Engine preservation

Introduction

The recommendations indicated below are designed to prevent damage to the engine when it is withdrawn from service for a prolonged period. Use these procedures after the engine is withdrawn from service. The instructions for the use of POWERPART products are given on the outside of each container.

Procedure

1 Completely clean the outside of the engine.

2 When a preservative fuel is to be used, drain the fuel system and fill it with the preservative fuel. POWERPART Lay-Up 1 can be added to the normal fuel to change it to a preservative fuel. If preservative fuel is not used, the system can be completely filled with normal fuel but the fuel must be drained and discarded at the end of the storage period together with the fuel filter canister.

3 Operate the engine until it is warm. Then correct leakages of fuel, lubricating oil or air. Stop the engine and drain the lubricating oil from the sump.

4 Renew the canister of the lubricating oil filter.

5 Fill the sump to the full mark with new and clean lubricating oil and add POWERPART Lay-up 2 to the oil to protect the engine against corrosion. If POWERPART Lay-Up 2 is not available, use a correct preservative fluid instead of the lubricating oil. If a preservative fluid is used, this must be drained and the lubricating oil sump must be filled to the correct level with normal lubricating oil at the end of the storage period.

6 Drain the coolant circuit, refer to "How to drain the cooling system" on page 23. In order to protect the cooling system against corrosion, fill it with an approved antifreeze mixture because this gives protection against corrosion, refer to "Coolant specification" on page 41.

Caution: *Certain corrosion inhibitor mixtures could cause damage to some engine components. It is recommended that you consult the Perkins Service Department, Peterborough.*

7 Operate the engine for a short period in order to circulate the lubricating oil and the coolant in the engine.

8 Disconnect the battery. Then put the battery into safe storage in a fully charged condition. Before the battery is put into storage, protect its terminals against corrosion. POWERPART Lay-Up 3 can be used on the terminals.

9 Clean the engine breather pipe (if one is fitted) and seal the end of the pipe.

10 Remove the atomisers and spray POWERPART Lay-Up 2 for one to two seconds into each cylinder bore with the piston at BDC.

Slowly turn the crankshaft one revolution and then fit the atomisers, complete with new seat washers.

11 Remove the air filter. Then, if necessary, remove the pipe installed between the air filter and the induction manifold. Release the cap screws and remove the rocker cover. Spray POWERPART Lay-Up 2 around the rocker shaft assembly and into the induction ports in the cylinder head, as indicated on the container label. Fit the rocker cover. Seal the manifold with waterproof tape.

12 Remove the exhaust pipe. Spray POWERPART Lay-Up 2 into the exhaust manifold. Seal the manifold with waterproof tape.

13 Seal the vent pipe of the fuel tank or the fuel filler cap with waterproof tape.

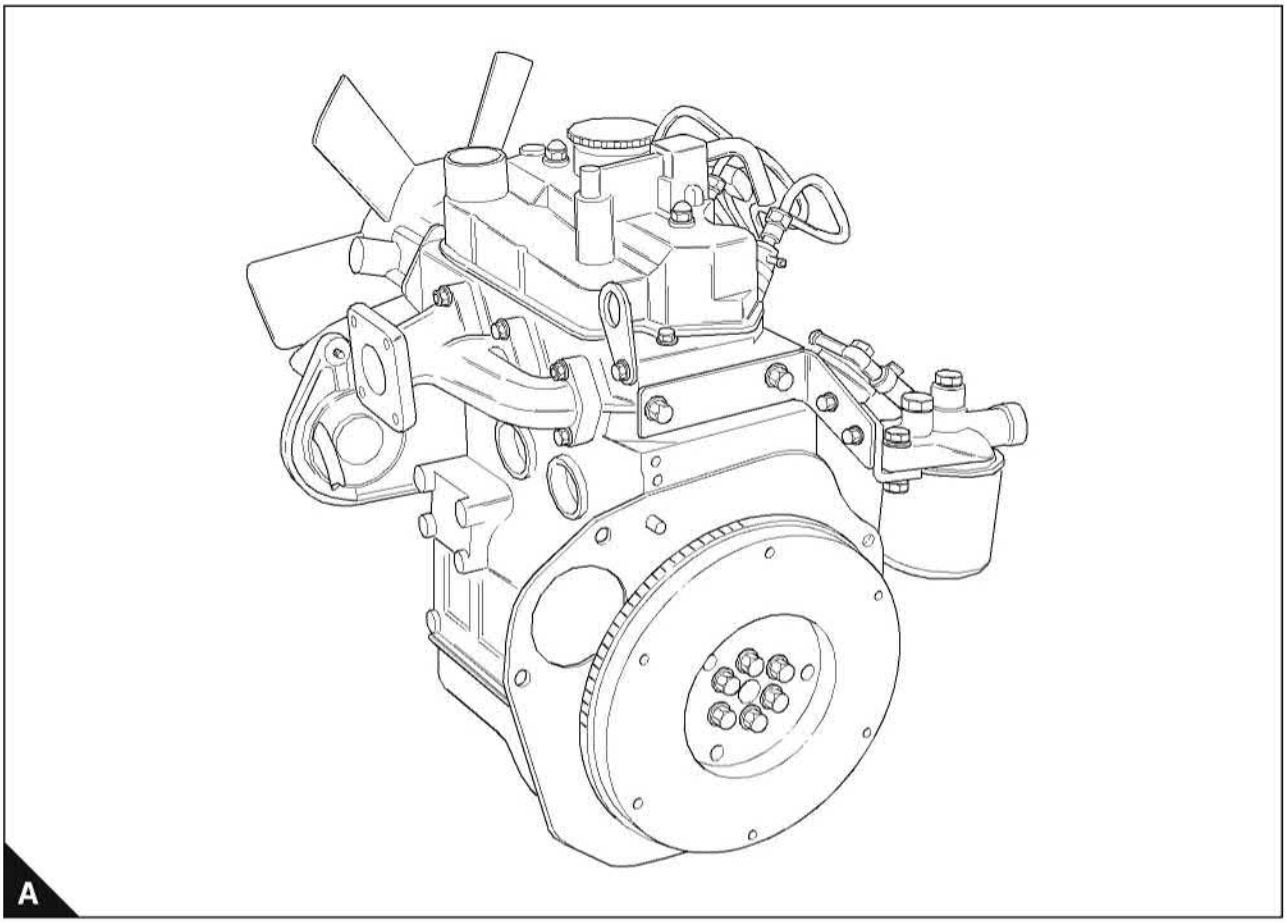
14 Remove the alternator drive belt and put it into storage.

15 In order to prevent corrosion, spray the engine with POWERPART Lay-Up 3. Do not spray the area inside the alternator cooling fan.

