

Product: ENGINE - MACHINE
Model: C4.4 ENGINE - MACHINE JKT
Configuration: C4.4 Industrial Engine JKT00001-UP

Disassembly and Assembly C4.4 Industrial Engine

Media Number -UENR4488-01

Publication Date -01/11/2014

Date Updated -30/06/2017

i06954656

Inlet and Exhaust Valve Springs - Remove and Install

SMCS - 1108-010

Removal Procedure

Table 1

Required Tools			
Tool	Part Number	Part Description	Qty
A	9U-6193	Valve Spring Compressor	1
	416-0288	Adapter	1
	416-0292	Head	1
B ⁽¹⁾	9U-6198	Crankshaft Turning Tool	1
B ⁽²⁾	5P-7306	Housing	1
	5P-7305	Engine Turning Tool	1

⁽¹⁾ The Crankshaft Turning Tool is used on the front pulley.

⁽²⁾ This Tool is used in the aperture for the electric starting motor.

Start By:

- a. Remove the rocker shaft assembly. Refer to Disassembly and Assembly, "Rocker Shaft and Pushrod - Remove" for the correct procedure.

Note: Either Tooling (B) can be used. Use the Tooling that is most suitable.

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

Note: The following procedure should be adopted to remove the valve springs when the cylinder head is installed to the engine. Refer to Disassembly and Assembly, "Inlet and Exhaust Valves - Remove and Install" for the procedure to remove the valve springs from a cylinder head that has been removed from the engine.

Note: Ensure that the appropriate piston is at top dead center before the valve spring is removed. Failure to ensure that the piston is at top dead center may allow the valve to drop into the cylinder bore.



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

Plug the apertures for the push rods in the cylinder head to prevent the entry of loose parts into the engine.

