



Service Repair Manual

Models

216B2 Skid Steer Loader

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Product: SKID STEER LOADER

Model: 216B SKID STEER LOADER RLL

Configuration: 216B2 Skid Steer Loader RLL06800-UP (MACHINE) POWERED BY 3024C Engine

Disassembly and Assembly

C1.1, C1.5 and C2.2 Engines for Caterpillar Built Machines

Media Number -KENR6948-06

Publication Date -01/06/2015

Date Updated -02/08/2018

i02602655

Turbocharger - Remove and Install

SMCS - 1052-010

Removal 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.

Note: Plug and cap all open ports and tube assemblies.

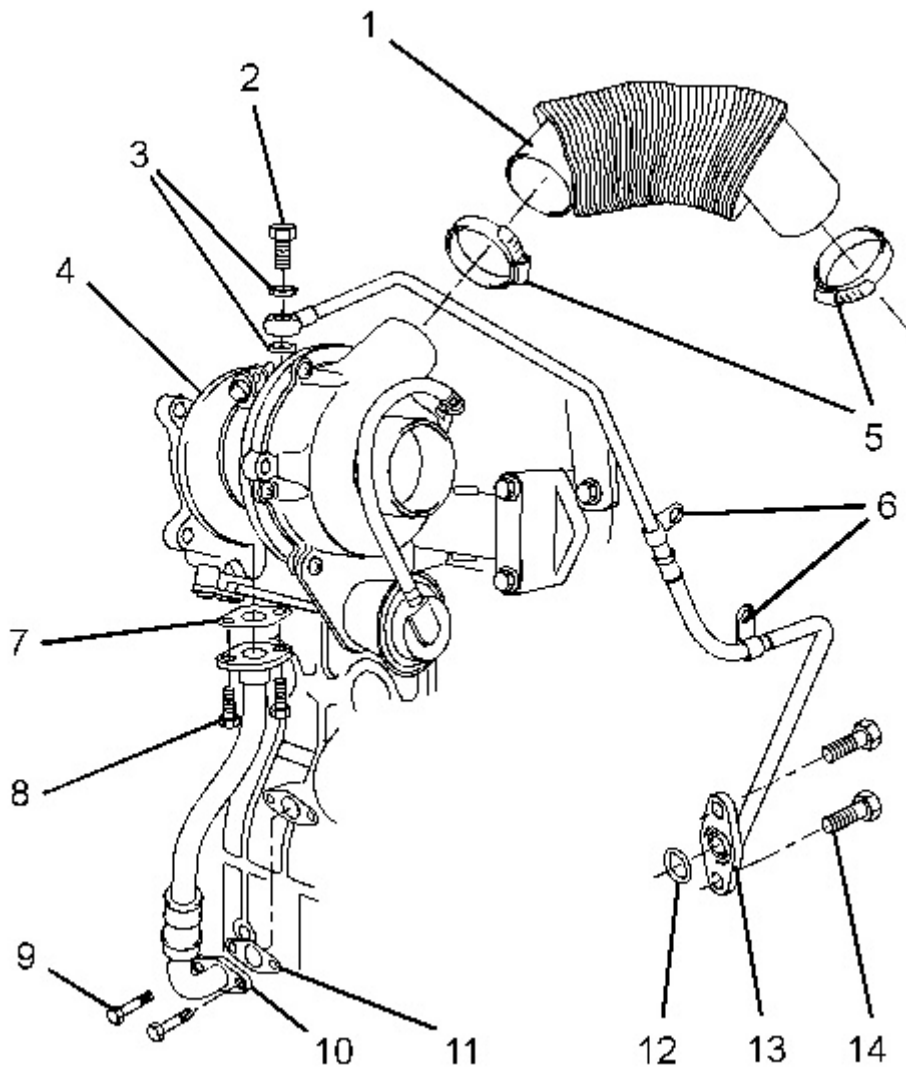


Illustration 1

g01304121

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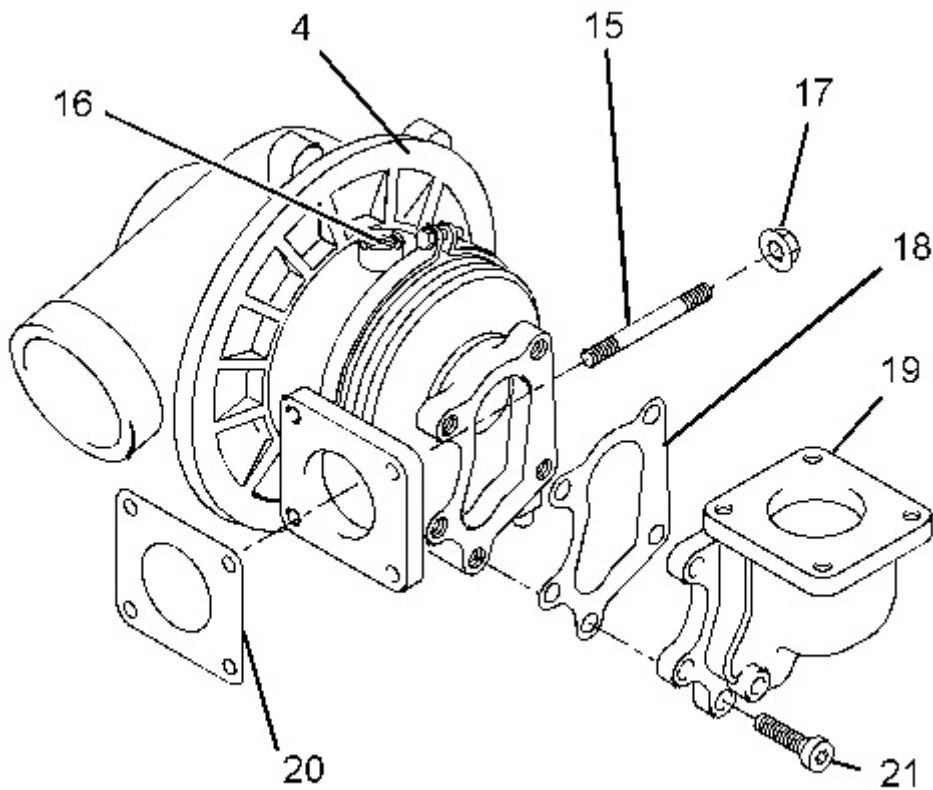


