KENR6223-03 (en-us)
May 2021

Perkins®

THE HEART OF EVERY GREAT MACHINE

Specifications

400A and 400D Industrial Engines

GG (Engine)
GH (Engine)
GJ (Engine)
GK (Engine)
GL (Engine)
GM (Engine)
GN (Engine)
GP (Engine)
GR (Engine)
GS (Engine)
GT (Engine)
GU (Engine)
GV (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 correctly.

Incorrect 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. You must not use this product in any manner different from that considered by this manual without first satisfying yourself that you have considered all safety rules and precautions applicable to the operation of the product in the location of use, including site-specific rules and precautions applicable to the worksite. 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 you are authorized to perform this work, and that the product will not be damaged or become unsafe by the operation, lubrication, maintenance or repair procedures that you intend to use.

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.

In the United States, the maintenance, replacement, or repair of the emission control devices and systems may be performed by any repair establishment or individual of the owner's choosing.

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i06752656

Engine Design

402D-05 Engine

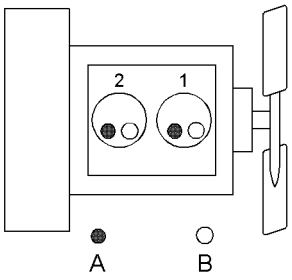

Illustration 1 g01111232

Cylinder and valve location

(A) Exhaust valve
(B) Inlet valve

Bore . . . . . 67 mm ((2.64 inch))

Stroke . . . . . 72 mm ((2.83 inch))

Displacement . . . . . 0.507 L ((31 in^3))

Cylinder arrangement . . . . . In-line

Type of combustion . . . . . Indirect injection

Compression ratio 23.5:1

Number of cylinders 2

Valves per cylinder 2

Valve lash

Inlet valve . . . . . 0.2 mm ((0.0078 inch))
Exhaust valve . . . . . 0.2 mm ((0.0078 inch))

Firing order 1, 2

When the crankshaft is viewed from the front of the engine, the crankshaft rotates in the following direction. . . . . Clockwise

When the camshaft is viewed from the front of the engine, the camshaft rotates in the following direction. . . . . Clockwise

The front of the engine is opposite the flywheel end of the engine. The left side and the right side of the engine are determined from the flywheel end. Number 1 cylinder is the front cylinder of the engine.

403D-07 Engine

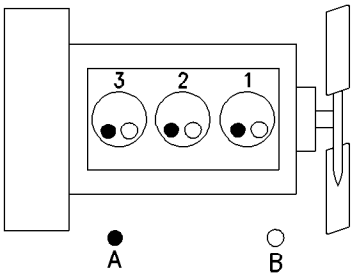

Illustration 2 g00852304

Cylinder and valve location

(A) Exhaust valve
(B) Inlet valve

Bore . . . . . 67 mm ((2.64 inch))

Stroke . . . . . 72 mm ((2.83 inch))

Displacement . . . . . 0.762 L ((46.5 in^3))

Cylinder arrangement . . . . . In-line

Type of combustion . . . . . Indirect injection

Compression ratio 23.5:1

Number of cylinders 3

Valves per cylinder 2

Valve lash

Inlet valve . . . . . 0.2 mm ((0.0078 inch))
Exhaust valve . . . . . 0.2 mm ((0.0078 inch))

Firing order 1, 2, 3

When the crankshaft is viewed from the front of the engine, the crankshaft rotates in the following direction. . . . . Clockwise

When the camshaft is viewed from the front of the engine, the camshaft rotates in the following direction. . . . . Clockwise

The front of the engine is opposite the flywheel end of the engine. The left side and the right side of the engine are determined from the flywheel end. Number 1 cylinder is the front cylinder of the engine.

403A-11 and 403D-11 Engines

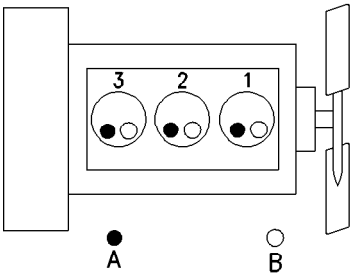

Illustration 3 g00852304

Cylinder and valve location

(A) Exhaust valve
(B) Inlet valve

Bore . . . . . 77 mm ((3.03 inch))

Stroke . . . . . 81 mm ((3.19 inch))

Displacement . . . . . 1.131 L ((69 in^3))

Cylinder arrangement . . . . . In-line

Type of combustion . . . . . Indirect injection

Compression ratio 22.75:1

Number of cylinders 3

Valves per cylinder 2

Valve lash

Inlet valve . . . . . 0.2 mm ((0.0078 inch))
Exhaust valve . . . . . 0.2 mm ((0.0078 inch))

Firing order 1, 2, 3

When the crankshaft is viewed from the front of the engine, the crankshaft rotates in the following direction. . . . . Clockwise

When the camshaft is viewed from the front of the engine, the camshaft rotates in the following direction. . . . . Clockwise

The front of the engine is opposite the flywheel end of the engine. The left side and the right side of the engine are determined from the flywheel end. Number 1 cylinder is the front cylinder of the engine.

403A-15 and 403D-15 Engine

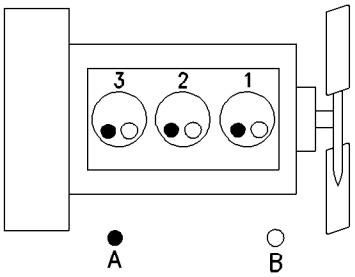

Illustration 4 g00852304

Cylinder and valve location

(A) Exhaust valve
(B) Inlet valve

Bore . . . . . 84 mm ((3.3 inch))

Stroke . . . . . 90 mm ((3.5 inch))

Displacement . . . . . 1.496 L ((91 in^3))

Cylinder arrangement . . . . . In-line

Type of combustion . . . . . Indirect injection

Compression ratio 22.2:1

Number of cylinders 3

Valves per cylinder 2

Valve lash

Inlet valve . . . . . 0.2 mm ((0.0078 inch))
Exhaust valve . . . . . 0.2 mm ((0.0078 inch))

Firing order 1, 2, 3

When the crankshaft is viewed from the front of the engine, the crankshaft rotates in the following direction. . . . . Clockwise

When the camshaft is viewed from the front of the engine, the camshaft rotates in the following direction. . . . . Clockwise

The front of the engine is opposite the flywheel end of the engine. The left side and the right side of the engine are determined from the flywheel end. Number 1 cylinder is the front cylinder of the engine.

403D-15T Engine

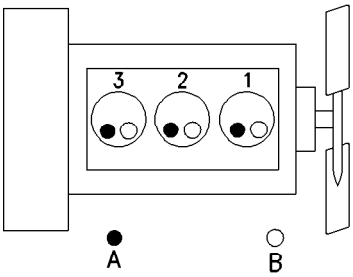

Illustration 5 g00852304

Cylinder and valve location

(A) Exhaust valve
(B) Inlet valve

Bore . . . . . 84 mm ((3.3 inch))

Stroke . . . . . 90 mm ((3.5 inch))

Displacement . . . . . 1.496 L ((91 in^3))

Cylinder arrangement . . . . . In-line

Type of combustion . . . . . Indirect injection

Compression ratio 22.5:1

Number of cylinders 3

Valves per cylinder 2

Valve lash

Inlet valve . . . . . 0.2 mm ((0.0078 inch))
Exhaust valve . . . . . 0.2 mm ((0.0078 inch))

Firing order 1, 2, 3

When the crankshaft is viewed from the front of the engine, the crankshaft rotates in the following direction. . . . . Clockwise

When the camshaft is viewed from the front of the engine, the camshaft rotates in the following direction. . . . . Clockwise

The front of the engine is opposite the flywheel end of the engine. The left side and the right side of the engine are determined from the flywheel end. Number 1 cylinder is the front cylinder of the engine.

403D-17 Engine

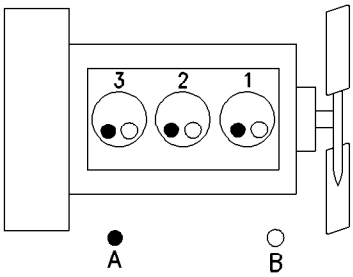

Illustration 6 g00852304

Cylinder and valve location

(A) Exhaust valve
(B) Inlet valve

Bore . . . . . 84 mm ((3.3 inch))

Stroke . . . . . 100 mm ((3.94 inch))

Displacement . . . . . 1.662 L ((101.4 in^3))

Cylinder arrangement . . . . . In-line

Type of combustion . . . . . Indirect injection

Compression ratio 23.1:1

Number of cylinders 3

Valves per cylinder 2

Valve lash

Inlet valve . . . . . 0.2 mm ((0.0078 inch))
Exhaust valve . . . . . 0.2 mm ((0.0078 inch))

Firing order 1, 2, 3

The crankshaft is viewed from the front of the engine.
Direction of rotation . . . . . Clockwise

The camshaft is viewed from the front of the engine.
Direction of rotation . . . . . Clockwise

The front of the engine is opposite the flywheel end of the engine. The left side and the right side of the engine are determined from the flywheel end. Number 1 cylinder is the front cylinder of the engine.

404D-15 Engine

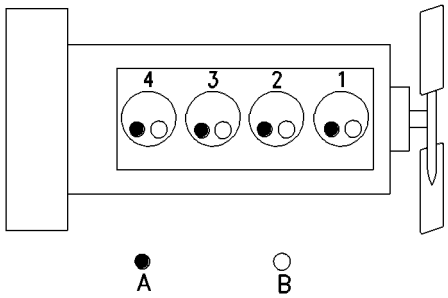

Illustration 7 g00296424

Cylinder and valve location

(A) Exhaust valve
(B) Inlet valve

Bore . . . . . 77 mm ((3.03 inch))

Stroke . . . . . 81 mm ((3.19 inch))

Displacement . . . . . 1.508 L ((92 in^3))

Cylinder arrangement . . . . . In-line

Type of combustion . . . . . Indirect injection

Compression ratio 23:1

Number of cylinders 4

Valves per cylinder 2

Valve lash

Inlet valve . . . . . 0.2 mm ((0.0078 inch))
Exhaust valve . . . . . 0.2 mm ((0.0078 inch))

Firing order 1, 3, 4, 2

When the crankshaft is viewed from the front of the engine, the crankshaft rotates in the following direction. . . . . Clockwise

When the camshaft is viewed from the front of the engine, the camshaft rotates in the following direction. . . . . Clockwise

The front of the engine is opposite the flywheel end of the engine. The left side and the right side of the engine are determined from the flywheel end. Number 1 cylinder is the front cylinder of the engine.

404A-22 and 404D-22 Engines

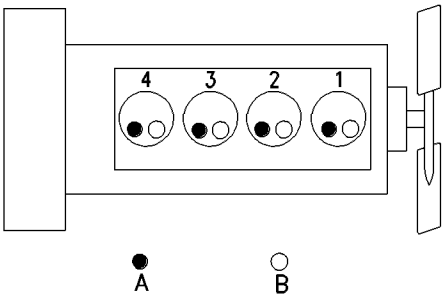

Illustration 8 g00296424

Cylinder and valve location

(A) Exhaust valve
(B) Inlet valve

Bore . . . . . 84 mm ((3.3 inch))

Stroke . . . . . 100 mm ((3.9 inch))

Displacement . . . . . 2.216 L ((135 in^3))

Cylinder arrangement . . . . . In-line

Type of combustion . . . . . Indirect injection

Compression ratio 23.3:1

Number of cylinders 4

Valves per cylinder 2

Valve lash

Inlet valve . . . . . 0.2 mm ((0.0078 inch))
Exhaust valve . . . . . 0.2 mm ((0.0078 inch))

Firing order 1, 3, 4, 2

When the crankshaft is viewed from the front of the engine, the crankshaft rotates in the following direction. . . . . Clockwise

When the camshaft is viewed from the front of the engine, the camshaft rotates in the following direction. . . . . Clockwise

The front of the engine is opposite the flywheel end of the engine. The left side and the right side of the engine are determined from the flywheel end. Number 1 cylinder is the front cylinder of the engine.

404D-22T Engine

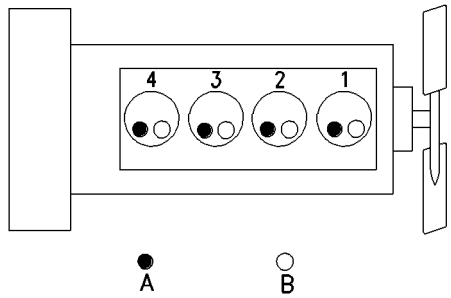

Illustration 9 g00296424

Cylinder and valve location

(A) Exhaust valve
(B) Inlet valve

Bore . . . . . 84 mm ((3.3 inch))

Stroke . . . . . 100 mm ((3.9 inch))

Displacement . . . . . .2.216 L ((135 in^3))

Cylinder arrangement . . . . . In-line

Type of combustion . . . . . Indirect injection

Compression ratio 23.5:1

Number of cylinders 4

Valves per cylinder 2

Valve lash

Inlet valve . . . . . 0.2 mm ((0.0078 inch))
Exhaust valve . . . . . 0.2 mm ((0.0078 inch))

Firing order 1, 3, 4, 2

When the crankshaft is viewed from the front of the engine, the crankshaft rotates in the following direction. . . . . Clockwise

When the camshaft is viewed from the front of the engine, the camshaft rotates in the following direction. . . . . Clockwise

The front of the engine is opposite the flywheel end of the engine. The left side and the right side of the engine are determined from the flywheel end. Number 1 cylinder is the front cylinder of the engine.

404D-22TA Engine

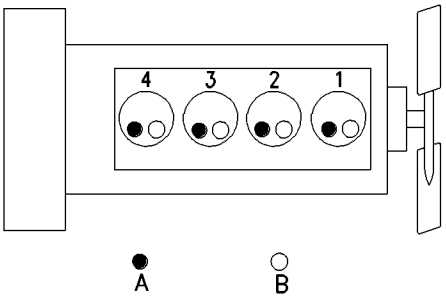

Illustration 10 g00296424

Cylinder and valve location

(A) Exhaust valve
(B) Inlet valve

Bore . . . . . 84 mm ((3.3 inch))

Stroke . . . . . 100 mm ((3.9 inch))

Displacement . . . . . .2.216 L ((135 in^3))

Cylinder arrangement . . . . . In-line

Type of combustion . . . . . Indirect injection

Compression ratio 23.5:1

Number of cylinders 4

Valves per cylinder 2

Valve lash

Inlet valve . . . . . 0.2 mm ((0.0078 inch))
Exhaust valve . . . . . 0.2 mm ((0.0078 inch))

Firing order 1, 3, 4, 2

When the crankshaft is viewed from the front of the engine, the crankshaft rotates in the following direction. . . . . Clockwise

When the camshaft is viewed from the front of the engine, the camshaft rotates in the following direction. . . . . Clockwise

The front of the engine is opposite the flywheel end of the engine. The left side and the right side of the engine are determined from the flywheel end. Number 1 cylinder is the front cylinder of the engine.

