



Specifications

3500B and 3500C Marine Engines

S2A1-Up (Engine)
S2B1-Up (Engine)
S2D1-Up (Engine)
S2E1-Up (Engine)
S2F1-Up (Engine)
B5G1-Up (Engine)
MRG1-Up (Engine)
PAG1-Up (Engine)
S2G1-Up (Engine)
MKH1-Up (Engine)
S2H1-Up (Engine)
S2J1-Up (Engine)
S2K1-Up (Engine)
S2L1-Up (Engine)
S2M1-Up (Engine)
S2N1-Up (Engine)
S2P1-Up (Engine)
S2R1-Up (Engine)
S2S1-Up (Engine)
S2T1-Up (Engine)
S2W1-Up (Engine)
S2X1-Up (Engine)
S2Y1-Up (Engine)
S2Z1-Up (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.



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.

Caterpillar 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 Caterpillar 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. Caterpillar dealers have the most current information available.



When replacement parts are required for this product Caterpillar recommends using Caterpillar replacement parts or parts with equivalent specifications including, but not limited to, physical dimensions, type, strength and material.

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

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Specifications Section

Engine Design

i01939435

SMCS Code: 1000

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2D1-Up

S/N: S2E1-Up

S/N: S2F1-Up

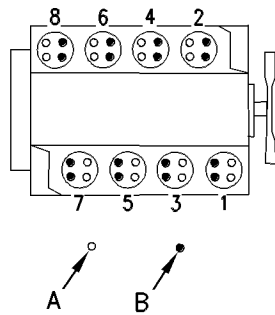


Illustration 1
Cylinder and valve location
(A) Inlet valves
(B) Exhaust valves

Number and arrangement of cylinders 60 degree V-8

Valves per cylinder 4

Displacement 34.5 L (2105 cu in)

Bore 170 mm (6.7 inch)

Stroke 190 mm (7.5 inch)

Compression ratio 14:1

Combustion Direct injection

When the crankshaft is viewed from the flywheel end the crankshaft rotates in the following direction. Counterclockwise

Firing order (injection sequence)

Standard rotation CCW 1, 2, 7, 3, 4, 5, 6, 8

Reverse rotation CW 1, 8, 7, 2, 6, 5, 4, 3

Valve lash

Inlet 0.50 mm (0.020 inch)

Exhaust 1.00 mm (0.040 inch)

Note: The front end of the engine is opposite the flywheel end of the engine. The left and the right side of the engine are determined from the flywheel end. The number 1 cylinder is the front cylinder on the right side. The number 2 cylinder is the front cylinder on the left side.

i01939560

Engine Design

SMCS Code: 1000

S/N: S2G1-Up

S/N: S2H1-Up

S/N: S2K1-Up

S/N: S2L1-Up

S/N: S2M1-Up

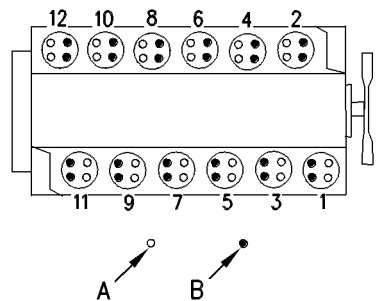


Illustration 2
Cylinder and valve location
(A) Inlet valves
(B) Exhaust valves

Number and arrangement of cylinders 60 degree V-12

Valves per cylinder 4

Displacement 51.8 L (3158 cu in)

Bore 170 mm (6.7 inch)

Stroke 190 mm (7.5 inch)

Compression ratio 14:1

Combustion Direct injection

When the crankshaft is viewed from the flywheel end the crankshaft rotates in the following direction. Counterclockwise

Firing order (injection sequence)

Standard rotation

CCW 1, 12, 9, 4, 5, 8, 11, 2, 3, 10, 7, 6

Reverse rotation

CW 1, 4, 9, 8, 5, 2, 11, 10, 3, 6, 7, 12

Valve lash

Inlet 0.50 mm (0.020 inch)

Exhaust 1.00 mm (0.040 inch)

Note: The front end of the engine is opposite the flywheel end of the engine. The left and the right side of the engine are determined from the flywheel end. The number 1 cylinder is the front cylinder on the right side. The number 2 cylinder is the front cylinder on the left side.

i01443411

Engine Design

SMCS Code: 1000

S/N: MRG1-Up

S/N: MKH1-Up

S/N: S2J1-Up

S/N: S2N1-Up

Bore 170 mm (6.7 inch)

Stroke 215 mm (8.5 inch)

Compression ratio 15.5:1

Combustion Direct injection

When the crankshaft is viewed from the flywheel end the crankshaft rotates in the following direction. Counterclockwise

Firing order (injection sequence)

Standard rotation

CCW 1, 12, 9, 4, 5, 8, 11, 2, 3, 10, 7, 6

Reverse rotation

CW 1, 4, 9, 8, 5, 2, 11, 10, 3, 6, 7, 12

Valve lash

Inlet 0.50 mm (0.020 inch)

Exhaust 1.00 mm (0.040 inch)

Note: The front end of the engine is opposite the flywheel end of the engine. The left and the right side of the engine are determined from the flywheel end. The number 1 cylinder is the front cylinder on the right side. The number 2 cylinder is the front cylinder on the left side.

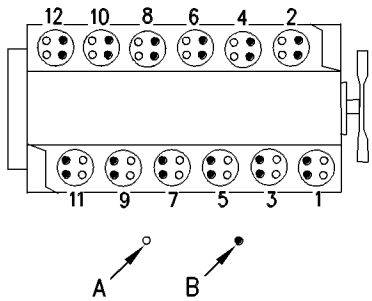


Illustration 3

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Cylinder and valve location

(A) Inlet valves

(B) Exhaust valves

Number and arrangement of

cylinders 60 degree V-12

Valves per cylinder 4

Displacement 58.5 L (3570 cu in)

Engine Design

SMCS Code: 1000

S/N: S2P1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2W1-Up

S/N: S2Y1-Up

i01939608

Inlet 0.50 mm (0.020 inch)

Exhaust 1.00 mm (0.040 inch)

Note: The front end of the engine is opposite the flywheel end of the engine. The left and the right side of the engine are determined from the flywheel end. The number 1 cylinder is the front cylinder on the right side. The number 2 cylinder is the front cylinder on the left side.

i01939644

Engine Design

SMCS Code: 1000

S/N: B5G1-Up

S/N: PAG1-Up

S/N: S2T1-Up

S/N: S2X1-Up

S/N: S2Z1-Up

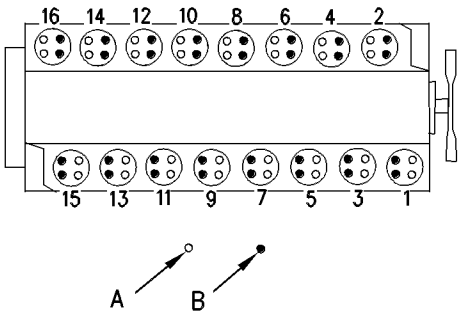


Illustration 4
Cylinder and valve location
(A) Inlet valves
(B) Exhaust valves

Number and arrangement of cylinders 60 degree V-16

Valves per cylinder 4

Displacement 69.1 L (4210 cu in)

Bore 170 mm (6.7 inch)

Stroke 190 mm (7.5 inch)

Compression ratio 14:1

Combustion Direct injection

When the crankshaft is viewed from the flywheel end the crankshaft rotates in the following direction. Counterclockwise

Firing order (injection sequence)

Standard rotation
CCW .. 1, 2, 5, 6, 3, 4, 9, 10, 15, 16, 11, 12, 13, 14, 7, 8

Reverse rotation
CW .. 1, 6, 5, 4, 3, 10, 9, 16, 15, 12, 11, 14, 13, 8, 7, 2

Valve lash

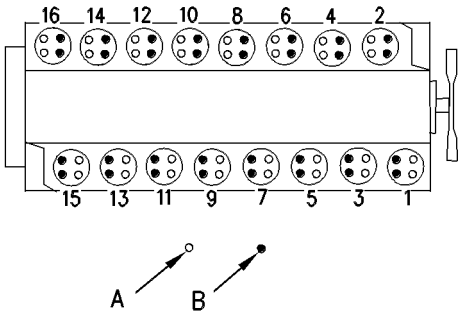


Illustration 5
Cylinder and valve location
(A) Inlet valves
(B) Exhaust valves

Number and arrangement of cylinders 60 degree V-16

Valves per cylinder 4

Displacement 78.0 L (4760 cu in)

Bore 170 mm (6.7 inch)

Stroke 215 mm (8.5 inch)

Compression ratio 15.5:1

Combustion Direct injection

When the crankshaft is viewed from the flywheel end the crankshaft rotates in the following direction. Counterclockwise

Firing order (injection sequence)

i01939720

Standard rotation

CCW .. 1, 2, 5, 6, 3, 4, 9, 10, 15, 16, 11, 12, 13, 14, 7, 8

Reverse rotation

CW .. 1, 6, 5, 4, 3, 10, 9, 16, 15, 12, 11, 14, 13, 8, 7, 2

Valve lash

Inlet 0.50 mm (0.020 inch)

Exhaust 1.00 mm (0.040 inch)

Note: The front end of the engine is opposite the flywheel end of the engine. The left and the right side of the engine are determined from the flywheel end. The number 1 cylinder is the front cylinder on the right side. The number 2 cylinder is the front cylinder on the left side.

i01939668

Fuel Filter (Primary)

SMCS Code: 1260

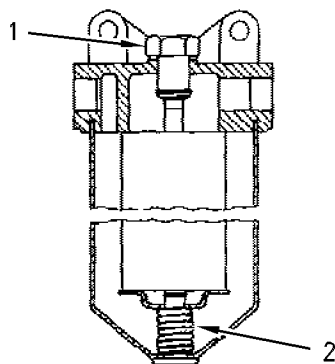


Illustration 6

g00111701

(1) Nut

Torque 25 ± 5 N·m (18 ± 4 lb ft)

(2) 7S-9323 Spring

Length under test force 27.9 mm (1.10 inch)

Test force 125 to 147 N (28 to 33 lb)

Free length after test 42.7 mm (1.68 inch)

Outside diameter 17.3 mm (0.68 inch)

Fuel Filter Base (Spin-on Filter)

SMCS Code: 1262

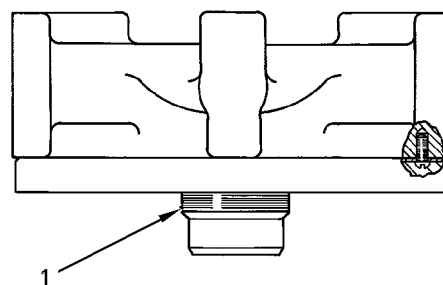


Illustration 7

g00111730

Typical example

(1) Stud

Put 154-9731 Sealant on the last 10.0 ± 1.5 mm (0.39 ± 0.06 inch) of the threads at the base end of the stud.

Torque 68 ± 7 N·m (50 ± 5 lb ft)

i02548574

Fuel Filter

SMCS Code: 1261

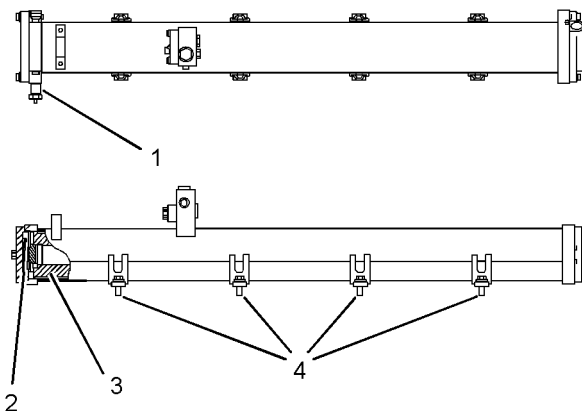


Illustration 8

g01275418

(1) Ball valve

(2) 1N-2895 Spring

Free length 62.48 mm (2.4598 inch)
Assembled length 20.75 mm (0.8169 inch)
Load at assembled length 222 N (50 lb)

(3) Element

(4) Bolt

Torque 47 ± 9 N·m (35 ± 7 lb ft)

i01758002

Fuel Pressure Regulator

SMCS Code: 1277

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2D1-Up

S/N: S2E1-Up

S/N: S2F1-Up

S/N: B5G1-Up

S/N: MRG1-Up

S/N: PAG1-Up

S/N: S2G1-Up

S/N: MKH1-Up

S/N: S2H1-Up

S/N: S2J1-Up

S/N: S2K1-Up

S/N: S2L1-Up

S/N: S2M1-Up

S/N: S2N1-Up

S/N: S2P1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2T1-Up

S/N: S2W1-Up

S/N: S2X1-Up

S/N: S2Y1-Up

Part No.: 114-5477

S/N: S2Z1-Up

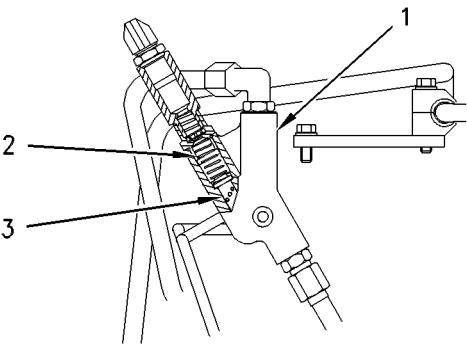


Illustration 9
Typical example

(1) Fuel manifold adapter

(2) 9N-4053 Spring

Length under test force 28.5 mm (1.12 inch)
Test force 40.8 ± 2.1 N (9.17 ± 0.46 lb)
Free length after test force .. 57.2 mm (2.25 inch)
Outside diameter 15.24 mm (0.600 inch)

(3) Regulator valve plunger

The regulator valve must maintain fuel manifold pressure within the following values: 415 to 450 kPa (60 to 65 psi)

i02202308

Fuel Transfer Pump

SMCS Code: 1256

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2D1-Up

S/N: S2E1-Up

S/N: S2F1-Up

S/N: B5G1-Up

S/N: MRG1-Up

S/N: PAG1-Up

S/N: S2G1-Up

S/N: MKH1-Up

S/N: S2H1-Up

S/N: S2J1-Up

S/N: S2K1-Up

S/N: S2L1-Up

S/N: S2M1-Up

S/N: S2N1-Up

S/N: S2P1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2T1-Up

S/N: S2W1-Up

S/N: S2X1-Up

S/N: S2Y1-Up

Part No.: 8N-6151

S/N: S2Z1-Up

Length of gears 25.347 ± 0.008 mm
(0.9979 ± 0.0003 inch)

(2) Bushing

The bushing bores for the gear shaft are the following value: 12.736 mm (0.5014 inch)
The bearings are installed at the following depth: 1.5 ± 0.5 mm (0.06 ± 0.02 inch)

(3) Check valve

(4) Bypass valve

(5) 1W-4655 Spring

Length 28.4 mm (1.12 inch)
Inside diameter 7.1 mm (0.28 inch)
Outside diameter 10.7 mm (0.42 inch)

i02544785

Fuel Injector Mechanism

SMCS Code: 1102; 1290

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2D1-Up

S/N: S2E1-Up

S/N: S2F1-Up

S/N: B5G1-Up

S/N: MRG1-Up

S/N: PAG1-Up

S/N: S2G1-Up

S/N: MKH1-Up

S/N: S2H1-Up

S/N: S2J1-Up

S/N: S2K1-Up

S/N: S2L1-Up

S/N: S2M1-Up

S/N: S2N1-Up

S/N: S2P1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2T1-Up

S/N: S2W1-Up

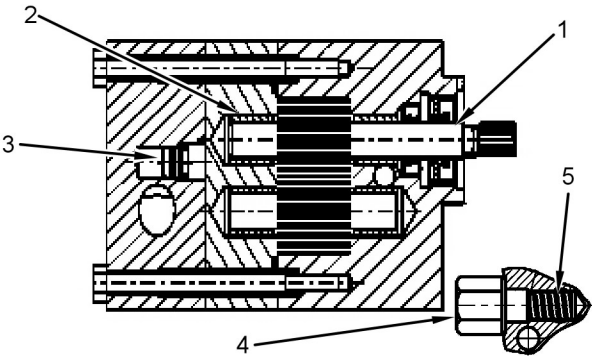


Illustration 10

g01112058

When the drive gear is viewed from the drive end the drive gear rotates in the following direction: Clockwise

Minimum output 21 L/min (5.5 US gpm)

The minimum output is attained under the following conditions:

Pump pressure 415 kPa (60 psi)

Pump speed 2400 rpm

The setting for the check valve is the following value: 860 kPa (125 psi)

The setting for the bypass valve is the following value: 860 kPa (125 psi)

(1) Gear shaft assemblies

Diameter of shafts 12.6875 ± 0.0125 mm
(0.4995 ± 0.0005 inch)

Diameter of gears 29.801 ± 0.006 mm
(1.1733 ± 0.0002 inch)

i02547255

S/N: S2X1-Up**S/N:** S2Y1-Up**Part No.:** 224-9869**S/N:** S2Z1-Up

Fuel Injector

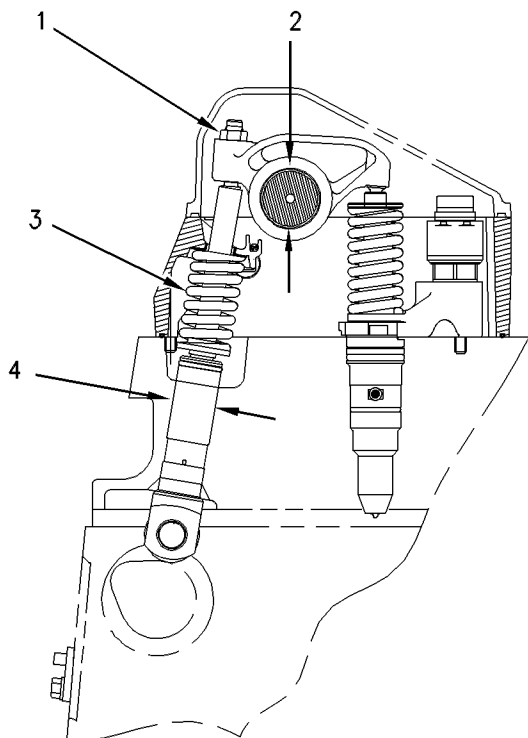
SMCS Code: 1290**S/N:** S2A1-Up**S/N:** S2B1-Up**S/N:** S2D1-Up**S/N:** S2E1-Up**S/N:** S2F1-Up**S/N:** B5G1-Up**S/N:** MRG1-Up**S/N:** PAG1-Up**S/N:** S2G1-Up**S/N:** MKH1-Up**S/N:** S2H1-Up**S/N:** S2J1-Up**S/N:** S2K1-Up**S/N:** S2L1-Up**S/N:** S2M1-Up**S/N:** S2N1-Up**S/N:** S2P1-Up**S/N:** S2R1-Up**S/N:** S2S1-Up**S/N:** S2T1-Up**S/N:** S2W1-Up**S/N:** S2X1-Up**S/N:** S2Y1-Up**Part No.:** 254-1417**S/N:** S2Z1-Up

