

SERVICE MANUAL

VM117, VM137

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This manual contains original instructions, verified by the manufacturer (or their authorized representative).

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Foreword

The Operator's Manual



You and others can be killed or seriously injured if you operate or maintain the machine without first studying the Operator's Manual. You must understand and follow the instructions in the Operator's Manual. If you do not understand anything, ask your employer or JCB dealer to explain it.

Do not operate the machine without an Operator's Manual, or if there is anything on the machine you do not understand.

Treat the Operator's Manual as part of the machine. Keep it clean and in good condition. Replace the Operator's Manual immediately if it is lost, damaged or becomes unreadable.

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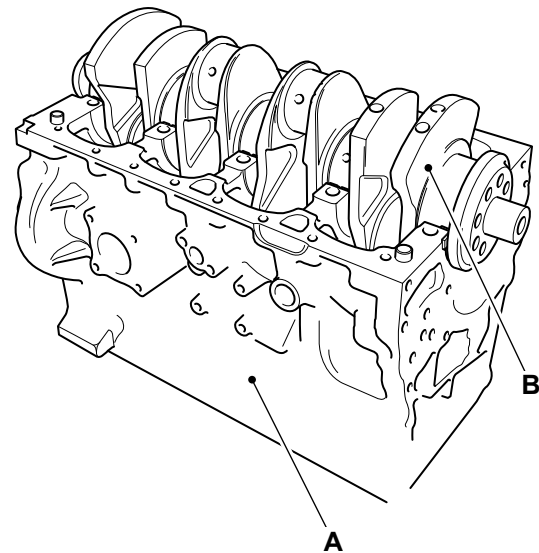
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Introduction

Figure 48.



A Crankcase
B Crankshaft

Technical Data

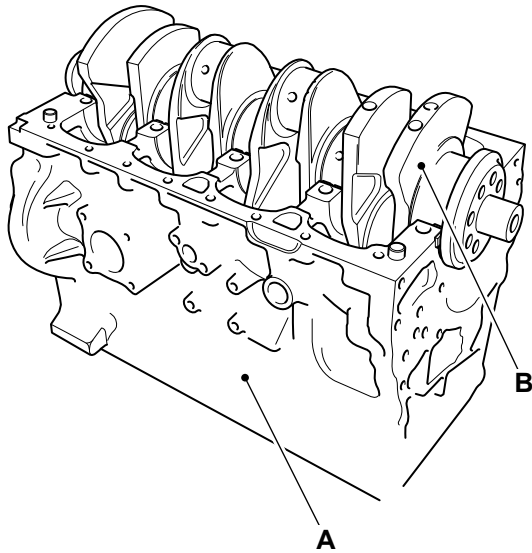
Table 35.

Main bearing journal diameter (x4)	
- min	87.98mm
- max	88mm
Main rear bearing journal diameter (x1)	
- min	99.98mm
- max	100mm
Connecting rod bearing journal diameter	
- min	72.98mm
- max	73mm
Maximum wear and ovality on journals ⁽¹⁾	
Crankshaft induction hardness	55 HRc min on surface
Thrust washer width	
- min	2.44mm
- max	2.5mm
Crankshaft end float	
- min	0.05mm
- max	0.28mm

(1) No visible damage/wear or marks

Component Identification

Figure 49.



