



# SERVICE MANUAL

SKIDSTEER LOADER  
**135 [T4F], 150T [T4F], 155 [T4F],  
175 [T4F], 190T [T4F],  
205T [T4F], 210 [T4F], 215 [T4F]**

EN - 9813/9750  
ISSUE 1 - 05/2017


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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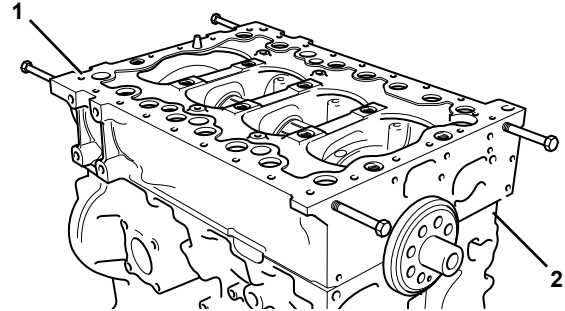
## 00 - General

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## Introduction

The bedplate acts as the main strength component of the engine. It maintains the correct alignment and supports the weight of the internal components.

**Figure 122.**



- 1 Bedplate
- 2 Crankcase

## Remove and Install

For: KDI 1903 TCR Elec Engine  
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(For: KDI 1903 TCR Elec Engine)

### 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

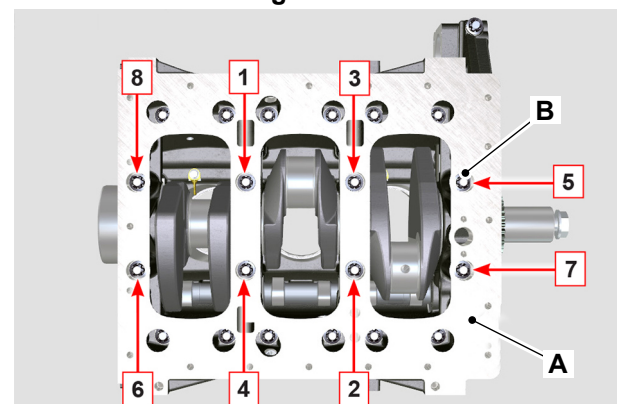
1. This procedure requires service parts. Make sure you have obtained the correct service parts before you start, refer to Parts Catalogue.
2. Make sure that the engine is safe to work on. If the engine has been running, let it cool before you start the service work.
3. Get access to the engine.
4. Remove the drive belt. Refer to (PIL 15-18).
5. Remove the oil sump. Refer to (PIL 15-45).
6. Remove the turbocharger. Refer to (PIL 18-35).
7. Remove the exhaust manifold. Refer to (PIL 18-24).
8. Remove the starter motor. Refer to (PIL 15-75).
9. Remove the flywheel housing. Refer to (PIL 15-51).
10. Remove the crankshaft rear oil seal flange. Refer to (PIL 15-12).
11. Remove the EGR (Exhaust Gas Recirculation). Refer to (PIL 18-27).
12. Remove the inlet manifold. Refer to (PIL 18-24).
13. Disconnect and remove the high and low pressure fuel pipes. Refer to (PIL 18-96).
14. Remove the timing gear front case. Refer to (PIL 15-51).
15. Remove the fuel injection pump. Refer to (PIL 18-18).

16. Remove the fuel injection drive gear. Refer to (PIL 15-51).
17. Remove the intermediate drive gear. Refer to (PIL 15-51).
18. Remove the high duty PTO (Power Take-Off) device (if installed).
19. Remove the fuel injectors. Refer to (PIL 18-18).
20. Remove the rocker cover. Refer to (PIL 15-42).
21. Remove the rocker assembly including the push rods. Refer to (PIL 15-42).
22. It is not necessary to remove the cylinder head assembly to remove the bedplate. 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).
23. Position the engine upside down in a suitable jig or fixture, supported at the front of the crankcase.

### Remove

1. Remove the main bearing bolts in the sequence shown.

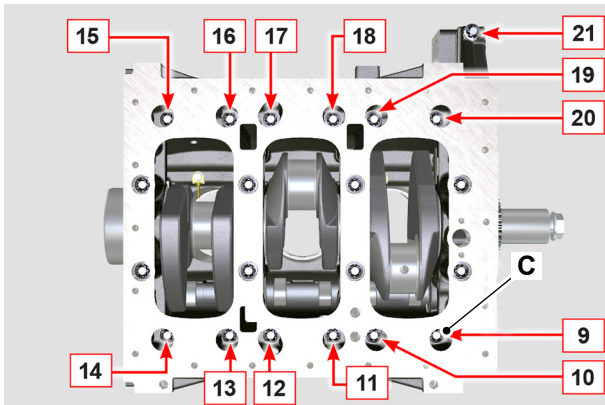
**Figure 123.**



**A** Bedplate  
**B** Main bearing bolts (x8)

2. Remove the bedplate peripheral bolts in the sequence shown.

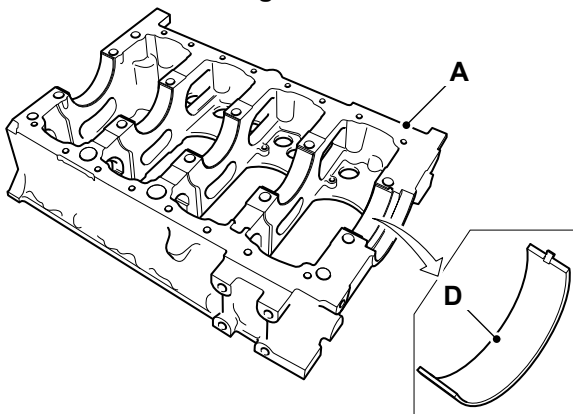
**Figure 124.**



**C** Peripheral bolts (x13)

3. Carefully separate the bedplate from the crankcase. Use suitable lifting equipment (if the bedplate is lifted manually, two people will be required). Do not use a lever to separate the bedplate.
4. Carefully remove the lower bearing shells from the bedplate.

