Perkins Phaser 135 Ti

Model AL (Euro 2)

WORKSHOP MANUAL

4 cylinder diesel engines for automotive applications

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PACE

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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	Turbocharged/intercooled
Combustion system	Direct injection
Nominal bore	100 mm (3.937 in)
Stroke	127 mm (5.000 in)
Compression ratio	17.25:1
Cubic capacity	4 litres (243 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)**	280 kpa (40 lbf/in^2) 2,8 kgf/cm^2

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

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Standard torque tensions

Most of the torque tensions on the engine are standard. Special torque tensions are listed in the separate special torque tables. The standard torque tensions listed in the tables below can be used when a special torque is not necessary.

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

Standard torques for setscrews and nuts

Thread size	Torque		
	Nm	lbf ft	kgf m
M6 x 1,00	9	7	0,9
M8 x 1,25	22	16	2,2
M10 x 1,50	44	33	4,5
M12 x 1,75	78	58	8,0
M14 x 2,00	124	91	12,6
M16 x 2,00	190	140	19,3

Standard torques for studs (metal end)

Thread size	Torque		
	Nm	lbf ft	kgf m
M6 x 1,00	5	4	0,5
M8 x 1,25	11	9	1,1
M10 x 1,50	18	14	1,8
M12 x 1,75	25	19	2,5

Standard torques for pipe unions, plugs, and adaptors

Thread size (Inches)	Torque		
	Nm	lbf ft	kgf m
$^{1}/_{8}$ PTF	9	7	0,9
$^{1}/_{4}$ PTF	17	13	1,7
$^{3}/_{8}$ PTF	30	23	3,0
$^{3}/_{4}$ PTF	45	35	4,5

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Rocker cover

To remove — Operation 3-1

Engines are supplied with rocker covers (A) made of a plastic material.

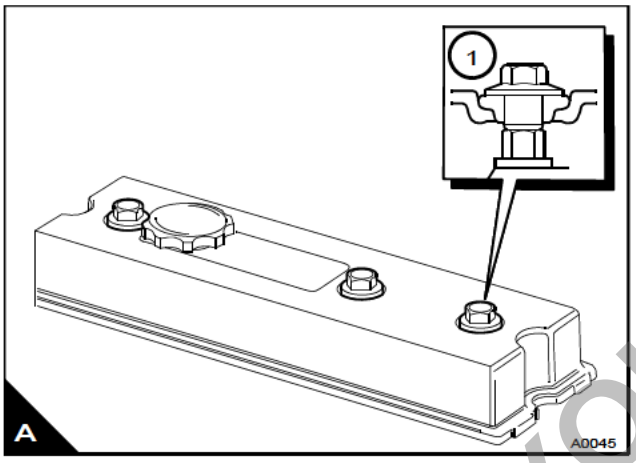
Note: Some rocker covers have a breather with a gauze strainer fitted (B).

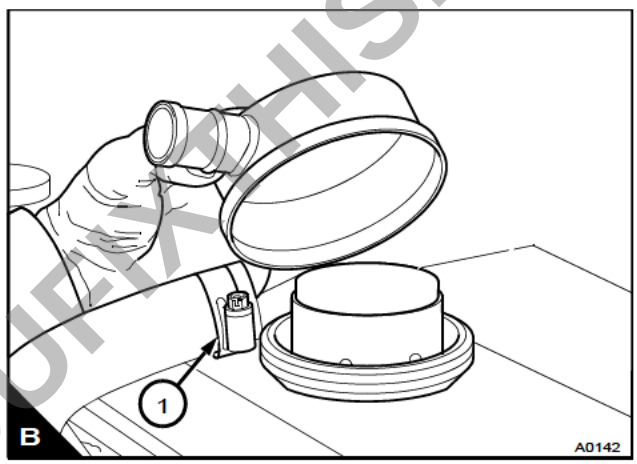
1 Disconnect the breather pipe fitted to the side of the rocker cover or if a gauze strainer is fitted, remove the pipe (B1).

