



# SERVICE MANUAL

COMPACT EXCAVATOR  
**48Z-1, 51R-1**

EN - 9813/6200 - ISSUE 1 - 0H/2016

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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## Introduction

The cylinder head is located above the cylinders on top of the crankcase. It closes in the top of the cylinder, forming the combustion chamber. This joint is sealed by a cylinder head gasket.

The cylinder head also provides the space for the passages that feed air and fuel to the cylinder and allow the exhaust to escape. The cylinder head is also used to mount the valves (PIL 15-30) and fuel injectors (PIL 18-18).

## Technical Data

**Table 38. Cylinder head gasket**

Piston height below top face of crankcase	Gasket Thickness
+0.35mm to +0.5mm	1.2mm
+0.5mm to +0.6mm	1.3mm

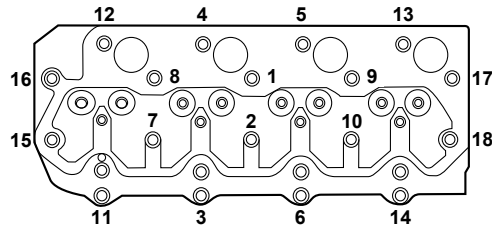
**Table 39. Distortion of the cylinder head**

Description	Data
Distortion of the cylinder head	0–0.05mm
Maximum service limit	0.12mm
Maximum limit for re-grinding the cylinder head	0.15mm

## Check (Condition)

1. Make the machine safe. Refer to (PIL 01-03).
2. Get access to the engine. Refer to (PIL 06-06).
3. Remove the cylinder head bolts in the reverse numerical order. This will prevent distortion of the cylinder head. Refer to Figure 72.

**Figure 72.**



4. Remove the cylinder head from the engine.
5. Clean the cylinder head thoroughly.
6. Make sure that the contact surface of the cylinder head and the contact surface of the crankcase are clean, smooth and flat.
7. Inspect the bottom surface of the cylinder head for pitting, corrosion and cracks.
8. Inspect the area around the valve seats and the holes for the fuel injectors.
9. Put the cylinder head on a suitable support.

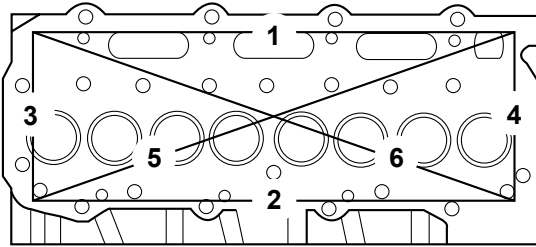
**Figure 73.**



- A** Cylinder head  
**B** Support

10. Use a straight edge and a feeler gauge to check the six positions for distortion. Refer to Figure 74.

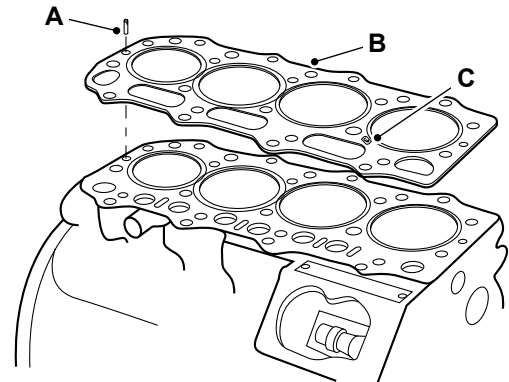
**Figure 74.**



**Calibrate**

- The dowel pins in the crankcase hold the cylinder head gasket in the correct position when the cylinder head is installed. Refer to Figure 75.
- The stamped marking on the cylinder head gasket must face upward. This makes sure that the cylinder head gasket is installed correctly. Refer to Figure 75.

