Perkins 2800 Series

Models 2806C-E18 TAG1 TAG2 and TAG3

WORKSHOP MANUAL

6 cylinder turbocharged diesel engines for industrial, applications

Chapters

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1

General information

Introduction

The 2800 Series engines are from Perkins Engines Company Limited, a world leader in the design and manufacture of high-performance diesel engines.

Perkins approved assembly and quality standards, together with the latest technology, have been applied to the manufacture of your engine to give you reliable and economic power.

This Workshop Manual has been designed to provide assistance in the service and the overhaul of Perkins 2806 C 18 engines. Most of the general information, which is included in the User's Handbook (Chapters 1 to 6), has not been repeated in this Workshop Manual and the two publications should be used together.

To ensure that you use the relevant information for your specific engine type, refer to "Engine identification" on page 6.

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 is given in Chapter 16, Special tools. Reference to the relevant special tools is also made at the beginning of each operation.

Data and dimensions are included in Chapter 2, Specifications.

Read the "Safety precautions" on page 2 and remember them. They are given for your protection and must be applied at all times.

In addition to the general safety precautions, danger to both operator and engine are highlighted by the following conventions:

Warning! *This indicates that there is a possible danger to the person (or the person and engine).*

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.

Safety precautions

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

- Always refer to the text of this handbook for specific warnings and cautions.
- 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 make adjustments that you do not understand.
- Do not allow the engine to stand on its sump.
- 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).
- 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.

Warning! *Keep away from moving parts during engine operation. 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 or any component of the coolant 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. Always disconnect the negative terminal first.
- Only one person must control the engine.
- Ensure that the engine is operated only from the control panel or from the operator's 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.
- Discard used lubricating oil and coolant in accordance with local regulations to prevent contamination.
- 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.

Continued

- 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.
- Turbochargers operate at high speed and at high temperatures. Keep fingers, tools and debris away from the inlet and outlet ports of the turbocharger and prevent contact with hot surfaces.
- Some components are not waterproof and should not be washed with a high-pressure water jet or steam.
- Fit only genuine Perkins parts.

Viton seals

Some seals used in engines and in components fitted to engines are made from Viton (fluorocarbon).

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, ensure that the precautions which follow are used:

- Ensure that the components have cooled.
- Use Neoprene gloves and discard the gloves safely after use.
- Wash the area with a calcium hydroxide solution and then with clean water.
- Disposal of gloves and components 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 a calcium hydroxide solution for 15-60 minutes. Obtain immediate medical attention.

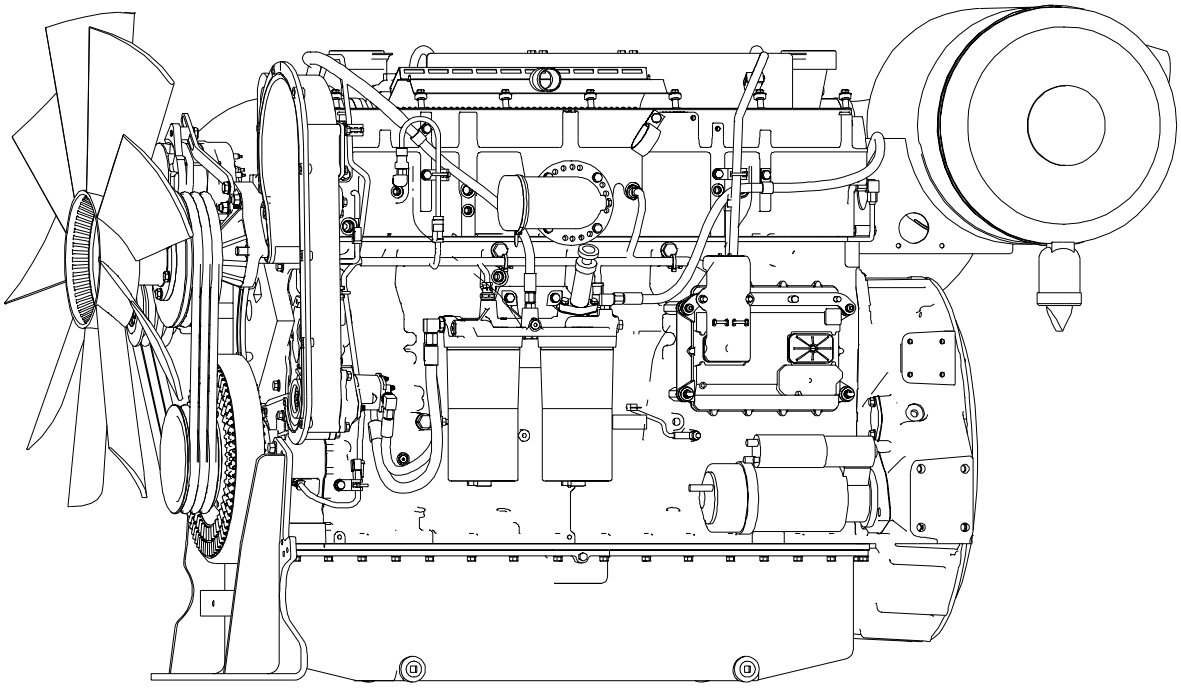
Welding

Welding can cause damage to the electronic components fitted to the engine. If welding is necessary, the precautions which follow must be undertaken before and during the welding operation.

