

Product: INDUSTRIAL ENGINE
Model: C2.2 INDUSTRIAL ENGINE C4M
Configuration: C2.2 Industrial Engine C4M00001-UP

Disassembly and Assembly C0.5, C0.7, C1.1/3011C, C1.5/3013C, C1.6 and C2.2/3024C/3024CT Industrial Engines and Engines for Caterpillar Built Machines

Media Number -REN2424-09

Publication Date -01/04/2007

Date Updated -14/07/2017

i02797468

Fuel Injection Pump - Remove

SMCS - 1251-011

Removal Procedure

Start By:

- a. Remove the fuel injection lines. Refer to Disassembly and Assembly, "Fuel Injection Lines - Remove and Install".
- b. Remove the fuel shutoff solenoid. Refer to Disassembly and Assembly, "Fuel Shutoff Solenoid - Remove and Install".

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.

Refer to Special Publication, NENG2500, "Dealer Service Tool Catalog" for tools and supplies suitable to collect and contain fluids on Cat products.

Dispose of all fluids according to local regulations and mandates.

Note: The removal procedure is similar for the two cylinder, the three cylinder and the four cylinder engines. The illustrations show the four cylinder engine.

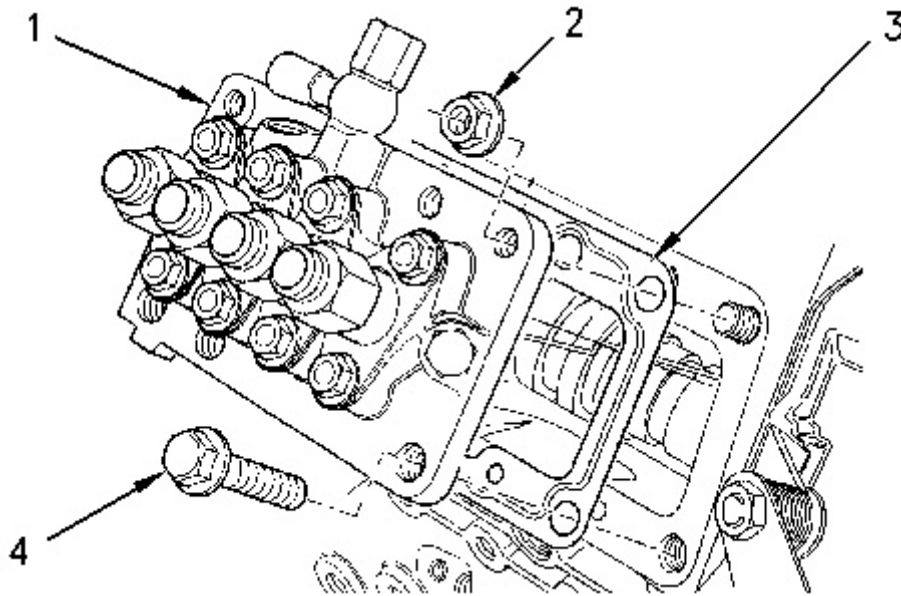


Illustration 1
Typical example

g00825132

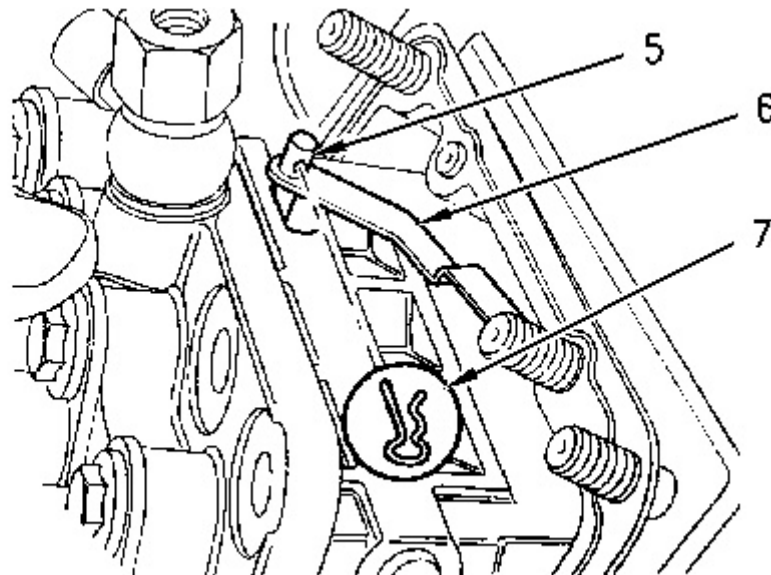


Illustration 2

g00825137

Typical example

1. Remove the setscrews (4) and the nuts (2) that fasten the fuel injection pump to the cylinder block.

Note: Ensure that the fuel rack control (5) has been moved away from the recess of the stop solenoid. If this is not done damage may occur.

2. Carefully raise the fuel injection pump (1) from the cylinder block and remove the clip (7) that connects the link (6) to the fuel rack control (5).
3. Remove the fuel injection pump (1) from the cylinder block.
4. Remove the shims (3) from the mounting face of the cylinder block.

Note: Record the thickness of each shim and the number of shims for reassembly. The fuel injection timing is determined by the thickness of the shim pack that is between the fuel injection pump and the mounting face on the cylinder block. For more information on the fuel injection pump, refer to Specifications, "Fuel Injection Pump".

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Media Number -REN2424-09

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i02235619

Fuel Injection Pump - Install

SMCS - 1251-012

Installation 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.