**Figure 125.**



**A** Bedplate  
**D** Lower bearing shells (x4)

**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: Anaerobic sealant will not start to cure whilst it is open to the atmosphere, however when air is excluded (for instance when the two parts are put together) it will immediately start to harden. Make sure that all the necessary tools, bolts etc. are readily

available prior to assembling the components. The parts must be installed and tightened to the correct torque value within 5min minutes (with a maximum permissible time of 15min).

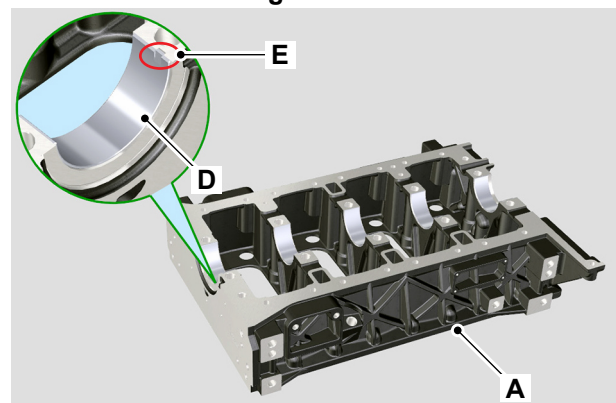
Important: BEFORE you install the bedplate: DO NOT rotate the crankshaft. Make sure that the upper main bearing shells are flush with the bottom face of the crankcase.

**Install**

Important: The crankshaft half bearings are made of special material. Therefore, they must be replaced every time they are removed to prevent seizures. The lower and upper crankshaft half bearings cannot be replaced singularly, and both halves must be replaced together.

1. Make sure that all items are clean and free from damage and corrosion.
2. Use a suitable degreasing agent to clean both sides of the lower bearing shells.  
 Consumable: [Cleaner/Degreaser - General purpose solvent based parts cleaner](#)
3. Install the lower bearing shells into the bedplate. Make sure that the reference notches are at the correct location.

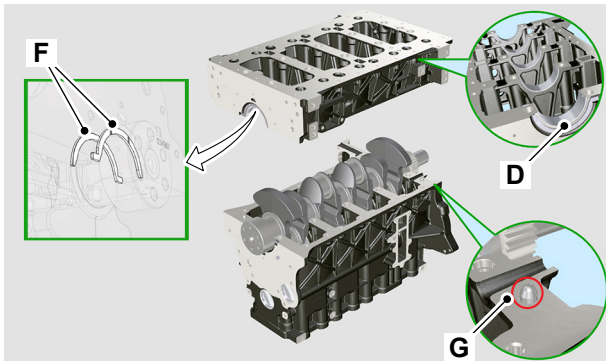
**Figure 126.**



**A** Bedplate  
**D** Lower bearing shells (x4)  
**E** Reference notch

4. Lubricate the lower bearing shells with clean engine oil.
5. Install the two shoulder half-rings onto the lower crankcase. Apply two dots of ITP GX100 grease to hold the rings in position.