Illustration 2

g01304528

1. Loosen hose clamps (5) and remove air inlet hose (1).
2. Remove allen head screws (21) and remove exhaust elbow (19) from turbocharger (4). Remove gasket (18) from the turbocharger.
3. Remove banjo bolt (2) and washers (3). Remove the fasteners and the spacers (not shown) for tube clips (6). Remove bolts (14) and remove tube assembly (13) from the cylinder block. Remove O-ring seal (12).
4. Remove bolts (8) and disconnect tube assembly (10) from the turbocharger. Remove joint (7).
If necessary, remove bolts (9) and remove tube assembly (10) from the cylinder block. Remove joint (11).
5. Remove nuts (17) and remove turbocharger (4) from the exhaust manifold. Remove gasket (20) from the exhaust manifold. If necessary, remove studs (15) from the exhaust manifold.

Note: Do not use the actuator rod of the wastegate to lift the turbocharger.

Installation procedure

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

1. Ensure that the turbocharger is clean and free from damage. Inspect the turbocharger for wear. If the turbocharger is worn, the complete turbocharger must be replaced.
 2. Test the actuator for correct operation. Refer to Systems Operation, Testing and Adjusting, "Wastegate - Test" for more information. If the actuator is damaged or the actuator does not operate within the specified limits, the complete turbocharger must be replaced.
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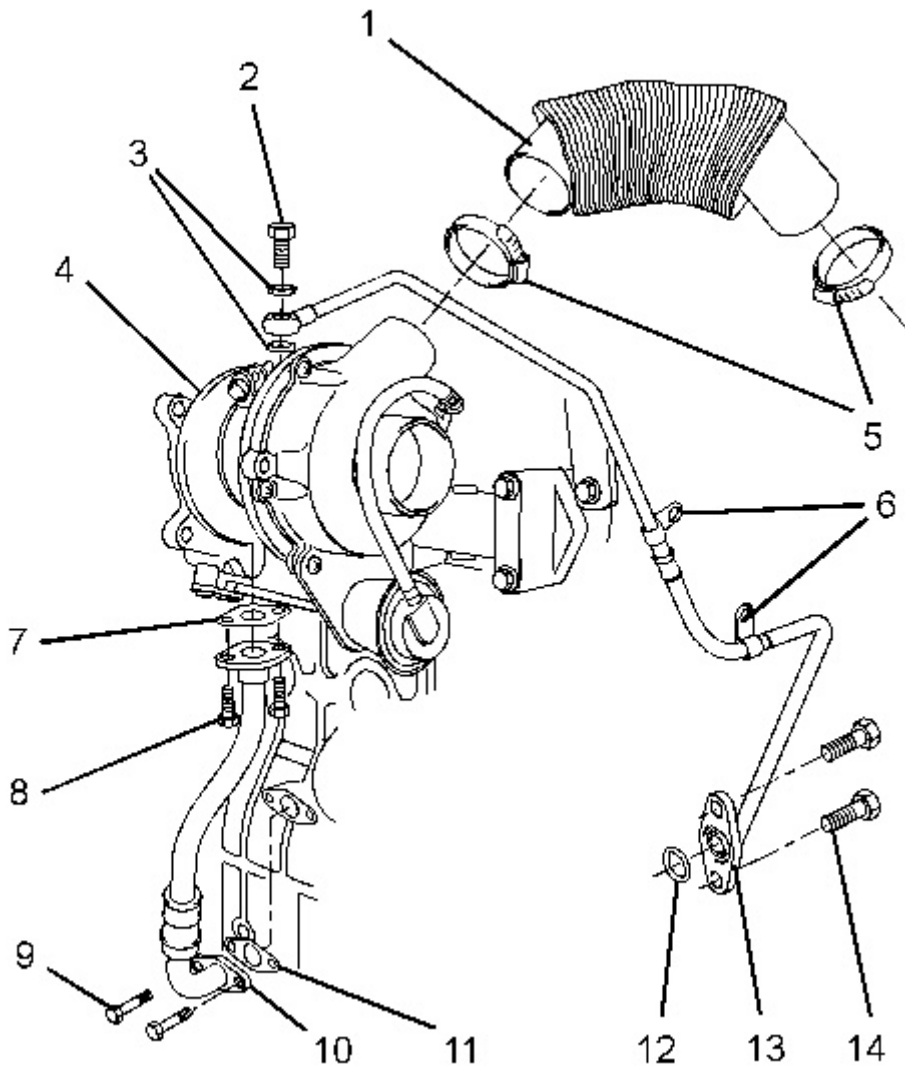


