Perkins 4.41 Series

Model LM

WORKSHOP MANUAL

4 cylinder, naturally aspirated, diesel engine for agricultural and industrial use

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Specifications

Basic engine data

Number of cylinders	4
Cylinder arrangement	In-line
Cycle	Four stroke
Direction of rotation	Clockwise from the front
Induction system	Naturally aspirated
Combustion system	Direct injection
Nominal bore	101 mm (3.98 in)
Stroke	127 mm (5.000 in)
Compression ratio	15.3:1
Cubic capacity	407 litres (248 in^3)
Firing order	1, 3, 4, 2
Valve tip clearance (cold):	
- Inlet	0,20 mm (0.008 in)
- Exhaust	0,45 mm (0.018 in)
Lubricating oil pressure **(1)**	207 kpa (30 lbf/in^2) 2,1 kgf/cm^2

(1) Minimum at maximum engine speed and normal engine temperature.

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Rocker cover

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

Engines are supplied with a rocker cover (A) made of a composite material.

To remove

1 Disconnect the breather pipe.

2 Remove the cap nuts (A2) together with the steel washers (A3) and the shim washers (A4) from the top of the rocker cover.

3 Lift off the rocker cover and the joint (A6).

Caution: *When the rocker cover is fitted, the cap nuts are tightened onto the nuts of the rocker brackets. During removal of the cap nuts, it is possible to loosen the nuts of the rocker brackets. The nuts of the rocker brackets should be tightened to the correct torque every time the cover is removed.*

To fit

1 Check the seal of the oil filler cap (A1), the sealing washers (A5), the steel washer (A3) and, if fitted, the shim washer (A4) for the cap nuts (A2).

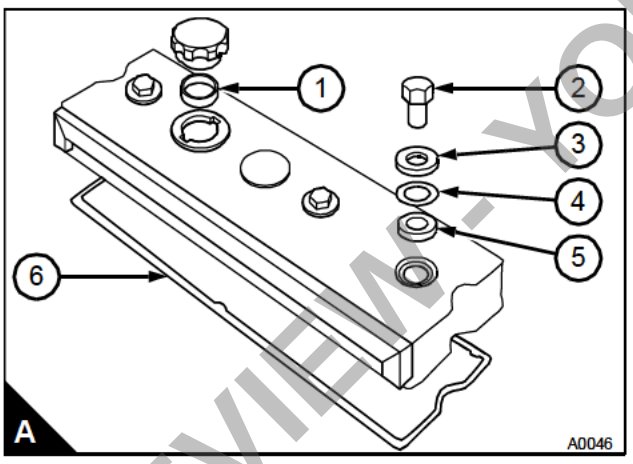
2 Check the condition of the rocker cover joint (A6). If necessary, the joint can be removed and renewed.

3 Clean the joint face of the cylinder head and fit the rocker cover.

4 Fit the sealing washers, the steel washers, the shims (if fitted) and the cap nuts.

Caution: *Damage to the sealing washer can occur if the cap nut is not tightened centrally through the sealing washer and the rocker cover. If the sealing washer is damaged it must be renewed.*

5 Tighten the cap nuts to 20 Nm (15 lbf ft) 2,1 kgf m.



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Recommended torque settings

The torque tensions below apply to components lubricated lightly with clean engine oil before they are fitted.

Description	Thread size	Torque		
		Nm	lbf ft	kgf m
Cylinder head assembly				
Setscrews, cylinder head	$^1/_2$ UNF	See Operation 3-8		
Fasteners, rocker shaft brackets:				
- Aluminium brackets	M12	40	30	4,1
- Sintered steel brackets	M12	75	55	7,6
Cap nuts, rocker cover	M12	20	15	2,1
Setscrews, inlet manifold to cylinder head	M10	44	33	4,5
Nuts, exhaust manifold to cylinder head	M10	44	33	4,5
Setscrews, engine lift bracket	M10	44	33	4,5
Piston and connecting rod assembly				
Nuts, connecting rods	$^1/_2$ UNF	125	92	12,7
Crankshaft assembly				
Setscrews, main bearings	$^5/_8$ UNF	250	185	26,0
Setscrews, crankshaft pulley	$^7/_{16}$ UNF	115	85	11,8
Torxscrew, rear oil seal housing to cylinder block	M8	22	16	2,2
Cap screws, bridge piece to cylinder block	M6	16	12	1,6
Cap screws, rear oil seal housing to bridge piece	M6	13	10	1,3
Torxscrew, rear oil seal housing to bridge piece	M8	18	13	1,9
Setscrew, idler gear hub of balancer unit	M12	93	68	9,5
Nut, drive gear of balance weight	$^1/_2$ UNF	82	60	8,4
Setscrews, rear cover of balancer frame	M10	54	40	5,5
Setscrews, oil transfer plate (balancer unit)	M10	30	22	3,1
Setscrews, oil pump to balancer frame	M8	27	20	2,8
Setscrews, balancer to cylinder block	M10	54	40	5,5
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
Bolt, hub of idler gear	M10	44	33	4,5
Setscrew, camshaft gear	M12	78	58	8,0
Setscrews, timing case cover to timing case and block	M8	22	16	2,2
Cylinder block				
Setscrews, fitted instead of piston cooling jets	$^3/_8$ UNF	27	20	2,8
Aspiration system				
Setscrew, breather pipe to head	M8	22	16	2,8
Fuel system				
Nuts, high-pressure fuel pipes	M12	22	16	2,2
Setscrews, atomiser	M8	22	16	1,2
Setscrews, fuel lift pump	M8	22	16	2,2
Screw, for gear of fuel injection pump	$^3/_8$ UNF	27	20	2,8
Nuts for flange of fuel injection pump	M8	22	16	2,2