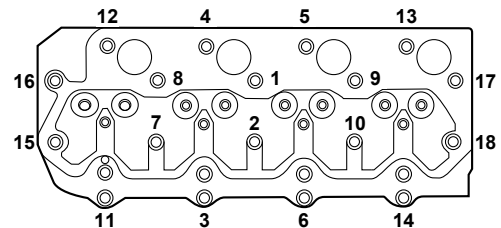
**Figure 75.**



- A** Dowel pins
- B** Gasket
- C** Stamped marking

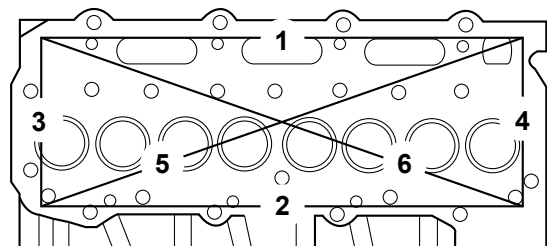
- Before you tighten the bolts, apply clean engine oil on the threads of the bolts. The bolts must be tightened to the torque of 101N·m in the specified numerical sequence only. Refer to Figure 76.

**Figure 76.**



- Use a straight edge and a feeler gauge to check the six positions for distortion. Refer to Figure 77.

**Figure 77.**



- If you grind the cylinder head, check the valve depth below the cylinder head face. Refer to (PIL 15-30).

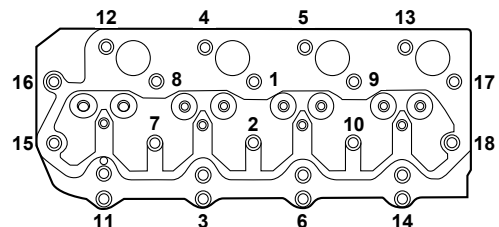
## Remove and Install

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

### Remove

1. Make the machine safe. Refer to (PIL 01-03).
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 exhaust manifold. Refer to (PIL 18-24).
4. Remove the fuel filter. Refer to (PIL 18-09).
5. Remove the fuel injectors. Refer to (PIL 18-18).
6. Remove the glow plugs. Refer to (PIL 15-80).
7. Remove the rocker shaft and the push rods. Refer to (PIL 15-42).
8. Remove the cooling pump. Refer to (PIL 21-09).
9. Drain the cooling system. Refer to (PIL 21-00).
10. Gradually loosen the bolts in reverse numerical order. This will prevent distortion of the cylinder head. Refer to Figure 78.

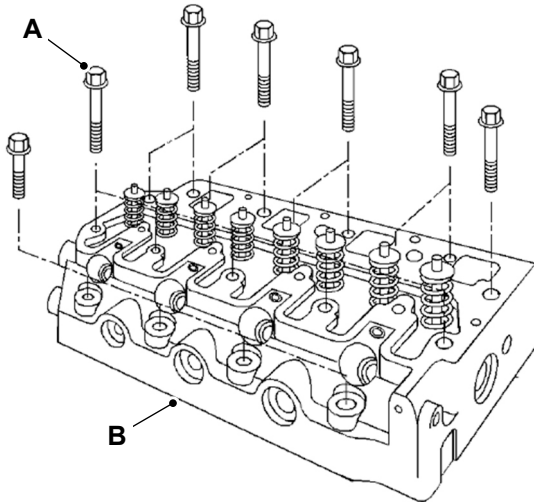
**Figure 78.**



11. Remove the bolts from the cylinder head.
12. Carefully lift the cylinder head off the crankcase with a suitable lifting device.
13. Make sure of the following:
  - 13.1. Do not use a lever to separate the cylinder head from the crankcase.
  - 13.2. Take care not to damage the machined surfaces of the cylinder head.
  - 13.3. Avoid contamination of the cylinder bores with coolant or with debris.
  - 13.4. Place the cylinder head on a surface that will not scratch the face of the cylinder head.
14. Remove the cylinder head gasket. Retain the old gasket to help identification.

