

SERVICE MANUAL

ROLLER
JCB116, JCB116D, JCB116DD, VM116

EN - 9813/7700 - ISSUE 3 - 09/2017


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

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

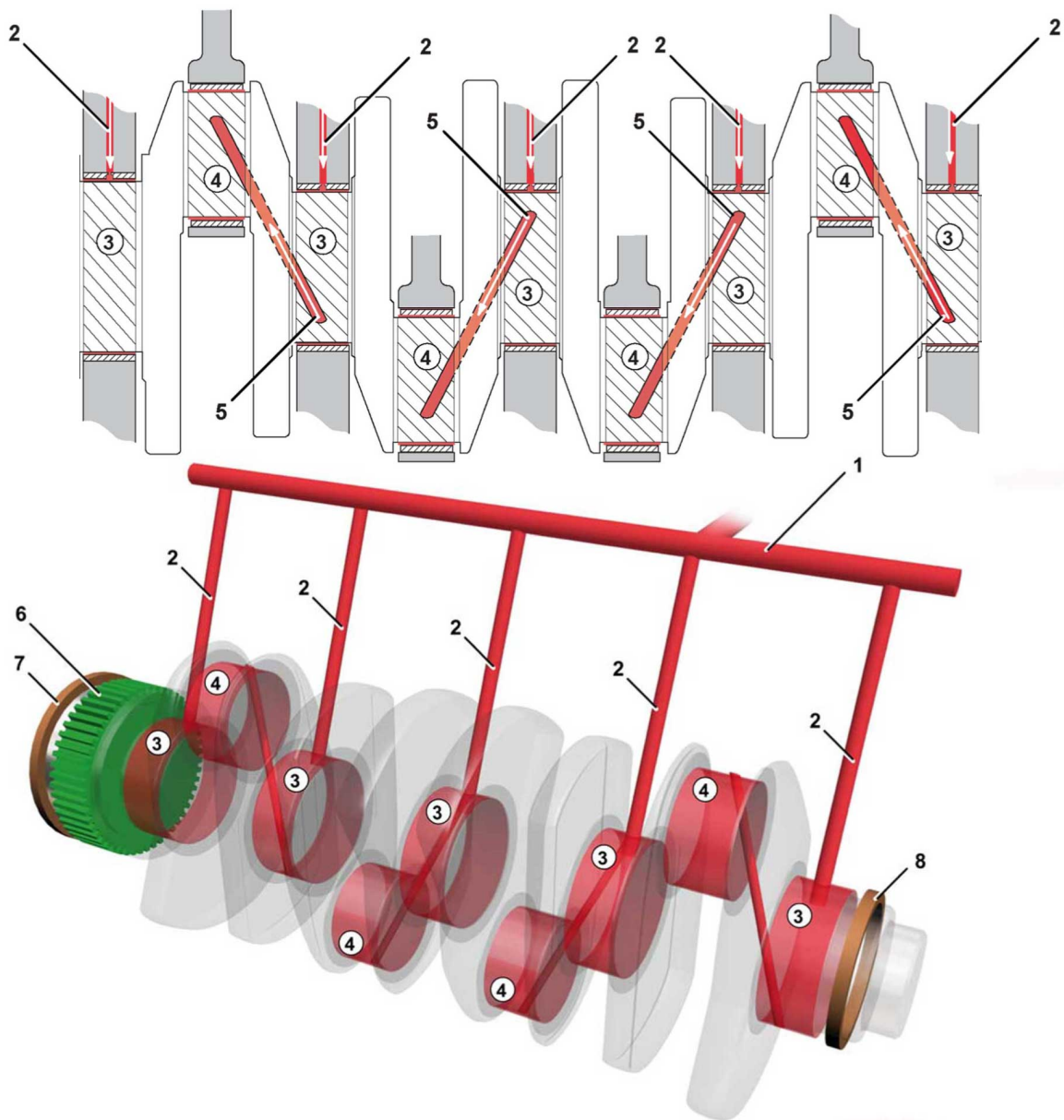
Refer to Camshaft-Operation [PIL 15-15-00](#) .

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 64.



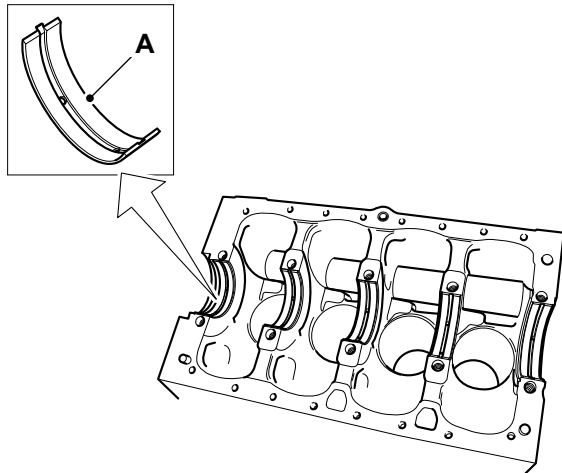
- 1 Main gallery
- 3 Main bearings
- 5 Cross drillings
- 7 Crankshaft oil seal

- 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.

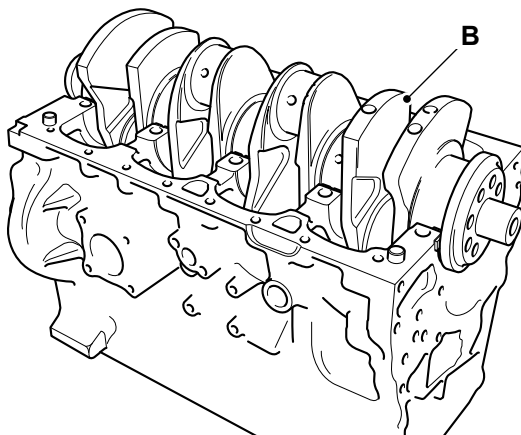
Figure 65.