Illustration 11

g00111756

(1) LocknutTorque $120 \pm 15 \text{ N}\cdot\text{m}$ ($90 \pm 11 \text{ lb ft}$)**(2) Rocker arm shaft**Diameter of the rocker arm
shaft $45.000 \pm 0.013 \text{ mm}$
($1.7716 \pm 0.0005 \text{ inch}$)Bore in the bearing for the rocker arm
shaft $45.077 \pm 0.015 \text{ mm}$
($1.7747 \pm 0.0006 \text{ inch}$)**(3) Fuel injector spring**Length under test force 85 mm (3.3 inch)
Test force $300 \pm 25 \text{ N}$ ($67 \pm 6 \text{ lb}$)
Free length after test 87.65 mm (3.451 inch)
Outside diameter 43.85 mm (1.726 inch)**(4) Lifter**Diameter of a new unit injector
lifter .. $34.950 \pm 0.010 \text{ mm}$ ($1.3760 \pm 0.0004 \text{ inch}$)
Bore in the head for the unit injector
lifter .. $35.000 \pm 0.025 \text{ mm}$ ($1.3780 \pm 0.0010 \text{ inch}$)

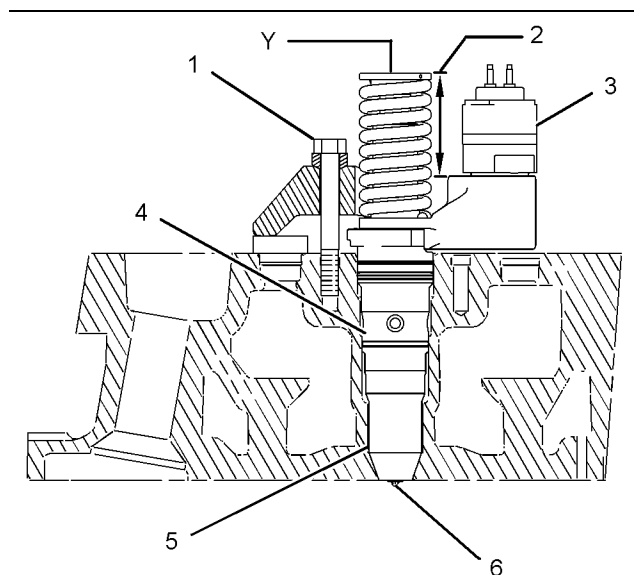


Illustration 12

g01275023

- (1) Clamp bolt
Torque $65 \pm 7 \text{ N}\cdot\text{m}$ ($48 \pm 5 \text{ lb ft}$)
- (2) Injector lash
Dimension $64.34 \pm 0.20 \text{ mm}$
($2.533 \pm 0.008 \text{ inch}$)
- (3) Valve assembly
Lubricate the bore and threads of valve assembly with multipurpose lithium grease.
Torque for valve assembly $165 \pm 10 \text{ N}\cdot\text{m}$
($122 \pm 7 \text{ lb ft}$)
Torque for terminal nuts $2.50 \pm 0.25 \text{ N}\cdot\text{m}$
($22 \pm 2 \text{ lb in}$)
- (4) Case assembly
- (5) Nozzle
Torque $310 \pm 20 \text{ N}\cdot\text{m}$ ($230 \pm 15 \text{ lb ft}$)
- (6) Nozzle tip assembly

Fuel injector installation

1. For lubrication of the O-ring seals, put multipurpose grease in the bore of the cylinder head.
2. Put the injector in the bore. Use the clamp bolt (1) and the fuel injector clamp to push the injector into the correct position.

Note: Do not tap or hit surface (Y) in order to install the injector.

3. Tighten the clamp bolt (1) that holds the fuel injector clamp to the specified torque.
4. Be certain that the fuel injector body below the solenoid is not in contact with the valve springs.

i01390111

Camshaft

SMCS Code: 1210

S/N: S2A1-Up

S/N: S2D1-Up

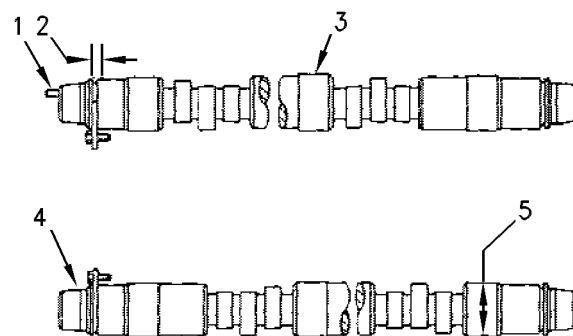


Illustration 13

g00289972

Typical example

- (1) Pin
The pin extends from the camshaft by the following distance: $12.0 \pm 0.5 \text{ mm}$
($0.47 \pm 0.02 \text{ inch}$)
- (2) New washer
Thickness of a new washer $8.50 \pm 0.05 \text{ mm}$
($0.335 \pm 0.002 \text{ inch}$)
Thickness of the groove in a new camshaft ... $8.75 \pm 0.05 \text{ mm}$ ($0.344 \pm 0.002 \text{ inch}$)
End play for new camshafts $0.15 \text{ to } 0.35 \text{ mm}$
($0.006 \text{ to } 0.014 \text{ inch}$)
- (3) LH camshaft
- (4) RH camshaft
- (5) Journal surface
Diameter of surface (journals) for new camshaft bearings .. $91.88 \pm 0.02 \text{ mm}$ ($3.617 \pm 0.001 \text{ inch}$)
Bore in bearings for camshafts after assembly $92.00 \pm 0.06 \text{ mm}$
($3.622 \pm 0.002 \text{ inch}$)

i01735832

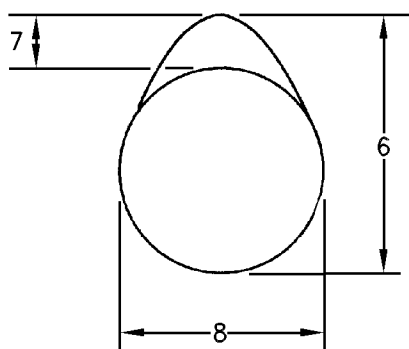


Illustration 14

g00290053

(6) Camshaft lobe height

In order to determine the height, use the procedure that follows:

1. Measure camshaft lobe height (6).
2. Measure base circle (8).
3. Subtract the base circle (Step 2) from the lobe height (Step 1). The difference is the actual lobe lift.

4. Specified camshaft lobe lift (7)

Inlet lobe	13.250 mm (0.5217 inch)
Injector lobe	13.731 mm (0.5406 inch)
Exhaust lobe	13.250 mm (0.5217 inch)

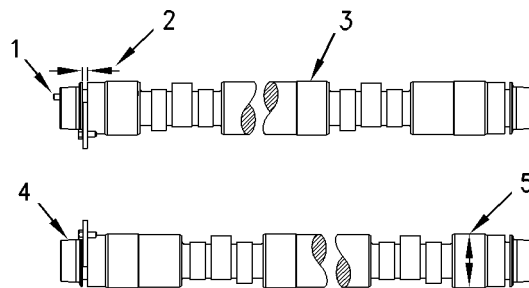
Camshaft**SMCS Code:** 1210**S/N:** S2B1-Up**S/N:** S2E1-Up**S/N:** S2F1-Up

Illustration 15

g00889902

Typical example

(1) Pin

The pin extends from the camshaft by the following distance: 12.0 ± 0.5 mm
(0.47 ± 0.02 inch)

(2) Washer

Thickness of a new washer 8.50 ± 0.05 mm
(0.335 ± 0.002 inch)
Thickness of the groove in a new camshaft ... 8.75 ± 0.05 mm (0.344 ± 0.002 inch)
End play for new camshafts 0.15 to 0.35 mm
(0.006 to 0.014 inch)

(3) LH camshaft**(4) RH camshaft****(5) Journal surface**

Diameter of surface (journals) for new camshaft bearings .. 91.88 ± 0.02 mm (3.617 ± 0.001 inch)
Bore in bearings for camshafts after assembly 92.00 ± 0.06 mm
(3.622 ± 0.002 inch)

i02549735

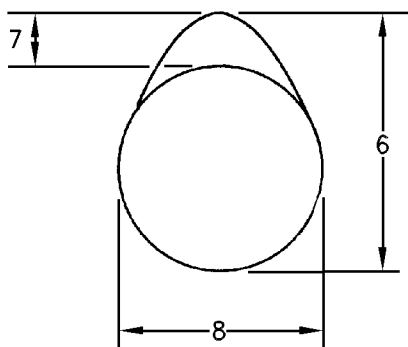


Illustration 16

g00290053

(6) Camshaft lobe height

In order to determine the height, use the following procedure:

1. Measure camshaft lobe height (6).
 2. Measure base circle (8).
 3. Subtract the base circle (Step 2) from the lobe height (Step 1). The difference is the actual lobe lift.
 4. Specified camshaft lobe lift (7)
- | | |
|---------------------|-------------------------|
| Inlet lobe | 12.750 mm (0.5020 inch) |
| Injector lobe | 13.731 mm (0.5406 inch) |
| Exhaust lobe | 13.250 mm (0.5217 inch) |

Camshaft

SMCS Code: 1210

S/N: B5G1-Up

S/N: MRG1-Up

Part No.: 231 -9123

S/N: PAG1-Up

S/N: MKH1-Up

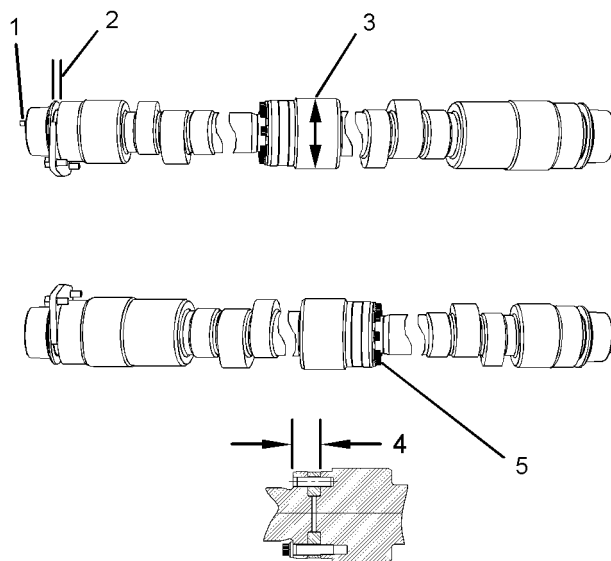


Illustration 17

g01276007

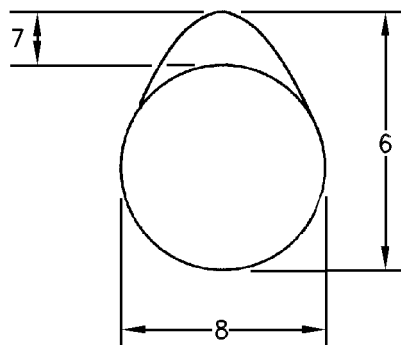


Illustration 18

g00290053

(1) Pin

The pin extends from the rear left hand camshaft and from the front right hand camshaft by the following distance: 12.0 $\pm$ 0.5 mm (0.47 $\pm$ 0.02 inch)

(2) Washer

Thickness of a new washer 8.50 ± 0.05 mm
(0.335 ± 0.002 inch)

Thickness of the groove in a new
camshaft ... 8.75 ± 0.05 mm (0.344 ± 0.002 inch)

End play for new camshafts 0.15 to 0.35 mm
(0.006 to 0.014 inch)

(3) Journal surface

Diameter of surface (journals) for new camshaft
bearings .. 91.88 ± 0.02 mm (3.617 ± 0.001 inch)

Bore in bearings for camshafts after
assembly 92.00 ± 0.06 mm
(3.622 ± 0.002 inch)

(4) Dowel

The dowel extends from the end of the rear right
hand camshaft and the front left hand camshaft
by the following distance: 22.0 ± 0.5 mm
(0.87 ± 0.02 inch)

(5) Bolt

Clean the threads of the bolts and the contact
surfaces of the parts thoroughly. Hand tighten the
bolts to the following torque. 55 ± 7 N·m
(40 ± 5 lb ft)

(6) Camshaft lobe height

In order to determine the height, use the following
procedure:

1. Measure camshaft lobe height (6).
2. Measure base circle (8).
3. Subtract the base circle (Step 2) from the lobe
height (Step 1). The difference is the actual lobe
lift.
4. Specified camshaft lobe lift (7)

Inlet lobe 12.730 mm (0.5012 inch)

Injector lobe 13.731 mm (0.5406 inch)

Exhaust lobe 13.100 mm (0.5157 inch)

Camshaft

SMCS Code: 1210

S/N: S2G1-Up

S/N: S2K1-Up

S/N: S2L1-Up

S/N: S2M1-Up

S/N: S2N1-Up

S/N: S2P1-Up

S/N: S2T1-Up

S/N: S2W1-Up

S/N: S2Z1-Up

i02549655

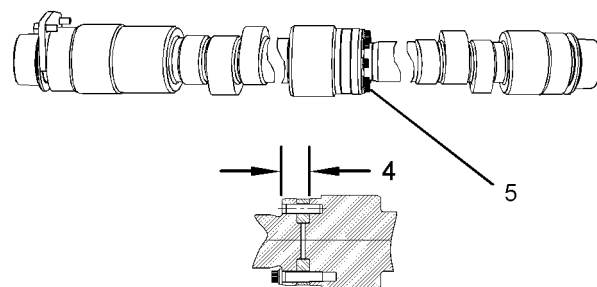
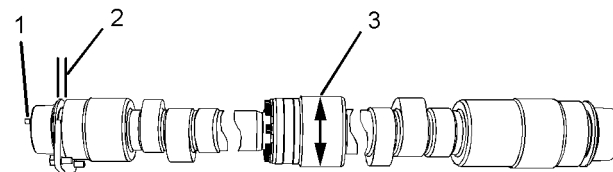


Illustration 19

g01276007

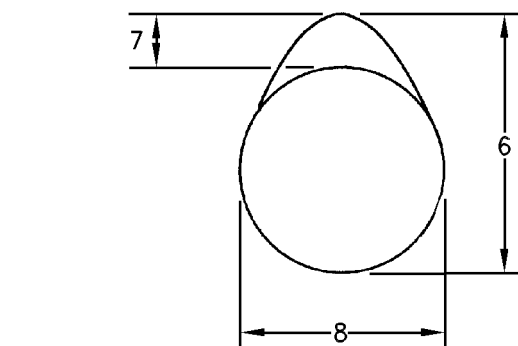


Illustration 20

g00290053

(1) Pin

The pin extends from the rear left hand camshaft by the following distance. 12.0 ± 0.5 mm
(0.47 ± 0.02 inch)

i01441708

(2) Washer

Thickness of a new washer 8.50 ± 0.05 mm
(0.335 ± 0.002 inch)

Thickness of the groove in a new
camshaft ... 8.75 ± 0.05 mm (0.344 ± 0.002 inch)
End play for new camshafts 0.15 to 0.35 mm
(0.006 to 0.014 inch)

(3) Journal surface

Diameter of surface (journals) for new camshaft
bearings .. 91.88 ± 0.02 mm (3.617 ± 0.001 inch)
Bore in bearings for camshafts after
assembly 92.00 ± 0.06 mm
(3.622 ± 0.002 inch)

(4) Dowel

The dowel extends from the end of the rear right
hand camshaft and the front left hand camshaft
by the following value. 22.0 ± 0.5 mm
(0.87 ± 0.02 inch)

(5) Bolt

Clean the threads of the bolts and the contact
surfaces of the parts thoroughly. Hand tighten the
bolts to the following torque. 55 ± 7 N·m
(40 ± 5 lb ft)

(6) Camshaft lobe height

In order to determine the height, use the following
procedure:

1. Measure camshaft lobe height (6).
2. Measure base circle (8).
3. Subtract the base circle (Step 2) from the lobe height (Step 1). The difference is the actual lobe lift.

