SERVICE MANUAL

TRUCKS

L 385

Export Service Department

AKTIEBOLAGET
VOLVO
GÖTEBORG . SWEDEN

CYLINDER BLOCK

Inspection

After the block has been thoroughly cleaned, inspection should be carried out to ensure that there are no cracks and that all the channels are free from dirt and deposits.

Should there by any signs of small cracks in the block, repair can be carried out by welding but in a case of larger defects, the block should be replaced since if welding is carried out extensively the result can be certain tensions which are difficult to get rid off. If any welding is carried out on the upper surface, the block should be ground.

Check that all sealing plugs as well as protector caps are removed when cleaning is carried out to ensure that all channels are thoroughly flushed to be sure that there is no dirt or deposits left. After flushing out with water, the channels are blown dry with compressed air.

When fitting sealing plugs in the block, one plug is first driven in. Then a suitable sealing compound is smeared on and another plug is then driven in. Stud bolts are then checked for damage. Damaged stud bolts should be replaced.

CYLINDER LINERS

Measurement of the Cylinder Bore

In order to determine the amount of wear in the cylinder, the inner diameter or bore of the cylinder must be measured and this is most conveniently carried out by using a cylinder bore indicator.

Most of the wear occurs in the upper part of the cylinder so that the shape of the cylinders have a tendency to become conical. Wear also results in a certain amount of out-of-roundness caused by the forces converting the reciprocating motion of the pistons to the rotating motion of the crankshaft.

The cylinder bores should be thoroughly cleaned before measurements are carried out.

Measurement should be carried out at several points both diametrically and axially.

In order to determine the actual wear of the cylinder, the cylinder bore indicator is first set to the original bore of the cylinder by using a micrometer. The indicator can be used to obtain values for both the taper and the out-of-roundness of the cylinders. Cylinder liners are classified in accordance with the table below. In order to be certain as to which class the cylinder liner belongs, the indicator is zeroed in the upper edge of the liner above the top center position of the piston rings since cylinder wear at this point is negligible.

Axial measurements are carried out slightly below the top dead center position, at a point about 50 mm (2 inches) from the lower edge of the cylinder liner and at a third point, for example about half-way down the piston stroke.

If wear in the cylinder bores has reached 0.35-0.40 mm (0.014"-0.016") or if out-of-roundness exceeds 0.08 mm (0.003"), both the cylinder liners concerned and the pistons should be replaced. Replacement is also necessary if there are any signs of severe or deep scoring in the cylinder walls.

The procedure to be followed depends on the degree of wear.

Classification	Cylinder bore
A	104.74-104.75 mm (4.1236"-4.1240")
B	104.75-104.76 mm (4.1240"-4.1244")
C	104.76-104.77 mm (4.1244"-4.1248")
D	104.77-104.78 mm (4.1248-4.1252")
E	104.78-104.79 mm (4.1252"-4.1256")
F	104.79-104.80 mm (4.1256"-4.1260")
G	104.80-104.81 mm (4.1260"-4.1264")
H	104.81-104.82 mm (4.1264"-4.1268")

These cylinder liners should never be bored, so when the above wear tolerances are exceeded a new set of cylinder liners should be fitted.

Removal

The cylinder liners are removed by using the cylinder liner puller SVO 1531 and the puller plate SVO 2178.

Due to their relatively loose fit in the block, the cylinder liners are usually easy to remove. When the engine has been run for some considerable time, however, a little difficulty may be encountered.

Do not remove cylinder liners until it has been ascertained that they must be replaced.

Inspection

If the condition of the cylinder liners is such that they do not require replacing, check that there is no damage whatsoever on the liners. The most important fact in this inspection is a check for cracks since one cracked cylinder liner can have extremely serious consequences for the complete engine.

Fitting

When fitting cylinder liners make sure that all surfaces as well as the upper shoulders are completely free from any deposits.

