

General safety precautions

These safety precautions are important.

Reference must also be made to the local regulations in the country of operation.

- Only use these engines in the type of application for which they have been designed.
- Do not change the specification of the engine.
- Do not smoke when you put fuel in the tank.
- Clean away fuel which has been spilt. Material which has been contaminated by fuel must be moved to a safe place.
- Do not put fuel in the tank while the engine runs (unless it is absolutely necessary).
- Do not clean, add lubricating oil, or adjust the engine while it runs (unless you have had the correct training; even then extreme caution must be used to prevent injury).
- Do not make adjustments that you do not understand.
- Ensure that the engine does not run in a location where it can cause a concentration of toxic emissions.
- Other persons must be kept at a safe distance while the engine or equipment is in operation.
- Do not permit loose clothing or long hair near moving parts.
- Keep away from moving parts during engine operation. **Warning!** *The fan cannot be seen clearly while the engine runs.*
- Do not operate the engine if a safety guard has been removed.
- Do not remove the filler cap of the cooling system while the engine is hot and while the coolant is under pressure as dangerous hot coolant can be discharged.
- Fuel and oil pipes MUST be inspected for cracks or damage before they are fitted to the engine.
- Do not allow sparks or fire near the batteries (especially when the batteries are on charge), because the gases from the electrolyte are highly flammable. The battery fluid is dangerous to the skin and especially to the eyes.
- Disconnect the battery terminals before a repair is made to the electrical system.
- Only one person must control the engine.
- Ensure that the engine is operated only from the control panel or from the operator's position.
- Be extremely careful if emergency repairs must be made in adverse conditions.
- If your skin comes into contact with high pressure fuel, obtain medical assistance immediately.
- Read and use the instructions relevant to lift equipment which are given on [page 15](#).
- Always use a safety cage to protect the operator when a component is to be pressure tested in a tank of water. Fit safety wires to secure the plugs which seal the hose connections of a component which is to be pressure tested.
- Do not allow compressed air to contact your skin. If compressed air enters your skin, obtain medical help immediately.
- Turbochargers operate at a high speed and at high temperatures. Keep fingers, tools and other items away from the inlet and outlet ports of the turbocharger and prevent contact with hot surfaces.
- Diesel fuel and lubricating oil (especially used lubricating oil) can damage the skin of certain persons. Protect your hands with gloves or a special solution to protect the skin.
- Do not wear clothing which is contaminated by lubricating oil. Do not put material which is contaminated with oil into the pockets.
- Discard used lubricating oil in a safe place to prevent contamination.
- Ensure that the control lever of the transmission drive is in the 'out-of-drive' position before the engine is started.
- The combustible material of some components of the engine (for example certain seals) can become extremely dangerous if it is burned. Never allow this burnt material to come into contact with the skin or with the eyes.
- Fit only genuine Perkins parts.

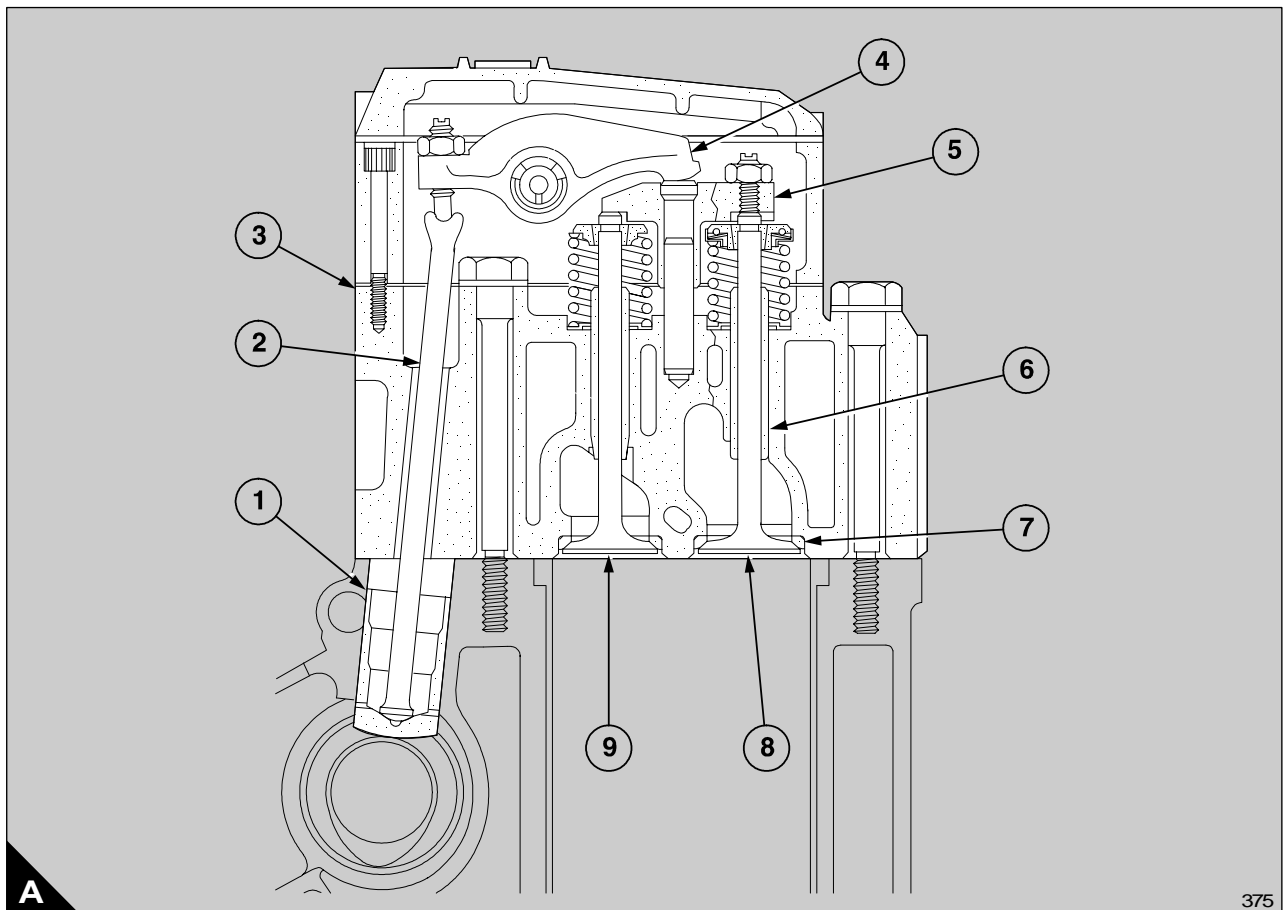
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Cylinder head assembly

General description

The four cylinder heads, which are all the same, are made from high quality cast iron and are retained by bolts or by studs on early engines. They are machined on the top and bottom faces for the rocker box and the cylinder head gaskets respectively. Joint faces are machined on the inner and outer sides for the induction and the exhaust manifolds. There are passages for coolant in the cylinder head around the valve guides and the pockets for the fuel injectors.

The valve guides (A6) are made from an alloy of high quality nickel chromium and are a press fit in the cylinder head. The valve seat inserts (A7) are cooled and pressed into recesses which are machined in the cylinder heads.



10 Remove the guard of the auxiliary drive coupling and remove the fuel injection pump, [operation 20-11](#).

11 Remove the induction manifold, [operation 18-5](#).

12 **For early engines**, remove the pipes for the surplus fuel from the relevant cylinder head and then remove the rocker box cover, [operation 12-4](#).

13 Release the connections for surplus fuel from the fuel injectors, release the clamps and remove the fuel injectors, [operation 20-7](#).

14 **For new engines**, disconnect the leak-off banjo connections from the fuel injectors and remove the pedestal rocker cover, [operation 12-1](#). Release the clamps and remove the fuel injectors, [operation 20-7](#).

15 **For early engines**, remove the rocker box, [operation 12-5](#). If relevant for new engines, remove the pedestal rocker assembly, [operation 12-2](#). Remove and keep the six bridge pieces of the valves and withdraw the six push rods.