4. Specified camshaft lobe lift (7)

Inlet lobe 13.250 mm (0.5217 inch)
Injector lobe 13.731 mm (0.5406 inch)
Exhaust lobe 13.250 mm (0.5217 inch)

Camshaft

SMCS Code: 1210

S/N: S2H1-Up

S/N: S2J1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2X1-Up

S/N: S2Y1-Up

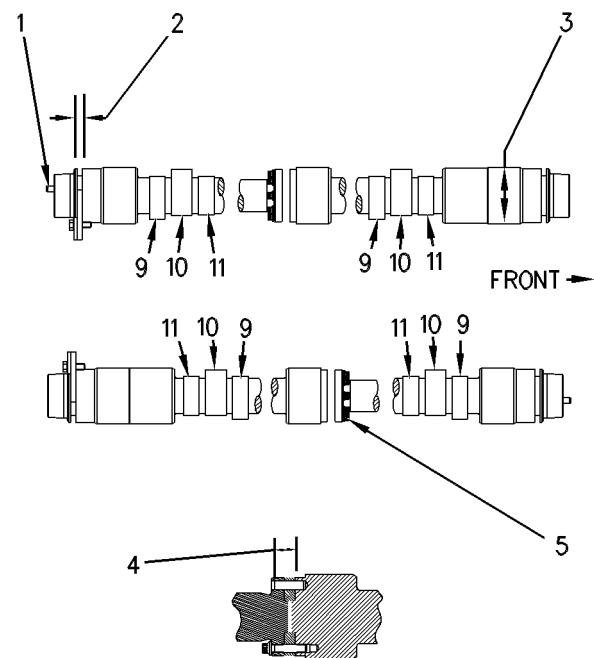


Illustration 21

g00277216

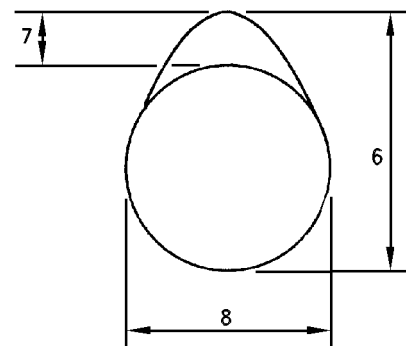


Illustration 22

g00277223

(1) Pin

The pin extends from the rear left hand camshaft. The pin extends by the following distance. 12.0 ± 0.5 mm (0.47 ± 0.02 inch)

(2) Washer

Thickness of a new washer 8.50 ± 0.05 mm (0.335 ± 0.002 inch)
Thickness of the groove in a new camshaft ... 8.75 ± 0.05 mm (0.344 ± 0.002 inch)
End play for new camshafts 0.15 to 0.35 mm (0.006 to 0.014 inch)

(3) Journal surface

Diameter of surface (journals) for new camshaft bearings .. 91.88 ± 0.02 mm (3.617 ± 0.001 inch)
Bore in bearings for camshafts after assembly 92.00 ± 0.06 mm (3.622 ± 0.002 inch)

(4) Dowel

The dowel extends from the end of the rear right hand camshaft and the front left hand camshaft by the following value. 22.0 ± 0.5 mm (0.87 ± 0.02 inch)

(5) Bolt

Clean the threads of the bolts and the contact surfaces of the parts thoroughly.
Hand tighten the bolts to the following torque. 55 ± 7 N·m (40 ± 5 lb ft)

(6) Camshaft lobe height

In order to determine the height, use the following procedure:

1. Measure camshaft lobe height (6).
2. Measure base circle (8).
3. Subtract the base circle (Step 2) from the lobe height (Step 1). The difference is the actual lobe lift.
4. Specified camshaft lobe lift (7)

Inlet lobe (9)	12.750 mm (0.5020 inch)
Injector lobe (10)	13.731 mm (0.5406 inch)
Exhaust lobe (11)	13.250 mm (0.5217 inch)

Valve Mechanism

SMCS Code: 1102

Type 1

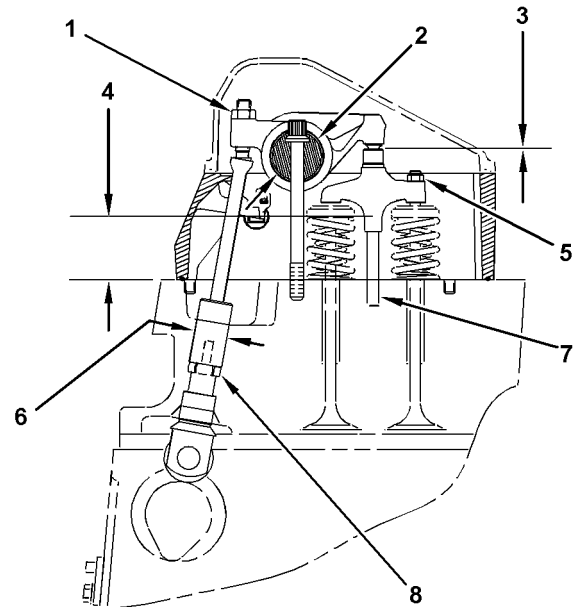


Illustration 23

g01147392

(1) Locknut

Torque 70 ± 15 N·m (50 ± 11 lb ft)

(2) Rocker arm shaft

Bore in the bearings for the rocker arm shaft
After the 123-4271 Sleeve Bearing is installed in the rocker arm the bearing must be machined to size. 45.056 ± 0.015 mm (1.7739 ± 0.0006 inch)
Maximum roughness average (Ra) 0.8 micrometer (32 microinch)
After the 230-2620 Sleeve Bearing is installed in the rocker arm the bearing must be machined to size. ... $45.077 \pm .015$ mm (1.7747 ± 0.0006 inch)
Maximum roughness average (Ra) 0.8 micrometer (32 microinch)
Diameter of the rocker arm shaft 45.000 ± 0.013 mm (1.7716 ± 0.0005 inch)

(3) Valve lash

Inlet	0.50 mm (0.020 inch)
Exhaust	1.00 mm (0.040 inch)

(4) Height of Dowel

Height to the top of the dowel 66.5 ± 0.5 mm
(2.62 ± 0.02 inch)

(5) Locknut

Torque 30 ± 4 N·m (22 ± 3 lb ft)

(6) Valve lifter

Diameter of the new valve
lifter .. 29.900 ± 0.010 mm (1.1772 ± 0.0004 inch)
Bore in the head for the valve
lifter .. 30.000 ± 0.025 mm (1.1811 ± 0.0010 inch)

(7) Dowel

Diameter of the new dowel ... 11.008 ± 0.003 mm
(0.4334 ± 0.0001 inch)
Bore in the bridge for the dowel .. 11.07 ± 0.03 mm
(0.436 ± 0.001 inch)
Bore in the head for the
dowel 10.968 ± 0.020 mm
(0.4318 ± 0.0008 inch)

(8) Guide springs

Refer to Guidelines For Reusable Parts, SEBF8172,
"Visual Inspection of 7N-4782 Lifter Guide Spring –
3500 Family of Engines".

Type 2

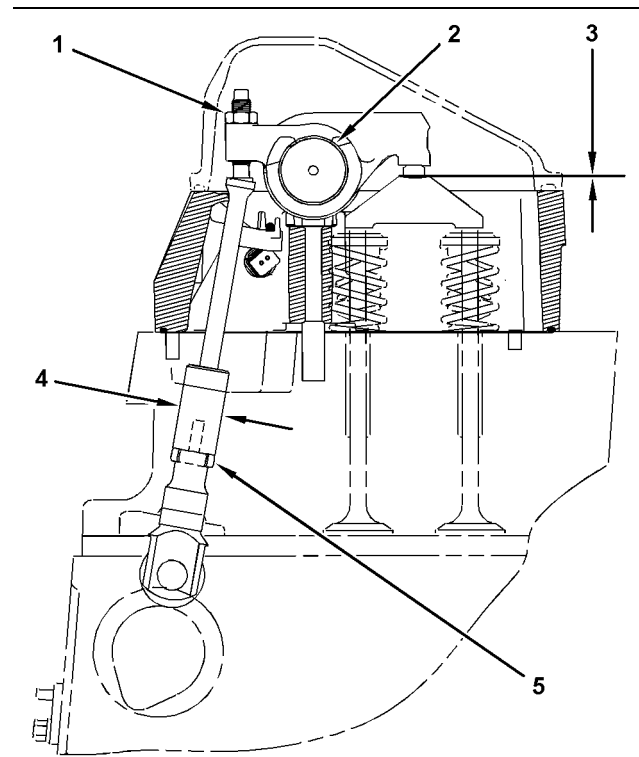


Illustration 24

g01147396

(1) Locknut

Torque 70 ± 15 N·m (50 ± 11 lb ft)

(2) Rocker arm shaft

Bore in the bearings for the rocker arm shaft

After the 123 - 4271 Sleeve Bearing is installed
in the rocker arm the bearing must be machined
to size. 45.056 ± 0.015 mm
(1.7739 ± 0.0006 inch)

Maximum roughness average
(Ra) 0.8 micrometer (32 microinch)

After the 230 - 2620 Sleeve Bearing is installed in
the rocker arm the bearing must be machined to
size. .. $45.077 \pm .015$ mm (1.7747 ± 0.0006 inch)

Maximum roughness average
(Ra) 0.8 micrometer (32 microinch)

Diameter of the rocker arm
shaft 45.000 ± 0.013 mm
(1.7716 ± 0.0005 inch)

(3) Valve lash

Inlet 0.50 mm (0.020 inch)
Exhaust 1.00 mm (0.040 inch)

(4) Valve lifter

Diameter of the new valve
lifter .. 29.900 ± 0.010 mm (1.1772 ± 0.0004 inch)
Bore in the head for the valve
lifter .. 30.000 ± 0.025 mm (1.1811 ± 0.0010 inch)

(5) Guide springs

Refer to Guidelines For Reusable Parts, SEBF8172, "Visual Inspection of 7N-4782 Lifter Guide Spring - 3500 Family of Engines".

i02147197

Cylinder Head

SMCS Code: 1100

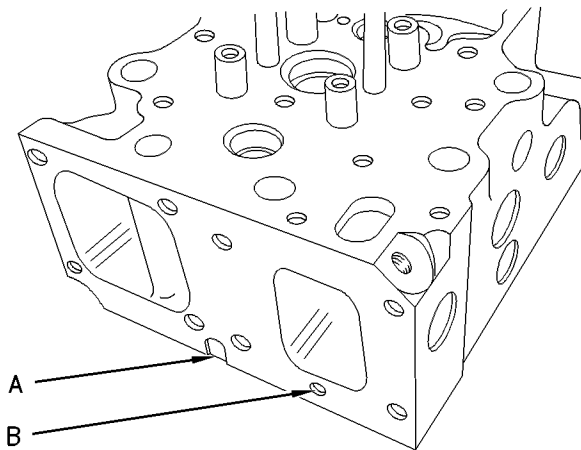


Illustration 25

g00115241

Typical example

(A) Locating pad
(B) Plug

NOTICE

The plug at location (B) **MUST** be installed on this engine.

Use the following procedure to tighten the cylinder head bolts.

1. Coat the threads of the cylinder head bolts with clean engine oil.
2. Tighten bolts 1 through 8 in the numbered sequence that is pictured in Illustration 26.

Torque 30 ± 5 N·m (22 ± 4 lb ft)

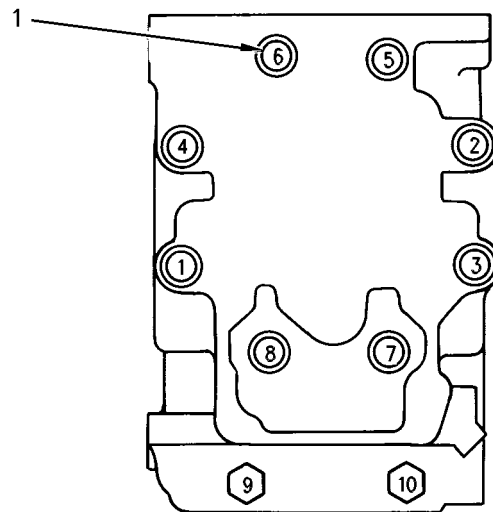


Illustration 26

g00122946

Typical example

(1) Cylinder head bolts

3. Tighten bolts 1 through 8 in the numbered sequence.

Torque 200 ± 15 N·m (148 ± 11 lb ft)

4. Tighten bolts 1 through 8 again in the numbered sequence.

Torque 200 ± 15 N·m (148 ± 11 lb ft)

5. Tighten bolts 1 through 8 again to the following rotation.

Rotation for bolts 180 ± 5 degrees

6. Tighten bolt 9 and bolt 10.

Torque 55 ± 10 N·m (40 ± 7 lb ft)

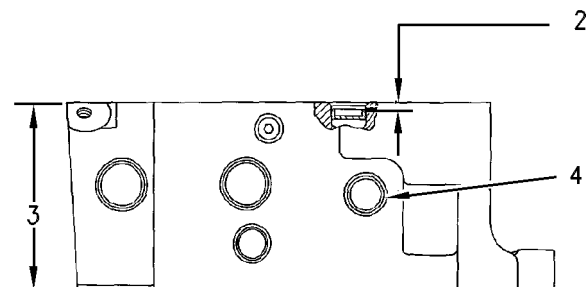


Illustration 27

g00122947

Typical example

(2) Plugs

Use 6V-6640 Sealant in the plug bores prior to assembly.

S/N: S2X1-Up

Two plugs are installed in the top of the cylinder head to the following depth: 9.0 ± 0.5 mm
(0.35 ± 0.02 inch)

S/N: S2Y1-Up

(3) Height of new cylinder head .. 142.00 ± 0.15 mm
(5.591 ± 0.006 inch)

(4) Plugs

Use 6V-6640 Sealant in the plug bores prior to assembly.

The remainder of the plugs are installed in the cylinder head below the bottom of the chamfer to the following depth: 1.0 ± 0.5 mm
(0.04 ± 0.02 inch)

i02303503

Cylinder Head Valves

SMCS Code: 1105

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2D1-Up

S/N: S2E1-Up

S/N: S2F1-Up

S/N: B5G1-Up

S/N: MRG1-Up

S/N: PAG1-Up

S/N: S2G1-Up

S/N: MKH1-Up

S/N: S2H1-Up

S/N: S2J1-Up

S/N: S2K1-Up

S/N: S2L1-Up

S/N: S2M1-Up

S/N: S2N1-Up

S/N: S2P1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2T1-Up

S/N: S2W1-Up

Type 1

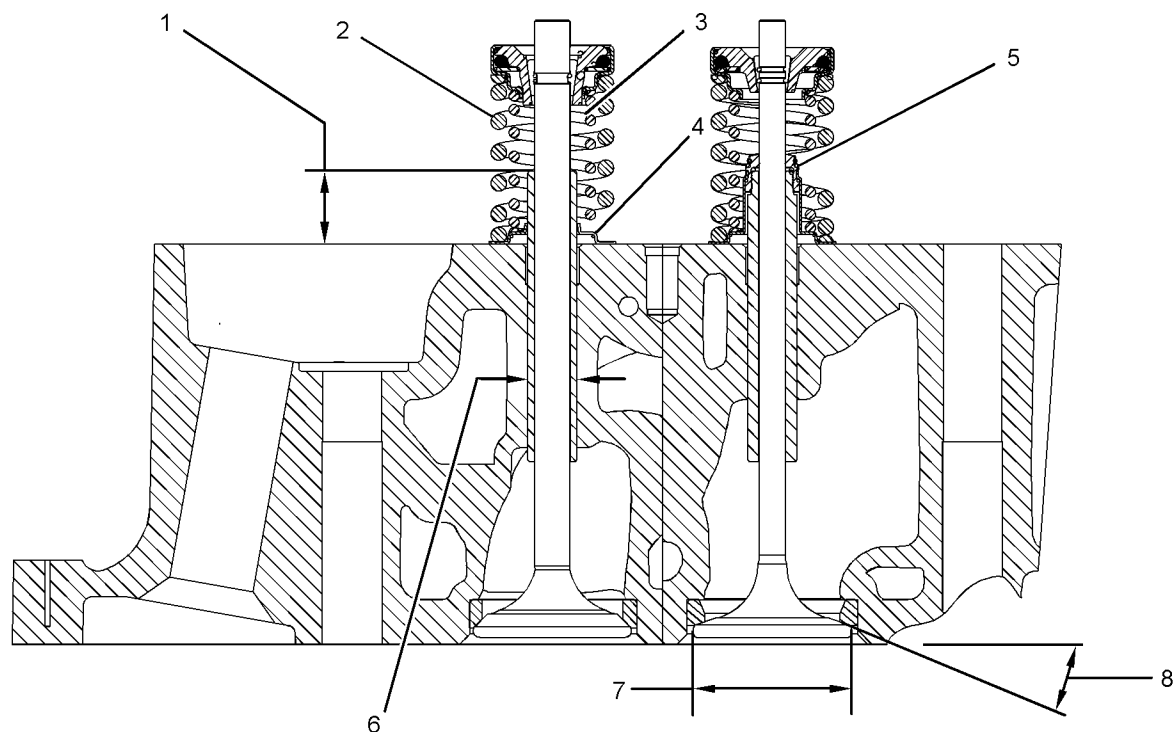


Illustration 28

g01021601

Typical example

(1) Height to the top of the valve guides 26.00 ± 0.50 mm (1.024 ± 0.020 inch)

(2) 194 - 4901 Spring

Length under test force 59.3 mm (2.33 inch)
 Test force 562 ± 28 N (126 ± 6 lb)
 Free length after test 75.8 mm (2.98 inch)
 Outside diameter 43.5 mm (1.71 inch)

(3) 194 - 4902 Spring

Length under test force 50.3 mm (1.98 inch)
 Test force 146 ± 7 N (33 ± 2 lb)
 Free length after test 60.7 mm (2.39 inch)
 Outside diameter 30.7 mm (1.21 inch)

(4) Washer

(5) Valve stem seal

Install the valve stem seals to the intake valves.
 Install the washers to the exhaust valves.

