



# SERVICE MANUAL

EXCAVATOR  
**JS115, JS130, JS131,  
JS145, JS160, JS180, JS190**

EN - 9813/7150 - ISSUE 1 - 04/2016

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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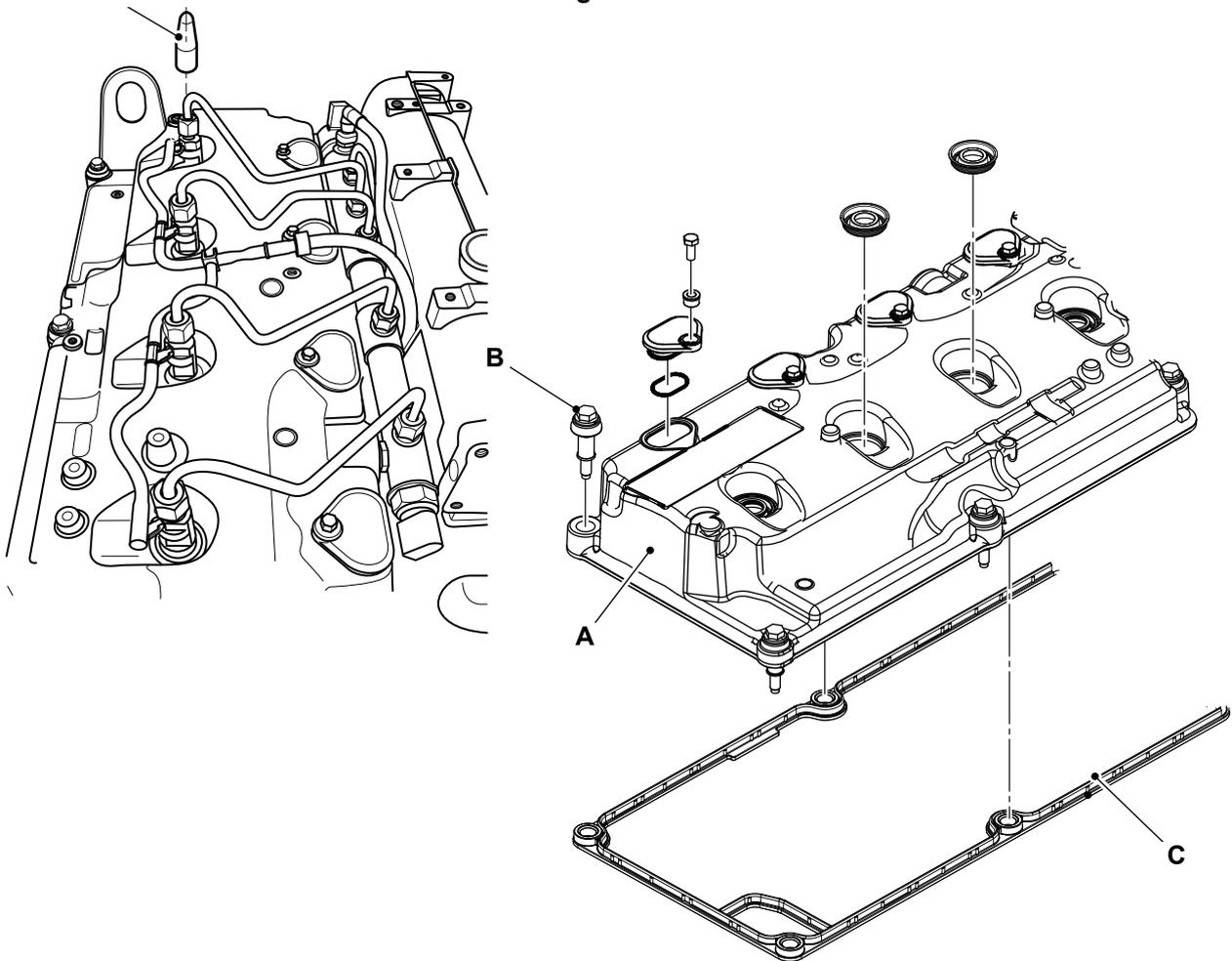
## 06 - Rocker Cover

### Remove and Install

#### Before Removal

1. 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.
2. Clean the engine. Refer to Engine - Clean (PIL 15-00).

**Figure 199.**



**A** Rocker cover  
**C** Gasket

**B** Bolts  
**D** Injector seals

## Remove

1. Get access to the engine.
2. Remove the high pressure fuel pipes. Refer to Fuel Pipes (PIL 18-96).
3. Remove the fuel bleed off fuel pipes. Refer to Fuel Pipes (PIL 18-96).
4. Disconnect the electrical connectors at the fuel injectors. Refer to Fuel Injection (PIL 18-18).
5. Disconnect the electrical connector at the coolant temperature sensor. Refer to Engine Sensors (PIL 15-84).
6. Move the electrical harness away from the rocker cover.
7. Remove the bolts and lift the rocker cover from the cylinder head.
8. Discard the gasket.
9. The rocker cover injector seals must be replaced. Refer to Injector seals (PIL 18-18).