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Fuel Injection Lines

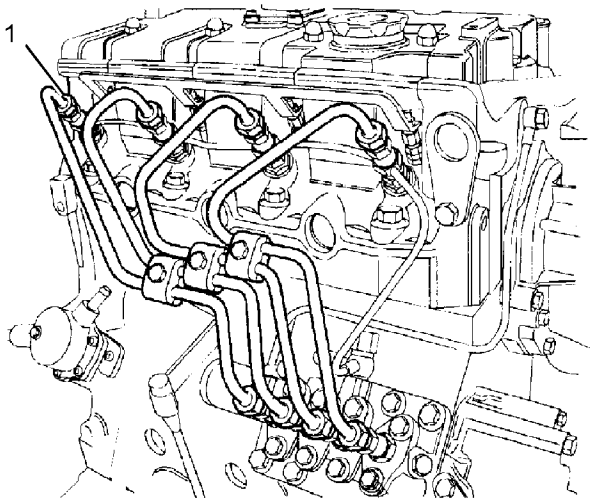

Illustration 11 g01442026

(1) Torque for the union nuts for the fuel injectors

All models . . . . . 20 N·m ((15 lb ft))

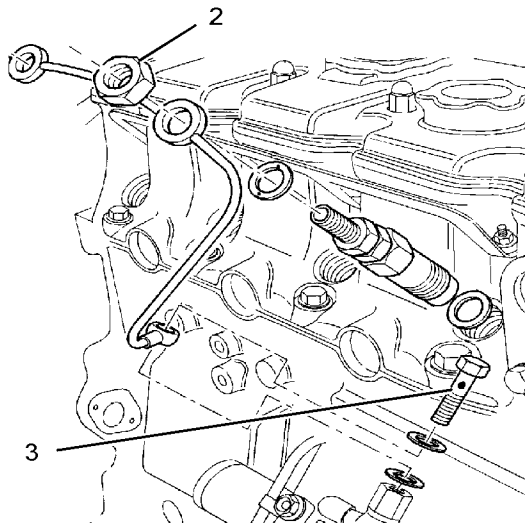

Illustration 12 g01442096

(2) Torque for the nut . . . . . 27 N·m ((20 lb ft))

(3) Torque for the banjo bolt . . . . . 2.5 N·m ((22 lb in))

Note: All washers must be replaced when the fuel lines are removed.

i06752658

Fuel Injection Pump

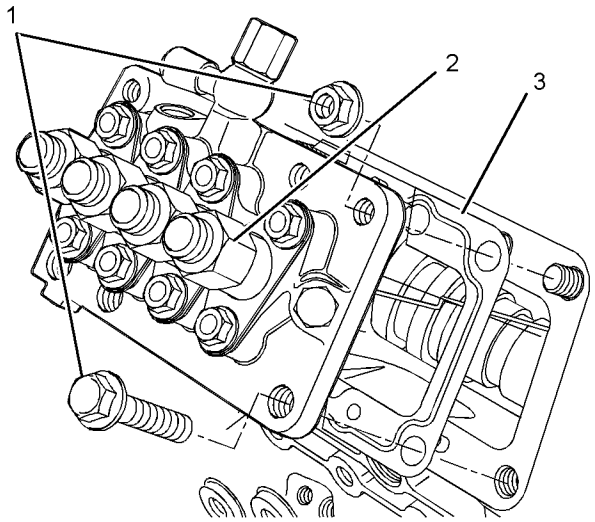

Illustration 13 g01329882
Typical example

Type of fuel injection pump . . . . . In-line cassette

Direction of rotation of the camshaft for the fuel injection pump . . . . . Clockwise from the drive end

(1) Torque for the mounting nuts and setscrews

402D-05, 403D-07, 403A-11, 403D-11, and 404D-15 . . . . . 10 N·m ((89 lb in))

403A-15, 403D-15, 403D-15T, 403D-17, 404A-22, 404D-22, 404D-22T, and 404D-22TA . . . . . 15 N·m ((11 lb ft))

(2) Torque for the delivery valve holders. . . . . 42 N·m ((31 lb ft))

(3) Shim

The shim adjusts the timing of the fuel injection pump. A thicker shim retards the timing. A thinner shim advances the timing. The timing changes 1 degree for each 0.10 mm (0.004 inch) difference in the thickness of the shim. More than one shim can be used. If the fuel injection pump is reinstalled, new shims, which have the same thickness as the original shims, must be installed.

If any of the following new components are installed, new shims which have the same thickness as the original shims must be used.

- Camshaft
- Cylinder block

The following thicknesses of shims are available:

- 0.20 mm (0.008 inch)
- 0.25 mm (0.010 inch)
- 0.35 mm (0.014 inch)
- 0.50 mm (0.020 inch)

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Fuel Injector

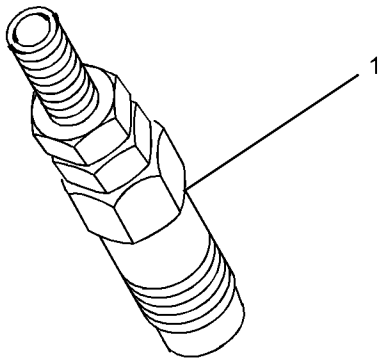

Illustration 14 g01335248
Typical example

(1) Torque for the fuel injectors

All models . . . . . 64 N·m ((47 lb ft))

Note: Remove the original seat washer from the hole for the fuel injector. Do not reuse the original seat washer.

Note: Apply a 2 mm (0.0787 inch) bead of Hyloma Universal Sealing Compound to the first 6 mm (0.2362 inch) of the thread to the fuel injector.

Table 1

Injector Opening Pressures	
Engine Model	**Opening pressure**
402D-05	11960 kPa (1734 psi)
403D-07	11960 kPa (1734 psi)
403A-11	13930 kPa (2020 psi)
403D-11	13930 kPa (2020 psi)
404D-15	14700 kPa (2132 psi)
403A-15	14700 kPa (2132 psi)
403D-15	14700 kPa (2132 psi)
403D-15T	14700 kPa (2132 psi)
403D-17	14700 kPa (2132 psi)
404A-22	14700 kPa (2132 psi)
404D-22	14700 kPa (2132 psi)
404D-22T	14700 kPa (2132 psi)
404D-22TA	14700 kPa (2132 psi)

Leakage in 10 seconds . . . . . 0 drops

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Fuel Transfer Pump

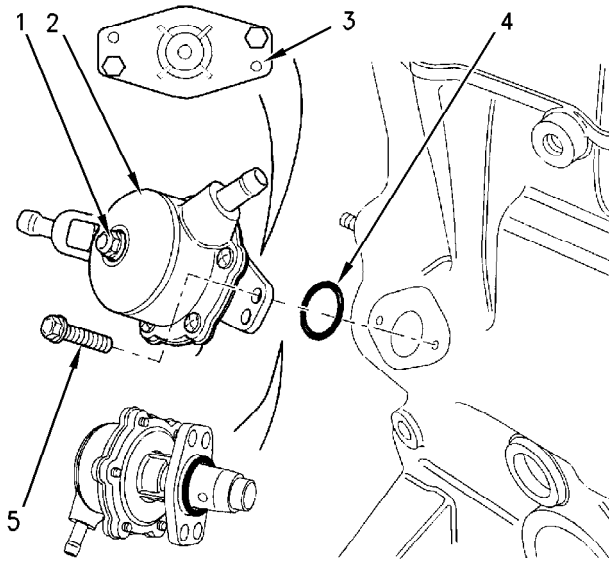

Illustration 15 g00819278

Typical example

(1) Torque for the adjustment screw for the fuel priming pump . . . . . 2.5 N·m ((22 lb in))

(2) Fuel priming pump

(3) Flange for the fuel priming pump

Note: The fuel inlet for the fuel priming can be rotated 360 degrees. The fuel inlet is adjustable in 15 degree increments.

Note: The flange of the fuel priming pump has two sets of locating holes. The two sets of locating holes allow the fuel priming pump to be mounted in four positions for the outlet connection.

(4) O-ring

(5) Tighten the mounting bolts to the following torque. . . . . 9 N·m ((80 lb in))

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Lifter Group

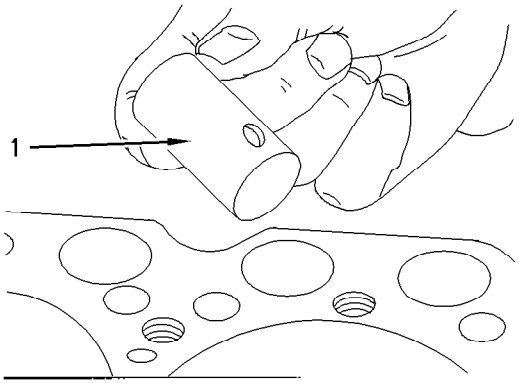

Illustration 16 g00692979

Typical example

Clearance between the lifter and the bore in the engine for the lifter

Standard maximum clearance
403D-11, 403A-11, 403A-15, 403D-15, 403D-15T, 403D-17, 404A-22, 404D-22, 404D-22T, and 404D-22TA . . . . . 0.058 mm ((0.0023 inch))
402D-05, 403D-07, and 404D-15. . . . . 0.053 mm ((0.0021 inch))
Repair limit for all engines . . . . . 0.080 mm ((0.0031 inch))

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Rocker Shaft

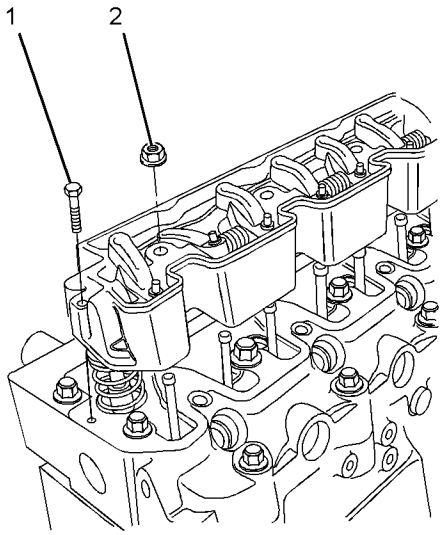

Illustration 17 g01440959
Typical example

Note: Before assembly, lubricate the components with clean engine oil.

(1) Torque for the setscrews

All models . . . . . 10 N·m ((89 lb in))

(2) Torque for the nuts

402D-05 and 403D-07 . . . . . 10 N·m ((89 lb in))

403A-11, 403D-11, and 404D-15 . . . . . 23 N·m ((17 lb ft))

403A-15, 403D-15, 403D-15T, 403D-17, 404A-22, 404D-22, 404D-22T, and 404D-22TA . . . . . .33 N·m ((24 lb ft))

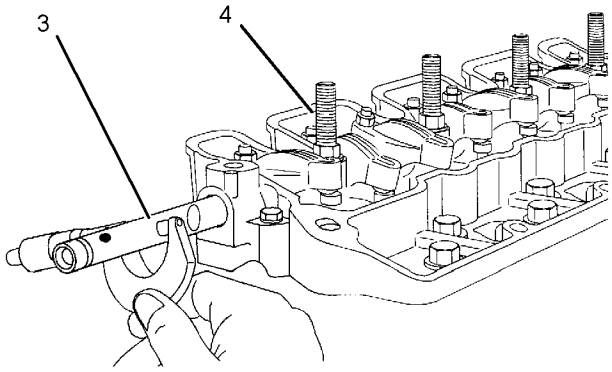

Illustration 18 g01440976
Typical example

(3) Rocker shaft

Diameter of the rocker shaft for the 402D-05 and 403D-07 engines. . . . . 9.95 to 9.968 mm ((0.3917 to 0.3924 inch))

Service limit . . . . . 9.87 mm ((0.3886 inch))

Diameter of the rocker shaft for the 403A-11, 403D-11, and 404D-15 engines . . . . 11.65 to 11.67 mm ((0.4587 to 0.4595 inch))

Service limit . . . . . .11.57 mm ((0.4555 inch))

Diameter of the rocker shaft for the 403A-15, 403D-15, 403D-15T, 403D-17, 404A-22, 404D-22, 404D-22T, and 404D-22TA engines . . . . 14.95 to 14.97 mm ((0.5886 to 0.5894 inch))

Service limit . . . . . 14.87 mm ((0.5854 inch))

(4) Torque for the studs

402D-05 and 403D-07 engines . . . . . 10 N·m ((89 lb in))

403A-11, 403D-11, and 404D-15 engines . . . . . .26 N·m ((19 lb ft))

403A-15, 403D-15, 403D-15T, 403D-17, 404A-22, 404D-22, 404D-22T, and 404D-22TA engines . . . . . .56 N·m ((41 lb ft))

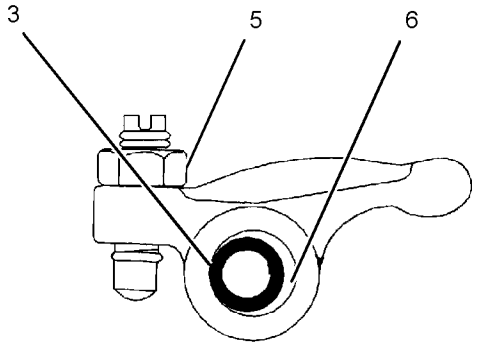

Illustration 19 g01440948

(5) Torque for the locknut. . . . . 14 N·m ((10 lb ft))

(6) Rocker arm clearance on the rocker shaft

Minimum permissible clearance for the 402D-05 and 403D-07 engines . . . . . 0.032 to 0.065 mm ((0.00126 to 0.00260 inch))

Minimum permissible clearance for the 403A-11, 403D-11, and 404D-15 engines . . 0.032 to 0.068 mm ((0.00126 to 0.00268 inch))

Minimum permissible clearance for the 403A-15, 403D-15, 403D-15T, 403D-17, 404A-22, 404D-22, 404D-22T, and 404D-22TA engines . . 0.030 to 0.093 mm ((0.00120 to 0.00366 inch))

Maximum permissible clearance (All models) . . . . . .0.2 mm ((0.008 inch))

i06752673

Valve Mechanism Cover

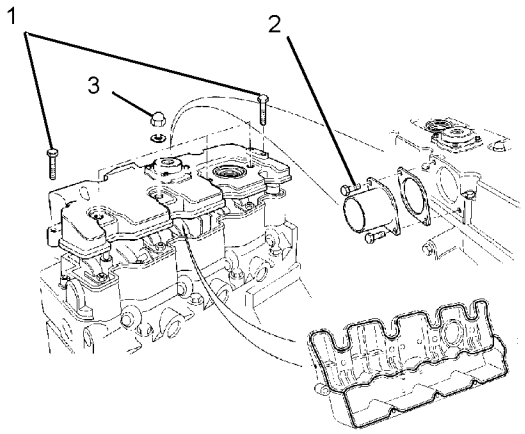

Illustration 20 g01441024
Typical example

(1) Torque for the setscrews for the valve mechanism cover

All models . . . . . 10 N·m ((89 lb in))

(2) Torque for the setscrews for the connector on the inlet manifold

All models . . . . . 14 N·m ((10 lb ft))

(3) Torque for the cap nuts for the valve mechanism cover

402D-05, 403D-07, 403A-11, 403D-11, and 404D-15 . . . . . 10 N·m ((89 lb in))

403A-15, 403D-15, 403D-15T, 403D-17, 404A-22, 404D-22, 404D-22T, and 404D-22TA . . . . . 14 N·m ((10 lb ft))

i06753489

Cylinder Head Valves

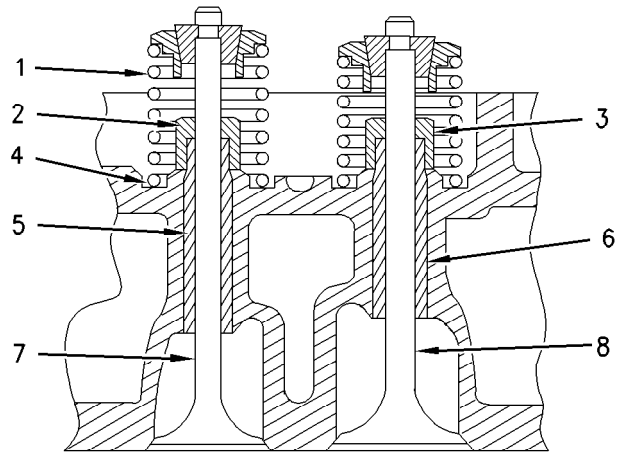

Illustration 21 g00903737

Typical example

(1) Valve spring

Standard free length for 403A-11, 403D-11, 403A-15, 403D-15, 403D-15T, 403D-17, 404D-15, 404A-22, 404D-22, 404D-22T, and 404D-22TA . . . . . 35.0 mm ((1.378 inch))
Standard free length for 402D-05 and 403D-07 . . . . . 33 mm ((1.2992 inch))