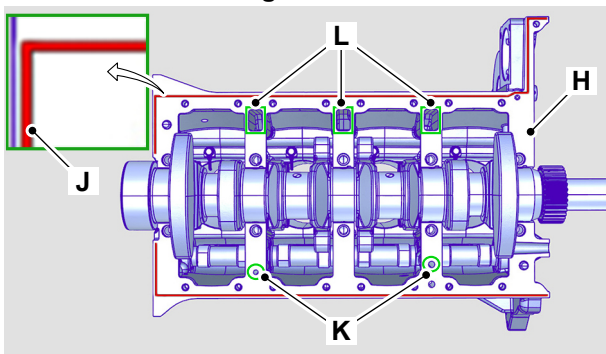
**Figure 127.**



- D** Lower bearing shells (x4)
- F** Shoulder half-rings (x2)
- G** Guide pins

6. Apply a 1.0mm (0.04in) thick bead of Loctite 5188 around the crankcase/bedplate mating face as shown.

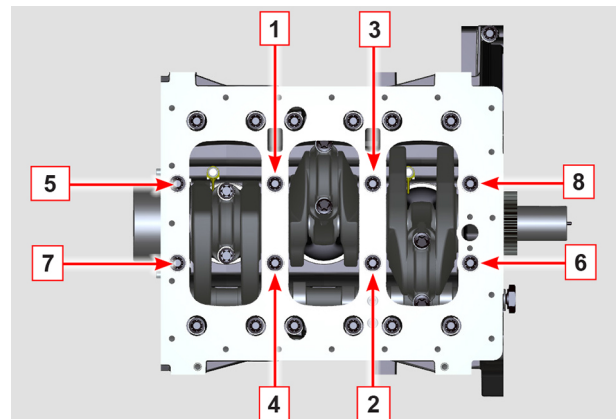
**Figure 128.**



- H** Crankcase
- J** Loctite 5188
- K** Oil feed holes
- L** Return oil grooves

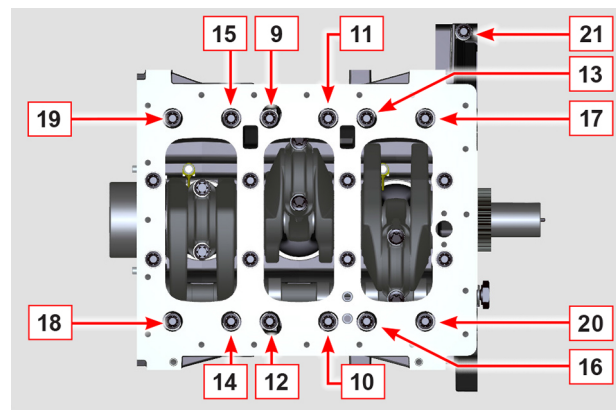
7. Make sure that you do not block the oil feed holes and the return oil grooves.
8. Assemble the bedplate to the crankcase. Make sure that the guide pins on the crankcase are engaged properly in the slots on the bedplate.
9. Note: The bedplate is heavy. Two people will be required to lift and rotate the bedplate safely on to the crankcase.
10. Install the main bearing bolts (x8).
11. Tighten the bolts to the correct torque value in three stages. Strictly follow the torque sequence shown.

**Figure 129.**



12. Install the bedplate peripheral bolts (x13).
13. Tighten the bolts to the correct torque value in two stages. Strictly follow the torque sequence shown.

**Figure 130.**



Important: If the parts have not been tightened to the correct torque value within the maximum 15min time period, then the parts must be separated, thoroughly cleaned and fresh sealant should be applied.

### After Installation

1. Check that the crankshaft can be freely rotated by hand.
2. Measure the crankshaft end float. Make sure that the end float is between 0.18mm (0.007in) and 0.38mm (0.015in).
3. Carry out the procedures listed in the 'Before Removal' section in reverse order.

**Table 37. Torque Values**

Item	Description	Nm
B	Main bearing bolts (x8) (1st Stage)	40
B	Main bearing bolts (x8) (2nd Stage)	70
B	Main bearing bolts (x8) (3rd Stage)	120
C	Peripheral bolts (x13) (4th Stage)	20
C	Peripheral bolts (x13) (5th Stage)	35

(For: KDI 2504 TCR Elec Engine)

**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**

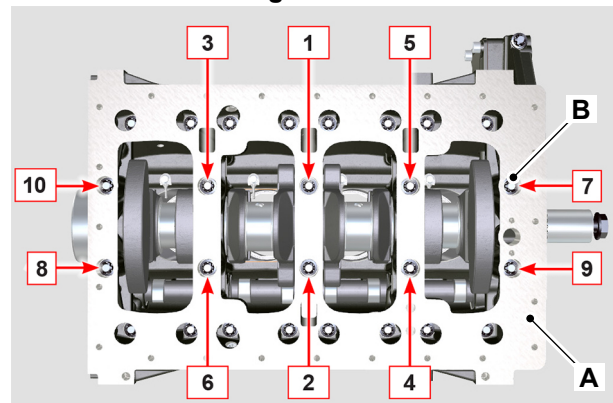
1. This procedure requires service parts. Make sure you have obtained the correct service parts before you start, refer to Parts Catalogue.
2. Make sure that the engine is safe to work on. If the engine has been running, let it cool before you start the service work.
3. Get access to the engine.
4. Remove the drive belt. Refer to (PIL 15-18).
5. Remove the oil sump. Refer to (PIL 15-45).
6. Remove the turbocharger. Refer to (PIL 18-35).
7. Remove the exhaust manifold. Refer to (PIL 18-24).
8. Remove the starter motor. Refer to (PIL 15-75).
9. Remove the flywheel housing. Refer to (PIL 15-54).
10. Remove the crankshaft rear oil seal flange. Refer to (PIL 15-12).
11. Remove the EGR. Refer to (PIL 18-27).
12. Remove the inlet manifold. Refer to (PIL 18-24).
13. Disconnect and remove the high and low pressure fuel pipes. Refer to (PIL 18-96).

14. Remove the timing gear front case. Refer to (PIL 15-51).
15. Remove the fuel injection pump. Refer to (PIL 18-18).
16. Remove the fuel injection drive gear. Refer to (PIL 15-51).
17. Remove the intermediate drive gear. Refer to (PIL 15-51).
18. Remove the high duty PTO device (if installed).
19. Remove the fuel injectors. Refer to (PIL 18-18).
20. Remove the rocker cover. Refer to (PIL 15-42).
21. Remove the rocker assembly including the push rods. Refer to (PIL 15-42).
22. It is not necessary to remove the cylinder head assembly to remove the bedplate. 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).
23. Position the engine upside down in a suitable jig or fixture, supported at the front of the crankcase.