(6) Valve stem diameter and valve guide bore

Diameter of the new valve stems in the area of the valve guide
 Intake .. 9.441 ± 0.01 mm (0.3717 ± 0.0004 inch)
 Exhaust 12.573 ± 0.01 mm (0.4950 ± 0.0004 inch)

When the valve guides are installed in the cylinder head the bore in the intake valve guide is the following value: 9.487 ± 0.025 mm (0.3735 ± 0.0010 inch)

When the valve guides are installed in the cylinder head the bore in the exhaust valve guide is the following value: 12.619 ± 0.025 mm (0.4968 ± 0.0010 inch)

(7) Diameter of the valve heads 56.00 ± 0.15 mm (2.205 ± 0.006 inch)

(8) Angle of the valve faces:

Inlet 19.40 ± 0.25 degrees
 Exhaust 44.40 ± 0.25 degrees

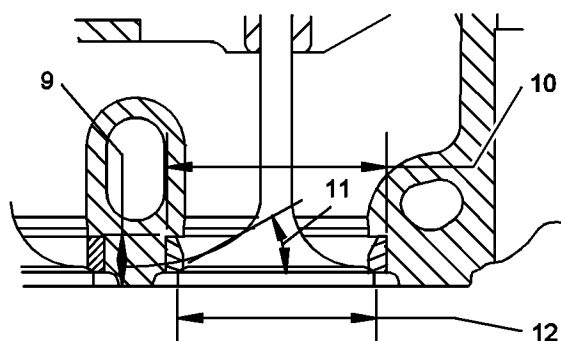


Illustration 29

g01127866

Typical example

(9) Depth of bore in head for valve seat inserts 16.00 ± 0.15 mm (0.630 ± 0.006 inch)

(10) Diameter of valve seat inserts:

Inlet .. 60.627 ± 0.015 mm (2.3869 ± 0.0006 inch)
Exhaust 60.119 ± 0.015 mm
(2.3669 ± 0.0006 inch)

Bore in head for valve seat inserts

Inlet .. 60.508 ± 0.025 mm (2.3822 ± 0.0010 inch)
Exhaust 60.000 ± 0.025 mm
(2.3622 ± 0.0010 inch)

(11) Angle of face of valve seat inserts

Inlet 20 ± 0.25 degrees
Exhaust 45 ± 0.25 degrees

(12) Outside diameter of the face of the valve seat inserts 53.60 mm (2.110 inch)

Type 2

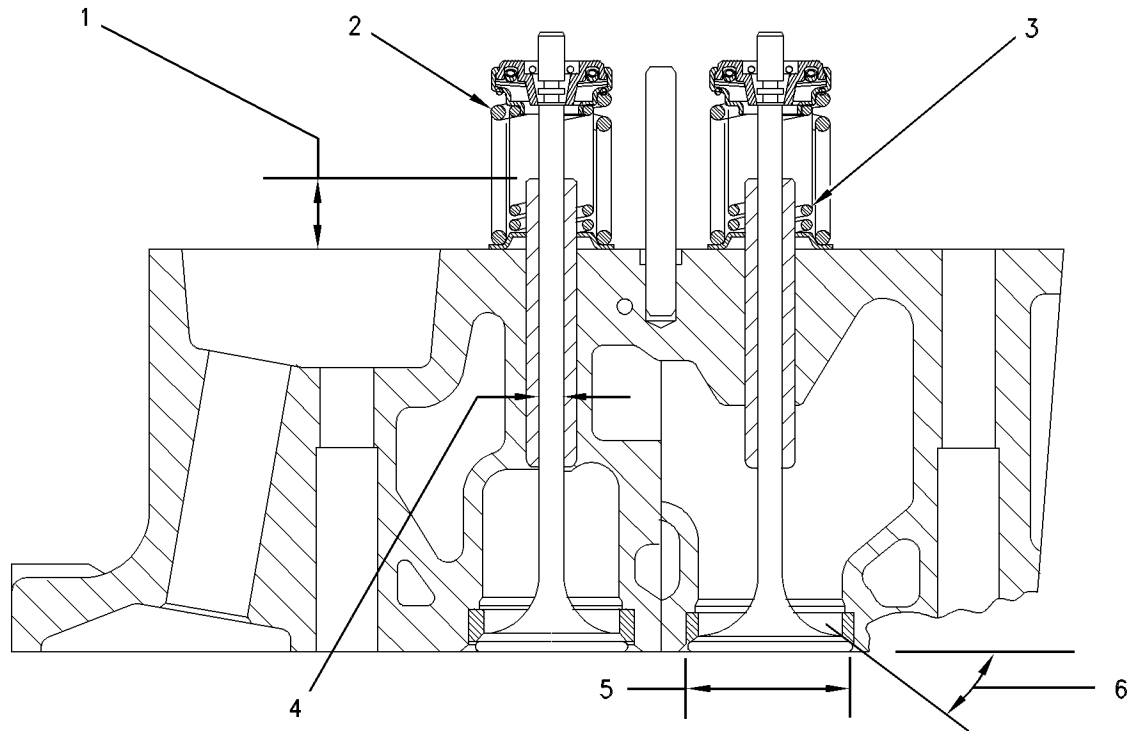


Illustration 30

g00114735

Typical example

(1) Height to the top of the valve guides 26.00 ± 0.50 mm (1.024 ± 0.020 inch)

(2) 101 - 1180 Spring

Length under test force 57.4 mm (2.26 inch)
 Test force 450 ± 23 N (101 ± 5 lb)
 Free length after test 70.6 mm (2.78 inch)
 Outside diameter 43.7 mm (1.72 inch)

(3) 101 - 1177 Spring

Length under test force 46.5 mm (1.83 inch)
 Test force 133 ± 7 N (30 ± 2 lb)
 Free length after test 55.5 mm (2.19 inch)
 Outside diameter 28.7 mm (1.13 inch)

(4) Valve stem diameter and valve guide bore

Diameter of the new valve stems in the area of the valve guide 9.441 ± 0.008 mm (0.3717 ± 0.0003 inch)

When the valve guides are installed in the cylinder head the bore in the valve guides is the following value: 9.487 ± 0.025 mm (0.3735 ± 0.0010 inch)

When the valve guides are installed in the cylinder head the maximum bore that can be used again in the valve guides is the following value: 9.540 mm (0.3756 inch)

(5) Diameter of the valve heads 56.00 ± 0.15 mm (2.205 ± 0.006 inch)

(6) Angle of the valve faces:

Inlet 19.40 ± 0.25 degrees
 Exhaust 44.40 ± 0.25 degrees

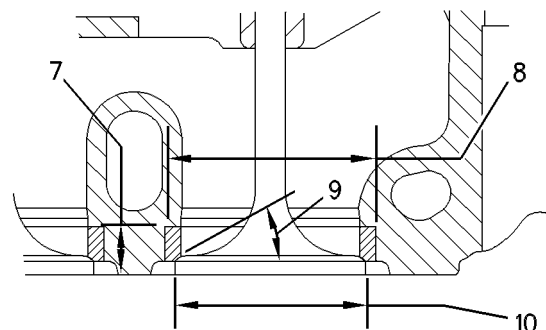


Illustration 31

g00122935

Typical example

(7) Depth of bore in head for valve seat inserts 16.00 ± 0.15 mm (0.630 ± 0.006 inch)

(8) Diameter of valve seat inserts:

Inlet .. 60.627 ± 0.015 mm (2.3869 ± 0.0006 inch)

Exhaust 60.119 ± 0.015 mm
(2.3669 ± 0.0006 inch)

Bore in head for valve seat inserts

Inlet .. 60.508 ± 0.025 mm (2.3822 ± 0.0010 inch)
Exhaust 60.000 ± 0.025 mm
(2.3622 ± 0.0010 inch)

(9) Angle of face of valve seat inserts

Inlet 20 ± 0.25 degrees
Exhaust 45 ± 0.25 degrees

(10) Outside diameter of the face of the valve seat inserts 53.60 mm (2.110 inch)

i01939813

Turbocharger

SMCS Code: 1052

S/N: S2A1-Up

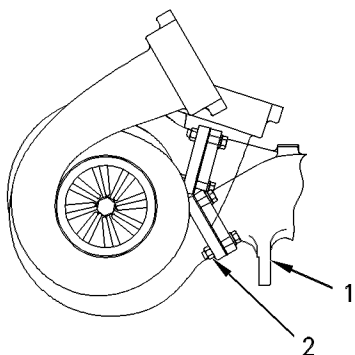


Illustration 32
Right side view

g00277601

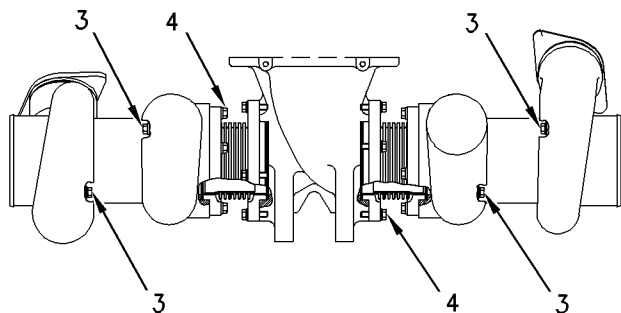


Illustration 33
Rear view

g00733806

(1) Exhaust manifold

(2) Bolts

Put 5P - 3931 Anti-Seize Compound on the bolt threads and the bearing surface before assembly.

Torque 54 ± 5 N·m (40 ± 4 lb ft)

(3) Bolts

Tighten eight bolts for the clamp for the compressor and tighten eight bolts for the clamp for the turbine.

Torque 40 ± 2 N·m (30 ± 1 lb ft)

(4) Bolts

Put 5P - 3931 Anti-Seize Compound on the bolt threads and the bearing surface before assembly.

Torque 54 ± 5 N·m (40 ± 4 lb ft)

i01939862

Turbocharger

SMCS Code: 1052

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2E1-Up

S/N: S2F1-Up

S/N: S2G1-Up

S/N: S2K1-Up

S/N: S2N1-Up

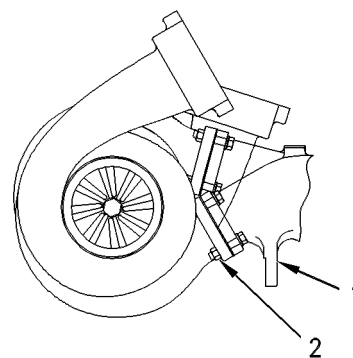


Illustration 34

g00277601

(1) Exhaust manifold

(2) Bolt

Apply 5P - 3931 Anti-Seize Compound to the threads of the bolt.

Torque 54 ± 5 N·m (40 ± 4 lb ft)

i01939880

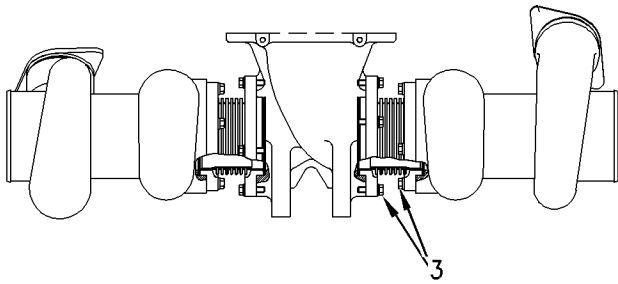


Illustration 35

g00787809

(3) Bolts

Apply 5P-3931 Anti-Seize Compound to the threads of the bolts.

Torque $54 \pm 5 \text{ N}\cdot\text{m}$ ($40 \pm 4 \text{ lb ft}$)

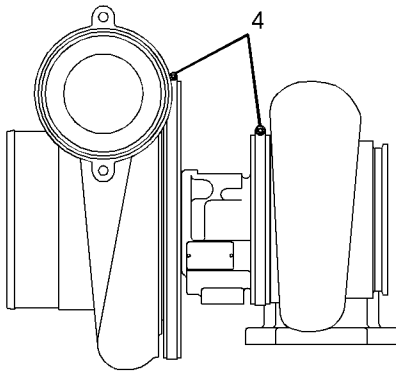


Illustration 36

g01009454

(4) Clamp bolt

Use the following procedure to tighten the clamp bolt.

1. Tighten the clamp bolt.

Torque $14.0 \pm 1.5 \text{ N}\cdot\text{m}$ ($10 \pm 1 \text{ lb ft}$)

2. Gently tap around the clamp bolt with a soft faced hammer.**3. Tighten the clamp bolt again.**

Torque $14.0 \pm 1.5 \text{ N}\cdot\text{m}$ ($10 \pm 1 \text{ lb ft}$)

Turbocharger

SMCS Code: 1052

S/N: S2B1-Up

S/N: S2E1-Up

S/N: S2G1-Up

S/N: S2K1-Up

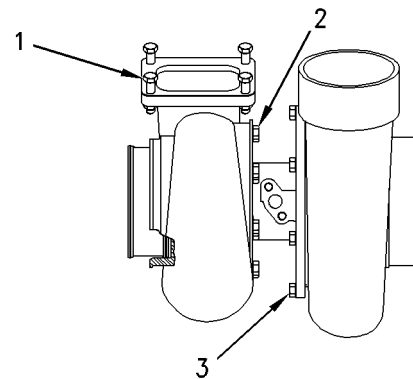


Illustration 37

g00756506

(1) Bolt

Apply 5P-3931 Anti-Seize Compound to the bolt threads.

Torque $54 \pm 5 \text{ N}\cdot\text{m}$ ($40 \pm 4 \text{ lb ft}$)

(2) Bolt

Torque $40 \pm 2 \text{ N}\cdot\text{m}$ ($30 \pm 1 \text{ lb ft}$)

(3) Bolt

Torque $40 \pm 2 \text{ N}\cdot\text{m}$ ($30 \pm 1 \text{ lb ft}$)

i01939881

Turbocharger

SMCS Code: 1052

S/N: S2D1-Up

S/N: S2H1-Up

S/N: S2J1-Up

S/N: S2L1-Up

S/N: S2M1-Up

S/N: S2S1-Up

S/N: S2T1-Up

S/N: S2Z1-Up

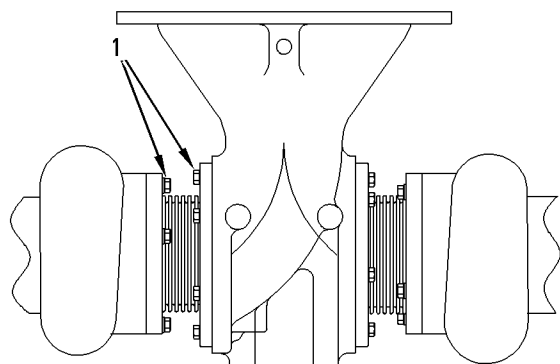


Illustration 38

g00756456

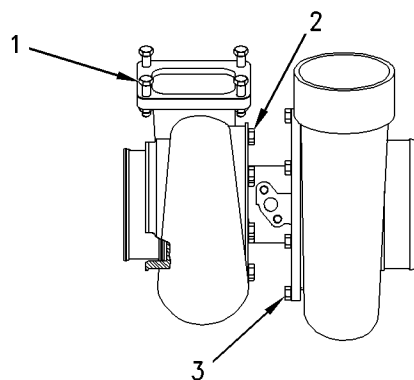


Illustration 39

g00756506

Typical example

(1) Bolt

Apply 5P-3931 Anti-Seize Compound to the bolt threads.

Torque 54 ± 5 N·m (40 ± 4 lb ft)

(2) Bolt

Torque 40 ± 2 N·m (30 ± 1 lb ft)

(3) Bolt

Torque 40 ± 2 N·m (30 ± 1 lb ft)

i02051385

Turbocharger

SMCS Code: 1052

S/N: B5G1-Up

S/N: MRG1-Up

S/N: PAG1-Up

S/N: MKH1-Up

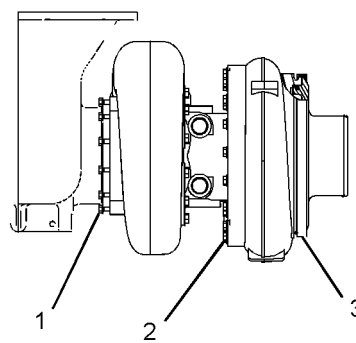


Illustration 40

g01052152

(1) Bolt

Torque 40 ± 5 N·m (30 ± 4 lb ft)

(2) Bolt

Torque 65 ± 5 N·m (48 ± 4 lb ft)

(3) Clamp

Tighten each clamp in two places.

Torque 60 ± 5 N·m (44 ± 4 lb ft)

i01939886

i01939903

Turbocharger

SMCS Code: 1052

S/N: S2P1-Up

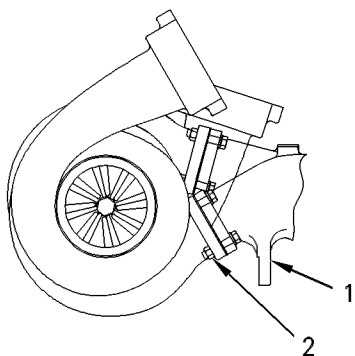


Illustration 41
Right side view

g00277601

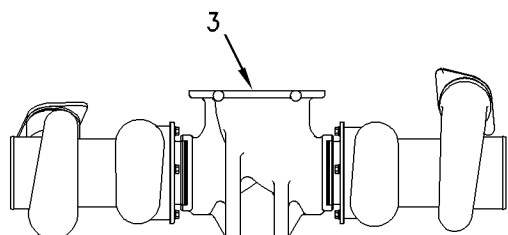


Illustration 42
Rear view

g00784716

(1) Exhaust manifold

(2) Bolts

Put 5P-3931 Anti-Seize Compound on the bolt threads and the bearing surface before assembly.

Torque $54 \pm 5 \text{ N}\cdot\text{m}$ ($40 \pm 4 \text{ lb ft}$)

(3) Exhaust elbow

Turbocharger

SMCS Code: 1052

S/N: S2R1-Up

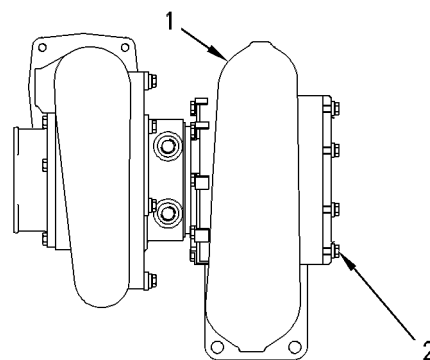


Illustration 43

g00584306

(1) Bolts

Tighten eight bolts that hold the bearing housing to the turbine housing. Tighten eight bolts that hold the compressor housing to the bearing housing. After assembly, bend the short end of the lock against the bolt head. Bend the long end of the lock around the turbine clamp. Do not reuse an opened lock.

Torque $55 \pm 10 \text{ N}\cdot\text{m}$ ($40 \pm 7 \text{ lb ft}$)

(2) Bolts

Lubricate the washer face and threads with 5P-3931 Anti-Seize Compound before assembly. Tighten 16 bolts to the following torque.