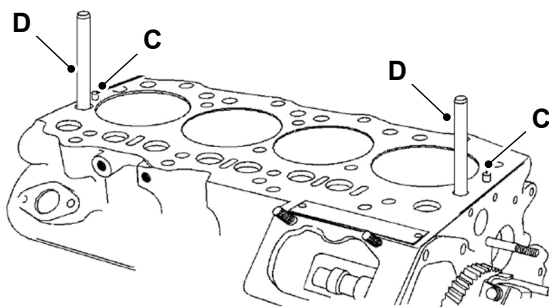
15. Make a note of the position of the dowels. Do not remove the dowels unless they are damaged.
16. If necessary, remove the thermostat from the cylinder head. Refer to (PIL 21-12).

**Figure 79.**



- A Bolt
- B Cylinder head

**Figure 80.**



- C Dowel
- D Guide bolt (M11 by 100mm)

### Install

1. Clean the mating surfaces of the cylinder head and the crankcase.
2. Make sure that no debris enters the cylinder bores, the coolant passages, or the lubricant passages.
3. Inspect the mating surface of the cylinder head for distortion. If the mating surface of the cylinder head is distorted beyond the maximum permitted limits, replace the cylinder head.
4. Inspect dowels for damage. If necessary, replace the dowels in the crankcase.
5. Install the guide bolts to the crankcase.

6. Make sure that the new gasket is of the same thickness as the old gasket.
7. Align the gasket with the guide bolt and the dowels. Install the gasket onto the crankcase.
8. Lift the cylinder head with a suitable lifting device.
9. Align the cylinder head with the guide bolts on the crankcase. Install the cylinder head onto the crankcase.
10. Make sure that the cylinder head is correctly positioned on the dowels.
11. Remove the guide bolts.
12. Install the bolts to the cylinder head.
13. Tighten the bolts to the correct torque value in the specified numerical sequence only. Refer to Figure 78.
14. If removed, install the thermostat to the cylinder head. Refer to (PIL 21-12).
15. Install the cooling pump. Refer to (PIL 21-09).
16. Install the rocker shaft and the push rods. Refer to (PIL 15-42).
17. Install the glow plugs. Refer to (PIL 15-80).
18. Install the fuel injectors. Refer to (PIL 18-18).
19. Install the fuel filter. Refer to (PIL 18-09).
20. Install the exhaust manifold. Refer to (PIL 18-24).

**Table 40. Torque Values**

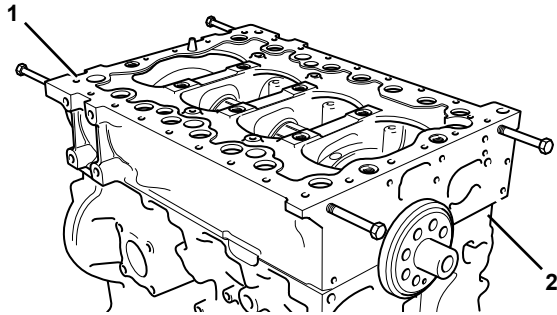
Item	Description	Nm
A	Bolt	100

## 00 - General

### 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 81.**



- 1 Bedplate
- 2 Crankcase



## 00 - General

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## Introduction

The crankshaft is housed inside the crankcase. It is connected to the piston via a connecting rod, they form a simple mechanism that converts reciprocating motion into rotating motion. Refer to Engine- General, Operation, The Four Stroke Cycle (PIL 15-00).



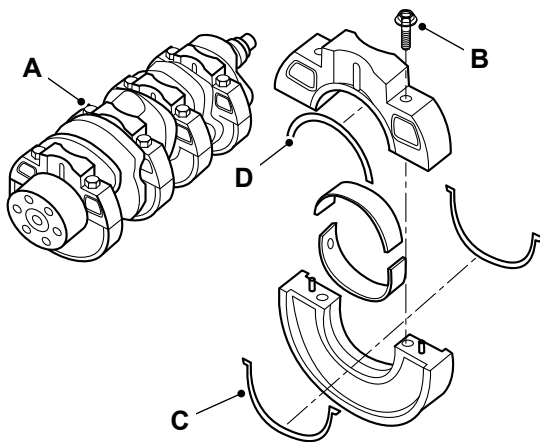
## Technical Data

**Table 41.**

Description	Data	
	Standard	Service limit
Thrust washer thickness	2.95–3mm	0.5mm
Crankshaft end play	0.1–0.3mm	0.5mm

- Make sure that the oil grooves of all of the thrust washers are toward the crankshaft.

