

Product: INDUSTRIAL ENGINE
Model: C2.2 INDUSTRIAL ENGINE G9P
Configuration: C2.2 Industrial Engine G9P00001-UP

Disassembly and Assembly C1.5 and C2.2 Industrial Engines

Media Number -KENR9140-03

Publication Date -01/04/2013

Date Updated -19/07/2017

i05298456

Inlet and Exhaust Valves - Remove and Install

SMCS - 1105-010

Removal Procedure

Table 1

| Required Tools | | | |
|----------------|-------------|-------------------------|-----|
| Tool | Part Number | Part Description | Qty |
| A | 1P-3527 | Valve Spring Compressor | 1 |

Start By:

- a. Remove the cylinder head. Refer to Disassembly and Assembly, "Cylinder Head - Remove" for the correct procedure.

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

Note: The removal procedure is identical the three cylinder and the four cylinder engines. The Illustrations show a four cylinder engine.

1. Clean the bottom face of the cylinder head. Check the depth of the valves below the face of the cylinder head before the valve springs are removed. Refer to Specifications, "Cylinder Head Valves" for the correct dimensions.

2. Place a temporary identification mark on the heads of the valves in order to identify the correct position.

Note: Do not stamp the heads of the valves. Stamping or punching the heads of the valves could cause the valves to fracture.



Personal injury can result from being struck by parts propelled by a released spring force.

Make sure to wear all necessary protective equipment.

Follow the recommended procedure and use all recommended tooling to release the spring force.

NOTICE

Ensure that the valve spring is compressed squarely or damage to the valve stem may occur.

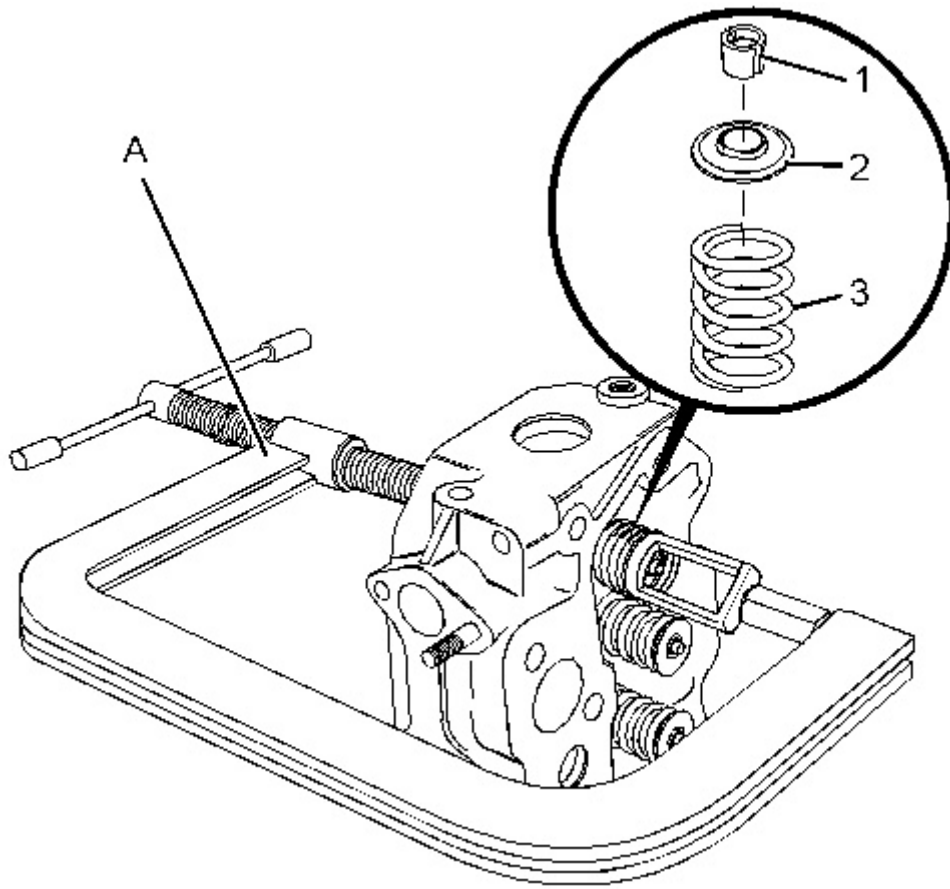


Illustration 1

g03341245

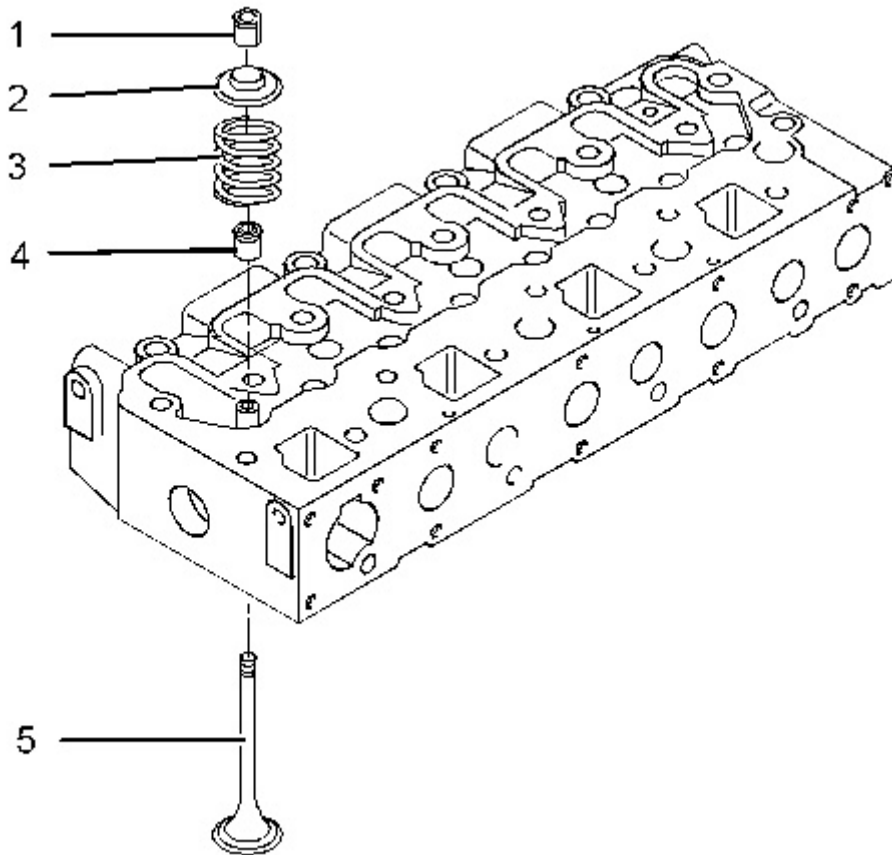


Illustration 2

g03341246

3. Use Tooling (A) in order to compress the appropriate valve spring (3).

Note: Do not compress the valve spring so that valve spring retainer (2) touches valve stem seal (4).

