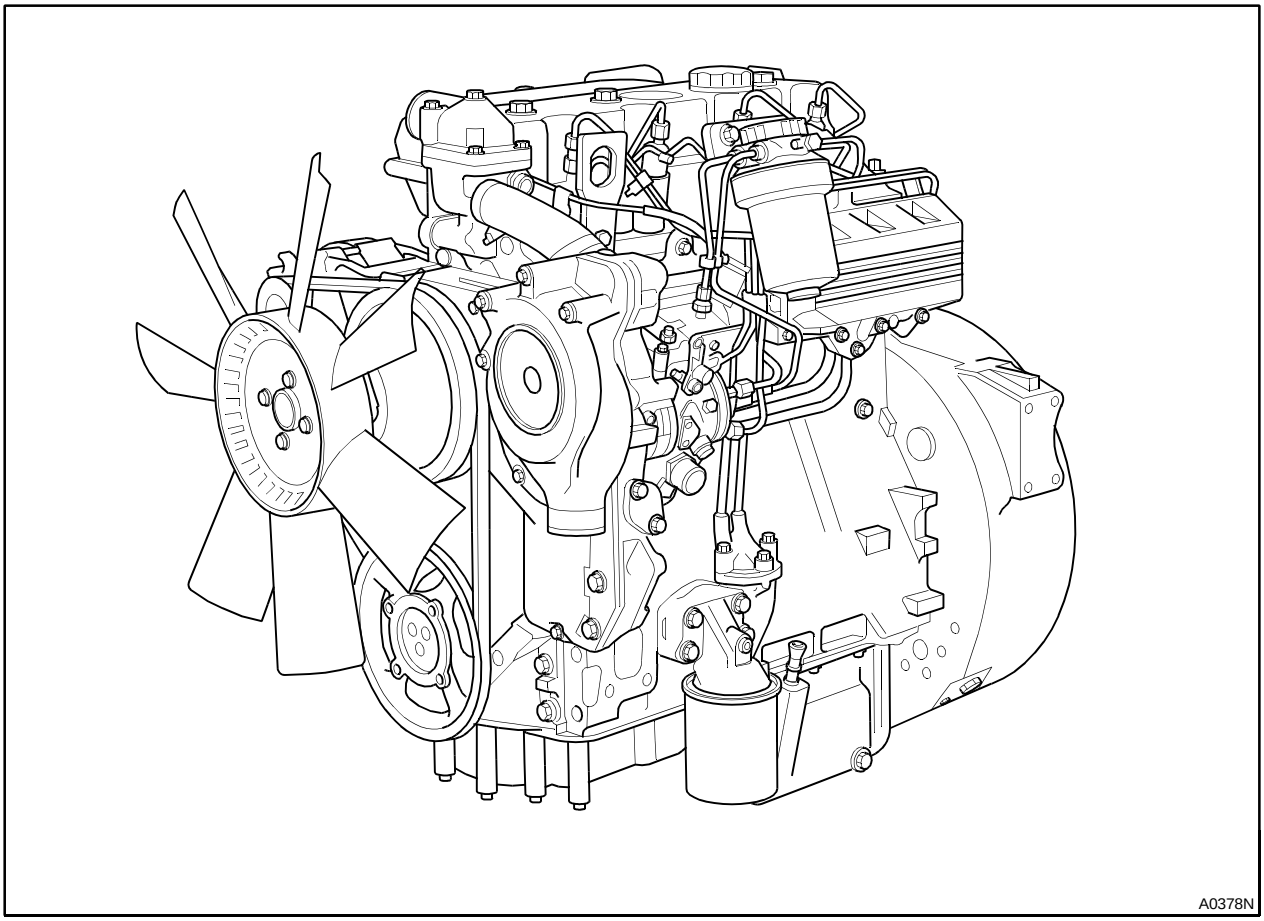
Chapters

The following pages contain a detailed table of contents.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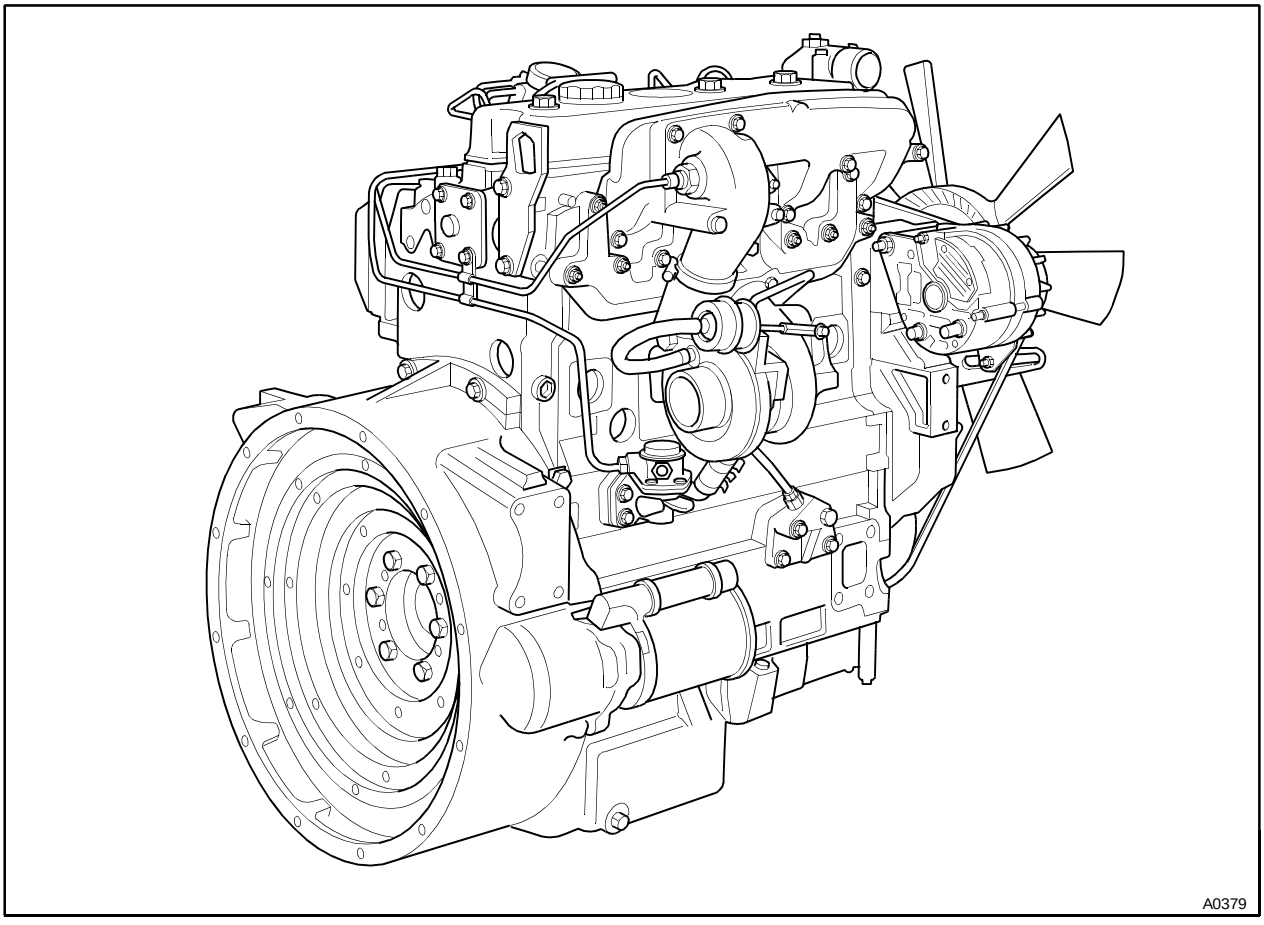
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Special torques for setscrews and nuts

Description	Thread size	Torque		
		Nm	lbf ft	kgf m
Flywheel and housing				
Setscrews, flywheel to crankshaft	1/2 UNF	105	77	10,7
Setscrews, cast iron flywheel housing to cylinder block	M10	44	33	4,5
- Head stamped 8.8	M12	75	55	7,6
- Head stamped 10.9	M10	63	46	6,4
- Head stamped 10.9	M12	115	85	11,7
Setscrews, aluminium flywheel housing to cylinder block	M10	70	52	7,1
Setscrews, flywheel housing to cylinder block (paper joint)	M10	70	52	7,1
Aspiration system				
Nuts, turbocharger to manifold	M10	44	33	4,5
Electrical equipment				
Nut, alternator pulley:				
- CAV AC5RA and AC5RS	5/8 UNF	55	40	5,6
- Thin nut A127, and motorola pulley, 22 mm A/F	M17	60	44	6,1
- Thick nut A127, and motorola pulley, 24 mm A/F	M17	80	59	8,2
- Bosch 55A	M14	45	33	4,5
- Bosch 55A	M16	50	37	5,1
- Butec 5524	5/8 UNF	78	58	8,0
Fuelled start aid to induction manifold	7/8 UNF	31	23	3,1
Port heater to induction manifold	M22	60	44	6,1
Nut/screw, starter motor	3/8 UNF	30	23	3,0
Auxiliary equipment				
Nut, compressor drive gear to compressor crankshaft	5/8 UNF	120	93	12,0
Nut, (30 A/F) Compressor gears	M20	130	101	13,0