Refer to Special Publication, NENG2500, "Dealer Service Tool Catalog" for tools and supplies suitable to collect and contain fluids on Cat products.

Dispose of all fluids according to local regulations and mandates.

Note: The installation procedure is similar for the two cylinder, the three cylinder and the four cylinder engines. The illustrations show the four cylinder engine.

1. Clean the mounting face of the fuel injection pump on the cylinder block. Clean the mating surface of the fuel injection pump.

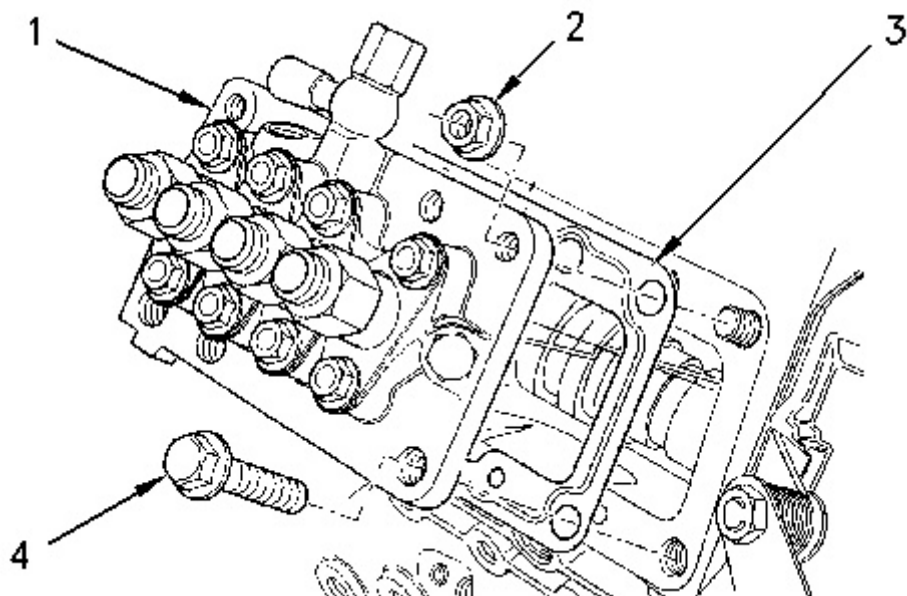


Illustration 1

g00825132

Typical example

2. Install the correct thickness and the correct number of shims (3) on the mounting face of the cylinder block. Refer to Specifications, "Fuel Injection Pump".

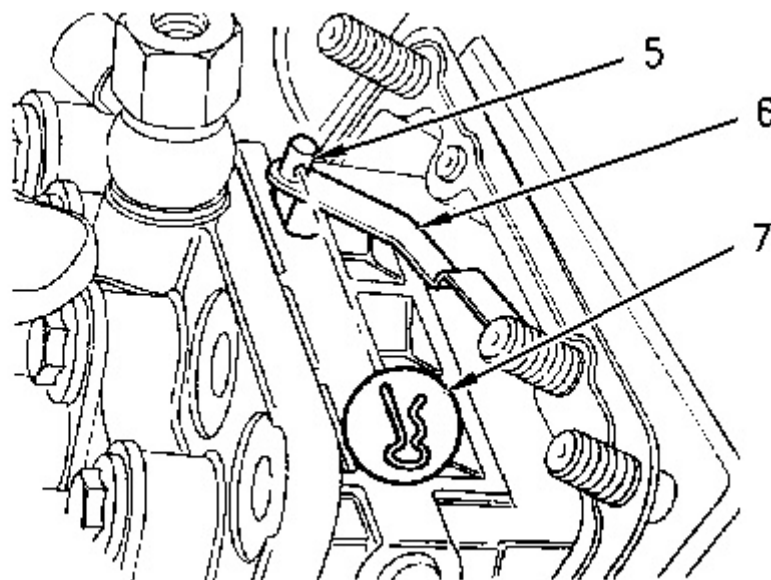


Illustration 2

g00825137

Typical example

3. Position the fuel injection pump (1) close to the mounting face of the cylinder block, and connect the link (6) and the fuel rack control (5) with the clip (7).
4. Put fuel injection pump (1) in position on the mounting face of the cylinder block.

5. Install the setscrews (4) and the nuts (2) that fasten the fuel injection pump to the cylinder block.

For C0.5, C0.7, C1.1/3011C and C1.6 engines, tighten the setscrews (4) and the nuts (2) to a torque of 6 N·m (53 lb in).

For C1.5/3013C, C2.2/3024C and C2.2/3024CT engines, tighten the setscrews (4) and the nuts (2) to a torque of 15 N·m (11 lb ft).

End By:

- a. Install the fuel shutoff solenoid. Refer to Disassembly and Assembly, "Fuel Shutoff Solenoid - Remove and Install".
 - b. Install the fuel injection lines. Refer to Disassembly and Assembly, "Fuel Injection Lines - Remove and Install".
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i02233013

Turbocharger - Remove and Install

SMCS - 1052-010

S/N - 4241-UP

S/N - C3M1-UP

S/N - C4M1-UP

S/N - G1P1-UP

S/N - G3P1-UP

S/N - G4P1-UP

S/N - G7M1-UP

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.

Refer to Special Publication, NENG2500, "Dealer Service Tool Catalog" for tools and supplies suitable to collect and contain fluids on Cat products.

Dispose of all fluids according to local regulations and mandates.