A Main bearing shells

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

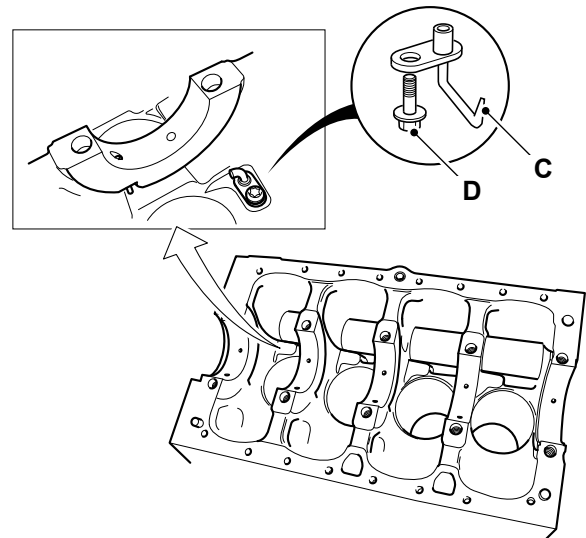
Figure 66.



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 67.



C J-jets
D Fixing screws

<https://www.ebooklibonline.com>

Hello dear friend!

Thank you very much for reading.

Enter the link into your browser.

The full manual is available for immediate download.

<https://www.ebooklibonline.com>

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

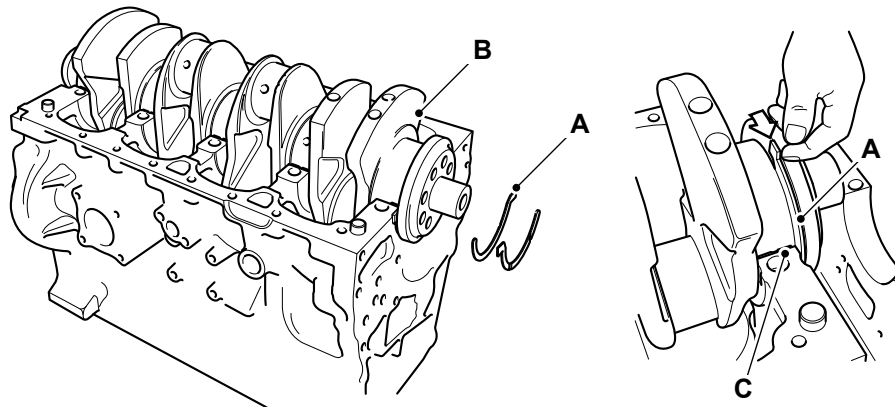
reasons (for piston and connecting rod removal for example) remove it now, refer to (PIL 15-06).

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 68.



- A** Thrust Washers
- C** Rear main bearing

- B** Crankshaft

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.

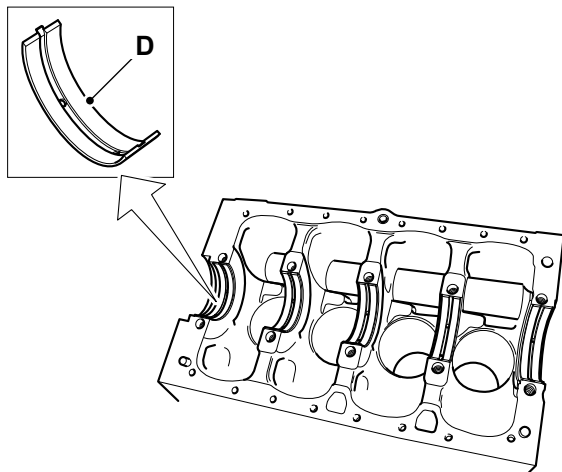
Before Installation

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.

Figure 69.



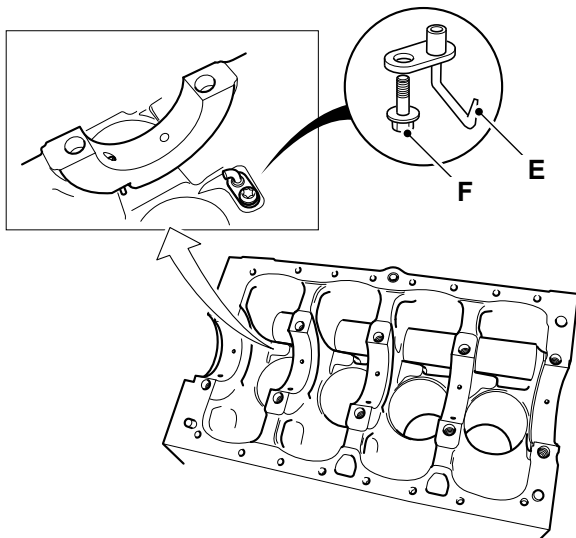
- D** Main bearing shells

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).

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following steps.
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 70.

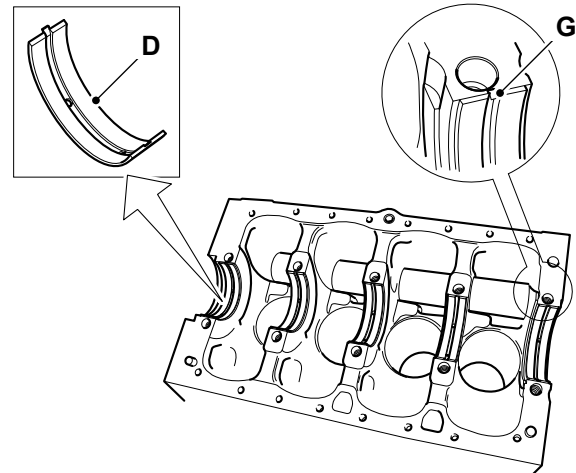


- E** J jets (x4)
- F** Fixing screws

- 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:

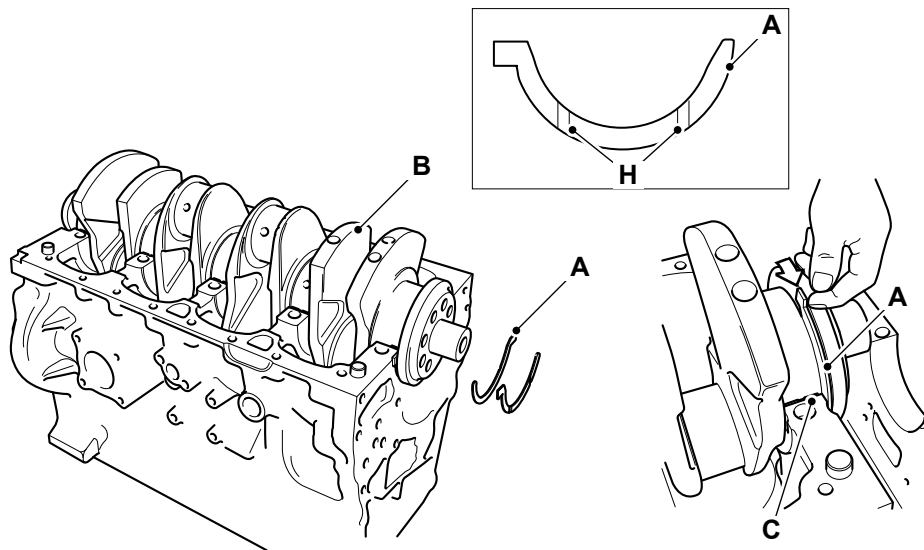
Figure 71.



- 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 72.



A Thrust washers
C Rear main bearing

B Crankshaft
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 54. Torque Values

Item	Nm
F	24

03 - Main Bearing

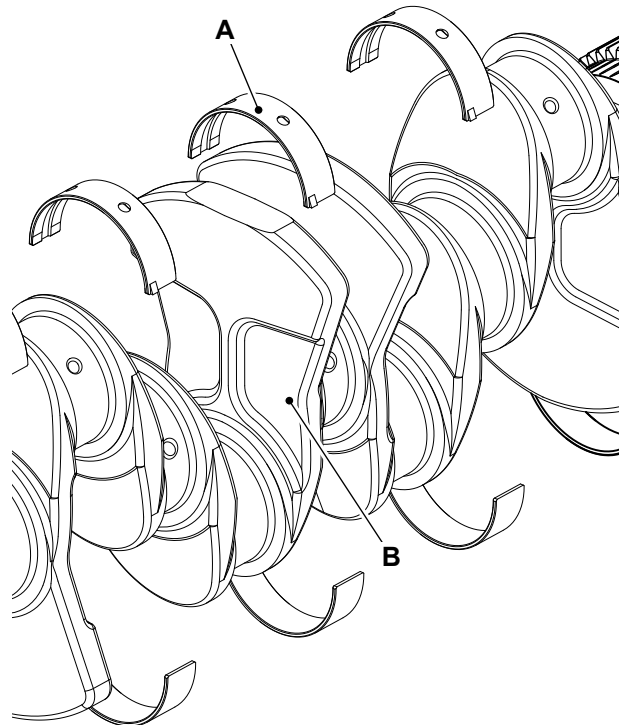
Introduction	15-64
Check (Condition)	15-65
Remove and Install	15-65

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 73.



- 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 Technical Data (PIL 15-12).
3. Renew any parts that are worn or not within the specified tolerances.

Remove and Install

Refer to Crankshaft- Remove and Install. Refer to (PIL 15-12).

06 - Front Oil Seal

Remove and Install

Special Tools

Description	Part No.	Qty.
Crankshaft Front Oil Seal Installation Tool	892/01157	1

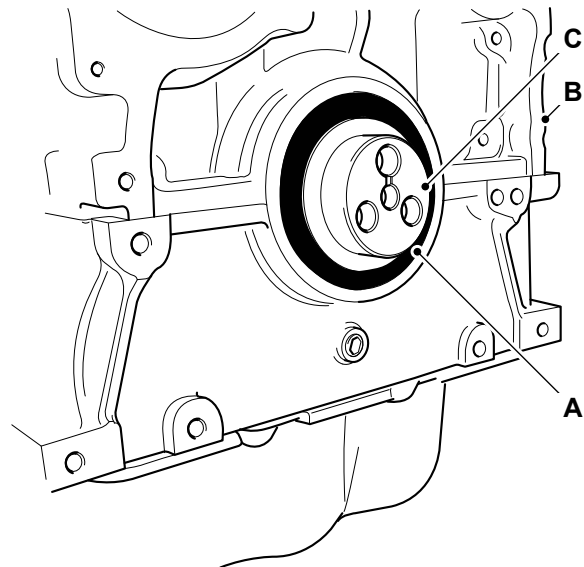
Before Removal

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 drive belt, refer to (PIL 15-18).
5. Remove the crankshaft pulley, refer to (PIL 15-12-12).

Remove

1. Use a suitable lever behind the lip of the seal, carefully prise out the oil seal from the counterbore in the crankcase. Take care not to scratch or damage the counterbore or the crankshaft hub. Damaged or dirty sealing faces will cause the oil seal to fail.

Figure 74.



- A Crankshaft oil seal
- B Crankcase
- C Crankshaft hub

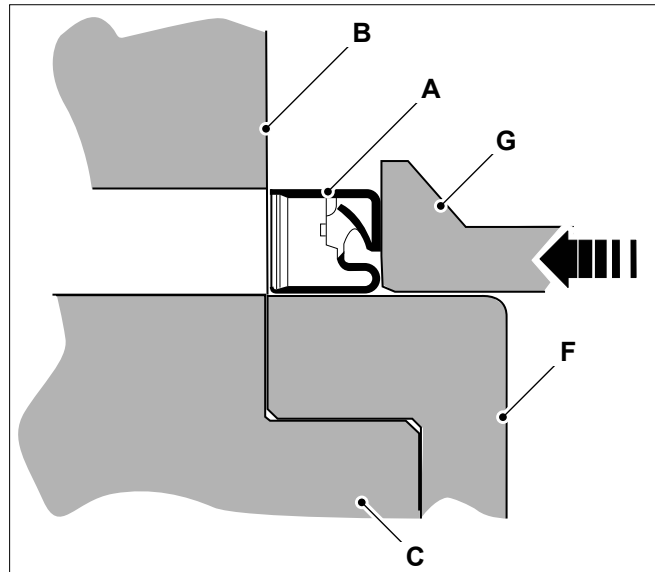
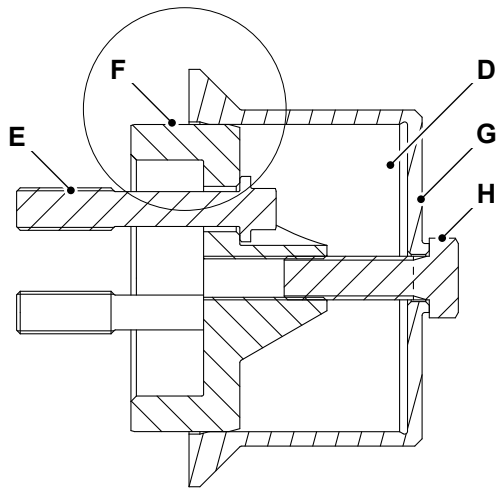
Install

