UENR4546 (en-us)
March 2016

Perkins®
THE HEART OF EVERY GREAT MACHINE

Disassembly and Assembly

404A-22SG1 Gas Industrial Engine

EX (Engine)

Important Safety Information

Most accidents that involve product operation, maintenance and repair are caused by failure to observe basic safety rules or precautions. An accident can often be avoided by recognizing potentially hazardous situations before an accident occurs. A person must be alert to potential hazards. This person should also have the necessary training, skills and tools to perform these functions properly.

Improper operation, lubrication, maintenance or repair of this product can be dangerous and could result in injury or death.

Do not operate or perform any lubrication, maintenance or repair on this product, until you have read and understood the operation, lubrication, maintenance and repair information.

Safety precautions and warnings are provided in this manual and on the product. If these hazard warnings are not heeded, bodily injury or death could occur to you or to other persons.

The hazards are identified by the “Safety Alert Symbol” and followed by a “Signal Word” such as “DANGER”, “WARNING” or “CAUTION”. The Safety Alert “WARNING” label is shown below.

⚠ WARNING

The meaning of this safety alert symbol is as follows:

Attention! Become Alert! Your Safety is Involved.

The message that appears under the warning explains the hazard and can be either written or pictorially presented.

Operations that may cause product damage are identified by “NOTICE” labels on the product and in this publication.

Perkins cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in this publication and on the product are, therefore, not all inclusive. If a tool, procedure, work method or operating technique that is not specifically recommended by Perkins is used, you must satisfy yourself that it is safe for you and for others. You should also ensure that the product will not be damaged or be made unsafe by the operation, lubrication, maintenance or repair procedures that you choose.

The information, specifications, and illustrations in this publication are on the basis of information that was available at the time that the publication was written. The specifications, torques, pressures, measurements, adjustments, illustrations, and other items can change at any time. These changes can affect the service that is given to the product. Obtain the complete and most current information before you start any job. Perkins dealers or Perkins distributors have the most current information available.

⚠ WARNING

When replacement parts are required for this product Perkins recommends using Perkins replacement parts.

Failure to heed this warning can lead to premature failures, product damage, personal injury or death.

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NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

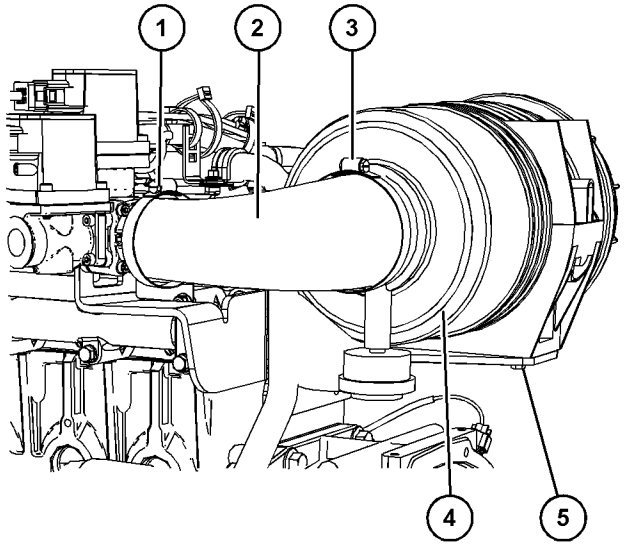

Illustration 1 g06038783

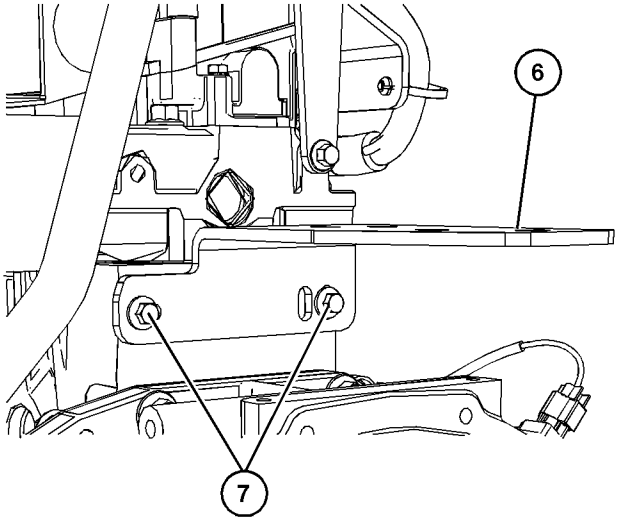

Illustration 2 g06038784

1. Loosen hose clamp (1) and hose clamp (3). Remove hose assembly (2) from the assembly of air cleaner (4) and the fuel ratio control inlet.

