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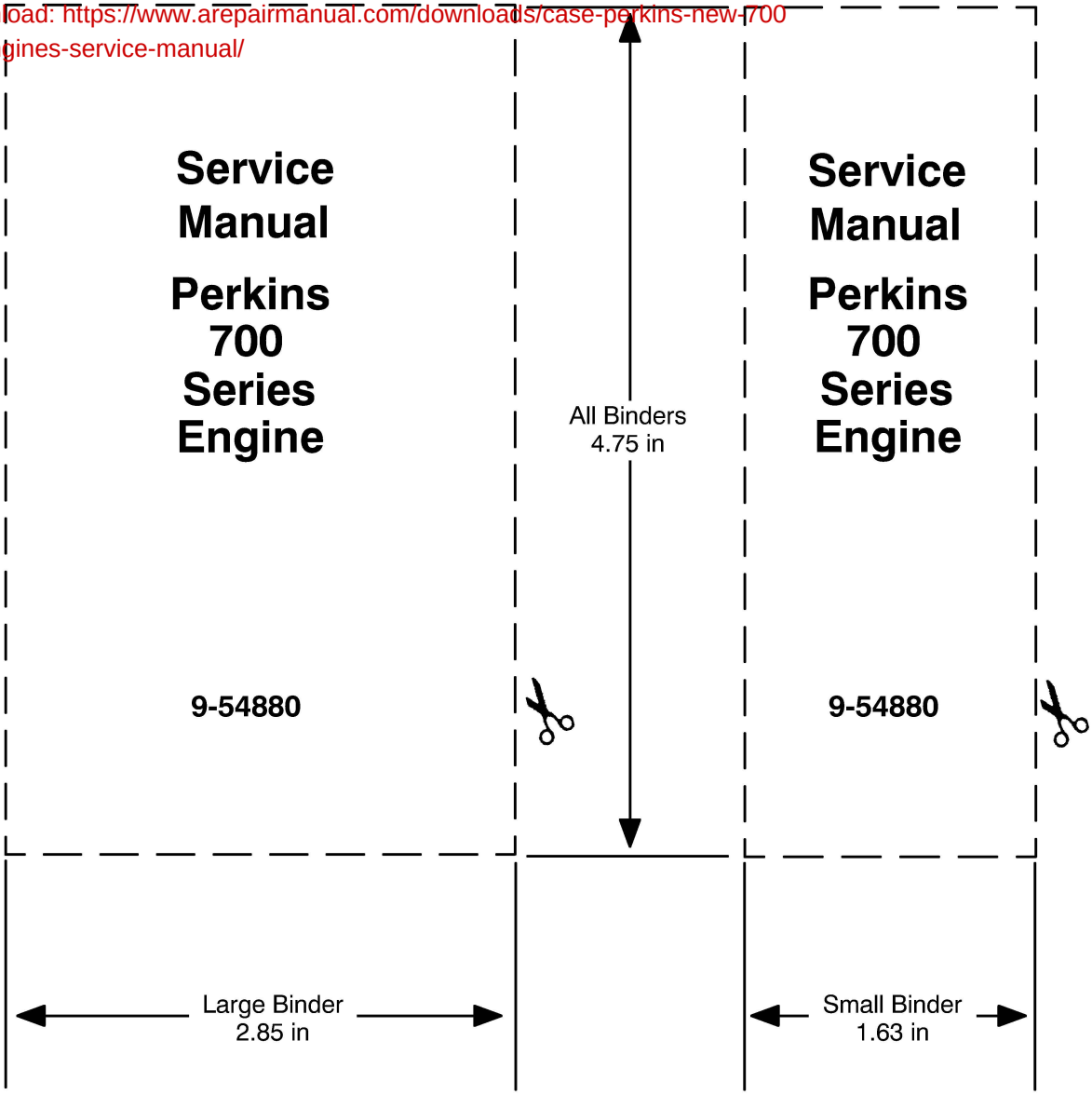

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SERVICE MANUAL

PERKINS NEW 700 SERIES

ENGINES

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10-02 GENERAL INFORMATION

Introduction

This workshop manual has been designed to provide assistance in the service and overhaul of Perkins 700 Series engines.

Warning! *Read and remember the "Safety precautions". They are given for your protection and must be used at all times.*

The engines that are referred to in this manual are the UA (3,0 litre - direct injection), and the UB (2,6 litre - indirect injection). Both engines conform to Stage 1 off-highway emissions to Cl -8 mode cycle ref. ISO 8178 part. 4.

Where the information applies only to one engine type, this will be indicated in the text.

When reference is made to the "left" or "right" side of the engine, this is as seen from the flywheel end of the engine.

Special tools have been made available and a list of these tools is given in section 25. Reference to the relevant special tools is also made at the beginning of each operation.

Loctite recommended consumable products are listed in section 10. Reference to the relevant consumable products is made at the beginning of operation.