1. Make sure that the counterbore and the crankshaft hub are clean and free from damage and corrosion. Use a suitable degreasing agent to clean all traces of oil and grease from the counterbore. Important: The oil seal has a special coating and MUST be installed dry without lubricant.
2. Dismantle the seal installation tool. Bolt the centre body to the crankshaft hub, using the bolts. Refer to Figure 75.

Special Tool: Crankshaft Front Oil Seal Installation Tool (Qty.: 1)

3. Install the oil seal on to the centre body. Make sure that the seal is installed the correct way around. Assemble the outer sleeve on to the centre body and install the screw. Refer to Figure 75.

Figure 75.



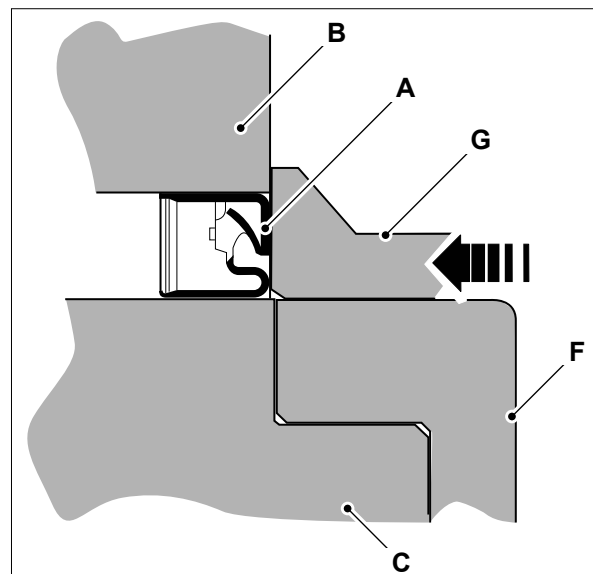
- A** Crankshaft oil seal
- C** Crankshaft hub
- E** Fixing bolts (x3)
- G** Outer sleeve

- B** Crankcase
- D** Seal installation tool
- F** Centre body
- H** Screw

4. Turn the screw to push the seal squarely into the counterbore until the outer sleeve comes up against the front edge of the counterbore. When correctly installed, the front face of the seal should be flush with the edge of the counterbore within the specified tolerance. Refer to Figure 76.

Dimension: $-0.5 -0/+0.5\text{mm}$

Figure 76.



- A** Crankshaft oil seal
- B** Crankcase
- C** Crankshaft hub
- F** Centre body
- G** Outer sleeve

5. Remove the seal installation tool.



After Installation

1. Install the crankshaft pulley, refer to (PIL 15-12-12).
2. Install the drive belt, refer to (PIL 15-18).

09 - Rear Oil Seal

Remove and Install

Special Tools

Description	Part No.	Qty.
Crankshaft Rear Oil Seal Installation Tool	892/01156	1
Crankshaft Rear Oil Seal Alignment Tool	892/01158	1

Note: The flywheel hub and crankshaft rear oil seal need to be replaced as a pair.

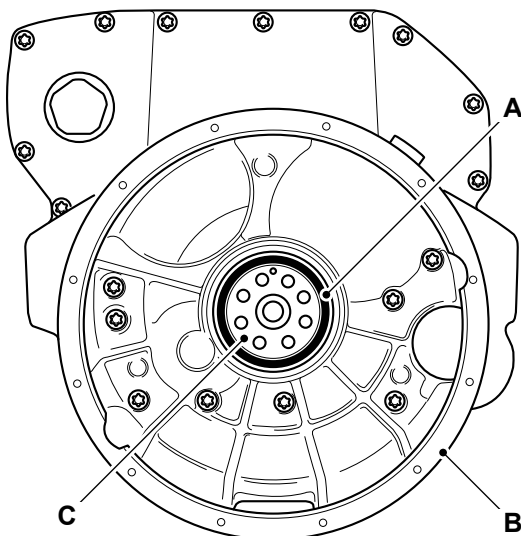
Before Removal

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 flywheel, refer to (PIL 15-54).

Remove

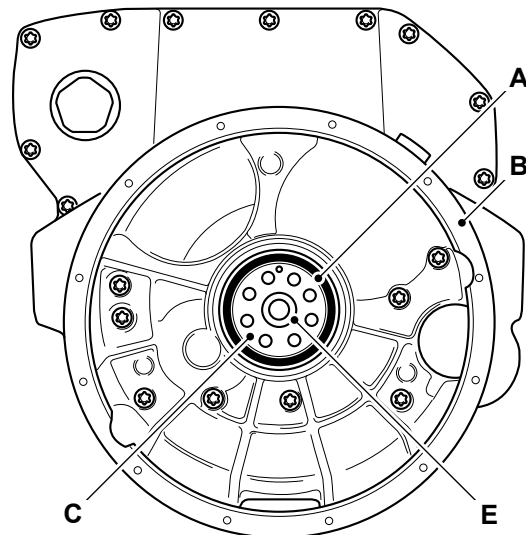
1. Use a suitable lever behind the lip of the seal to carefully prise out the rear oil seal from the counterbore in the flywheel housing. Take care not to scratch or damage the counterbore or the flywheel hub. Damaged or dirty sealing faces will cause the oil seal to fail.