Cap screw, bracket to idler hub	M10	60	47	6,0
Cap screw, bracket to timing case	M8	35	27	3,5

Notes:

- The latest oil transfer plate is fitted without a joint or sealant; always give the correct engine number when parts are needed.
- There are two plugs in the balancer frame, a short tapered plug with a hexagonal socket head and a long plug with a square socket head. These plugs control the flow of oil through the balancer frame. The position of the plugs is decided by which side of the engine the filter is fitted. When the filter is fitted on the left side, the short plug is fitted in the side of the balancer and the long plug is fitted in the bottom. When the filter is fitted on the right side of the engine, the short plug is fitted in the bottom of the balancer and the long plug is fitted in the side.

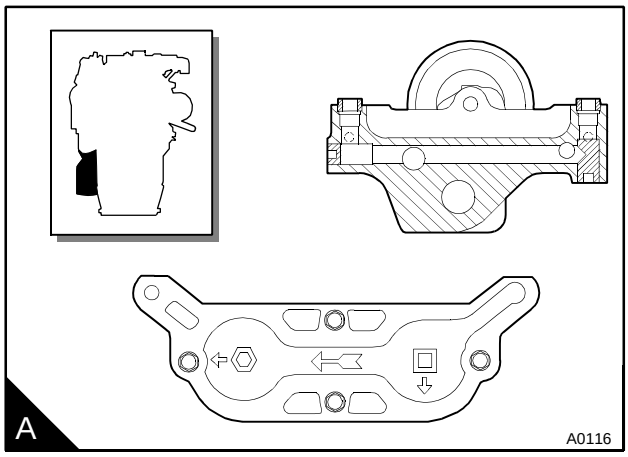
Caution: *Removal of these plugs can cause damage to the threads in the balancer frame and a new balancer frame will be needed. When a balancer unit is to be fitted, ensure that the lubricating oil flow through the balancer frame is correct for the position of the lubricating oil filter.*

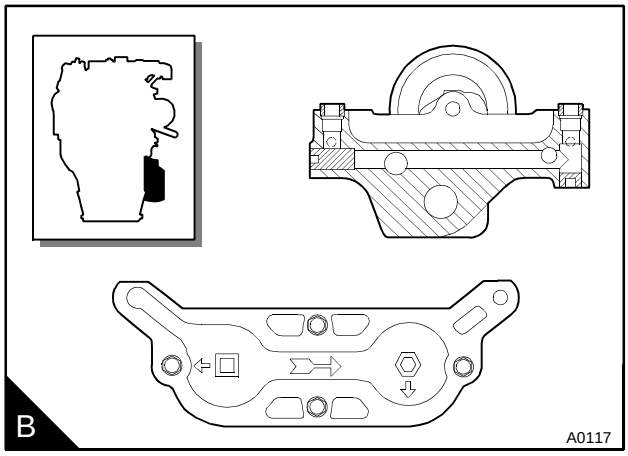
6 Release the setscrews and remove the rear cover of the balancer frame (page 96/A6). A hammer and a suitable drift will be necessary to remove the rear cover from the dowels.