Illustration 3

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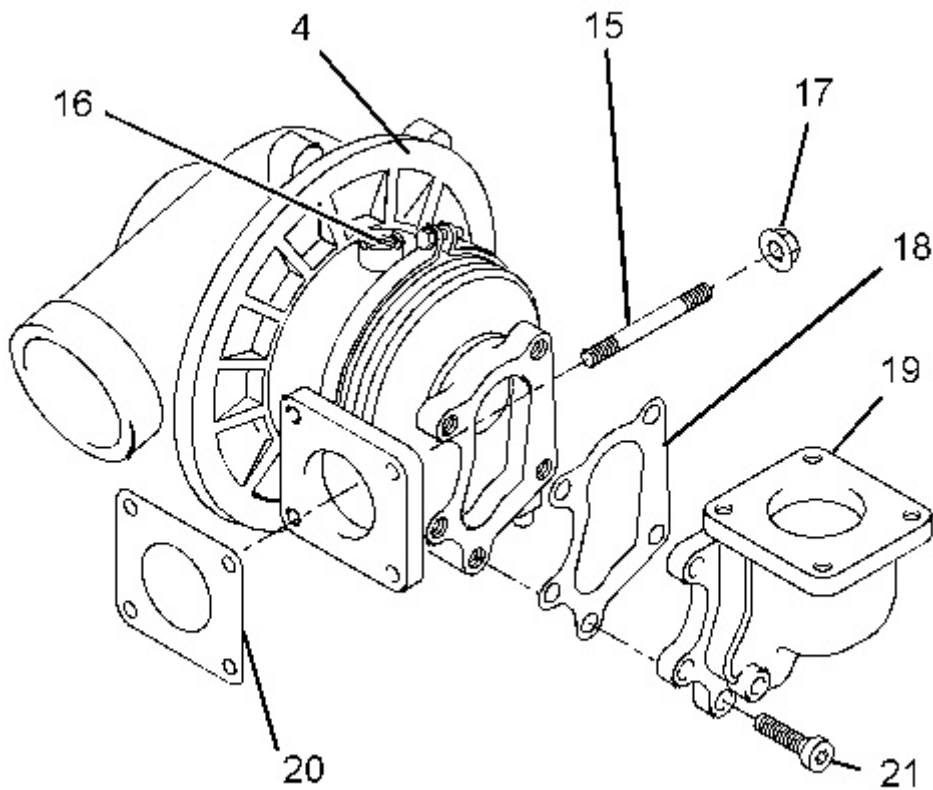


Illustration 4

g01304528

3. Clean the mating surfaces of the exhaust manifold. If necessary, install studs (15) to the exhaust manifold. Tighten the studs to a torque of 18 N·m (13 lb ft). Install a new gasket (20) over the studs.
4. Position turbocharger (4) onto the exhaust manifold. Install nuts (17) and tighten to a torque of 25 N·m (18 lb ft).

Note: Do not use the actuator rod of the wastegate to lift the turbocharger .

5. Ensure that tube assemblies (10) and (13) are clean and free from damage. If necessary, replace the tube assemblies.
6. If necessary, position a new joint (11) and tube assembly (10) onto the cylinder block. Install bolts (9). Tighten the bolts finger tight.

Position a new joint (7) on tube assembly (10). Align tube assembly (10) to the bottom of the turbocharger. Install bolts (8). Tighten the bolts finger tight.

Tighten bolts (8) and (9) to a torque of 10 N·m (89 lb in).

7. Lubricate the bearings of turbocharger (4) with clean engine oil through oil inlet port (16). Rotate the shaft of the turbocharger in order to distribute the lubricant.
8. Install a new O-ring seal (12) to tube assembly (13). Position tube assembly (13) against the cylinder block. Install bolts (14). Tighten the bolts to a torque of 10 N·m (89 lb in).

9. Install new washers (3) and banjo bolt (2) to tube assembly (13). Position tube assembly (13) onto turbocharger (4). Tighten the banjo bolt finger tight.
10. If necessary, install the spacer and install the fasteners (not shown) to tube clips (6). Torque the fasteners to 10 N·m (89 lb in).
11. Tighten banjo bolt (2) to a torque of 18 N·m (13 lb ft).

Note: Ensure that the tube assembly does not come into contact with any other components.

12. Clean the mating surfaces of exhaust elbow (19). Position a new gasket (18) and exhaust elbow (19) on turbocharger (4). Install allen head screws (21). Tighten the bolts to a torque of 32 N·m (24 lb ft).
13. Ensure that inlet hose (1) is clean and free from defects or restrictions. Loosely install hose clamps (5) to air inlet hose (1). Install the air inlet hose to the connection of the inlet manifold (not shown) and to the turbocharger. Tighten the hose clamps.

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Product: SKID STEER LOADER

Model: 216B SKID STEER LOADER RLL

Configuration: 216B2 Skid Steer Loader RLL06800-UP (MACHINE) POWERED BY 3024C Engine

Disassembly and Assembly

C1.1, C1.5 and C2.2 Engines for Caterpillar Built Machines

Media Number -KENR6948-06

Publication Date -01/06/2015

Date Updated -02/08/2018

i07360106

Exhaust Manifold - Remove and Install

SMCS - 1059-010

Removal Procedure

Start By:

- a. If the engine is equipped with a turbocharger, remove the turbocharger. Refer to Disassembly and Assembly, "Turbocharger - Remove and Install".

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

Note: The three cylinder and the four cylinder engines have different exhaust manifolds. The removal procedure is similar for all models.