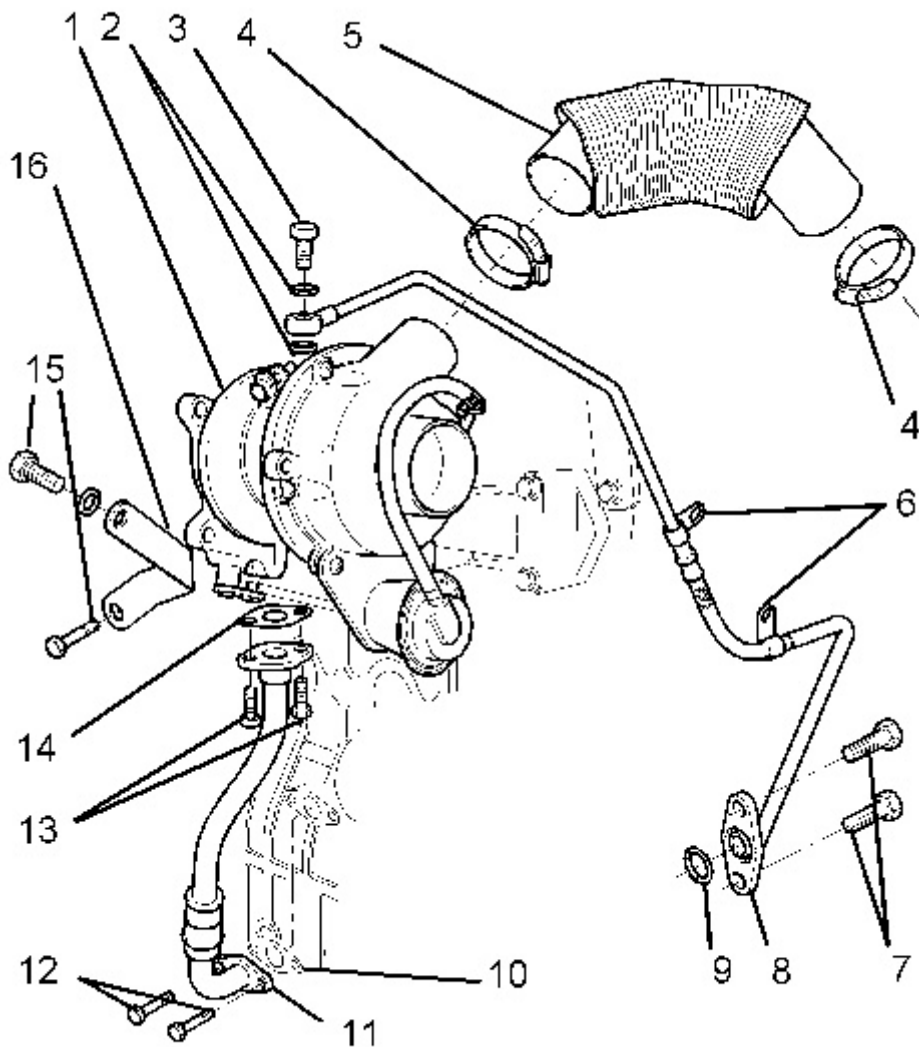


Illustration 1

g01114005

1. Clean the outer surfaces of the turbocharger (1).
2. Loosen the hose clamps (4). Remove the air inlet hose (5).

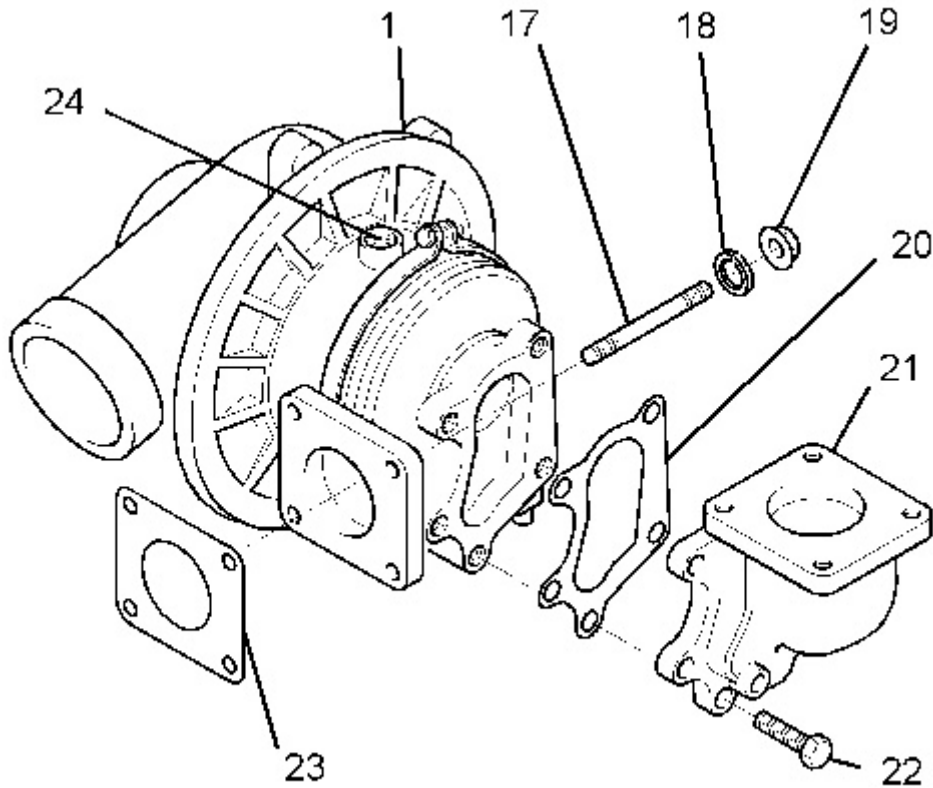


Illustration 2

g01114003

3. Remove the exhaust pipe (not shown) from the exhaust elbow (21). Refer to the OEM provided information for the correct procedure in order to remove the exhaust pipe.
4. Remove the setscrews (15) and remove the support bracket for the turbocharger (16). Note the position of the support bracket for installation.
5. Remove the setscrews (22). Remove the exhaust elbow (21) from the turbocharger (1). Remove the gasket for the exhaust elbow (20) from the turbocharger. Discard the gasket.
6. Place a suitable container below the turbocharger (1) in order to collect any spillage of oil.
7. Remove the banjo bolt (3). Remove the oil supply tube assembly (8). Remove the washers (2) from the turbocharger. Discard the washers. If necessary, remove the setscrews (not shown) for the tube clips (6). Remove the setscrews (7). Remove the oil supply tube assembly (8) from the cylinder block. Remove the O-ring (9). Discard the O-ring.