Be extremely careful with the upper shoulder so that its surface is not damaged. Fitting is carried out in the following way:

1. Smear the underside of the liner flange with marking paint.
2. Push down the liner into position without inserting the sealing ring and then twist it somewhat on its shoulder.
3. Then pull up the liner and see if the marking paint has been left over the complete surface of the shoulder. If the distribution of the marking paint is poor, adjustment can be carried out by using a milling cutter or another suitable tool.
4. If the contact surface is good check that the edge of the liner is 0.05-012 mm (0.002"-0.005") above the level of the cylinder block. Control in this respect can be carried out by using a steel ruler and a feeler gauge or a dial indicator. See Fig. 1-46. The indicator should be zeroed when the point rests on the block. The indicator then moved up on to the liner flange and read off.
5. If the liner flange is too high in spite of the fact that the shoulder in the block is absolutely clean, the height can be adjusted by polishing the upper surface using a facing plate. All the residual powder must then be carefully removed.
6. Fit the sealing rings in the block and smear the lower guide of the cylinder liner with soft soap. The ring should also be smeared with soft soap to avoid twisting while the liner is being fitted.
7. Push down the liner into position. It is not necessary to use force when doing this since the liner will go slide down easily on condition that the O-rings are in their correct positions.

PISTONS

Cleaning and Inspection

The pistons should be thoroughly cleaned in an alkali bath suitable for light-alloy or they can be cleaned in kerosene using a brush.

When removing carbon deposits from the pistons neither emery paper nor pointed tools may be used since this can cause damage to the contact surfaces of the piston.

Oil deposits on the piston and in the recessed toroidal combustion chambers are removed by using a rotating brush made of brass wire. The ring grooves are cleaned by using a special tool. Do not forget to remove all carbon from the bottom of the piston since it functions as an insulator and can prevent effective cooling.

When the piston rings have been removed and the pistons have been cleaned, they should be carefully examined to see if they can be used again.

Dust the piston with French chalk in order to detect any possible cracks on the inside of the piston particularly on the piston pin reinforcements which are subjected to very heavy loading. Examine carefully for scoring, signs of seizure and burns.

Measure the piston pin holes to ensure that these are not excessively worn. Carry out control measurements of the piston ring grooves. If necessary, fit an oversize piston pin, increase the size of the ring grooves and fit wider rings. Standard dimensions and clearances are shown on the specifications. See also under the headings "Piston Pin Fit" and "Piston Ring Fit" (pages 1-34 and 1-33 respectively).

Measuring the Pistons

Measurements are carried out at right angles to the piston pin holes on the lower edge of the piston. A micrometer should be used for this purpose.

Piston Fit

As is the case with the cylinder liners, the pistons are also classified so that the piston fitted in any particular cylinder should correspond to the classification of the cylinder liner in that cylinder.

That is to say that a cylinder liner of class A should be fitted with a piston of class A. There are no oversizes. The classification of the pistons and their corresponding diameters and clearance are shown below:

Mahle

Piston clearance 0.11-0.13 mm (0.0043"-0.0051")

Class	Diameter
A	104.62-104.63 mm (4.1188"-4.1192")
B	104.63-104.64 mm (4.1192"-4.1196")
C	104.64-104.65 mm (4.1196"-4.1200")
D	104.65-104.66 mm (4.1200"-4.1204")
E	104.66-104.67 mm (4.1204"-4.1208")
F	104.67-104.68 mm (4.1208"-4.1212")
G	104.68-104.69 mm (4.1212"-4.1216")
H	104.69-104.70 mm (4.1216"-4.1220")

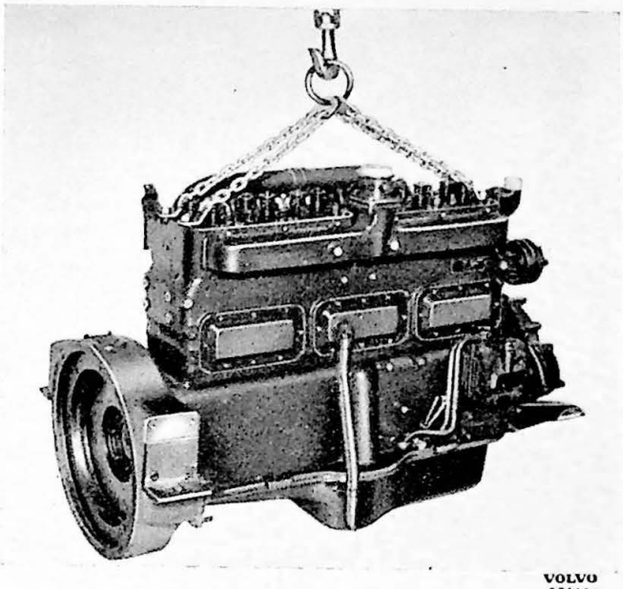

Fig. 1—42. Lifting out the engine.