***Cautions*:**

- *Switch off the engine.*
- *Disconnect the cable from the negative terminal of the battery. If the machine is fitted with a battery disconnect switch, then open the switch.*
- *If welding to the engine, remove the ECM (electronic control module).*
- *If welding onto the machine chassis, ensure that the earth clamp is attached as close to the welding point as possible and NOT near to the ECM.*
- *If it is necessary to weld near to the ECM, remove the ECM from the engine.*

Engine views



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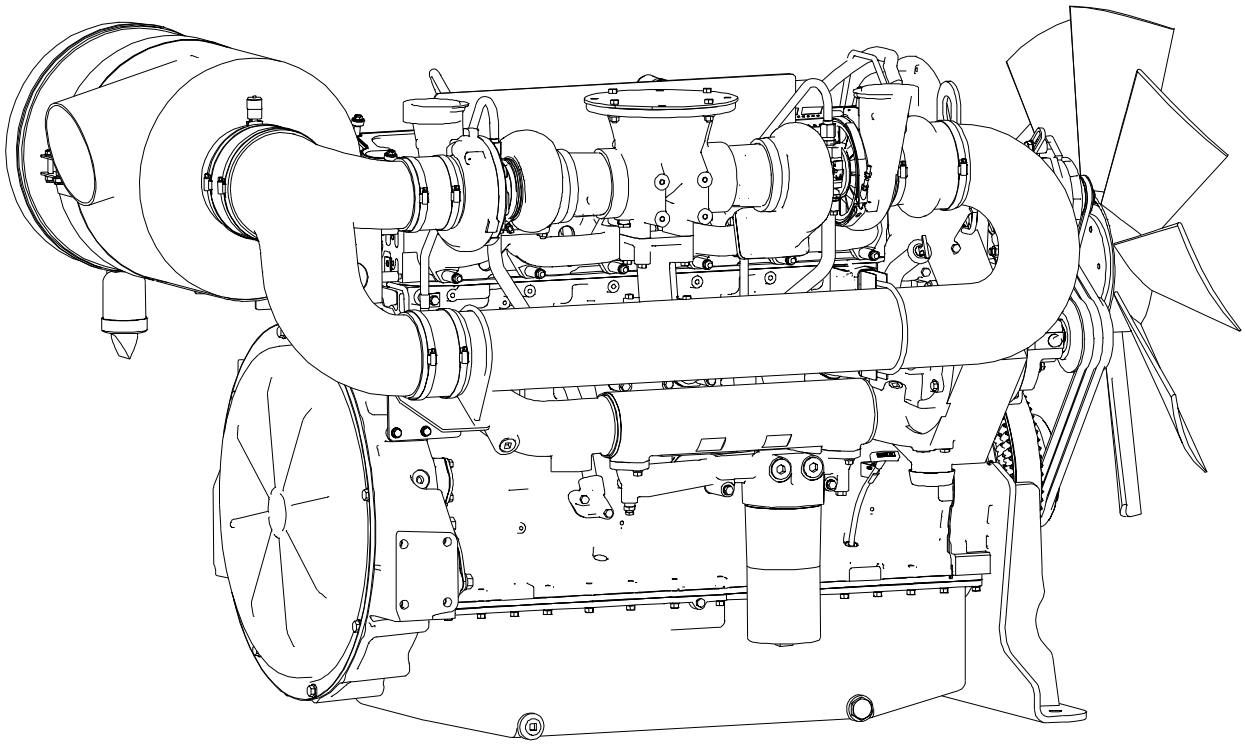

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Engine identification

If you need parts, service or information for your engine, you must give the complete engine number. The engine number is stamped on a data plate which is fastened to the right side of the engine.

A typical engine number is: HGA060125U 1103H, which consists of these codes:

G	Code for engine capacity
G	Engine application
A	Engine type
06	Number of engine cylinders
0125	Engine specification number
U	The country of manufacture
1103	Build line number
H	Year of manufacture

Engine lift equipment

The total dry weighs is approximately 2050 kg (4516.4 lb). Ensure that the lift equipment used is suitable. An adjustable lifting beam should be used and the chains or cables must be parallel to each other during use.

Before the engine is lifted:

- Always use lift equipment of the approved type and of the correct capacity to lift the engine. Never use a single lift bracket to raise an engine.
- Check the engine lift brackets for damage and security before the engine is lifted.

Use suitable lift equipment or obtain assistance to lift heavy engine components such as the cylinder block, cylinder head, damper unit, flywheel housing, crankshaft and flywheel.

Warning! *The lifting eyes which are fitted to the engine must be used for lifting only the engine. Do NOT use them to lift the engine if it is still attached to its driven unit.*

2

Specifications

Basic engine data

Number of cylinders. 6
Cylinder arrangement.. ... ... .In line
Cycle ... ... Four stroke
Induction system.. ... ... Air to air charged cooled
Combustion system . ...Direct injection
Nominal bore ... ... .145 mm (5.708 in)
Nominal stroke. ... ... .183 mm (7.204 in)
Compression ratio 14.5:1
Cubic capacity . ...18,13 litres (1106.36 in^3)
Firing order 1, 5, 3, 6, 2, 4
Direction of rotation . ... Anti-clockwise viewed on flywheel

Lubricating oil capacity:

Total system ... ...55,5 litres (97.6 UK pints)
Sump maximum... ... ... 53,5 litres (94.14 UK pints)
Sump minimum ... ... 37,5 litres (65.99 UK pints)

Lubricating oil pressure:

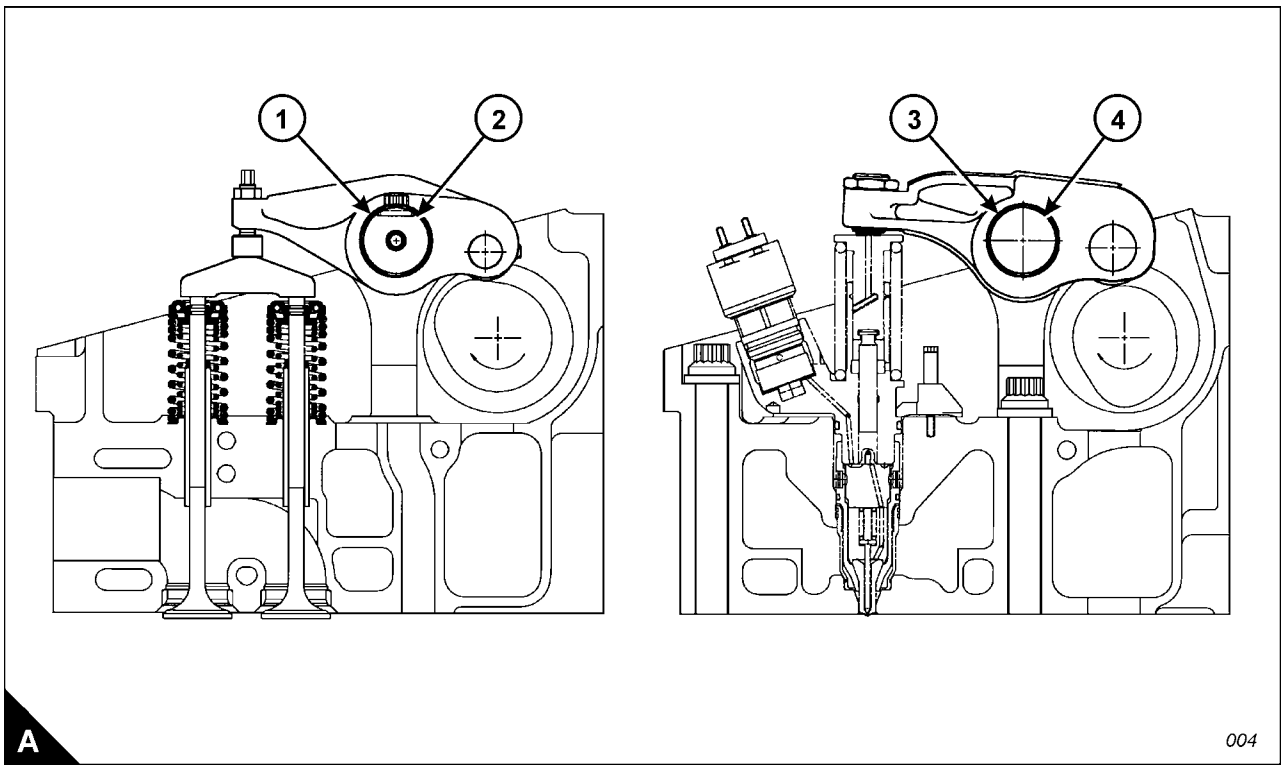
At rated speed . ...4,2 bar (60.9 PSI)
Typical coolant capacity of engine... ... ... 20,8 litres (4.6 UK gallons)
Typical coolant capacity of engine and radiator .. .. .61 litres (13.4 UK gallons)

Rocker assemblies

Rocker shaft diameter (A2) ... ... 40,000 +/- 0,010 mm (1.5748 +/- 0.0004 in)
Valve rocker lever bore (A1) .. .. 40,065 +/- 0,015 mm (1.5774 +/- 0.0006 in)
Bearing clearance between valve rocker lever and shaft .. .. 0,040 to 0,090 mm (0.0016 to 0.0035 in)
Unit injector rocker lever bore (A3) ... ... 43,000 +/- 0,020 mm (1.6929 +/- 0.0008 in)

If a new bearing is fitted to the unit injector rocker lever, the oil hole in the bearing must be aligned with the oil passage in the rocker lever within 2,4 mm (0.09 in). The bearing must not extend beyond either face of the rocker lever.

Bore in the rocker lever bearing (A4) . ... 40,065 +/- 0,15 mm (1.5774 +/- 0.0006 in)
Maximum permissible worn dimension .. .. 40,193 (1.5824 in)



Valves

Diameter of valve stem (A1) ... ... 9,441 +/- 0,010 mm (0.3717 +/- 0.0004 in)
Permissible worn dimension ... ... 9,309 mm (0.3665 in)

Diameter of valve head (A3):

Inlet valve ... ... 47,00 +/- 0,13 mm (1.850 +/- 0.005 in)
Exhaust valve .. .. 41,81 +/- 0,13 mm (1.646 +/- 0.005 in)

Angle of face of valve (A2):

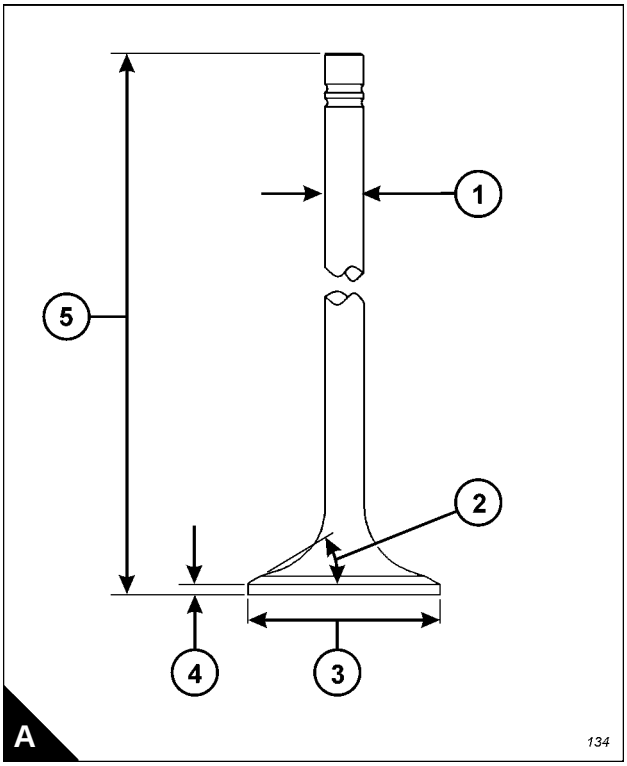
Inlet valve ... ...29 1/4 +/- 1/4 degrees
Exhaust valve .. ..44 1/4 +/- 1/4 degrees

Minimum thickness of valve lip (A4):

Inlet valve ... ... 2,75 mm (0.108 in)
Exhaust valve .. .. 2,05 mm (0.081 in)

Length of valve:

Inlet.. ... ... 202,00 +/- 0,45 mm (7.953 +/- 0.018 in)
Exhaust ... ... 202,06 +/- 0,45 mm (7.955 +/- 0.018 in)

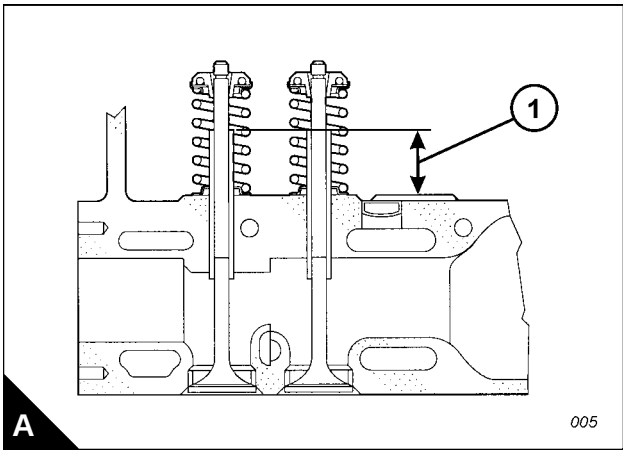


Valve guides

Bore of valve guide when installed ... ... 9,484 +/- 0,026 mm (0.3734 +/- 0.010 in)
Maximum permissible dimension... ... ...9,538 mm (0.3755 in)

Do not use a combination of a valve and valve guide which have a difference of 0,13 mm (0.005 in) or more.