2 Remove the cap nuts and rubber seal (A1) from the top of the rocker cover.

3 Lift off the rocker cover and the joint.

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.*





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Cylinder liner specifications

Caution: *Specialist training and equipment is needed to machine the finish of a partially finished liner. For further information contact your nearest Perkins Distributor.*

Partially finished liner

Interference fit of liner in parent bore ... 0,025/0,076 mm (0.003/0.001 in)
Inside diameter of partially machined liner ... 99,162/99,415 mm (3.9040/3.9139 in)

Surface finish of the preliminary bore

Final size of liner before it is honed ... 99,873/99,924 mm (3.9320/3.9340 in)
Grade of surface finish ... RA 3,2 to 4,0 micrometers
Maximum ovality and taper ... 0,02 mm (0.0008 in)

Surface finish of the diamond hone

Hone angle (cross hatch) ... 35°
Surface finish size, diamond honed ... 99,95 mm (3.9350 in)
Grade of surface finish ... RA 2,2 to 3,0 micrometers
Maximum ovality and taper ... 0,012 mm (0.0005 in)

Surface finish of the silicone carbide base hone

Hone angle (cross hatch) ... 35°
Surface finish size, silicon carbide base hone ... 100,012 mm (3.9374 in)
Grade of surface finish ... RA 1,3 to 1,6 micrometers
Maximum ovality and taper ... 0,010 mm (0.0004 in)

Surface finish of the silicone carbide plateau hone

Final surface finish size, silicon carbide (plateau hone) ... 100,017 mm (3.9376 in)
Final surface finish grade, silicon carbide (plateau hone) ... 0,65/1,3 micrometers

Turbocharger

The make and type of turbocharger fitted is marked on the turbocharger identification plate.

Make and type ... Garrett T20

Waste-gate test pressure for rod movement of 1,00 mm (0.039 in)

Waste-gate pressure ... 150 kPa (21.8 lbf/in^2) 1,53 kgf/cm^2

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To remove **Operation 3-14**

Special requirements

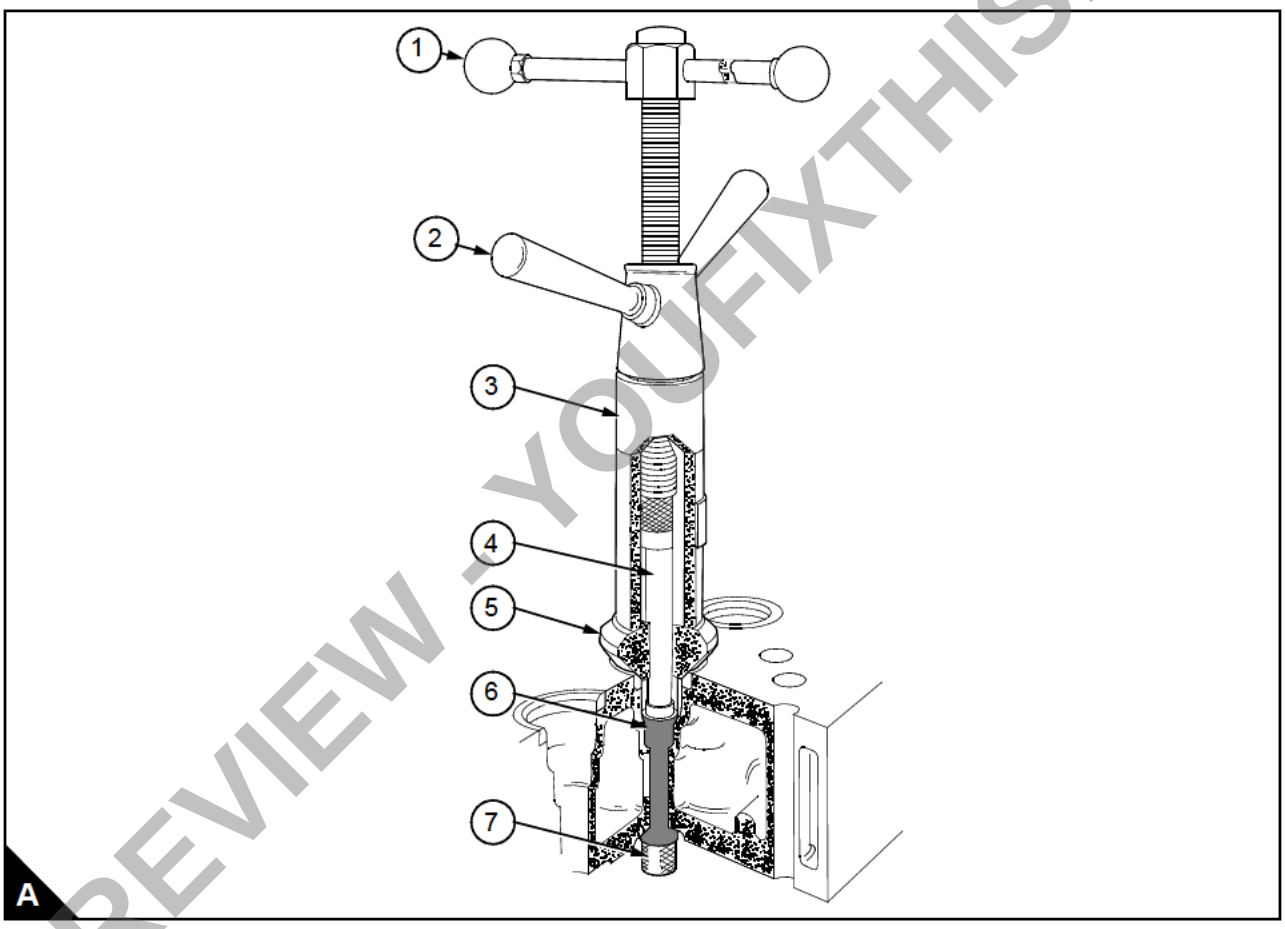
Special tools			
Description	**Part number**	**Description**	**Part number**
Remover/replacer for valve guides	PD.1D	Adaptor PD.1D-13 used with PD.1D	PD.1C-6 and PD.248