Figure 77. 24mm Hub



- A Crankshaft rear oil seal
- B Flywheel housing
- C Flywheel hub

Figure 78. 15mm Hub

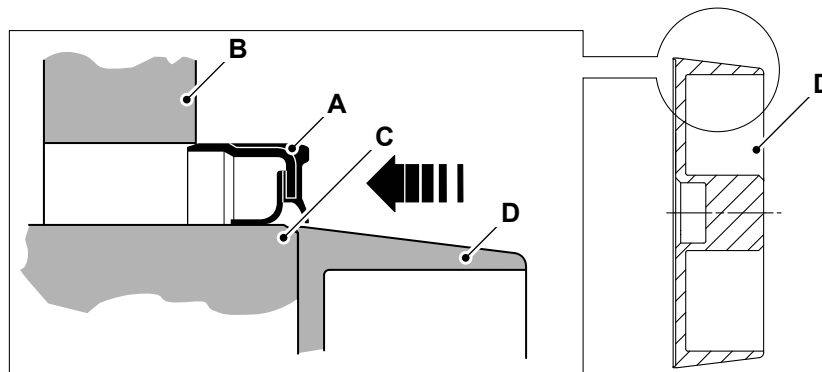


- A Crankshaft rear oil seal
- B Flywheel housing
- C Flywheel hub
- E Fixing bolt

Install (24mm Hub)

1. Make sure that the counterbore and the flywheel hub are clean and free from damage and corrosion.

Figure 79.



- A** Crankshaft rear oil seal
- C** Flywheel hub

- B** Flywheel housing
- D** Oil seal alignment tool

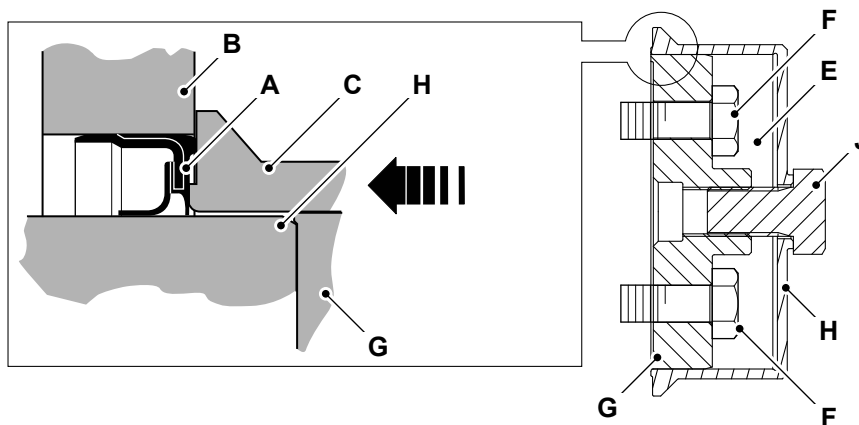
2. To prevent the seal lip rolling over and becoming damaged, make sure that you use the oil seal alignment tool to initially install the oil seal on to the flywheel hub. Locate the alignment tool over the end of the hub, then carefully push the oil seal over the alignment tool and on to the crankshaft diameter. Make sure that the oil seal is installed the correct way around.

Special Tool: Crankshaft Rear Oil Seal Alignment Tool (Qty.: 1)

- 3. Apply lubricant P80 around the seal outer rubber diameter.
- 4. Dismantle the oil seal installation tool. Bolt the centre body to the flywheel hub, using the two flywheel bolts. Assemble the outer sleeve on to the centre body and install the screw.

Special Tool: Crankshaft Rear Oil Seal Installation Tool (Qty.: 1)

Figure 80.



- A** Crankshaft rear oil seal
- C** Outer sleeve
- F** Flywheel bolts
- H** Flywheel hub

- B** Flywheel housing
- E** Oil seal installation tool
- G** Centre body
- J** Screw

5. Turn the screw to push the seal squarely into the counterbore until the outer sleeve comes up against the front edge of the counterbore. When correctly installed, the front face of the seal should be flush with the edge of the counterbore within the tolerance specified.

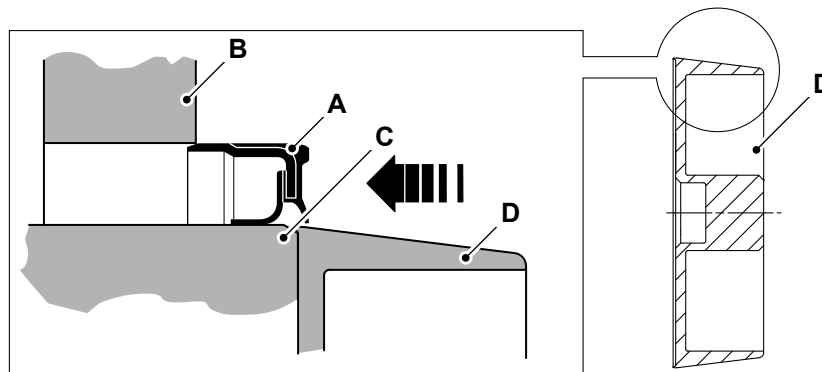
6. Remove the oil seal installation tool.

Length/Dimension/Distance: 0.5mm

Install (15mm Hub)

- 1. Make sure that the counterbore and the hub are clean and free from damage.

Figure 81.



- A Crankshaft rear oil seal
- C Flywheel hub

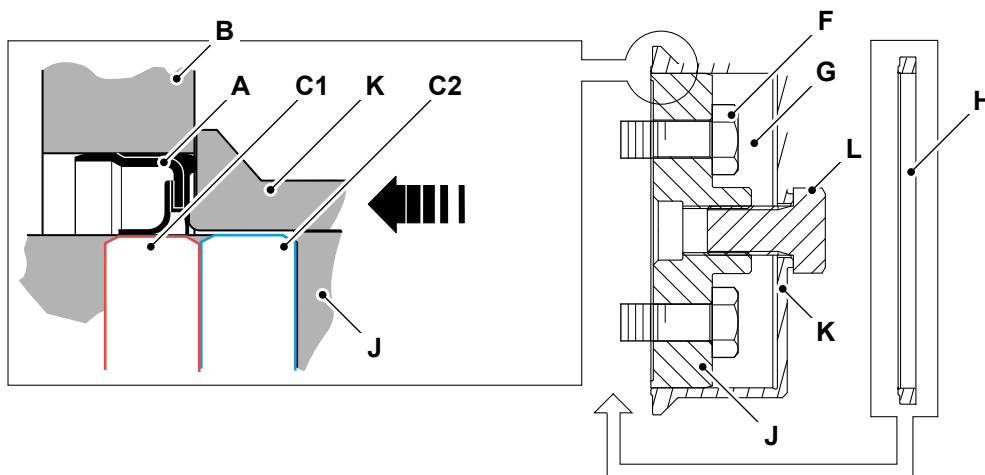
- B Flywheel housing
- D Oil seal alignment tool