**Remove**

1. Remove the main bearing bolts in the sequence shown.

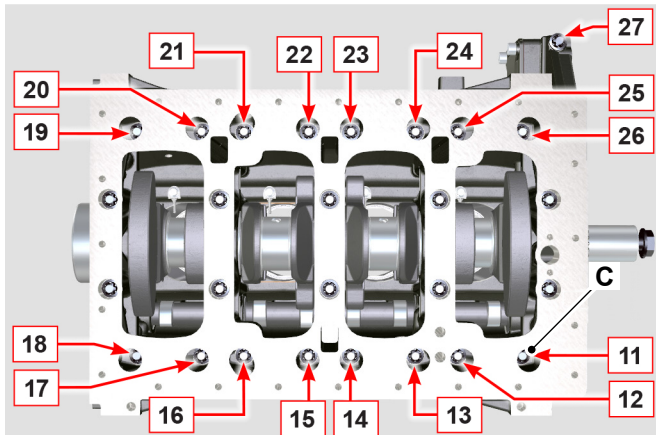
**Figure 131.**



**A** Bedplate  
**B** Main bearing bolts (x10)

2. Remove the bedplate peripheral bolts in the sequence shown.

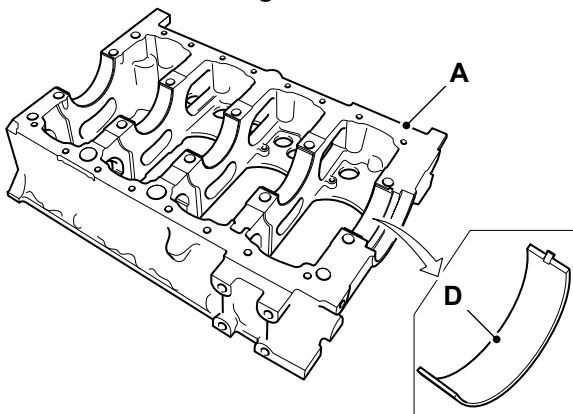
**Figure 132.**



**C** Peripheral bolts (x17)

3. Carefully separate the bedplate from the crankcase. Use suitable lifting equipment (if the bedplate is lifted manually, two people will be required). Do not use a lever to separate the bedplate.
4. Carefully remove the lower bearing shells from the bedplate.

**Figure 133.**



**A** Bedplate  
**D** Lower bearing shells (x5)

**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:** Anaerobic sealant will not start to cure whilst it is open to the atmosphere, however when air is excluded (for instance when the two parts are put together) it will immediately start to harden. Make

sure that all the necessary tools, bolts etc. are readily available prior to assembling the components. The parts must be installed and tightened to the correct torque value within 5min minutes (with a maximum permissible time of 15min).

**Important:** Before installing the bedplate: Do not rotate the crankshaft. Make sure that the upper main bearing shells are flush with the bottom face of the crankcase.

**Install**

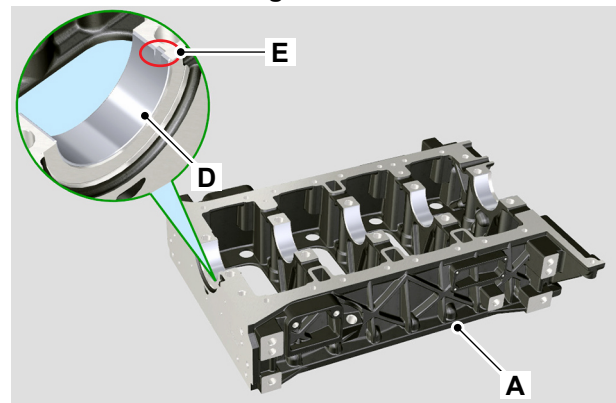
**Important:** The crankshaft half bearings are made of special material. Therefore, they must be replaced every time they are removed to prevent seizures. The lower and upper crankshaft half bearings cannot be replaced singularly, and both halves must be replaced together.

1. Make sure that all items are clean and free from damage and corrosion.
2. Use a suitable degreasing agent to clean both sides of the lower bearing shells.

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

3. Install the lower bearing shells into the bedplate. Make sure that the reference notches are at the correct location.

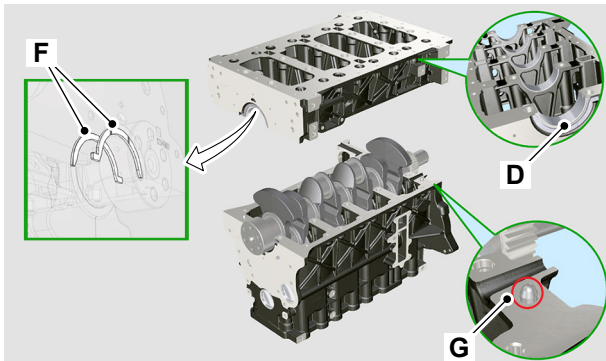
**Figure 134.**



**A** Bedplate  
**D** Lower bearing shells (x5)  
**E** Reference notch

4. Lubricate the lower bearing shells with clean engine oil.
5. Install the two shoulder half-rings onto the lower crankcase. Apply two dots of ITP GX100 grease to hold the rings in position.