Service limit for the standard free length for 403A-11,403D-11, 403A-15, 403D-15, 403D-15T, 403D-17, 404D-15, 404A-22, 404D-22, 404D-22T, and 404D-22TA . . . . 33.5 mm ((1.319 inch))

Service limit for the standard free length for 402D-05 and 403D-07 . 31.5 mm ((1.2402 inch))

Standard test force for 403A-11, 403D-11, 403A-15, 403D-15, 403D-15T, 403D-17, 404D-15, 404A-22, 404D-22, 404D-22T, and 404D-22TA . . . . . 79 N ((17.8 lb))

Standard test force for 402D-05 and 403D-07 . . . . . 68 N ((15.3 lb))

Service limit for the standard test force for 403A-11, 403D-11, 403A-15, 403D-15, 403D-15T, 403D-17, 404D-15, 404A-22, 404D-22, 404D-22T, and 404D-22TA . . . . . 68.6 N ((15.4 lb))

Service limit for the standard test force for 402D-05 and 403D-07. . . . . 59 N ((13.3 lb))

Length under test force for 403A-11, 403D-11, 403A-15, 403D-15, 403D-15T, 403D-17, 404D-15, 404A-22, 404D-22, 404D-22T, and 404D-22TA. . . . . 30.4 mm ((1.197 inch))

Length under test force for 402D-05 and 403D-07 . . . . . .28.3 mm ((1.1142 inch))

(2) Valve guide seal for the exhaust valve

Identification . . . . . .Black garter spring
Label on the black garter spring . . . . . “EX”

(3) Valve guide seal for the inlet valve

Identification . . . . . .Silver garter spring

(4) Valve spring recess for the valve spring

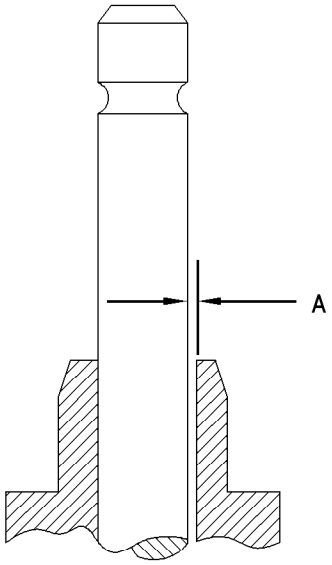

Illustration 22 g00903744

(5) Exhaust valve guide

(A) Clearance between the exhaust valve and the valve guide

402D-05, 403D-07, 403A-11, 403D-11, and 404D-15 . . . . . 0.045 to 0.072 mm ((0.0020 to 0.0030 inch))

403A-15, 403D-15, 403D-15T, 403D-17, 404A-22, 404D-22, 404D-22T, and 404D-22TA . . . . 0.050 to 0.075 mm ((0.0020 to 0.0030 inch))

Service limit (All models) . . . . . 0.25 mm ((0.010 inch))

(6) Inlet valve guide

(A) Clearance between the inlet valve and the valve guide

402D-05, 403D-07, 403D-11, 403D-11, and 404D-15 . . . . . 0.025 to 0.052 mm ((0.0010 to 0.0020 inch))

403A-15, 403D-15, 403D-15T, 403D-17, 404A-22, 404D-22, 404D-22T, and 404D-22TA . . . . 0.030 to 0.060 mm ((0.0012 to 0.0024 inch))

Service limit (All models) . .0.2 mm ((0.008 inch))

(7) Exhaust valve stem

Diameter of the exhaust valve stem for 402D-05 and 403D-07 . . . . . 5.940 to 5.955 mm ((0.2339 to 0.2344 inch))

Service limit . . . . . 5.90 mm ((0.232 inch))

Diameter of the exhaust valve stem for 403D-11, 403D-11, 403A-15, 403D-15, 403D-15T, 403D-17, 404D-15, 404A-22, 404D-22, 404D-22T, and 404D-22TA. . . . . 6.940 to 6.955 mm ((0.2732 to 0.2738 inch))

Service limit . . . . . 6.84 mm ((0.269 inch))

(8) Inlet valve stem

Diameter of the inlet valve stem for 402D-05 and 403D-07 . . . . . 5.960 to 5.975 mm ((0.2346 to 0.2352 inch))

Service limit . . . . . 5.90 mm ((0.232 inch))

Diameter of the inlet valve stem for 403A-11, 403D-11, 403A-15, 403D-15, 403D-15T, 403D-17, 404D-15, 404A-22, 404D-22, 404D-22Tand 404D-22TA. . . . . 6.955 to 6.970 mm ((0.27382 to 0.27441 inch))

Service limit . . . . . 6.89 mm ((0.271 inch))

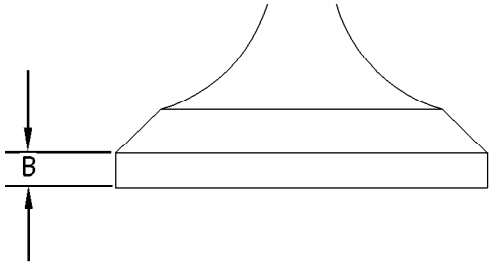

Illustration 23 g00845823

(B) Thickness of the valve head . . 0.925 to 1.075 mm ((0.03642 to 0.04232 inch))

Service limit . . . . . .0.5 mm ((0.020 inch))

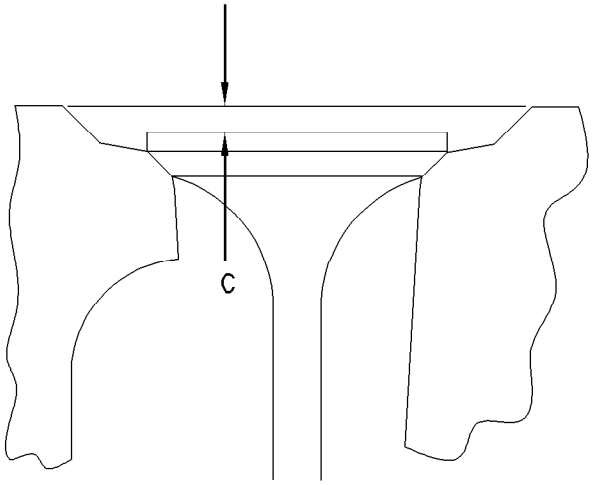

Illustration 24 g00903773

(C) Valve depth below the cylinder head face

Exhaust valve for 402D-05, 403D-07, 403A-11, 403D-11, and 404D-15 . . . . . 0.85 to 1.15 mm ((0.0335 to 0.0453 inch))

Inlet valve for 402D-05, 403D-07, 403A-11, 403D-11, and 404D-15 . . . . . 0.65 to 0.95 mm ((0.0256 to 0.0374 inch))

Inlet and exhaust valves for 403D-15, 403D-15T, 403D-17, 404A-22, 404D-22, 404D-22T, and 404D-22TA. . . . . 0.65 to 0.95 mm ((0.0256 to 0.0374 inch))

Service limit (All models) . .1.8 mm ((0.071 inch))

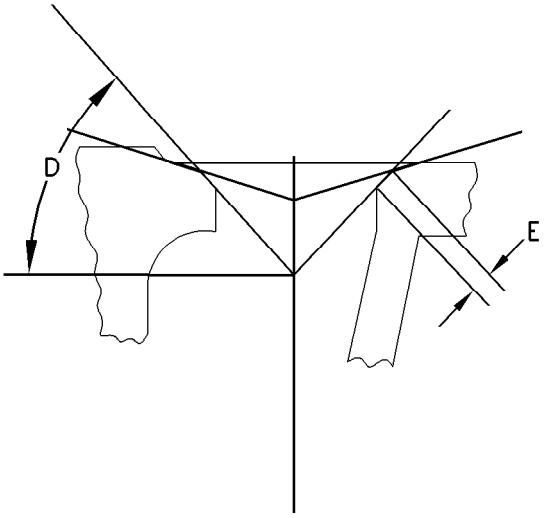

Illustration 25 g00903760

(D) Valve seat angle. . . . . 45 degrees

(E) Contact face

Exhaust valve
402D-05, 403D-07, 403A-11, 403D-11, and 404D-15. . . . . 1.70 to 2.10 mm ((0.0670 to 0.0830 inch))

403A-15, 403D-15, 403D-15T, and 403D-17 . . . . . 1.66 to 1.73 mm ((0.0653 to 0.0681 inch))

404A-22, 404D-22, 404D-22T, and 404D-22TA . . . . . 1.94 to 2.16 mm ((0.0764 to 0.0850 inch))

Service limit (All models) . .2.5 mm ((0.098 inch))

Inlet valve
402D-05, 403D-07, 403A-11, 403D-11, and 404D-15. . . . . 1.70 to 2.10 mm ((0.0670 to 0.0830 inch))

403A-15, 403D-15, 403D-15T, and 403D-17 . . . . . 1.66 to 1.87 mm ((0.0653 to 0.0736 inch))

404A-22, 404D-22, 404D-22T, and 404D-22TA . . . . . 1.50 to 2.00 mm ((0.0591 to 0.0790 inch))

Service limit (All models) . .2.5 mm ((0.098 inch))

i06753534

Cylinder Head

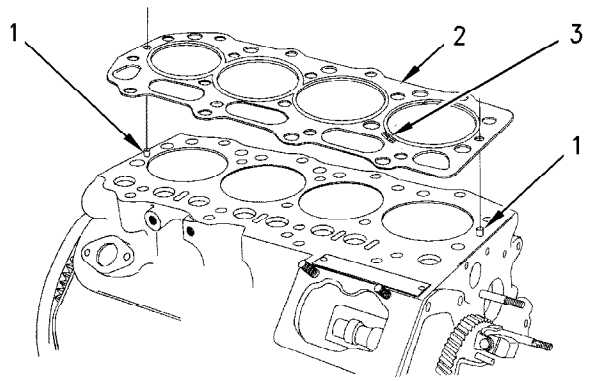

Illustration 26 g00819698

Typical example

(1) Dowel pins

The dowel pins in the cylinder block hold the cylinder head gasket in the correct position when the cylinder head is installed.

(2) Cylinder head gasket

Table 2

Selection of Head Gasket for the 402D-05, 403D-07, 403A-11, 403D-11, and 404D-15 Engines	
Piston Height above Top Face of Cylinder Block	**Gasket Thickness**
0.55 to 0.64 mm (0.0217 to 0.0252 inch)	1.2 mm (0.047 inch)
0.65 to 0.75 mm (0.0256 to 0.0295 inch)	1.3 mm (0.051 inch)

Table 3

Selection of Head Gasket for the 403A-15, 403D-15, and 403D-15TEngines	
Piston Height above Top Face of Cylinder Block	**Gasket Thickness**
0.60 to 0.69 mm (0.0236 to 0.0272 inch)	1.3 mm (0.051 inch)
0.70 to 0.79 mm (0.0276 to 0.0311 inch)	1.4 mm (0.055 inch)

Table 4

Selection of Head Gasket for the 403D-17 Engine	
Piston Height Above Top Face of Cylinder Block	**Gasket Thickness**
0.45 to 0.55 mm (0.0177 to 0.0217 inch)	1.3 mm (0.051 inch)
0.56 to 0.70 mm (0.0220 to 0.0276 inch)	1.4 mm (0.055 inch)

Table 5

Selection of Head Gasket for the 404A-22, 404D-22, 404D-22T, and 404D-22TAEngine	
Piston Height Above Top Face of Cylinder Block	**Gasket Thickness**
0.35 to 0.5 mm (0.0138 to 0.020 inch)	1.2 mm (0.047 inch)
0.5 to 0.6 mm (0.020 to 0.024 inch)	1.3 mm (0.051 inch)

(3) The stamped marking on the cylinder head gasket must face upward. This ensures that the cylinder head gasket is installed correctly.

Tightening Procedure for the Cylinder Head

402D-05 Engine

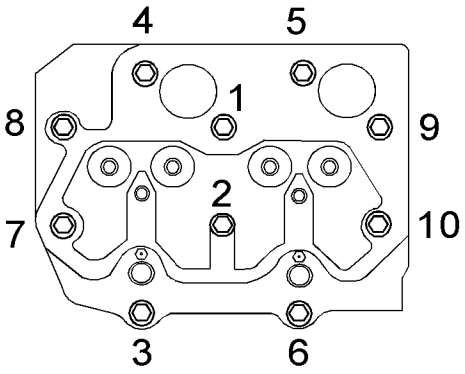

Illustration 27 g01317344

Use the following procedure to tighten the bolts for the cylinder head.

1. Put clean engine oil on the threads of the bolts. The bolts are tightened in the numerical sequence that is shown in Illustration 27 .

Torque for bolts

402D-05 . . . . . 37 N·m ((27 lb ft))

2. Repeat the procedure in step 1 to ensure that all the bolts are tightened to the correct torque.

403D-07, 403A-11, 403D-11, 403A-15, 403D-15, 403D-15T, and 403D-17 Engines

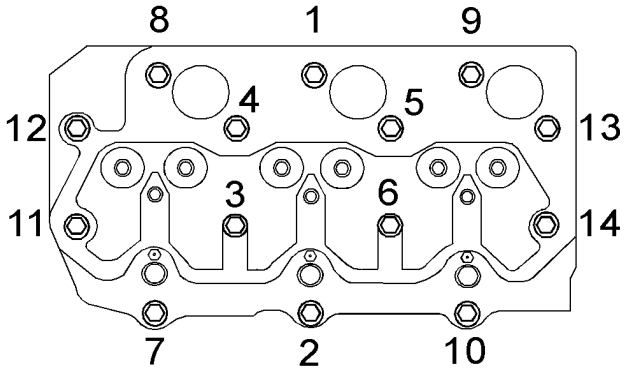

Illustration 28 g01317351

Use the following procedure to tighten the bolts for the cylinder head.

1. Put clean engine oil on the threads of the bolts. The bolts are tightened in the numerical sequence that is shown in Illustration 28 .

Torque for bolts

403D-07 . . . . . 37 N·m ((27 lb ft))

403A-11 and 403D-11 . . . . . 51 N·m ((37 lb ft))

403A-15, 403D-15, 403D-15T, and 403D-17 . . . . . 101 N·m ((75 lb ft))

2. Repeat the procedure in step 1 to ensure that all the bolts are tightened to the correct torque.

404D-15, 404A-22, 404D-22, 404D-22T, and 404D-22TA Engines

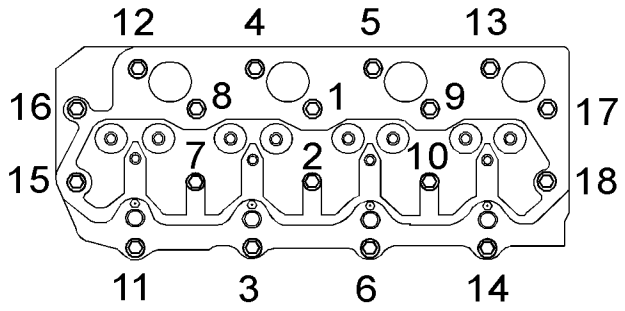

Illustration 29 g01309552

Use the following procedure to tighten the bolts for the cylinder head.

1. Put clean engine oil on the threads of the bolts. The bolts are tightened in the numerical sequence that is shown in Illustration 29 .