7 Remove the balance weights (page 96/A5). Ensure that the gear of the driven weight does not damage the bush in the balancer frame.

8 Dismantle the lubricating oil relief valve, see operation 19-10.

9 Clean the lubricating oil passages with an approved kerosene cleaning solution and dry them with low pressure compressed air.





Filter canister

Warning! *Discard the used canister (B4) and lubricating oil in a safe place and in accordance with local regulations.*

Caution: *The canister contains a valve and special tube to ensure that lubricating oil does not drain from the filter. Therefore, ensure that the correct Perkins POWERPART canister is used.*

The filter can have one or two canisters (B4) or (A1) fitted. When two canisters are fitted, both must be renewed at the same time. On some engines an oil cooler (B2) is fitted to the filter head. This arrangement is fitted on the left side or the right side of the engine.

On some four and six cylinder engines the adaptor (A2) or (B1) is sealed into the filter head. A new filter head is supplied without the adaptor fitted; if either the adaptor or the filter head is to be renewed, both parts will be necessary.

1 Put a tray under the filter to contain spilt lubricating oil.

2 Remove the filter canister with a strap wrench or a similar tool and then discard the canister.

Note: If the adaptor is to be renewed, insert the end of the adaptor, which has the thread sealant applied during manufacture, into the filter head.

3 Clean the seal face of the filter head (A3).

Caution: *Ensure that the adaptor (A2) or (B1) is secure in the filter head.*

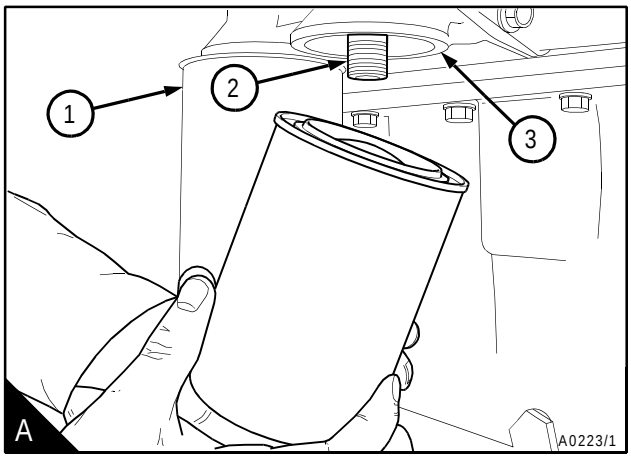
4 Add clean engine lubricating oil to the new canister. Give the oil time to fill the canister through the filter element.

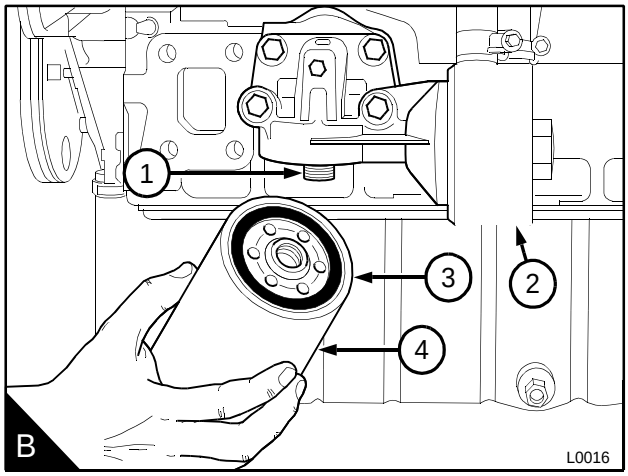
5 Lubricate the top of the canister seal (B3) with clean engine lubricating oil.

6 Install the new canister and tighten it by hand only. Do not use a strap wrench.

For turbocharged engines: Ensure that the engine will not start and operate the starter motor until oil pressure is obtained. To ensure that the engine will not start, either put the manual stop control in the "stop" position or disconnect the electrical stop control of the fuel injection pump. Oil pressure is indicated when the warning light is extinguished or by a reading on the gauge.

7 After the lubricating oil has been added to the sump, operate the engine and check for leakage from the filter. When the engine has cooled, check the oil level on the dipstick and add oil to the sump, as necessary.





To eliminate air from the fuel system Lucas DP200 pump 20-12

Air will usually be removed from the fuel pump automatically when the engine is in operation. If the fuel pipes are disconnected or if the canister of the fuel filter has been renewed, or the engine runs out of fuel, it will be necessary to eliminate air from the fuel system.

Caution: *If the fuel system is empty or if the canister(s) of the fuel filter have been renewed, it will be necessary to eliminate air from the fuel system, especially the fuel injection pump.*

1 Release the vent plug on the fuel filter head (A1).

2 Operate the priming lever of the fuel lift pump (B) until fuel, free of air, comes from the vent plug. Tighten the vent plug. If the drive cam of the fuel lift pump is at the point of maximum lift, it will not be possible to operate the priming lever. In this situation, the crankshaft must be rotated one revolution.