## Install

1. Replacement is the reversal of the removal procedure.
2. Remove all oil and sludge contamination from inside the rocker chamber.
3. Renew the injector seals. Refer to Injector seals (PIL 18-18).
4. Renew the rocker cover gasket.
5. Prevent damage to the seals. Put sleeves/covers on the four injectors. Apply a rubber lubricant to the seals and then install the rocker cover.
6. Tighten the bolts to the correct torque value.
7. Remove the sleeves/covers.

## After Installation

1. The high pressure fuel pipes must be replaced with new parts. Refer to Fuel Pipes (PIL 18-96).
2. Start the engine and check for oil and fuel leaks.

**Table 72. Torque Values**

Item	Nm
B	24

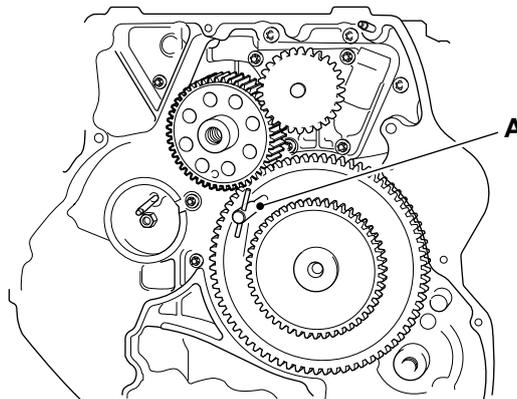
## 21 - Tappet

### 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.

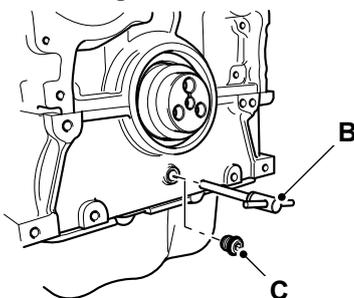
**Figure 200.**



#### A Timing pin - camshaft

11. Remove the taper blanking plug and insert the 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 201.**



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

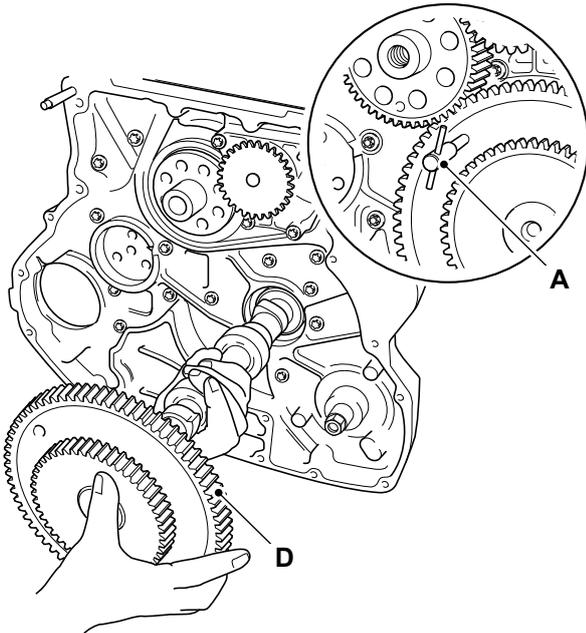
12. Remove the fuel injection pump drive gear. Refer to (PIL 15-51).

#### Removal

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 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.

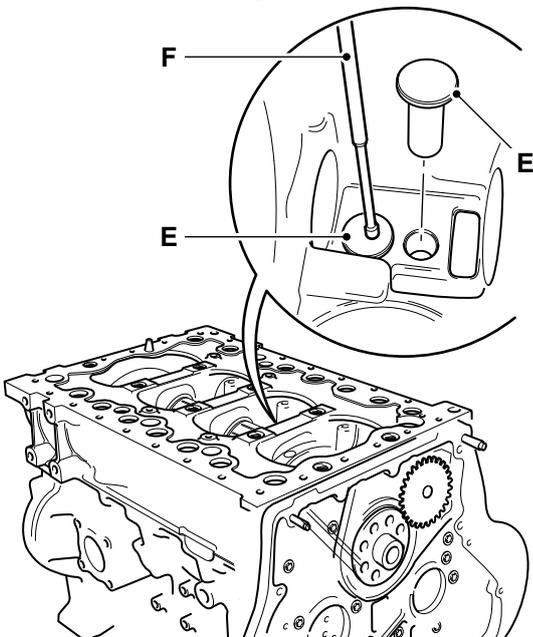
**Figure 202.**



**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 203.**



**E** Tappet (8 off)  
**F** Magnetic probe

### Inspection

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.

