SERVICE MANUAL

LOADALL (ROUGH TERRAIN VARIABLE REACH TRUCK)
506-23, 509-23, 512-26

EN - 9813/9400 - ISSUE 1 - 11/2017

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.

Contents

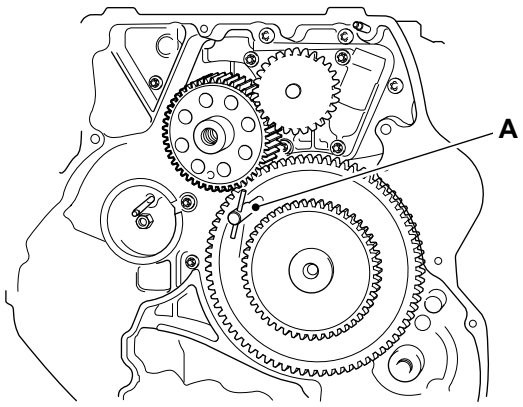
21 - Tappet

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.

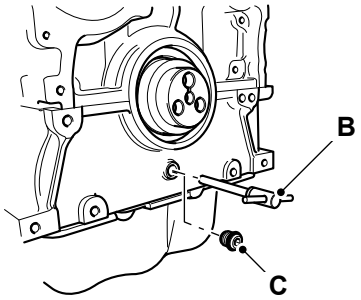
Figure 219.



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 220.



B Timing pin - crankshaft
C Blanking plug

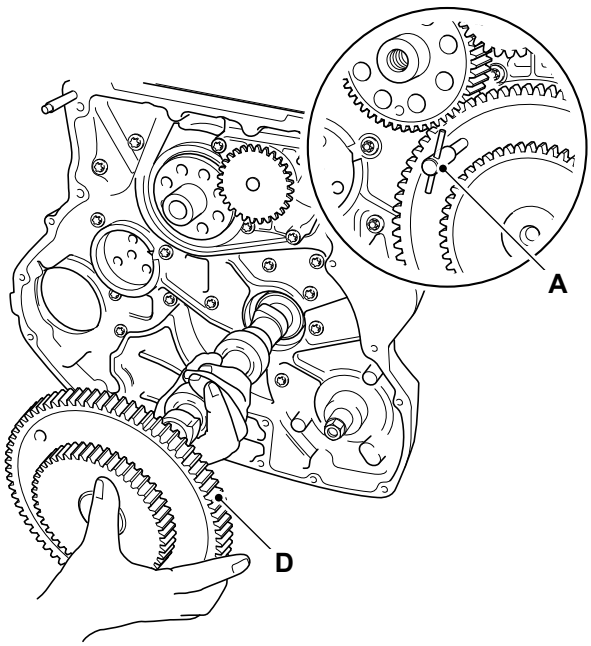
12. Remove the fuel injection pump drive gear. Refer to (PIL 15-51).

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.

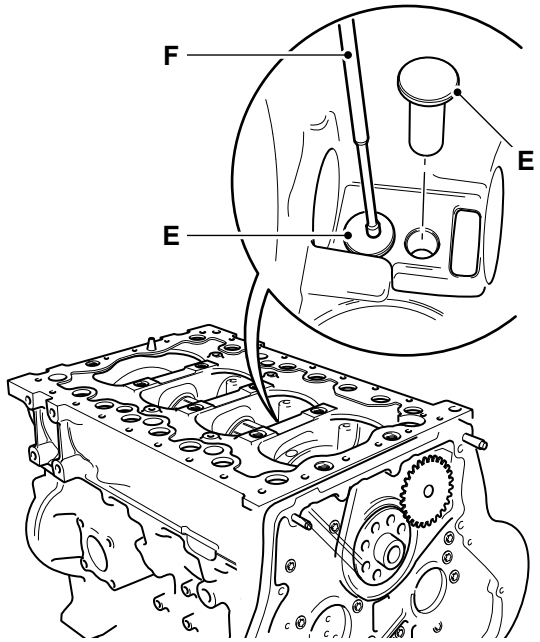
Figure 221.



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 222.



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

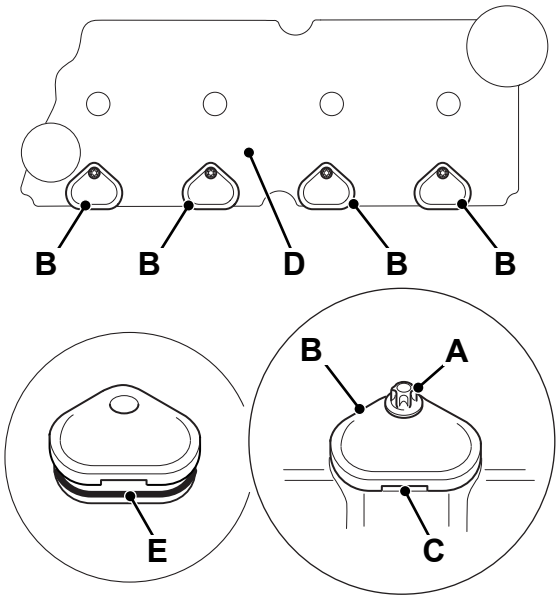
Remove and Install

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.

Figure 223.



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

Install

1. The installation procedure is the opposite of the removal procedure. Additionally do the following steps.
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 84. Torque Values

Item	Nm
A	9

00 - General

Introduction

The lubrication system distributes oil around the engine by a system of galleries and drillings in the crankcase and cylinder head. The oil lubricates and seals the moving parts of the engine, reducing friction and wear. In addition the oil plays an important role in cooling the engine by carrying heat from the engine to the cooler. A piston cooling jet sprays oil onto the underside of the pistons to keep them cool, refer to (PIL 15-36).

Oil is drawn from the oil sump by the integral oil pump via the suction strainer. The strainer prevents any large particles of debris passing through, which may damage the pump.

The oil passes from the outlet side of the pump through a relief valve which limits the maximum oil pressure by venting oil back to the inlet side of the pump, refer to (PIL 15-36).

