

SERVICE MANUAL

LOADER
406, 407, 409

EN - 9813/3100 - ISSUE 4 - 04/2018


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

Copyright 2017 © JCB SERVICE
All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any other means, electronic, mechanical, photocopying or otherwise, without prior permission from JCB SERVICE.

www.jcb.com

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.

Contents

- 01 - Machine**
- 03 - Attachments, Couplings and Load Handling**
- 06 - Body and Framework**
- 09 - Operator Station**
- 12 - Heating, Ventilating and Air-Conditioning (HVAC)**
- 15 - Engine**
- 18 - Fuel and Exhaust System**
- 21 - Cooling System**
- 24 - Brake System**
- 25 - Steering System**
- 27 - Driveline**
- 30 - Hydraulic System**
- 33 - Electrical System**
- 72 - Fasteners and Fixings**
- 75 - Consumable Products**
- 78 - After Sales**

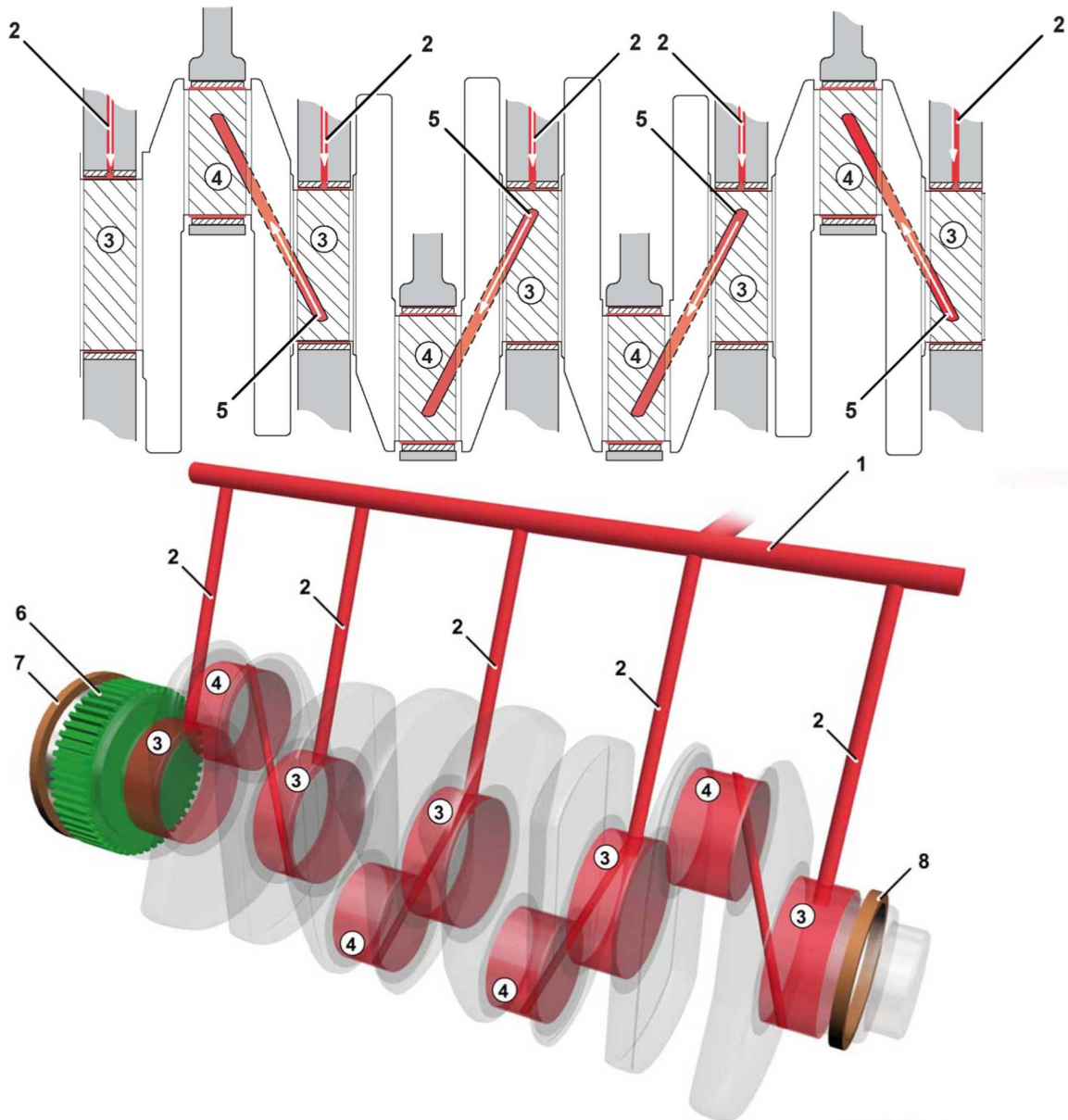
Operation

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 137.