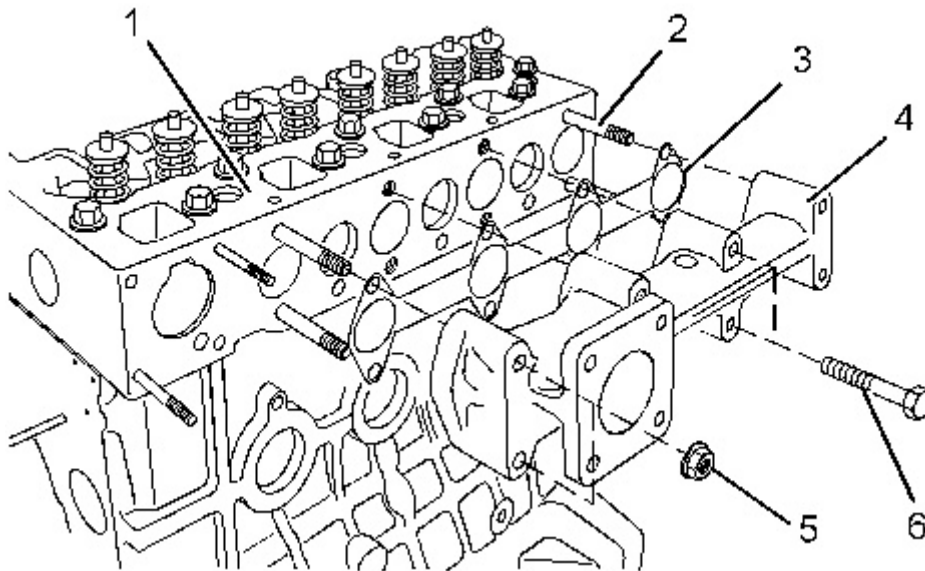


Illustration 1

g01326567

Typical example

1. Loosen nuts (5) and bolts (6).

Note: To prevent distortion of the exhaust manifold, loosen the outer fasteners first.

2. Remove nuts (5) and bolts (6).

Note: Identify bolts of different lengths so that the bolts can be installed in the correct positions.

3. Remove exhaust manifold (4) from cylinder head (1). Note the orientation of the exhaust manifold for installation.
4. Remove gasket (3) from cylinder head (1).
5. If necessary, remove exhaust manifold studs (2) from cylinder head (1).

Installation Procedure

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

Note: The three cylinder and the four cylinder engines have different exhaust manifolds. The installation procedure is similar for all models.

1. Ensure that the mating surfaces of the cylinder head and the exhaust manifold are clean and free from damage.

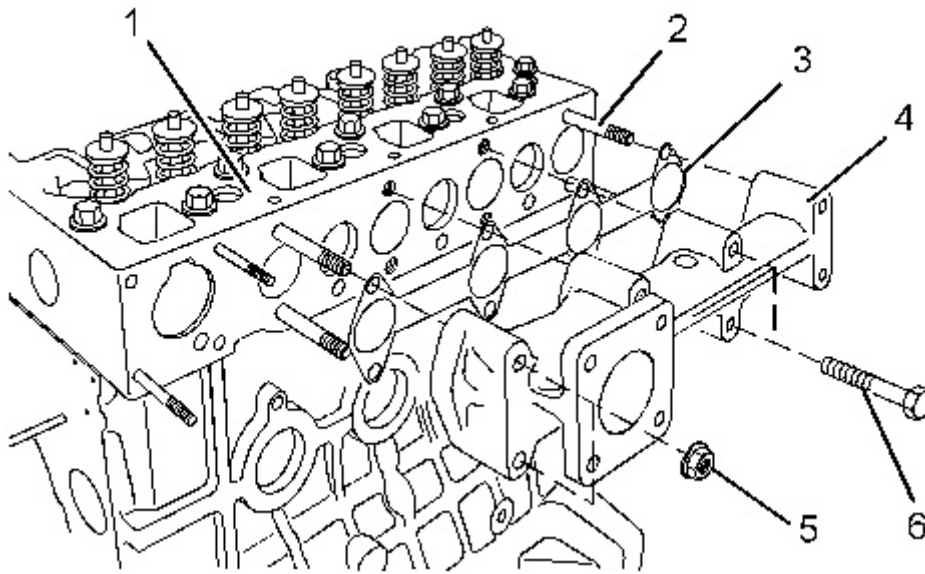


Illustration 2

g01326567

Typical example

2. If necessary, install exhaust manifold studs (2) to cylinder head (1).
3. Install a new exhaust manifold gasket (3) to cylinder head (1).
4. Align exhaust manifold (4) with studs (2) and install the exhaust manifold to cylinder head (1).

Note: Ensure that the exhaust manifold is installed in the correct orientation.

5. Install nuts (5) and bolts (6) finger tight.

Note: Ensure that bolts of different lengths are installed in the correct positions.

6. For the C1.1 and C1.5 engines, tighten nuts (5) and bolts (6) to a torque of 10 N·m (89 lb in).

For the C2.2 engine, tighten nuts (5) and bolts (6) to a torque of 25 N·m (18 lb ft).

Note: Tighten the inner bolts first.

End By:

- a. If the engine is equipped with a turbocharger, install the turbocharger. Refer to Disassembly and Assembly, "Turbocharger - Remove and Install".

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Product: SKID STEER LOADER

Model: 216B SKID STEER LOADER RLL

Configuration: 216B2 Skid Steer Loader RLL06800-UP (MACHINE) POWERED BY 3024C Engine

Disassembly and Assembly

C1.1, C1.5 and C2.2 Engines for Caterpillar Built Machines

Media Number -KENR6948-06

Publication Date -01/06/2015

Date Updated -02/08/2018

i07360109

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-6195	Valve Spring Compressor	1
B ⁽¹⁾	268-1969	Adapter	1
B ⁽²⁾	9U-6194	Adapter	1

⁽¹⁾ C1.1 engine

⁽²⁾ C1.5 and C2.2 engines

Start By:

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



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

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

NOTICE

Install suitable plugs to the inlet ports of the cylinder head in order to prevent the entry of loose parts into the engine.

NOTICE

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

Note: The removal procedure is similar for the three cylinder and the four cylinder engines. 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 the top center position before the valve spring is removed. Failure to ensure that the piston is at the top center position may allow the valve to drop into the cylinder bore.