Torque $45 \pm 10 \text{ N}\cdot\text{m}$ ($33 \pm 7 \text{ lb ft}$)

i01939952

Turbocharger

SMCS Code: 1052

S/N: S2S1-Up

S/N: S2X1-Up

S/N: S2Y1-Up

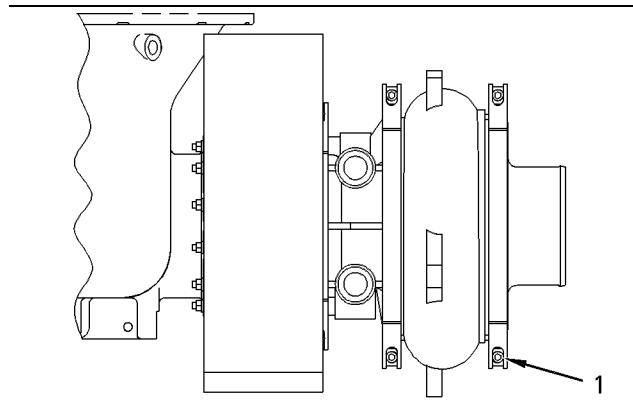


Illustration 44

g00593373

(1) Clamp bolt

Torque $60 \pm 5 \text{ N}\cdot\text{m}$ ($44 \pm 4 \text{ lb ft}$)

i01941453

Turbocharger Support

SMCS Code: 1052

S/N: S2E1-Up

S/N: S2Z1-Up

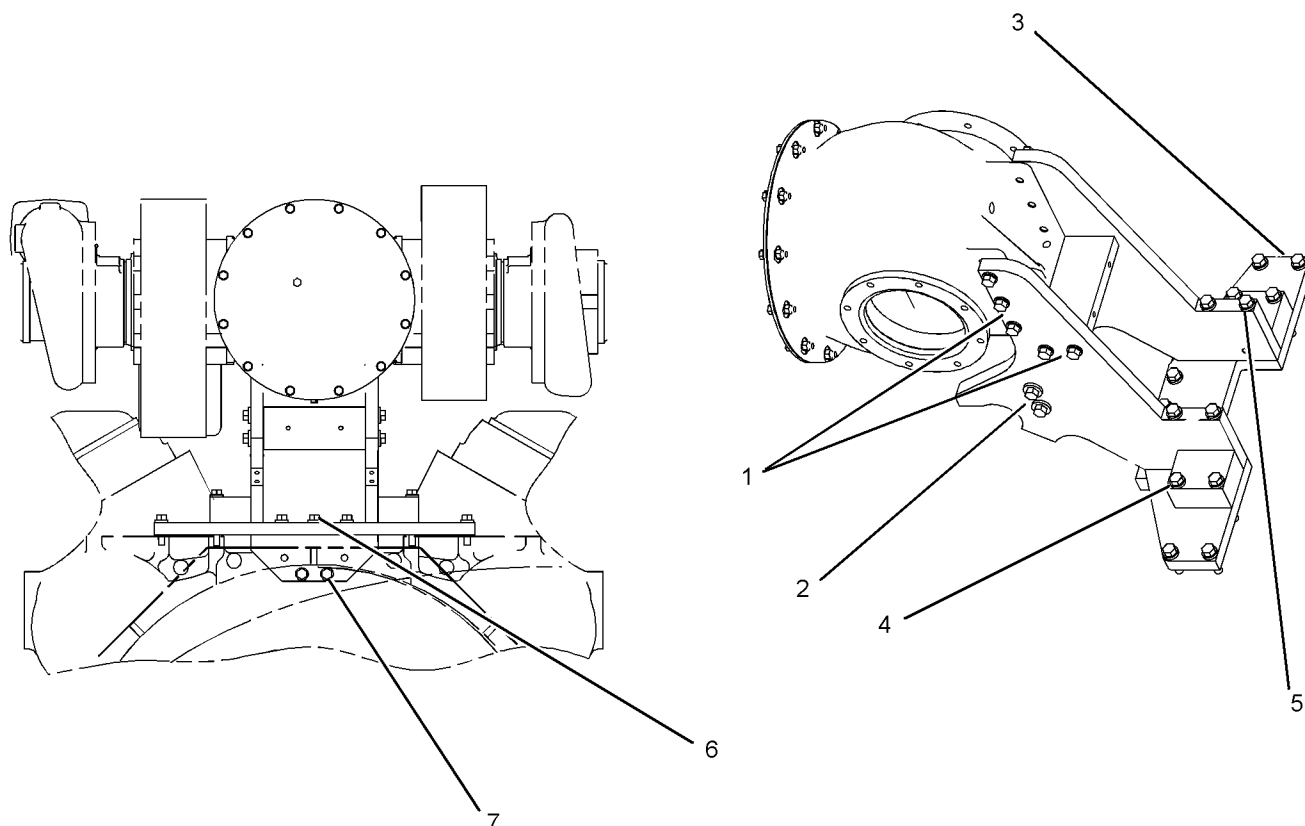


Illustration 45

g01010394

(1) Bolts

Torque $135 \pm 20 \text{ N}\cdot\text{m}$ ($100 \pm 15 \text{ lb ft}$)

(2) Bolts

Torque $120 \pm 20 \text{ N}\cdot\text{m}$ ($88 \pm 15 \text{ lb ft}$)

(3) Bolts

Torque $120 \pm 20 \text{ N}\cdot\text{m}$ ($88 \pm 15 \text{ lb ft}$)

(4) Bolts

Torque $120 \pm 20 \text{ N}\cdot\text{m}$ ($88 \pm 15 \text{ lb ft}$)

(5) Bolts

Torque $120 \pm 20 \text{ N}\cdot\text{m}$ ($88 \pm 15 \text{ lb ft}$)

(6) Bolts

Torque $120 \pm 20 \text{ N}\cdot\text{m}$ ($88 \pm 15 \text{ lb ft}$)

(7) Bolts

Torque $120 \pm 20 \text{ N}\cdot\text{m}$ ($88 \pm 15 \text{ lb ft}$)

i01888590

Exhaust Bypass Valve

SMCS Code: 1057

Part No.: 259-1436

S/N: PAG1-Up

Part No.: 282-3016

S/N: MKH1-Up

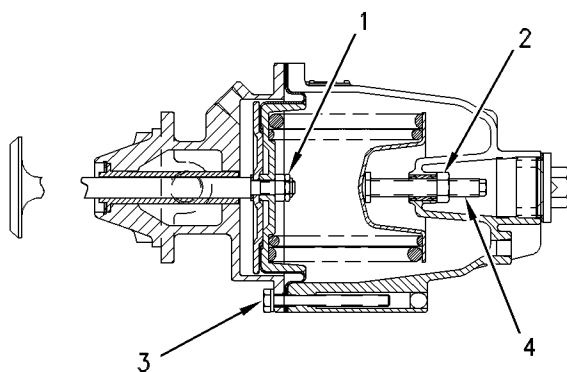


Illustration 46

g00477506

(1) Nut

Torque $12.5 \pm 1.0 \text{ N}\cdot\text{m}$ ($110.00 \pm 9.00 \text{ lb in}$)

(2) Nut

Torque $14 \pm 3 \text{ N}\cdot\text{m}$ ($10 \pm 2 \text{ lb ft}$)

(3) Machine screw

Torque $6.5 \pm 1.0 \text{ N}\cdot\text{m}$ ($60.00 \pm 9.00 \text{ lb in}$)

(4) Setscrew

Before assembly, lubricate the threads and the bearing surfaces of the setscrew with 4C-5598 High Temperature Anti-Seize.

i02065134

Exhaust Manifold

SMCS Code: 1059

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2D1-Up

S/N: S2E1-Up

S/N: S2F1-Up

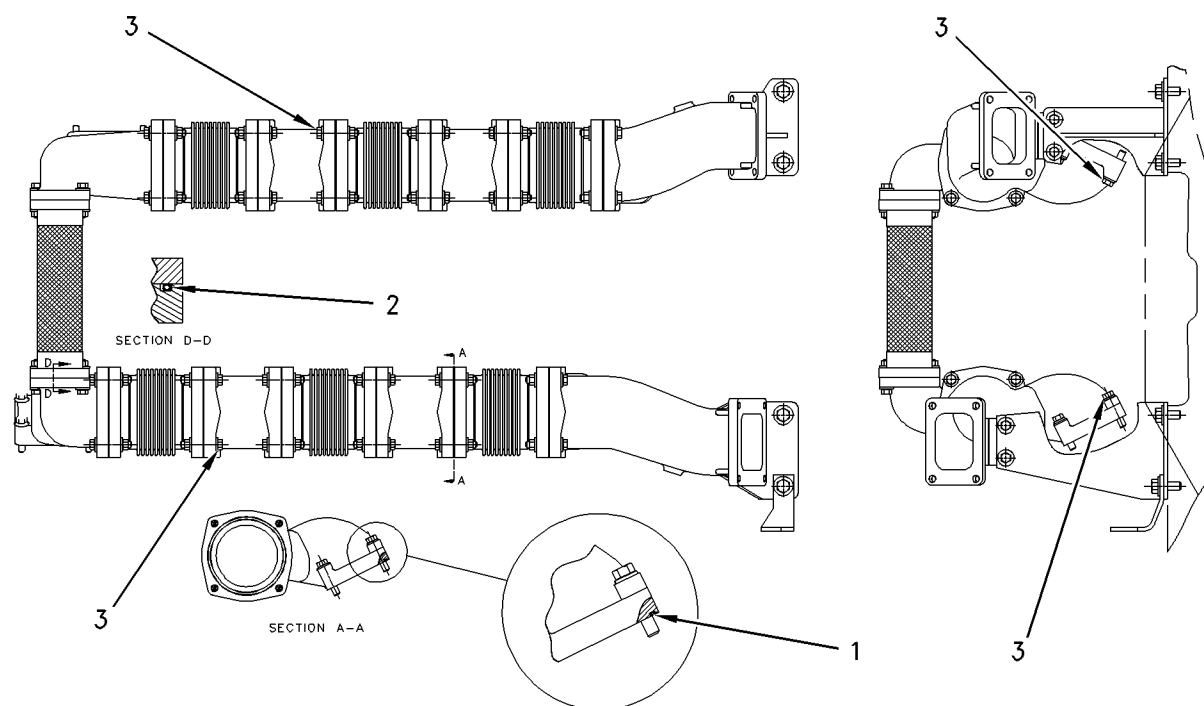


Illustration 47

g00996437

(1) Seal

(2) Seal

(3) Bolt

Put 5P-3931 Anti-Seize Compound on the threads of the bolts. Tighten diagonal bolts simultaneously.

Torque $55 \pm 5 \text{ N}\cdot\text{m}$ ($41 \pm 4 \text{ lb ft}$)

i02051171

Exhaust Manifold

SMCS Code: 1059

S/N: PAG1-Up

S/N: MKH1-Up

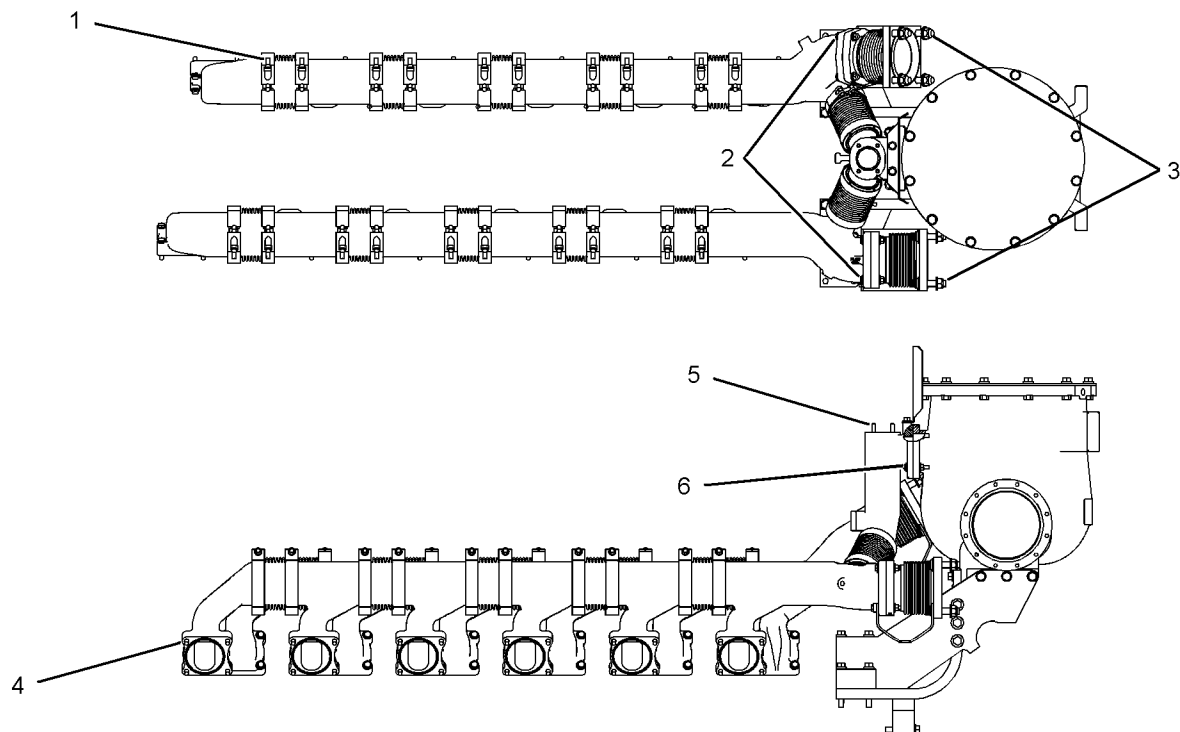


Illustration 48

g01052090

- | | |
|--|--|
| (1) Clamp | Torque 35 ± 5 N·m (26 ± 4 lb ft) |
| Torque 25 ± 6 N·m (18 ± 4 lb ft) | |
| (2) Bolt | Torque 55 ± 5 N·m (41 ± 4 lb ft) |
| Lubricate the washer face and the thread with 5P-3931 Anti-Seize Compound before assembly. Tighten diagonally opposite bolts simultaneously. | |
| Torque 55 ± 5 N·m (41 ± 4 lb ft) | |
| (3) Bolt | |
| Lubricate the washer face and the thread with 5P-3931 Anti-Seize Compound before assembly. | |
| (4) Bolt | |
| Lubricate the washer face and the thread with 5P-3931 Anti-Seize Compound before assembly. | |
| (5) Stud | |

i02051280

Exhaust Manifold

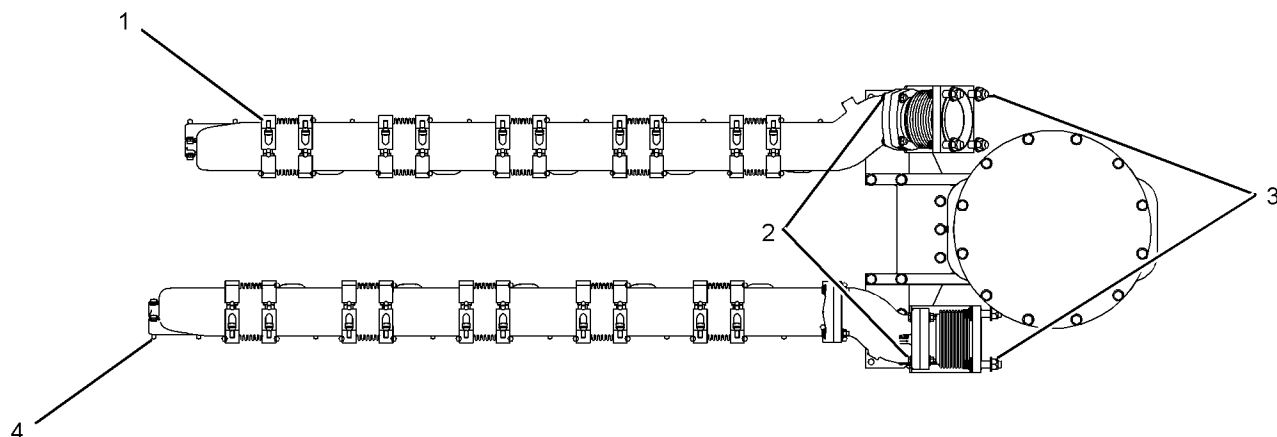
SMCS Code: 1059**S/N:** B5G1-Up**S/N:** MRG1-Up

Illustration 49

g01052130

(1) ClampTorque $25 \pm 6 \text{ N}\cdot\text{m}$ ($18 \pm 4 \text{ lb ft}$)**(2) Bolt**

Lubricate the washer face and the thread before assembly. Tighten diagonally opposite bolts simultaneously.

Torque $55 \pm 5 \text{ N}\cdot\text{m}$ ($41 \pm 4 \text{ lb ft}$)**(3) Bolt**

Lubricate the washer face and the thread before assembly.

(4) Bolt

Lubricate the washer face and the thread before assembly.

i02462940

Exhaust Manifold

SMCS Code: 1059

S/N: S2G1-Up

S/N: S2H1-Up

S/N: S2J1-Up

S/N: S2K1-Up

S/N: S2L1-Up

S/N: S2N1-Up

S/N: S2P1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2T1-Up

S/N: S2W1-Up

S/N: S2X1-Up

S/N: S2Z1-Up

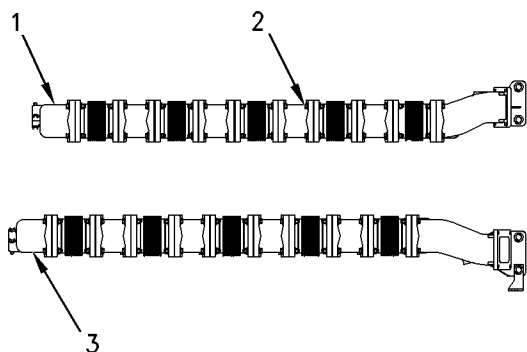


Illustration 50

g00787886

Top view

(1) Right manifold

(2) Bolts

Put 5P-3931 Anti-Seize Compound on the threads of the bolts and the face of the washers. Tighten diagonally opposite bolts simultaneously.

Torque $55 \pm 5 \text{ N}\cdot\text{m}$ ($40 \pm 4 \text{ lb ft}$)

(3) Left manifold

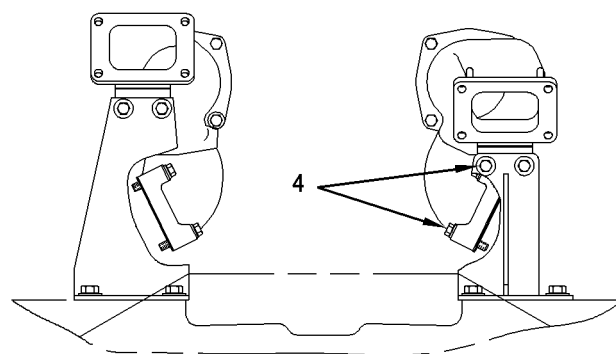


Illustration 51

g00743233

Rear view

(4) Bolts

Put 5P-3931 Anti-Seize Compound on the threads of the bolts and washer face that hold exhaust manifolds to the cylinder head and the bracket assembly. Tighten diagonally opposite bolts simultaneously.

