SERVICE MANUAL

VOLVO
P 1800

Export Service Department

AKTIEBOLAGET

VOLVO

GÖTEBORG · SWEDEN

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PART 1

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 output of the engine is 100 b.h.p. at 5500 r.p.m. and the torque is 15 kgm (108 lb.ft.) at 4000 r.p.m. The compression ratio is 9.5:1, the capacity 1.78 liters (109 cu.in.), the bore is 84.14 mm (3.313") and the stroke, 80 mm (3.15").

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.

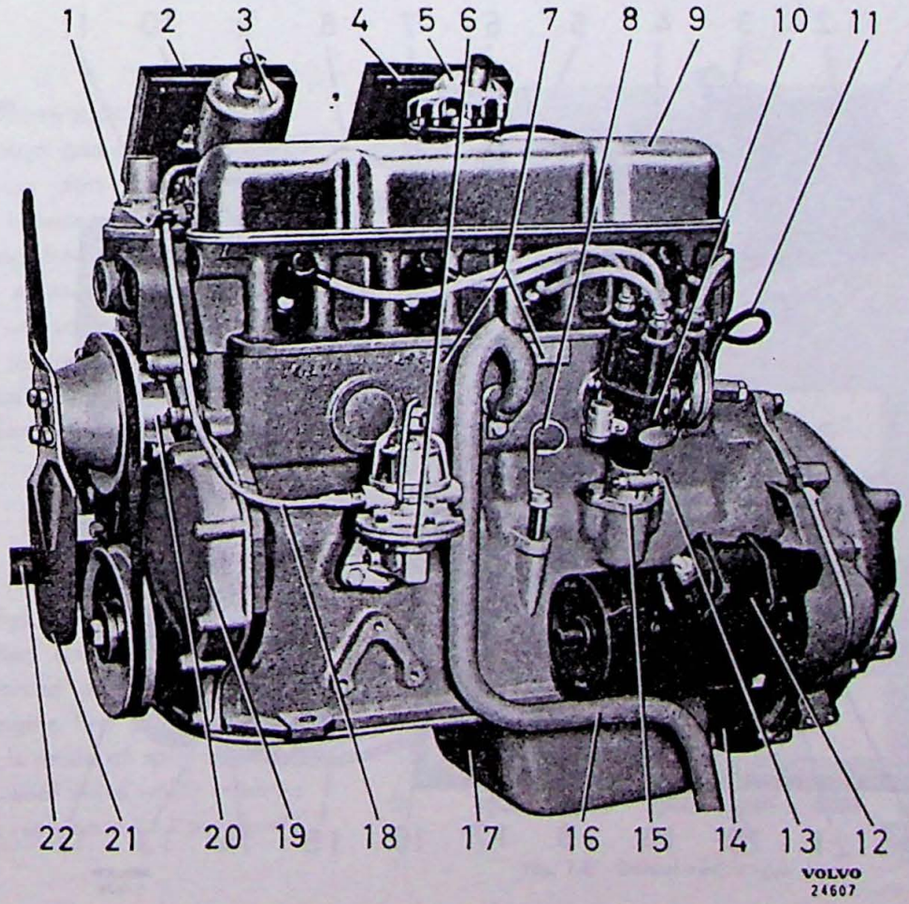


Fig. 1-1. The engine (left side)

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

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 cast-iron 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 valves 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—3. 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

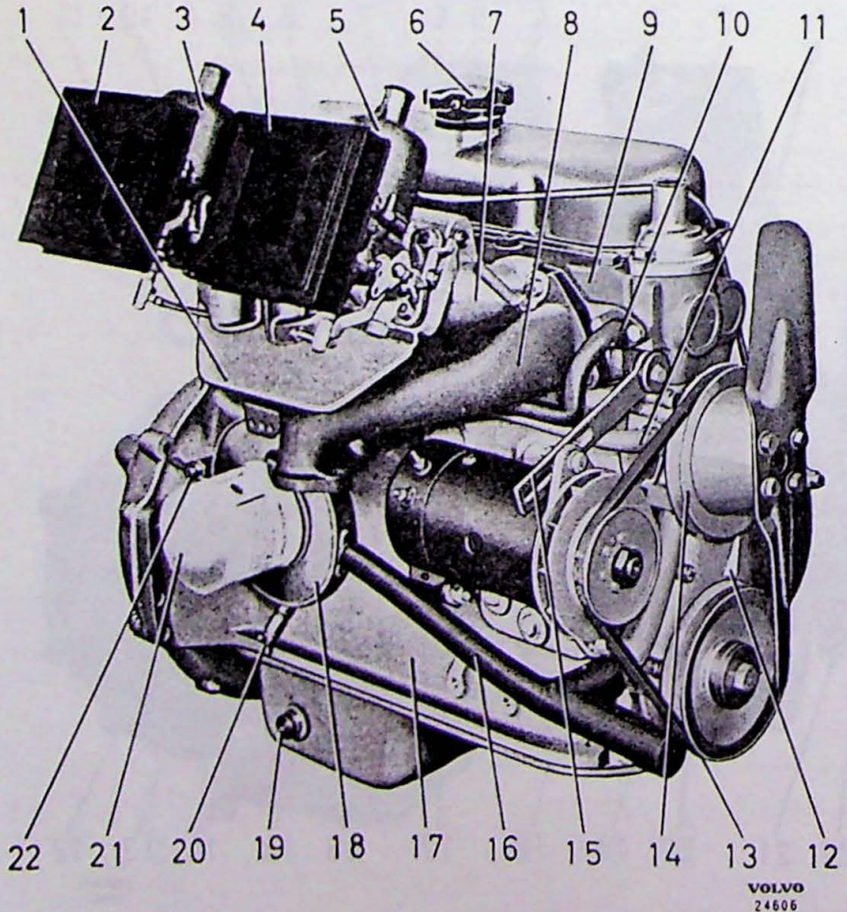


Fig. 1-2. The engine (right side)

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

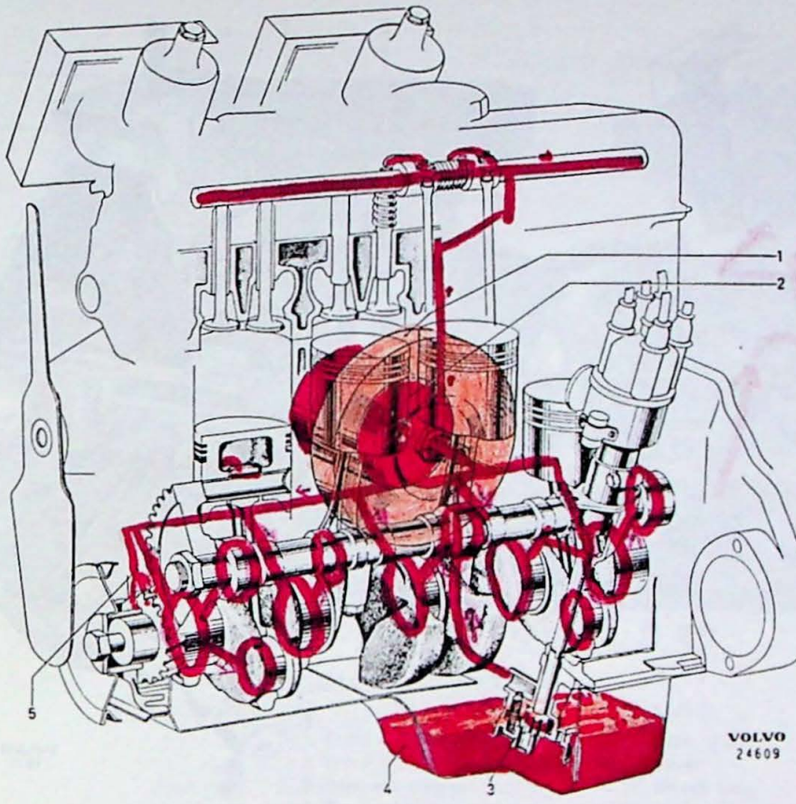


Fig. 1-3. The lubricating system
1. Oil cooler
2. Oil cleaner
3. Oil pump
4. Oil pan
5. Nozzle

out to the lubricating points thus first passes through the oil cleaner.

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.

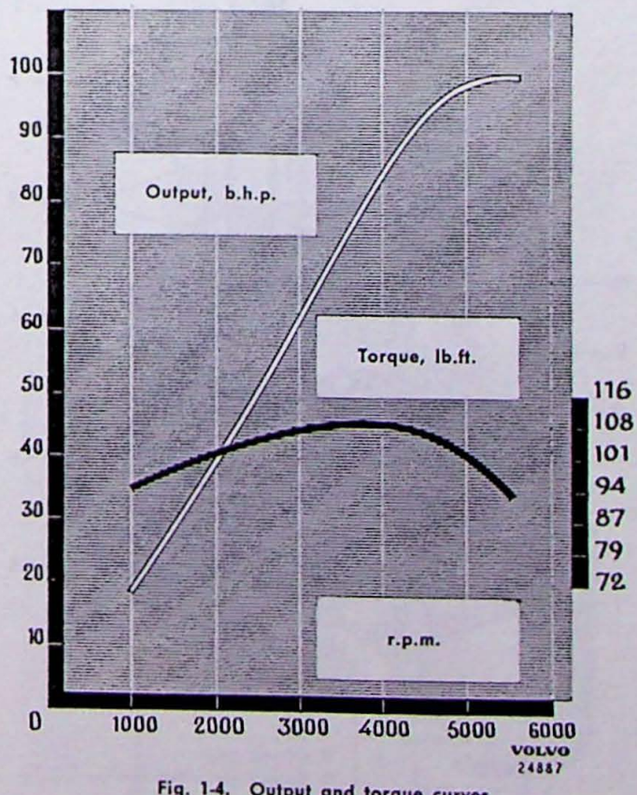


Fig. 1-4. Output and torque curves

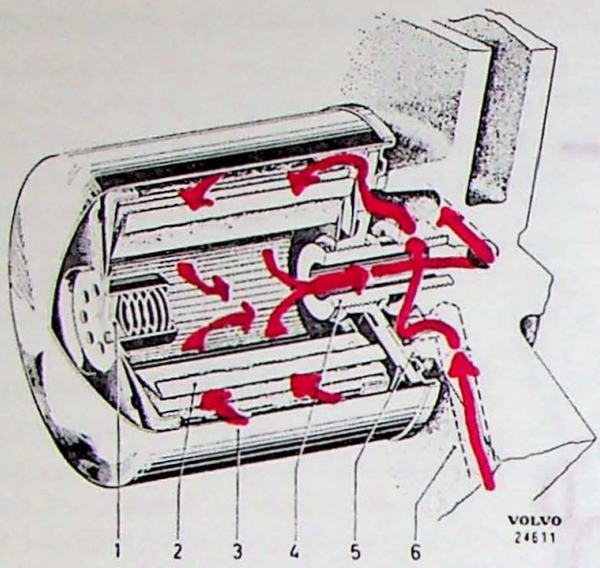


Fig. 1-5. Oil cleaner

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

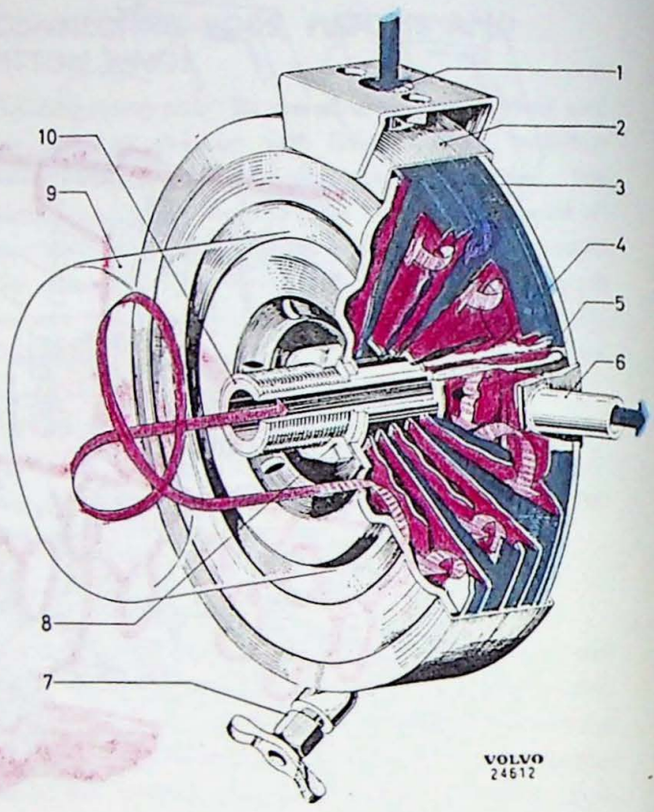


Fig. 1-6. Oil cooler

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

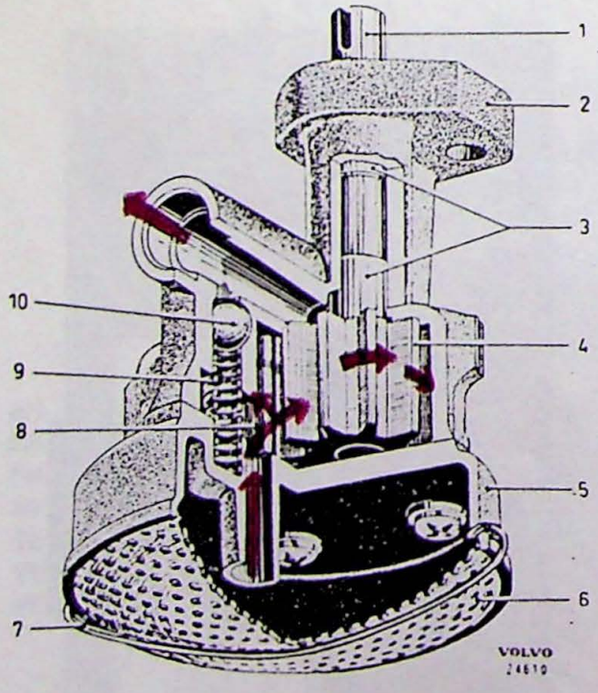


Fig. 1-7. Oil pump

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 cooler

The oil cooler (Fig. 1-6) 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.

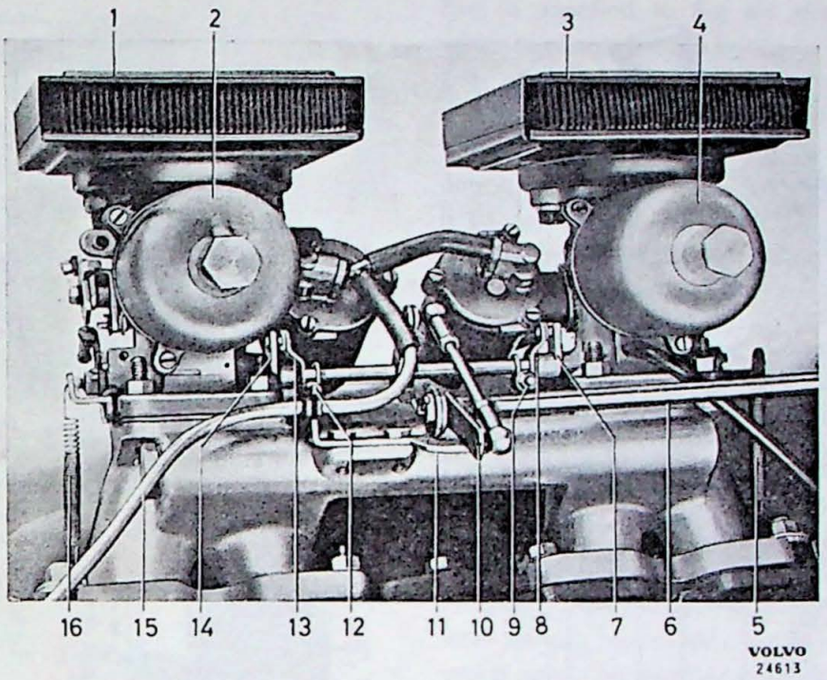


Fig. 1-8. Carburetor layout

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

FUEL SYSTEM

The fuel is sucked by a diaphragm type pump from the fuel tank through a filter and then is 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:

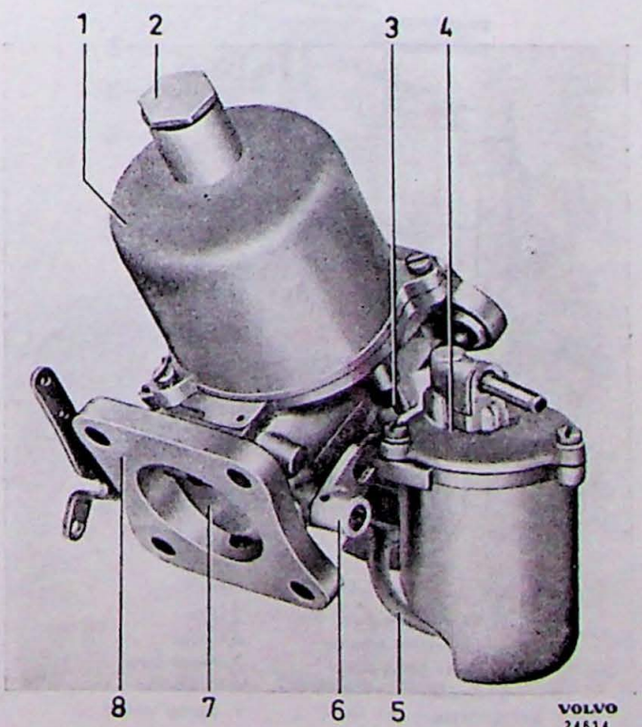


Fig. 1-9. Carburetor viewed from the left

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

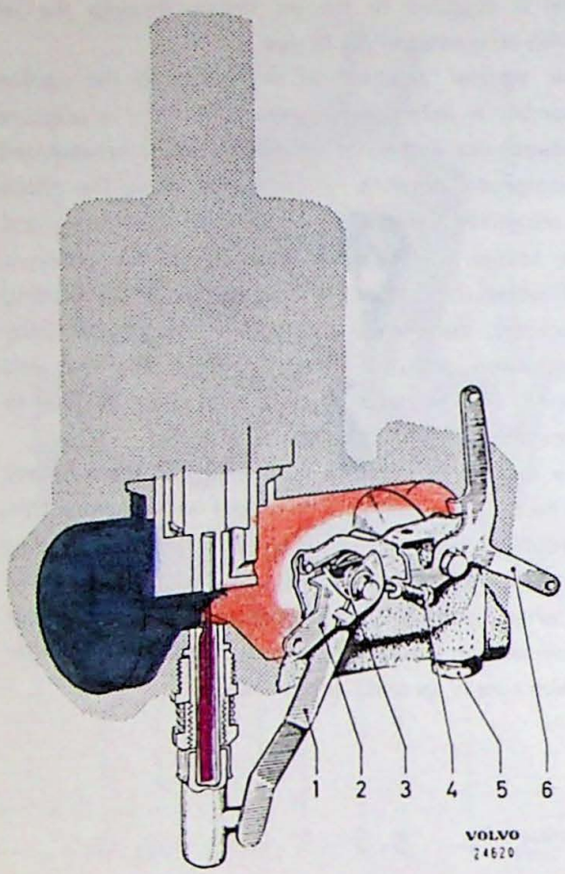
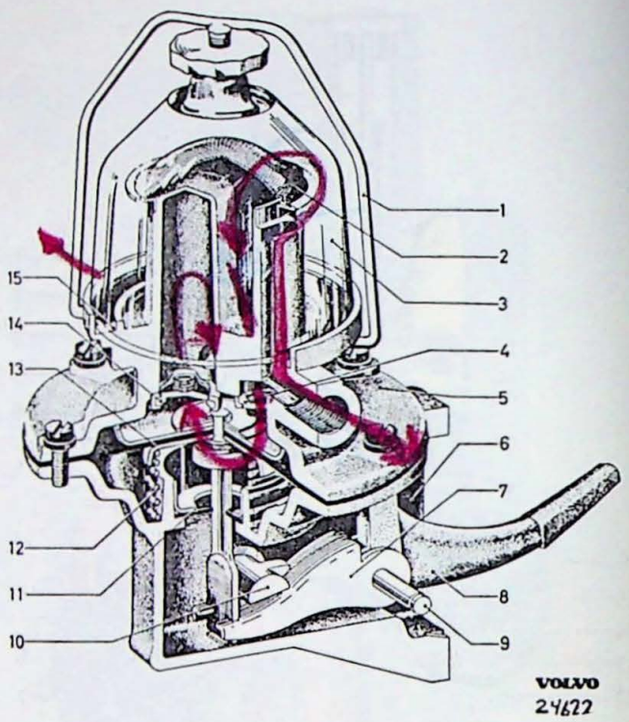


Fig. 1-15. Carburetor, rapid idling

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 as 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 to 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.

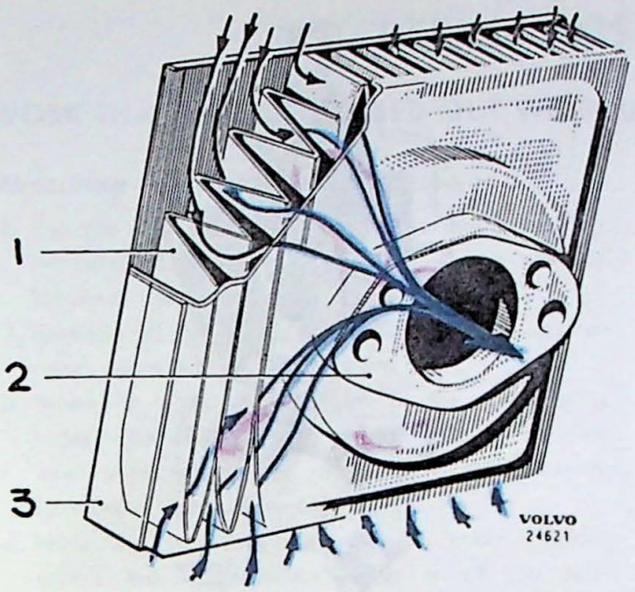


Fig. 1-17. Air cleaner

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

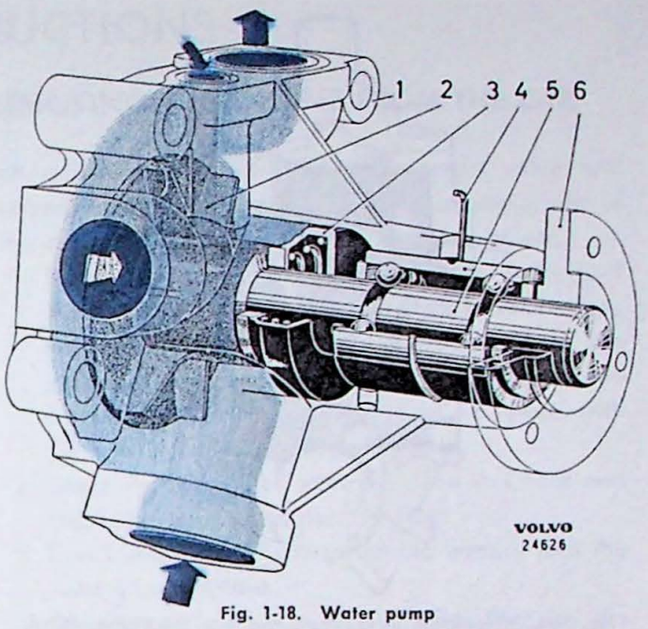


Fig. 1-18. Water pump

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.

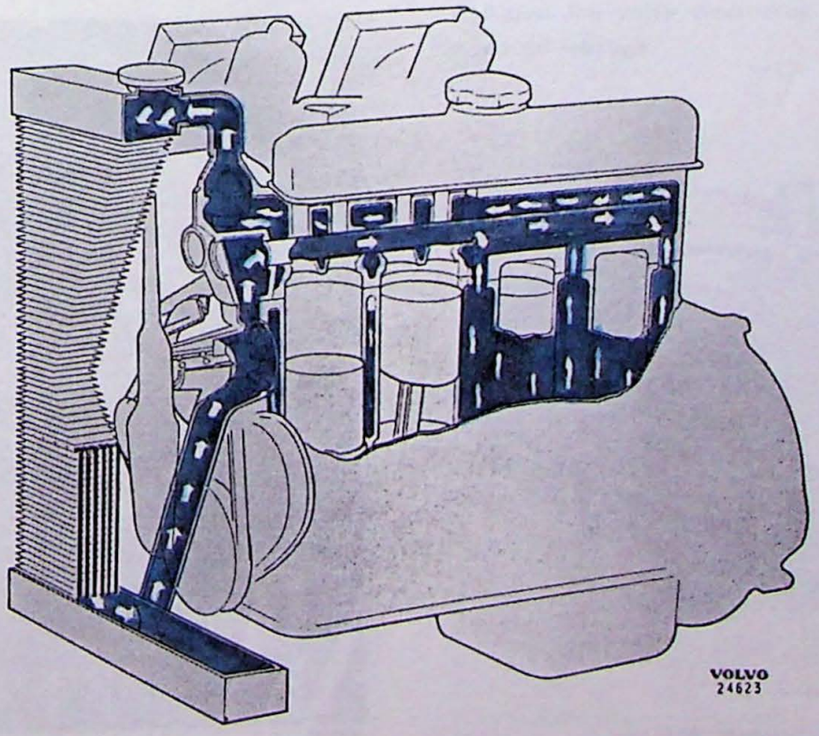


Fig. 1-19. Cooling system

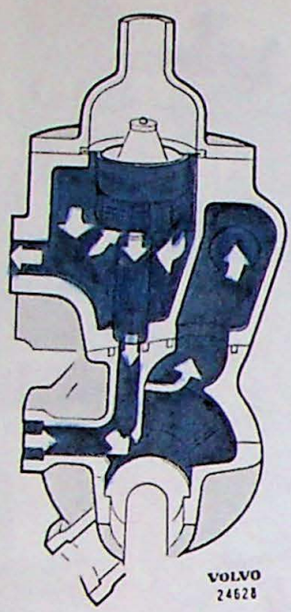


Fig. 1-20. Circulation of cooling water with thermostat closed

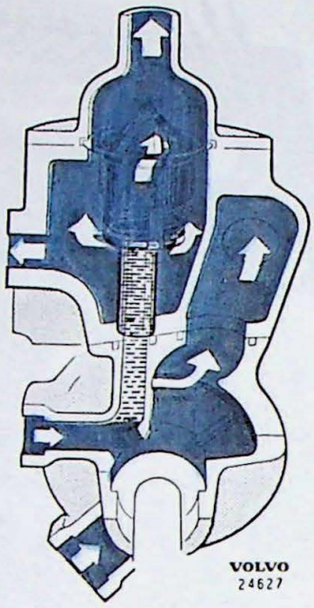


Fig. 1-21. Circulation of cooling water with thermostat open

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 through the warmest parts of the cylinder head. The cooling water round the walls of the cylinders circulates by the thermo-siphon principle.

REPAIR INSTRUCTIONS

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 defects 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.

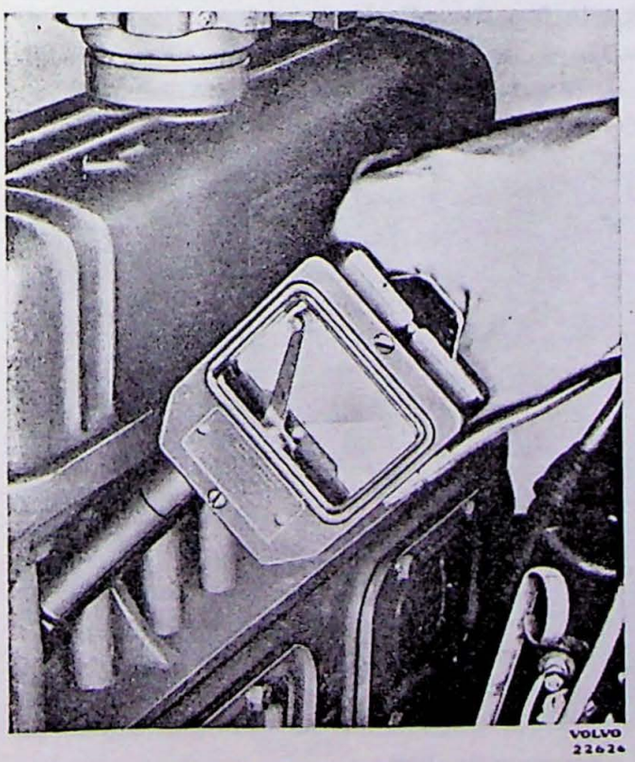


Fig. 1-22. Testing compression

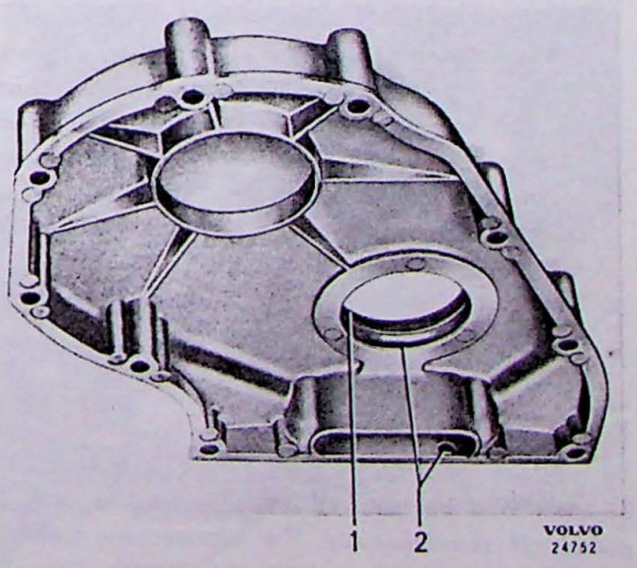
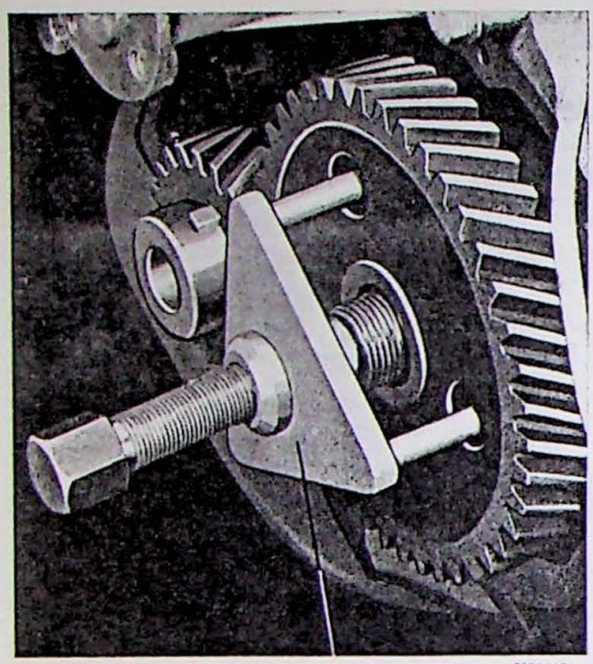
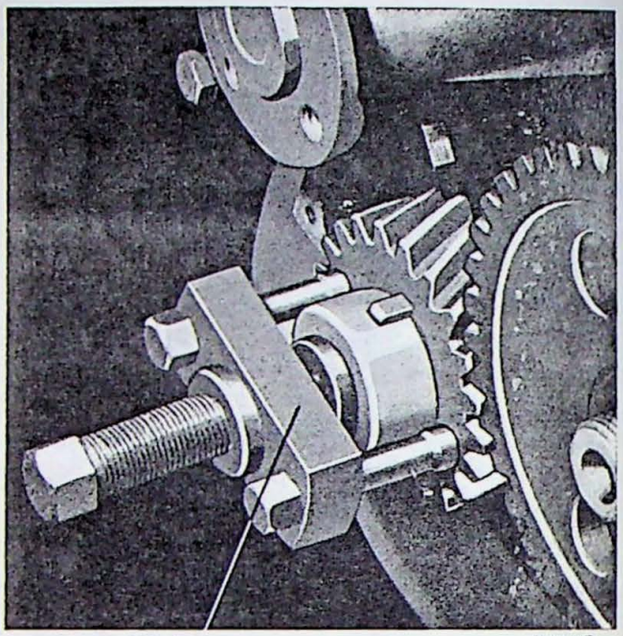


Fig. 1-23. Timing gear casing
1. Seal ring 2. Drain holes



SVO 2250 VOLVO 24830

Fig. 1-24. Removing the camshaft gear



SVO 2405 VOLVO 24828

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 1-23.

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 1-23.

Replacing the timing gear casing

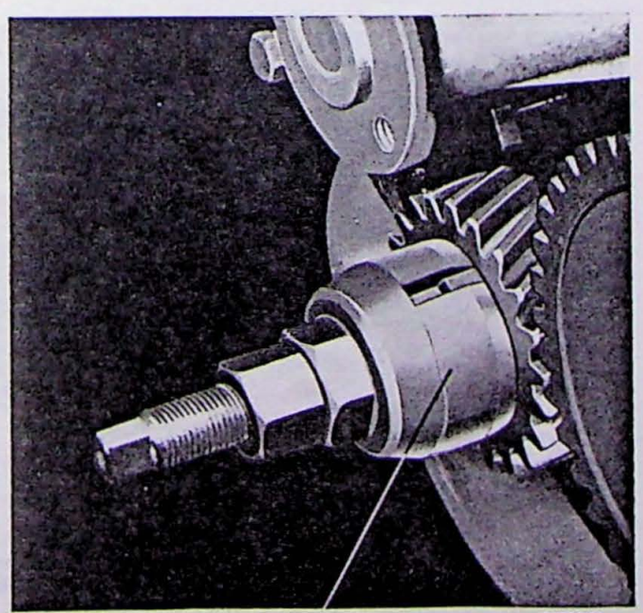
1. Release fan belt tension.
2. Remove the fan and the pulley on the water pump.
3. Remove the crankshaft pulley bolt. Remove the pulley.
4. Remove the timing gear casing. Loosen a couple of extra bolts for the oil pan and be careful to ensure that the oil pan gasket is not damaged.
5. Make sure that 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 internal 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.

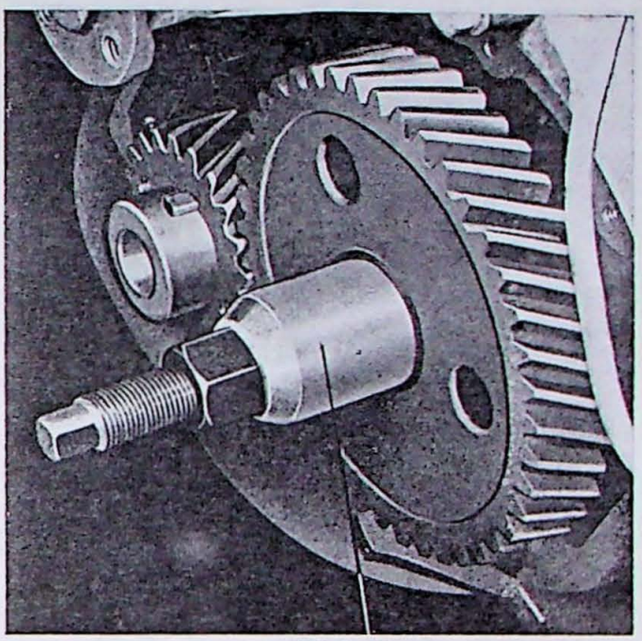
Valve-grinding and decarbonizing

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.