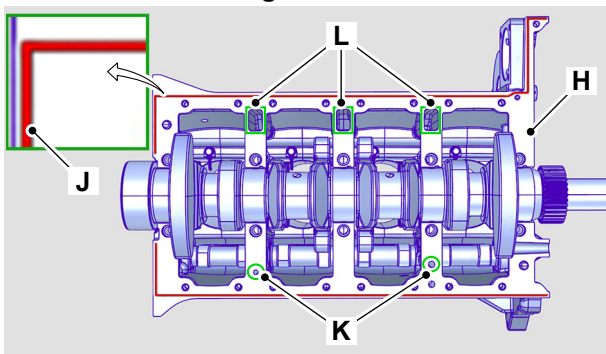
**Figure 135.**



- D** Lower bearing shells (x5)
- F** Shoulder half-rings (x2)
- G** Guide pins

6. Apply a 1.0mm (0.04in) thick bead of Loctite 5188 around the crankcase/bedplate mating face as shown.

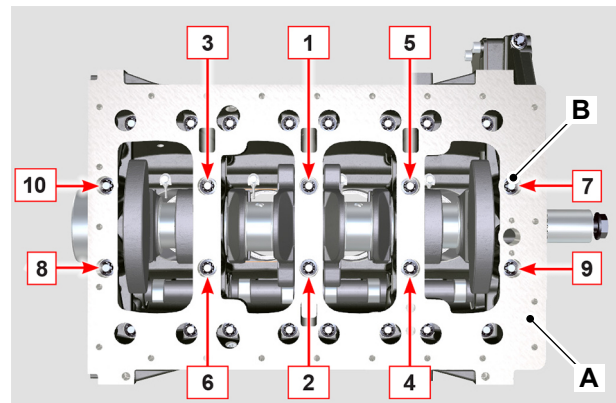
**Figure 136.**



- H** Crankcase
- J** Loctite 5188
- K** Oil feed holes
- L** Return oil grooves

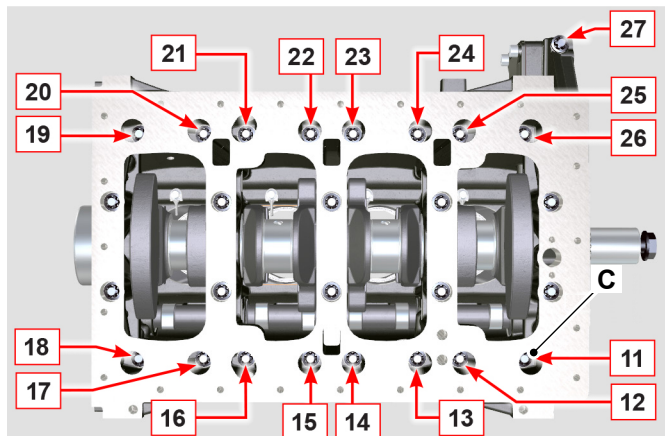
7. Make sure that you do not block the oil feed holes and the return oil grooves.
8. Assemble the bedplate to the crankcase. Make sure that the guide pins on the crankcase are engaged properly in the slots on the bedplate.
9. Note: The bedplate is heavy. Two people will be required to lift and rotate the bedplate safely on to the crankcase.
10. Install the main bearing bolts (x10).
11. Tighten the bolts to the correct torque value in three stages. Strictly follow the torque sequence shown.

**Figure 137.**



12. Install the bedplate peripheral bolts (x17).
13. Tighten the bolts to the correct torque value in two stages. Strictly follow the torque sequence shown.

**Figure 138.**



**Important:** If the parts have not been tightened to the correct torque value within the maximum 15min time period, then the parts must be separated, thoroughly cleaned and fresh sealant should be applied.

**After Installation**

1. Check that the crankshaft can be freely rotated by hand.
2. Measure the crankshaft end float. Make sure that the end float is between 0.18mm (0.007in) and 0.38mm (0.015in).
3. Carry out the procedures listed in the 'Before Removal' section in reverse order.



## Technical Data

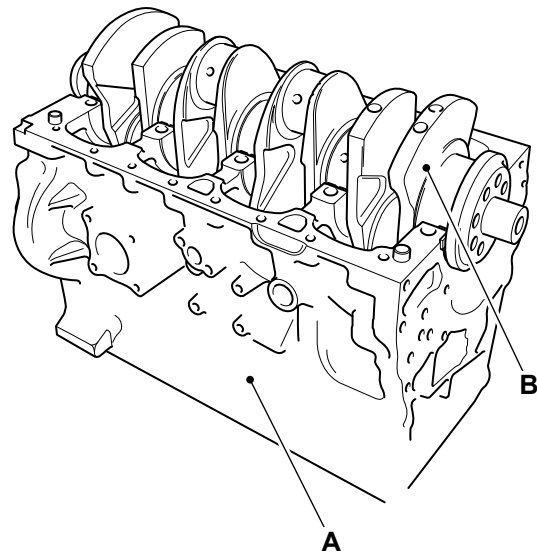
**Table 39.**

Main bearing journal diameter (x4)	
- min	63.981mm (2.5189in)
- max	64.00mm (2.5196in)
Connecting rod bearing journal diameter	
- min	54.035mm (2.1274in)
- max	54.066mm (2.1286in)
Maximum wear and ovality on journals <sup>(1)</sup>	
Crankshaft end float	
- min	0.18mm ( 0.0070in)
- max	0.38mm ( 0.0149in)