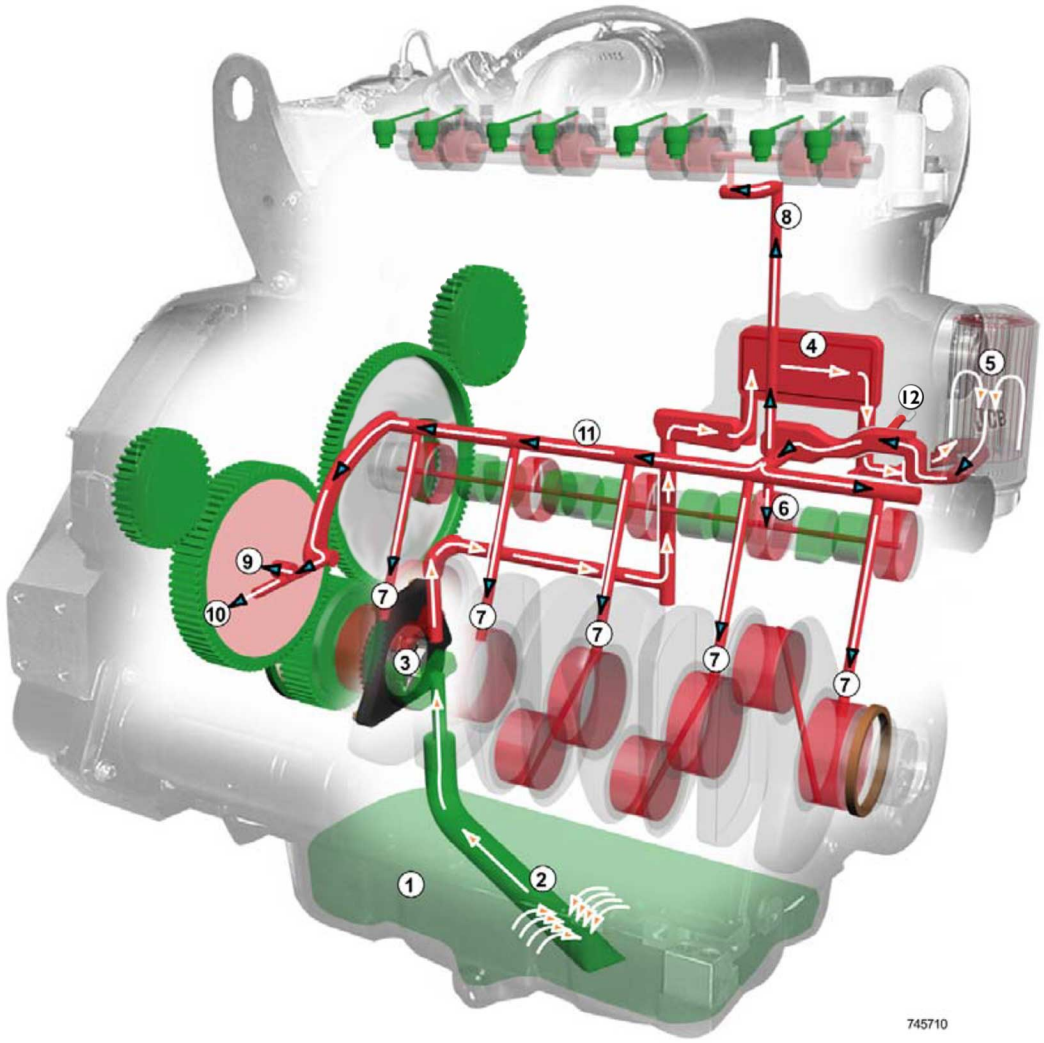
From the pump the oil passes through the oil cooler and filter, refer to (PIL 15-69 and PIL 15-21).

After cooling and filtering, the oil passes into the main oil gallery. An oil pressure switch senses the oil pressure. From the main gallery oil is delivered, via drillings, to the crankshaft main bearings, rocker assembly, camshaft and timing gears. Note that drillings are through the crankcase and cylinder head.

When the high pressure oil has passed through the bearings it reverts to sump pressure and splash lubricates the internal components such as rocker tips, cam lobes and timing gear teeth. Gravity drains the oil via drains into the cylinder head and crankcase, back into the oil sump. A drain slot allows the oil to drain from the timing case back to the oil sump.

Component Identification

Figure 224.



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)
Green- Oil at sump pressure
Pink- Oil at lower pressure but higher than sump pressure
12 Oil pressure switch
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

