Section 2

ENGINE

INDEX

TOOLS

Special tools are preceded by 999 or SVO (e.g. 999 2837 or SVO 2837).

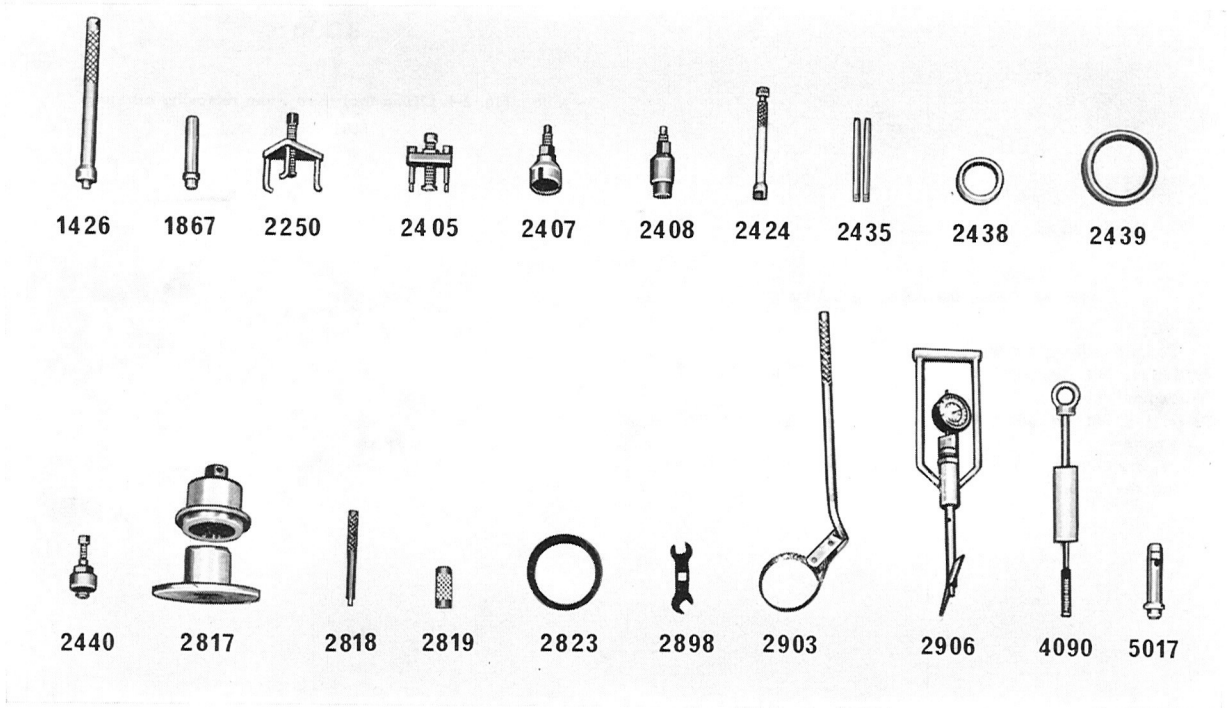


Fig. 2-1. Tools for engine

999 (SVO)
1426 Drift for installing pilot bearing
1867 Drift for removing and installing bushing in rocker arm
2250 Puller for camshaft gear
2405 Puller for crankshaft gear (SVO 2822 can be used as alternative)
2407 Press tool for installing crankshaft gear
2408 Press tool for installing camshaft gear
2424 Grip tool for removing and installing valve tappets
2435 Guide pins (2) for installing cylinder head
2438 Centering sleeve for timing gear cover and installing ring circlip

999 (SVO)
2439 Centering sleeve for rear sealing flange and installing felt ring circlip
2440 Puller for crankshaft hub
2817 Drift for installing crankshaft oil seal on engine rear end (rubber lips seal)
2818 Drift for removing valve guide
2819 Drift for installing valve guide
2823 Ring for installing standard piston
2898 Wrench 11/16″ for final-tightening of cylinder head bolts
2906 Fan belt tensioner
4090 Drift for removing and installing connection rod bushing
5017 Drift for removing and installing connecting rod bushing

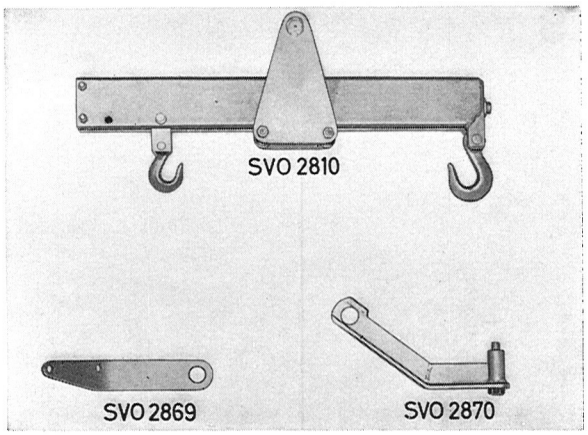


Fig. 2-2. Tools for removing engine

999 (SVO)
2810 Beam for lifting out and installing engine
2869 Lifting lug for attaching lifting beam 2810 in front end of engine
2870 Lifting lug for attaching lifting beam 2810 in rear end of engine
(The previous lifting tool 2425 can also be used for lifting out and installing the engine)

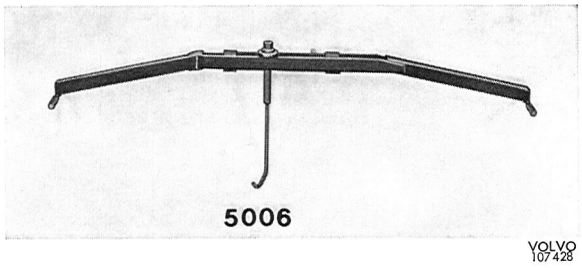


Fig. 2-4. Lifting tool used when removing oil sump.

5006 Lifting tool

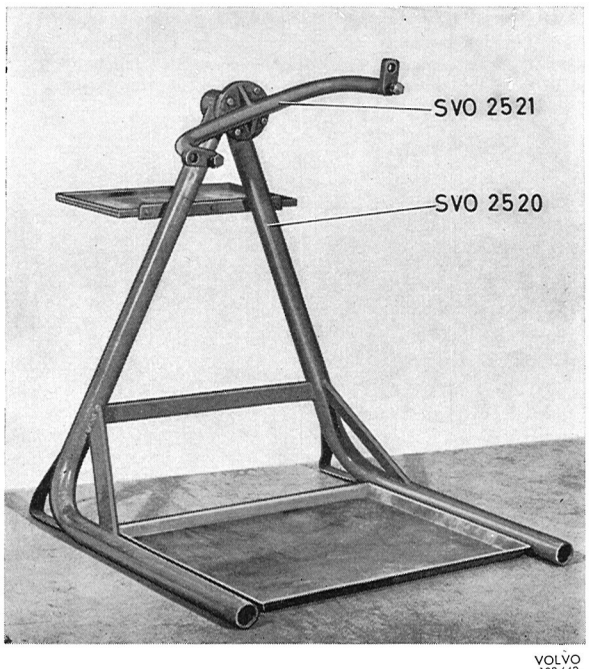


Fig. 2-3. Stand 2520 and fixture 2521 for engine

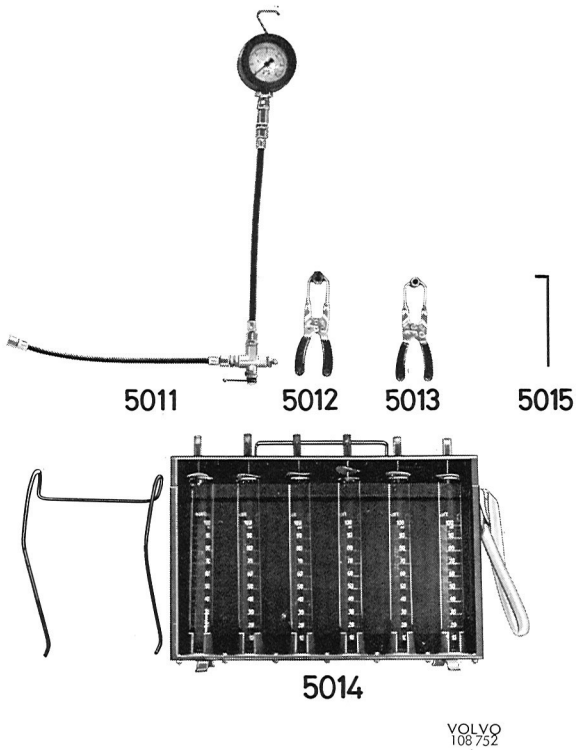


Fig. 2-5. Special tools for B 20 E/F

999 (SVO)
5011 Pressure gauge, for testing line pressure and control pressure
5012 Tool, for installation of nylon hoses 5 and 8 mm diam.
5013 Same, but for 10 mm diam. hose
5015 Gauge, for checking injected fuel quantity for each injector
5015 Wrench 3 mm, for CO adjustment

GROUP 20

GENERAL

GENERAL INFORMATION

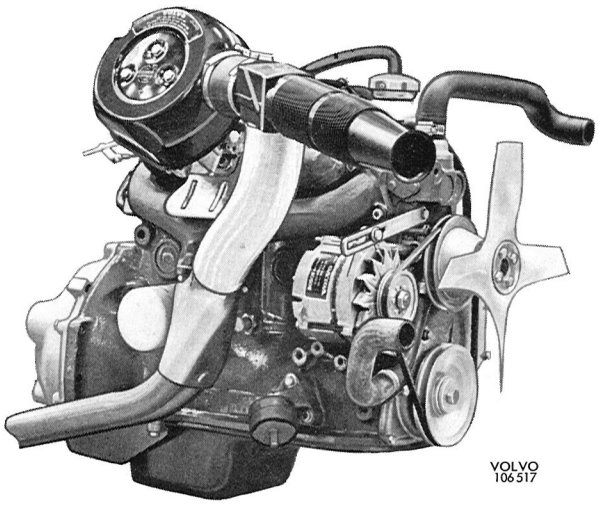


Fig. 2-6. Engine B 20 A viewed from right

The B 20 engine has four type designations: B 20 A (Figs. 2-6 and 2-7), B 20 B (Figs. 2-9 and 2-10) and B 20 E, B 20 F (Figs. 2-11 and 2-12).

The engine is a four-cylinder, water-cooled, overhead-valve unit with positive crankcase ventilation. The crankshaft is journalled in five bearings.

The difference in output between the various engines arises mainly from different camshafts and compression ratios. The engines have a fuel system with low pollutant exhaust gases.

The B 20 A engine is equipped with a single horizontal carburetor, while the B 20 B unit has two horizontal carburetors.

The B 20 E and B 20 F have fuel injection system, called CI system.

On certain cars, the engine has a slip coupling type fan.

Engine output is shown in Figs. 2-8 and 2-13 and specifications.

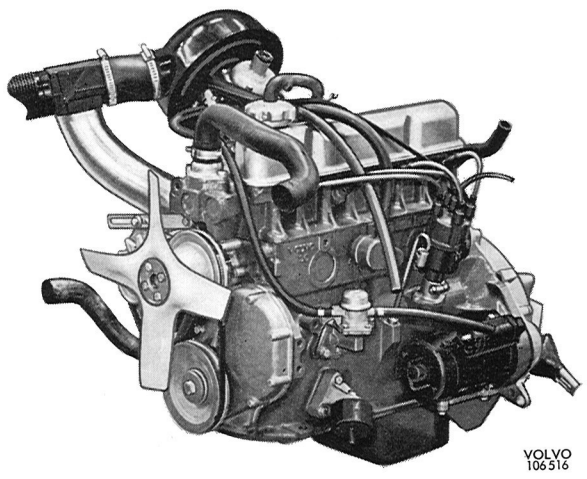


Fig. 2-7. Engine B 20 A viewed from left

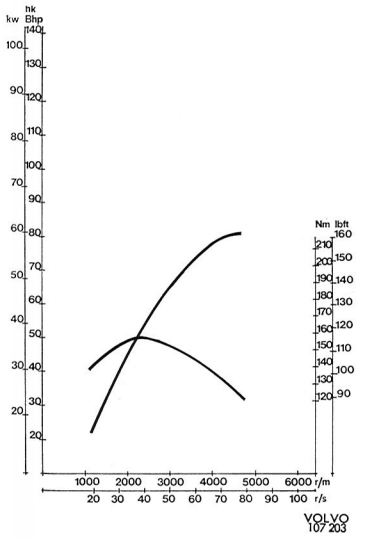


Fig. 2-8. Output and torque curves, B 20 A (DIN)

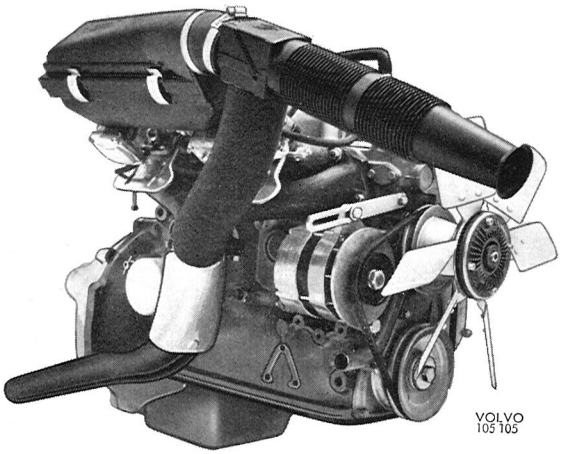


Fig. 2-9. Engine B 20 B viewed from right

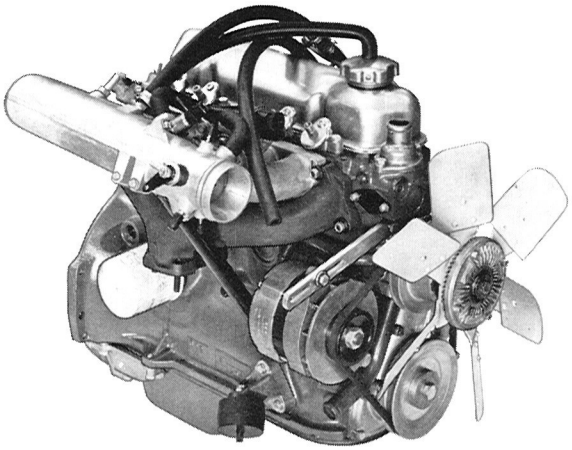


Fig. 2-11. Engine B 20 E (B 20 F) viewed from right

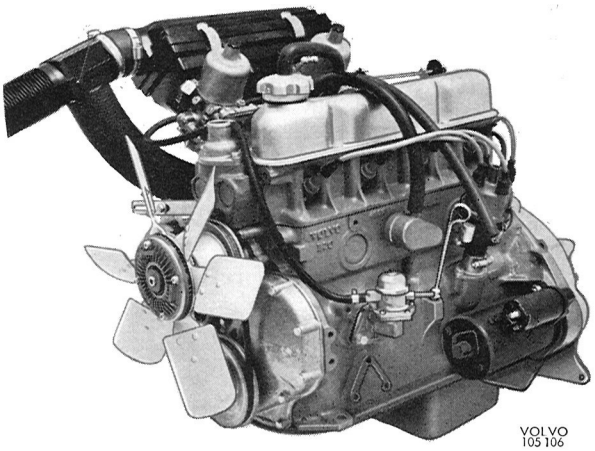


Fig. 2-10. Engine B 20 B viewed from left

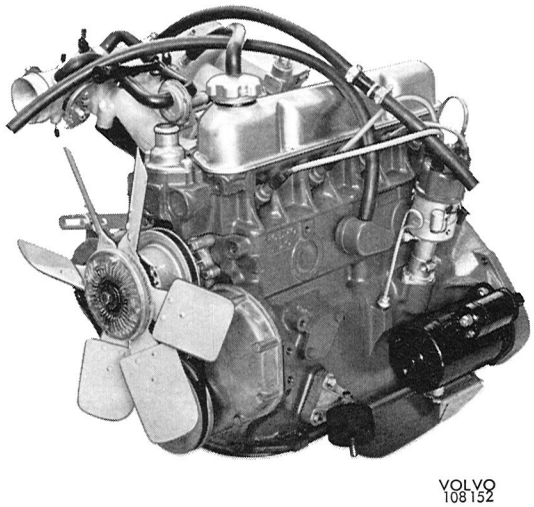
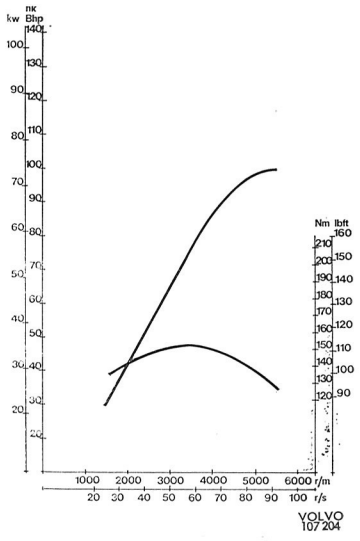
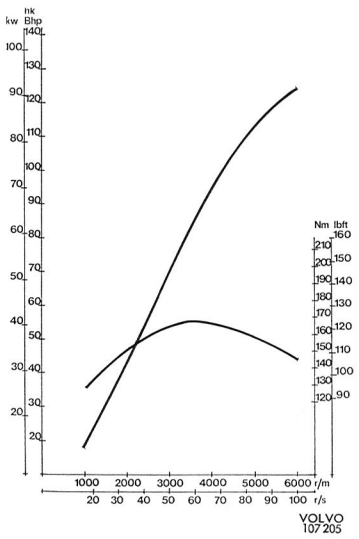


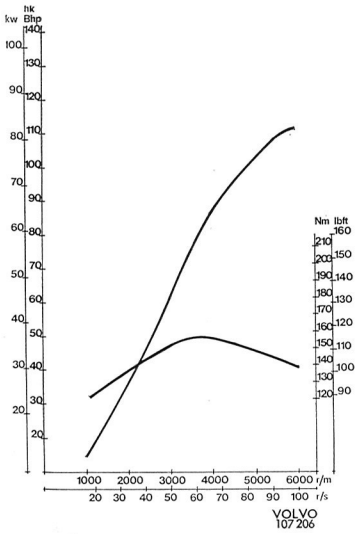
Fig. 2-12. Engine B 20 E (B 20 F) viewed from left



B 20 B (DIN)

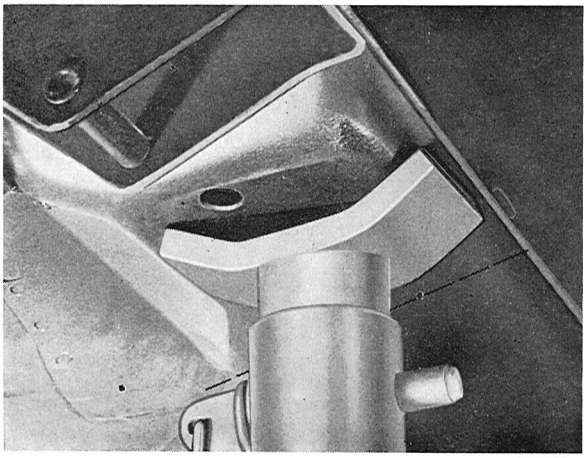


B 20 E (DIN)



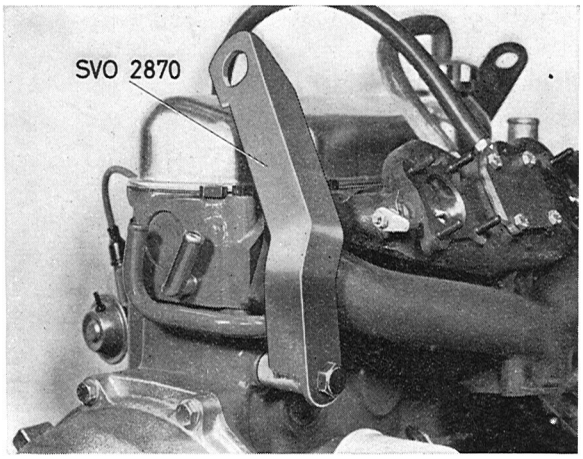
B 20 F (SAE J 245)

Fig. 2-13. Output and torque curves



VOLVO 101791

Fig. 2-14. Location of axle prop



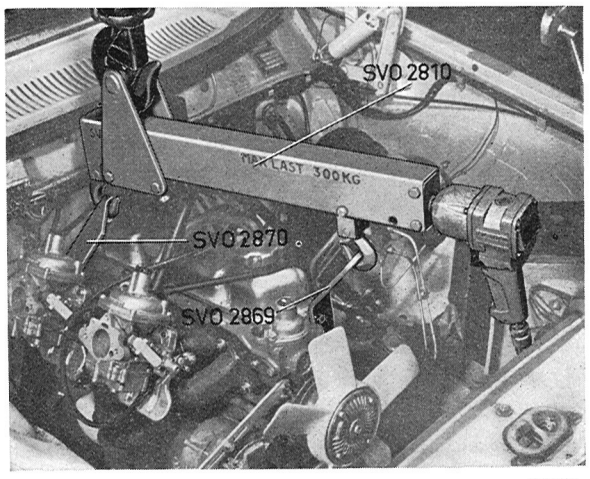
VOLVO 103735

Fig. 2-16. Lifting lug on engine rear end

REMOVING ENGINE, B 20 A, B 20 B

Engine, remove, install replacement unit=Volvo Standard Times Op. No. 20114

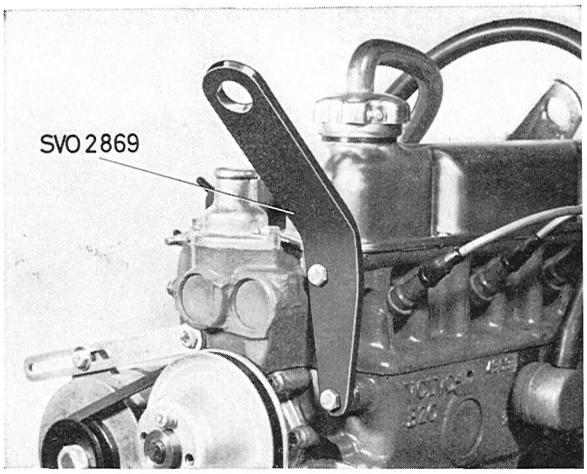
1. Remove the gear lever.
2. Remove the hood from the hinges.
3. Empty the coolant.
4. Disconnect the battery plus cable.
   Remove the distributor cap and the ignition leads from the spark plugs. Remove the electric wire from the distributor. Remove the ignition coil and place it on the one side.
5. Disconnect the fuel hoses from the pump and plug the hose. Remove the electric cables from the starter motor.
6. Remove the air cleaner with air cleaner cover and lift if forwards together with the attached hoses. Remove the electric wires from the alternator and also the temperature and oil pressure units.



VOLVO 103733

Fig. 2-15. Lifting out engine

   Disconnect the electric wire for the back-up lights in the jack box (Remove the wire for the overdrive.)
7. Remove preheating plate and attaching nuts for exhaust manifold flange.
8. Remove throttle cable from the throttle control shaft. Remove throttle control shaft. Remove choke wire from the carburetor and vacuum hose for brake servo from the manifold. Disconnect water hoses for heater element from the engine.
9. Disconnect hose for expansion tank as well as lower radiator hose from the radiator. Remove upper radiator hose from the engine and finally the radiator.
10. Fit lifting arm 2867 to the front end of the engine as shown in Fig. 2-17 and lifting arm 2870 to the engine rear end as shown in Fig. 2-16.
11. Drain engine oil. Remove the lower nuts from the engine front mountings. Install the engine hoist unit with lifting beam 2810 and move the block runner to the rear end of the lifting beam, see Fig. 2-15. (Use a nut puller for this adjustment).
12. Remove return spring and clutch wire from the lever and clutch wire sleeve from the clutch casing.
13. Disconnect the ground cable from the engine.
14. Remove exhaust pipe clamp from the bracket. Remove gearbox member.
15. Remove speedometer hose.
    Remove propeller shaft from the gearbox.
16. Hoist engine with the lifting unit, lowering at the same time engine rear end by adjusting



VOLVO
103738

Fig. 2-17. Lifting lug on engine front end

block unit on the lifting beam. Pull the engine forwards across the front member while raising it at the same time. Level out engine and gearbox and pull the entire unit forwards.

INSTALLING ENGINE, B 20 A, B 20 B

1. Install lifting arm 2869 and arm 2870. Install the engine in position with lifting beam 2810.
   NOTE: Check that the exhaust manifold does not come into contact with the oil filter.
2. Install the gearbox member.
3. Install the ground cable. Install speedometer hose as well as propeller shaft.
4. Remove lifting beam and lifting lugs from the engine. Install the nuts for the engine front mountings.
5. Secure exhaust manifold together with gasket and install preheating plate.
6. Install the clutch wire sleeve and connect the wire to the lever. Install the return spring. Adjust the clutch according to Section 4 (41).
7. Install the clamp for the exhaust manifold. Lower the vehicle.
8. Connect the water hoses for the heater unit. Install the electric wires to the temperature and oil pressure senders as well as the alternator. Connect the electric wire for the back-up light in the rapid contact. (Connect the wire for the overdrive.)
9. Connect the vacuum hose. Install the throttle control shaft, the throttle cable, the choke wire as well as the air cleaner housing. Connect the hoses to the air intake and preheating plate respectively.
10. Connect the electric cables to the starter motor and connect fuel hose.
11. Install ignition coil, distributor cap and the ignition leads as fell as the electric wires.
12. Install radiator and connect radiator hoses and hose for expansion tank. Fill coolant and engine oil.
13. Install the hood and connect the battery cable. Install the gear lever. Check function and for leakage.

REMOVING ENGINE, B 20 E, B 20 F

1. Remove the gear shift lever.
2. Remove the hood.
3. Disconnect the battery plus cable.
4. Place a pan under the engine and drain the coolant by loosening the lower radiator hose.
5. Disconnect following fuel hoses: 1 rubber hose to the control pressure regulator, 2 plastic hose from control pressure regulator at the fuel distributor, 3 hose at the cold start injector, 4 hose at the fuel filter, 5 fuel return hose at the fuel distributor.
6. Remove pipe connecting air cleaner and intake manifold.
7. Disconnect wires from cold start injector, control pressure regulator, auxiliary air valve, coolant temperature sensor and thermal time switch at the engine side.
8. Disconnect the control pressure regulator ground wire.
9. Disconnect the four fuel hoses at the injectors.
10. Disconnect the throttle cable at the throttle and the intake manifold.
11. Disconnect the oil pressure sender wire and alternator wires.
12. Disconnect the heater hoses at the firewall.
13. Disconnect the brake vacuum booster hose at the intake manifold and the crankcase ventilation hose at the air cleaner.
14. Disconnect the ignition wires at the spark plugs and the distributor. Remove the distributor cap. Disconnect the distributor wire.
15. Disconnect the starter cable.
16. Disconnect the hose at the thermostat housing.
17. Remove the fan cover. Disconnect the hose from the radiator at the expansion tank.
18. Remove the radiator grille. Remove radiator screws, lift out the radiator and the fan cover.
19. Vehicle with combined unit: remove the vacuum hose at the intake manifold.

20. Remove the thermal time switch at the right side of the engine block.
21. Install lifting lug 2870 on engine rear end and lifting lug 2869 on the engine front end, see Figs. 2-16 and 2-17.
22. Jack up the vehicle and put it on stands.
23. Drain the engine oil.
24. Remove nuts and washers for front and rear mounts.
25. Remove the exhaust flange nuts. For a vehicle equipped with Exhaust Gas Recirculation: remove the EGR valve pipe.
26. Attach lifting beam 2810 to the lugs and adjust the trolley to the rear position. Lift the engine rear end, see Fig. 2-18.

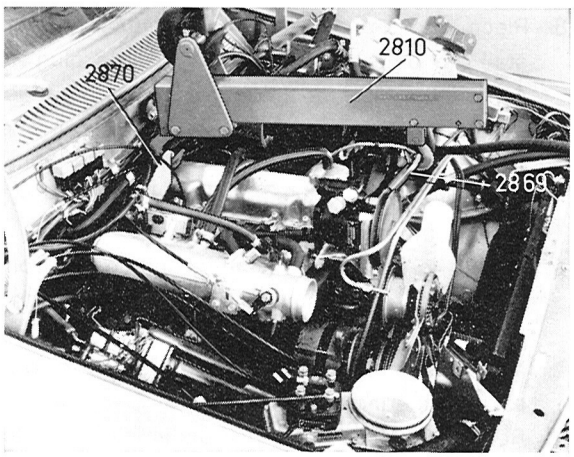


Fig. 2-18. Lifting out engine

27. Disconnect the engine ground strap. Remove clutch spring and clutch cable.
28. Remove front exhaust clamp. Remove transmission member.
29. Remove speedometer wire at the transmission and electrical wires.
30. Remove the propeller shaft at the transmission flange.
31. Lift the engine slightly. Lower the engine rear end by adjusting the trolley forwards. Pull the engine forwards and lift it at the same time.

INSTALLING ENGINE, B 20 E, B 20 F

1. Install the lifting lugs on the engine and hoist the engine to position in the engine compartment.
2. Connect speedometer cable and transmission electrical wires.
3. Attach the propeller shaft.
4. Install transmission member and front exhaust pipe clamp.
5. Re-connect the engine ground strap. Install clutch wire and spring.
6. Check that the engine is in place and resting on the engine mounts. Unhook the lifting beam.
7. Install washers and nuts for the engine mounts.
8. Install the exhaust pipe flange. For vehicles equipped with Exhaust Gas Recirculation: attach the pipe for the EGR valve.
9. Jack up the vehicle, remove the stands and lower the vehicle to the ground.
10. Install the thermal time switch on the engine side.
11. For vehicles equipped with combined unit: connect the hose at the intake manifold.
12. Locate the fan cover over the fan. Install the radiator. Install the radiator grille. Install the fan cover on the radiator.
13. Connect the hose from the expansion tank and the upper radiator hose.
14. Reconnect the starter cable.
15. Reconnect distributor wire. Install rotor and distributor cap. Reconnect high tension leads to spark plugs and ignition coil.
16. Connect the heater hoses at the firewall.
17. Connect the brake vacuum booster hose and the crankcase ventilation hose.
18. Reconnect oil pressure sender wire and alternator wires.
19. Install the throttle cable.
20. Reconnect the four fuel hoses to the injectors.
21. Reconnect the control pressure regulator ground wire. Reconnect cold start injector, control pressure regulator, auxiliary air valve, temperature sensor and thermal time switch wires.
22. Reconnect fuel hoses to control pressure regulator and fuel distributor.
23. Reconnect fuel hoses to fuel filter, cold start injector and the fuel return hose to the fuel distributor.
24. Install pipe between air filter and intake manifold.
25. Install lower radiator hose and fill coolant.
26. Fill engine oil.
27. Reconnect the battery plus cable.
28. Install the hood.
29. Install the gear shift lever.

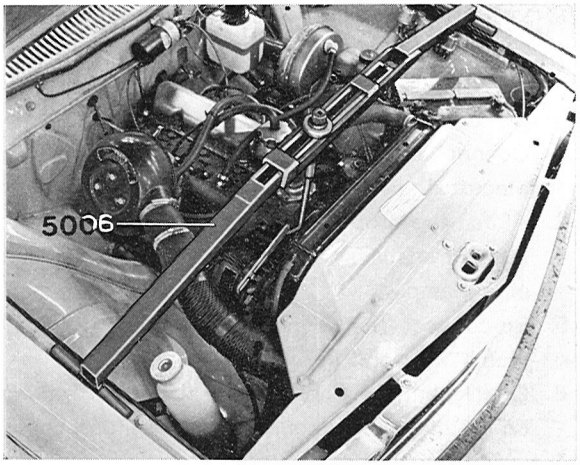


Fig. 2-19. Lifting tool 5006

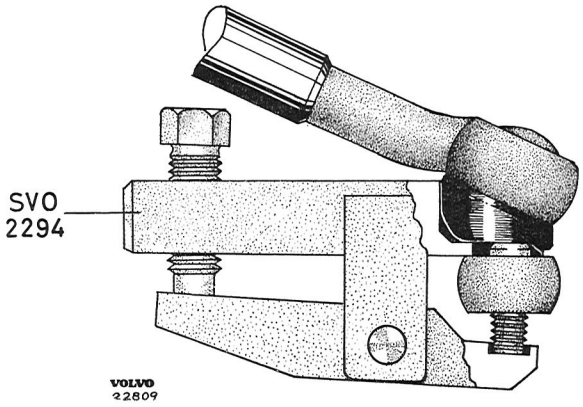


Fig. 2-20. Removing steering rod

REPLACING SUMP GASKET

1. Place the lifting tool 5006 shown in Fig. 2-19 and hook the hook round the alternator tensioning bar next to the engine block. Raise the front end of the engine until there is no weight on the engine mountings. Remove the oil dipstick.
2. Jack up the vehicle and put stands under the front jack points. Drain the engine oil.
3. Remove the lower nuts for the engine mounts. Remove the steering rods from the pitman arm and relay arm with tool 2294 according to Fig. 2-20.
4. Place a jack under the front axle member. Remove the rear bolts on the front axle member and screw on instead two auxiliary bolts (UNC 1/2—13×114). Remove the front bolts for the front axle member. Lower and remove the jack so that the front axle member is suspended in the two auxiliary bolts.
5. Remove the plug for the oil temperature gauge and reinforcing bracket at the flywheel housing.
6. Remove the bolts for the sump and lift off the sump.
7. Remove the old gasket and clean the contact surfaces of cylinder block and sump.
8. Place sump and gasket in position and install the bolts. Tighten well the drain plug as well as the plug for the oil temperature gauge.
9. Place the reinforcing bracket in position and tighten all the bolts by and. Screw in firmly the bolts in the flywheel housing and then the bolts in the cylinder block.
10. Raise the front axle member, tighten the front bolts. Remove the auxiliary bolts. Install and tighten the rear bolts.
11. Install the nuts for the engine mounts as well as the steering rods.
12. Remove the blocks from under the vehicle. Remove the lifting tool. Install the bolt (with washer) for the timing gear cover.
13. Top up with oil and insert the oil dipstick.
14. Start the engine and check for leakage.

GROUP 21

ENGINE

GENERAL INFORMATION

CYLINDER BLOCK

The cylinder block (Illustration A) is made of special cast iron and is cast in a single unit. The cylinder bores, which are surrounded by cooling jackets, are machined directly in the block. The oilways in the block are arranged so that the oil filter, of the full-flow type, is directly attached to the right side of the block. A reinforcing bracket is mounted to the cylinder block and timing gear cover for taking up vibrations, see Fig. 2-21.

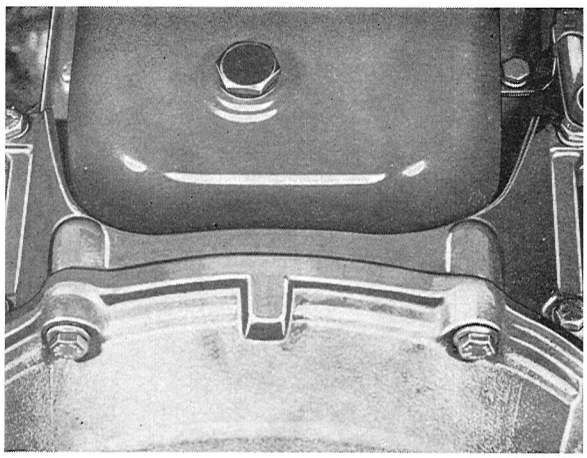


Fig. 2-21. Reinforcing bracket, cylinder block—flywheel housing

CYLINDER HEAD AND VALVES

The cylinder head is secured to the block by bolts. All the combustion chambers are machined throughout and have separate inlet and exhaust ports, one for each valve.

The valves, which are suspended in the cylinder head, are made of special steel and carried in replaceable guides. The valve stems are chromed. The valve collet is provided with three lands and the valve with corresponding grooves, which hold the valve but also make suitable rotation possible. (Compare with Fig. 2-33). The valves are provided with valve guide rubber seals, which are mounted on the guides.

The cooling jackets are designed so that the air around the spark plugs is also cooled. Water distribution is by means of a pipe, the water being directed towards the warmest parts of the engine.

The difference in compression between the engines is due to different cylinder head gasket thicknesses and different cylinder heads.

CRANKSHAFT AND BEARINGS

The crankshaft is made of steel and has ground, case-hardened bearing journals. It is carried in five main bearings, the rear flange bearing also functions as a pilot bearing axially. There are drilled oilways in the crankshaft for the lubricating oil.

The bearing shells, which are replaceable, consist of a steel backing with indium-plate lead-bronze bearing metal.

CAMSHAFT AND VALVE TAPPETS

The camshaft is made of special-alloy cast iron and has case-hardened cams. It is driven from the crankshaft through a gear train which has a ratio of 1:2. Camshaft axial location is maintained by a bronze axial washer located at the front end of the camshaft. Axial play is determined by a spacer ring behind the camshaft gear, which has a steel hub.

The valve tappets are actuated directly by the camshaft. They are located in holes in the block above the camshaft and transfer movement to the valves by means of push rods and rocker arms. There are no inspection covers for the valve tappets since these are accessible after the cylinder head has been removed.

CONNECTING RODS, PISTONS AND PISTON RINGS

The connecting rods are made of drop-forged steel and are provided with a precision-machined bushing which acts as a bearing for the piston pin. The big-end bearing shells are precision-manufactured and are replaceable.

The pistons are made of light-alloy and have two compression rings and one oil scraper ring. The upper compressing ring is chromed in order to reduce cylinder wear.

The piston pin has a floating fit in both the piston and connecting rod. The axial movement of the piston pins is limited by circlips in the piston pin hole.

POSTIVE CRANKCASE VENTILATION

This arrangement prevents crankcase gases from being released into the atmosphere. They are instead sucked into the engine through the intake manifold and take part in the combustion process. The residue is blown out through the exhaust pipe together with the other combustion residues.

Between the valve cover and the intake manifold there is a hose (4, Fig. 2-22). It is connected to the intake manifold by a calibrated nipple (3). (This nipple should be cleaned every 40.000 km = 24.000 miles. Between the oil trap, which is connected to the crankcase, and the air cleaner there is a hose (2) connected for the fresh-air supply. At the connection to the oil trap there is a flame arrester (5), which consists of a metal filter. The partial vacuum which arises in the intake manifold when the engine is running, causes a partial vacuum in the valve cover and crankcase through the hose (4). Fresh air is supplied to the crankcase through the air cleaner via the hose (2).

As the fresh air supply passes through the carburetor air cleaner, impurities are prevented from getting into the engine. Where there is a high or medium degree of partial vacuum in the crankcase (intake manifold), which happens during idling and when operating under a light load, the system functions as described above. When the partial vacuum in the crankcase is less than that in the air cleaner, which occurs at full load and/or with large flow quantities, no fresh air is supplied. Instead the flow in the connection between the flame arrester and air cleaner reverses and the crankcase gases go both ways, partly through the hose (4) and partly through the air cleaner and carburetor to the intake manifold. In this way, the crankcase ventilation system can deal with relatively large quantities of crankcase gases without any escaping into the atmosphere.

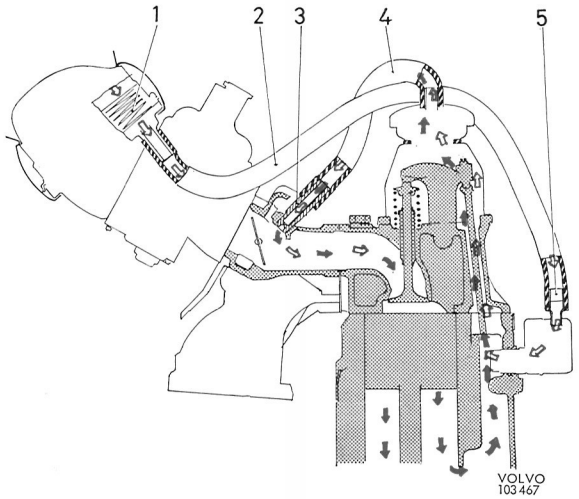


Fig. 2-22. Positive crankcase ventilation

1. Cleaner insert
2. Hose for fresh air supply
3. Nipple
4. Hose for crankcase gases
5. Flame arrester

SERVICE PROCEDURES

DISASSEMBLING ENGINE

After the engine has been lifted out of the vehicle, disassembling is as follows. (Instructions for the individual parts are under the separate headings concerned.)

1. Place the engine on stand 2520 with fixture 2521 (see Fig. 2-23). Check that the oil has been drained.
2. Remove the starter motor and reinforcing plate on the lower front edge of the flywheel housing. Remove the flywheel housing together with the transmission and then remove clutch and flywheel.
3. Remove the rear flange, taking care not to damage the contact surfaces, thereafter the alterna-

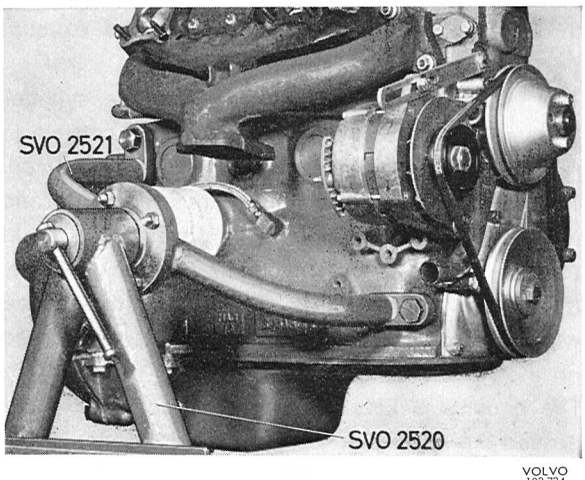


Fig. 2-23. Engine on stand

tor, water pump and distributor, valve cover, rocker arms, manifold, cylinder head and oil filter.

Remove valve tappets with tool 2424, see Fig. 2-24.

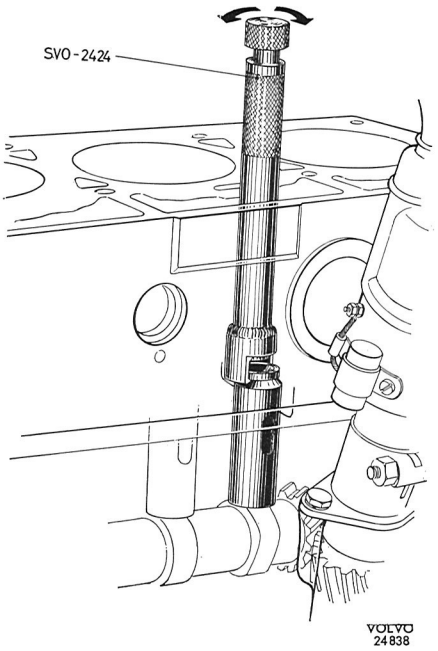


Fig. 2-24. Removing valve tappets

4. Remove the timing gear cover and the timing gears. Regarding tools, see under the heading "Replacing timing gears". Remove the camshaft.
5. Remove the carbon ridge from the cylinder bores. Remove the sump, oil pump and connecting rods with pistons. Replace the caps correctly on their respective connecting rods.
6. Turn the engine upside down and remove the crankshaft. Replace the caps correctly in their respective positions.

CLEANING

After disassembling, all the parts should be thoroughly cleaned.

Pistons, light alloy parts and bearing shells must never be washed in caustic soda. Rinse the parts with warm water and blow them dry with compressed air after washing. Clean the oilways thoroughly. All sealing plugs at the oilway openings in the cylinder block must be removed during the cleaning process.

ASSEMBLING ENGINE

When assembling the engine, follow the instructions for the parts concerned. Check the marking of the bearings according to Fig. 2-25. The main bearings are marked 1—5, and the big-end bearings 1—4, counting from the front.

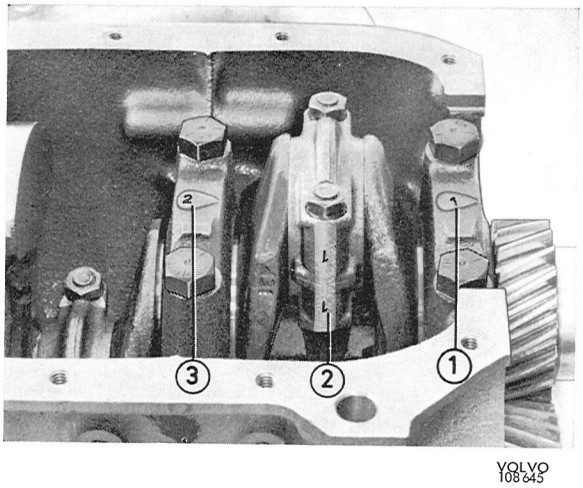


Fig. 2-25. Marking main and big-end bearings

1. Main bearing No. 1 2. Big-end bearing No. 1
3. Main bearing No. 2

Check that all parts are clean and lubricate sliding surfaces with oil before assembling. Always use new gaskets, cotter pins and lock washers.

No adhesive should be used on the gaskets.

The seals on the ends of both the oil pump delivery pipe and the water pump pipes are rubber rings, "O-rings". These rings, which seal radially, are made of special rubber with very close tolerances. Only genuine Volvo parts should be used. Installation is facilitated by coating the rings with soap solution. The rings are installed on the pipes and then pressed into their correct positions before the attaching bolts are tightened. The oil pump flange should lie flush against the cylinder block before tightening. The timing gear cover and rear seal flange must be accurately centered when installed. See under the headings "Replacing timing gear cover" and "Installing rear seal flange".

The big-end bearing bolts and nuts should be replaced with new ones when reconditioning.

The reinforcing bracket on the flywheel housing is installed according to point 9 under "Replacing sump gasket " (page 2:8).

The cylinder head is installed with the help of guide pins 2435. The bolts must be tightened in a certain sequence as shown in Fig. 2-28 in order to avoid unnecessary stresses. Check that the oil hole (Fig.

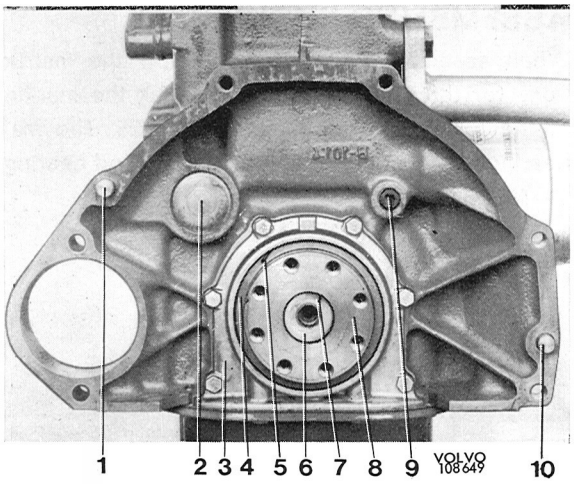


Fig. 2-26. Rear end of engine

1. Guide pin
2. Core plug
3. Sealing flange
4. Sealing washer
5. Circlip
6. Pilot bearing
7. Circlip
8. Crankshaft
9. Lug
10. Guide pin

2-27) for lubricating the rocker arms is clear. The pilot bearing (6, Fig. 2-26) should be lubricated before installation with heat-resistant ball bearing grease. The bearing and protecting washer are held in position by a circlip (6).

The most important bolts and nuts should be tightened with a torque wrench, see "Tightening Torques" in "Specifications". Re-tighten the cylinder head bolts. See "Valve grinding and decarbonizing". Use a cylinder head gasket of the right thickness, see "Specifications".

VALVE GRINDING AND DECARBONIZING, B 20 A, B 20 B

Volvo Standard Times Op. No. 21404

1. Drain the coolant from the radiator and cylinder block. To do this, remove the plug on the right-hand side of the engine and disconnect the lower radiator hose.
2. Disassemble the throttle control. Disconnect the choke control.
3. Remove air cleaner and carburetor.
4. Disconnect the exhaust pipe at the exhaust manifold and disconnect the hoses to the radiator as well as other connections to the cylinder head.
5. Remove valve cover, rocker arm shaft and push rods.
6. Remove the cylinder head bolts and disconnect the water pipe as well as the attachment on the rear exhaust manifold. Loosen the alternator tensioner arm. Lift off the cylinder head.

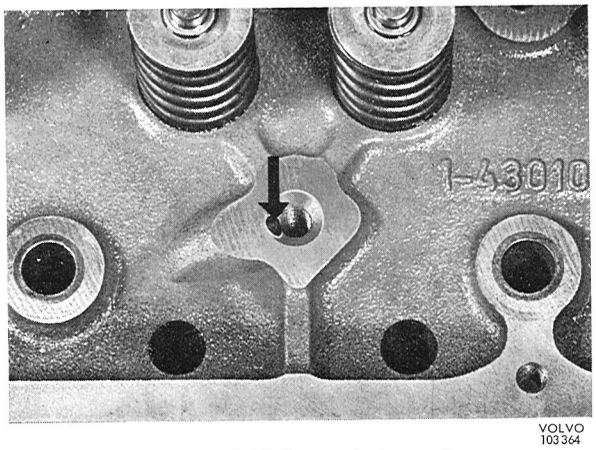


Fig. 2-27. Oil hole in cylinder head

7. Clean the piston, combustion chambers, inlet ports and exhaust ports very thoroughly. Do not use emery cloth since small grinding particles can get in between the piston and cylinder walls and consequently cause scoring.
8. Recondition the valve system as described under "Cylinder head and valves".
9. Install the valves. Screw the guide pins 2435 into the block, one in the front right-hand hole and the other in the left-hand rear hole, see Fig. 2-29. Install a new cylinder head gasket with the "TOP" upwards (wide edge). Install new seals for the water pump and the cylinder head. Screw out the guide pins and install the bolts in these holes as well. For tightening sequence, see Fig. 2-28. Tightening should be in three stages: 1st stage 40 Nm (29 lb ft), 2nd stage 80 Nm (58 lb ft); 3rd stage: after running the engine, see point 11.