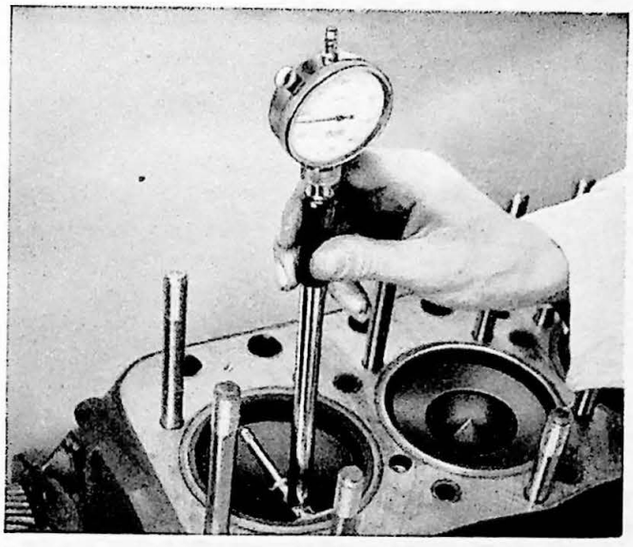

Fig. 1—43. Measuring the cylinder bore.

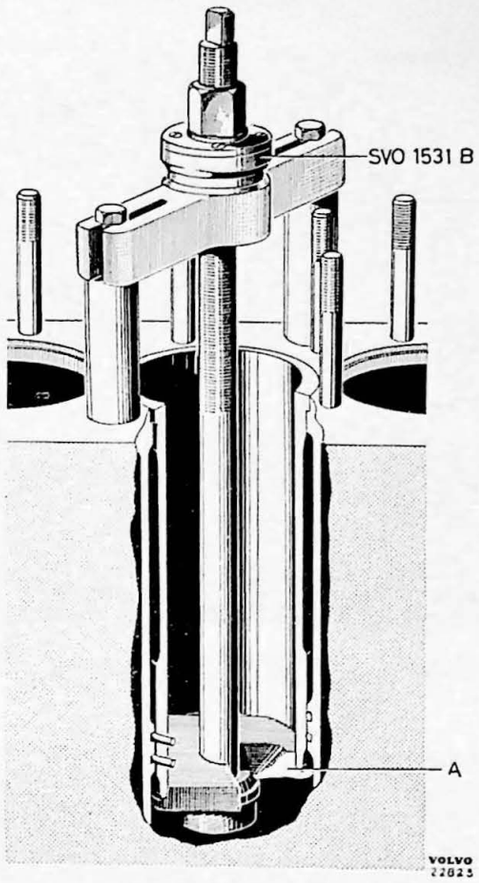

Fig. 1—44.
A. Puller plate SVO 2178.