- 1 Main gallery
- 3 Main bearings
- 5 Cross drillings
- 7 Crankshaft oil seal

- 2 Drillings (x5)
- 4 Big end bearings
- 6 Crankshaft gear
- 8 Crankshaft oil seal

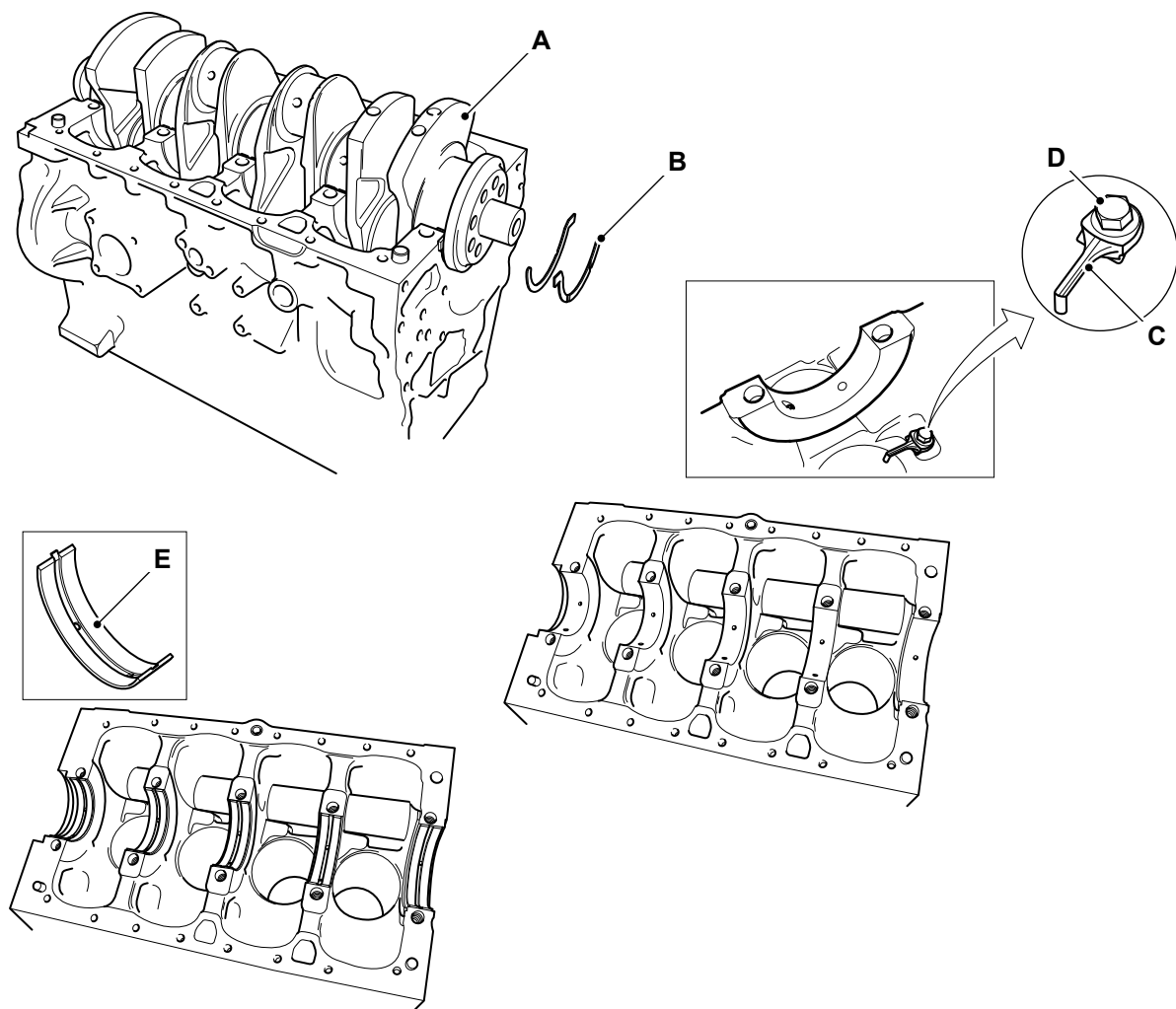
Check (Condition)

1. Check the main bearing surfaces for damage and excessive wear.
2. Measure the crankshaft diameters to confirm they are within service limits.
 Refer to: PIL 15-12-00.
3. Check that the oilway cross drillings in the crankshaft are clear and free from debris.

Blocked or restricted oilways will cause oil starvation at the big end bearings.

4. Check that the piston cooling oil sprayers are clear (if installed). If the sprayers cannot be cleared remove the fixing screws. Remove the sprayers and discard them.

Figure 138.