2. Install the new hub on to the crankshaft gear and install the old hub on the outside of the new hub to create a double thickness flywheel hub, install the fixing bolt as shown at A. Do not touch the PTFE seal lips of the crankshaft oil seal.
3. Make sure that you use the oil seal alignment tool to initially install the oil seal on to the flywheel hub to prevent damage to the seal lip. Locate the alignment tool over the end of the hub, carefully push the oil seal over the alignment tool as far on to the crankshaft hub as possible. Make sure that the seal is installed the correct way around.

Special Tool: Crankshaft Rear Oil Seal Installation Tool (Qty.: 1)
 Special Tool: Crankshaft Rear Oil Seal Alignment Tool (Qty.: 1)

4. Apply the lubricant P80 around the seal outer rubber diameter.
5. Dismantle the oil seal installation tool. Use the two flywheel bolts to attach the centre body on to the flywheel hub. Assemble the outer sleeve on to the centre body include the extension ring and install the screw.

Figure 82.



- A Crankshaft rear oil seal
- C1 New hub
- F Flywheel bolts
- H Extension ring
- K Outer sleeve

- B Flywheel housing
- C2 Old hub
- G Oil seal installation tool
- J Centre body
- L Screw

6. Turn the screw to push the seal into position in the counterbore so that the screw will not turn.

7. Remove the oil seal installation tool, remove the old hub and install the fixing bolt. Repeat steps 5 and 6 to fully install the rear oil seal.
8. Remove the oil seal installation tool.

After Installation

1. Install the flywheel, refer to (PIL 15-54).

Table 55. Torque Values

Item	Nm
E	47

12 - Pulley

Remove and Install

Special Tools

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

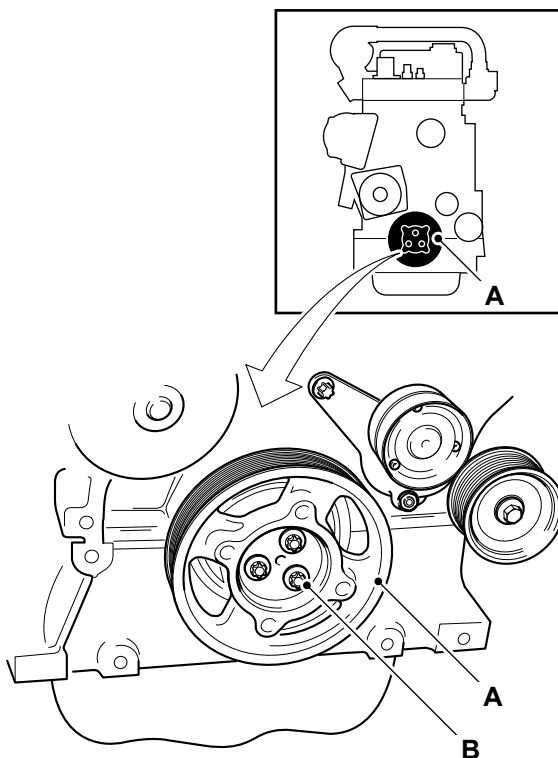
Before Removal

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 drive belt. Refer to (PIL 15-18).

Remove

1. Remove the fixing bolts and withdraw the pulley from the crankshaft.

Figure 83.



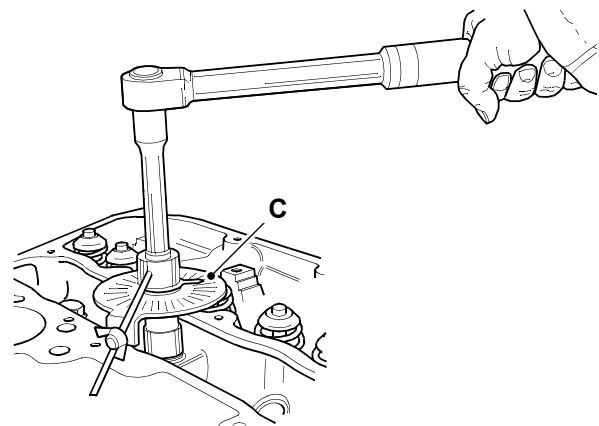
- A Crankshaft pulley
- B Fixing bolts (x3)

2. The bolts must not be reused. Discard the bolts.

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following steps.
2. Make sure that all items are clean and free from damage and corrosion.
3. Renew the fixing bolts. Tighten the new bolts in three stages to the correct torque value.
 Special Tool: Torque Wrench (10-100Nm) (Qty.: 1)
4. The bolts are tightened using a torque and angle method. Refer to Fasteners and Fixings, General, Introduction (PIL 72-00).

Figure 84.



- C Angle gauge (obtain locally)

After Replacement

1. Install the drive belt. Refer to (PIL 15-18).

Table 56.

Item	Torque Value (Nm)	Torque Angle (Degrees)
2 (1st stage)	30N·m	
2 (2nd stage)	75N·m	
2 (Final stage)		180°

Operation

As the crankshaft rotates the camshaft also rotates, driven by a gear on the crankshaft. The inlet and exhaust valves are opened by lobes on the camshaft in time with the cycle.

The diagrams show the position of the camshaft at each part of the four stroke cycle, refer to Engine-General, Operation. Refer to: [PIL 15-00-00](#).

