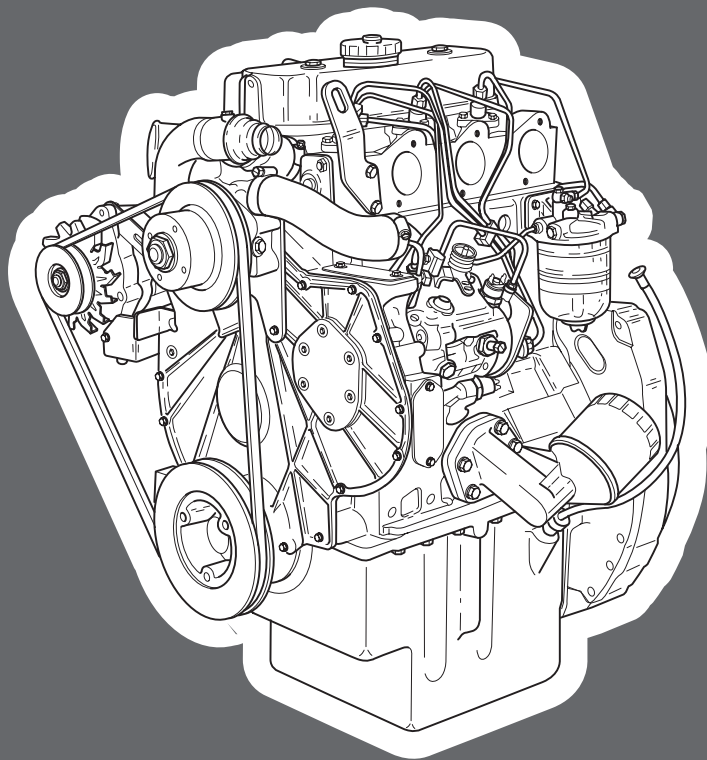


647068EN (27/08/2009)

**ENGINE**  
**903-27**  
Repair manual



CLICK HERE TO **DOWNLOAD** THE COMPLETE MANUAL

- Thank you very much for reading the preview of the manual.
- You can download the complete manual from: [www.heydownloads.com](http://www.heydownloads.com) by clicking the link below



- Please note: If there is no response to CLICKING the link, please download this PDF first and then click on it.

CLICK HERE TO **DOWNLOAD** THE COMPLETE MANUAL

## General safety precautions

**These safety precautions are important.** You must refer also to the local regulations in the country of use. Some items only refer to specific applications.

- 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 care 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 auxiliary equipment is in operation.
- Do not permit loose clothing or long hair near moving parts.
- Keep away from moving parts during engine operation. **Warning!** *Some moving parts 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, because dangerous hot coolant can be discharged.
- 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 operators position.
- If your skin comes into contact with high-pressure fuel, obtain medical assistance immediately.
- 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 of clothing.
- 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.
- Use extreme care if emergency repairs must be made in adverse conditions.
- 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.
- Read and use the instructions relevant to lift equipment which are given on page 1.06.
- Always use a safety cage to protect the operator when a component is to be pressure tested in a container 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.
- Fit only genuine Perkins parts.

# RECOMMENDED TORQUE TENSIONS **11B**

Description	Thread size	Torque		
		Nm	lbf ft	kgf m
<b>Cylinder block</b>	-	-	-	-
<b>Aspiration system</b>				
Setscrews, inlet manifold to cylinder head	M8	22	16	2,2
Nuts, exhaust manifold to cylinder head	M8	22	16	2,2
<b>Fuel system</b>				
Nuts, high-pressure fuel pipes	M12	22	16	2,2
Setscrews, atomiser	M8	22	16	2,2
Setscrews, fuel lift pump	M8	22	16	2,2
Setscrews, pump support bracket to cylinder block	M8	22	16	2,2
Nut, pump support bracket to fuel injection pump	M8	22	16	2,2
Nut, drive gear of fuel injection pump	M14	80	59	8,2
Nuts for flange of fuel injection pump	M8	22	16	2,2
<b>Lubrication system</b>				
Plug, lubricating oil sump	3/4 UNF	34	25	3,5
Setscrews, oil pump to front bearing cap	M8	22	16	2,2
Setscrews, suction pipe to main bearing cap	M6	9	7	0,9
Nuts and setscrews, lubricating oil sump	M8	22	16	2,2
Setscrews, filter head	M10	44	32	4,5
<b>Cooling system</b>				
Setscrews, adaptor plate to timing case	M8	22	16	2,2
Setscrews and nuts, coolant pump to timing case, front cover and adaptor plate	M8	22	16	2,2
Setscrews, fan to coolant pump pulley	M8	22	16	2,2
<b>Flywheel and housing</b>				
Setscrews, flywheel to crankshaft	1/2 UNF	105	77	10,7
Setscrews, flywheel housing adaptor plate	M10	44	32	4,5
<b>Electrical equipment</b>				
Nut, alternator pulley (Lucas A127)	80	80	59	8,2