SVO 2407 VOLVO 24829

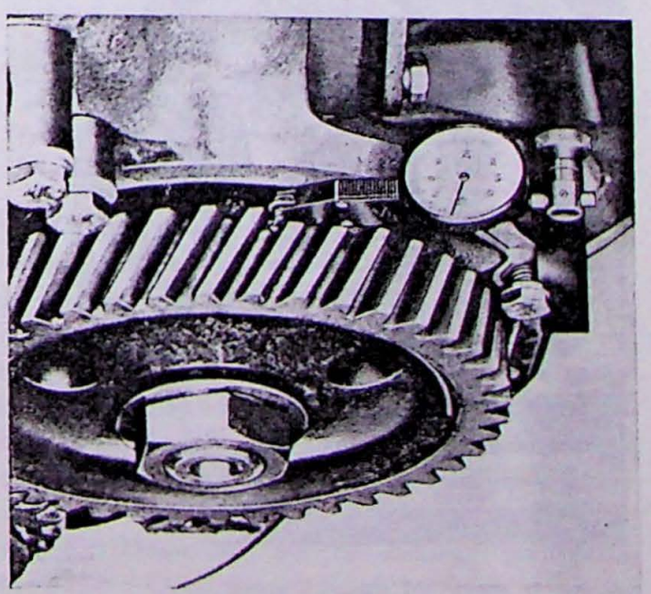
Fig. 1-26. Fitting the crankshaft gear



SVO 2408 VOLVO 24831

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 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



VOLVO 24646

Fig. 1-28. Measuring tooth flank clearance

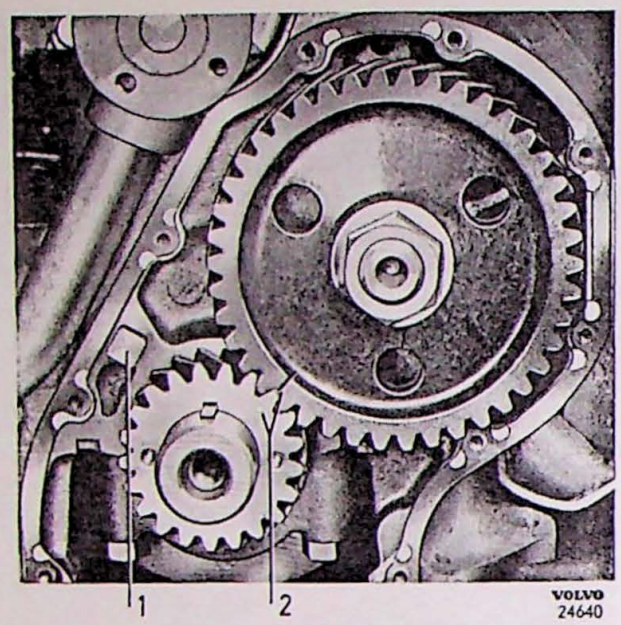


Fig. 1-29. Timing gear setting
1. Jet for lubrication of gears 2. Markings

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.

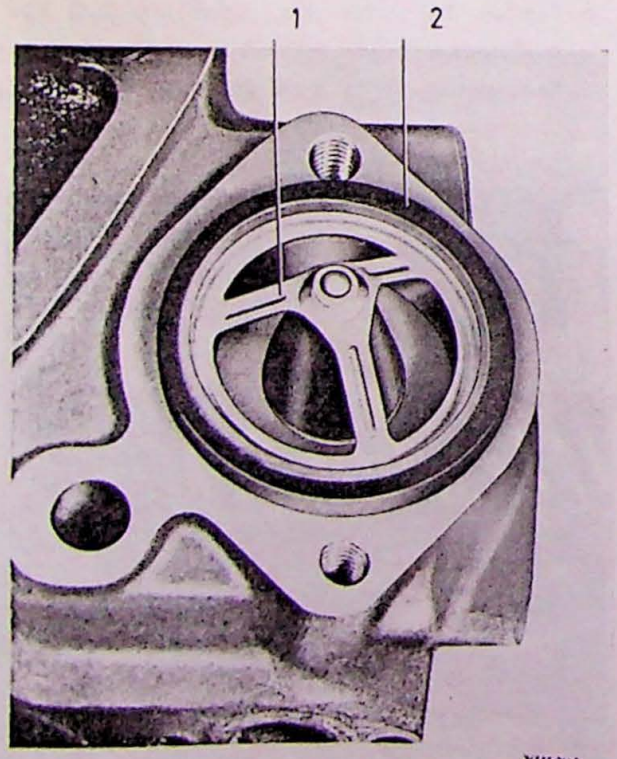


Fig. 1-30. Thermostat
1. Thermostat 2. Gasket

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

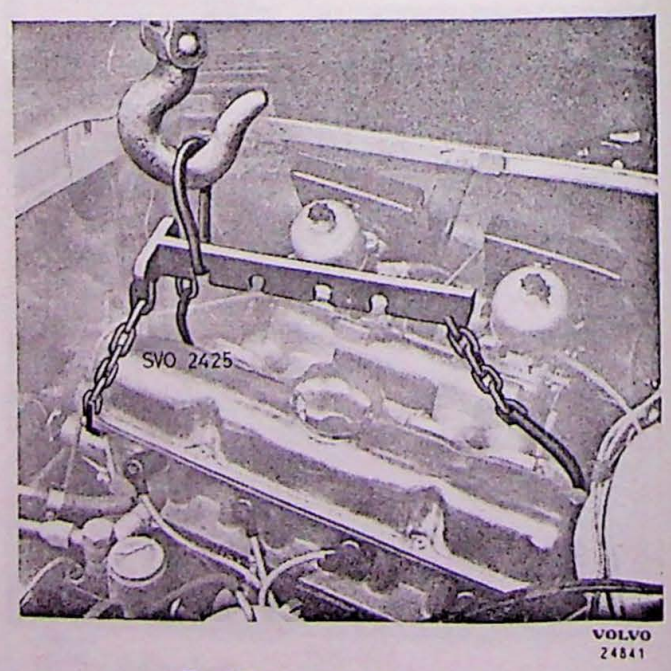


Fig. 1-31. Lifting out the engine

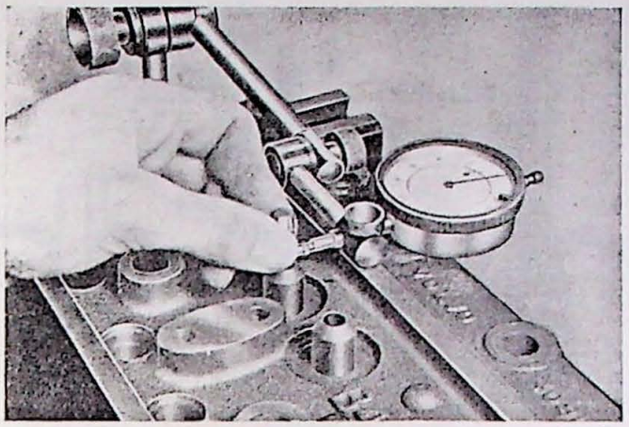


Fig. 1-32. Measuring clearance

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 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

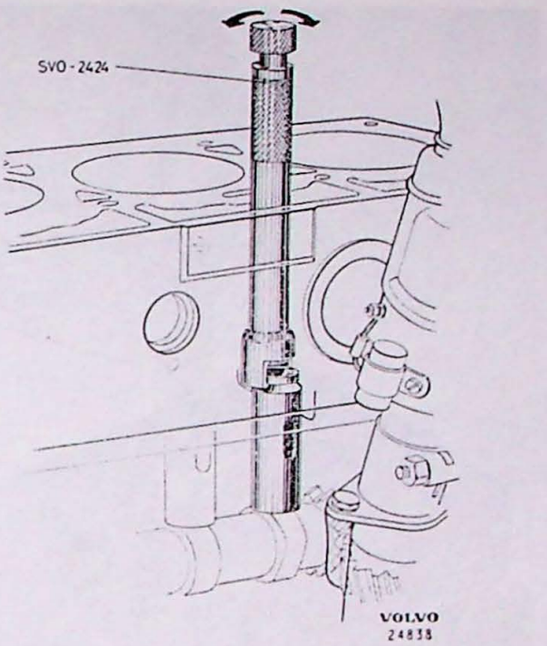


Fig. 1-33. Removing a valve lifter

cover, the rocker arm 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 castiron 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. Newer 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.

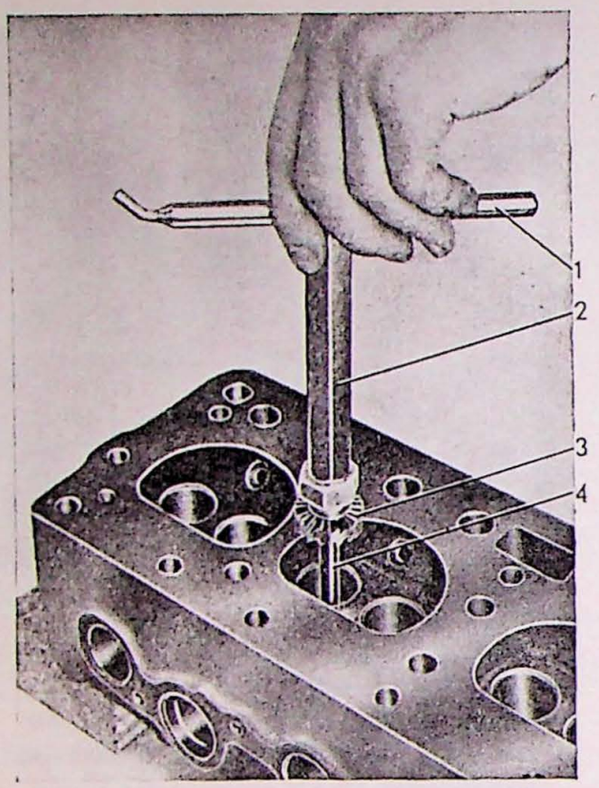


Fig. 1-34. Reaming a valve seat

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 them 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.

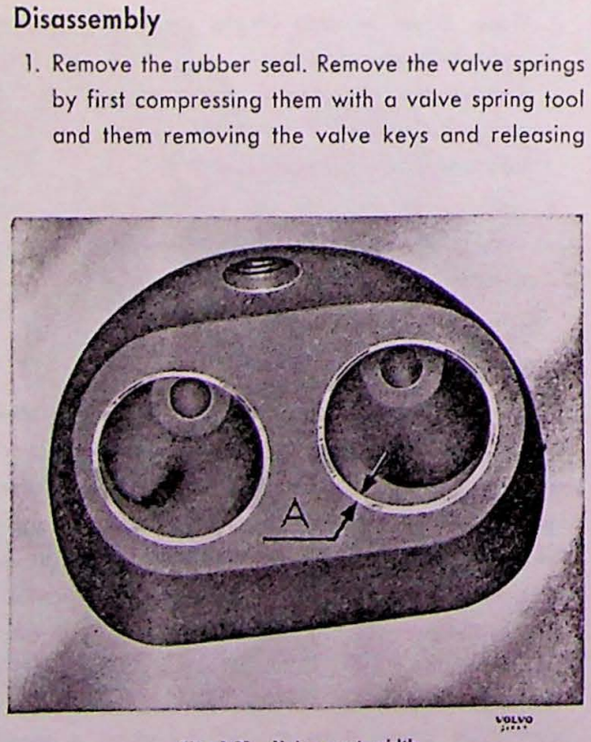


Fig. 1-35. Valve seat width
A = 1.5 mm (0.060")

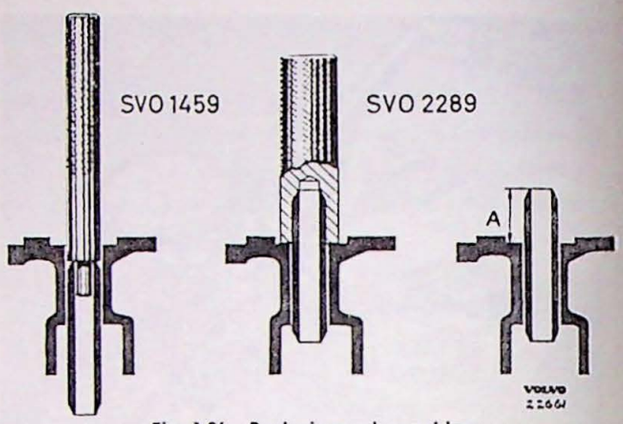


Fig. 1-36. Replacing valve guides
A = 21 mm (0.827")

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 broad 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.

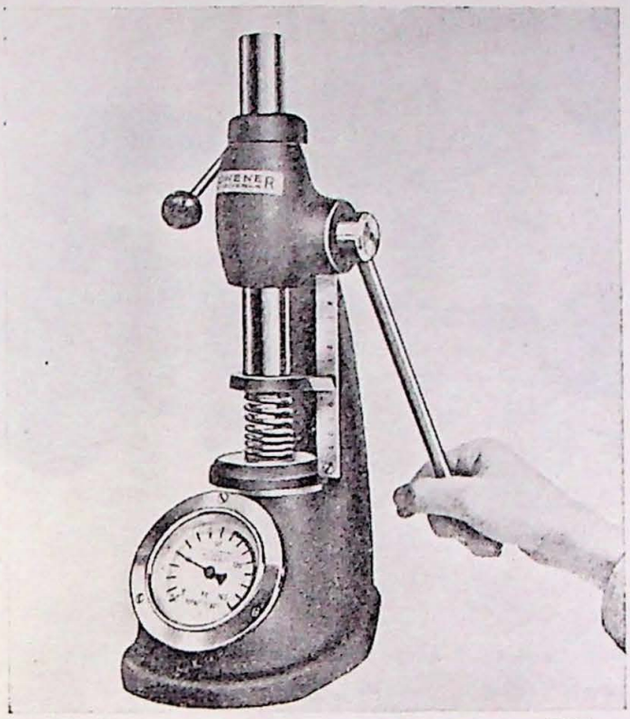


Fig. 1-37. Spring testing

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 into 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.

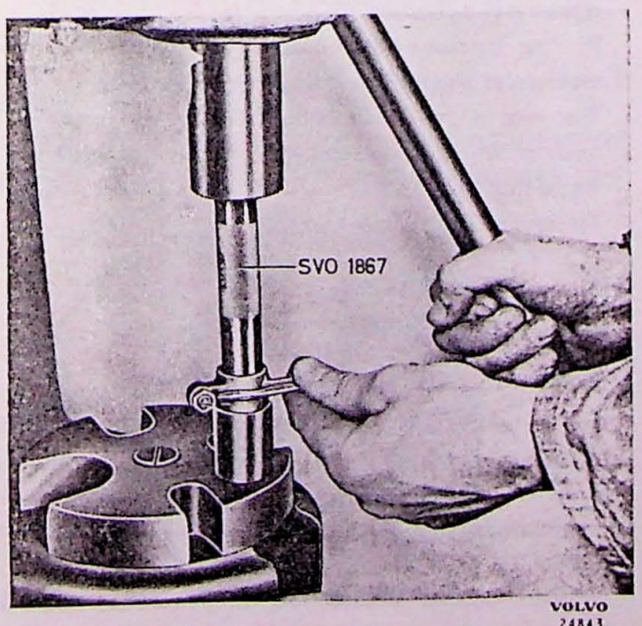


Fig. 1-38. Replacing a rocker arm bushing

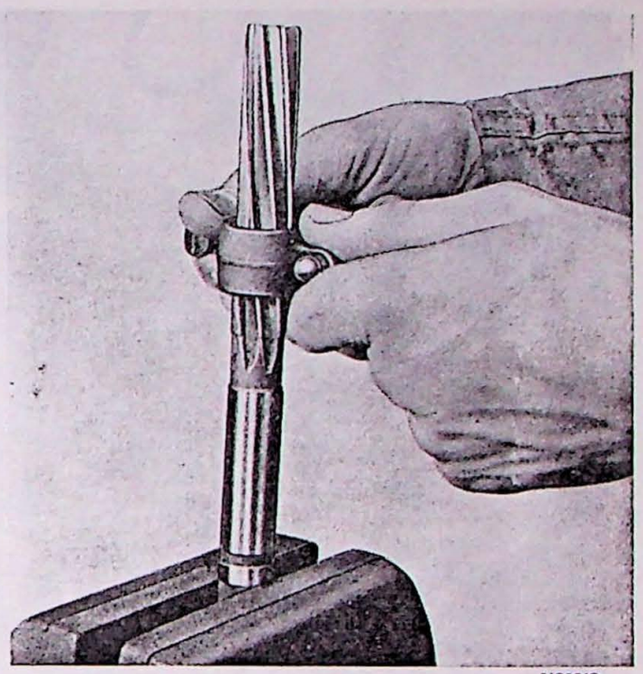


Fig. 1-39. Reaming a new bushing

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 key. Finally fit the rubber ring.