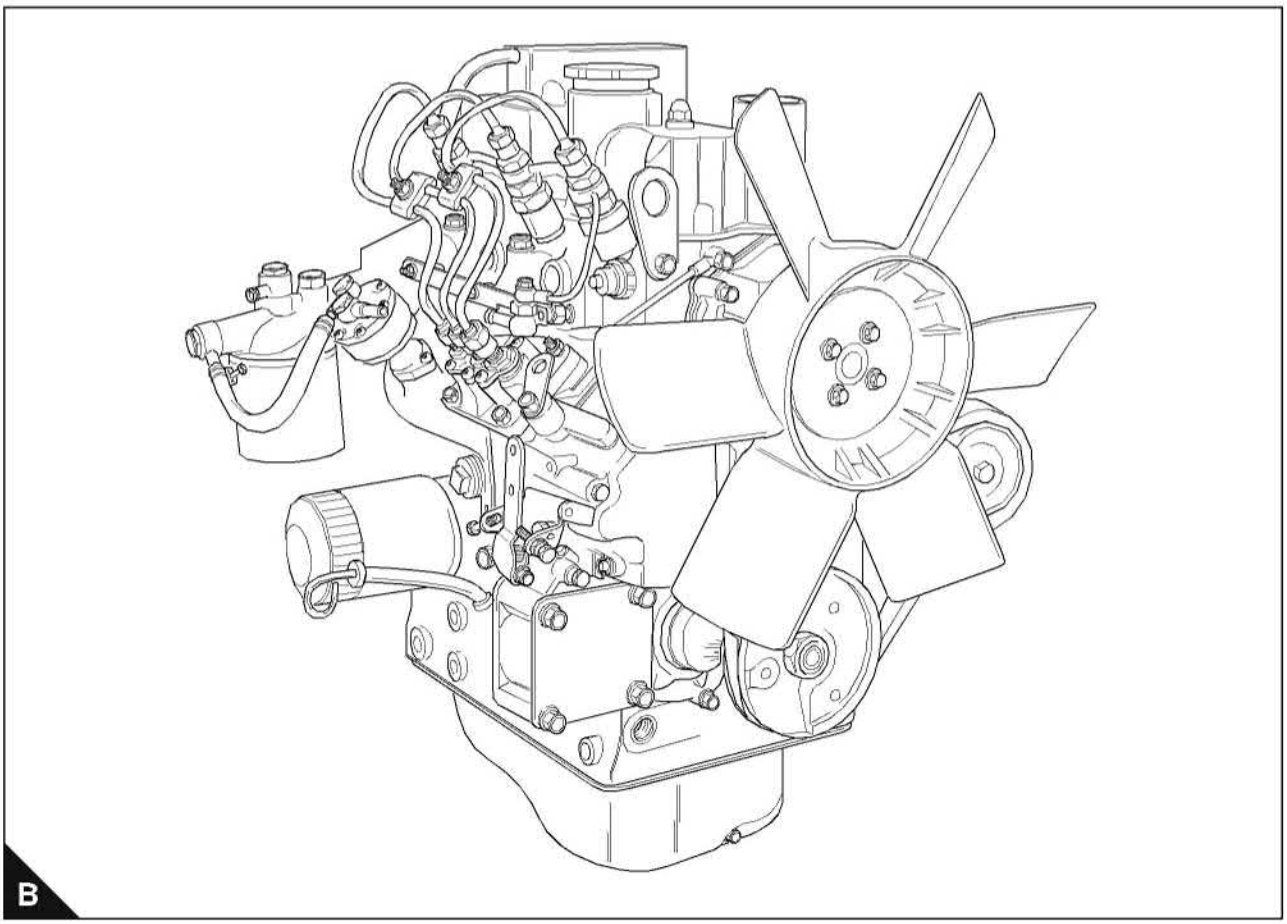
Caution: *After a period in storage, but before the engine is started, operate the starter motor with the stop switch (refer to illustration A under "How to start a cold engine with the fuelled starting aid" on page 17) held in the "STOP" position until oil pressure is indicated. Oil pressure is indicated when the low pressure warning light is extinguished. If a solenoid stop control is used on the fuel injection pump, it must be disconnected for this operation.*

If the engine protection is done correctly according to the above recommendations, no corrosion damage will normally occur. Perkins are not responsible for damage which may occur when an engine is in storage after a period in service.

Engine views - 3 cylinder front and rear



A



B

Recommended torque tensions

Most of the torques on the engine are standard. Torques specific to individual operations are listed in the relevant operation. The standard torques listed in the tables below can be used when a specific torque is not necessary.

Note: The torques below apply to components lubricated lightly with clean engine oil before they are fitted.

Standard torques for setscrews, studs and nuts

Thread size	Bolt Strength	Coarse Screw Thread				Fine Screw Thread			
		Pitch (mm)	Torque (Nm)	Torque (lbf ft)	Torque (kgf m)	Pitch (mm)	Torque (Nm)	Torque (lbf ft)	Torque (kgf m)
M4	8.8 11T	0,7	3 4	2 3	0,3 0,4				
M5	8.8 11T	0,8	6 8	4 6	0,6 0,8				
M6	8.8 11T	1,0	10 14	7 10	1,0 1,4				
M8	8.8 11T	1,25	26 32	19 24	2,7 3,3	1,0	30 35	22 26	3,0 3,6
M10	8.8 11T	1,5	50 62	37 46	5,1 6,3	1,25	56 66	41 49	5,7 6,7
M12	8.8 11T	1,75	75 104	55 77	7,6 10,6	1,25	84 113	62 83	8,6 11,5
M14	8.8 11T	2,0	118 157	87 116	12,0 16,0	1,5	132 167	97 123	13,5 17,0
M16	8.8 11T	2,0	167 230	123 170	17,0 23,4	1,5	175 245	129 181	17,8 20,5

Examples of applicable material

Bolt Strength	Example
8.8 11T	S45C SCM435

Crankshaft journal diameters

Engine model/Journal type	Journal No.	Diameter mm (in)	
		Standard	Service limit
102-05			
Standard	1	42,964 - 42,975 (1.69150 - 1.69193)	42,90 (1.689)
	2	45,948 - 45,959 (1.80897 - 1.80941)	45,90 (1.807)
Undersize 0,25 mm (0.01 in)	1	42,714 - 42,725 (1.68165 - 1.68210)	42,65 (1.679)
	2	45,698 - 45,709 (1.79913 - 1.79960)	45,65 (1.797)
Undersize 0,50 mm (0.02 in)	1	42,464 - 42,475 (1.67181 - 1.67224)	42,40 (1.669) (1)
	2	45,448 - 45,459 (1.78930 - 1.78972)	45,40 (1.787) (1)
103-07			
Standard	1, 2	42,964 - 42,975 (1.69150 - 1.69193)	42,90 (1.689)
	3	45,948 - 45,959 (1.80897 - 1.80941)	45,90 (1.807)
Undersize 0,25 mm (0.01 in)	1, 2	42,714 - 42,725 (1.68165 - 1.68210)	42,65 (1.679)
	3	45,698 - 45,709 (1.79913 - 1.79960)	45,65 (1.797)
Undersize 0,50 mm (0.02 in)	1, 2	42,464 - 42,475 (1.67181 - 1.67224)	42,40 (1.669) (1)
	3	45,448 - 45,459 (1.78930 - 1.78972)	45,40 (1.787) (1)
103-10			
Standard	1, 2, 3	45,964 - 45,975 (1.80960 - 1.81004)	45,90 (1.807)
Undersize 0,25 mm (0.01 in)	1, 2, 3	45,714 - 45,725 (1.79980 - 1.80020)	45,65 (1.797)
Undersize 0,50 mm (0.02 in)	1, 2, 3	45,464 - 45,475 (1.78992 - 1.79035)	45,40 (1.787) (1)
103-13			
Standard	1, 2, 3	57,957 - 57,970 (2.28177 - 2.28228)	57,9 (2.280)
Undersize 0,25 mm (0.01 in)	1, 2, 3	57,707 - 57,720 (2.27192 - 2.27244)	57,6 (2.268)
Undersize 0,50 mm (0.02 in)	1, 2, 3	57,457 - 57,470 (2.26210 - 2.26260)	57,4 (2.260) (1)
103-15			
Standard	1, 2, 3	67,957 - 67,970 (2.67550 - 2.67597)	67,90 (2.6732)
Undersize 0,25 mm (0.01 in)	1, 2, 3	67,707 - 67,720 (2.66563 - 2.66614)	67,65 (2.6634)
Undersize 0,50 mm (0.02 in)	1, 2, 3	67,457 - 67,470 (2.65579 - 2.65630)	67,40 (2.6535) (1)
104-19, 104-22			
Standard	1, 2, 3, 4	67,957 - 67,970 (2.67550 - 2.67597)	67,90 (2.6732)
Undersize 0,25 mm (0.01 in)	1, 2, 3, 4	67,707 - 67,720 (2.66563 - 2.66614)	67,65 (2.6634)
Undersize 0,50 mm (0.02 in)	1, 2, 3, 4	67,457 - 67,470 (2.65579 - 2.65630)	67,40 (2.6535) (1)

(1) If the diameter is less than this value, the crankshaft must be renewed.