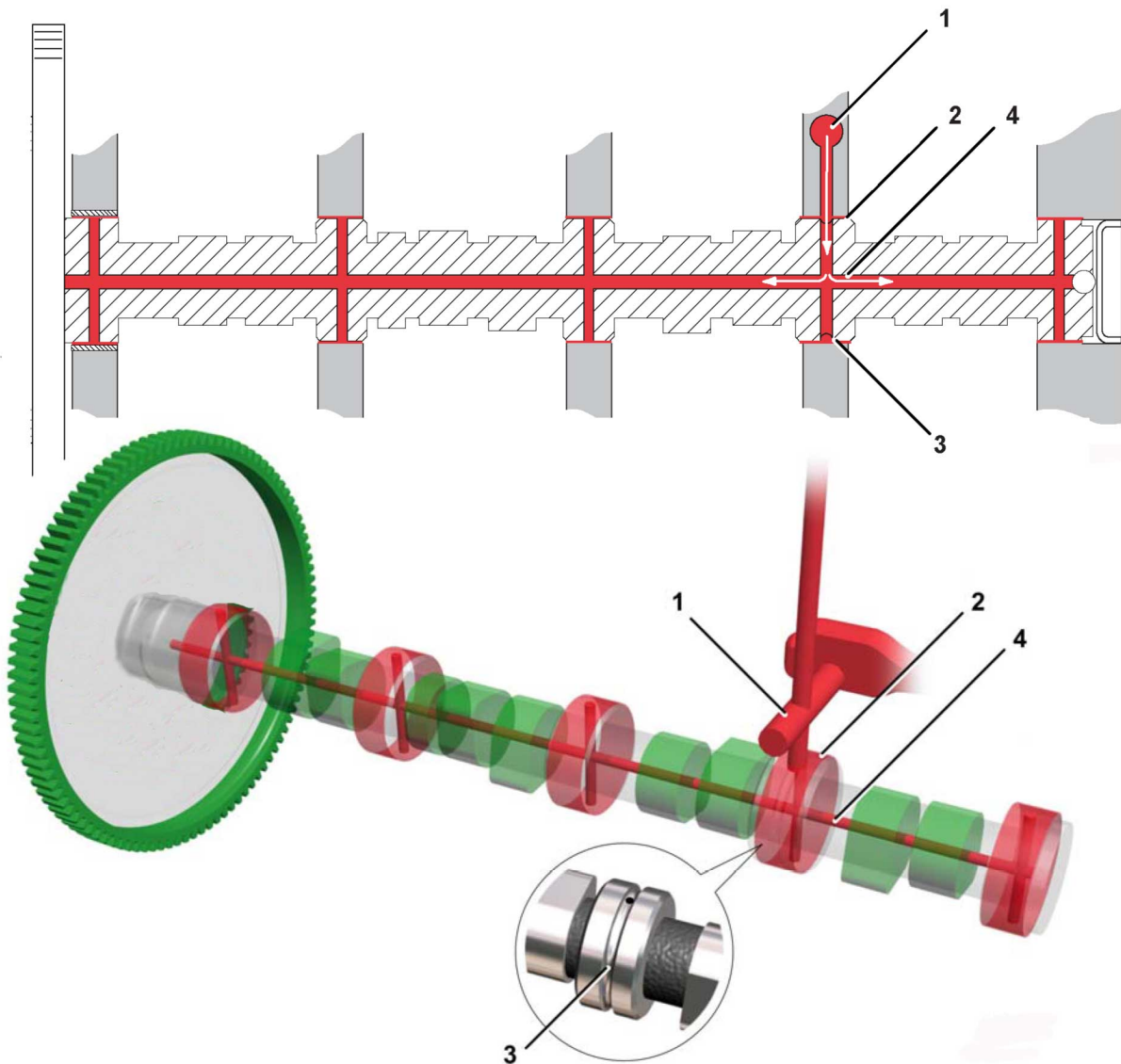
It can be seen that for a complete cycle the camshaft revolves once. Since the crankshaft revolves twice

during the cycle it follows that the camshaft is driven at half crankshaft (engine) speed.

Lubrication

Oil is fed from the main gallery via a drilling to the camshaft bearing. A groove around the diameter of the bearing and connecting the cross drilling ensures that oil is always fed to the centre drilling. Oil is then transferred to the remaining camshaft bearings by further cross drillings in the shaft. The cam lobes and tappets are 'splash' lubricated.

Figure 86.



1 Main gallery
 3 Groove

2 Camshaft bearing
 4 Centre drilling

Check (Condition)

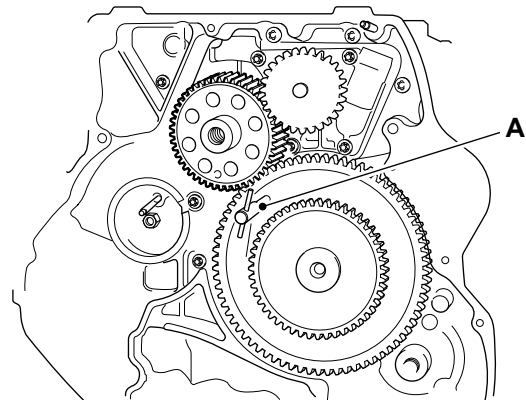
1. Inspect the camshaft gear teeth for signs of damage or excessive wear.
2. Inspect the cam lobes for signs of excessive wear, scoring or pitting.
3. Inspect the cam bearing surfaces for signs of excessive wear, or scoring. Check that the dimensions are within service limits.
4. Inspect the cam bearing surfaces inside the crankcase for signs of excessive wear, or scoring. Check that the dimensions are within service limits.
5. Inspect the bearing surfaces of the tappets for signs of excessive wear or damage. Check that the dimensions are within service limits.
6. Inspect the tappet bores inside the crankcase for signs of excessive wear or damage. Check that the dimensions are within service limits.
7. If any of the camshaft bearings or lobes are worn or damaged then the relative oil feed galleries in the crankcase and camshaft may be blocked. Make sure all oil ways are clear and free from debris.