Replacing the rocker arm bushings and grinding the rocker arms

1. If wear is as much as 0.1 mm (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.

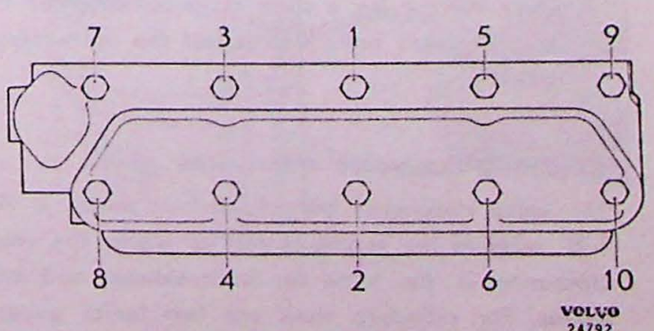


Fig. 1-40. Order of tightening for cylinder head bolts

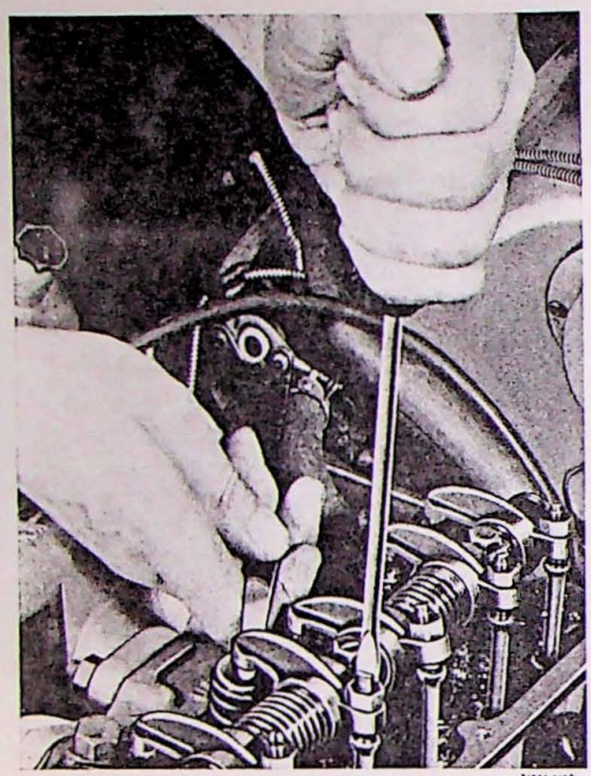


Fig. 1-41. Adjusting valve clearance

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").

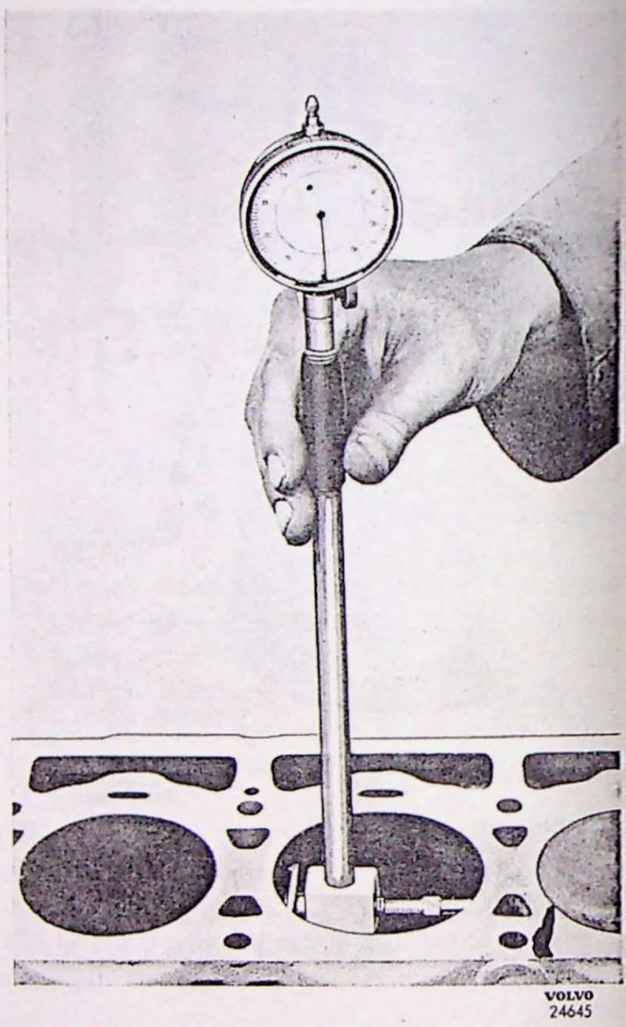


Fig. 1-42. Measuring the cylinder bore

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 disassembled, 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 dimensions for the specifications.

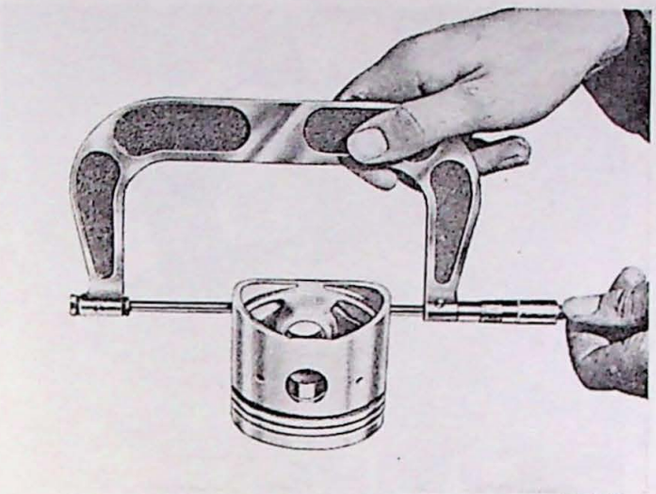


Fig. 1-43. Measuring a piston

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 AND 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 piston 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.

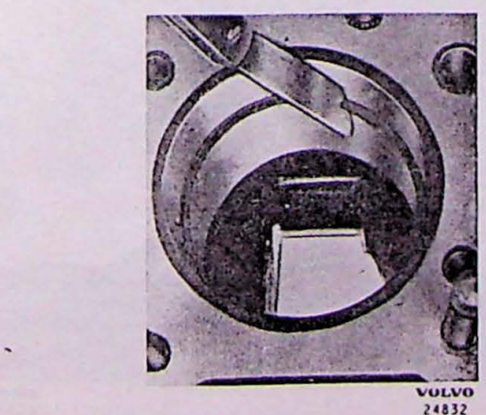


Fig. 1-44. Measuring the piston ring gap

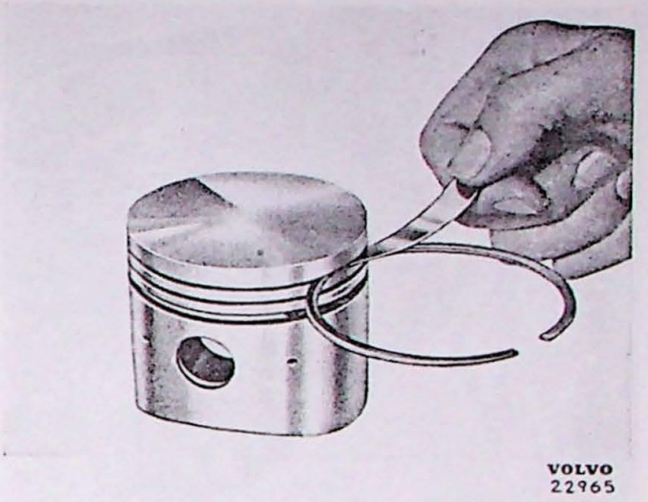


Fig. 1-45. Piston ring clearance in groove

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 (0.001—

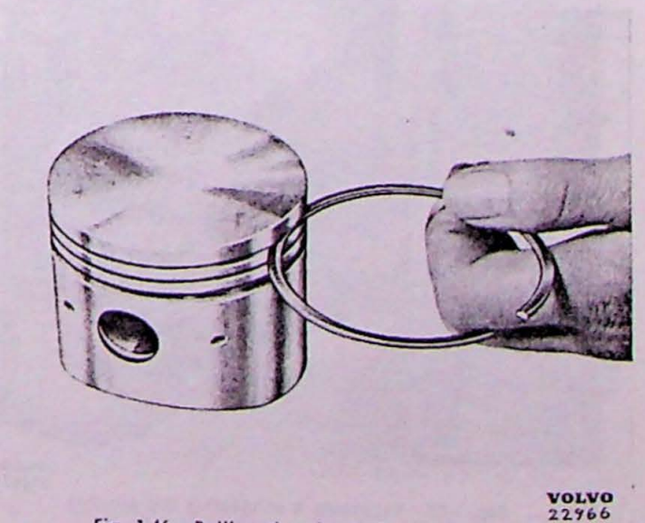


Fig. 1-46. Rolling the piston ring in the groove

VOLVO 20357

Fig. 1-47. Fitting the piston rings

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

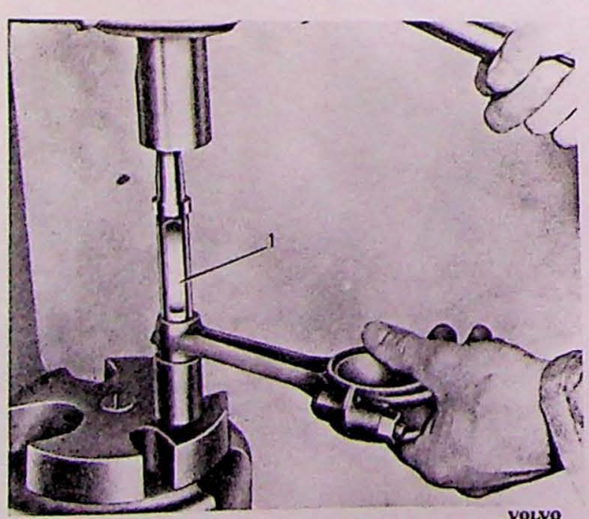
3. Check the piston rings in their respective ring grooves by rolling them in the groove, Fig. 1-46. Also measure the clearance at several points, Fig. 1-45. See the specifications for the dimensions.

In a worn cylinder bore

When checking the fit of the rings in a worn cylinder bore, the rings must be tested at the 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")



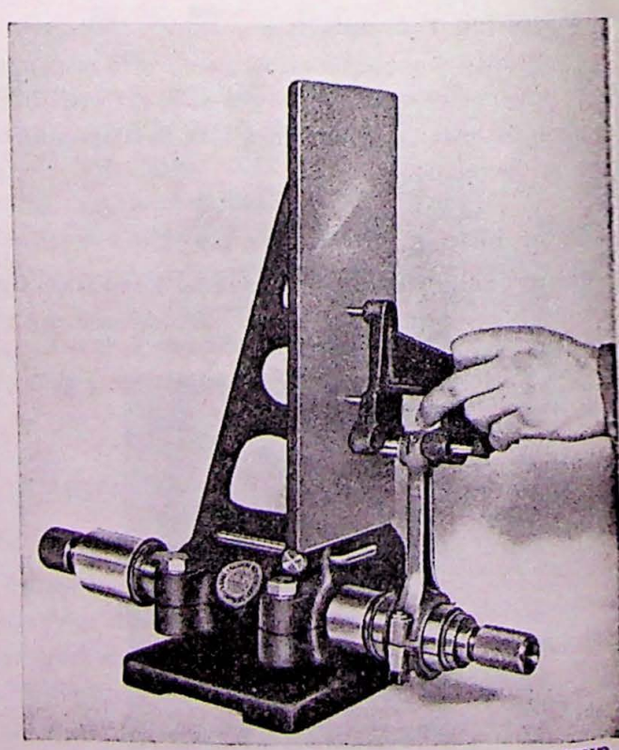
VOLVO 24663

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

VOLVO 20348

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



VOLVO 20355

Fig. 1-50. Checking connecting rod alignment

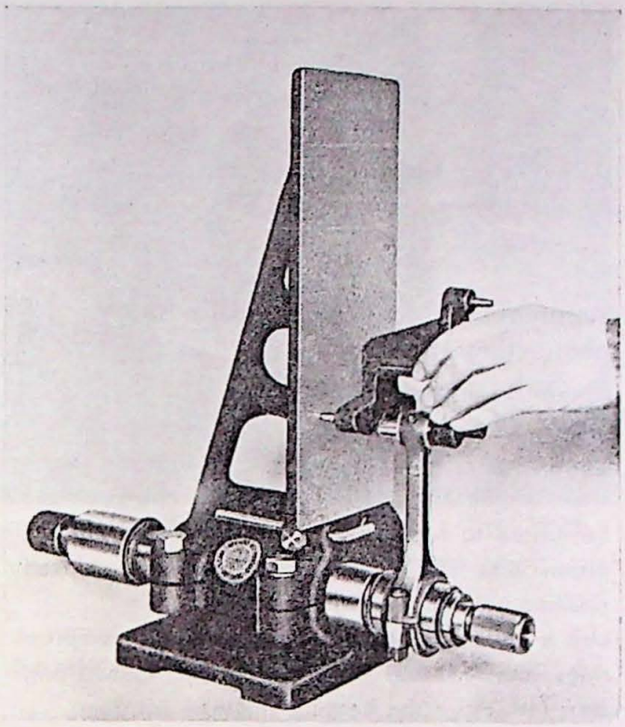


Fig. 1-51. Checking connecting rod alignment

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.

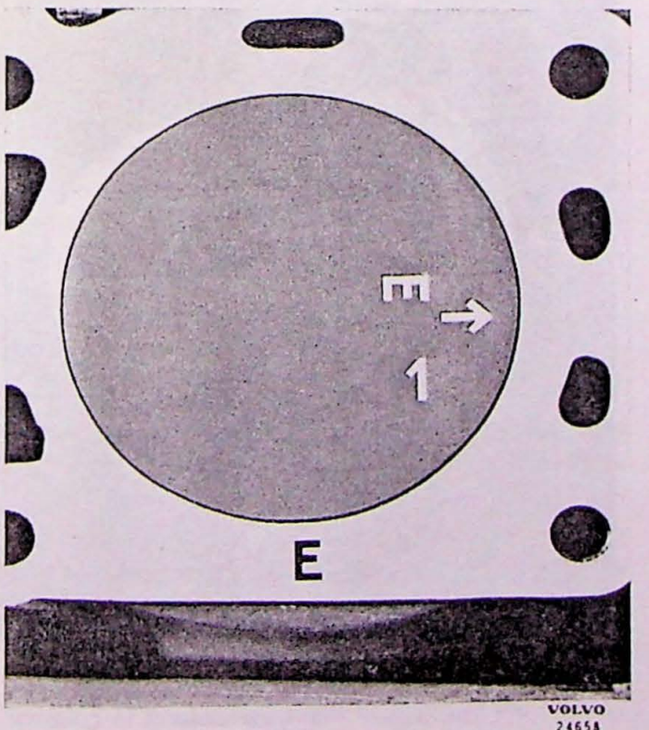


Fig. 1-52. Markings on pistons and cylinder blocks

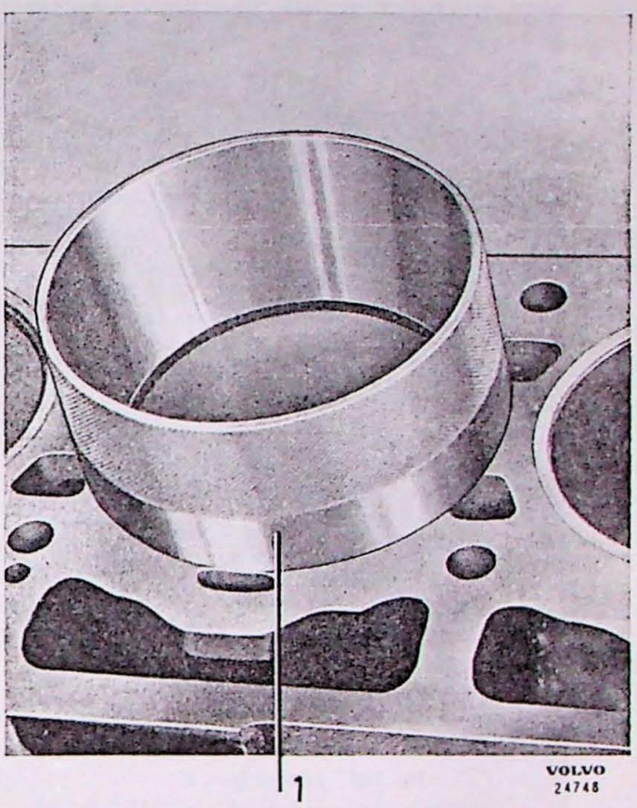


Fig. 1-53. Fitting a piston
1. Piston-inserting tool SVO 2176

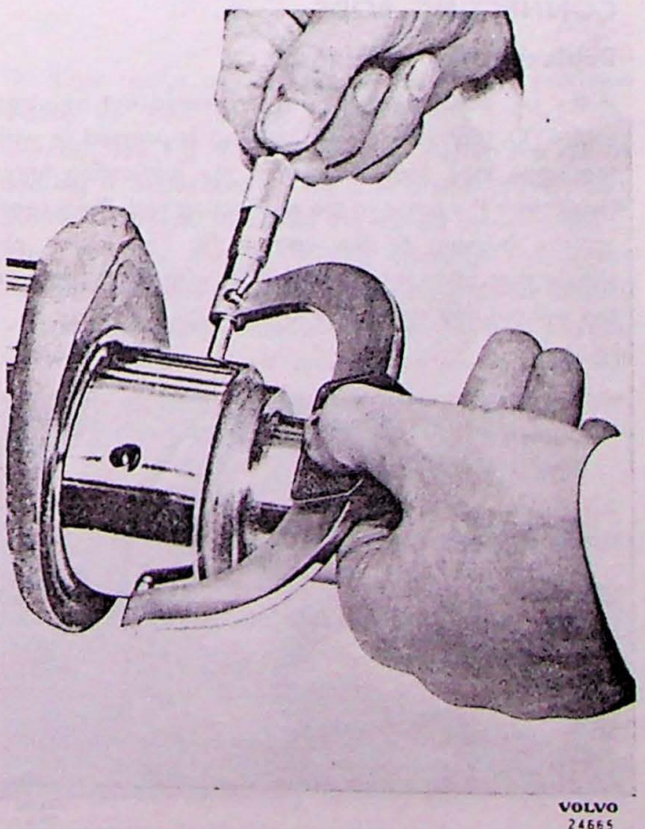


Fig. 1-54. Measuring the crankshaft

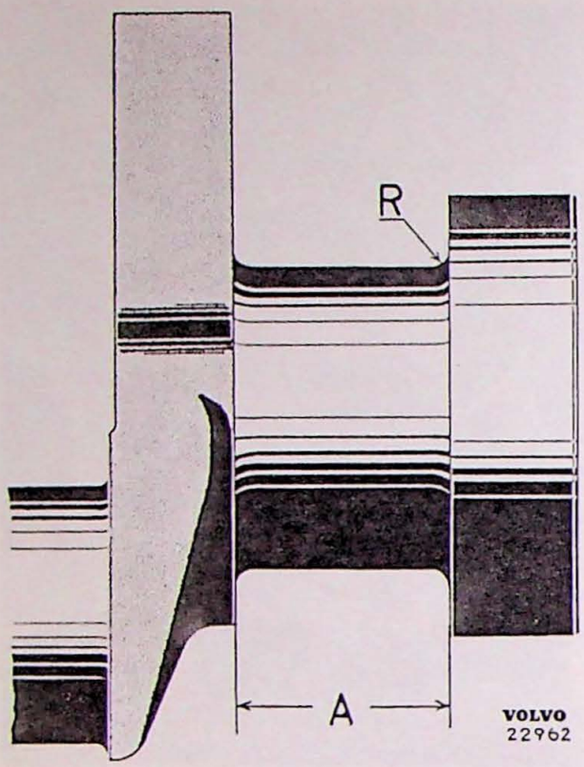


Fig. 1-55. Bearing journal

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.

