	Bosch W 225 T1 or corresponding types
spark gap	0.7–0.8 mm (0.028–0.032")
tightening torque	3.8–4.5 kgm (28–32 lb.ft.)

Distributor

Type	Bosch
Designation	VJU 4 BL 33
Contact breaker point gap	0.4–0.5 mm (0.016"–0.020")
" " " pressure	0.5–0.6 kg (1–1 1/4 lb.)
Dwell angle	60±3°
Direction of rotation	Counter-clockwise

COOLING SYSTEM

Type	Pressure
Radiator cap valve opens at	0.23–0.30 kg/cm² (3–4.5 lb./sq.in.)
Capacity	9 liters (8 Imp. quarts=9 US quarts)
Fan belt, designation	HC 38×35"

Antifreeze

Amount of glycol for frost protection down to –10° C (14° F)	2 liters (4 US pints = 3 1/2 Imp. pints)
" " " " " " " " –20° C (–5° F)	3.25 liters (7 US pints = 5 3/4 Imp. pints)
" " " " " " " " –30° C (–22° F)	4.25 liters (9 US pints = 7 1/2 Imp. pints)
" " " " " " " " –40° C (–40° F)	5 liters (10 1/2 US pints = 8 3/4 Imp. pints)

Thermostat

Type	Fulton Sylphon 1–1700-D-3
Marked	170
Starts to open at	75–78° C (167–172° F)
Fully open at	89° C (192° F)

WEAR TOLERANCES

Cylinders

Rebore (if engine has abnormal oil consumption) when wear reaches	0.25 mm (0.010")

Crankshaft

Permissible out-of-roundness on main bearing journals, max.	0.05 mm (0.002")
Permissible out-of-roundness on connecting rod bearing journals, max.	0.07 mm (0.003")
Maximum axial clearance on crankshaft	0.15 mm (0.006")

Valves

Permissible clearance between valve stems and valve guides, max.	0.15 mm (0.006")
Valve stems, permissible wear, max.	0.02 mm (0.008")

Camshaft

Permissible out-of-roundness (with new bearings), max.	0.07 mm (0.003")
Bearings, permissible wear	0.02 mm (0.008")

Timing gears

Permissible tooth flank clearance, max.	0.12 mm (0.005")

TIGHTENING TORQUES

	kgm	lb.ft.
Cylinder head	8.5–9.5	61–68
Main bearings	12–13	87–94
Connecting rod bearings	5.2–5.8	38–42
Flywheel	4.5–5.5	33–40
Nut for oil cooler	3.0–3.5	22–25
Spark plugs	3.8–4.5	28–32
Camshaft nut	13–15	94–108
Bolt for crankshaft pulley	7–8	50–58
Bolt for generator (3/8"–16)	3.5–4	25–29
Nipple for oil cooler and oil cleaner	4.5–5.5	33–40
Oil pan bolts	0.8–1.1	6–8

Illustration 1-A. Section through B 18 B engine

1. Front air cleaner
2. Front carburetor
3. Upper valve washer
4. Exhaust valve
5. Shield plate
6. Inlet manifold
7. Valve cotter
8. Inlet valve
9. Valve guide
10. Throttle control
11. Seal ring
12. Valve spring
13. Rocker arm
14. Rocker arm shaft
15. Breather (oil filler)
16. Spring
17. Lower valve washers (rubber and steel washers, rubber washer lowest)
18. Push rod
19. Bearing bracket
20. Rocker arm cover
21. Gasket
22. Water distributor tube
23. Cylinder head
24. Vacuum line
25. Distributor
26. Flywheel housing
27. Valve lifter
28. Retainer
29. Cylinder block
30. Gear
31. Lock ring
32. Pilot bearing
33. Flywheel
34. Bushing
35. Flange bearing shell
36. Sealing flange
37. Main bearing cap
38. Cover plate
39. Oil pan
40. Gasket
41. Oil pump
42. Main bearing shell
43. Oil pipe
44. Crankshaft
45. Camshaft
46. Piston
47. Piston rings
48. Connecting rod
49. Lock ring
50. Piston pin
51. Connecting rod bearing shell
52. Connecting rod bushing
53. Thrust washer and spacer
54. Camshaft gear
55. Timing gear casing
56. Crankshaft gear
57. Sleeve
58. Washer
59. Pulley
60. Bolt
61. Fan
62. Key
63. Oil jet
64. Key
65. Lock washer
66. Cooling water inlet
67. Gasket
68. Water pump
69. Generator
70. Pulley
71. Gasket
72. Seal
73. Tensioner
74. Cylinder head gasket
75. Thermostat
76. Gasket
77. Cooling water outlet