16 Use the slide hammer, 21825 849, and the adaptor, 21825 859, to withdraw the three blanking plugs from the induction ports of the cylinder head.

17 **For early engines**, release the 22 nuts and the three short bolts in the induction port, which retain the cylinder head and remove the lift bracket if relevant.

18 **For new engines**, release two bolts, one at each end of the three groups of four long bolts and fit two guide studs, 21825 921. Release the remainder of the 22 long bolts and the three short bolts in the induction port, and remove the lift bracket if relevant.

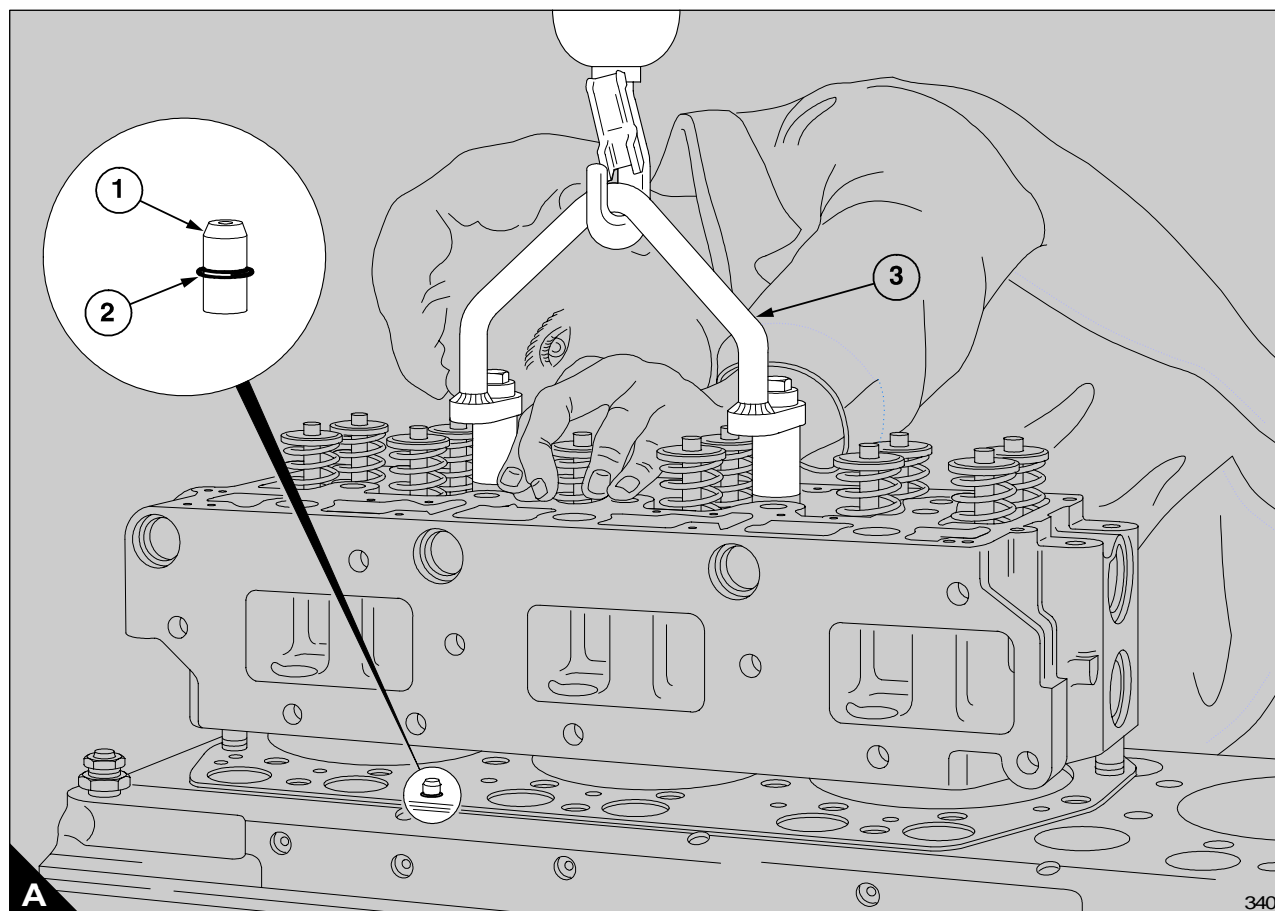
Caution: *The nuts or the bolts should be loosened evenly and gradually from the centre to prevent local stresses in the cylinder head.*

19 Use the lift adaptor (A3), 21825 816, to lift away the cylinder head from the engine. Fit the lift adaptor with the point of attachment for the hoist approximately above the centre of gravity of the cylinder head.

Caution: *The lift adaptor, 21825 816, is designed for use when the engine is in a build stand and the cylinder heads are horizontal.*

20 **For early engines**, remove the bobbin from its location; **for new engines**, remove the sleeve (A1) and the sealing ring (A2). Discard the cylinder head gasket.

21 Put the cylinder head on a bench with a soft surface, to avoid damage to the flame face.



Fits and clearances - Cylinder heads, rocker assemblies and valves

Bridge pieces on guides (A3)

Bore of bridge piece	12,755 to 12,780 mm (0.5021 to 0.5031 in)
Diameter of guide	12,728 to 12,739 mm (0.5011 to 0.5015 in)
Clearance (new)	0,016 to 0,052 mm (0.0006 to 0.0020 in)
Permissible worn clearance	0,10 mm (0.004 in)

Valve springs (A4)

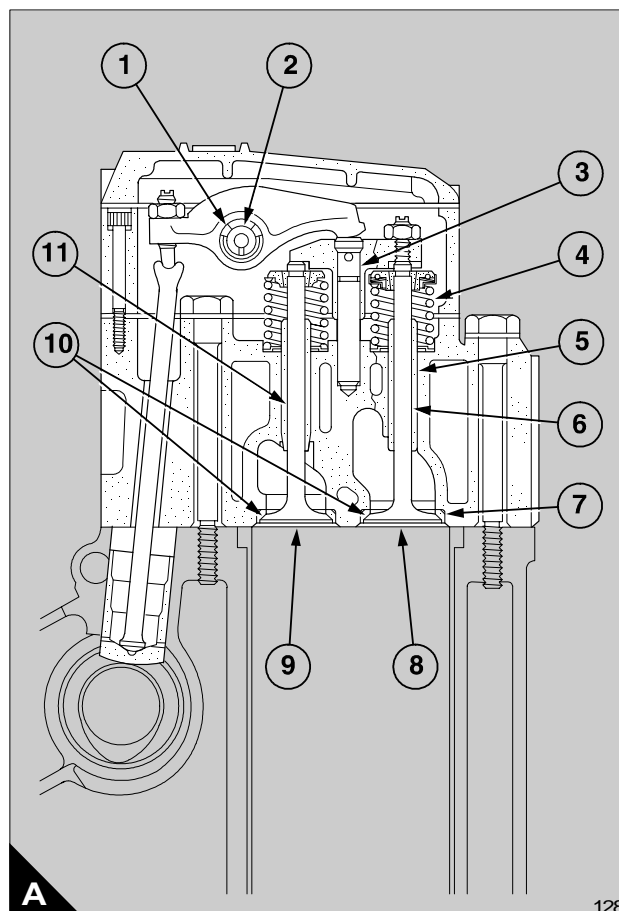
Free length (nominal)	47,066 mm (1.853 in)
Permissible worn length	44,713 mm (1.76 in)
Load when compressed to 26,87 mm (1.058 in)	0,5071 to 0,5605 kN (114 to 126 lbf)

Valve guides (A5)

Bore in cylinder head for valve guide	18,00 to 18,02 mm (0.7087 to 0.7094 in)
Outside diameter of valve guide (inlet and exhaust)	18,028 to 18,041 mm (0.7097 to 0.7103 in)
Interference fit (new)	0,008 to 0,041 mm (0.0003 to 0.0016 in)
Permissible interference fit (worn)	0,008 mm (0.0003 in)

Inlet valves in guides (A11)