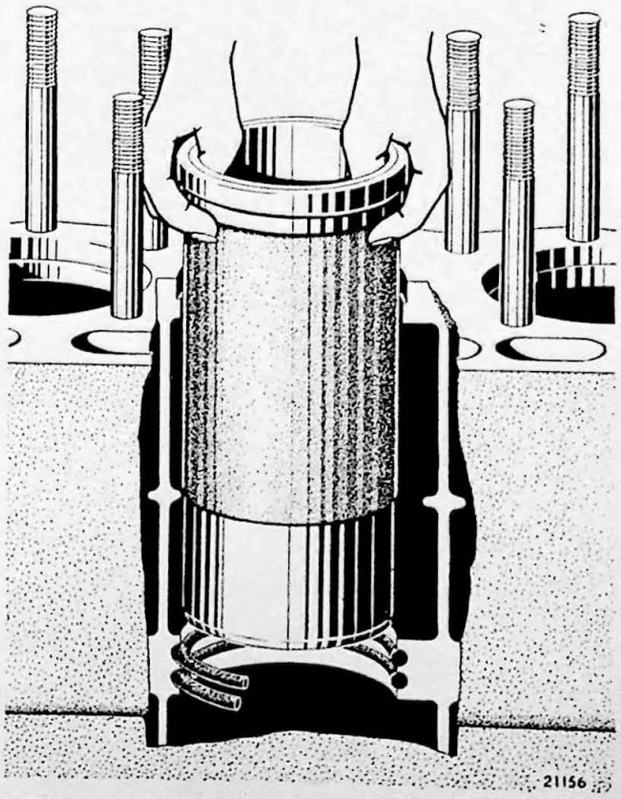

Fig. 1—45. Fitting a cylinder liner.

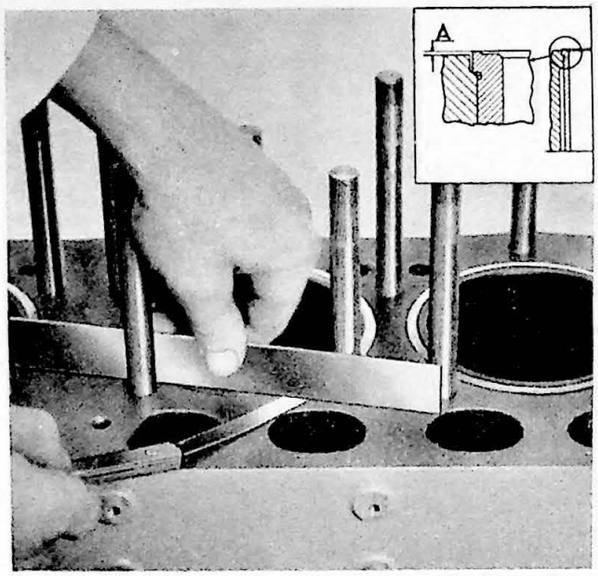

Fig. 1—46. Checking liner level.

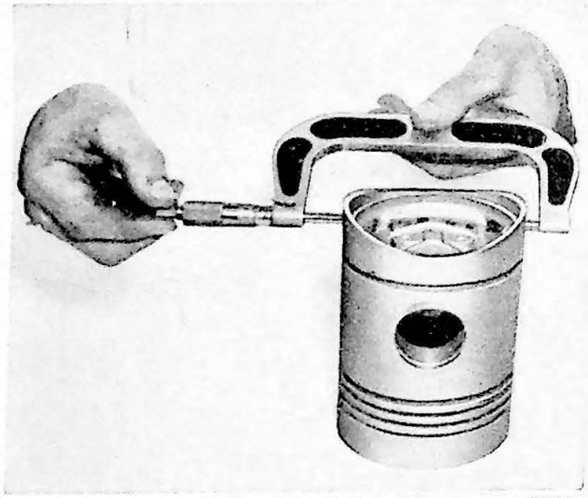

Fig. 1—47. Measuring a piston.

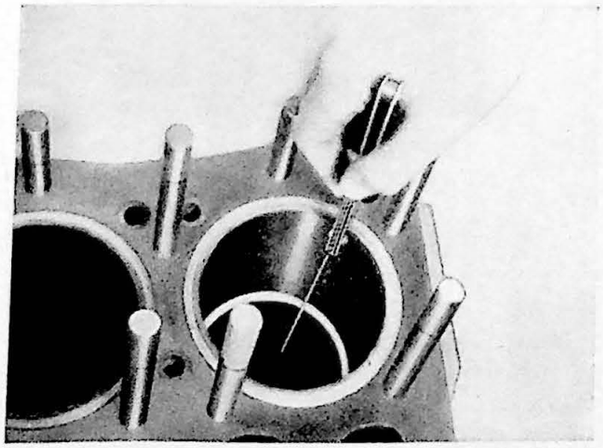

Fig. 1—48. Measuring ring gap.