- A** Crankshaft
- C** Oil spray jets (if installed)
- E** Main bearing shells

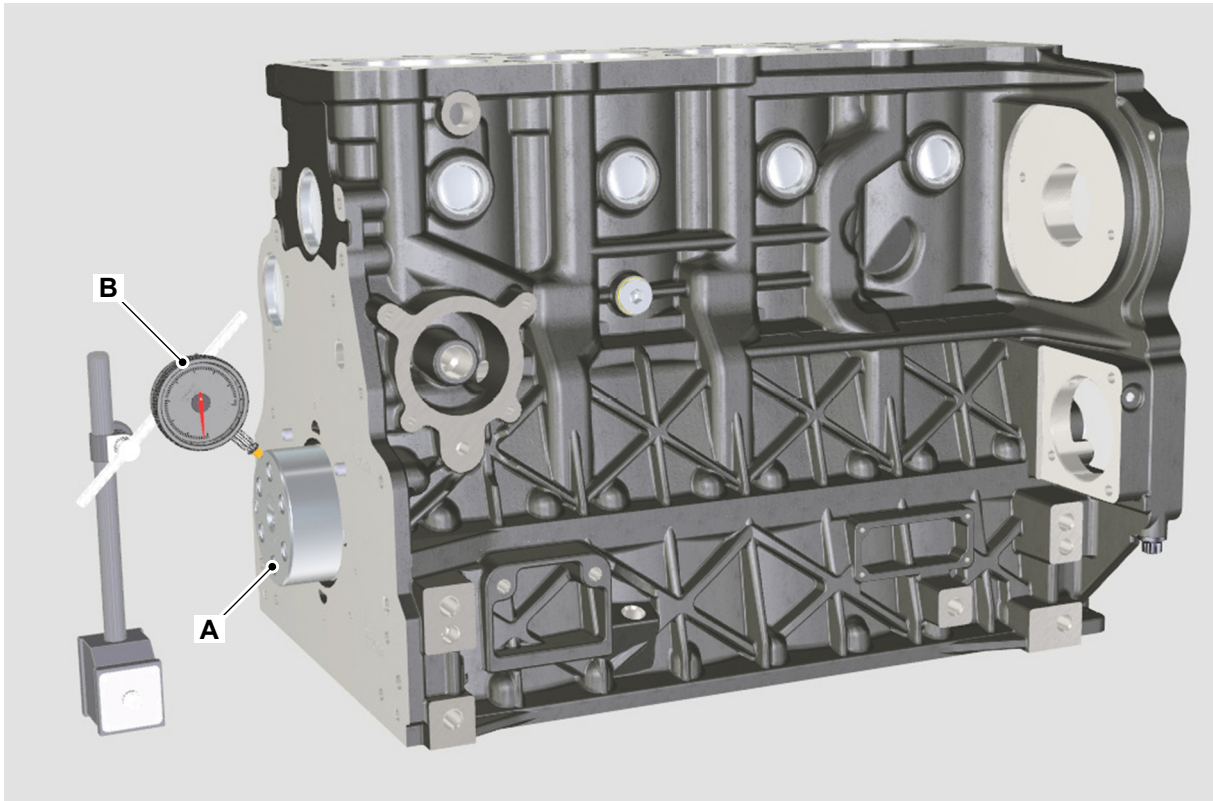
- B** Shoulder half-rings
- D** Fixing screws

Calibrate

Axial clearance check

1. To measure the axial clearance of the crankshaft, it is necessary to assemble the shaft in the crankcase.
2. Measure the axial shift of the crankshaft with a dial gauge. The axial shift must range between 0.18-0.38mm (0.007-0.015in).
3. If the value is more than or less than the specified range, replace the shoulder rings.

Figure 139.