8. Remove the setscrews (13). Remove the oil drain tube assembly (11) from the turbocharger. Remove the joint (14) and discard the joint. If necessary, remove the setscrews (12) and remove the oil drain tube assembly (11) from the cylinder block. Remove the joint (10). Discard the joint.
9. Remove the nuts (19) and the washers (18). Remove the turbocharger (1) from the exhaust manifold. Remove the turbocharger gasket (23) from the exhaust manifold. Discard the gasket. If necessary, remove the studs (17) from the exhaust manifold.

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

10. Inspect the turbocharger for damage. If the turbocharger is damaged use a new part for replacement. Refer to Testing and Adjusting, "Wastegate - Test".
11. Install suitable plastic plugs into the oil supply and into the oil drain ports of the turbocharger (1). Install suitable plastic covers to the inlet and to the outlet of the turbocharger. Install suitable plastic plugs to the oil supply tube assembly (8) and to the oil drain tube assembly (11).

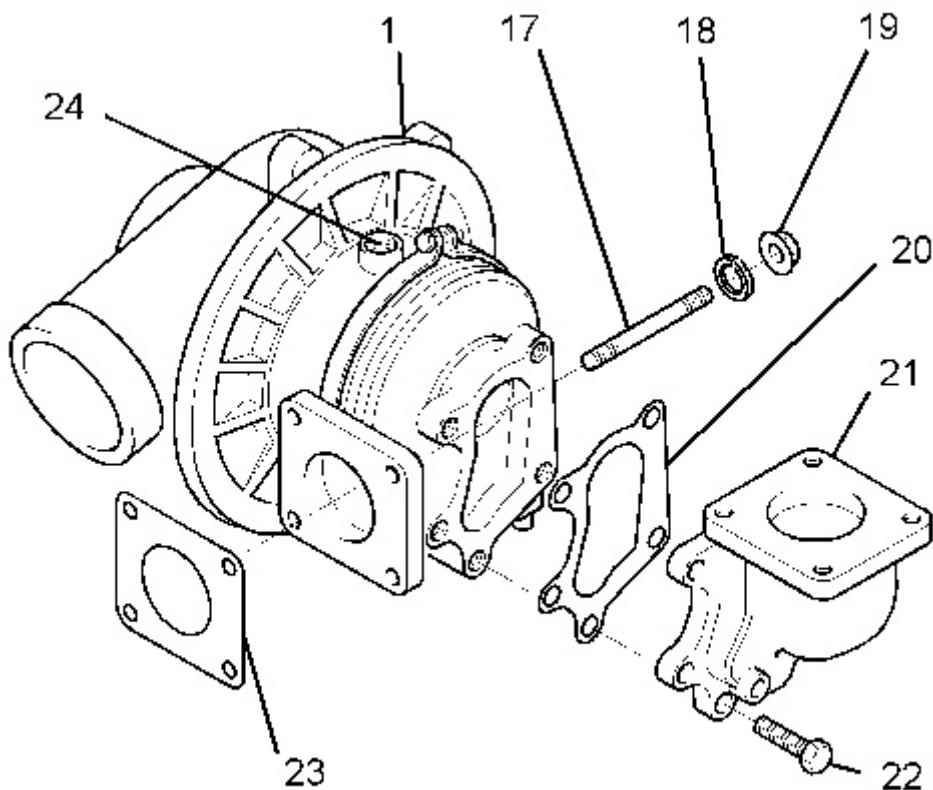
Installation procedure

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

1. Remove all of the plastic plugs from all of the ports of the turbocharger (1). Clean the mating surfaces of the exhaust manifold and the turbocharger.