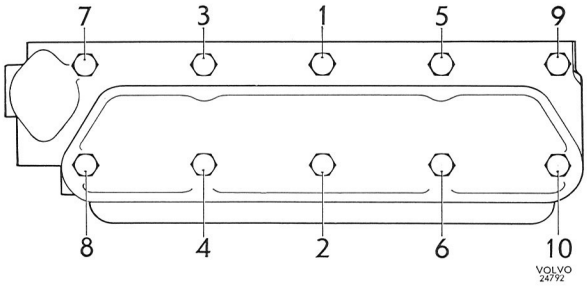


Fig. 2-28. Tightening sequence for cylinder head bolts

Install the other parts. Fill coolant according to the instructions under "Filling coolant when the system has been emptied".

11. Adjust the valve clearance for B 20 A .45—.50 mm (.018—.020″) and for B 20 B .55—.60 mm (.022—.024″). (Not final clearance.) Run the engine for 10 minutes. Re-tighten the cylinder head bolts to 90 Nm (65 lb ft) with tool 2889. Fig. 2-30. **Re-adjust** valve clearance according to "Specifications".

VALVE GRINDING AND DECARBONIZING, B 20 E, B 20 F

Volvo Standard Times Op. No. 21404

1. Drain the coolant from the radiator and cylinder block by removing the plug on the right side of the engine and, if necessary, disconnect the lower radiator hose.
2. Remove the positive lead from the battery.
3. Disconnect hoses to brake vacuum booster and crankcase ventilation.
4. Remove the cold start injector hose and the fuel return hoses on both sides of the T-connection (at the control pressure regulator).
5. Remove the outlet fuel hose at the fuel filter and remove fuel filter with clamp from the firewall.
6. Disconnect the fuel hose from the fuel distributor at the control pressure regulator.
7. Disconnect electrical wires at cold start injector, auxiliary air valve, control pressure regulator and temperature sensor.
8. Remove the air cleaner connecting pipe.
9. Disconnect the throttle cable at the intake manifold.
10. Disconnect hose for heater and the upper radiator hose.
11. Remove the alternator adjustment bracket.
12. Remove the straps for the injector hoses. Remove injectors with hoses from the cylinder head.
13. Remove the bracket for the intake manifold, remove the manifold.
14. Remove exhaust manifold from exhaust pipe and cylinder head.
15. Remove ignition leads and spark plugs.
16. Remove cover, rocker arm shaft and the push rods.
17. Remove the cylinder head bolts and lift off the head. Take off the cylinder head gasket, the flange gasket and the rubber rings for the water pump.
18. Clean piston crowns, combustion chambers, inlet ports and exhaust ports very thoroughly. Do not use emery cloth since small grinding particles can get in between the piston and cylinder walls and consequently cause scoring. Recondition the valve system as described under "Cylinder head and valves". Check that the oilway to the rocker arm mechanism on the valve tappet side in the middle of the head is clean. In the cylinder head oil goes up through the bolt hole, between the bolt and hollow partition, through a diagonal oilway to the attaching bolt for the rocker arm shaft and then up into the shaft.

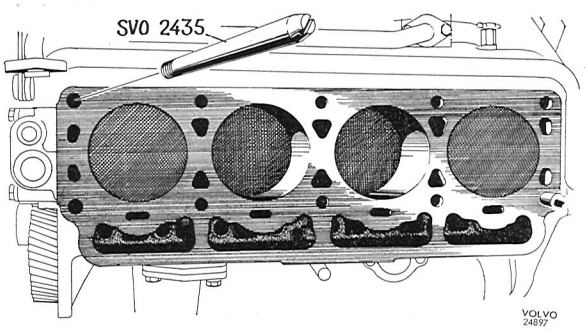


Fig. 2-29. Guide pins for cylinder head installation

19. Screw the guide pins 2435 into the block, one in the front right-hand hole and the other in the left-hand rear hole, see Fig. 2-29. Install a new cylinder head gasket with the "TOP" upwards (wide edge). Install a new inlet duct gasket and new seal for the water pump. Install the cylinder head. Screw out the guide pins and install the bolts in these holes as well. For tightening sequences, see Fig. 2-28. Tightening should be in three stages: 1st stage 40 Nm (29 lb ft); 2nd stage 80 Nm (58 lb ft); 3rd stage: after running the engine, see point 34.
20. Install push rods and rocker arm shaft. Adjust the valves to .45—.50 mm (.018—.020"). (Not final clearance.)
21. Install the rocker arm cover, the spark plugs and the ignition leads.
22. Attach the exhaust manifold to the cylinder head and connect the exhaust pipe.
23. Install the intake manifold with bracket.
24. Install injectors with hoses. Attach the hose straps.
25. Install the alternator adjustment bracket.
26. Connect heater hose and upper radiator hose.
27. Install the throttle cable.
28. Install the air cleaner connecting pipe.
29. Reconnect wires to cold start inejctor, auxiliary air valve, control pressure regulator and thermal time switch.
    Reconnect the control pressure regulator ground wire.
30. Reconnect brake vacuum booster hose and crankcase ventilation hose.
31. Install the hose for the cold start injector and the fuel return hoses on both sides of the T-connection (at the control pressure regulator).
32. Install fuel filter with clamp.
33. Connect the control pressure regulator hose at the fuel distributor.
34. Reconnect the battery cable.

35. Install the drain plug on the right side of the engine. Reinstall the lower radiator hose if it has been disconnected.
    Fill coolant.
36. Run the engine for 10 minutes. Re-tighten the cylinder head bolts to 90 Nm (65 lb.ft.) with tool 2898. Re-adjust valve clearance according to "Specifications".

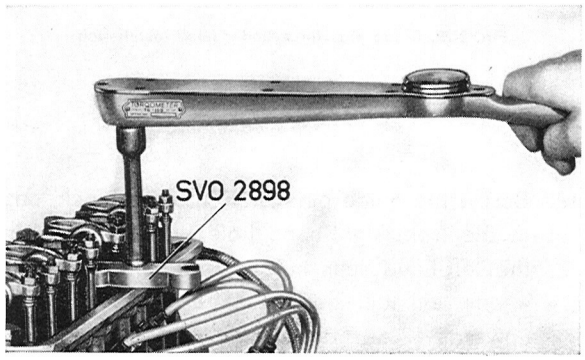


Fig. 2-30. Re-tightening cylinder head bolts

CYLINDER HEAD AND VALVES

DISASSEMBLY

1. Remove the valve springs by first compressing them with valve pliers and removing the valve collets, after which the pliers are released. Place the valves in order in a valve rack. Remove the valve guide seals.
2. Measure the clearance between stem and guide. With a new valve the clearance should not exceed .15 mm (.006″). Also check that the valves are not excessively worn. See "Specifications" under "Valve system" and "Wear tolerances".

CLEANING

Remove carbon and combustion deposits from the valves, combustion chambers and ports by using rotating brushes.

GRINDING VALVES AND VALVE SEATS

1. Grind the valves in a machine after they have been cleaned. Install new valves if the old ones are excessively worn.
2. Grind the valve seats. Use an electrically driven grinder or a hand milling cutter. A pilot spindle must be carefully installed before work is started and any worn guides must be replaced with new ones. The seat should be ground until a good sealing surface is obtained. The angle is 45° and the width of the sealing surface should be approx. 2.0 mm (.08″), see "A" Fig. 2-31. If

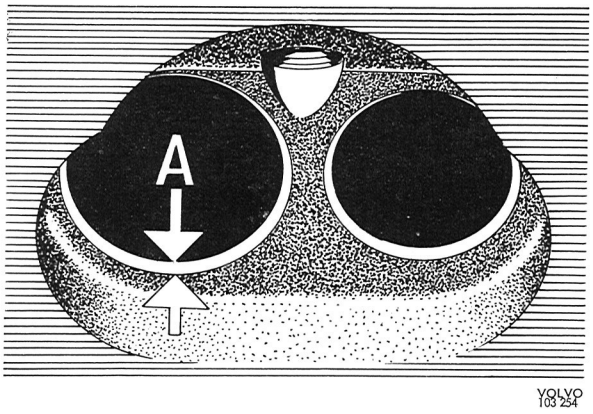


Fig. 2-31. Valve seat width A=2 mm (.08″)

the sealing surface is too wide after grinding, it can be reduced by using a 70° grinding stone from the inside and a 20° grinding stone from the outside.
3. Coat the valve sealing surfaces with a thin layer of fine grinding paste and lap in the valves against their seats.
   Then clean the valves and seats and check that good sealing is obtained.

REPLACING VALVE GUIDES

Volvo Standard Times Op. No. 21415

1. Press out the old guides with tool 2818.
2. Press in the new guides using drift 2819 which gives the correct depth, see Fig. 2-32. For the B 20 E/F engine a .4 mm (.016″) thick washer is placed between the tool and the cylinder head.

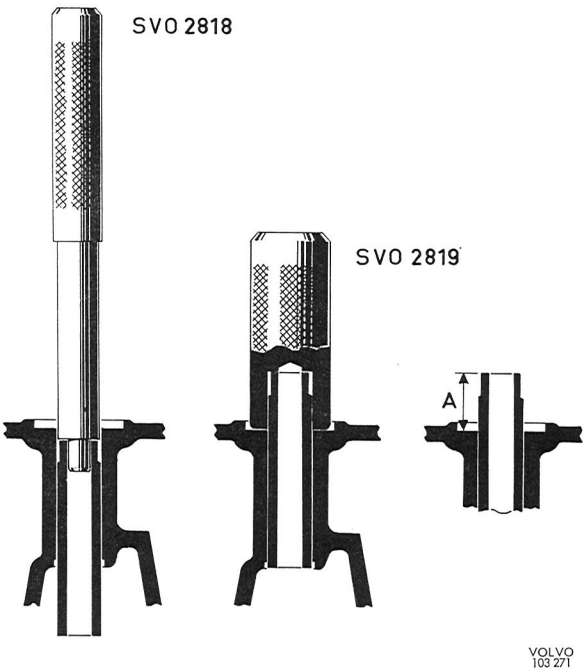


Fig. 2-32. Replacing valve guides
A=17.5 mm (.689″) For B 20 E/F, 17.9 mm=.705″)

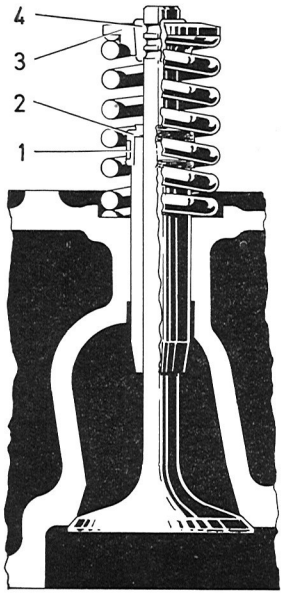


Fig. 2-33. Valve collet and valve guide seal

1. Metal ring
2. Rubber seal
3. Washer
4. Valve collet

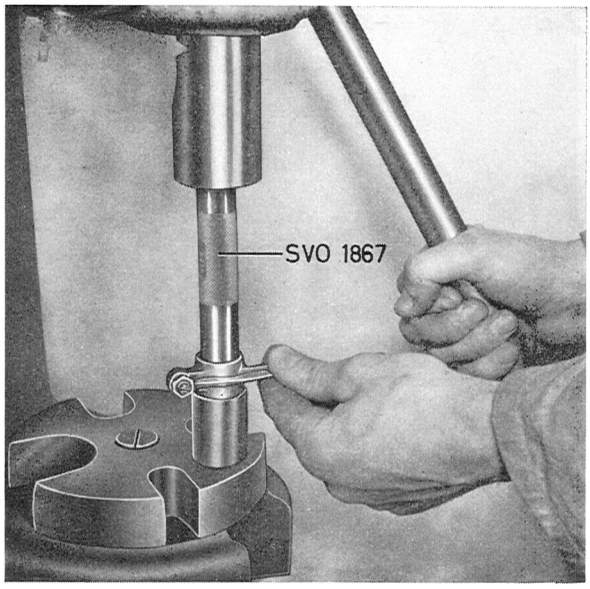


Fig. 2-34. Replacing rocker arm bushing

3. Check that the guides are free from burr and that the valves move easily in them.

ASSEMBLING

1. Check that the parts are in good condition and clean. Test the springs to ensure that they maintain the values in "Specifications".
2. Place the valves in position. Install valve guide seal, valve spring, upper washer and collet.

REPLACING ROCKER ARM BUSHING AND GRINDING ROCKER ARMS

Volvo Standard Times	Op. No.
ROCKER ARM MECHANISM, remove and install, incl. adjust valves	21439
ROCKER ARMS, machine grind, rocker arm mechanism removed	21477

1. If wear amounts to .1 mm (.004″), replace the rocker arm bushing. Use tool 1867 for pressing the bushing out and in, see Fig. 2-34. Then ream the bushing to an accurate fit on the shaft using a suitable reamer. The hole in the bushing should coincide with the hole in the rocker arm.
2. If necessary grind the pressure surface against the valve in a special machine.

INSTALLING CYLINDER HEAD

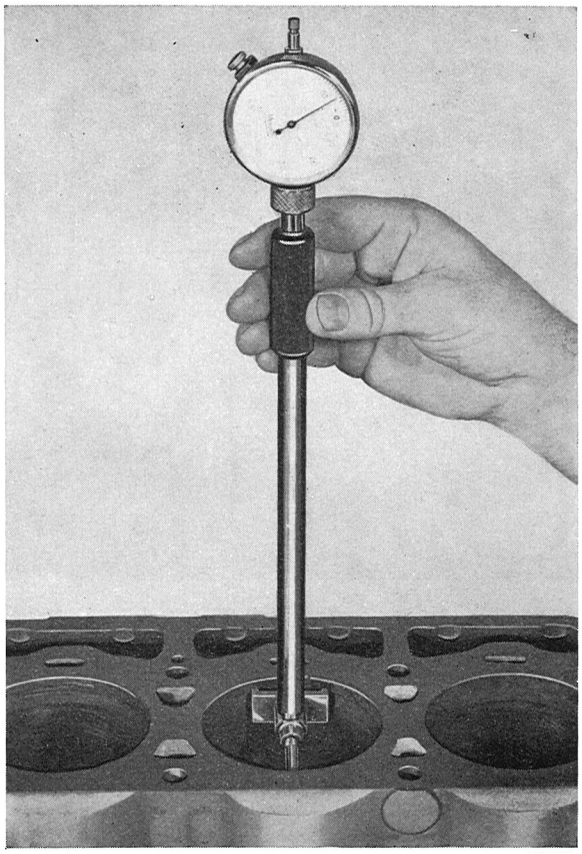
See under "Valve grinding and decarbonizing".

ADJUSTING VALVE CLEARANCE

The valves clearance can be adjusted satisfactorily with the engine stationary, irrespective of whether it is cold or warm. The clearance is the same for both inlet and exhaust valves. When adjusting, use two feeler gauges, one "Go" .40 mm (.016″) thick and the other "No-Go" .45 mm (.018″) thick for the B 20 A, E and F (.50 and .55 mm = .020—.022″ for the B 20 B). The clearance is adjusted so that the thinnest gauge can be inserted easily while the thicker one must not enter.

VALVE ADJUSTMENT PROCEDURE

1. Turn the crankshaft until cyl. No 4 rocker arms "rock" (the exhaust valve has just closed and the intake valve is just to open. Piston No 1 has reached firing position and the crankshaft pulley marking is on 0.)
   Adjust No 1 valve clearance.
2. Turn the crankshaft until No 2 rocker arms "rock" and adjust No 3 valve clearance.
3. Turn the crankshaft until No 1 rocker arms "rock" and adjust No 4 valve clearance.
4. Turn the crankshaft until No 3 rocker arms "rock" and adjust No 2 valve clearance.



VOLVO
101 955

Fig. 2-35. Measuring cylinder bore

CYLINDER BLOCK

MEASURING CYLINDER BORES

The cylinder bores are measured with a special dial indicator as shown in Fig. 2-35. Measuring should be done just below the top edge of the bore and only in the transverse direction of the engine. A letter is stamped on each cylinder bore indicating the classification of the bore and piston (standard models only).

PISTONS, PISTON RINGS AND PISTON PINS

Volvo Standard Times Op. No. 21210 comprises "replace piston rings".

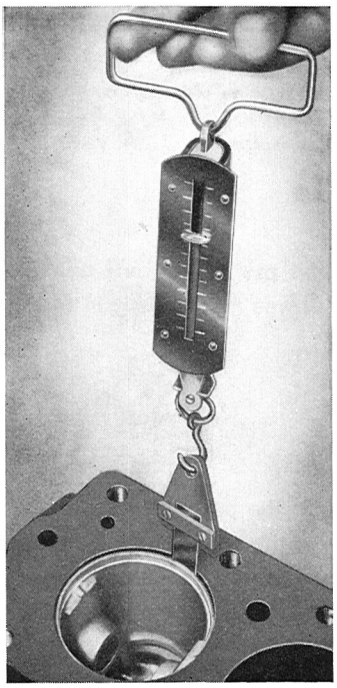
Volvo Standad Times Op. No. 21250 comprises "replace piston rings, lap valves".

Measuring pistons

The pistons are measured with a micrometer at right angles to the piston pin hole 7 mm (.28″) from the lower edge.

Fit of pistons in cylinders

The fit of the pistons in their respective cylinders is tested with the piston rings not installed. The clearance should be .01—.03 mm (.0004—.0012″). The clearance at right angles to the piston pin hole is measured with a feeler gauge, 1/2″ wide and .02 mm (.0008″) thick, attached to a spring balance. The force applied should be 10 N (2.2 lb). This gives the average value for piston clearance. When the above mentioned force is applied, the piston clearance obtained is equal to the thickness of the feeler gauge used. Test at several different depths. See Fig. 2.36.



VOLVO
22785

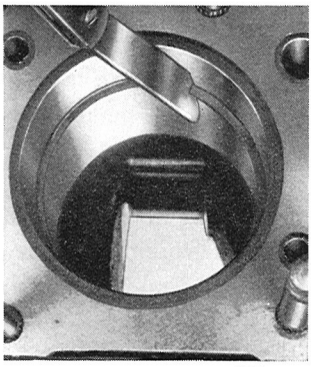
Fig. 2-36. Measuring piston clearance

Standard bore cylinders have a letter stamped on which shows the dimensions, and the pistons concerned should be marked with the same letter.

Piston ring fit

IN A NEW OR RE-BORED CYLINDER

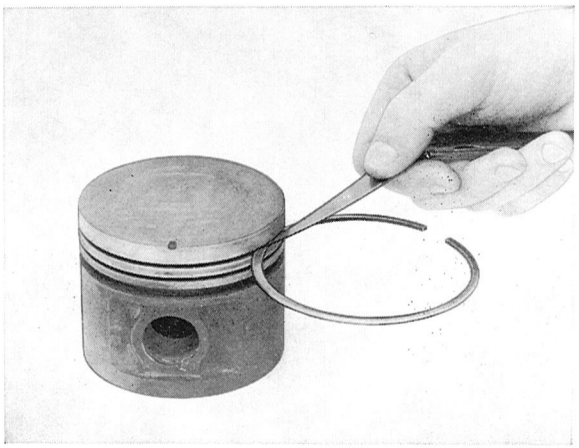
1. Push down the piston rings one after another in the cylinder bore. Use a reversed piston to ensure that the rings come into the correct position.



VOLVO 24 832

Fig. 2-37. Measuring piston ring gap

2. Measure the ring gap with a feeler gauge, see Fig. 2-37. The gap should be .40—.55 mm (.016—.022″). If necessary, the gap can be increased with a special file.
3. Check the piston rings by rolling them in their respective grooves. Also measure the clearance at a few points. See "Specifications" for measurements.



VOLVO 108 646

Fig. 2-38. Piston ring clearance in groove

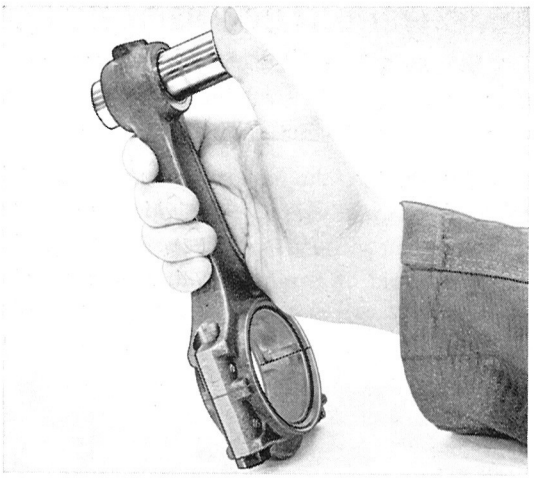
IN A WORN CYLINDER BORE

When checking the fit in a worn cylinder bore, the rings must be checked at the bottom dead center position where the diameter of the bore is smallest.

Piston pins

The piston pins are available in oversize .05 mm (.002″) larger than the standard diameter 24.00 mm (.945″). If the piston pin hole in the piston is worn so much that an oversize is necessary, the hole should first be reamed to the correct measurement. Use a reamer with a pilot guide and only take small cuts at a time.

The fit is correct when the piston pin can be pushed through the hole by hand with light resistance, see Fig. 2-39.



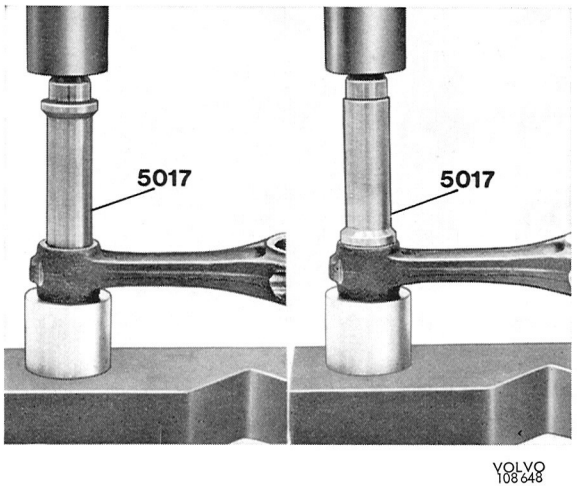
VOLVO 108 647

Fig. 2-39. Piston pin fit

CONNECTING RODS

Replacing bushing

If the old bushing in a connecting rod is worn, press it out by using drift 5017 and press in a new bushing with the same tool, see Fig. 2-40. Make sure that the lubricating holes index with the holes in the connecting rod. Then ream the bushing to the correct fit. The piston pin should slide through the hole under light thumb pressure but without any noticeable looseness, see Fig. 2-39.



VOLVO 108 648

Fig. 2-40. Replacing connecting rod bushing

STRAIGHTENING CONNECTING ROD

Volvo Standard Times Op. No. 21279 comprises: Replace piston, incl. straighten connecting rod, first one (each additional = Op. No. 21281)

Before installation, the connecting rod should be checked for straightness, twist and any S-distortion. Straighten if necessary, see Fig. 2-41. Nuts and bolts should be replaced with new ones when reconditioning.

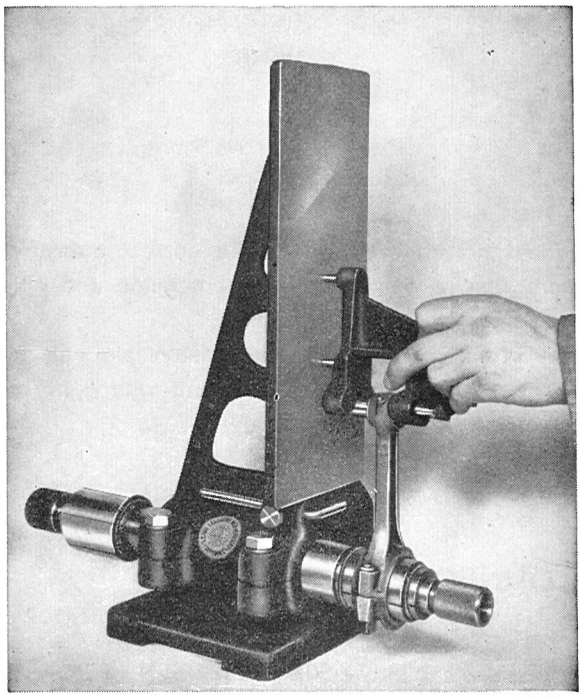


Fig. 2-41. Checking connecting rod

Assembling and installing piston and connecting rod

When assembling make sure that the piston is facing correctly so that the slot on the piston crown points forwards, see Fig. 2-42. There will be a loud noise if the piston is turned the wrong way. The connecting rod marking should face away from the camshaft side. The piston pins are then installed, the circlips placed in position and the piston rings installed.

Use piston ring pliers for the rings. The upper compression ring is chromed. Place the bearing shells in their seats. Turn the rings so that their gaps are not opposite one another. Lubricate the piston and bearing surfaces.

Use installation ring 2823, see Fig. 2-43, when installing the piston and a torque wrench, see "Specifications", for the correct tightening torque.

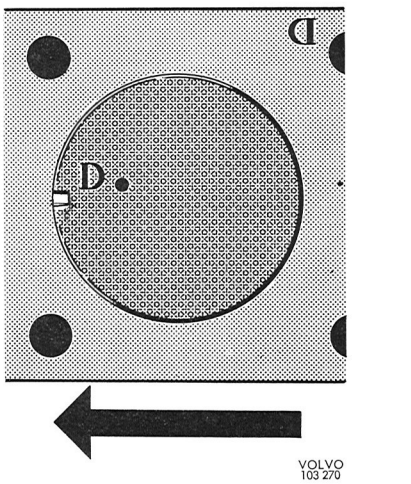


Fig. 2-42. Marking on piston and block

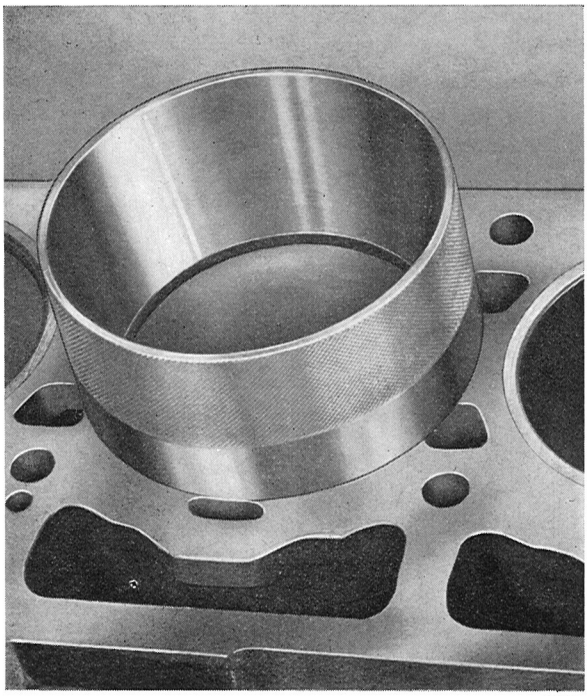


Fig. 2-43. Piston installation
Installation ring 2823

CRANKSHAFT

Replace crankshaft, Volvo Standard Times Op. No. 21693

After the crankshaft has been cleaned, its journals must be measured with a micrometer. Measuring should be at several points round the circumference and along the longitudinal axis of each journal. Out-of-roundness on the main bearing journal should not exceed .05 mm (.002″), and .07 mm (.003″) on the big-end bearing journals. Taper

should not exceed .05 mm (.002″) on any of the journals.

If the values obtained are close to or exceed the wear limit mentioned above, the crankshaft should be ground to undersize. Suitable bearing shells are available in 2 undersizes. The measurements are in the "Specifications".

Check that the crankshaft is straight to within .05 mm (.002″) by using a dial gauge. The crankshaft is placed on two V-blocks and a dial gauge placed against the center bearing journal after which the crankshaft is rotated. If necessary, straighten the crankshaft in a press.

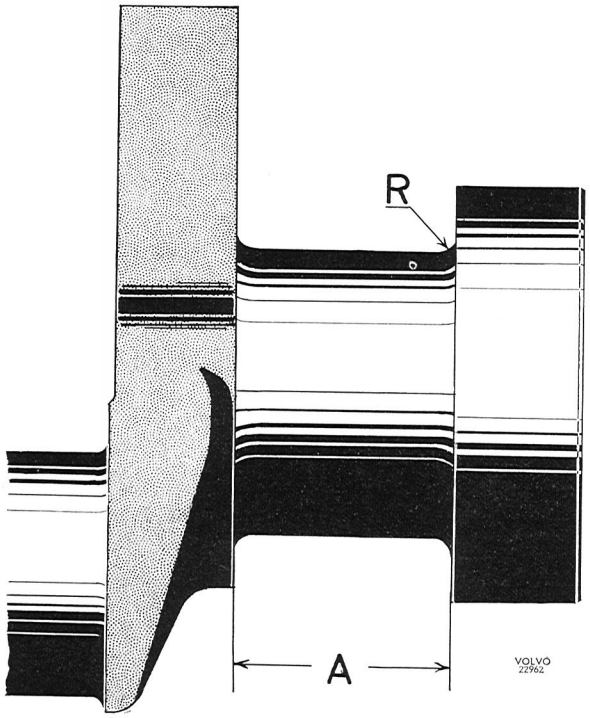


Fig. 2-44. Bearing journal

Grinding crankshaft

Before the crankshaft is ground, a check should be made to ensure that it is straight, this being done as described previously. Grinding is done in a special machine whereby the main bearing journals and the big-end bearing journals are ground to identical measurements. These measurements, which are given in "Specifications", must be carefully followed in order to ensure correct clearance with ready-machined bearing shells.

On no account must the bearing shells be shaved or the bearing caps filed.

The fillets at the ends of the journal should have a radius of 2.0—2.5 mm (.080—.100″) on all journals, see Fig. 2-44. The width measurement (A) for the pilot bearing depends on the size of the journal and should be ground in order to obtain the correct measurement.

After grinding has been completed, all the burr should be carefully removed from the oilway openings and all the journals lapped with a fine grinding paste to the finest possible surface finish. The crankshaft should then be washed. All the oilways should be cleaned with particular thoroughness in order to remove any metal chippings and grinding residue.

Main and big-end bearings

In addition to standard sizes, bearings shells are available in undersizes of .010″ and .020″. The rear main bearing shells are provided with flanges and have a larger width relative to their size. If the crankshaft has been ground to the correct measurement, the right bearing clearance is automatically obtained when the bearing shell concerned is installed. The bearing shells must not be shaved and the caps must never be filed in order to obtain closer bearing fit.

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

REPLACING CRANKSHAFT REAR SEAL

Type "Felt ring"

Volvo Standard Times Op. No. 21667 comprises: replace crankshaft rear seal, transmission removed, incl. replace clutch if necessary.

INSTALLING REAR SEAL FLANGE

1. Make sure that the seal is in good condition and that the flange is clean. The drain hole must not be blocked by incorrect installation of the sump gasket. The seal must not be installed in the flange.
2. Install the flange but do not tighten the bolts.

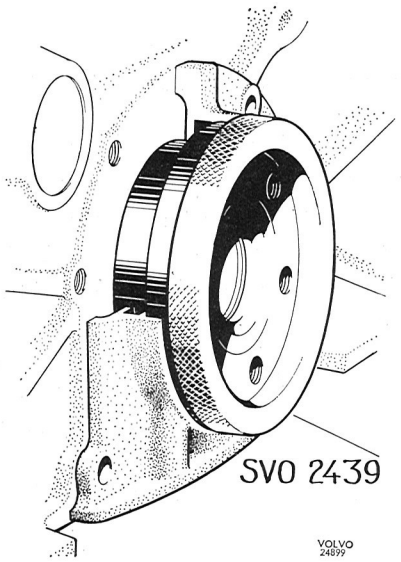


Fig. 2-45. Centering rear sealing flange

3. Center the flange with sleeve 2439, Fig. 2-45. Turn the sleeve round while tightening the bolts and adjust the position of the flange if the sleeve jams. Check that the flange comes flush against the underside of the block.
4. Install a new felt ring and place in the washer and circlip. Press the circlip into position with the centering sleeve. Check that the circlip engages in its groove.

REPLACING CRANKSHAFT REAR SEAL

Type "Rubber lip"

Volvo Standard Times Op. No. 21667

1. After having removed the transmission, clutch and flywheel from the engine, remove the two bolts for the oil sump in the flange. Slacken one of the two bolts on each side so that oil sump pressure on the flange will not be so great. Remove the flange.
2. Press out the seal with the drift for tool 2817. Use a suitable cushion for the flange to prevent it from being damaged.
3. Press in the seal with tool 2817, see Fig. 2-46. NOTE: First inspect the wear surface of the crankshaft.
   The seal can be installed in various positions with tool 2817. With a new crankshaft or a crankshaft with approved wear surface install the seal in its outer position (fully screwed in center bolt). With the wear mark on the crankshaft, install the crankshaft with the center bolt screwed out a couple of turns or completely.

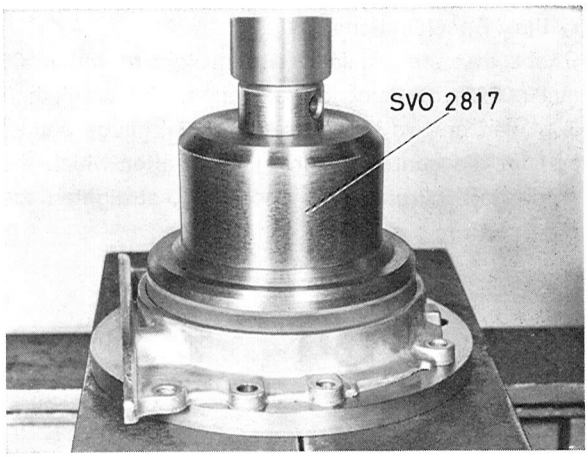


Fig. 2-46. Seal installation

4. Install the flange, its sealing surface being well cleaned, and a new gasket. (Oil first the seal.) The flange should be mounted on the crankshaft carefully, se Fig. 2-47. Use your finger to position the sealing lip.

The seal retainer is provided with bosses which guide the retainer at installation on the crankshaft journal.

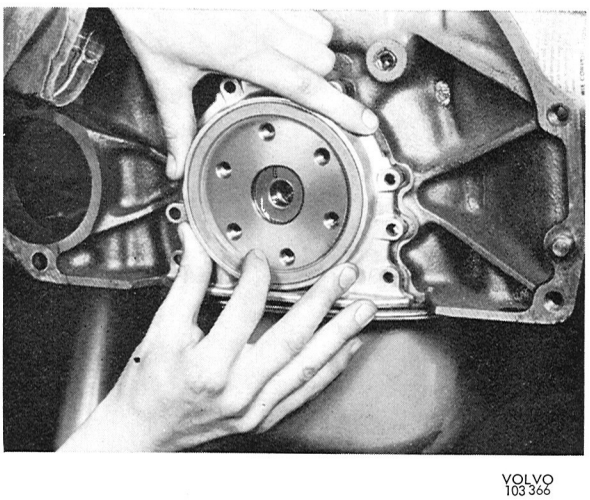


Fig. 2-47. Flange installation

GRINDING FLYWHEEL

If the wear surface of the flywheel is uneven or burnt, the surface can be ground in a saddle-mounted grinding machine. Not more than .75 mm (.03″) of the original thickness must be ground off.

PILOT BEARING FOR INPUT SHAFT

Volvo Standard Times Op. No. 21607 comprises: FLYWHEEL BEARING, replace, pressure plate removed.

The pilot bearing circlip and protecting washer are removed, the pilot bearing pulled out with tool 4090 and checked after cleaning.

If the bearing is worn, it should be replaced with a new one. Before installation, pack the bearing with heat-resistant ball bearing grease. The bearings are installed with drift 1426, the install protecting washer and circlip.

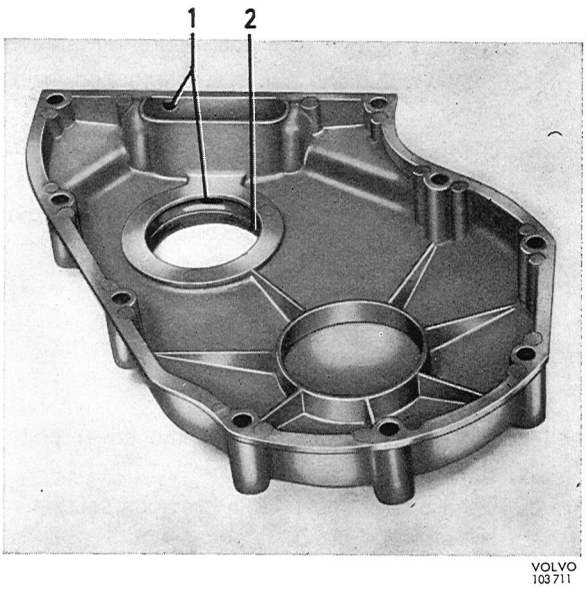


Fig. 2-48. Timing gear cover
1. Drain holes 2. Sealing ring

REPLACING OIL SEAL IN TIMING GEAR COVER

Volvo Standard Times Op. No. 21520

1. Release the fan belt. Loosen the attachment of the stabilizer at the frame.
2. Screw out the bolt in the crankshaft. Remove the belt pulley.
3. Remove the circlip for the washer which retains the felt ring. Remove the washer and felt ring. Check that the cover is correctly installed by inserting a .10 mm (.004″) feeler gauge in the gap between cover and hub on the crankshaft and moving it all round. If the feeler gauge jams at any point, the cover should be centered, see under "Replacing timing gear cover".
4. Install a new felt ring. Place the washer in position and install the circlip. Check that the circlip fits properly in position.
5. Install the remaining parts and tension the fan belt.

REPLACING TIMING GEAR COVER

Replace timing gear cover gasket = Volvo Standard Times Op. No. 21502

1. Loosen the fan belt. Remove the fan and pulley on the water pump. Disconnect the stabilizer attachment from the frame.
2. Remove the bolt for the crankshaft belt pulley and remove the pulley.
3. Remove the timing gear cover. Slacken a couple of extra bolts for the sump and be careful not to damage the gasket. Remove circlip, washer and felt ring.
4. Make sure that the gaskets are in good condition and that the drain hole is open and clean inside the timing gear cover. See Fig. 2-48.
5. Position cover and bolts without tightening.
6. Center the cover with sleeve 2438, see Fig. 2-49. Turn the sleeve while tightening and adjust the position of the cover so that the sleeve is not jammed. Check after final tightening of the cover that the sleeve can be easily rotated without jamming.

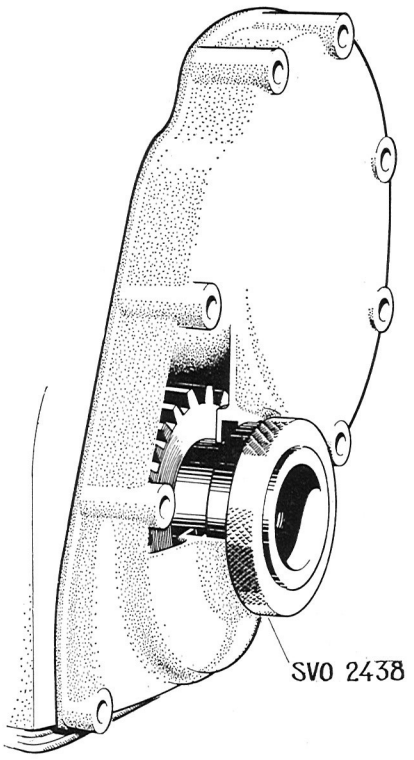


Fig. 2-49. Centering timing gear

7. Install a new felt ring washer and circlip. Push them into position with the centering sleeve 2438. Check that the circlip has engaged in its groove.
8. Install the other parts and tension the fan belt. See "Specifications" for the tightening torque. Fix the stabilizer attachments firmly to the frame.

REPLACING TIMING GEARS

Volvo Standard Times Op. No. 21530

1. Drain the coolant and remove the cover plate and radiator.
2. Carry out operations 1—3 in previous section.

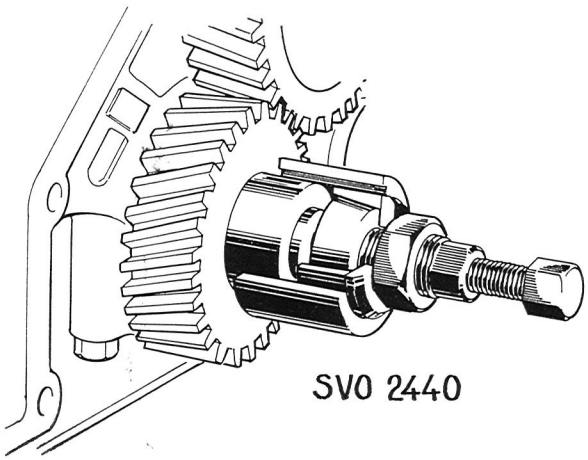


Fig. 2-50. Removing hub on crankshaft

3. Remove the hub from the crankshaft with puller 2440. See Fig. 2—50.
   Before applying the tool, its large nut must be screwed backwards so that the cone is not tensioned. The center bolt should also be screwed back.

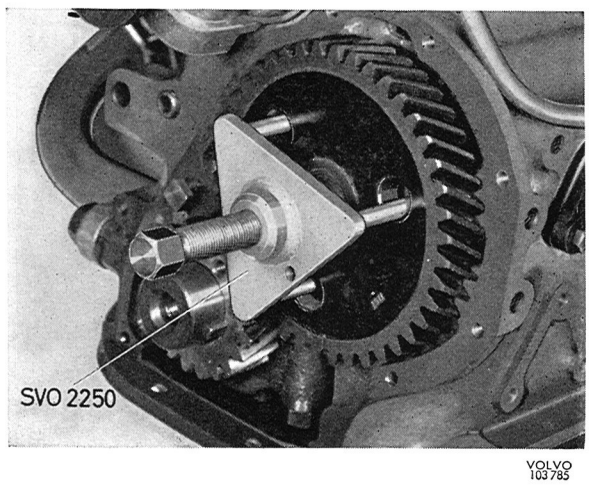


Fig. 2-51. Removing camshaft gear

Then install the tool, screw in the large nut so that the hub is firmly held and pull it off by screwing in the center bolt.

4. Remove the camshaft nut and pull off the gear by using puller 2250, see Fig. 2-51.

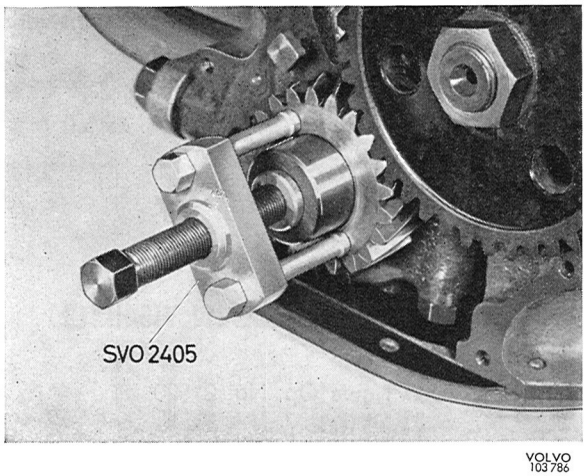


Fig. 2-52. Removing crankshaft gear

5. Pull off the crankshaft gear by using puller 2405, Fig. 2-52. Screw out the oil nozzle, blow it clean and then re-install it as shown in Fig. 2-54. The gears are lubricated by oil fed through this nozzle.

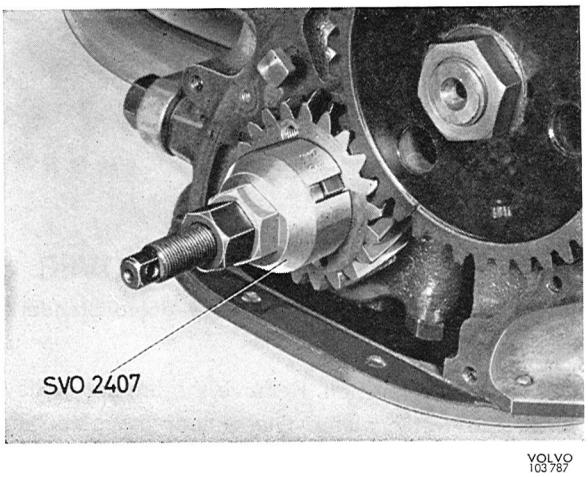


Fig. 2-53. Installing crankshaft gear

6. Install the crankshaft gear by using tool 2407 and the camshaft gear by using 2408, see Figs. 2-53 and 2-54. Install the hub on the crankshaft. Do not push the camshaft backwards so that the seal washer on the rear end loosens.

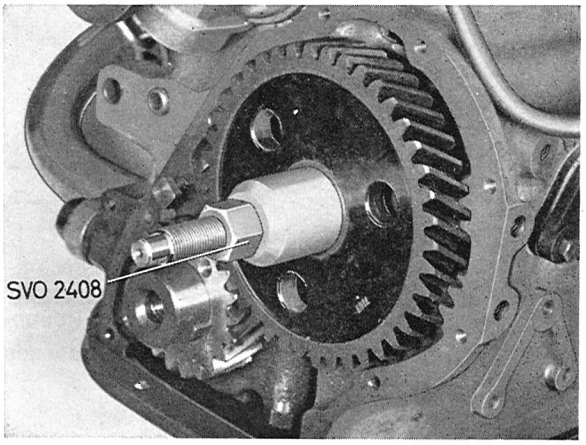


Fig. 2-54. Installing camshaft gear

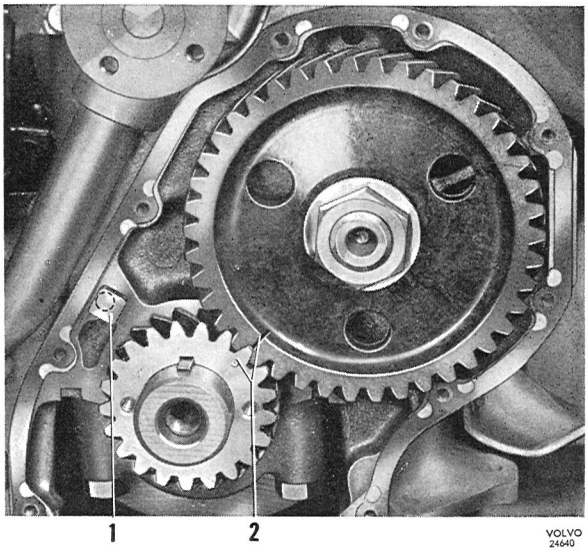


Fig. 2-55. Marking on timing gears
1. Oil nozzle 2. Markings

Check that gears are in the correct position relative to each other, as shown in Fig. 2-55. Tool 2407 has a socket intended for turning the crankshaft.

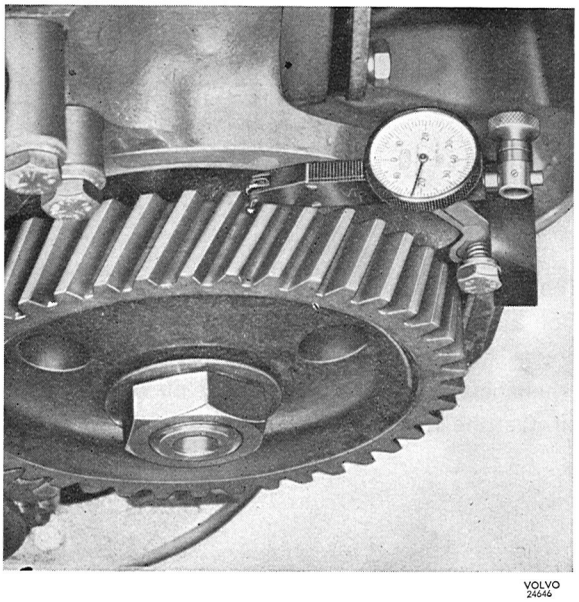


Fig. 2-56. Measuring tooth flank clearance

The tooth flank clearance and camshaft axial clearance, determined by the spacer ring behind the camshaft gear, are given in the "Specifications".

Center and install the timing gear cover as well as the other parts according to operations 4—8 in the previous section.

POSITIVE CRANKCASE VENTILATION

OVERHAUL

At intervals of 40 000 km (24 000 miles) remove and clean nipple (3, Fig. 2-22), and flame arrester (5). Check the hoses at the same time. Replace any that are in a poor condition.

For U.S.A. vehicles, the nipples are cleaned during the 20 000 km (12 000 miles) servicing.

GROUP 22

LUBRICATING SYSTEM

GENERAL INFORMATION

The engine has a force-feed lubricating system, see Fig. 2-57. Pressure is provided by a gear pump driven from the camshaft and located under the crankshaft in the sump. The gear pump forces the oil past the relief valve, which is part of the pump, through the oil filter and then through oilways out to the various lubricating points. All the oil supplied to the lubricating points therefore, first passes through the oil filter.