Height from cylinder head to top of valve guide (A1). ... ... 35,00 +/- 0,50 mm (1.378 +/- 0.020 in)



Valve springs

Inner

Assembled length .. .. 60,14 mm (2.368 in)
Load at assembled length.. ... ...150 +/- 12 N (34 +/- 3 lb)
Minimum operating length.. ... ... 44,02 mm (1.733 in)
Load at minimum operating length. ... ...400 +/- 20 N (90 +/- 4 lb)
Free length after test.. ... ...71,7 mm (2.823 in)
Outside diameter ... ... 25,17 mm (0.991 in)

Outer

Assembled length .. .. 67,12 mm (2.643 in)
Load at assembled length.. ... ...320 +/- 25 N (72 +/- 6 lb)
Minimum operating length.. ... ... 51,00 mm (2.008 in)
Load at minimum operating length. ... ...900 +/- 45 N (202 +/- 10 lb)
Free length after test.. ... ... 76,7 mm (3.02 in)
Outside diameter ... ... 36,30 mm (1.429 in)

Valve seat inserts

Depth of bore in cylinder head for valve seat insert (A5):

Inlet valve ... ... 14,00 +/- 0,10 mm (0.551 +/- 0.004 in)
Exhaust valve .. .. 13,90 +/- 0,10 mm (0.547 +/- 0.004 in)

Diameter of valve seat insert (A2):

Inlet valve ... ... 48,025 +/- 0,13 mm (1.8907 +/- 0.0005 in)
Exhaust valve .. .. 42,840 +/- 0,13 mm (1.6866 +/- 0.0005 in)

Bore in cylinder head for valve seat insert (A2):

Inlet valve ... ... 47,950 +/- 0,025 mm (1.8878 +/- 0.0010 in)
Exhaust valve .. .. 42,774 +/- 0,025 mm (1.6840 +/- 0.0010 in)

Angle of face of valve seat insert (A1):

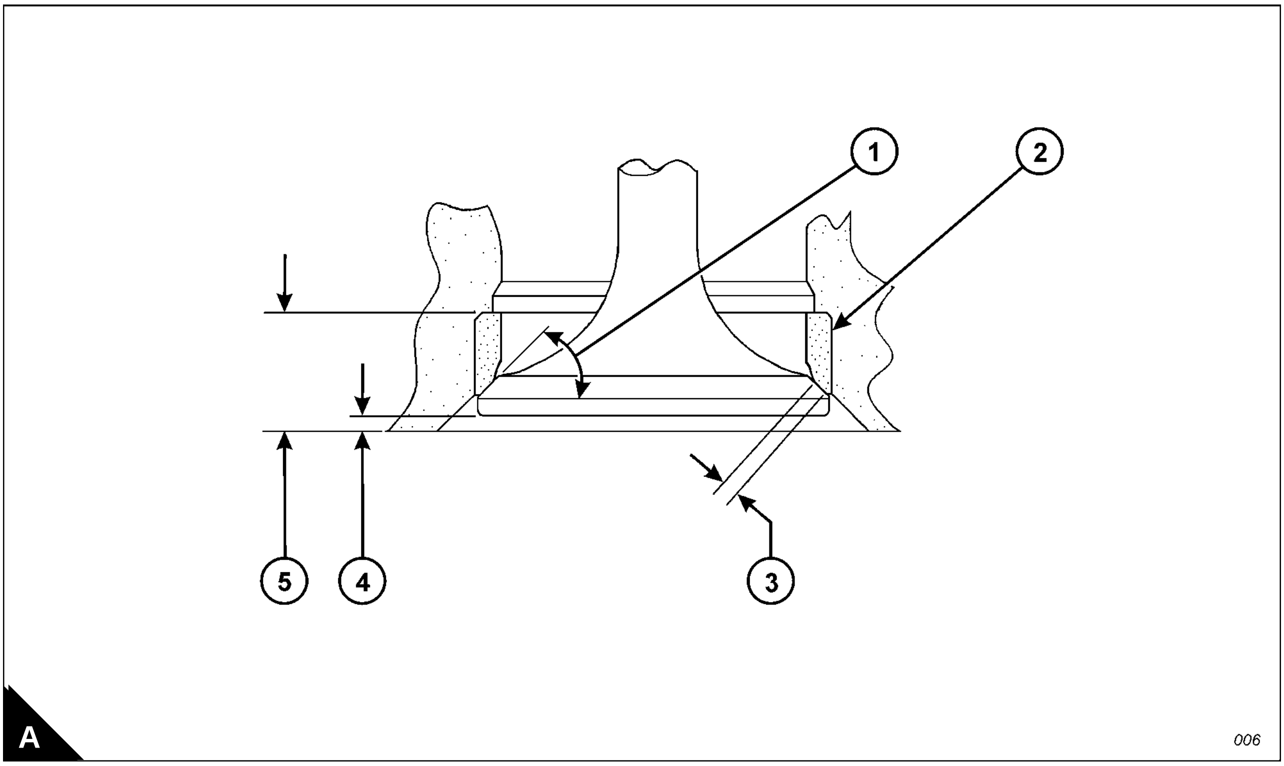
Inlet valve insert... ... ...30 1/4 +/- 1/2 degrees
Exhaust valve insert ... ...45 1/4 +/- 1/2 degrees

Valve recess (A4):