Torque $55 \pm 5 \text{ N}\cdot\text{m}$ ($40 \pm 4 \text{ lb ft}$)

i02013932

Exhaust Flange

SMCS Code: 1061

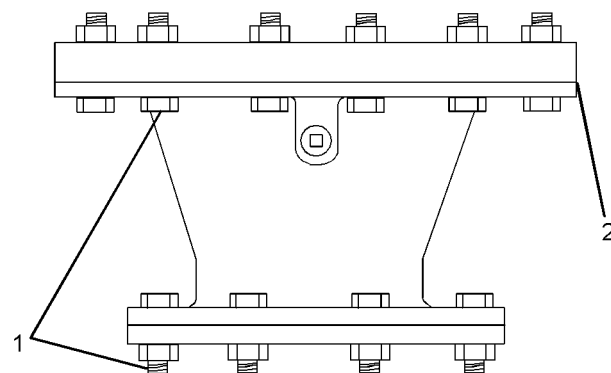


Illustration 52

g01041244

Typical example

(1) Bolts

Apply 5P-3931 Anti-Seize Compound to the bolt threads.

(2) Gasket

i01659336

Air Cleaner

SMCS Code: 1051

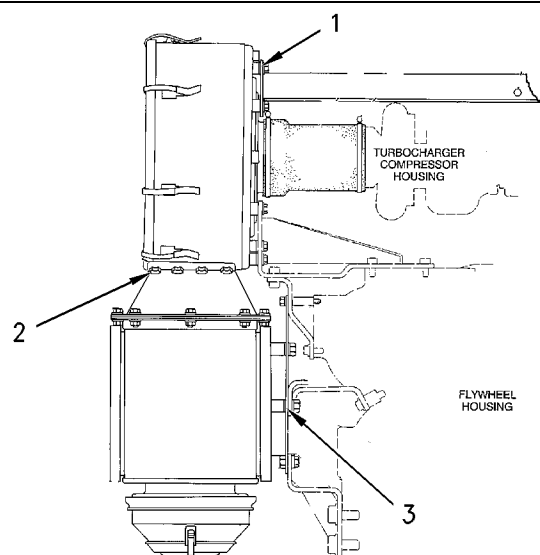


Illustration 53

g00856159

(1) Washer

In order to align the precleaner with the air cleaner, use the 8T-4896 Hard Washers as spacers for the air cleaner.

(2) Bolt

Torque $12 \pm 4 \text{ N}\cdot\text{m}$ ($9 \pm 3 \text{ lb ft}$)

(3) Washer

In order to align the precleaner with the air cleaner, use the 8T-4122 Hard Washers as spacers for the precleaner.

i01940000

Air Cleaner Adapter

SMCS Code: 1051

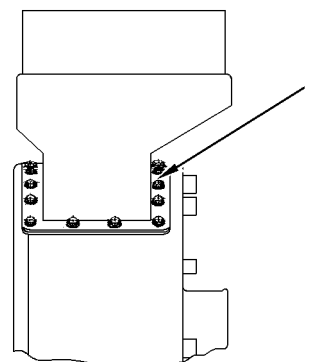


Illustration 54

g00280999

(1) Locknut

Torque $12 \pm 4 \text{ N}\cdot\text{m}$ ($9 \pm 3 \text{ lb ft}$)

i01659718

Engine Air Cleaner Service Indicator

SMCS Code: 7452

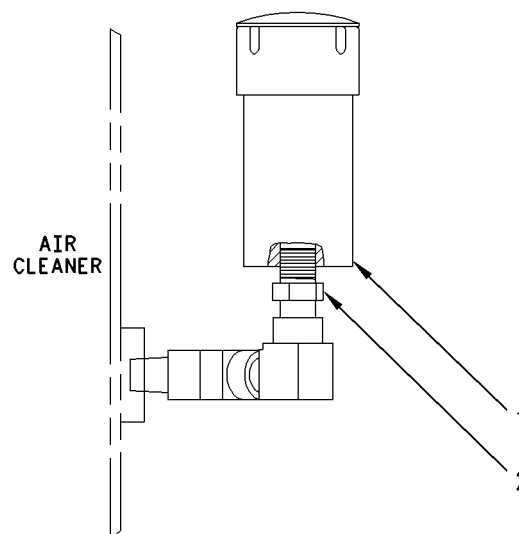


Illustration 55

g00856480

(1) Engine air cleaner service indicator

Torque $2 \pm 0.7 \text{ N}\cdot\text{m}$ ($18 \pm 6 \text{ lb in}$)

(2) Fitting

Install the filter end of the fitting toward the engine air cleaner service indicator.

i01904647

Air Inlet and Exhaust Lines

SMCS Code: 1058; 1061

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2D1-Up

S/N: S2E1-Up

S/N: S2F1-Up

S/N: B5G1-Up

S/N: MRG1-Up

S/N: PAG1-Up

S/N: S2G1-Up

S/N: MKH1-Up

S/N: S2H1-Up

S/N: S2J1-Up

S/N: S2K1-Up

S/N: S2L1-Up

S/N: S2M1-Up

S/N: S2N1-Up

S/N: S2P1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2W1-Up

S/N: S2Y1-Up

Apply 4C-5598 High Temperature Anti-Seize to the threads of the plug.

Torque $20 \pm 5 \text{ N}\cdot\text{m}$ ($15 \pm 4 \text{ lb ft}$)

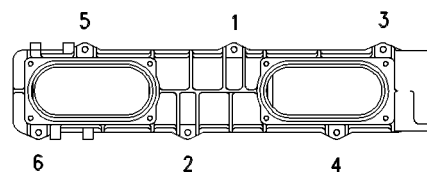


Illustration 57

g00115247

Bolt tightening sequence (3508B)

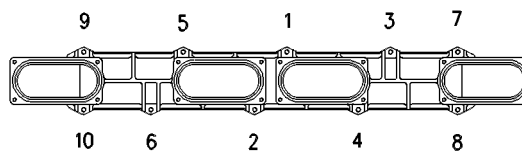


Illustration 58

g00280590

Bolt tightening sequence (3512B)

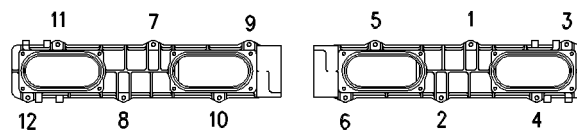


Illustration 59

g00280589

Bolt tightening sequence (3516B)

(2) Bolt

Use the following procedure to tighten the bolts for the aftercooler:

1. Assemble seals to the aftercooler core.
2. Temporarily secure the bottom seal with tape. Do not use an adhesive, a silicone lubricant, or any other lubricant for retention of the seal.
3. Assemble the aftercooler with the seals to the inlet manifold.
4. Inspect the bottom seal in order to ensure that the seating in the recess is correct.
5. Install the aftercooler cover.
6. Inspect the upper seal in order to ensure that the seating in the recess is correct.
7. Install the cover bolts and hand tighten the bolts.

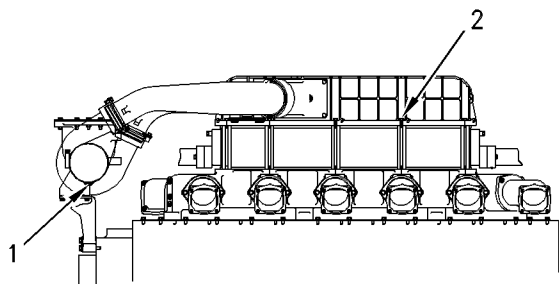


Illustration 56

g00281371

Typical example

(1) Plug

8. Tighten the bolts according to the numerical sequence to the following torque.

Torque 24 N·m (18 lb ft)

9. Tighten the bolts again according to the numerical sequence to the following torque.

Torque 47 N·m (35 lb ft)

10. Remove the tape.

i01954924

Air Inlet and Exhaust Lines

SMCS Code: 1058; 1061

S/N: S2T1-Up

S/N: S2X1-Up

S/N: S2Z1-Up

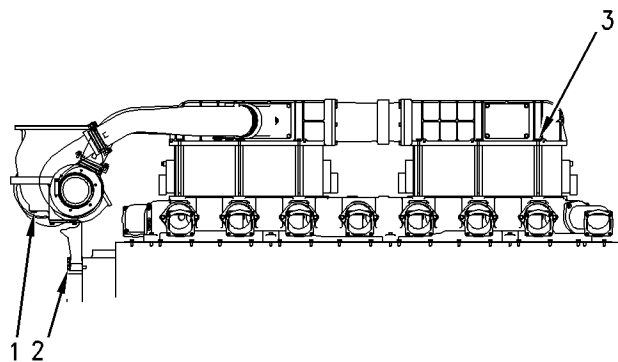


Illustration 60

g00756632

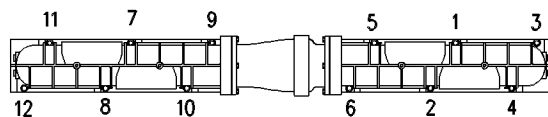


Illustration 61

g00593641

Bolt tightening sequence

(1) Plug

1. Apply 4C-5598 High Temperature Anti-Seize to the threads.

2. Tighten the plug.

Torque 20 ± 5 N·m (15 ± 4 lb ft)

(2) Bolt

Torque 120 ± 20 N·m (90 ± 15 lb ft)

(3) Bolt

Tighten the bolts for the aftercooler according to the following procedure:

1. Assemble seals to the aftercooler core.
 2. Temporarily secure the bottom seal with tape. Do not use an adhesive, a silicone lubricant, or any other lubricant for retention of the seal.
 3. Assemble the aftercooler with the seals to the inlet manifold.
 4. Inspect the bottom seal in order to ensure that the seating in the recess is correct.
 5. Install the aftercooler cover.
 6. Inspect the upper seal in order to ensure that the seating in the recess is correct.
 7. Install the cover bolts and hand tighten the bolts.
 8. Tighten the bolts according to the numerical sequence.
- Torque 24 N·m (18 lb ft)
9. Tighten the bolts again according to the numerical sequence.
- Torque 47 N·m (35 lb ft)
10. Remove the tape.

i01957468

Air Shutoff

SMCS Code: 1078

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2D1-Up

S/N: S2E1-Up

S/N: S2F1-Up

S/N: B5G1-Up

S/N: MRG1-Up

S/N: PAG1-Up

S/N: S2G1-Up

S/N: MKH1-Up

S/N: S2H1-Up

S/N: S2J1-Up

S/N: S2K1-Up

S/N: S2L1-Up

S/N: S2M1-Up

S/N: S2N1-Up

S/N: S2P1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2T1-Up

S/N: S2W1-Up

S/N: S2X1-Up

S/N: S2Y1-Up

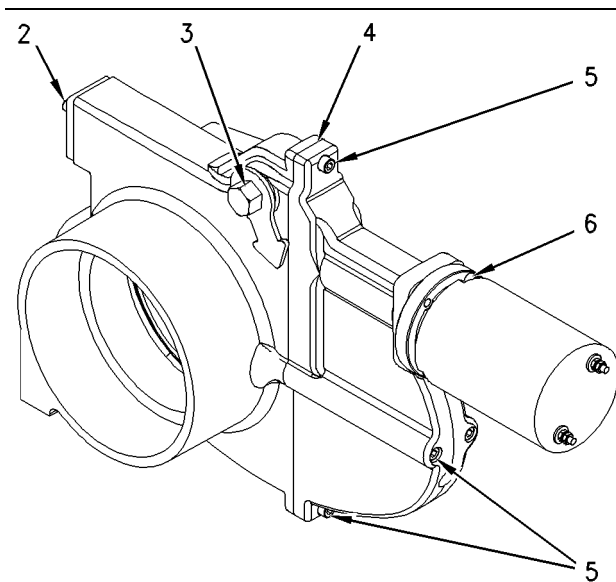


Illustration 63

g00986704

(1) Switch assembly

Lubricate the threads of the capscrews with 4C-5598 High Temperature Anti-Seize prior to assembly.

Torque 12 N·m (106 lb in)

(2) Capscrew

Lubricate the threads of the capscrews with 4C-5598 High Temperature Anti-Seize prior to assembly.

Torque 7 ± 1 N·m (60 ± 9 lb in)

(3) Shaft

Lubricate the shaft with 4C-5598 High Temperature Anti-Seize prior to assembly.

(4) Cover

Apply 4C-9614 Silicone Sealant between the body and the cover of the air shutoff prior to assembly.

(5) Capscrew

Lubricate the threads of the capscrew with 4C-5598 High Temperature Anti-Seize prior to assembly.

Torque 10 ± 2 N·m (84 ± 13 lb in)

(6) Capscrew

Torque 10 ± 2 N·m (84 ± 13 lb in)

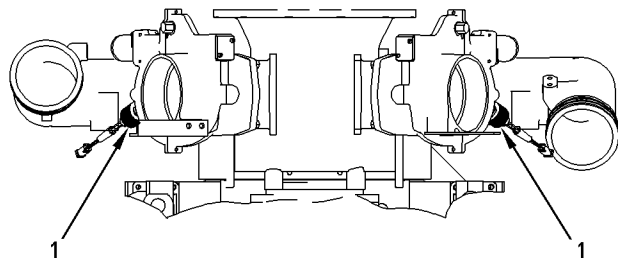


Illustration 62

g00956104

i02540817

Engine Oil Pump

SMCS Code: 1304

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2D1-Up

S/N: S2E1-Up

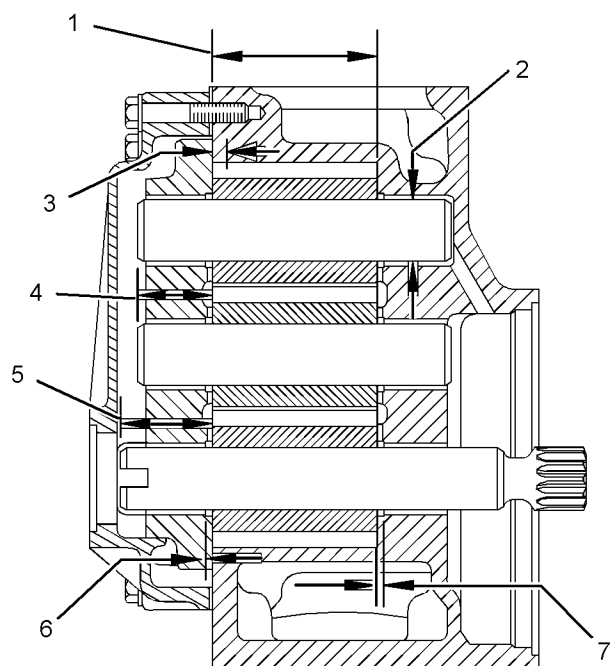


Illustration 64

g01272180

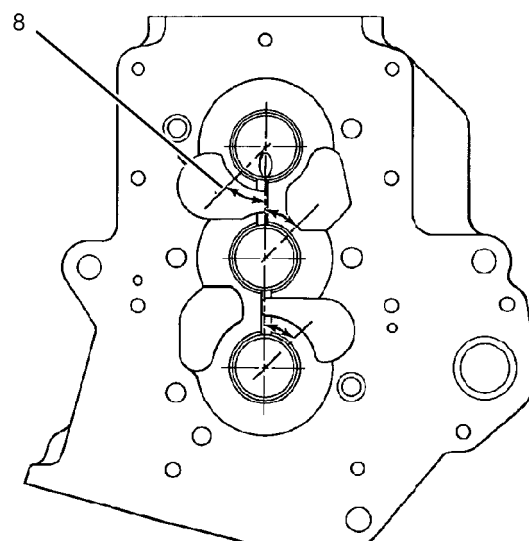


Illustration 65

g01272197

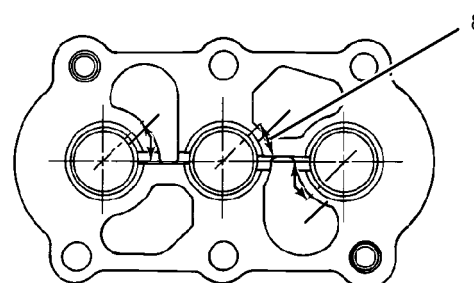


Illustration 66

g01272201

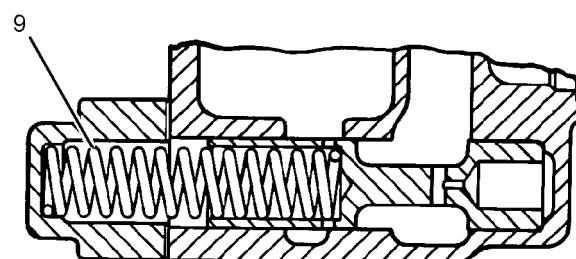


Illustration 67

g01272198

When the engine oil pump is viewed from the drive end the drive gear rotates in the following direction: Clockwise

(1) Length of new gears 54.000 ± 0.015 mm
(2.1260 ± 0.0006 inch)

Depth of bores for new gears 54.150 ± 0.020 mm
(2.1319 ± 0.0008 inch)

(2) Diameter of new gear shafts .. 31.742 ± 0.008 mm
(1.2497 ± 0.0003 inch)

Bore in bearings for gear shafts after assembly 31.811 ± 0.013 mm
(1.2524 ± 0.0005 inch)

(3) The dowels extend from the cover by the following distance: 6.0 ± 0.5 mm
(0.24 ± 0.02 inch)

(4) Distance from the end of the idler shafts to gear faces 34.0 ± 0.5 mm (1.34 ± 0.02 inch)

(5) Distance from the end of the drive shaft to gear face 47.0 ± 0.5 mm (1.85 ± 0.02 inch)

(6) The bearings are installed in the cover at the following depth: .. 1.5 ± 0.5 mm (0.06 ± 0.02 inch)

(7) The bearings are installed in the housing at the following depth: .. 1.5 ± 0.5 mm (0.06 ± 0.02 inch)

(8) The location of each bearing junction is shown. Position the bearing junctions from the centerline through the bearing bores to the following angle: 45 ± 15 degrees

(9) 2S-2760 Spring

Length under test force .. 117.14 mm (4.612 inch)
Test force 499 ± 24 N (112 ± 5 lb)
Free length after test 152.91 mm (6.020 inch)
Outside diameter 27.00 mm (1.063 inch)

Bench test specifications

Unrestricted flow rate per minute at 700 rpm 135 L (36 US gal)
Pump pressure at 300 rpm with fully blocked outlet 600 ± 30 kPa (87 ± 4 psi)

Note: Before you install the pump, lubricate the moving parts with engine oil. Rotate the pump by hand in order to ensure that the pump rotates freely.