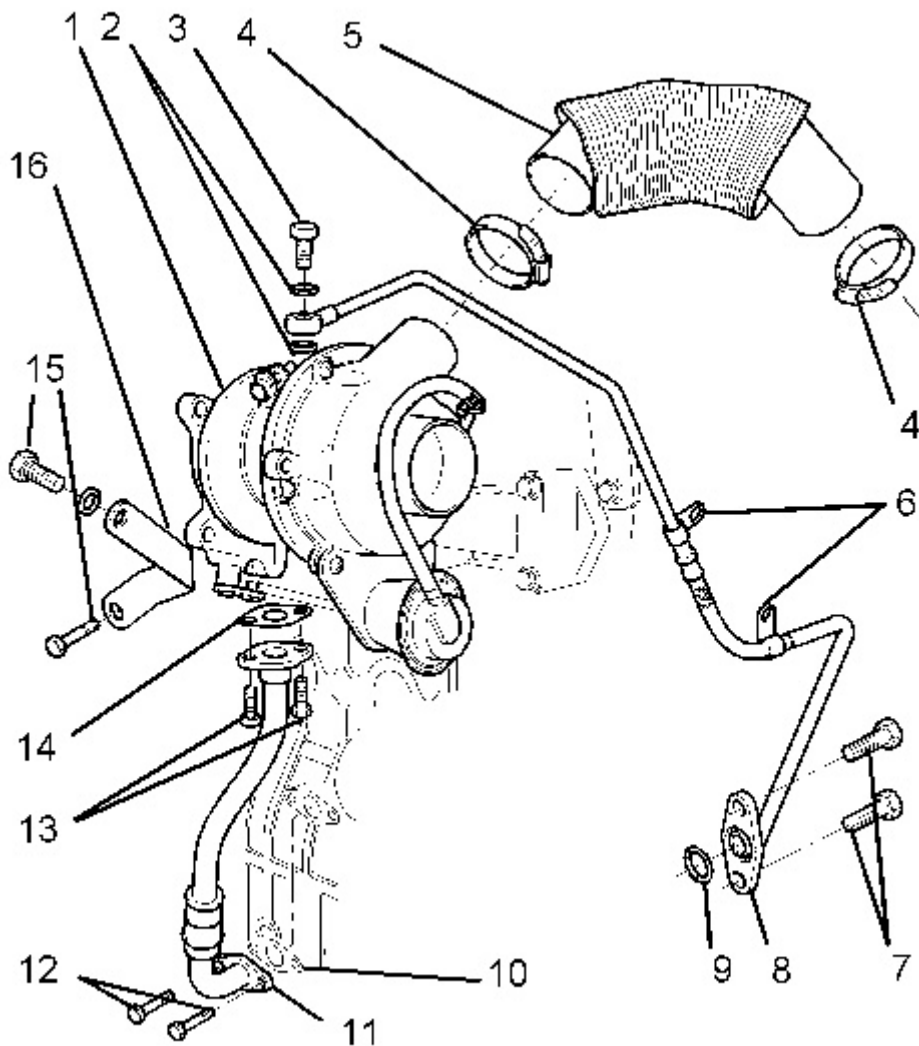


2. Ensure that all of the turbocharger inlet and outlet ports are clean and free from restrictions. The turbocharger shaft must rotate freely.
3. If the studs (17) were previously removed, install the studs into the exhaust manifold. Install a new gasket (23) over the studs (17).

Note: Do not use any sealant on the gasket (23).

Note: Do not use the actuator rod of the wastegate to lift the turbocharger (1).

4. Position the turbocharger (1) onto the exhaust manifold.
5. Install the washers (18) and install the nuts (19). Tighten the nuts to a torque of 25 N·m (18 lb ft).
6. Lubricate the bearing housing of the turbocharger (1) with clean engine oil. Apply the lubricant through the oil supply port (24).



7. Clean the oil supply tube assembly (8) and the oil drain tube assembly (11). Inspect the oil supply tube assembly and the oil drain tube assembly. If necessary, replace the tube assemblies.
8. Position a new joint (14) and the oil drain tube assembly (11) onto the bottom of the turbocharger. Install the setscrews (13). Tighten the setscrews to a torque of 10 N·m (7 lb ft).
9. If necessary, position a new joint (10) and the oil drain tube assembly (11) onto the cylinder block. Install the setscrews (12). Tighten the setscrews to a torque of 10 N·m (7 lb ft).
10. Position the new washers (2) and the oil supply tube assembly (8) onto the turbocharger (1). Install the banjo bolt (3). Tighten the banjo bolt to a torque of 18 N·m (13 lb ft).
11. If necessary, install a new O-ring (9) and the oil supply tube assembly (8) to the cylinder block. Install the setscrews (7). Tighten the setscrews to a torque of 10 N·m (7 lb ft).
12. If necessary, install the spacer (not shown) and install the setscrews (not shown) to the tube clips (6). Torque the setscrews to 10 N·m (7 lb ft).

Note: Ensure that the oil supply tube assembly (8) does not come into contact with any other component when the assembly is installed onto the engine.

13. Clean the mating surfaces of the exhaust elbow (21). Position a new gasket (20) and the exhaust elbow (21) on the turbocharger (1). Install the setscrews (22). Tighten the setscrews to a torque of 32 N·m (24 lb ft).
14. Install the set screws (15) and install the support bracket for the turbocharger (16). Tighten the setscrews to a torque of 25 N·m (18 lb ft).
15. Ensure that the inlet hose (5) is clean and free from defects or restrictions. Loosely install the hose clamps (4) to the air inlet hose (5). Install the air inlet hose to the connection of the inlet manifold and to the inlet of the turbocharger. Tighten the hose clamps.

Note: Do not use oil or grease in order to install the air inlet hose. In order to install a new air inlet hose, lubricate the connection of the inlet manifold and lubricate the inlet of the turbocharger with a solution of water and 5% soap.