Torque for bolts

404D-15 . . . . . 51 N·m ((37 lb ft))

404A-22, 404D-22, 404D-22T, and 404D-22TA . . . . . 101 N·m ((75 lb ft))

2. Repeat the procedure in step 1 to ensure that all the bolts are tightened to the correct torque.

Measuring the Distortion of the Cylinder Head

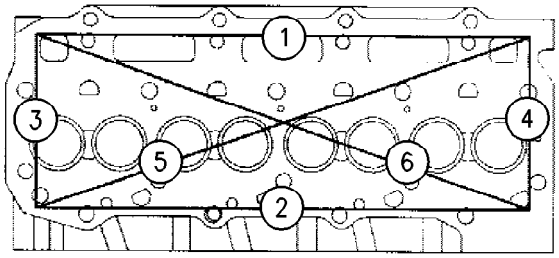

Illustration 30 g00900977

Typical example

Distortion of the cylinder head . . . . . 0.00 to 0.05 mm ((0.000 to 0.002 inch))

Maximum service limit . . . . . 0.12 mm ((0.005 inch))

Maximum limit for regrinding the cylinder head . . . . . 0.15 mm ((0.006 inch))

Note: Use a straight edge and a feeler gauge to check the six positions for distortion.

Refer to Systems Operation, Testing and Adjusting, “Cylinder Head - Inspect” for the procedures for measuring the cylinder head.

Note: If the cylinder head has been machined, check the valve depth below the cylinder head face. Refer to Specifications, “Cylinder Head Valves” for valve depth.

i02961020

Turbocharger

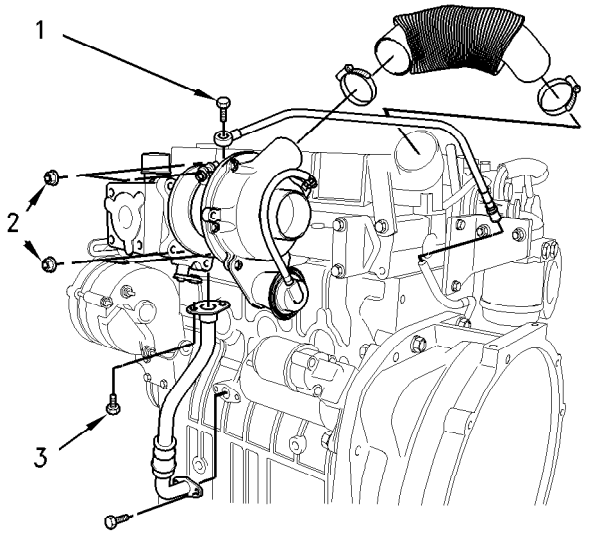

Illustration 31 g00921767

(1) Torque for the banjo bolt for the oil supply line . . . . . 18 N·m ((13.3 lb ft))

(2) Torque for the nuts that secure the turbocharger to the exhaust manifold . . . . . 25 N·m ((18 lb ft))

(3) Torque for the setscrews for the oil drain tube . . . . . 10 N·m ((7 lb ft))

i06752663

Exhaust Manifold

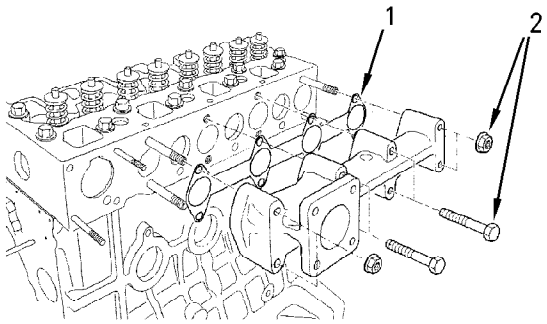

Illustration 32 g00899933

Typical example

(1) Gasket

(2) Torque for the nuts and the setscrews for the exhaust manifold

402D-05, 403D-07, 403A-11, 403D-11, and 404D-15 . . . . . 9.8 N·m ((7.2 lb ft))

403A-15, 403D-15, 403D-15T, 403D-17, 404A-22, 404D-22, 404D-22T, and 404D-22TA . . . . . 25 N·m ((18.4 lb ft))

i06753486

Camshaft

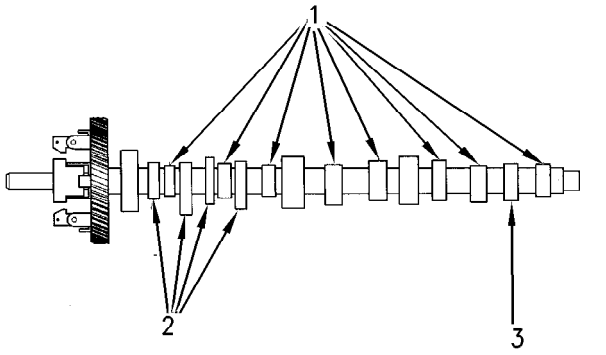

Illustration 33 g00819857

Typical example

(1) Height of the camshaft lobe for the inlet and exhaust valves

402D-05, 403D-07, 403A-11, 403D-11, and 404D-15 . . . . . 26.955 to 27.010 mm ((1.0612 to 1.0634 inch))

403A-15, 403D-15, 403D-15T, and 403D-17 . . 34.453 to 34.507 mm ((1.3564 to 1.3585 inch))

404A-22, 404D-22, 404D-22T, and 404D-22TA . . 34.453 to 34.507 mm ((1.3564 to 1.3585 inch))

Service limit
402D-05, 403D-07, 403A-11, 403D-11, and 404D-15 . . . . . 26.5 mm ((1.0430 inch))

403A-15, 403D-15,403D-15T, 403D-17, 404A-22, 404D-22, 404D-22T, and 404D-22TA . . . . . 33.7 mm ((1.3270 inch))

(2) Height of the camshaft lobe for the fuel injection pump

402D-05, 403D-07, 403A-11, and 403D-11 . . 39.900 to 40.100 mm ((1.5709 to 1.5787 inch))

404D-15 . . . . . 40.900 to 41.100 mm ((1.6102 to 1.6181 inch))

403A-15, 403D-15, 403D-15T, and 403D-17 . . 41.940 to 42.060 mm ((1.6512 to 1.6559 inch))

404A-22, 404D-22, 404D-22T, and 404D-22TA . . 41.940 to 42.060 mm ((1.6512 to 1.6559 inch))

Service limit
402D-05, 403D-07, 403A-11, 403D-11, and 404D-15 . . . . . 39.8 mm ((1.5669 inch))

403A-15, 403D-15, 403D-15T, 403D-17, 404A-22, 404D-22, 404D-22T, and 404D-22TA . . . . . 41.8 mm ((1.6450 inch))

(3) Height of the camshaft lobe for the fuel priming pump

402D-05, 403D-07, 403A-11, 403D-11, and 404D-15 . . . . . 27.900 to 28.000 mm ((1.0984 to 1.1024 inch))

403A-15, 403D-15, 403D-15T, and 403D-17 . . 31.900 to 32.000 mm ((1.2559 to 1.2598 inch))

404A-22, 404D-22, 404D-22T, and 404D-22TA . . 31.900 to 32.000 mm ((1.2559 to 1.2598 inch))

Service limit
402D-05, 403D-07, 403A-11, 403D-11, and 404D-15 . . . . . 27.0 mm ((1.0630 inch))

403A-15, 403D-15, 403D-15T, 403D-17, 404A-22, 404D-22, 404D-22T, and 404D-22TA . . . . . 30.0 mm ((1.1810 inch))

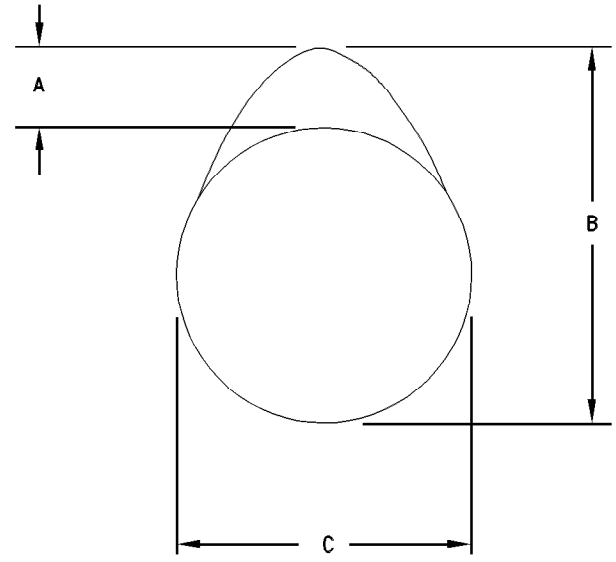

Illustration 34 g00295323

(A) Actual camshaft lobe lift

(B) Height of the camshaft lobe

(C) Base circle

To determine the lobe lift, use the procedure that follows:

1. Measure the height of the camshaft lobe (B).

2. Measure the base circle (C).

3. Subtract the base circle that is found in Step 2 from the height of the camshaft lobe that is found in Step 1. The difference is the actual camshaft lobe lift.

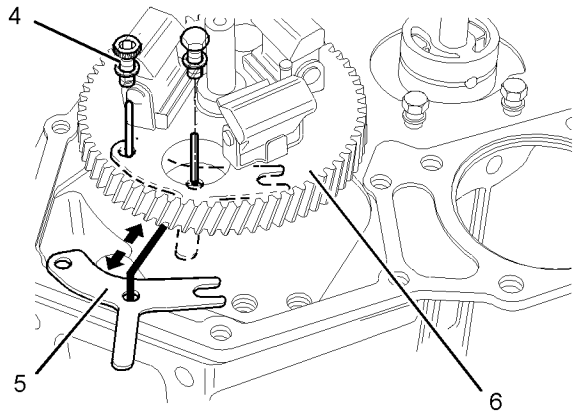

Illustration 35 g01297670
Typical example

(4) Tighten the setscrews for the retainer plate for the camshaft to the following torque. . 11 N·m ((8.0 lb ft))

(5) Retainer plate for the camshaft

(6) Camshaft gear

i02961066

Engine Oil Lines

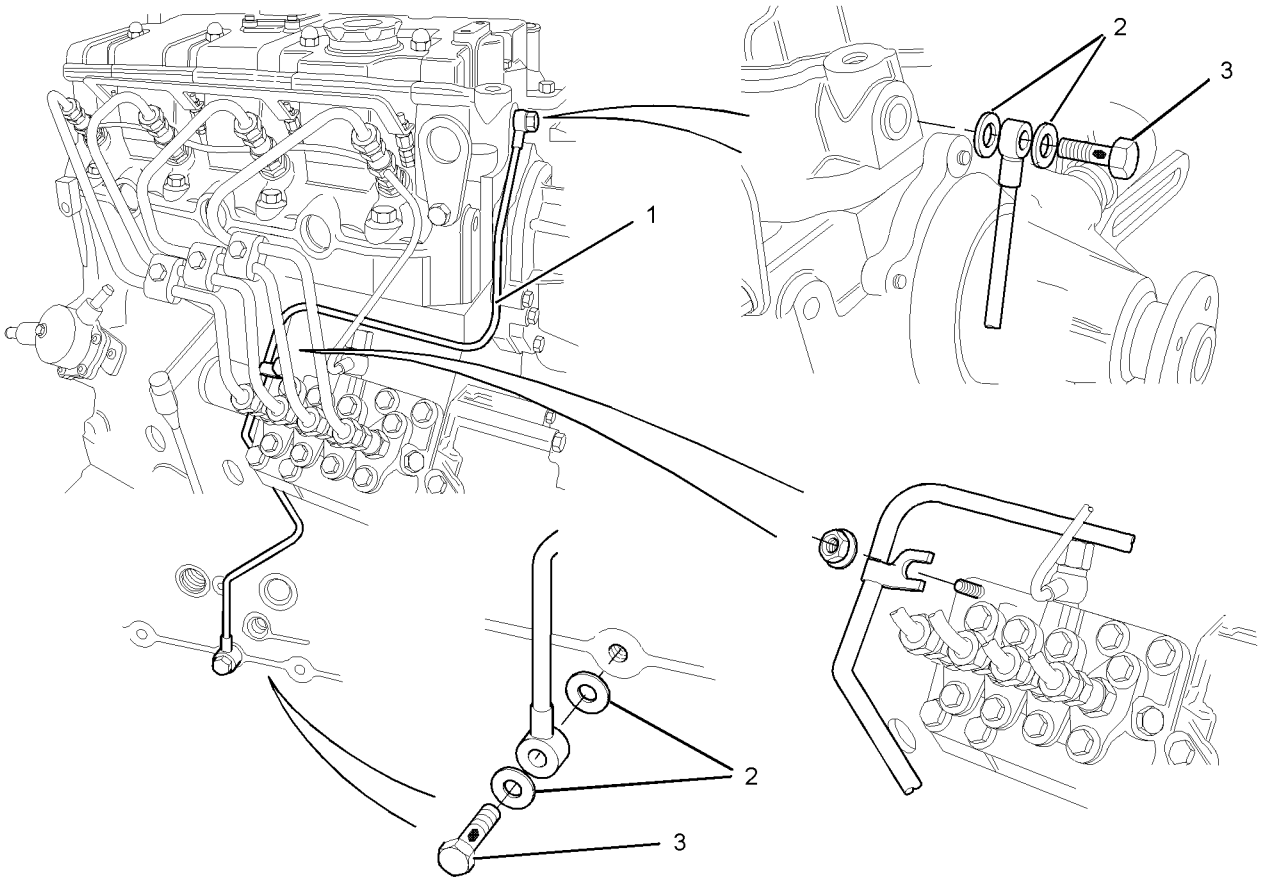

Illustration 36 g01093847

Typical example

(1) Engine oil line

(2) Washers

Note: The washers must be replaced with new washers when the engine oil line is removed.

(3) Torque for the banjo bolts . . . . . 12 N·m ((9 lb ft))

i08477363

Engine Oil Relief Valve

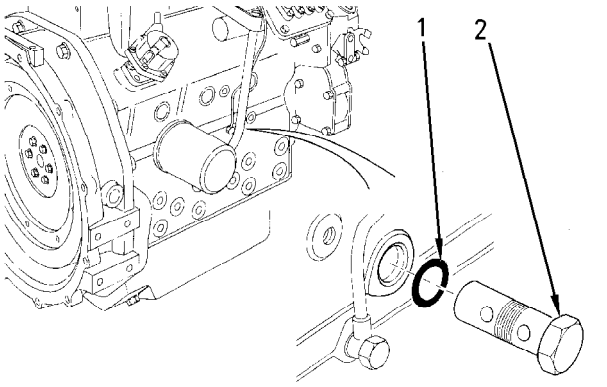

Illustration 37 g00820218

Typical example

Note: When the engine oil relief valve is installed, ensure that all components are clean. Lightly lubricate all components with clean engine oil.

(1) A new O-ring should be used when the engine oil relief valve is installed.

(2) Tighten the engine oil relief valve to the following torque.. . . . . 50 N·m ((37 lb ft))

The engine oil pressure at the engine oil relief valve is the following value.