Engine Oil Pump

SMCS Code: 1304

S/N: S2F1-Up

S/N: S2G1-Up

S/N: S2H1-Up

S/N: S2J1-Up

S/N: S2K1-Up

S/N: S2L1-Up

S/N: S2M1-Up

S/N: S2N1-Up

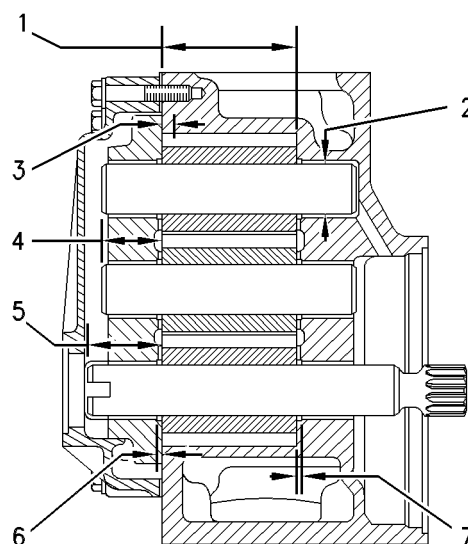


Illustration 68

g00118020

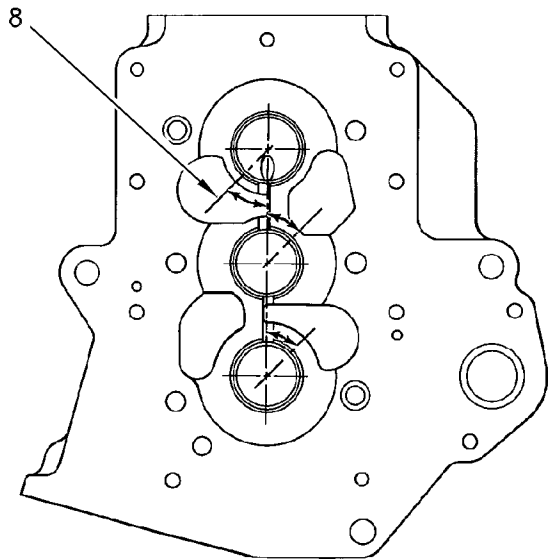


Illustration 69

g00118029

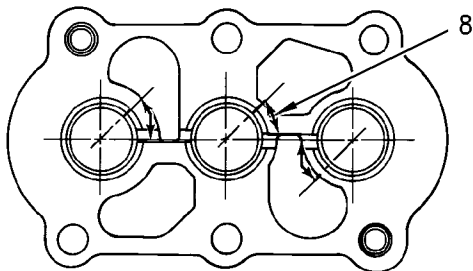


Illustration 70

g00118052

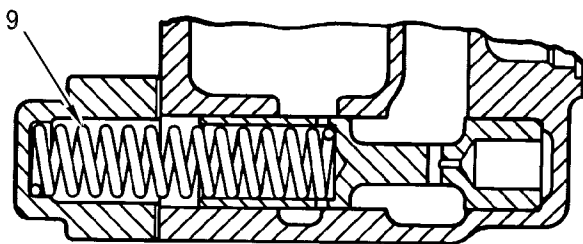


Illustration 71

g00118053

Note: Before you install the pump, lubricate the moving parts with engine oil. Rotate the pump by hand in order to ensure that the pump rotates freely.

When the engine oil pump is viewed from the drive end the drive gear rotates in the following direction. Clockwise

(1) Length of new gears 84.000 ± 0.015 mm
(3.3071 $\pm$ 0.0006 inch)

Depth of bores for new gears 84.150 ± 0.020 mm
(3.3130 $\pm$ 0.0008 inch)

(2) Diameter of new gear shafts .. 31.742 ± 0.008 mm
(1.2497 $\pm$ 0.0003 inch)

Bore in bearings for gear shafts after assembly 31.811 ± 0.013 mm
(1.2524 $\pm$ 0.0005 inch)

(3) The dowels extend from the cover by the following distance. 6.00 ± 1.00 mm
(0.236 $\pm$ 0.039 inch)

(4) Distance from the end of the idler shafts to gear faces 34.0 ± 0.5 mm (1.34 $\pm$ 0.02 inch)

(5) Distance from the end of the drive shaft to gear face 47.0 ± 0.5 mm (1.85 $\pm$ 0.02 inch)

(6) The bearings are installed in the cover at the following depth. .. 1.5 ± 0.5 mm (0.06 $\pm$ 0.02 inch)

(7) The bearings are installed in the housing at the following depth. .. 1.5 ± 0.5 mm (0.06 $\pm$ 0.02 inch)

(8) The location of each bearing junction is shown. Position the bearing junctions from the centerline through the bearing bores to the following angle. 45 ± 15 degrees

(9) Spring

Length under test force .. 117.14 mm (4.612 inch)
Test force 499 ± 24 N (112 $\pm$ 5 lb)
Free length after test 152.9 mm (6.02 inch)
Outside diameter 27.00 mm (1.063 inch)

Bench test specifications

Unrestricted flow rate per minute at 700 rpm 220 L (58 US gal)
Pump pressure at 300 rpm with fully blocked outlet 600 ± 30 kPa (87 $\pm$ 4 psi)

i02617837

Engine Oil Pump

SMCS Code: 1304

Part No.: 244-8985

S/N: MKH1-Up

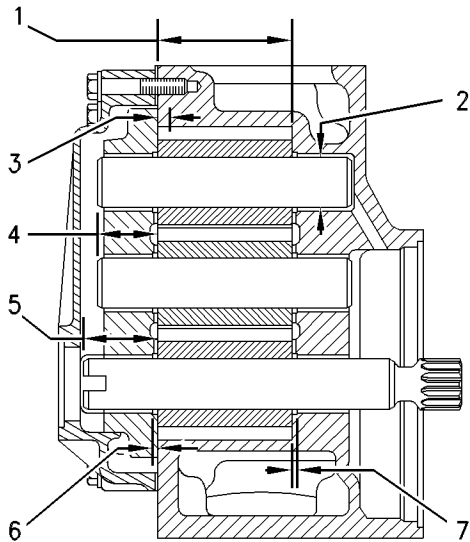


Illustration 72

g00118020

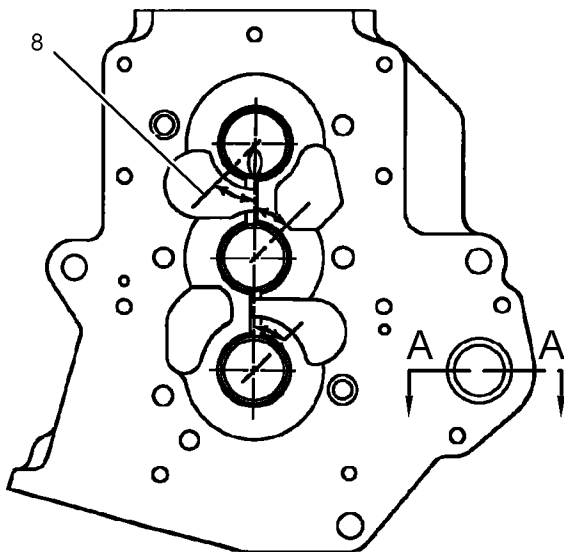


Illustration 73

g01319312

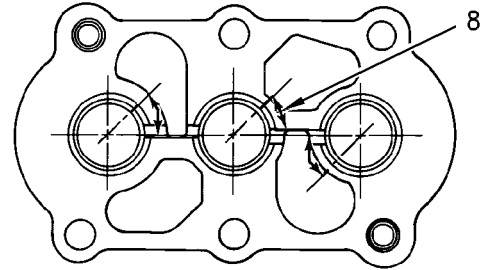


Illustration 74

g00118052

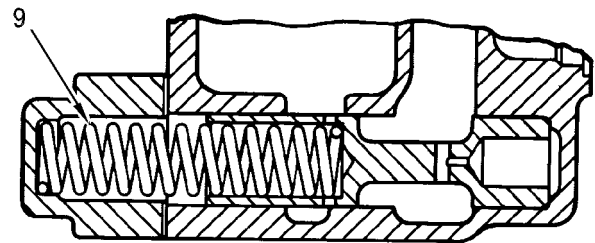


Illustration 75

g00118053

View A-A

When the engine oil pump is viewed from the drive end the drive gear rotates in the following direction. Clockwise

(1) Gears

Length of new gears 84.000 ± 0.015 mm
(3.3071 ± 0.0006 inch)

Depth of bores for new
gears 84.150 ± 0.020 mm
(3.3130 ± 0.0008 inch)

(2) Shafts

Diameter of new gear shafts .. 31.742 ± 0.008 mm
(1.2497 ± 0.0003 inch)

Bore in bearings for gear shafts after
assembly 31.811 ± 0.013 mm
(1.2524 ± 0.0005 inch)

(3) The dowels extend from the cover by the
following distance. 6.0 ± 1.0 mm
(0.24 ± 0.04 inch)

(4) Distance from the end of the idler shafts to gear
faces 34.0 ± 0.5 mm (1.34 ± 0.02 inch)

i01889000

- (5) Distance from the end of the drive shaft to gear face 47.0 ± 0.5 mm (1.85 ± 0.02 inch)
- (6) The bearings are installed in the cover at the following depth. ... 1.5 ± 0.5 mm (0.06 ± 0.02 inch)
- (7) The bearings are installed in the housing at the following depth. ... 1.5 ± 0.5 mm (0.06 ± 0.02 inch)
- (8) The location of each bearing junction is shown. Position the bearing junctions from the centerline through the bearing bores to the following angle. 45 ± 15 degrees
- (9) Spring
- Length under test force .. 117.14 mm (4.612 inch)
 Test force 499 ± 24 N (110 ± 5.4 lb)
 Free length after test 152.91 mm (6.020 inch)
 Outside diameter 27 mm (1.1 inch)

Bench test specifications

Unrestricted flow rate per minute at 700 rpm 220 L (58 US gal)
 Pump pressure at 300 rpm with fully blocked outlet 740 ± 30 kPa (105 ± 4.5 psi)

Note: Before you install the pump, lubricate the moving parts with clean engine oil. Rotate the pump by hand in order to ensure that the pump rotates freely.

Engine Oil Pump

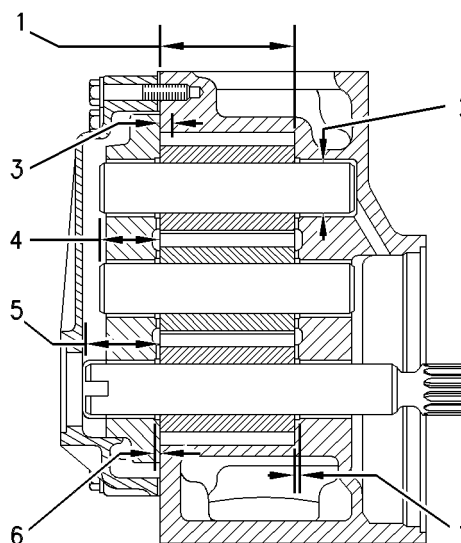
SMCS Code: 1304**S/N:** B5G1-Up**S/N:** MRG1-Up**S/N:** PAG1-Up**S/N:** S2P1-Up**S/N:** S2R1-Up**S/N:** S2S1-Up**S/N:** S2T1-Up**S/N:** S2W1-Up**S/N:** S2X1-Up**S/N:** S2Y1-Up**S/N:** S2Z1-Up

Illustration 76

g00118020

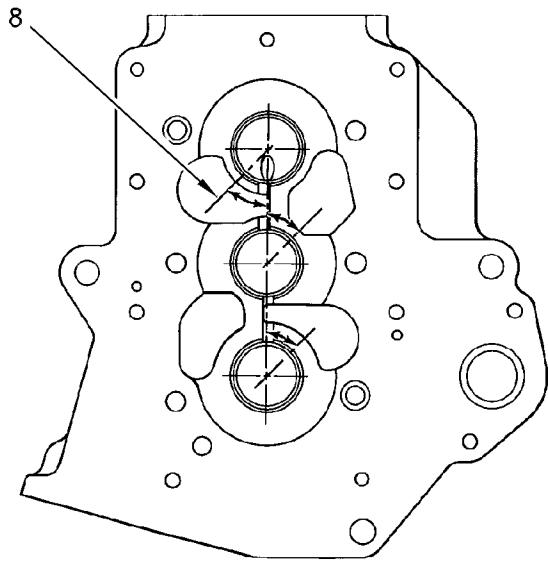


Illustration 77

g00118029

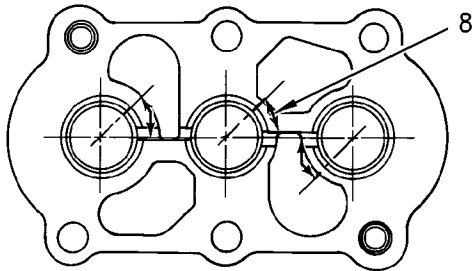


Illustration 78

g00118052

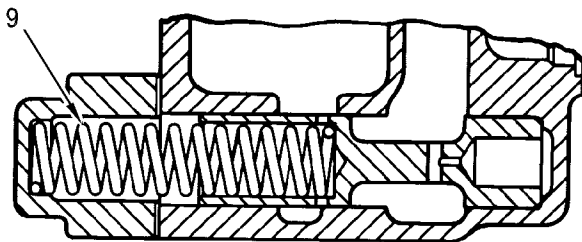


Illustration 79

g00118053

When the engine oil pump is viewed from the drive end the drive gear rotates in the following direction. Clockwise

- (1) Length of new gears 110.000 ± 0.015 mm
(4.3307 $\pm$ 0.0006 inch)

Depth of bores for new gears ... 110.150 ± 0.020 mm
(4.3366 $\pm$ 0.0008 inch)

- (2) Diameter of new gear shafts .. 31.742 ± 0.008 mm
(1.2497 $\pm$ 0.0003 inch)

Bore in bearings for gear shafts after assembly 31.811 ± 0.013 mm
(1.2524 $\pm$ 0.0005 inch)

- (3) The dowels (not shown) extend from the cover by the following distance. 6.0 ± 0.5 mm
(0.24 $\pm$ 0.02 inch)

- (4) Distance from the end of the idler shafts to gear faces 34.0 ± 0.5 mm (1.34 $\pm$ 0.02 inch)

- (5) Distance from the end of the drive shaft to gear face 47.0 ± 0.5 mm (1.85 $\pm$ 0.02 inch)

- (6) The bearings are installed in the cover at the following depth. .. 1.5 ± 0.5 mm (0.06 $\pm$ 0.02 inch)

- (7) The bearings are installed in the housing at the following depth. .. 1.5 ± 0.5 mm (0.06 $\pm$ 0.02 inch)

- (8) The location of each bearing junction is shown. Position the bearing junctions from the centerline through the bearing bores to the following angle. 45 ± 15 degrees

- (9) Spring

Length under test force 107.2 mm (4.22 inch)
Test force 556 $\pm$ 20 N (125 $\pm$ 4 lb)
Free length after test 144.5 mm (5.69 inch)
Outside diameter 27.00 mm (1.063 inch)

Bench test specifications

Unrestricted flow rate per minute at 1000 rpm 410 L (108 US gal)
Pump pressure at 300 rpm with fully blocked outlet 600 $\pm$ 30 kPa (87 $\pm$ 4 psi)

Note: Before you install the pump, lubricate the moving parts with engine oil. Rotate the pump by hand in order to ensure that the pump rotates freely.

i02617863

Engine Oil Cooler Bypass and Cooling Jet Sequence Valves

SMCS Code: 1314; 1331

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2D1-Up

S/N: S2E1-Up

S/N: S2F1-Up

S/N: B5G1-Up

S/N: MRG1-Up

S/N: PAG1-Up

S/N: S2G1-Up

S/N: MKH1-Up

S/N: S2H1-Up

S/N: S2J1-Up

S/N: S2K1-Up

S/N: S2L1-Up

S/N: S2M1-Up

S/N: S2N1-Up

S/N: S2P1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2T1-Up

S/N: S2W1-Up

S/N: S2X1-Up

S/N: S2Y1-Up

Part No.: 115-7860

S/N: S2Z1-Up

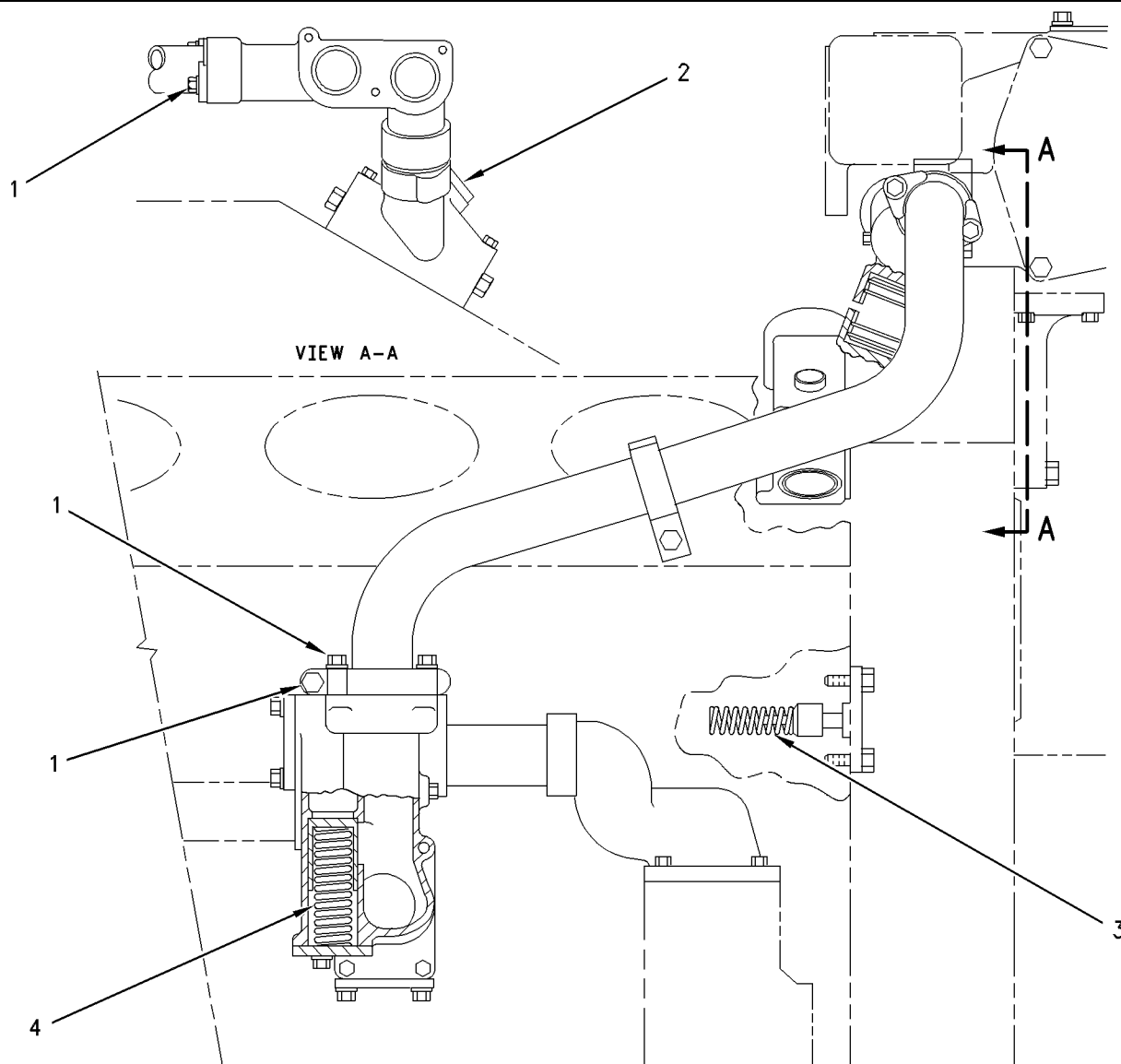


Illustration 80
Typical example

g00277849

(1) Clamp bolts

Torque $47 \pm 9 \text{ N}\cdot\text{m}$ ($35 \pm 7 \text{ lb ft}$)

Tightening sequence for the clamp bolts

1. Snugly tighten the clamp assembly to the tube.
2. Tighten the clamp assembly to the elbow.
3. Tighten the clamp assembly to the tube.