(1) No visible damage/wear or marks

## Component Identification

**Figure 139.**



- A** Crankcase
- B** Crankshaft

## Operation

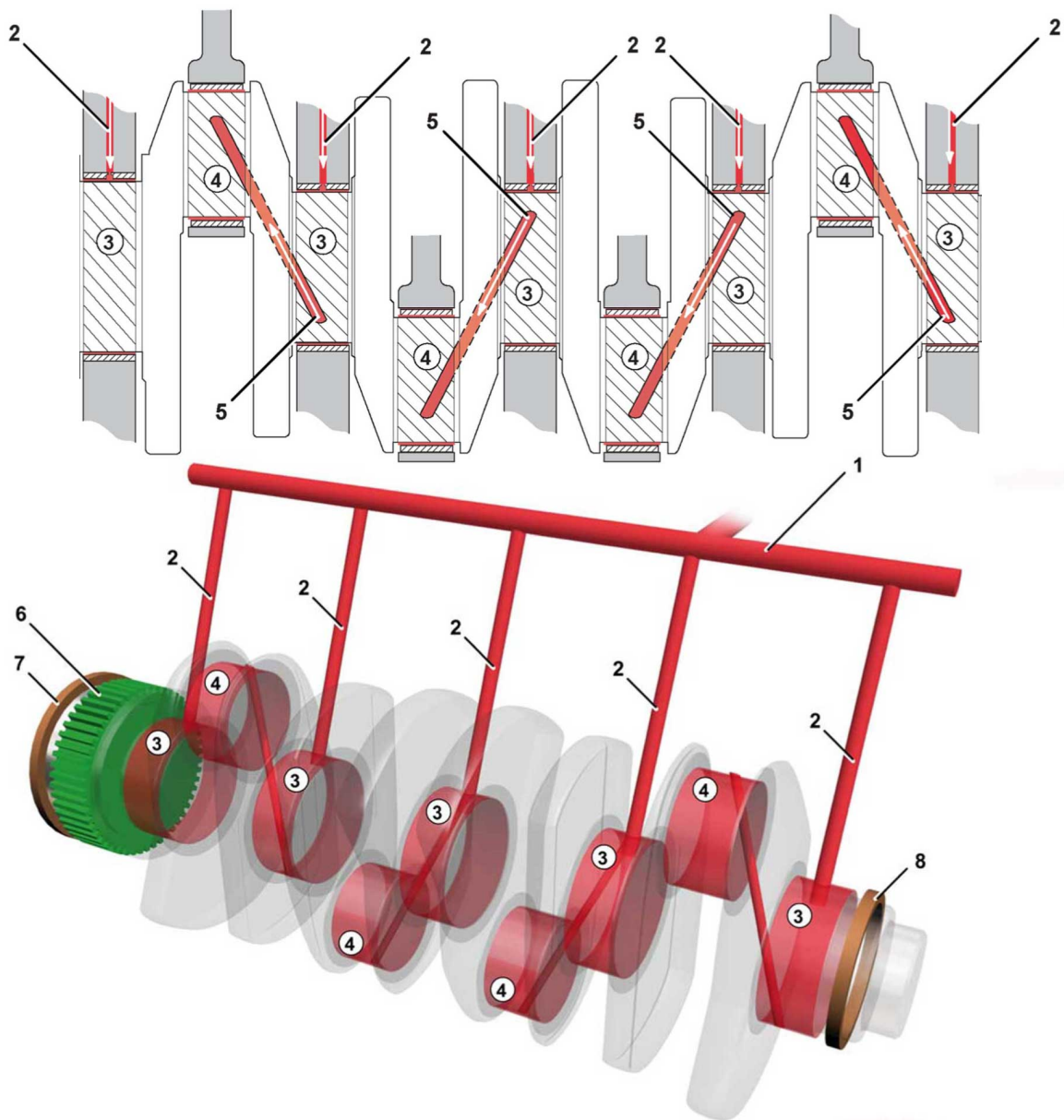
Refer to Camshaft-Operation (PIL 15-15).

## 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 140.



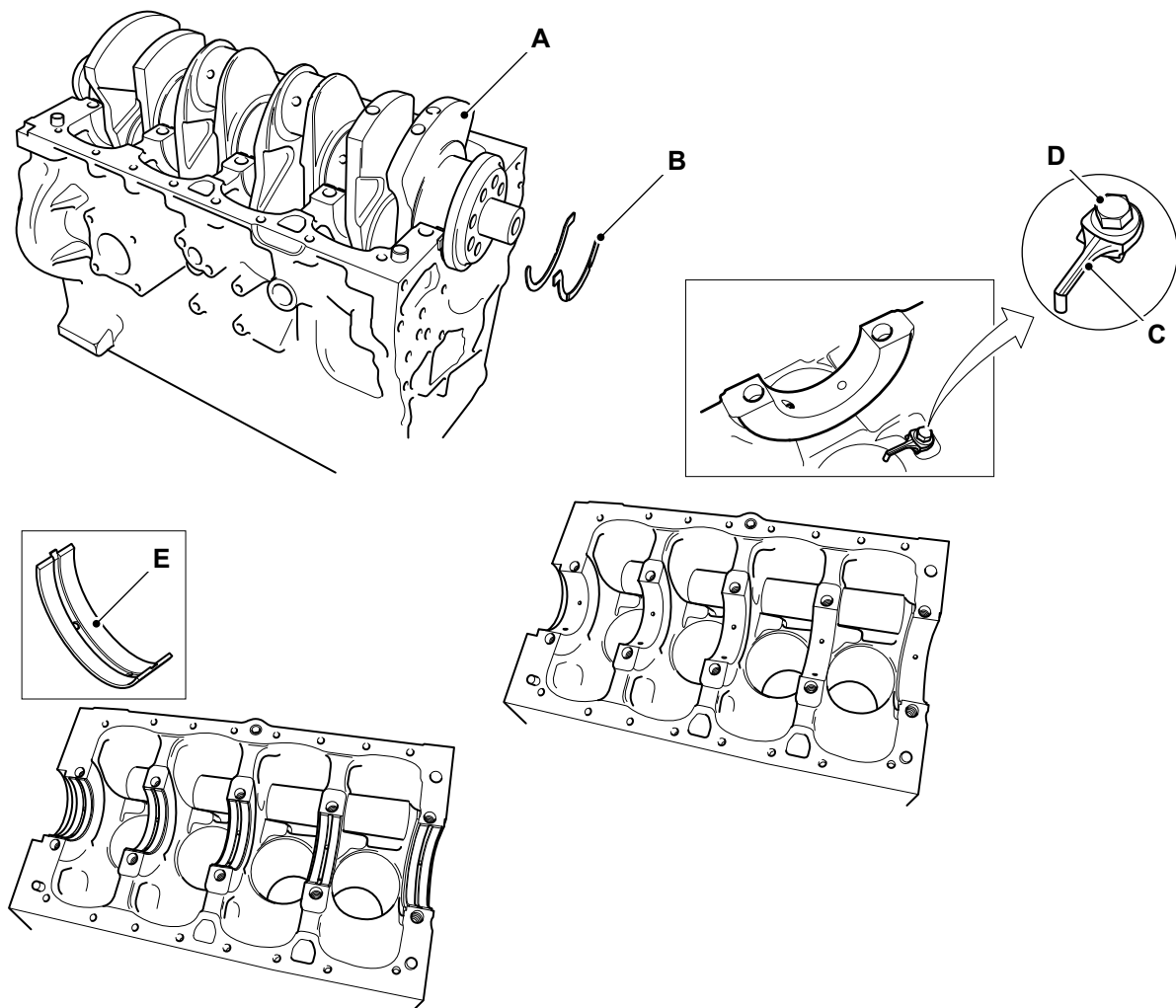
- 1 Main gallery
- 3 Main bearings
- 5 Cross drillings
- 7 Crankshaft oil seal