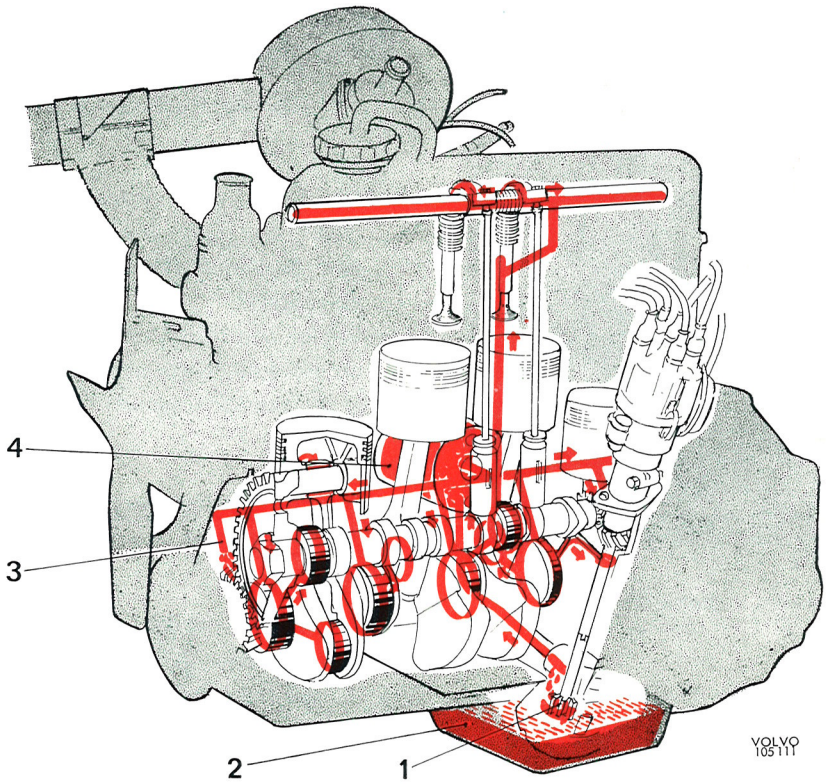


Fig. 2-57. Lubricating system

1. Oil pump
2. Sump
3. Nozzle
4. Oil filter

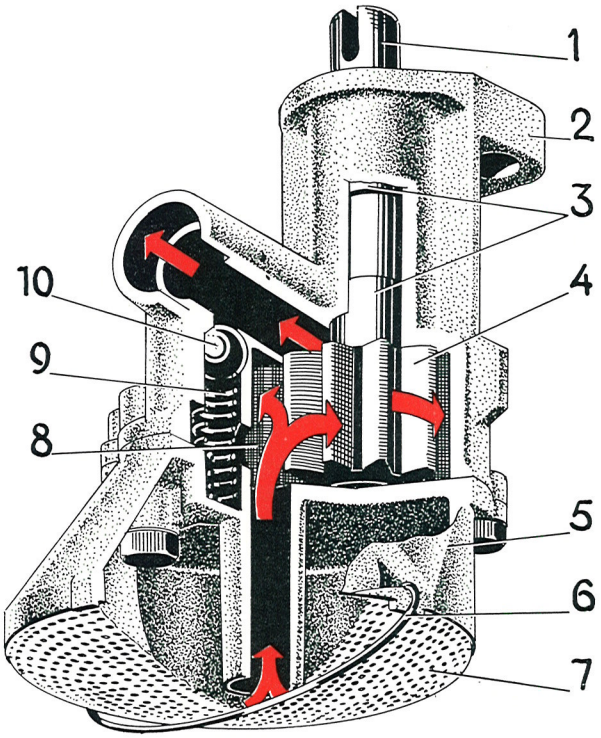


Fig. 2-58. Oil pump

1. Drive shaft
2. Pump body
3. Bushings
4. Driving gear
5. Cover
6. Retainer clip
7. Strainer
8. Drive gear
9. Spring for relief valve
10. Valve ball

OIL PUMP, RELIEF VALVE

The oil pump, see Fig. 2-58, is of the gear type and is driven through a gear train from the camsahft. The delivery pipe from the pump to the cylinder block does not have screw unions and is, therefore, automatically tightened in position when the attaching bolts for the pump are tightened. At each end of the pipe there are sealing rings made of special rubber. The relief valve is located directly on the pump and consists of a spring-loaded ball. The ball has a cylindrical guide with a stop at the end position and, therefore, operates flexibly. Even at idling speed there is a certain amount of overflow, so that the oil pressure is then relatively low.

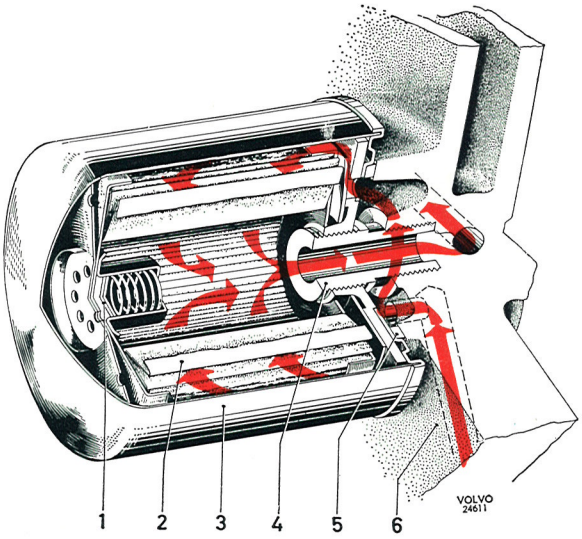
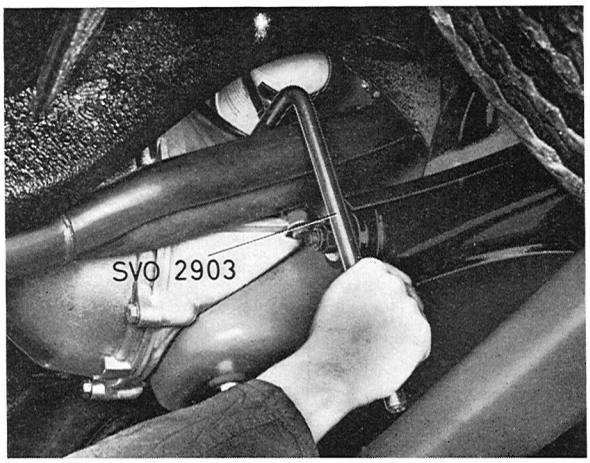


Fig. 2-59. Oil filter

1. Relief valve
2. Element
3. Body
4. Nipple
5. Gasket
6. Cylinder block

OIL FILTER

The oil filter (see Fig. 2-59), which is a single unit complete with element, is of the full-flow type and is screwed directly onto the cylinder block. The oil which is fed out to the various lubricating points in the engine first passes through the oil filter element which is made of special paper. In the oil filter there is a by-pass valve which allows the oil to by-pass the element if resistance to flow should become excessive. When replacing the filter, the old one is discarded completely and a new one installed.



VOLVO 105112

Fig. 2-60. Removing oil filter

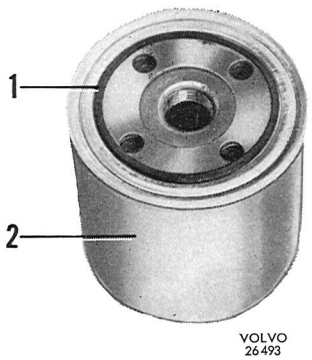
REPLACING OIL FILTER

Volvo Standard Times Op. No. 22207

Together with the element and relief valve, the oil filter (see Fig. 2-59) is screwed as a complete unit on to a nipple in the cylinder block.

The filter should be replaced every 10 000 km (6 000 miles), when the old filter is discarded. With a new or reconditioned engine, the filter should also be changed the first time after 5 000 km (3 000 miles).

1. Remove the old filter with an oil filter wrench, see Fig. 2-60.



VOLVO 26493

Fig. 2-61. Oil filter

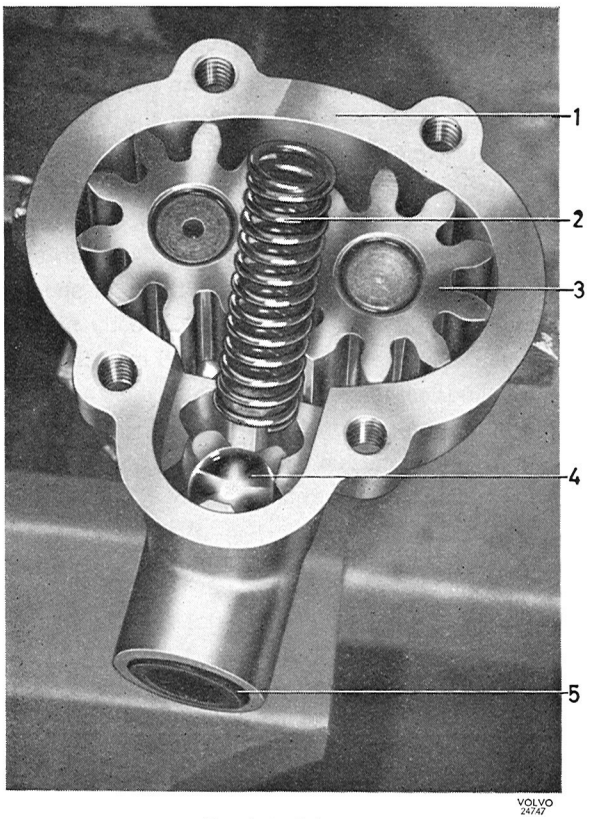
1. Gasket
2. Filter cartridge

2. Coat the rubber gasket (1, Fig. 2-61) of the new filter with oil and make sure that the contact surface for the oil filter is free from dirt. By smearing it with oil, the gasket slides into better contact with the sealing surface. Screw on the filter by hand until it just touches the cylinder block.
3. Screw on the oil filter a further half turn by hand. **Do not use tools.**
   Start the engine and check that there is no leakage at the joint. Fill oil if necessary.

OIL PUMP AND RELIEF VALVE

Volvo Standard Times	Op. No.
Replace oil pump	22114
Remove and install oil pump, oil pan removed	22111

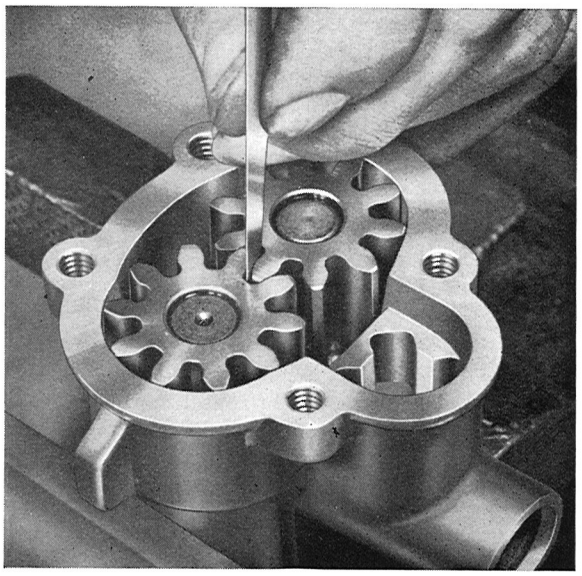
After the pump has been disassembled and cleaned, check that all the parts are in good condition. Test the relief valve spring (2, Fig. 2-62), see "Specifications" for the values concerned.



VOLVO 24747

Fig. 2-62. Oil pump

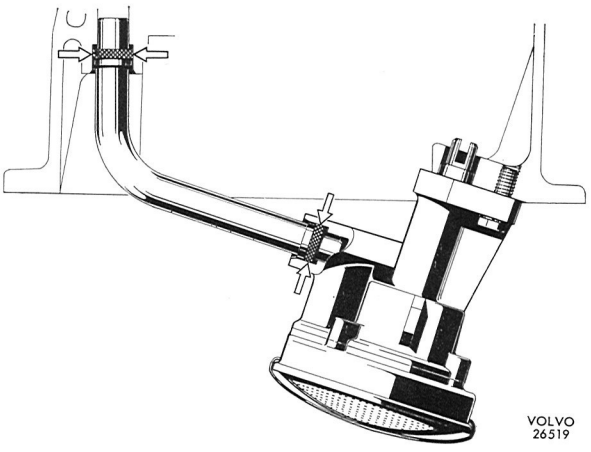
1. Pump body
2. Spring for relief valve
3. Gear
4. Valve ball
5. Hole for oil pipe



VOLVO 24644

Fig. 2-63. Measuring tooth flank clearance

Check that the tooth flank clearance is .15—.35 mm (.006—.014″), see Fig. 2-63.
Measure the end float, .02—.10 mm (.0008—.0040″), with a feeler gauge and a new cover or the old one if not noticeably worn. If bushings or shaft are worn, replace them with new ones. Note that the driving shaft with gear is replaced as a single unit. The new bushings should be reamed after pressing in with a reamer provided with a pilot guide.
The seals at the ends of the delivery pipe are made of special rubber and are manufactured to very close tolerances, see Fig. 2-64. Use only genuine Volvo parts. The delivery pipe must be clamped in its correct position first in the oil pump and then the oil pump and pipe together clamped against the block. The pump connecting flange should lie flush against the block before being tightened. Before assembly, the rubber rings on the pipe can be coated with soapy water since this enables the pipe to take up its position more easily. Tap lightly on the pipe with a soft mallet if necessary.

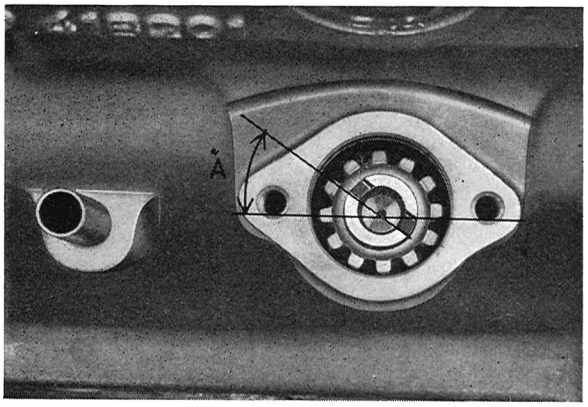


VOLVO 26519

Fig. 2-64. Delivery pipe seals

OILWAYS

Before assembly, all the oilways must be cleaned very thoroughly to avoid damage to the bearings, bearing journals and other components.
To clean the cylinder block oilways, remove the sealing plugs. After cleaning and drying with compressed air, install new plugs.



VOLVO 24655

Fig. 2-65. Distributor drive position

For B 20 A: A=approx. 35°
For B 20 B, B 20 E and B 20 F: A=approx. 5°

INSTALLING OIL PUMP

When No. 1 cylinder is at top dead center, install the oil pump drive and distributor. The small part at the groove is turned obliquely upwards-backwards and the groove set at an angle of 35° or 5° to the longitudinal axis of the engine, see Fig. 2-65 (A). Make sure that the shaft goes down into its groove in the pump shaft.
NOTE: When the timing gear marks are opposite each other, then the piston for No. 4 cylinder is in the top dead center position, firing position).

GROUP 23

FUEL SYSTEM

CARBURETOR ENGINES

GENERAL INFORMATION

The B 20 A engine is equipped with a horizontal carburetor of type Stromberg 175 CD-2 SE, see Fig. 2-66.
The B 20 B engine is equipped with two horizontal carburetors of type SU-HIF 6, see Fig. 2-67.

The B 20 B engine in a car with right-hand drive is equipped with two horizontal carburetors of type Stromberg 175 CD-2 SE, see Fig. 2-68.

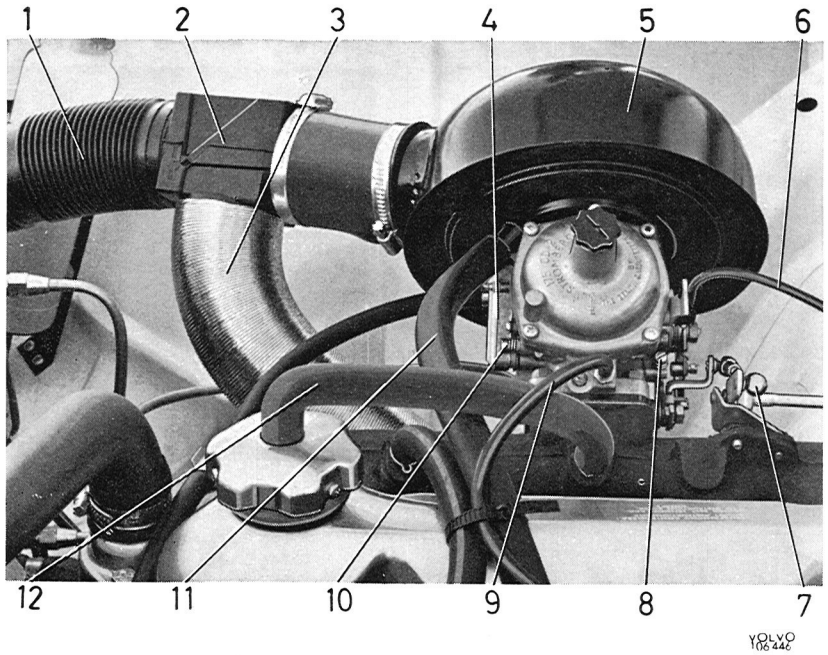


Fig. 2-66. Stromberg carburetor on B 20 A

1. Cold-air hose
2. Constant temperature device
3. Warm-air hose
4. Temperature compensator
5. Air cleaner
6. Choke wire
7. Throttle control
8. Throttle stop screw
9. Vacuum hose for distributor
10. Idle trimming screw
11. Fresh-air hose for crankcase ventilation
12. Hose for crankcase gases

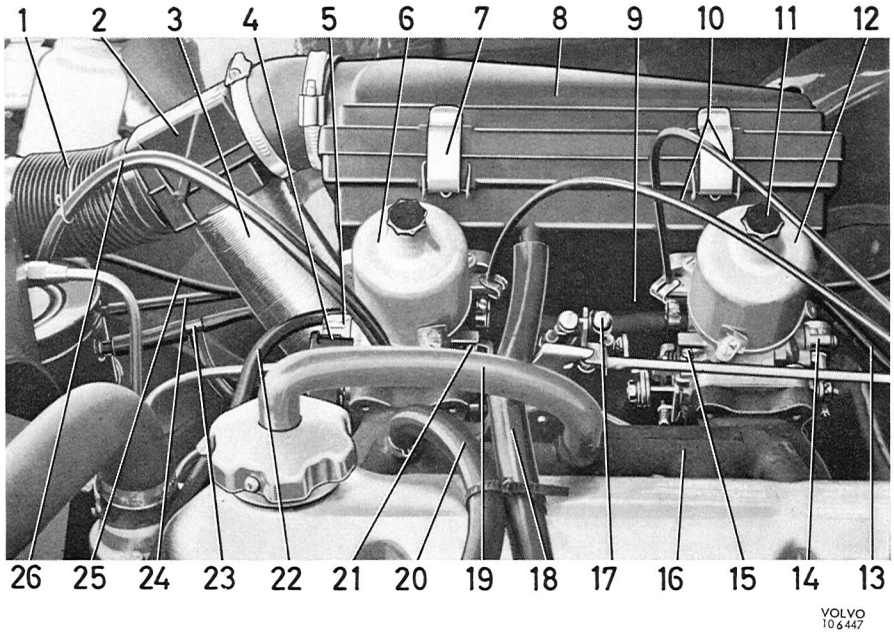
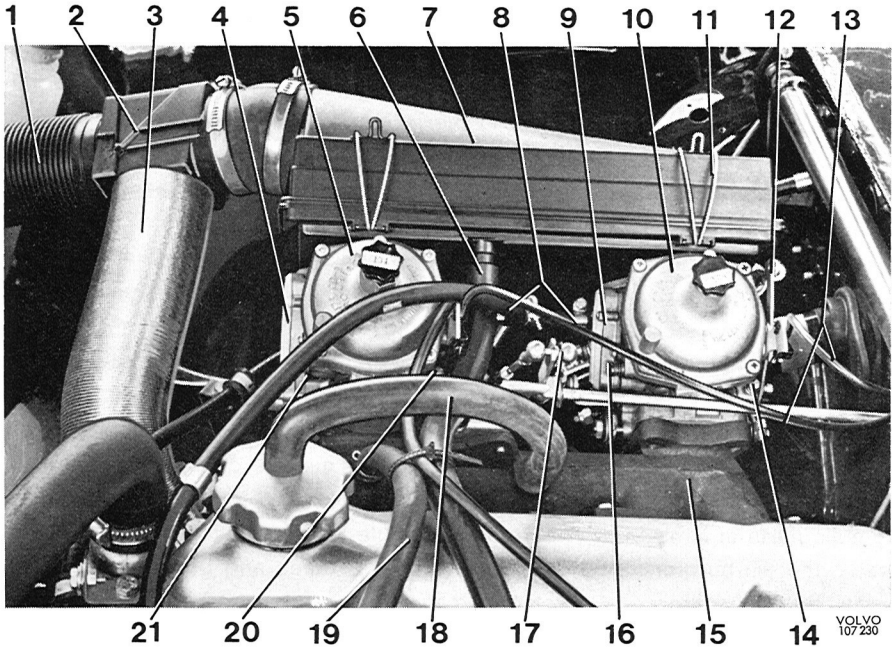


Fig. 2-67. SU carburetors on B 20 B

1. Cold air hose
2. Constant temperature device flap
3. Warm air hose
4. Guard for throttle spindle
5. Hot start valve
6. Front carburetor
7. Clamp for air cleaner cover
8. Air cleaner
9. Fuel hose
10. Choke wires
11. Hydraulic damper
12. Rear carburetor
13. Vacuum hose for distributor (Negative vacuum setting)
14. Hot start valve
15. Idle trimming screw
16. Mainfold
17. Throttle control
18. Fresh-air intake for crankcase ventilation
19. Hose for crankcase gases
20. Hose for brake servo
21. Idle trimming screw
22. Fuel hose
23. Hoses connected to hot start valves
24. Hose to fuel tank
25. Vacuum hose (joined to "negative connection'' on carburetor)
26. Hose for fuel fumes

EGR valve, see Fig. 2-104



1. Cold-air hose
2. Constant temperature device flap
3. Warm-air hose
4. Temperature compensator
5. Front carburetor
6. Fresh-air intake for crankcase ventilation
7. Air cleaner
8. Fuel hoses
9. Temperature compensator
10. Rear carburetor
11. Clasp for air cleaner cover
12. Hot start valve
13. Choke wires
14. Throttle stop screw
15. Manifold
16. Idle trimming screw
17. Throttle control
18. Hose for crankcase gases
19. Hose for power brake
20. Throttle stop screw
21. Idle trimming screw

Fig. 2-68. Stromberg carburetors on B 20 B (r-h drive)

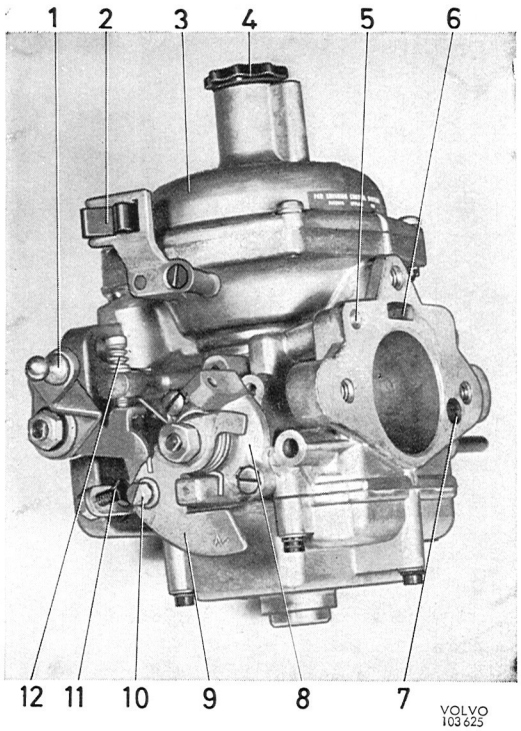


Fig. 2-69. Stromberg carburetor, left side, B 20 A

1. Lever for throttle control
2. Clamp for choke wire
3. Suction chamber
4. Hydraulic damper
5. Vent drilling from float chamber
6. Drilling for air supply under diaphragm
7. Drilling for air supply to temp. compensator and idle trimming screw
8. Cold start device
9. Cam disc for fast idle
10. Connection for choke control
11. Fast idle stop screw
12. Throttle stop screw

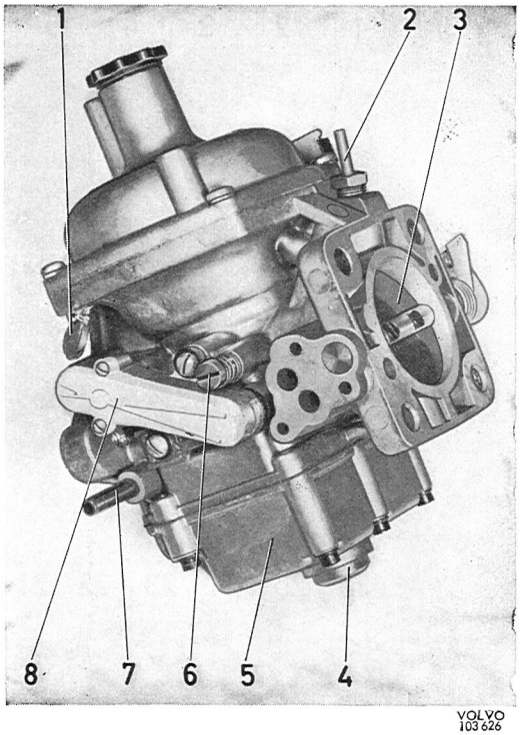


Fig. 2-70. Stromberg carburetor, right side, B 20 A

1. Sealed plug
2. Connection for vacuum hose to distributor (positiv setting)
3. Primary throttle
4. Float chamber plug
5. Float chamber
6. Idle trimming screw
7. Connection for fuel hose
8. Temperature compensator

ZENITH-STROMBERG CARBURETOR

The carburetor for the B 20 A engine is shown in Figs. 2-69 and 2-70. It has been designed to obtain cleaner exhaust gases by a gas evaporative control system.

It is provided with a fixed jet, pressed into the carburetor housing, the fuel flow orifice area is varied by means of a movable tapered needle. The position of the needle is determined by the carburetor housing vacuum operating an air valve in which the needle is installed in a spring-loaded suspension. The spring force always presses the needle against the same side of the jet and this ensures an accurately controlled fuel flow through the jet.

The carburetor consists of three main parts of light-alloy, the middle part comprises the carburetor housing. The lower section is a float chamber, which encloses the jet and the float. The upper section consists of a suction chamber cover, which forms a suction chamber together with a diaphragm fixed in the air valve. The suction chamber regulates the air valve lift and thereby the location of the needle in the jet.

By means of channels in the valve, the suction chamber is linked to the space between the carburetor throttle and valve.

The carburetor is equipped with a cold start device (8, Fig. 2-69) in order to provide the engine with extra fuel for cold starting.

The carburetor is equipped with a temperature compensator (8, Fig. 2-70). This is constructed as an air valve regulated by the carburetor temperature. It maintains the fuel-air mixture constant irrespective of the fuel temperature.

The throttle spindle is provided with seals to reduce wear on the spindles and bushings and also to eliminate air leakage.

Figs. 2-71, 2-72, 2-73 and 2-74 show carburetors for B 20 B engines.

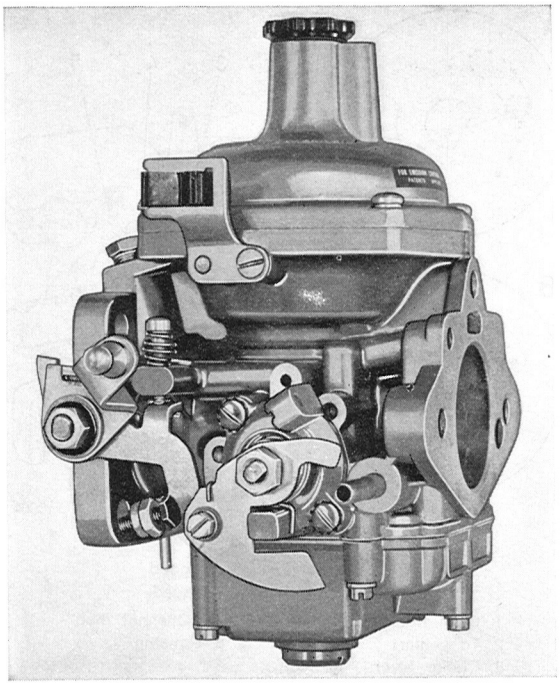


Fig. 2-71. Stromberg carburetor, front, left side, B 20 B

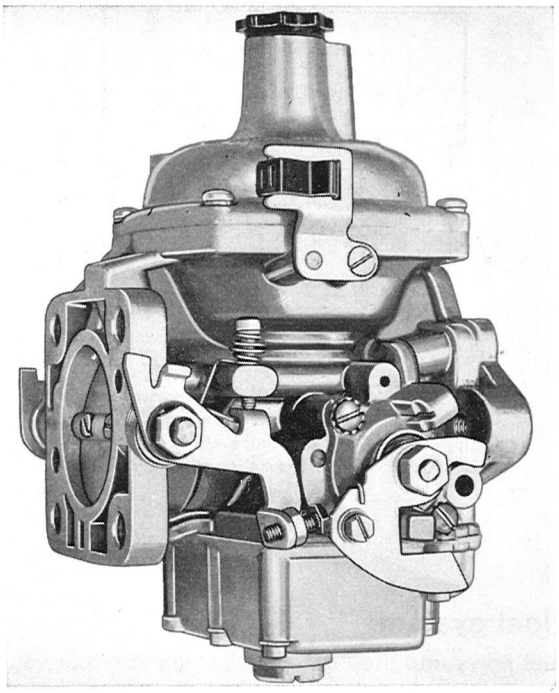


Fig. 2-73. Stromberg carburetor, rear, left side, B 20 B

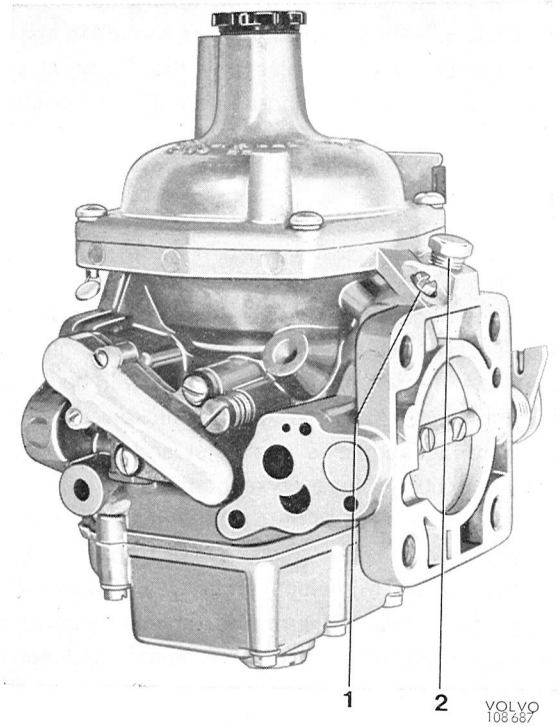


Fig. 2-72. Stromberg carburetor, front, right side, B 20 B

1. Plug for outlet for speed compensator (air conditioning)
2. Plug (vehicles equipped with Gas Evaporative Emission Control System have here a connection for the venting filter)

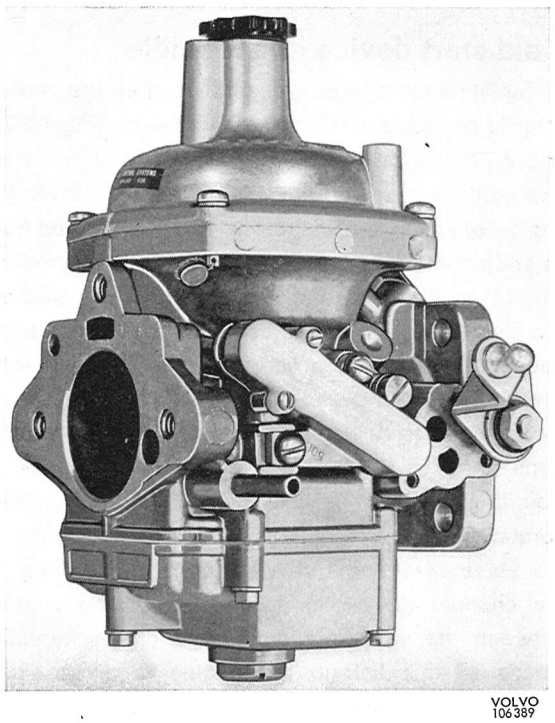


Fig. 2-74. Stromberg carburetor, rear, right side, B 20 B

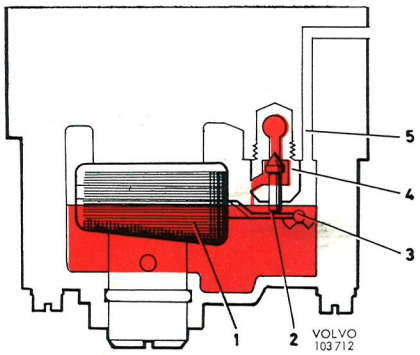


Fig. 2-75. Float system

1. Float
2. Float arm
3. Float shaft
4. Float valve
5. Venting channel from float chamber to air cleaner

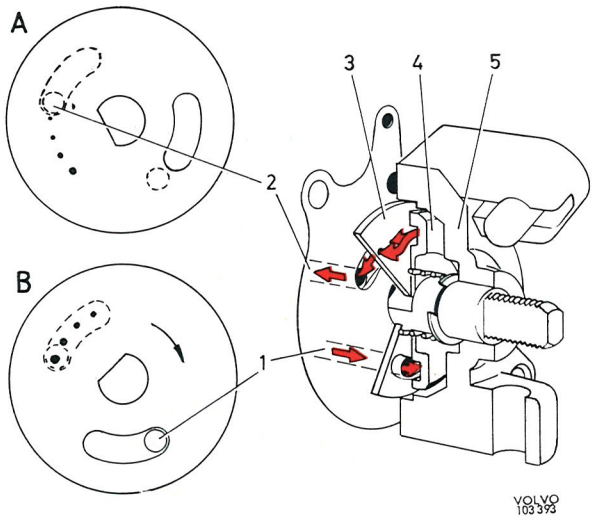


Fig. 2-76. Cold-start device

A. Cold-start device, designed
B. Cold-start device, engaged

1. From floatchamber
2. To venturi
3. Choke lever
4. "Channel disc"
5. Housing

Float system

Fuel flows into the float chamber via the float valve (4, Fig. 2-75). The float (1), which is made up of twin expanded rubber floats, is carried on a bridge in the lower part of the carburetor housing. As the fuel level rises, the float lifts and, by means of the float arm (2) and tab, closes the needle on its seating when the correct level has been attained.

The fuel goes through holes in the float chamber plug and then to the inside of the jet, where the level is the same as in the float chamber. Sealing between the float chamber plug and chamber is provided by an O-ring.

Cold start device and fast idle

To facilitate starting during cold weather, the carburetor is provided with a cold start device (Figs. 2-76 and 2-77).

The cold start device consists of a choke lever (3, Fig. 2-76) which is provided with four calibrated holes and an elongated opening as well as a channeled disc (4) mounted on a spindle which is operated by the choke control. On the same spindle, outside the housing (5), there is a cam disc (9, Fig. 2-69) with connection for the choke control pull wire. When the cold start device is engaged, the valve disc turns and this links up the channel, (1, Fig. 2-76) from the float chamber via one or several of the calibrated holes to the channel on the other side of the valve disc and further through the drilling in the channel (2), which terminates in the venturi between the vacuum plunger and choke flap. By means of this link-up the engine receives extra fuel (richer mixture) to facilitate cold starting. At the same time, a little extra air is obtained by means of the choke device. When the choke control is pushed in, the valve disc turns and closes the inlet to the channel. At the same time as the cam disc is operated, the throttle flap opening is also influenced in such a way that turning the cam disc opens the throttle through the fast idle stop screw (11, Fig. 2-69) and the lever, before any of the calibrated holes open the connection to the fuel drilling. With this arrangement, the idling speed can, if necessary, be raised by the driver of the vehicle during the warming-up period of the engine.

Idling

When the engine is idling, the vacuum in the carburetor suction chamber is low and the column between the air valve and the bridge will be small (see Fig. 2-78). At this stage, the thicker section of the metering needle is in the jet and thus only a small quantity of fuel, corresponding to idling requirements, is sucked into the engine. The temperature compensator (Fig. 2-77) is regulated by a bi-metal spring (3) which influences a valve (2). When the engine is warm and the temperature in the carburetor rises, the valve opens and air is supplied to the carburetor venturi to compensate for the increase in the fuel flow, which is obtained due to the alteration in the fuel's viscosity, see Fig. 2-78. Fine adjustment of the engine idling speed can be made with the idle trimming screw (1, Fig. 2-77).

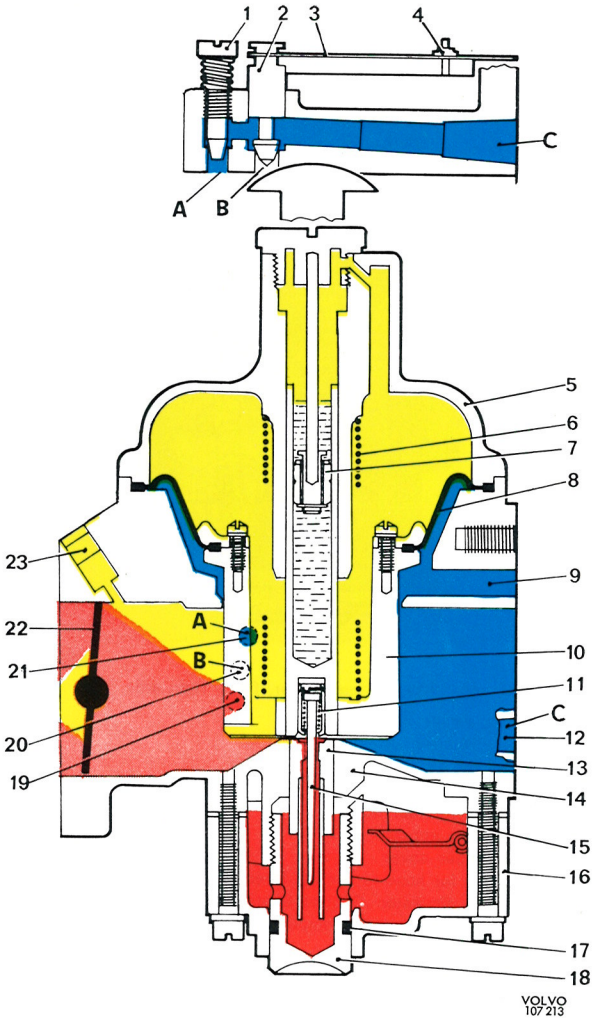


Fig. 2-77. Cold starting, principle

1. Idle trimming screw
2. Valve for temperature compensator
3. Bi-metal spring for temperature compensator
4. Adjuster nut
5. Suction chamber
6. Spring
7. Damper plunger
8. Diaphragm
9. Drilling for air supply under diphragm
10. Air valve
11. Metering needle suspension
12. Drilling for air supply to temp. compensator and idle trimming screw
13. Fuel jet
14. Carburetor housing (middle section)
15. Metering needle
16. Float chamber
17. Rubber ring
18. Float chamber plug
19. Drilling for cold start fuel (located in carb. opposite wall)
20. Drilling for extra air through temperature compensator
21. Drilling for extra air through idle trimming screw
22. Throttle
23. Vacuum outlet for distributor, B 20 A

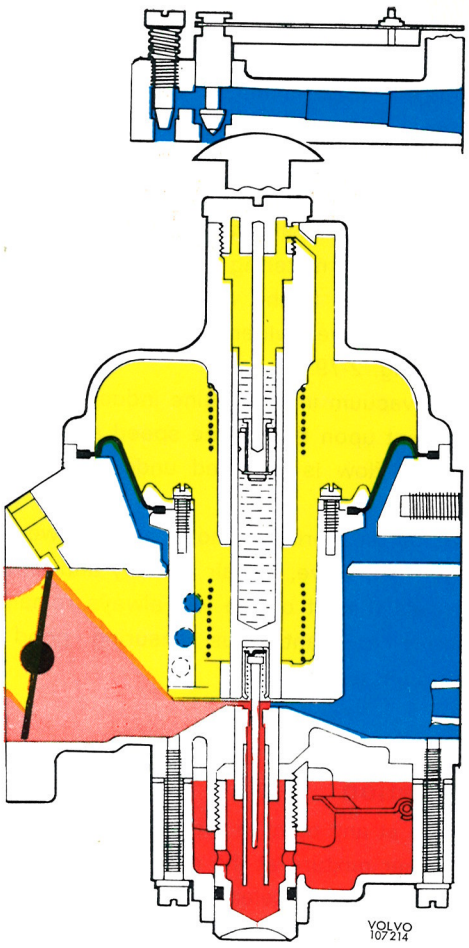


Fig. 2-78. Idling, warm engine

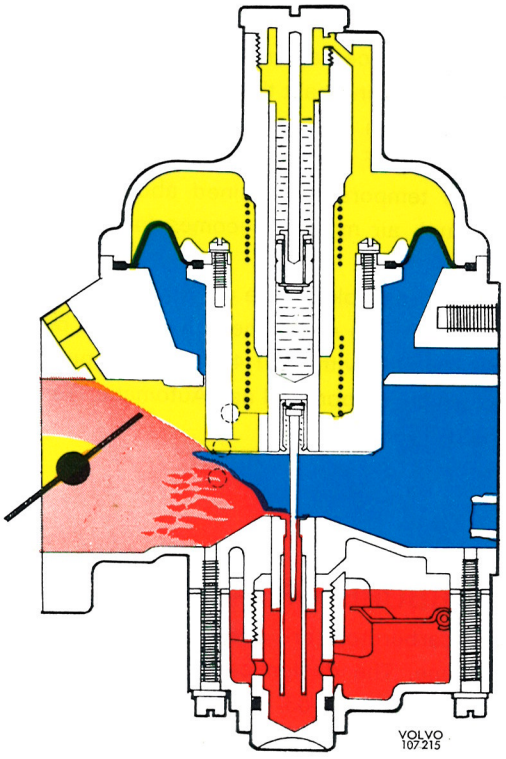


Fig. 2-79. Normal operation

Normal running

When the throttle flap opens, approximately the same vacuum is obtained in the suction chamber as in the engine intake manifold. Due to the pressure difference between the underside of the air valve, where there is pressure in the carburetor inlet port, and the upper side of the valve, where there is vacuum, the valve lifts from the bridge. This also lifts the tapered metering needle (15, Fig. 2-77), which is attached to the valve, out of the jet. The effective choke area widens and increases the fuel flow. See Fig. 2-79.

Since the vacuum in the engine induction manifold is dependent upon the engine speed and load, the correct fuel flow is obtained under all operating conditions.

Because of the variable choke area between the bridge and the valve, the air velocity and pressure drop across the jet orifice will always remain approximately constant, thus ensuring good fuel atomization at all speeds.

Acceleration

To provide at any point in the throttle range a temporary richer mixture at the moment the throttle is suddenly opened = acceleration, a hydraulic damper is incorporated in the valve rod. The hydraulic damper consists of a plunger mounted on a rod. The plunger operates in oil. When the throttle is suddenly opened, the vacuum in the suction chamber increases rapidly.

When the air valve (10, Fig. 2-77) lifts, the damper plunger (7) is forced against its seat and oil is prevented from flowing past the lower side of the damper plunger from the upper side, and this retards the movement of the valve (10). A more powerful vacuum is temporarily obtained above the jet so that the fuel- air mixture becomes for the moment richer.

The downward stroke of the air valve is assisted by the spring (6). The rod in the valve should be filled to approximately within a 1/4″ from the upper edge with oil which is approved as "Automatic Transmission Fluid, Type A".

SU CARBURETOR — HIF TYPE

Two SU carburetors are used for then twin-carburetor engine. The design can be seen from Figs. 2-80, 2-81, 2-82 and 2-83.

The carburetors are constructed for the exhaust emission control system. They are with a tempera-

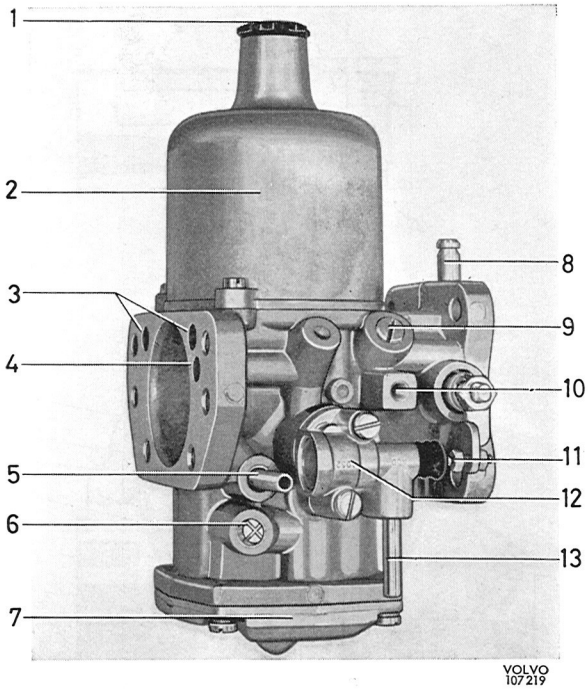


Fig. 2-80. SU carburetor, front, right side

1 Hydraulic damper
2. Suction chamber
3. Drillings for air supply under air valve
4. Vent hole from float chamber
5. Connection for fuel line
6. Jet adjusting screw
7. Float chamber cover
8. Connection for hose to venting filter (vehicles equipped with Evaporative Emission Control System)
9. Plug for outlet for speed compensator (air condition)
10. Boss for guard
11. Hot start valve adjusting screw
12. Hot start valve
13. Outlet from float chamber

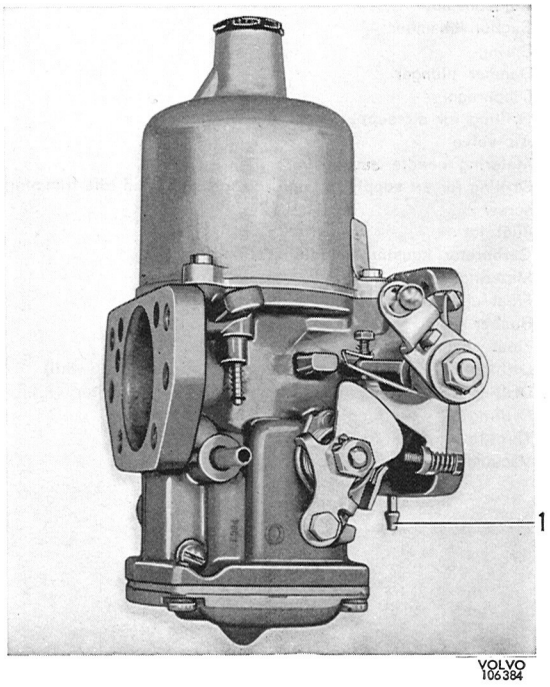


Fig. 2-81. SU carburetor, rear, right side

1. Vacuum hose connection for distributor

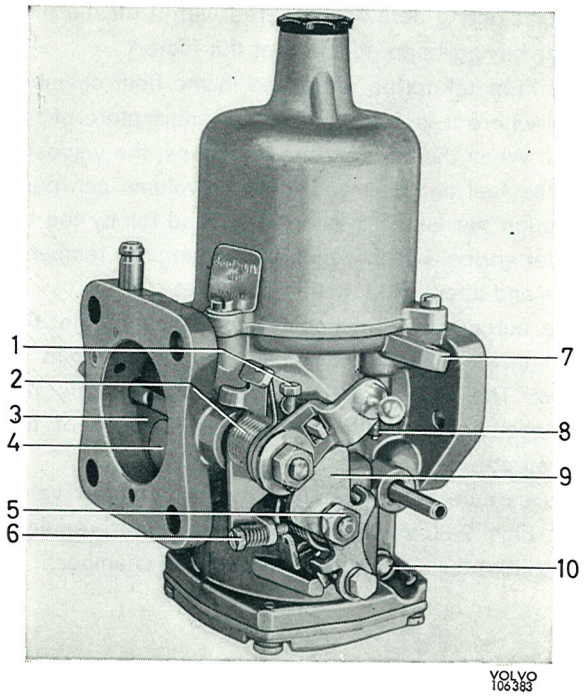


Fig. 2-82. SU carburetor, front, left side

1. Throttle stop screw
2. Return spring
3. Throttle
4. Overrev valve (vehicles equipped with Evaporative Emission Control System)
5. Cold-start device
6. Fast-idle stop screw
7. Attachment for choke control
8. Lift pin
9. Cam disc for fast idle
10. Screw head for float shaft

ture-controlled fuel jet, metering needle, spring suspension, hot start valve and, for the Canadian market, overrev valve in throttle.

The carburetor consists of a carburetor housing (12, Fig. 2-84), the lower part of which is designed

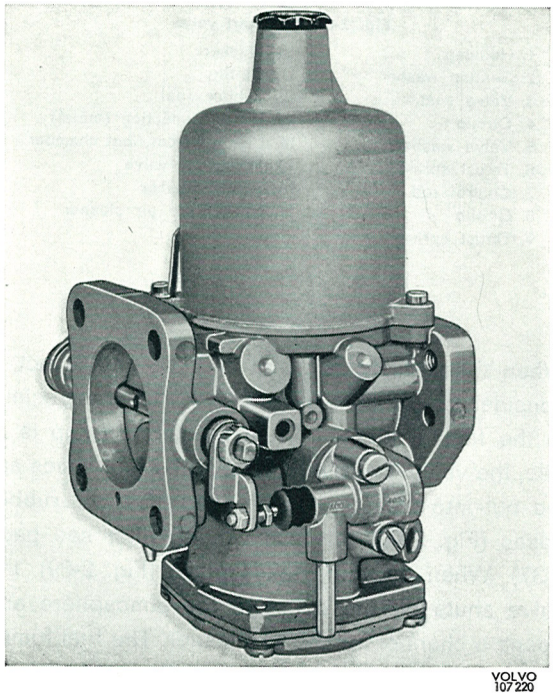


Fig. 2-83. SU carburetor, rear, left side

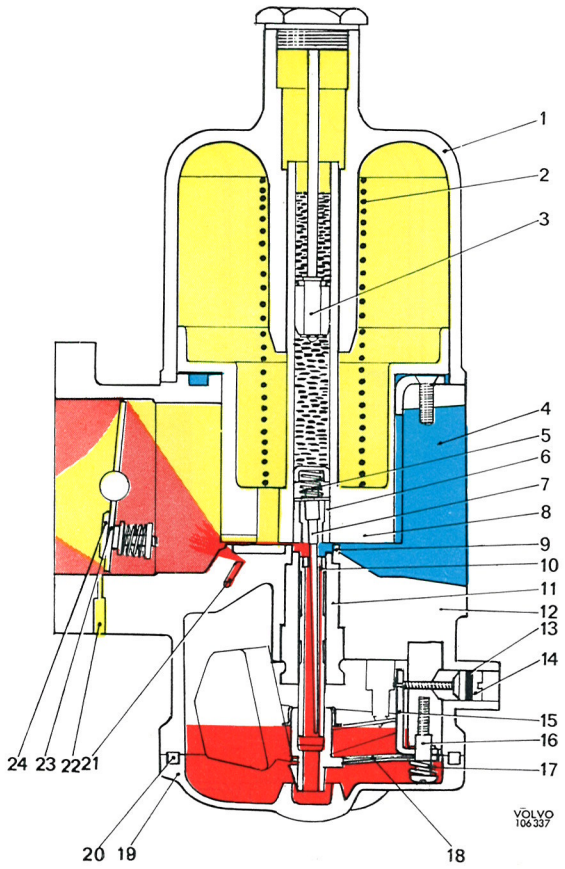


Fig. 2-84. Cold starting, principle

1. Suction chamber
2. Spring
3. Damper plunger
4. Air intake
5. Spring
6. Sleeve
7. Metering needle
8. Air valve
9. Bridge
10. Fuel jet
11. Jet sleeve
12. Carburetor housing
13. Rubber ring
14. Adjusting screw
15. Lever
16. Screw for bi-metal assembly
17. Spring
18. Bi-metal assembly
19. Floatchamber cover
20. Rubber seal
21. Drilling for cold start fuel
22. Vacuum outlet for ignition distributor (negativ setting)
23. Throttle
24. By-pass valve

as a float chamber, and an upper part which is called a suction chamber (1). A movable spring-loaded air valve (8) is located in the suction chamber. It is the lower section of the valve which regulates the volume of air admitted. The suction chamber is connected by channels to the space between the carburetor throttle and valve.