## Valve springs

To change the valve springs  
(with cylinder head fitted)

12A-06

### Special tools:

Valve spring compressor, PD.6118B

Stud adaptor used with PD.6118B, PD.6118B-10

**Warning:** Wear eye protection when the valve spring is compressed.

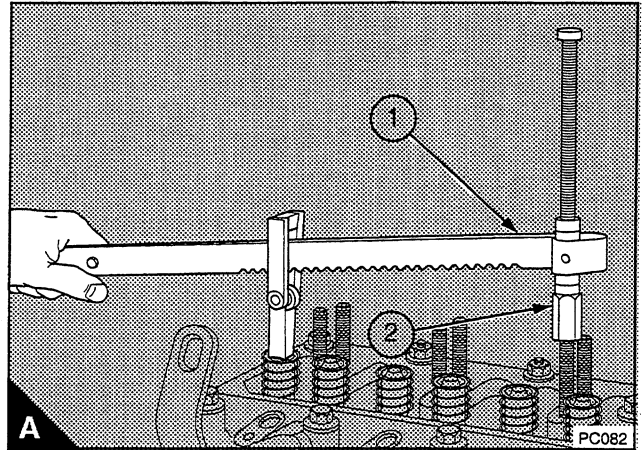
**Note:** Paragraphs 1 to 12 refer to a change of valve springs for a single cylinder.

- 1 Remove the rocker cover, operation 12A-01.
- 2 Turn the crankshaft in the normal direction of rotation until the inlet valve of the relevant cylinder has just opened and the exhaust valve has not fully closed. In this position the piston will be at approximately top dead centre (TDC).
- 3 Remove the rocker assembly, operation 12A-02.
- 4 Fit the valve spring compressor (A1) and the adaptor (A2).
- 5 Compress the valve spring(s) and remove the collets. Ensure that the valve springs are compressed squarely or damage to the valve stem can occur.
- 6 Release the valve spring compressor and remove the valve spring caps and the valve spring.
- 7 Put the new valve springs in position.
- 8 Fit the valve spring cap.

**Caution:** Do not turn the crankshaft while the valve springs are removed.

- 9 Fit the valve spring compressor, compress the valve spring and fit the collets. Remove the valve spring compressor.
- 10 Fit the rocker assembly, operation 12A-02.
- 11 Check the valve tip clearances, operation 12A-05.
- 12 Fit the rocker cover, operation 12A-01.

**Note:** If other or all of the valve springs are to be changed, they can be changed one cylinder at a time in the sequence of cylinders 1, 2 and 3.



**To tighten the nuts:****Cautions:**

- The cylinder head nuts are tightened in **three increments**, see paragraphs 15 to 17. Cylinder head fasteners which are tightened in one operation can loosen in service.
- Do not tighten the cylinder head fasteners again with the engine hot or after a limited period in service.

**15** Tighten nuts 9 -12 in the correct sequence (A) to 50 Nm (37 lbf ft) 5,1 kgf m.

**16** Repeat paragraph 15 to ensure that all the nuts are tightened to the correct torque.

**17** Tighten further the nuts by 60° (1 flat), in the correct sequence by the method shown for setscrews, see paragraph 14.