### Installation

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 to lock the camshaft in this position.

### 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.

## 24 - Tappet Cover

### Remove and Install

It is not necessary to remove the tappet covers unless a new rocker cover is to be installed. It is necessary to remove the tappet covers to measure and adjust the valve clearances. Refer to Valve-Adjust, Valve Clearances (PIL 15-30).

#### Remove

1. 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.
2. Get access to the engine.
3. Clean the tappet covers and the adjacent areas of the rocker cover. Refer to Engine - Clean. Important: Make sure that the screws do not fall into the engine.
4. Remove the tappet cover screws.
5. Keep the screws away from the engine.
6. Use a screwdriver in the slot to remove the tappet covers. Make sure that dirt or debris does not fall into the engine.

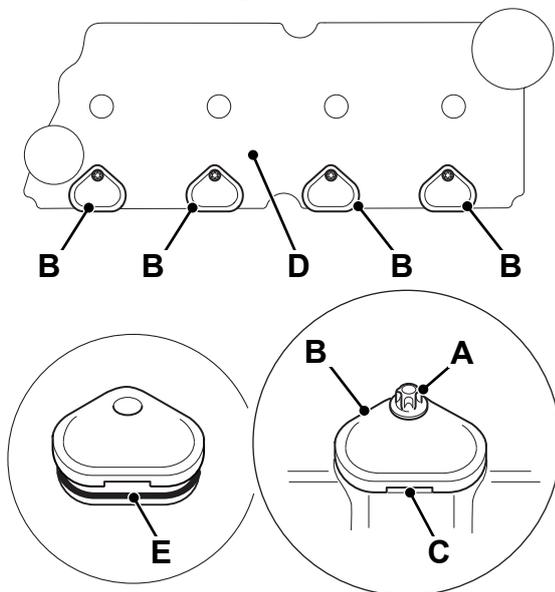
#### Install

1. Replacement is the reversal of the removal procedure.
2. Inspect the tappet cover seals for signs of damage. Replace any damaged seals.
3. Install the tappet covers. Tighten the screws to the correct torque value.