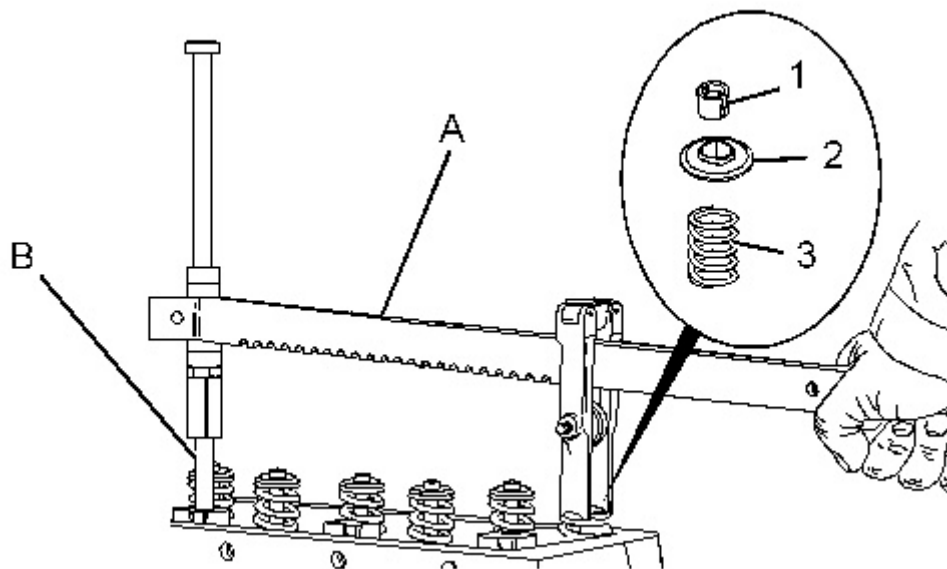


Illustration 1

g01304583

Typical example

1. Follow Steps 1.a through 1.d to position the appropriate piston at top center.
 - a. Install Tooling (A) and (B) in position on the cylinder head to compress a valve spring for the appropriate piston.
 - b. Use Tooling (A) to compress valve spring (3) and open the valve slightly.

Note: Do not compress the spring so that the valve spring retainer (2) touches the valve stem seal.
 - c. Carefully rotate the crankshaft 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 center position. The valve is now held in a position that allows the valve spring to be safely removed.

NOTICE

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

2. Use tool (A) to compress valve spring (3). Remove valve keepers (1).

Note: For four cylinder engines, 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 the valve keepers (1).

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

Remove valve keepers (1).

4. Slowly release the pressure on Tooling (A).

5. Remove valve spring retainer (2) and remove valve spring (3).

6. Remove Tooling (A) and (B).

Installation Procedure

Table 2

Required Tools			
Tool	Part Number	Part Description	Qty
A	9U-6195	Valve Spring Compressor	1
B ⁽¹⁾	268-1969	Adapter	1
B ⁽²⁾	9U-6194	Adapter	1

⁽¹⁾ C1.1 engine

⁽²⁾ C1.5 and C2.2 engines

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 in order to prevent the entry of loose parts into the engine.

NOTICE

Install suitable plugs to the inlet ports of the cylinder head in order to prevent the entry of loose parts into the engine.

1. Inspect the valve springs for the correct length. Refer to Specifications, "Cylinder Head Valves".
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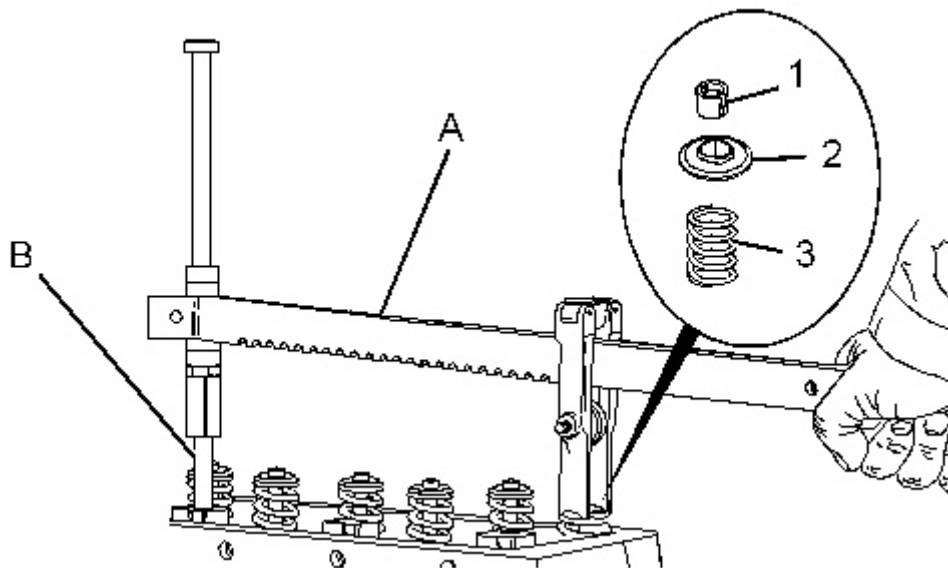


Illustration 2
Typical example

g01304583

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

 **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.

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

4. Apply sufficient pressure to Tooling (A) to install valve keepers (1).

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

Install the valve spring keepers.

5. Carefully release the pressure on Tooling (A).

Note: Ensure that the valve keepers are correctly seated.



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.

6. Remove Tooling (A). Ensure that all the valves are secured in place by a valve spring and valve keepers. Rotate the crankshaft through about 45 degrees to clear the piston from the valve. Lightly strike the top of the valve with a soft hammer to ensure that the valve keepers are properly installed.

End By:

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

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Product: SKID STEER LOADER

Model: 216B SKID STEER LOADER RLL

Configuration: 216B2 Skid Steer Loader RLL06800-UP (MACHINE) POWERED BY 3024C Engine

Disassembly and Assembly

C1.1, C1.5 and C2.2 Engines for Caterpillar Built Machines

Media Number -KENR6948-06

Publication Date -01/06/2015

Date Updated -02/08/2018

i06720078

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".