3

Cylinder head assembly

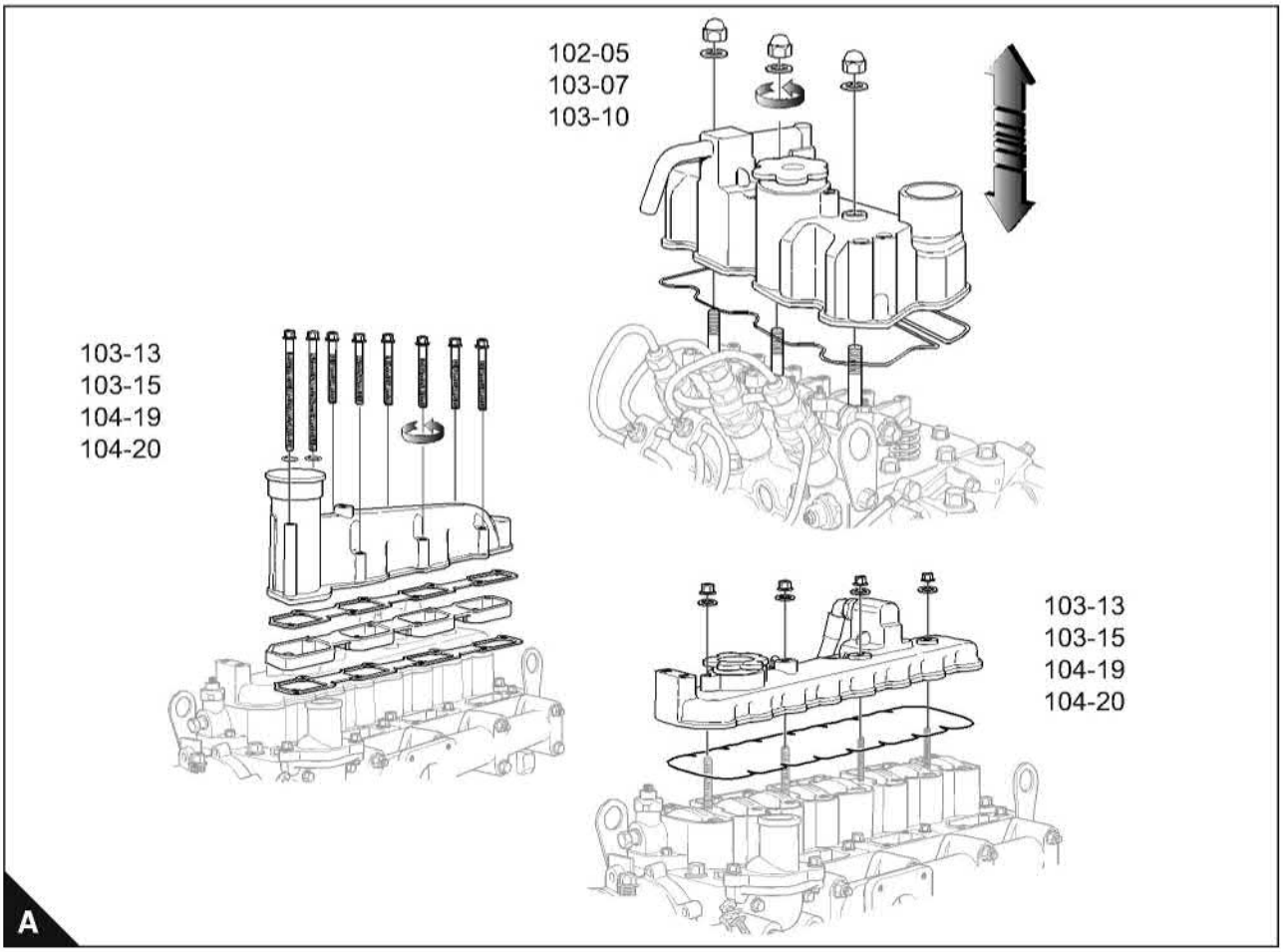
Rocker cover and inlet manifold

To remove and to fit **Operation 3-1**

Special requirements

Torque Nm (lbf ft) kgf m	
102-05, 103-07, 103-10	11 (8) 1,1
103-13, 103-15	10 (7) 1,0
104-19, 104-22	14 (10) 1,4

Note: Inspect the joint, renew if necessary.