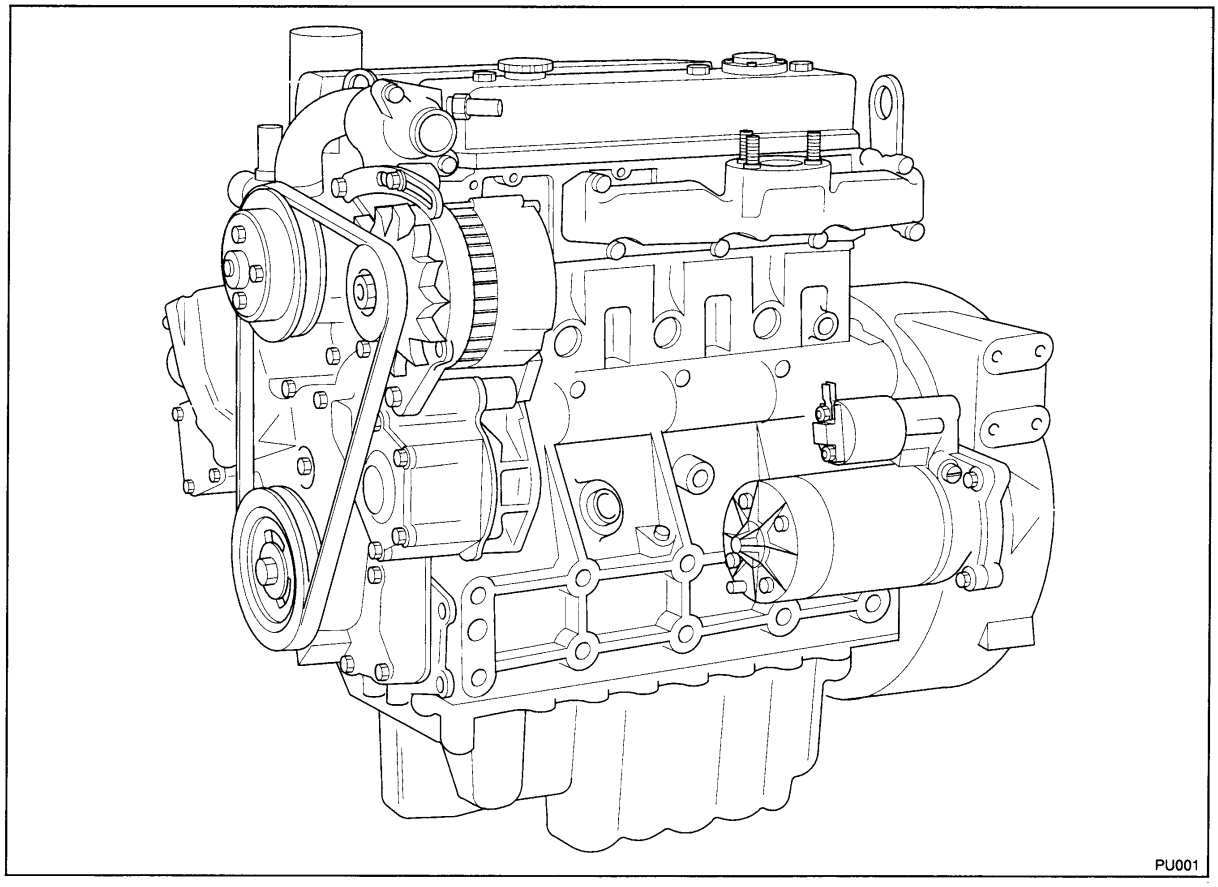
Data and dimensions are included at the end of each section.

Danger is indicated in the text by two methods:

Warning! *This indicates that there is a possible danger to the person.*

Caution: *This indicates that there is a possible danger to the engine.*

Note: *Is used where the information is important, but there is not a danger.*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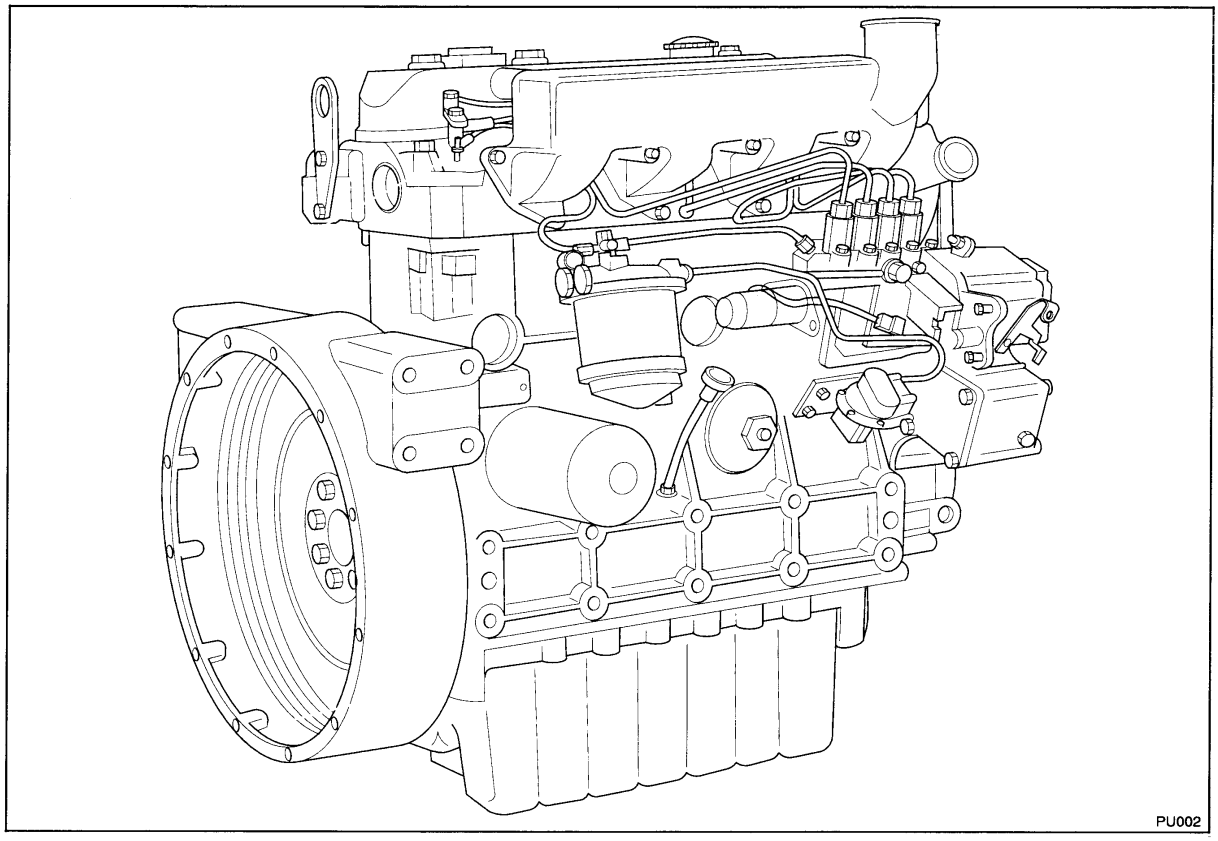
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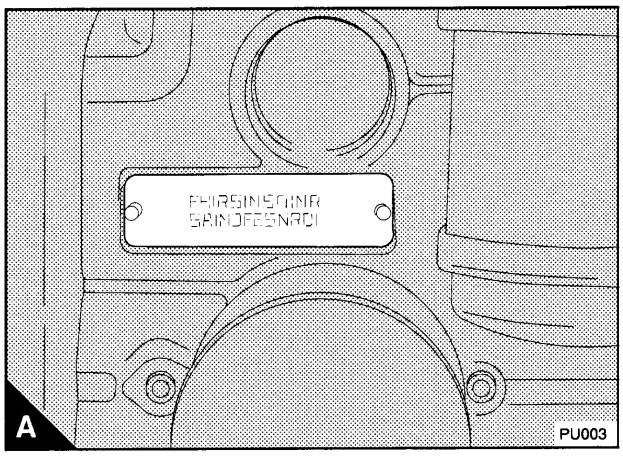
Engine identification



The 3,0 litre version, is a water cooled, naturally aspirated, four cylinder diesel engine with direct injection. It has been specifically designed for industrial and agricultural applications and is identified with the letters UA.

The 2,6 litre version, is a water cooled, naturally aspirated, four cylinder diesel engine with indirect injection. It has been specifically designed for forklift truck applications and is identified with the letters UB.

The engine number is stamped on a label (A) which is fastened to the right, rear side of the cylinder block.

An example of an engine number is:

UA80862UI23456A

The components of the engine number are as follows:

UA80862UI23456A

UA	Type code letters
80862	Build list number
U	Built in the UK
123456	Engine serial number
A	Year of manufacture

If you need parts, service or information for your engine, you must give the complete engine number to your Case distributor.

Safety

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 caution must be used to prevent injury).
- Do not make adjustments that you do not understand.
- Make sure 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, 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 white the engine runs.*
- Do not operate the engine if a safety guard has been removed.
- Do not remove the filler cap or any component 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.
- Make sure that the engine is operated only from the control panel or from the operator's position.
- If your skin comes into contact with highpressure 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.
- Discard used lubricating oil in accordance with local regulations to prevent contamination.
- Make sure 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.
- Always use a safety cage to protect the operator when a component is to be pressure tested in a container of water. Install 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.
- Do not clean an engine while it runs. If cold cleaning fluids are applied to a hot engine, certain components on the engine may be damaged.
- Install only genuine Case parts.