4. Remove valve keepers (1).
5. Remove Tooling (A).
6. Remove valve spring retainer (2).
7. Remove valve spring (3).
8. Remove valve (5).
9. Remove valve stem seal (4).
10. Repeat Step 3 through Step 9 to remove the remaining valves.

Installation Procedure

Table 2

| Required Tools | | | |
|----------------|-------------|------------------|-----|
| Tool | Part Number | Part Description | Qty |
| | | | |

| | | | |
|------------------|----------|--------------------------|---|
| A | 1P-3527 | Valve Spring Compressor | 1 |
| B ⁽¹⁾ | 256-4865 | Valve Stem Seal Replacer | 1 |

⁽¹⁾ C1.5 and C2.2

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

Note: The installation procedure is identical the three cylinder and the four cylinder engines. The Illustrations show a four cylinder engine.

1. Clean all components of the cylinder head assembly. Ensure that all ports, all coolant passages, and all lubrication passages in the cylinder head are free from debris. Follow Step 1.a through Step 1.e in order to inspect the components of the cylinder head assembly. Replace any components that are worn or damaged.
 - a. Inspect the cylinder head for wear and for damage. Refer to Systems Operation, Testing and Adjusting, "Cylinder Head Inspect" for the correct procedure.
 - b. Inspect the valve seats for wear and for damage. Refer to Specifications, "Cylinder Head Valves" for further information.
 - c. Inspect the valve guides for wear and for damage. Refer to Specifications, "Cylinder Head Valves" and Systems Operation, Testing and Adjusting, "Valve Guide - Inspect" for further information.
 - d. Inspect the valves for wear and for damage. Refer to Specifications, "Cylinder Head Valves" for the correct procedure.
 - e. Inspect the valve springs for the correct length. Refer to Specifications, "Cylinder Head Valves" for the correct procedure.
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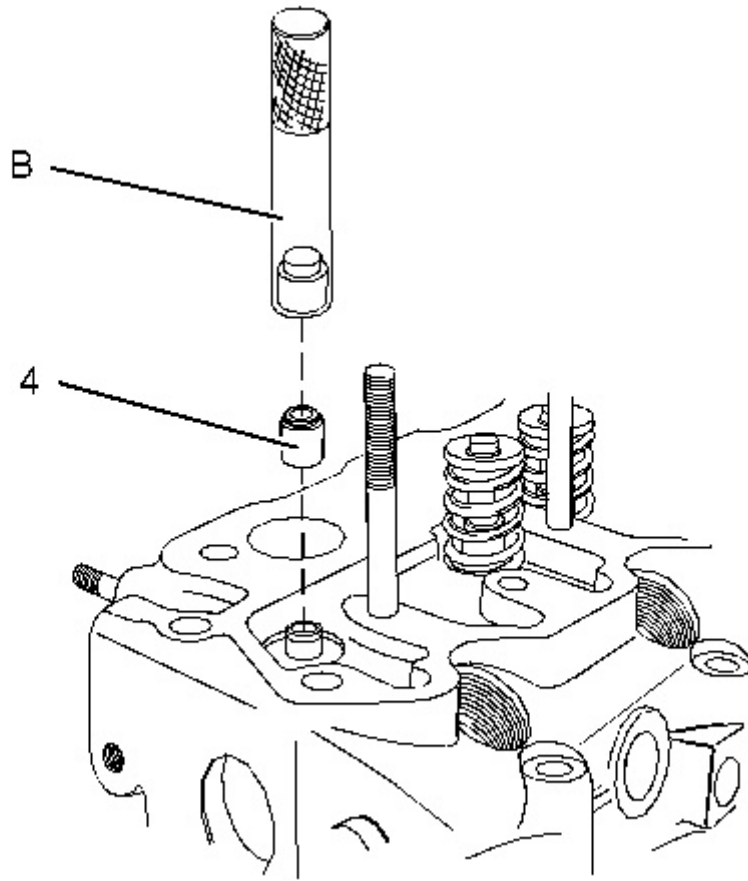


Illustration 3

g03341247

2. Use Tooling (B) to install new valve stem seals (4) onto each of the valve guides.

Note: The outer face of the valve guides must be clean and dry before installing the valve stem seals.

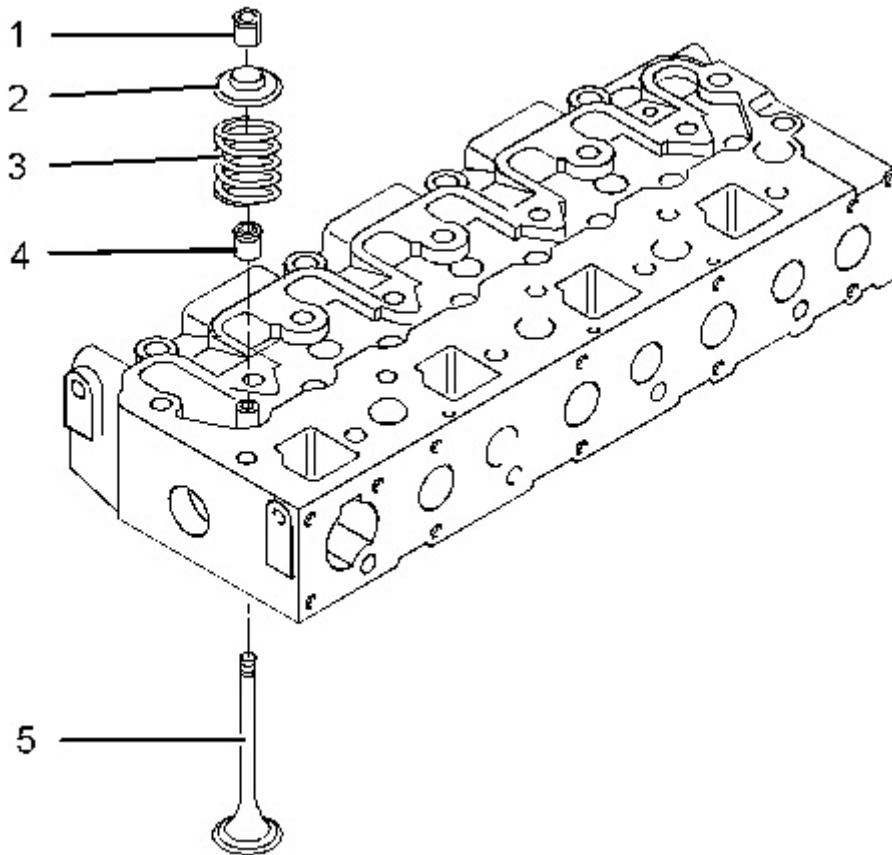


Illustration 4

g03341246

3. Lubricate the stem of valve (5) with clean engine oil. Install valve (5) in the appropriate position in the cylinder head. Check the depth of the valve below the face of the cylinder head. Refer to Systems Operation, Testing and Adjusting, "Valve Depth - Inspect" for more information.
4. Install valve spring (3) to the cylinder head.
5. Position valve spring retainer (2) onto valve spring (3).