Inlet valve (new parts) . ...2,20 to 2,80 mm (0.087 to 0.110 in)
Exhaust valve (new parts) ... ...1,20 to 1,80 mm (0.047 to 0.071 in)
Inlet valve (reconditioned parts) .. ..2,20 to 3,29 mm (0.087 to 0.129 in)
Exhaust valve (reconditioned parts) ... ...1,20 to 2,29 mm (0.047 to 0.090 in)

Minimum recommended width of valve seat (A3):

Inlet.. ... ...2,334 mm (0.079 in)
Exhaust ... ...1,507 mm (0.049 in)



Cylinder head

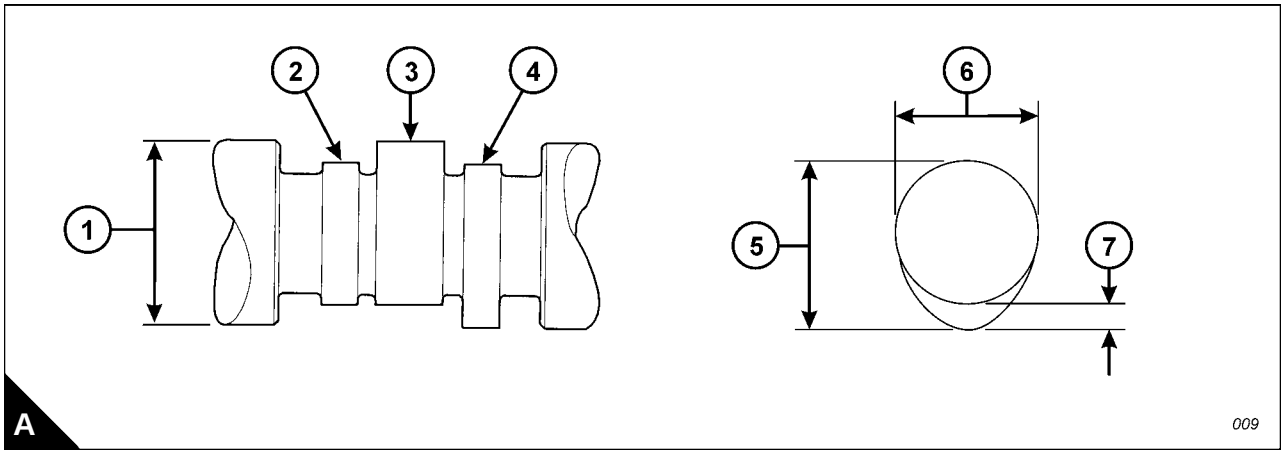
Thickness of cylinder head (new) .. .. 120,00 +/- 0,15 mm (4.724 +/- 0.006 in)
Minimum thickness for a used cylinder head . ...119,50 mm (4.705 in)

Flatness of cylinder head: The cylinder head must be flat to within a total of 0,13 mm (0.005 in). Additionally, the cylinder head must be flat within a maximum of 0,03 mm (0.001 in) across any 76,2 mm (3.00 in) span.

Camshaft and bearings

Diameter of camshaft journal (A3) . ... 84,85 +/- 0,02 mm (3.341+/- 0.001 in)
Exhaust lobe lift.. ... ...8,515 mm (0.3352 in)
Inlet lobe lift ... ... 9,702 mm (0.382 in)
Injector lobe lift... ... ... 10,451 mm (0.4114 in)
Maximum permissible difference between the actual lobe lift (E7)
and the specified dimension .. ..0,100 mm (0.0039 in)

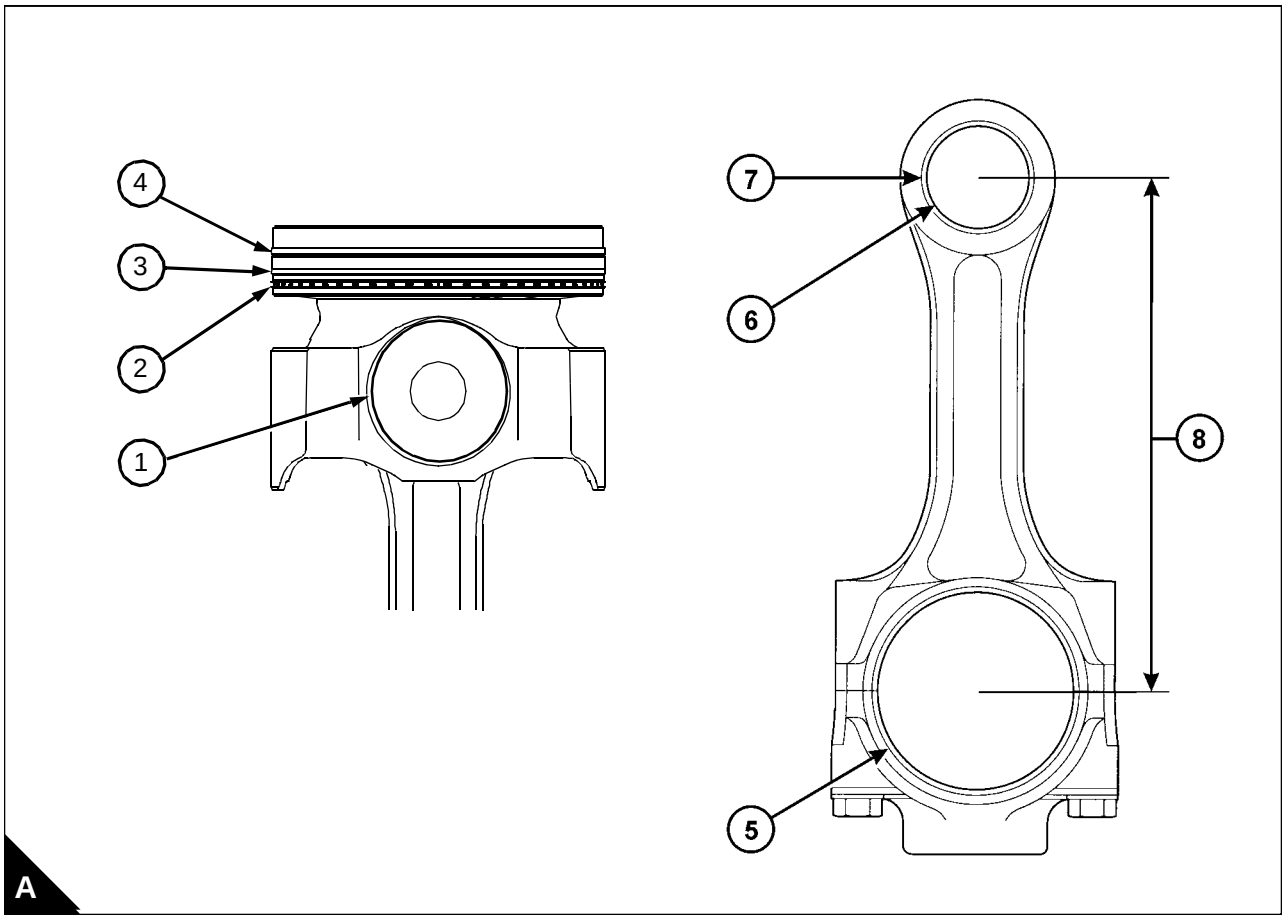
To obtain the lobe lift (A7) proceed as follows: Measure the lobe height (A5) and measure the base circle (A6). Subtract the base circle from the lobe height to give the lobe lift.