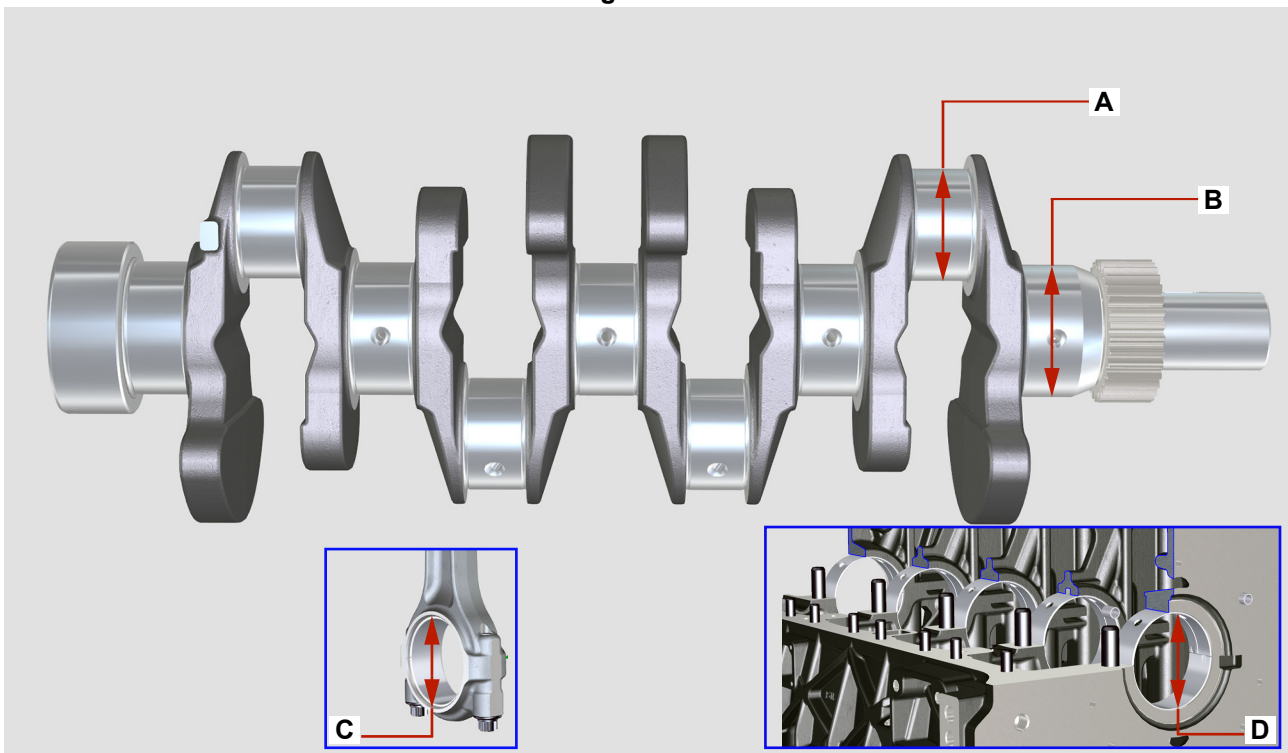
A Crankshaft

B Dial gauge

Dimensional Check

1. Make sure that you clean the crankshaft thoroughly with a suitable detergent.
2. Use a pipe cleaner into the lubrication ducts to remove any residual dirt.
3. Use a compressed air jet to thoroughly clean the oil passages.
4. Check the surfaces of the main journals and crank-pins for wear limit, to see whether grinding is necessary.
5. Install the half-bearings on the semi-crankcases, without crankshaft, and couple the semi-crankcases by tightening the fixing screws.
6. Measure the diameter of the crank-pins and main journals with a micrometer.