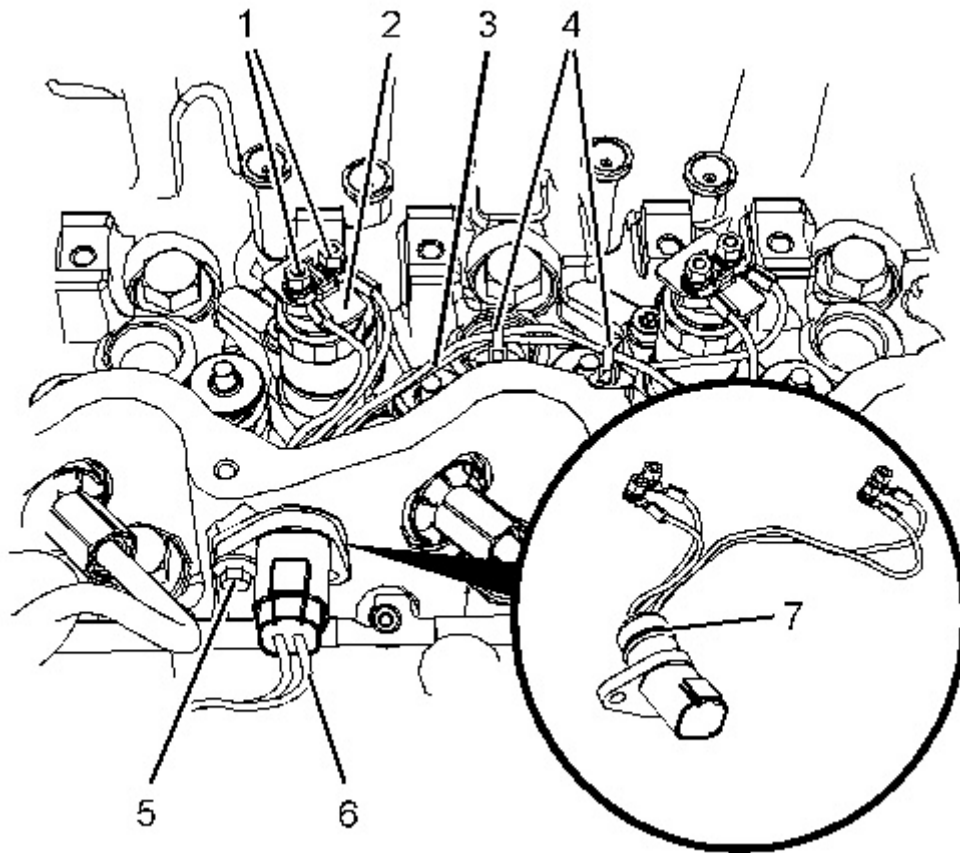


Illustration 1

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1. Follow Step 1.a through Step 1.h to remove the harness assemblies for the electronic unit injectors.
 - a. Place a temporary identification mark on connections (1) for harness assembly (3) for electronic unit injectors (2).
 - b. Use a deep socket to remove connections (1) from electronic unit injectors (2).
 - c. Cut cable straps (4) and remove the remaining sections of the cable straps from the cylinder head.
 - d. Disconnect plug (6) from harness assembly (3).
 - e. Remove bolt (5) from harness assembly (3).
 - f. Withdraw harness assembly (3) from the cylinder head.
 - g. Remove O-ring seal (7) from harness assembly (3).
 - h. Repeat Step 1.a through Step 1.g to remove the remaining harness assemblies.
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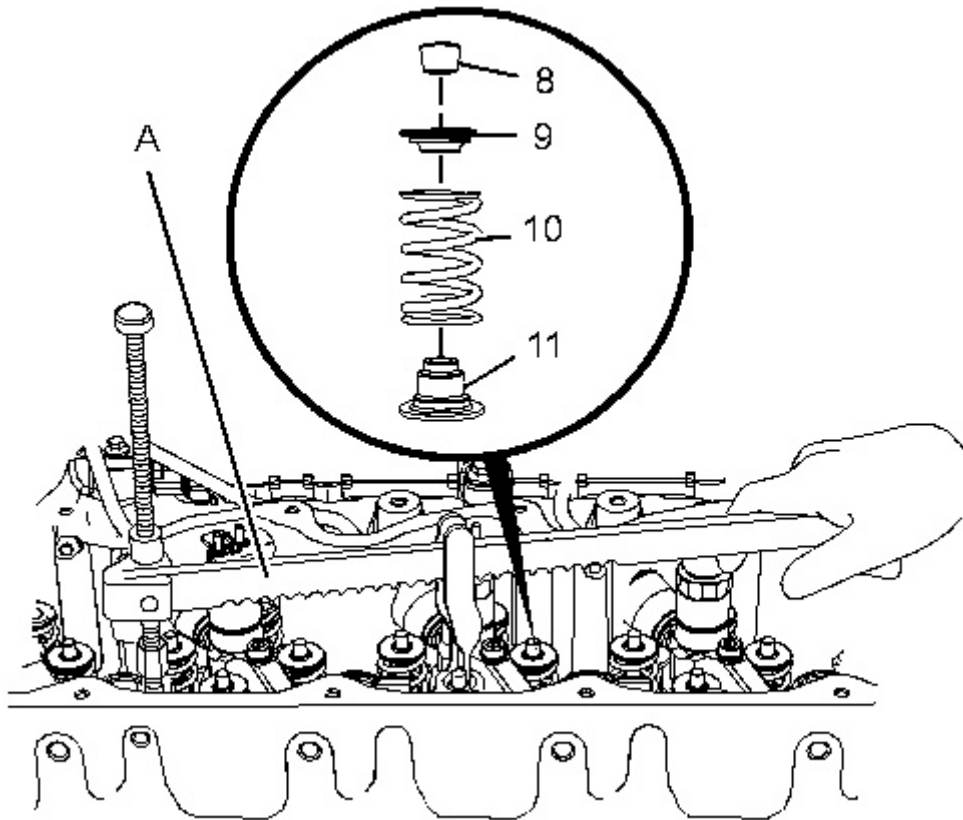


Illustration 2

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NOTICE

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

2. Follow Step 2.a through Step 2.d to position the appropriate piston at top dead center.
 - a. Install Tooling (A) in position on the cylinder head to compress a valve spring (10) for the appropriate piston.
 - b. Use Tooling (A) to compress valve spring (10) and open the valve slightly.

Note: Do not compress the spring so that valve spring retainer (9) touches valve stem seal (11).

- c. Use Tooling (B) to rotate the crankshaft carefully, until the piston touches the valve.

Note: Do not use excessive force to turn the crankshaft. The use of force can result in bent valve stems.

- d. **Continue to rotate the crankshaft and gradually release the pressure on Tooling (A) until the piston is at the top dead center position. The valve is now held in a position that allows the valve spring to be safely removed.**

Note: Valve springs must be replaced in pairs for the inlet valve or the exhaust valve of each cylinder. If all valve springs require replacement, the procedure can be carried out on two cylinders at the same time. The procedure can be carried out on the following pairs of cylinders. 1 with 4 and 2 with 3. Ensure that all the valve springs are installed before changing from one pair of cylinders to another pair of cylinders.

NOTICE

Do not turn the crankshaft while the valve springs are removed.

3. Apply sufficient pressure to Tooling (A) to allow removal of valve keepers (8).

Note: Do not compress the spring so that valve spring retainer (9) touches valve stem seal (11).

Remove valve keepers (9).

4. Slowly release pressure on Tooling (A).
5. Remove valve spring retainer (9) and remove valve spring (10).
6. If necessary, remove valve stem seals (11).
7. Repeat Step 3 through Step 6 to remove the remaining valve springs from the appropriate cylinder.
8. Remove Tooling (A).

Installation Procedure

Table 2

Required Tools			
Tool	Part Number	Part Description	Qty
	9U-6193	Valve Spring Compressor	1
A	416-0288	Adapter	1
	416-0292	Head	1
B ⁽¹⁾	9U-6198	Crankshaft Turning Tool	1
	5P-7306	Housing	1
B ⁽²⁾	5P-7305	Engine Turning Tool	1

⁽¹⁾ The Crankshaft Turning Tool is used on the front pulley.

⁽²⁾ This Tool is used in the aperture for the electric starting motor.

Note: Either Tooling (B) can be used. Use the Tooling that is most suitable.

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

NOTICE

Do not turn the crankshaft while the valve springs are removed.

NOTICE

Plug the apertures for the push rods in the cylinder head to prevent the entry of loose parts into the engine