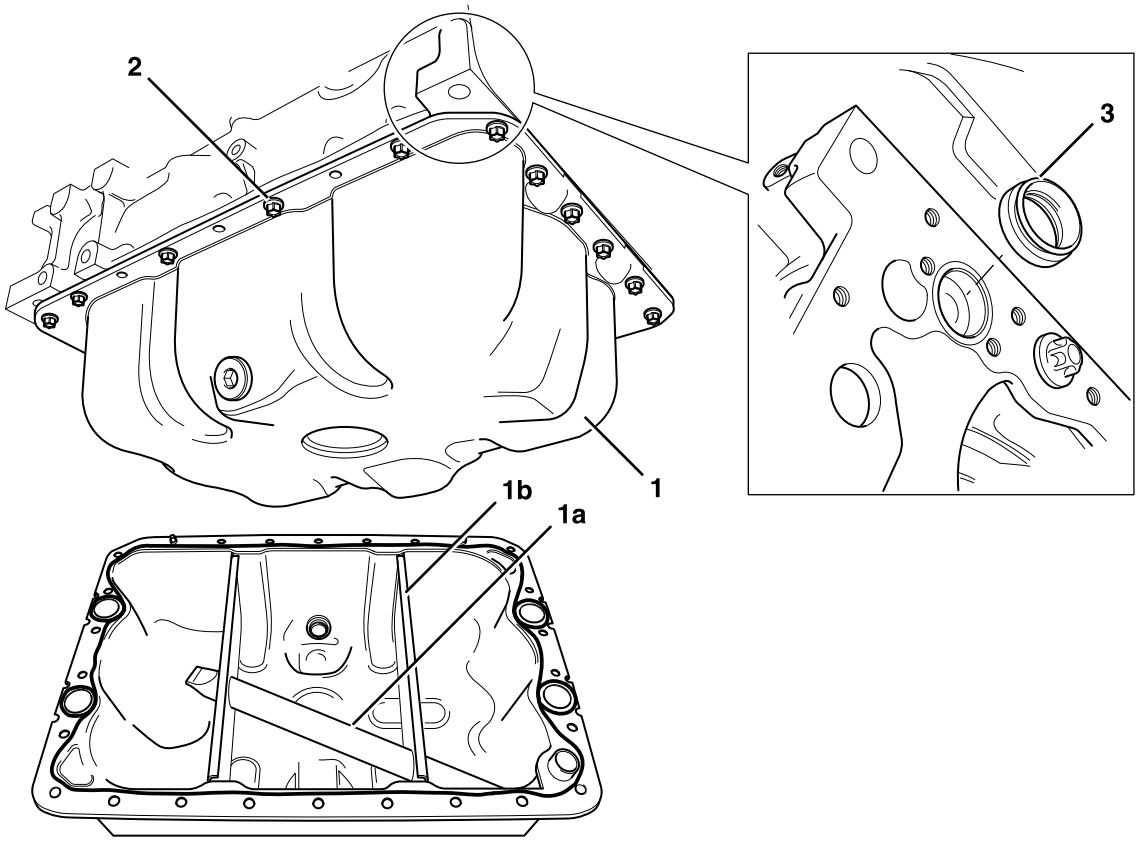
Before Removal

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 225.

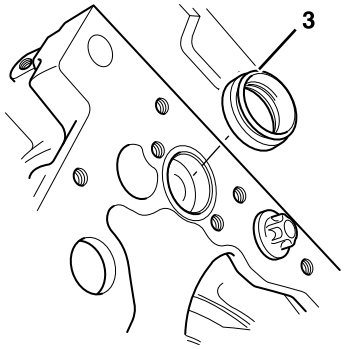


1 Oil sump
1a Integral suction tube
1b Integral baffle plates
2 Oil sump fixing bolts (x20)
3 Oil pick up seal

Installation

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

Figure 226.



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.

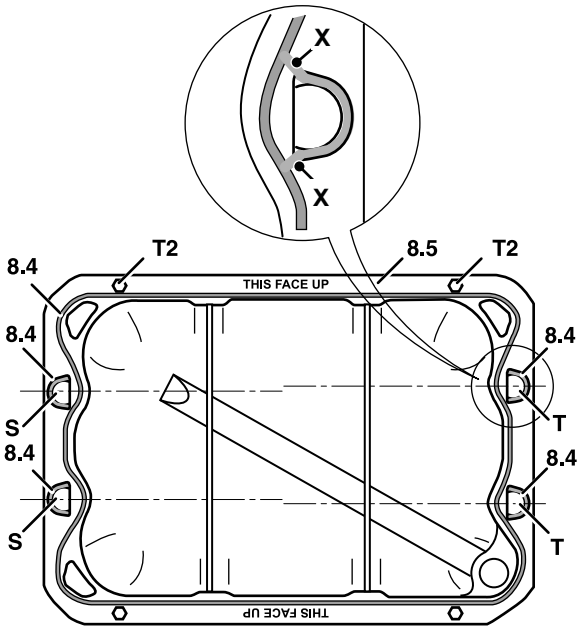
6. Apply a bead of sealant so as to join the sealant beads around holes with the bead around the oil sump flange.

   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 227.



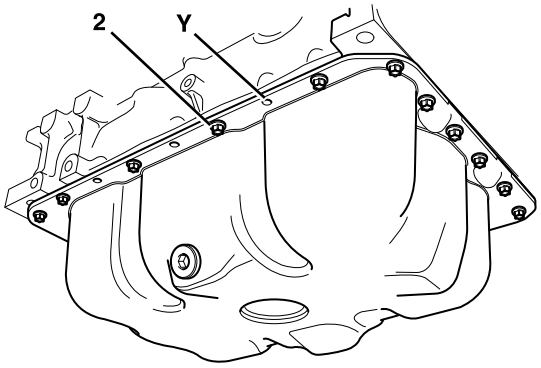
S Hole
T Hole
T2 Guide pins
X 4mm Bead of sealant

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 228.