Located in the carburetor housing is an adjustable fuel jet (10), in which a movable tapered needle (7) varies the through-flow volume of fuel. The needle is mounted in the air valve and in a spring-loaded suspension (5). This spring load always forces the needle against the same side of the jet and results in an accurately regulated through-flow of fuel.

The fuel jet is manually adjusted by the adjusting screw (14) and automatically by the bi-metal spring (18).

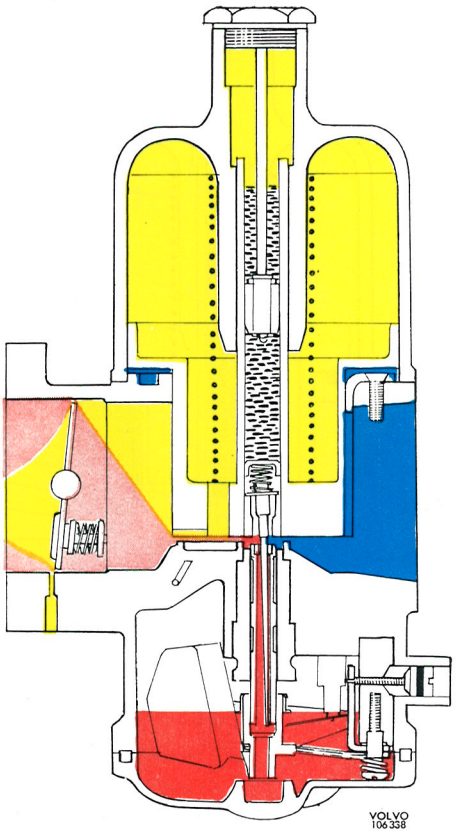


Fig. 2-85. Idling, hot engine

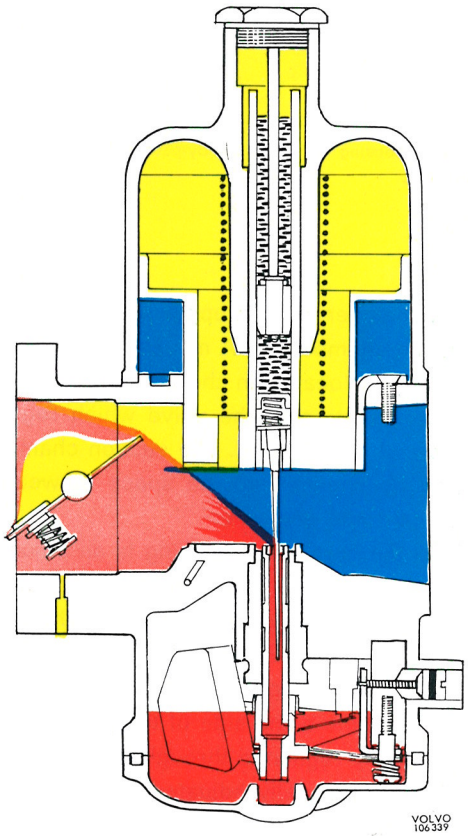


Fig. 2-86. Normal operation

The adjusting screw is covered with a plastic plug after having been adjusted at the factory.

The bi-metal spring is located in the float chamber fuel where it is actuated by the temperature of the fuel. When the temperature increases, the viscosity of the fuel changes and a larger volume can pass through the jet. This is compensated for by the bi-metal spring, which bends with change in temperature and alters the location of the jet.

This automatic regulation of the jet means that the carburetor is stable from a temperature point of view. The fuel-air mixture relationship does not change with alteration in the temperature of the carburetor.

The carburetor is equipped with a hot start valve (12, Figs. 2-80 and 2-87), the purpose is to regulate the outlet for a channel from the float chamber.

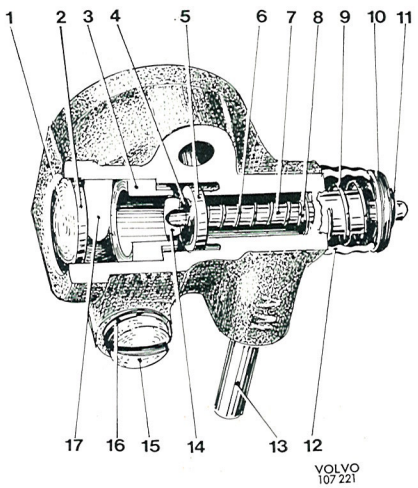


Fig. 2-87. Hot start valve

1. Housing
2. Sealing washer
3. Valve seat
4. Circlip
5. Valve washer
6. Thrust spring
7. Control rod
8. Circlip
9. Thrust spring
10. Washer
11. Circlip
12. Rubber seal
13. Hose connection (outlet)
14. Channel from float chamber
15. Screw for valve
16. Spring washer
17. Channel to air cleaner

When the weather is warm and the engine hot, a considerable amount of fuel fumes form especially in the float chamber. When the throttle flap is at idle, the valve is actuated so that the fuel fumes are led out into the atmosphere (Fig. 2-88) via rubber hoses (Fig. 2-90) (or to a venting filter see page 2-37). When throttling takes place (Fig. 2-89), the valve shuts off the outlet to the atmosphere and opens a channel for the air cleaner. The fuel fumes are led to the cleaner under suction with the air current and take part in the combustion.

By evacuating the fuel fumes to the atmosphere when the throttle flap is at idle, hot start difficulties are avoided.

The throttle spindle is provided with seals (Fig. 2-132) in order to reduce wear on spindle and bushings as well as eliminate air leakage.

On vehicles for the Canadian market an overrev valve (4, Fig. 2-82) is located in the carburetor throttle. This valve opens when the throttle is closed during engine braking. A suitable quantity of fuel-air mixture passes through the valve and this reduces considerably the volume of noxious exhaust gases (see Fig. 2-91).

The cold start device (5, Fig. 2-82) is connected manually. Turning the cold start device spindle opens a channel between the float chamber and venturi. Extra fuel for the venturi is obtained through this channel (see Fig. 2-93).

A damping device (3, Fig. 2-84) is located in the spindle of the valve in order to produce a temporarily richer fuel-air mixture with acceleration.

The rear carburetor is provided with a vacuum connection for the distributor. It is located on the upper side of the carburetor neck and accomplishes so called "positive" vacuum advance. Vehicles equipped with Gas Evaporative Emission Control System (Canada) are provided with a vacuum connection on the underside, Fig. 2-81, accomplishing "negative" vacuum advance.

These vehicles have also on the front carburetor a vacuum connection (8 Fig. 2-80) for the Evaporative Emission Control Filter and, next to it, a connection for the EGR valve. Both connections are "positive".

For Canda, the levers on both carburetors are rigidly connected to the throttle shaft, not via the flange as on other carburetors. The reason is that, if the throttle return spring is defective, the throttle control return spring can bring the throttle back to idle position.

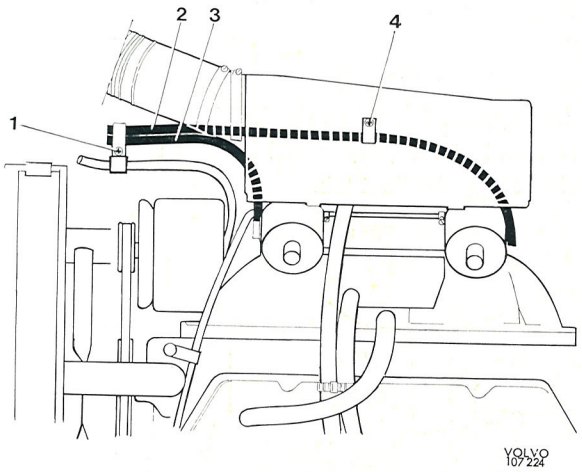


Fig. 2-90. Hoses installed from hot start valves (does not apply to vehicles with Gas Evaporative Control)

1. Clamp
2., 3. Hoses from hot start valve
4. Clamp

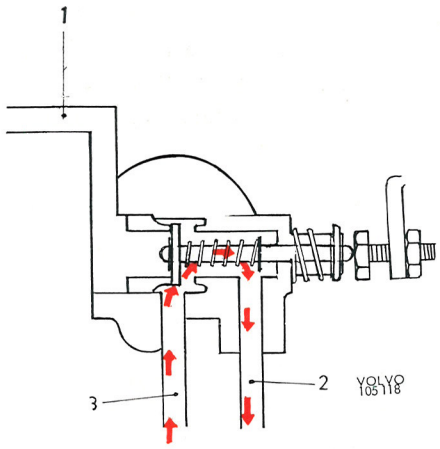


Fig. 2-88. Principle, hot start valve with throttle control inidling position

1. Channel to air cleaner
2. Channel to atmosphere or venting filter
3. Channel from float chamber

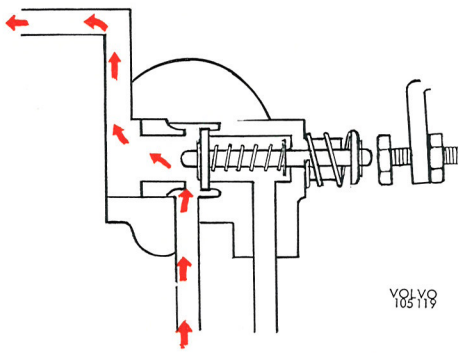


Fig. 2-89. Principle, hot start valve with throttle control in running position

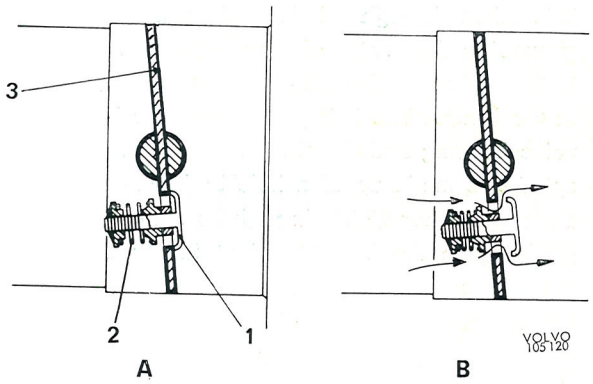


Fig. 2-91. Overrev valve (only on vehicles with Gas Evaporative Emission Control)

A. Idling and running
B. Engine braking

1. Valve
2. Thrust spring
3. Primary throttle

Float system

Fuel flows into the float chamber through the float valve (4, Fig. 2-82). The float (9) is journaled on a float spindle (7). When the fuel level rises, the float lifts and at the proper fuel level the float valve is shut off by the float tab.

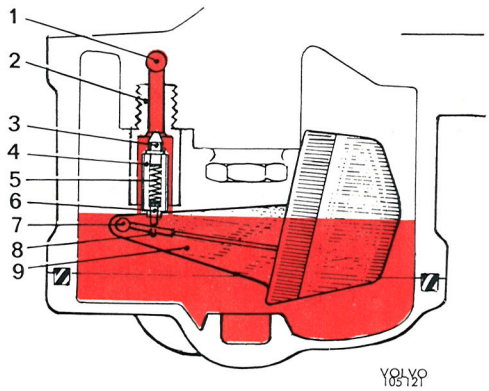


Fig. 2-92. Float system

1. Fuel inlet
2. Float valve house
3. Float valve point
4. Float valve
5. Spring
6. Spring-loaded pin
7. Float spindle
8. Retainer
9. Float

Cold start device and fast idle

During cold starting, the fuel-air mixture is given extra fuel through the cold start device. This device consists of a valve housing (14, Fig. 2-93) partly located in a space in the lower section of the carburetor housing and is provided with seals (8 and 15). A pivotable spindle (16) is located in the center of the valve housing. When the spindle is turned to cold start position, fuel is drawn from the bottom of the float chamber through the channel (2) to the space round the valve housing. From there it is taken through a hole in the valve housing, a channel in the center of the spindle and a channel in the carburetor housing to the carburetor venturi at the bridge. The linkage between the hole in the valve housing and the channel in the center of the spindle is made up of a hole and a V-slot. When the spindle turns, the through-flow area is altered gradually in the V-slot, and at full turn, the fuel goes directly through the hole, see Fig. 2-93. In this way the quantity of additional fuel is regulated. A channel (4) between the float chamber space above the fuel level and the channel (2) for the fuel give the cold start fuel a little extra supply of air. The fast idle cam (6) follows the pivotal movement of the spindle and actuates the position of the throttle. The fast idle cam opens the throttle slightly before the slot in the spindle reaches the hole in the valve housing. With this arrangement, the driver can raise the idling speed while the engine is warming up.

Idling

When the engine is idling, the vacuum in the carburetor suction chamber is low and the column between the air valve and bridge is narrow (Fig. 2-85). The metering needle is then positioned in the thicker section of the jet and only a small amount of fuel, corresponding to idling requirements, is drawn into the engine. The amount of air is determined by the size of the column between the valve and the bridge.

Running

When the throttle is opened, the suction chamber obtains about the same vacuum as in the engine intake manifold. Owing to the pressure difference between the bottom side of the air valve, where there is pressure at the inlet port of the carburetor, and the top side of the valve, where there is vacuum, the valve lifts from the bridge and also causes the tapered needle (7, Fig. 2-84) secured at the valve to lift from the jet. The effective choke area widens and increases the fuel flow. Since

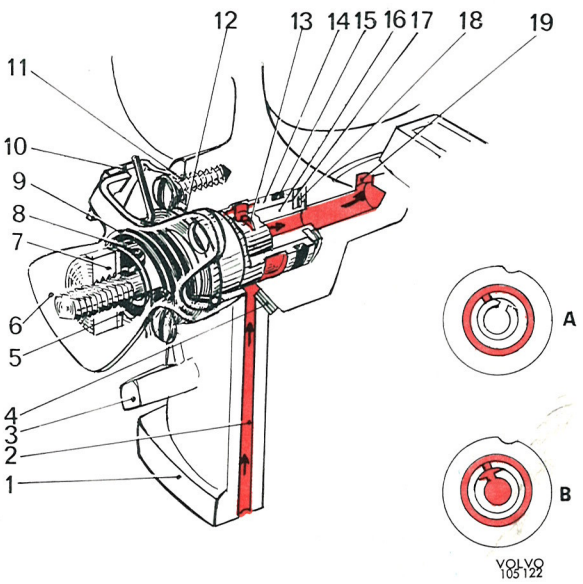


Fig. 2-93. Cold start device

A. Disengaged
B. Engaged
1. Charburetor housing
2. Channel from float chamber
3. Stop tab for lever
4. Channel for additional air
5. Tab washer
6. Cam for fast idle
7. Nut
8. Seal
9. Return spring
10. Spring retainer
11. Screw
12. Packing
13. V-slot
14. Valve housing
15. Seal
16. Spindle
17. Washer
18. Circlip
19. Channel to carburetor venturi

the vacuum in the engine induction manifold is dependent upon the engine speed and load, correct fuel flow is obtained for all operating conditions. Because of the variable choke area between the bridge and the valve, the air velocity and pressure drop across the jet will always remain approximately constant, thus ensuring good fuel atomization at all speeds.

Acceleration

To provide at any point in the throttle range a temporarily richer mixture at the moment the throttle is suddenly opened = acceleration, a hydraulic damper is incorporated in the valve rod. The hydraulic damper consists of a damper plunger (3, Fig. 2-84) mounted on a rod. The plunger operates in oil. When the throttle is suddenly opened, the vacuum in the suction chamber increases rapidly.

When the air valve (8) lifts, the damper plunger is forced against its seat and oil is prevented from flowing past the lower side of the damper plunger from the upper side, and this retards the movement of the valve (8). A more powerful vacuum is temporarily obtained above the jet so that the fuel-air mixture becomes richer for the moment.

The downward stroke of the air valve is assisted by the spring. The rod in the valve should be filled within 1/4″ from the upper edge with oil which is approved as "Automatic Transmission Fluid, Type A".

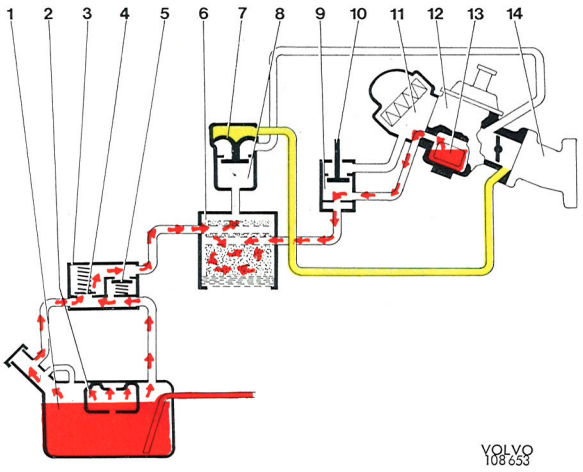


Fig. 2-94. Gas Evaporative Emission Control System. Function with control rod (10) at idle position

1. Fuel tank
2. Expansion tank
3. Equalizing valve
4. Overpressure valve
5. Underpressure valve
6. Venting filter
7. Diaphragm
8. Vacuum valve
9. Hot start valve
10. Control rod
11. Air cleaner
12. Carburetor
13. Float chamber
14. Intake manifold

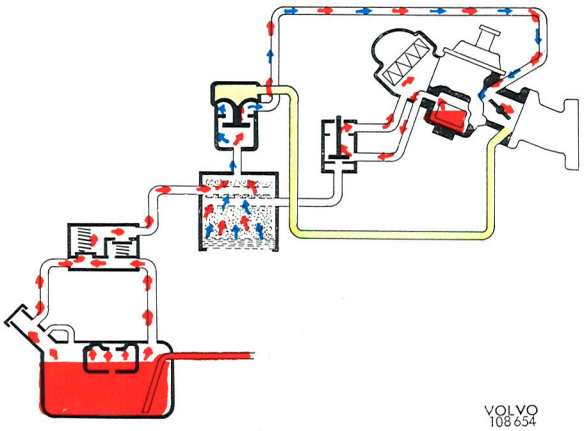


Fig. 2-95. Gas Evaporative control system. Function with control rod at running position

GAS EVAPORATIVE EMISSION CONTROL SYSTEM

Vehicles intended for Canada are equipped with a Gas Evaporative Emission Control system, which prevents fuel fumes from tank and carburetor to be released out into the atmosphere.

The system comprises equalizing valve 3, venting filter 6, vacuum valve 8 and hot start valve 9, Fig. 2-94. See also Figs. 2-96 to 2-103.

The expansion tank 2 (all models) is also a part of the Gas Evaporative Emission Control System, as it absorbs the warm gas expansion at full tank.

Figs. 2-94 and 2-95 show the function of the system. Fuel fumes formed in the fuel tank, especially during hot weather, are led through the hoses to the equalizing valve 3, see the red arrows.

The equalizing valve 3 comprises the overpressure valve 4 and the underpressure valve 5. The valve 4 opens when the pressure exceeds .05—.2 kp/cm^2 = .7—3 psi and the fuel fumes are directed to the venting filter 6 where they are absorbed by active carbon.

The valve 3 prevents fuel (in curves etc.) from being pressed up in the hose and to the venting filter. The valve 5 opens when the tank underpressure exceeds .1—.2 kp/cm^2 = 1.4—2.8 psi and air is led to the tank via the venting filter.

Fuel fumes from the float chamber are led via the valve (3) to the venting filter when the engine has been switched off or during idling. Throttling shuts off the connection between the venting filter and the float chamber so that the fumes travel via the valve to the air cleaner. (Fig. 2-95).

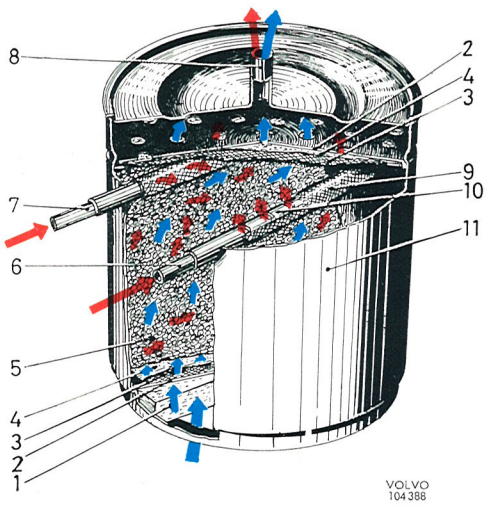


Fig. 2-96. Venting filter

1. Foam plastic filter (replace every 40 000 km =24 000 miles)
2. Plate (perforated)
3. Wire net (gauze)
4. Felt
5. Active carbon
6. Hose connection from expansion container
7. Hose connection from hot start valve
8. Connection to air valve
9. Wire net stocking
10. Perforated pipe
11. Canister

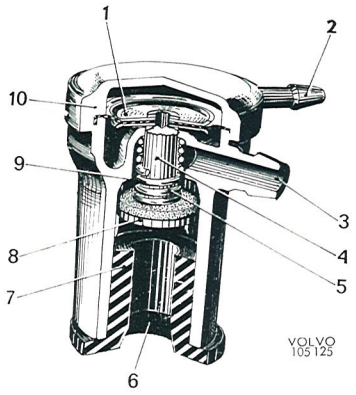


Fig. 2-97. Air valve

1. Diaphragm
2. Connection for hose to rear carburetor
3. Connection for hose to front carburetor
4. Valve rod
5. Thrust spring
6. Connection for venting filter
7. Rubber sleeve
8. Valve
9. Valve seat
10. Housing

The air valve (Fig. 2-97) controls the connection between the venting filter and the carburetor venturi. The space above the diaphragm (1) is connected by a line to the carburetor venturi on the side of the throttle facing the induction manifold, see Fig. 2-94.

The vacuum in the induction manifold depends on the engine load and speed.

At high vacuum, the vacuum valve is kept closed (Fig. 2-94). When the vacuum drops, the valve opens and air is drawn through the venting filter and vacuum valve to the carburetor venturi. Fuel fumes stored in the venting filter follow the air into

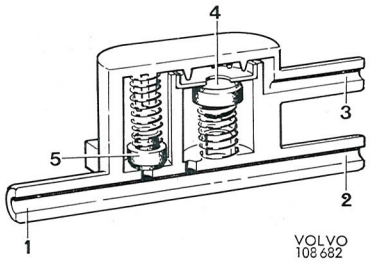


Fig. 2-98. Equalizing valve (located on the fuel tank)

1. Hose from the tank filler neck.
2. Hose from tank (fuel gauge sender)
3. Hose from venting filter
4. Underpressure valve
5. Overpressure valve

the engine and take part in the combustion (Fig. 2-95). The valve (9), which is known as the hot start valve, is to be found on all vehicles with twin carburetors. The difference between a valve used on a vehicle with or without a gas exaporative system is that in the latter case there is no hose from the valve to the venting filter and the fumes are led directly out into the atmosphere when the engine is switched off or idling.

HOT START VALVE

For the SU-carburetor, the hot start valve is described together with the carburetor.

The function of the hot start valve on the Stromberg carburetor is as follows:

During warm weather and when the engine is hot a great deal of fuel fumes develop in the float chamber. These are vented through a channel to the air cleaner and result in the engine obtaining a somewhat "richer" fuel mixture. This makes it difficult to start the engine. To counteract this on B 20 B, the hot start valve is attached to the connection between the float chamber and air cleaner by hoses.

When the throttle is at idling position, the lever (1, Fig. 2-102) presses against the valve control (2). The piston (14) is thereby lifted to its upper position by the control rod (16). The connection between the float chamber and air cleaner is closed and fuel fumes are led directly out into the atmosphere through the outlet (12).

When the accelerator pedal is depressed (see Fig. 2-103), the lever (1) releases the valve control (2) and the piston (14) is pressed by the spring (15) against its lower position. The outlet (12) is shut off, the fuel fumes are led into the air cleaner and, when the engine starts running, then through the

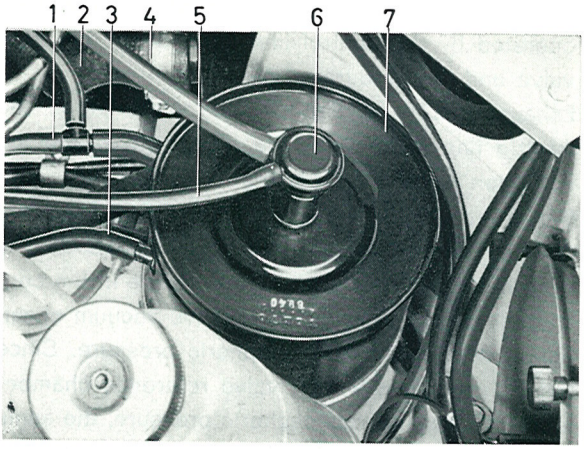


Fig. 2-99. Venting filter

1. Hose for rear carburetor hot start valve
2. Hose for front carburetor hot start valve
3. Hose from fuel tank via expansion tank
4. Hose for front carburetor positive vacuum connection
5. Hose for rear carburetor negative vacuum connection
6. Air valve
7. Venting filter

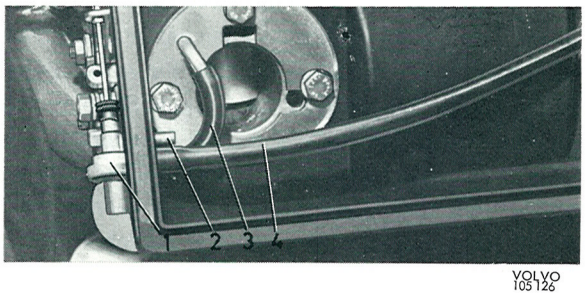


Fig. 2-100. Hose connections, Zenith-Stromberg

1. Hot start valve
2. Outlet to air cleaner
3 and 4. Hoses to carburetor floatchamber

carburetor and into the engine combustion chambers.

If it is to function properly, it is important that the hot start valve is accurately adjusted so that it has proper contact with the carburetor lever.

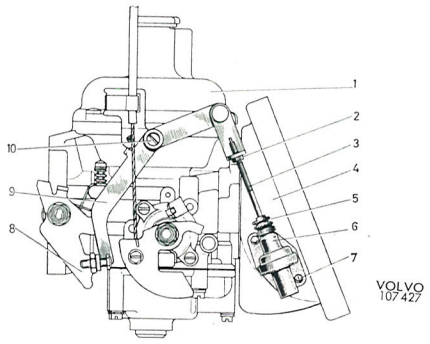


Fig. 2-101. Hot start valve on Zenith-Stromberg carburetor (B 20 B)

1. Carburetor
2. Lock nut
3. Control rod
4. Air cleaner, lower section
5. Rubber seal
6. Hot start valve
7. Attaching rivet
2. Throttle lever
9. Valve control
10. Screw for valve control

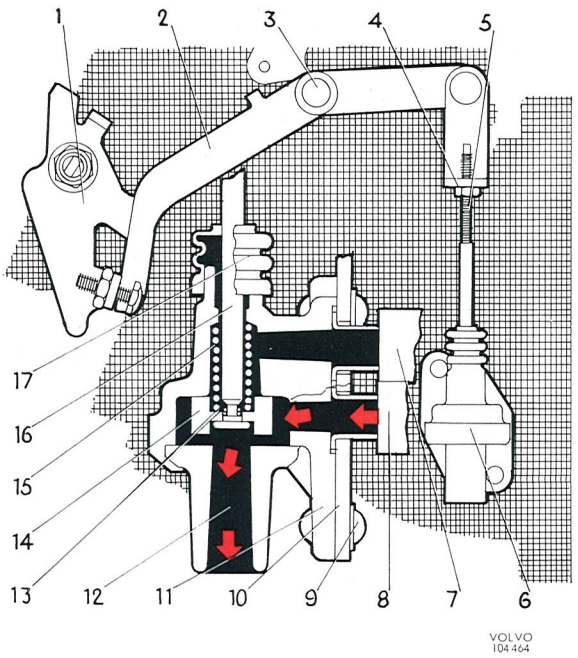


Fig. 2-102. Hot start valve, function, idling (Zenith-Stromberg carburetor)

1. Throttle lever
2. Valve control
3. Screw for valve control
4. Lock nut
5. Control rod
6. Hot start valve
7. Outlet to air cleaner
8. Hose to float chamber
9. Rivet
10. Air cleaner housing
12. Outlet to atmosphere
13. Rubber rings
14. Piston
15. Thrust spring
16. Control rod
17. Rubber seal

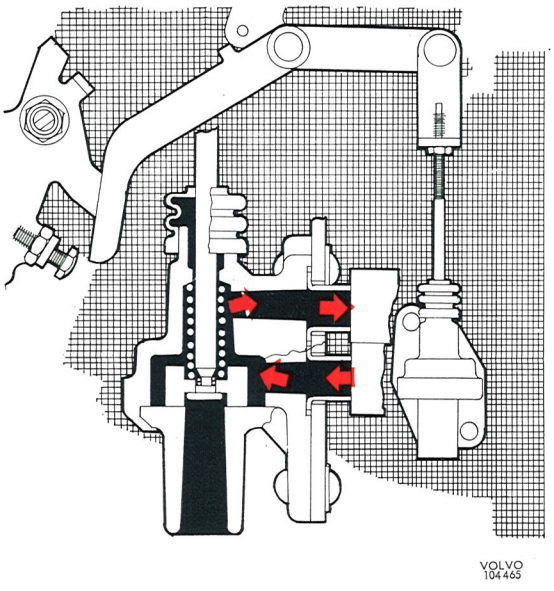


Fig. 2-103. Hot start valve, function, driving (Zenith-Stromberg carburetor)

EXHAUST GAS RECIRCULATION (EGR)

Vehicles for the Canadian market and with B 20 B-engines are equipped with Exhaust Gas Recirculation. This makes for cleaner exhaust gases when driving on half throttle.

The system consists of a recirculation line (1, Fig. 2-104) between the exhaust manifold and the intake manifold, and a vacuum-operated EGR valve (2) connected to the return channel. The system is operated by the control line (4) between the EGR valve and the carburetor venturi.

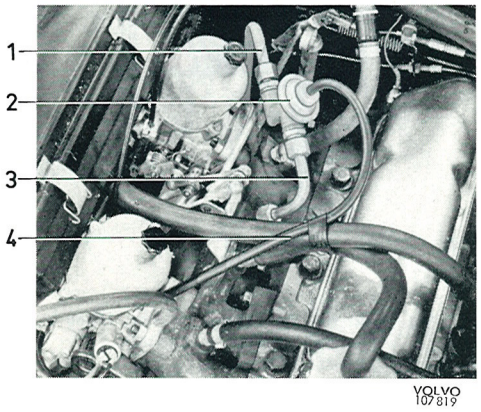


Fig. 2-104. EGR valve, installed

1. EGR line to exhaust manifold
2. EGR valve
3. EGR line to intake manifold
4. EGR line to carburetor

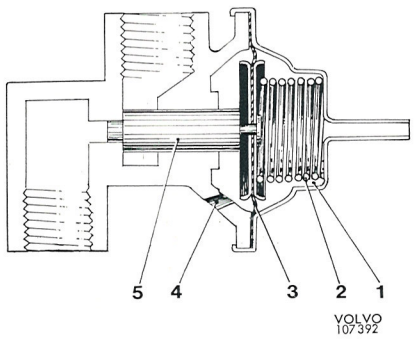


Fig. 2-105. EGR valve

1. Vacuum chamber
2. Return spring
3. Diphragm
4. Reference chamber
5. Piston

Exhaust gas recirculation takes place when the throttle flap is **between** the closed (idle) and the half-open position (full throttle).

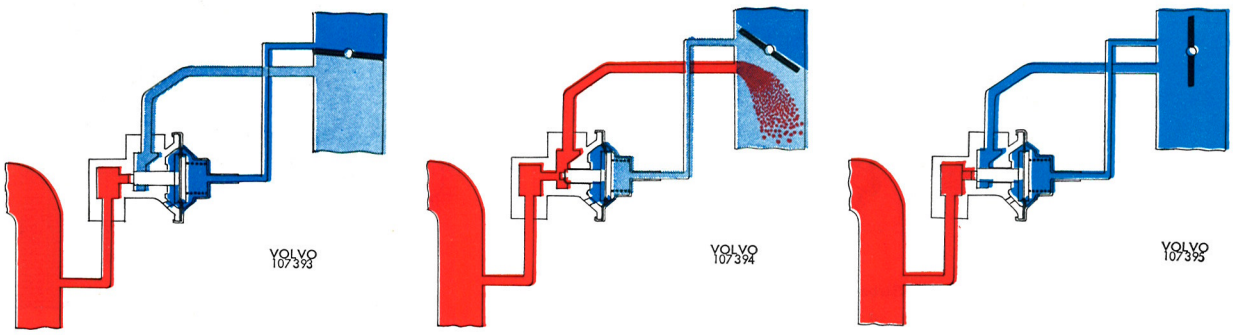
When the throttle flap is closed, Fig. 2-106a, the opening for the control line on the EGR valve is in front of the air shutter. The pressure in the control line and also in the EGR valve vacuum chamber is then equal to atmospheric pressure. Since the pressure in the EGR valve reference chamber is always equal to atmospheric pressure, the same pressure exists on both sides of the diaphragm and this keeps the valve in a closed position under the force of the spring. In other words, there is no exhaust gas recirculation.

When the throttle flap is partly open, Fig. 2-106b, the opening for the control line "moves" behind the air shutter. Behind the throttle flap there is partial vacuum which is transmitted to the vacuum chamber of the EGR valve. The atmosperic pressure in the EGR valve reference chamber now presses the diaphragm backwards so that the valve opens. Exhaust gas recirculation now takes place to the intake manifold and back into the cylinders.

With a fully open throttle flap, Fig. 2-106c, there is atmospheric pressure in the intake manifold and this is transmitted to the vacuum chamber of the control valve. The pressure on both sides of the diaphragm is now equal so that the valve is closed by the spring. Exhaust gas recirculation has now stopped.

When adjusting the carburetors, it is particularly important that the synchronizing is done accurately in order to ensure the function of the exhaust gas recirculation.

The EGR system should be cleaned at certain intervals, see "Service Procedures".



a b c

Fig. 2-106. EGR valve, function

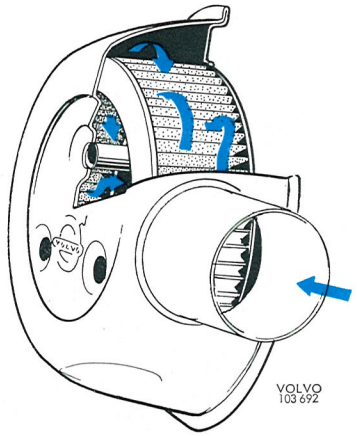


Fig. 2-107. Air cleaner B 20 A

AIR CLEANER

The air cleaner functions both as a cleaner for the intake air and as an intake.

The air cleaner (Fig. 2-107) on the B 20 A units is replaced complete. Change it every 40 000 km (24 000 miles) or earlier if driving conditions require it.

(For certain markets the B 20 A is equipped with an air cleaner as shown in Fig. 2-108.)

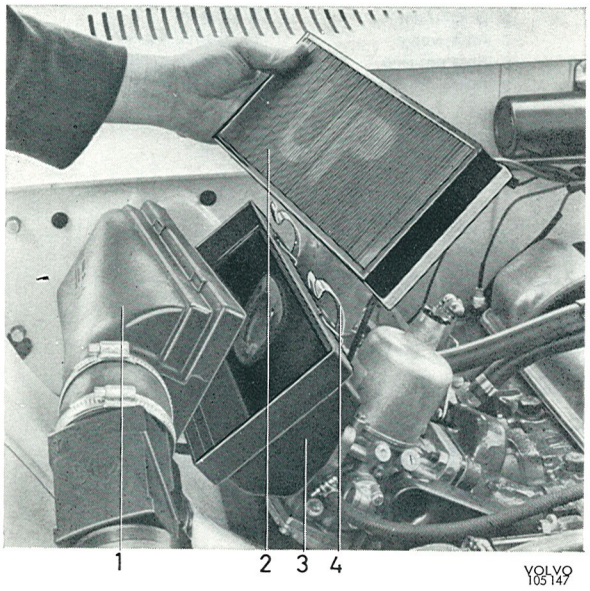


Fig. 2-108. Air cleaner B 20 B

1. Air cleaner housing, cover
2. Cleaner insert
3. Air cleaner housing, bottom section
4. Clamp

The air cleaner (Fig. 2-108) on the B 20 B engine has a replaceable paper insert. Note that the inserts for the SU carburetors and the Stromberg carburetors differ and must not be confused.

The engine is equipped with a **constant air temperature unit** for the air cleaner, see Fig. 2-109.

The constant air temperature unit consists of a flap housing (5), a hose (6) for cold air and heat-resistant hose (7) for warm air as well as a heater plate (8), which is secured to the exhaust pipe. The thermostat (2) in the flap housing is inserted in the air cleaner housing and regulates the flap (4) by the

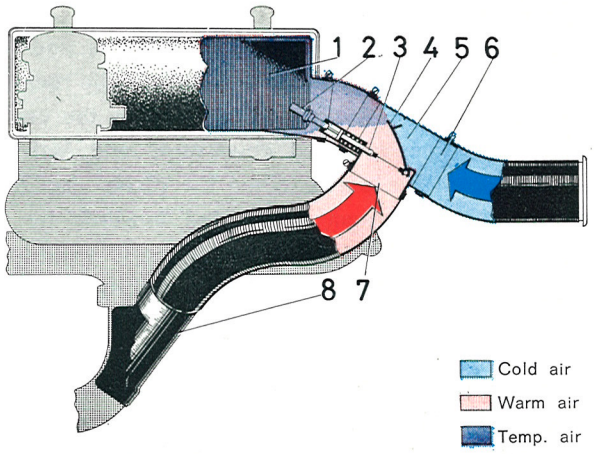


Fig. 2-109. Constant air temperature unit

1. Air cleaner
2. Thermostat
3. Flap control
4. Flap
5. Flap housing
6. Cold-air intake
7. Warm-air intake
8. Heater plate

flap control (3). The warm air taken at the exhaust pipe and the cold air taken at the front of the vehicle are regulated by the flap, mixed. The temperature of the mixture then influences the thermostat. In this way, the air supplied to the carburetors is maintained at a constant temperature of approximately 90°F.

This device eliminates the formation of ice in the carburetor. It also ensures that the driving properties of the vehicle are independent of the temperature of the outside air.

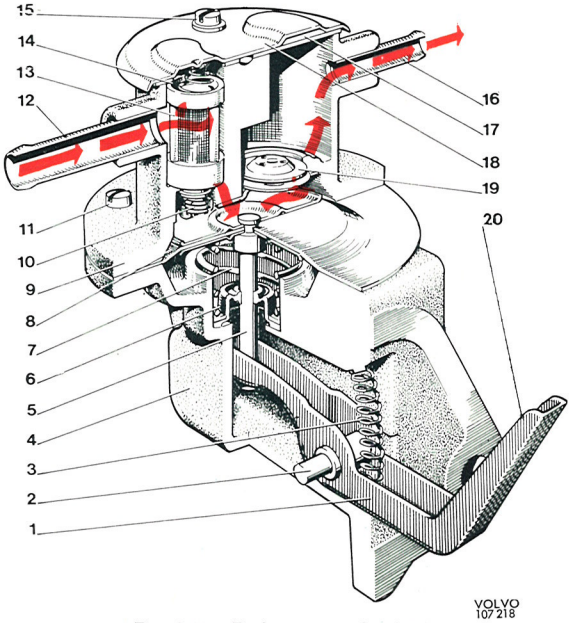


Fig. 2-110. Fuel pump, make S E V.

1. Rocker arm
2. Shaft
3. Spring
4. Lower pump body
5. Thrust rod
6. Seal
7. Spring
8. Diaphragm
9. Upper pump body
10. Inlet valve
11. Screw for body
12. Inlet
13. Filter
14. Spring
15. Screw for cover
16. Outlet
17. Seal
18. Cover
19. Outlet valve

FUEL PUMP

The fuel pump is of the diaphragm type and is driven by a cam on the camshaft. When the rocker arm in the pump is pressed upwards by the cam, the diaphragm is pulled downwards and fuel is drawn up to the pump. When the rocker arm returns, the diaphragm is pressed upwards by a spring (5, Fig. 2-111) and fuel is fed to the float chamber in the carburetor. When the level in the float chamber is sufficiently high, the float valve closes and the pressure in the delivery line rises until the pressure on the upper side of the pumping action ceases. The red arrows show the direction taken by the fuel.

Two alternative fuel pumps are used. One (Fig. 2-110) is of S.E.V. make and the other (Fig. 2-111) is produced by Pierburg.

For both the pumps, the filter (13, Figs. 2-110 and 2-111) should be cleaned after every 10 000 km (6 000 miles). No parts are stocked for these pumps. If the pumps are defective, they must be replaced by new ones, of make Pierburg. However, there is a filter kit for both the pumps when cleaning.

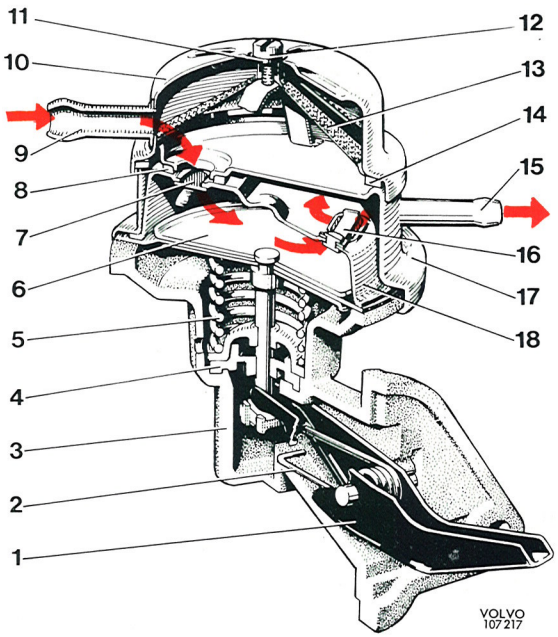


Fig. 2-111. Fuel pump, make Pierburg

1. Lever
2. Spring
3. Lower pump body
4. Seal
5. Spring
6. Diaphragm
7. Inlet valve
8. Sealing ring
9. Inlet
10. Cover
11. Washer
12. Screw
13. Filter
14. Sealing ring
15. Outlet
16. Outlet valve
17. Upper pump body
18. Valve housing

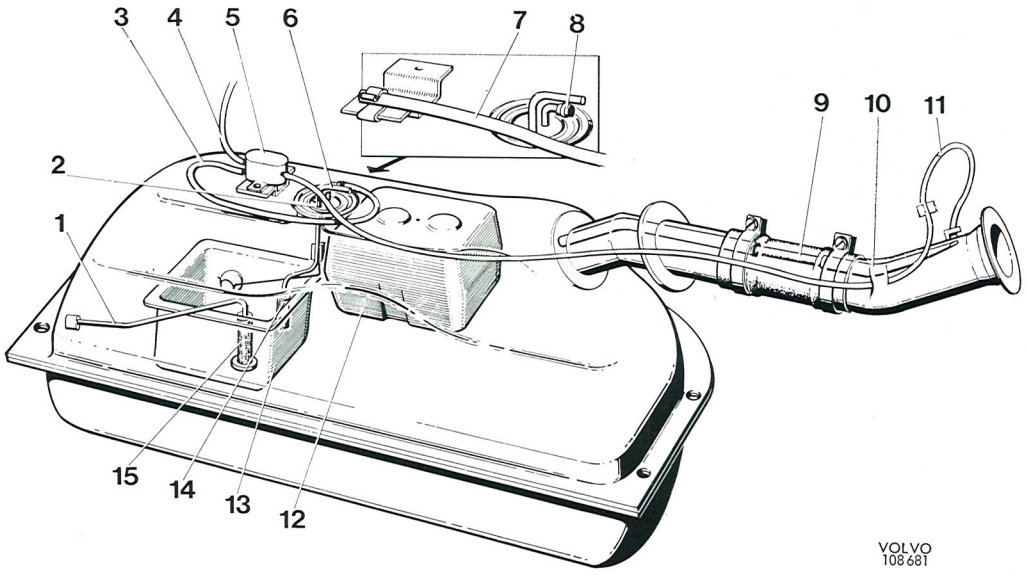


Fig. 2-112. Fuel tank

Type: Gas Evaporative Control System. P. 7 and 8 show type without Gas Evaporative Control System

1. Fuel outlet, fuel injection engines
2. Fuel gauge sender
3. Hose, connecting tank and equalizing valve
4. Hose to venting filter
5. Equalizing valve
6. Fuel outlet, carburetor engines (fuel return line on vehicles with fuel injection engines)
7. Equalizer hose from tank filler neck, see p. 11 (version without equalizing valve)
8. Rubber plug for connection to hose acc. to p. 3 (version without equalizing valve)
9. Hose
10. Venting pipe
11. Equalizer hose
12. Expansion tank
13. Baffle can (vehicles with fuel injection engines only)
14. Fuel filter, carburetor engines
15. Fuel filter, fuel injection engines.

FUEL TANK

Fig. 2-112 shows the tank. The tank capacity is 60 liters = 15.8 US gallons = 13.2 Imp. gallons. The built-in plastic expansion tank has a volume of 5 liters = approx. 5 quarts.

The expansion tank is provided with an equalizing hole on the upper side and an excess hole on the underside. The excess hole is sized to accomplish a slow filling. When the fuel tank is filled, the expansion tank has still a capacity to absorb the increased fuel volume when the fuel is subject to temperature increases.

Vehicles equipped with fuel injection have the tank equipped with a baffle can with fuel outlet through the filter (15). The fuel return line is connected to (6), which serves as fuel outlet in cars equipped with carburetor engines.

The filter (15), in cars with fuel injection engines, is accessible after removal of the tank drain plug. The filter should be cleaned every 20 000 km = 12 000 miles.

The filter (14), in cars with carburetor engines, is accessible after removal of the fuel gauge sender, see Fig. 2-113. The filter should be cleaned every 40 000 km = 24 000 miles.

The tank is provided with the ventilation pipe (10) and the equilizer hose (11). The hose is clamped to the bracket on the tank (see 7, Fig. 2-112) and ends in the air.

Vehicles equipped with Gas Evaporative Emission Control System have the hose connected to the equalizing valve (5). The valve is also connected to the tank via the hose (3), and to the venting filter (carbon filter, carbon canister) in the engine compartment via hose (4).

For equalizing valve function, see under "Gas Evaporative Control System".