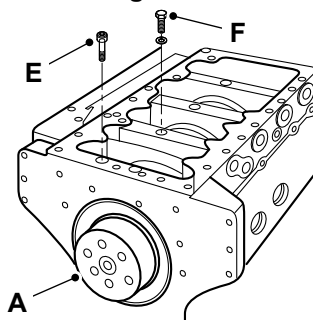
**Figure 82.**



- A Crankshaft
- B Main bearing holder bolt
- C Thrust washer
- D Top thrust washer

- If the crankshaft end play exceeds the service limit, check the thrust washers for wear.

**Figure 83.**



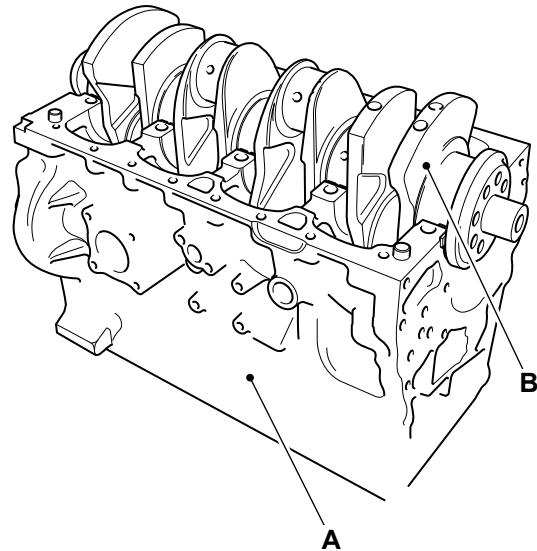
- A Crankshaft
- E Allen head screw
- F Retaining bolt

**Table 42. Torque Values**

Item	Description	Nm
B	Main bearing holder bolt	52
E	Allen head screw	27
F	Retaining bolt	52

## Component Identification

**Figure 84.**



- A Crankcase
- B Crankshaft

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

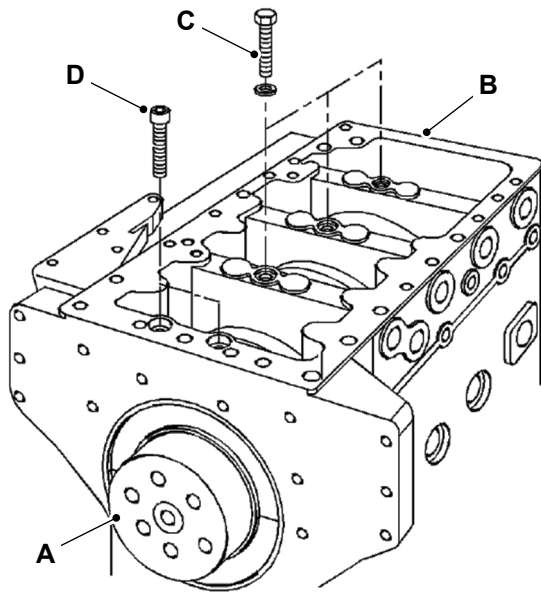
## Remove and Install

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

### Remove

1. Remove the engine oil relief valve. Refer to (PIL 15-60).
2. Remove the crankshaft rear seal. Refer to (PIL 15-12).
3. Remove the engine oil pump and the suction pipe. Refer to (PIL 15-60).
4. Remove the pistons and the connecting rods. Refer to (PIL 15-36).
5. Mount the engine in a suitable stand with the rear end facing upwards.
6. Remove the bolts from the crankcase.
7. Remove the Allen screws from the crankcase.
8. Attach a suitable lifting device to the crankshaft assembly.
9. Carefully lift the crankshaft assembly from the crankcase.
10. If necessary, gently tap the nose of the crankshaft with a soft faced hammer.
11. Install the nut for the crankshaft pulley to protect the nose of the crankshaft. Do not scratch the finished surfaces of the crankshaft.