- A** Crankcase
- B** Crankshaft

Operation

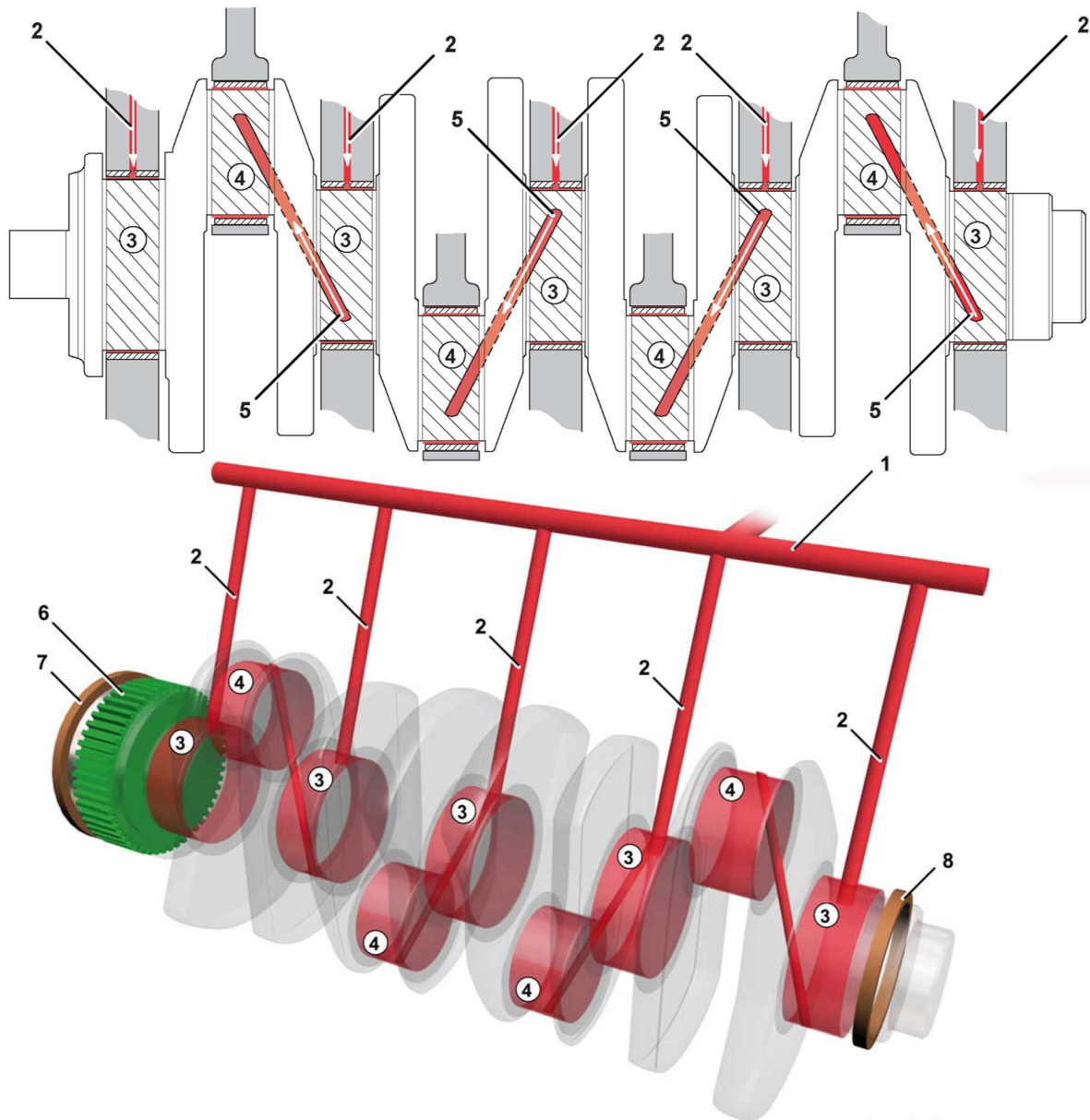
Refer to Camshaft-Operation (PIL 15-15).

Lubrication

Oil is fed from the main gallery via five drillings, one to each of the main bearings. A groove around the

diameter of the upper main bearing shell allows oil transfer to cross drillings in the crankshaft to feed each of the big end bearings. Crankshaft gear is 'splash' lubricated. Front and rear crankshaft oil seals prevent oil leakage from, and dirt ingress to, the engine.

Figure 50.