2. Remove nuts and bolts (5) from the assembly of air cleaner (4). Remove the assembly of air cleaner from bracket (6).

3. If necessary, remove bolts (7) and remove bracket (6). Support the bracket as the bolts are removed.

Installation Procedure

NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

1. Ensure all components of the assembly of the air cleaner and bracket are from wear or damage. Replace any component that is worn or damaged.

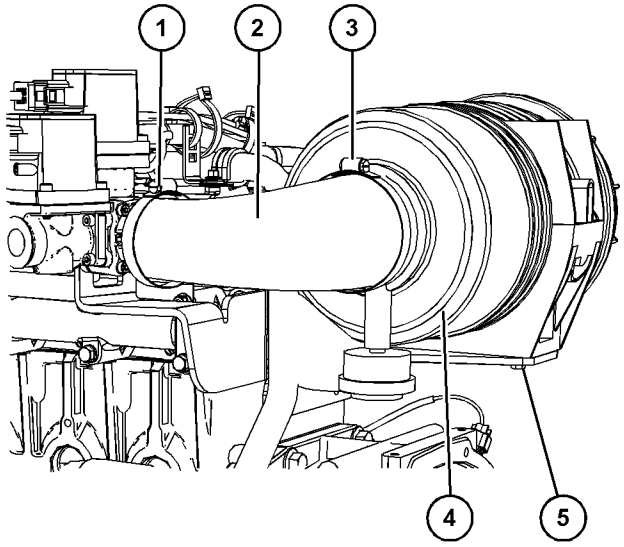

Illustration 3 g06038783

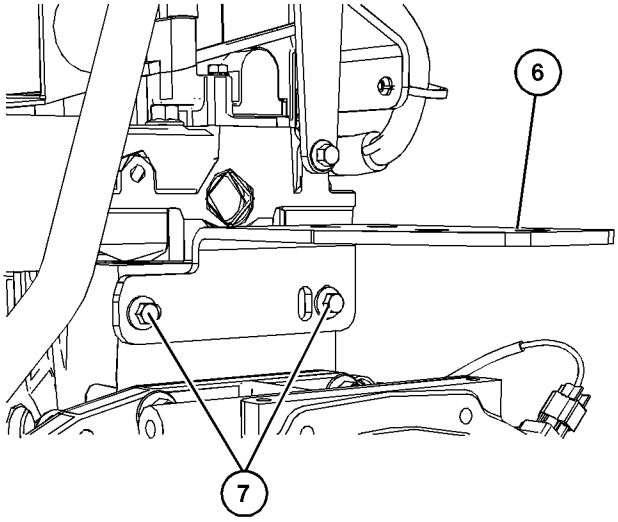

Illustration 4 g06038784

2. If necessary, install bracket (6) onto the engine. Install bolts (7) to the bracket. Support the bracket as the bolts are installed. Tighten the bolt to a torque of 22 N·m (195 lb in).

3. Install the assembly of air cleaner (4) onto bracket (6). Install nuts and bolts (5) to the assembly of the air cleaner. Tighten the nuts and bolts to a torque of 22 N·m (195 lb in).

4. Install hose assembly (2) to the assembly of air cleaner (4) and the fuel ratio control inlet. Ensure that hose clamp (1) and hose clamp (3) are correctly orientated.

5. Tighten hose clamp (1) and hose clamp (3) to a torque of 8 N·m (71 lb in).

6. If necessary, replace air cleaner element for the assembly air cleaner (4). Refer to Operation and Maintenance Manual, Engine Air Cleaner Element - Replace for the correct procedure.

i06590650

Ignition Coil - Remove and Install

Removal Procedure

⚠ WARNING

The ignition system may cause an electrical shock hazard, which may cause personal injury or death. Avoid contacting the ignition system components and the ignition system wiring during operation.

NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

1. Turn the battery disconnect switch to the OFF position.

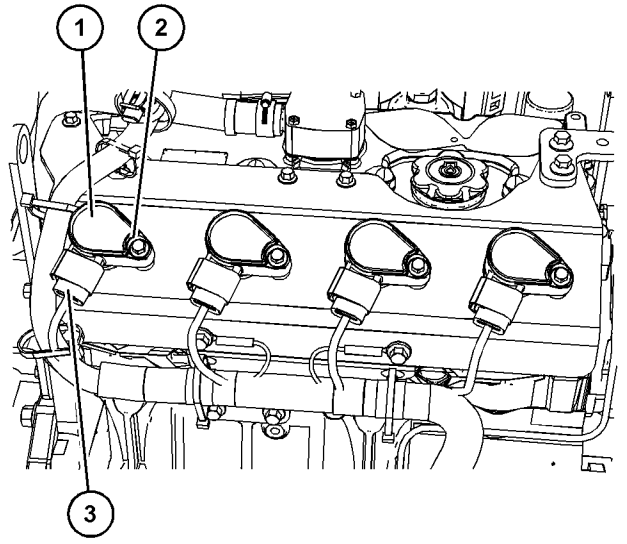

Illustration 5 g06037856

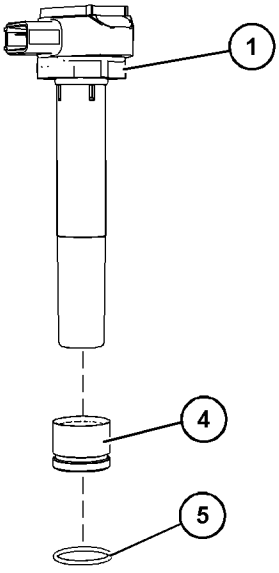

Illustration 6 g06037888

2. Disconnect harness assembly (3) from ignition coil (1).

3. Remove bolt (2) from ignition coil (1). Remove the ignition coil from the bracket.

4. Remove sleeve (4) from ignition coil (1).

5. Remove O-ring seal (5) from sleeve (4)

6. If necessary, follow Step 2 through Step 5 to remove remaining ignition coil (1) from the bracket.

Installation Procedure

1. Ensure that all components of the ignition coil are free from wear or damage. If any component is worn or damaged replace the component.

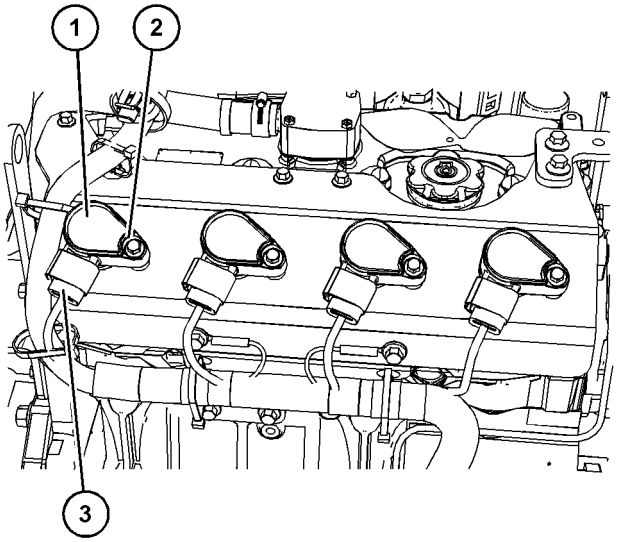

Illustration 7 g06037856

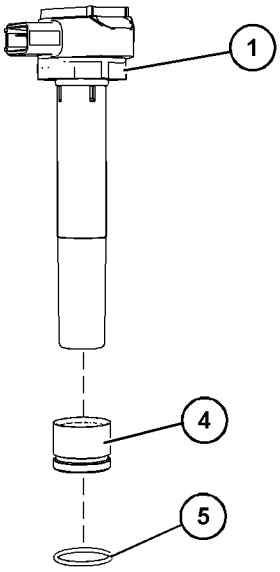

Illustration 8 g06037888

2. Install a new O-ring seal (5) to sleeve (4). Install the sleeve to ignition coil (1).

3. Install ignition coil (1) to the bracket. Install bolt (2) hand tight. Ensure that the ignition coil is correctly seated onto the bracket.