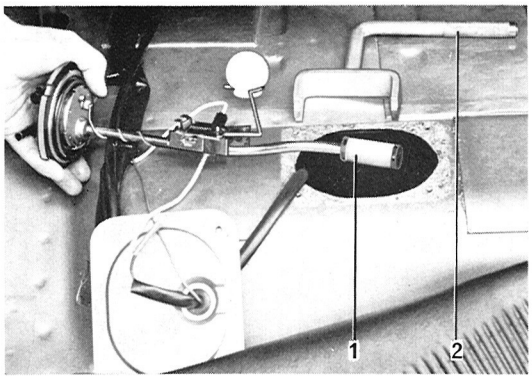


Fig. 2-113. Fuel gauge sender removed

1. Filter for cars equipped with carburetor engines.
2. Tool 999 5016

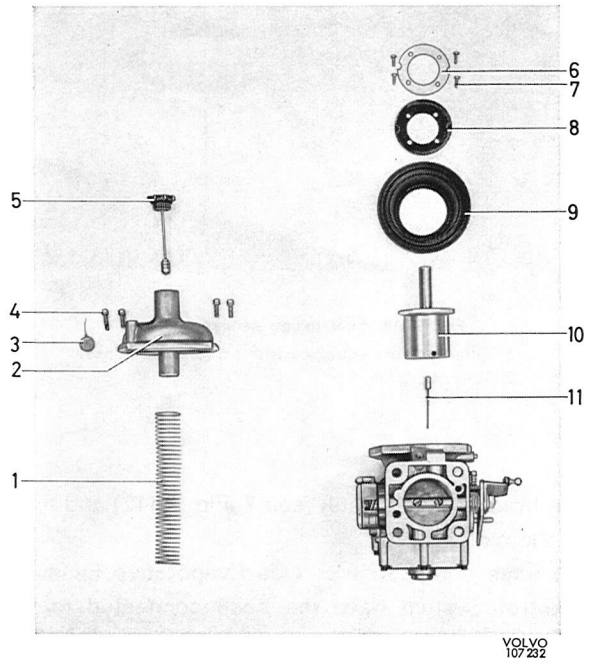


Fig. 2-114. Upper section disassembled

1. Spring
2. Suction chamber cover
3. Sealing plug
4. Screw
5. Hydraulic damper
6. Washer
7. Screw for diaphragm
8. Washer
9. Diaphragm
10. Air valve
11. Metering needle

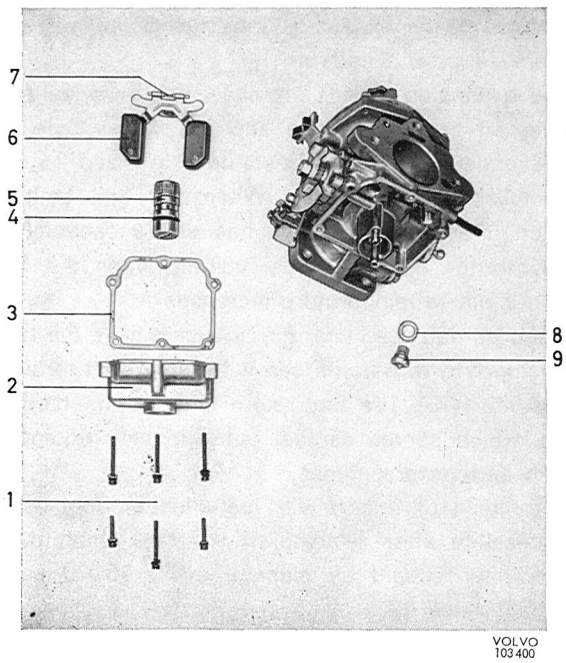


Fig. 2-115. Float chamber disassembled

1. Screw for float chamber
2. Float chamber
3. Gasket
4. Rubber ring
5. Float chamber plug
6. Float
7. Float pin
8. Washer
9. Float valve

ZENITH-STROMBERG CARBURETOR

Volvo Standard Times	Op. No.
Remove two Stromberg Carburetors	23170
Stromberg Carburetor: clean and adjust removed carburetor, each	23173
Install two Stromberg Carburetors, clean sludge trap, replace air cleaner	23172
Stromberg cold start device: clean or replace	23139

The carburetor is specially set by the manufacturer and adjusted at the factory. In order not to disturb the setting of the carburetor, it is absolutely essential that the following repair instructions are accurately followed when any work it to be done on the carburetor.

PERIODICAL CHECK

Every 10 000 km (6 000 miles) check that there is oil in the damper cylinder(s). The spindle in the piston should be filled to about a 1/4″ from the upper edge with oil approved as "Automatic Transmission Fluid, Type A". See Fig. 2-116.

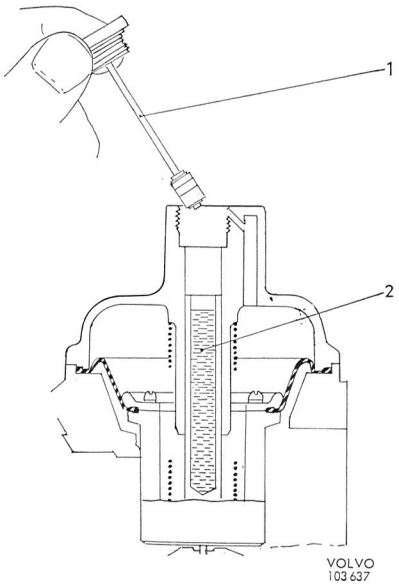


Fig. 2-116. Checking the damper oil

1. Damper piston
2. Oil approved as "Automatic Transmission Fluid, Type A"

Before any adjustment or repair, the following should be checked and, if necessary, remedied:
Valve clearance, spark plugs, compression, ignition breaker (dwell angle) and ignition. Also check that there is no air leakage on the intake side and that the air cleaner is not blocked. To be safe, check also the flap function of the constant air temperature unit.
The function of the throttle control and throttle(s) should be checked as well.

SETTING CARBURETOR

The best setting of the carburetor is obtained by using a CO-meter.
However, the setting can be checked without the use of this meter, but if checking with either of these methods results in unsatisfactory running of the engine and it has been established that the fault is due to an "over-rich" carburetor or "too lean" fuel mixture, the carburetor nozzle should be adjusted by a special tool in accordance with Workshop Bulletin P-23-44.
Use a synchro test for synchronizing the carburetors on the B 20 B.

SETTING WITHOUT CO-METER

B 20 A

1. Check that there is oil in the damper cylinder. See under "Periodical Check".
2. Cannect a tachometer and run the engine warm at 25 r/s (1500 rpm) until the coolant thermostat opens. The setting should be made within about 10 minutes after the coolant thermostat has opened.
   (One way of finding this out is by feeling the radiator at the upper radiator hose which should start to get warm).
3. Adjust the engine speed to 12 r/s (700 rpm) with the throttle stop screw (12, Fig. 2-69).
4. Adjust the idle trimming screw (6, Fig. 2-70) so the best idling speed is obtained.
5. Adjust the link rod. With the control against its stop on the manifold bracket, the link rod should be adjusted so that there is a clearance of approx. .1 mm (.004″) between the lever and the flange of the primary throttle spindle. See Fig. 2-118.
6. Setting the fast idle: Pull out the choke 20 mm (3/4″). Then adjust the fast idle screw (11, Fig. 2-69) to give an engine speed of 23—25 r/s (1400—1500 rpm).
7. Check that the cable (Fig. 2-129) is well stretched and, if necessary, adjust the cable sleeve adjustment (6).
   Right-hand steered vehicles:
   Adjust the lenght of the long vertical link (2, Fig. 2-117) for the pedal so that there is a clearance of 1 mm (.040″) between the throttle lever lug and the full throttle stop on the carburetors, when the accelerator pedal is fully depressed.
8. Lubricate all ball joints.

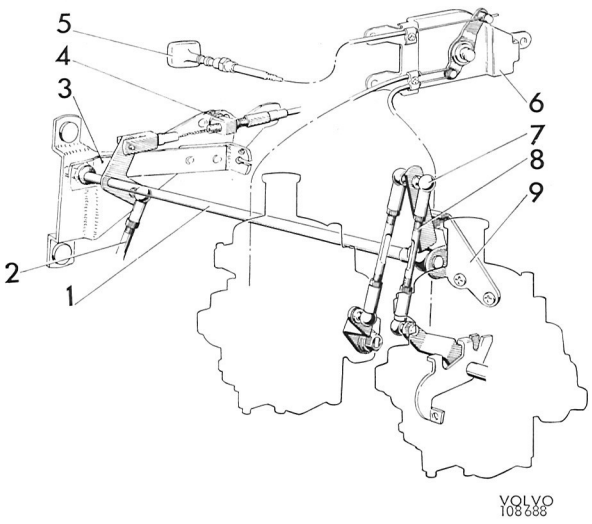


Fig. 2-117. Throttle control, B 20 B

1. Throttle control spindle
2. Link rod
3. Bracket (placed on dash)
4. Throttle cable (only vehicles with autom. transmission)
5. Choke control knob
6. Bracket for choke control (only twin carbs engines, placed on dash)
7. Ball joint
8. Link rod
9. Bracket (placed on manifold)

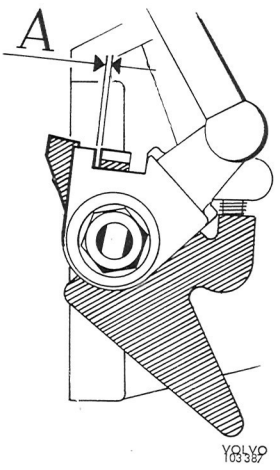


Fig. 2-118. Setting the control
A=.1 mm (.004″)

B 20 B

1. Check that there is oil in the damper cylinders. See under "Periodical Check" (page 2:42).
2. Screw the idlc trimming screw (6, Fig. 2-70) to its bottom position.
3. Connect a tachometer and run the engine warm at 25 r/s (15000 rpm) until the coolant thermostat opens. The setting should be made within about 10 minutes after the coolant thermostat has opened.
   (One way of finding this out is by feeling the radiator at the upper radiator hose which should start to get warm.)
4. Adjust the engine spee dto 13 r/s (800 rpm) with the throttle stop screws (12, Fig. 2-69). The speed should be adjusted to 12 r/s (700 rpm) for a vehicle with automatic transmission.
5. Check with a synchro test that the stream of induction air to both carburetors is the same. Make sure that the synchro test is installed so that its opening corresponds with the carburetor venturi. Turn the synchro test throttling washer until a suitable register for its piston is achieved.
6. Adjust the idling screws until the synchro test shows the same register for both carburetors (adjust both screws so that the idling speed is withheld).
7. Adjust with the idle trimming screws (6, Fig. 2-70), so that the best idling speed is obtained. Screw equally for both carburetors.
8. Adjust the link rods. With the control against its stop on the manifold bracket, the link rods should be adjusted so there is a clearance of about .1 mm (.004″) between the lever and the primary throttle spindle flange. See Fig. 2-118.
9. Adjust so that the valve control of the hot start valve is against the carburetor lever with the valve piston in the upper position and the throttle control at idle. (See Figs. 2-100, 2-101 and 2-102).
   Lubricate the contact surface with Molykote and check that the engine returns to idling speed after briefly revving-up several times.
10. Setting the fast idle: Pull out the choke control 20 mm (3/4″). Then adjust the fast idle screw (11, Fig. 2-69) to an engine speed of 18—27 r/s (1100—1600 rpm).
11. Adjust the length of the long, vertical link (2, Fig. 2-117) for the pedal, so there is a clearance of 1 mm (.040″) between the throttle lever lug and the full throttle stop on the carburetors, when the accelerator pedal is fully depressed.
12. Lubricate all ball joints.

SETTING WITH CO-METER

Check CO, incl. warm-up = Volvo Standard Times Op. No. 23002

The setting should be made at a temperature of 60—80°F and must be made within 8 minutes after the coolant thermostat has opened. Warming-up should be done with a completely cold engine.

When measuring with a CO-meter, it is important that the **carburetor temperature** is correct.

When the engine is idling, the float chamber is exposed to heat radiation from the exhaust manifold while the flow of cold fuel through the float chamber is small. The resultant rise in temperature causes an increase in the fuel flow through the jet due to the alteration in the viscosity and an increase in the CO-value. Racing the engine speed cools the carburetor to a certain extent due to the step up in the fuel flow. The temperature can be checked to make sure that it is not excessive by feeling the float chamber with the hand. It should "feel cold", that is, it more or less should not exceed room temperature.

Before reading, rev up the engine so that the air valve takes up the proper position.

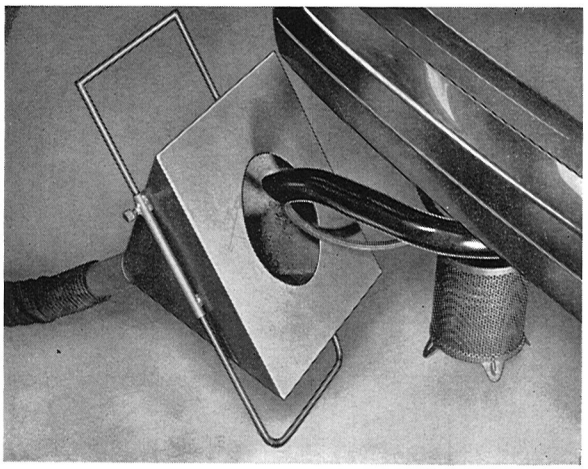
In order to be certain that the measured CO-value is correct, **measuring should be done within the time period mentioned above.**

There are a number of different types of CO-meters available which function with acceptable accuracy. The instructions on their use accompany each meter. Note that when connecting the hose for evacuating the exhaust gases, the hose must not be placed so that the exhaust gases are completely evacuated from the CO-meter connection to the exhaust manifold. A funnel, see Fig. 2-119, could suitably be used here. With the funnel installed, the suction at the connection would not be so great as to upset the measuring but sufficient to suck up the exhaust gases so that they do not fill the workshop.

When measuring with the CO-meter, it is important that the exhaust pipe and silencer are in good condition, that is, they do not leak.

B 20 A

1. Check that there is oil in the damper cylinder. See under "Periodical Check" (page 2:42).



VOLVO
103732

Fig. 2-119. Funnel for exhaust evacution

2. Connect a tachometer and run the engine warm at 25 r/s (1500 rpm) until the coolant termostat opens. (One way of finding this out is by feeling the radiator at the upper radiator hose which should start to get warm.)
3. Adjust the engine speed to 12 r/s (700 rpm with the throttle stop screw (12, Fig. 2-69).
4. Connect a CO-meter and check that the CO is 2.5 %. With the idle trimming screw (6, Fig. 2-70), the CO-content can be adjusted within small deviations. (If the CO is too high, check first the temperature compensator, see under the heading "Temperature Compensator".)
5. Adjust the link rod. With the control against its stop on the manifold bracket, the link rod should be adjusted so that there is a clearance of about .1 mm (.004″) between the lever and the flange of the primary throttle spindle. See Fig. 2-118.
6. Setting the fast idle: Pull out the choke control 20 mm (3/4″). Then adjust the fast idle screw (11, Fig. 2-69) to give an engine speed of 23—25 r/s (1400—1500 rpm).
7. Check that the cable (Fig. 2-129) is well stretched and, if necessary, adjust the cable sleeve adjustment (6).
   Right-hand steered vehicles:
   Adjust the length of the long vertical link (2, Fig. 2-117) for the pedal so that there is a clearance of 1 mm (.040″) between the throttle lever lug and the full throttle stop on the carburetors, when the accelerator pedal is fully depressed.
8. Lubricate all ball joints.

B 20 B

1. Check that there is oil in the damper cylinders. See under "Periodical Check" (page 2:42).
2. Screw the idle trimming screws (6, Fig. 2-70) to bottom position.
3. Connect a tachometer and run the engine warm at 25 r/s (1500 rpm) until the coolant thermostat opens. (One way of finding this out is by feeling the radiator at the upper radiator hose which should start to get warm.)
4. Adjust the engine speed to 13 r/s (800 rpm) with the throttle stop screws (12, Fig. 2-69). The speed should be adjusted to 12 r/s (700 rpm) for a vehicle with automatic transmission.
5. Check with a synchro test that the stream of induction air to both carburetors is the same. Make sure that the synchro test is installed so that its opening corresponds with the throats of the carburetors. Turn the synchro test throttle washer until a suitable register for its piston is achieved.
6. Adjust the idling screws until the synchro test shows the same register for both carburetors (adjust both screws so that the idling speed is withheld).
7. Connect a CO-meter and check that the CO is 2.5 %. With the idle trimming screw (6, Fig. 2-70) the CO-content can be adjusted within small deviations. Screw **equally** for both carburetors. (If the CO-content is too high, check first the temperature compensator, see under "Temperature Compensator".)
8. Adjust the link rods. With the control against its stop on the manifold bracket, the link rods should be adjusted so that there is a clearance of about .1 mm (.004″) between the lever and the flange of the primary throttle spindle. See Fig. 2-118.
9. Adjust so that the valve control of the hot start valve is against the carburetor lever with the valve piston in the upper position and the throttle control at idle. (See Figs. 2-100, 2-101 and 2-102).
   Lubricate the contact surface with Molykote and check that the engine returns to idling speed after revving-up briefly several times.
10. Setting the fast idle: Pull out the choke control 20 mm (3/4″).
    Then adjust the fast idle screw (11, Fig. 2-69) to give an engine speed of 18—26 r/s (1100—1600 rpm).
11. Adjust the length of the long, vertical link (2, Fig. 2-117) for the pedal, so that there is a clearance of 1 mm (.040″) between the throttle lever lug and the full throttle stop on the car-

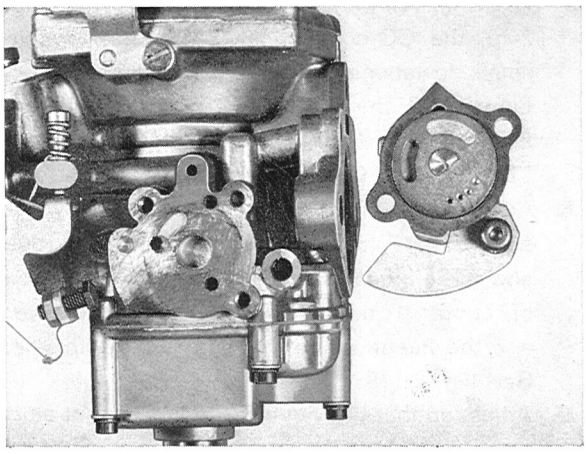
buretors, when the accelerator pedal is fully depressed.

12. Lubricate all ball joints.

INCORRECT CARBURETOR FUNCTION

1. Check to make sure that the reason for the function is not due to wrong damper oil or oil level, impurities in the float chamber or a faulty float valve and float. See the respective headings.
2. Remove the air cleaner and check that the suction valve(s) operate easily and without jamming. (The damper piston(s) removed.) If this is not the case, remove the suction chamber cover and clean the pistons. At the same time, check to make sure the diaphragm is in good condition. Plug-seal after.

   NOTE: if the metering needle must be released or moved, it should be adjusted, see under the heading "Replacing the metering needle". **A CO-meter is recommended for this purpose.**



VOLVO 103402

Fig. 2-120. Cold start device

TEMPERATURE COMPENSATOR

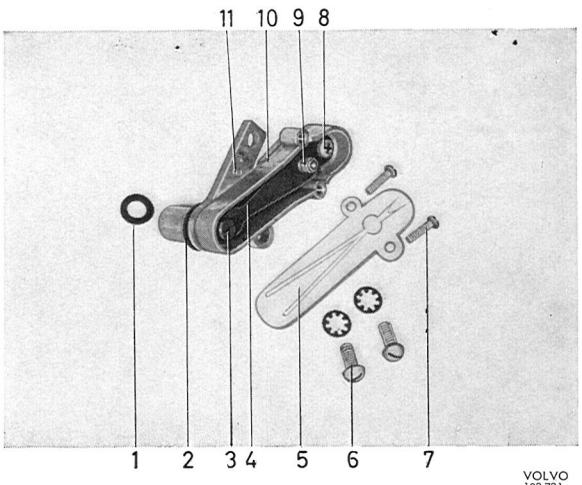
Check and adjust=Volvo Standard Times Op. No. 23147

3. Should there be a powerful drop in the idling speed during idling for a lengthy period, especially when the weather is warm, check the function of the temperature compensator by removing the plastic cover and pressing in the valve (3, Fig. 2-121). This should move under very light pressure and return to its position without jamming. This applies at a temperature above 85°F. The valve starts opening at 70°—77°F. Pressing the valve inwards deteriorates the quality of the idle. If the valve has a tendency to be stiff in operation or if the compensator is incorrectly adjusted, the latter should be replaced complete. See under "Replacing temperature compensator".

   For adjusting, slacken one of the Phillips screws (8), for the bi-metal spring and center the valve so that its function will be as above. If necessary adjust as follows:

   At 70°—77°F the valve should just start to open. In other words, the valve should be loose in its seat at this temperature.

   When checking the setting, remove the temperature compensator from the carburetor and store it at a temperature of 70°—77°F until it has reached this temperature. Adjust with the nut (9) for the bi-metal spring.



VOLVO 103731

Fig. 2-121. Temperature compensator

1. Rubber seal
2. Rubber seal
3. Valve
4. Bi-metal spring
5. Cover
6. Screw for temperature compensator
7. Screw for cover
8. Phillips screw
9. Adjuster nut
10. Housing
11. Marking

REPLACING TEMPERATURE COMPENSATOR

Volvo Standard Times Op. No. 23145

The temperature compensator is replaced complete. It is removed from the carburetor by removing the screws (6, Fig. 2-121). Take out the old seal (1)

from the carburetor and install a new one. Place a new seal (2) on the temperature compensator and install the compensator.

NOTE. The temperature compensator is marked "120°" for the B 20 A engine and "60°" for the B 20 B engine (see 11, Fig. 2-121).

REMOVING CARBURETORS, B 20 B

(In principle, the same method is used as for the B 20 A.) Release the control for the hot-start valve and remove the air cleaner. Remove the link rod ball joints from the carburetors. Take off the fuel hoses, vacuum hose and choke wire.

Remove the nuts for the carburetors and take off the carburetors. Remove the protection plates and gaskets. Mask over the intake holes with tape.

FITTING CARBURETORS, B 20 B

Clean the gasket surface. Install protection plates, new gaskets and then the carburetors. Connect ball joints, fuel hoses, vacuum hose and choke wire. Make sure that the choke control on the dashboard is pushed in. Then secure the pull wire in the clamping screw of the rapid idle cam. After this clip on the outer sleeve of the pull wire.

Install air cleaner and connect the hose for the crankcase ventilation. Install and adjust the control for the hot start valve. Adjust the carburetors, see under "Setting carburetors".

CLEANING FLOAT CHAMBER

The float chamber is removed by removing the float chamber plug (5, Fig. 2-115) and the screws (1). Clean the gasket surface and install a new rubber ring (4). Install the float chamber with a new gasket.

(Later versions of float chamber plugs (5) are made of plastic and retained in the float chamber only.)

Before tightening the float chamber screws install the plug (5). (Metal plugs only.)

FLOAT LEVEL

Before checking the float level, remove the carburetor, invert it and take out the float chamber.

The float is removed by carefully breaking the float spindle from the bridge. The float is installed with the sloping side facing away from the carburetor housing.

At the correct float level, the top point on the float should lie 15—17 mm (5/8") and the rear edge 9—13 mm (1/2") above the sealing surface (see Fig. 2-122). If the level is incorrect, adjust by bending the tab at the float valve.

NOTE: Do not bend the arm between the float and the pin.

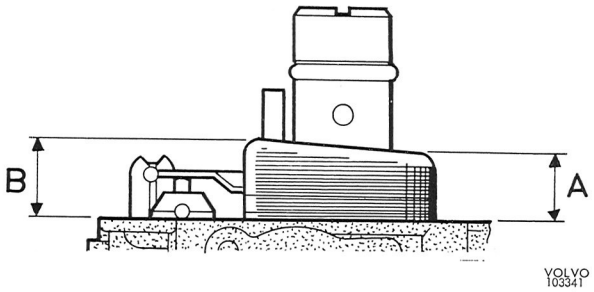


Fig. 2-122. Float level
A= 9—13 mm (1/2")
B=15—17 mm (5/8")

REPLACING DIAPHRAGM

Volvo Standard Times Op. No. 23141

1. Screw out the damper piston. Make line-up marks on the suction chamber cover and carburetor housing. Remove the seal plug, release the screws and take off the suction chamber cover. Remove the spring.
2. Pull up the air valve with diaphragm. Remove the diaphragm by removing the four screws. Clean the air valve.
   NOTE: Observe due care that the metering needle is not bent or moved from its position.
3. Install the new diaphragm, see Fig. 2-123. The rubber register should install into the valve groove.

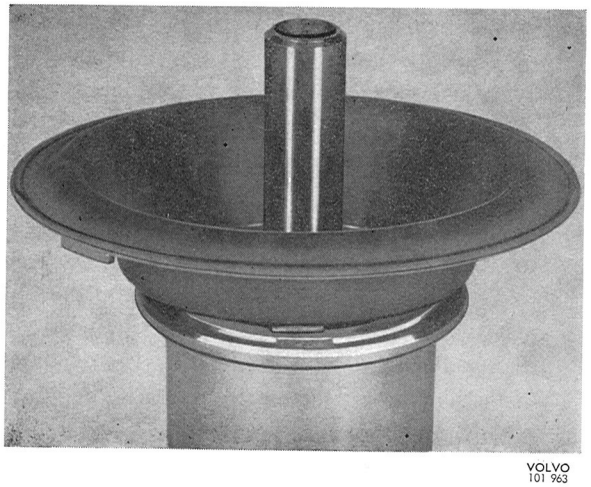
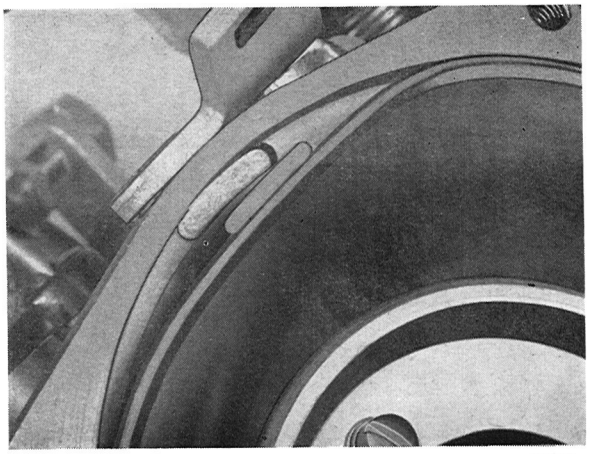
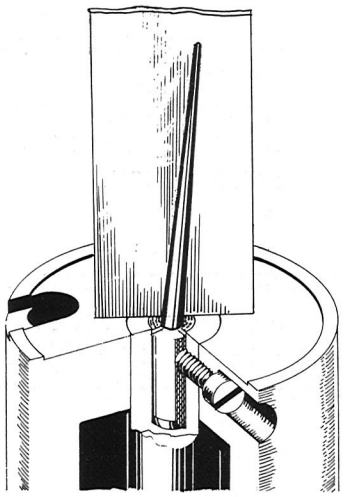


Fig. 2-123. Diaphragm in air valve



VOLVO 101 964

Fig. 2-124. Diaphragm in carburetor housing



VOLVO 104 380

Fig. 2-125. Installing metering needle

4. Move the air valve down and install in the rubber register as shown in Fig. 2-123. Install the cover and fill damper oil.
5. Plug-seal the suction chamber cover.

REPLACING METERING NEEDLE

After replacing the metering needle, a check with a CO-meter is recommended.

If necessary, the carburetor nozzle should be adjusted by a special tool in accordance with Workshop Bulletin P-23-44.

1. Remove the air valve from the carburetor and clean it.
2. Remove the needle by removing the lock screw and pull the needle out with the spring suspension.
3. Before installing the new needle, check the needle designation.
   The designation is punched on the needle and can be read by pulling the needle out of the spring suspension far enough to reveal the designation.
4. Install the needle with the spring suspension so that the flat surface faces the lock screw. The needle should incline from the holes in the air valve, i.e., in towards the air cleaner flange.
   The needle should be inserted so far that the plastic washer lies flush with the valve, see Fig. 2-125. Tighten the lock screw.
5. Install the air valve in the carburetor. Plug-seal the suction chamber cover.

VOLVO 103 818

Fiå. 2-126. Damper plunger clearance

DAMPER DEVICE

If the engine does not react properly during acceleration, the reason may be an incorrect clearance on the damper plunger: the axial clearance (see A, Fig. 2-126) should be 1.0—1.3 mm (.04—.07″).

With any fault in the damper plunger, change it complete.

If thc damper device is to function correctly, then the level of the damper oil must be correct (see Fig. 2-116). The interval prescribed for the periodical check is 10 000 km (6 000 miles).

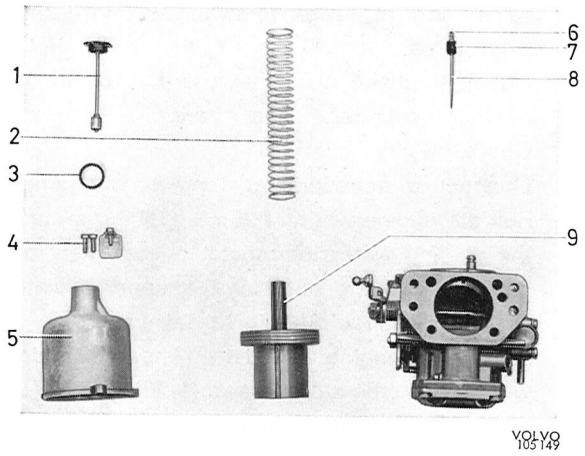


Fig. 2-127. Upper section diassembled

1. Hydraulic damper
2. Spring
3. Seal
4. Screw for suction chamber
5. Suction chamber
6. Spring
7. Sleeve
8. Metering needle
9. Air valve

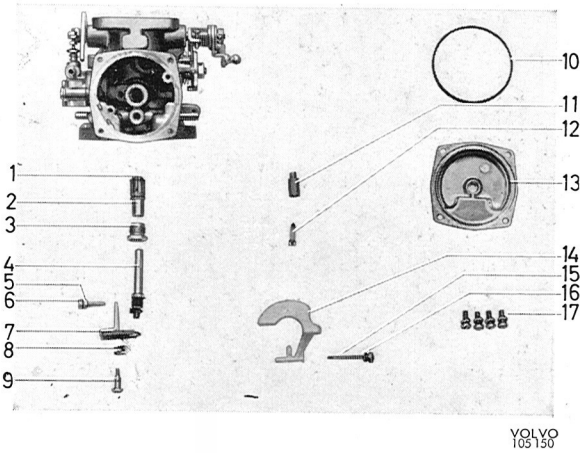


Fig. 2-128. Lower section diassembled

1. Seal
2. Jet sleeve
3. Lock nut
4. Fuel jet
5. Rubber seal
6. Jet adjusting screw
7. Bi-metal assembly
8. Spring
9. Screw for bi-metal assembly
10. Rubber seal
11. Valve house
12. Float valve
13. Float chamber cover
14. Float
15. Float shaft
16. Seal
17. Screws for float chamber cover

SU CARBURETOR B 20 B

The carburetor is specially adjusted by the manufacturer and CO-adjusted at the factory. **In order not to disturb the setting of the carburetor, it is absolutely essential that the following repair instructions are accurately followed when any work has to be done on the carburetor.**

PERIODICAL CHECK

Every 10 000 km (6 000 miles), check that there is oil in the damper cylinders. The spindle in the piston should be filled to about 1/4″ from the upper edge with oil approved as "**Automatic Transmission Fluid, Type A**", see Fig. 2-116.

Before any adjustment or repair to the carburetor is made, the following should be checked and, if necessary, remedied:

Valve clearance, spark plugs, compression, contact breaker (dwell angle) and ignition setting.

Also check that there is no air leakage on the intake side and that the air cleaner is not blocked. To be safe, check also the flap function of the constant air temperature unit.

The function of the throttle control and throttles should be checked as well. It should be noted here that, on vehicles for Canada, because of both the overrev valves, the engine drops its idling speed, after having been revved up, somewhat more slowly than the engine which does not have overrev valves.

Check that the control rod of the hot start valve does not prevent the return of the throttle to idling position.

At certain intervals, for example when changing the air cleaner, it is suitable to remove and carefully clean the suction chamber and air valve.

The float chambers should be cleaned at the same time.

ADJUSTING CARBURETOR

Use a synchro test for synchronizing the carburetors.

The best setting of the carburetor is obtained by a CO-meter. However, the setting can be checked without the use of this meter.

There are various makes of CO-meters in the market which give good results. Instructions for their use are supplied with the respective meter.

Note that when connecting the exhaust gas evacuation hose, it must not be placed so that the exhaust gases are completely drawn away from the CO-meter connection in the exhaust pipe. A funnel such as the one shown in Fig. 2-119 can suitably be used. With it the suction at the connection will not be so great as to disturb the measuring, but at the same time exhaust gases will be collected and prevented from coming out into the workshop.

When measuring with a CO-meter, it is important that the exhaust pipe and muffler are in good condition and do not leak.

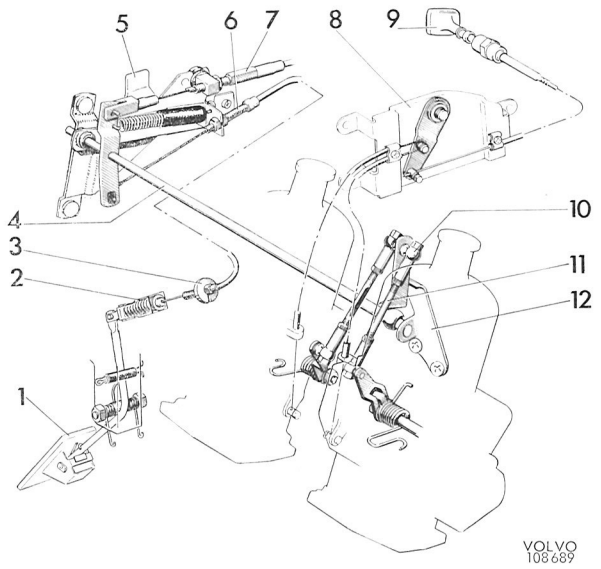


Fig. 2-129. Throttle and choke control linkage, left-hand steered vehicle

1. Accelerator pedal
2. Unloading spring
3. Wear washer (for attachment to firewall)
4. Throttle control shaft
5. Bracket (placed on firewall)
6. Adjuster sleeve for throttle control cable
7. Throttle cable (only vehicles with automatic transmission)
8. Bracket for choke control (only twin carb. engines. Placed on firewall)
9. Choke control knob
10. Ball joint
11. Link rod
12. Bracket (placed on manifold)

After each adjustment and before reading the CO-value, briefly rev up the engine so that the air valves are in their proper position.

Since the carburetors are with temperature controlled jets, the temperature of both the carburetors (float chambers) should be about the same at the basic setting.

With temperature regulation, the carburetors are not so sensitive if the engine is allowed to idle for any length of time.

1. Remove the air cleaner.
2. Make the basic setting for the fuel jets:
   Lift the air valve and screw in the adjusting screw (6, Fig. 2-80) so that the upper edge of the fuel jet comes level with the bridge (9, Fig. 2-84).
   Then lower the jet by turning the adjusting screw 2 1/2 turns clockwise.
   This applies with a carburetor temperature of about 70°F. If the temperature is otherwise, compensation should be accordingly made.
   Turning the adjusting screw a 1/4 turn compensates for a temperature difference of about 70°F. If the temperature is higher than 70°F, screw the adjusting screw less than 2 1/2 turns, and at lower temperature more than 2 1/2 turns.
3. Check to make sure that there is oil in the damper cylinder. See under "Periodical Check".
4. Connect a speedometer (and a CO-meter). Run the engine warm at 25 r/s (1500 rpm) until the cooling water thermostat opens. (Feel the radiator with the hand at the upper radiator hose which should begin to get warm.)
5. Adjust the engine speed to 13 r/s (800 rpm) with the throttle stop screws (1, Fig. 2-83). The speed should be adjusted to 12 r/s (700 rpm) for a vehicle with automatic transmission.
6. Check with a synchro test that the stream of induction air to both carburetors is the same. Make sure that the synchro test is installed so that its opening corresponds with the carburetor venturi. Turn the synchro test throttling washer until a suitable register for its piston is achieved.
7. Adjust the idling screws until the synchro test shows the same register for both carburetors (adjust both screws so that the idling speed is withheld).

8a. With CO-meter: Screw equally and simultaneously on both the adjusting screws (6, Fig. 2-80) so that the CO is 2.5 %. (Counter-clockwise screwing reduces the CO). After each adjustment and before reading the CO-value, briefly rev up the engine so that the air valves are in their proper position.

b. Without CO-meter: Screw equally and simultaneously on both the adjusting screws (6, Fig. 2-80) so that maximum rpm is obtained. Then screw both equally counter-clockwise so that the speed just starts to drop (briefly race the engine a couple of times during adjustment).

9. Lift the air valve for one of the carburetors with the pin and check the drop in engine speed. Repeat the procedure with the other carburetor.
10. If adjustment is correct, the speed drop should be approximately 2.5—4 r/s (150—250 rpm) in both cases.
    If the speed drops too much when lifting, for example, the rear carburetor valve, adjust the front carburetor to a somewhat richer mixture (clockwise screwing).

11a. With CO-meter: Screw equally and simultaneously on both the adjusting screws so that CO is 2.5 %.

b. Without CO-meter: If a carburetor has been adjusted to a richer mixture according to point 10, this can be remedied by screwing equally

and simultaneously on both the adjusting screws (counter-clockwise) until there is a slight indication that the rpm is starting to drop.

12. Check and adjust if necessary the idling speed with the synchro test as per point 7.
13. Adjust the link rods. With the control against its stop on the manifold bracket, the link rods should be adjusted so that there is a clearance of about .1 mm (.004″) between the lever and the flange of the throttle spindle. See Fig. 2-130.

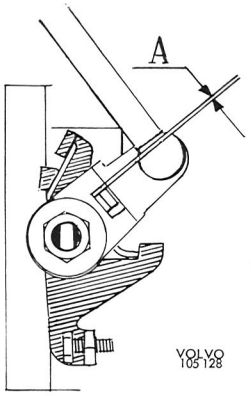


Fig. 2-130. Setting the control (not Conada)
A=.1 mm (.004″)

Vehicles intended for Canada have the lever 16, Fig. 2-132, rigidly connected to the throttle shaft. Adjust the links so that the throttle is closed when the throttle shaft lever is touching the bracket 12, Fig. 2-129.

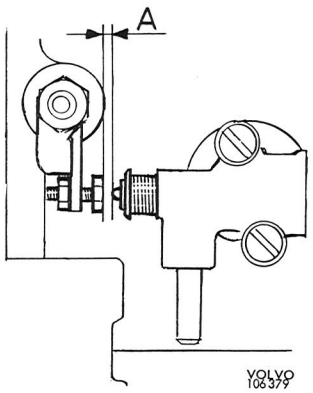


Fig. 2-131. Setting the hot start valve

14. Adjust the hot start valve. With the control rods (Fig. 2-131) pressed down to the bottom position, the distance (A) between rod and adjusting screw should be max 1.0 mm (.04″). (Check to make sure that the control rods move without jamming.)

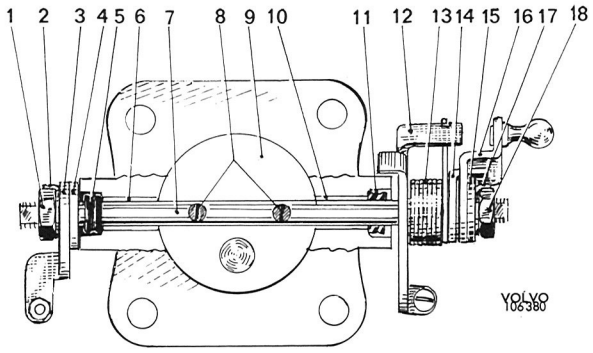


Fig. 2-132. Throttle spindle

1. Nut
2. Tab washer
3. Lever
4. Washer
5. Seal
6. Bushing
7. Throttle spindle
8. Screw for throttle
9. Throttle
10. Bushing
11. Seal
12. Lever
13. Return spring
14. Flange (not Canda)
15. Washer
16. Lever
17. Tab washer
18. Nut

15. Adjusting fast idle: Pull out the cold start control at the instrument panel 20 mm (.8″). Then adjust the engine speed to 18—27 r/s (1100—1600 rpm). Screw equally on both fast idle stop screws.
16. Check that the cable (Fig. 2-129) is well-streched and if necessary adjust with the cable sleeve adjustment (6).
17. Lubricate all ball joints.
18. Install the air cleaners and test run the car. During test running, make a new "pin test" and any adjustment necessary. Install the plastic plugs over the adjusting screws.

REMOVING CARBURETORS

Remove the air cleaner. Remove the link rod ball joints from the carburetors. Remove fuel hoses, vacuum hoses, hose for hot-start valve and choke wires.

Remove the nuts for the carburetors and then the carburetors. Remove the protection plates and gaskets. Mask over the intake holes with tape.

INSTALLING CARBURETORS

Clean the gasket surface. Install protection plates, new gaskets and then the carburetors. Connect ball joints, fuel hoses, vacuum hoses, hose for hot-start valve and choke wires. Make sure that the choke control on the dashboard is pushed in. Then secure the pull wire in the clamping screws of the fast idle cam.

Install the air cleaner and connect the hose for the crankcase ventilation. Adjust the carburetors, see under "Setting the carburetors".

CLEANING FLOAT CHAMBER

Remove the float chamber by removing the four screws (17, Fig. 2-128) for the cover. Use a new rubber ring (10) when installing the cover. The cover shuld be installed with the inside collar at the float valve.

FLOAT LEVEL

To check the float level, remove the carburetor, turn it upside down and remove the float chamber cover.

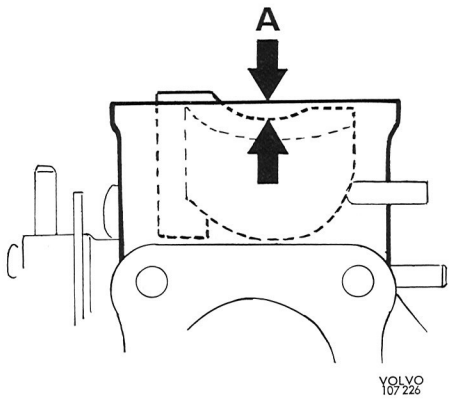


Fig. 2-133. Float level
A=.5—1.5 mm (.02—.06″)

At the correct float level, the measurement A (Fig. 2-133) between float and flange should be .5—1.5 mm (.02—.06″).
The float has an adjustable metal tab.
The float is removed by screwing the float shaft out of the chamber.
Note when installing that the float valve retainer should hook round the float tab (Fig. 2-135).

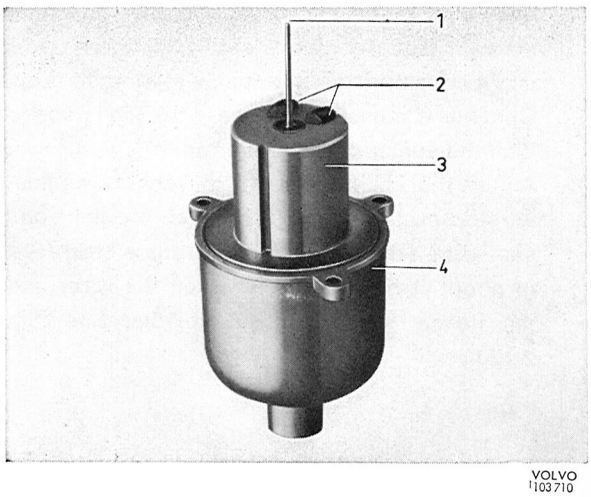


Fig. 2-134. Air valve

1. Metering needle
2. Plugs, e.g. rubber or cork
3. Air valve
4. Suction chamber

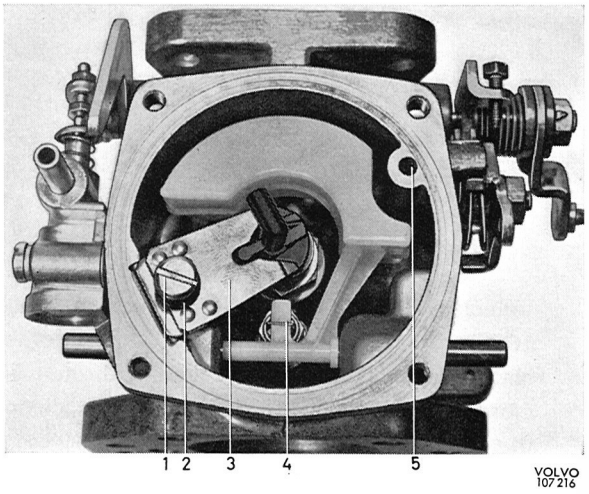


Fig. 2-135. Float chamber

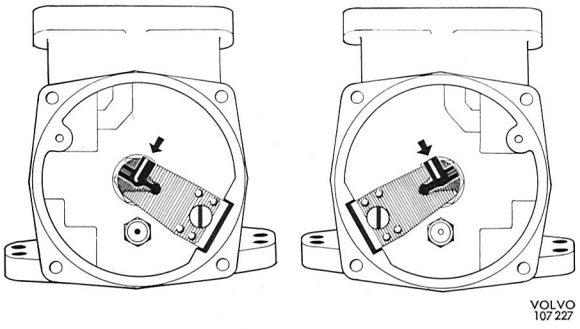
1. Screw for bi-metal assembly
2. Spring
3. Bi-metal assembly
4. Float valve retainer
5. Drilling to cold start valve

FIT OF AIR VALVE

The fit can be checked by plugging the air holes in the valve with, for example, small corks. The damper plunger is installed but not filled with oil. The air valve spring is not installed. Normally the valve should sink to the bottom, from the position shown in Fig. 2-134 in about 5—7 seconds.
If the valve is worn, both valve and suction chamber should be replaced since they are matched together.

REPLACING METERING NEEDLE AND FUEL JET

1. Remove the suction chamber and take out the air valve.
2. Remove the float chamber cover.
   Remove the screw (1, Fig. 2-135) and lift the bi-metal spring out with the jet.
3. Unhook the jet from the bi-metal spring and hook on the new jet.
4. If the seal (1, Fig. 2-128) for the jet sleeve has to be replaced, this is done by removing the lock nut (3) and lifting out the jet sleeve. (First remove the float.)
5. Install the jet in the sleeve and the bi-metal spring in position. Make sure that the slot on the lever fits on the adjusting screw pin. Install the spring (8) and the screw (9).
   Note: Make sure that the correct jet is installed in the right carburetor according to Fig. 2-136.



A
Nozzle installed
in rear carburetor

B
Nozzle installed
in front carburetor

Fig. 2-136. Nozzle angle

6. Screw on the adjusting screw so that the upper edge of the jet comes level with the bridge (9, Fig. 2-84). Then screw the adjusting screw 2 1/2 turns clockwise.
7. Install the float chamber cover with a new gasket.
8. Install the lock screw in the air valve and pull out the metering needle with sleeve.
9. Install the new metering needle in the air valve. Check the needle designation, see "Specifications".

   The needle should incline in the direction of the carburetor air cleaner flange. This is obtained when the mark A, Fig. 2-137 on the sleeve points from the holes in the air valve. The mark shows where the pin, which presses over the needle, is located. The sleeve should lie level with the valve, see Fig. 2-137.
10. Install the air valve and suction chamber.

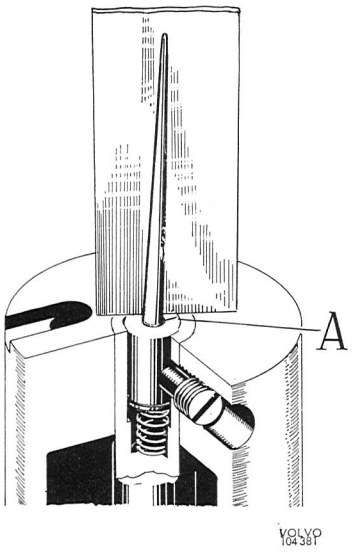


Fig. 2-137. Installing metering needle

COLD START DEVICE

Replacing seals

1. Bend up the lock washer and remove the nut for the "channel disc" on the cold start device.
2. Disconnect the spring and remove the "channel disc". Remove the spring.
3. Remove the two screws and the spring retainer.
4. Pull out the cold start device from the carburetor housing. Press the spindle out of the cold start device housing. Remove the gasket (7, Fig. 2-138), the rubber ring (4) and the seal (6). Clean all parts. Blow clean all channels with air.

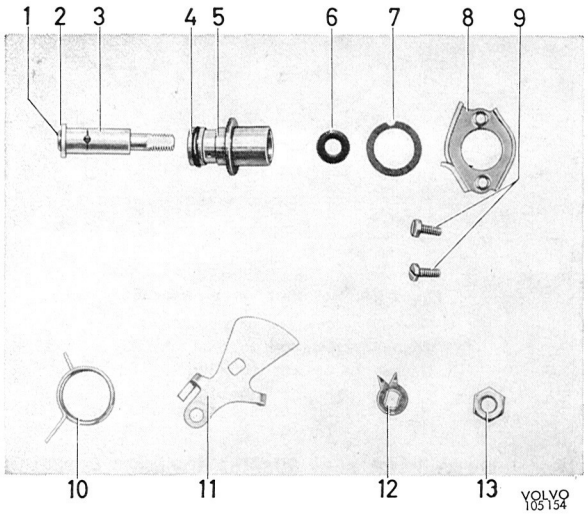


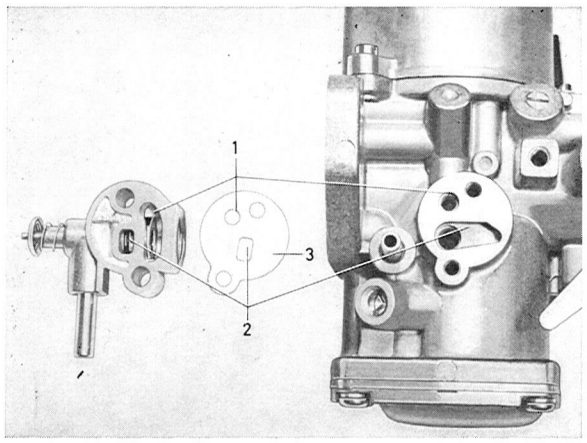
Fig. 2-138. Cold start device, diassembled

1. Circlip
2. Washer
3. Spindle
4. Rubber ring
5. House
6. Rubber seal for spindle
7. Gasket
8. Spring retainer
9. Screw for cold start device
10. Return spring
11. Fast idle screw
12. Tab washer
13. Nut

5. Install a new rubber ring and seal. Oil the seals. Install the spindle in the housing.
6. Place a new gasket on the housing and move the device into position in the carburetor housing so that recess is at the upper screw.
7. Install the spring retainer and the screws. Place the return spring in position with the shorter wire end in the spring retainer slot.
8. Hook the "channel disc" onto the spring end and place the disc on the spindle. Install lock washer and nut.

HOT START VALVE

The hot start valve cannot be disassembled. Removal from the carburetor housing for cleaning is done by removing the two screws. Clean all the channels with air. Check to make sure that no impurities prevent the valve disc from sealing. This can be done by blowing lightly with the mouth in the hose connection. Do this first with the control rod in the outer position, then pressed in and with a finger covering the hole (2, Fig. 2-139).