403A-11, 403D-11, and 404D-15 . . . . . 304 to 500 kPa ((44 to 73 psi))

403A-15, 403D-15, 403D-15T, and 403D-17 . . . . . 262 to 359 kPa ((38 to 52 psi))

402D-05, 403D-07, 404A-22, 404D-22, 404D-22T, and 404D-22TA . . . . . 352 to 448 kPa ((51 to 65 psi))

Note: Always remove the engine oil relief valve before removing or installing the crankshaft. Damage to the engine oil relief valve or damage to the crankshaft may occur.

i05164987

Engine Oil Pump

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

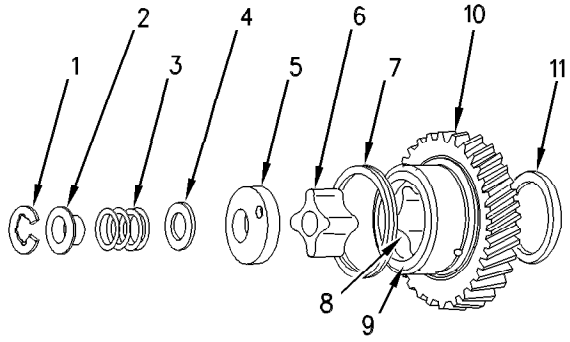

Illustration 38 g00458938

Idler gear and components of the engine oil pump

Type . . . . . Gerotor pump

(1) Circlip

(2) Collar

(3) Spring

(4) Shim

(5) Oil pump cover

(6) Inner rotor

Number of lobes 4

(7) Spring

(8) Outer rotor

Number of lobes 5

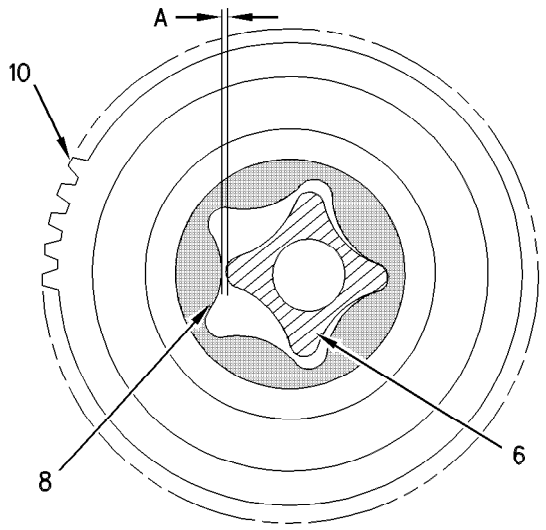

Illustration 39 g00459701

(A) Clearance between the inner rotor and the outer rotor is the following value. . . . . 0.01 to 0.15 mm ((0.0004 to 0.006 inch))

Service Limit . . . . . 0.25 mm ((0.0098 inch))

(9) Bushing

(10) Idler gear

(11) Thrust washer

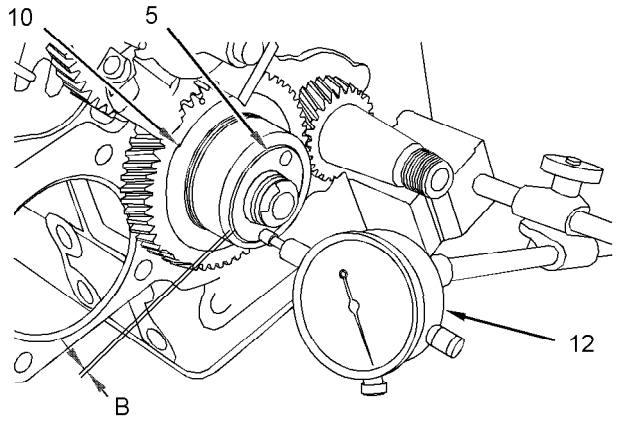

Illustration 40 g01088627

(12) Dial indicator

(B) When the components of the oil pump are installed on the front housing, measurement (B) between C-clip (1) and collar (2) must not exceed the following distance. . . . . 0.10 to 0.15 mm ((0.004 to 0.006 inch))

Service limit . . . . . 0.20 mm ((0.008 inch))

The distance between the faces is adjusted with shims (4). The following sizes of shims are available:

- 0.10 mm
- 0.15 mm
- 0.20 mm
- 0.50 mm

i02586871

Engine Oil Pan

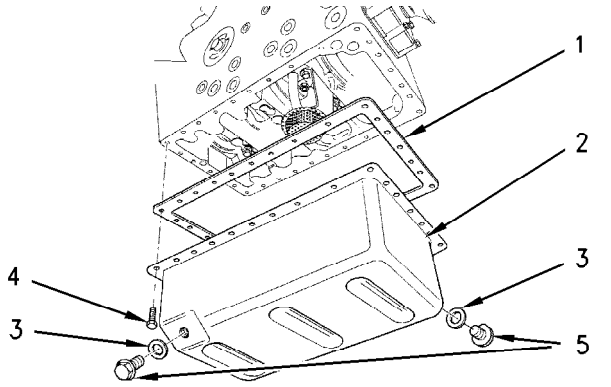

Illustration 41 g00820013

(1) Gasket

(2) Engine oil pan

(3) Washer

(4) Tighten the bolts for the engine oil pan to the following torque. . . . . 11 N·m ((8 lb ft))

(5) Tighten the drain plugs of the engine oil pan to the following torque. . . . . 35 N·m ((26 lb ft))

Note: Install a new gasket (1) when the engine oil pan is removed or replaced.

Oil Suction Tube and Oil Strainer

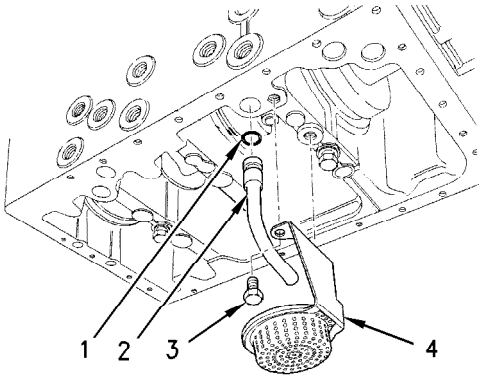

Illustration 42 g00820021

(1) O-ring

(2) Oil suction tube

(3) Tighten the bolts for the oil strainer to the following torque. . . . . 11 N·m ((8 lb ft))

(4) Strainer

Note: Install a new O-ring (1) in the hole of the cylinder block when the oil suction tube is removed or replaced.

i06752738

Water Temperature Regulator

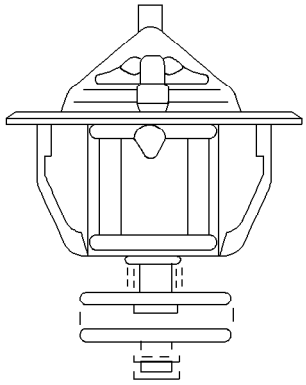

Illustration 43 g00877006

Typical example

Opening temperature of the water temperature regulator

402D-05, 403D-07, 403A-11, 403D-11, and 404D-15 . . . . . 75 °C ((167 °F))

403A-15, 403D-15, 403D-15T, and 403D-17 . . . . . 80° to 84°C ((176° to 183°F))

404A-22, 404D-22. . . . . 80° to 84 °C ((176° to 183 °F))

404D-22T, and 404D-22TA. . . . . 82 °C ((180 °F))

Fully open temperature of the water temperature regulator

402D-05, 403D-07, 403A-11, 403D-11, and 404D-15 . . . . . 87 °C ((189 °F))

403A-15, 403D-15, 403D-15T, and 403D-17 . . . . . 95 °C ((203 °F))

404A-22 and 404D-22. . . . . 95 °C ((203 °F))

404D-22T and 404D-22TA . . . . . 95 °C ((203 °F))

Water Temperature Regulator Housing for 402D-05, and 402D-07 Engines

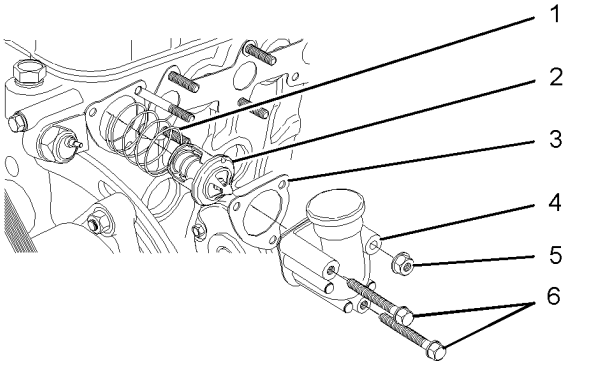

Illustration 44 g01112497

Typical example

(1) Spring

(2) Water temperature regulator

(3) Gasket

(4) Cover

(5) Torque for the nut for the water temperature regulator housing . . . . . 6 N·m ((4.4 lb ft))

(6) Torque for the two setscrews for the water temperature regulator housing . . . . 6 N·m ((4.4 lb ft))

Water Temperature Regulator Housing for 403A-11, 403D-11, 403A-15, 403D-15, 403D-15T, 403D-17, 404D-15, 404A-22, 404D-22, 404D-22T, and 404D-22TA Engines

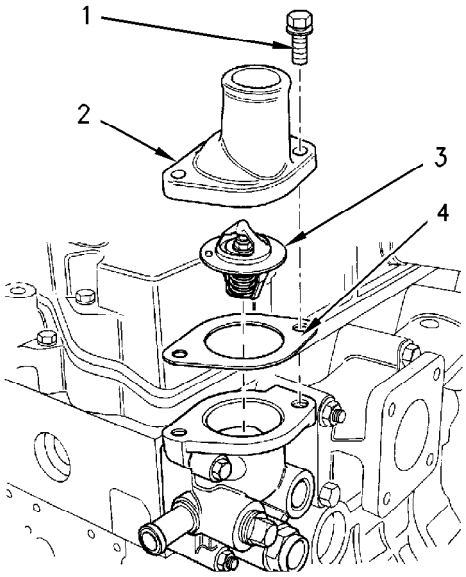

Illustration 45 g00820265

Typical example

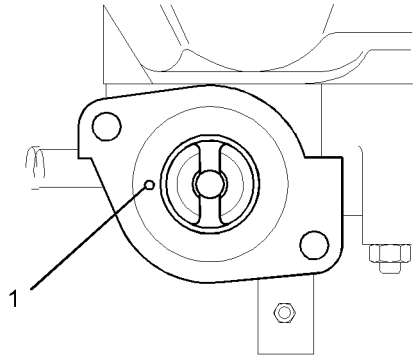

Illustration 46 g01114379

Water temperature regulator for naturally aspirated engines

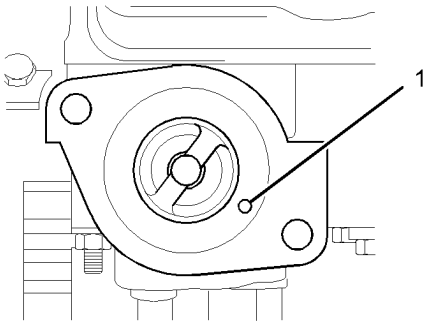

Illustration 47 g01114381

Water temperature regulator for turbocharged engines

Note: Ensure that the water temperature regulator is seated correctly in the housing.

Note: Ensure that the jiggle pin (1) on the water temperature regulator is correctly positioned. Refer to illustrations 46 and 47 .

(1) Torque for the two setscrews for the water temperature regulator housing

403A-11, 403D-11, and 404D-15 engines . . . . . 6 N·m ((53 lb in))

(1) Torque for the two setscrews for the water temperature regulator housing

403A-15, 403D-15, 403D-15T, 403D-17, 404A-22, 404D-22, 404D-22T, and 404D-22TA engines . . . . . 14 N·m ((10 lb ft))

(2) Cover

(3) Water temperature regulator

(4) Gasket

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Cylinder Block

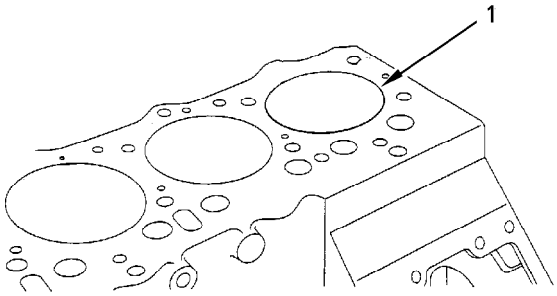

Illustration 48 g00904878
Typical example

(1) Diameter of the bore in the cylinder block

402D-05 and 403D-07 . . . . 67.000 to 67.019 mm ((2.6378 to 2.6385 inch))

403A-11, 403D-11, and 404D-15 . . 77.000 to 77.019 mm ((3.0310 to 3.0320 inch))

403A-15, 403D-15, 403D-15T, 403D-17, 404A-22, 404D-22, 404D-22T, and 404D-22TA . . 84.000 to 84.019 mm ((3.3071 to 3.3078 inch))

Service limit
402D-05 and 403D-07 . . . . . 67.200 mm ((2.6457 inch))

403A-11, 403D-11, and 404D-15 . . . . 77.200 mm ((3.0390 inch))

403A-15, 403D-15, 403D-15T, 403D-17, 404A-22, 404D-22, 404D-22T, and 404D-22TA . . . . . 84.200 mm ((3.3150 inch))

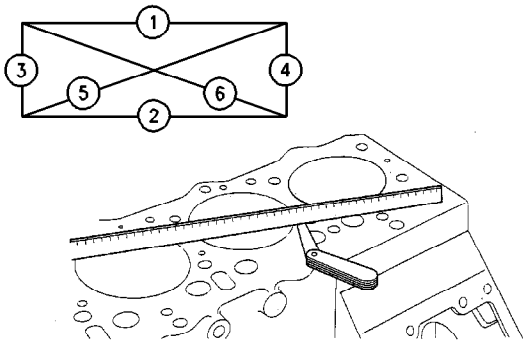

Illustration 49 g00901145
Typical example

Flatness of the top of the cylinder block . . . Less than 0.05 mm (0.002 inch)

Service limit . . . . . 0.12 mm ((0.005 inch))

Note: Use a straight edge and a feeler gauge to check the six positions for flatness.

Note: The front bush for the crankshaft must be installed with the chamfer toward the cylinder block. Ensure that the oil hole in the front bush for the crankshaft is aligned with the oil hole in the cylinder block.

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Crankshaft

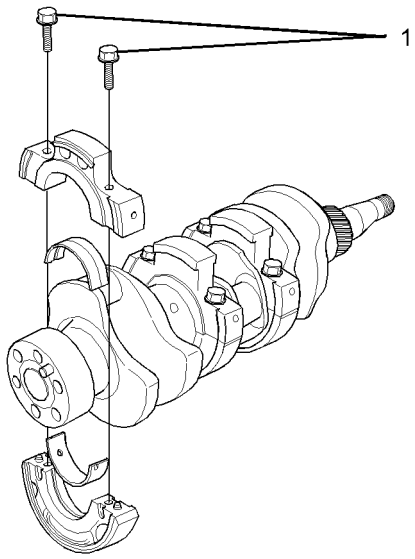

Illustration 50 g01113243

Typical crankshaft for a 3 cylinder engine

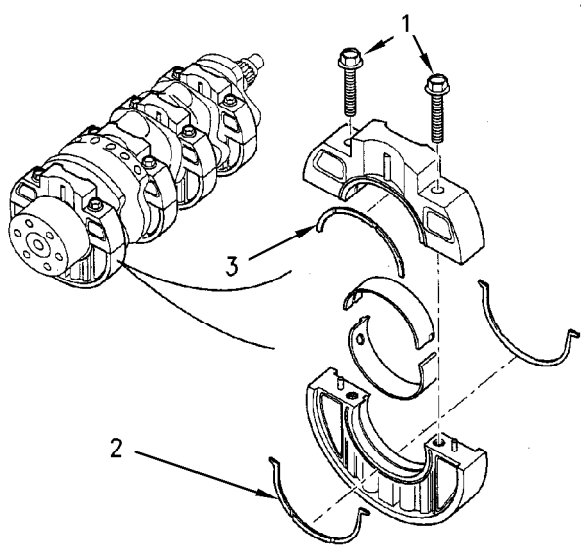

Illustration 51 g00904902

Typical crankshaft for a 4 cylinder engine

(1) Tighten the bolts of the holder for the main bearing to the following torque.