4. Tighten bolt (2) to a torque of 10 N·m (89 lb in).

5. Connect harness assembly (3) to ignition coil (1).

6. If necessary, follow Step 2 through Step 5 to install remaining ignition coil (1) to the bracket.

7. Turn the battery disconnect switch to the ON position.

i06505946

Exhaust Manifold - Remove and Install

Removal Procedure

NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

1. Disconnect the Original Equipment Manufacture (OEM) exhaust system from the adaptor on the exhaust manifold. Refer to the OEM for the correct procedure.

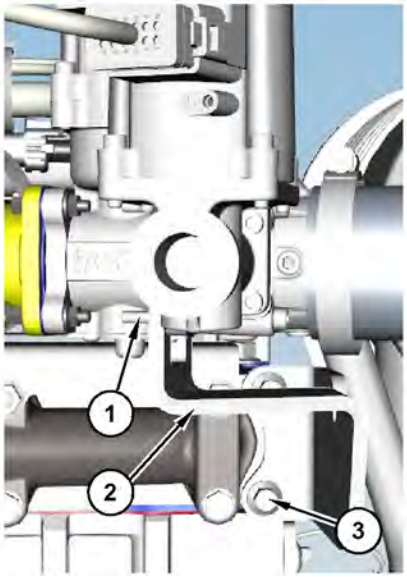

Illustration 9 g06035072

2. Remove nuts (1) from the Allen head bolts.

3. Remove bolts (3) from bracket (2). Remove the bracket.

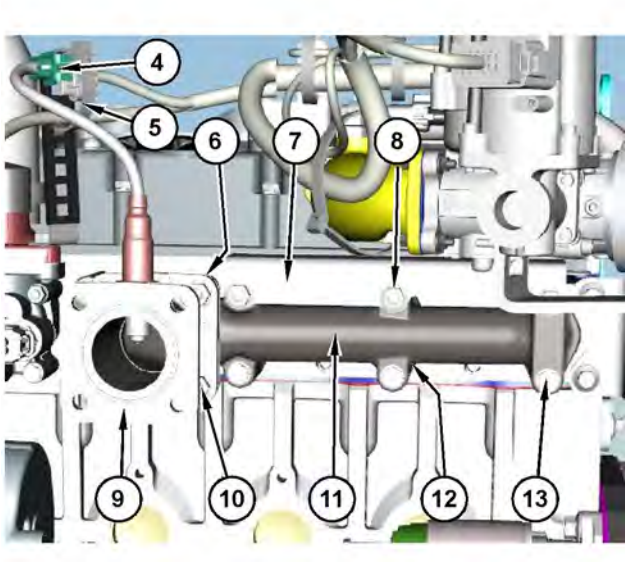

Illustration 10 g06034680

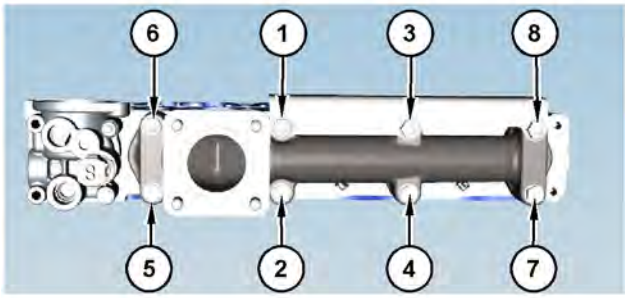

Illustration 11 g06035076

Tightening sequence

4. Cut cable strap (5) and disconnect harness assembly (4).

5. Remove nuts (10) and remove adapter (9) from exhaust manifold (11). Remove gasket (6) (not shown).

6. Loosen nuts (8) and bolts (13) in reverse numerical sequence. Refer to Illustration 17 . Identify bolts of different lengths so that the bolts can be installed in the correct positions.

Note: Loosen the bolts and the nuts in reverse numerical sequence will help to prevent distortion of the exhaust manifold.