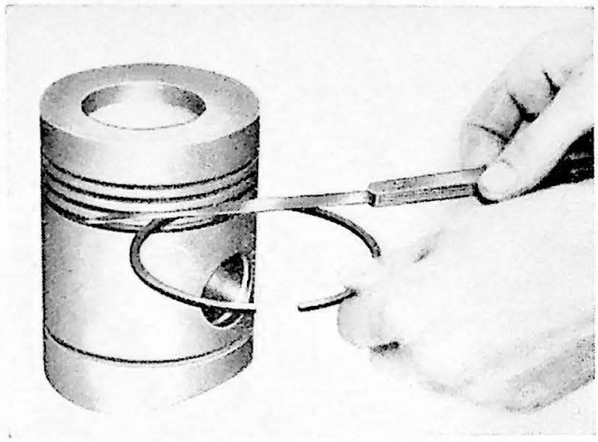

Fig. 1—49. Checking ring clearance in groove.

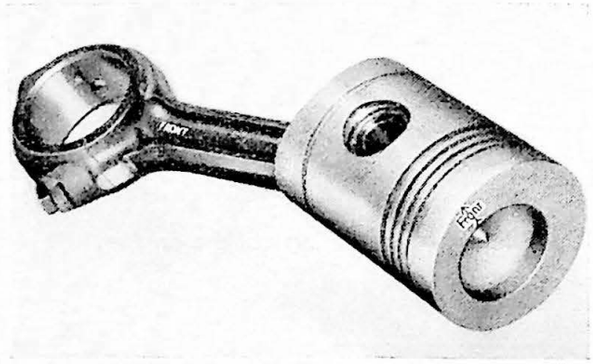

Fig. 1—50. Markings on piston and connecting rod.

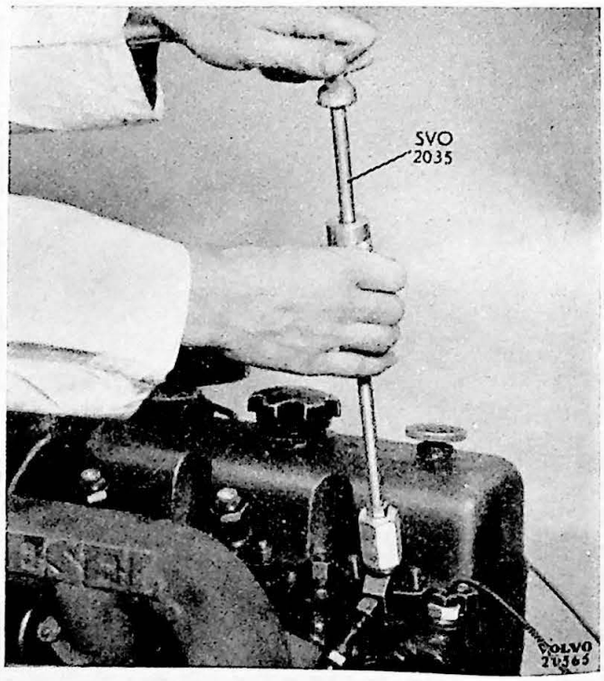

Fig. 1—51. Removing an injector.

Wellworthy

Piston clearance 0.10-0.12 mm (0.0039"-0.0047")

Class	Diameter
A	104.63-104.64 mm (4.1192"-4.1196")
B	104.64-104.65 mm (4.1196"-4.1200")
C	104.65-104.66 mm (4.1200"-4.1204")
D	104.66-104.67 mm (4.1204"-4.1208")
E	104.67-104.68 mm (4.1208"-4.1212")
F	104.68-104.69 mm (4.1212"-4.1216")
G	104.69-104.70 mm (4.1216"-4.1220")
H	104.70-104.71 mm (4.1220" -4.1224")

PISTON RINGS

Inspection

In diesel engines it is even more important than in gasoline engines that the piston rings are in good condition since they must stand up to higher pressure and resist higher temperatures. The consequence of this is that they must also resist the higher gas pressure which causes increased pressure against the cylinder and is responsible for increased wear.

The point at which piston rings should be replaced depends on the oil consumption and the output of the engine.

It is not advisable to use old rings in spite of the fact that the engine has only been run for a short time since it is almost impossible to fit the ring in the same way as it was fitted earlier as far as wear is concerned. Should piston rings be removed at any time, they should be replaced by new rings even if the oil consumption was low before the rings were removed.

Piston Ring Fit

Piston rings must be fitted so that both the ring gap and the ring-to-groove clearance are correct. If the rings are to provide a "gas-tight" seal, they must be in good contact with the cylinder walls and also in the ring grooves when the piston moves up and down.