7. Measure the internal diameter of the connecting rod and crankshaft half-bearings with a dial gauge.
8. Lubricate the contact surfaces with oil to prevent oxidation.
9. The crankshaft and connecting rod half-bearings must necessarily be replaced every time they are disassembled.
10. Make sure that the measurements are within the allowable limits.

Figure 140.



A Crank-pin
C Connecting rod half-bearing

B Main journal
D Crankshaft half-bearing

Remove and Install

Consumables

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

▲ 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. Get access to the engine.

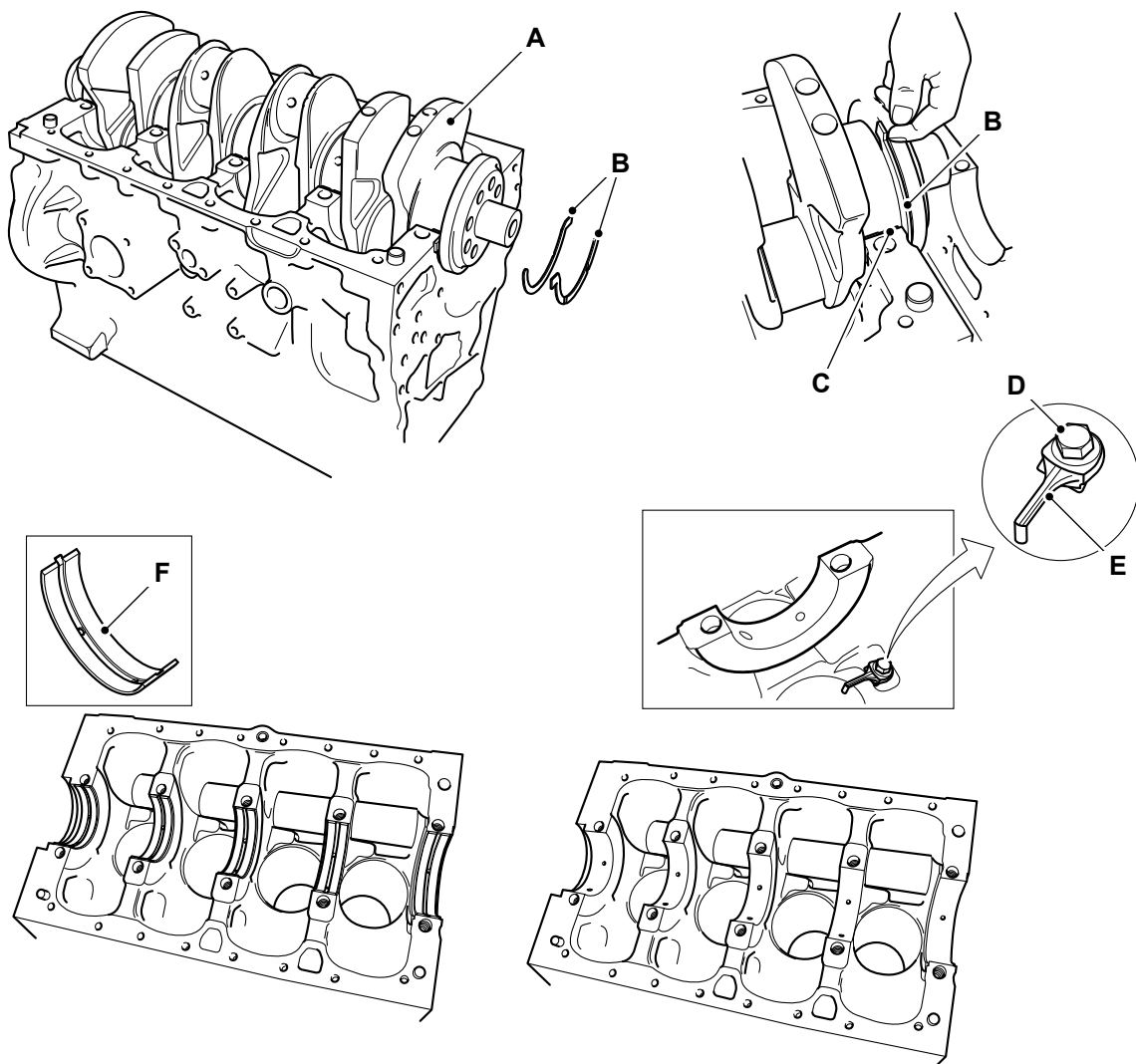
4. Remove the bedplate.