402D-05, 403D-07, 403A-11, 403D-11, and 404D-15 . . . . . 23 N·m ((16.9 lb ft))

403A-15, 403D-15, 403D-15T, 403D-17, 404A-22, 404D-22, 404D-22T, and 404D-22TA . . . . . 52 N·m ((38.3 lb ft))

(2) Thrust washers

402D-05 and 403D-07
Standard thickness . . . . . 21.85 to 21.95 mm ((0.8602 to 0.8642 inch))

Service limit . . . . . 21.60 mm ((0.8504 inch))

403A-11, 403D-11, and 404D-15
Standard thickness . . . . . 21.85 to 21.95 mm ((0.8602 to 0.8642 inch))

Service limit . . . . . 21.60 mm ((0.8504 inch))

403A-15, 403D-15, 403D-15T, 403D-17, 404A-22, 404D-22, 404D-22T, and 404D-22TA
Standard thickness . . . . . 2.95 to 3.00 mm ((0.1161 to 0.1181 inch))

Service limit . . . . . .2.80 mm ((0.1102 inch))

Note: The thrust washer for the 402D-05, 403D-07, 403A-11, 403D-11, and 404D-15 engines is machined into the holder for the main bearing.

(3) Top thrust washer

Note: The top thrust washer (3) is used only on the 404A-22, 404D-22, 404D-22T, and 404D-22TA engine.

Ensure that the oil grooves of all the thrust washers are toward the crankshaft.

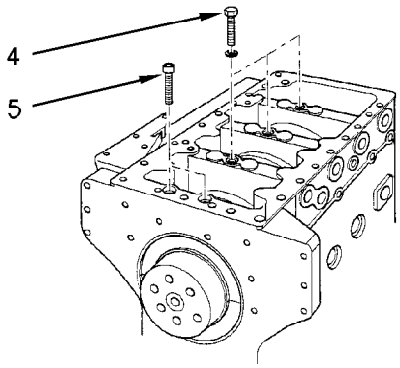

Illustration 52 g00904925

Typical example

(4) Tighten the retaining bolts for the crankshaft to the following torque.

402D-05, 403D-07, 403A-11, 403D-11, and 404D-15 . . . . . 27 N·m ((19.9 lb ft))

403A-15, 403D-15, 403D-15T, 403D-17, 404A-22, 404D-22, 404D-22T, and 404D-22TA . . . . . 52 N·m ((38.3 lb ft))

(5) Tighten the allen head screws to the following torque.. . . . . 27 N·m ((19.9 lb ft))

Crankshaft end play (All models) . . . 0.10 to 0.30 mm ((0.0040 to 0.0118 inch))

Service limit (All models) . . . 0.50 mm ((0.0197 inch))

Note: If the crankshaft end play exceeds the service limit, check the thrust washers for wear.

Refer to Specifications, “Connecting Rod Bearing Journal” for information on the connecting rod bearing journals of the crankshaft.

Refer to Specifications, “Main Bearing Journal” for information on the main bearing journals of the crankshaft.

i06752875

Connecting Rod Bearing Journal

Table 6

Diameter of the 402D-05 and 403D-07 Connecting Rod Bearing Journals		
Journals	**Diameter**	**Service limit**
Standard	34.964 to 34.975 mm (1.3765 to 1.3770 inch)	34.9 mm (1.3740 inch)
Undersize 0.25 mm (0.010 inch)	34.714 to 34.725 mm (1.3667 to 1.3671 inch)	34.65 mm (1.3642 inch)
Undersize 0.50 mm (0.020 inch)	34.464 to 34.475 mm (1.3568 to 1.3573 inch)	34.4 mm (1.3543 inch)(1)

(1) If the diameter of the connecting rod bearing journal is less than the maximum undersize service limit, the crankshaft must be replaced.

Table 7

Diameter of the 403A-11, 403D-11, and 404D-15 Connecting Rod Bearing Journals		
Journals	**Diameter**	**Service limit**

(continued)

(Table 7, contd)

Standard	40.964 to 40.975 mm (1.61280 to 1.61320 inch)	40.90 mm (1.6102 inch)
Undersize 0.25 mm (0.010 inch)	40.714 to 40.725 mm (1.60290 to 1.60330 inch)	40.65 mm (1.6003 inch)
Undersize 0.50 mm (0.020 inch)	40.464 to 40.475 mm (1.59310 to 1.59350 inch)	40.40 mm (1.5905 inch)(1)

(1) If the diameter of the connecting rod bearing journal is less than the maximum undersize service limit, the crankshaft must be replaced.

Table 8

Diameter of the 403A-15, 403D-15, 403D-15T, 403D-17, 404A-22, 404D-22, 404D-22T, and 404D-22TA Connecting Rod Bearing Journals		
Journals	**Diameter**	**Service limit**
Standard	51.964 to 51.975 mm (2.04582 to 2.04626 inch)	51.90 mm (2.0433 inch)
Undersize 0.25 mm (0.010 inch)	51.714 to 51.725 mm (2.03598 to 2.03641 inch)	51.65 mm (2.0335 inch)
Undersize 0.50 mm (0.020 inch)	51.464 to 51.475 mm (2.02614 to 2.02660 inch)	51.40 mm (2.0236 inch)(1)

(1) If the diameter of the connecting rod bearing journal is less than the maximum undersize service limit, the crankshaft must be replaced.

Clearance between the connecting rod bearing and the connecting rod bearing journal

Standard clearance
402D-05 and 403D-07 . . . . . 0.031 to 0.079 mm ((0.00122 to 0.00311 inch))

403A-11, 403D-11 (Journals 1 and 2) . . . . 0.035 to 0.083 mm ((0.0014 to 0.0033 inch))

403A-15, 403D-15, 403D-15T, and 403D-17 . . 0.035 to 0.085 mm ((0.00138 to 0.00335 inch))

404D-15 . . . . . 0.035 to 0.083 mm ((0.0014 to 0.0033 inch))

404A-22, 404D-22, 404D-22T, and 404D-22TA . . 0.035 to 0.085 mm ((0.00138 to 0.00335 inch))

Service limit (All models) . . . . . 0.20 mm ((0.0079 inch))

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Main Bearing Journal

Table 9

Diameter of 402D-05 Main Bearing Journals			
Size	**Journal**	**Diameter**	**Service limit**
Standard	1	42.964 to 42.975 mm (1.69150 to 1.69193 inch)	42.90 mm (1.6890 inch)
	2	45.948 to 45.959 mm (1.80897 to 1.80941 inch)	45.90 mm (1.8071 inch)

Table 10

Diameter of 403D-07 Main Bearing Journals			
Size	**Journal**	**Diameter**	**Service limit**
Standard	1 and 2	42.964 to 42.975 mm (1.69150 to 1.69193 inch)	42.90 mm (1.6890 inch)
	3	45.948 to 45.959 mm (1.80897 to 1.80941 inch)	45.90 mm (1.8071 inch)

Table 11

Diameter of 403A-11 and 403D-11 Main Bearing Journals			
Size	**Journal**	**Diameter**	**Service limit**
Standard	1 and 2	47.964 to 47.975 mm (1.8883 to 1.8888 inch)	47.90 mm (1.8858 inch)
	3	47.954 to 47.965 mm (1.88800 to 1.88830 inch)	47.90 mm (1.8858 inch)

Table 12

Diameter of 404D-15 Main Bearing Journals			
Size	**Journal**	**Diameter**	**Service limit**
Standard	1, 2 and 3	47.964 to 47.975 mm (1.8883 to 1.8888 inch)	47.90 mm (1.8858 inch)
	4	47.954 to 47.965 mm (1.88800 to 1.88830 inch)	47.90 mm (1.8858 inch)

Table 13

Diameter of 403D-15, 403D-15, 403D-15T, 403D-17, 404D-22, 404D-22, 404D-22T, and 404D-22TA Main Bearing Journals		
Journals	**Diameter**	**Service limit**
Standard	67.957 to 67.970 mm (2.67550 to 2.67597 inch)	67.90 mm (2.6732 inch)

Clearance between the main bearing and the main bearing journal

Standard clearance
402D-05 and 403D-07 . . . . . 0.035 to 0.088 mm ((0.0014 to 0.0035 inch))

403A-11, 403D-11, and 404D-15
. . . . 0.039 to 0.092 mm ((0.0015 to 0.0036 inch))

403A-15, 403D-15, 403D-15T, and 403D-17
. . . . . 0.044 mm to 0.102 mm ((0.0017 inch to 0.0040 inch))

404D-22, 404D-22, 404D-22T, and 404D-22TA
. . . . 0.044 to 0.102 mm ((0.0017 to 0.0040 inch))

Service limit (All models) . . . 0.20 mm ((0.0079 inch))

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Connecting Rod

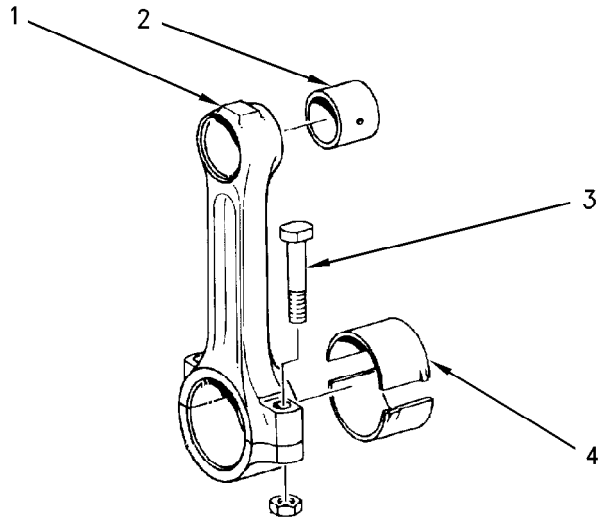

Illustration 53 g00693257

Typical example

(1) Connecting rod

(2) Piston pin bearing

Clearance between the piston pin and the piston pin bearing (All models) . . . . . 0.010 to 0.025 mm ((0.00040 to 0.00099 inch))

Service limit
402D-05 and 403D-07 . . 0.10 mm ((0.004 inch))

403A-11, 403D-11, and 404D-15 engines . . . . . 0.08 mm ((0.0031 inch))

403A-15, 403D-15, 403D-15T, and 403D-17 engines . . . . . 0.10 mm ((0.004 inch))

404A-22, 404D-22, 404D-22T, and 404D-22TA engines . . . . . 0.10 mm ((0.004 inch))

(3) Torque for the nut and the bolt

402D-05 and 403D-07 engines . . . . . 23 N·m ((17 lb ft))

403A-11, 403D-11, and 404D-15 engines . . . . . 32 N·m ((23.6 lb ft))

403A-15, 403D-15, 403D-15T, and 403D-17 engines . . . . . 52 N·m ((38 lb ft))

404A-22, 404D-22, 404D-22T, and 404D-22TA engines . . . . . 52 N·m ((38 lb ft))

(4) Connecting rod bearing

Clearance between the connecting rod bore and the connecting rod bearing . . . . . 0.10 to 0.30 mm ((0.004 to 0.012 inch))

Service limit . . . . . 0.70 mm ((0.0276 inch))

Markings on the Connecting Rod

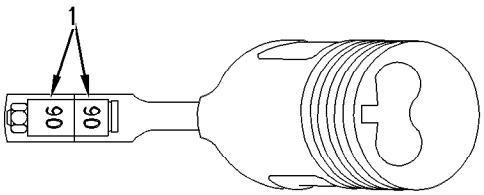

Illustration 54 g00555416

Typical example

The pistons and connecting rods are matched to each cylinder. Note the position of each connecting rod and piston for correct assembly.

Identification marks (1) on the connecting rod and on the connecting rod cap must be matched and aligned. When the connecting rod is installed correctly, the marks should face the right side of the engine.

Refer to Systems Operation, Testing and Adjusting, “Connecting Rod - Inspect” for the procedure to measure distortion and parallelism of the connecting rod.

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Piston and Rings

Markings on the Piston

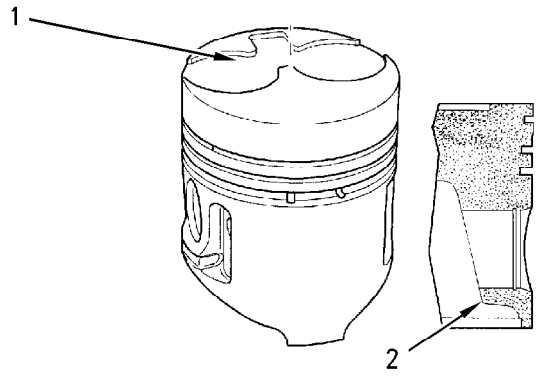

Illustration 55 g00845975

Typical example

(1) The chamber that is on the top of the piston must face the right side of the engine.

(2) An identification mark is located inside the piston.

Piston and Piston Rings

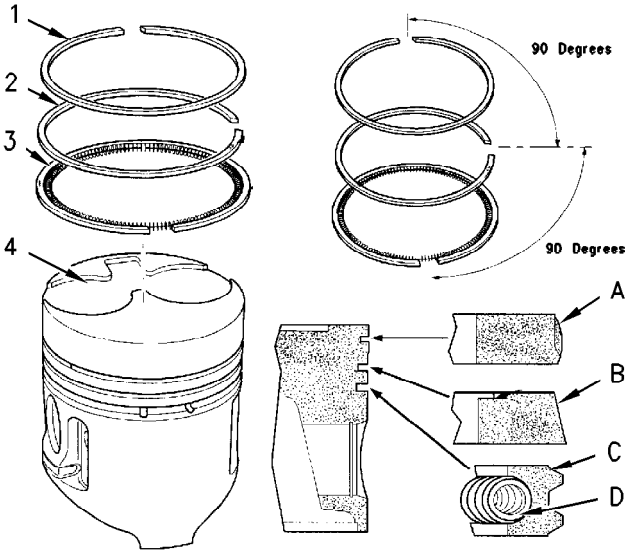

Illustration 56 g00845969

Typical example

Use a feeler gauge to measure the clearance between the piston ring groove and the piston ring. If the clearance is greater than the service limit, use a new piston ring and check the clearance.

If the clearance is within the service limit, renew the piston rings. If the clearance is outside of the service limit, renew the piston.

(1) Top piston ring

Shape of top ring (A)

Naturally aspirated . . . . . Barrel face

Turbocharged . . . . . Half keystone

402D-05 and 403D-07
Clearance between piston ring groove and top piston ring . . . . . 0.06 to 0.10 mm ((0.0024 to 0.0039 inch))

Service limit for clearance of top piston ring . . . . . 0.25 mm ((0.0098 inch))

Gap of top piston ring . . . . . 0.13 to 0.28 mm ((0.0051 to 0.0110 inch))

Service limit for gap of top piston ring . . . 1.0 mm ((0.039 inch))

403A-11, 403D-11, and 404D-15
Clearance between piston ring groove and top piston ring . . . . . 0.08 to 0.12 mm ((0.0031 to 0.0047 inch))

Service limit for clearance of top piston ring . . . . . 0.25 mm ((0.0098 inch))

Gap of top piston ring . . . . . 0.20 to 0.35 mm ((0.0079 to 0.0138 inch))

Service limit for gap of top piston ring . . . 1.0 mm ((0.039 inch))

403A-15, 403D-15, 403D-15T, 403D-17, 404A-22, and 404D-22
Clearance between piston ring groove and top piston ring . . . . . 0.07 to 0.11 mm ((0.0028 to 0.0043 inch))

Service limit for clearance of top piston ring . . . . . 0.25 mm ((0.0098 inch))

Gap of top piston ring . . . . . 0.20 to 0.35 mm ((0.0079 to 0.0138 inch))

Service limit for gap of top piston ring . . . 1.0 mm ((0.039 inch))

Note: It is difficult to measure the wear of the top piston ring on the 403D-15T, 404D-22T, and 404D-22TA turbocharged engines. When either the intermediate ring or the oil control ring is outside the service limit, renew all the rings.