! WARNING

Personal injury can result from being struck by parts propelled by a released spring force.

Make sure to wear all necessary protective equipment.

Follow the recommended procedure and use all recommended tooling to release the spring force.

NOTICE

Ensure that the valve spring is compressed squarely or damage to the valve stem may occur.

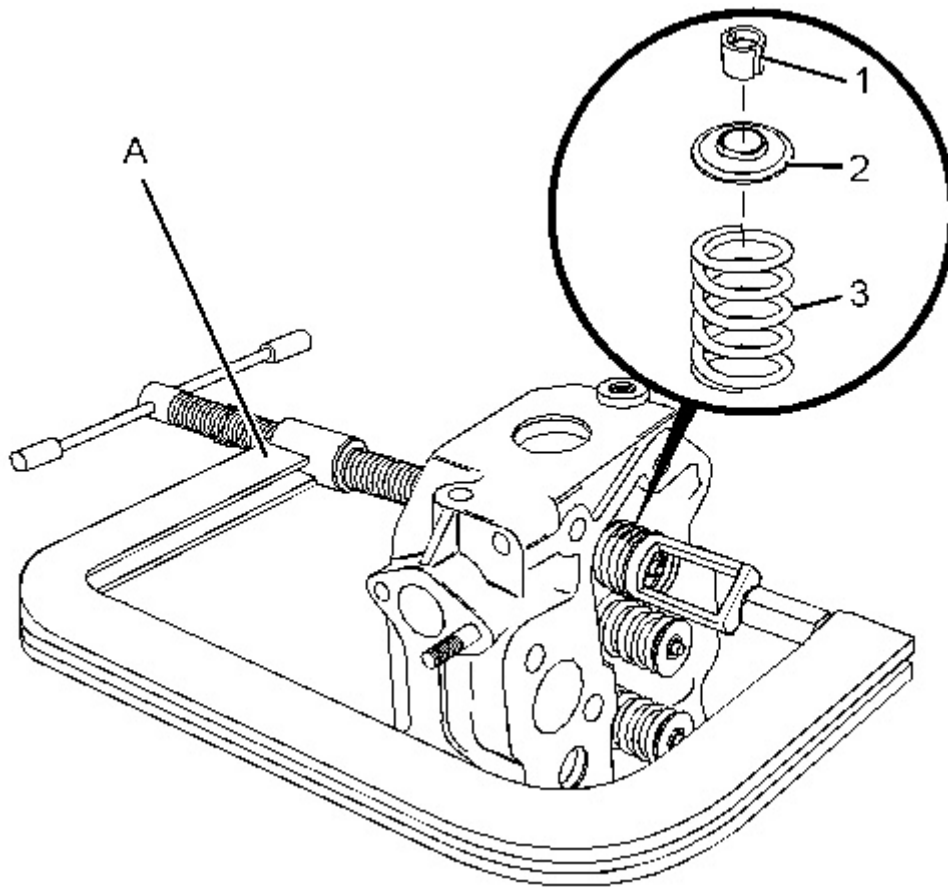


Illustration 5

g03341245

6. Use Tooling (A) in order to compress valve spring (3).

Note: Do not compress the spring so that valve spring retainer (2) touches valve stem seal (4).

7. Install valve keepers (1).

 **WARNING**

The valve spring keepers can be thrown from the valve when the valve spring compressor is released. Ensure that the valve spring keepers are properly installed on the valve stem. To help prevent personal injury, keep away from the front of the valve spring keepers and valve springs during the installation of the valves.

8. Remove Tooling (A).
9. Repeat Step 4 through Step 8 to install the remaining valves.
10. Place the cylinder head on a suitable support. Ensure that the heads of the valves are not obstructed. Gently strike the top of the valves with a soft face hammer in order to ensure that valve keepers (1) are correctly installed.

End By:

- a. Install the cylinder head. Refer to Disassembly and Assembly, "Cylinder Head - Install" for the correct procedure.
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Disassembly and Assembly C1.5 and C2.2 Industrial Engines

Media Number -KENR9140-03

Publication Date -01/04/2013

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i05298421

Engine Oil Line - Remove and Install

SMCS - 1307-010

Removal Procedure

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

NOTICE

Care must be taken to ensure that fluids are contained during performance of inspection, maintenance, testing, adjusting and repair of the product. Be prepared to collect the fluid with suitable containers before opening any compartment or disassembling any component containing fluids.

Dispose of all fluids according to local regulations and mandates.