VOLVO 105 153

Fig. 2-139. Hot start valve removed

1. Channel, connected to air cleaner
2. Channel, connected to float chamber
3. Gasket (in assembly position)

The valve will not seal against any high pressure. Also check that the control rod does not jam when moving. The rubber bellow should be filled with grease.

Install the valve with a new gasket. Make sure that the gasket faces in the proper direction.

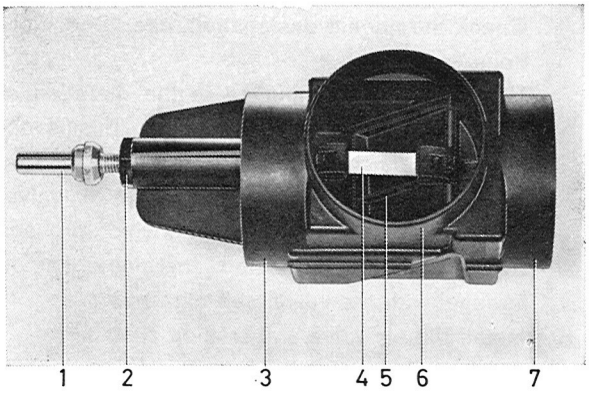
DAMPER DEVICE

If the engine does not react properly during acceleration, the reason may be a faulty clearance on the damper plunger: the axial clearance (see A, Fig. 2-126) should be 1.1—1.7 mm (.04—.07″). With any fault in the damper plunger, change it complete.

If the damper device is to function correctly, then the level of the damper oil must be correct (see Fig. 2-116). The interval prescribed for the periodical checks is 10 000 km (6 000 miles).

REPLACING THROTTLE CABLE

1. Disconnect the cable end from the lever for the control rod.
2. Remove the cable sleeve from the bracket on the dashboard.
3. Remove the cable split pin and split pin bolt from the spring retainer at the attachment to the accelerator pedal.
4. Remove the cable sleeve from the attachment to the cowl and pull the cable through the hole.
5. Unhook the cable end from the spring retainer.
6. Hook the new cable onto the spring retainer.
7. Insert the cable through the hole in the cowl. Place the wear washer in position from inside the engine compartment and lock the cable sleeve by installing washer and nut and tightening up the nut from inside the car compartment.
8. Connect up the spring retainer to the pedal. Lock the split pin bolt with the split pin.
9. Connect the end of the cable to the lever and the cable sleeve to the bracket on the cowl.
10. With the cable sleeve, adjust the cable so that it is properly stretched.



VOLVO 103 817

Fig. 2-140. Constant air temperature device flap

1. Thermostat
2. Lock
3. Air cleaner connection
4. Flap control
5. Flap
6. Warm air intake
7. Cold air intake

FLAP HOUSING FOR CONSTANT AIR TEMPERATURE DEVICE

If the flap (5, Fig. 2-140) does not open, there will be too high a temperature for the intake air and this will have a negative effect on the engine.

The thermostat can be checked in lukewarm water. The flap should be closed for cold air at a temperature of 70—77°F and for warm air at 95—105°F. If correct function is not obtained, replace the flap housing with the thermostat complete.

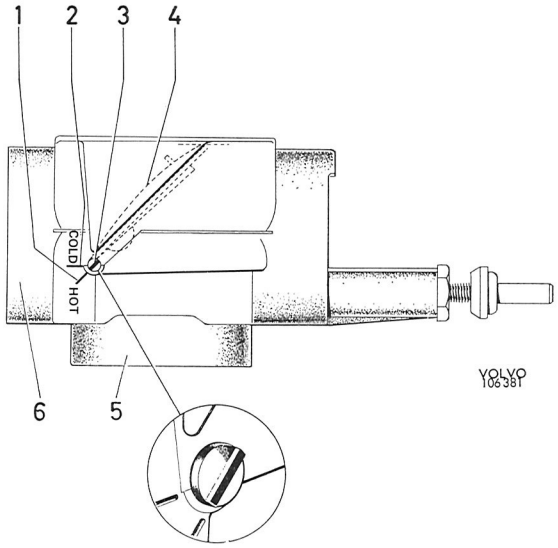


Fig. 2-141. Checking flap function

1. Hot=open for warm air
2. Cold=open for cold air
3. Tab
4. Shutter
5. Warm air intake
6. Cold air intake

The flap location can be checked with the flap housing installed in position. A small tab on the flap spindle projects from both sides of the housing (see 3, Fig. 2-141). The longitudinal pin for these tabs conicides with that of the spindle and turns parallel with the spindle. In other words, the location of the flap can be seen at different temperatures by comparing the angle of a tab in relation to the marks (1) and (2). Cold=open for cold air. Hot=open for warm air.

When installing the flap housing, note that the thermostat should be in the middle of the air flow and that the hose clamp screw should be on top of the flap.

AIR CLEANER

Replace air cleaner=Volvo Standard Times Op. No. 23209

The air cleaner on the B 20 A and the insert on the B 20 B should be changed every 40 000 km (24 000 miles) unless the driving conditions are severe, in which case replacement should take place more frequently.

No cleaning of any kind should be done between the changes.

On no condition must the insert be moistened or oiled.

A sign of a blocked air cleaner is increased fuel consumption.

FUEL PUMP

Volvo Standard Times	**Op. No.**
Replace fuel pump	23312
Re-build fuel pump	23305

PIERBURG

If the fuel pump is defective, replace it complete. There is a filter kit for cleaning it.

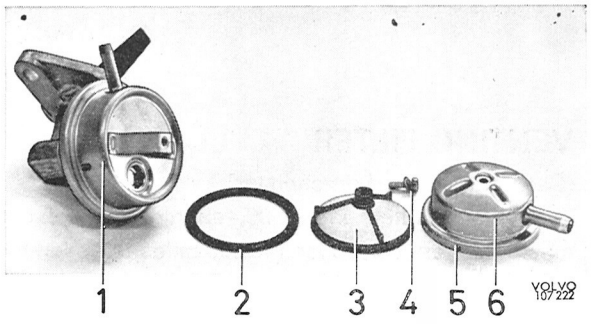


Fig. 2-142. Fuel pump, Pierburg

1. Profile
2. Seal
3. Filter
4. Screw for cover
5. Profile
6. Cover

Cleaning fuel pump, Pierburg

1. Remove the cover (6, Fig. 2-142), the filter (3) and the seal (2).
2. Clean the body and cover. Blow the filter clean or replace it.
3. Place the seal and filter on the body.
4. Install the cover. Make sure that the profiles in the body and cover (see 1 and 5, Fig. 2-142) coincide.

S. E. V.

If a S. E. V. fuel pump becomes defective, replace it complete with the Pierburg fuel pump. AB Volvo Parts stocks only the Pierburg type fuel pump. However, a filter kit is stocked for cleaning both the Pierburg pump and the S. E. V. pump.

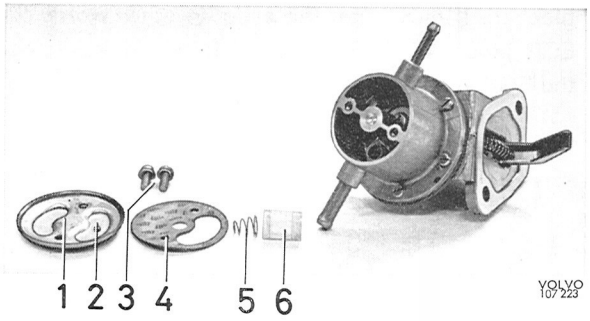


Fig. 2-143. Fuel pump, S.E.V.

1. Cover
2. Boss for centering spring (5)
3. Screw for cover
4. Seal
5. Spring
6. Filter

Cleaning fuel pump, S.E.V.

1. Remove the cover (1, Fig. 2-143), the spring (5) and the seal (4).
2. Blow clean in the fuel pump body.
3. Remove the filter (6) and blow it clean or replace it.
4. Install the filter. Place the seal in position with the open part over the filter. Place the spring (5) in position and the cover with the boss (2) facing the spring

VENTING FILTER

(Carbon filter, carbon canister)

The venting filter, Fig. 2-96, should be replaced as a unit every 80 000 km (48 000 miles). Loosen the bracket screws and lift up the filter.

EXHAUST GAS RECIRCULATION (EGR)

Volvo Standard Times	Op. No.
Clean EGR line	25402
Check EGR line	25404
Replace EGR valve	25406

The EGR lines and valve should be cleaned at intervals of 20 000 km (12 000 miles).

At every other cleaning, that is, every 40 000 km (24 000 miles) the EGR valve should be **replaced by a new one.**

When cleaning, remove the lines from their connections at the exhaust pipe and carburetor.

The intake manifold should only be cleaned when necessary. Remove the manifold to do this. The function of the EGR system is checked by connecting the distributor vacuum hose to the EGR valve vacuum chamber with the engine at idle. This should cause the engine to stop or to run very unevenly, If this does not happen, check to make sure that the EGR pipe and the EGR line are not blocked. If this is not the case, in other words the EGR pipe and EGR line are without fault, replace the EGR valve with a new one.

FUEL TANK FILTER

FUEL INJECTION ENGINES

The filter should be cleaned at intervals of 20 000 km (12 000 miles).

The filter is accessible after the bottom plug (see Fig. 2-144), has been removed.

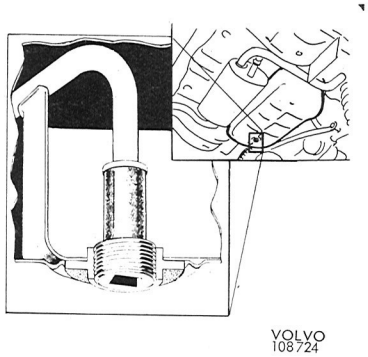


Fig. 2-144. Fuel filter in tank fuel injection engines

When installing the filter, check to make sure that the suction pipe is centered with the flange hole. Otherwise the filter can be pressed down at an angle when installing the pipe or the bottom plug and at worse this could shut off the fuel supply.

CARBURETOR ENGINES

Clean the filter every 40.000 km (24.000 miles). The filter is accessible after removal of the fuel gauge sender, see Fig. 2-145.

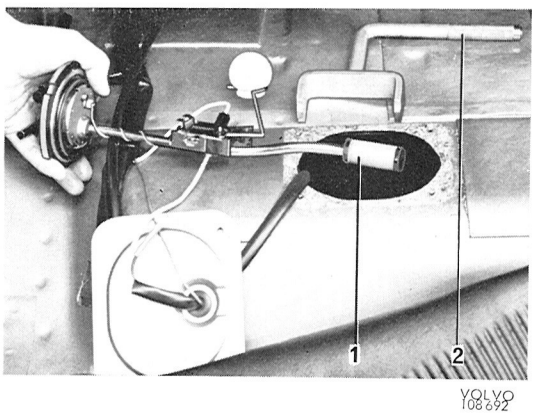


Fig. 2-145. Fuel filter in tank carburetor engines

1. Filter 2. Tool 999 5016

GROUP 24

FUEL INJECTION ENGINES

GENERAL INFORMATION

The B 20 E and B 20 F engines are equipped with a fuel injection system, called the CI system. CI stands for Continous Injection, which means that the injectors always are open, that means always are injecting fuel when the engine is working. The amount of fuel is not controled by variation of the injection duration, but through variation of the fuel flow through the injectors.

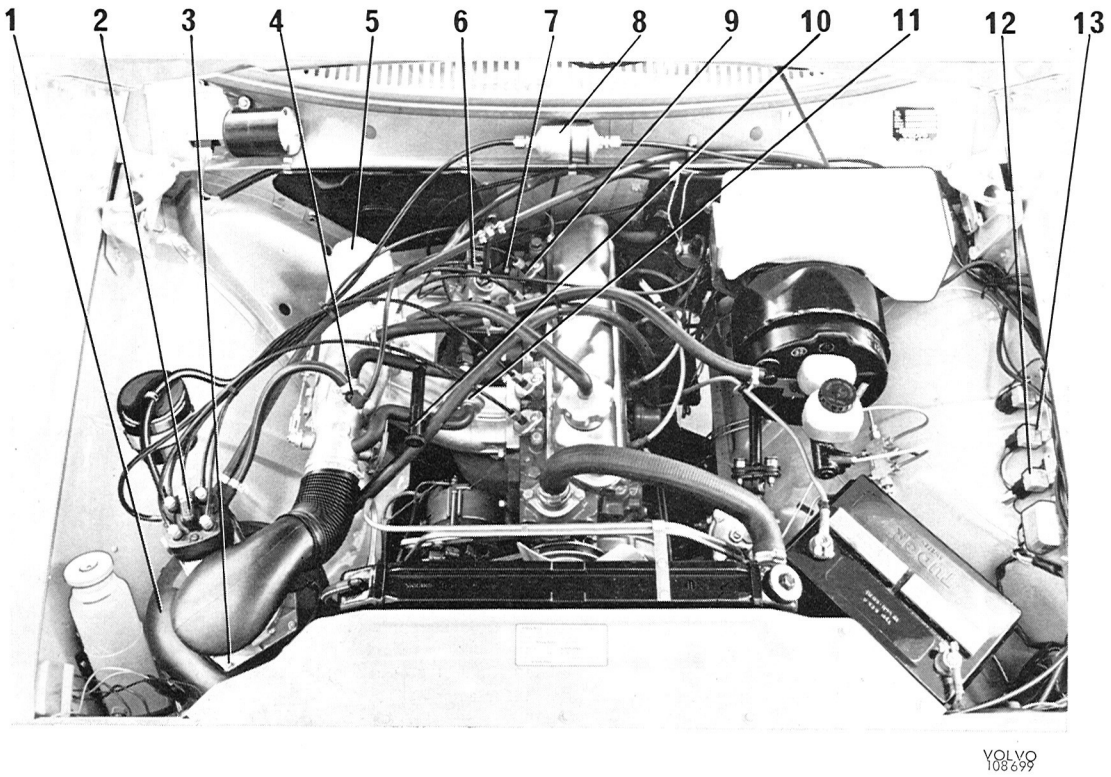


Fig. 2-146. CI Fuel injection system

1. Air cleaner
2. Fuel distributor
3. Air flow sensor
4. Cold start injector
5. Intake manifold
6. Control pressure regulator
7. Thermal time switch
8. Fuel filter
9. Injector
10. Idle adjustment screw
11. Auxiliary air valve
12. Pump relay
13. Relay (stops the pump if the engine stops)

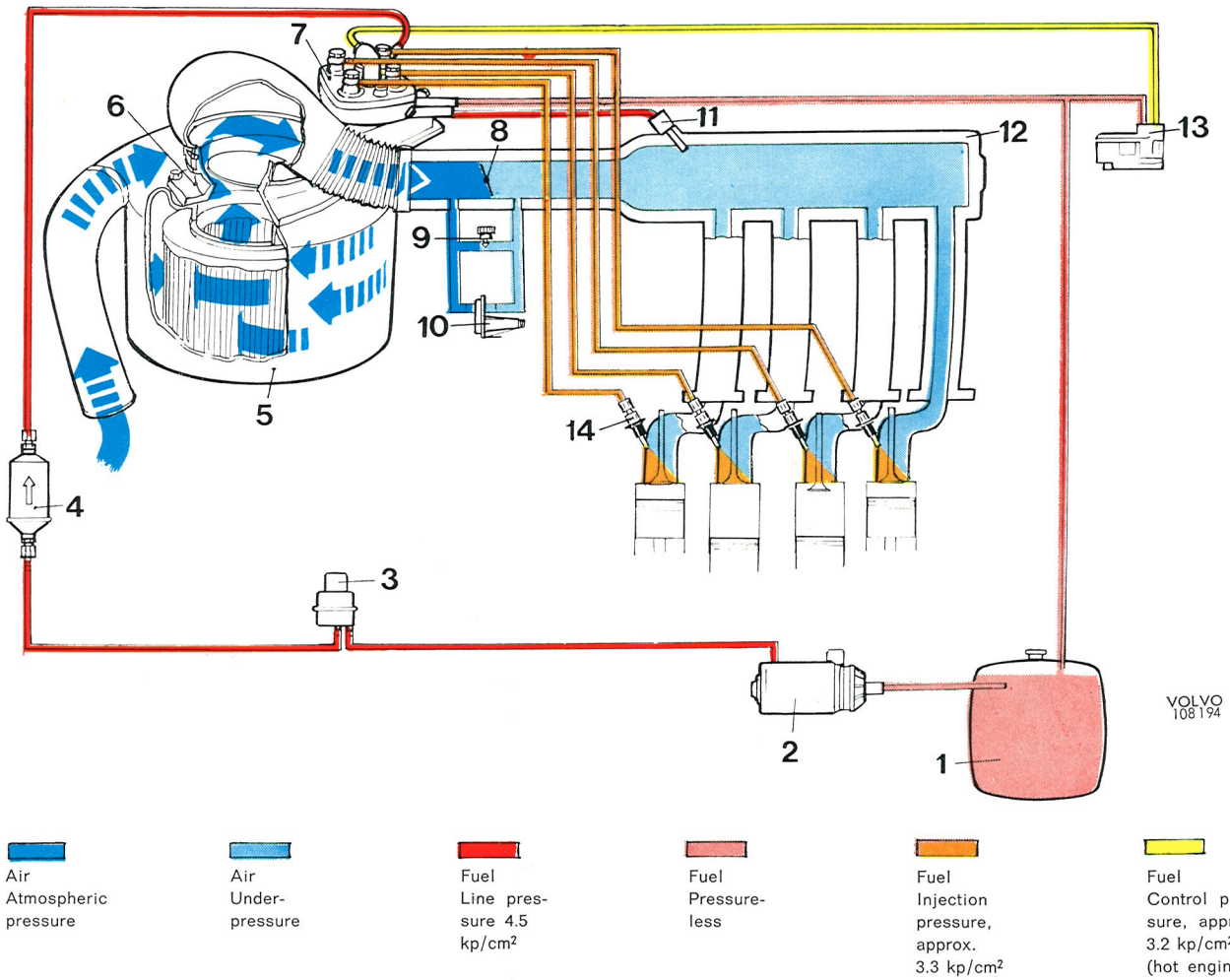


Fig. 2-147. The principles of the CI fuel injection system

1. Fuel tank
2. Fuel pump
3. Pressure accumulator
4. Fuel filter
5. Air cleaner
6. Air flow sensor
7. Fuel distributor
8. Throttle
9. Idle adjustment screw
10. Auxiliary air valve
11. Cold start injector
12. Intake manifold
13. Control pressure regulator
14. Injector

The fuel flow is governed by the **air-fuel control unit** which comprises the **air flow sensor,** 6, Fig. 2-147, and the **fuel distributor** 7. The idea is to measure the inducted air flow and let it determine the injected fuel quantity.

The air flow sensor consists of an air flow sensor plate in an air venturi. The air flow through the air venturi lifts the air flow sensor plate to a position where the slot is large enough to let the air pass through. A large air flow lifts the air flow sensor plate to a high position, a small air flow to a low position. The air flow sensor plate is connected to a lever and its weight is equalized by a balance weight. The movements of the lever control the movements of a control plunger in the fuel distributor.

The control plunger is located in a cylinder ("barrel"), which is provided with four metering slots, one for each cylinder. The control plunger uncovers the metering slots when lifted. A high air flow sensor plate position (thus also a high control plunger position) corresponds to a large uncovered metering slot area, a low position to a small.

The fuel distributor is provided with four pressure regulating valves, one for each metering slot (and cylinder), which maintain a constant pressure drop of .1 kp/cm² = 1.4 psi over the slot. This makes the fuel quantity passing through the metering slots constantly proportional to the uncovered metering slot area, and the amount of fuel proportional to the inducted air.

This is the main idea of the fuel control. The system comprises some more details, cooperating to achieve a good result at every driving condition.

These details are:

Fuel tank, 1 Fig. 2-147.

Electrical fuel pump, 2.

Fuel accumulator, 3.

Fuel filter, 4.

Air filter, 5.

Throttle, 8, in the intake manifold.

Idle adjustment screw, 9.

Auxiliary air valve, 10, providing extra air at cold engine.

Cold start injector, 11, providing extra fuel at cold start.

Intake manifold, 12.

Control pressure regulator, 13, providing a counter-pressure on top of the control plunger. The control pressure regulator provides a lower pressure at cold engine, resulting in an increased fuel quantity.

Injectors, 14.

Electrical system, providing current to fuel pump, control pressure regulator, cold start injector and auxiliary air valve.

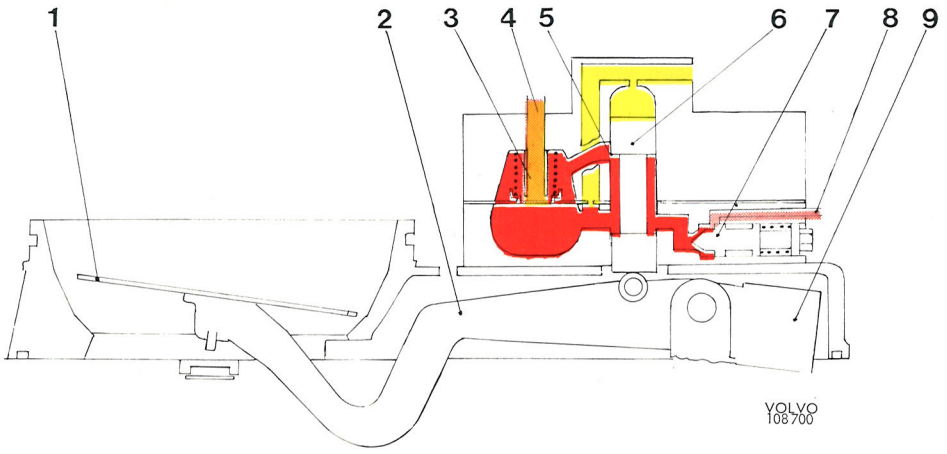


Fig. 2-148. Air-fuel control unit

1. Air flow sensor plate
2. Lever
3. Pressure regulating valve
4. To injector
5. Control plunger head
6. Control plunger
7. Line pressure regulator
8. To tank
9. Balance weight

AIR SYSTEM

The air system consists of: air inlet, air filter, air flow sensor, throttle, auxiliary air valve and intake manifold. The air is cleaned, measured, controled and after mixing with the injected fuel directed to the engine cylinders.

Air filter

The air filter is located in a container directly under the air flow sensor and consists of an interchangeable paper cartridge. The cartridge should be changed every 40 000 km (24 000 miles).

Air flow sensor

The air flow sensor consists of an air venturi, 1, Fig. 2-149, and of an air flow sensor plate 2 moving in the air venturi. The air flow sensor plate is connected to the lever 8 and thereby in contact with a control plunger in the fuel distributor. The lever has a balance weight 4 which compensates for the weight of the lever and sensor plate. The CO adjustment is achieved by the adjustment screw 3, which regulates the basic location of the control plunger.

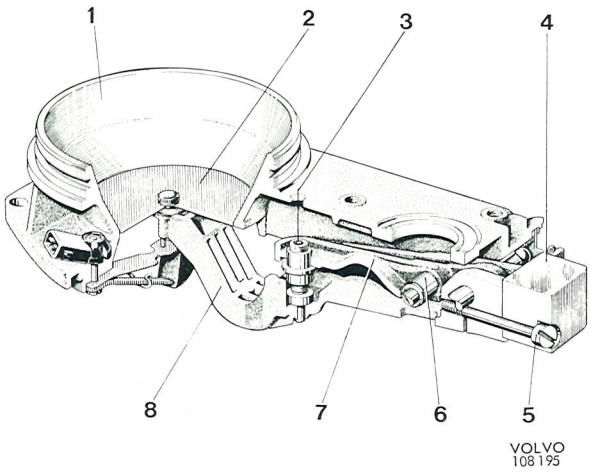


Fig. 2-149. The air flow sensor

1. Air venturi
2. Air flow sensor plate
3. CO adjustment screw
4. Balance weight
5. Lock screw
6. Pivot
7. Adjustment arm
8. Lever

Throttle

The throttle is located on the intake manifold and is controled by the throttle pedal.

Auxiliary air valve

The proper idle speed is achieved by an auxiliary air valve which by-passes the throttle. The auxiliary air valve provides extra air at cold start and during the warm-up period and consists of a plate which is controled by a bi-metallic spring.

The auxiliary air valve is completely open when the engine is cold and thus a higher idle rpm is achieved. The bi-metallic spring is heated by an electrical coil after the engine has started, thus the auxiliary air valve is gradually closed and the engine returns to normal idle speed.

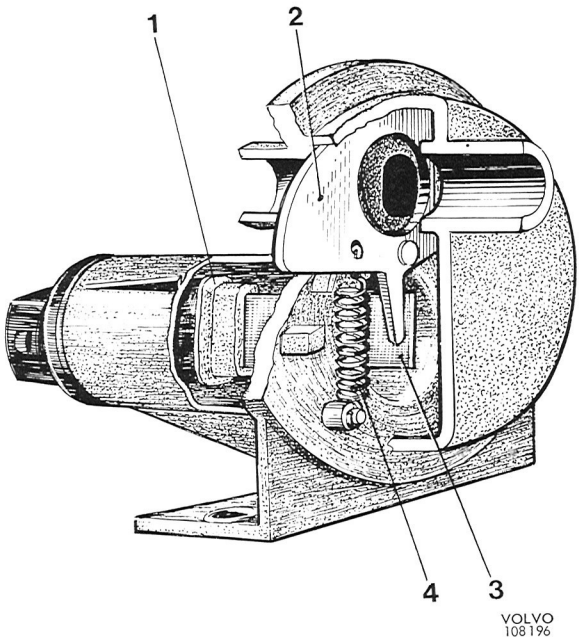


Fig. 2-150. Auxiliary air valve

1. Coil
2. Air valve
3. Bi-metallic spring
4. Return spring

FUNCTION

When the throttle is opened, the air flow will raise the sensor plate in the air venturi acc. to the opening of the throttle. The movement of the air flow sensor plate is transferred through the lever to the control plunger in the fuel distributor. The control plunger controls fuel in relation to the air flow, see Fuel System. The mass of the air flow sensor plate would temporarily move the plate to a higher position than is motivated by the air flow, but this is counteracted by a hydraulic pressure on the control plunger.

This means that the air flow pressure and the hydraulic pressure on the control plunger counteract each other.

The hydraulic pressure on the control plunger counteracts the lift of the air flow sensor plate so that a position of balance is reached. The lifting height of the air flow sensor plate is thus controled by the air flow and by the hydraulic pressure on the control plunger. The hydraulic pressure (control pressure) is described under Fuel System.

The inclination of the venturi walls varies in stages so that a correct fuel/air mixture is obtained at all rpms.

FUEL SYSTEM

The fuel system consists of fuel pump, fuel accumulator, fuel filter, fuel distributor, line pressure regulator, injectors and cold start injector with a thermal time switch.

Fuel pump

The fuel pump is a roller-type pump combined with an electric motor. The unit is sealed and cannot be repaired. The fuel intake is located at the front end of the motor and the outlet at the rear end of the pump. It is the so-called "wet" pump design meaning that fuel is also present in the electrical part. If the line pressure regulator is defective or there is a pinched line, excessive pressure is prevented by opening of a built-in relief valve, which re-circulates the fuel inside the pump without any pressure increase. A check valve in the pump closes the pressure line in the rest position so that the supply pressure is maintained in the fuel circuit.

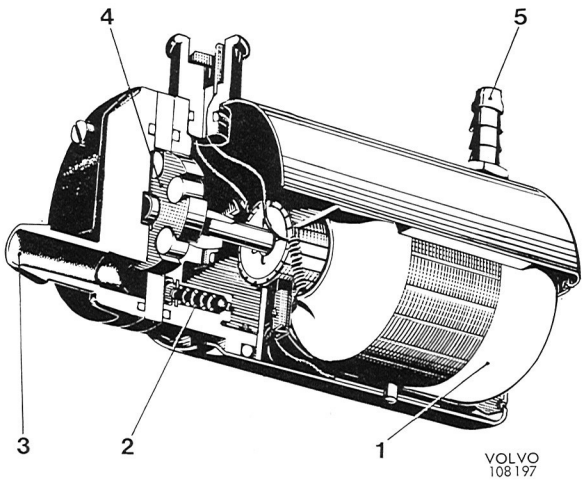


Fig. 2-151. Fuel pump

1. Rotor
2. Relief valve
3. Intake
4. Pump rotor
5. Outlet

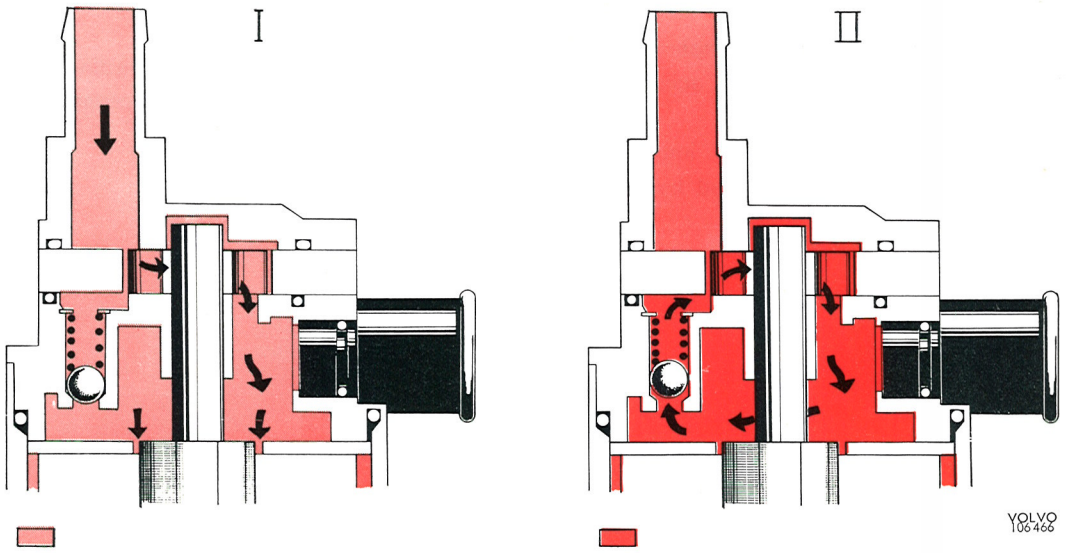


Fig. 2-152. Relief valve function
I=Closed valve II=Open valve

Fuel accumulator

The fuel accumulator is located between the fuel pump and the fuel filter. When the fuel pump starts working, the pressure chamber 3, Fig. 2-153, is filled with fuel and the diaphragm 4 is pressed against the stop 5 and compressing the spring 6.

The time delay which results before the pressure in the fuel distributor has reached the injectors opening pressure, enables the control plunger to be pressed to its lower position and cut out the fuel supply to the injectors. The chance of too much fuel being injected into the engine because the control plunger has reached a higher position during the standstill is thereby removed.

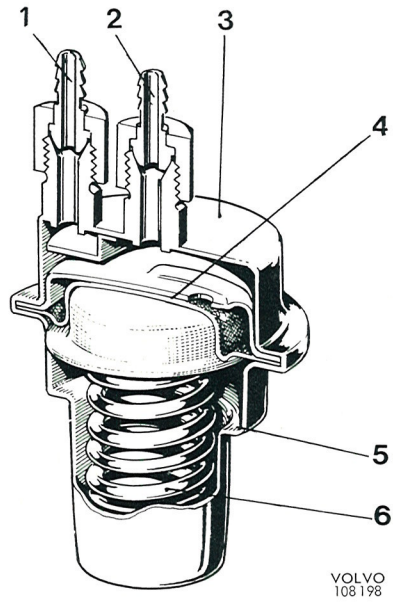


Fig. 2-153. Fuel accumulator

1. Intake
2. Outlet
3. Housing
4. Diaphragm
5. Stop
6. Spring

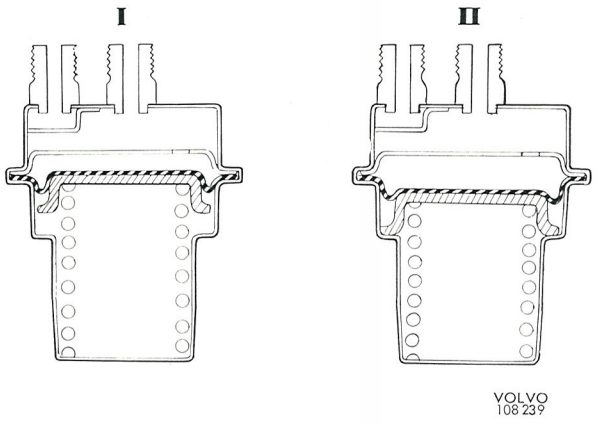


Fig. 2-154. Fuel accumulator function
I=Fuel pump not operating
II=Fuel pump operating

The line pressure is lowered to approx. 2 kp/cm^2 =28.4 psi when the engine is shut off and the fuel pump stops working. The spring 6 and the diaphragm 4 counteract a pressure drop for a long time. A remaining fuel pressure makes safer starts and prevents vapor locks at high ambient temperatures.

The fuel accumulator pressure chamber also acts as a muffler on fuel pump noise.

Fuel filter

The fuel filter is a line filter with a paper element and is located between the pressure accumulator and the fuel distributor.

The filter change interval is 80 000 km = 48 000 miles. The direction of flow is marked by arrows on the housing.

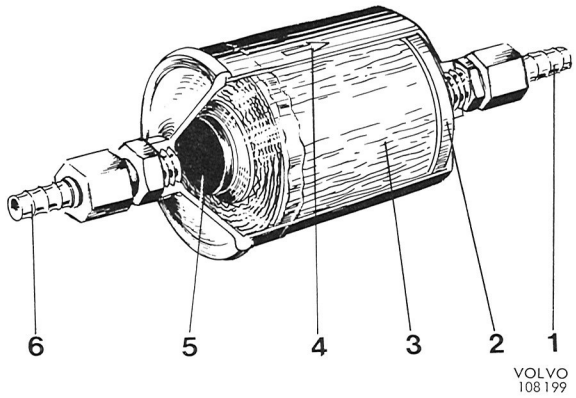


Fig. 2-155. Fuel filter

1. Outlet
2. Nylon fine filter
3. Paper filter
4. Direction of flow
5. Rubber cone
6. Intake

rence between intake and outlet of the control plunger.

The fuel distributor also contains lines to the cold start injector and the control pressure regulator and a fuel inlet and a fuel outlet.

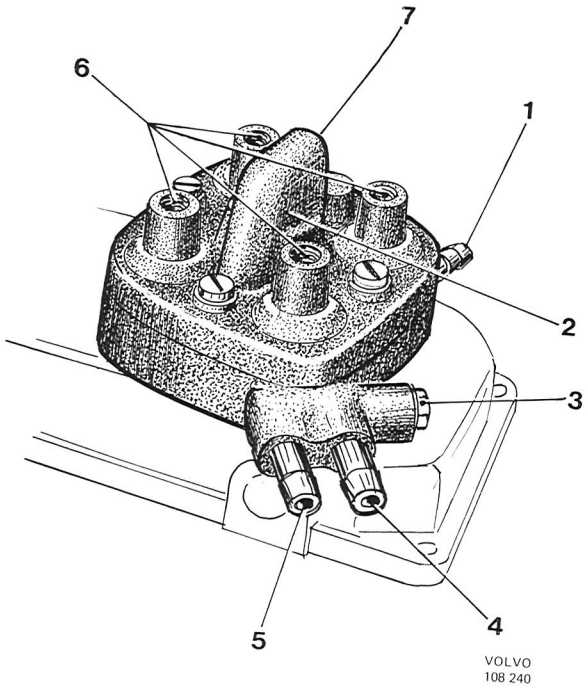


Fig. 2-156. Fuel distributor

1. Fuel supply
2. Fuel control unit
3. Line pressure regulator
4. Tank return
5. To cold start injector
6. To the injectors
7. To the control pressure regulator

Fuel distributor

The fuel distributor controls and distributes the amount of fuel to the injectors in relation to the air flow.

The fuel distributor consists of:

A line pressure regulator which controls the pressure to the fuel distributor.

A control plunger (fuel control unit) which controls and distributes the fuel to the injectors.

Four pressure regulating valves (one for each injector) which maintain a constant pressure diffe-

LINE PRESSURE REGULATOR

The line pressure regulator controls the fuel pressure to the fuel distributor. The line pressure regulator closes the tank return if the fuel pressure is below 4.5 kp/cm^2 = 64 psi. The line pressure regulator opens the tank return when the pressure exceeds 4.5 kp/cm^2 = 64 psi and thereby a constant pressure of 4.5 kp/cm^2 = 64 psi is maintained.

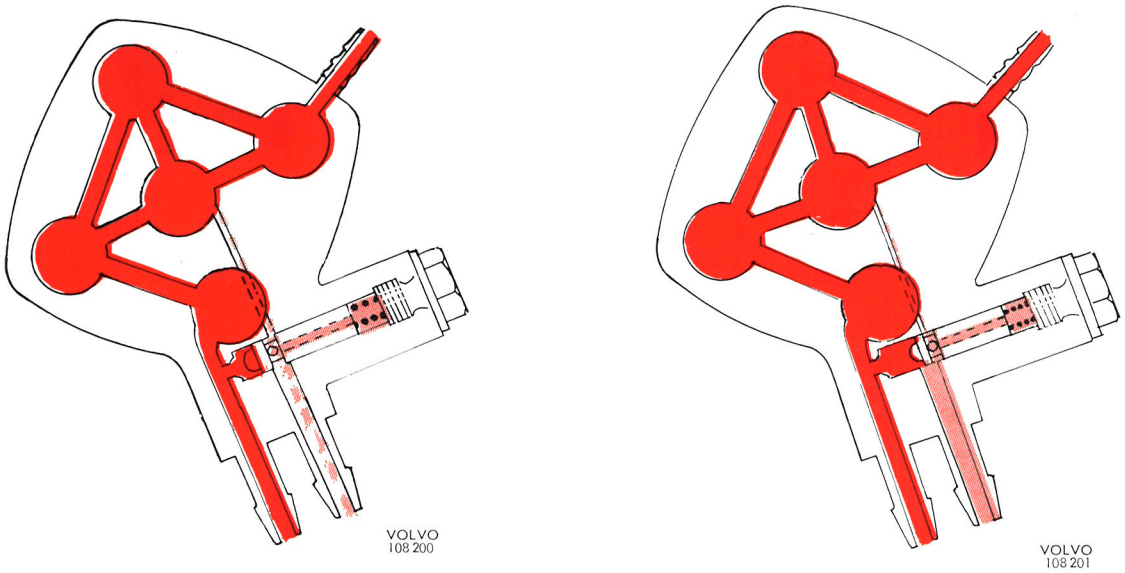


Fig. 2-157. Line pressure regulator, function

I=Line pressure regulator closed No tank return

II=Line pressure regulator open Fuel returning to the tank

FUEL CONTROL UNIT

The air flow sensor plate controls through the lever the fuel distributor, which consists of a cylinder 1, Fig. 2-158, in which the control plunger 2 operates.

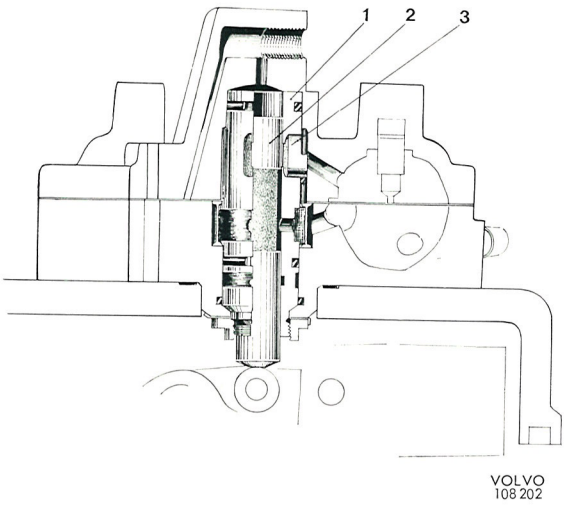


Fig. 2-158. Fuel control unit

1. Cylinder
2. Control plunger
3. Metering slots

The cylinder wall has four metering slots, 3, feeding the fuel to the four pressure regulating valves, one for each slot.

Depending on the position of the air flow sensor plate in the air venturi, the control plunger opens the metering slots more or less. When the air flow sensor plate is positioned higher, the metering slots are opened further and more fuel is directed through the pressure regulating valves, see Fig. 2-159.

As mentioned before, a hydraulic pressure (the control pressure) is counteracting the control plunger's movement upwards.

Some fuel is diverted from the fuel inlet to the upper side of the control plunger. From there it goes to the control pressure regulator and later on to the tank.

The control pressure is controled by the control pressure regulator and is normally 3.7 kp/cm^2 = 52.5 psi.

The control pressure regulator is described later on.

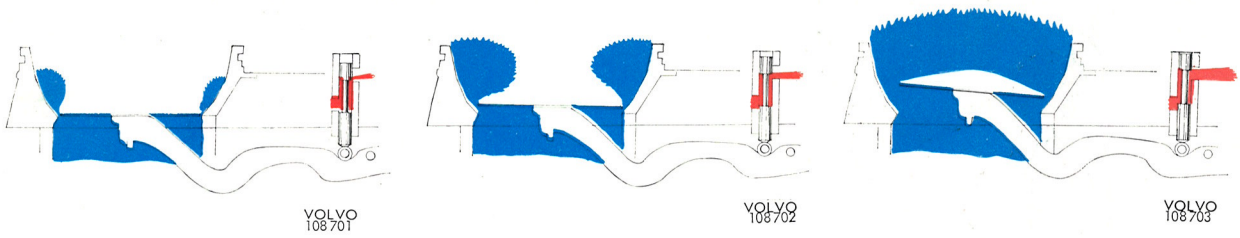


Fig. 2-159. Function of air flow sensor plate and fuel control unit

The control pressure fuel acts on top of the control plunger and passes a restriction. The restriction dampens the movements of the air flow sensor plate, and prevents it from getting excessive positions at fast acceleration.

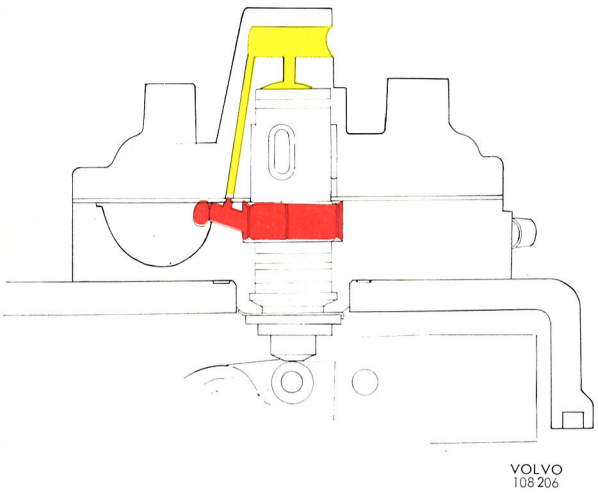


Fig. 2-160. Control pressure, function

PRESSURE REGULATING VALVES

The pressure regulating valves provide a constant pressure drop through the metering slots, independent of the amount of fuel passing through the metering slots. A constant pressure drop is necessary in order to keep the injected amount of fuel proportional to the opening area of the metering slots, i.e. the position of the control plunger.

Each of the pressure regulating valves has two chambers, separated by a steel diaphragm.

The upper chambers have a spring, pressing on the diaphragm and a valve whose opening area varies

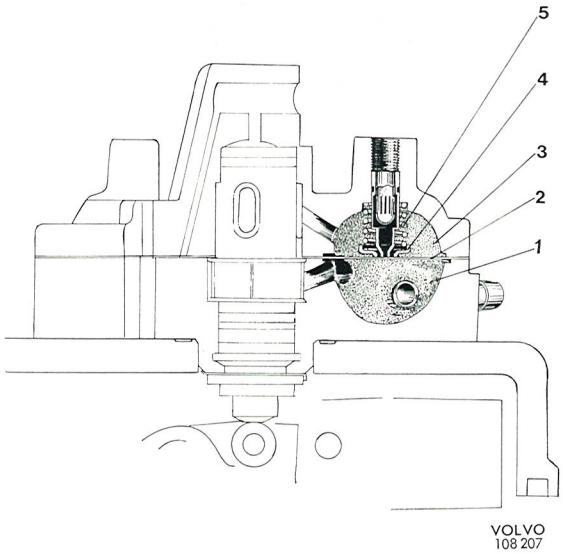


Fig. 2-161. Pressure regulating valve

1. Lower chamber
2. Steel diaphragm
3. Upper chamber
4. Seat
5. Spring

with the position of the diaphragm. The lower chambers are in connection with each other and with the outlet of the fuel control unit.

The fuel pressure in the lower chambers is the same as the line pressure, i.e. 4.5 kp/cm^2=64 psi. The diaphragm registers the total pressure in each chamber and maintains a position where the total pressure is the same on both sides of the diaphragm.

The spring pressure is equal to a pressure of .1 kp/cm^2=1.5 psi. In order to maintain a total pressure of 4.5 kp/cm^2=64 psi, the same as in the lower chamber, the diaphragm has a position giving a fuel pressure of 4.4 kp/cm^2=62.5 psi.

The difference between the fuel pressures in the upper and the lower chambers is thus .1 kp/cm^2= 1.5 psi.

When fuel is fed from one metering slot of the fuel control unit into the upper chamber, the pressure rises and the diaphragm is pressed downwards and the valve opening increased. When the valve opening has reached a position where the increased fuel amount to the chamber is equalized by the same increase from the chamber to the injectors, the diaphragm has reached its new position.

The diaphragm will then keep its new position as long as the pressure difference is the same, i.e. as long as the fuel amount through the fuel control unit is not changed.

If the fuel amount to the upper chamber is decreased, the pressure will decrease and the diaphragm is pressed upwards and the valve opening is decreased until the total pressure again is the same on both sides of the diaphragm.

This happens each time the air flow sensor plate, and thereby also the control plunger, change positions.

The fuel is fed through separate fuel lines from the pressure regulating valves to the injectors.

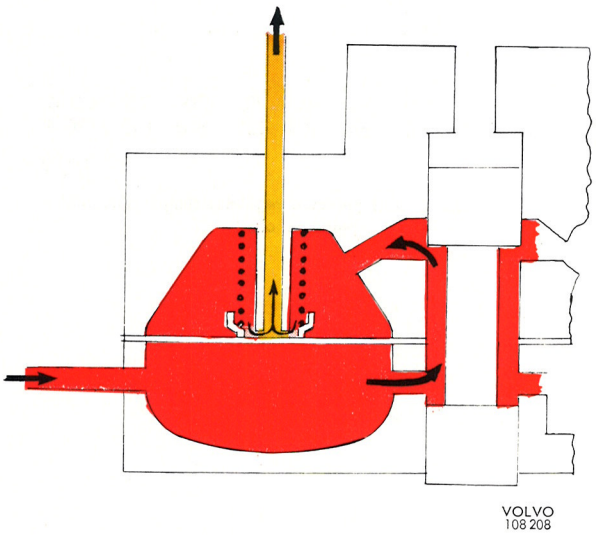


Fig. 2-162. Pressure regulating valve, function

Injectors

The injectors are provided with a rubber seal and installed in a bracket on the cylinder head by a retainer. The injectors have a spring controled valve which opens at a fuel pressure of 3.3 kp/cm^2 =47 psi. The valves are designed to finally atomize the fuel, also at low fuel flows.

The fuel pressure is always exceeded when the metering slots are open and this means that the fuel is injected continuously. The amount of fuel varies with the air flow.

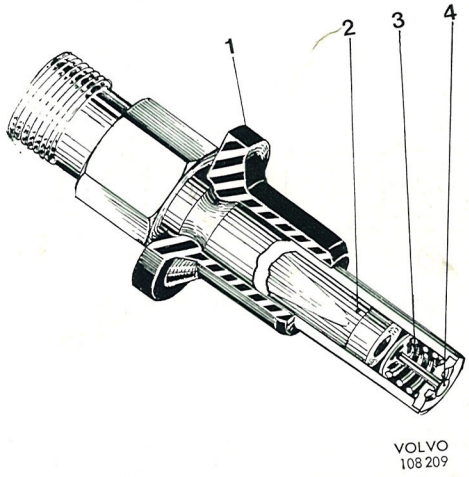


Fig. 2-163. Injector

1. Rubber seal
2. Insert
3. Valve spring
4. Valve

Control pressure regulator

The control pressure is controled by the control pressure regulator.

The regulator has a spring-loaded diaphragm valve 1, Fig. 2-164. At low temperatures the spring pressure is counteracted by a bi-metallic spring 4. The bi-metallic spring is provided with an electric coil 3.

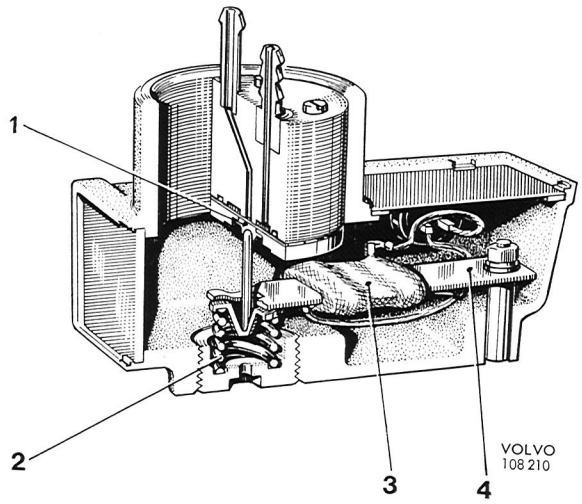


Fig. 2-164. Control pressure regulator

1. Diaphragm valve
2. Spring
3. Coil
4. Bi-metallic spring

A cold bi-metallic spring compresses the coil spring. The compression increases with decreasing bi-metallic spring temperatures (ambient temperatures).

The compression of the coil spring causes the diaphragm valve to open and more fuel can pass to the tank, see Fig. 2-165, lowering the control pressure. Lower control pressure will allow the air flow sensor plate, and consequently also the control plunger, to raise further in the air flow thus providing a richer air fuel ratio.