- 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 Crankshaft- Technical Data (PIL 15-12).
3. Check that the oilway cross drillings in the crankshaft are clear and free from debris.
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 141.**



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

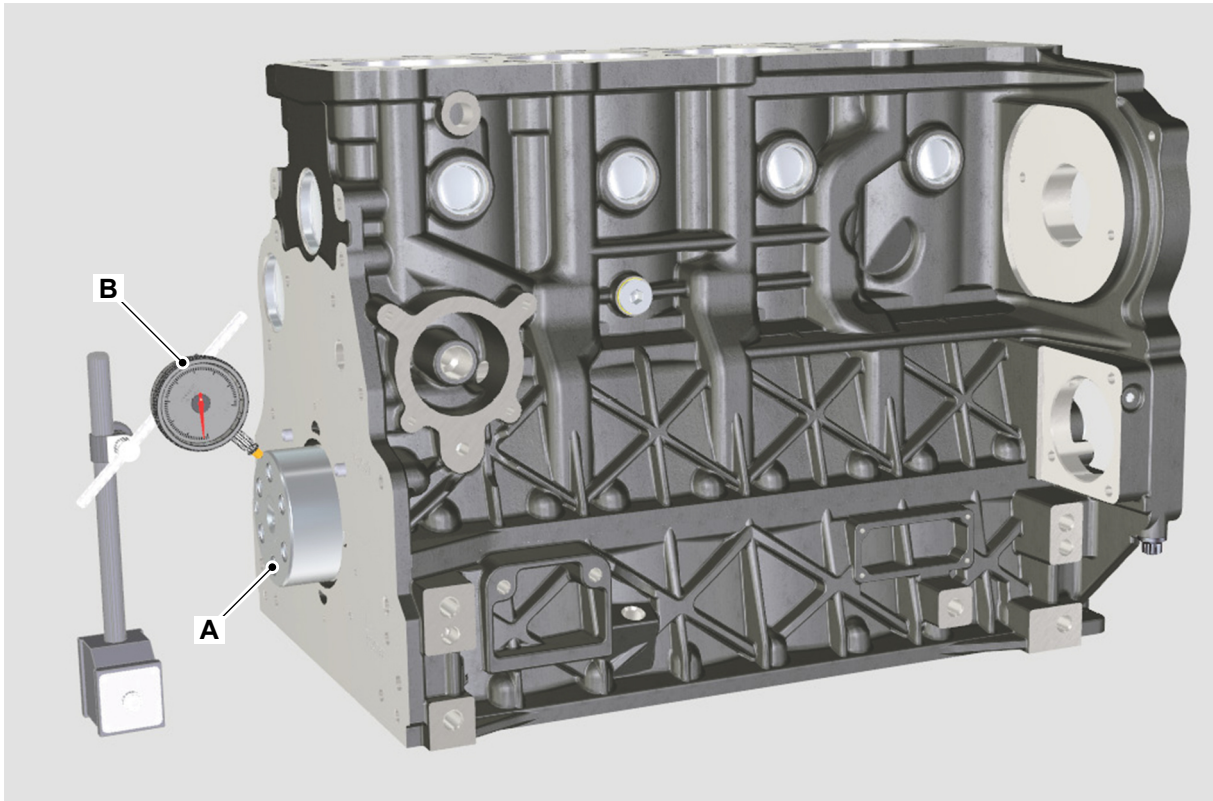
**B** Shoulder half-rings  
**D** Fixing screws