**Table 73. Torque Values**

Item	Nm
A	9

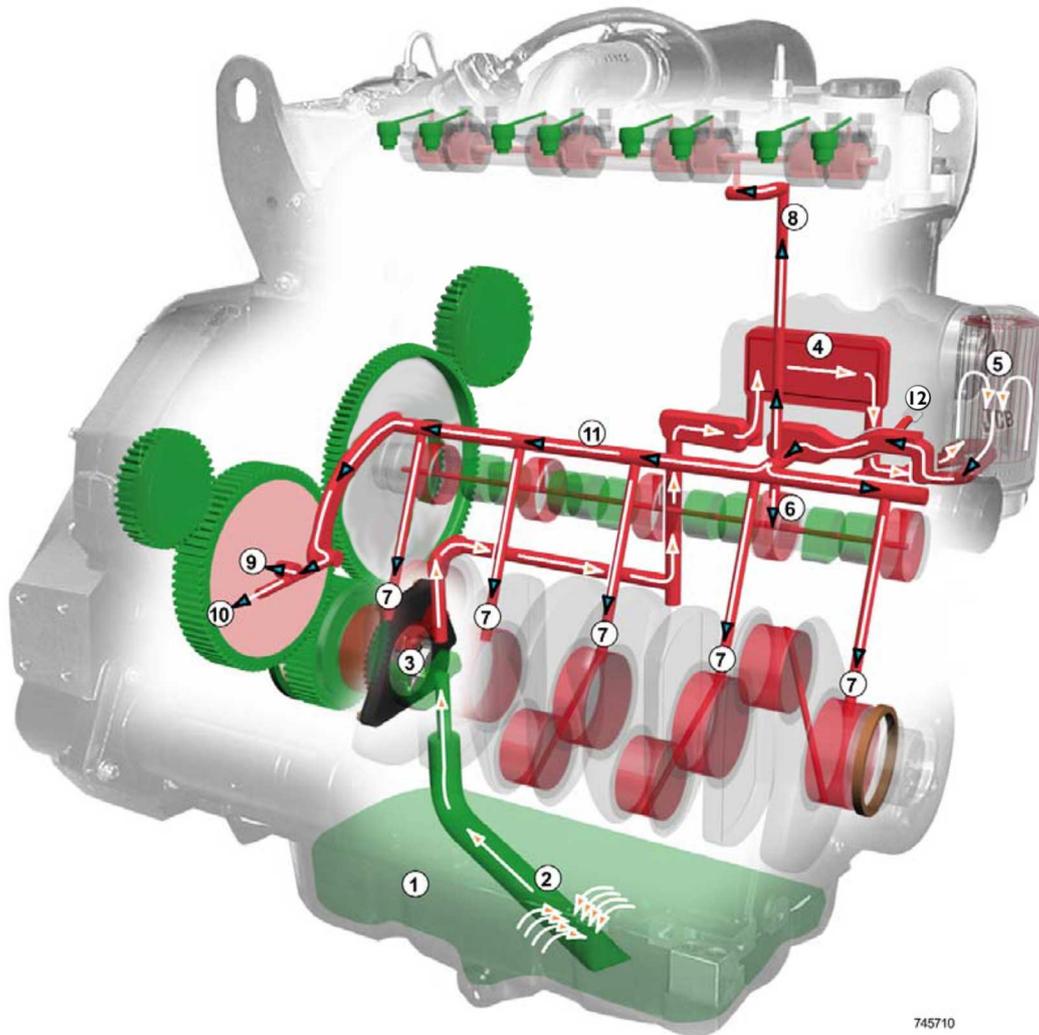
**Figure 204.**



- A** Screws
- B** Tappet covers
- C** Slot
- D** Rocker cover
- E** Tappet cover seals

## Component Identification

Figure 205.



- |    |                                                                               |    |                                                                                      |
|----|-------------------------------------------------------------------------------|----|--------------------------------------------------------------------------------------|
| 1  | Oil sump                                                                      | 2  | Suction strainer                                                                     |
| 3  | Oil pump                                                                      | 4  | Oil cooler                                                                           |
| 5  | Filter                                                                        | 6  | Camshaft - high pressure oil feed                                                    |
| 7  | Crankshaft main bearings - high pressure oil feed                             | 8  | Rocker assembly - high pressure oil feed                                             |
| 9  | PTO (Power Take-Off) idler gear bearing/ timing case - high pressure oil feed | 10 | External high pressure oil feed connection (crankcase) - Turbocharger (if installed) |
| 11 | Main high pressure oil feed gallery (crankcase)                               | 12 | Oil pressure switch                                                                  |
- Green- Oil at sump pressure  
 Pink- Oil at lower pressure but higher than sump pressure  
 Red- Oil at high pressure

## Remove and Install

### Special Tools

Description	Part No.	Qty.
Template for Sealant Oil Sump (Pressed)	892/01149	1
Oil Sump Location Dowel	892/01150	2
Template for Sealant Oil Sump (Cast)	892/12354	1

### Consumables

Description	Part No.	Size
Clear Silicone Sealant	4102/0901	0.31L

### Before Removal

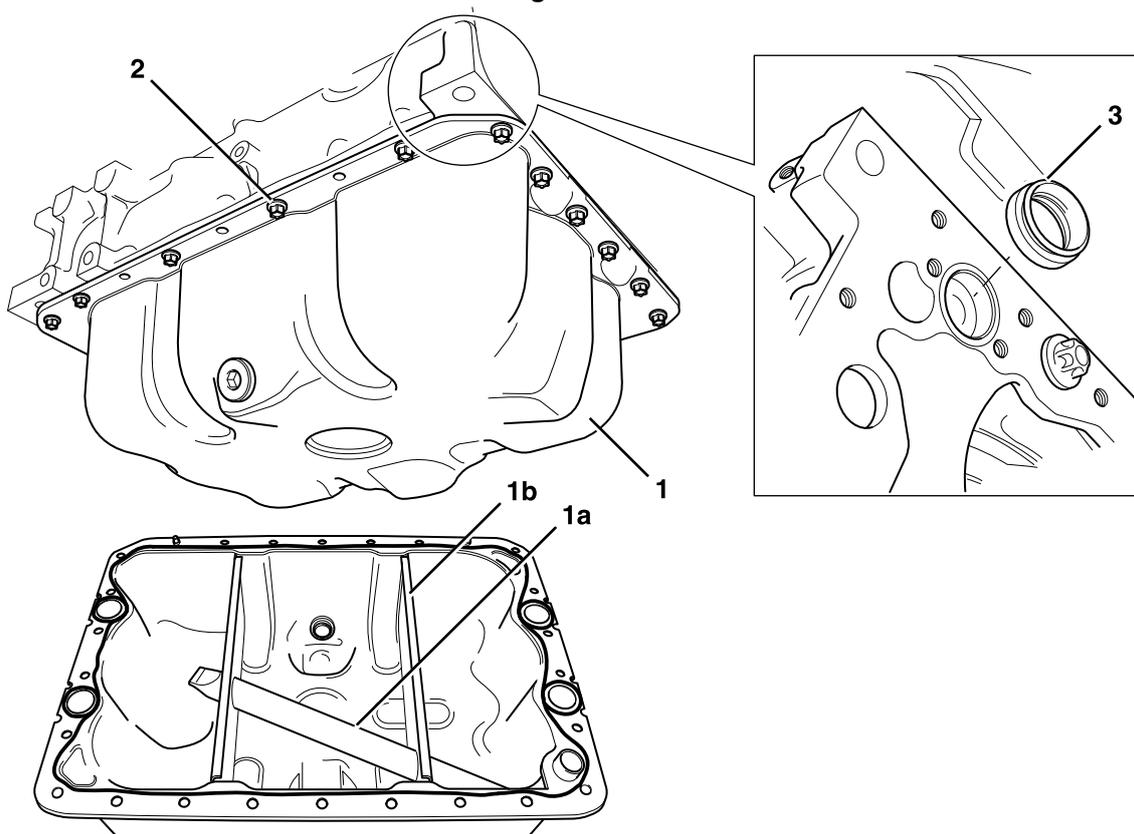
1. Make sure that the engine is safe to work on. If the engine has been running, make sure the engine has cooled sufficiently before you start.