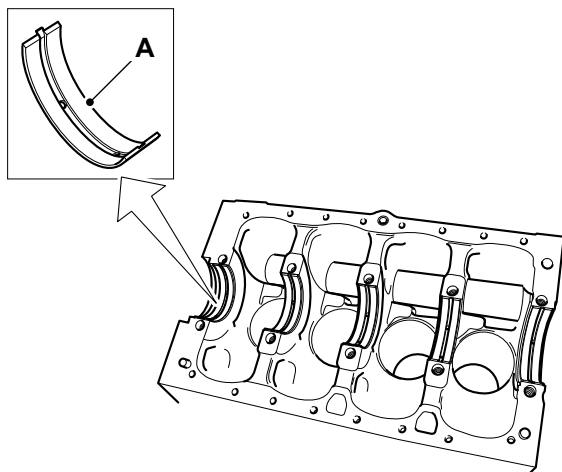
- 1 Main gallery
- 2 Drillings (x5)
- 3 Main bearings
- 4 Big end bearings

- 5 Cross drillings
- 6 Crankshaft gear
- 7 Crankshaft oil seal
- 8 Crankshaft oil seal

Check (Condition)

1. Check the main bearing surfaces for damage and excessive wear.

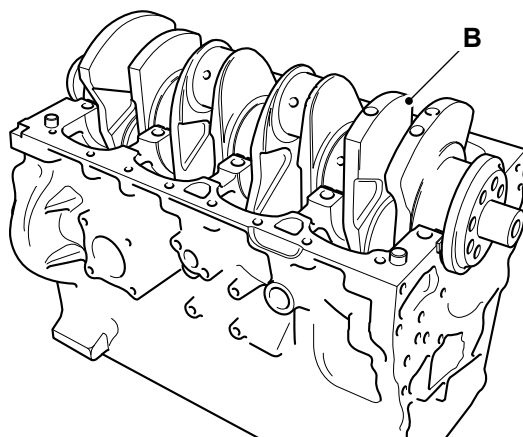
Figure 51.



A Main bearing shells

2. Measure the crankshaft diameters to confirm they are within service limits, refer to Technical Data (PIL 15-12).

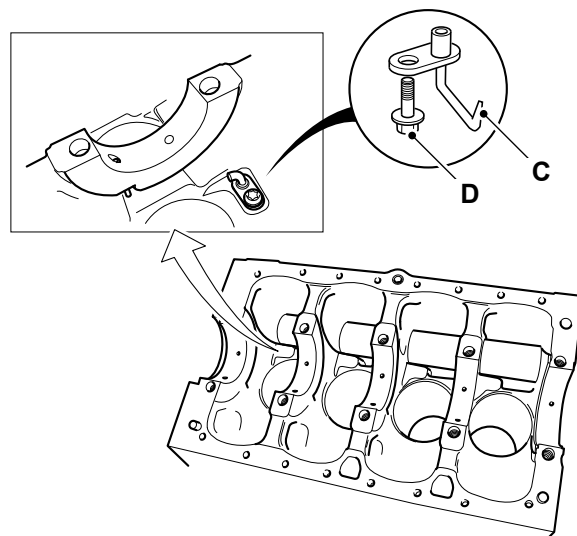
Figure 52.



B Crankshaft

3. Check that the oil-way cross drillings in the crankshaft are clear and free from debris. Blocked or restricted oil-ways will cause oil starvation at the big end bearings.
4. Check that the piston cooling J-jets are clear. If the J-jets cannot be cleared remove the fixing screws. Remove the J-jets and discard them.
5. Install new J-jets.

Figure 53.



C J-jets
D Fixing screws

Remove and Install

Consumables

Description	Part No.	Size
Cleaner/Degreaser - General purpose solvent based parts cleaner	4104/1557	0.4L

▲ CAUTION This component is heavy. It must only be removed or handled using a suitable lifting method and device.