**Figure 85.**



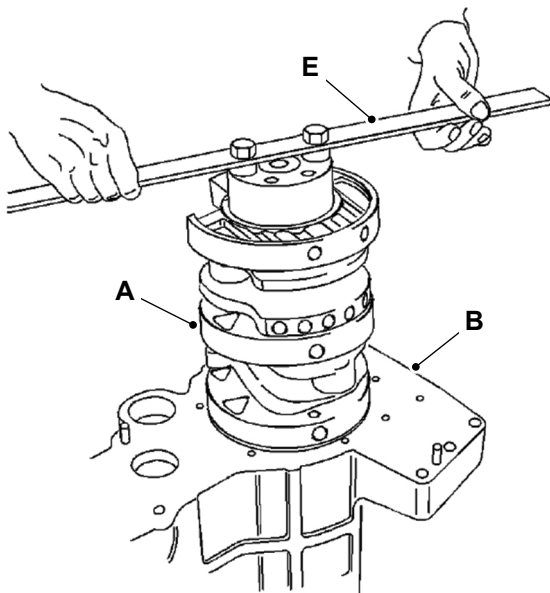
- A** Crankshaft
- B** Crankcase
- C** Bolt
- D** Allen screw

3. Tighten the bolts and the screws to the correct torque value.
4. Check the crankshaft end play.
  - 4.1. Push the crankshaft towards the front of the engine.
  - 4.2. Install a DTI (Dial Test Indicator) to the crankcase and the rear face of the crankshaft.
  - 4.3. Push the crankshaft toward the rear of the engine.
  - 4.4. Measure the crankshaft end play with the DTI.
  - 4.5. Make sure that the end play does not exceed the maximum permissible crankshaft end play. Refer to Crankshaft - Technical Data - (PIL 15-12).

**Table 43. Torque Values**

Item	Description	Nm
C	Bolt	52
D	Allen screw	27

**Figure 86.**



- A** Crankshaft
- B** Crankcase
- E** Lifting device

**Install**

1. Installation is the opposite of the removal procedure. Additionally do the following steps.
2. Before installation make sure that all the components are clean and free from damage.

## 03 - Main Bearing

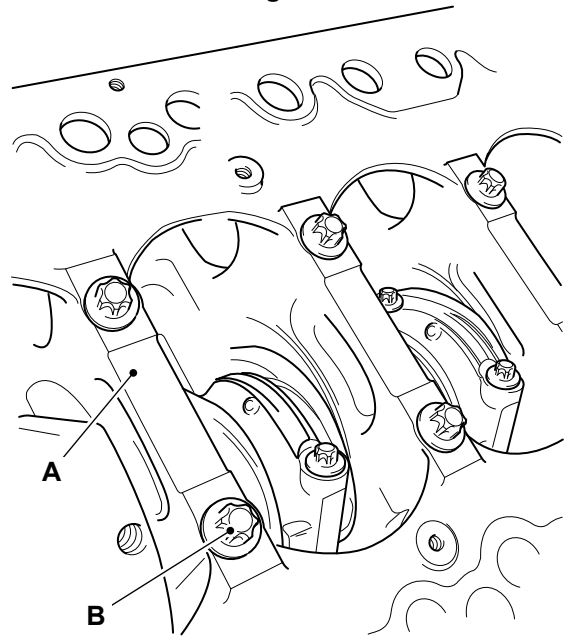
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## Introduction

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 87.**



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

## Check (Condition)

Check the condition of the main bearings by measuring the clearance between the two bearing halves.