2. Drain the engine oil.

### Removal

1. Remove the fixing bolts and remove the oil sump from the engine. The oil sump may be difficult to remove due to adhesion of sealing compound. If necessary, carefully lever the mating flanges apart. Do not use excessive force, the oil sump could be damaged. Be sure to retrieve the oil pick up seal.
2. Use a gasket removal compound, carefully remove all traces of sealing compound from the oil sump and engine mating faces. Do not allow the sealing compound to enter the engine.
3. Use a suitable degreasing agent to thoroughly clean the oil sump.

Figure 206.

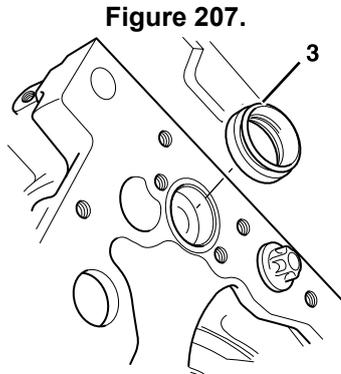


- 1 Oil sump
- 1b Integral baffle plates
- 3 Oil pick up seal

- 1a Integral suction tube
- 2 Oil sump fixing bolts (x20)

## Installation

1. Lightly smear the new oil pick up seal with oil and install into the bedplate as shown.



**3** Oil pick up seal

2. Install the two guide pins at the oil sump screw holes in the engine.

**Special Tool: Oil Sump Location Dowel (Qty.: 2)**

3. Use the fixing bolts to locate the template to the oil sump mating face. Make sure that the template is the correct way round (note that holes are on different centres).

**Special Tool: Template for Sealant Oil Sump (Cast) (Qty.: 1)**

**Special Tool: Template for Sealant Oil Sump (Pressed) (Qty.: 1)**

4. Apply a bead of sealing compound around the oil sump flange using the inside edge of the template as a guide as shown. Note the beads around holes.

Length/Dimension/Distance: 4mm

**Consumable: Clear Silicone Sealant**

5. Carefully remove the template without smudging the sealant beads.

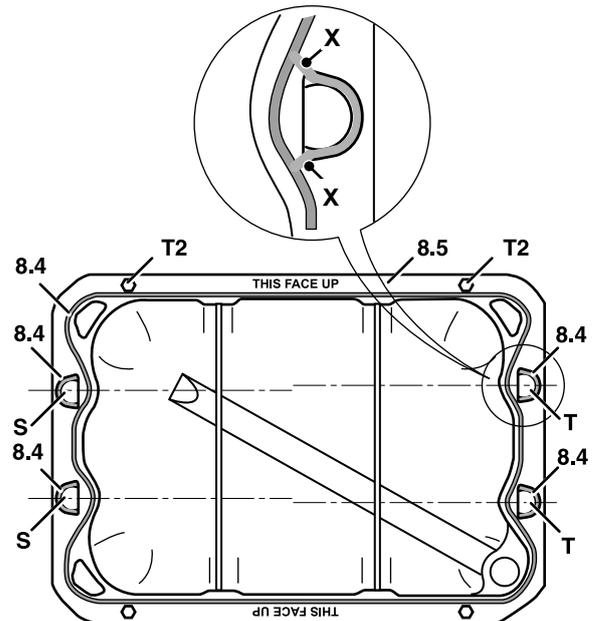
6. Apply a bead of sealant so as to join the sealant beads around holes with the bead around the oil sump flange.