2 Bolts
Y No bolts to be installed 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 85. Torque Values

Item	Nm
2	24

15 - Heavy Duty PTO Gear

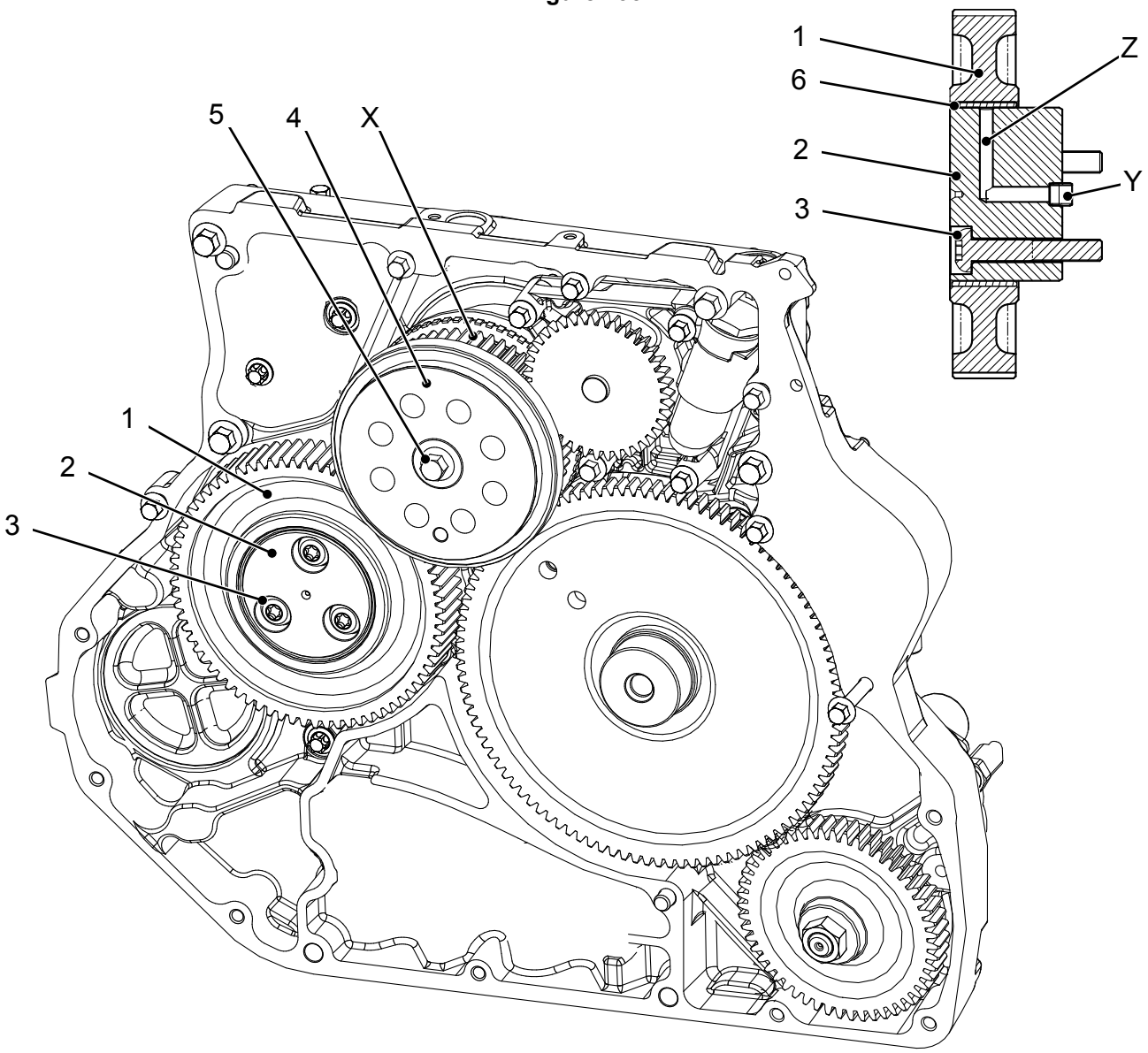
Remove and Install

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. This procedure requires service parts. Make sure you have obtained the correct service parts before you start, refer to Parts Catalogue.
2. Remove the starter motor. Refer to (PIL 15-75).
3. Remove the flywheel. Refer to (PIL 15-54).
4. Remove the flywheel housing. Refer to (PIL 15-54-03).

Figure 235.



1 High duty PTO idler gear
2 Idler gear hub
3 Idler gear hub retaining screws (x3)
4 Flywheel hub
5 Flywheel hub fixing bolt
6 Idler gear bearing bush
X Crankshaft gear
Y Idler gear hub location dowel
Z Oil feed drilling

Remove

1. Remove the flywheel hub fixing bolt and remove the flywheel hub. DO NOT remove the crankshaft gear.
2. Lift the High duty PTO (Power Take-Off) idler gear from the hub.
3. If required, remove the idler gear hub retaining screws and lift out the hub.

Inspect

1. Check the idler gear teeth and idler gear bearing bush for signs of damage or excessive wear.

2. Measure the bearing bush inside diameter to confirm it is within service limits, refer to Technical Data.

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. Make sure the oil way in the idler gear hub is clear and free from debris. Use an air line to blow through the oil feed drilling.
4. When you install the idler gear hub, make sure the Idler gear hub location dowel locates into the hole in the crankcase.
5. Lubricate the idler gear bearing bush with clean engine oil.
6. Install the flywheel hub to the crankshaft gear, locate on the dowel. Tighten the bolt to the correct torque value.

After Installation

1. Install the flywheel housing. Refer to (PIL 15-54-03)
2. Install the flywheel to the crankshaft hub. Refer to (PIL 15-54)
3. Install the starter motor. Refer to (PIL 15-75).