Caution: *Use a spanner to prevent movement of the fuelled starting aid (C1) when the union nut (C2) is loosened or tightened.*

3 Loosen the union nut (C2) at the fuelled starting aid and operate the priming lever of the fuel lift pump until fuel, free of air, comes from the connection. Tighten the union nut at the starting aid.

4 Loosen the union nut at the outlet connection of the low pressure fuel leak off pipe which is on top of the governor housing of the fuel injection pump. Operate the priming lever of the fuel lift pump until fuel, free of air, comes from the connection. Tighten the union nut.

Caution: *Do not tighten the union nuts of the high-pressure pipes more than the recommended torque tension. If there is a leakage from the union nut, ensure that the pipe is correctly aligned with the atomiser inlet. Do not tighten the atomiser union nut more, as this can cause a restriction at the end of the pipe. This can affect the fuel delivery.*

5 Loosen the high-pressure connections at two of the atomisers (D1).

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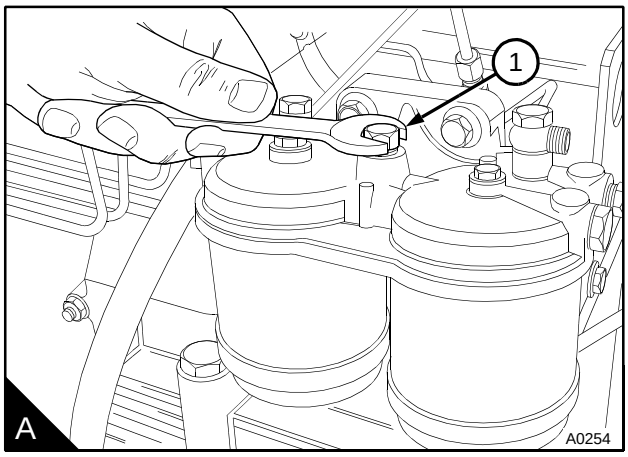
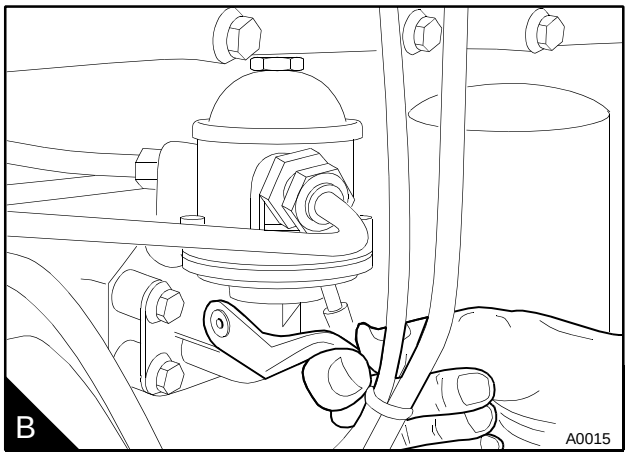
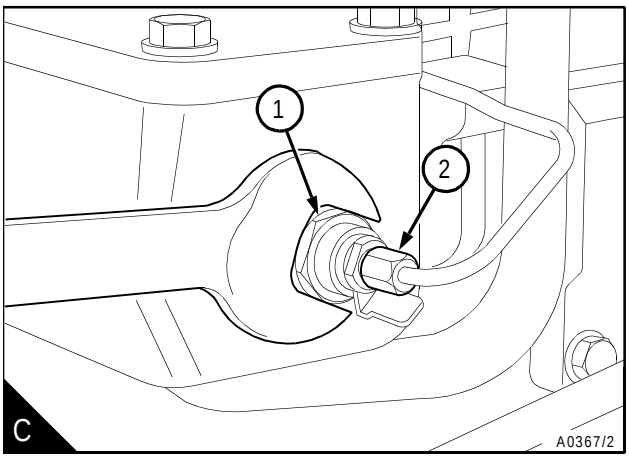
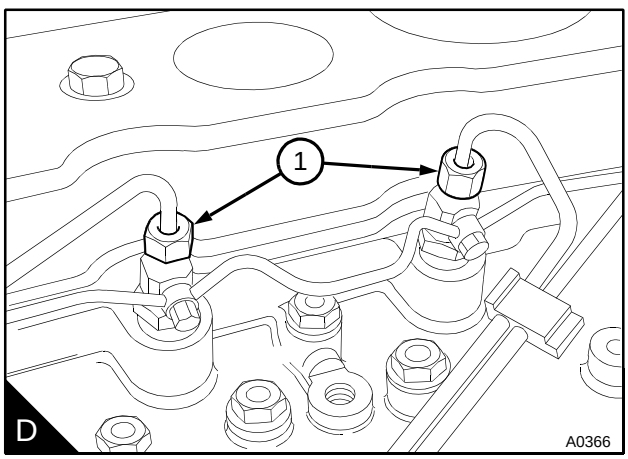
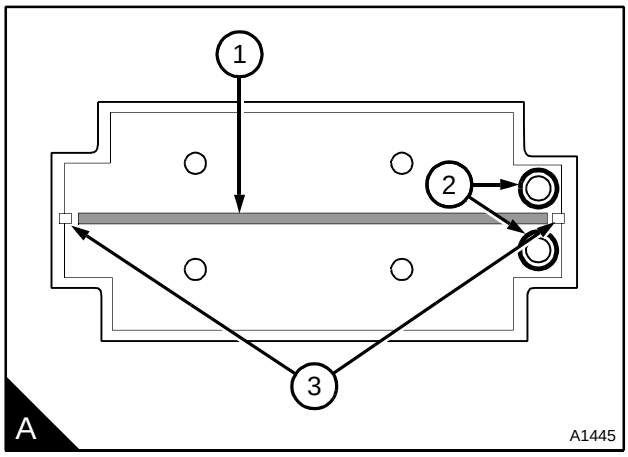








To fit



Adhesive sealing strips are fitted to the top cover and the induction manifold to seal the external surfaces of the tubestack. This is necessary to ensure that all of the air which enters the intercooler passes through the fins of the tubestack.