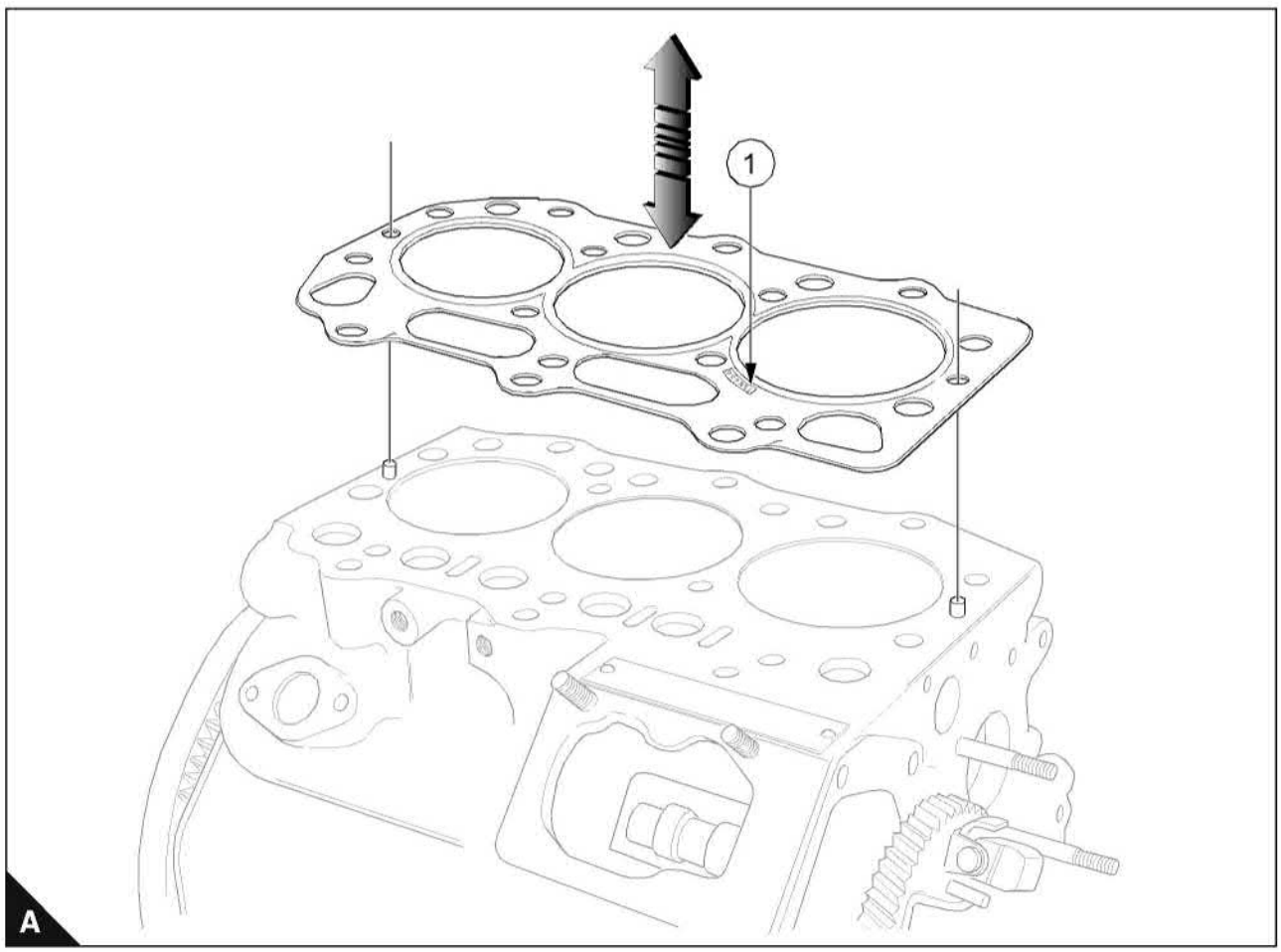


Cylinder head gasket

To remove and to fit — Operation 3-13

Align gasket on dowels, gasket must only be assembled with markings (A1) facing up.

Note: Always fit dry.



4

Piston and connecting rod assemblies

Big end bearing and cap

To remove and to fit **Operation 4-1**

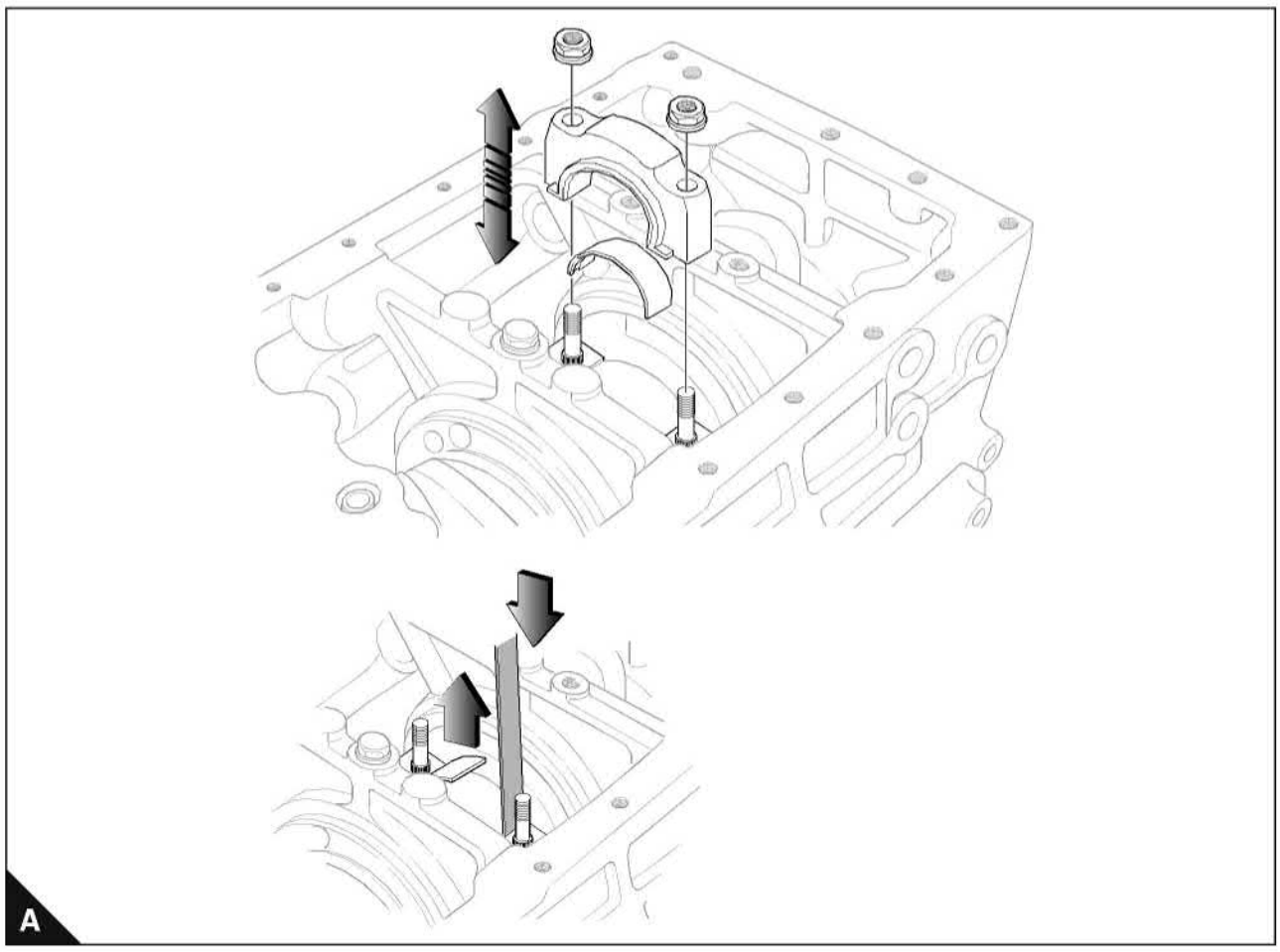
Special requirements

Torque Nm (lbf ft) kgf m		Clearance mm (in)	
102-05, 103-07	23 (17) 2,3	**Standard**	**Service limit**
103-10	32 (24) 3,2	0,1 - 0,3 (0.004 - 0.012)	0,7 (0.276)
103-13, 103-15, 104-19, 104-22	52 (38) 5,3		

Ensure that when the connecting rods are fitted an axial play (clearance) is provided.

Note: Identify each rod/piston/cylinder pair on disassembly.

During assembly apply a thin layer of clean engine lubricating oil to the crank pins with .