Refer to: [PIL 15-09-00](#).

5. If the pistons and connecting rods have not been removed, then remove the main bearing caps.

Refer to: [PIL 15-12-00](#).

Figure 141.



A Crankshaft

B Thrust Washers



C Rear main bearing
E Cooling jets (x4)

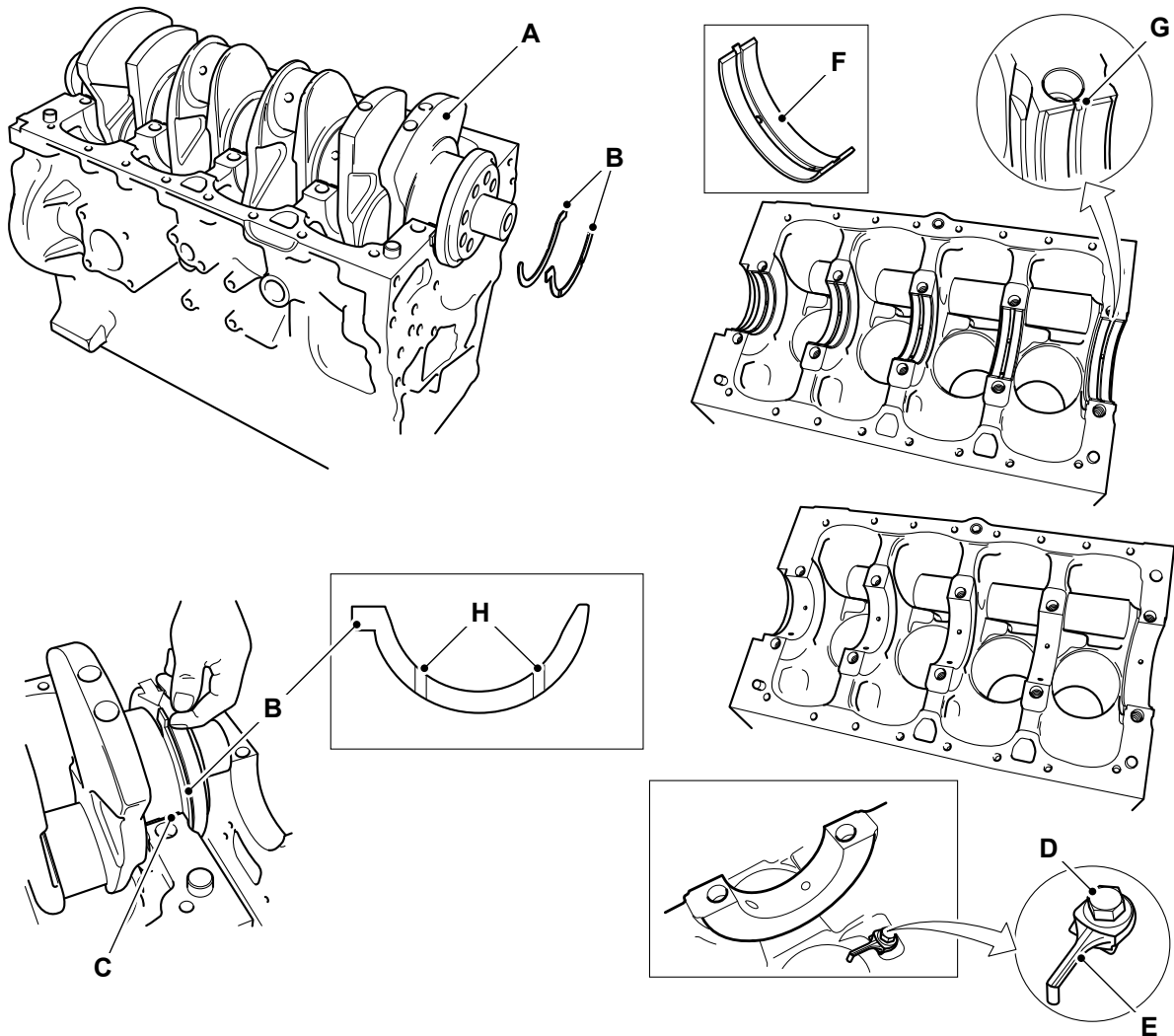
D Fixing screws
F Main bearing shells

Remove

1. Remove the thrust washers between the crankshaft and crankcase rear main bearing.
2. Put labels on the thrust washers to make sure that they are installed in the correct positions on 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. It is recommended that the bearing shells are renewed.
5. If the bearing shells are to be used again, put labels on the shells to make sure that they are installed in their original positions on assembly.
6. Inspect the crankshaft and main bearings etc. for damage and excessive wear.

Figure 142.



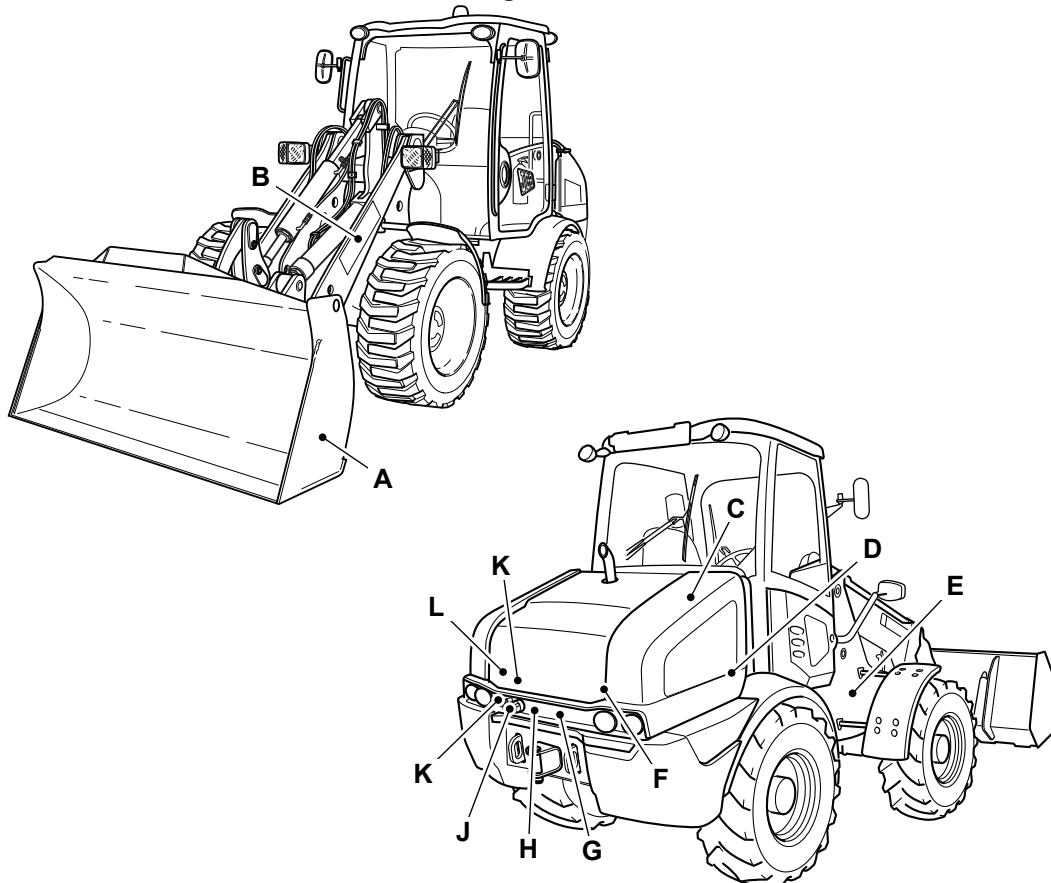
- A** Crankshaft
- C** Rear main bearing
- E** Cooling jets x4 (PIL 15-03)
- G** Bearing location tab

- B** Thrust Washers
- D** Fixing screws
- F** Main bearing shells
- H** Oil slot-thrust washers

12 - Main Component Locations

Introduction

Figure 7.