Length/Dimension/Distance: 4mm

7. After applying the sealing compound, the oil sump must be installed and the bolts torque tightened within

Duration: 5min

**Figure 208.**



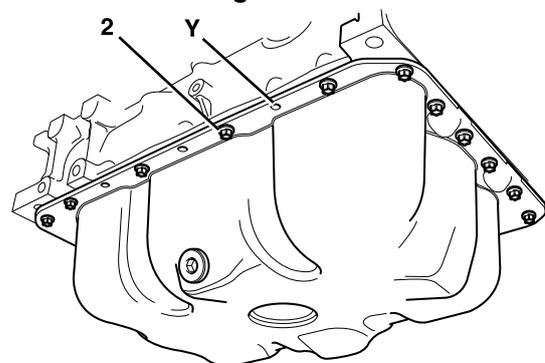
- S** Hole
- T** Hole
- T2** Guide pins
- X** 4mm Bead of sealant

8. Position the oil sump with the suction tube outlet aligned with the oil pump inlet port on the engine. Take care not to damage the oil pick up seal when you install the oil sump. Damage to the seal could cause a drop in oil pressure and subsequently damage to the engine.

9. Locate the oil sump on the guide pins on the engine. Avoid smudging the sealant beads. **DO NOT** remove the guide pins until sufficient bolts have been installed to secure the oil sump.

10. Install the bolts and tighten the bolts to the correct torque value. Note that the bolts are not installed at 6 positions.

**Figure 209.**



- 2** Bolts
- Y** No bolts to be fitted at this position (x6)

### After Replacing

1. Allow the sealant to cure for  
Duration: 20min
2. Refill the engine with the recommended engine oil. Refer to (PIL 75-00).
3. Start the engine and check for oil leaks.

**Table 74. Torque Values**

Item	Nm
2	24



## 00 - General

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## Introduction

The timing gears are located inside a case at the flywheel end of the engine.

The engine must be timed so that the camshaft operates the valves at the correct times relative to the crankshaft position.

Valve timing is achieved by ensuring that the camshaft drive gear is meshed to the crankshaft gear at their correct angular positions, refer to Engine-General, Operation, The Four Stroke Cycle (PIL 15-00) for more information about valve timing.

## Component Identification

**Figure 210.**



- A** Crankshaft gear
- C** High pressure fuel pump gear
- E** Heavy duty PTO device gear (if fitted)
- G** Low duty PTO device gear (if fitted)

- B** Camshaft gear
- D** Oil pump gear
- F** Heavy duty PTO device gear (if fitted)

## Operation

All the gears are driven via the crankshaft gear as follows:

- Camshaft gear-The camshaft is driven at half crankshaft speed.
- High pressure fuel pump gear-The high pressure fuel pump is driven via the camshaft gear installed to the camshaft.
- Oil pump gear-The lubrication oil pump is driven directly by the crankshaft gear.
- Power Take-Off (PTO)-driven by the crankshaft gear via idler gear.
- Low Duty Power Take-Off (PTO) Gear (if installed)-driven by the camshaft gear.