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

Note: The removal procedure is identical for 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 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.



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.

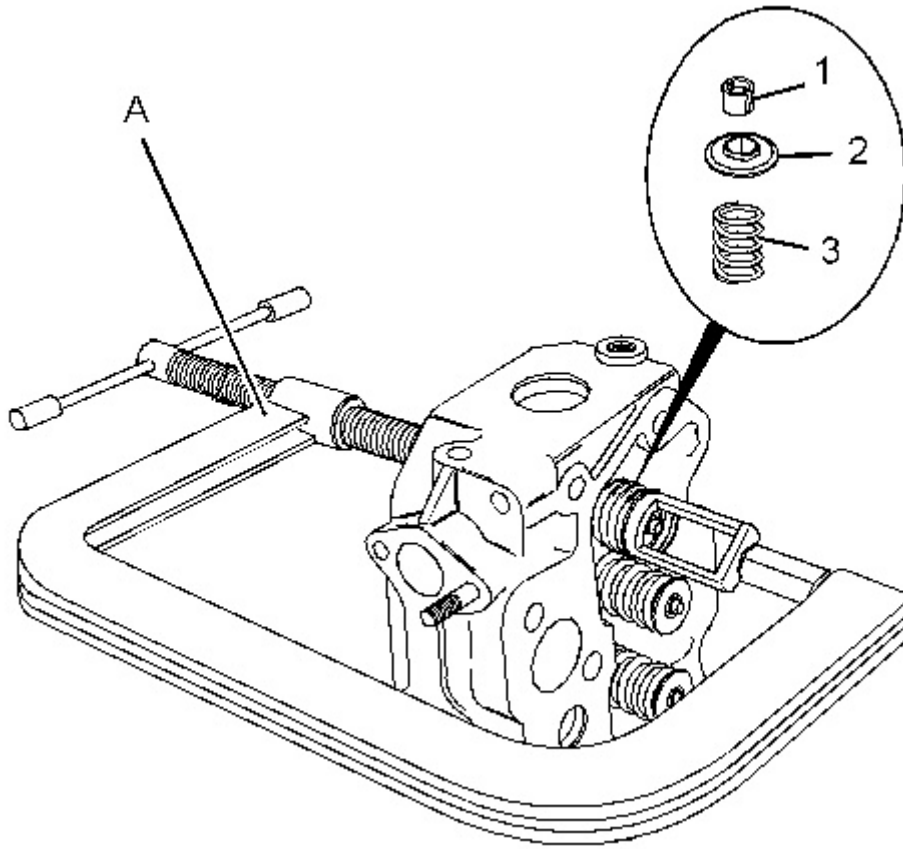


Illustration 1
Typical example

g01315963

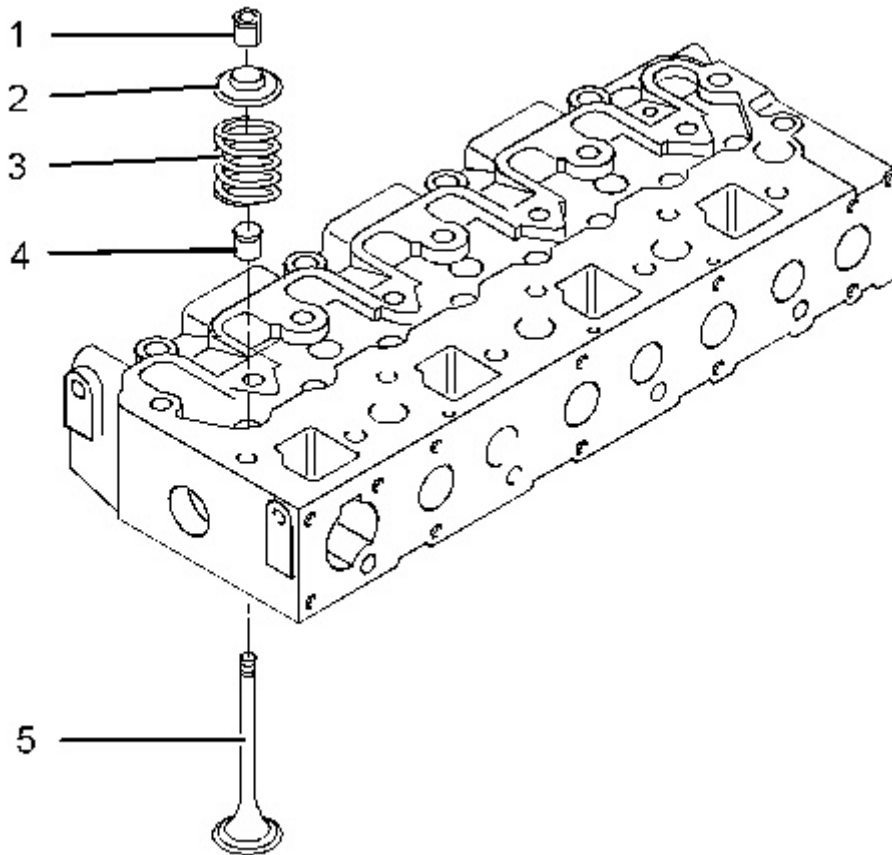


Illustration 2
Typical example

g01325840

3. Use Tooling (A) to compress the appropriate valve spring (3). Remove valve keepers (1).

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

4. Remove Tooling (A).
5. Remove valve spring retainer (2). Remove valve spring (3).
6. Remove valve (5).
7. Remove valve stem seal (4).
8. Repeat Steps 3 to 7 for the remaining valves.