Diameter of valve stem	9,464 to 9,482 mm (0.3726 to 0.3733 in)
Bore of valve guide	9,525 to 9,550 mm (0.3750 to 0.3760 in)
Clearance (new)	0,043 to 0,086 mm (0.0017 to 0.0034 in)
Permissible worn clearance	0,137 mm (0.0054 in)



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Fits and clearances - Pistons and connecting rods

Pistons - 4 rings

Gudgeon pin in piston (A1)

(Gudgeon pin to be push fit at 20°C)

Bore in piston (new) 54,999 to 55,004 mm (2.1653 to 2.1655 in)

Gudgeon pin diameter (new) 54,995 to 55,000 mm (2.1652 to 2.1654 in)

Gudgeon pin in piston - clearance (new) -0,001 to +0,009 mm (-0.00004 to +0.00036 in)

Top groove in piston

(wedge shaped for top ring CV 5907)

Diameter over 3,302 mm (0.1300 in) dia. Rollers 136,073 to 135,855 mm (5.3572 to 5.3486 in)

Piston clearance at TDC (A2)

Top of piston below top face of crankcase. 0,310 to 0,380 mm (0.012 to 0.015 in)

(Machine top face of piston to obtain correct clearance)

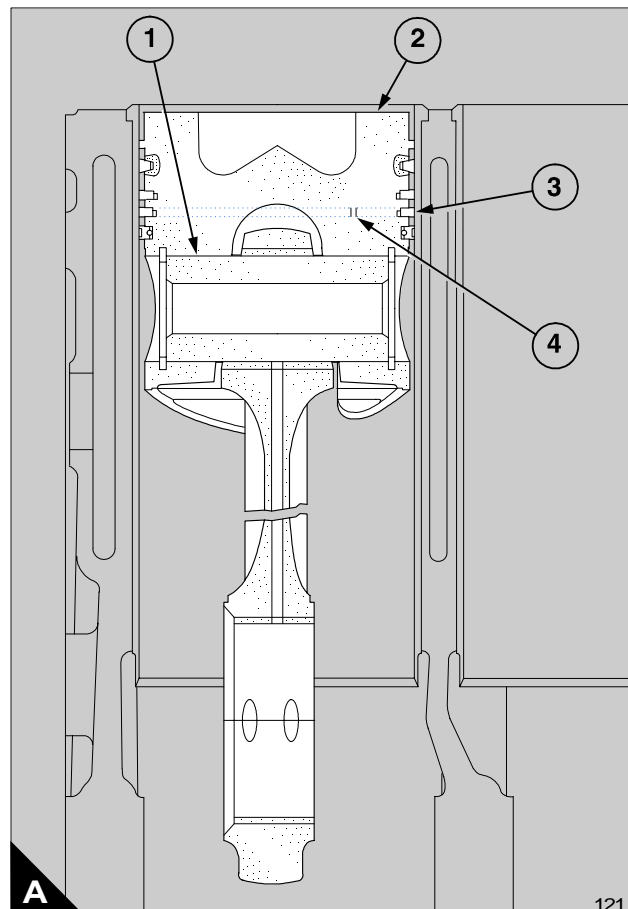
Piston rings

Clearances of piston rings in grooves (A3)

Top ring CV 5907 (wedge shaped - new) Refer to **ring gap dimensions**

Second ring OE41689 (new) 0,0635 to 0,1016 mm (0.0025 to 0.0040 in)

Maximum permissible worn clearance. 0,152 mm (0.006 in)



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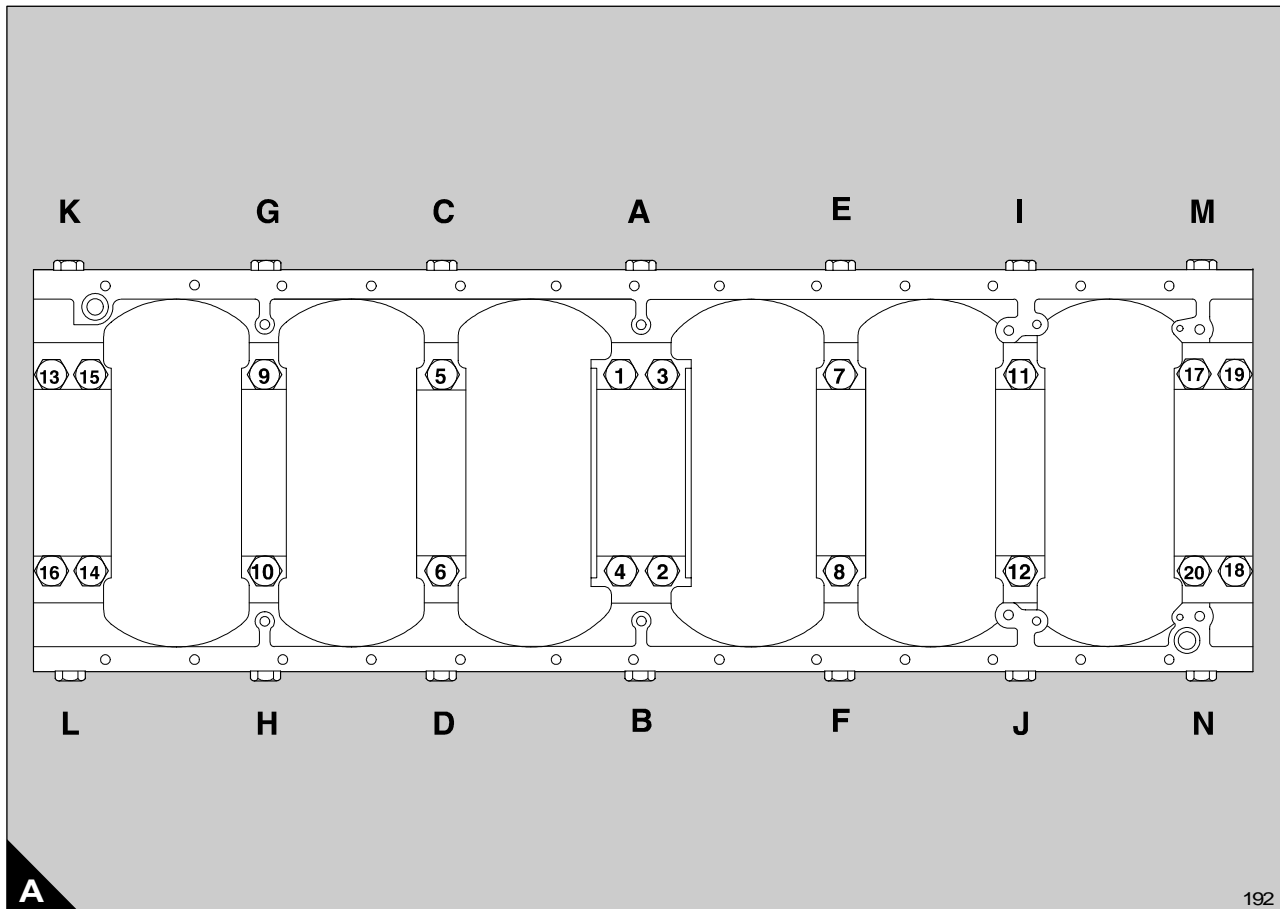
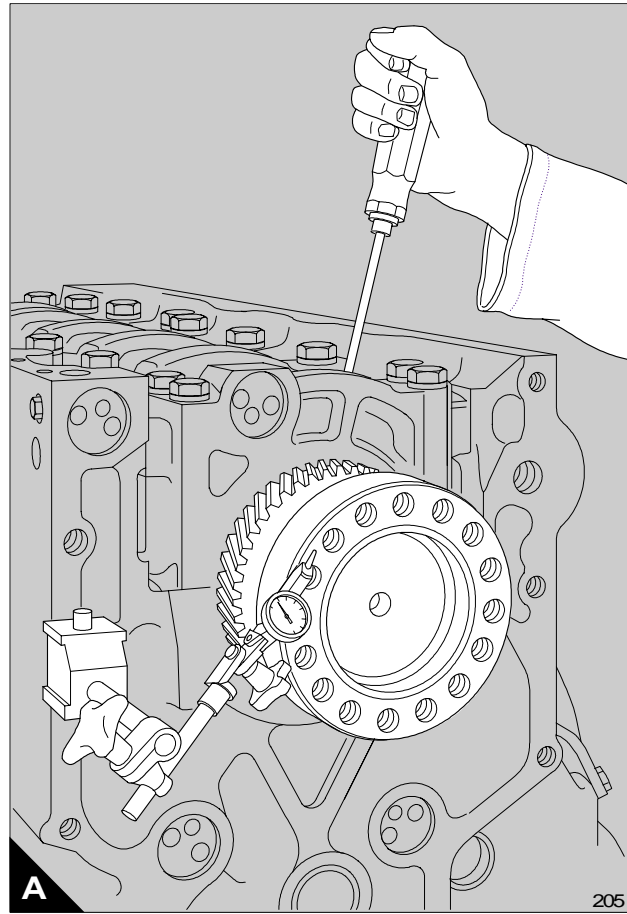
13 Continue to tighten the bolts - numbers 5 to 12 (B) - for the remainder of the main bearing caps, until the maximum torque of 488 Nm (360 lbf ft) is applied.