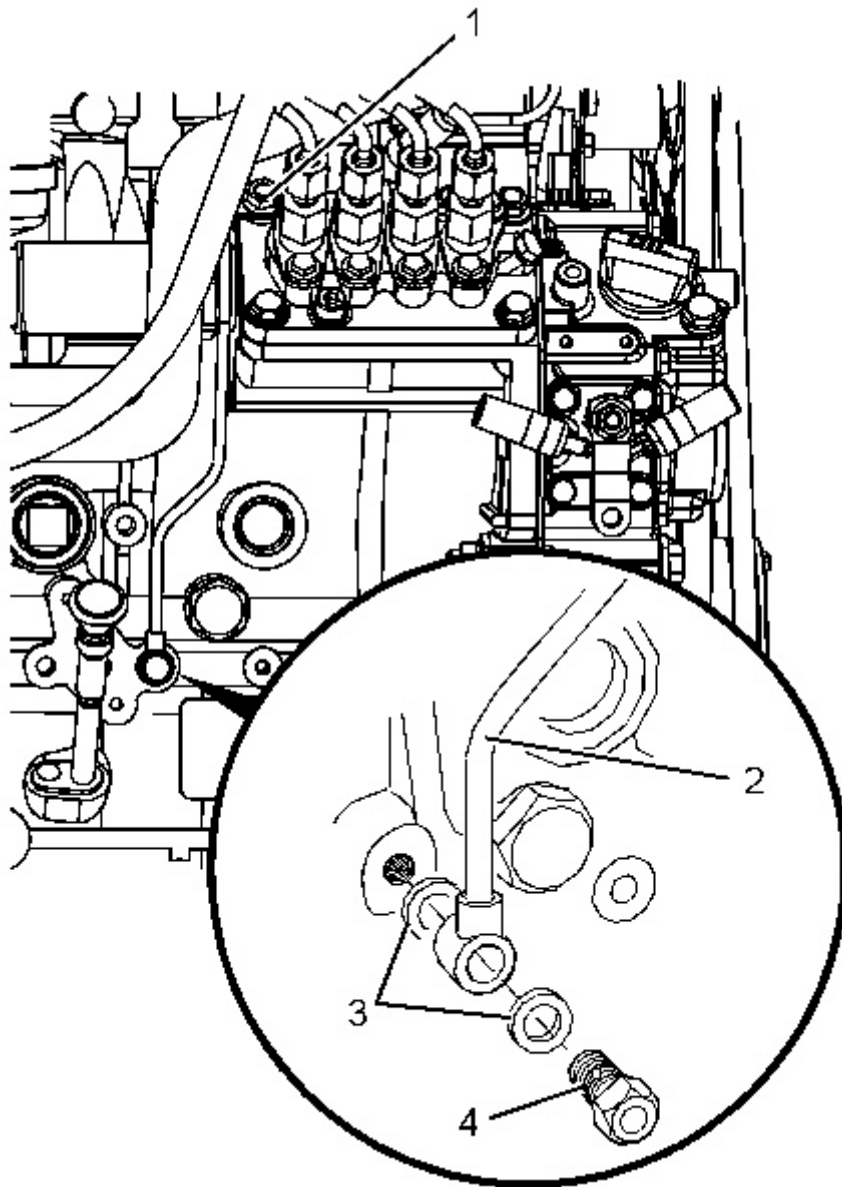


Illustration 1

g03332142

1. Loosen nut (1) for oil line (2) retaining clip.
 2. If necessary, remove the engine oil pressure switch from adapter (4). Refer to Disassembly and Assembly, "Engine Oil Pressure Switch - Remove and Install" for the correct procedure.
 3. Remove adapter (4) from oil line (2).
 4. Remove washers (2).
-

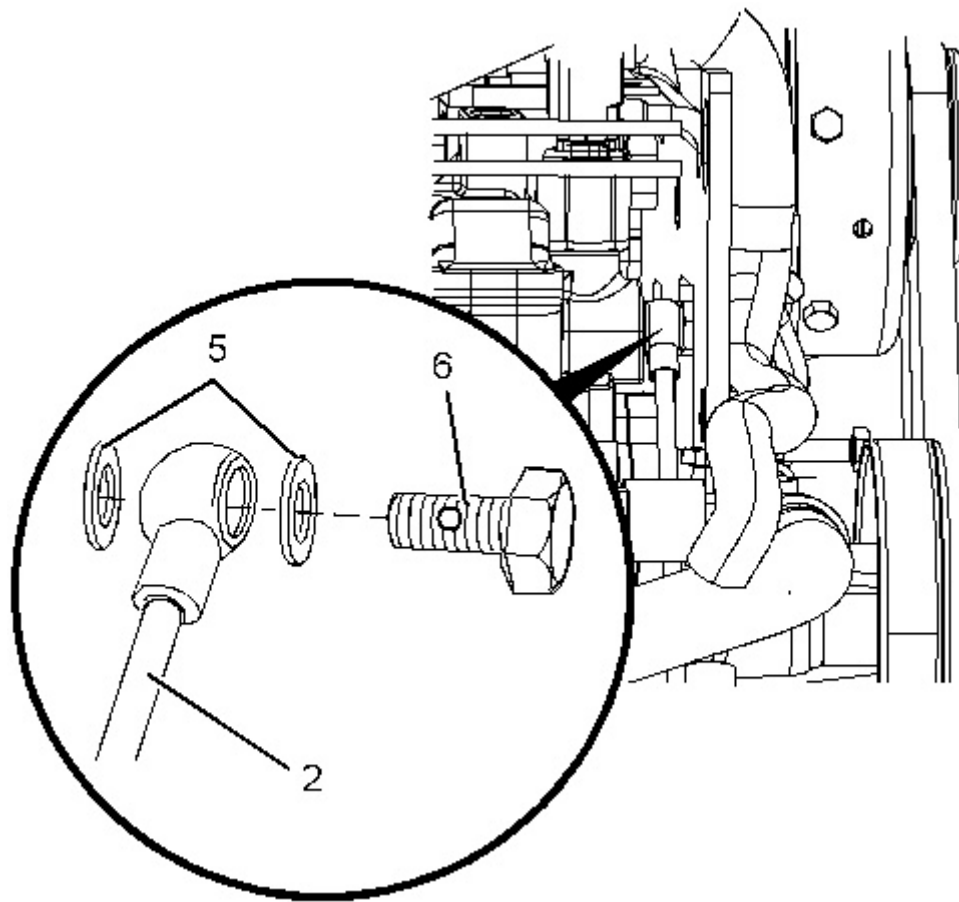


Illustration 2

g03332143

5. Remove banjo bolt (6) from oil line (2).
6. Remove washers (5).
7. Remove the assembly of oil line (2) from the engine.