Safety

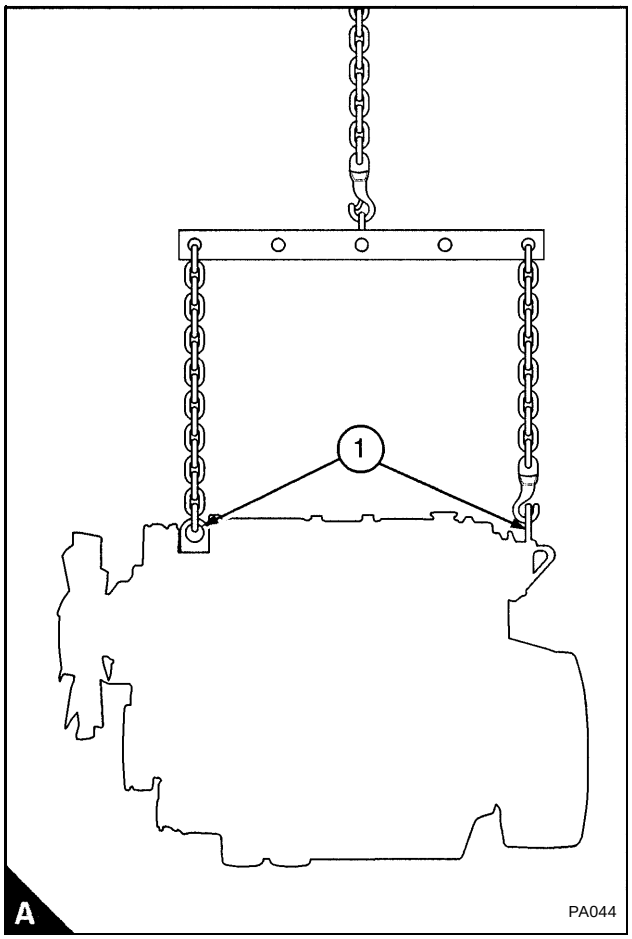
Engine lift equipment

Caution: *If the sump contains engine lubricating oil and the engine is tilted to an extreme angle or turned onto its side or end faces, lubricating oil can enter the closed breather system, pass into the induction manifold and the cylinder bores. If this occurs, it will cause an hydraulic lock in the engine and the engine may be damaged. If it is necessary to move an engine in this way, the lubricating oil must first be drained.*

The maximum weight of the engine without coolant, lubricant or a gearbox installed will vary for different applications. It is recommended that lift equipment of 300 kg (662 lbs) minimum capacity is used.

Before the engine is lifted:

- Always use engine lift equipment of the approved type and of the correct capacity to lift the engine. It is recommended that lift equipment of the type shown in (A) is used to provide a vertical lift, directly above the engine lift brackets (A1). Never use a single lift bracket to raise an engine.
- Check the engine lift brackets for damage and that they are secure before the engine is lifted. The torque for the setscrews for the engine lift brackets is 22 N m (16 lbf ft) 2,2 kgf m.
- To prevent damage to the rocker cover, make sure that there is clearance between the hooks and the rocker cover.
- Use lift equipment or obtain assistance to lift heavy engine components such as the cylinder block, the cylinder head, the flywheel housing, the crankshaft and the flywheel.



Viton seals

Some seals used in engines and in components installed to engines are made of Viton.

Viton is used by many manufacturers and is a safe material under normal conditions of operation.

If Viton is burned, a product of this burnt material is an acid which is extremely dangerous. Never allow this burnt material to come into contact with the skin or with the eyes.

If it is necessary to come into contact with components which have been burnt, make sure that the precautions which follow are used:

- Make sure that the components have cooled.
- Use Neoprene gloves and discard the gloves safely after use.
- Wash the area with calcium hydroxide solution and then with clean water.
- Disposal of components and gloves which are contaminated must be in accordance with local regulations.

If there is contamination of the skin or eyes, wash the affected area with a continuous supply of clean water or with calcium hydroxide solution for 15-60 minutes. Obtain immediate medical attention.

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Recommended torque tensions.....11B

Compression test data 11C

Basic engine data 11A

Basic engine data..... 11A.02

Basic engine data

Cycle.....Four stroke
Number of cylinders.....4
Cylinder arrangement..... In line
Firing order 1,3,4,2
Direction of rotation ..... Clockwise from the front

Induction system.....Naturally aspirated

Cubic capacity:
- UA engines..... 2,956 litres (183 in^3)
- UB engines..... 2,602 litres (159 in^3)

Compression ratio:
- UA engines.....17.5:1
- UB engines.....22.0:1

Combustion system:
- UA engines..... Direct injection
- UB engines.....Indirect injection

Nominal bore:
- UA engines.....97,0 mm (3.82 in)
- UB engines.....91,0 mm (3.58 in)
- Stroke.....100,0 mm (3.94 in)