Before Removal

1. This procedure requires service parts. Make sure you have obtained the correct service parts before you start, refer to Parts Catalogue.
2. Make sure that the engine is safe to work on. If the engine has been running, let it cool before you start the service work.
3. Remove the engine, refer to (PIL 15-00).
4. Remove the drive belt, refer to (PIL 15-18).
5. Remove the crankshaft pulley, refer to (PIL 15-12).
6. Remove the oil sump, refer to (PIL 15-45).
7. Disconnect and remove the fuel pipes from the injectors, refer to (PIL 18-96).
8. Remove the rocker cover, refer to (PIL 15-42).
9. Remove the fuel injectors, refer to (PIL 18-18).
10. Remove the rocker assembly including the push rods, refer to (PIL 15-42).
11. It is not necessary to remove the cylinder head assembly to remove the crankshaft. If however the cylinder head needs to be removed for other

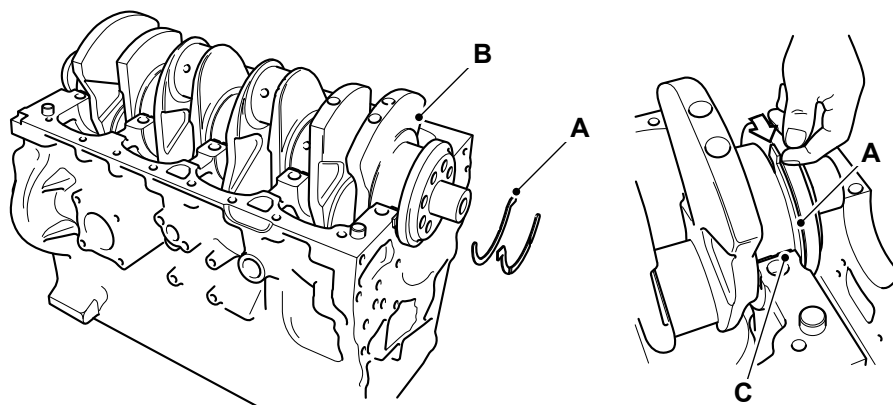
reasons (for piston and connecting rod removal for example) remove it now, refer to (PIL 15-06).

12. Remove the fuel injection pump, refer to (PIL 18-18).
13. Remove the starter motor, refer to (PIL 15-75).
14. Remove the high duty PTO device (if installed).
15. Position the engine upside down in a suitable jig or fixture, supported at the front of the cylinder block.
16. Remove the flywheel, refer to (PIL 15-54).
17. Remove the flywheel housing, refer to (PIL 15-54).
18. Remove the fuel injection pump drive gear, refer to (PIL 15-51).
19. Remove the oil pump, refer to (PIL 15-60).
20. Remove the high duty PTO idler drive gear (if installed), refer to (PIL 15-51).
21. Remove the crankshaft drive gear, refer to (PIL 15-51).
22. Remove the camshaft, refer to (PIL 15-15).
23. Remove the rear timing case, refer to (PIL 15-51).
24. If the pistons and connecting rods have not been removed, undo and remove the main bearing caps, refer to (PIL 15-12).
25. Remove the bedplate, refer to (PIL 15-09).

Remove

1. Remove the thrust washers between the crankshaft and crankcase rear main bearing.

Figure 54.

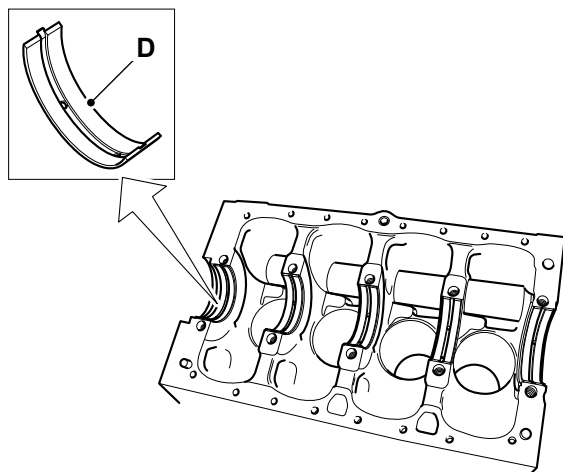


A Thrust Washers
B Crankshaft

C Rear main bearing

2. Put labels on the thrust washers to make sure that they are installed in the correct positions during assembly.
3. Use suitable lifting equipment to carefully lift the crankshaft from the crankcase (if the crankshaft is lifted manually, two people will be required).
4. Carefully lift out the bearing shells.