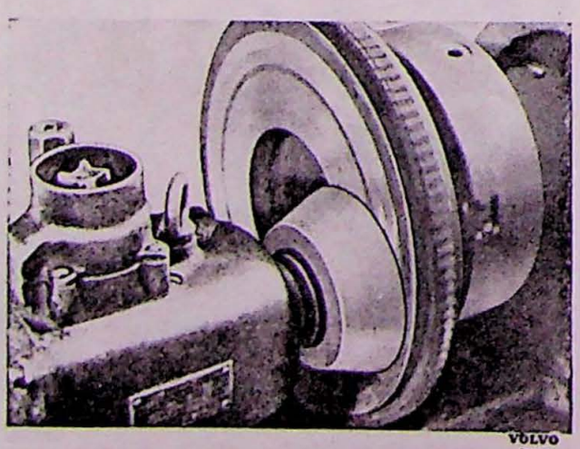


Fig. 1-56. Grinding the flywheel

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.

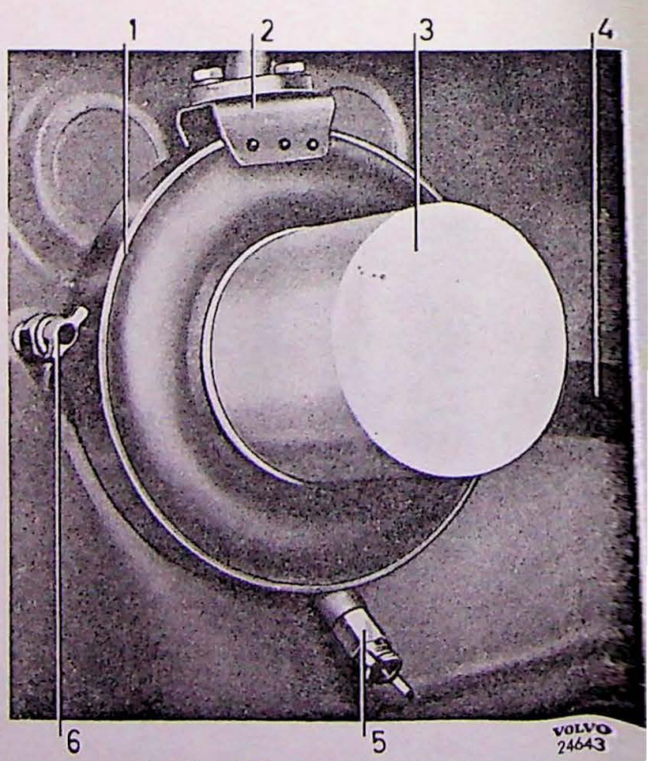


Fig. 1-57. Oil cleaner and oil cooler

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

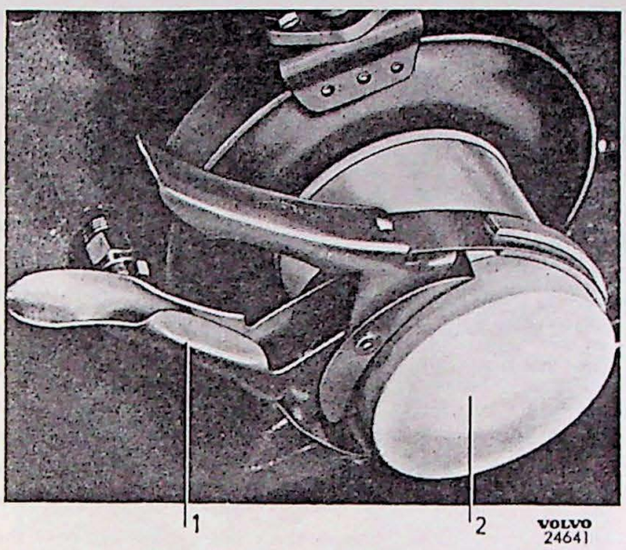


Fig. 1-58. Removing the oil cleaner
1. Tool 2. Cleaner

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 filling of the bearing caps is absolutely forbidden.

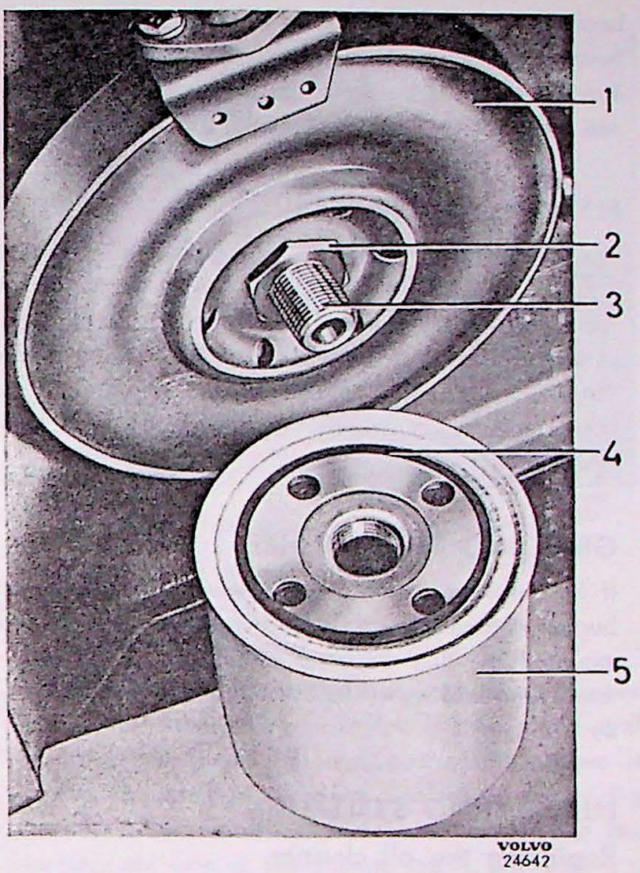


Fig. 1-59. Oil cleaner ready for fitting
1. Cooler 4. Gasket
2. Nut 5. Cleaner
3. Nipple

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.

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 even 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 not 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 (0.0008—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 on 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.

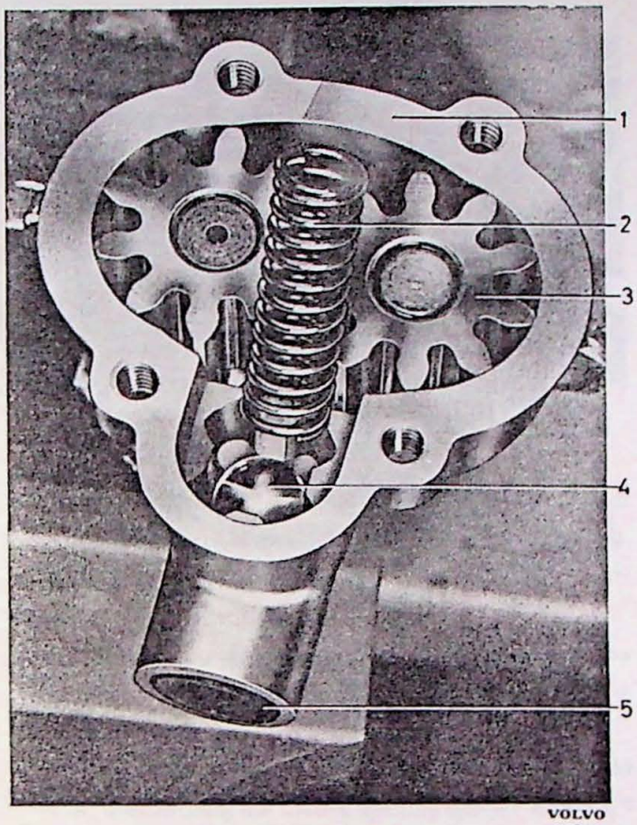


Fig. 1-60. Oil pump with relief valve

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

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.).

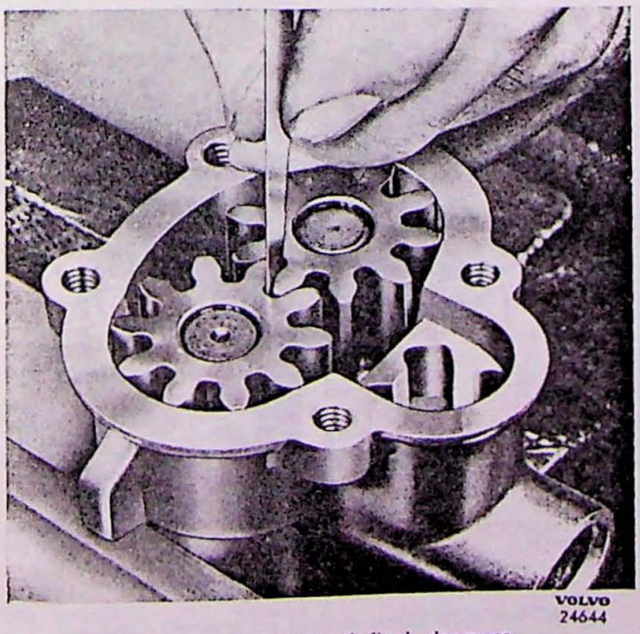


Fig. 1-61. Measuring tooth flank clearance

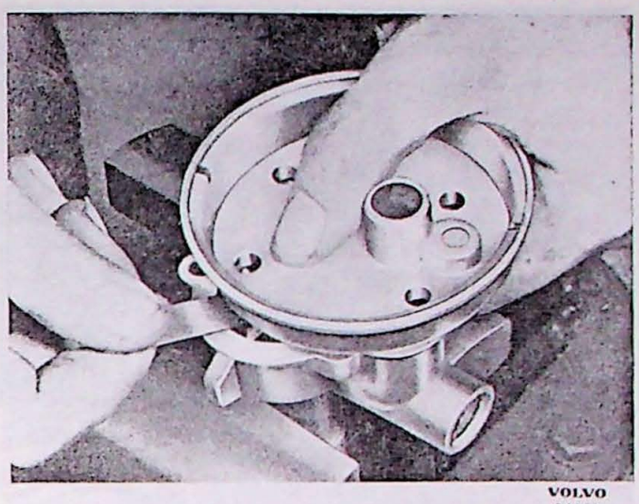


Fig. 1-62. Measuring axial clearance

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 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.

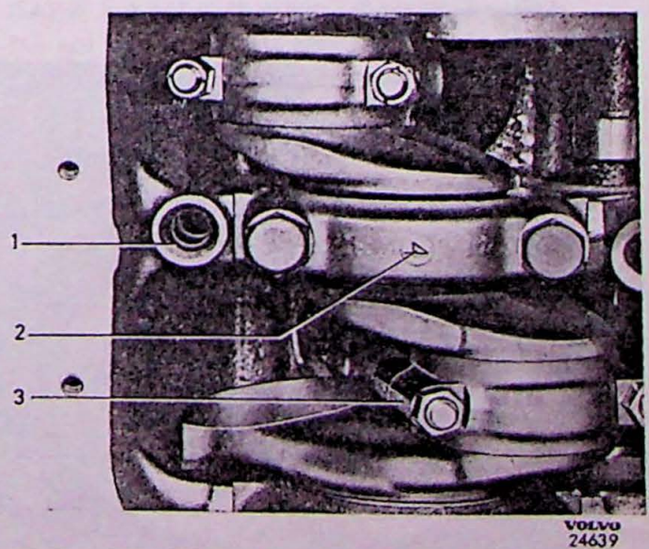


Fig. 1-63. Connecting hole for oil pipe

1. Hole for oil pipe
2. Marking on main bearing
3. Marking on connecting rod

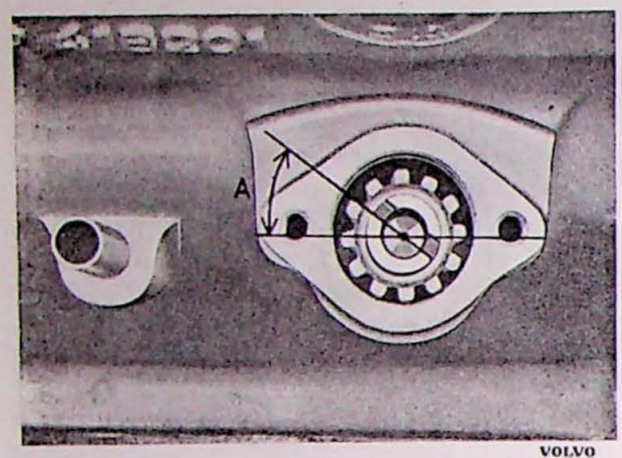


Fig. 1-64. The position of the distributor drive gear
A = 35°

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 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.

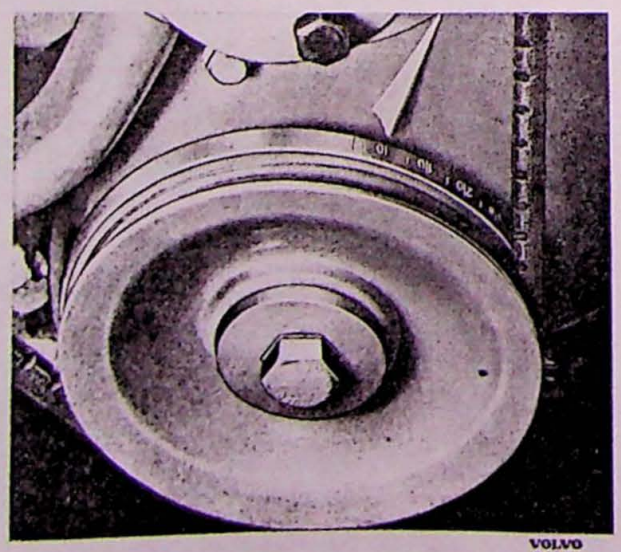


Fig. 1-65. Graduations for timing setting

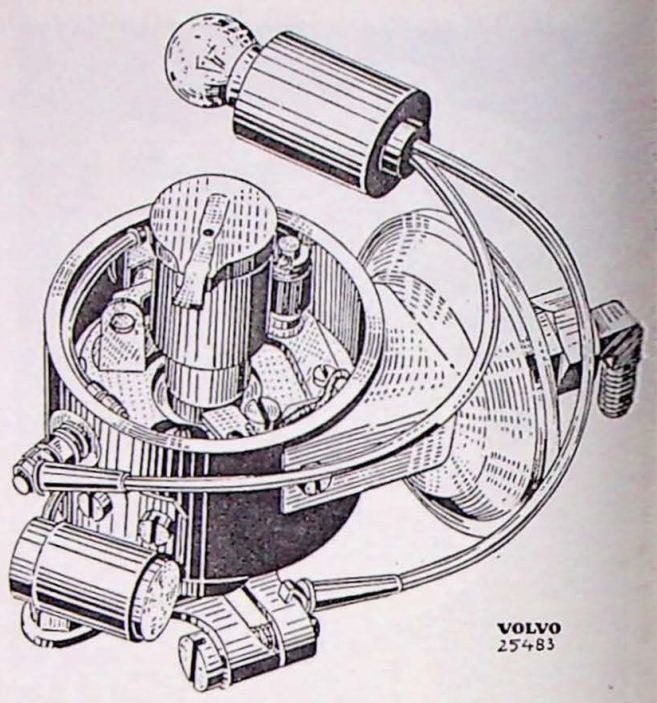


Fig. 1-66. Lamp connected up for basic ignition timing setting

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

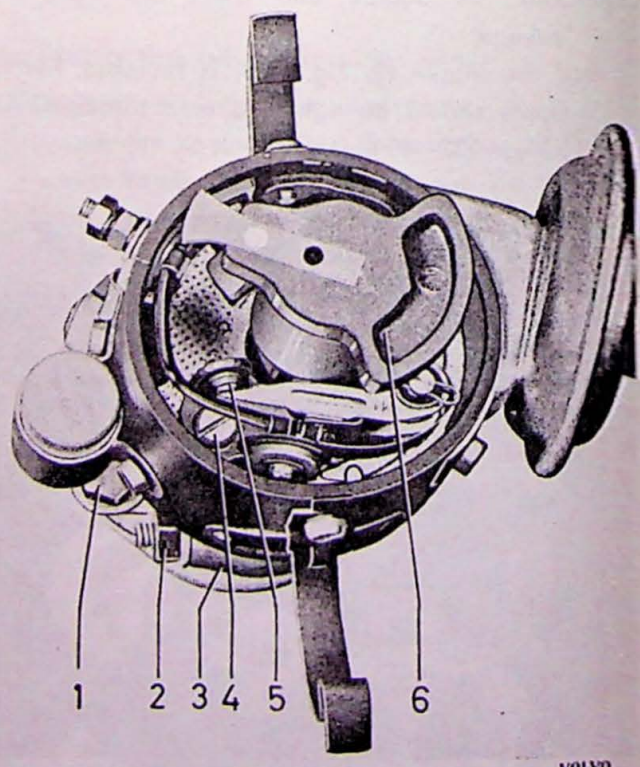


Fig. 1-67. Attachment of distributor

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

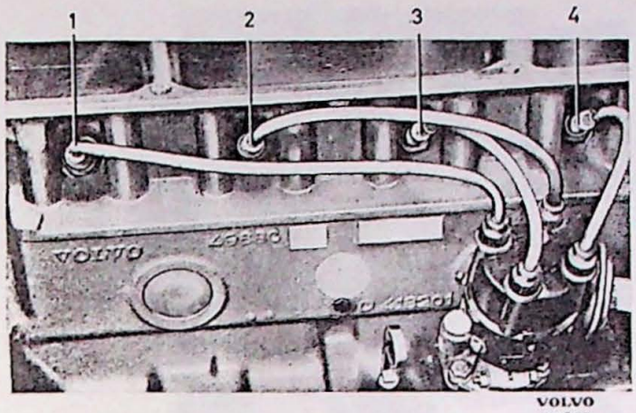


Fig. 1-68. Numbering of cables

described above applies for assembly but the final adjustment is carried out while the engine is running.