Table 87. Torque Values

Item	Nm
3	65
5	47

22 - Rear Case

Remove and Install

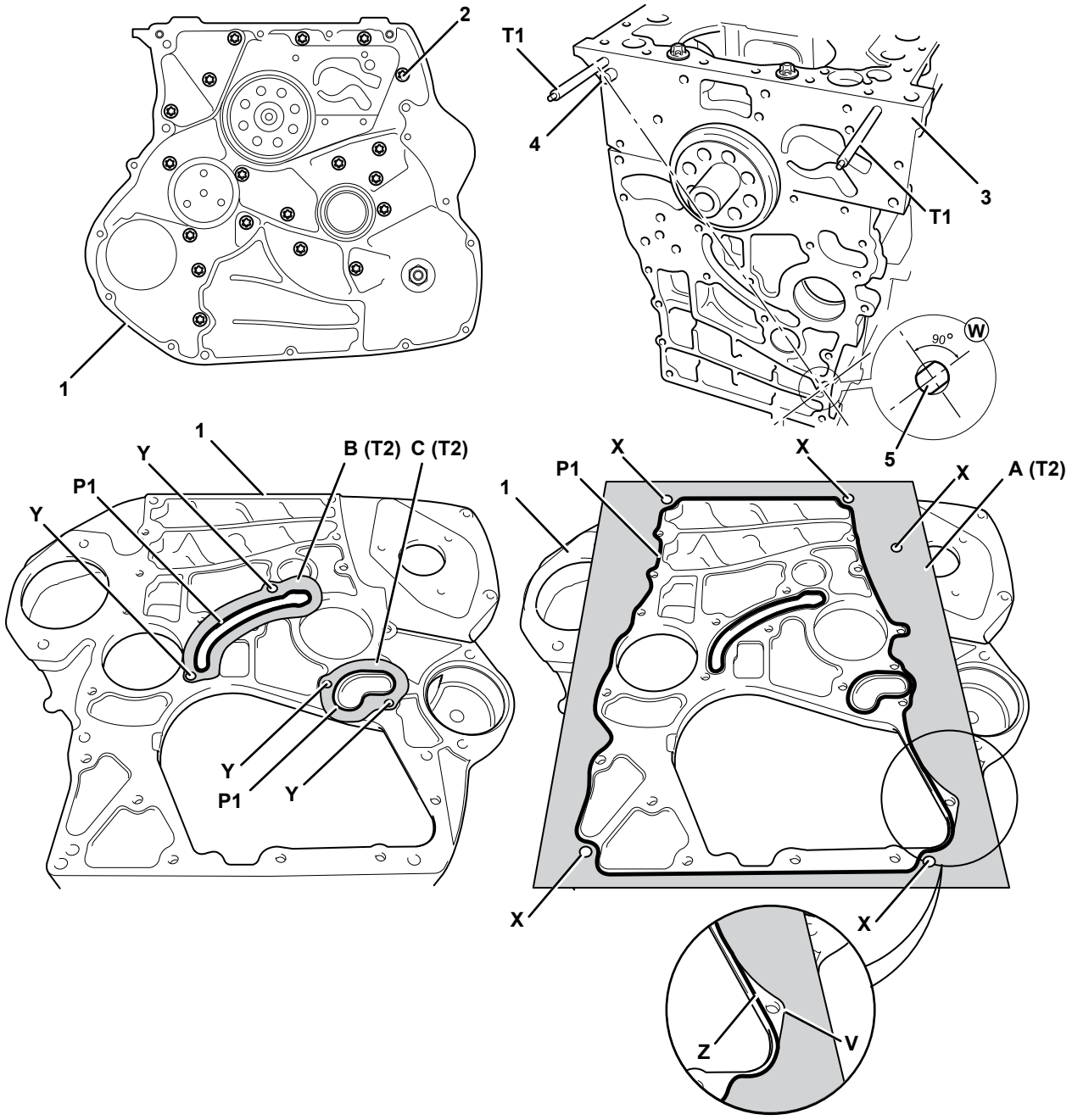
Special Tools

Description	Part No.	Qty.
Template for Sealant Flywheel Housing to Gear Case (4 Cyl and 6 Cyl Elec)	892/01176	1

Before Removal

1. Drain the oil from the engine. Refer to (PIL 15-21).
2. Disconnect and remove the fuel pipes from the injectors. Refer to (PIL 18-96).
3. Remove the fuel injection pump. Refer to (PIL 18-18).
4. Remove the fuel lift pump. Refer to (PIL 18-21).
5. Remove the starter motor. Refer to (PIL 15-75).
6. Remove the high duty PTO (Power Take-Off) device (if installed).
7. Remove the low duty PTO device (if installed).
8. Remove the flywheel. Refer to (PIL 15-54).
9. Remove the flywheel housing. Refer to (PIL 15-54).
10. Remove the fuel injection pump drive gear. Refer to (PIL 15-51).
11. Remove the oil pump. Refer to (PIL 15-60).
12. Remove the high duty PTO idler drive gear (if installed). Refer to (PIL 15-51).
13. Remove the crankshaft drive gear. Refer to (PIL 15-51).
14. Remove the camshaft. Refer to (PIL 15-15).

Figure 236.



1 Timing gear case - rear
2 Timing case fixing bolts (x19)
3 Crankcase/bedplate assembly
4 Dowel
5 Dowel - with flats
P1 Anaerobic sealant
T1 Alignment pins (Locally manufacture)
T2 Sealant template (comprises: Main template - A, Long gallery template - B, Short gallery template - C

Remove

1. Remove the timing case fixing bolts and then separate the timing case from the crankcase/ bedplate assembly. Do not use a lever to separate the timing case from the crankcase/ bedplate assembly.

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 torque tightened within 5 minutes (with a maximum permissible time of 15 minutes).

Install

1. Carefully remove all traces of the old sealing compound from the timing case and crankcase/ bedplate assembly mating faces. Make sure that the mating faces are clean and free from damage. Clean the inside of the timing case using a suitable degreaser.
2. Install two alignment pins T1 to the crankcase/ bedplate assembly.
3. Make sure that dowels are correctly located in the crankcase. Note: Dowel 5 has flats which must be positioned relative to dowel 4, as shown at W. This ensures correct alignment of the timing cover.
4. The sealant template T2 comprises three pieces. Locate parts B and C using the holes in the templates and fixing bolts at positions Y as shown.

   Special Tool: Template for Sealant Flywheel Housing to Gear Case (4 Cyl and 6 Cyl Elec) (Qty.: 1)
5. Use the templates B and C as a guide apply a continuous 1.5 mm (0.060 in.) bead of sealant P1 to the case. Remove the bolts from positions Y. Remove the templates make sure you do not smudge the sealant. Discard the templates.
6. Locate part A of the template T2 using the holes in the template and bolts at positions X as shown.
7. Use the template A as a guide apply a continuous 1.5 mm (0.060 in.) bead of sealant P1 to the case. Do not follow the template at V, instead apply a continuous bead Z (inboard of the fixing hole). Remove the bolts from positions X. Remove the template make sure you do not smudge the sealant. Discard the template.
8. Locate the timing case on the alignment pins T1 and install the timing case fixing bolts (remove pins T1 to install the final two bolts). Tighten the bolts to the correct torque value.

Important: If the parts have not been torque tightened within the maximum 15 minute time period, then the parts must be separated, thoroughly cleaned and fresh sealant applied

After Installation

1. Replace all the components listed under Before removal in reverse order.

Table 88. Torque Values

Item	Nm
2	37

00 - General

Introduction

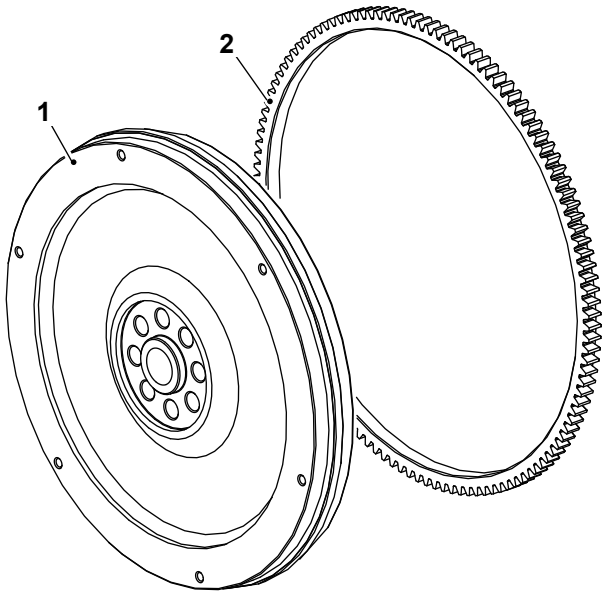
Flywheels are used to provide continuous energy in systems, where the energy source is not continuous. In such cases, the flywheel stores energy when torque is applied by the energy source, and it releases stored energy when the energy source is not applying torque to it.

In a reciprocating engine, a flywheel is used to maintain constant angular velocity of the crankshaft.

The flywheel, which is mounted on the crankshaft, stores energy when torque is exerted on it by a firing piston, and it releases energy to its mechanical loads when no piston is exerting torque on it.

Component Identification

Figure 237.