Figure 55.



D Main bearing shells

5. It is recommended that the bearing shells are replaced. If however they are to be used again, put label on the shells to make sure that they are installed in their original positions during assembly.
6. Inspect the crankshaft and main bearings etc. for damage and excessive wear. Refer to Check Condition (PIL 15-12).

Before Installation

1. Clean off all traces of the old sealant compound from the crankcase and bedplate mating faces.
2. Use a suitable degreasing agent to carefully clean the main bearing saddles in the bedplate and crankcase. Take care not to block the oil ways or the piston cooling jets.

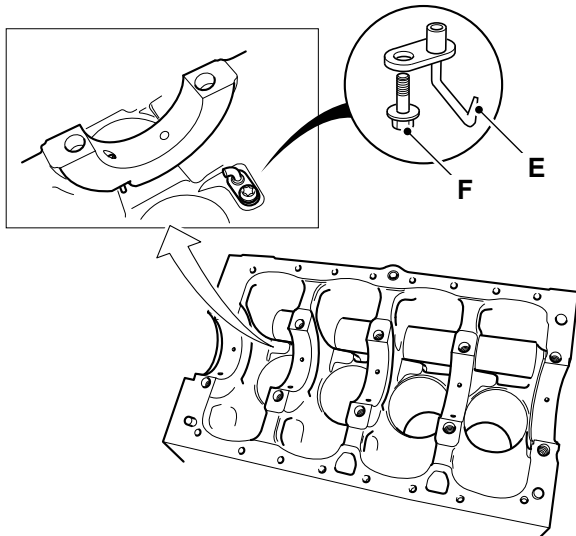
Consumable: [Cleaner/Degreaser](#) - [General purpose solvent based parts cleaner](#)

Important: Cleanliness is of the utmost importance. Blocked oil-ways or oil jets will cause engine failure. Before you install the crankshaft make sure that ALL oil-ways and jets are clear and free from debris.

Install

1. Replacement is the reversal of the removal procedure.
2. Make sure that all items are clean and free from damage and corrosion.
3. If removed or a new crankcase is being installed then install cooling J jets as follows:

Figure 56.

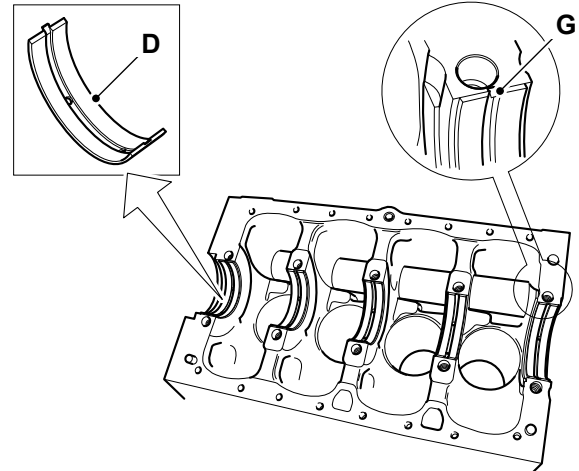


E J jets (x4)
F Fixing screws

- 3.1. Insert the cooling jets into the crankcase.
- 3.2. Note: There are different types of cooling jets installed depending on the engine application. The jets are colour coded.
- 3.3. Be sure to install the correct jets. Refer to the relevant parts catalogue for the correct cooling jet identification.
- 3.4. Tighten the retaining screws to the correct torque value.