**18** Fit the rocker assembly, see operation 12A-02.

**19** Set the valve tip clearances, see operation 12A-05.

**20** Fit the atomisers, see section 20.

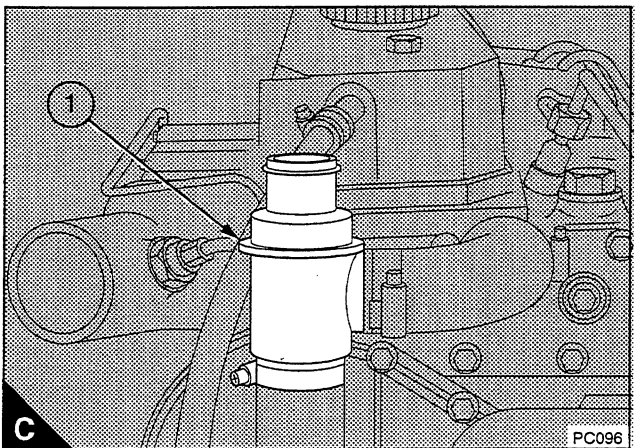
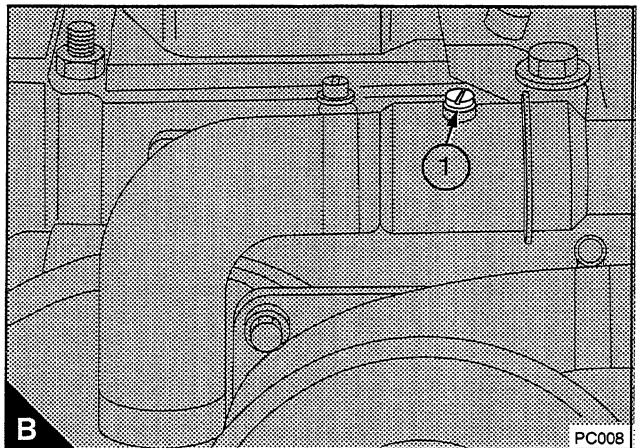
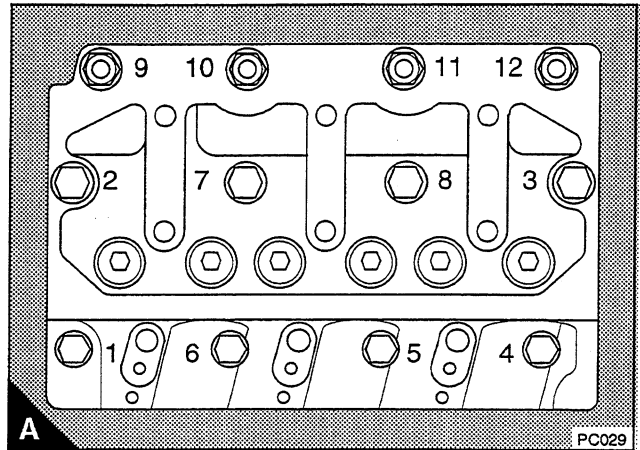
**21** Fit the high-pressure fuel pipes; tighten the union nuts to 22 Nm (16 lbf ft) 2,2 kgf m.

**22** Fit the vent pipe which is fitted between the fuel injection pump and the first atomiser. Connect, to the rear of the cylinder head, the clip which retains the fuel pipe between the fuel filter and the fuel lift pump.

**Caution:** If the thermostat is fitted incorrectly, the engine will overheat.

**23** Connect the thermostat assembly. Tighten the clips. If the thermostat assembly is in the horizontal position, the assembly is fitted correctly when the vent screw (B1) is at the top. If the thermostat assembly is fitted in the vertical position (C), the shoulder (C1) will be at the top.

*Continued*



**Data and dimensions****Introduction**

**Note:** This information is given as a guide for personnel engaged on engine overhauls. The dimensions which are shown are those which are mainly used in the factory.

**Cylinder head assembly****Angle of valve seats**

- Inlet .....	36° (108° included angle)
- Exhaust .....	46° (88° included angle)
Diameter of parent bores for valve guides .....	12,000/12,027 mm (0.4724/0.4735 in)
Leak test pressure .....	200 kPa (29 lbf/in <sup>2</sup> ) 2,0 kgf/cm <sup>2</sup>
Cylinder head thickness .....	87,6/88,4 mm (3.45/3.48 in)
Maximum permissible amount to machine from cylinder head face .....	0,40 mm (0.016 in)
Maximum protrusion of the atomiser nozzle .....	1,61/2,13 mm (0.063/0.084 in)
Diameter of bore for tappets .....	14,000/14,027 mm (0.5512/0.5522 in)

**Valve guides**

Inside diameter .....	7,027/7,052 mm (0.2767/0.2776 in)
Outside diameter .....	12,034/12,047 mm (0.4738/0.4743 in)
Interference fit of guide in cylinder head .....	-0,007/-0,047 mm (-0.0003/-0.0019 in)
Length .....	51,0/51,5 mm (2.00/2.03 in)
Protrusion above face of spring seat .....	11,10/11,40 mm (0.437/0.449 in)

**Inlet valves**

Diameter of valve stem .....	6,980/7,000 mm (0.2748/0.2756 in)
Clearance fit of valve in guide .....	0,027/0,072 mm (0.0011/0.0028 in)
Maximum permissible clearance in valve guide .....	0,15 mm (0.006 in)
Diameter of valve head .....	41,63/41,87 mm (1.639/1.648 in)
Angle of valve face .....	35°
Depth of valve head below cylinder head face .....	1,10/1,40 mm (0.043/0.055 in)
- Service limit .....	1,65 mm (0.065 in)
Seal arrangement (1) .....	Rubber seal fitted to valve guide

(1) Certain engines do not have a seal fitted to the valve guide for the inlet valve.