1 Fit the adaptor (A4) into the remover/replacer tool (A3).

2 With the adaptor fitted to the tool, put the spacer (A5) in position on the tool. Pass the adaptor through the valve guide (A6) and put the spacer and tool in position on the valve seat.

3 Fit the attachment (A7) to secure the adaptor to the valve guide.

4 Hold the top handle (A1) and turn the bottom handle (A2) clockwise to pull the valve guide out of the cylinder head.



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To remove and to fit — Operation 5-6

To remove

1 Drain the lubricating oil and remove the lubricating oil sump, see Operation 10-3.

2 Remove the lubricating oil strainer and suction pipe, see Operation 10-4.

3 Release the setscrews of the centre main bearing and remove the main bearing cap complete with the lower halves of the thrust washers.

4 Use a suitable tool (A1) made of a soft material to push the upper halves of the thrust washers from their recesses. Where necessary, move the crankshaft to the front or to the rear to loosen a tight washer.

To fit

1 Lubricate the thrust washers with clean engine lubricating oil.

2 Slide the upper halves of the thrust washers into their recesses in the cylinder block. Ensure that the sides of the thrust washers that have the grooves are against the crankshaft.

3 Fit the lower half thrust washers to the main bearing cap with the location tags in their recesses.

4 Ensure that the location thimbles are fitted correctly in the main bearing cap or in the cylinder block.

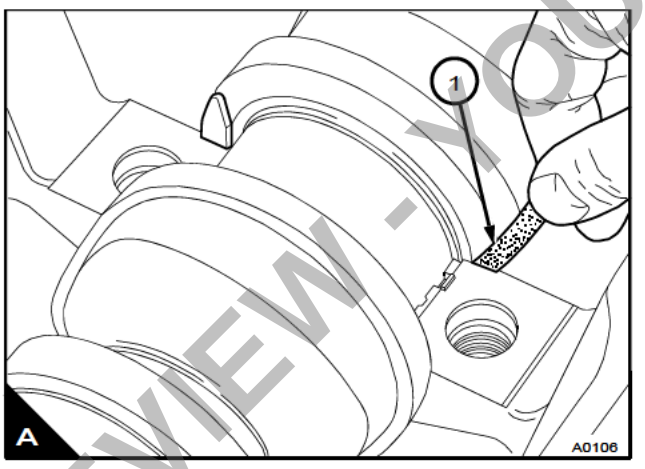
5 Ensure that the bearing is fitted correctly in the cap and that the bearing and the crankshaft journal are clean. Lubricate the bearing with clean engine lubricating oil.

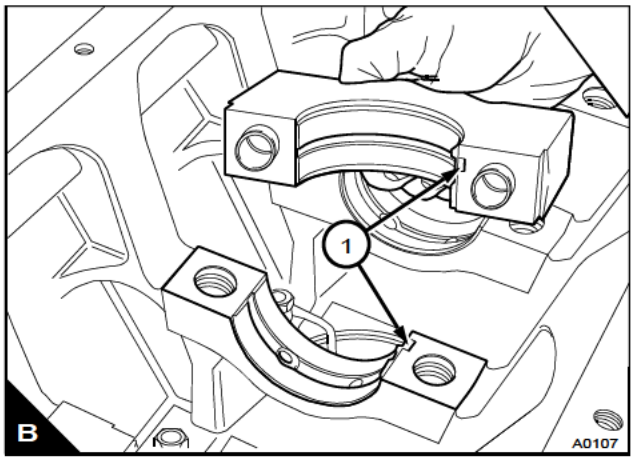
6 Fit the cap with the location tags of both halves of the shell bearings to the same side (B1). Tighten the main bearing setscrews gradually and evenly to 250 Nm (185 lbf ft) 26,0 kgf m.