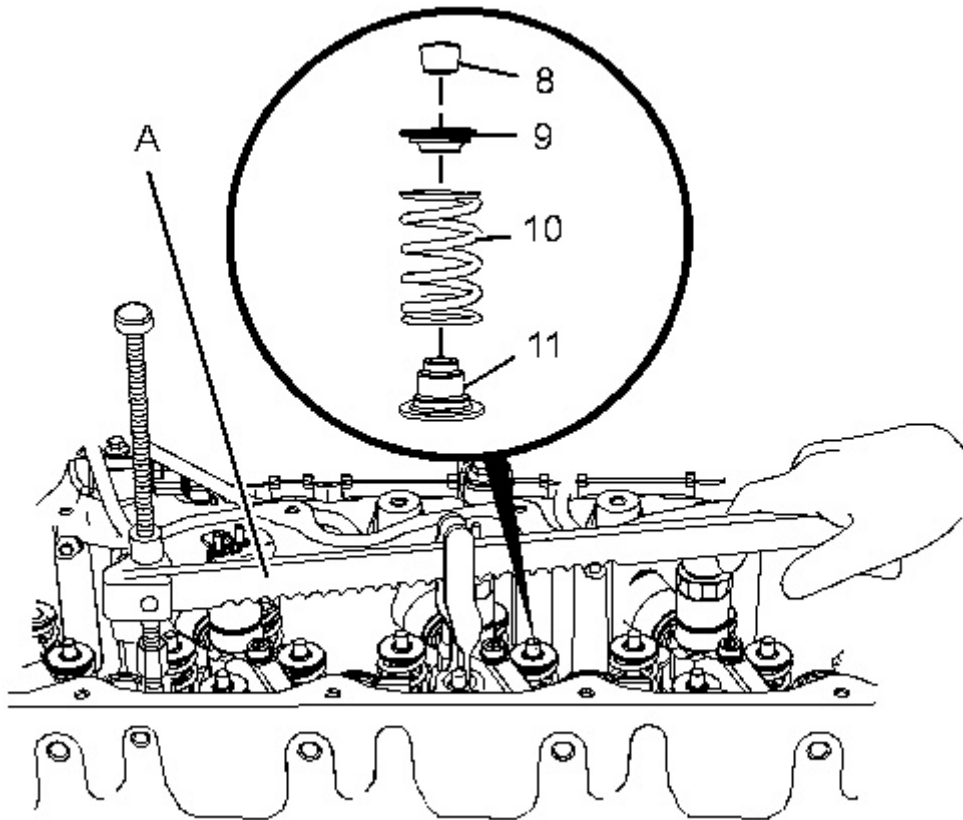


Illustration 3

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1. Inspect valve springs (10) for damage and for the correct length. Refer to Specifications, "Cylinder Head Valves" for further information.
2. If necessary, install a new valve stem seal (11) onto the valve guide.
Note: The outer face of the valve guide must be clean and dry before installing the valve stem seal.
3. Install valve spring (10) onto the cylinder head. Position valve spring retainer (9) on valve spring (10).

 **WARNING**

Improper assembly of parts that are spring loaded can cause bodily injury.

To prevent possible injury, follow the established assembly procedure and wear protective equipment.

NOTICE

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

4. Install Tooling (A) in the appropriate position on the cylinder head to compress valve spring (10).
5. Apply sufficient pressure to Tooling (A) to install valve keepers (8).

Note: Do not compress the spring so that valve spring retainer (9) touches valve stem seal (11).

6. Install valve spring keepers (8).
7. Carefully release the pressure on Tooling (A).
8. Repeat Step 2 through Step 7 for the remaining valves.



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.

9. Remove Tooling (A).

Note: If all valve springs require replacement, the procedure can be carried out on two cylinders at the same time. The procedure can be carried out on the following cylinders. 1 and 4 and 2 and 3. Remember that the crankshaft must not be turned while the valve springs are removed. Ensure that all the valve springs are installed before changing from one pair of cylinders to the other pair of cylinders. If all valve springs do not require replacement, the springs must be replaced in pairs.

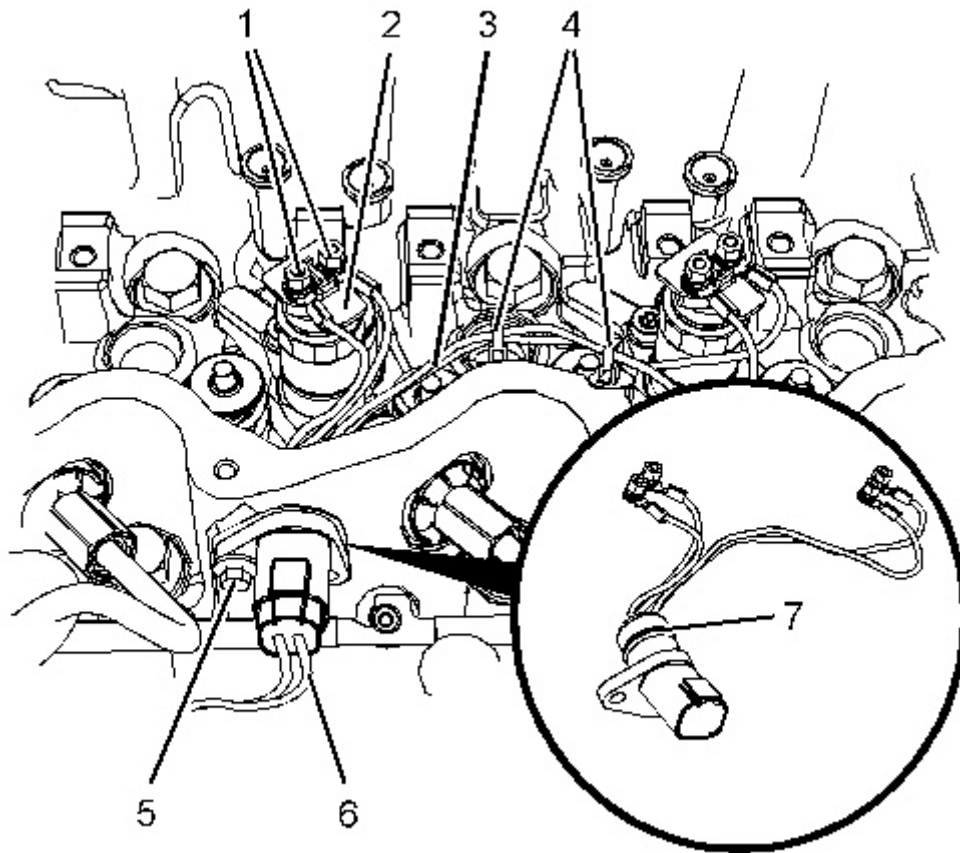


Illustration 4

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10. Follow Step 10.a through Step 10.g to install the harness assemblies for electronic unit injectors (2).
 - a. Ensure that harness assembly (3) for the electronic unit injectors is clean and free from damage. Replace any damaged components.
 - b. Install a new O-ring seal (7) onto harness assembly (3) for electronic unit injectors (2).

Note: Do not lubricate the O-ring seal.
 - c. Push harness assembly (3) into the cylinder head.
 - d. Install a new bolt (5) and tighten the bolt to a torque of 5.5 N·m (49 lb in).
 - e. Connect plug (6) from harness assembly (3).
 - f. Use a deep socket to install connections (1) to electronic unit injectors (2). Use Tooling (C) to tighten the connections to a torque of 2.0 N·m (18 lb in).
 - g. Install new assemblies of the cable straps (4) to harness assembly (3).