5

Crankshaft assembly

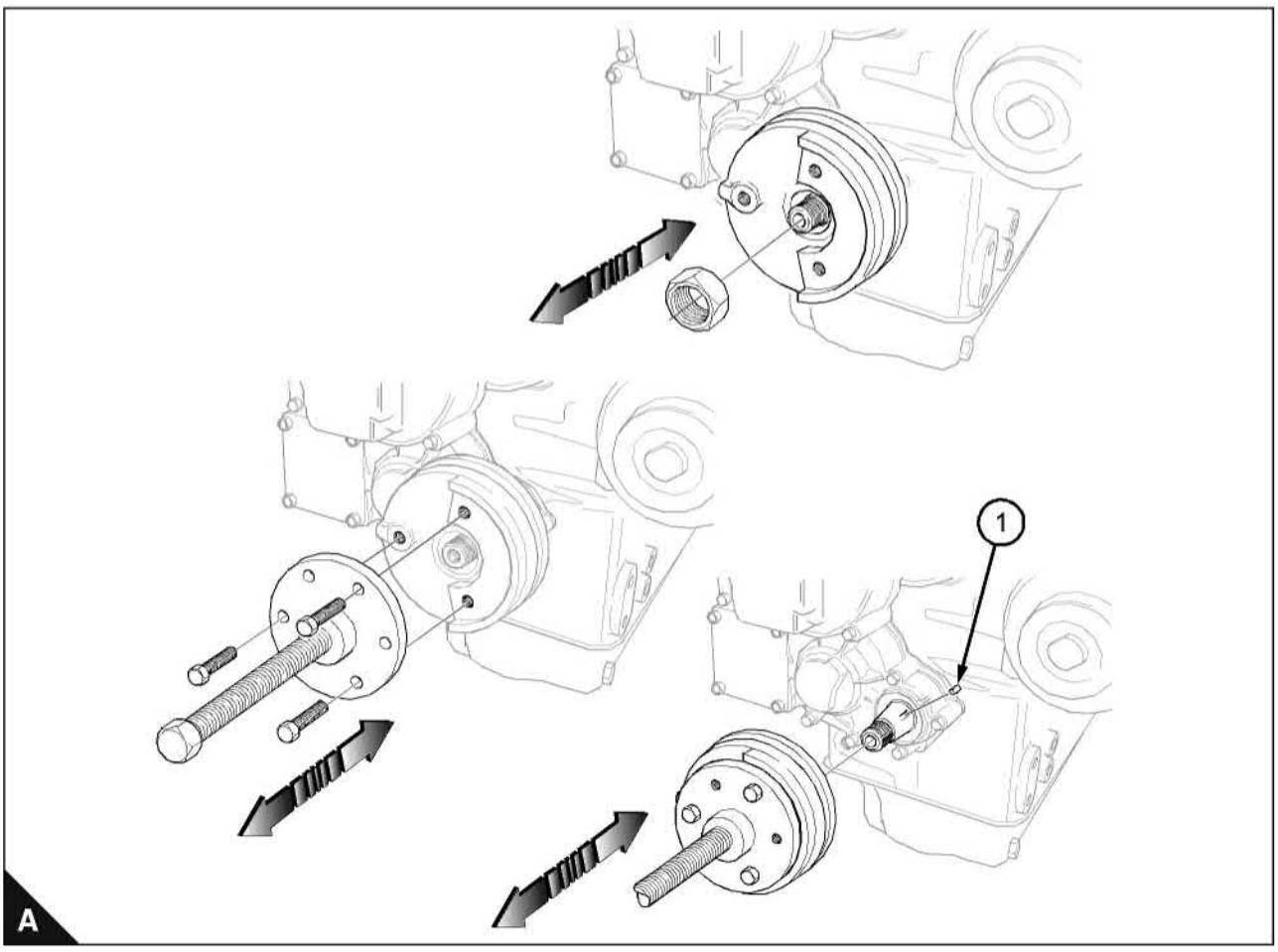
Crankshaft pulley

To remove and to fit **Operation 5-1**

Special requirements

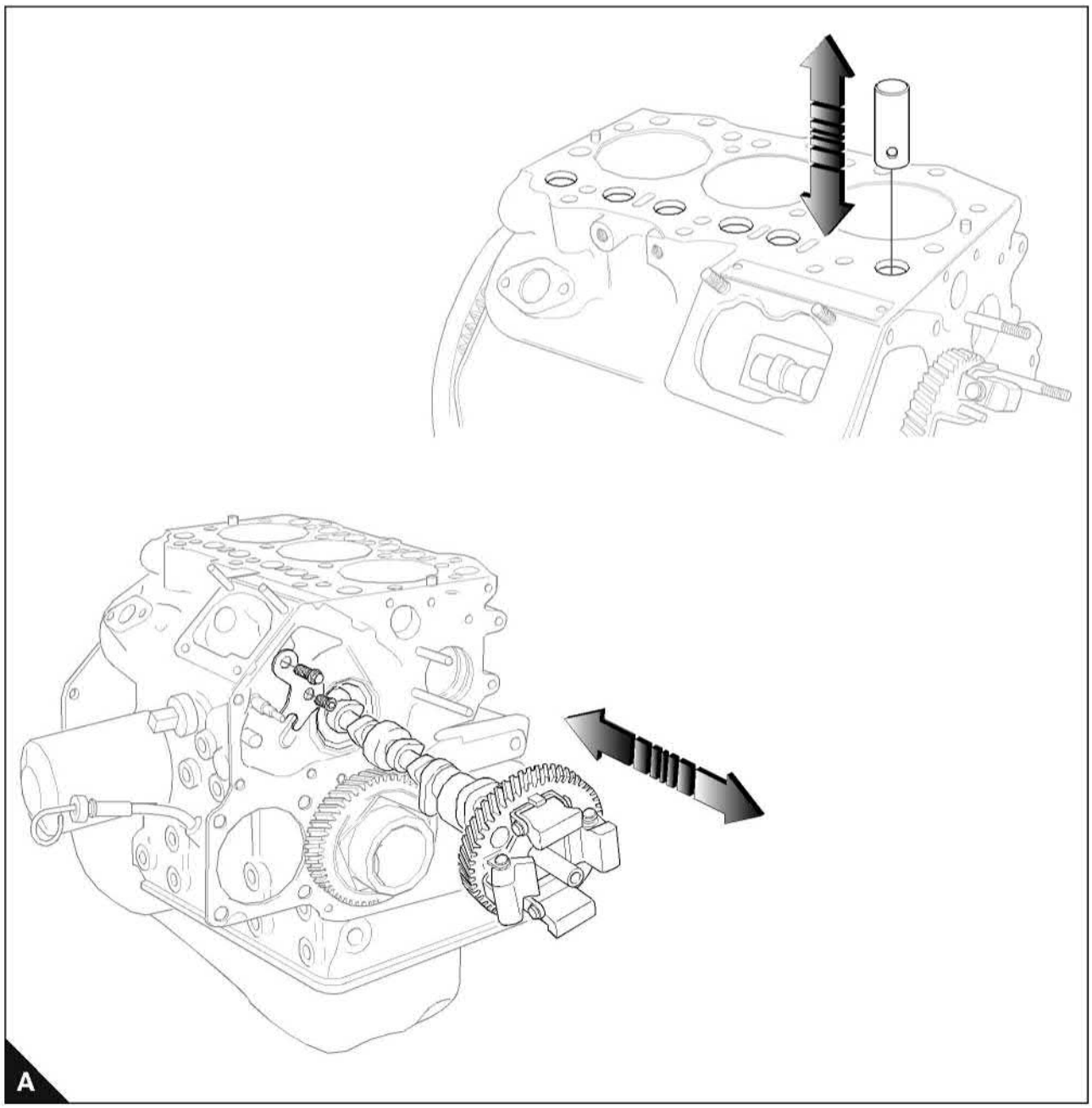
Special tools		Torque Nm (lbf ft) kgf m	
Description	**Part number**	102-05, 103-07	93 (69) 9,5
Crankshaft pulley remover	21825619	103-10	123 (91) 12,5
		103-13, 103-15, 104-19, 104-22	304 (224) 31

Note: Store the key (A1) in a safe place until assembly.