4. Install the upper bearing shells as follows:

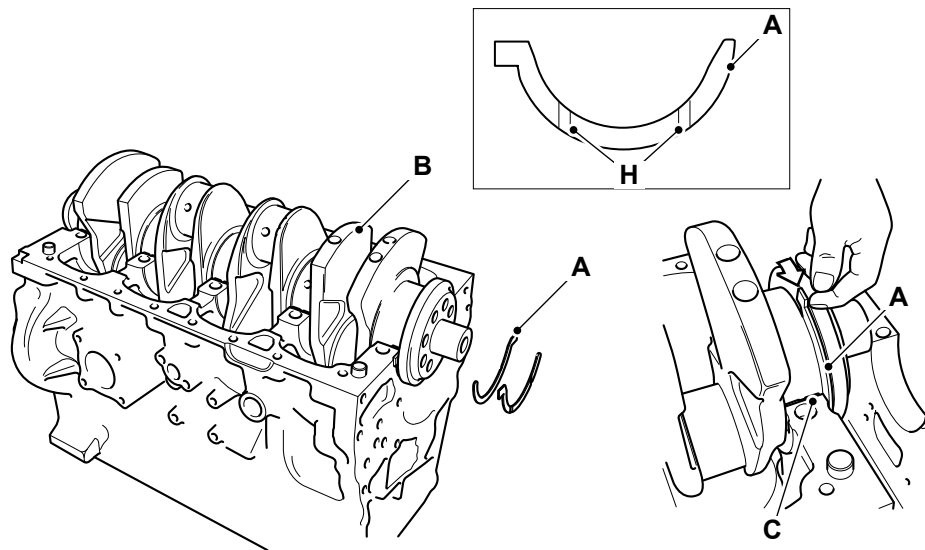
Figure 57.



D Main bearing shells
G Bearing location tab

- 4.1. Use a suitable degreasing agent to make sure that the surface of the upper bearing shells are clean.
[Consumable: Cleaner/Degreaser - General purpose solvent based parts cleaner](#)
- 4.2. Assemble the bearing shells into the crankcase bearing saddles. Make sure that the location tab engages into the slot as shown.
- 4.3. Important: Make sure that the oil-way holes in the bearing saddles align with the holes in the bearing shell. If the holes are even partially misaligned the piston cooling oil jet will be restricted, causing the engine to fail.
- 4.4. Lubricate the upper bearing shells with clean engine oil.
5. Use suitable lifting equipment (if the crankshaft is lifted manually, two people will be required), to carefully lower the crankshaft into the crankcase. DO NOT rotate the crankshaft, the bearing shells can become dislodged, refer to step 4.
6. Install the thrust washers as follows:

Figure 58.



A Thrust washers
B Crankshaft

C Rear main bearing
H Oil slot - thrust washers

- 6.1. Slide the thrust washers between the crankshaft and the crankcase rear main bearing.
- 6.2. Make sure that they are installed in the correct positions, with the two slots facing outwards from the bearing saddle.
- 6.3. If necessary, push the crankshaft forward and then backwards to obtain clearance to install the thrust washers.
- 6.4. DO NOT rotate the crankshaft, the bearing shells can become dislodged, refer to step 4.
7. Check that the crankshaft end float is within service limits, refer to Technical Data (PIL 15-12).

Table 36. Torque Values

Item	Nm
F	24

03 - Main Bearing

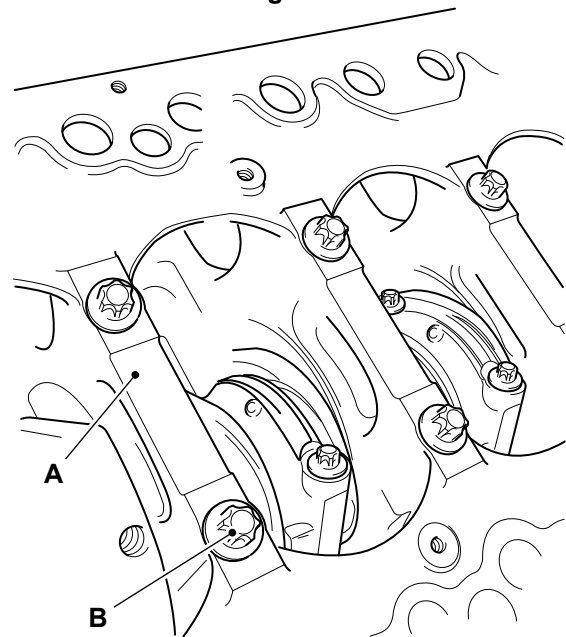
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Introduction

In a piston engine, the main bearings are the bearings on which the crankshaft rotates.