- A Shovel
- C Coolant expansion tank
- E Articulation lock
- G Engine oil dipstick
- J Trailer socket (if installed)
- L Oil filter

- B Lift arm
- D Fuel filter and water trap
- F Engine oil filler
- H Fuel pump and filter
- K Battery isolation switch

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.

Consumable: [Cleaner/Degreaser - General purpose solvent based parts cleaner](#)
3. Take care not to block the oil ways or the piston cooling jets.

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. The installation procedure is the opposite of the removal procedure.
2. Make sure that all items are clean and free from damage and corrosion.
3. If the cooling jets have been removed or a new crankcase is being installed, install the jets on the crankcase.
4. Tighten the retaining screws to the correct torque value.
5. 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](#)
6. Assemble the bearing shells into the crankcase bearing saddles.
7. Make sure that the location tab engages into the slot.
8. Important: Make sure that the oil-way holes in the bearing saddles align with the holes in the bearing shell. Misaligned holes will cause engine failure.
9. Lubricate the upper bearing shells with clean engine oil.
10. Use suitable lifting equipment (if the crankshaft is lifted manually, two people will be required), to carefully lower the crankshaft into the crankcase.
11. DO NOT rotate the crankshaft, the bearing shells can become dislodged. Refer to step 5.
12. Slide the thrust washers between the crankshaft and the crankcase rear main bearing.

13. Make sure that they are installed in the correct positions, with the two slots facing outwards from the bearing saddle.
14. If necessary, push the crankshaft forward and then backwards to obtain clearance to install the thrust washers.
15. DO NOT rotate the crankshaft, the bearing shells can become dislodged. Refer to step 5.
16. Check that the crankshaft end float is within service limits.

Refer to: [PIL 15-12-00](#).
17. Install the bedplate.

Refer to: [PIL 15-09-00](#).

Table 69. Torque Values

| Item | Nm |
|------|----|
| D | 10 |

03 - Main Bearing

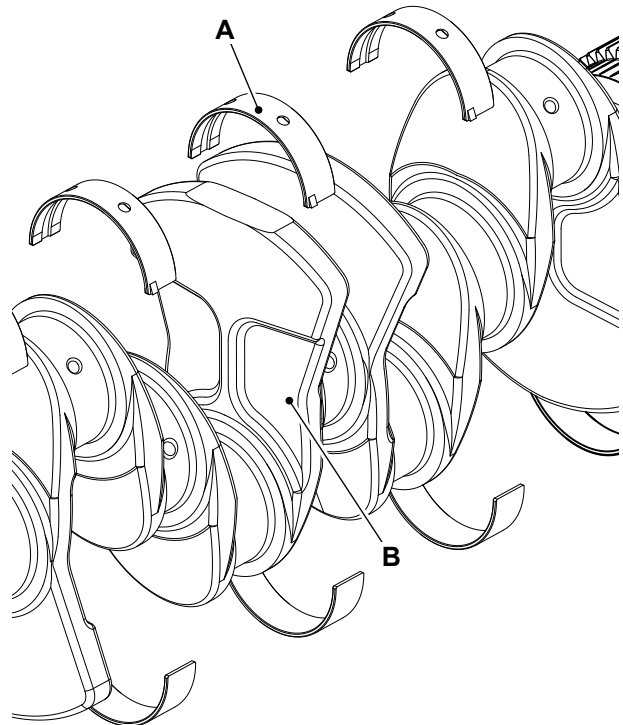
| | |
|--------------------------|-------|
| Introduction | 15-61 |
| Check (Condition) | 15-62 |
| Remove and Install | 15-62 |

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 143.



- A** Main bearing
- B** Crankshaft

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: PIL 15-33-00.](#)
3. Measure the bearing journal diameters to confirm they are within service limits.
[Refer to: PIL 15-12-00.](#)
4. Replace 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 |