*Continued*

**8** Clean the connecting rod cap and the lower half of the shell bearings. Fit the bearing to the cap; ensure that the location tag is fitted correctly in its recess (A1). Lubricate the bearing with clean engine lubricating oil.

**9** Fit the cap and ensure that the assembly number is the same as that on the connecting rod and that the numbers (B) are on the same side. Fit the nuts finger tight; ensure that the flat side of the head of the bolts is towards the connecting rod. Tighten the nuts gradually and evenly to the recommended torque of 77 Nm (57 lbf ft) 7,9 kgf.

**10** Check that the crankshaft will rotate freely.

**11** Check the piston height above the top face of the cylinder block, operation 13A-05.

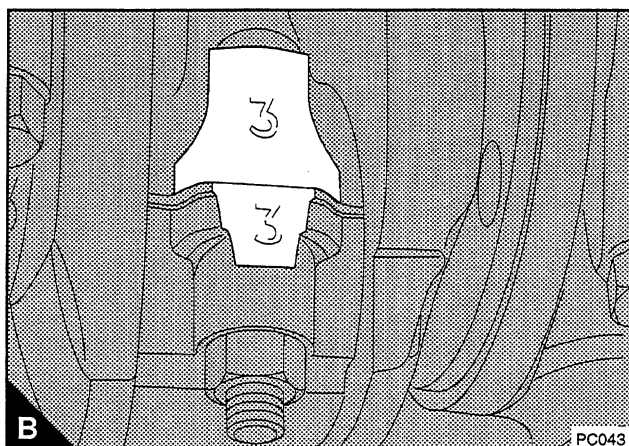
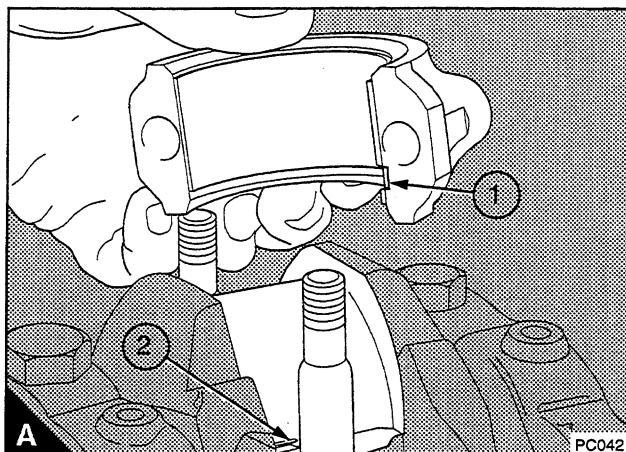
**12** Fit the lubricating oil strainer and suction pipe, operation 19A-04.

**13** Fit the lubricating oil sump, operation 19A-03.

**14** Fit the cylinder head assembly, operation 12A-07.

**15** Fill the sump to the correct level with lubricating oil of an approved grade.

**16** Fill the cooling system.



**Crankshaft assembly****14**

<b>General description</b> .....	14A.03
<b>Crankshaft pulley</b>	
14A-01 To remove and to fit .....	14A.03
<b>Rear oil seal assembly</b>	
14A-02 To remove and to fit .....	14A.04
14A-03 To renew the rear oil seal .....	14A.05
<b>Thrust washers</b>	
14A-04 To check crankshaft end-float .....	14A.06
14A-05 To remove and to fit .....	14A.07
<b>Main bearings</b>	
14A-06 To remove and to fit (with the crankshaft in position) .....	14A.09
14A-07 To inspect .....	14A.10
<b>Crankshaft</b>	
14A-08 To remove and to fit .....	14A.11
14A-09 To inspect .....	14A.14
14A-10 To overhaul .....	14A.14
<b>Data and dimensions</b> .....	14A.15

---

## Crankshaft

---

To remove and to fit **14A-08**

---

**Warning!** Use lift equipment or obtain assistance to lift heavy engine components such as the flywheel, the flywheel housing and the crankshaft .

### To remove

**Note:** Perkins recommend, for safety reasons, that this operation is done with the engine upside down. This will ensure that the crankshaft can be lifted out. Also the pistons will be retained in the cylinder bores.