1 Flywheel
2 Flywheel gear ring

Remove and Install

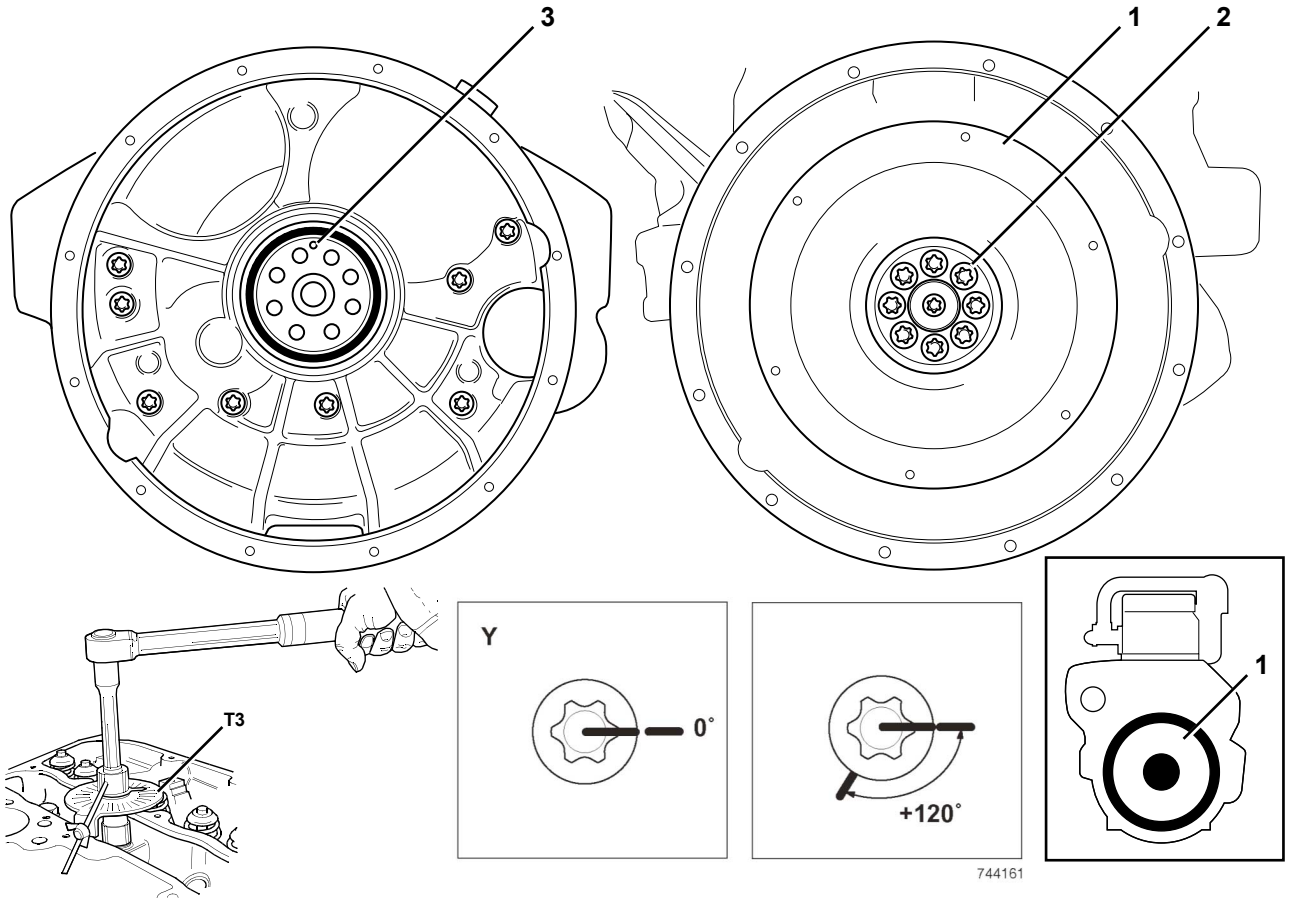
Before Removal

1. This procedure requires service parts. Make sure you have obtained the correct service parts before you start. The flywheel is installed with a crankshaft position sensor target disc. DO NOT remove the target disc. If the disc is defective the flywheel must be replaced.
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.

Removal

1. Remove the bolts and withdraw the flywheel from the crankshaft hub. The bolts MUST NOT be reused. Discard the bolts.

Figure 238.



1 Flywheel
2 Flywheel fixing bolts (x8)
3 Flywheel location dowel
Y Angle tightening mark

Installation

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. Align the flywheel location dowel.
4. Renew the fixing bolts. Tighten the new bolts to the correct torque value in three stages.

Tighten the bolts in sequence in diagonally opposing pairs. As a visual check, mark the bolts to the flywheel before you start. When the bolts have been angle tightened the marks will appear as at 120°.

Table 89. Torque Table

Item	Torque Value (Nm)	Angle (degrees)
2 (Ist Stage)	40	
2 (2nd Stage)	120	
2 (Final Stage)		+120

03 - Housing

Remove and Install

Special Tools

Description	Part No.	Qty.
Template for Sealant Flywheel Housing to Gear Case (4 Cyl Elec)	892/12349	1