Note: Ensure that the cable straps meet the OEM specification. Ensure that the assemblies of the cable straps are correctly installed into the cylinder head.
 - h. Repeat Step 10.a through Step 10.g for the remaining harness assemblies.

End By:

- a. Install the rocker shaft assembly. Refer to Disassembly and Assembly, "Rocker Shaft and Pushrod - Install" for the correct procedure.
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i05820268

Inlet and Exhaust Valves - Remove and Install

SMCS - 1105-010

Removal Procedure

Table 1

Required Tools			
Tool	Part Number	Part Description	Qty
A	9U-6195	Valve Spring Compressor	1
	268-1969	Adapter	1
	276-1221	Head	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.

1. Clean the bottom mating surface 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: Inlet valves have a recess in the center of the head.

3. Use a suitable lifting device to position the cylinder head with the valve springs upward. The weight of the cylinder head is approximately 65 kg (143 lb).

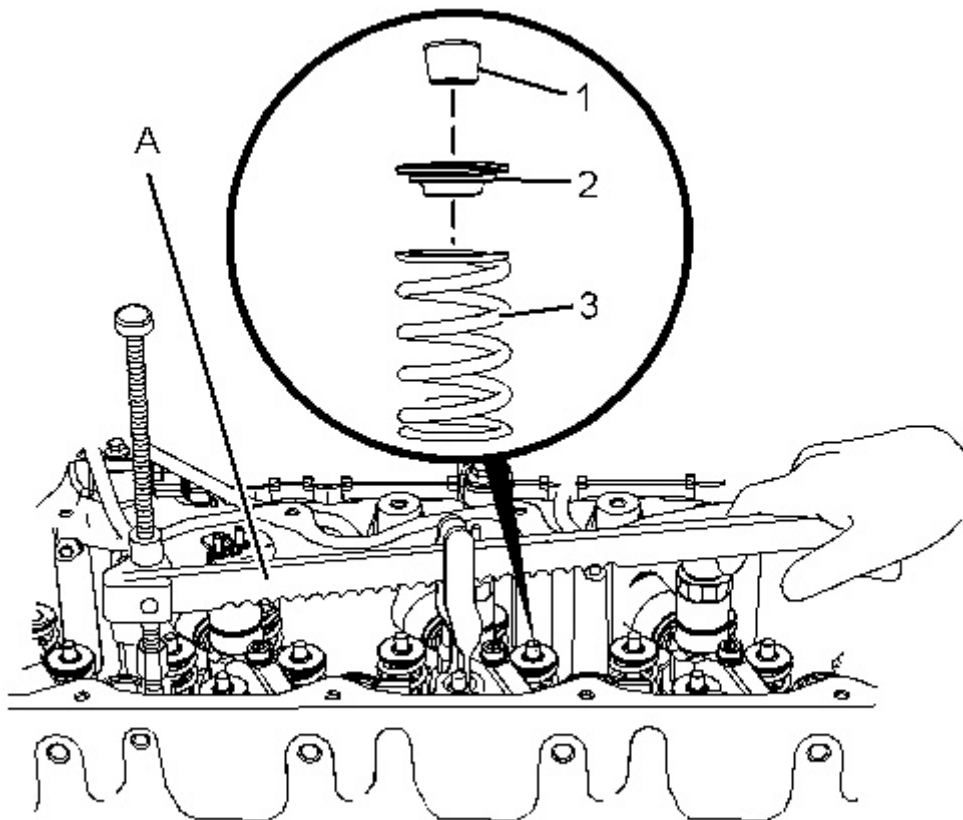
Note: Ensure that the cylinder head is kept on a clean, soft surface in order to prevent damage to the machined face.

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.



4. Install Tooling (A) in position on the cylinder head in order to compress appropriate valve spring (3).

NOTICE

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

5. Apply sufficient pressure to Tooling (A) in order to remove valve keepers (1).

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

6. Slowly release pressure on Tooling (A).

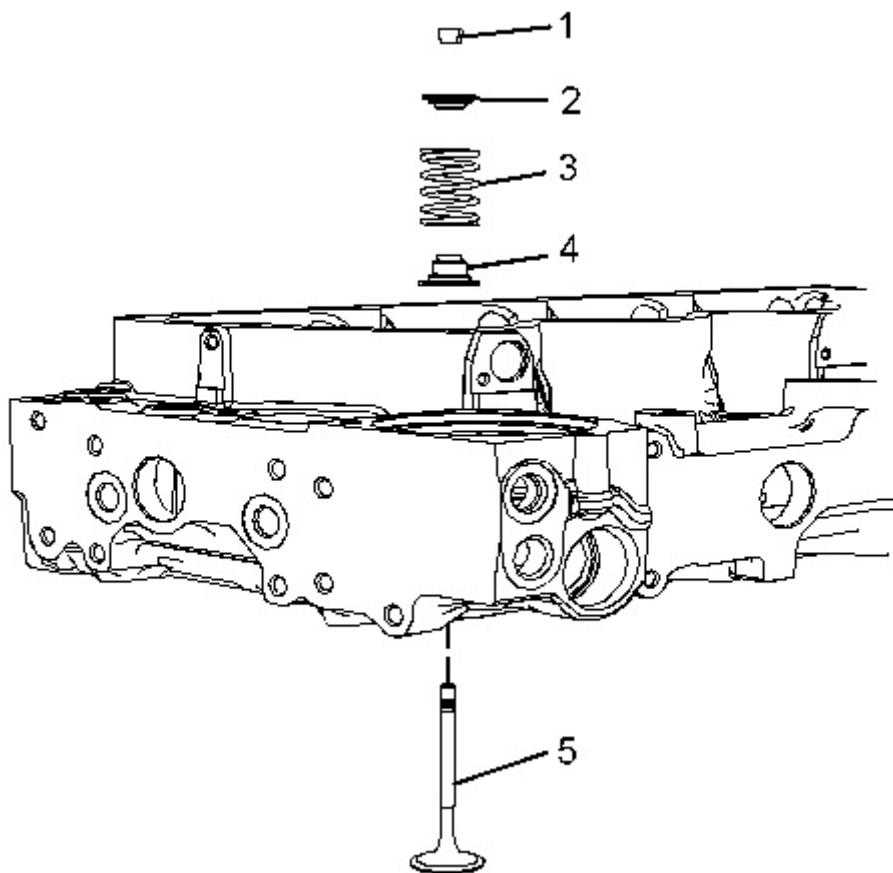


Illustration 2

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7. Place a temporary identification mark on valve spring (3) in order to identify the correct position.
8. Remove valve spring retainer (2). Remove valve spring (3).
9. Repeat Step 4 through Step 8 for the remaining valves.