Pistons and connecting rods

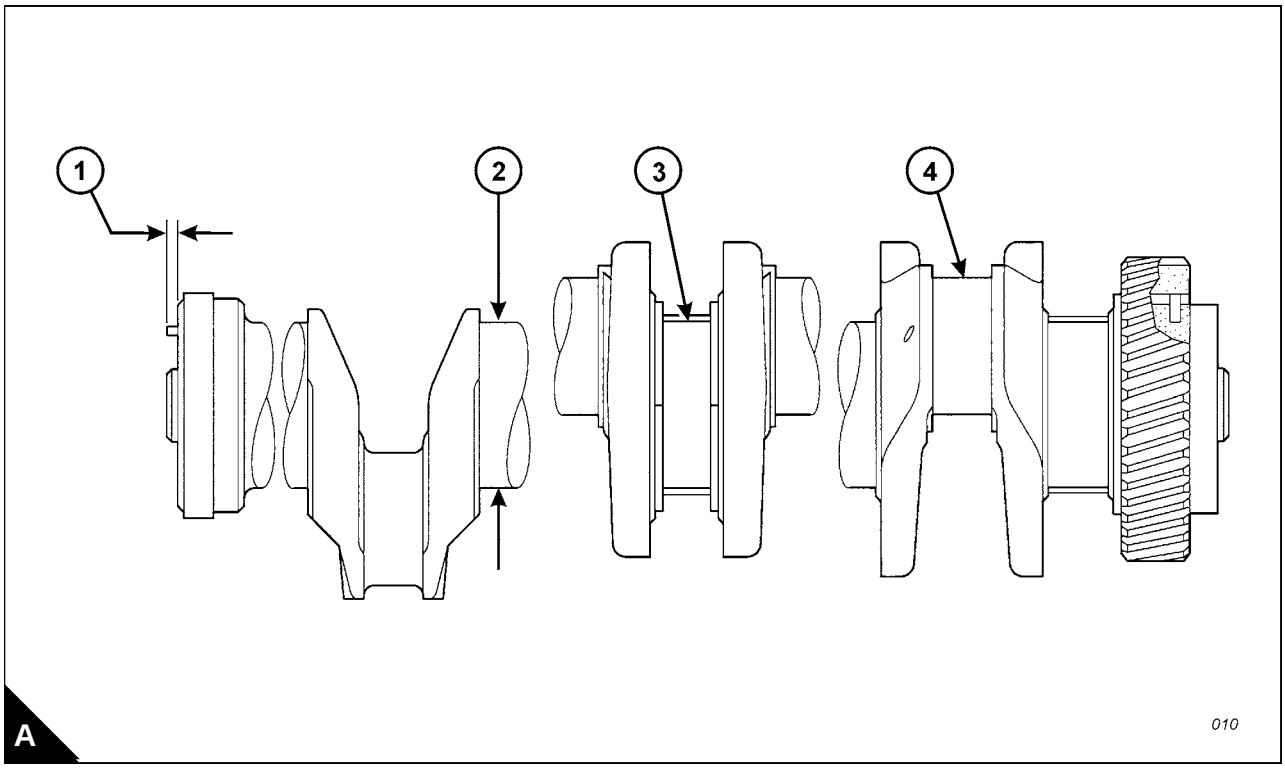
Piston ring gaps measured with the ring fitted in a new liner with a bore size 144,975 mm (5.7077 in):

Top piston ring (A4) . ... 0,4 +/- 0,1 mm (0.020 +/- 0.004 in)
Intermediate ring (A3) .. .. 0,6 +/- 0,1 mm (0.002 +/- 0.004 in)
Oil control ring (A2) .. .. 0,550 +/- 0,150 mm (0.0216 +/- 0.0059 in)
Width of groove for oil control ring in new piston . ... 3,02 +/- 0,010 mm (0.119 +/- 0.0004 in)
Thickness of a new oil control ring .. .. 2,98 +/- 0,010 mm (0.117 +/- 0.0004 in)
Clearance between piston ring groove and new oil control ring .. .. 0,04 +/- 0,023 mm (0.002 +/- 0.0009 in)
Maximum permissible clearance between piston
ring groove and a used oil control ring ... ... 0,15 mm (0.006 in)
Bore of piston crown bearing (A1) ... ... 65,635 +/- 0,010 mm (2.5840 +/- 0.0004 in)
Gudgeon pin diameter (A1) . ... 59,975 +/- 0,005 mm (2.3612 +/- 0.0002 in)
Length of gudgeon pin . ... 113,20 +/- 0,15 mm (4.457 +/- 0.006 in)
Bore in connecting rod for small end bearing (A7) .. .. 64,592 +/- 0,013 mm (2.5430 +/- 0.0005 in)
Bore of connecting rod small end bearing (A6) ... ... 60,035 +/- 0,008 mm (2.3636 +/- 0.0003 in)
Bore in connecting rod for big end bearing shells (A5) ... ... 103,2 +/- 0,013 mm (4.063 +/- 0.0005 in)
Distance between centres of big and small end bearings (A8) ... . 270,76 +/- 0,05 mm (10.660 +/- 0.002 in)