- 1 Before the engine is removed from the vehicle or from the machine, drain the lubricating oil and the coolant.
  - 2 Remove the fan and the drive belt, operation 23A-03.
  - 3 Remove the crankshaft pulley, operation 14A-01.
  - 4 Remove the timing case cover, operation 15A-01.
  - 5 Remove the idler gear, operation 15A-03.
  - 6 Remove the front bridge piece, operation 15A-07.
  - 7 Remove the starter motor, see section 23. Remove the flywheel and the flywheel housing, see section 22.
  - 8 Remove the rear oil seal housing, operation 14A-02.
  - 9 Remove the lubricating oil sump, operation 19A-03.
  - 10 Remove the lubricating oil suction pipe, the delivery pipe, and the lubricating oil pump see section 19.
  - 11 Release and remove the bolts and nuts of the connecting rods. Remove the big end bearing caps. Keep the bearings and with the relevant caps, see operation 13A-01.
  - 12 Ensure that the tops of the main bearing caps are stamped with their relevant position number (14A.12/A). Release and remove the setscrews for the main bearing caps. Remove the main bearing caps, the lower half of the shell bearings and the upper and lower thrust washers. Keep the bearings with the relevant caps.
  - 13 Lift out the crankshaft. Remove the upper half of the bearings and keep each bearing with its relevant lower half and cap.
- Note:** If the main bearings are to be used again, they must be fitted in the same positions from which they were removed.

CLICK HERE TO **DOWNLOAD** THE COMPLETE MANUAL

- Thank you very much for reading the preview of the manual.
- You can download the complete manual from: [www.heydownloads.com](http://www.heydownloads.com) by clicking the link below



- Please note: If there is no response to CLICKING the link, please download this PDF first and then click on it.

CLICK HERE TO **DOWNLOAD** THE COMPLETE MANUAL

**Idler gear and hub**

To remove and to fit

**15A-03****To remove**

**Note:** Do not rotate the crankshaft when the idler gear is removed. If the crankshaft is rotated, top dead centre (TDC) will have to be set on number 1 cylinder, see section 17.

- 1 Remove the timing case cover, operation 15A-01.
- 2 Rotate the crankshaft until the marked teeth of the crankshaft gear, the camshaft gear, and the fuel pump gear are in mesh with the idler gear (A). The marked teeth of the idler gear will not necessarily be in mesh with the marked teeth of the other gears because of the different speed of rotation of the idler gear.

**Note:** The latest engines do not have a tab washer and use an M12 setscrew instead of a ½ UNF setscrew.

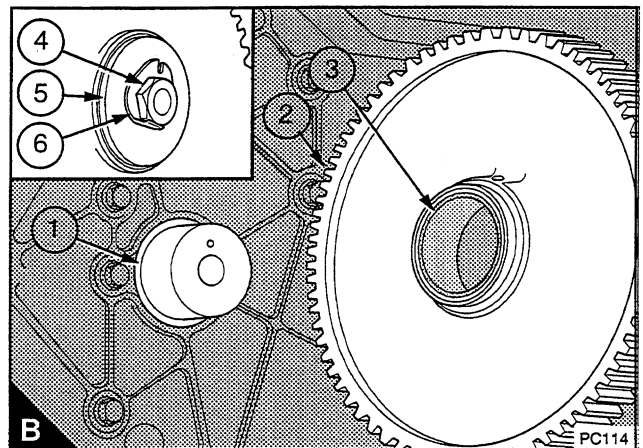
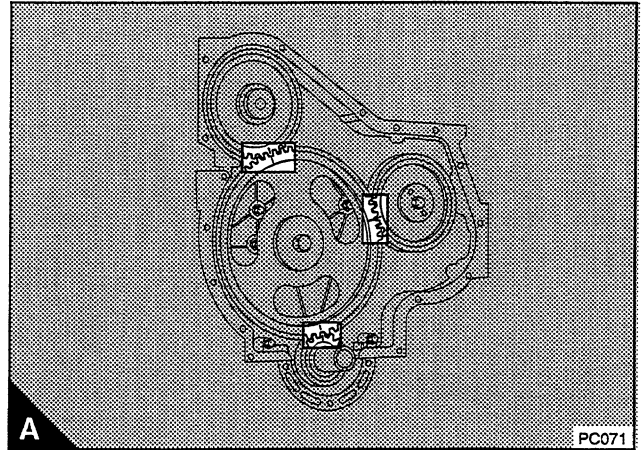
- 3 Release the tab washer (B6) from the setscrew (B4) which retains the idler gear. Remove the setscrew, the tab washer and the large washer (B5) from the idler gear.

- 4 Remove the idler gear (B2) from its hub (B1). If necessary, remove the hub from the cylinder block.