When the ignition is switched on, current flows through the coil which heats the bi-metallic spring. The heat causes the bi-metallic spring to lower the pressure of the coil spring, reducing the valve opening and increasing the control pressure. The bi-metallic spring pressure is completely removed at normal operating temperatures and the control pressure is now 3.7 kp/cm^2 = 52.2 psi. This is obtained after 1.5 minute at an ambient temperature of +20°C = 68°F. Lower temperatures mean increased heating periods.

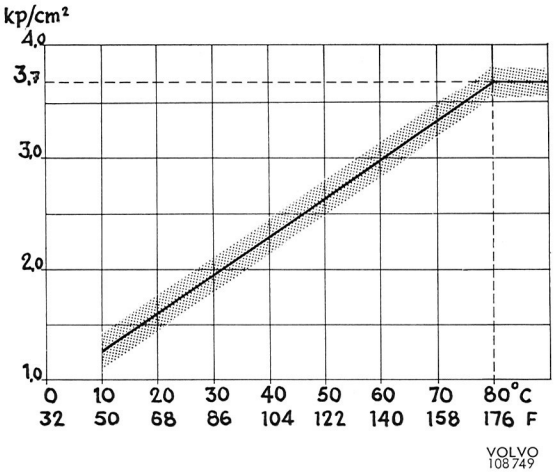


Fig. 2-166. Control pressure regulator temperature and pressure chart

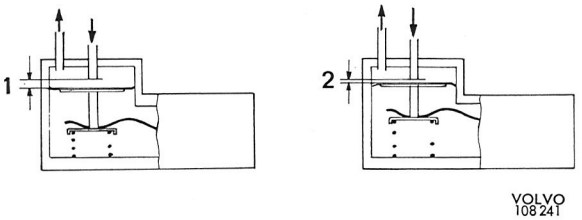


Fig. 2-165. Control pressure regulator, function

Cold engine	**Hot engine**
Large opening area (1)	Small opening area (2)
Low control pressure	High control pressure
Rich mixture	Lean mixture

Cold start injector

The cold start injector consists of a housing containing a solenoid coil, an actuator, a return spring and a seal. When there is no current flow through the solenoid coil, the return spring 2 presses the actuator 3 against the gasket 4 and the cold start valve is closed. When there is a current flow from the thermal time switch through the solenoid coil the actuator is withdrawn and fuel fed through the seal, through the cold start injector and into the intake manifold.

The injection time is controlled by the thermal time switch. The thermal time switch provides extra fuel for 12 seconds at —20°C=—5°F. At temperatures higher (warmer) than —20°C=—5°F the cold start injector injection time decreases gradually and ceases completely at +35°C=95°F.

The cold start injector is injecting fuel only when the starter is operating. The cold start injector stops injecting fuel if the engine starts and the starter stops operating before the time permitted by the thermal time switch is up.

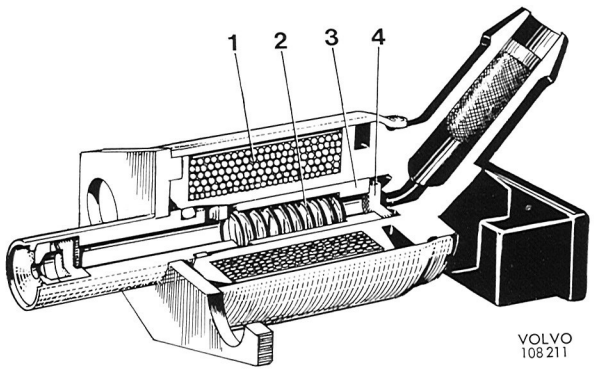


Fig. 2-167. Cold start injector

1. Coil
2. Return spring
3. Accuator
4. Seal

Thermal time switch

The thermal time switch is a sealed unit, utilizing contacts controlled by a bi-metallic spring. The bi-metallic spring has two coils, one activated from the cold start injector and one from the starter.

The contacts 1 are closed at cold engine (below +35°C=95°F). When the starter operates, there is a current flow from the starter to the cold start injector and via the wire 4 and the contacts 1 to ground. At the same time there is a current flow from the starter via wire 3 and contacts 1 to ground. The cold start injector operates as long as the contacts 1 are closed and the starter operates. The wire 3 heats the bi-metallic spring 2, which reacts, the contacts 1 open and the cold start valve ceases operating. The heating time varies with the engine temperature; the warmer the engine the shorter the heating time for the bi-metallic spring and consequently also the injection time for the cold start injector.

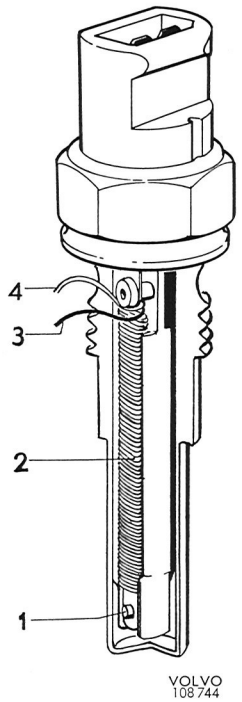


Fig. 2-168. Thermal time switch

1. Contacts
2. Bi-metallic spring
3. Wire from starter
4. Wire from cold start injector

Electrical circuits

When the ignition is switched on, current flows from the ignition coil terminal 15, see Fig. 2-169, to main relay terminal 86, through relay coil to terminal 85 and finally to air-fuel control unit and ground. The main relay is thus activated.

When the ignition key is turned to starting position, current flows from the starter terminal 50 to the main relay terminal 87, through the closed contacts to terminal 30 and to the pump relay terminal 86. From there through the relay coil to terminal 85 and ground.

The pump relay is thus activated and current flows from fuse No. 7 to the pump relay terminal 30, through the closed contacts to terminal 87, to fuel pump and ground. The fuel pump is thus activated and pumps fuel.

The control pressure regulator and the auxiliary air valve are activated at the same time as the fuel pump.

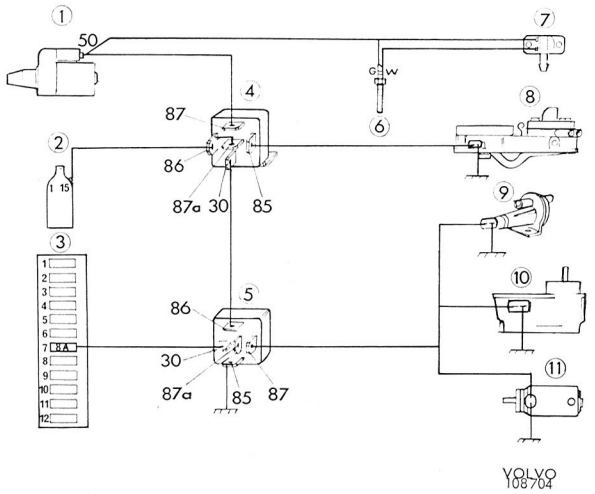
When the starter motor is operating or after the engine has started, the contacts at the air-fuel control unit open, the ground circuit is opened, and the main relay is de-activated. Current now flows from terminal 86 to terminal 87a, through the contacts to terminal 30, and the fuel pump relay is thus still activated, and pumps fuel.

There is no current flow to main relay terminal 87 when the engine is running and the starter motor not operating.

If the engine stops (with the ignition still switched on), the contacts at the air-fuel control unit close. Main relay terminal 85 is grounded, the relay is activated, and terminal 30 is connected to terminal 87. As there is no current flow to terminal 87, the pump relay is de-activated and the fuel pump stops working.

When the engine is stopped by switching off the ignition, the whole system is de-activated which means that also the fuel pump stops.

The cold start injector is activated only when the starter motor is operating and the engine temperature at the same time is so low that the thermal time switch cuts in.



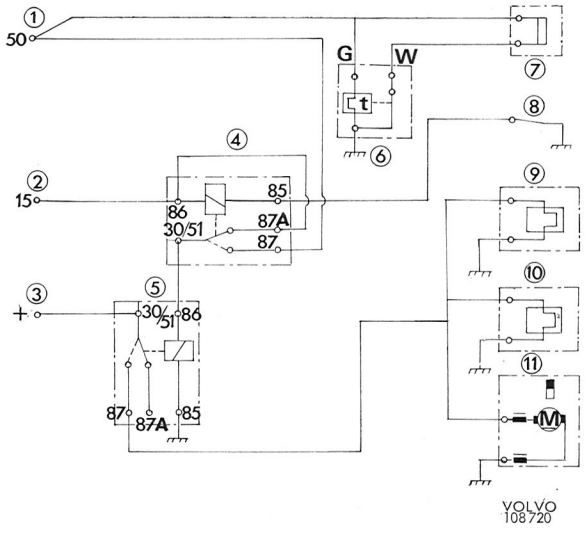


Fig. 2-169. Electrical circuits

1. Starter motor
2. Ignition coil
3. Fuse box (Fuse No. 7)
4. Main relay
5. Fuel pump relay
6. Thermal time switch
7. Cold start injector
8. Air-fuel control unit
9. Auxiliary air valve
10. Control pressure regulator
11. Fuel pump

GAS EVAPORATIVE EMISSION CONTROL SYSTEM

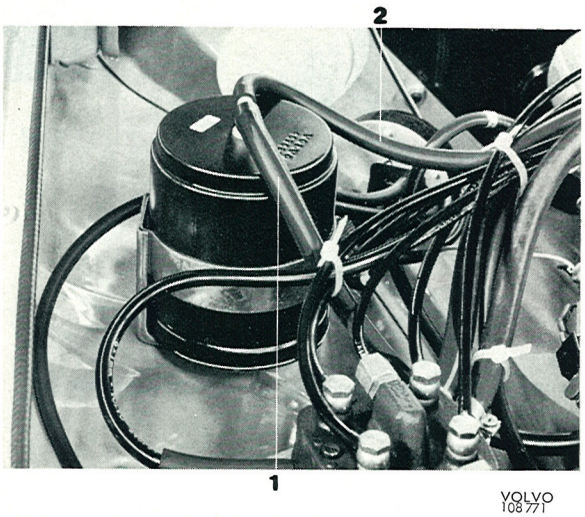


Fig. 2-170. Venting filter

1. Connection to inlet duct
2. Connection from equalizing valve

Vehicles intended for USA are equipped with a gas evaporative emission control system, which prevents fuel fumes from being released into the atmosphere.

The system consists of a venting filter ("carbon filter, carbon canister"), see Fig. 2-170, equalizing valve, Fig. 2-171, and hose connections.

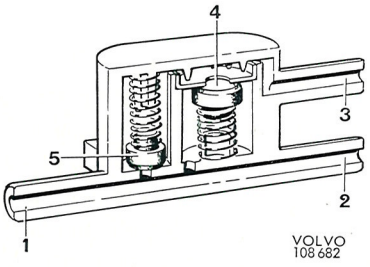


Fig. 2-171. Equalizing valve, located on the fuel tank

1. Hose to filler neck
2. Hose to tank (fuel gauge sender)
3. Hose to venting filter
4. Underpressure valve
5. Overpressure valve

The expansion tank, see Fig. 2-172, which is introduced on all models, is also part of the gas evaporative emission control system as it absorbs the fuel expansion caused by raising temperature, at full tank.

Fig. 2-172 shows the function of the system.

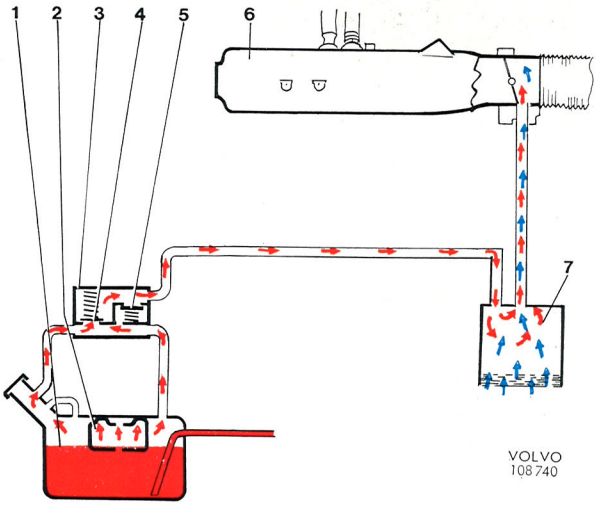


Fig. 2-172. Gas evaporative emission control system

1. Fuel tank
2. Expansion tank
3. Inlet duct
4. Venting filter

Fuel fumes from the fuel tank are led to the equalizing valve, see red arrows.

The equalizing valve consists of the overpressure valve 4 and the underpressure valve 5. The valve 4 opens when the pressure exceeds .05—.2 kp/cm^2 = .7—3 psi and the fuel fumes are directed to the venting filter where they are absorbed by the active carbon.

The equalizing valve prevents fuel, when driving in curves, from being pressed up in the hose and to the venting filter. The valve 5 opens when the underpressure exceeds .1—.2 kp/cm^2 = 1.4—3 psi and directs air to the fuel tank via the venting filter. When the engine starts, air is drawn through the venting filter and into the engine. Gas fumes stored in the active carbon are drawn by the air flow into the engine where they take part in the combustion. The venting filter should be replaced every 80.000 km = 48.000 miles.

EXHAUST GAS RECIRCULATION (EGR)

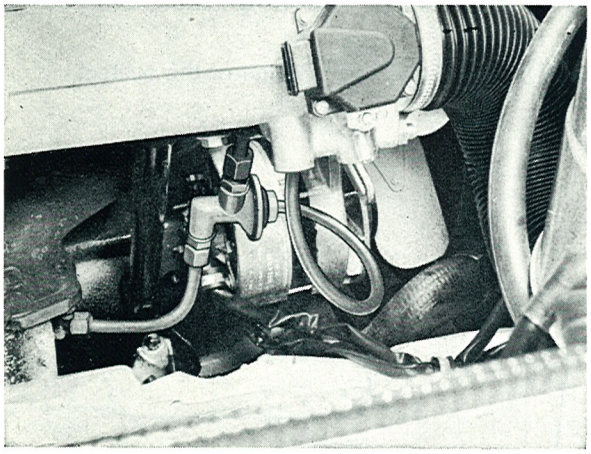


Fig. 2-173. EGR valve, installed

Vehicles with a B 20 F-engine in combination with automatic transmission are equipped with exhaust gas recirculation. This makes for cleaner exhaust gases when driving on half throttle. The system consists of a recirculation channel and an EGR valve operated under a vacuum.

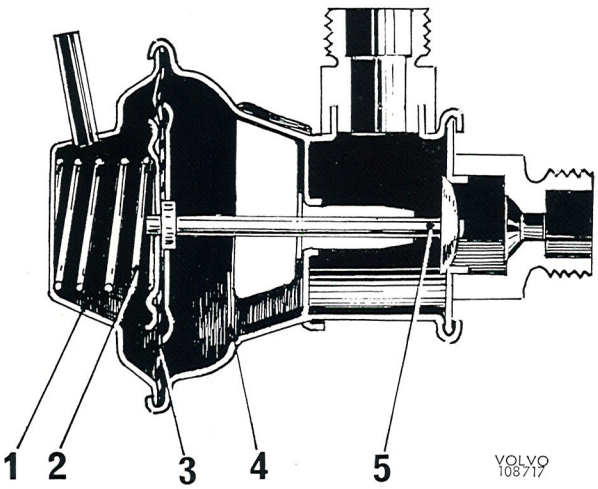


Fig. 2-174. EGR valve

1. Vacuum chamber
2. Return spring
3. Diaphragm
4. Reference chamber
5. Piston

Exhaust gas recirculation takes place when the air shutter is **between** the closed position (idle) and the half-open position (full throttle).

When the air shutter is closed, Fig. 2-175 a, the opening for the EGR line on the EGR valve is in front of the air shutter. The pressure in the EGR line and also in the EGR valve vacuum chamber is then equal to atmospheric pressure. Since the pressure in the EGR valve reference chamber is always equal to atmospheric pressure, the same pressure exists on both sides of the diaphragm and this keeps the valve in a closed position under the force of the spring. In other words, there is no exhaust gas recirculation.

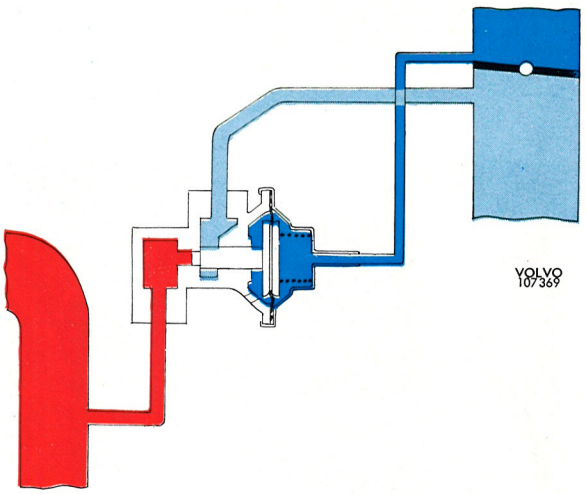


Fig. 2-175a. Air shutter closed, no exhaust gas recirculation

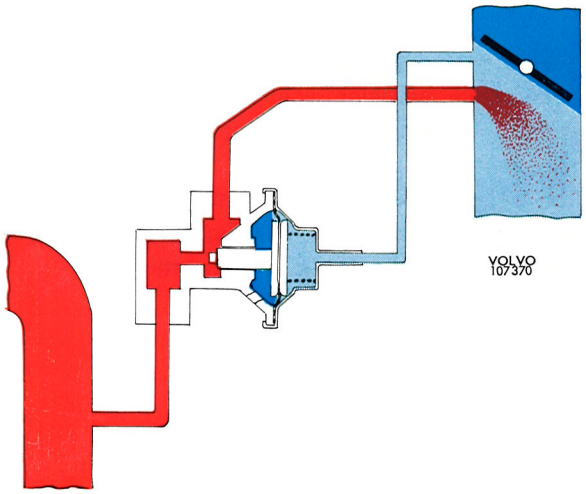


Fig. 2-175b. Air shutter partly open, exhaust gas recirculation

When the air shutter is partly open, Fig. 2-175 b, the opening for the EGR line "moves" behind the air shutter. Behind the air shutter there is partial vacuum which is transmitted to the vacuum chamber of the EGR valve. The atmospheric pressure in the EGR valve reference chamber now presses the diaphragm backwards so that the valve opens. Exhaust gas now recirculates to the intake manifold and back into the cylinders.

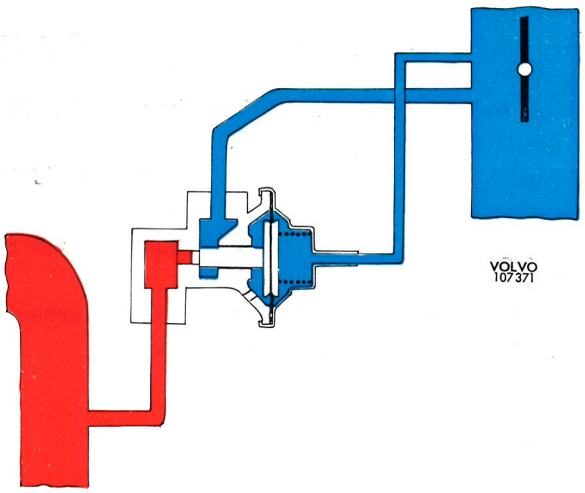


Fig. 175c. Air shutter fully open, no exhaust gas recirculation

With a fully open air shutter, Fig. 2-175 c, there is atmospheric pressure in the intake manifold and this is transmitted to the vacuum chamber of the EGR valve. The pressure on both sides of the diaphragm is now equal so that the valve is closed by the spring. Exhaust gas recirculation has now stopped.

EXHAUST GAS RECIRCULATION SYSTEM, WITH VACUUM AMPLIFIER

The purpose of the EGR with Vacuum amplifier is to control the amount of EGR, dependent on the driving condition, to meet the NO× emission standards with minimal sacrifice in vehicle driveability. The principal of operation is based on utilization of the Venturi vacuum at the air cleaner as a measure of the total air flow.

This weak Venturi signal of vacuum controls the vacuum amplifier to regulate the EGR valve to give the right amount of exhaust gas recirculated in relation to the intake air flow. The amplifier receives two inputs:

A. The weak Venturi signal to be amplified.
B. The strong mainfold vacuum for its power source.

The system has a vacuum reservoir and a check valve to maintain adequate vacuum regardless of variations in engine manifold vacuum. The amplifier thus continues to provide desired amplification at higher speeds, and moderate accelerations when the manifold vacuum generally drops.

The EGR valve is closed at engine idling by a solenoid valve in front of the EGR valve. This solenoid valve is controlled by a micro-switch on the throttle valve.

The EGR valve is closed at:

1. Engine idling.
2. Full throttle.

The EGR valve is open in varying degrees depending on driving conditions and engine load, from slight throttle opening until wide open throttle.

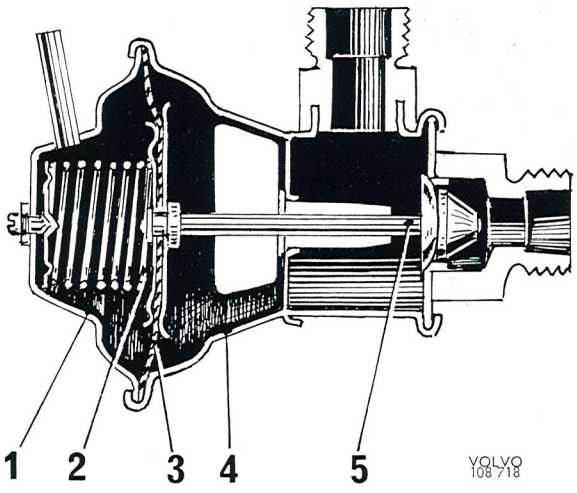


Fig. 2-176. EGR valve

1. Vacuum chamber
2. Return spring
3. Diaphragm
4. Reference chamber
5. Piston

The system consists of the following parts: (see Fig. 2-177).

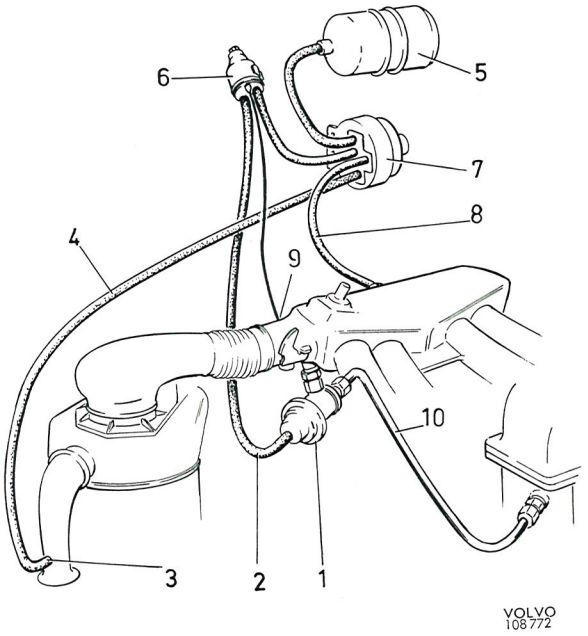


Fig. 2-177. EGR system with vacuum amplifier

1. EGR valve
2. Vacuum control hose
3. Air venturi
4. Vacuum control hose
5. Vacuum tank
6. Vacuum valve
7. Vacuum amplifier
8. Vacuum supply hose
9. Micro switch
10. EGR-line

Vacuum operated EGR valve, 1, governing the exhaust gas recirculation.

Vacuum amplifier, 7, amplifying the vacuum from the venturi.

Vacuum tank, 5, providing the vacuum amplifier with vacuum.

Air venturi, 3, providing a vacuum proportional to the inducted air quantity.

Electrically operated vecuum valve, 6 which closes the vacuum for the EGR valve when the engine is idling.

Micro switch, 9, connected to the throttle, and closing the vacuum valve electrical circuit when the throttle is closed (at idle).

Hose for control vacuum, 4, fram the venturi to the vacuum amplifier.

Vacuum supply hose, 8, from intake manifold to vacuum tank.

Vacuum control hose, 2, from vacuum amplifier to EGR valve.

Line for exhaust gas recirculation, 10, from exhaust pipe to EGR valve and intake manifold.

SERVICE PROCEDURES

For Service Diagnosis, see Illustration 2-B.

RUBBER BELLOW REPLACEMENT

Replace rubber bellow and/or O-ring for rubber bellow = Volvo Standard Times Op. No. 24749

Removal

1. Remove two clamps, see Fig. 2-178.

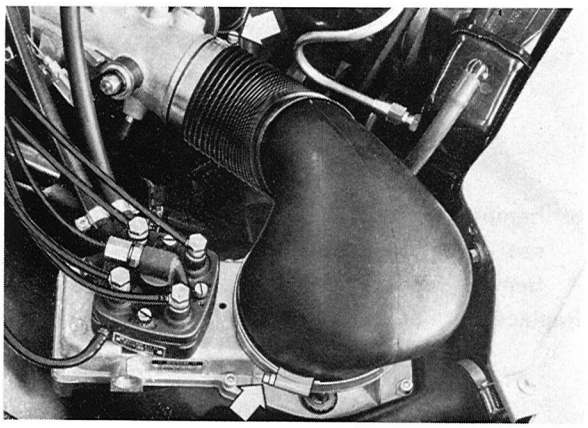


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Fig. 2-178. Rubber bellow removal

2. Remove the rubber bellow. Check for damages. Replace a damaged rubber bellow.
3. Check the O-ring on the air flow sensor. Replace a damaged O-ring.

Installation

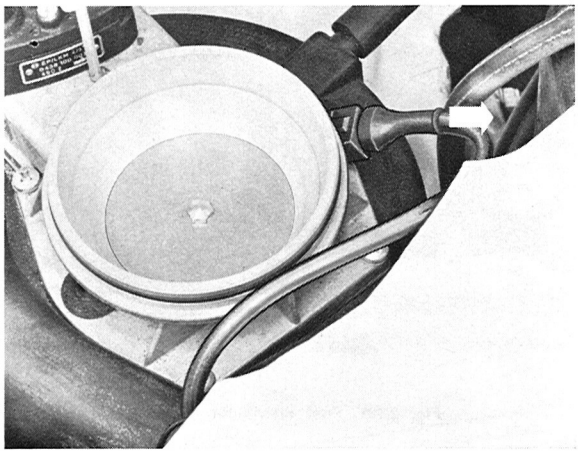
1. Install the rubber bellow.
2. Tighten the clamps.
3. Check that there is no leakage between the air flow sensor and the intake manifold.

AIR-FUEL CONTROL UNIT

Remove and replace Air-Fuel Control Unit, incl. replace gasket = Volvo Standard Times Op. No. 24753

Removal

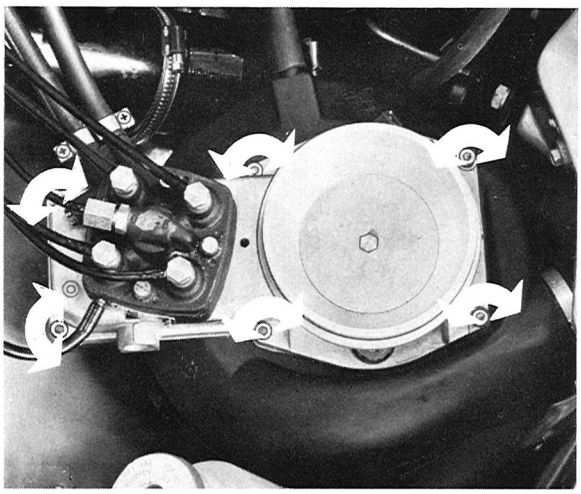
1. Remove the rubber bellow.
2. Remove the injector line strap.
3. Carefully clean the fuel distributor line connections.
4. Remove the injector lines and the fuel supply line at the fuel distributor.
5. Disconnect the terminal at the air flow sensor, see Fig. 2-179.



VOLVO 108247

Fig. 2-179. Removal of connector

6. Remove the fuel supply line at the cold start valve and the fuel return line.
7. Remove the fuel line at the fuel filter.
8. Remove the screws and the air-fuel control unit, see Fig. 2-180.



VOLVO 108231

Fig. 2-180. Air-fuel control unit removal installation

9. Check the gasket. Replace damaged gaskets.

Air-fuel control unit disassembly

1. Loosely fasten the air-fuel control unit in a vise. Excessive vise pressure may damage the unit.
2. Remove the three screws, Fig. 2-181, and carefully lift out the fuel distributor so the control plunger does not fall out and get damaged.
3. Check the gasket. Replace a damaged gasket.
4. Remove the air flow sensor plate stop by removing the two retaining screws, see Fig. 2-182.

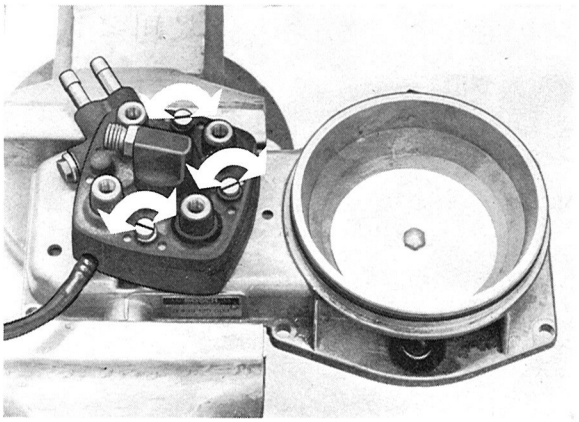


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Fig. 2-181. Fuel distributor removal

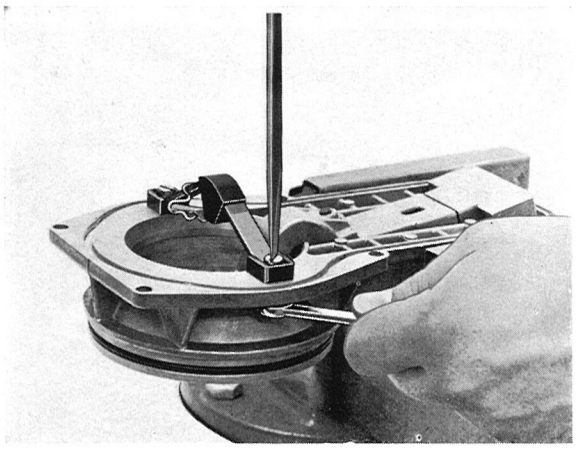

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Fig. 2-182. Removal of air flow sensor plate stop

5. Remove the screw for the lever counterweight, see Fig. 2-183, and remove the counterweight.

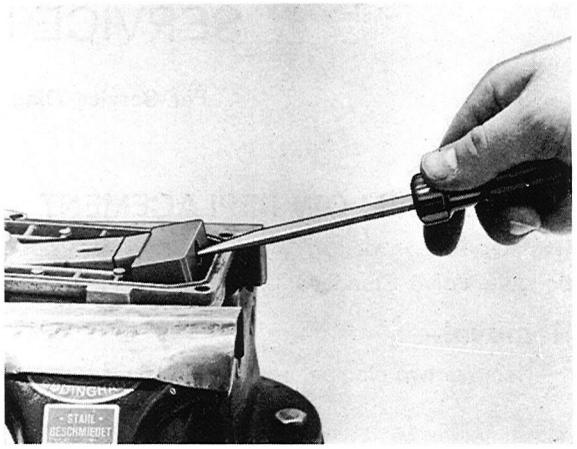

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Fig. 2-183. Removal of counterweight retaining screw

6. Remove the lock ring, the cover, the rubber seal, springs and bolts and shaft, see Fig. 2-184 Remove the lever and the adjustment arm.

Replace worn or defective parts.

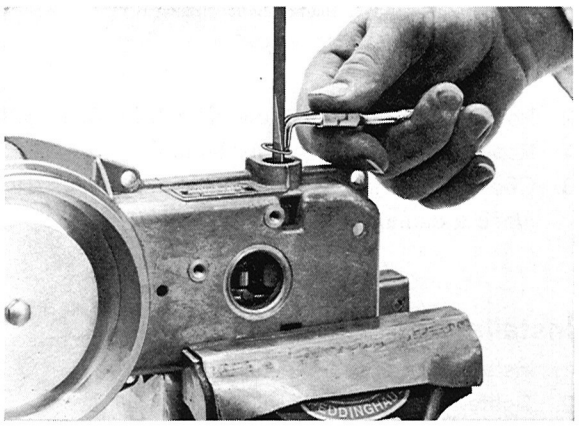

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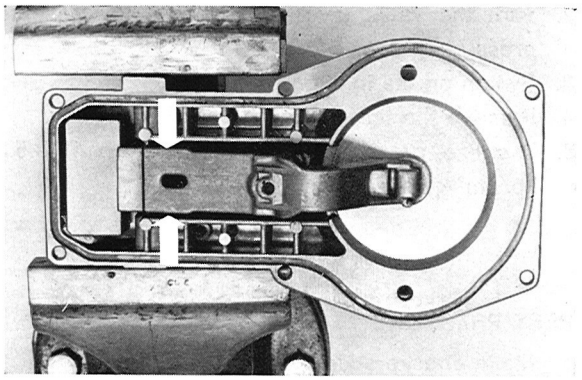
Fig. 2-184. Lock ring removal

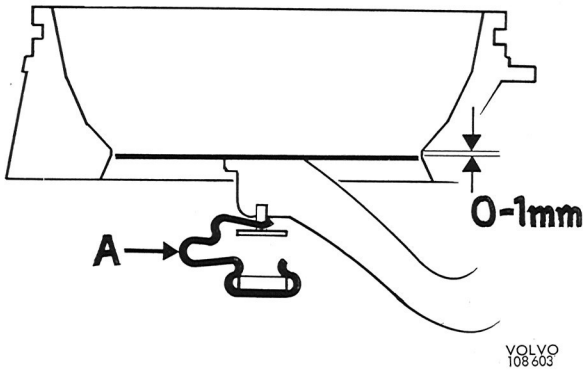
Air-fuel control unit assembly

1. Install the lever and the adjustment arm. Install the adjustment arm so that the control plunger roller is towards the fuel distributor. Install in order: shaft, balls, springs, rubber seals, washers and lock rings.
2. Install the counterweight and center the lever, see Fig. 2-185. Carefully tighten the counterweight.



VOLVO
108 238

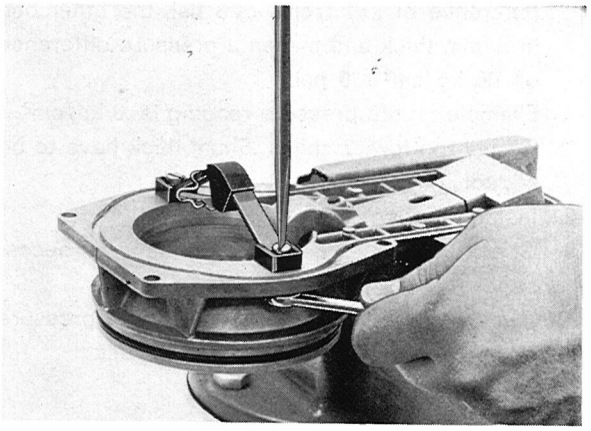
Fig. 2-185. Installation of lever



VOLVO
108 603

Fig. 2-187. Air flow sensor plate leveled in the air venturi

3. Install the air flow sensor plate stop so that the spring and terminal are located on the right side, see Fig. 2-186.



VOLVO
108 236

Fig. 2-186. Installation of air flow sensor plate stop

4. Install the fuel distributor with O-ring.
5. Center the air flow sensor plate. (The air flow sensor plate must not touch the air venturi in any point).
6. Adjust the spring so that the air flow sensor plate is in level with, or maximum 1.0 mm = .040″ below the end of the conical shape, see Fig. 2-187.

Adjust by compressing or extending the spring, see Fig. 2-188.

VOLVO
108 233

Fig. 2-188. Adjustment of air flow sensor plate level

Installation

1. Attach the air-fuel control unit to the air cleaner.
2. Connect the fuel lines to the filter.
3. Connect the cold start valve fuel line and the fuel return line.
4. Connect the wire to the air-fuel control unit terminal.
5. Connect the injector fuel lines and the fuel supply line.
6. Attach the strap around the four injector lines.
7. Install the rubber bellow.

Volvo Standard Times	0p. No.
Replace Fuel Distributor	24737
Clean or replace Fuel Distributor O-rings	24739
Adjust or replace Line Pressure Regulator O-rings	24741
Replace Air Flow Sensor Plate, or adjust position in air venturi	24743

Line pressure regulator adjustment

1. Remove the plug and the spring.
   NOTE: In the plug there are several shims which easily fall out if the plug opening is turned downwards.
2. Pull out the piston, pressing the spring towards one side while pulling it out at the same time.
3. Remove the O-ring from the piston.
4. Replace defective parts.
5. Check that piston and O-ring are clean. Install the O-ring on the piston. Be very careful so that neither piston nor O-ring are damaged. Never install damaged parts.
   The piston and the fuel distributor are paired, and parts from other units must not be used.
6. Install piston, spring, plug with copper gasket and the amount of shims removed.
7. Use a pressure gauge to test the line pressure.

LINE PRESSURE

1. Connect pressure gauge 5011 between the fuel distributor and the line pressure regulator, see Fig. 2-189.

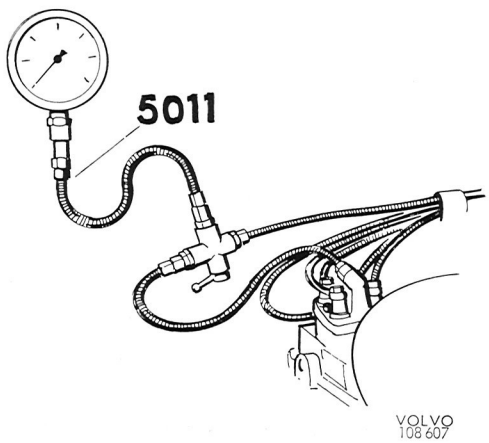


Fig. 2-189. Pressure gauge connection

2. Turn the valve lever so it points towards the pressure gauge.
3. Switch on the ignition.
4. Remove the terminal at the air flow sensor.
5. The line pressure reading should be 4.5—5.2 kp/cm² = 64—74 psi.

REST PRESSURE

1. Make checks according to 1—4 above.
2. Re-connect the terminal at the air flow sensor.
3. Read the rest pressure to 1.7—2.4 kp/cm² = 24—34 psi. The pressure is supposed to remain unchanged for at least 1 minute.

Line pressures and rest pressures which are too high or too low are adjusted as follows:

1. Remove the line pressure regulator plug.

   Pressure too high
   Remove shims

   Pressure too low
   Add shims

   There are two different shim thicknesses available. One is .5 mm thick and makes a pressure difference of .3 kp/cm² = 4.3 psi, the other one is .1 mm thick and makes a pressure difference of .06 kp/cm² = .8 psi.
   Example: if the pressure reading is .6 kp/cm² = 8.5 psi too low, 2 shims .5 mm thick have to be added.
2. Install the plug.
3. Check the pressures again and adjust if necessary.
4. Switch off the ignition and remove the pressure gauge when the pressures are correct.

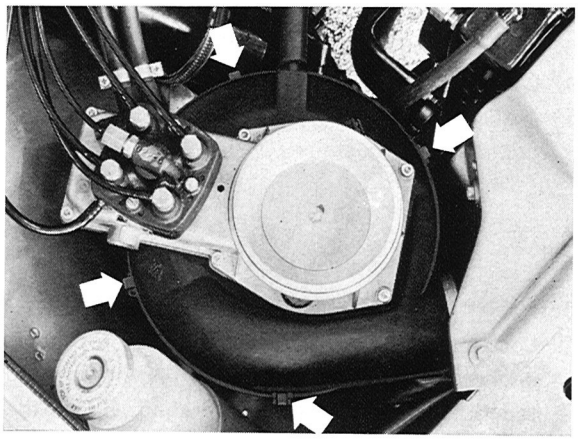
INJECTOR REPLACEMENT

1. Clean the line connection and round the injector.
2. Remove injector fuel line.
3. Remove the injector retainer and lift out the injector.
4. Check the injector rubber seal. Replace a damaged rubber seal.
5. Install the injector and tighten the retainer.
6. Re-connect the fuel line.
7. Start the engine and check for leakage.

AIR FILTER CHANGE

Volvo Standard Times Op. No. 23209

1. Remove the rubber bellow.
2. Remove the terminal at the air-fuel control unit.
3. Unlatch the retainers, see Fig. 2-190, and lift out the upper part of the air cleaner, complete with air-fuel control unit.



VOLVO
108 250

Fig. 2-190. Removal of air cleaner uppert part

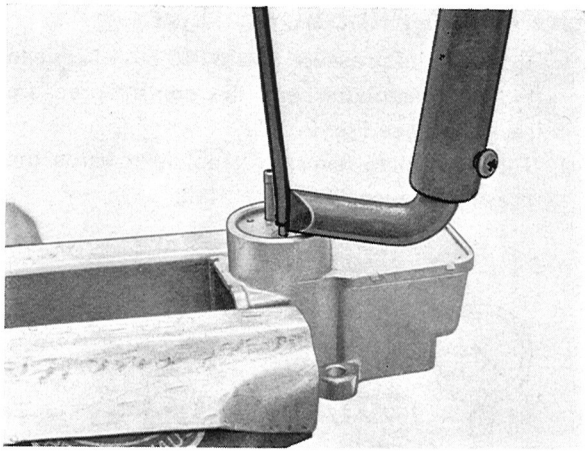
4. Replace air filter cartridge.
5. Install air cleaner upper part assembly.
6. Re-connect the air-fuel control unit terminal.
7. Re-install the rubber bellow.

REPLACEMENT OF CONTROL PRESSURE REGULATOR

Volvo Standard Times Op. No. 24751

Removal

1. Clean the hose connections at the control pressure regulator and the connection at the fuel distributor.
2. Remove the fuel line strap.
3. Remove the control pressure regulator hose connection at the fuel distributor.
4. Disconnect the terminal at the control pressure regulator.
5. Remove the control pressure regulator outlet line.
6. Remove the control pressure regulator.
7. Install the control pressure regulator in a vise.
8. Remove the line.

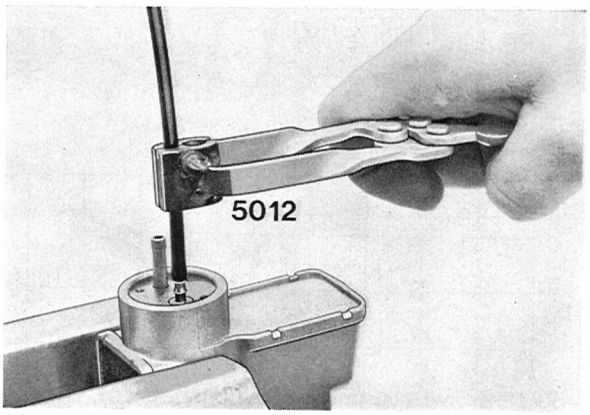


VOLVO
108 234

Fig. 2-191. Fuel line removal

Installation

1. Cut and install the fuel line to the control pressure regulator.



VOLVO
108 235

Fig. 2-192. Fuel line installation

2. Install the control pressure regulator and tighten it. Connect the ground wire to one of the retaining screws.
3. Connect the outlet line to the control pressure regulator.
4. Use a pressure gauge to test the control pressure.

CONTROL PRESSURE TEST

1. Connect the pressure gauge 999 5011 between the fuel distributor and the control pressure regulator, see Fig. 2-193.
2. Turn the valve lever so it points towards the pressure gauge, see Fig. 2-193.

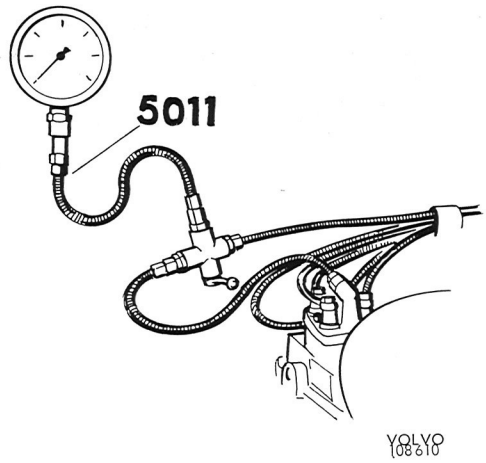


Fig. 2-193. Control pressure test

3. Switch on the ignition.
4. Start the fuel pump by disconnecting the air flow sensor terminal.
5. Read the control pressure and compare with the chart, Fig. 2-194.

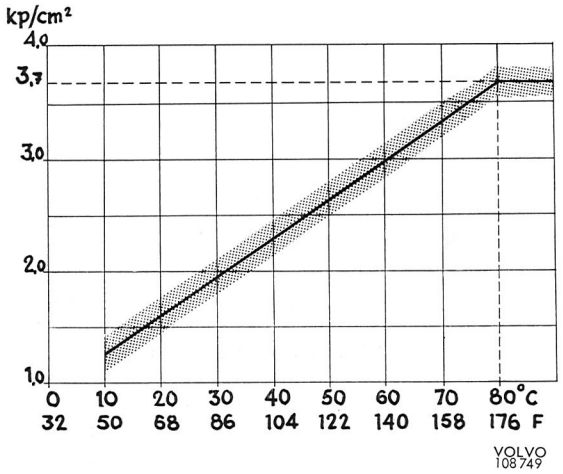


Fig. 2-194. Control pressure at various temperatures

6. Re-connect the control pressure regulator terminal.
   The control pressure should be 3.7±.2 kp/cm² 52.5±3 psi after 3 minutes or when the engine is warm.
7. Re-connect the air flow sensor terminal.
8. Switch off the ignition.
9. Remove the pressure gauge and re-connect the fuel line at the fuel distributor.
10. Attach the fuel line strap.

Replacement of micro switch

1. Disconnect the electrical wire.
2. Remove the micro switch from the retainer.
3. Install the new micro switch.
4. Connect the electrical wire.
5. Adjust the micro switch, see "Throttle with micro switch, adjustment".

Throttle with micro switch, adjustment

1. Loosen the lock nut for the throttle stop screw and screw out the stop screw until it does not touch the stop on the throttle shaft. Check that the throttle closes completely.
2. Screw in the stop screw until it just touches the stop on the throttle shaft. Then screw in another 1/2 turn and lock with the lock nut. Check that the throttle does not bind or seize when closed.

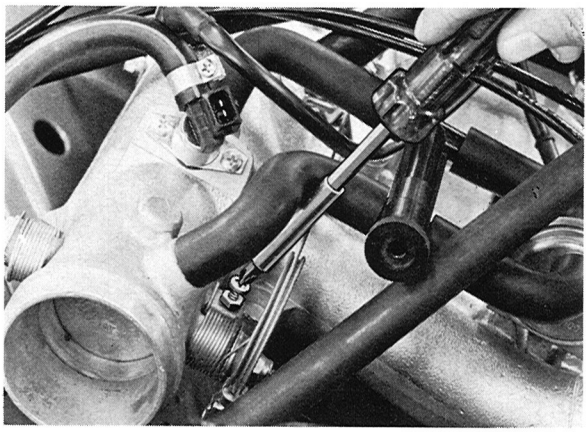


Fig. 2-195. Throttle adjustment

3. Connect a test light to the micro switch and to the removed wire from the electrically operated vacuum valve. Switch on the ignition. Insert a feeler gauge 1 mm=.040″ thick between the throttle adjustment screw and the stop for the screw.

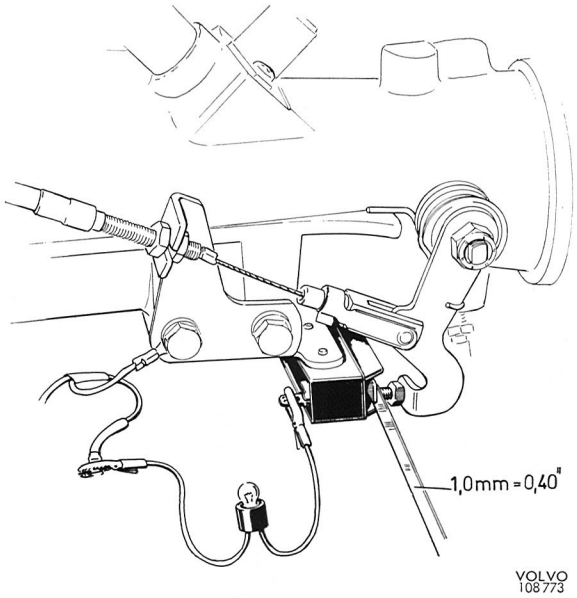


Fig. 2-196. Micro switch adjustment

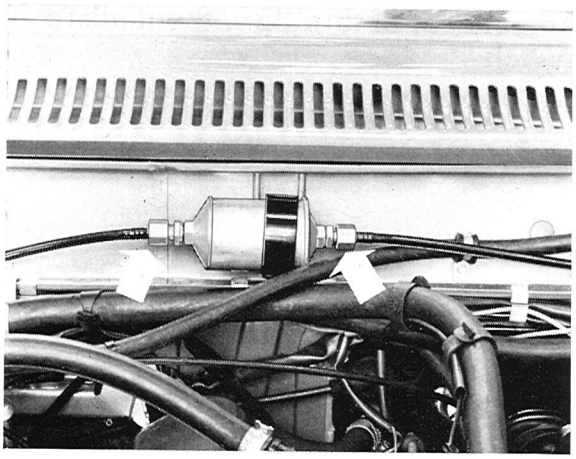


Fig. 2-197. Fuel filter replacement

4. Loosen the lock nut for the micro switch adjustment screw and screw out the adjustment screw until the micro switch is free. Then screw in the screw again until the test light just comes on. Lock the adjustment screw with the lock nut. Remove feeler gauge and test light. Switch off the ignition.

Replacement of thermal time switch

1. Disconnect the electrical wires.
2. Remove the thermal time switch.
3. Install the new thermal time switch.
4. Re-connect the electrical wires.