This means that the rings must fit comparatively loosely in the grooves at all temperatures since they must follow the cylinder surface even when this becomes worn.

When fitting piston rings, the clearances stated in the specifications must be maintained since excessive ring-to-groove clearance can cause oil to come into the cylinders with consequent increased oil consumption. An excessively large gap can be responsible for

both lack of compression and lubricating oil looses.

To check the ring gap, the ring is pushed down into the cylinder bore to a point rather lower than half-way up the piston stroke. A piston should be used for this purpose to ensure that the ring comes into its right position. Measure the ring gap by using a feeler gauge (see Fig. 1-48). If the gap is too small, the ends of the ring should be filed, using a piston ring file for this purpose. NOTE. An excessively large ring gap is not permissible.

Sufficient ring-to-groove clearance is checked by rolling the ring round in the piston ring groove. It should bottom easily without chafing but, at the same time, it should not be possible to move it up and down. When the ring has been fitted, the ring-to-groove clearance is checked by using a feeler gauge and checking the clearance round the circumference of the piston (Fig. 1-49).

Carry out a check to ensure that the ring grooves are sufficiently deep so that there is no danger of the ring being clamped radially.

PISTON PINS

Piston Pin Fit

The fit of the piston pins in the bushings should be such that an oiled-in pin should slowly slide through the bushing at room temperature after the bushing has been reamed. On new pistons the piston pin has already been fitted in the piston so that there is no problem in this respect. However, when an oversize piston pin is being fitted, the piston pin hole must be reamed. An exceptionally good quality tool should be used for this purpose and it should be fitted with guides. Only very small amounts of material should be removed at a time before checking again to prevent the tool from sticking.

At room temperature the fit of the piston pin in the piston should be a light thumb fit.

ASSEMBLY OF PISTON, CONNECTING ROD AND PISTON RINGS

When the fit of the piston pin is correct both in the piston and the bushing, the alignment of the connecting rod should be checked, as well as the tension of the circlips and their position. Alignment and fitting are carried out in accordance with instructions under the separate headings "Connecting Rods","Pistons" and "Piston Pins".

When the above work has been carried out, assemble as follows:

1. Fit one of the circlips in the piston.
2. Oil in the piston pin and the connecting rod bushing.
3. Arrange the piston and the connecting rod in such a way that the "Front" mark on the piston and the connecting rod face the same direction (Fig. 1-50) and then drive in the piston pin using tool SVO 2009.

4. Fit the other circlip.

5. Check to ensure that the piston is in right angles to the piston pin center. This check is carried out in a control and aligning apparatus for connecting rods. See the instructions on page 1-44 "Alignment of connecting rods". The maximum permissible deviation from a right angle is 0.03 mm (0.0012") measured over 100 mm (4").

6. Fit the piston rings (Fig. 1-33) on the piston. Make sure that the piston ring gaps are correct. Take the oil control rings first and then the lower compression rings. These can be turned as desired. Always use a piston ring tool in order to avoid ring breakages.

   Finally the upper chromed compression ring is fitted and this should be turned so that the inner groove faces upwards.

CYLINDER HEADS

Removing

1. Remove the rocker arm covers, the intake manifold and the exhaust manifold.

2. Remove the thermostat housing and disconnect the water tube (28) between the cylinder heads.

3. Disconnect the delivery tubes and the leak-off line from the injectors. Fit protector caps.

4. Loosen the oil pipes (21) for rocker arm lubrication and the attaching bolt for the rocker arm bearing bracket after which the rocker arm mechanism is lifted out.

5. Lift up the push rods.

6. Remove the cylinder head nuts and lift off the cylinder heads.

7. Remove the cylinder head gaskets.

Disassembly

1. Remove the leak-off line and the cap nut. Place tool SVO 2035 in the position occupied by the cap nut.

   Remove the nuts retaining the injectors and then remove the injectors by using puller SVO 2035. See Fig. 1-51. Place injectors in a protected place.

2. Remove the valves and valve springs. Use a valve spring compressor. See Fig. 1-52. Place the valves in order in the fixture for this purpose.

3. Clean all parts, being particularly careful to ensure that the channels are not overlooked.