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Crankshaft bearings and thrust washers

Main bearings

Type (All bearings) ... Steel back, 20% tin-aluminium bearing material

Bearing width

Centre bearing ... 36,32/36,70 mm (1.430/1.445 in)
All other bearings ... 31,62/31,88 mm (1.245/1.255 in)

Bearing thickness at centre

All bearings ... 2,083/2,089 mm (0.0820/0.0823 in)

Bearing clearance

All bearings ... 0,057/0,117 mm (0.0022/0.0046 in)
Available undersize bearings ... -0,25 mm (-0.010 in); -0,51 mm (-0.020 in); -0,76 mm (-0.030 in)

Crankshaft thrust washers

Type ... Steel back, lead bronze bearing material
Position ... Each side of centre main bearing

Thickness:

Standard ... 2,26/2,31 mm (0.089/0.091 in)
Oversize ... 2,45/2,50 mm (0.096/0.098 in)

Balancer unit

Diameter of drive shaft for front bearing ... 28,562/28,575 mm (1.1245/1.1250 in)
Diameter of drive shaft for rear bearing ... 23,787/23,800 mm (0.9365/0.9370 in)
Number of teeth on gear of drive shaft ... 21
Backlash from gear of drive shaft to idler gear ... 0,17/0,29 mm (0.007/0.011 in)
End-float of drive shaft ... 0,13/0,30 mm (0.005/0.012 in)
Diameter of bore for front bearing of drive shaft ... 34,912/34,937 mm (1.3745/1.3755 in)
Diameter of bore for rear bearing of drive shaft ... 29,972/29,993 mm (1.1800/1.1808 in)
Diameter of bore for idler gear ... 47,64/47,65 mm (1.8755/1.8760 in)
Diameter of hub of idler gear ... 38,09/38,10 mm (1.4996/1.5000 in)
End-float of idler gear ... 0,07/0,23 mm (0.003/0.009 in)
Thickness of thrust washer for idler gear ... 4,14/4,29 mm (0.163/0.169 in)
Number of teeth on idler gear ... 37
Inside diameter of bushes in balancer frame and end cover (fitted) ... 38,133/38,174 mm (1.5013/1.5029 in)
Diameter of spigots for balance weights ... 38,054/38,069 mm (1.4982/1.4988 in)
Fit of spigot in bush ... 0,064/0,120 mm (0.0025/0.0047 in)
End-float of balance weights ... 0,19/0,40 mm (0.007/0.016 in)
Backlash of gears on balance weights ... 0,10/0,27 mm (0.004/0.011 in)
Backlash of drive gear to spline on balance weight ... 0,05/0,20 mm (0.002/0.008 in)
Number of teeth on drive gear ... 24
Number of teeth on spline on balance weight ... 16

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To inspect and to correct — Operation 3-15

1 Remove the cylinder head assembly, see Operation 3-7.

2 Remove the thermostat housing.

3 Inspect the cylinder head for signs of gas or coolant leakage.

4 Remove the valve springs and the valves, see Operation 3-9.

5 Clean the face of the cylinder head and the passages for coolant and for lubricating oil. The water jacket can be cleaned with a special solvent which must be used in accordance with the manufacturer's instructions.

6 Test the cylinder head for leaks at the pressure given in the relevant Data and dimensions for the "Cylinder head" on page 12.

7 When the cylinder head is thoroughly clean, check it for cracks. Inspect carefully the areas around the valve seats and around the holes for the atomiser nozzles.

8 The bottom face of the cylinder head can be machined if: there is distortion, see step 9; there are deep scratches; or, for engines without valve seat inserts, the valve depths are below the service limit.

9 Use a straight edge and feeler gauges to check the cylinder head for distortion across and along its bottom face, see "Maximum permissible distortion of cylinder head" on page 12. If the distortion is more than the given limit, the bottom face can be machined.

***Cautions*:**

- *Remove only the minimum material and ensure that the thickness of the cylinder head will not be less than 102,48 mm (4.035 in) after the cylinder head has been machined.*
- *After the cylinder head has been machined the valve seats must be corrected to give the correct valve head depth. Work to the minimum limit to allow for later wear.*

10 Check the valve seats for wear and for damage.

11 Before any work is done on the valve seats, new valve guides must be fitted, see Operation 3-13 and Operation 3-14.

12 Where there is little damage, the valve and valve seat can be lapped. When the valve seats are lapped keep the seat as narrow as possible and ensure that all the compound used to lap the valve and the seat is removed.