If the crankshaft journals and the bores for the crankcase and connecting rods were measured, no further checks are necessary. If the bearing clearance measurement is necessary, the use of the plastic gauge is an acceptable method. The plastic gauge is less accurate on journals with small diameters if the clearances are less than 0.1mm. When you use the plastic gauge make a note of the following:

- Make sure that the backs of the bearings and the bores are clean and dry.
- Make sure that the bearing locking tabs are properly seated in the tab grooves.
- The crankshaft must be free of oil at the contact points of the plastic gauge.

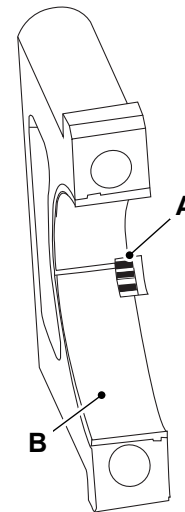
**Table 44. Plastic Gauges**

Colour code	Dimensions
Green	0.025–0.076mm
Red	0.051–0.152mm
Blue	0.102–0.229mm
Yellow	0.23–0.51mm

## Measurement Procedure

1. Put the plastic gauge on the crown of the bearing that is in the cap.
2. Do not allow the plastic gauge to extend over the edge of the bearing.
3. Use the correct torque-turn specifications in order to install the bearing cap.
4. Do not use an impact wrench. Be careful not to dislodge the bearing when the cap is installed.
5. Do not turn the crankshaft when the plastic gauge is installed.
6. Carefully remove the cap, but do not remove the plastic gauge.

**Figure 88.**



- A** Plastic gauge  
**B** Bearing

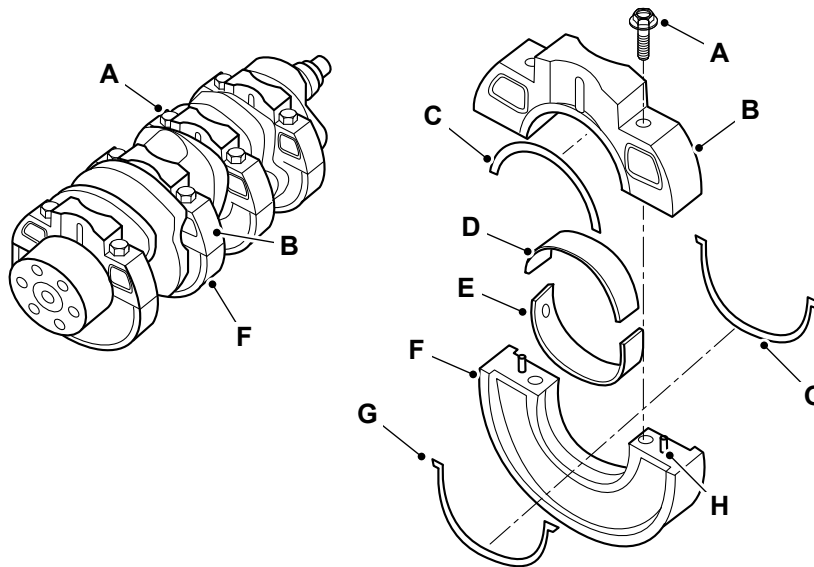
7. Measure the width of plastic gauge while the plastic gauge is in the bearing cap or on the crankshaft journal.
8. Remove all of plastic gauges before you install the bearing cap.

## Remove and Install

### Remove

1. Remove the crankshaft. Refer to (PIL 15-12).
2. Make sure that the bearing caps are marked for orientation and the correct position.
3. Remove the bolt and the upper main bearing cap from the lower main bearing cap.
4. Remove the thrust washer1 and the thrust washer2.
5. Remove the upper main bearing and the lower main bearing from the upper main bearing cap and the lower main bearing cap respectively.
6. Keep the main bearings with the respective bearing caps.
7. Do not remove the dowels from the main bearing caps.
8. Remove the front bearing with the driver tool.

**Figure 89.**



**A** Bolt  
**C** Thrust washer1  
**E** Lower main bearing  
**G** Thrust washer2

**B** Upper main bearing cap  
**D** Upper main bearing  
**F** Lower main bearing cap  
**H** Dowel

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