Valve tip clearances (cold):
- Inlet and exhaust.....0,35 mm (0.014 in)

Lubricating oil pressure (at normal engine temperature):
- Minimum pressure at maximum engine speed.....280 kPa (41 lbf/ in^2) 2,86 kgf/cm^2

Typical dry installed engine weight (1) .....200 kg (440 lb)
(1) Engine weight may alter with final specification

Recommended torques tensions 11B

General information

Thread sealant 11B.02

Recommended torques tensions

Standard torque tensions 11B.03

Special torque tensions 11B.03

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Fuel system 11B.04
Lubrication system 11B.04
Cooling system 11B.05
Flywheel and housing 11B.05
Auxiliary equipment 11B.05

11B-02 RECOMMENDED TORQUES

General information

Thread sealant

When setscrews or studs are installed into holes which are tapped into the inside of the engine, a suitable sealant should be used.

M.E.A.S. (Micro encapsulated anaerobic sealant) fasteners are installed into the holes that are open to the inside of the engine. A thin layer of sealant is applied to the threads of the fasteners when they are manufactured. The colour of the sealant can be red, yellow or blue.

With M.E.A.S. sealed studs, the sealed end must be installed into the cylinder head / cylinder block etc. Make sure that the threaded holes have a 1,59 mm (0.0625 in) 45° chamfer, such that when the new fasteners are installed the M.E.A.S. sealant is not removed. If the fasteners have to be removed and installed again, the threads must be cleaned and a suitable sealant applied.

Recommended torque tensions

Most of the fasteners referred to in this manual have standard torque tensions which are shown in the table below. Those fasteners that need special torque tensions are listed in separate tables together with some standard torque tensions most frequently used.

Procedures referred to in this manual will have the torque tensions (standard or special) shown in the text and also listed in the tables for special torque tensions.

The torque tensions that are shown in this manual apply to fasteners with dry threads.

Standard torques tension for setscrews, studs and nuts

Thread size	Torque tension - setscrews and nuts			Torque tension - studs (metal end)		
	Nm	lbf ft	kgf m	Nm	lbf ft	kgf m
M6 x 1,00	9	7	0,9	5	4	0,5
M8 x 1,25	22	16	2,2	11	8	1,1
M10 x 1,50	44	33	4,5	18	13	1,8
M12 x 1,75	78	58	8,0	25	18	2,5
M14 x 2,00	124	91	12,6	-	-	-
M16 x 2,00	190	140	19,3	-	-	-

Special torque tensions for setscrews and nuts

Description	Thread size	Torque tension		
		Nm	lbf ft	kgf m
Cylinder head assembly		*See*	*page*	*12A.10*
Setscrews, cylinder head to cylinder block	M6	9	7	0,9
Setscrews, rocker shaft bracket	M8	22	16	2,2
Nuts, rocker shaft bracket	M8	11	8	1,1
Cap nuts, rocker cover	M8	22	16	2,2
Setscrews, inlet manifold to cylinder head	M8	18	13	1,8
Setscrews, engine lift brackets	M8	22	18	2,2
Piston and connecting rod assembly				
Nuts, connecting rod big end caps	M9	54	40	5,5

Description	Thread size	Torque tension		
		Nm	lbf ft	kgf m
Crankshaft assembly				
Setscrews, main bearing caps	M14	147	108	15,0
Setscrews, crankshaft pulley to crankshaft	M16	185	136	19,0
Timing case and drive assembly				
Setscrews, timing case to cylinder block	M8	22	16	2,2
Setscrews, timing case to cylinder block	M10	44	33	4,5
Setscrews, retainer plate - camshaft for fuel injection pump	M6	9	7	0,9
Setscrews, thrust washer - camshaft for the engine	M6	9	7	0,9
Setscrews, timing case to blanking plate	M8	22	16	2,2
Nuts, timing case to blanking plate	M8	22	16	4,5
Setscrews, timing case to blanking plate	M10	44	32	4,5
Aspiration system				
Setscrews, breather cover	M6	9	7	0,9
Fuel system				
Nuts, high-pressure fuel pipes	M12	22	16	2,2
Setscrews, atomiser clamps	M8	12	9	1,2
Injector - 704.26 (UB) engines	M20	39	29	4,0
Nuts, low-pressure fuel pipes	M12	20	15	2,0
Setscrews, fuel lift pump to cylinder block	M8	22	16	2,2
Setscrews, cassette pump to cylinder block	M8	22	16	2,2
Nuts, cassette pump to cylinder block	M8	22	16	2,2
Screw, fuel leak-off	M6	12	9	2,2
Nuts, maximum fuel adjustment screw	M8	14	10	1,4
Angleich unit	M16	18	13	1,8
Governor assembly to camshaft gear	M5	7	5	0,7
Lubrication system				
Plug, lubricating oil sump	3/4 UNF	34	25	3,5
Cap screws, oil pump to timing case	M6	9	7	0,9
Setscrews, lubricating oil sump	M8	22	16	2,2
Relief valve assembly to timing case	M18	20	15	2,0