Installation Procedure

Table 2

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

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

Note: The installation procedure is identical for 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 Steps 1.a through 1.e 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".
 - 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".
 - e. Inspect the valve springs for the correct length. Refer to Specifications, "Cylinder Head Valves".
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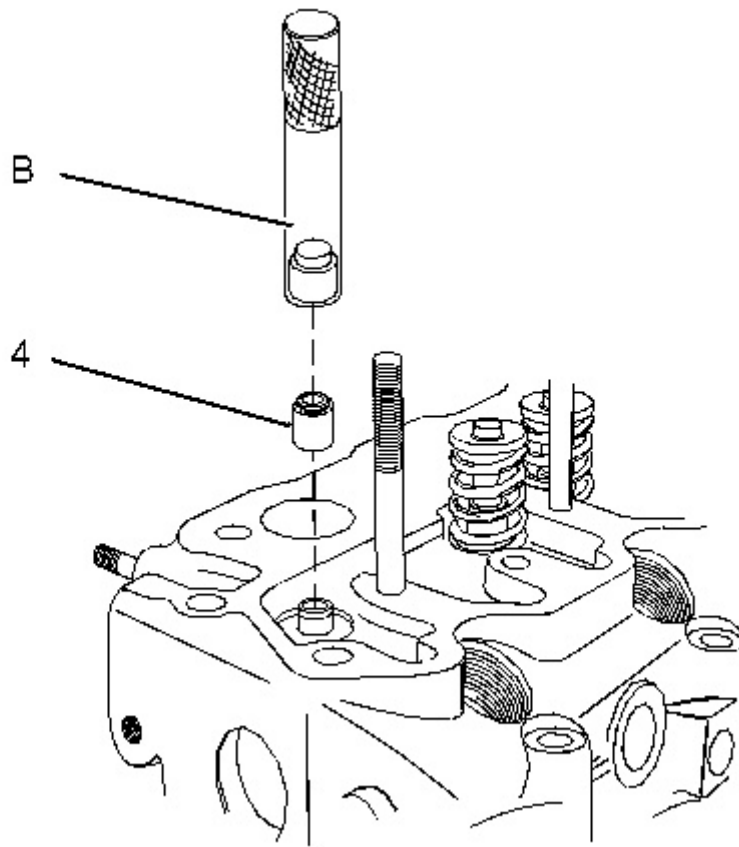


Illustration 3
Typical example

g01315893

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.

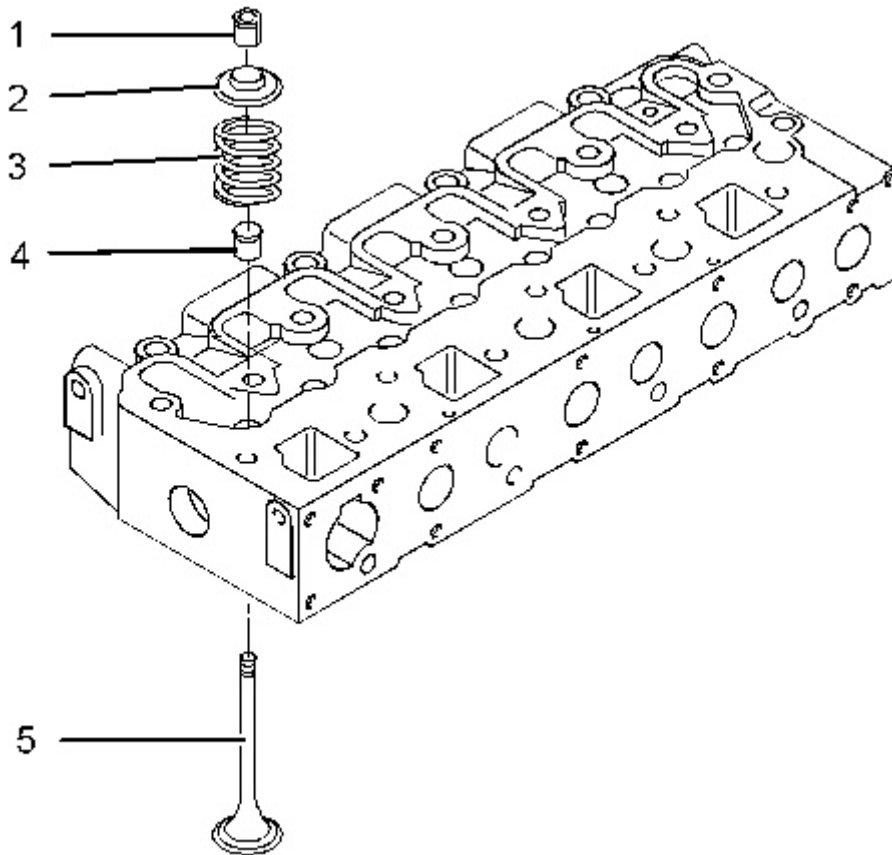


Illustration 4
Typical example

g01325840

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. 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.