16. Position the exhaust pipe onto the exhaust elbow (21). Refer to the OEM information for the correct procedure in order to install the exhaust pipe.
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Media Number -REN2424-09

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i02236283

Exhaust Manifold - Remove and Install

SMCS - 1059-010

Removal Procedure

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

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

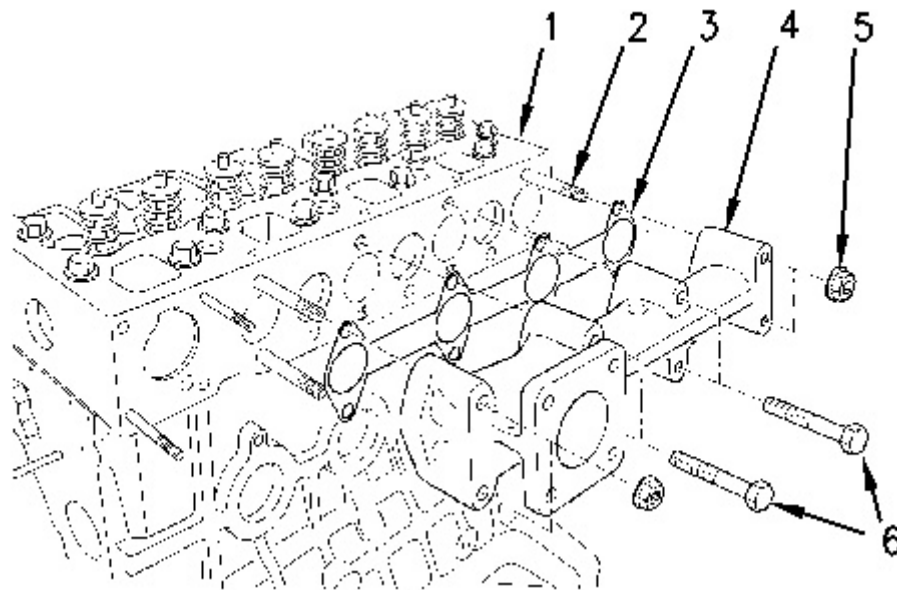


Illustration 1
Typical example

g00825291

1. Loosen the nuts (5) and the setscrews (6).

Note: In order to prevent distortion of the exhaust manifold, loosen the outer fasteners first.

2. Remove the nuts (5) and the setscrews (6).

Note: Identify setscrews of different lengths so that the setscrews can be reinstalled in the correct positions.

3. Remove the exhaust manifold (4) from the cylinder head (1).

4. Remove the gasket (3) from the cylinder head.

5. Remove any remaining gasket material and carbon from the cylinder head and the exhaust manifold. Be careful not to damage the mating surface on the cylinder head or the mating surface on the exhaust manifold.

6. If necessary, remove the exhaust manifold studs (2) from the cylinder head (1).

Installation Procedure

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

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

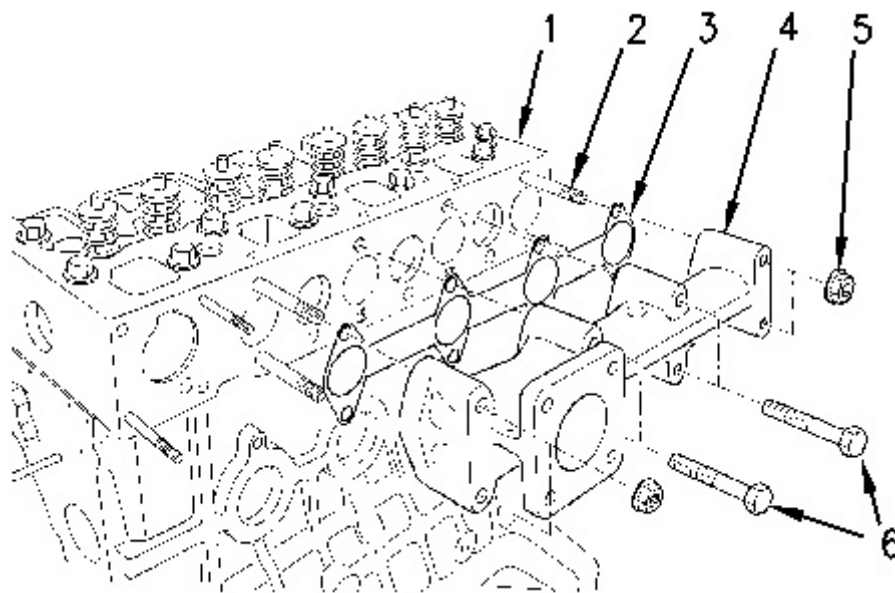


Illustration 2

g00825291

Typical example

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

Note: Do not use any sealant on the exhaust manifold gasket.

3. Put the exhaust manifold (4) in position on the cylinder head (1).
4. Install the nuts (5) and the setscrews (6).

Note: Ensure that setscrews with different lengths are installed in the correct holes.

5. For C0.5, C0.7, C1.1/3011C, C1.5/3013C and C1.6 engines, tighten the nuts (5) and the setscrews (6) to a torque of 10 N·m (89 lb in).

For C2.2/3024C, and C2.2/3024CT engines, tighten the nuts (5) and the setscrews (6) to a torque of 25 N·m (18 lb ft).

Note: On three cylinder engines, tighten the two inner setscrews first. On four cylinder engines, tighten the four inner setscrews first. Then tighten the two outer setscrews and the two nuts.

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i02236281

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

Start By:

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

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

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

Note: Before you begin the removal of the valve springs, refer to Specifications, "Cylinder Head - Valves" and Testing and Adjusting, "Cylinder Head - Inspect" for appropriate information on the valve springs.

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.