The bearings hold the crankshaft in place and prevent the forces created by the piston and transmitted to the crankshaft by the connecting rods from dislodging the crankshaft, instead forcing the crank to convert the reciprocating movement into rotation.

Figure 59.



- A** Main bearing
- B** Main bearing bolts

Check (Condition)

1. Check the bearing shell surfaces for signs of damage and excessive wear.
2. Measure the crank pin diameters to confirm they are within service limits, refer to Technical Data (PIL 15-12).
3. Renew any parts that are worn or not within the specified tolerances.

Remove and Install

Special Tools

Description	Part No.	Qty.
Torque Wrench (10-100Nm)	993/70111	1

Before Removal

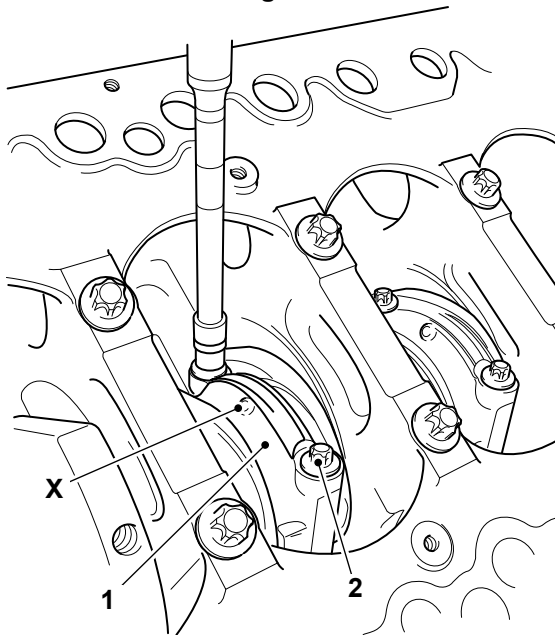
1. This procedure requires service parts. Make sure you have obtained the correct service parts before you start, refer to Parts Catalogue.
2. Make sure that the engine is safe to work on. If the engine has been running, let it cool before you start the service work.
3. Get access to the engine.
4. Disconnect and remove the fuel pipes from the injectors, refer to (PIL 18-96).
5. Remove the rocker cover, refer to (PIL 15-42).
6. Remove the fuel injectors, refer to (PIL 18-18).
7. Drain the oil from the engine, refer to (PIL 15-21).
8. Remove the oil sump, refer to (PIL 15-45).
9. Position the engine upside down in a suitable jig or fixture, supported at the front of the crankcase.

Important: The connecting rod and the big-end bearing cap have been fracture split and must be kept together as a set. Utmost care must be taken to avoid contamination and or damage to the fracture split surfaces Z.

Remove

1. It is recommended that the big-end bearing caps are removed in pairs, cylinders 1 and 4 and cylinders 2 and 3. Rotate the crankshaft so that the big-end bearing caps on cylinders 2 and 3 are positioned as shown.
2. Remove the bolts and lift off the big-end bearing caps from the connecting rods. Note that the bolts must not be re-used, discard the bolts.

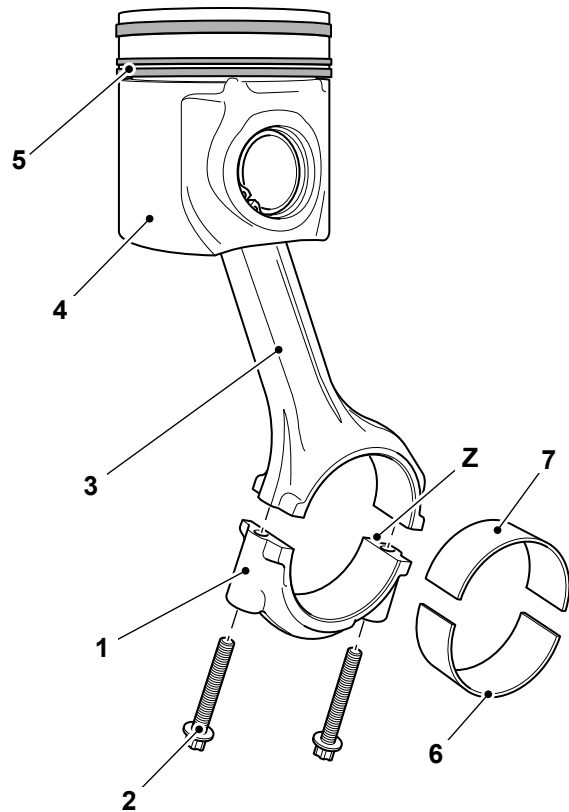
Figure 60.