1 Renew the adhesive sealing strips (A1) that fitted to the bottom of the induction manifold and the top cover:

Remove the tape from the adhesive strip. Ensure that the sealing strip is fitted in a straight line, onto the flat machined surface on the cover and the cast surface of the manifold. Ensure that the ends are aligned with the vertical machined surface (A3) on each side of the manifold.

Note: Be careful with the tubestack when it is removed and fitted, be especially careful not to damage the fins.

2 Put the "O" rings (A2) into position against the large shoulder, on the inlet and outlet connections of the tubestack. Carefully position the tubestack in the induction manifold, ensure that the inlet and outlet connections are centred as they enter the holes in the manifold.

The tubestack will be in contact with the bottom of the manifold, if the "O" rings are fitted correctly.

3 Fit the setscrews which retain the tubestack to the induction manifold and tighten them gradually and evenly to 22 Nm (16 lb ft) 2,2 kgf m.

4 Renew the joint between the flange face of the top cover and induction manifold. The joint is fitted without sealant.

5 Put the top cover into position and fit the setscrews which retain the top cover to the induction manifold and tighten them gradually and evenly to 22 Nm (16 lb ft) 2,2 kgf m. Work from the centre of the flange to the outside.

6 Connect the fuel pipe to the connection of the fuelled starting aid and fit the electrical connection. Eliminate air from the fuelled starting aid, see operation 20-9.

7 Fit the hoses and the hose clips to the coolant inlet and the outlet connections of the tube stack and tighten the clips. Fill the coolant system.

8 Fit the air hose from the turbocharger to the intercooler assembly and tighten the hose clips.

Note: If a hose that has a heat shield is renewed, ensure that the new part is of the correct type and it is fitted in the correct position.

9 Operate the engine and check for coolant and air leaks.

3

Cylinder head assembly

General description

In a diesel engine there is little carbon deposit and for this reason the number of hours run is no indication of when to overhaul a cylinder head assembly. The factors which indicate when an overhaul is necessary are how easily the engine starts and its general performance.

The cast iron cylinder head is fastened to the cylinder block by flanged head setscrews. The cylinder head gasket is a multi-layer construction. The individual inlet and exhaust ports are designed to assist air swirl and improve air flow.

The intake manifold is integral within the cylinder head, and the rocker cover also contains the engine breather pipe.

The cylinder head assembly has two overhead valves fitted for each cylinder. Each overhead valve is held in place by a single coil spring, cap, and two collets. The face angle of the intake and the exhaust valves are both 30°. The cylinder head has steel valve seat inserts fitted for both the intake and the exhaust valves, and these can be renewed. The angles of the valve seats in the cylinder head for the intake and the exhaust valves are both 30°. The valves move in sintered steel valve guides which can also be renewed. The exhaust valve guides have a counterbore to prevent seizure of the valve stem caused by a build up of carbon under the head of the valve. Each valve stem is fitted with a synthetic rubber oil seal.

The overhead valves are operated by a rocker shaft assembly fitted to the top of the cylinder head and under a composite rocker cover. The forged steel rocker levers are operated by cold drawn push rods with hardened heads. The rocker shaft is secured to the cylinder head by sintered steel brackets between each pair of valves. The rockers and valve gear are lubricated by an oil flow from the hollow rocker shaft that receives a reduced oil flow from the camshaft oil feed.

Tappet adjustment is achieved by adjustment screws and locknuts at the push rod end of each rocker lever.

To renew (element type oil filter) **Operation 10-2**

Warning! *Discard the used element and lubricating oil in a safe place and in accordance with local regulations.*

Caution: *Ensure that the application is on a level surface to ensure an accurate reading on the dipstick.*

1 Put a suitable container below the lubricating oil filter.

Note: On the horizontal filter assembly the drain plug (A2) is in the filter head and should not be removed.

2 Remove the drain plug (A2) together with the seal and drain the lubricating oil.

3 Fit a 1/2” square drive ratchet into the recess (A1) and remove the filter casing (A3). Discard the old filter element.

4 Clean the filter casing and replace the seal (B2). Fit a new seal to the drain plug and fit the plug finger tight.

5 Fit the new filter element (B1) into the casing and rotate the element to locate it into position.

6 If the filter casing is in vertically mounted position (A), add clean engine lubricating oil to the filter casing. Allow the oil enough time to pass through the filter element.

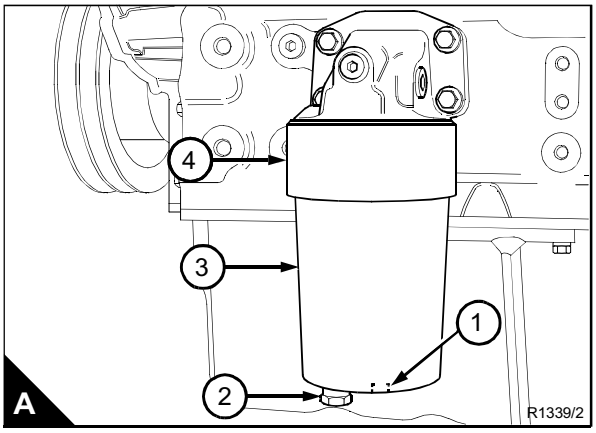
7 Lubricate the seal (B2) with clean engine lubricating oil. Fit the casing (A3) into the filter head (A4).