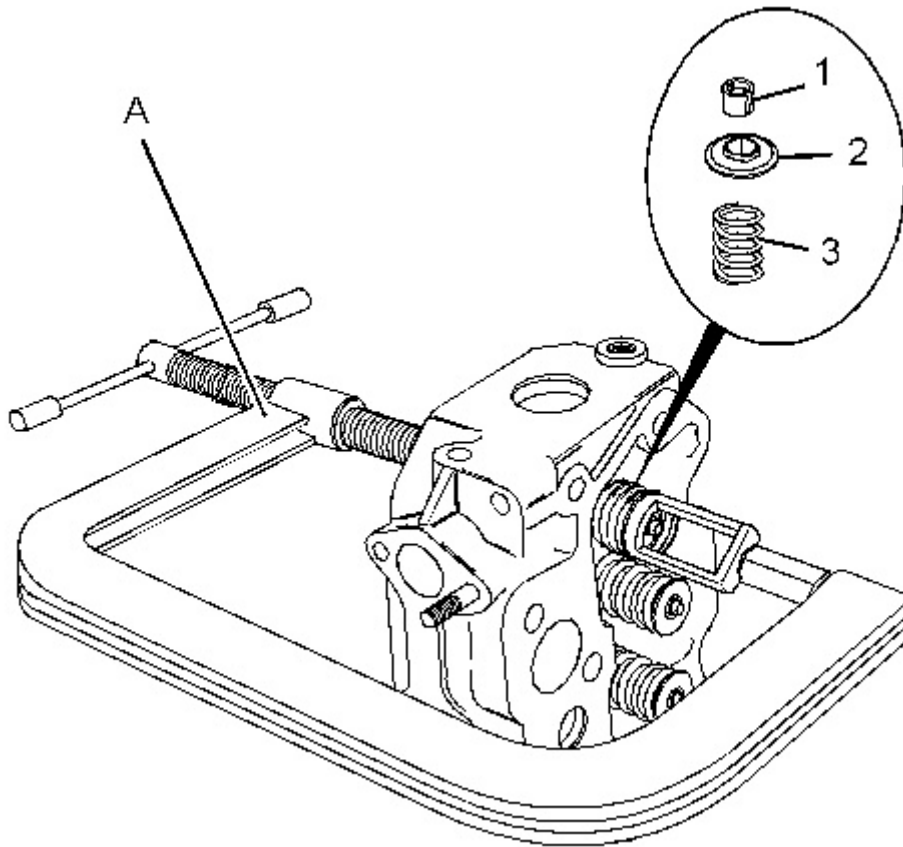


Illustration 5
Typical example

g01315963

5. Use Tooling (A) to compress valve spring (3). 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.

6. Remove Tooling (A).
7. Repeat Steps 4 to 6 for the remaining valves.
8. 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 hammer to ensure that valve keepers (1) are properly installed.

End By:

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

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Product: SKID STEER LOADER

Model: 216B SKID STEER LOADER RLL

Configuration: 216B2 Skid Steer Loader RLL06800-UP (MACHINE) POWERED BY 3024C Engine

Disassembly and Assembly

C1.1, C1.5 and C2.2 Engines for Caterpillar Built Machines

Media Number -KENR6948-06

Publication Date -01/06/2015

Date Updated -02/08/2018

i07360118

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.



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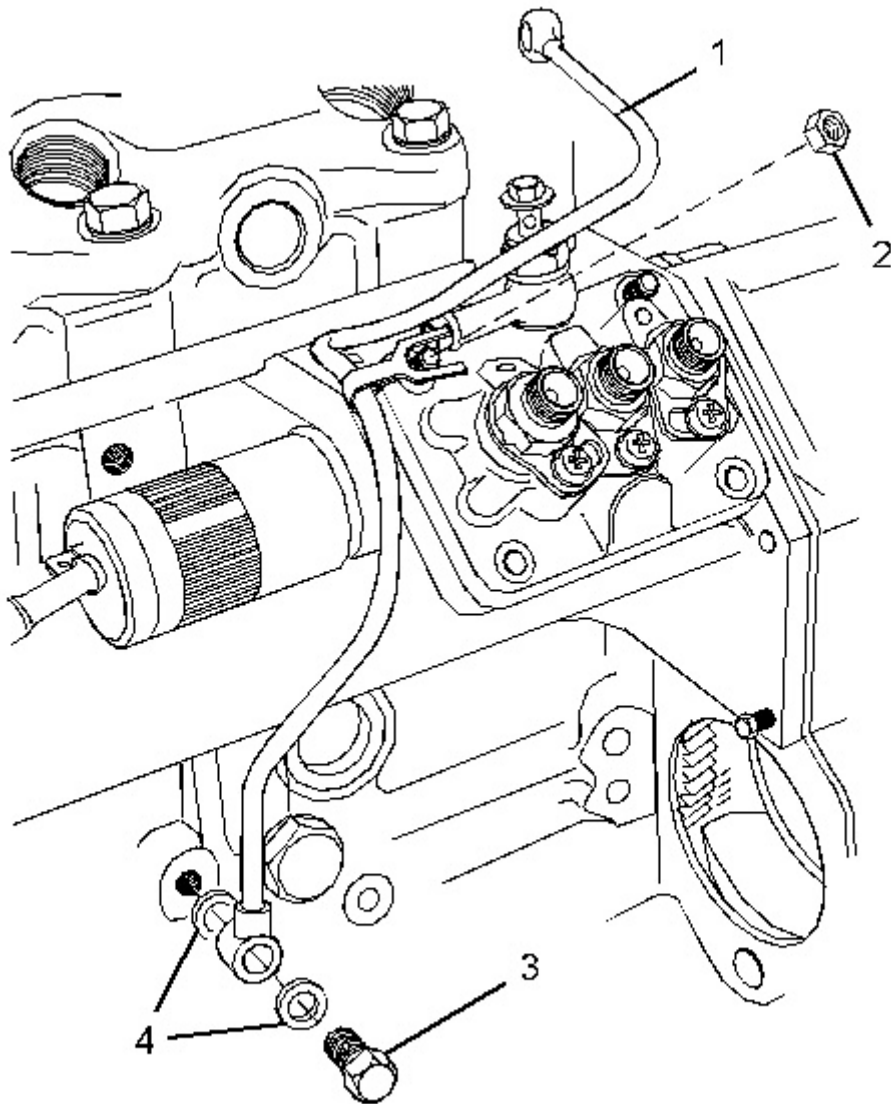


Illustration 1
Typical example

g01304820

1. Loosen nut (2) that attaches the clip on oil line (1) to the fuel injection pump.
 2. Remove banjo bolt (3) and remove washers (4) from the cylinder block.
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