Installation Procedure

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

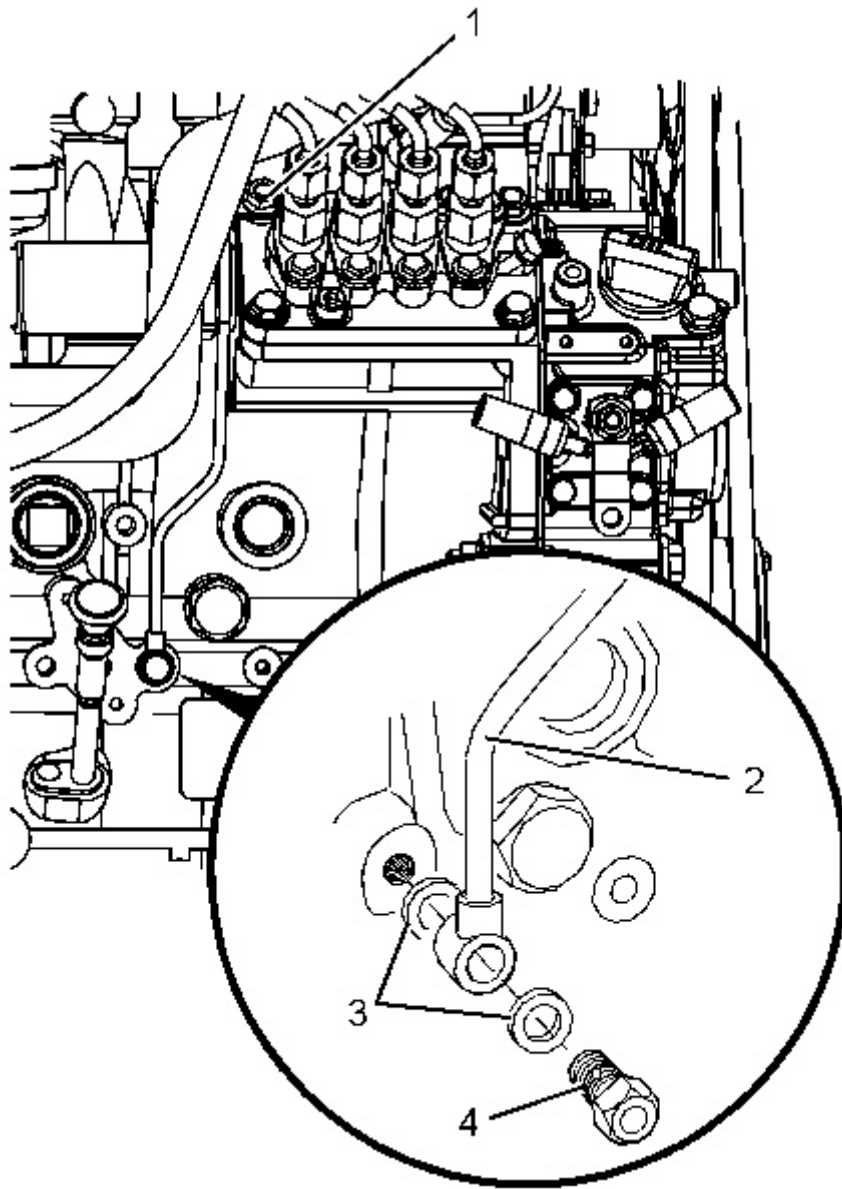


Illustration 3

g03332142

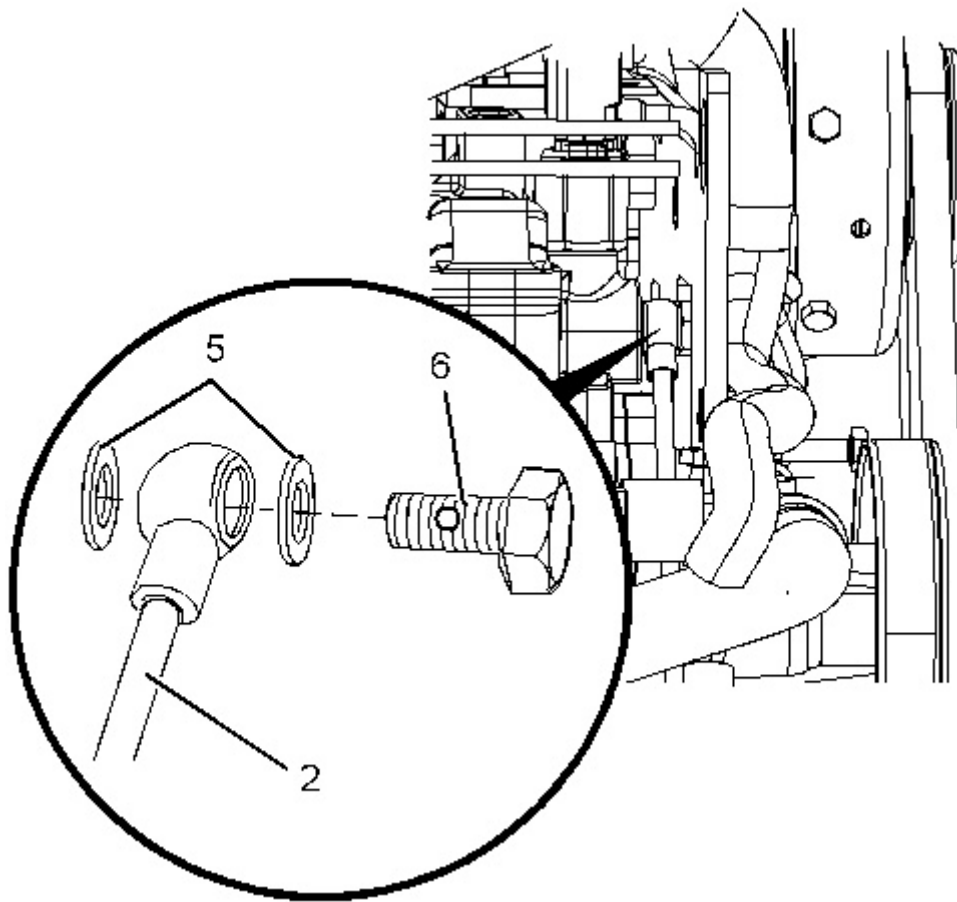


Illustration 4

g03332143

1. Position oil line (2) onto the engine. Ensure that the retaining clip for oil line (2) is located below nut (1).
2. Position a new washer (3) onto adaptor (4).
3. Install adaptor (4) to oil line (2) and install remaining new washer (3).
4. Tighten adaptor (4) finger tight.
5. Position a new washer (5) onto banjo bolt (6).
6. Install banjo bolt (6) to oil line (2) and install remaining new washer (5).
7. Tighten banjo bolt (6) finger tight.
8. Position banjo bolt (5) and new washers (6) onto oil line (1). Install the banjo bolt and the oil line to the cylinder head finger tight.
9. Tighten nut (1) for oil line (2) retaining clip.

For C1.5 engines, tighten nut (1) to a torque of 6 N·m (53 lb in).

For C2.2 engines, tighten nut (1) to a torque of 15 N·m (133 lb in).
10. Tighten banjo bolts (6) to a torque of 12 N·m (106 lb in). Ensure that the oil line is not strained as the banjo bolt is tightened.

11. Tighten adapter (4) to a torque of 11 N·m (97 lb in). Ensure that the oil line is not strained as the adapter is tightened.
 12. If necessary, install the engine oil pressure switch from adapter (4). Refer to Disassembly and Assembly, "Engine Oil Pressure Switch - Remove and Install" for the correct procedure.
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Publication Date -01/04/2013

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i05298420

Engine Oil Cooler - Remove and Install

SMCS - 1378-010

Removal Procedure

Table 1

| Required Tools | | | |
|----------------|-------------|------------------|-----|
| Tool | Part Number | Part Description | Qty |
| A | 185-3630 | Strap Wrench | 1 |

NOTICE

Care must be taken to ensure that fluids are contained during performance of inspection, maintenance, testing, adjusting and repair of the product. Be prepared to collect the fluid with suitable containers before opening any compartment or disassembling any component containing fluids.