**Note:** Some engines have an idler gear which has a bush.

- 5 Inspect the gear and the bush (B3) for wear and other damage and renew as necessary. The gear and the bush are available as an assembly, or a separate bush is available.

- 6 If the bush is to be renewed, remove it with a suitable adaptor and a press.



---

**Camshaft**

---

To remove and to fit

**15A-08**

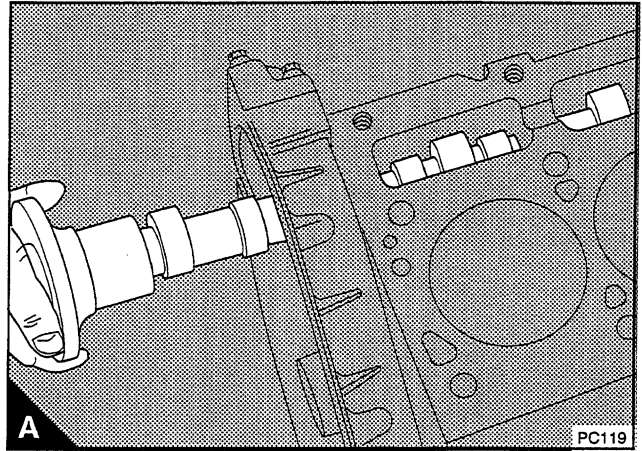
---

**To remove**

- 1 Drain the coolant system and remove the cylinder head, see section 12.
- 2 Remove the alternator together with its mounting bracket and front support plate.
- 3 Remove the timing case cover, operation 15A-01.
- 4 Remove the fuel lift pump, see operation 20A-03.
- 5 Remove the camshaft (A).
- 6 Inspect the camshaft for wear and other damage, renew the camshaft, if necessary.

**To fit**

- 1 Lubricate the journals of the camshaft with clean engine lubricating oil.
- 2 Fit the camshaft into the cylinder block (A).
- 3 Fit the fuel lift pump, see operation 20A-03.
- 4 Fit the camshaft gear, operation 15A-03.
- 5 Fit the cylinder head, see section 12.
- 6 Fit the timing case cover, operation 15A-01.
- 7 Fill the coolant system with coolant of the correct specification.



To set the engine to top dead centre (TDC) on the compression stroke **17A-01**

**Special tools:**

Locking pin for the crankshaft, PD.241

TDC on number 1 cylinder can be found by the alignment of a hole in the flywheel with a hole in the backplate.

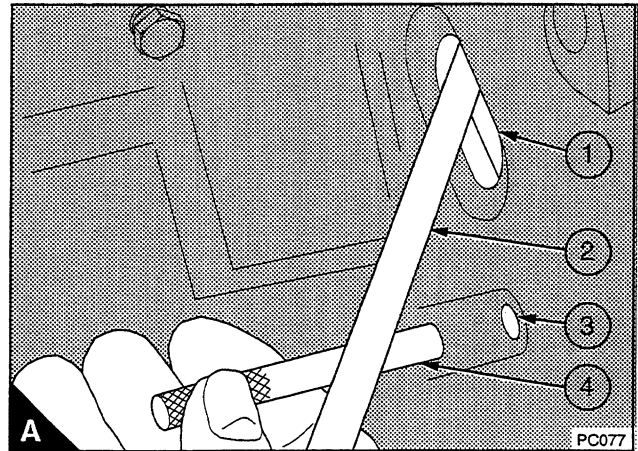
**1** Remove the rocker cover, see operation 12A-01.

**2** Rotate the crankshaft clockwise, when seen from the front, until the inlet valve, the first valve, has just closed. There is a slot (A1) in the left side of the backplate, seen from the rear, to give access to the starter ring. A suitable lever (A2) can be used through the slot to rotate the flywheel.

**3** Insert the locking pin (A4) into the hole (A3) below the slot in the backplate. Continue to rotate the crankshaft clockwise slowly until the pin enters a hole in the flywheel. The engine is now set at TDC number 1 cylinder, compression stroke.