10. Remove Tooling (A).
11. Remove valve stem seals (4).
12. Use a suitable lifting device in order to carefully turn over the cylinder head.
13. Remove valves (5).

Installation Procedure

Table 2

Required Tools			
Tool	Part Number	Part Description	Qty
A	9U-6195	Valve Spring Compressor	1
	268-1969	Adapter	1
	276-1221	Head	1

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

Note: The valves have a hard surface finish. Grinding compound must not be used on the valves. Grinding compound will damage the hard surface finish of the valves.

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.d 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 System 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 System 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 further information.
 - e. Inspect valve springs (3) for damage and for the correct length. Refer to Specifications, "Cylinder Head Valves " for further information.

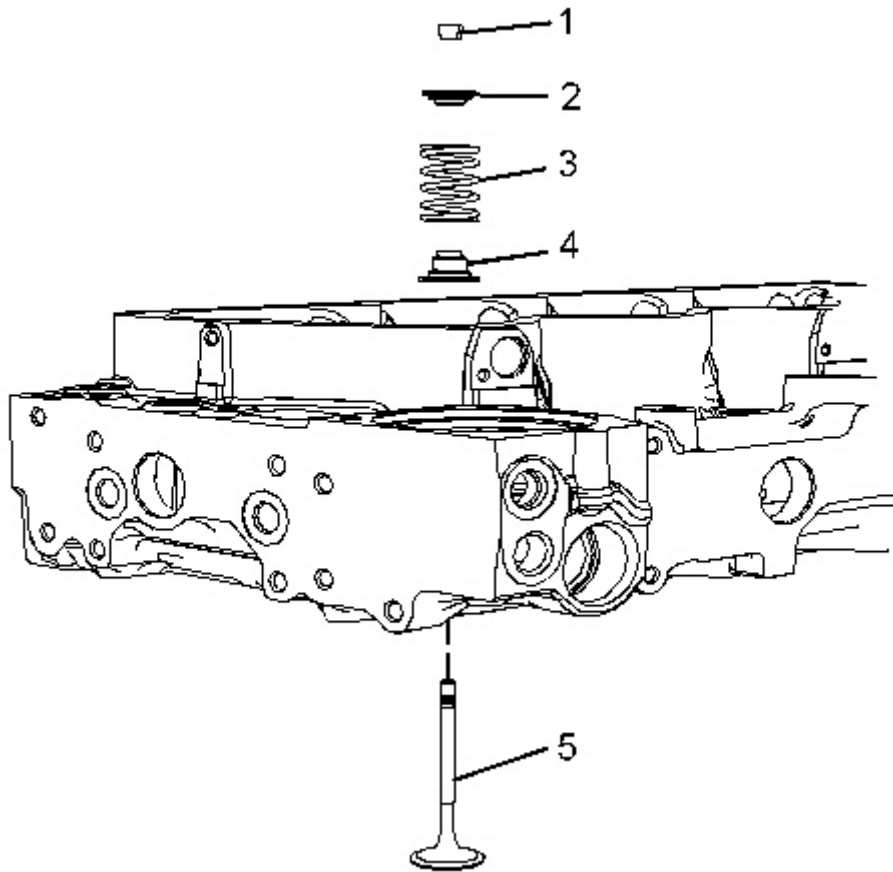


Illustration 3

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2. Lubricate the stems of valves (5) with clean engine oil. Install valves (5) in the appropriate positions in the cylinder head. Check the depth of the valves below the face of the cylinder head. Refer to System Operation, Testing and Adjusting, "Valve Depth - Inspect" for more information.
3. Use a suitable lifting device in order to carefully turn over the cylinder head. The weight of the cylinder head is approximately 65 kg (143 lb).

Note: Ensure that all of the valves remain in place.

4. 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 valve stem seals (4).

5. Install valve spring (3) onto the cylinder head. Position valve spring retainer (2) on 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.