To remove and to fit **Operation 6-5**

Caution: *Remove fuel lift pump and all the cam followers before removing the camshaft.*



8

Engine timing

Fuel injection pump timing

To adjust timing — Operation 8-1

Special requirements

Special tools		Torque Nm (lbf ft) kgf m	
Description	Part number		
Fuel pump spill pipe	21825680	Delivery valve holder	42 (31) 4,2

1 Set the piston for number 1 cylinder to TDC on the compression stroke. Turn the crankshaft counter-clockwise a quarter of a revolution.

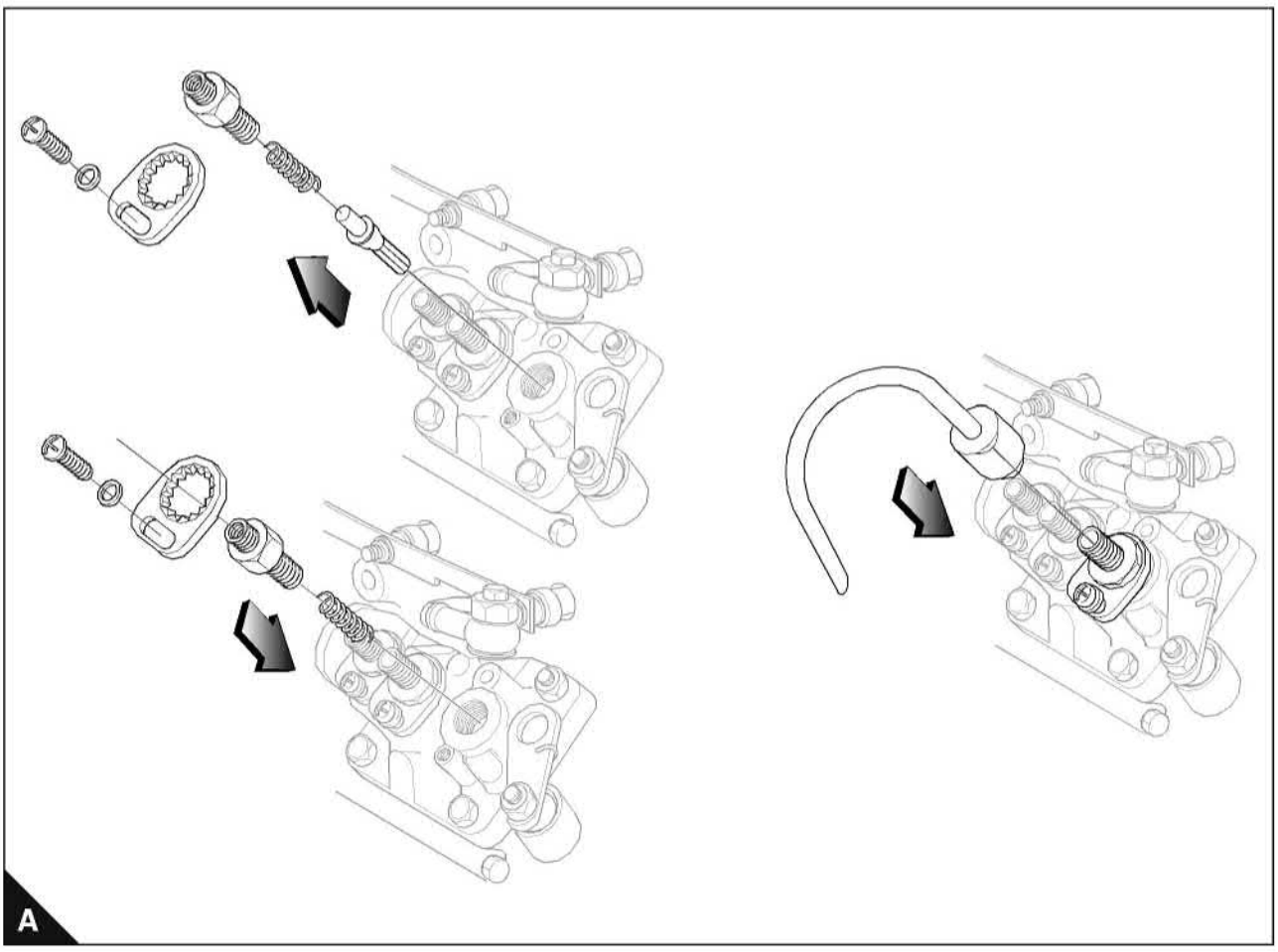
2 Disconnect or remove the ESOS, HP pipes and LP fuel inlet pipes from pump (A).

3 Ensure the throttle lever is held in the maximum fuel position after the procedure.

4 Remove the delivery valve holder for number 1 cylinder and remove the delivery valve. Store the delivery valve in appropriate clean fuel until assembly.

Note: The fuel pump may need to be moved to an upright position to remove and to fit the delivery valves.