**4 Remove the pin from the flywheel and the backplate.**

**5** Fit the rocker cover, see section 12A-01.



## Filter head

To remove and to fit

19A-02

### Consumable products:

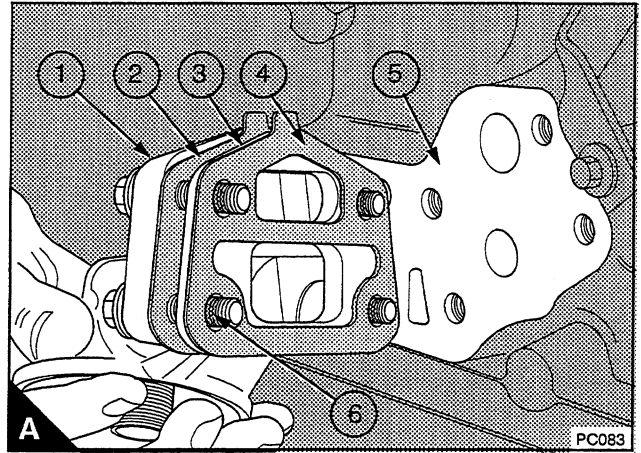
POWERPART threadlock

- 1 Put a tray under the filter head to contain spilt lubricating oil.
- 2 Remove the filter canister, operation 19A-01.
- 3 Release the four setscrews (A6) and remove the filter head (A1) and the spacer (A3) from the cylinder block (A5). Discard the two joints (A2) and (A4).

**Note:** Some engines do not have a spacer fitted. When a spacer is not fitted there is only one joint between the filter head and the cylinder block.

- 5 Thoroughly clean the joint face of the filter head, the spacer and the flange face of the cylinder block. Fit the filter head, the spacer and the two new joints. Apply POWERPART threadlock to the first three threads of the setscrews and tighten the setscrews to 44 Nm (32 lbf ft) 4,5 kgf m.

- 6 Fit new filter canister(s), operation 19A-01.



---

**Fuel system** **20****General description** ..... 20A.02**Fuel filter element**

20A-01 To renew ..... 20A.03

**Atomisers**

20A-02 Atomiser fault ..... 20A.04

20A-02 To remove and to fit ..... 20A.05

**Fuel lift pump**

20A-03 To remove and to fit ..... 20A.06

20A-04 To dismantle and to assemble ..... 20A.07

20A-05 To test ..... 20A.08

**Fuel injection pump**

20A-06 To remove and to fit ..... 20A.09

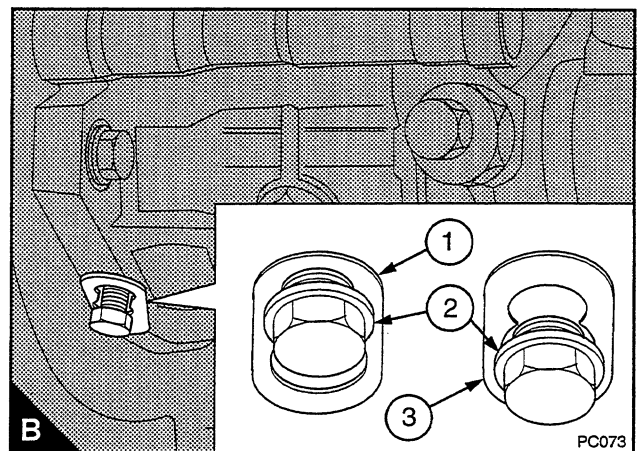
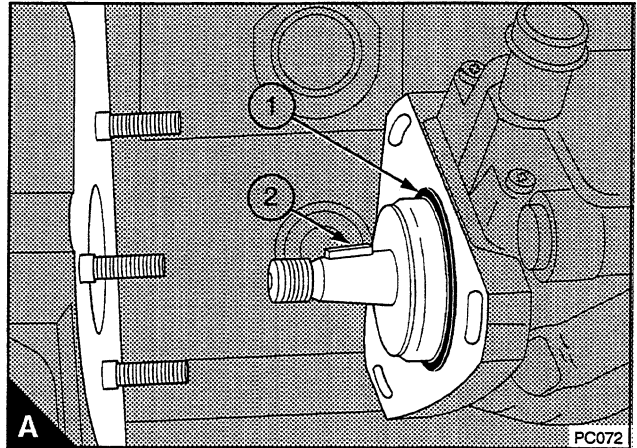
20A-07 To adjust ..... 20A.12