14 Tighten all the side bolts, in alphabetical sequence, until a maximum torque of 114 Nm (85 lbf ft) is applied. At the end of this phase of the operation, the side bolts of the front, central and rear main bearings are tightened fully.

15 Continue to tighten the remainder of the side bolts - letters C to J (B) - in alphabetical sequence, until a maximum torque of 177 Nm (130 lbf ft) is applied.

16 Put a dial test indicator with a magnetic base on the end face of the crankcase. Set the button of the dial test indicator on the end of the crankshaft (A). Use a lever to move the crankshaft backward and forward against the thrust washers and check the readings on the dial test indicator. Permissible endfloat is 0,10 to 0,30 mm (0.004 to 0.012 in).

Turn the crankcase in the build stand so that the 'A' bank cylinders are horizontal. Fit each of the connecting rods, of the 'A' bank cylinders, to their respective crank pins, **operation 13-3**.



Crankshaft gear - idler gear for lubricating oil pump

Clearance (new) 0,10 to 0,20 mm (0.004 to 0.008 in)

Idler gear for lubricating oil pump - gear of lubricating oil pump

Clearance (new) 0,10 to 0,39 mm (0.004 to 0.015 in)

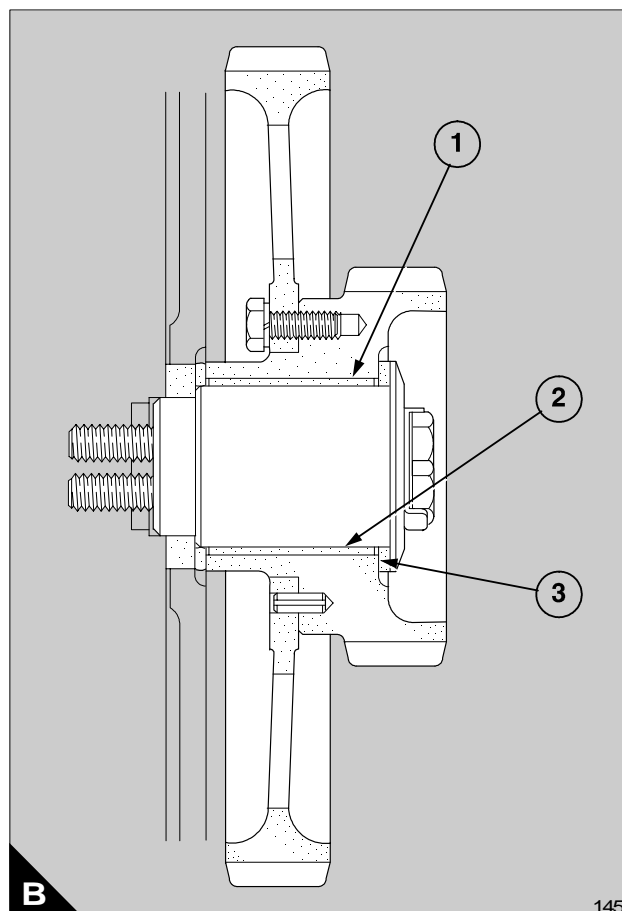
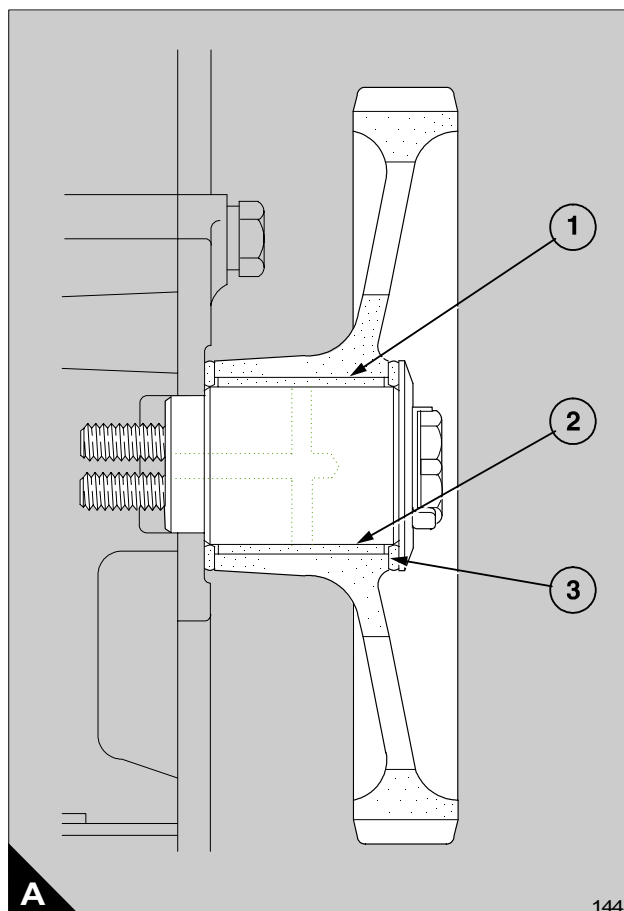
Idler gears on axles

Main idler gear (A)

Bore of gear (new) (A1) 50,000 to 50,025 mm (1.9685 to 1.9695 in)
 Diameter of bush (new) 50,089 to 50,127 mm (1.9720 to 1.9735 in)
 Interference (new) 0,064 to 0,127 mm (0.0025 to 0.0049 in)
 Bore of bush (new) (A2) 44,983 to 45,034 mm (1.7709 to 1.7729 in)
 Axle diameter (new) 44,910 to 44,950 mm (1.7681 to 1.7697 in)
 Clearance (new) 0,033 to 0,124 mm (0.0013 to 0.0048 in)
 Permissible worn clearance 0,199 mm (0.0078 in)

Double idler gear (B)

Bore of gear (B1) 50,000 to 50,025 mm (1.9685 to 1.9695 in)
 Diameter of bush 50,089 to 50,127 mm (1.9720 to 1.9735 in)
 Interference (new) 0,064 to 0,127 mm (0.0025 to 0.0049 in)
 Bore of bush (B2) 44,983 to 45,034 mm (1.7709 to 1.7729 in)
 Diameter of axle 44,910 to 44,950 mm (1.7681 to 1.7697 in)
 Clearance (new) 0,033 to 0,124 mm (0.0013 to 0.0048 in)
 Permissible worn clearance 0,199 mm (0.0078 in)



Fits and clearances

Cylinder liners in crankcase

Bore of crankcase (A7)	140,488 to 140,513 mm (5.5310 to 5.5320 in)
Diameter of cylinder liner	140,449 to 140,475 mm (5.5295 to 5.5305 in)
Clearance (new)	0,013 to 0,064 mm (0.0005 to 0.0025 in)
Depth of counterbore in crankcase (nominal)	11,900 to 11,930 mm (0.4685 to 0.4696 in)
Depth of flange of cylinder liner (nominal)	12,000 to 12,025 mm (0.4724 to 0.4734 in)
Protrusion of cylinder liner (A2)	0,0760 to 0,127 mm (0.003 to 0.005 in)

Caution: Cylinder liners must be selected for their fit to obtain the limits for correct protrusion.