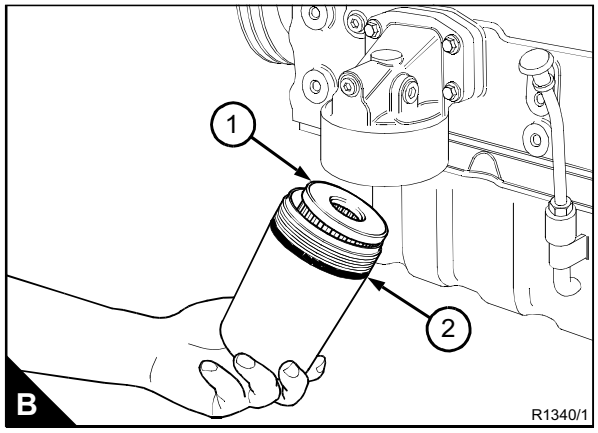
8 Tighten the casing (A3) to 25 Nm (18 lbf ft) 2,5 kgf m.

9 Tighten the drain plug to 12 Nm (9 lbf ft) 1,2 kgf m.

10 Remove the container and discard the old lubricating oil.

11 Operate the engine and check for leakage from the filter. When the engine has cooled, check the oil level on the dipstick and add more oil into the sump, as necessary.





To remove and to fit the speed and timing sensor **Operation 14-16**

Warning! *The 'O' ring (B1) fitted to the speed and timing sensor is made of "Viton", see the safety precautions for "Viton seals" on page 8.*

Note: The engine speed and timing sensor is not adjustable. The sensor and securing bracket is a single unit and should not be dismantled. The sensor must be fitted so that the securing bracket (A2) is fully against the machined surface of the cylinder block.

To remove

1 Disconnect the electrical connector from the sensor.

2 Remove the setscrew (A1) that secures the sensor to the cylinder block.

3 Carefully remove the sensor (A3) from the cylinder block. Do not use a lever, this can cause damage to the sensor.

4 Discard the 'O' ring (B1).

To fit

1 Ensure that the sensor body and the bore in the cylinder block are clean and free from oil and dirt.

2 Fit a new 'O' ring to the sensor in the first groove (B1). Apply a small amount of clean engine oil to the 'O' ring.

Note: The second groove (B2) in the sensor is not used.

3 Push the sensor fully into the bore of the cylinder block (A). Do not use the setscrew to pull the sensor into position. Align the hole in the sensor bracket to the hole in the cylinder block and loosely fit the setscrew (A1).

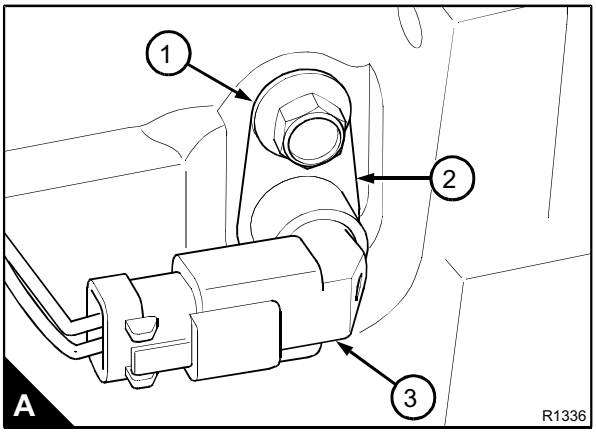
4 Tighten the setscrew to 22 Nm (16 lbf ft) 2,2 kgf m.

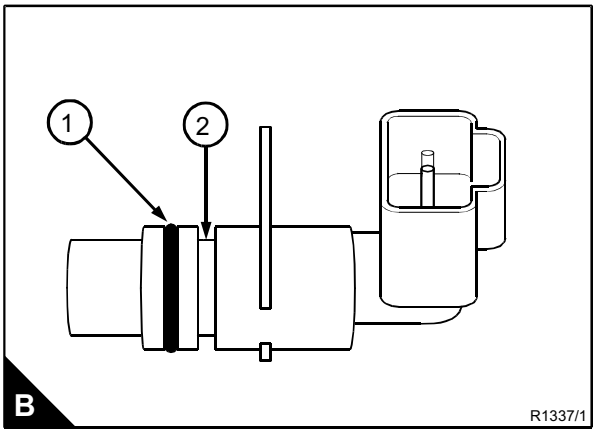
5 Check that the sensor bracket is fitted fully against the machined surface of the cylinder block.

6 Check that the connector seal is in place, that it is clean and is not damaged. Renew the seal if it is damaged.

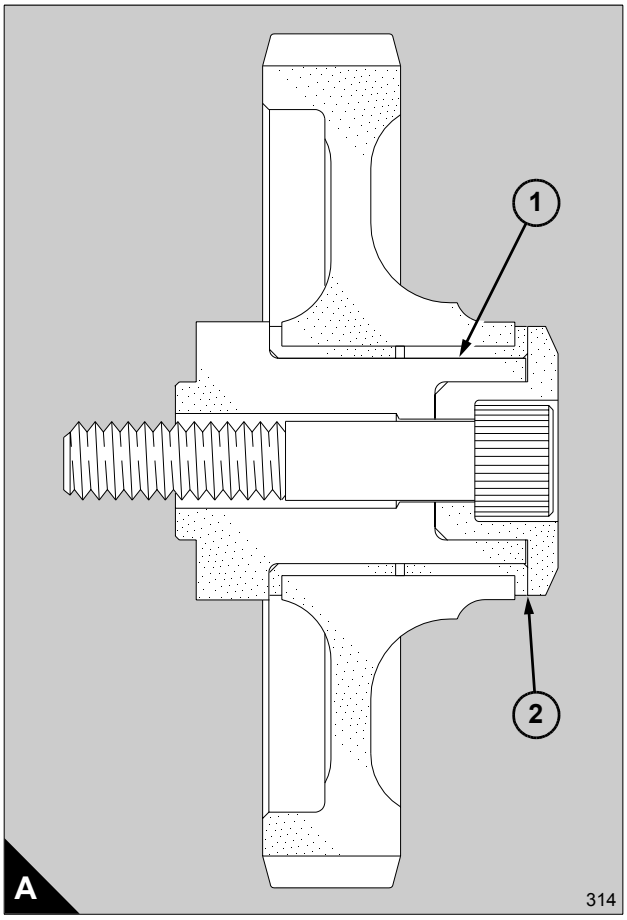
7 Carefully fit the electrical connector to the sensor to ensure that the connector pins are not bent during this operation.