Fuel filter replacement

1. Clean the hose connections.
2. Remove the fuel filter.
3. Remove two nipples with washers.
4. Install the new filter. An arrow shows the direction of flow.
5. Switch on the ignition.
6. Disconnect the wires at the air-fuel control unit and check that the fuel filter connections do not leak.
7. Re-connect the electrical wires.
8. Switch off the ignition.

Auxiliary air valve replacement

1. Disconnect the electrical wires and the hoses.
2. Remove the auxiliary air valve.
3. Install the auxiliary air valve.
   NOTE: The ground wire which should be attached at one of the retaining screws.
4. Re-connect wires and hoses.

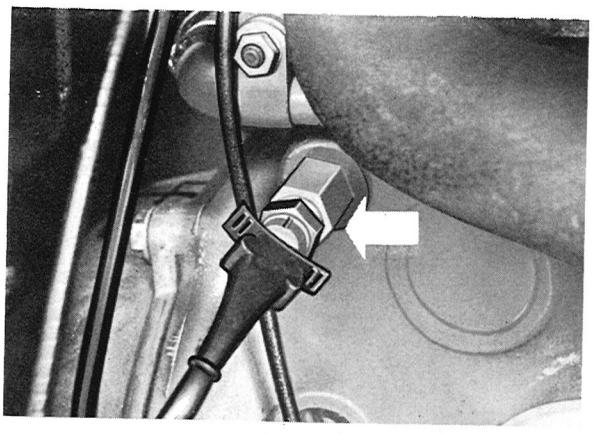


Fig. 2-198. Thermal time switch replacement

Adjustment of throttle without micro switch

See "Throttle with micro switch, adjustment", p. 1 and 2.

Cleaning of control plunger

Wipe the control plunger with a rag which does not leave any fluff. Check the plunger for defects. Replace it if it is worn or scratched.

Fuel line replacements

Replacement of fuel lines to control pressure regulator or the inlet hose to the fuel distributor should be done with the part removed from the vehicle.

1. Use a throughly cleaned soldering iron to melt the line and pull it off the nipple.
   NOTE: Do not cut the line loose, as the nipple may get damaged and cause leaks.
2. Install the new line with tol 999 5012.

Idle adjustment

Adjust with the idle adjustment screw, see Fig. 2-203. The idle rpm shuld be:

13.3 r/s=800 rpm for vehicles equipped with automatic transmission.

15.0 r/s=900 rpm for vehicles equipped with manual transmission.

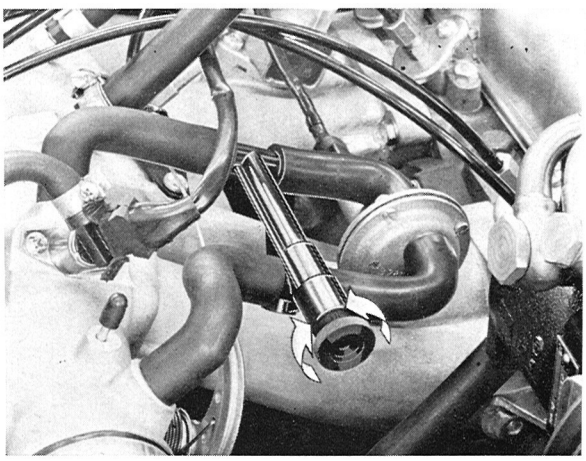


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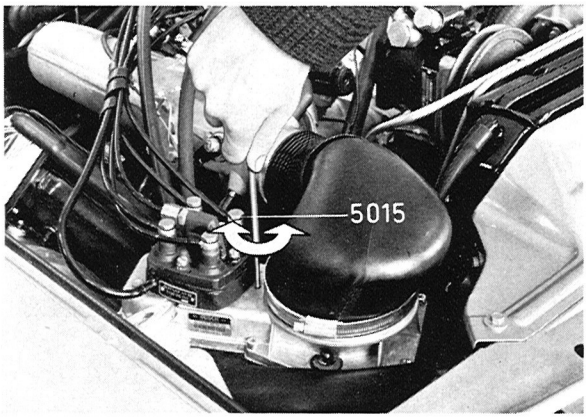
Fig. 2-199. Idle adjustment

CO adjustment

1. Check the idle rpm, adjust if necessary.
2. Check CO with (setscrew tool) 999 5015, see Fig. 2-204. Adjust CO to .5—3.0 % (USA 1.5 %).



VOLVO 108259

Fig. 2-200. CO adjustment

Check of EGR valve

1. Start the engine.
2. Remove the EGR valve vacuum hose at the intake manifold and create a vacuum by sucking at the end of the hose, by mouth or vacuum pump.
   a. The EGR valve is in order if the engine stops or starts to run erratiely.
   b. The EGR valve is defective if there is no reaction. Clean or replace if necessary.
3. Re-install the vacuum hose at the intake manifold.
4. Stop the engine.

EGR valve replacement

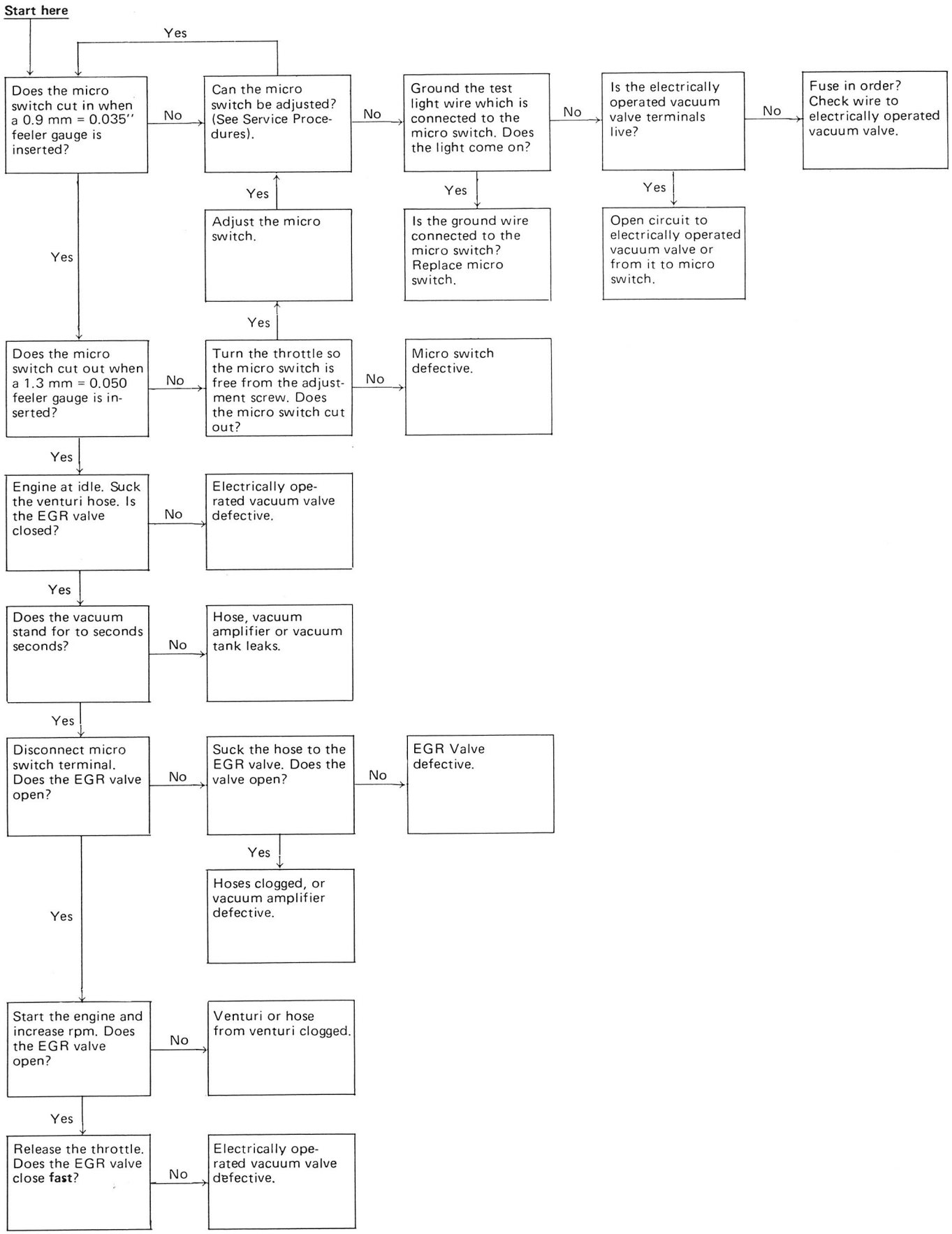
Volvo Standard Times Op. No. 25406

1. Disconnect the vacuum hose at the EGR valve.
2. Remove the EGR valve.
3. Install the new EGR valve.
4. Re-install the vacuum hose.

Check of exhaust gas recirculation

1. Switch on the ignition.
   Disconnect the wire at the micro switch, see Fig. 2-201.
2. Connect a test light to the disconnected wire and to the micro switch terminal.
3. Insert a feeler gauge .9 mm=.035″ between the throttle adjustment screw and stop. Open and close the throttle by hand. (The throttle should not be allowed to slap back to closed position). The test light should light.
4. Replace the feeler gauge with one on 1.3 mm =.050″. Open and close the throttle, see p. 3 above. The test light should **not** light.
   Re-connect the wire at the micro switch.
5. Start the engine and let it idle. Remove the hose from the venturi, marked 1, at the vacuum amplifier. Connect an auxiliary hose to the vacuum amplifier and suck by mouth or vacuum pump. The EGR valve is not allowed to open (the idle does not change).
6. Check that the vacuum stands for at least 10 seconds (connect a vacuum meter or, if vacuum is sucked by mouth, feel with the tongue that the vacuum remains).
7. Let the vacuum remain and disconnect the wire at the micro switch. The EGR valve should now open, the engine stops or runs erraticly.
8. Re-connect the wire at the micro switch. Remove the auxiliary hose and connect the venturi hose.
9. Rev upp the engine and check at the same time that the EGR valve opens by checking that the diaphragm is pressed towards the vacuum chamber.
10. Release the throttle. The EGR valve should close fast when the engine rpm goes down.

Check of Exhaust Gas Recirculation



GROUP 25

INTAKE AND EXHAUST SYSTEM

GENERAL INFORMATION

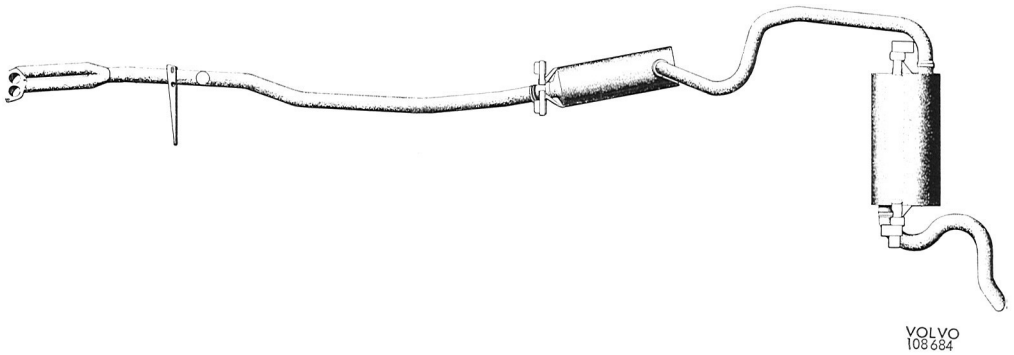


Fig. 2-201. Exhaust system

INTAKE AND EXHAUST MANIFOLDS

The B 20 A and B 20 B intake and exhaust manifolds are integrally cast to a branch pipe. The material is nodular iron.

The B 20 E intake and exhaust ducts are separate. The intake duct is of light alloy and designed for the CI system (Continous Injection).

MUFFLER AND EXHAUST PIPES

The exhaust system comprises front pipe, front muffler, intermediate pipe, rear muffler (resonator) and rear pipe. The front pipe is attached to the exhaust manifold flange by studs and nuts.

There are two versions of pipe joints, one **earlier** with clamps of standard type and one **later** where the joints, pipe/rear muffler and rear muffler/rear pipe are hydraulically clamped.

The front pipe is supported at the transmission in order to reduce exhaust manifold tensions.

The front muffler is at the front end supported by two rubber rings, while the rear muffler is supported at both ends by rubber rings.

Vehicles intended for certain markets are equipped with an Exhaust Gas Recirculation System (EGR). For Information and Service Procedures on these systems, see 2:42 and 2:60 for carburetor engines and 2:74 and 2:85 for fuel injection engines.

Exhaust manifold gasket replacement

Volvo Standard Times Op. No. 25242.

Fuel injection engines

1. Disconnect the battery ground cable.
2. (Automatic Transmission). Remove the oil filler pipe retaining screw and turn the pipe out of the way.
3. Remove the retainer above the control pressure regulator.
4. Remove the connection pipe between the air flow sensor and the intake manifold.
5. Loosen the upper bolts for the intake manifold bracket, remove the lower bolt.
6. Remove the exhaust pipe clamp at the transmission, and the exhaust manifold flange nuts.
7. Remove the manifold nuts and bolts.
8. Lift out the manifold so that the gasket is uncovered.
9. Remove the gasket and clean mating surfaces on branch pipes and cylinder head.
10. Position the new gasket on the cylinder head studs.
11. Position the exhaust manifold. Re-install manifold nuts and bolts and torque.
    B 20 E and B 20 F: 9—11 N = .0—1.1 kp = 6.5—8 lb.ft.
    B 20 A and B 20 B: 18—22 N = 1.8—2.2 kp = 13—16 lb.ft.
12. Install the exhaust manifold flange gasket, flange nuts and exhaust pipe clamp at the transmission.
13. Position the intake manifold bracket lower bolts, torque the three bracket bolts.
14. Install the connection pipe between the intake manifold and the air flow sensor.
15. Clamp the fuel hoses, above the control pressure regulator.
16. (Automatic Transmission). Install the bolt for the oil filler pipe.
17. Re-connect the battery ground cable.

Replacement of complete exhaust system

Volvo Standard Times	Op. No.
Replace front pipe	25216
Replace intermediate pipe	25206
Replace rear pipe	25218
Replace exhaust pipe support	25224
Replace front muffler	25212
Replace rear muffler	25210
Replace front pipe and muffler	25232
Replace exhaust system suspension O-rings	25234

1. Loosen the clamps for the front muffler.
2. Remove the intermediate pipe from the front muffler.
3. Remove the front muffler suspension rings. Use a screwdriver to pull the rubber rings off the brackets.
4. Pull the front muffler loose from the front pipe.
5. Remove the rear muffler suspension rings and remove intermediate pipe, rear muffler and rear pipe as a unit.
6. a. (Carburetor engines). Remove the pre-heater shield.
6. b. (F-engines) Remove air cleaner and battery. Disconnect the vacuum hose at the EGR valve and remove the EGR valve. Remove lower pipe and nipple with washer from the front pipe.
7. Remove the front pipe nuts at the manifold flange, and the clamp at the transmission.
8. Remove the front pipe by wriggling.
9. Position a new gasket on the manifold flange. Position the front pipe with the clamp at the transmission.
10. Install the flange nuts.
11. a. (Carburetor engines). Position and install the pre-heater shield.
11. b. (F-engines). Install nipple with washer on the front pipe. Install the lower pipe and the EGR valve on the lower pipe, but do not tighten. Position the EGR valve to the upper pipe. Tighten the two nuts on the lower pipe, start at the EGR valve. Connect the vacuum hose to the EGR valve. Install battery and air cleaner.

12. Tighten the clamp at the transmission.
13. Position clamp on the front pipe and install the front muffler on the front pipe, the pipe ends joint approx. 40 mm=1 1/2".
14. Install the front muffler rubber rings, use a screwdriver and push the rings over the bracket.
15. Install the rear muffler rubber rings on the floor brackets.
16. Position clamps on the rear muffler and install the rear pipe in the rear muffler, approx. 40 mm=1 1/2".
    NOTE: Rear muffler P/N 461356 and P/N 460981 are marked "IN" at the end towards the intermediate pipe (inlet to the muffler).
17. Install the intermediate pipe in the rear muffler, approx 40 mm=1 1/2". Lift up the unit, now consisting of intermediate pipe, rear muffler, rear pipe and attach the rear muffler to the rubber rings.
18. Position clamp on the front muffler and connect the intermediate pipe to the front muffler.
19. Adjust the position of the rear muffler. Adjust by turning the rear muffler, also by changing position of the front muffler on the front pipe.
    Round rear muffler: The muffler brackets should be aligned immediately under the body brackets. A line through the muffler bracket and the muffler center should deviate approx. 4° from vertical, see Fig. 2-202.

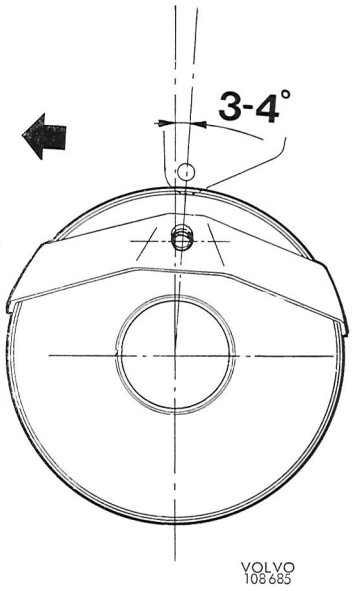


Fig. 2-202. Position of the round rear muffler

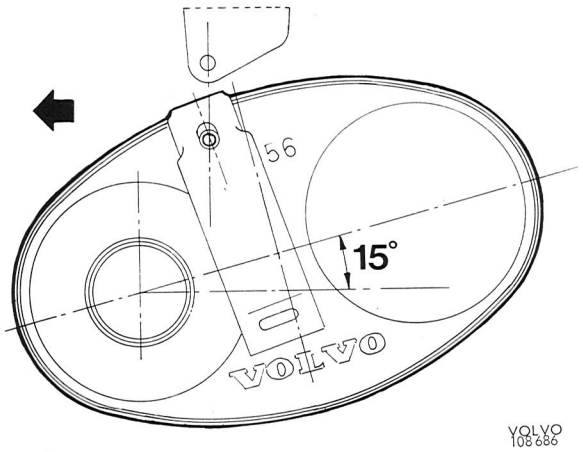


Fig. 2-203. Position of the oblong rear muffler

Oblong rear muffler: The muffler brackets should be aligned immediately under the body brackets. The muffler should deviate forwards (front end lower than rear end) approx. 15° from vertical, see Fig. 2-203.

20. Tighten all clamps, clamp positioned over slotted parts.

GROUP 26

COOLING SYSTEM

GENERAL INFORMATION

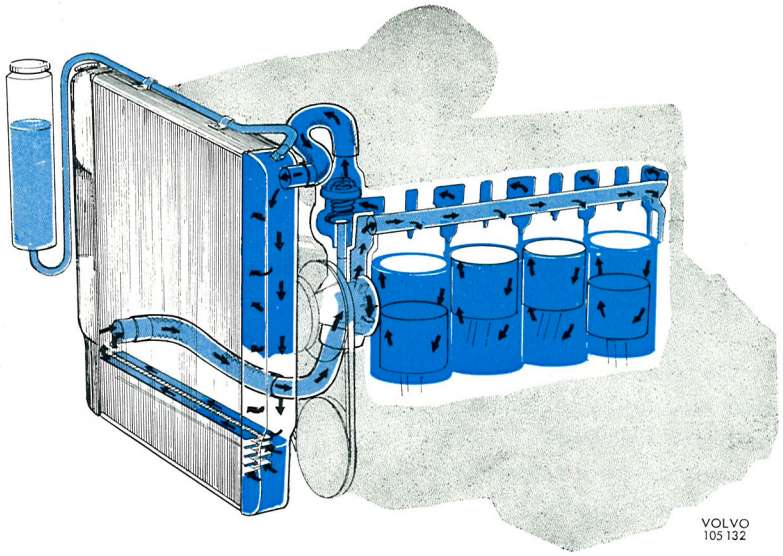


Fig. 204. Sealed type cooling system

GENERAL

The engine is water-cooled and the cooling system sealed, see Fig. 2-204.

The fan is a fixed fan or a speed-regulated fan, a so-called viscous type (see Fig. 2-205).

The function of the viscous type is to ensure that the fan blades do not exceed a certain speed even if the engine speed is exceeded. See Fig. 2-205. The six fan blades are mounted asymmetrically to keep down the noise level. The fan coupling consists of the housing (11, Fig. 2-205) in which the fan blades (1) are secured with the bolt (2). The housing (11) has two halves which cannot be separated for repairs, the fan coupling must be replaced as a unit. The hub (8) has a light fit on the water pump flange (6) and is locked by the center bolt (7). The hub is provided with a slip disc of friction material (9) surrounded by oil. During idling and at low speeds, slipping is insignificant, so that the fan provides an air current for good cooling. When the speed (that of the water pump) exceeds about 58 r/s (3500 pm), slipping increases (see Fig. 2-213). With this arrangement the fan speed should never exceed 42 r/s (2500 pm).

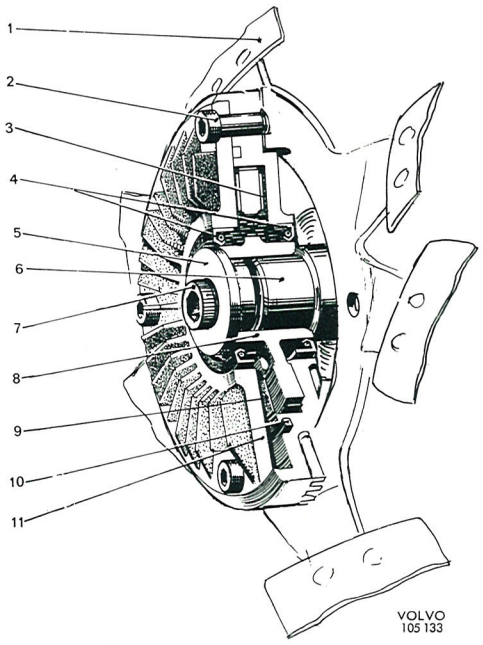


Fig. 2-205. Viscous fan

1. Fan blade
2. Bolt
3. Oil
4. Seals
5. Washer
6. Flange, water pump
7. Center bolt
8. Hub
9. Friction material
10. Rubber ring
11. Housing

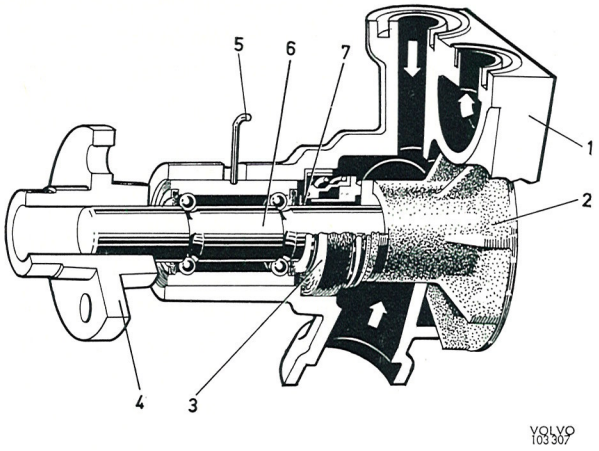


Fig. 2-206. Water pump

1. Housing
2. Impeller
3. Seal ring
4. Flange
5. Lock spring
6. Shaft with ball bearings (integral unit)
7. Wear ring

The fan noise output would then be low compared with a fan which runs at the same high speeds as the water pump. Compared with this latter type of fan, the output loss will be less for the viscous type fan. A centrifugal pump, Fig. 2-206, takes care of the coolant circulation and a twin operating thermostat provides fast warming up of the engine and contributes to the engine maintaining the most suitable temperature under all operating conditions. The cooling system has a capacity of 10 liters (10 qts.). Of this quantity, .6 liter (.6 qt.) fills the expansion tank at maximum level.

In order to achieve the desired effect with the sealed cooling system, it must be well filled and not leak. As coolant, a mixture consisting of 50 % ethylene glycol and 50 % water is used all year round. This mixture provides protection against frost down to minus 35°C (minus 32°F), is an efficient summer coolant, and should be changed every other year. At the same time the engine radiator and expansion tank should be flushed with clean water.

If Volvo anti-freeze for cars is used (it has a red color), it should not be mixed with other types of anti-freeze.

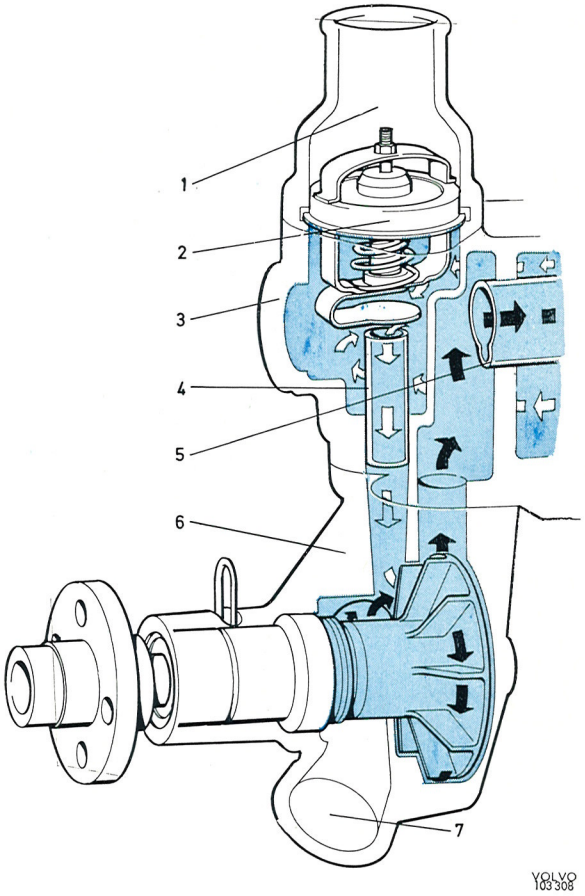


Fig. 2-207. Coolant flow, thermostat closed

1. To radiator
2. Thermostat
3. Cylinder head
4. By-pass pipe
5. Distributor pipe
6. Water pump
7. From radiator

COOLING SYSTEM INNER CIRCUIT (BY-PASS)

The cooling system consists of two circuits, an inner and an outer one. When the engine is warming up and in very cold weather when large quantities of heat are required for warming up the inside of the car, the coolant circulates almost exclusively through the inner circuit (the by-pass). This circuit covers the engine and car heater. The thermostat is closed, that is, the outlet to the radiator is shut off. The coolant passes through the thermostat by-pass to the distributor pipe (5, Fig. 2-207) in the cylinder head. This results in a uniform cooling of the warmest parts in the cylinder head. Even the parts around the spark plugs are also cold and thereby maintained at a constant temperature. The coolant surrounding the cylinder walls is circulated by thermo-syphon action.

COOLANT SYSTEM OUTER CIRCUIT

When the coolant in the inner circuit reaches a suitable temperature for the engine, the thermostat begins to open, during which time the by-pass between the thermostat housing and the pump gradually closes, see Fig. 2-208.

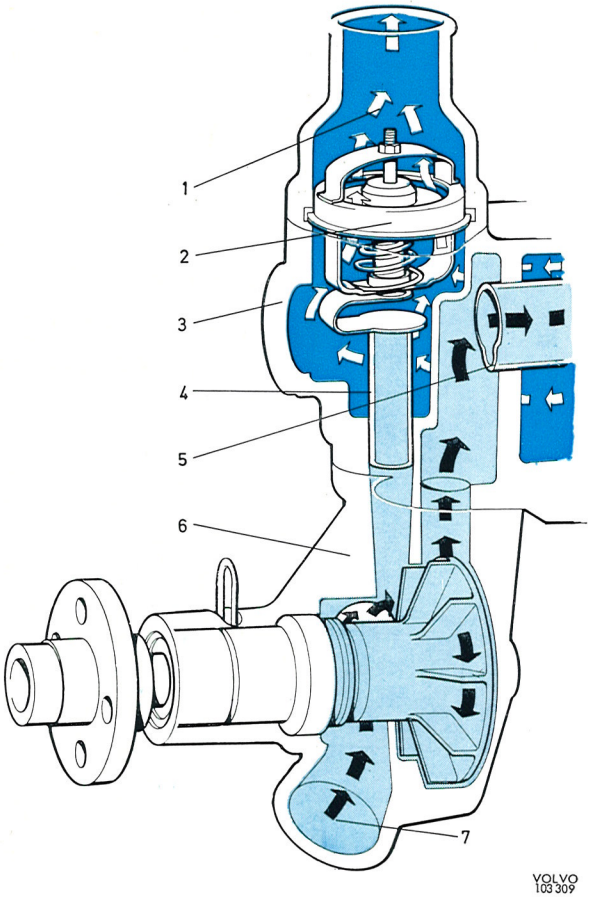


Fig. 2-208. Coolant flow, thermostat open
Concerning numbers above, see previous figure

Coolant flows from the engine into the upper part of the radiator is cooled and then sucked by the pump out from the lower part of the radiator from where it is conveyed into the engine through the distributing pipe.

An air cushion forms in the upper part of the expansion tank and permits the coolant to expand without involving any loss of coolant so that there is air suction at reduced temperature and volume. This arrangement ensures that the cooling system is always filled with coolant, thus minimizing the risk of corrosion. When the cooling system is being topped up, it will probably be difficult to prevent air from entering this system. The air, however, is subsequently separated and forced out into the expansion tank where it is replaced by coolant from this tank. It is, therefore, important to check the coolant level after the system has been emptied and filled with new coolant.

The expansion tank cap is provided with a valve which opens when the pressure in the system exceeds .7 kp/cm^2 = 10 psi. There is also a valve which opens when there is a partical vacuum in the system and admits air into the expansion tank.

SERVICE PROCEDURES

RADIATOR TOPPING UP WITH COOLANT

Topping up with coolant, consisting of 50 % ethylene glycol and 50 % water (all year round) is done in the expansion tank, when the level has fallen to the "Min" mark.

NOTE: Never top up with water only.

DRAINING COOLING SYSTEM

To drain the cooling system, remove the plug on the right side of the engine and the lower radiator hose. The expansion tank is emptied by first taking it off its mounting and holding it at a sufficient height so that the coolant runs into the radiator. Another way to empty the tank is to turn it upside down.

FILLING EMPTY SYSTEM WITH COOLANT

Before filling, flush the cooling system with clean water. When filling with coolant, through the filler opening on top of the radiator, the heater control should be set at max. heat. Fill the radiator to the top and install the cap. Fill also the expansion tank to the "Max" mark or to max. 30 mm (1 1/8") above this mark. Run the engine for several minutes at different speeds. If necessary, top up with more coolant and then install the expansion tank cap. After driving for a short time, check the coolant level and top up with more coolant since it takes some time before the system is completely devoid of air.

COOLING SYSTEM LEAKAGE TEST

Volvo Standard Times Op. No. 26006

The cooling system is checked for leakage as follows: Connect a cooling system pressure tester to the hose between the expansion tank and radiator. Use a suitable T-nipple and two pieces of hoses. Carefully pump the pressure up to almost .7 kp/cm^2 (10 psi). Observe the pressure tester gauge. The pressure must not drop noticeably during 30 seconds. If it does, examine and remedy the leakage.

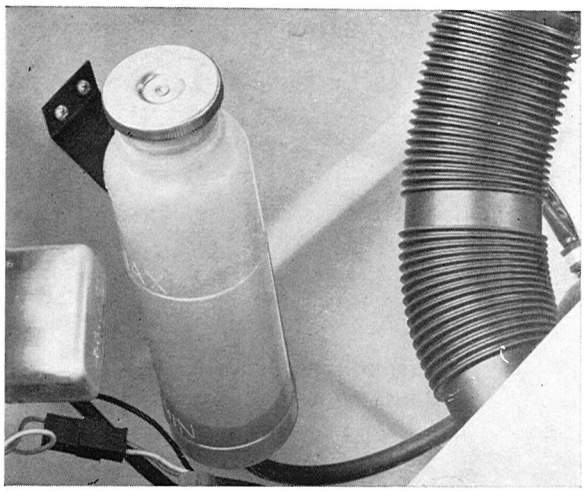


Fig. 2-209. Expansion tank

REPLACING RADIATOR

Volvo Standard Times Op. No. 26108

1. Remove the radiator cap and drain the system by disconnecting the lower radiator hose.
2. Remove the expansion tank with hose and empty out the coolant. Remove the upper radiator hose.
3. Remove the bolts for the radiator (and fan housing). Lift off the radiator.
4. Place the radiator in position and tighten the bolts for the radiator.
5. Install the radiator hoses as well as the expansion tank with hose.
6. Fill coolant, see under "Filling empty system with coolant". Start the engine and check for leakage.

REPLACING WATER PUMP

Volvo Standard Times Op. No. 26202

Remove the radiator according to the instructions given under "Replacing radiator" and screw off the water pump. Clean sealing surfaces and refit the pump with new gasket. Make sure that the seals on the upper side of the pump locate correctly. Also press the pump upwards against the cylinder head extension under the bolting, so that the sealing between the pump and cylinder head will be satisfactory. Make sure that the seals at the water pipes are not damaged and press in the pipes thoroughly when attaching.

THERMOSTAT

Replace thermostat = Volvo Standard Times Op. No. 26298

After being removed, the thermostat can be tested in a vessel containing heated water. The thermostat should open and close according to the values given in "Specifications". A faulty thermostat should be discarded. Use a new gasket when installing the thermostat.

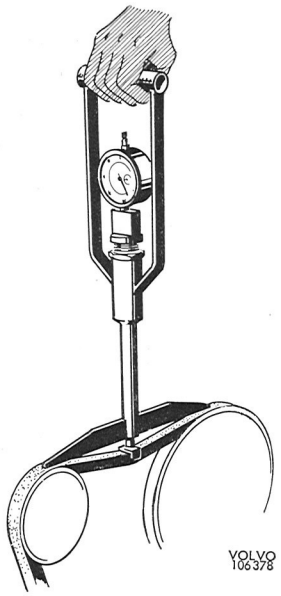


Fig. 2-210. Belt tensioner 2906

TENSIONING PULLEY BELT

Volvo Standard Times	Op. No.
Adjust fan belt	26205
Replace fan belt	26212

Tool 999 2906 can be used for checking and adjusting belt tension.

The gauge is placed on the belt as shown in the Fig. 2-210. The belt must lie in the fork on the thrust rod. Push the gauge down until both ends on the stop rule lie against the belt. In this position, read the gauge. Fig. 2-211 shows the correct values. (See also the table.)

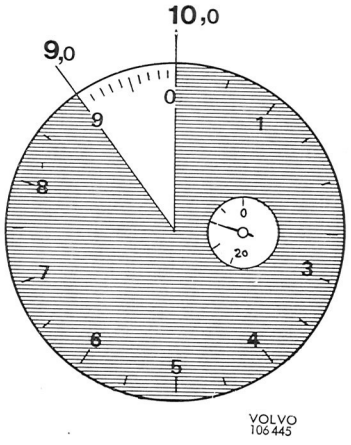


Fig. 2-211. Belt tensioning gauge values
See also the table

When adjusting the belt, use the upper, max. limiting value indicated, since the tensioning reduces somewhat after the engine has been turned over several times.

NOTE: The alternator must not be obliquely loaded. If a lever is used for adjusting, it should be placed between the engine and the **front end of the alternator.**

Note that if the lower alternator bolt is not slackened during adjustment, there will be heavy stresses on the drive end bearing shield.

On installing a new belt, final tensioning should be carried out after driving for abot 10 minutes. This will ensure a longer lifetime for the pulley belt.

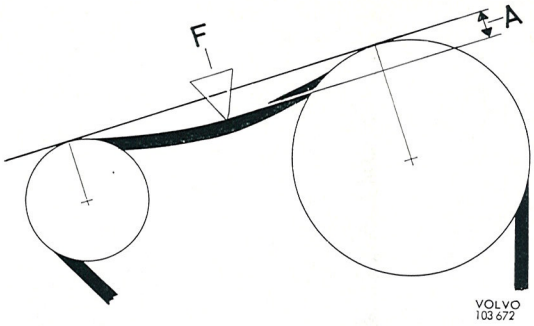


Fig. 2-212. Fan belt tension
F=See table A=10 mm (approx. 3/8")

Without 2906

The pulley belt is tensioned so that it can be deflected 10 mm (approx. 3/8") with a force acc. to table applied to the belt midway between the water pump pulley and alternator pulley, see Fig. 2-212. The amount of force applied will depend on the location of the bolt in the oblong slot in the tensioner. With the bolt at the end of the slot (long belt), the force applied should be the lower value; and with the bolt at the beginning of the slot (short belt), a force of the higher value should be applied. If the bolt is located anywhere between these extremes, the force applied should be proportionally within the two limits given.

FAN COUPLING

The fan coupling fuction can be checked with a stroboscope with variable blinking frequency. Make a mark on the fan and one on the water pump pulley. Find out the speed relationship between fan and pulley by means of the stroboscope. The fan speed should follow the speed of the water pump according to the curve given in Fig. 2-213.

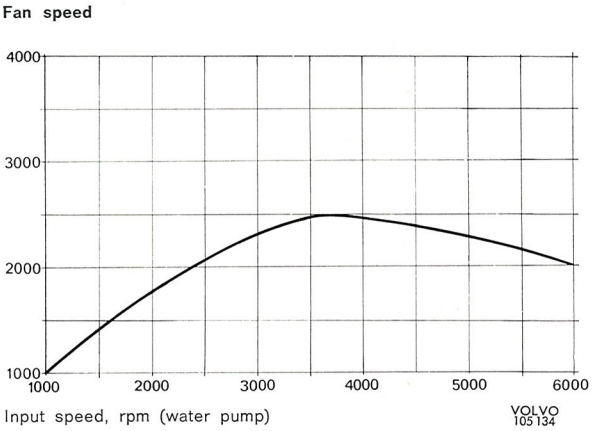


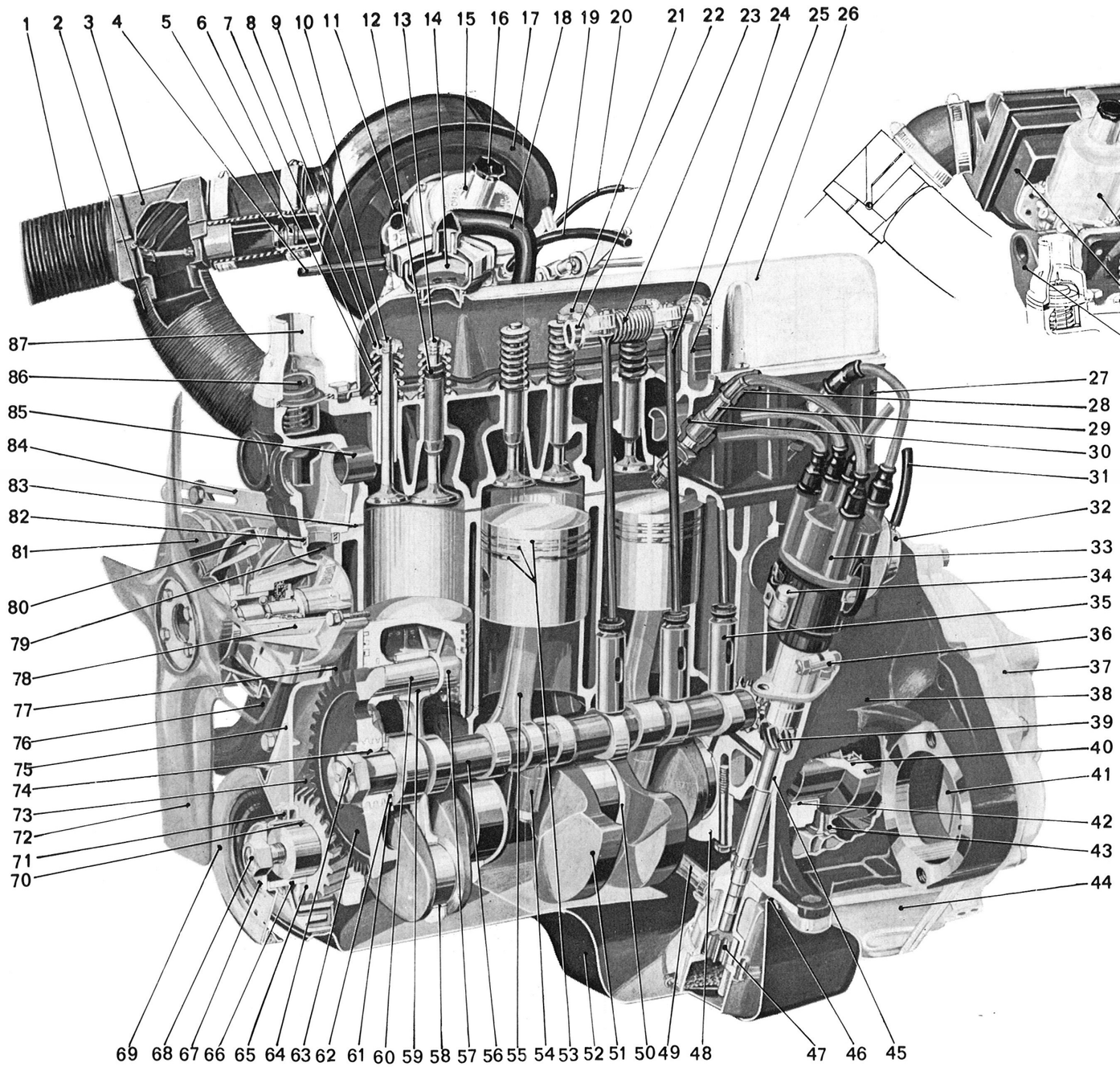
Fig. 2-213. Curve for fan coupling slip

Fan belt tensioning:

	with 2906			F N (lbs)
	A	B	C	
Vehicle with l-h drive	9.0—10.0	7.5—8.0	11.0	70—100 (15.5—22)
Vehicle with r-h drive	7.2— 8.3	6.5—7.1	9.5	55— 70 (12 —15.5)
Vehicle with r-h drive and air conditioning	9.0—10.0	8.8—9.3	11.0	85—100 (19 —22)

A=Check value with belt tensioner gauge, 2906, new belt
B=With belt in outer position (stretched belt)
C=Value when installing new belt
F=Depression force in N (lbs) when depressing 10 mm (3/8") midway between pulleys.
(The lower value with belt in outer position, stretched.)

1. Cold air hose
2. Hot air hose
3. Flap, constant air temperature device
4. Fuel line
5. Thermostat
6. Valve tappet
7. Valve spring
8. Washer
9. Valve collet
10. Exhaust valve
11. Connection for crankcase hose
12. Valve tappet seal
13. Intake valve
14. Oil filler cap
15. Carburetor
16. Damping device
17. Air cleaner
18. Hose for crankcase gases
19. Vacuum hose for distributor
20. Choke wire
21. Rocker arm
22. Rocker arm shaft
23. Spring
24. Push rod
25. Bearing bracket
26. Valve cover
27. Rubber seal
28. Rubber terminal
29. Rubber seal
30. Cylinder head
31. Vacuum hose
32. Vacuum governor
33. Distributor
34. Condenser
35. Valve tappet
36. Retainer
37. Flywheel casing
38. Gear wheel
40. Pilot bearing
41. Flywheel
42. Flange bearing shell
43. Sealing flange
44. Reinforcing bracket
45. Bushing
46. Seal
47. Oil pump
48. Main bearing cap
49. Delivery pipe
50. Main bearing shell
51. Crankshaft
52. Sump
53. Piston rings
54. Connecting rod cap
55. Connecting rod
56. Camshaft
57. Piston
58. Bushing
59. Big-end bearing shell
60. Piston pin
61. Washer
62. Spacing ring
63. Camshaft gear
64. Nut
65. Crankshaft gear
66. Hub
67. Washer
68. Bolt
69. Pulley
70. Key
71. Seal



72. Fan
73. Oil nozzie
74. Key
75. Timing gear cover
76. Coolant inlet
77. Gasket
78. Water pump
79. Gasket
80. Pulley
81. Alternator
82. Sealing ring
83. Cylinder head gasket
84. Tensioner
85. Water distributing pipe
86. Thermostat
87. Coolant outlet
88. Guard for throttle spindle
89. Air cleaner
90. Carburetor
91. Manifold
92. Connection for power brake hose
93. Connection for crankcase hose
94. Hose for crankcase gases
95. Clamp

Illustration 2-A. Engine, B 20

POSSIBLE FAULTS AND CAUSES

Excessive fuel consumption	6						
Poor performance, low top speed	5						
Engine stalls sporadically	4						
Uneven running	3						
Starting difficulties with warm engine	2						
Starting difficulties with cold engine	1						
Causes		1	2	3	4	5	6
Weak battery		x					
Distributor cap and high tension leads		x		x	x	x	
Distributor rotor		x					
Breaker points		x	x	x		x	x
Distributor incl. advance mechanism		x	x	x	x	x	x
Spark plugs		x	x	x		x	x
Ignition timing						x	x
Fuel pump electrical circuit		x	x		x		
Valve clearance				x			x
Compression pressure				x		x	x
Air filter clogged						x	x
Intake system leaking		x	x	x	x	x	
Throttle loose				x			
Throttle or throttle linkage misadjusted				x	x		
CO misadjusted			x	x	x	x	x
Air flow sensor plate misadjusted		x	x				
Fuel distributor or air flow sensor seizure		x	x	x	x	x	
Auxiliary air valve does not open		x					
Auxiliary air valve does not close				x			
Cold start injector leaking		x	x	x		x	x
Cold start injector does not spray		x					
Thermal time switch, open electrical circuit		x					
Thermal time switch, shorted			x				
Fuel system, external leakage			x				x
Fuel system, internal leakage			x	x			
Fuel lines (filters) clogged		x			x	x	
Injectors leaking			x	x			
Injectors defective (clogged)				x		x	
Fuel distributor clogged				x		x	
Air-fuel control unit leaking			x				
Line pressure too low		x	x				x
Line pressure, cold, too low				x			
Line pressure, cold, too high		x		x			
Line pressure, hot, too low			x	x		x	x
Line pressure, hot, too high			x	x		x	
Rest pressure too low			x				
Rest pressure too high (injectors leaking)			x				

ENGINE CRANKS BUT DOES NOT START

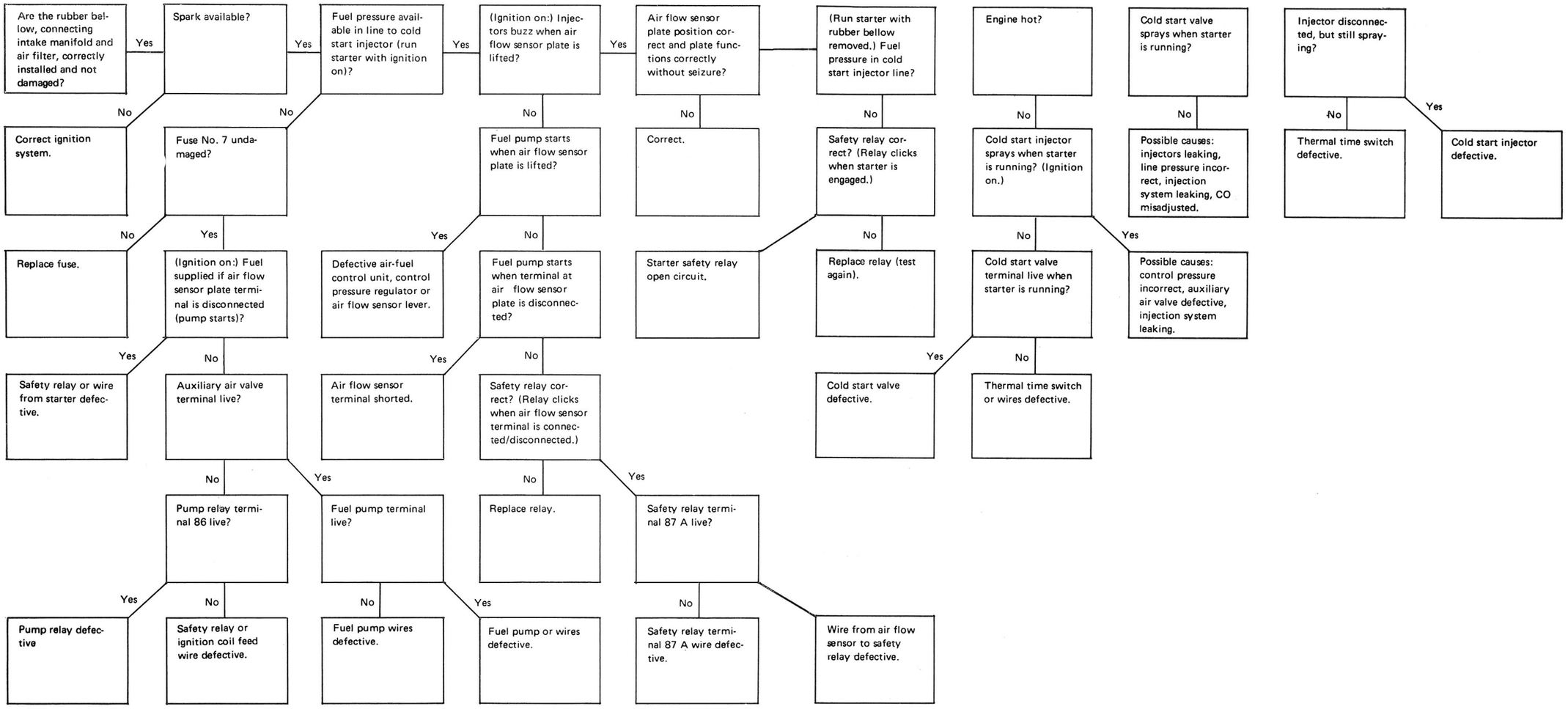


Illustration 2-B. Service Diagnosis, B 20 with CI-system