Description	Thread size	Torque tension		
		Nm	lbf ft	kgf m
Cooling system				
Nuts / screws, coolant pump to cylinder block	M8	22	16	2,2
Setscrews, fan and pulley to coolant pump hub	M8	22	16	2,2
Setscrews, fan and pulley to coolant pump hub	M6	9	7	0,9
Flywheel and housing				
Setscrews, flywheel to crankshaft	M12	100	77	10,7
Electrical equipment				
Nuts, alternator pulley	M17	60	44	6,1
Bolt / nut, alternator to timing case	M10	24	18	2,4
Setscrew, adjusting lever to alternator	M8	12	9	1,2
Glow plugs	M10	17	13	1,7
Glow plug connections	M4	1,5	1	0,2

11B-06 RECOMMENDED TORQUES

Compression test data 11C

Compression test data 11C.02
How to do a compression test 11C.02

11C-02 COMPRESSION TEST DATA

Compression test data

Tests have shown that many factors affect compression pressures. Battery and starter motor condition, ambient conditions and the type of gauge used can give a wide variation of results for a given engine. It is not possible to give accurate data for compression pressure, but tests have shown that the results should be within 2000/3500 kPa (300/500 lbf/in2) 21,0/35,0 kgf/CM2 for diesel engines.

Compression tests should only be used to compare between the cylinders of an engine. If one or more cylinders vary by more than 350 kPa (50 lbf/in2) 3,5 kgf/cM2, then those cylinders may be faulty.

Compression tests should not be the only method used to show the condition of an engine, but they should be used together with other symptoms and tests.

How to do a compression test

Caution: *Before the compression test, make sure that the battery is in good condition and that it is fully charged. Also make sure that the starter motor is in good condition.*

1 Make sure that the valve tip clearances are set correctly.

2 Remove the atomisers.

3 Install a suitable gauge into the hole in the cylinder for the atomiser.

4 Make sure that the engine cannot start:

- Disconnect the stop solenoid or put the stop control in the no-fuel position.
- Operate the starter motor and note the pressure indicated on the gauge.

5 Repeat for each cylinder.

Cylinder head assembly 12

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Rocker cover

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Rocker assembly

12A-02 To remove and to install 12A.04
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Cylinder head

12A-12 To inspect and to correct 12A.19
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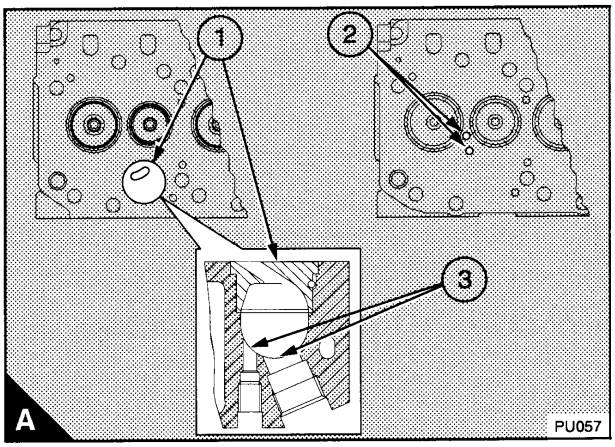
12A-02 CYLINDER HEAD ASSEMBLY

General description



Notes:

- *The front of the engine is when seen from the end with the timing case assembly.*
- *Number one cylinder is at the front of the engine.*

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 cylinder head assemblies for both the UA and UB engines contain two valves for each cylinder. From the front of the engine, the sequence for valves is first inlet and then exhaust.

The cylinder head for the UB engine contains a precombustion chamber (A1) that is made from a hardened manganese alloy. It will not be possible to, renew this chamber or to machine the bottom face of the cylinder head.

Included in the cylinder head assembly for UA and UB engines, there is a valve guide and a valve seat insert for each valve. The inserts and guides can be renewed if necessary. The new valve guides are pre-finished.

The face angle for all of the valves is 45° and the angle for all of the valve seats is 45°.

The Inlet and the exhaust valves are each installed to the cylinder head with a single valve spring and an oil seal that is installed over the top of the valve guide. The valve and valve spring are held in position with a hardened steel cap and two collets.