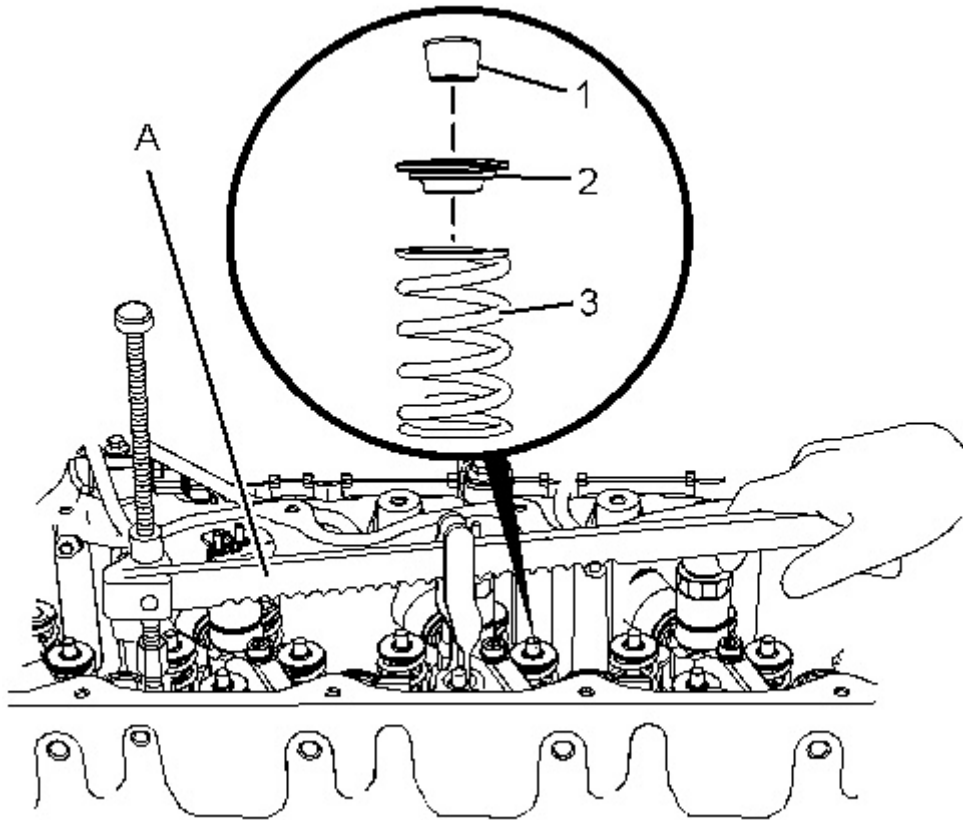


Illustration 4

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6. Install Tooling (A) in the appropriate position on the cylinder head in order to compress valve spring (3).
-

NOTICE

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

7. Apply sufficient pressure to Tooling (A) in order to install valve keepers (1).

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



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. Carefully release the pressure on Tooling (A).
9. Repeat Step 5 through Step 8 for the remaining valves.
10. Remove Tooling (A) from the cylinder head.

End By:

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

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i05820269

Engine Oil Filter Base - Remove and Install

SMCS - 1306-010

Removal Procedure

Table 1

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

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.

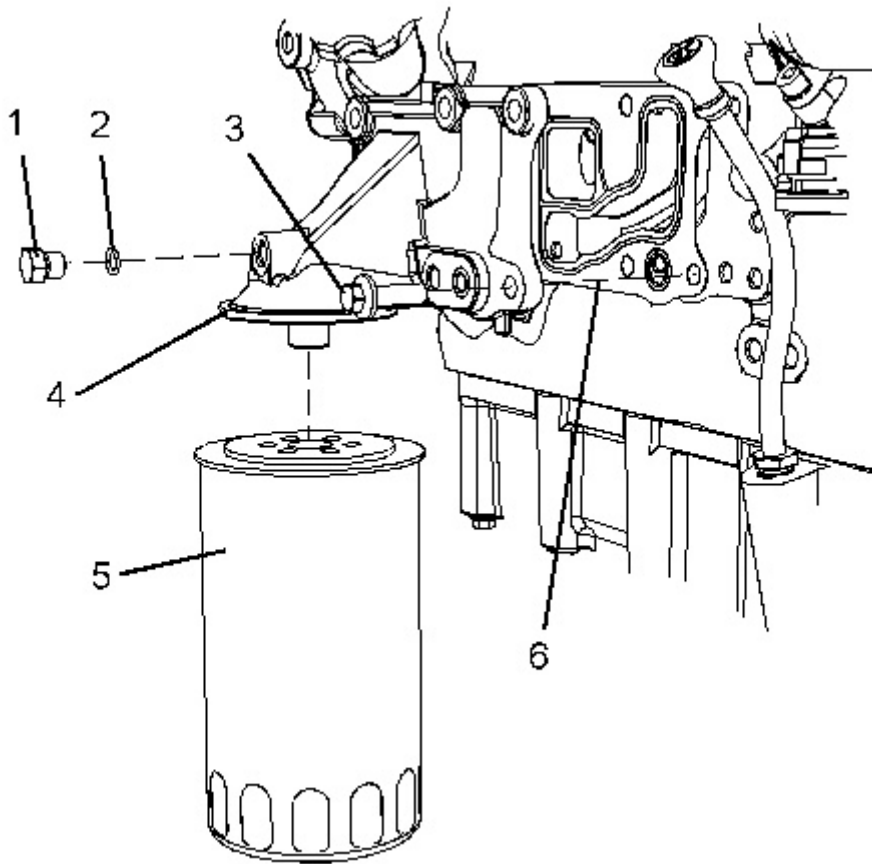


Illustration 1

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1. Place a suitable container below engine oil filter base (5) in order to catch any oil that might be spilled.
2. Use Tooling (A) to remove engine oil filter (5). Refer to Operation and Maintenance Manual, "Engine Oil and Filter - Change" for the correct procedure.
3. Remove bolts (3).
4. Remove engine oil filter base (4).
5. Remove gasket (6).
6. If necessary, remove plug (1) from engine oil filter base (4). Remove O-ring seal (2) from plug (1).