Before Removal

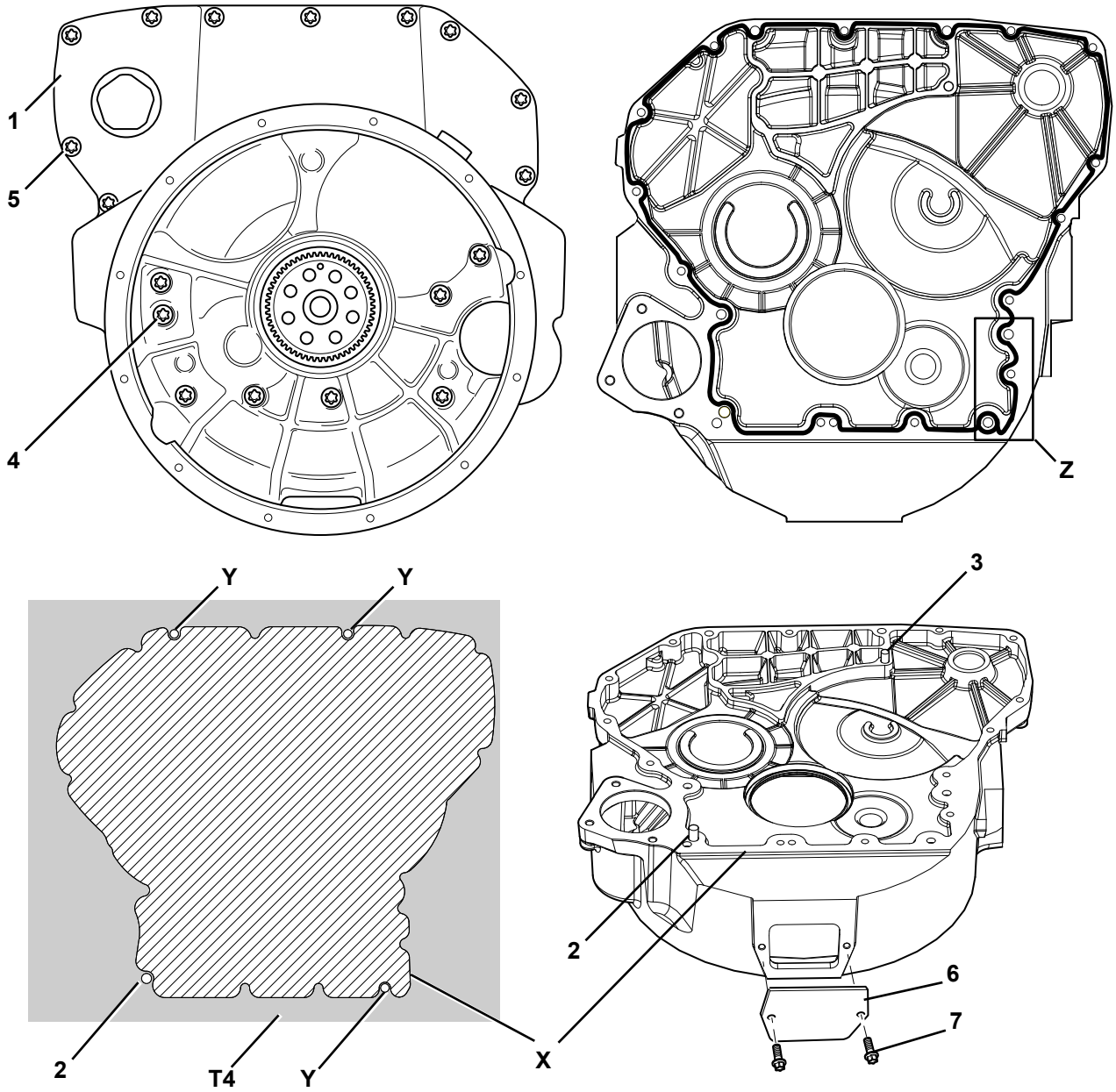
The flywheel housing is integral with the drive gears front case. When the housing is removed the drive gears will be exposed. DO NOT attempt to remove the camshaft and the drive gears. Removing the camshaft with the engine in the upright position will cause the tappets to dislodge, requiring the engine block to be dismantled.

1. This procedure requires service parts. Make sure you have obtained the correct service parts before you start.
2. Remove the flywheel. Refer to (PIL 15-54).
3. Remove the starter motor. Refer to (PIL 15-75).

Removal

1. Remove the flywheel housing fixing bolts and then separate the flywheel housing from the gear case.
2. If required, undo the bolts and remove the access cover.
3. Remove and discard the crankshaft rear oil seal. Take care not to damage the seal bore in the housing.

Figure 239.



1 Flywheel housing
2 Dowel - 12 mm
3 Dowel - 10 mm
4 Flywheel housing fixing bolts (x6) M10
5 Flywheel housing fixing bolts (x12) M8
6 Access cover
7 Access cover fixing bolts (x2)
X Flywheel housing mating face
Y Fixing point
T3 Alignment pins
Z Alternative fixing holes
T4 Sealant template

Before Installation

1. Carefully remove all traces of the old sealant compound from the flywheel housing mating faces.
2. Use a suitable degreasing agent to clean the inside of the flywheel housing.
3. Carefully inspect all gears, bearings and shafts for signs of excessive wear or damage. If wear or damage is evident, the components must be renewed.

Installation

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 torque tightened within5min with a maximum permissible time of 15min

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. Make sure that the dowels are installed to the mating face of the flywheel housing.
4. Install the sealant template T4 on the housing. Locate the holes in the template, use the dowel and three fixing bolts in the fixing points.

   Special Tool: Template for Sealant Flywheel Housing to Gear Case (4 Cyl Elec) (Qty.: 1)
5. Use the template T4 as a guide, apply a continuous bead of sealant around the flywheel housing mating face

   Length/Dimension/Distance: 1.5mm

   5.1. Some engines feature a flywheel housing with a different fixing hole pattern. Use the template to apply the sealant but apply sealant manually in the position shown at Z.
6. Remove the three fixing bolts at positions. Remove the template T4, make sure not to smudge the sealant. Discard the template.
7. Locate the flywheel housing on the alignment pins T3 on the crankcase and install the fixing bolts. Progressively tighten the bolts to the correct torque value.

   7.1. Remove the alignment pins to install the last two M10 fixing bolts.

   7.2. The parts must be separated, thoroughly cleaned and fresh sealant applied if the parts have not been torque tightened within the maximum time period.

   Duration: 15min
8. Install the access cover and use the bolts to secure. Tighten the bolts to the correct torque value. Refer to Table 90.