Note: Install the letters “T” or “RN” toward the top of the piston. New top piston rings have a red identification mark which must be on the left of the ring gap when the top piston ring is installed on an upright piston.

Note: New top piston rings for the 404D-22T, and 404D-22TA have a yellow identification mark which must be on the left of the ring gap when the top piston ring is installed on an upright piston.

Note: The top surface of the piston ring should be equally distant from the top face of the cylinder block at all points before the piston ring end gap is measured with a feeler gauge.

(2) Intermediate ring

Shape of intermediate ring (B) . . . . . Taper

402D-05 and 403D-07
Clearance between piston ring groove and intermediate ring . . . . . 0.05 to 0.09 mm ((0.0020 to 0.0035 inch))

Service limit for clearance of intermediate ring . . . . . 0.25 mm ((0.0098 inch))

Gap of intermediate ring . . . . . 0.10 to 0.25 mm ((0.0039 to 0.0098 inch))

Service limit for gap of intermediate ring . . . . . .1.0 mm ((0.039 inch))

403A-11, 403D-11, and 404D-15
Clearance between piston ring groove and intermediate ring . . . . . 0.05 to 0.09 mm ((0.0020 to 0.0035 inch))

Service limit for clearance of intermediate ring . . . . . 0.25 mm ((0.0098 inch))

Gap of intermediate ring . . . . . 0.20 to 0.35 mm ((0.0079 to 0.0138 inch))

Service limit for gap of intermediate ring . . . . . .1.0 mm ((0.039 inch))

403A-15, 403D-15, 403D-15T, 403D-17, 404A-22, 404D-22, 404D-22T, and 404D-22TA
Clearance between piston ring groove and intermediate ring . . . . . 0.04 to 0.08 mm ((0.0016 to 0.0032 inch))

Service limit for clearance of intermediate ring . . . . . 0.25 mm ((0.0098 inch))

403A-15, 403D-15, 403D-15T, 403D-17, 404A-22, and 404D-22 gap of the intermediate ring . . . . . 0.2 to 0.4 mm ((0.0079 to 0.0157 inch))

404D-22T and 404D-22TA gap of the intermediate ring . . . . . 0.5 to 0.7 mm ((0.020 to 0.023 inch))

Service limit for gap of intermediate ring . . . . . .1.2 mm ((0.047 inch))

Note: Install the word “Top” toward the top of the piston. New intermediate rings have a green identification mark which must be on the left of the ring gap when the intermediate ring is installed on an upright piston.

Note: The top surface of the piston ring should be equally distant from the top face of the cylinder block at all points before the piston ring end gap is measured with a feeler gauge.

(3) Oil control ring

402D-05 and 403D-07
Clearance between piston ring groove and oil control ring . . . . . 0.02 to 0.06 mm ((0.0008 to 0.0024 inch))

Service limit for clearance of oil control ring . . . . . 0.15 mm ((0.0059 inch))

Gap of oil control ring . . . . . 0.10 to 0.30 mm ((0.0039 to 0.0118 inch))

Service limit for gap of oil control ring . . . 1.0 mm ((0.039 inch))

403A-11, 403D-11, and 404D-15
Clearance between piston ring groove and oil control ring . . . . . 0.02 to 0.06 mm ((0.0008 to 0.0024 inch))

Service limit for clearance of oil control ring . . . . . 0.15 mm ((0.0059 inch))

Gap of oil control ring . . . . . 0.15 to 0.35 mm ((0.0059 to 0.0138 inch))

Service limit for gap of oil control ring . . . 1.0 mm ((0.039 inch))

403A-15, 403D-15, 403D-15T, 403D-17, 404A-22, 404D-22, 404D-22T, and 404D-22TA
Clearance between piston ring groove and oil control ring . . . . . 0.02 to 0.06 mm ((0.0008 to 0.0024 inch))

Service limit for clearance of oil control ring . . . . . 0.15 mm ((0.0059 inch))

Gap of oil control ring . . . . . 0.25 to 0.50 mm ((0.0098 to 0.0197 inch))

Service limit for gap of oil control ring . . . 1.0 mm ((0.039 inch))

The oil control ring has two components. The two components of the oil control ring are installed in the following order.

1. Spring (D)

2. Oil control ring (C)

Note: A latch pin is used to hold both ends of the spring of the oil control ring in position. The ends of the spring of the oil control ring must be 180 degrees opposite the end gap of the oil control ring.

Note: The top surface of the piston ring should be equally distant from the top face of the cylinder block at all points before the piston ring end gap is measured with a feeler gauge.

(4) Piston

402D-05 and 403D-07
Diameter of the piston skirt
. . . . . .66.9375 to 66.9525 mm ((2.6353 to 2.6359 inch))

Service limit . . . . . 66.7 mm ((2.6260 inch))

Clearance of the piston skirt to the cylinder wall
. . . . 0.048 to 0.082 mm ((0.0019 to 0.0032 inch))

Service limit . . . . . 0.25 mm ((0.010 inch))

Diameter of the piston pin
. . 18.996 to 19.002 mm ((0.7479 to 0.7481 inch))

Service limit . . . . . 18.98 mm ((0.7472 inch))

Clearance between the hole for the piston pin and the piston pin . . . . . 0 to +0.008 mm ((0 to +0.0003 inch))

Service limit . . . . . 0.02 mm ((0.0008 inch))

403A-11, 403D-11, and 404D-15
Diameter of the piston skirt
. . 76.932 to 76.947 mm ((3.0288 to 3.0294 inch))

Service limit . . . . . 76.7 mm ((3.020 inch))

Clearance of the piston skirt to the cylinder wall
. . . . . .0.0525 to 0.0865 mm ((0.00210 to 0.00340 inch))

Service limit . . . . . 0.25 mm ((0.010 inch))

Diameter of the piston pin
. . 20.996 to 21.002 mm ((0.8266 to 0.8269 inch))

Service limit . . . . . 20.98 mm ((0.826 inch))

Clearance between the hole for the piston pin and the piston pin . . . . . 0 to +0.008 mm ((0 to +0.0003 inch))

Service limit . . . . . 0.02 mm ((0.0008 inch))

403A-15, 403D-15,403D-15T, 403D-17, 404A-22, 404D-22, 404D-22T, and 404D-22TA
Diameter of the piston skirt
. . 83.948 to 83.963 mm ((3.3050 to 3.3056 inch))

Service limit . . . . . 83.7 mm ((3.295 inch))

Clearance of the piston skirt to the cylinder wall
. . . . . .0.0380 to 0.0720 mm ((0.00150 to 0.00283 inch))

Service limit . . . . . 0.25 mm ((0.010 inch))

Diameter of the piston pin
. . 27.994 to 28.000 mm ((1.1021 to 1.1024 inch))

Service limit . . . . . 27.98 mm ((1.1016 inch))

Clearance between the hole for the piston pin and the piston pin . . . . . −0.001 to +0.011 mm ((−0.0004 to +0.0004 inch))

Service limit . . . . . 0.02 mm ((0.0008 inch))

Refer to Specifications, “Cylinder Head” for the piston height for a given gasket thickness.

i02613910

Housing (Front)

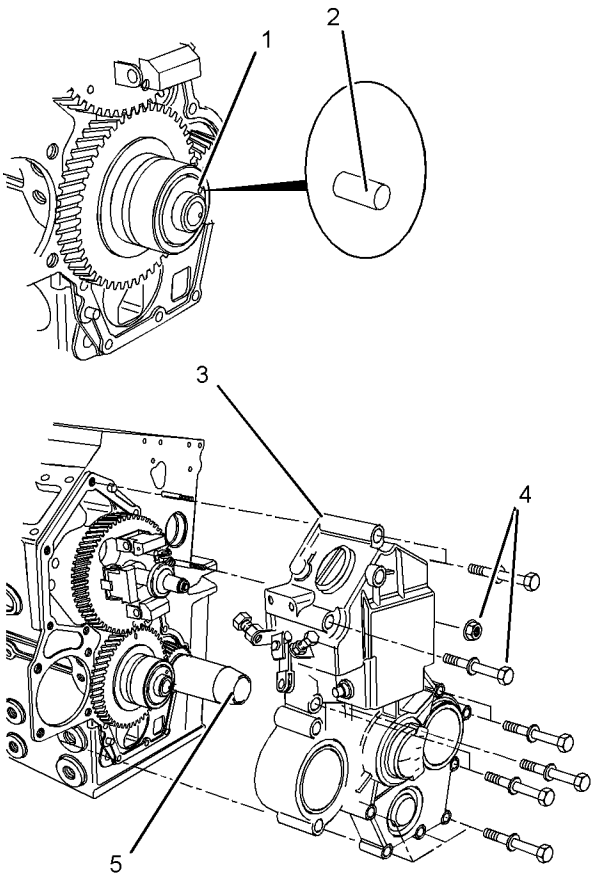

Illustration 57 g01308682

Typical example

(1) Locator hole

(2) Locator pin

(3) Front housing

(4) Tighten the setscrews and nuts to the following torque. . . . . 10 N·m ((7 lb ft))

Note: Note the positions of the setscrews when the bolts are removed. The setscrews have different lengths.

(5) Seal protector

i02961882

Gear Group (Front)

Table 14

Injection timing		
Engine	Maximum rated engine speed	Injection timing (BTDC)(1)
402D-05 Industrial engine	2800	18° ± 1°
402D-05 Industrial engine	3000	20° ± 1°
402D-05 Industrial engine	3600	21° ± 1°
403D-07 Industrial engine	2800	18° ± 1°
403D-07 Industrial engine	3000	20° ± 1°
403D-07 Industrial engine	3600	21° ± 1°
403D-11 Industrial engine	2200	23° ± 1°
403D-11 Industrial engine	2600	24° ± 1°
403D-11 Industrial engine	2800	24° ± 1°
403D-11 Industrial engine	3000	24° ± 1°
403D-11 Industrial engine	3400	23° ± 1°
403D-11 Industrial engine	3600	23° ± 1°
403D-15 Industrial engine	2200	22° ± 1°
403D-15 Industrial engine	2400	22° ± 1°
403D-15 Industrial engine	2600	22° ± 1°
403D-15 Industrial engine	2800	22° ± 1°
403D-15 Industrial engine	3000	22° ± 1°

(continued)

(Table 14, contd)

403D-15T Industrial engine	2200	17° ± 1°
403D-15T Industrial engine	2400	17° ± 1°
403D-15T Industrial engine	2600	17° ± 1°
403D-15T Industrial engine	2800	17° ± 1°
403D-15T Industrial engine	3000	17° ± 1°
403D-17 Industrial engine	2400	20° ± 1°
403D-17 Industrial engine	2600	20° ± 1°
404D-15 Industrial engine	2800	22° ± 1°
404D-15 Industrial engine	3000	22° ± 1°
404D-22 Industrial engine	2200	19° ± 1°
404D-22 Industrial engine	2400	19° ± 1°
404D-22 Industrial engine	2600	20° ± 1°
404D-22 Industrial engine	2800	20° ± 1°
404D-22 Industrial engine	3000	20° ± 1°
404D-22 Industrial engine	2800 DERATE	20° ± 1°
404D-22 Industrial engine	3000 DERATE	20° ± 1°
404D-22 with balancer	2800	20° ± 1°
404D-22T Industrial engine	2600	19° ± 1°
404D-22T Industrial engine	2800	20° ± 1°
404D-22T Industrial engine	3000	20° ± 1°
404D-22T with Balancer	2600	19° ± 1°
404D-22TA Industrial engine	2800	23° ± 1°

(1) Before Top Dead Center

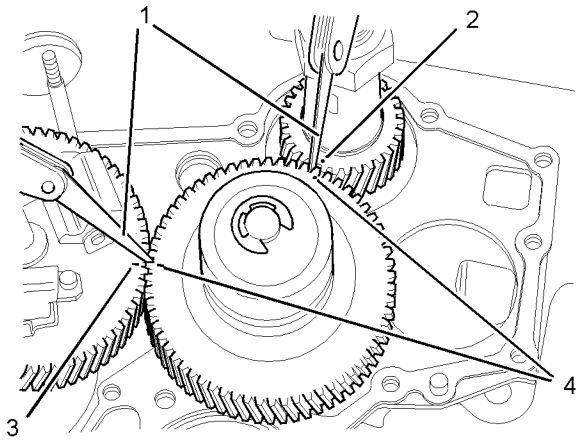

Illustration 58 g01298853

Typical example

(1) Feeler gauge

(2) Timing mark on the crankshaft gear

(3) Timing mark on the camshaft gear

(4) Timing mark on the idler gear

Minimum backlash for all gears . . . . . 0.08 mm ((0.003 inch))

Maximum backlash for all gears . . . . . 0.25 mm ((0.010 inch))

Note: If the backlash is greater than the maximum backlash, replace the camshaft gear, the idler gear and the crankshaft gear.

When the idler gear is installed on the shaft of the oil pump, align a timing mark on idler gear (4) with the timing mark on crankshaft gear (2). Also, align the other timing mark on idler gear (4) with the timing mark on camshaft gear (3).

i02590383

Flywheel

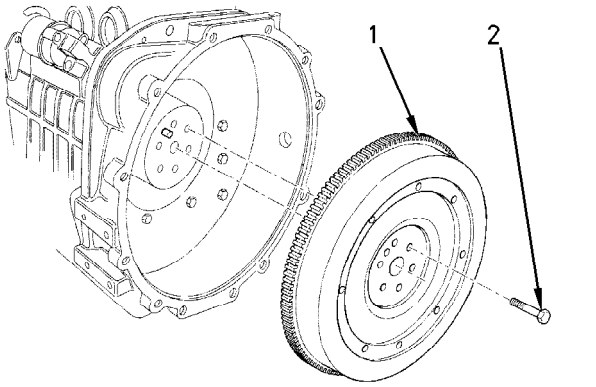

Illustration 59 g00820355

(1) Heat the flywheel ring gear to the following temperature. . . . . 120° to 150°C ((248° to 302°F))

Note: If the ring gear is excessively worn, renew the ring gear. If excessive wear is not present, remove the ring gear and install the ring gear at 90 degrees from the original position. Heat the ring gear evenly.