1. Disconnect the vàcuum governor by loosening its pipe at the distributor.
2. Mark out the 18° before TDC graduation on the crankshaft pulley with chalk so that it can be clearly seen.
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 ignition occurs opposite the chalked mark mentioned in point 2 above.
   Keep your fingers away from the fan.
5. Adjust the setting if so required by turning the distributor after loosening its clamp screw.
6. Screw the distributor firmly into position and fighten up the vacuum pipe.

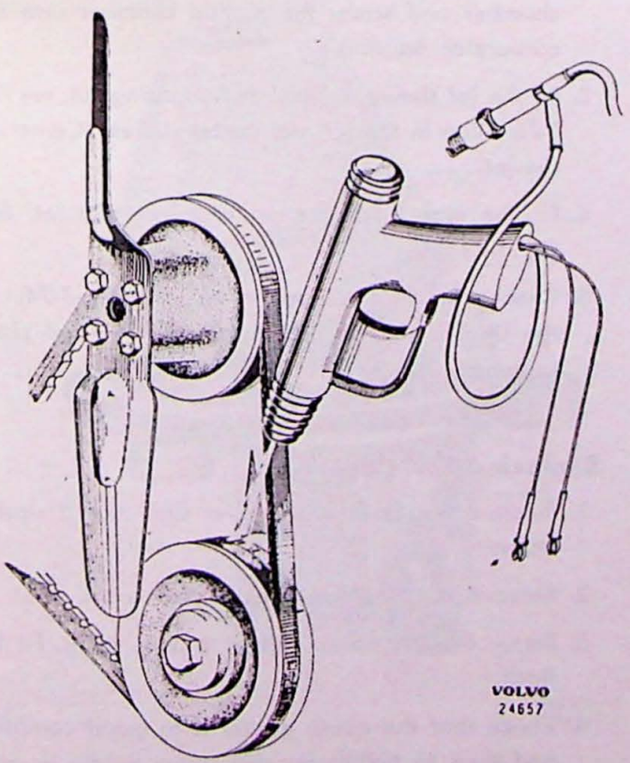


Fig. 1-69. Checking the ignition setting while the engine is running

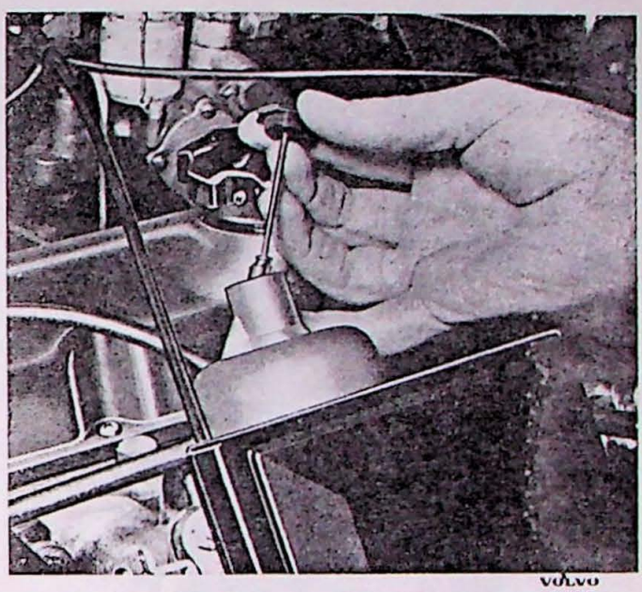


Fig. 1-70. Removing the damping plungers to fill oil in the damping cylinders

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.

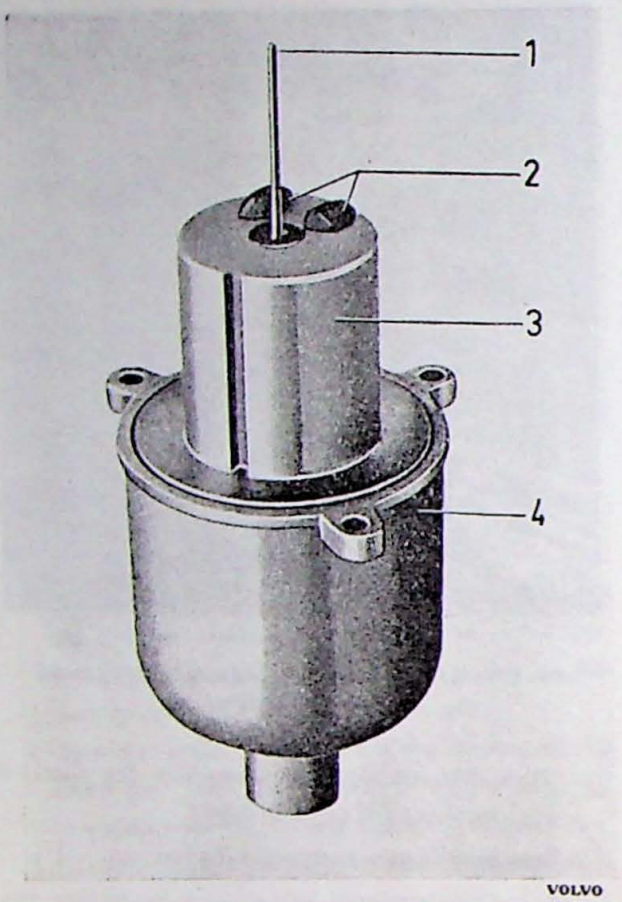


Fig. 1-71. Fit of piston in suction chamber
1. Fuel needle 2. Plugs 3. Vacuum piston 4. Suction chamber

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 filling 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

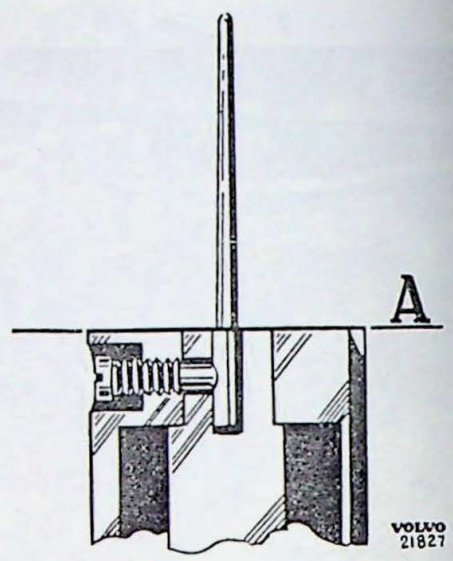


Fig. 1-72. Attachment of fuel needle
A = attaching level

piston, placing it in the suction chamber and holding the parts upside down. The damping plunger should be fitted but never 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 5-17 seconds.

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 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 then fit the cover and screw tightly in position.

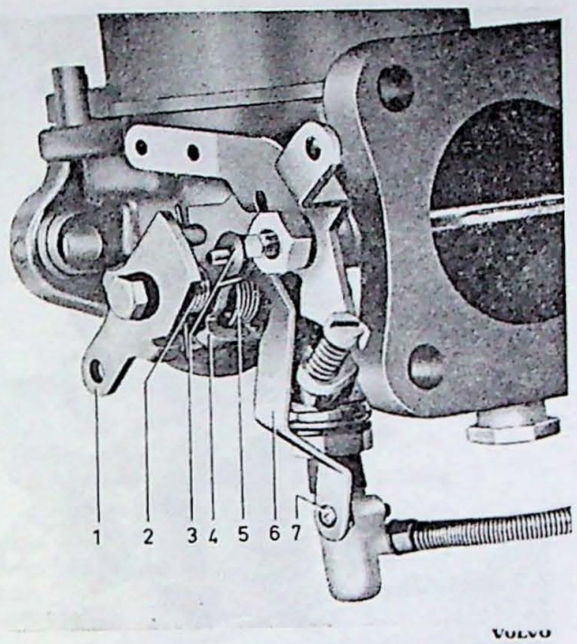


Fig. 1-73. Levers and springs

1. Lever
2. Return spring for lever 1
3. Lock washer
4. Lever to lower jet
5. Return spring for 4
6. Link between jet and lever
7. Screw

Centering the jet

The jet generally only requires centering after the carburetor has been completely disassembled, or when parts influencing the centering have been replaced.

1. Remove the air cleaners. Unscrew the fuel pipe to the jet on the lower part of the float bowl.
2. Remove the screw (7) retaining the link (6), Fig. 1-73. Remove the jet.
3. Unscrew the adjuster nut (2, Fig. 1-77) and remove its spring. Then screw the adjuster nut to the upper position.
4. Loosen the locknut (3, Fig. 1-77) so much that the jet sleeve can move. Slide up the jet by hand as far as possible, Fig. 1-77.
5. Lift up the suction chamber piston and release it. Turn the sleeve so that the piston falls freely against the bridge without being stopped by the needle. Tighten the lock screw. Check after tightening that the piston falls against the bridge without being stopped when it is lifted only 5—6 mm (1/4"). The jet should then be in its upper position.
6. Pull out the jet, unscrew the adjuster nut, then fit the spring and adjuster nut. Fit the other parts.
7. Check that the jet is pressed up against the adjuster nut correctly by spring tension when the choke lever (1, Fig. 1-73) is pulled up and released.
8. Carry out carburetor setting adjustments, see "Carburetor settings after assembly".

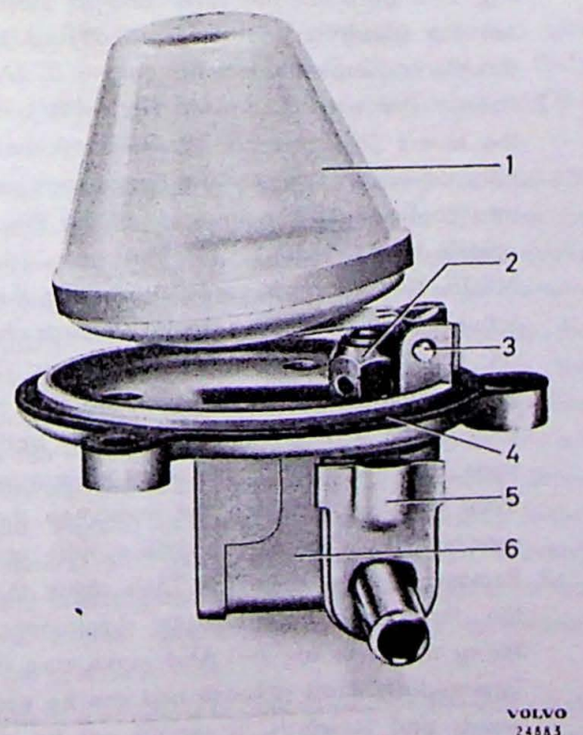


Fig. 1-74. Float

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

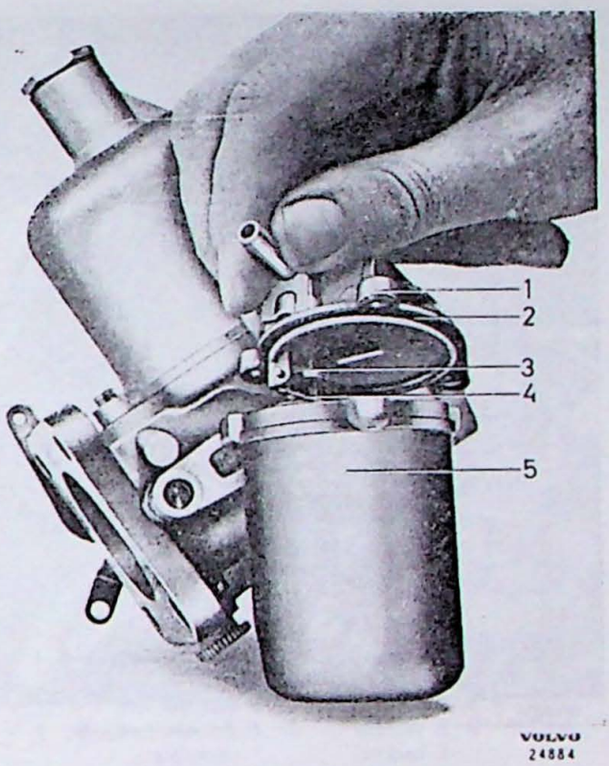


Fig. 1-75. Fitting the float bowl

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

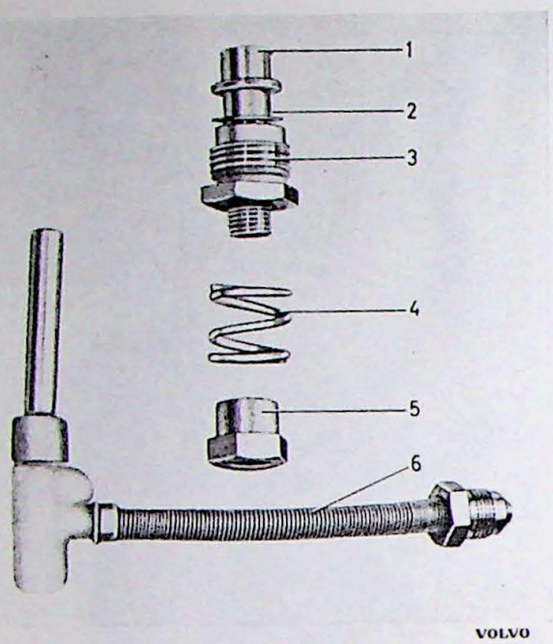


Fig. 1-76. Jet, disassembled

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

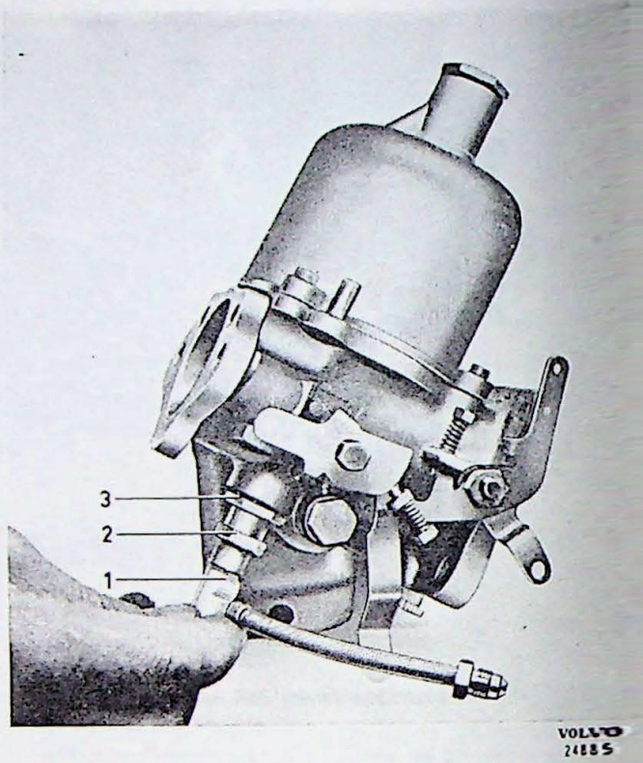


Fig. 1-77. Centering the jet

1. Jet
2. Adjuster nut
3. Locknut

Fitting the carburetors

1. Remove the protector over the inlet manifold port.
2. Press the intermediary shaft in position between the carburetors, see Fig. 1-78. See that the shield plate is in good condition and that the sealing faces are clean.
3. Fit the carburetors in position simultaneously with the intermediary shaft. Tighten the nuts and connect up the controls and fuel pipes.
4. Carry out the required adjustments of the carburetor settings, see "Carburetor settings after assembly".
5. Fit the air cleaners but make sure that the gaskets are correctly in position. Add SAE 20 engine oil (not multi-grade oil) in the damping cylinders if required.

Carburetor settings after fitting

After fitting the engine and the carburetors in the car, adjust the carburetors in order according to the following instructions. Check that oil and water has been added before starting the engine.

If settings are carried out carefully, they seldom require subsequent adjustment. It is a good thing, however, to remove the suction chamber and piston at regular intervals and clean them with a clean cloth.

The float housing should also be cleaned at the same time. This can easily be done after removing the flo housing cover.