After Installation

1. Install a new crankshaft rear oil seal.
2. Install the flywheel.
3. Install the starter motor.

Table 90. Torque Values

Item	Nm
4	47
5	24
7	24

09 - Gear Ring

Remove and Install

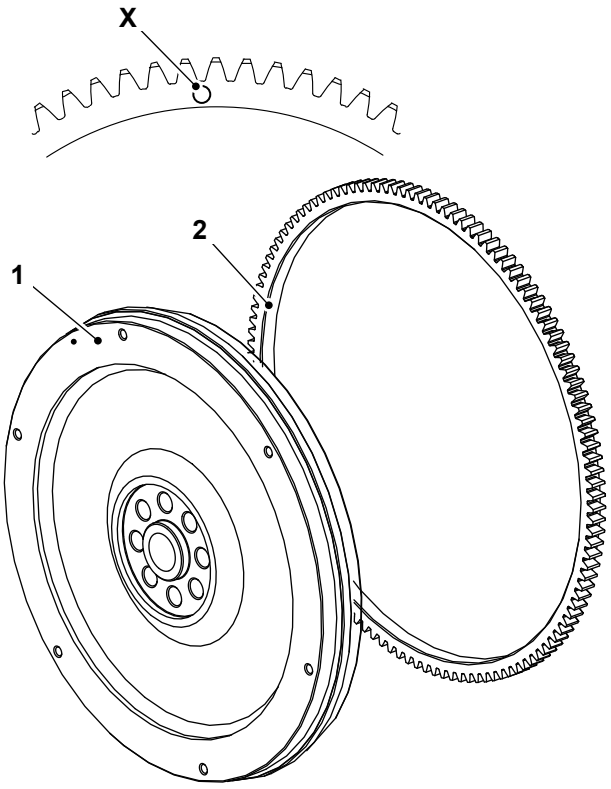
⚠ **CAUTION** Wear eye protection when you drive the gear ring off the flywheel.

If the flywheel gear teeth are damaged or excessively worn, the gear ring can be replaced with a new one.

Before Removal

1. This procedure requires service parts. Make sure you have obtained the correct service parts before you start.
2. Remove the flywheel from the crankshaft hub.

Figure 240.



1 Flywheel
2 Gear ring
x Position of hole

Removal

1. Note that the gear teeth have a lead-in chamfer on one side to assist the starter motor pinion to engage. Note which way around the gear ring is installed to make sure that the new gear ring is installed the same way on assembly.
2. Place the flywheel flat on a firm surface. Drill a hole through the gear ring below the root of one of the gear teeth as shown. Drive a chisel into the adjacent tooth to spread the gear ring apart. Take care not to damage the flywheel or the position sensor target disc.

Installation

1. Make sure that all items are clean and free from damage and corrosion.
2. Heat up the new gear ring, preferably in an oven to make sure that the heat is applied evenly around the circumference. Do not heat the gear ring above

   Temperature: 200°C (391.7°F)
3. When sufficiently heated, install the gear ring into position over the flywheel. Make sure that the gear ring is installed the correct way around.

After Installation

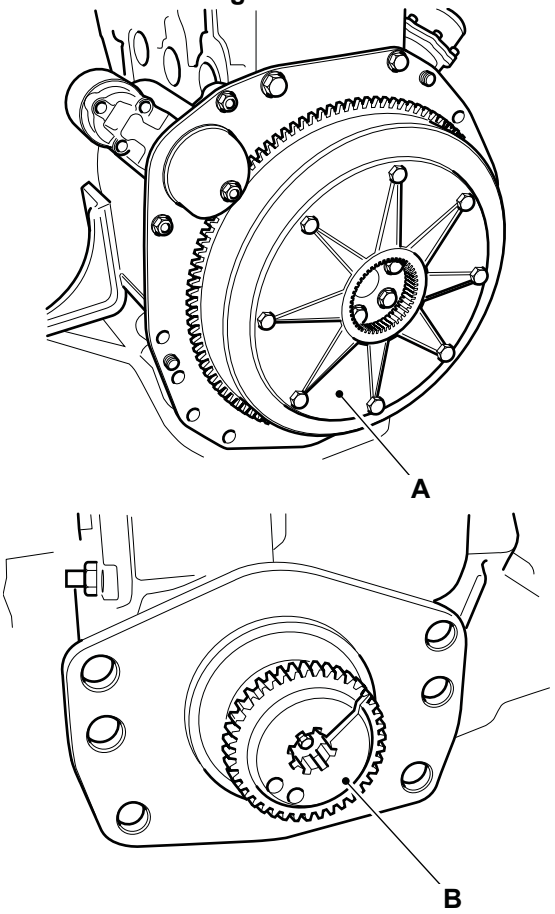
1. Install the flywheel to the crankshaft hub.

12 - Drive Plate

Introduction

This is a gear type coupling comprising a drive plate bolted to the engine flywheel and a coupling clamped to the input shaft of the wheel drive pump. Both are contained within the engine bell housing and rear support frame to which the wheel drive pump is fixed.

Figure 241.



A Drive plate
B Coupling (PIL 2731)

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

Remove and Install

Consumables

Description	Part No.	Size
JCB Threadlocker and Sealer (Medium Strength)	4101/0250	0.01L
	4101/0251	0.05L

Remove

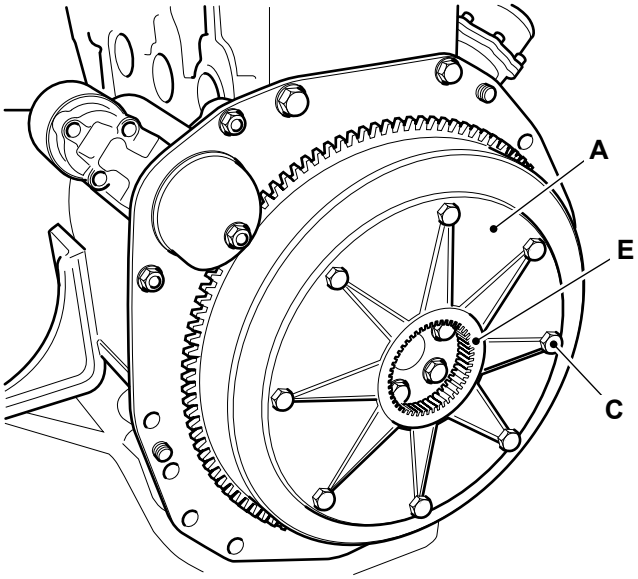
1. Make the machine safe with the lift arm and cab raised. Refer to (PIL 01-03).
2. Remove the Wheel drive pump and coupling, refer to (PIL 27-31).
3. Remove the bolts, remove the drive plate from the flywheel.

Install

1. The installation procedure is the opposite of the removal procedure. additionally do the following steps.
2. Make sure that the drive plate is installed with the flat face against the flywheel and the boss is facing outwards.
3. Coat the threads of the bolts with JCB Threadlocker and Sealer and tighten to the correct torque value.

   Consumable: JCB Threadlocker and Sealer (Medium Strength)

Figure 242.



A Drive plate
C Bolts
E Boss

Table 91. Torque Values

Item	Nm
C	23