7. Remove heat shield (7) from exhaust manifold (11).

8. Remove exhaust manifold (11) from the cylinder head.

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

10. Remove exhaust manifold (4) from cylinder head (1). Note the orientation of the exhaust manifold for installation.

11. Remove gasket (3) from cylinder head (1).

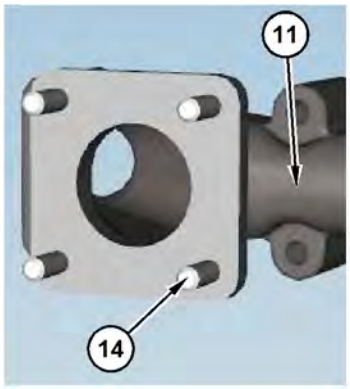

Illustration 12 g06035112

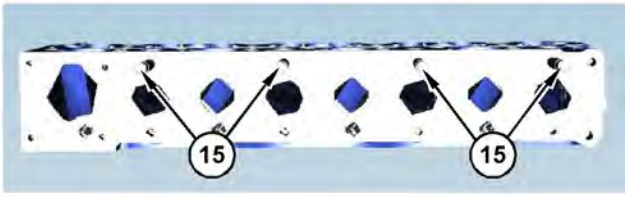

Illustration 13 g06035114

12. If necessary, remove studs (14) from exhaust manifold (11).

13. If necessary, remove studs (15) from the cylinder head.

Installation Procedure

NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

1. Ensure that the gasket surfaces of the cylinder head and the exhaust manifold are clean and free from damage. Ensure that all components of the exhaust manifold are free from wear or damage. Replace any component that is worn or damaged.