Crankshaft, main bearings and flywheel

Diameter of main bearing journal (A2) ... ... 120,650 +/- 0,020 mm (4.7500 +/- 0.0008 in)
Journal undersize by 0,63 mm (0.025 in) ... ... 120,015 +/- 0,020 (4.7250 +/- 0.0008 in)
Journal undersize by 1,27 mm (0.050 in) ... ... 119,380 +/- 0,020 mm (4.7000 +/- 0.0008 in)
Clearance between a new bearing and the journal (A3) ... ... 0,091 to 0,186 mm (0.0036 to 0.0073 in)
Maximum permissible clearance between the
bearing and journal ... ...0,25 mm (0.010 in)
Diameter of main bearing bore .. .. 129,891 +/- 0,013 mm (5.1138 +/- 0.0005 in)
Diameter of main bearing bore, oversize by 0,63 mm (0.025 in) . 130,526 +/- 0,013 mm (5.1388 +/- 0.0005 in)
Diameter of connecting rod journal (A4) ... ... 97,0 +/- 0,020 mm (3.819 +/- 0.0008 in)
Journal undersize by 0,63 mm (0.025 in) ... ... 96,370 +/- 0,020 (3.794 +/- 0.0008 in)
Journal undersize by 1,27 mm (0.050 in) ... ... 95,730 +/- 0,020 mm (3.769 +/- 0.0008 in)
Clearance between a new bearing and the journal ... ... 0,062 to 0,160 mm (0.0024 to 0.0063 in)
Maximum permissible clearance between the
bearing and journal ... ...0,20 mm (0.008 in)
End-float of crankshaft ... ... 0,11 to 0,57 mm (0.004 to 0.022 in)
Maximum permissible end-float (with used bearings) ... ...0,89 mm (0.035 in)
Maximum protrusion of dowel (A1) ... ...6,4 mm (0.25 in)



Crankshaft damper

Maximum permissible run-out of face of damper ... ...2,03 mm (0.080 in)

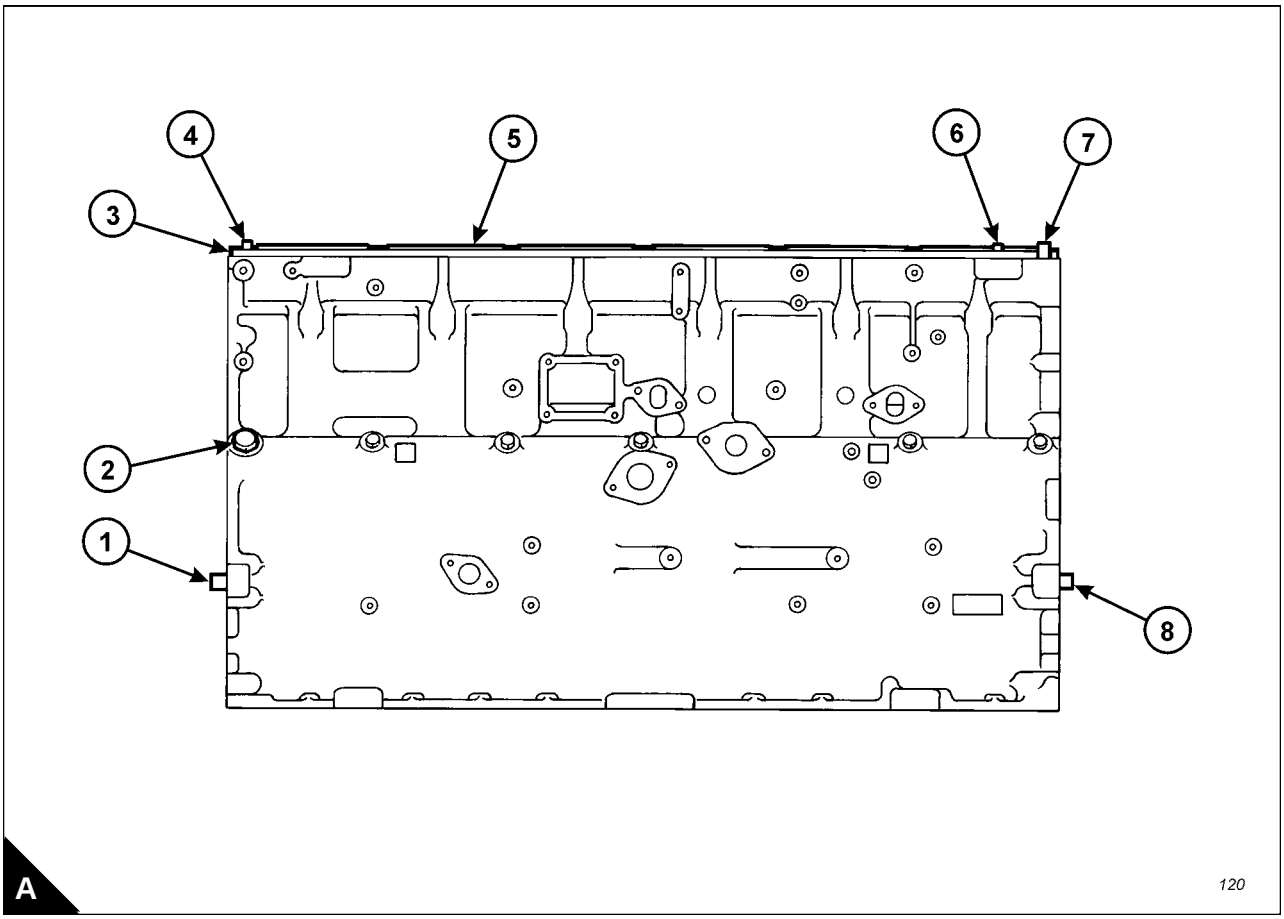
Crankcase and cylinder liners

Thickness of spacer plate (A3) ... ... 8,585 +/- 0,025 mm (0.3380 +/- 0.0010 in)
Thickness of gasket fitted between spacer plate and crankcase ... . 0,20 +/- 0,02 mm (0.008 +/- 0.0010 in)
Cylinder liner protrusion (A5) above the spacer plate . ...0,025 to 0,152 mm (0.0010 to 0.0060 in)
Maximum variation in each cylinder liner. ... ... 0,051 mm (0.0020 in)
Maximum average variation between adjacent cylinder liners ... ... 0,051 mm (0.0020 in)
Maximum variation between all cylinder liners ... ... 0,102 mm (0.0040 in)

Refer to Operation 7-3 for further cylinder liner information.