Dispose of all fluids according to local regulations and mandates.

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

1. Drain the coolant from the cooling system into a suitable container. Refer to Operation and Maintenance Manual, "Cooling System Coolant - Drain" for the correct procedure.
 2. Drain the engine lubricating oil into a suitable container. Refer to Operation and Maintenance Manual, "Engine Oil and Filter - Change" for the correct procedure.
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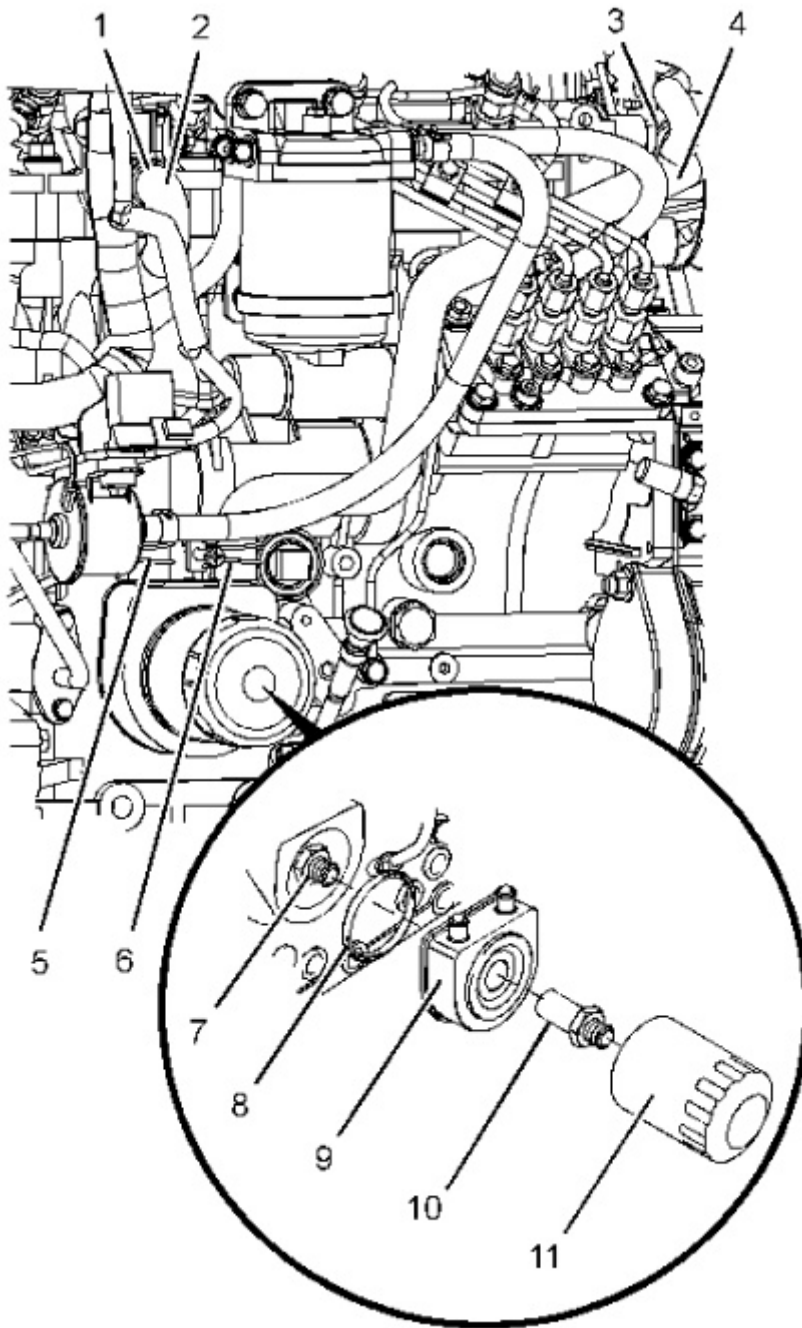


Illustration 1

g03332495

3. Use Tooling (A) to remove oil filter (11).
4. Loosen hose clamp (5) and hose clamp (6).
5. Disconnect hose (2) and hose (4) from engine oil cooler (9).

6. Remove adapter (10) from engine oil cooler (9) support the engine oil cooler as the adapter is removed.

Note: Make a temporary mark in order to show the orientation of the engine oil cooler for installation.
7. Remove engine oil cooler (9) from the cylinder block.
8. Remove O-ring seal (8).
9. If necessary, remove adapter (7) from the cylinder block.
10. If necessary, follow Step 3.a through Step 10.c in order to remove hose (2) and hose (4).
 - a. Loosen hose clamp (1) and hose clamp (3).
 - b. Disconnect hose (2) and hose (4) from the connections on the cylinder head and the cylinder block.
 - c. Remove hose (2) and hose (3).

Installation Procedure

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

1. Ensure that the engine oil cooler is clean, free from damage and restriction. If the engine oil cooler is not clean, free from damage and restriction, replace the engine oil cooler as an assembly.
 2. Clean the sealing surfaces of the cylinder block and engine oil cooler.
-