Adjusting the clearance on the intermediary shaft

1. Place a feeler gauge 0.5 mm (0.02") thick at "A Fig. 1-78 between the lever and its stop. Scre out the idling screws (5, Fig. 1-79) so that t throttle is completely closed.
2. Loosen the nuts (3 and 9, Fig. 1-78) and pre the levers (2, 8) on the intermediary shaft car fully downwards so that the flange pins just com into contact with the lower tooth on the throt spindle levers (1, 10).
   NOTE. Do not press so hard that the throttle influenced. Only remove the downwards clearanc on the flange pins. Tighten the nuts (3, 9) this position. Note when tightening that the en play of the shaft is equally divided in both dire tions and that there is a slight clearance in c axial direction between the levers on the inte mediary shaft and the throttle spindle levers.
3. Remove the feeler gauge. Then check that bo the throttles are influenced simultaneously lifting the lever at "A". Also make sure that t intermediary shaft is loose and can be slid bac wards and forwards. It should not be clampe firmly, for example by having the levers (2, fitted too near the carburetors.

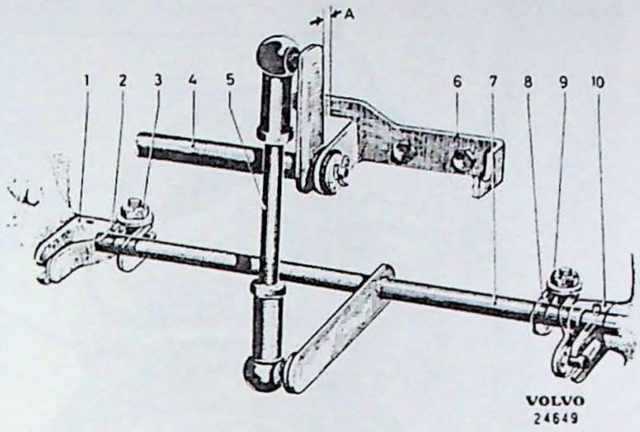


Fig. 1-78. Intermediary shaft and levers

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

Adjustment of fuel/air mixture and idling

1. Roughly adjust the height of the jet by first screwing up the adjuster nut (2, Fig. 1-79) to its upper position and then by screwing down one complete turn.
2. Turn the idling screws (5) so that they just touch the throttle levers while the throttle is closed. Then screw them down one turn.
3. Add oil to the carburetor damping cylinders. Use SAE 20 engine oil but not multi-grade oil. Only fill the vacuum piston center spindle but not the part above this.
4. Start the engine. Adjust the speed to 600—800 r.p.m. by means of the idling screws (5). Turn the screws so that the air intake sound is equally strong on both carburetors. Run the engine warm.
5. Adjust the height of the jet (and thereby the fuel/air relationship) carefully by turning the adjuster nut (2). The best position is attained when the highest engine speed is reached without altering the idling screw. When adjusting, screw the adjuster nut first slowly downwards (richer mixture) until the engine starts to run unevenly and then slightly upwards (leaner mixture) so that the engine runs evenly. Adjust the carburetors one at a time.
6. Check and adjust the idling speed (600—800 r.p.m.) by means of the idling screws. A vacuum meter should be used for a precision control of the air flow. This meter should be fitted to the cleaner connector surface. The air cleaners must, naturally, be removed while this is done.
7. Check that the fuel/air mixture is correct on both the carburetors. First lift the piston in one of the carburetors by means of the pin beside the air intake and then lift the other carburetor piston the same distance. The engine should run equally unevenly in both cases.

   If the engine should stall when one of the carburetor pistons is lifted, this is usually due to the fact that the mixture in the other carburetor is too lean. If engine speed increases, then the fuel/air mixture in the other carburetor is too rich.

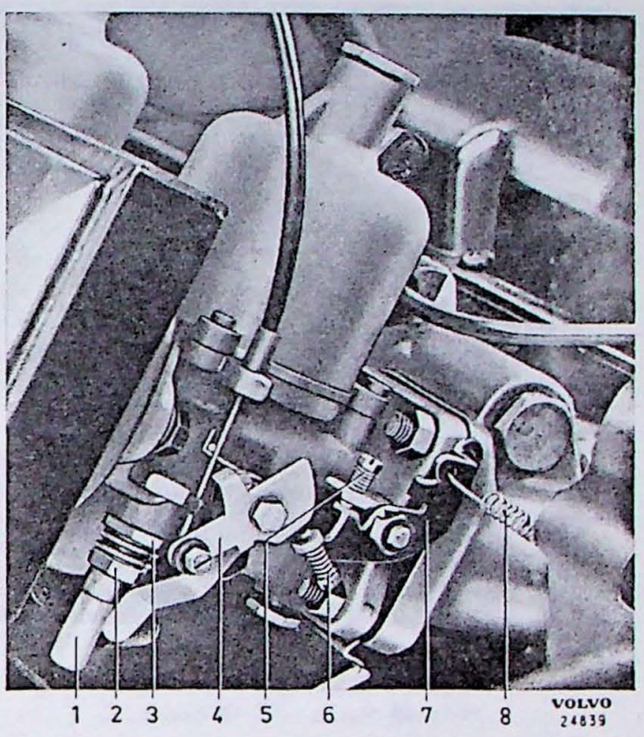


Fig. 1-79. Adjustment of controls

1. Lower part of jet
2. Adjuster nut
3. Locknut
4. Lever for choke control
5. Screw for idling
6. Rapid idling screw
7. Lever
8. Return spring

Adjusting the choke control and rapid idling

1. Pull out the choke control on the instrument panel 10 mm (1/2") from its pushed-in position.
2. Lift the lever (4, Fig. 1-79) so much that the jet is just influenced. Stretch and secure the cable in this position. The adjustment should be identical for both the front and rear carburetors.
3. Screw in the rapid idling screw (6) until it just touches the cam-shaped part of the lever (4) and then turn it a further half turn. Adjust the rapid

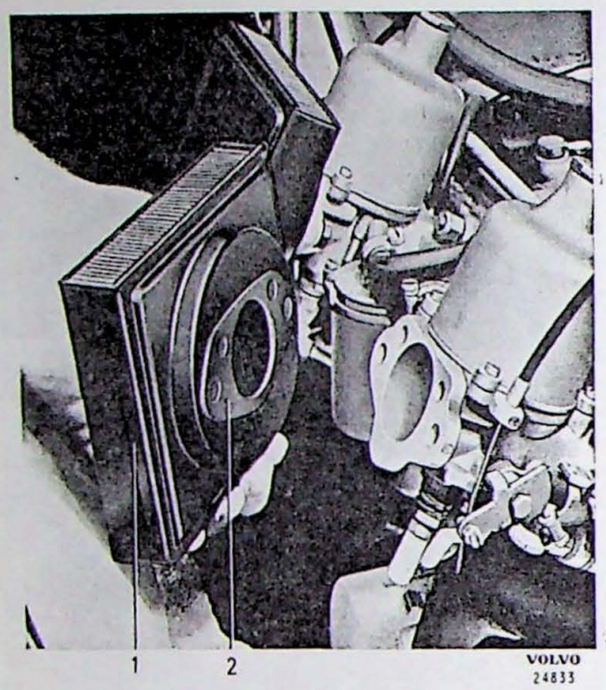


Fig. 1-80. Replacing the air cleaners
1. Air cleaner 2. Gasket

idling screw on the other carburetor in an identical way. Push in the choke control.

4. Check, by pulling out the choke control, that both the jets go down simultaneously when the control is pulled out about 10 mm (1/2"). Rapid idling should begin to function rather earlier.

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.

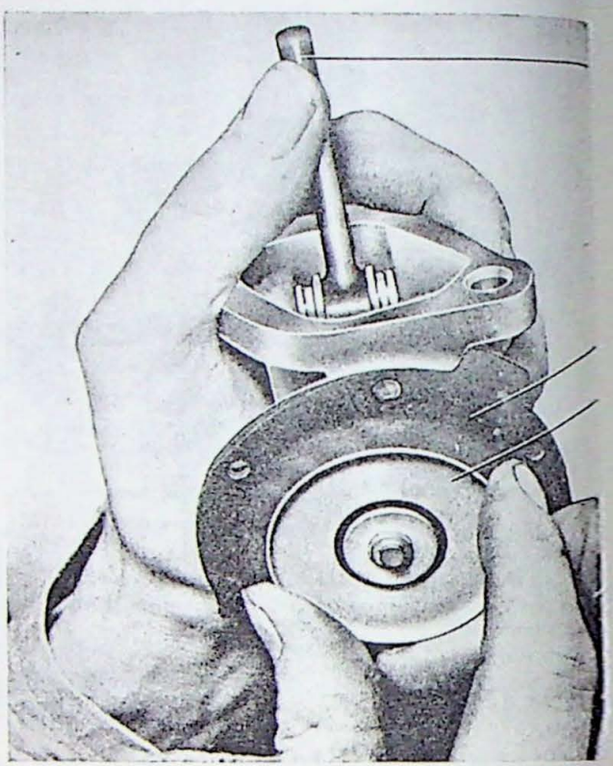


Fig. 1-81. Replacing the diaphragm
1. Lever 2. Diaphragm 3. Washer

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.

Replacing the fuel pump diaphragm and/or valves

Before disassembling the pump, first determine its pressure and capacity. If the values obtained (see specifications) are faulty, the pump should be disassembled for repair and this work most often consists in replacement of the diaphragm or valves.

1. Disassemble the pump.
2. Hold the pump as shown in Fig. 1-81. Remove the old diaphragm by pushing downwards and turning it a quarter of a turn.
3. Fit the new diaphragm by pressing with the rod and turning it a quarter of a turn.
   The distance between the end of the shaft and the support beneath should be about 2 mm (0.080") during assembly.
4. Check or replace the valves. Assemble and test the pump before refitting it on the engine.

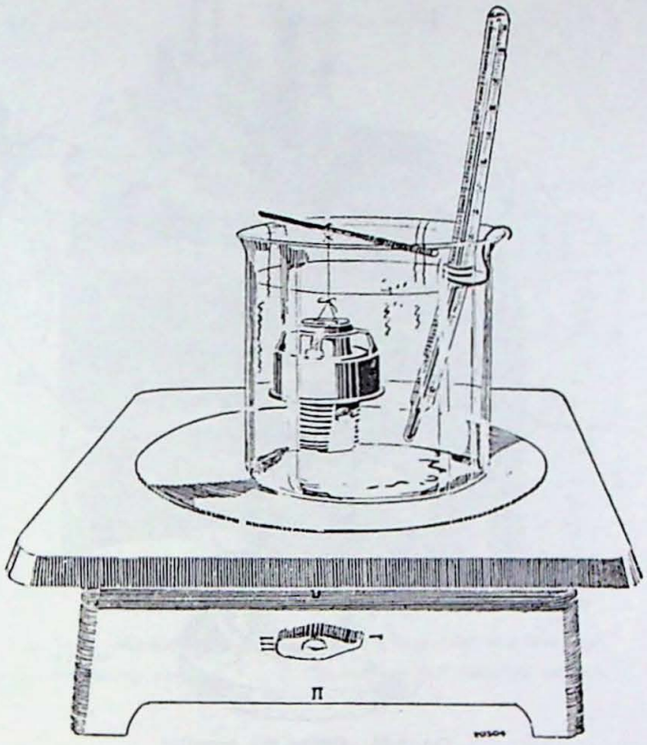


Fig. 1-82. Testing the thermostat

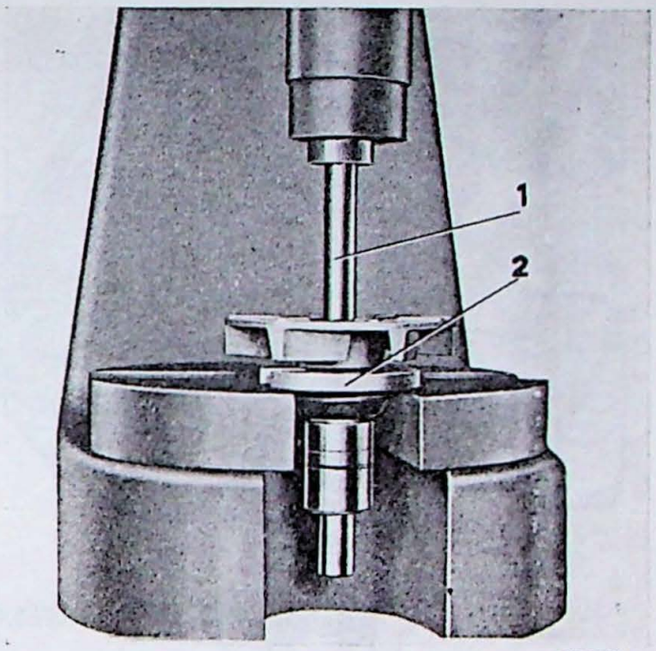


Fig. 1-84. Removing the impeller from the shaft
1. SVO 2266 2. SVO 2429

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.

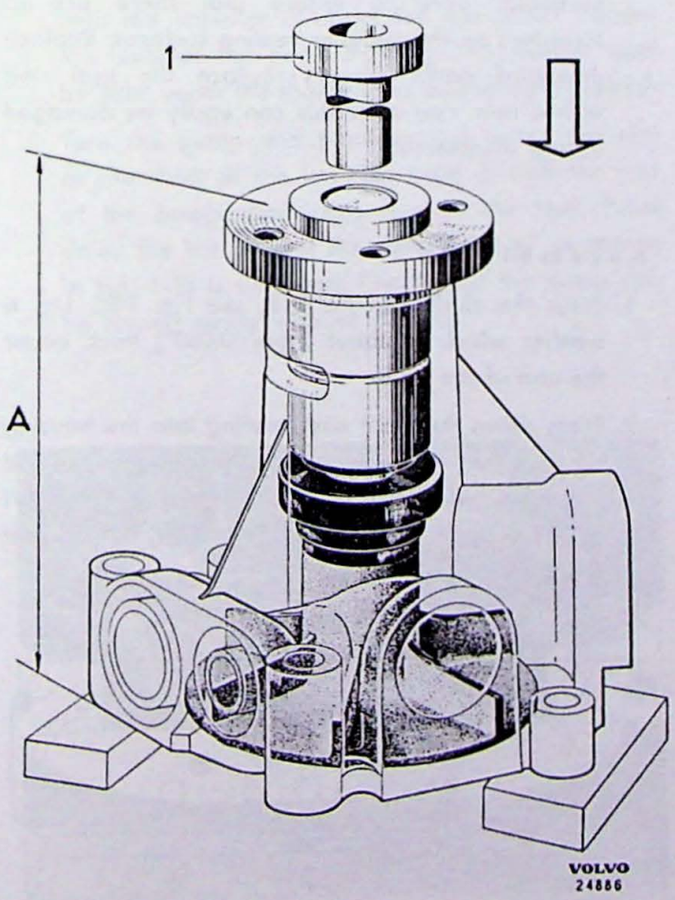


Fig. 1-83. Removing the shaft and impeller
1 = Tool SVO 2266
A = 105±0.2 mm (4.134±0.008") when the pump is assembled

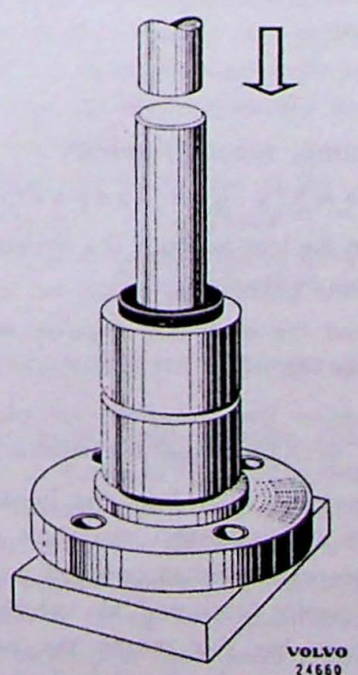


Fig. 1-85. Fitting the hub

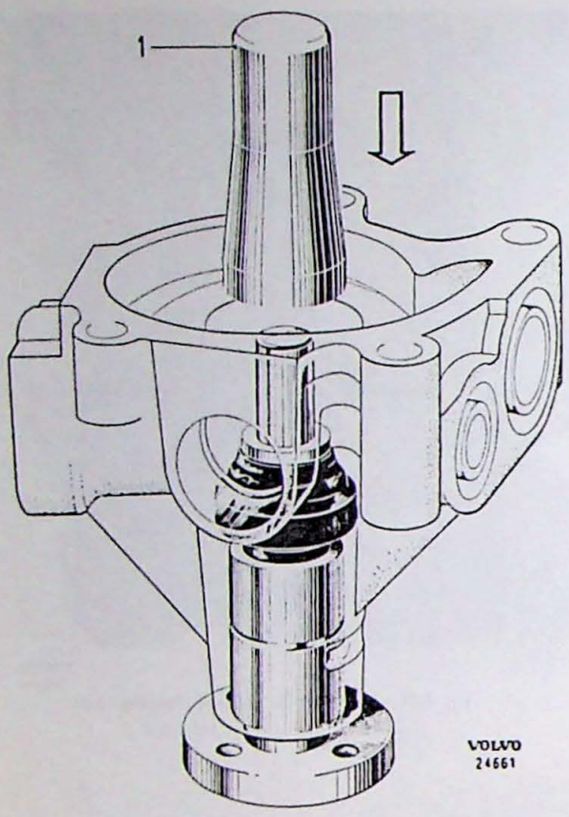


Fig. 1-86. Fitting the seal ring
1 = Tool SVO 2430

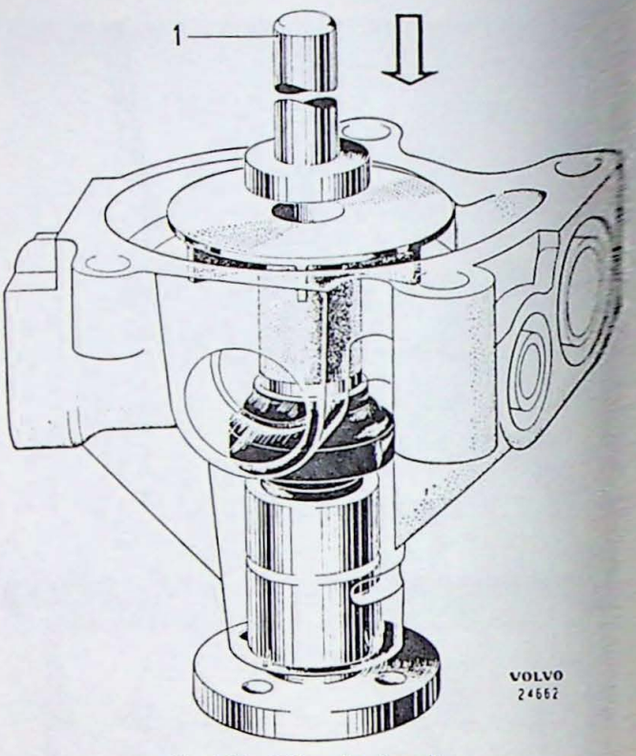


Fig. 1-87. Fitting the impeller
1 = Tool SVO 2266

Thermostat

The thermostat can be tested after it has been removed, in a vessel full of water which is heated up. See Fig. 1-82.