Remove and Install

Before Removal

1. Drain the oil from the engine.
2. Disconnect and remove the fuel pipes from the injectors. Refer to (PIL 18-96).
3. Remove the rocker cover. Refer to (PIL 15-42).
4. Remove the fuel injection pump. Refer to (PIL 18-18).
5. Remove the rocker assembly and push rods. Refer to (PIL 15-42).
6. Remove the starter motor. Refer to (PIL 15-75).
7. Remove the oil sump. Refer to (PIL 15-45).
8. Remove the flywheel. Refer to (PIL 15-54).
9. Remove the flywheel housing. Refer to (PIL 15-54).
10. Rotate the crankshaft until the camshaft timing pin can be inserted through the gear and into the aligning hole in the rear gear case.

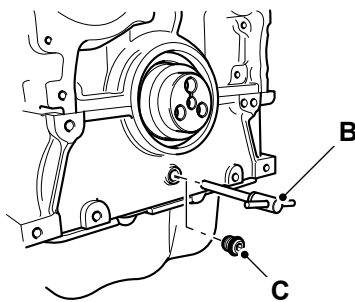
Figure 87.



A Timing pin- camshaft

11. Remove the taper blanking plug and insert crankshaft locking pin. The camshaft and crankshaft locking pins must be in position to lock the crankshaft and camshaft before removing the camshaft assembly.

Figure 88.



- B** Timing pin- crankshaft
- C** Blanking plug

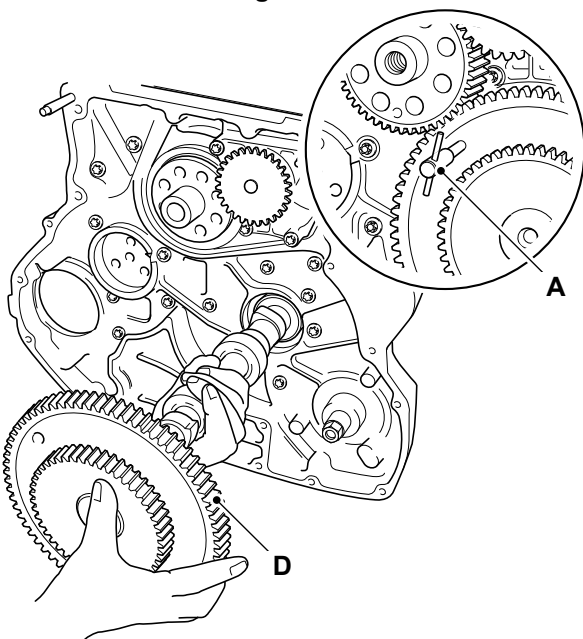
12. Remove the fuel injection pump drive gear. Refer to (PIL 15-51).

Remove

The engine must be inverted. Do not attempt to remove the camshaft and its drive gears with the engine upright. The tappets and push rods will fall into the engine and further dismantling will be required to retrieve them.

1. Remove the camshaft timing pin.
2. Carefully withdraw the camshaft and gear assembly from the crankcase. Make sure that you fully support the camshaft to prevent the lobes contacting the bearing surfaces in the crankcase. The bearing surfaces can easily be damaged by the sharp hard edges on the cam lobes.

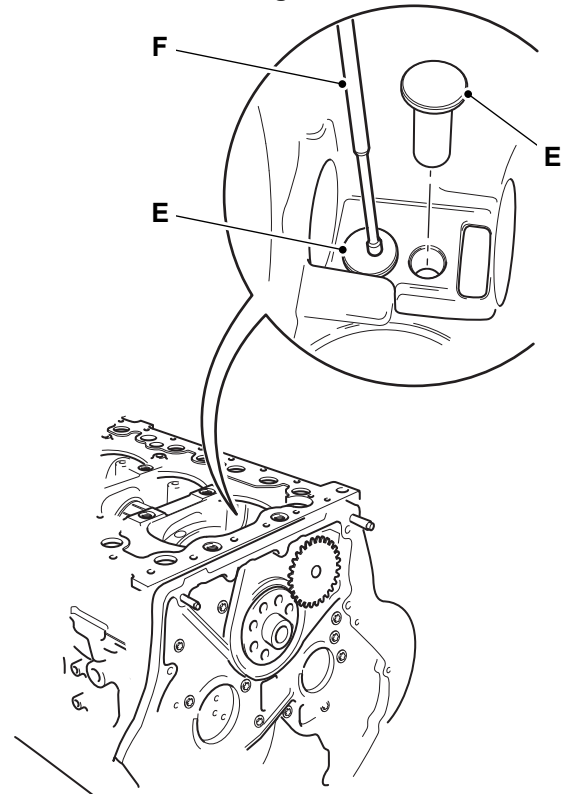
Figure 89.



- A** Timing pin - camshaft
- D** Camshaft and drive gear

3. Access the tappets through the apertures in the crankcase bedplate next to the crankshaft. Lift out the tappets from the crankcase using a suitable magnetic probe. Label the tappets to ensure replacement in their original positions.

Figure 90.



- E** Tappet
- F** Magnetic probe

Inspection

1. Refer to Camshaft- Check Condition (PIL 15-15).

Install

1. Lubricate the tappets and tappet bores inside the crankcase with clean engine oil.
2. Insert the tappets in their original positions in the crankcase using a suitable magnetic probe.
3. Lubricate the camshaft bearing journals inside the crankcase with clean engine oil.
4. Carefully insert the camshaft assembly into the crankcase as shown. Support the camshaft preventing the lobes contacting the bearing surfaces in the crankcase. Before meshing the camshaft gear with the crankshaft gear, rotate the camshaft until the timing hole in the gear aligns with the dowel hole in the gear casing. Insert the timing pin T1 to lock the camshaft in this position.



Suggest:

If the above button click is invalid.

Please download this document

first, and then click the above link

to download the complete manual.

Thank you so much for reading

After Installation

1. Note that the fuel injection pump drive gear fixing nut is torque tightened as part of the fuel injection pump replacement procedure. Refer to (PIL 18-18).
2. Do the procedures in Before Removal in reverse order.

<https://www.ebooklibonline.com>

Hello dear friend!

Thank you very much for reading.

Enter the link into your browser.

The full manual is available for immediate download.

<https://www.ebooklibonline.com>