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

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

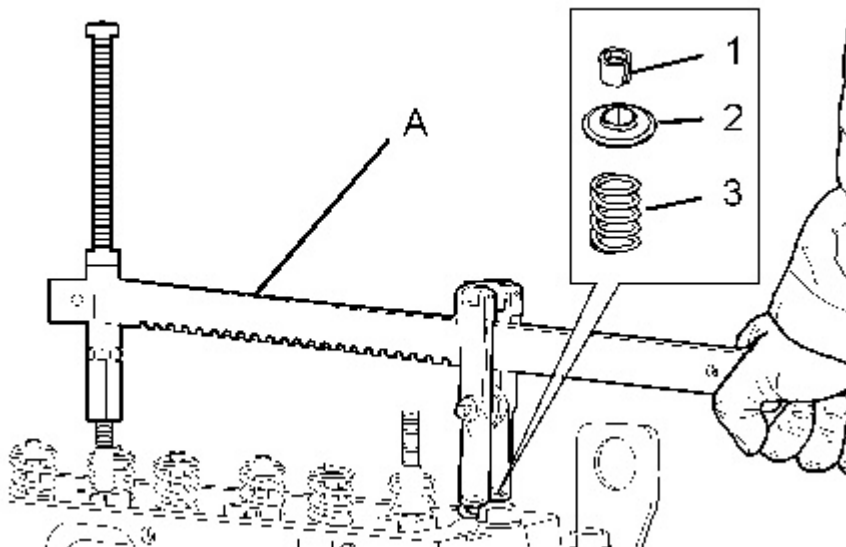


Illustration 1

Typical example

g01129177

1. Use the following procedure in order to find the top dead center position of the appropriate piston.
 - a. Install tool (A) in position on the cylinder head in order to compress the appropriate valve spring (3).
 - b. Compress the valve spring (3) sufficiently in order to open the valve only. Do not compress the valve spring so that the valve keepers (1) could be removed from the recess in the valve stem or so that the valve stem seal (not shown) could be damaged.
 - c. Slowly turn the crankshaft until the piston touches the valve.
 - d. Continue to turn the crankshaft and release the pressure on tool (A) until the piston is at the top center position.

NOTICE

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

Note: If you are replacing all of the valve springs, on four cylinder engines only, the procedure can be done on two cylinders at the same time. The procedure can be done on cylinder 1 and cylinder 4, or on cylinder 2 and cylinder 3. Remember that the crankshaft must not be turned while the valve springs are removed. Ensure that all of the valve springs are installed before changing from one pair of cylinders to the other pair of cylinders.

NOTICE

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

2. Use tool (A) in order to compress the valve spring (3). Remove the valve keepers (1).
3. Remove the valve spring retainer (2) and remove the valve spring (3).

Installation Procedure

Table 2

Required Tools			
Tool	Part Number	Part Description	Qty
A	9U-6195	Valve Spring Compressor	1

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

! 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

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

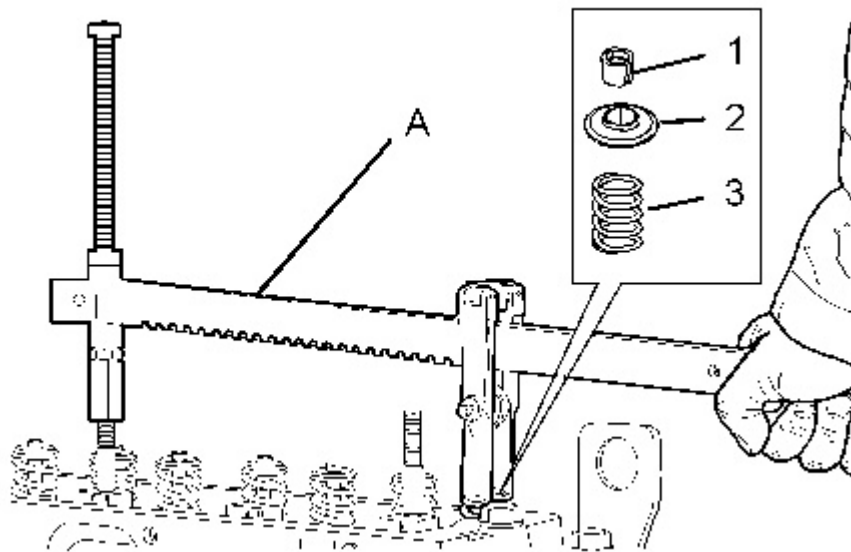


Illustration 2
Typical example

g01129177

1. Place the valve springs (3) into position on the cylinder head.
2. Install the valve spring retainer (2).

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

NOTICE

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

4. Install two valve keepers (1) in order to lock the valve springs in position.

NOTICE

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

5. Carefully release the pressure on tool (A). Remove tool (A). Ensure that all of the valves are secured in place by a valve spring and valve keepers. Rotate the crankshaft through about 45 degrees in order to clear the piston from the valve. Lightly strike the top of the valve with a soft hammer in order to ensure that the valve keepers (1) are properly installed.

Note: If you are replacing all of the valve springs, on four cylinder engines only, the procedure can be done on two cylinders at the same time. The procedure can be done on cylinder 1 and cylinder 4, or on cylinder 2 and cylinder 3.

End By:

- a. Install the rocker shaft assembly. Refer to Disassembly and Assembly, "Rocker Shaft and Pushrod - Install".
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i02236282

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

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 two cylinder, the three cylinder and the four cylinder engines. The illustrations show the 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 an identification mark on the heads of the valves for installation purposes.