Protrusion of front cylinder head dowel (A6) above top face of crankcase . . 16,0 +/- 0,5 mm (0.63 +/- 0.02 in)
Protrusion of rear cylinder head dowel (A4) above top face of crankcase .. . 18,5 +/- 0,5 mm (0.73 +/- 0.02 in)
Protrusion of oil transfer tube (A7) above top face of crankcase. ... ... 20,0 +/- 0,5 mm (0.79 +/- 0.02 in)
Protrusion of flywheel housing dowels (A1) from rear face of crankcase ... . 19,1 +/- 0,5 mm (0.75 +/- 0.02 in)
Protrusion of gear case dowels (A8) from front face of crankcase.. ... ... 19,1 +/- 0,5 mm (0.75 +/- 0.02 in)
Plug (A2) must be tightened to a torque of.. ... ...70 +/- 10 Nm (52 +/- 7 lbf ft)

The total flatness of the top face of the crankcase must be within 0,10 mm (0.004 in). The flatness must also be within 0,05 mm (0.002 in) for any 177,5 mm (6.99 in) section of the surface.



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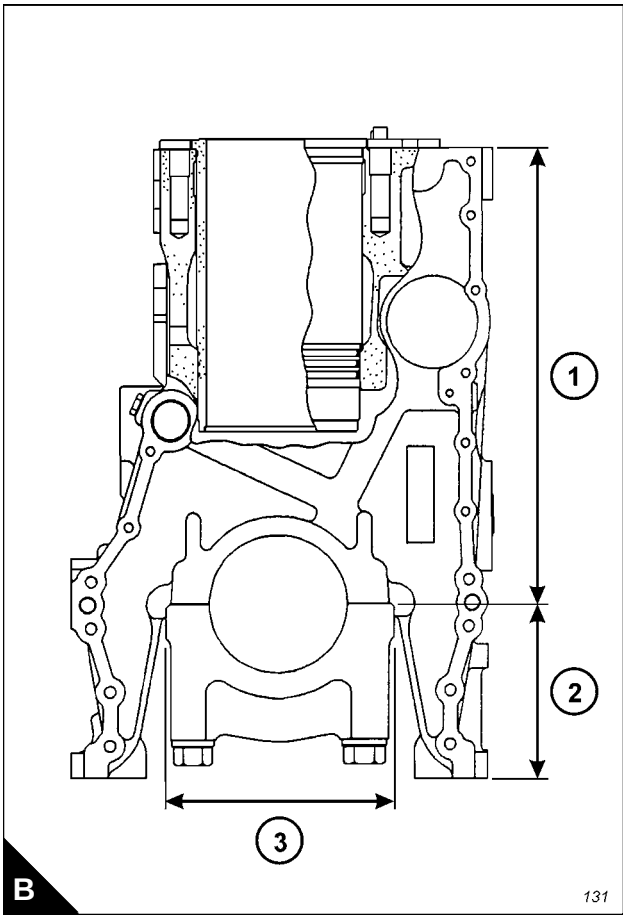
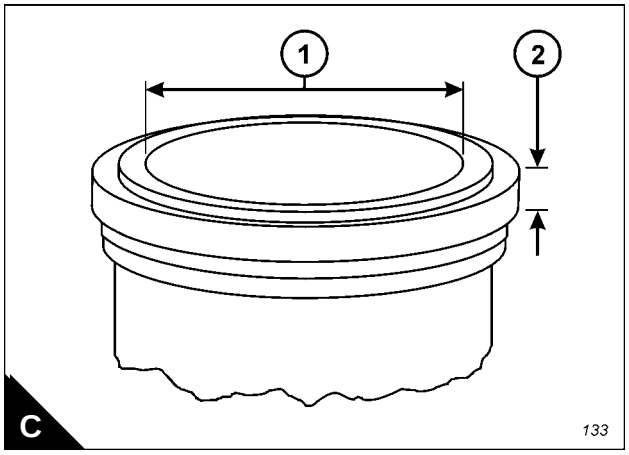
Distance from top of crankcase to centre of main bearing bore (B1) ... 425,45 +/- 0,15 mm (16.750 +/- 0.006 in)
Minimum permissible (B1) ... 425,02 mm (16.733 in)
Distance from bottom of crankcase to centre of main bearing bore (B2) ... 165,10 +/- 0,10 mm (6.500 +/- 0.004 in)
Bore in new cylinder liner (C1) ... 145 +/- 0,025 mm (5.71 +/- 0.0010 in)
Thickness of liner flange (C2) ... 8,890 +/- 0,020 mm (0.3500 +/- 0.0008 in)
Minimum thickness permissible (C2) ... 8,870 mm (0.3492 in)





Lubricating oil pump

Diameter of shafts (A1) ... ... 22,217 +/- 0,005 mm (0.8747 +/- 0.0002 in)
Diameter of bores in cover for shafts... ... ... 22,258 +/- 0,008 mm (0.8763 +/- 0.0003 in)
Length of gears (A3) ... ... 79,375 +/- 0,025 mm (3.1250 +/- 0.0010 in)
Depth of bores for gears (A3) .. .. 79,502 +/- 0,020 mm (3.1300 +/- 0.0008 in)

Spring (A2):

Test force. ... ... 150 +/- 8 Nm (110 +/- 6 lbf ft)
Length under test force ... ... 117,9 mm (4.64 in)
Free length after test ... ... 152,9 mm (6.02 in)
Outside diameter . ... 27 mm (1.063 in)