Cylinder liners out of crankcase

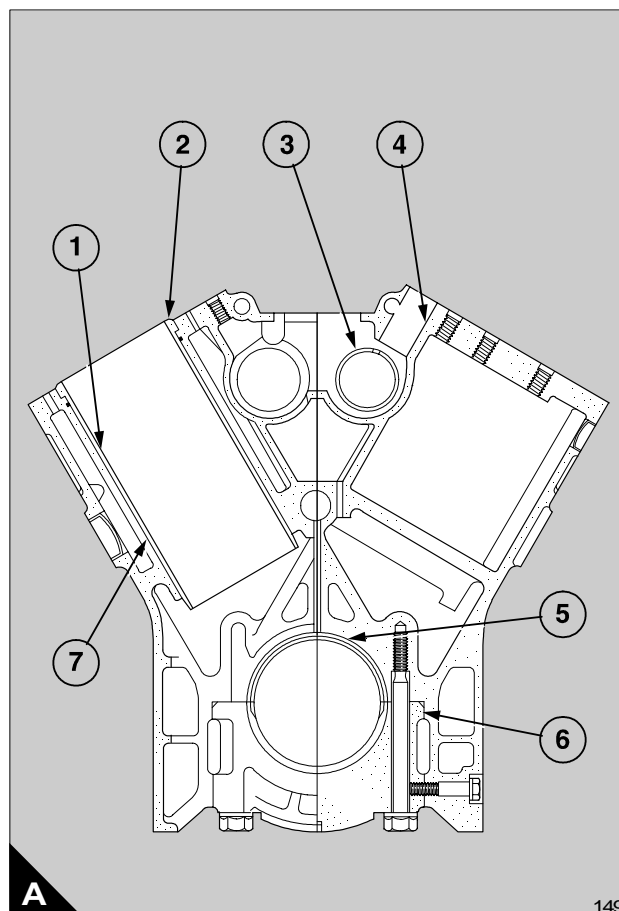
Bore of cylinder liner (A1)	135,000 to 135,025 mm (5.3150 to 5.3159 in)
Permissible worn dimensions	135,306 mm (5.3270 in)

Tappets in crankcase

Bore in crankcase (A4)	36,000 to 36,025 mm (1.4173 to 1.4183 in)
Diameter of tappet	35,959 to 35,975 mm (1.4157 to 1.4163 in)
Clearance (new)	0,025 to 0,066 mm (0.001 to 0.0025 in)
Permissible worn clearance	0.075 mm (0.0029 in)

Bearings of camshaft in crankcase

Bore in crankcase (A3)	71,500 to 71,530 mm (2.8150 to 2.8161 in)
Diameter of bearing of camshaft	71,590 to 71,640 mm (2.8185 to 2.8205 in)
Interference (new)	0.060 to 0.140 mm (0.0023 to 0.0055)



4 Check that the two spring type dowels are fitted and put the new joint on the joint face of the crankcase. Ensure that all the bolt holes are aligned correctly. Ensure also that the ends of the joint make full contact with the joint of the timing case. The joint may be held in position with a single, and very small, application of grease between each bolt hole. Apply Hylomar PL 32 sealant along the two corners where the joints are in contact.

Caution: *It is important that this procedure is done correctly to prevent leakage of the oil during the operation of the engine. Ensure that the joint between the sump adaptor and the timing case remains in its position and is not damaged when the sump adaptor is fitted.*

5 Fit carefully the sump adaptor.

6 Fit loosely the 14 bolts with plain washers and new spring washers into each side of the flange of the sump adaptor, and the four bolts with plain washers and new spring washers into the front edge of the flange.

Caution: *If the timing case is not yet fitted, refer to operation 19-5 (to fit), paragraph 5.*

7 Fit the five bolts, with plain washers and new spring washers, through the bolt holes in the lower edge of the timing case flange. Tighten lightly the bolts.

8 Start with the four bolts nearest to the corners where the joints are in contact and tighten, evenly and gradually, all the bolts which retain the sump adaptor. Tighten the bolts to 55 Nm (40 lbf ft).

9 Fit new 'O' rings into the grooves of the bobbin which is fitted to the discharge side of the lubricating oil pump. Apply a suitable quantity of clean engine oil to the 'O' rings and insert the bobbin into the outlet of the lubricating oil pump through the opening in the sump adaptor. Ensure that the small holes which are drilled across the bobbin are inside the oil gallery of the sump adaptor.

10 Fit a new 'O' ring around the spigot on the plug which closes the oil gallery. Insert the plug and retain it with two bolts, complete with plain washers and spring washers. Tighten securely the bolts.

11 Fit the lubricating oil sump, operation 19-1.

To clean and inspect

19-4

1 Clean thoroughly the sump adaptor with kerosene and dry with compressed air. Inspect for cracks or other damage and remove all of the material of the old joints which remains on the sump adaptor and the crankcase.

Single piece lubricating oil sump

To remove and to fit

19-5

To remove

If there is enough clearance below the engine, the sump may be removed while the engine is connected to its driven unit. It may be an advantage to remove also the filler assembly. It is important to conform to the normal safety precautions, such as to disconnect the circuit of the starter motor.

1 Remove the drain plug of the sump and drain the oil into a suitable container; replace the drain plug and apply only the correct torque of 47 Nm (35 lbf ft) to tighten it.

2 Remove the elbow connection and the joint from the 'B' bank side of the sump and withdraw the bobbin from the discharge side of the lubricating oil pump. Remove the short bobbin which is the connection to the heat exchanger.

3 Remove the bolts and the spring washers which secure the sump to the crankcase and to the timing case, and lower carefully the sump. Remove the shorter bobbin which returns oil from the relief valve to the sump.

Caution: *Unless the timing case is also to be removed, use care during the removal of the sump to prevent damage to the common joint. If this is not possible, remove all of the section of the joint which can be seen and clean the joint faces.*

19

Heat exchanger (oil to coolant) - early engines

To remove and to fit

19-10

Special tools:

Strap wrench, 21825 825

To remove

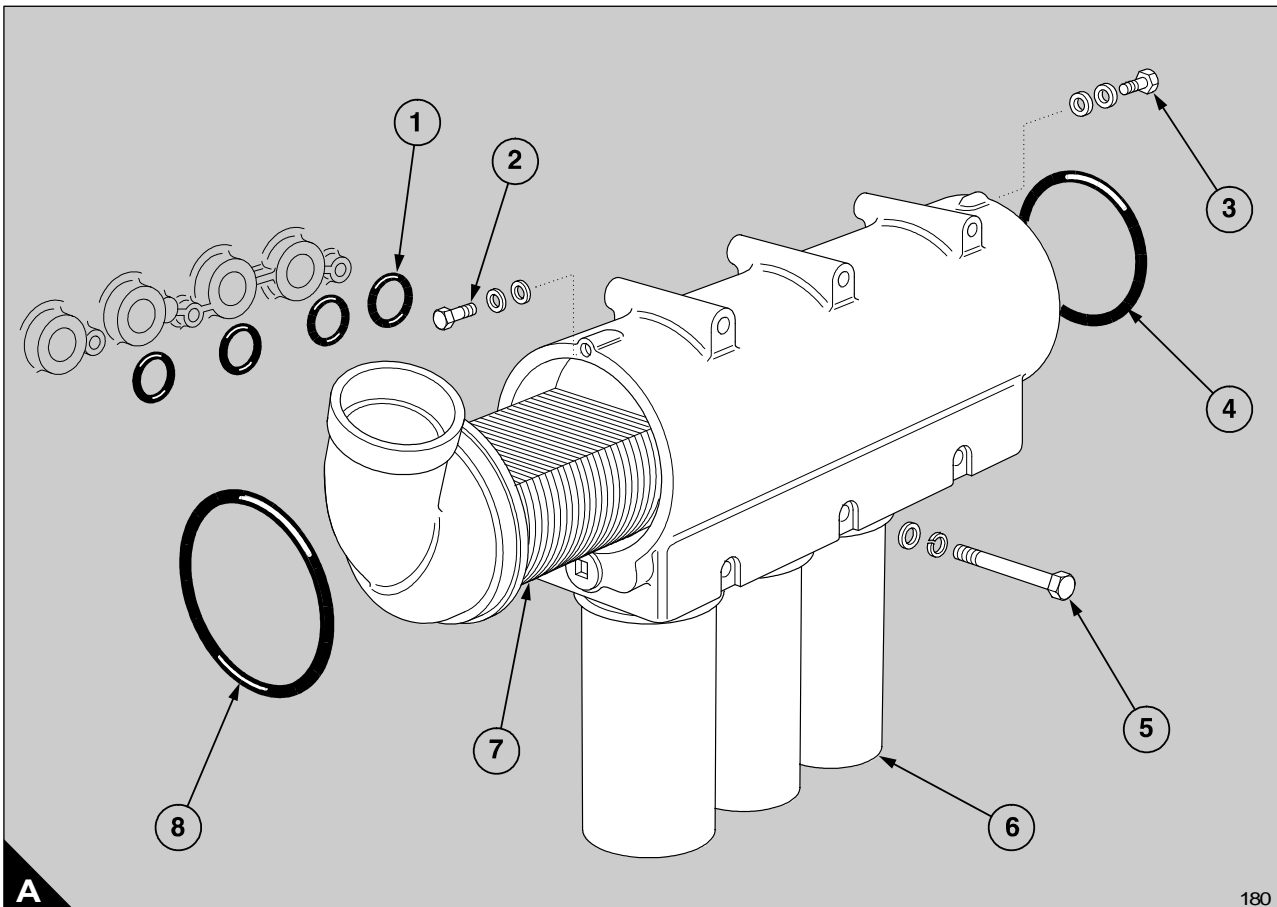
- 1 Remove the drain plug from under the outlet connection of the coolant pump and drain the coolant of the engine into a suitable container. Place another suitable container below, and to the rear of, the lubricating oil filters. Remove the drain plug at the rear of the heat exchanger to drain the engine lubricating oil. Use the strap wrench, 21825 825, to remove the filter canisters (A6).
- 2 Release the hose clips and remove the delivery pipe between the front end of the tube stack and the coolant gallery of 'B' bank.
- 3 Release the hose clips and slide the hose at the inlet for the coolant away from the rear end of the tube stack.

- 4 Remove the six bolts (A5) which retain the heat exchanger and lift the assembly away from its mounting adaptor.

To fit

- 1 Fit a new hose, and the two hose clips, onto the end of the pipe on the discharge side of the coolant pump.
- 2 Check that four new 'O' rings (A1) are fitted into their locations in the joint face of the heat exchanger and ensure that the 'O' rings remain in their positions during the operation. Use suitable guide studs, which are made locally, to fit the assembly of the heat exchanger to the adaptor. Insert the six bolts, complete with plain and spring washers, and tighten them evenly and securely.
- 3 Fit a new hose and the two hose clips onto the coolant elbow on the discharge side of the heat exchanger.

Check that the faces of the inlet to the coolant gallery and the flange of the inlet pipe are clean. Use a new gasket and fit the pipe to the coolant gallery, insert the four bolts, complete with plain washers and new spring washers, and tighten securely.



Primary fuel filter

How to clean the primary fuel filter 20-1

- 1 Remove the three bolts (A1) and remove the filter bowl (A2).
- 2 Clean all of the components with paraffin and dry them with a compressed air jet.
- 3 Fit the bowl to the filter head, together with a new sealing ring. Align the clamp ring (A3) and fasten it with the three bolts.

Early engines can be fitted with filters which have elements that can be cleaned. These elements should be removed, cleaned with fuel oil and dried with a compressed air jet.

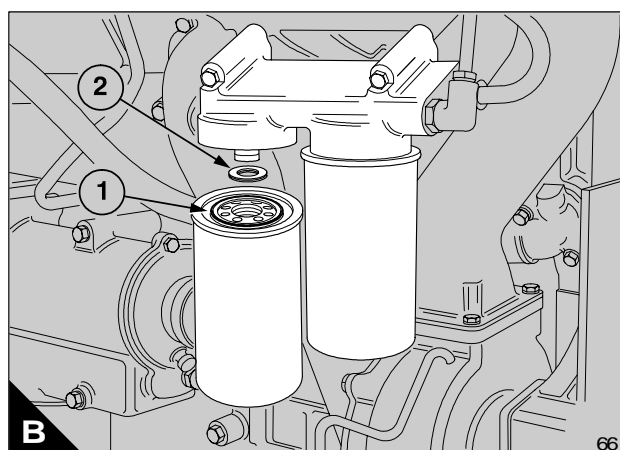
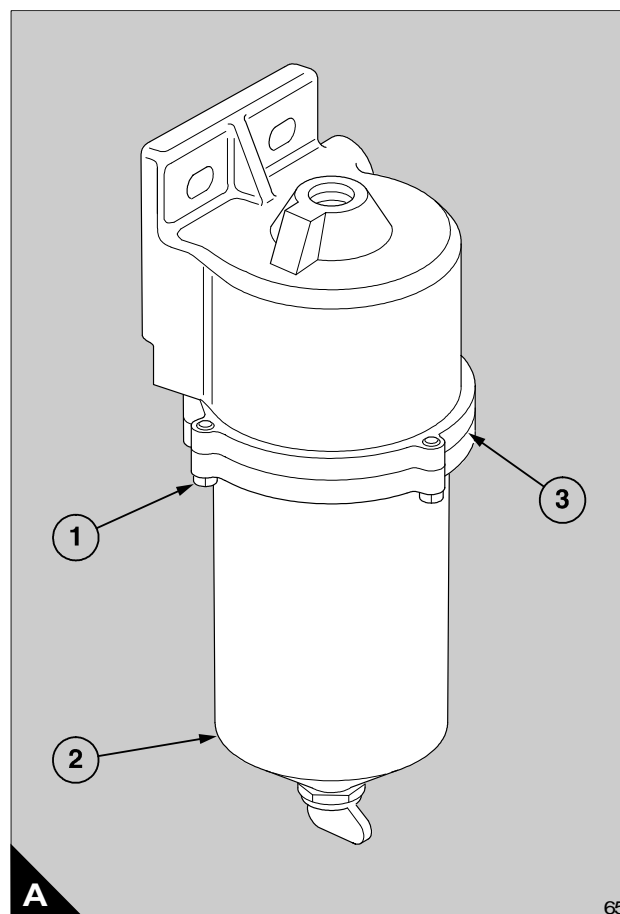
Fuel filter canisters

How to renew the canisters of the main fuel filter 20-2

On new engines the main fuel filter is fitted at the rear of the engine on the 'A' bank side. For early engines it is fitted to the 'B' bank side, against the cover of the coolant gallery as shown (B). The filter has two disposable canisters. Both canisters must be renewed at the same time.

- 1 Clean the area around the filter and remove the fuel filter canisters. If necessary, use a strap wrench. Discard the canisters.
- 2 Check that the sealing ring (B1) is fitted correctly to each new canister and clean the contact faces of the filter head.
- 3 Lubricate the top of the canister seal (B1) with clean fuel oil and renew the sealing ring (B2) on the adaptor.
- 4 Fit the new canisters to their threaded adaptors and tighten each canister until the sealing ring just comes into contact with the filter head. Continue to tighten each canister by a further $1\frac{1}{4}$ turns by hand. Do NOT overtighten.

After the fuel filter canisters have been renewed, eliminate air from the low pressure fuel system as given in [operation 20-16](#).