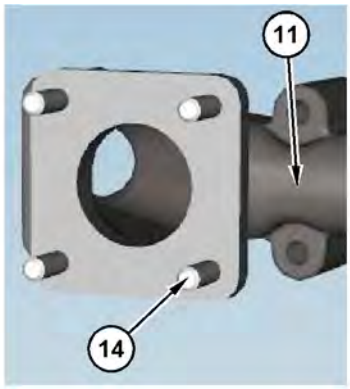

Illustration 14 g06035112

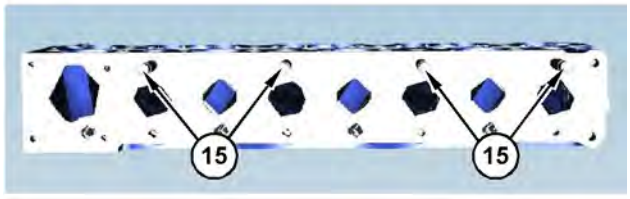

Illustration 15 g06035114

2. If necessary, install studs (14) to exhaust manifold (11). Tighten the studs to a torque of 11 N·m (97 lb in).

3. If necessary, install studs (15) to the cylinder head. Tighten the studs to a torque of 11 N·m (97 lb in).

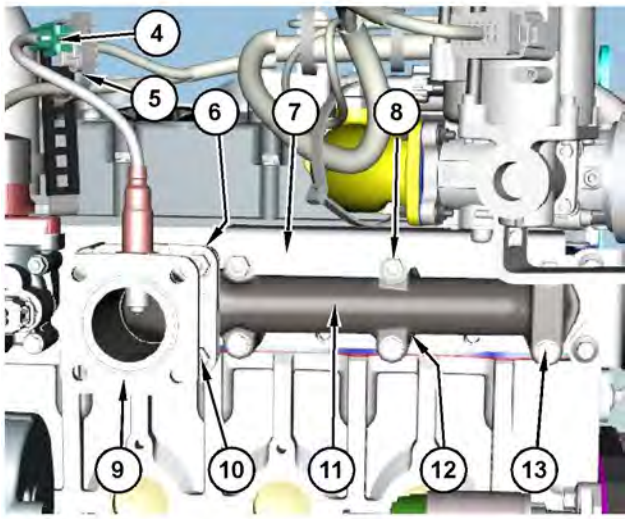

Illustration 16 g06034680

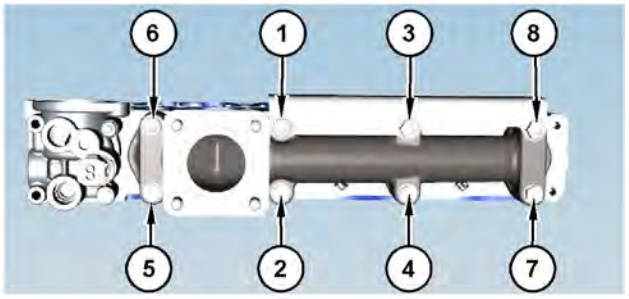

Illustration 17 g06035076
Tightening sequence

4. Install a new gasket (3) onto cylinder head (1). Ensure that the gasket is correctly orientated.

5. Install exhaust manifold (4) onto cylinder head (1). Ensure the correct orientation of the exhaust manifold.

6. Install heat shield (7) to exhaust manifold (11). Install nuts (5) to the exhaust manifold.

7. Install bolts (6) to exhaust manifold (11). Ensure that the different lengths bolts are installed into the correct positions.

8. Tighten nuts (8) and bolts (13) in numerical sequence to a torque of 26 N·m (230 lb in). Refer to Illustration 17 .

9. Install a new gasket (6) (not shown).

10. Install adapter (9) to exhaust manifold (11). Ensure that the adapter is correctly orientated. Install nuts (10) to the adapter. Tighten the nuts to a torque of 26 N·m (230 lb in).

11. Connect harness assembly (4) and install a new cable strap (5).

Note: Ensure that the cable straps meet Original Equipment Manufacture (OEM) specifications.

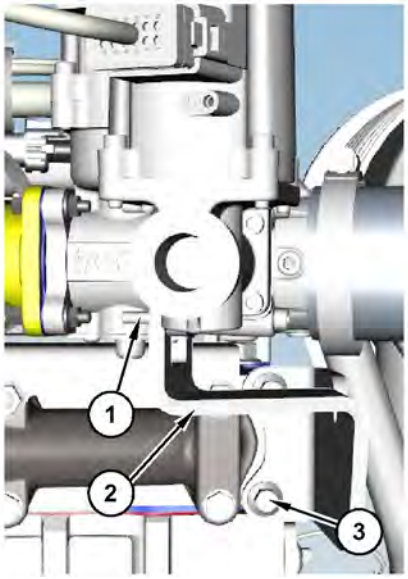

Illustration 18 g06035072

12. Install bracket (2) and install bolts (3).

13. Install nuts (1) to the Allen head bolts.

14. Tighten bolts (3) to a torque of 6 N·m (53 lb in).

15. Tighten Allen head bolts and nuts (1) to a torque of 25 N·m (221 lb in).

16. Connect the OEM exhaust system to the adaptor on the exhaust manifold. Refer to the OEM for the correct procedure.

i06505947

Inlet and Exhaust Valve Springs - Remove and Install

Removal Procedure

Table 1

Required Tools			
Tool	**Part Number**	**Part Description**	**Qty**
A	21825739	Valve Spring Compressor	1
	276102295	Head	1
	27610235	Adapter	1

Start By:

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

⚠ 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
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: 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.

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.

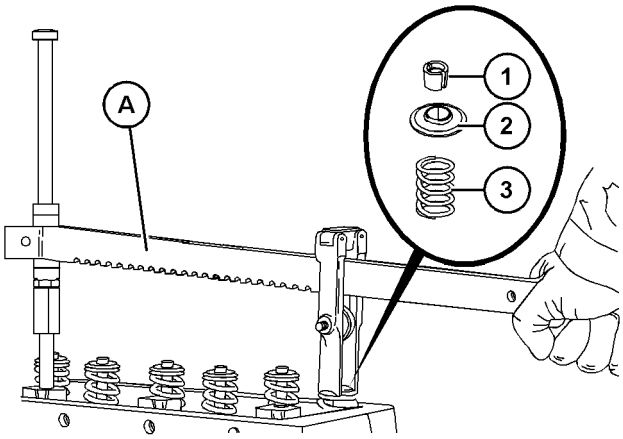

Illustration 19 g06035166

1. Follow Steps 1.a through 1.d to position the appropriate piston at top center.

a. Install Tooling (A) 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.

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.

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). Remove the valve keepers.

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

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

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

6. Remove Tooling (A).

Installation Procedure

Table 2

Required Tools			
Tool	**Part Number**	**Part Description**	**Qty**
A	21825739	Valve Spring Compressor	1
	276102295	Head	1
	27610235	Adapter	1

NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.