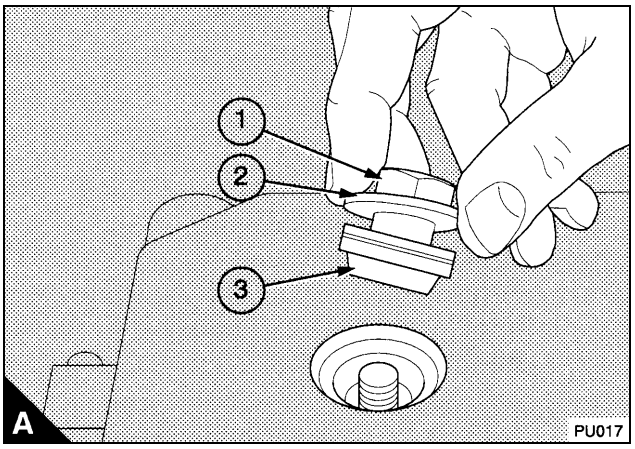
The glow plugs and the atomisers are both installed into the top of the cylinder head. The tip of the glow plug and the atomiser protrude through the bottorn face of the cylinder head (A2) on UA engines, and into the pre-combustion chamber (A3) on UB engines.

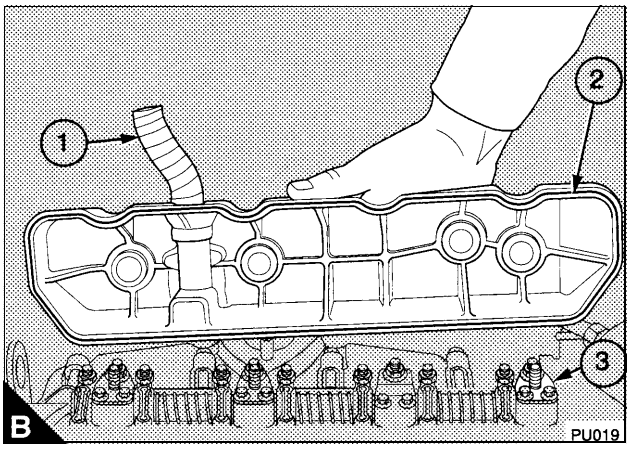
Caution: *The amount of protrusion for both atomiser and glow plug is important for the performance of the engine, therefore only Case parts should be used in service.*

Rocker cover

To remove and to install **12A-01**

The engine is installed with an aluminium rocker cover which includes a closed breather assembly and a connection for the breather pipe. A composite rubber seal is installed into a machined groove (B2) in the flange face of the cover.





To remove

1 Disconnect the breather pipe (B1).

2 Remove the cap nuts (A1), the steel washers (A2) and the rubber seals (A3).

3 Lift off the rocker cover (B).

To install

1 Check the condition of the rubber seals (A3) and the steel washers (A2) for the cap nuts (A1). If necessary, the seals for the cap nuts can be renewed.

2 If necessary, check, clean and renew the components of the breather system, operation 18A-02.

3 Check the condition of the rocker cover seal (B2) and renew the seal if necessary.

4 Clean the seal face of the cylinder head and install the rocker cover. When the cover is put on the cylinder head, make sure that the seal remains in the groove.

Caution: *If the cap nut (A1) is overtightened, the stud and plate assembly (B3), for the rocker pedestal may be damaged.*

5 Install the rocker cover. Make sure that the cap nuts, washers and the rubber seals are installed correctly. Tighten the cap nuts to 11 Nm (8 lbf ft) 1,1 kgf m.). Install the breather pipe.

Rocker assembly

To remove and to install **12A-02**

To remove

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

2 Release the eight setscrews (A1) for the brackets of the rocker shaft. Release gradually and evenly the nuts (A3) and then the nuts (A4) for the brackets of the rocker shaft.

Note: *The rocker assembly contains three plates (A2) which include the studs for the rocker cover. The plates must be installed to the correct rocker brackets (A).*

3 Remove the nuts and lift off the rocker assembly (B).

Note: *A hardened steel pin (B1) is installed in the lower part of the front bracket. The purpose of this pin, is to make sure that the bracket is in the correct position on the rocker shaft. The hole in the bracket will align with the oil hole (B2) in the cylinder head and make sure correct lubrication of the rocker assembly. Protect these holes to make sure that dirt cannot enter.*

To install

Cautions:

- *Before the rocker assembly is installed, make sure that the oit holes (B1) and (B2) are free of dirt.*
- *Check that the push rods (B3) install correctly in thesockets of the tappets.*

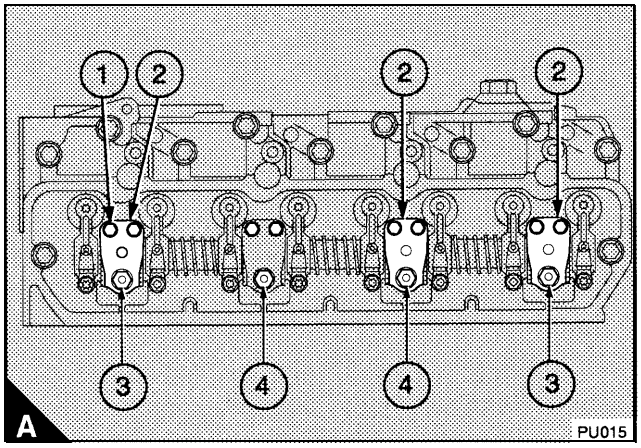
1 Put the rocker assembly (B) onto the cylinder head.