20A-08 To eliminate air from the fuel system ..... 20A.13

**Data and dimensions** ..... 20A.14

**To fit**

- 1 Inspect the "O" ring (A1) and, if necessary, fit a new "O" ring.
- 2 Lightly lubricate the "O" ring with clean engine lubricating oil and put the pump into position on the timing case. Ensure that the key (A2) is engaged correctly in the keyway of the drive gear.
- 3 Fit the spring washer and the nut to retain the drive gear. Tighten the nut to approximately 15 Nm (11 lbf ft) 1,5 kgf m.
- 4 Hold the top of the pump toward the engine to remove the backlash and fit the nuts to the pump flange. Tighten them to 22 Nm (16 lbf ft) 2,2 kgf m.
- 5 **Release the locking screw (B2) on the fuel pump and adjust the spacer to enable the locking screw to be tightened on the slot of the spacer (B1). Tighten the locking screw on the fuel pump to 12 Nm (9 lbf ft) 1,2 kgf m. Check that the spacer cannot move. The drive shaft of the fuel pump is now free to move.**
- 6 Fully tighten the nut for the drive gear to 80 Nm (59 lbf ft) 8,2 kgf m. Fit the gear cover.
- 7 Fit the fuel pipes, the cables and the electrical connections to the pump.
- 8 Eliminate air from the fuel system, see operation 20A-08.
- 9 Fit the rocker cover, operation 12A-01.
- 10 **Remove the locking pin from the flywheel.**
- 11 Operate the engine and check for leakage. With the engine at the normal temperature of operation, check that the idle speed and the maximum no-load speed are correct, see operation 20A-07.



**Coolant pump**

---

**To dismantle and to assemble**      **21A-03**

---

**Special tool:**

Puller, PD.155C

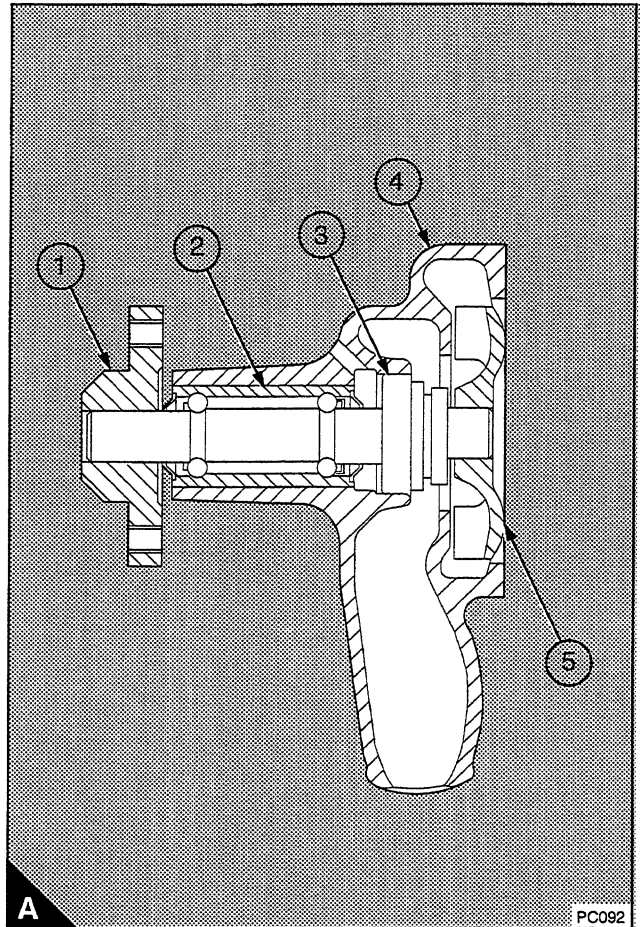
Adaptors, PD.155B-5, for use with the puller

**Consumable products:**POWERPART Retainer (oil tolerant)

---

**To dismantle**

- 1** Remove the coolant pump (A4) from the engine, operation 21A-02.
- 2** Withdraw the hub (A1) with the puller and the adaptors.
- 3** Support the pulley end of the pump body. Use a suitable adaptor to press the shaft and bearing assembly (A2) through the impeller (A5) and coolant seal (A3). Continue to press until the shaft and bearing assembly are out of the pump body.
- 4** Discard the impeller and the shaft and bearing assembly. Remove and discard the coolant seal.
- 5** Clean the body of the pump with a suitable safe cleaning fluid. Inspect the pump body for cracks.



---

## **Electrical equipment**

**23**

Alternators ..... 23A

Starter motors ..... 23B

Starting aid ..... 23C

## **Starter motors**

**23B**

**General description** ..... 23B.02

### **Starter motor**

23B-01 To remove and to fit ..... 23B.03

23B-02 To maintain the brush gear and the commutator ..... 23B.03

23B-03 To test on the engine ..... 23B.04

**Technical data** ..... 23B.05

CLICK HERE TO **DOWNLOAD** THE COMPLETE MANUAL

- Thank you very much for reading the preview of the manual.
- You can download the complete manual from: [www.heydownloads.com](http://www.heydownloads.com) by clicking the link below



- Please note: If there is no response to CLICKING the link, please download this PDF first and then click on it.

CLICK HERE TO **DOWNLOAD** THE COMPLETE MANUAL