Installation Procedure

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

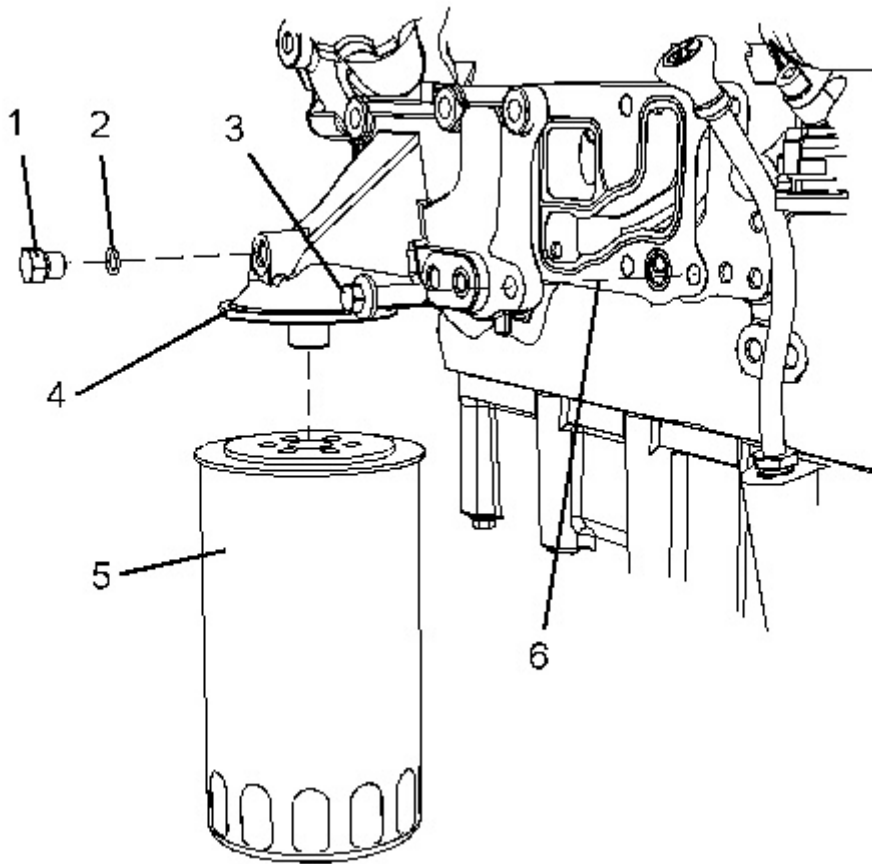


Illustration 2

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1. Clean engine oil filter base (4). Clean the gasket surfaces of the cylinder block.
 2. If necessary, install new O-ring seals (2) to plugs (1). Install plugs (1) to engine oil filter base (4). Tighten the plugs to a torque of 12 N·m (106 lb in).
 3. Install bolts (3) to engine oil filter base (4).
 4. Install a gasket (6) onto bolts (3). Install the assembly of the engine oil filter base to the cylinder block.
 5. Tighten bolts (3) to a torque of 22 N·m (195 lb in).
 6. Install a new engine oil filter (5) and check the level of the engine lubricating oil. Refer to Operation and Maintenance Manual, "Engine Oil Level - Check" for the correct procedure.
-

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i05820270

Engine Oil Cooler - Remove

SMCS - 1378-011

Removal Procedure

Start By:

- a. Remove the Electronic Control Module (ECM). Refer to Disassembly and Assembly, "Electronic Control Module - Remove" for the correct procedure.

NOTICE

Ensure that all adjustments and repairs that are carried out to the fuel system are performed by authorized personnel that have the correct training.

Before beginning ANY work on the fuel system, refer to Operation and Maintenance Manual, "General Hazard Information and High Pressure Fuel Lines" for safety information.

Refer to System Operation, Testing and Adjusting, "Cleanliness of Fuel System Components" for detailed information on the standards of cleanliness that must be observed during ALL work on the fuel system.

NOTICE

Keep all parts clean from contaminants.

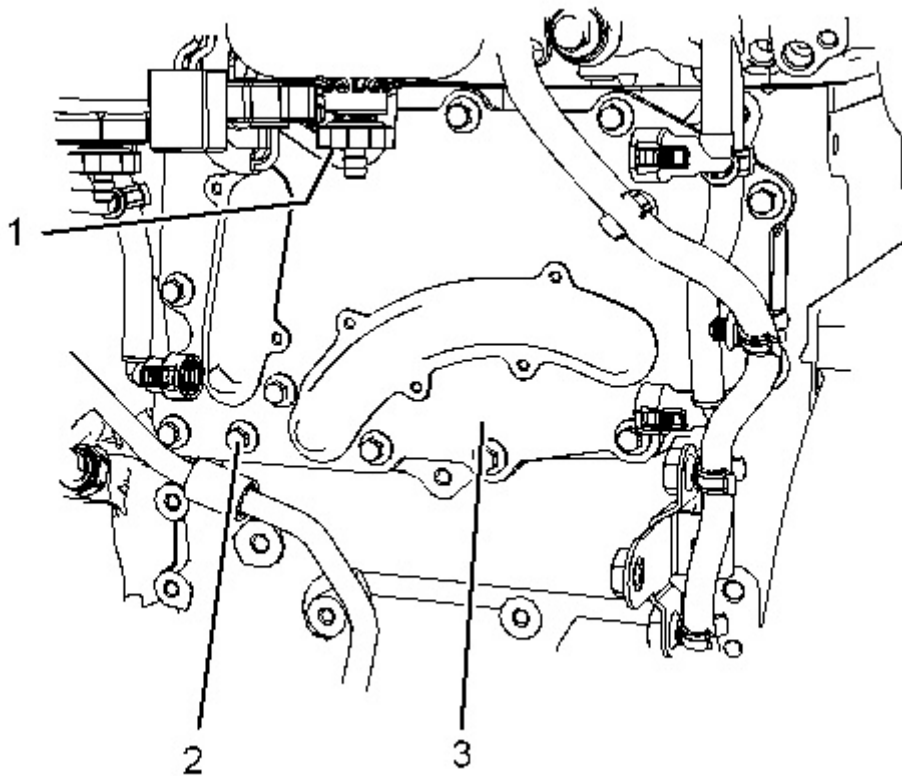
Contaminants may cause rapid wear and shortened component life.

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.