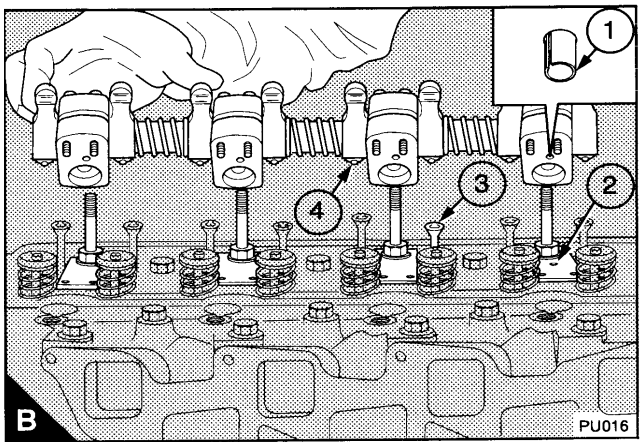
2 Install the plates (A2) to the correct brackets for the rocker shaft.

3 Install the fasteners (A1), (A3) and (A4) finger tight.

Caution: *As the fasteners are gradually tightened, make sure that the ends of the adjustment screws (B4) install correctly in the sockets (B3) of the push rods.*

4 Tighten gradually and evenly, the nuts (A4) and then the nuts (A3) to 22 Nm (1 6 lbt ft) 2,2 kgf m.





5 Tighten gradually and evenly, the eight setscrews (A1) to, 9 Nm (7 M ft) 0,9 kgf m. Tighten the inner setscrews first and then the outer setscrews.

6 Adjust the valve tip clearances, 12A-05.

7 Install the rocker cover, operation 12A-01.

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Rocker assembly

To disassemble and to assemble **12A-03**

To assemble

1 Remove the clips (A5) from both ends of the rocker shaft. Make sure that the ends of the rocker shaft are not damaged.

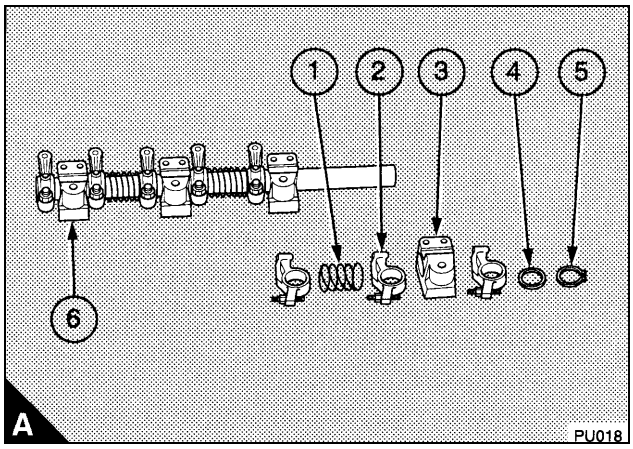
2 Remove the spacer (A4), the rocker levers (A2), the brackets (A3) and the springs (A1).

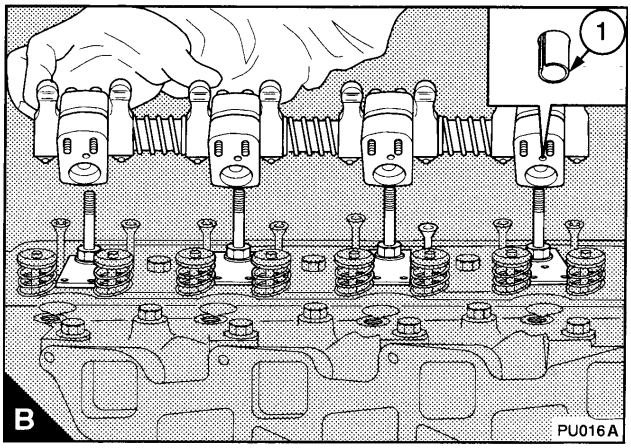
Note: *The bracket (A6), is installed to the rocker shaft with a hardened steel pin (B1) which aligns the oil holes. If either the rocker shaft or the bracket have to be renewed, a new pin must also be used.*

To assemble

1 Make sure that the oil holes in the rocker shaft and in the rocker levers are not restricted.

2 Before assembly, lubricate the components with clean engine lubricating oil. Assemble the components in the correct sequence; the rocker levers should be installed in the original sequence. Install the spacers and clips to the ends of the rocker shaft.





To inspect **12A-04**

1 Clean and inspect all the components for wear and any other damage. Check the clearance between the rocker levers and the rocker shaft. If the clearance is more than 0, 124 mm (0.0048 in), either renew the rocker lever or the rocker shaft, or both if necessary.

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