## 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 142.**



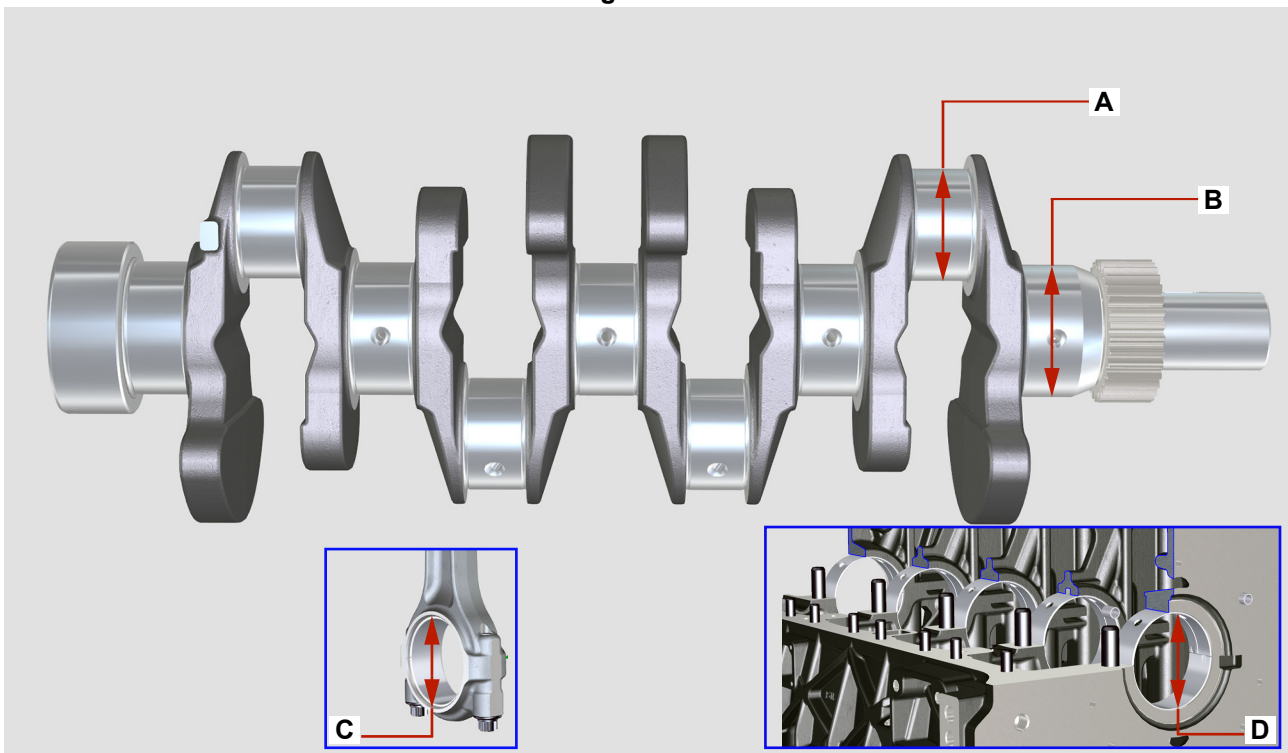
**A** Crankshaft

**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 143.**



**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	0.4L

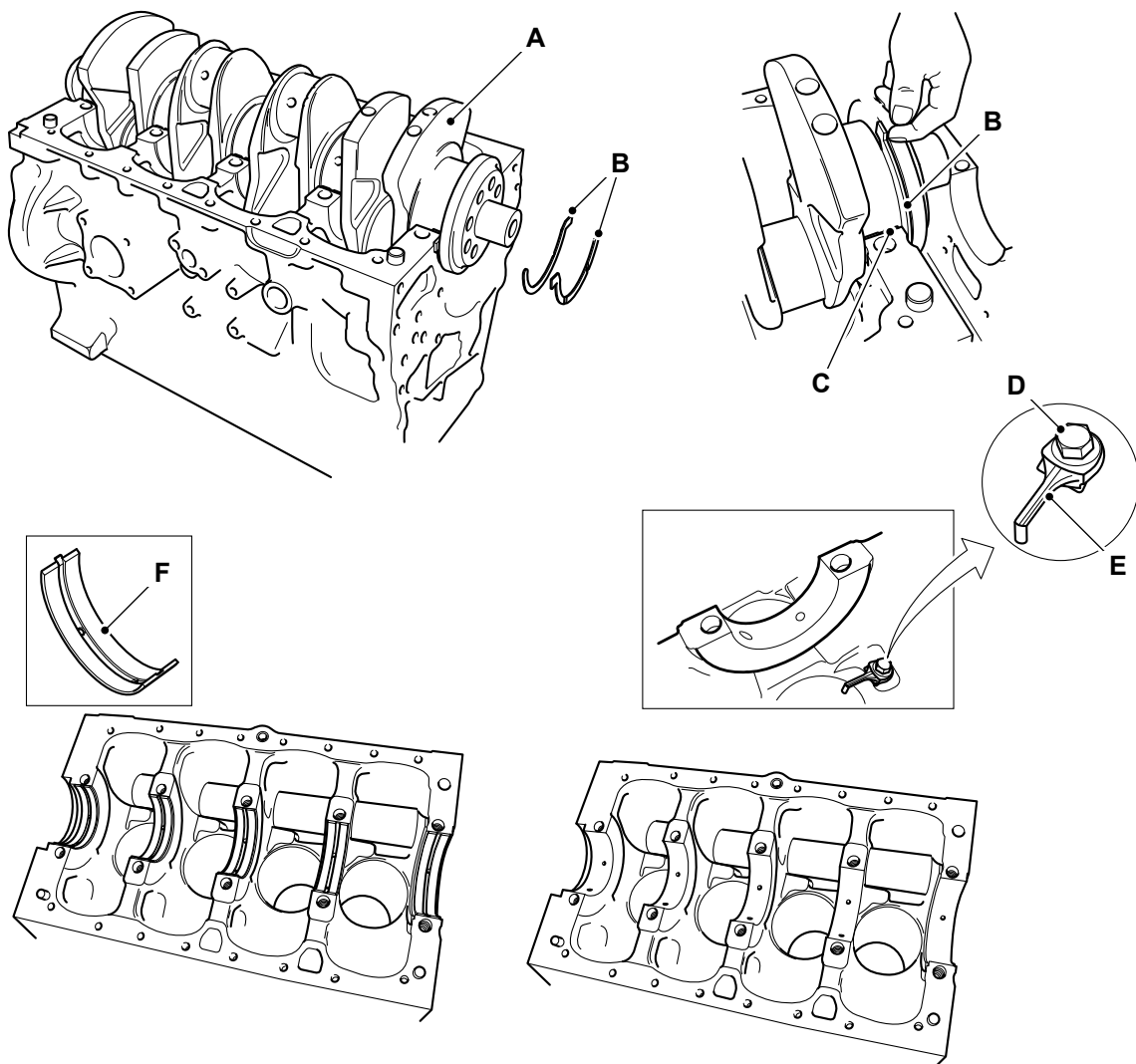
**▲ CAUTION** This component is heavy. It must only be removed or handled using a suitable lifting method and device.

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).
5. If the pistons and connecting rods have not been removed, then remove the main bearing caps. Refer to (PIL 15-12).

### Before Removal

1. This procedure requires service parts. Make sure you have obtained the correct service parts before you start, refer to Parts Catalogue.

Figure 144.



A Crankshaft

B Thrust Washers

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