8 Use the lift adaptor, 21825 876, and a suitable hoist to lower carefully the assembly of the fuel injection pump and the drive coupling into the 'V' of the crankcase. Move carefully the assembly toward the auxiliary drive shaft and enter the protrusions of the two bolts into their respective holes in the drive shaft of the fuel injection pump. Ensure that the two special washers remain on the bolts and fit the long nuts. Hold the head of each bolt with a ring spanner and tighten each nut to 120 Nm (88 lbf ft).

9 Insert the eight bolts, with the plain washers, which retain the fuel injection pump, through the bolt holes in the base of the fuel injection pump. Tighten each bolt to 41 Nm (30 lbf ft).

10 Loosen one or two turns the four cap screws (C1) or, if relevant, the four special bolts in the clamp ring, and turn the crankshaft until the timing mark on the flywheel is in alignment with the pointer (A).

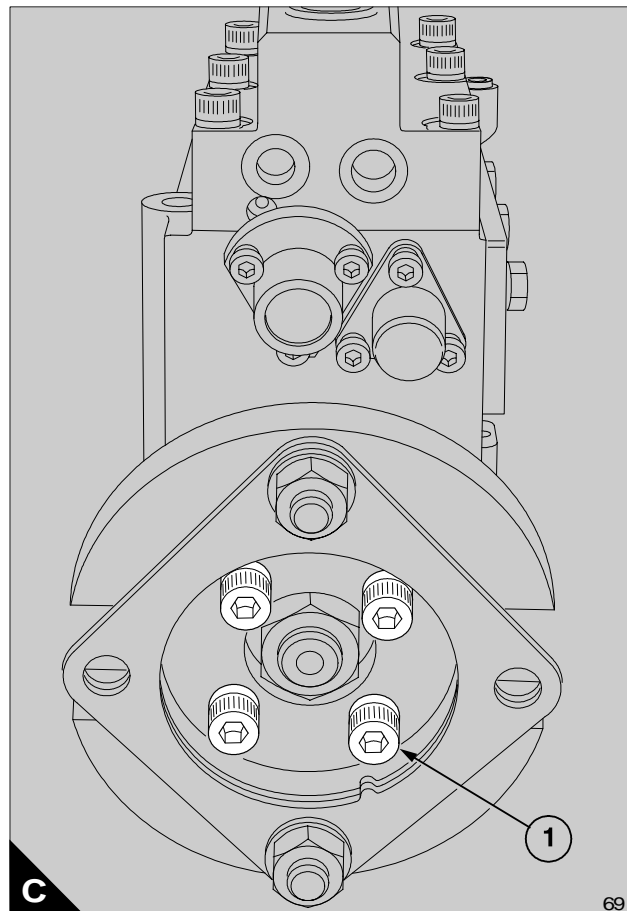
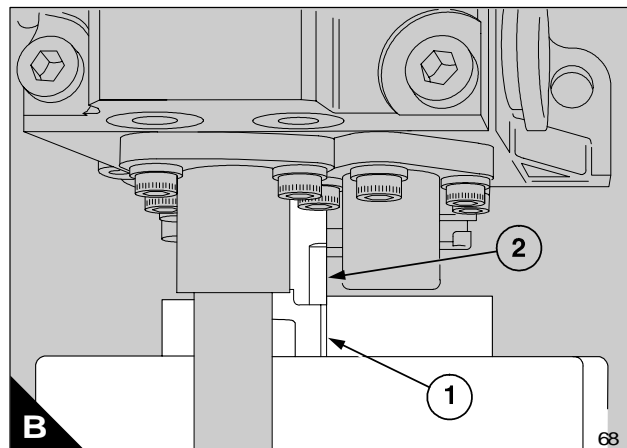
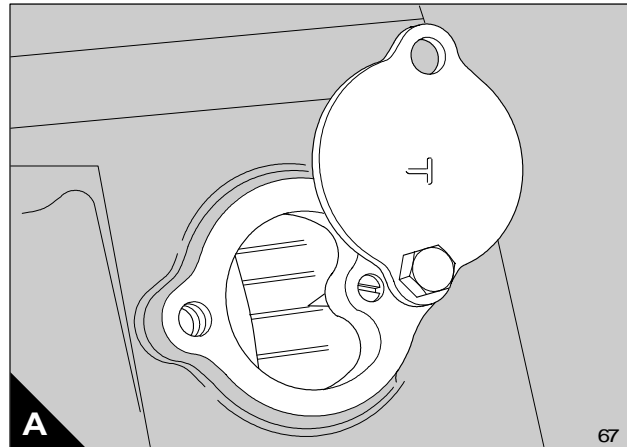
11 Turn the hub of the fuel injection pump by hand in the normal direction of its rotation (anti-clockwise as seen from the driven end) until the timing mark on the hub (B1) passes the timing pointer (B2). Turn slowly backward the hub until the timing mark and the timing pointer are correctly aligned. **For early engines** tighten the four cap screws (C1) to 69 Nm (51 lbf ft). **For new engines** tighten the four special bolts to 46 Nm (34 lbf ft).

Note: The clamp ring of the adjustable coupling is retained securely by special bolts. For early engines, cap screws (C1) are used and for new engines a special bolt is used which has a washer integral with the head.

12 Turn backward a quarter of a turn (90°) the crankshaft (anti-clockwise as seen from the front of the engine). Then turn slowly forward the crankshaft until the timing marks on the flywheel are aligned correctly. Check the timing mark of the fuel injection pump. This, also, should be aligned correctly. If necessary, use the same procedure to adjust the timing again.

13 Ensure that the two 'O' rings are fitted into the connection on the fuel injection pump which returns the lubricating oil from the driven end of the cambox. Slide the pipe on to the connection and engage the lower end of the pipe in the boss on the cover plate. Tighten securely the union nut.

14 Fit the guard for the auxiliary drive assembly.



20 Put the control fork (A2) for no.1 element 3,0 mm (0.118 in) from the end (dimension A) of the square section of the rod (A3) and tighten its locking screw (A1) to 4,75 to 6,0 Nm (3.5 to 4.5 lbf ft).

21 Slide backward the control rod by a small amount to align the no.1 control fork with the centre of the bore of its tappet. Align the remainder of the 11 control forks with the bores of their respective tappets and tighten the locking screws as instructed for no.1 control fork.

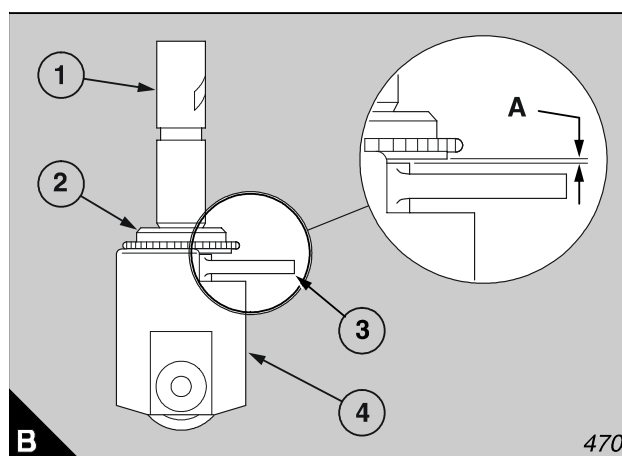
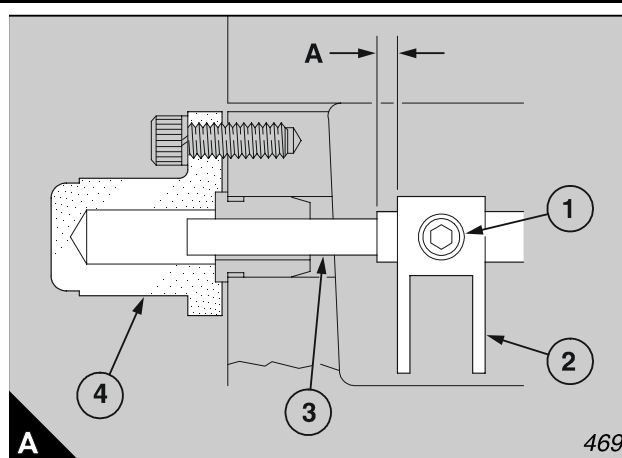
22 Fit the end cover (A4) for the control rod. Use a new gasket and new spring washers and tighten the three cap screws to 2,70 to 4,0 Nm (2 to 3 lbf ft). Check that the control rod slides freely in its bushes.