13 More badly damaged valve seats can be corrected by use of the cutter tool, see Operation 3-16, or new inserts can be fitted, see Operation 3-17.

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To fit **Operation 5-14**

1 Ensure that the contact faces of the cylinder block and of the balancer unit are clean and that the two thimbles (A1) are fitted correctly to the cylinder block.

2 Set the piston of number 1 cylinder to TDC, see Operation 8-2.

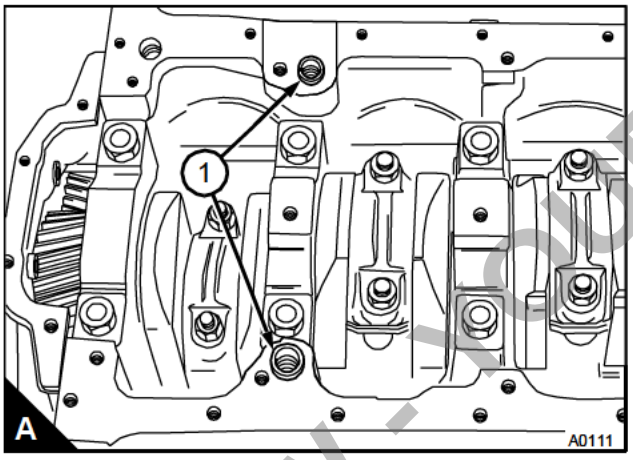
3 Before the balancer unit is fitted, ensure that the flat faces of the balance weights are level with each other (B1) and the weights hang down away from the cylinder block (B2). The timing of the balance weights to the drive shaft is correct when the large hole and small hole in the front of the drive shaft gear are in the positions shown (B).

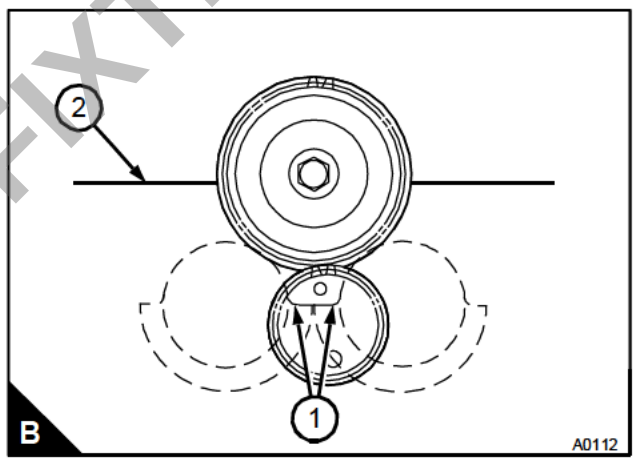
Note: If the gear position shown in (B) cannot be obtained, then the balancer must be partially dismantled and the timing corrected, refer to step 6 of Operation 5-16.

4 Fit the balancer unit to the cylinder block with the correct screws in the centre positions of the balancer frame. Ensure, when the idler and crankshaft gears are in mesh, that the flat faces of the balance weight are level with each other and that they are towards the cylinder block. Check that the balancer unit is fitted correctly on the thimbles and fit the remainder of the setscrews in their correct position. Tighten the setscrews to 54 Nm (40 lbf ft) 5,5 kgf m.

5 Rotate the crankshaft through two turns to ensure that it is free to rotate.

6 Fit the lubricating oil sump, see Operation 10-3 and fill the sump to the correct level with an approved oil.





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To inspect **Operation 7-3**

1 Clean the passages for the coolant and for the oil.

2 Check the cylinder block for cracks and for other damage.

3 The top face of the cylinder block must not be machined as this will affect the liner flange depth and the piston height above the top face of the cylinder block.

4 Check the camshaft bush for wear. If the bush is to be renewed, use a suitable adaptor to press it out of the bore. Ensure that the lubricating oil hole in the new bush will be towards the front of the engine, when fitted. Press in the bush with the oil hole on the same side and aligned with the oil hole in the block until the front end of the bush is aligned with the face of the recess.

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To inspect and to correct **Operation 10-5**

1 Wash the assembly in an approved cleaning fluid and dry it thoroughly.

2 Check the pipe, the strainer and the welded joints for cracks and other damage. Check that the mounting bracket is secure.

3 If the damaged component cannot be welded correctly, renew the assembly.

4 Composite material parts must be renewed if they have cracks or damage.

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Cooling system

General description

Coolant from the bottom of the radiator passes through the centrifugal coolant pump, which is fitted onto the front of the timing case to assist the flow of the coolant through the system.

The pump is driven by a "V" belt from the crankshaft pulley.

From the pump, the coolant passes through a passage in the timing case to a passage in the left side of the cylinder block and to the rear of the cylinder block.

Some coolant passes to a plate type oil cooler fitted to the oil filter head.

The coolant then passes around the cylinders and up into the cylinder head. The coolant leaves the cylinder head at the front and passes into the thermostat housing.

If the thermostat is closed, the coolant goes directly through a by-pass to the inlet side of the coolant pump. If the thermostat is open, the thermostat closes the by-pass and the coolant passes to the top of the radiator.

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