The thermostat should open and close at the temperatures shown in the specifications.

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

Water pump, reconditioning

Disassembly and inspection

1. Pull out the lock spring. Place the pump in a press as shown on Fig. 1-83.
2. Press out the shaft and impeller with tool SVO 2266. See Fig. 1-83.
3. Press down the seal ring and place the press washer SVO 2429 under the impeller, see Fig. 1-84.
4. Press out the shaft from the impeller. It is not possible to disassemble the shaft and bearings. They are assembled to one unit and the bearing is sufficiently lubricated to last the lifetime of the pump. For this reason the bearing should therefore not be immersed in fluid or heated up.
5. Check that the parts are in good condition, taking particular care to ensure that there are no scratches on the impeller sealing surfaces. Replace damaged parts. Always replace the seal ring with a new ring since this can easily be damaged during disassembly.

Assembly

1. Press the shaft into the hub, see Fig. 1-85. Lay a washer which is about 2 mm (0.080") thick under the end of the shaft.
2. Press down the shaft and bearing into the housing so that the outer sleeve of the bearing is level with the outer end of the pump housing. Exert pressure against the end of the shaft, not against the hub.

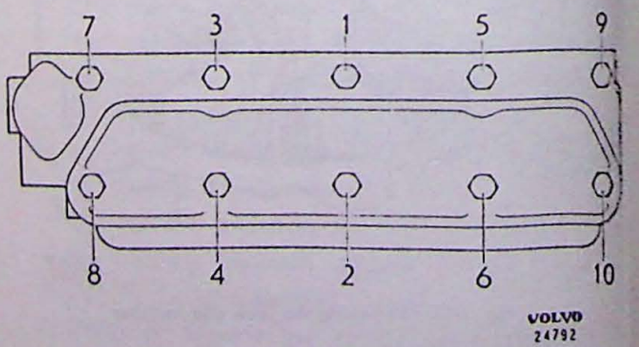


Fig. 1-88. The correct order to tighten the cylinder head bolts

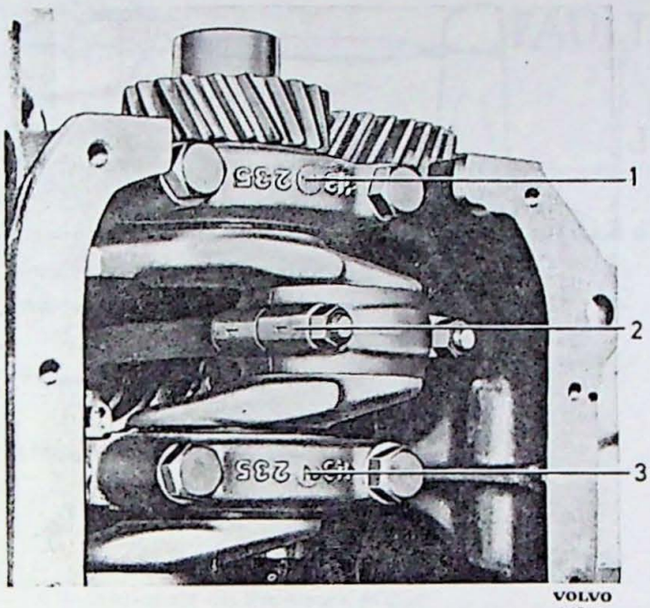


Fig. 1-89. Markings on the main and connecting rod bearings
1. Main bearing number 1 2. Connecting rod bearing number 1
3. Main bearing number 2

3. Fit the seal ring with tool SVO 2430, Fig. 1-86. Fit the lock spring.
4. Press on the impeller with tool SVO 2266 (Fig. 1-87) until the impeller is about 0.2 mm (0.008") under the level of the pump housing. The washer must be laid under the shaft end as mentioned in point 1.
5. Turn the pump and place a tool under the end of the shaft in the impeller hole so that the end of the pump shaft rests against the tool. Press down the hub so that the dimension "A" as shown in Fig. 1-83 is obtained. Check that the pump can be turned easily without chafing.

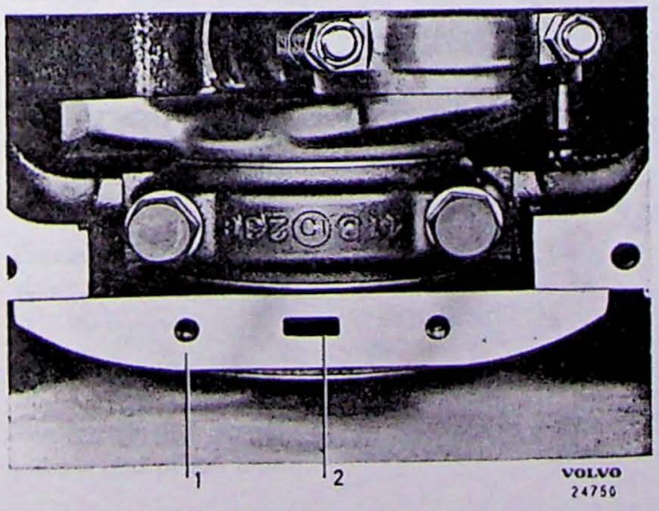


Fig. 1-90. Rear sealing flange
1. Flange 2. Drain hole

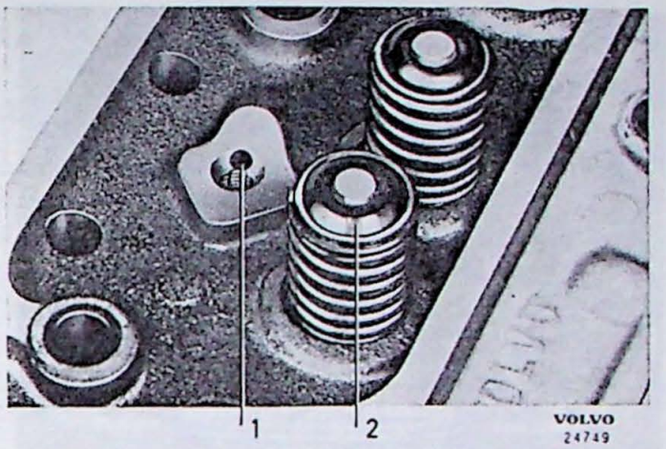


Fig. 1-91. Cylinder head
1. Oil hole 2. Rubber washer

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. 1-89. The main bearings are marked 1—5, the connecting rod bearings 1—4, starting from the front.

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. 1-90) are open and that the seals are in good conditions. Make sure also that the timing gear casing and flange are well centered.

Fit new connecting rods nut and bolts when reconditioning.

The cylinder head bolts must be tightened in a special order as shown in Fig. 1-88 in order to avoid unnecessary stresses. Check that the oil hole (1, Fig. 1-91) for the lubrication of the rocker arms is not blocked. The support bearing (5, Fig. 1-92) should be lubricated before fitting with heat-resistant bearing grease. The bearing is maintained in position by a lock ring (4).

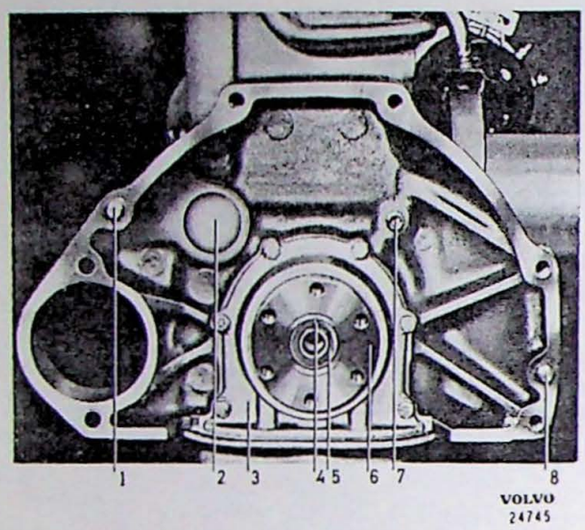


Fig. 1-92. Rear end of engine

1. Guide pin
2. Seal washer
3. Sealing flange
4. Lock ring
5. Support bearing
6. Crankshaft
7. Plug
8. Guide pin

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.

Exert pressure in the direction of the rotation of the engine and use a spring balance as shown in Fig. 1-93.

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.

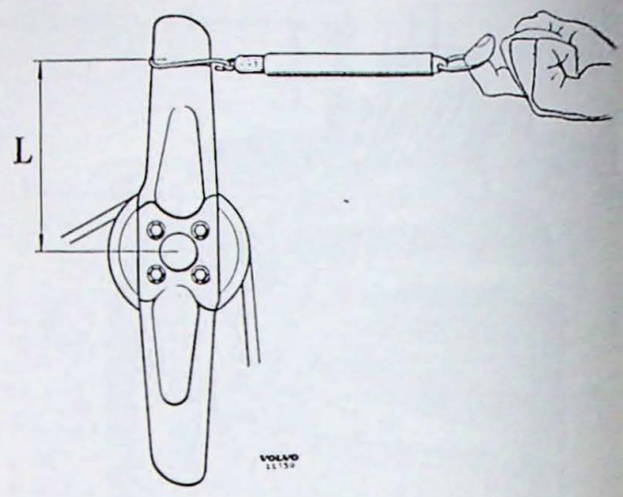


Fig. 1-93. Fan belt tension

L = 150 mm (6")

Force applied = 6.5—8.5 kg (14 1/2—19 lb.)

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 then usual. See the sections concerned in the instruction book.

If an engine test bench is accessible, 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 settings 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, replaced 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

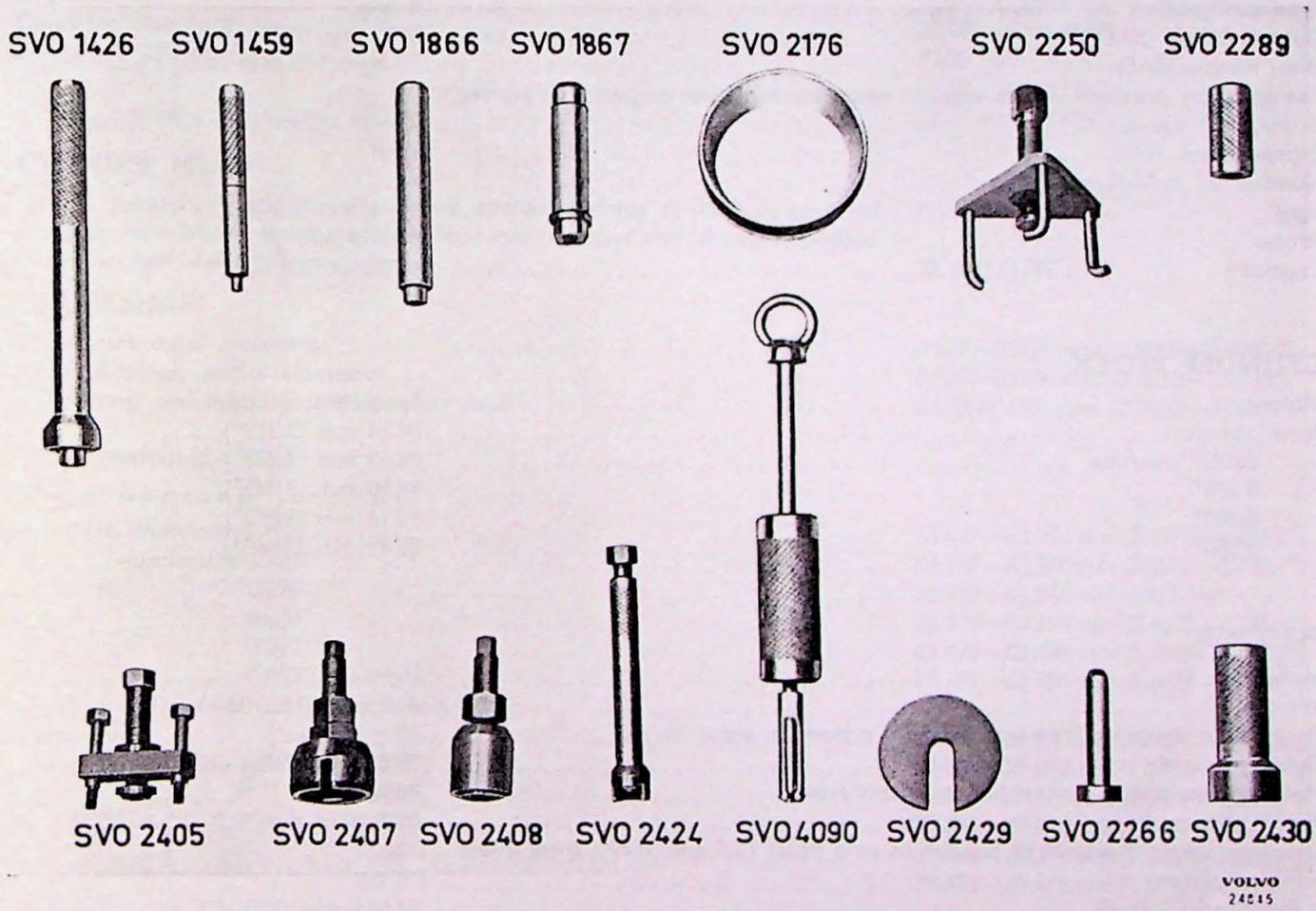


Fig. 1-94. Tools for engine

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 bearings
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

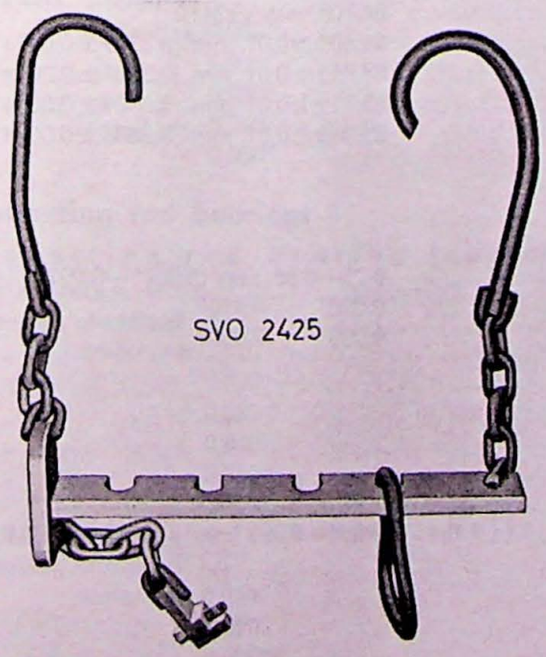


Fig. 1-95. Lifting tool for engine, SVO 2425

SPECIFICATIONS

GENERAL

Type designation	B 18 B
Output, b.h.p. (SAE)	100 b.h.p./5500 r.p.m.
Max. torque (SAE)	15 kgm (108 lb.ft.)/4000 r.p.m.
Compression pressure (warm engine) when turning over engine with starter motor, 200 r.p.m.	13—14 kg/cm² (184—200 lb./sq.in.)
Compression ratio	9.5:1
Number of cylinders	4
Bore	84.14 mm (3.313")
Stroke	80 mm (3.15")
Capacity	1.78 liter (109 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 g (15±0.18 oz.)
Permissible weight difference between pistons in same engine	10 g (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 (3.3104")
„ „ D	84.095 mm (3.3108")
„ „ E	84.105 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 (0.0021—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)	35 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 g (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")
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—0.3425")
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 (0.89")

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 type	SU-HS 6
Number of carburetors	2
Size (air intake diameter)	44.5 mm (1 3/4")
Fuel needle, designation	ST
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 setting, 97 octane Research Method, basic setting	5° before TDC
" " at 1500 engine r.p.m. (vacuum governor disconnected)	18° before TDC
Spark plugs	Bosch W225 T1 or corresponding types
Spark plugs, spark gap	0.7 mm (0.028")
" " tightening torque (steel washers)	4 kgm (29 lb.ft.)
" " (copper washers)	3.5 kgm (25 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	62±3°
Direction of rotation	Anti-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	9.5	68
Main bearings	12.5	90
Connecting rod bearings	6.5	47
Flywheel	6	43
Nut for oil cooler	3.0—3.5	22—25
Spark plugs with steel washers	4	30
Spark plugs with copper washers	3.5	25
Camshaft nut	15	108
Bolt for crankshaft pulley	8	58
Bolt for generator (3/8"—16)	4	30
Nipple for oil cooler and oil cleaner	4.5—5.5	32—39

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 key
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