Note: The head of the inlet valve has a larger diameter than the head of the exhaust valve.

3. Position the cylinder head on a suitable surface with the valve springs facing upward.

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

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.

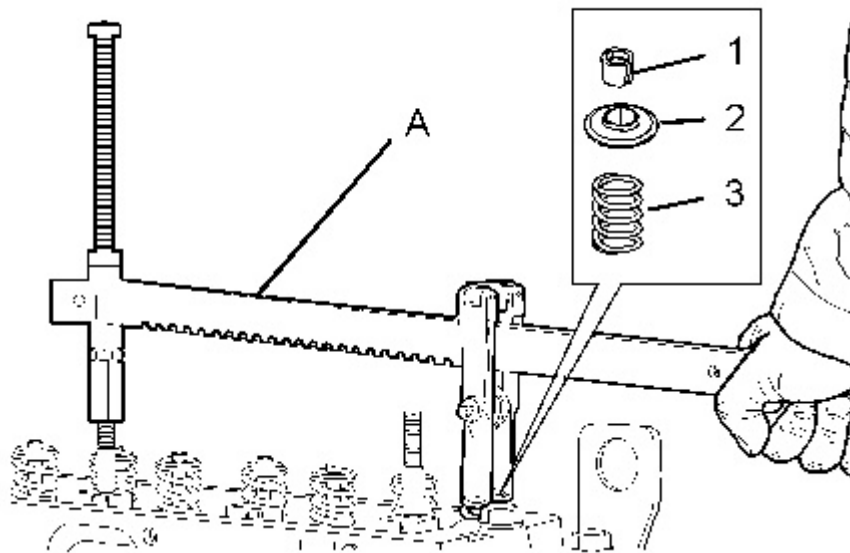


Illustration 1
Typical example

g01129177

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

NOTICE

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

-
5. Apply pressure to tool (A). Remove the valve keepers (1).
 6. Slowly release the pressure on tool (A).
-

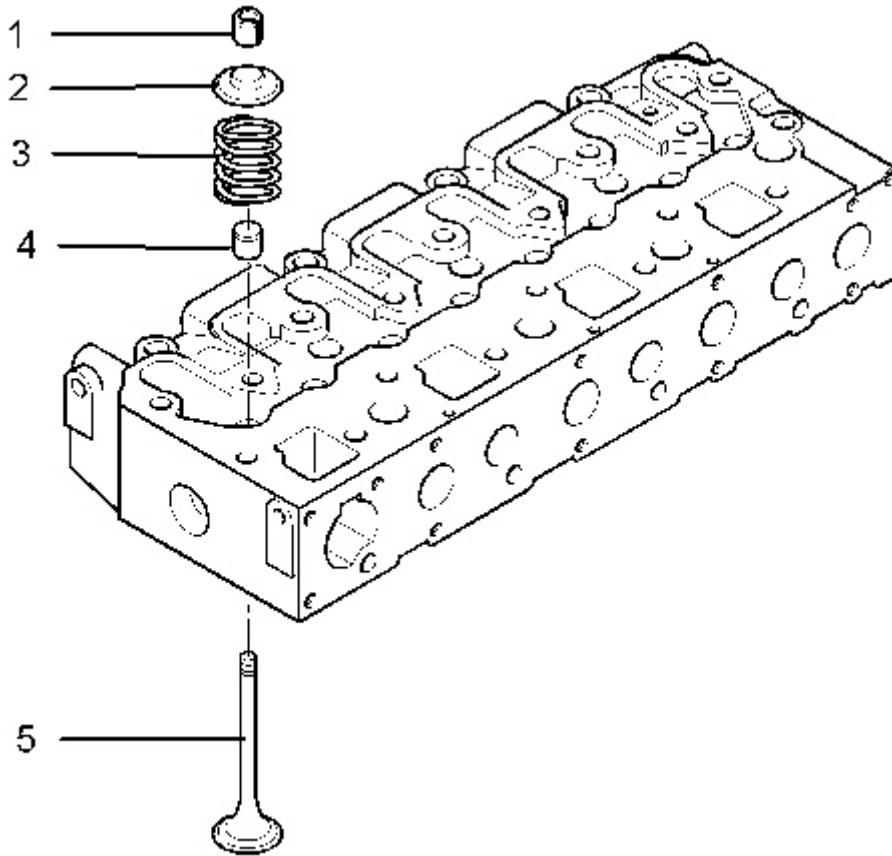


Illustration 2
Typical example

g01129220

7. Remove the valve spring retainer (2).
8. Remove valve spring (3).
9. Repeat steps 4 to 8 for the remaining valves.
10. Remove tool (A).
11. Remove the valve stem seals (4).
12. Carefully turn over the cylinder head.
13. Remove the valves (5).

Installation Procedure

Required Tools

Tool	Part Number	Part Description	Qty
A	9U-6195	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 two cylinder, the three cylinder and the four cylinder engines. The illustrations show the four cylinder engine.

1. Clean all parts. Ensure that all ports, all coolant passages and all lubrication passages are free from debris. To inspect the cylinder head, refer to Testing and Adjusting, "Cylinder Head Inspect" for further information.
 2. Inspect all of the valve seats for wear and for damage. Refer to Specifications, "Cylinder Head Valves" and refer to Testing and Adjusting, "Valve Depth - Inspect " for further information.
 3. Inspect all of the valve guides for wear and for damage. Refer to Specifications, "Cylinder Head Valves" and refer to Testing and Adjusting , "Valve Guide - Inspect" for further information.
-

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