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.
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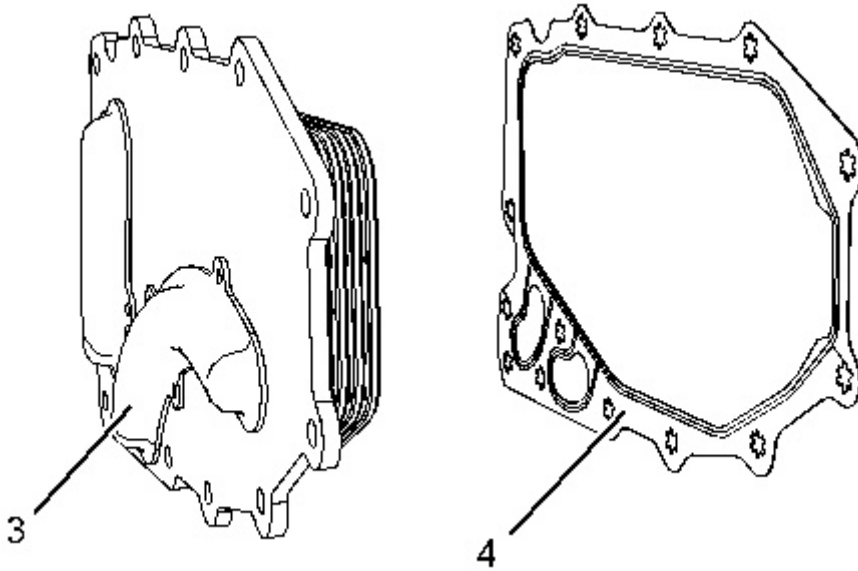


Illustration 2

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2. Remove spacer (1) (not shown) from the cylinder block.
3. Remove bolt (2) from the assembly of engine oil cooler (3).

Note: Support the engine oil cooler as the bolts are removed.

4. Remove the assembly of engine oil cooler (3) from the cylinder block.
 5. Remove gasket (4) from engine oil cooler (3).
-

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Engine Oil Cooler - Install

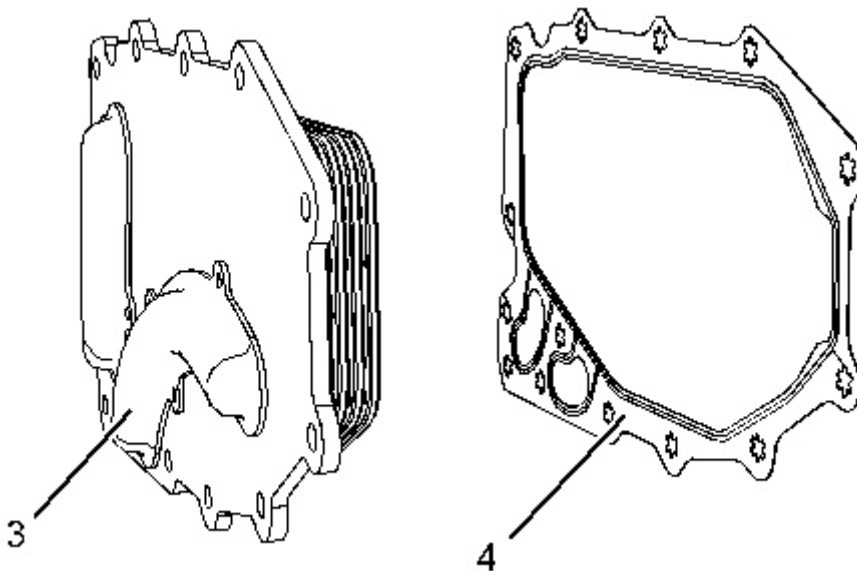
SMCS - 1378-012

Installation Procedure

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.



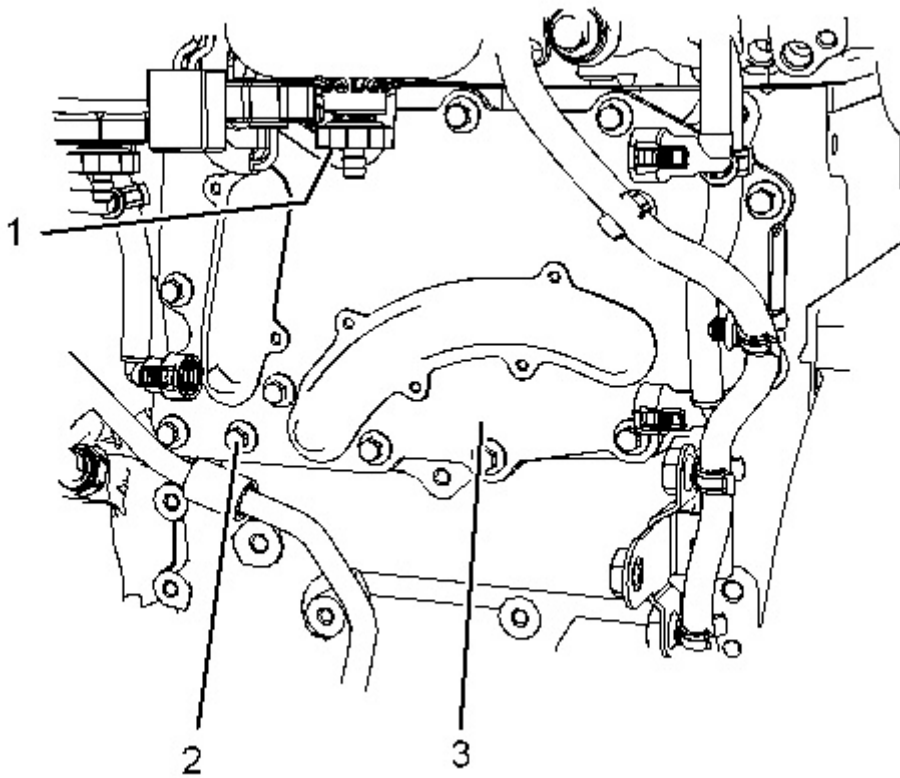


Illustration 2

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1. Ensure that engine cooler (3) is clean and free from damage. Ensure that the engine oil cooler is free from restriction.
2. Clean the gasket surfaces of the cylinder block.
3. Position a new gasket (4) onto engine oil cooler (3).
4. Push bolts (1) through the holes in the gasket.

Note: The holes in the gasket have serrations that hold the bolts captive.

5. Position engine oil cooler (3) onto the cylinder block. Hand tighten bolts (2). Support the engine oil cooler as the bolts are installed.
-

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