- 1 Big-end bearing caps
- 2 Big-end bearing cap bolts
- X Cast pip

3. Lift out the bearing shells from the bearing caps. Carefully rotate the crank to disengage from the connecting rods and gain access to the upper bearing shells. Lift out the upper bearing shells. It is recommended that the bearing shells are renewed. If however they are to be reused, label the bearing shells to make sure that they are installed in their original positions on assembly.

Figure 61.



- 1 Big-end bearing cap
- 2 Bolts
- 3 Connecting rod
- 4 Piston
- 5 Piston rings
- 6 Lower bearing shell
- 7 Upper bearing shell
- Z Fracture split surfaces

4. Carefully rotate the crankshaft to position the big-end bearing caps of cylinders 1 and 4. Make sure that the crank does not foul the connecting rods of cylinders 2 and 3. Remove the bearing caps and bearing shells as described in steps 1 and 2.
5. Inspect the big-end bearings for signs of damage and excessive wear, refer to Check Condition (PIL 15-12).

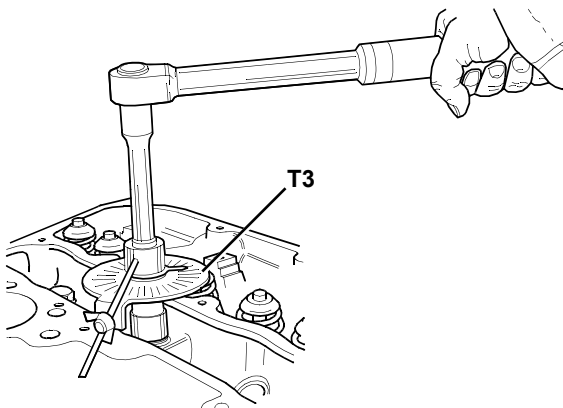
Install

1. Replacement is the reversal of the removal procedure.
2. Make sure that all items are clean and free from damage and corrosion.
3. Install the upper bearing shell to the connecting rod. Lubricate the bearing shell with clean engine oil.

4. Install the lower bearing shell to the big-end bearing cap. Lubricate the bearing shell with clean engine oil, then install the big-end bearing cap to the connecting rod. Make sure that the cast pip X on the bearing cap faces to the front of the engine. Note: Use compressed air to clean the fracture surfaces Z before assembly.
5. Renew the fixing bolts. Tighten the new bolts in three stages to the correct torque value.

Special Tool: Torque Wrench (10-100Nm) (Qty.: 1)

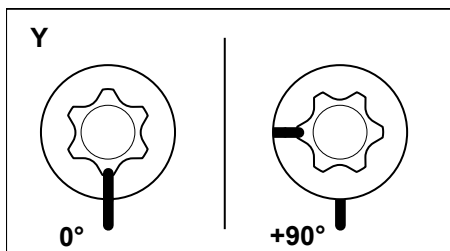
Figure 62.



T3 Angle gauge (obtain locally)

6. The bolts are tightened using a torque and angle method, refer to Fasteners and Fixings, General, Introduction (PIL 72-00).

Figure 63.



After Installation

1. Carry out the procedures listed, Before Removal in reverse order.

Table 37.

Item	Torque Value
2 - 1st Stage	35N·m
2 - 2nd Stage	65N·m
2 - Final Stage	90°



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