7 Check the crankshaft end-float, see Operation 5-5.

8 Fit the lubricating oil strainer and the suction pipe, see Operation 10-4.

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





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Cylinder liner

To inspect — Operation 7-4

To ensure the best performance during the life of the engine it is important that worn or damaged cylinder liners are renewed. If a change of liner becomes necessary in service, a partially finished liner is available.

The condition of a cylinder liner is decided by:

- The amount and location of any polished areas.
- Wear.
- Damage to the liner wall.

Note: It will not be necessary to renew the liners if:

- The honed finish can still be clearly seen
- The engine performance and oil consumption is acceptable.

To check the condition of a cylinder liner

1 Inspect the liner surface for cracks and deep scratches.

2 Check the liner wall for areas where the honed finish has been polished away. Check especially the area around the top of the liner bore just below the carbon ring. In this area, thrust from the top piston ring is at its maximum.

***Cautions*:**

- *Damaged or worn liners must be discarded.*
- *New piston rings must be fitted when the cylinder liner is renewed.*
- *An engine can have high oil consumption with very little wear of the liner bores, if the surfaces of the liners are glazed.*
- *Specialist training and equipment is needed to machine the finish of a partially finished liner.*

Partially finished cylinder liners must be bored and then diamond honed, silicon carbide base honed and silicon carbide plateau honed to the finished size to conform to the dimensions given in the Data and dimensions for the "Cylinder liners" on page 22.

Specialist training and equipment is needed to machine a partially finished liner. For further information contact your nearest Perkins Distributor.

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Filter head

To remove and to fit **Operation 10-2**

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

2 Remove the filter canister(s), see Operation 10-1.

3 Remove the canister type oil cooler from the filter head, if one is fitted.

4 If the oil cooler is integral with the cylinder block, release the set screws that fasten the oil cooler pipes to the filter head.

5 Release the setscrews and remove the filter head (A) from the cylinder block. Discard the joint (A3).

6 Clean the joint face of the filter head (A4) and the cylinder block.

7 Fit the new joint to the filter head, the joint is fitted dry.

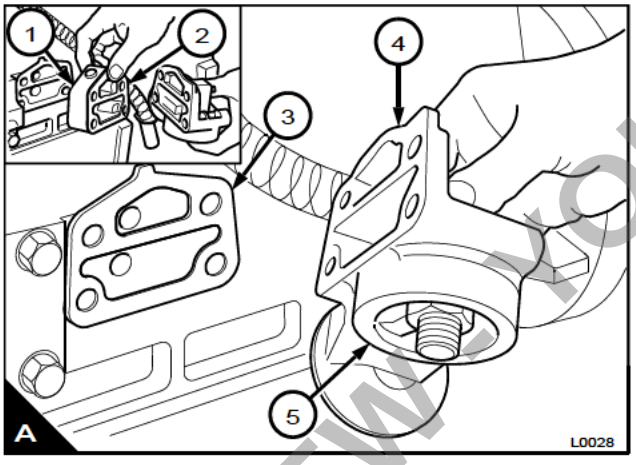
Note: Some engines have an adaptor (A1) between the cylinder block and the filter head. If an adaptor is used, two joints are fitted (A2) and (A3).

8 Apply POWERPART Nutlock to the first three threads of the setscrews and tighten the setscrews.

9 Fit the oil cooler to the filter head.

10 If the oil cooler is integral with the cylinder block, fit a new joint to the flange of the oil cooler pipes. Fit the flange to the filter head and tighten the setscrews.

11 Fit a new filter canister, see Operation 10-1.



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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 gear driven from the gear of the fuel injection pump.

From the pump, the coolant passes through a passage in the timing case to the water jacket in the left side of the cylinder block. The coolant continues to the rear of the cylinder block where some of the coolant passes into the lubricating oil cooler.

The oil cooler has an aluminium cover with a seven plate element and is fitted to the left side of the cylinder block. Some of the coolant passes around the element of the cooler and then to the rear of the cylinder block.

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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