**Figure 211.**



**A** Crankshaft gear  
**C** High pressure fuel pump gear  
**E** Heavy duty PTO device gear (if installed)

**B** Camshaft gear  
**D** Oil pump gear  
**F** Heavy duty PTO device gear (if installed)



**G** Low duty PTO device gear (if installed)

## **Check (Condition)**

1. Inspect the gears for wear or damage. If one or more of the gears are worn or damaged, replace them.

## 03 - Crankshaft Gear

### Remove and Install

#### Special Tools

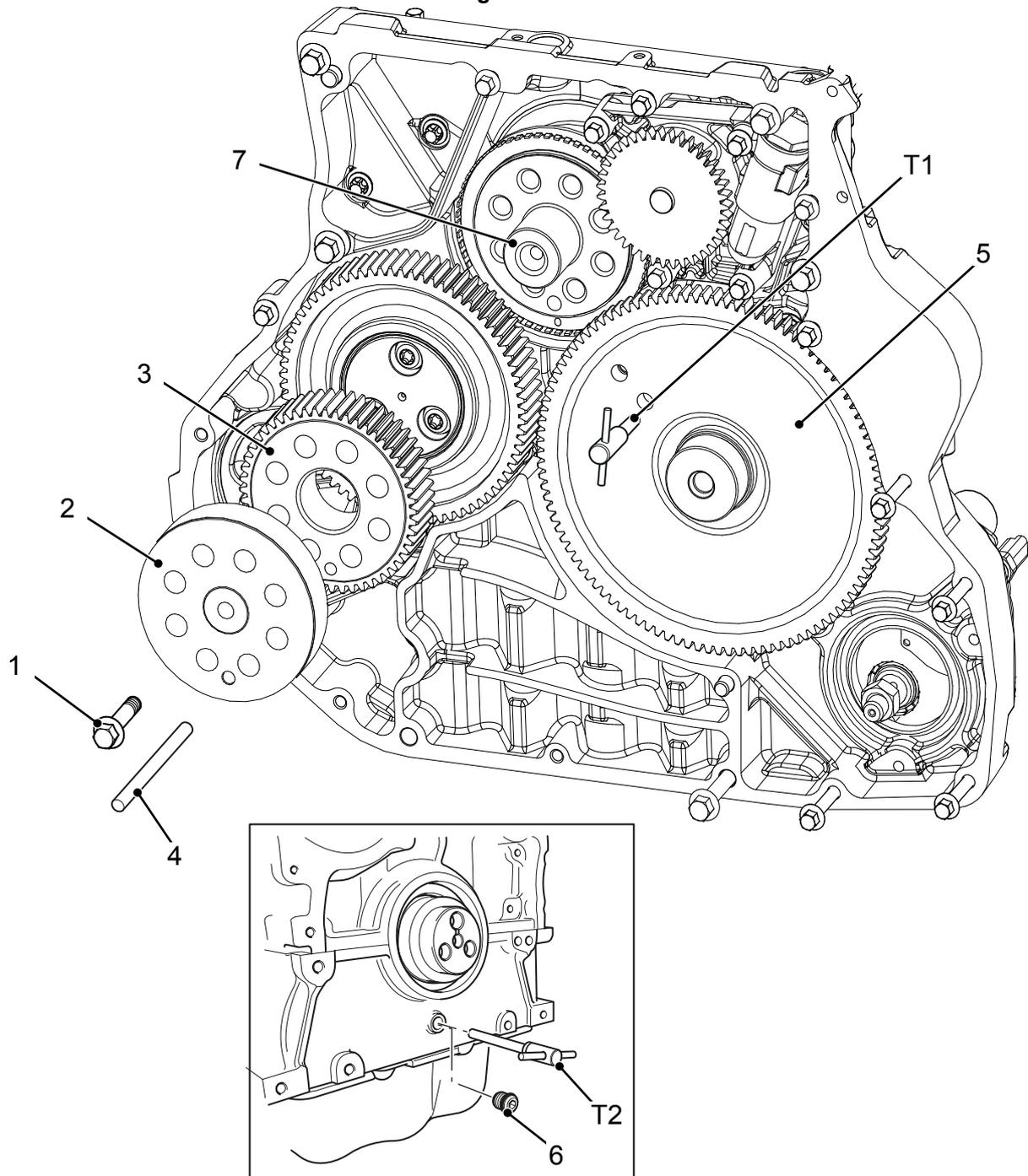
Description	Part No.	Qty.
<a href="#">Crankshaft / Camshaft Timing Pin</a>	<a href="#">892/01148</a>	2

Note: The illustrations show the engine inverted. If the drive gear components are being removed prior to crankshaft or camshaft removal the engine must be inverted. If the gear components only are being removed (for inspection/renewal) then the engine need not be inverted.

#### Before Removal

1. Remove the starter motor. Refer to (PIL 15-75).
2. Remove the flywheel. Refer to (PIL 15-54).
3. Remove the flywheel housing. Refer to (PIL 15-54).
4. Rotate the crankshaft until the camshaft locking pin can be inserted through the gear and into the aligning hole in the rear gear case. Note: The camshaft and crankshaft locking pins must be in position to lock the crankshaft and camshaft before removing the crankshaft gear.  
[Special Tool: Crankshaft / Camshaft Timing Pin \(Qty.: 2\)](#)
5. Remove the taper blanking plug and insert the crankshaft locking pin.

**Figure 212.**



- 1 Drive gear and flywheel hub fixing bolt
- 2 Flywheel hub
- 3 Crankshaft gear
- 4 Location dowel
- 5 Camshaft drive gear
- 6 Blanking plug - crankcase
- 7 Crankshaft - gear location spigot
- T1 Timing pin - camshaft
- T2 Timing pin - crankshaft

**Remove**

1. Remove the flywheel hub fixing bolt and remove the flywheel hub.
2. Remove the crankshaft gear from the crankshaft. Make sure you retrieve the location dowel.

## Inspect

1. Carefully inspect the outer diameter of the flywheel hub for signs of wear or damage. Wear or damage will cause the crankshaft rear oil seal to fail. If in doubt renew the hub.