8 Lightly pull the harness connector to ensure that it is locked to the sensor connector.





Fits and clearances



Idler gear (A)

Bore of bush when fitted and machined (A1) . . . . . 51,765 to 51,816 mm (2.038 to 2.040 in)
Axle diameter. . . . . .41,2850 to 41,2877 (1.6250 to 1.6255 in)
End-float - new 2000 Series (A2) . . . . . 0,010 to 0,254 mm (0.004 to 0.010 in)
End-float - earlier engines . . . . . 0,51 to 0,20 mm (0.002 to 0.008 in)

Gear train

Backlash - new 2000 Series . . . . . .0,15 to 0,25 (0.006 to 0.010 in)
Permissible worn limit . . . . . 0,38 mm (0.015 in)
Backlash - earlier engines . . . . . .0,051 to 0,152 (0.002 to 0.006 in)
Permissible worn dimension . . . . . .0,20 (0.008 in)

Oil pump drive gear

Backlash - new 2000 Series . . . . . 0,15 to 0,25 mm (0.006 to 0.010 in)
Permissible worn limit . . . . . 0,38 mm (0.015 in)
Backlash - earlier engines . . . . . 0,102 to 0,254 mm (0.004 to 0.010 in)
Permissible worn limit . . . . . 0,305 mm (0.012 in)

Double acting type

To remove

1 Before removing the lift pump from its mounting, slacken each of the banking plugs over the three valves, the priming pump body (A1) and the large cap plug over the pump plunger (A2). Disconnect the fuel pipes and remove the lift pump retaining bolts. Remove the pump from its mounting.

To fit

1 Refitting is a reversal of the removal procedure; use a new gasket.

Particulars of further tests for both pumps involving special apparatus are available from the pump manufacturer, if required.

To dismantle

1 Remove the priming pump, plugs, valve springs, valves and pump plunger. Check all components for wear and damage, and check that the springs are in good condition. The priming plunger of early models differs slightly from that shown (A).

Caution: *The pump plunger and spring are supplied as a matched pair, identified by a colour code and must be renewed as a pair if necessary.*

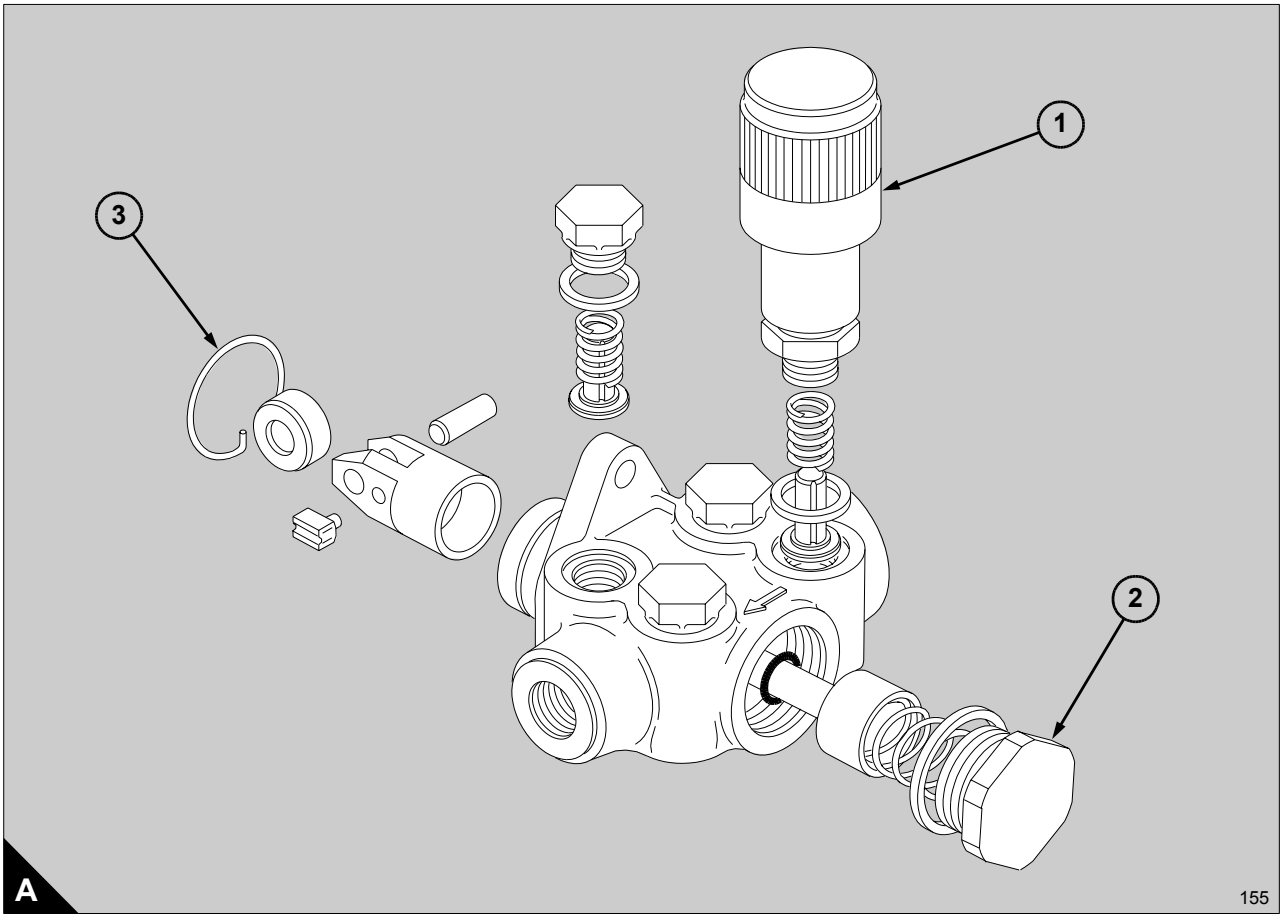
1 Remove the circlip (A3) from the pump body and withdraw the roller/tappet assembly. Dismantle the assembly and inspect the components for wear and damage. Renew any items in doubtful condition.