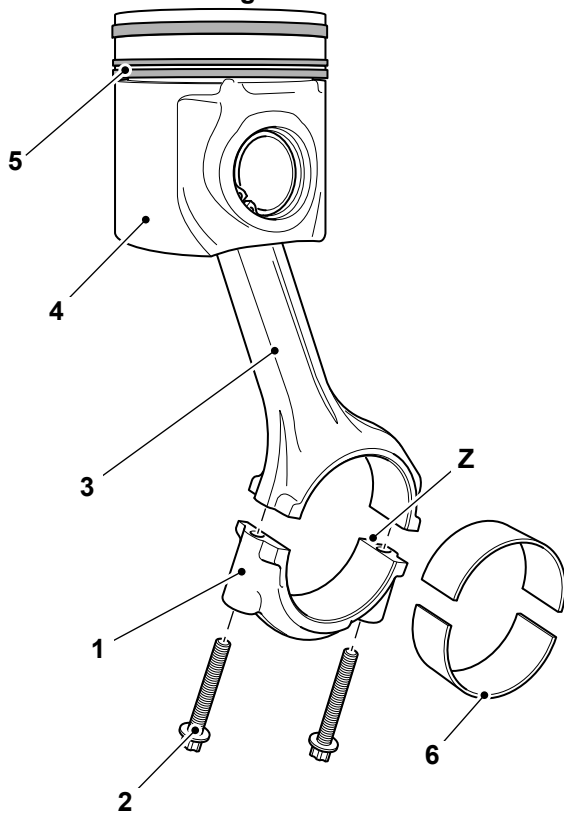
Before Removal

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. Remove the fuel injectors.
[Refer to: PIL 18-18-03.](#)
5. Remove the rocker cover.
[Refer to: PIL 15-42-06.](#)
6. Drain the oil from the engine.
[Refer to: PIL 15-00-00.](#)
7. Remove the oil sump.
[Refer to: PIL 15-45-00.](#)
8. Position the engine upside down in a suitable jig or fixture, supported at the front of the crankcase.

Important: The connecting rod and the main 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.

Remove

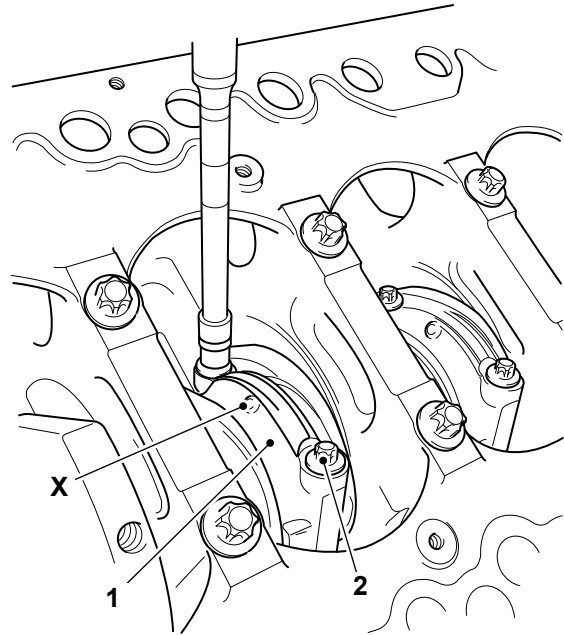
Figure 144.



- 1 Piston rings
- 2 Piston
- 3 Connecting rod
- 4 Main bearing cap
- 5 Bolts
- 6 Big end bearing shells
- Z Fracture split surfaces

1. It is recommended that the main bearing caps are removed in pairs according to the firing cycle.
 - 1.1. Cylinder 2
 - 1.2. Cylinders 1 and 3
2. Put marks on the main bearing caps to make sure that they are installed in their original positions on assembly.
3. Rotate the crankshaft so that the main bearing caps on cylinder 2 are positioned at the top.
4. Remove the bolts and lift off the main bearing caps from the connecting rods.
5. Make sure that the bolts are not used again. Discard the bolts.

Figure 145.



- 1 Main bearing caps
- 2 Main bearing cap bolts

6. Remove the bearing shells.
 - 6.1. Lift out the bearing shells from the main bearing caps.
 - 6.2. Carefully rotate the crank to disengage from the connecting rods and gain access to the upper bearing shells.
 - 6.3. Lift out the upper bearing shells.
 - 6.4. The bearing shells must be replaced every time they are removed.
7. Carefully rotate the crankshaft to position the main bearing caps of cylinders 1 and 3.
8. Make sure that the crankshaft does not hit the connecting rod of cylinder 2.
9. Do the steps 4 to 6 to remove the bearing caps and bearing shells for cylinders 1 and 3.
10. Inspect the main bearings for signs of damage and excessive wear.

[Refer to: PIL 15-12-03.](#)

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 main bearing cap. Lubricate the bearing shell with clean engine oil.
5. Use compressed air to clean the fracture surfaces of the main bearing caps before assembly.
6. Install the main bearing cap to the connecting rod.
7. Replace the fixing bolts.
8. Tighten the new bolts in two stages to the correct torque value.
[Special Tool: Torque Wrench \(10-100Nm\) \(Qty.: 1\)](#)
9. Make sure that the crankshaft rotates smoothly and the connecting rods have axial play.
10. After you perform the check, rotate the crankshaft to position the first cylinder at TDC (Top Dead Centre).

After Installation

1. Install the oil sump.
[Refer to: PIL 15-45-00.](#)
2. Install the rocker cover.
[Refer to: PIL 15-42-06.](#)
3. Install the fuel injectors.
[Refer to: PIL 18-18-03.](#)
4. Fill the engine with engine oil.
[Refer to: PIL 15-00-00.](#)

Table 70. Torque Values

| Item | Description | Nm |
|-------------|--------------------|-----------|
| 2 | 1st Stage | 40 |
| 2 | 2nd Stage | 85 |

Buy Now



Our support email:

ebooklibonline@outlook.com