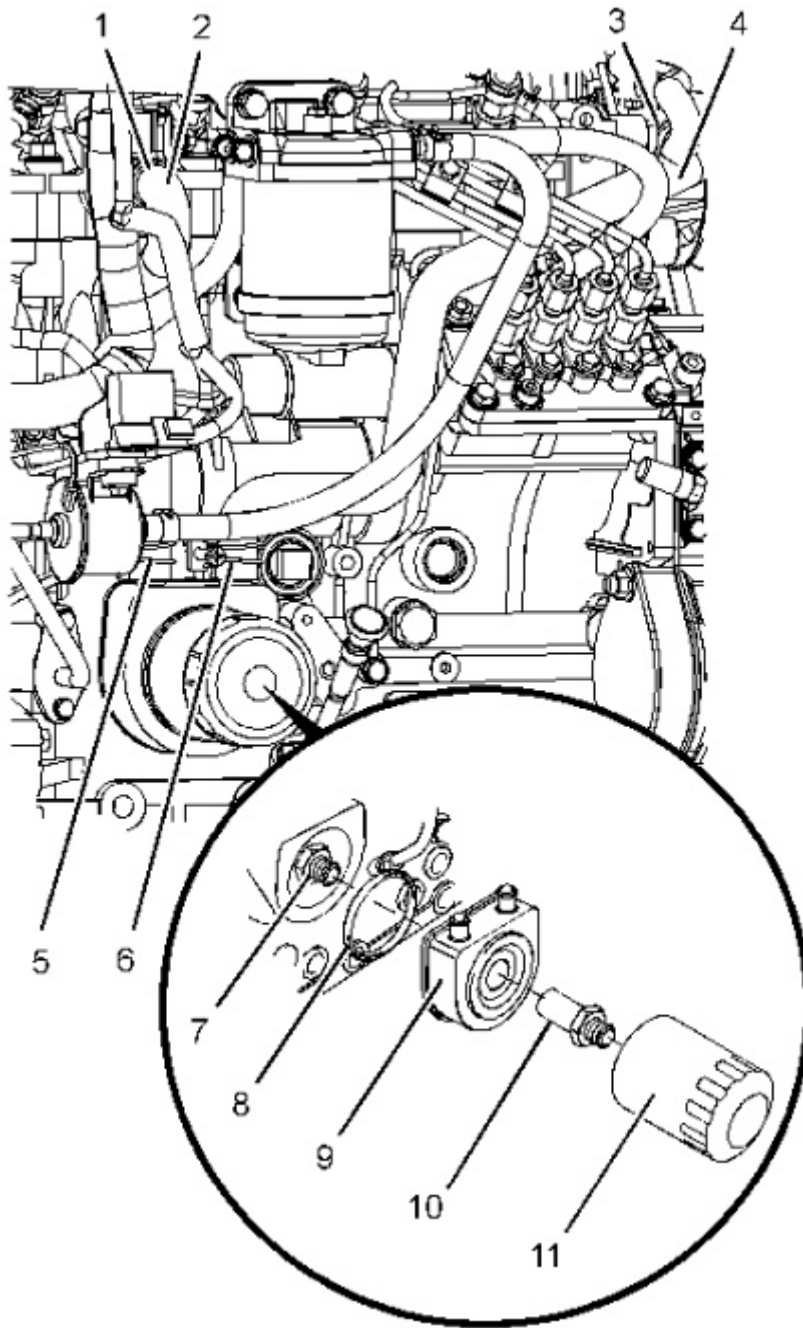


Illustration 2

g03332495

3. If necessary, follow Step 3.a through Step 3.c in order to install hose (2) and hose (3).
 - a. Position hose (2) and hose (4) onto the engine. Ensure that the hoses are correctly routed.
 - b. Connect hose (2) and hose (4) to the connections on the cylinder head and the cylinder block.
 - c. Securely tighten hose clamp (1) and hose clamp (3).
4. If necessary, install adapter (7) to the cylinder block. Tighten the adapter to a torque of 34 N·m (301 lb in).

5. Install a new O-ring seal (8) to engine oil cooler (3). Ensure that the O-ring seal is correctly installed into the recess of the engine oil cooler.
 6. Position engine oil cooler (3) onto the cylinder block. Ensure the correct orientation of the engine oil cooler.
 7. Install adapter (10) to engine oil cooler (9) support the engine oil cooler as the adapter is installed. Tighten adapter (10) finger tight.
 8. Connect hose (2) and hose (4) to engine oil cooler (9).
 9. Securely tighten hose clamp (5) and hose clamp (6).
 10. Tighten adapter (10) to a torque of 34 N·m (301 lb in). Ensure that the engine oil cooler is does not move as the adapter is tightened.
 11. Install a new oil filter element (11). Refer to Operation and Maintenance Manual, "Engine Oil Filter - Change" for the correct procedure.
 12. Fill the engine oil pan to the correct level. Refer to Operation and Maintenance Manual, "Engine Oil Filter - Change" for the correct procedure.
 13. Fill the cooling system to the correct level. Refer to Operation and Maintenance Manual, "Cooling System Coolant - Fill" for the correct procedure.
-

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Disassembly and Assembly C1.5 and C2.2 Industrial Engines

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i05298427

Engine Oil Relief Valve - Remove and Install

SMCS - 1315-010

Removal Procedure

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

NOTICE

Care must be taken to ensure that fluids are contained during performance of inspection, maintenance, testing, adjusting and repair of the product. Be prepared to collect the fluid with suitable containers before opening any compartment or disassembling any component containing fluids.

Dispose of all fluids according to local regulations and mandates.

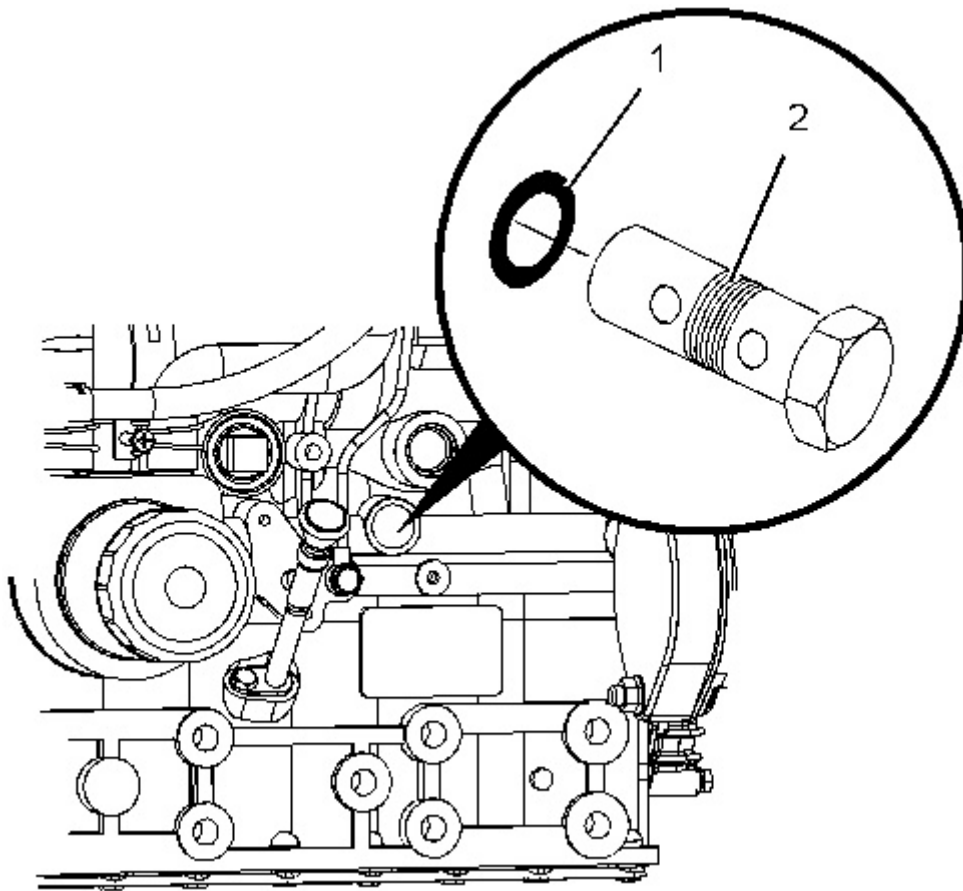


Illustration 1

g03331679

1. Remove engine oil relief valve (2) from the cylinder block.
2. Remove O-ring seal (1) from engine oil relief valve (2).