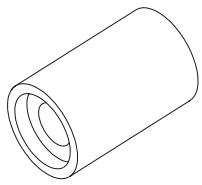
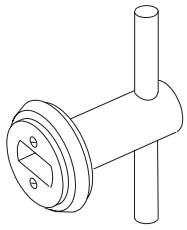
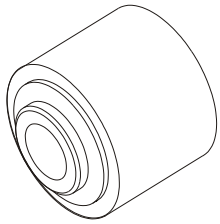
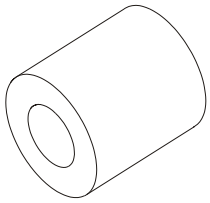
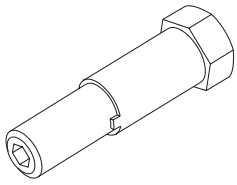
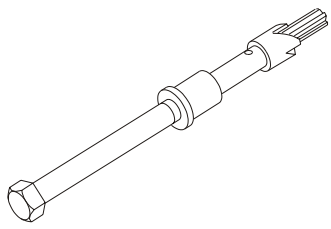
2 Check the action of the hand priming pump and replace as a unit if found to be unserviceable.

To assemble

1 Apply a light coat of clean engine oil to all components and assemble the pump using new joint washers. Tighten the plugs and priming pump securely.

2 Test the pump as given in operation 20-9.



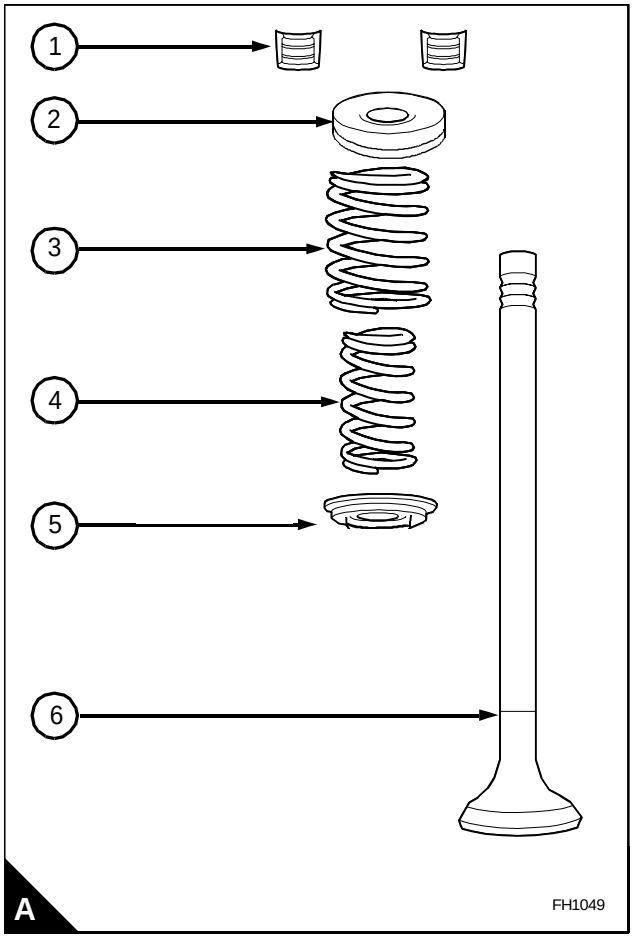
Number	Description	Illustration
21825 899 (GA5143)	Coolant pump water seal replacer	
21825 902 (GA5148A)	Lapping tool, cylinder liner flange	
21825 903 (GA5149)	Coolant pump oil seal replacer	
21825 904 (GA5150)	Coolant pump bearingseal replacer	
21825 908 (GA5164)	Injector sleeve remover/replacer wrench	
21825 909 (GA5165)	Tool holder for face cutter and reamer	

To fit

1 If removed fit new valve stem seal, see Operation 3-8.

2 Apply clean engine lubricating oil to the relevant valve stems (A6).

3 Fit the washer (A5) and both the valve spring (A4) and (A3). Fit the rotocoil (A2) to the valve assembly.



4 Use the valve spring compressor, GE50026, to compress the valve springs.

5 Fit the collets (A1) to each valve.

Caution: *The collets can move during the installation. Ensure that the collets are seated correctly during this procedure.*

Continued

To dismantle

1 Remove the setscrew and washer which retain the gear on the shaft.

2 Use a suitable gear puller to remove drive gear (A1) from the shaft. Remove the key from the shaft.

3 Remove retainer (A5) for the by-pass valve.

4 Remove the spring (A4) and the by-pass valve (A3).

5 Remove the cover (A6) from the pump body (A2).

6 Remove the idler gear and drive gear from pump body.

To assemble

1 Apply clean engine lubricating oil to the idler gear and drive gear and install the gears in the oil pump body (A2).

2 Fit the by-pass valve (A3) the spring (A4) and the retainer (A5) to the pump body (A2).

3 Fit the key to the shaft.

4 Fit the drive gear (A1) to the shaft. Install the washer and setscrew which retain the gear. Tighten the setscrew to a torque of 55 Nm (41 lbf ft) 5,6 kgf m. Ensure that the oil pump turns freely after assembly.