(2) Tighten the setscrews on the flywheel to the following torque. . . . . .74 N·m ((55 lb ft))

Maximum flywheel runout . . . 0.20 mm ((0.008 inch))

i06753426

Flywheel Housing

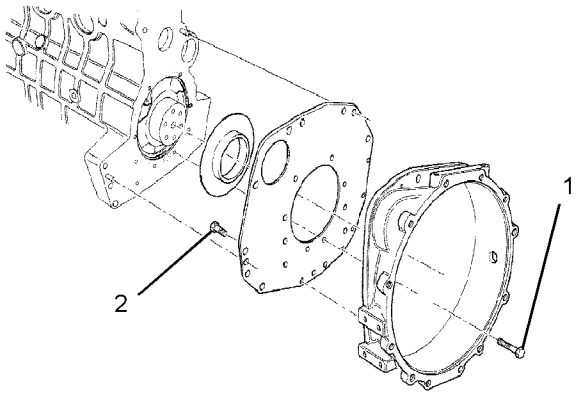

Illustration 60 g01442020
Typical example

(1) Torque for the setscrews for the back plate

402D-05 and 403D-07 . . . . . 15 N·m ((11 lb ft))

403A-11, 403D-11, and 404D-15 . . . . . 50 N·m ((36.9 lb ft))

403A-15, 403D-15, 403D-15T, 403D-17, 404A-22, 404D-22, 404D-22T, and 404D-22TA . . . . . 25 N·m ((18.8 lb ft))

(2) Torque for the setscrews for the flywheel housing

402D-05 and 403D-07 . . . . . 15 N·m ((11 lb ft))

403A-11, 403D-11, and 404D-15 . . . . . 50 N·m ((36.9 lb ft))

403A-15, 403D-15, 403D-15T, 403D-17, 404A-22, 404D-22, 404D-22T, and 404D-22TA . . . . . 25 N·m ((18.8 lb ft))

i06752680

Crankshaft Pulley

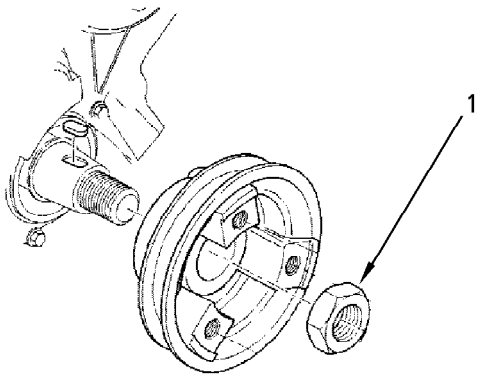

Illustration 61 g00904688

Typical example

(1) Torque for the crankshaft pulley nut

402D-05, and 403D-07 engines . . . . . 93 N·m ((69 lb ft))

403A-11, 403D-11, and 404D-15 engines . . . . . .123 N·m ((91 lb ft))

403A-15, 403D-15, 403D-15T, 403D-17, 404A-22, 404D-22, 404D-22T, and 404D-22TA engines . . . . . .304 N·m ((224 lb ft))

i08477367

Belt Tension Chart

Table 15

Alternator Belt Tension and Frequency					
Engine Model	**Approximate Span (mm)**	**New belt**		**Used Belt**	
		Frequency (Hz)	**Tension (Nm) and (lb)**	**Frequency (Hz)**	**Tension (Nm) and (lb)**
402-05	188 mm	190-200 Hz	350 to 405 N (79 to 91 lb)	160-170 Hz	267 to 356 N (60 to 80 lb)
403-07	169 mm - 188 mm	190-200 Hz	350 to 405 N (79 to 91 lb)	160-170 Hz	267 to 356 N (60 to 80 lb)
403-11	167 mm - 205 mm	190-200 Hz	400 N (90 lb)	160-170 Hz	300 N (67 lb)
403-11 Turbocharged	167 mm - 205 mm	222-229 Hz	425 to 456 N (96 to 103 lb)	205-214 Hz	364 to 395 N (82 to 89 lb)
403-15	220 mm - 232 mm	150-170 Hz	400 to 489 N (90 to 110 lb)	130-145 Hz	267 to 356 N (60 to 80 lb)
403-17	215 mm - 225 mm	150-170 Hz	400 to 489 N (90 to 110 lb)	130-145 Hz	267 to 356 N (60 to 80 lb)
404-15	236 mm - 247 mm	190-200 Hz	400 to 489 N (90 to 110 lb)	160-170 Hz	267 to 356 N (60 to 80 lb)
404-22	236 mm - 247 mm	130-150 Hz	400 to 489 N (90 to 110 lb)	110 -130 Hz	267 to 356 N (60 to 80 lb)

Note: The Used Belt Tension refers to a belt that has been in operation for 30 minutes or more at the rated speed.

i02590411

Fan Drive

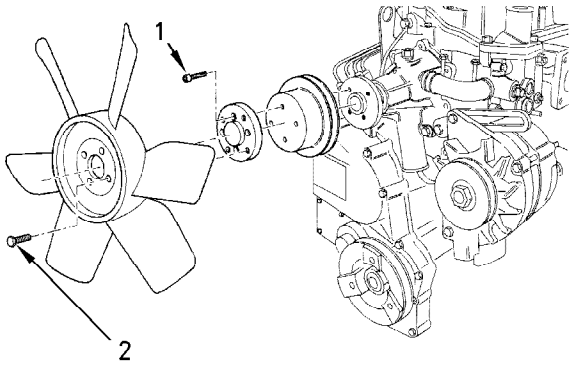

Illustration 62 g00904732

(1) Tighten the allen head screws for the adapter to the following torque. . . . . 11 N·m ((8 lb ft))

(2) Tighten the setscrews for the fan to the following torque. . . . . 11 N·m ((8 lb ft))

i02590622

Engine Lifting Bracket

All engines are equipped with two engine lifting brackets.

Tighten the setscrew on each engine lifting bracket to the following torque. . . . . 26 N·m ((20 lb ft))

i06753431

Alternator and Regulator

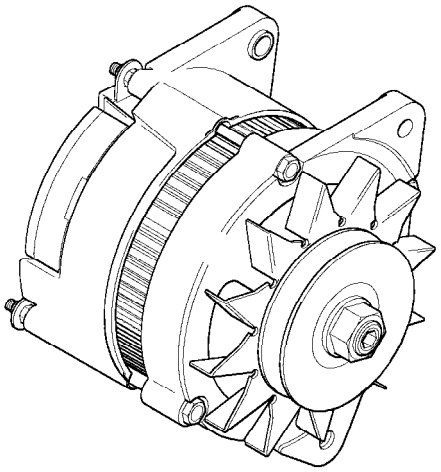

Illustration 63 g00909016

Typical Example

The rotation of the alternator is clockwise when the alternator is viewed from the pulley.

The regulator of the alternator is sealed. The regulator is a nonserviceable part.

Polarity . . . . . Negative ground to the case

Rotation . . . . . Either direction

Output voltage . . . . . 14.0 ± 0.5 volts

Rated voltage . . . . . 12 volts

Rated current output

- 402D-05 and 403D-07 . . . . . 14 amperes
- 403A-11, 403D-11 . . . . . 15 or 40 amperes
- 403A-15, 403D-15, 403D-15T, 403D-17, 404A-22, 404D-22, 404D-22T, and 404D-22TA . . . . 55, 65 or 85 amperes
- 404D-15 . . . . . 40 amperes

i06753446

Electric Starting Motor

Starting Motor

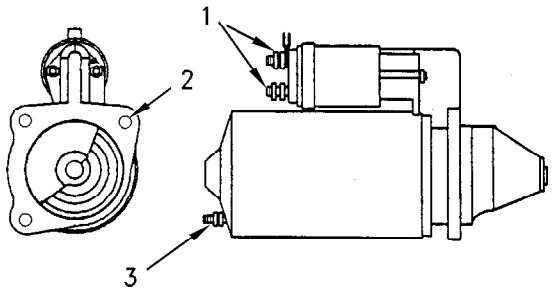

Illustration 64 g00379835

Starting motor and starting motor solenoid

No load conditions at 25°C (77°F)

- Rpm with no load . . . . . 4000 to 6000 rpm
- Maximum current . . . . . 540 A
- Current draw with no load . . . . . 130 A
- Voltage . . . . . 11.5 V
- Rated voltage . . . . . 12 V

Power rating . . . . . 2.0 kW

Power rating

- 402D-05 and 403D-07 Standard . . . . . 0.8 kW
- Option . . . . . 1.2 kW
- 403A-11 and 403D-11 Standard . . . . . 1.4 kW
- Option . . . . . 1.1 kW
- 404D-15 . . . . . 1.4 kW
- 403A-15, 403D-15, 403D-15T, 403D-17, 404A-22, 404D-22, 404D-22T, and 404D-22TA . . . . 2.0 kW

Minimum average cranking rpm 130

Starting motor solenoid

- Pull-in current . . . . . 54.5 A
- Hold-in current . . . . . 10.5 A

(1) Tighten the battery terminal nut to the following torque.. . . . . 15 N·m ((11 lb ft))

(2) Tighten the two mounting bolts to the following torque.. . . . . .50 ± 6 N·m ((37 ± 4 lb ft))

(3) Tighten the nut for the switch terminal to the following torque. . . . . 1.0 to 1.3 N·m ((9 to 12 lb in))

Maximum resistance of the starter cable at 20°C (68°F) and at 12 V . . . . . .0.04 ohms

Start Relays

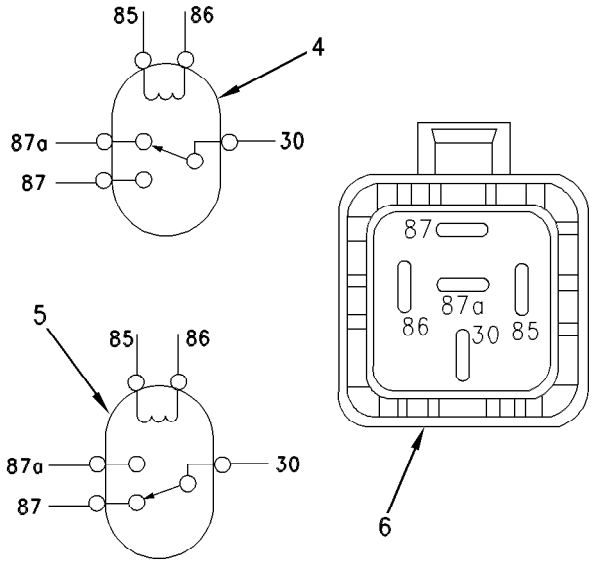

Illustration 65 g00381753

Schematic of the relays

(4) When the ignition switch is in the OFF position or the RUN position, the relay switch is closed across the contact “30” and the contact “87a” .

(5) When the ignition switch is in the START position, the relay switch is closed across the contact “30” and the contact “87” . Then, the starting motor is engaged.

Maximum voltage drop in closed position. . . .0.150 to 0.250 V

(6) Connector pins on the start relay

Resistance between contact “85” and contact “86” . . . . . 7.2 ± 0.7 ohms

i02590668

Coolant Temperature Switch

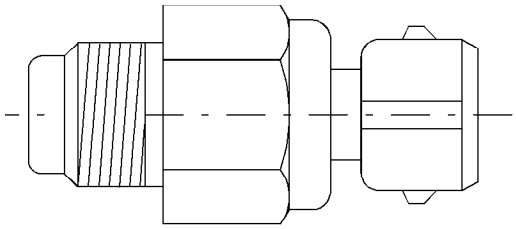

Illustration 66 g01094334

Typical coolant temperature switch

Tighten the coolant temperature switch to the following torque. . . . . .27 N·m ((20 lb ft))

i06753447

Engine Oil Pressure Switch

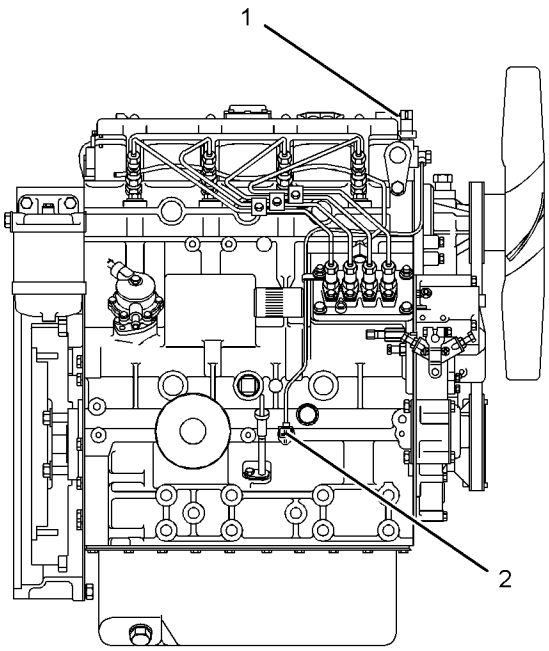

Illustration 67 g01335504
Typical example

Note: The engine oil pressure switch can be found in two positions.

(1) Engine oil pressure switch that is on the valve mechanism cover

Torque for the engine oil pressure switch
. . . . . 11 N·m ((97 lb in))
403D-11 and 403D-11. . . . . (Deutsch connector) Green sticker with a white dot

402D-05, 403D-07, 403A-15, 403D-15, 403D-15T, 403D-17, 404D-15, 404A-22, 404D-22, 404D-22T, and 404D-22TA. . . . . (Amp) Brown connector

Pressure rating
403A-11 and 403D-11. . . . . .49.0 kPa ((7.11 psi))
402D-05, 403D-07, 403A-15, 403D-15, 403D-15T, 403D-17, 404D-15, 404A-22, 404D-22, 404D-22T, and 404D-22TA. . . . . 29.4 kPa ((4.26 psi))

(2) Engine oil pressure switch that is on the cylinder block

Torque for the engine oil pressure switch
. . . . . .23 N·m ((17 lb ft))
403A-11 and 403D-11. . . . . (Deutsch connector) Green sticker with a white dot

402D-05, 403D-07, and 404D-15. . . . . (Deutsch connector) Green sticker with a red dot

403A-15, 403D-15, 403D-15T, 403D-17, 404A-22, 404D-22, 404D-22T, and 404D-22TA. . . . . (Amp) Black connector

Pressure rating
403A-11 and 403D-11. . . . . .49.0 kPa ((7.11 psi))

402D-05, 403D-07, and 404D-15. . . . . 68.9 kPa ((10.0 psi))

403A-15, 403D-15, 403D-15T, 403D-17, 404A-22, 404D-22, 404D-22T, and 404D-22TA
. . . . . 68.9 kPa ((10.0 psi))

i06753448

Glow Plugs

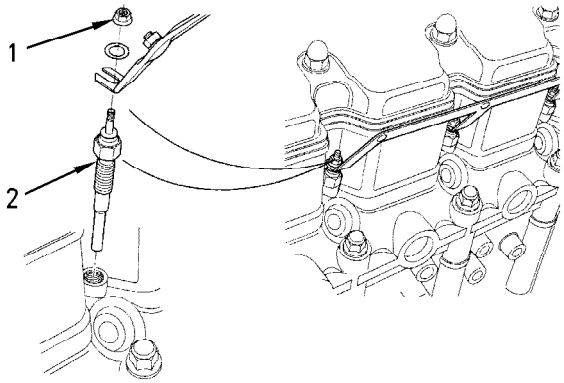

Illustration 68 g00904843
Typical example

(1) Torque for the nut on the bus bar (All models) . . . . . 1.2 N·m ((11 lb in))

(2) Torque for the glow plug

402D-05, 403D-07, 403A-11, 403D-11, and 404D-15 . . . . . 12 N·m ((106 lb in))

403A-15, 403D-15, 403D-15T, 403D-17, 404A-22, 404D-22, 404D-22T, and 404D-22TA . . . . . 18 N·m ((13 lb ft))

i08139392

Fuel Shutoff Solenoid

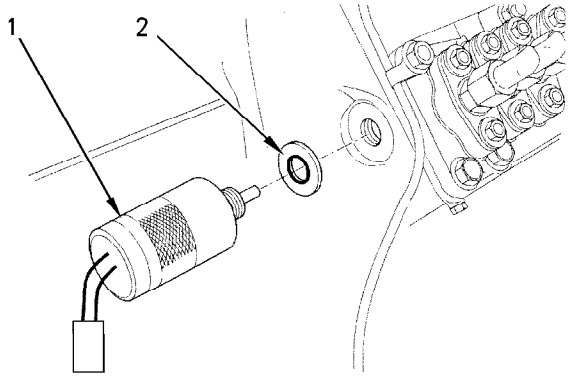

Illustration 69 g00820306
Typical example

(1) Tighten the fuel shutoff solenoid to the following torque.. . . . . 26 N·m ((230 lb in))

(2) Washer

Ensure that the washer is replaced with a new washer during the installation of the fuel shutoff solenoid (1).

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