## Install

1. Apply some clean engine oil to the location spigot on the end of the crankshaft.
2. Make sure that the dowel is located in the crankshaft gear and locate the gear and dowel on to the crankshaft spigot.
3. Install the flywheel hub to the gear, locate on the dowel. Fix the hub with fixing bolt. Tighten the bolt to the correct torque value.

**Table 75. Torque Values**

Item	Nm
1	47
6	11

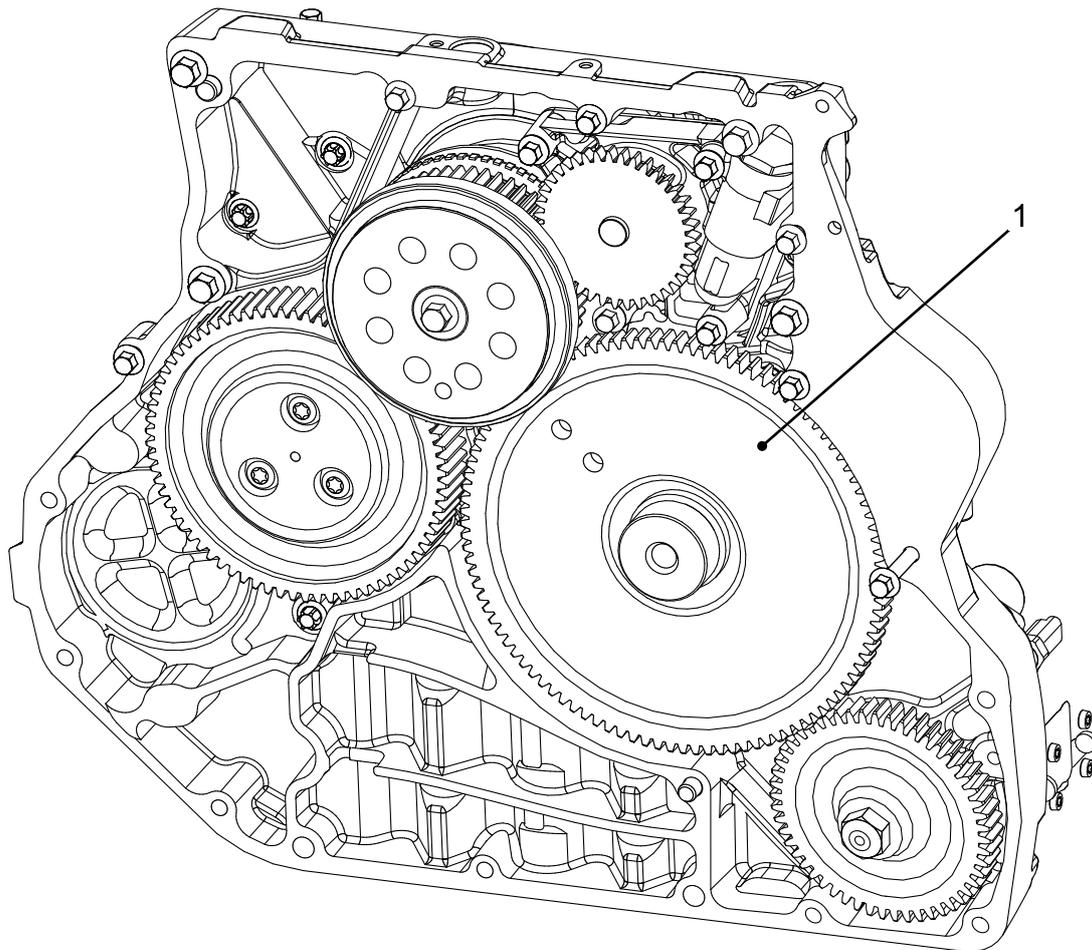
## 06 - Camshaft Gear

### Remove and Install

The camshaft drive gears are an interference fit on the end of the camshaft and cannot be removed individually. If the gears are damaged or worn the

complete camshaft and gear assembly must be renewed. Refer to Camshaft- Remove and Install. Refer to (PIL 15-15).

**Figure 213.**



1 Camshaft gear

## 09 - Fuel Injection Pump Gear

### Remove and Install

Note: The illustrations show the engine inverted. If the drive gear components are being removed prior to crankshaft or camshaft removal the engine must be inverted. If the gear components only are being removed (for inspection/renewal) then the engine need not be inverted.

#### Before Removal

1. Remove the high pressure fuel injection pump. Refer to (PIL 18-18).
2. Loosely install the high pressure fuel pump and fixing nut, retain the gear.
3. Remove the starter motor. Refer to (PIL 15-75).
4. Remove the flywheel. Refer to (PIL 15-54).
5. Remove the flywheel housing. Refer to (PIL 15-54).



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