Installation Procedure

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

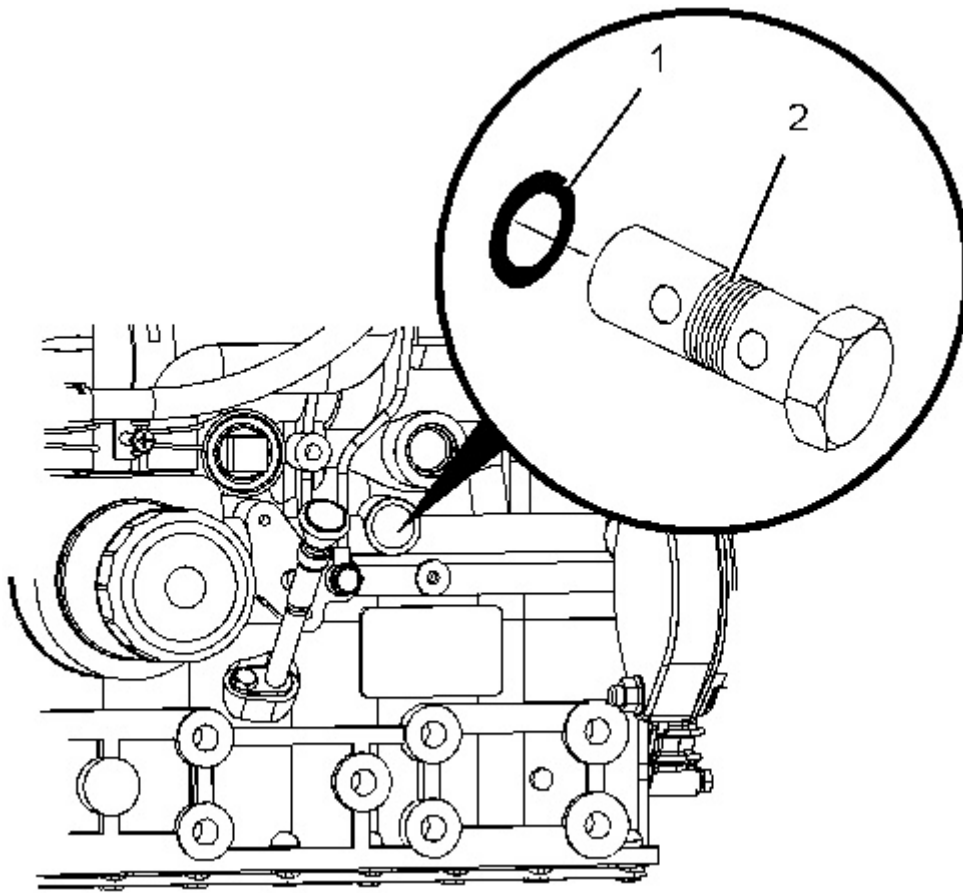


Illustration 2

g03331679

1. Install a new O-ring seal (1) to engine oil relief valve (2).
 2. Lubricate engine oil relief valve (2) with clean engine oil.
 3. Install engine oil relief valve (2) into the cylinder block. Tighten the engine oil relief valve to a torque of 64 N·m (47 lb ft).
-

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Disassembly and Assembly C1.5 and C2.2 Industrial Engines

Media Number -KENR9140-03

Publication Date -01/04/2013

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i05298426

Engine Oil Pump - Remove

SMCS - 1304-011

Removal Procedure

Start By:

- a. Remove the front housing. Refer to Disassembly and Assembly, "Housing (Front) - Remove" for the correct procedure.

NOTICE

Care must be taken to ensure that fluids are contained during performance of inspection, maintenance, testing, adjusting and repair of the product. Be prepared to collect the fluid with suitable containers before opening any compartment or disassembling any component containing fluids.

Dispose of all fluids according to local regulations and mandates.

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

NOTICE

**If the front housing is not installed, do not turn the crankshaft.
Damage to the engine may occur.**

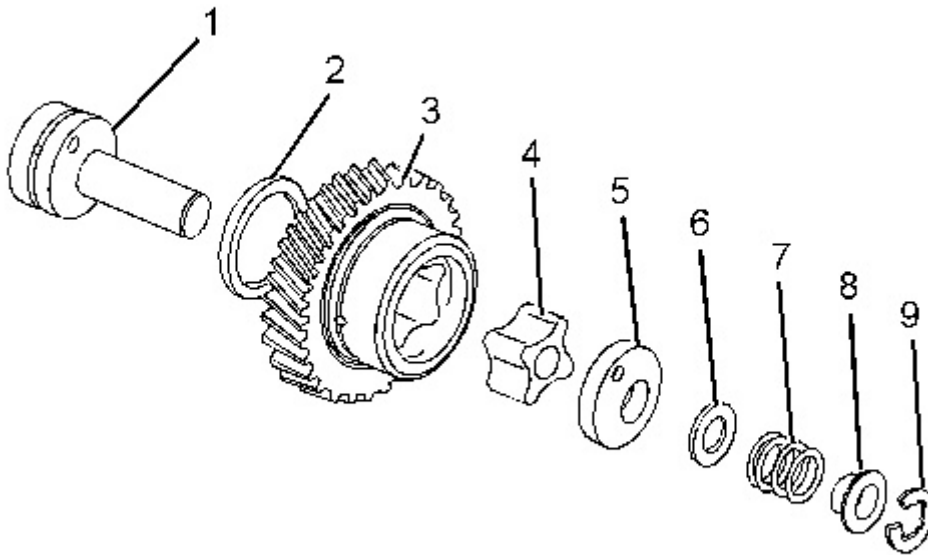


Illustration 1

g03331719

WARNING

Personal injury can result from being struck by parts propelled by a released spring force.

Make sure to wear all necessary protective equipment.

Follow the recommended procedure and use all recommended tooling to release the spring force.

1. Remove C-clip (9) that retains idler gear (3) onto idler hub (1).

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