Continued



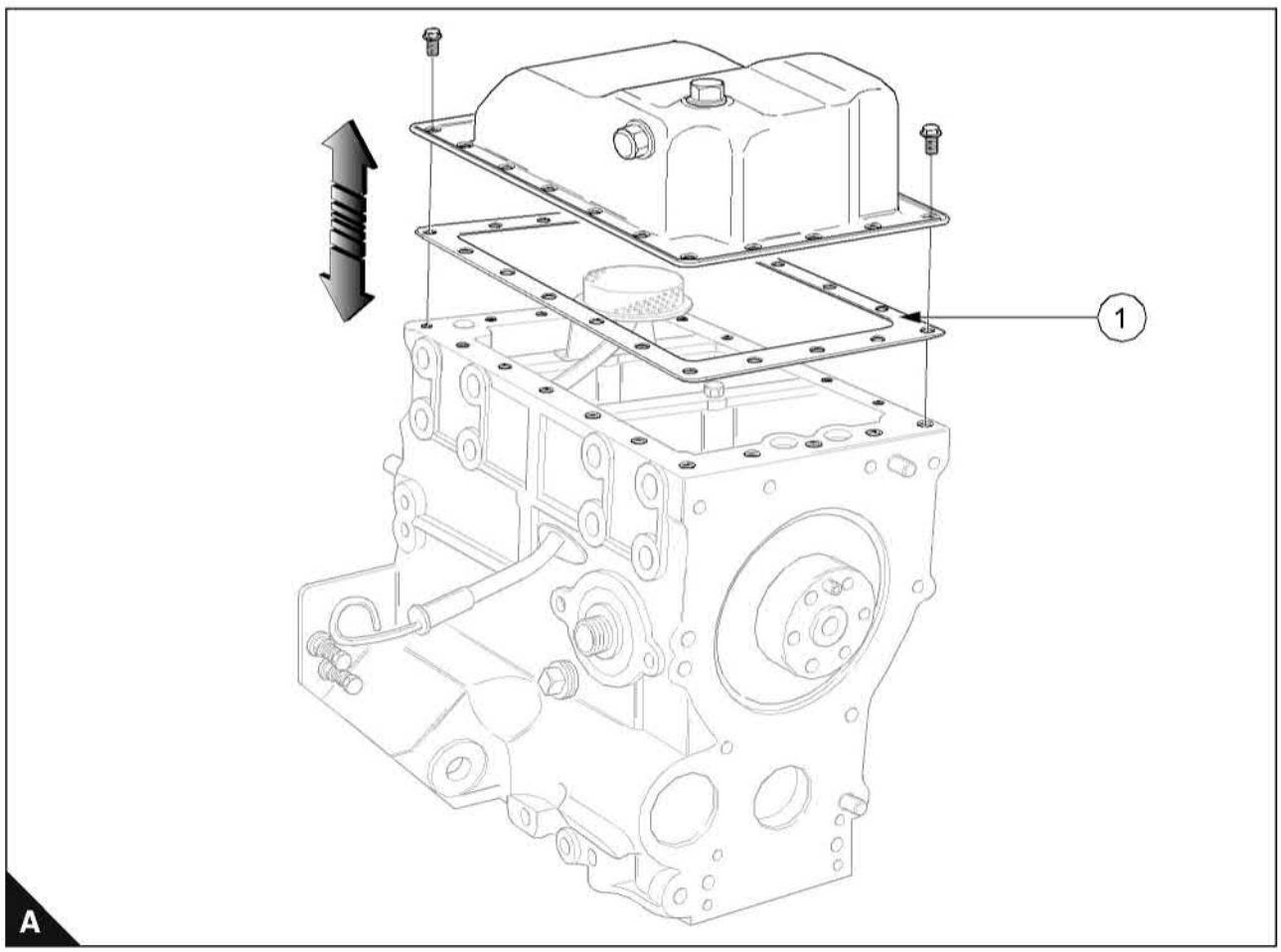
Lubricating oil sump

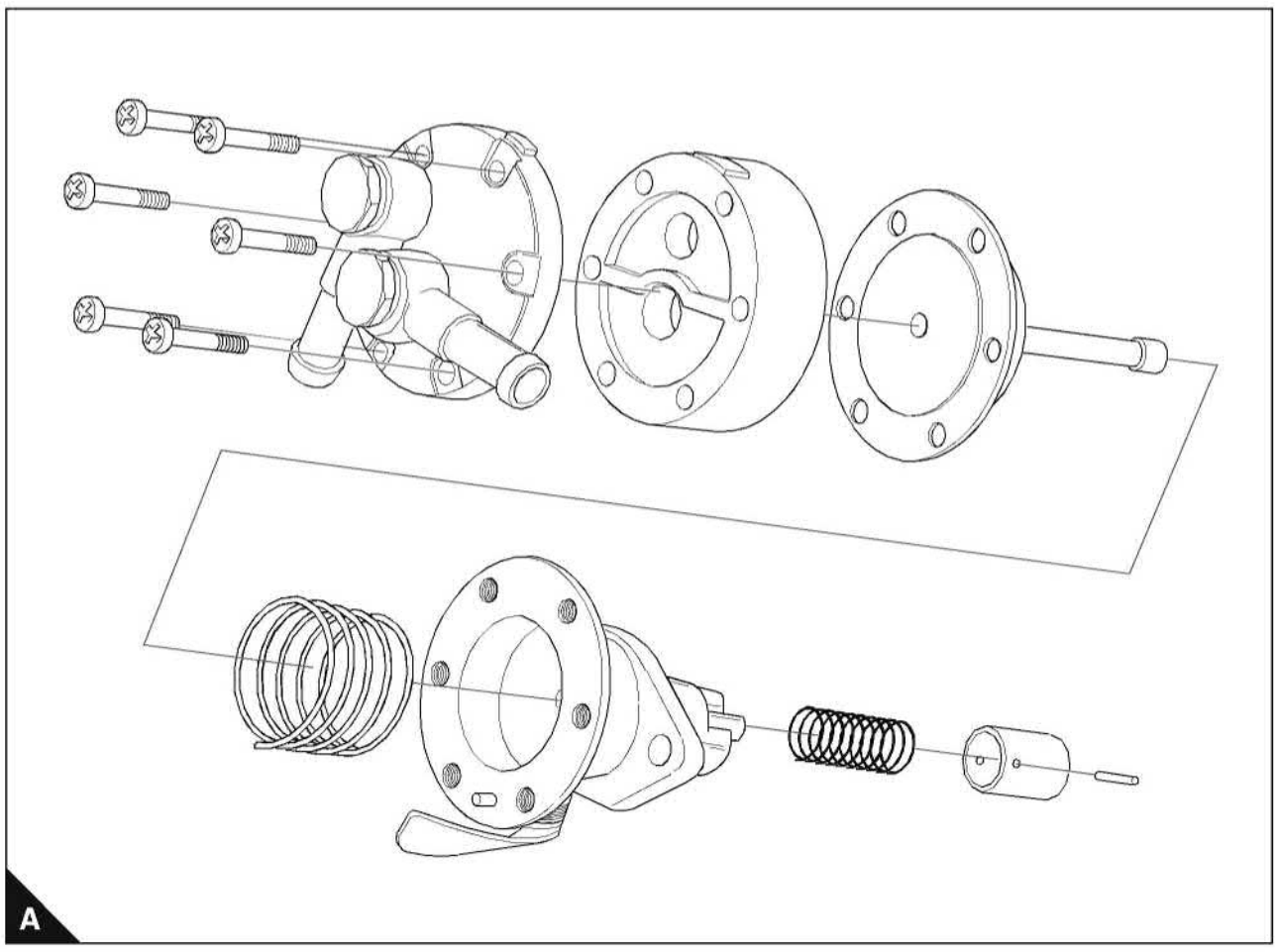
To remove and to fit **Operation 10-3**

Special requirements

Torque Nm (lbf ft) kgf m	
Sump setscrews	11 (8) 1,1

Note: When the sump is fitted renew the joint (A1).





A

To test and inspect — Operation 12-4

Special requirements

Engine model (wax pellet type thermostat)	Temperature when valve starts to open °C (°F)	Temperature when fully open °C (°F)
102-05, 103-07	73 to 77 (163.4 to 170.6)	87 (188.6)
103-10, 103-13, 103-15, 104-19, 104-22	80 to 84 (176 to 183.2)	95 (203)

Renew the thermostat if the valve is:

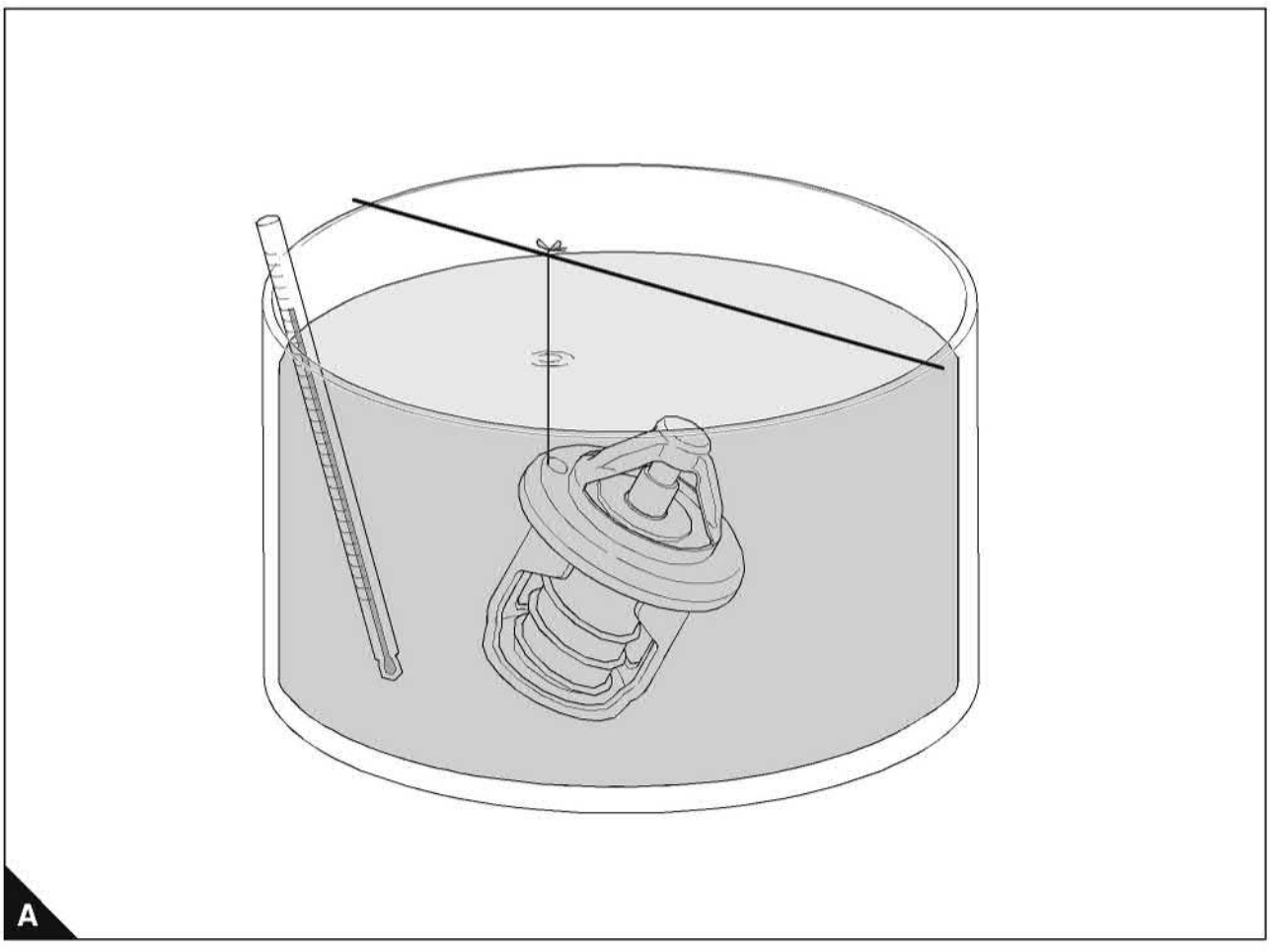
- Open at ambient temperature.
- Closed at the fully open temperature.

1 Place the thermostat into the water.

2 Increase the water temperature gradually and record the water temperature when the valve starts to open and the temperature when the valve is fully open. The standard values are given in the table.

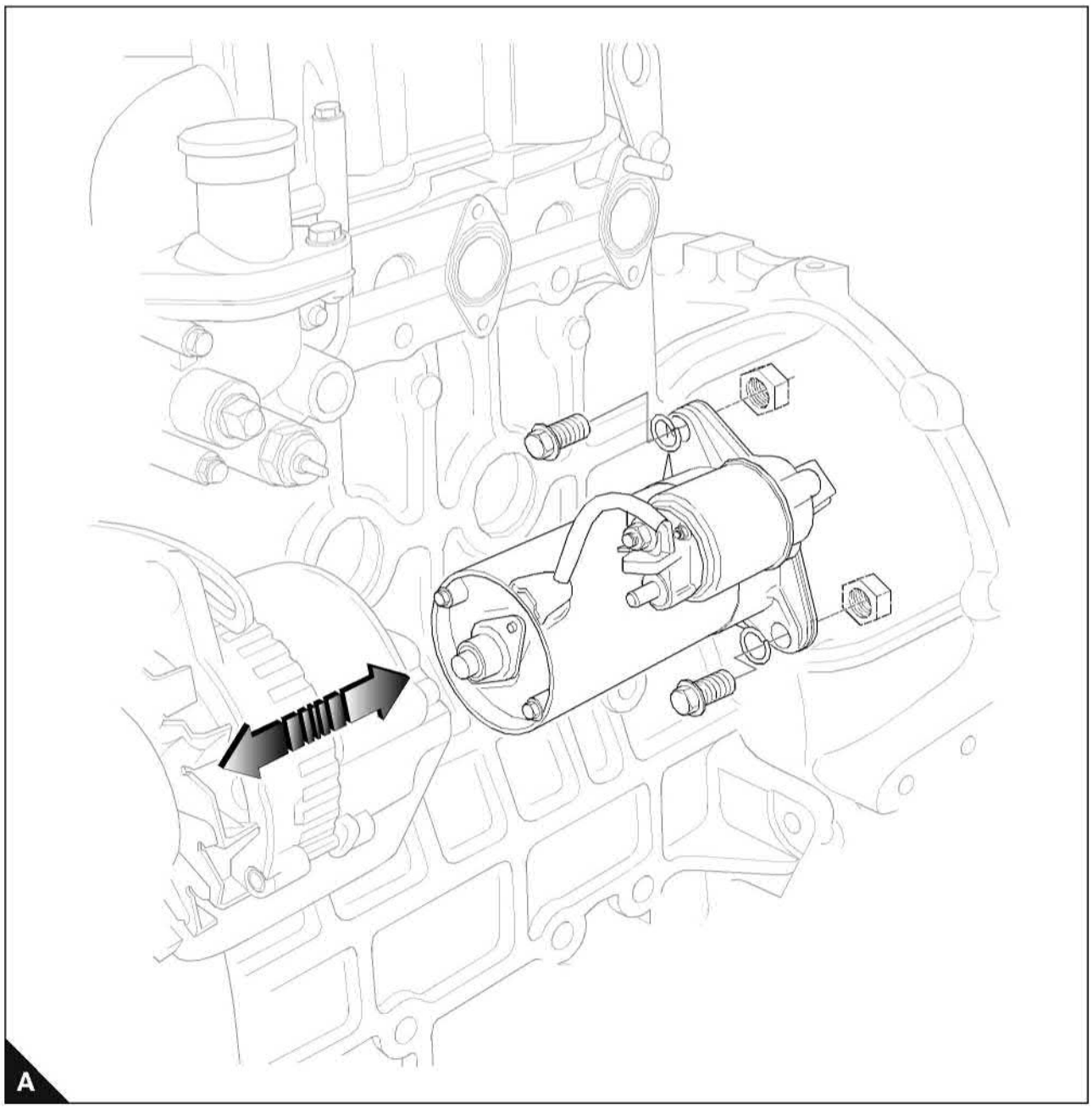
Notes:

- The "Start to open" temperature will be stamped on the thermostat.
- 3 to 5 minutes will be required before the valve starts to open.



A

To remove and to fit **Operation 14-3**



Auto shutdown wiring diagram

55 Amp alternator charge lamp

Note: Alternator charge lamp rating: 12V - 2.2W at 850 rev/min.

When the engine is at rest the alternator charge lamp is illuminated via the battery and it extinguishes when the alternator operates.

The use of a lower wattage bulb than the above will increase speed at which self excitation occurs upon initial run up, e.g. a charge lamp with a lower wattage bulb will have a rating of 12V - 1.2W at 1300 rev/min.

Pin number connector	Wire colour	Connection
1	Red	Key Switch - AC
2	Orange	Key Switch - 50
3	Red / Black	Solenoid
4	Brown	Oil Pressure Switch
5	Blue	Water Temperature Switch
6	Black	Ground (earth)