23 Assemble the roller of the tappet, the bush and the pin into each tappet guide. Insert the tappet spacer and fit the circlip, with the convex side next to the spacer, to retain the assembly.

24 Check the clearance, dimension 'A' as shown (B), between the arm of each plunger (B3) and its respective tappet spacer, as given below:

25 Assemble the lower spring plate (B2) to the plunger (B1) and hold firmly the seat of the lower spring plate in its position in the body of its relevant tappet. Use the feeler gauges to check the clearance between the bottom face of the lower spring plate and the shoulder on the arm of the plunger. The permissible clearance is from 0,05 to 0,20 mm (0.002 to 0.008 in). If the clearance exceeds these limits, the lower spring plate must be exchanged for a lower spring plate with a suitable thickness. Refer to the end of this section.

Move the mounting bracket of the fuel injection pump in the vice until the camshaft has an approximately 20° angle of tilt, with the drive end of the camshaft at the lower position, then proceed as follows:



21

Cooling system

General description

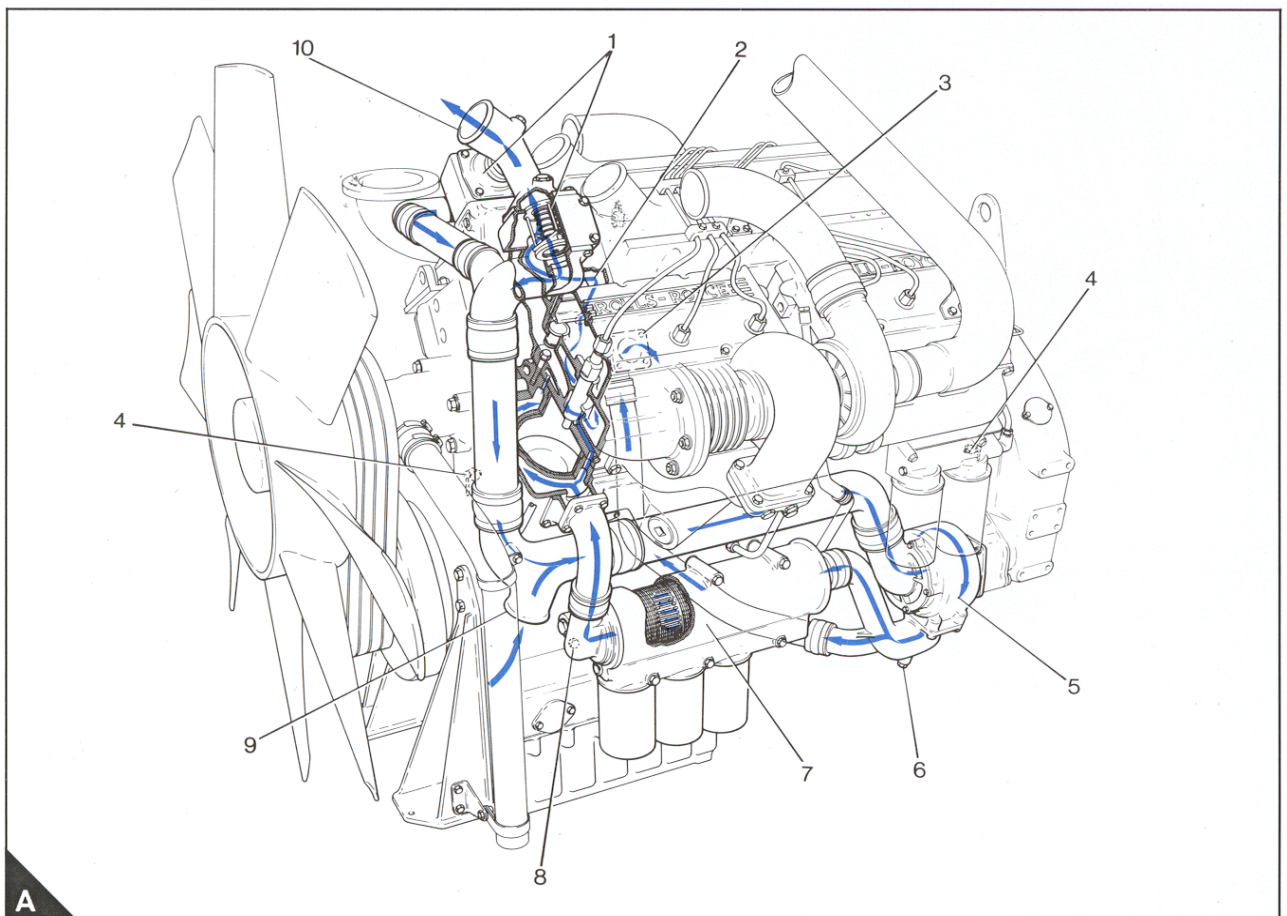
Refer to the illustration (A) which shows an early engine.

The coolant flows through a suction pipe (A9) from the radiator to a coolant pump (A5) which is fitted on the crankcase at the rear of 'B' bank. The coolant pump is driven by the crankshaft pinion through an idler gear.

The coolant then passes into a pipe which divides the flow between 'A' bank (A3) and 'B' bank. Before the coolant flows to 'B' bank, it passes through a heat exchanger (A7) where it cools the lubricating oil.

When the coolant has passed through the banks of the cylinders, it flows to the cylinder heads where it circulates around the valve guides and the pockets for the fuel injectors. The coolant then enters galleries (A2) which are integral with the induction manifolds, and passes to the two thermostats (A1) which are of the wax capsule type and are contained in housings at the front end of each manifold. The coolant then passes through the outlet (A10) to the radiator.

The coolant system is drained by the removal of drain plugs from below the coolant pump (A6), from the crankcase at the front of 'A' bank and the rear of 'B' bank (A4), and from the outlet at the front of the heat exchanger (A8).



To check the consumption rate of the engine lubricating oil

25-2

The check given below is suitable for an engine which is rated at 1500 rev/min or 1800 rev/min.

1 Ensure that the level of the engine lubricating oil is exactly to the 'MAXIMUM' mark on the dipstick.

2 Run the engine at its rated speed and power until the normal temperatures of the coolant and the engine lubricating oil are reached:

Coolant temperature at outlet 68°/85°C

Engine lubricating oil 90°/105°C

3 Run the engine at the minimum load for two minutes. Stop the engine and check the level of the engine lubricating oil on the dipstick. Fill with new engine lubricating oil to the 'MAXIMUM' mark if necessary.

4 Drain **immediately** the engine lubricating oil from the sump and from the heat exchanger into separate containers for exactly 20 minutes. The heat exchanger should be drained through the lowest point, which is the drain plug in the end of the housing.

5 Measure separately the weight of each container with its contents and make a record of the weights.

6 Fit the drain plugs in the sump and the heat exchanger and return the original engine lubricating oil to the sump. Measure the weight of the empty containers and make a record of the weight.

7 Find the difference in the weight of the containers when with and without the lubricating oil. This will give the total weight of the lubricating oil. Make a record of this total.

8 Run the engine at its rated speed with 90% of the maximum load, for two hours.

Caution: *If the engine is stopped during this period, the test must be started again from paragraph 1.*

9 At the end of the two hours, continue to run the engine without load for two more minutes. Stop the engine and repeat the procedures given in paragraphs 4, 5, 6 and 7.

The method for the calculation of the consumption of the engine lubricating oil, when the records of the weights of the oil are in pounds (lbs), is as follows:

$$\frac{\text{Initial weight of the oil} - \text{final weight}}{2.2} = \text{litres/hr}$$

An acceptable consumption rate will not exceed 1,02 litres/hour.