(2) Plug

Lubricate the bore lightly with clean engine oil.

Torque $100 \pm 15 \text{ N}\cdot\text{m}$ ($75 \pm 11 \text{ lb ft}$)

(3) 6B-9202 Spring for the cooling jet sequence valve

There is a spring at each end of the block.

Length under test force 68.3 mm (2.69 inch)

Test force 85 to 100 N (19.0 to 22.4 lb)

Free length after test 112.8 mm (4.44 inch)

Outside diameter 22.4 mm (0.88 inch)

Both of the cooling jet sequence valves must start to open at the following pressure difference: $130 \pm 30 \text{ kPa}$ ($19 \pm 4 \text{ psi}$)

Both of the cooling jet sequence valves must be fully open at the following pressure difference: $200 \pm 30 \text{ kPa}$ ($29 \pm 4 \text{ psi}$)

(4) 2W-1635 Spring for oil cooler bypass valve

Length under test force 102.0 mm (4.02 inch)
Test force 518 ± 26 N (115 ± 5.8 lb)
Free length after test 143.4 mm (5.65 inch)
Outside diameter 37.251 mm (1.4666 inch)

The oil cooler bypass valve must open with the
following pressure difference: 180 ± 20 kPa
(26 ± 3 psi)

i01888715

Engine Oil Filter

SMCS Code: 1318

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2D1-Up

S/N: S2E1-Up

S/N: S2F1-Up

S/N: B5G1-Up

S/N: MRG1-Up

S/N: PAG1-Up

S/N: S2G1-Up

S/N: MKH1-Up

S/N: S2H1-Up

S/N: S2J1-Up

S/N: S2K1-Up

S/N: S2L1-Up

S/N: S2M1-Up

S/N: S2N1-Up

S/N: S2P1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2T1-Up

S/N: S2W1-Up

S/N: S2X1-Up

S/N: S2Y1-Up

Part No.: 112-4921

S/N: S2Z1-Up

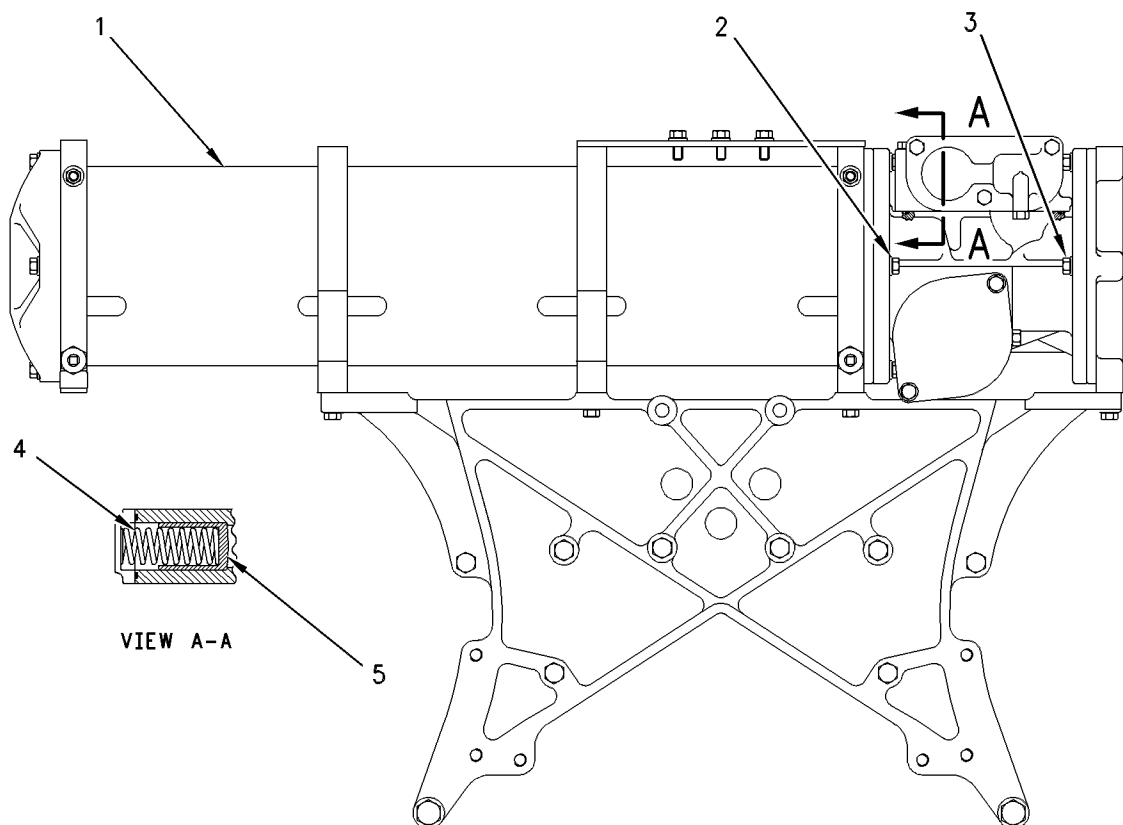


Illustration 81
Typical example

g00295366

Note: Lubricate the bores for the O-ring seals with engine oil.

Fully open pressure: 480 ± 7 kPa (70 ± 1 psi)

(1) Oil filter housing

(2) Bolt

Torque 55 ± 7 N·m (41 ± 5 lb ft)

(3) Bolt

Torque 55 ± 7 N·m (41 ± 5 lb ft)

(4) 2W-1635 Spring

Length under test force 102 mm (4.02 inch)

Test force 518 ± 26 N (116 ± 6 lb)

Free length after test force 143.4 mm
(5.65 inch)

Outside diameter 37.25 mm (1.467 inch)

(5) Oil filter bypass valve

Start to open pressure: .. 287 ± 7 kPa (42 ± 1 psi)

i01906041

Engine Oil Lines (Front Mounted Engine Oil Filter)

SMCS Code: 1307

2. Tighten the clamp assembly to the elbow.

3. Tighten the clamp assembly to the tube.

(2) O-rings

Lubricate the O-rings with clean engine oil prior to assembly.

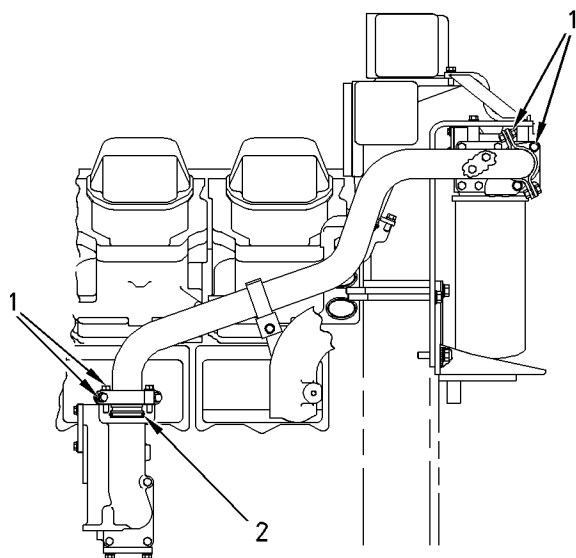


Illustration 82

g00992667

Right side view

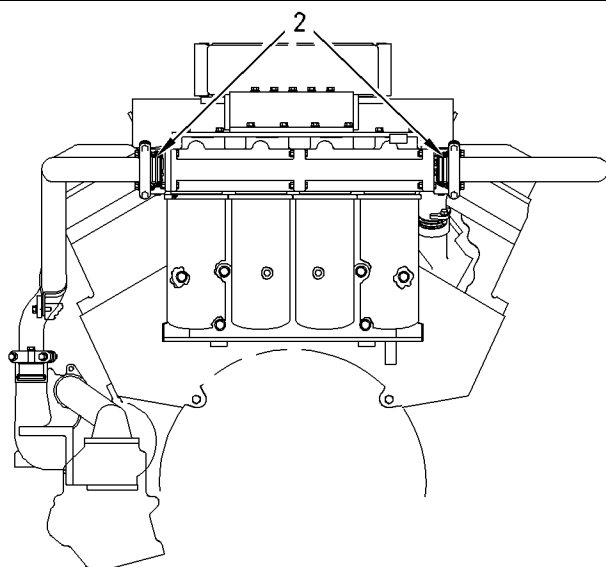


Illustration 83

g00992788

Front view (typical example)

(1) Clamp bolts

Torque $47 \pm 9 \text{ N}\cdot\text{m}$ ($35 \pm 7 \text{ lb ft}$)

Tightening sequence for the clamp bolts

1. Snugly tighten the clamp assembly to the tube.

i01697503

Duplex Engine Oil Filters

SMCS Code: 1318

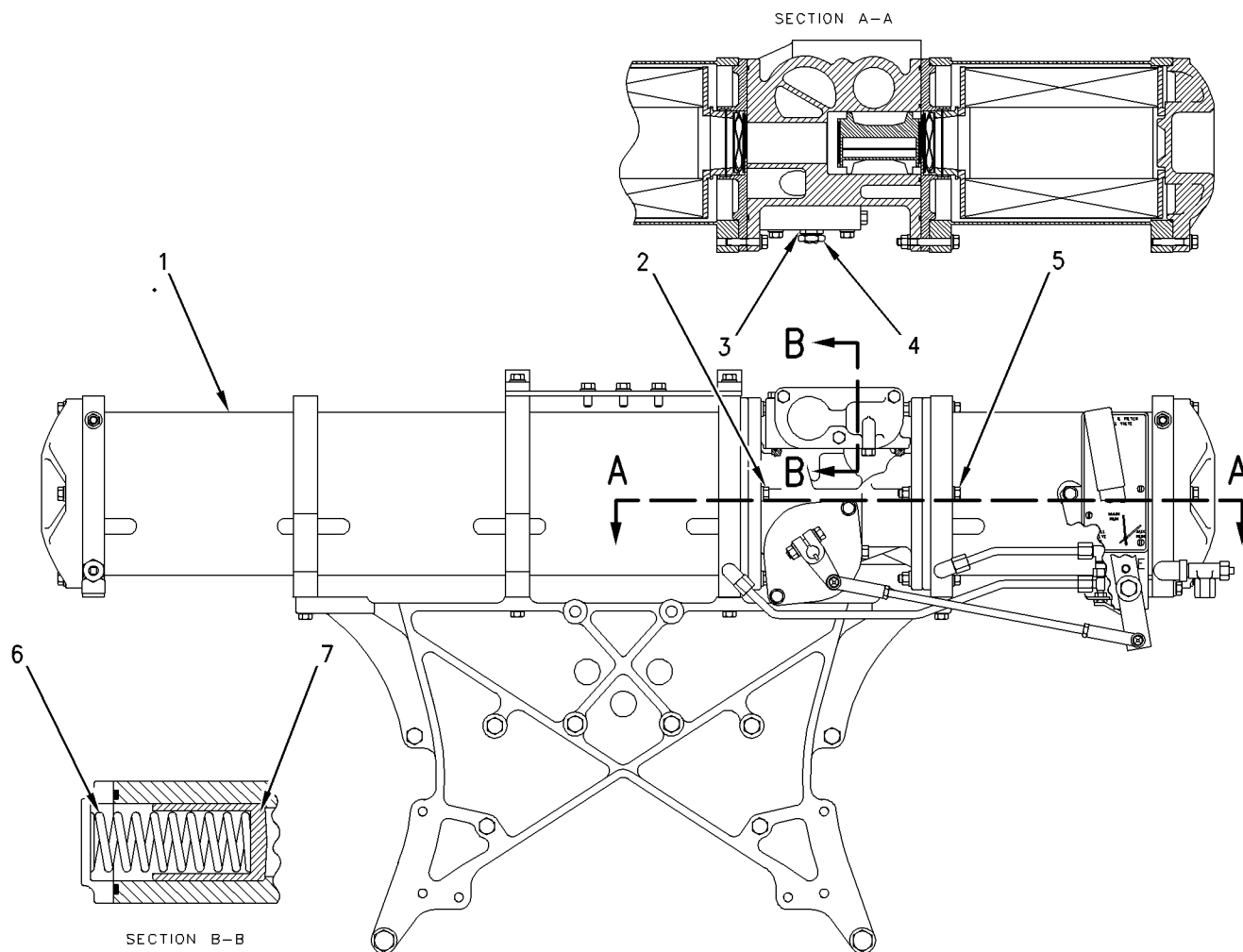


Illustration 84

g00873873

(1) Oil filter housing	(5) Bolts
(2) Bolts	Torque 55 ± 7 N·m (41 ± 5 lb ft)
Torque 55 ± 7 N·m (41 ± 5 lb ft)	(6) 2W-1635 Spring
(3) Nut	Length under test force 102 mm (4.02 inch)
Torque 45 ± 5 N·m (33 ± 4 lb ft)	Test force 518 ± 26 N (116 ± 6 lb)
(4) Nut	Free length after test force 143.4 mm (5.65 inch)
Torque 45 ± 5 N·m (33 ± 4 lb ft)	Outside diameter 37.25 mm (1.467 inch)
	(7) Oil filter bypass valve

The oil filter bypass valve must start to open at the following pressure: .. 287 ± 7 kPa (42 ± 1 psi)
The oil filter bypass valve must be fully open at the following pressure: .. 480 ± 7 kPa (70 ± 1 psi)

Refer to Testing and Adjusting, "Duplex Oil Filter - Adjust" for adjustment procedures.

i01940007

Engine Oil Filter Base

SMCS Code: 1306

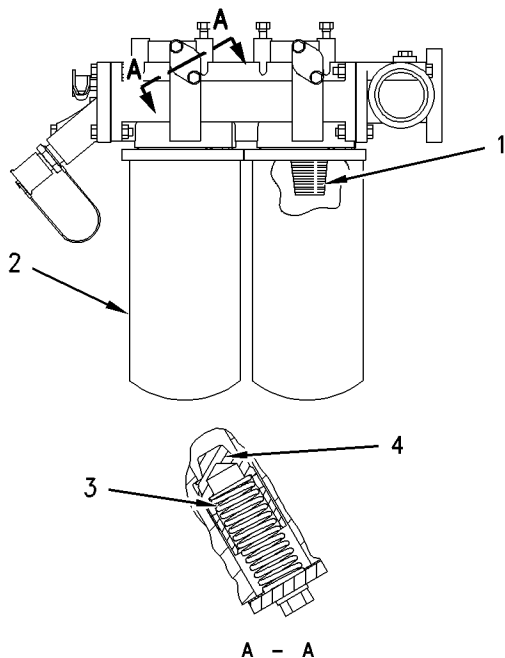


Illustration 85

g00887055

(1) Stud

Put 154-9731 Thread Lock Compound on the last 10.2 ± 1.5 mm (0.40 ± 0.06 inch) of the threads at the base end of the studs.

Torque 80 ± 14 N·m (60 ± 10 lb ft)

(2) Oil filter

1. Put clean engine oil on the oil filter seals.
2. Put filters (2) in position and tighten the oil filters until the seals make contact with the oil filter bases.
3. Tighten the filters for an additional one full turn (360 degrees).

(3) 7G-6713 Spring for the oil filter bypass valves

Length under test force 57.2 mm (2.25 inch)
Test force 109 ± 5 N (24.5 ± 1.1 lb)
Free length after test 99.7 mm (3.93 inch)
Outside diameter 21.23 mm (0.836 inch)
Color code (stripes) one light blue stripe

(4) Oil filter bypass valve

The oil filter bypass valves must open at the following pressure difference: 203 ± 20 kPa (29 ± 3 psi)

i01940011

Engine Oil Filter Base

SMCS Code: 1306

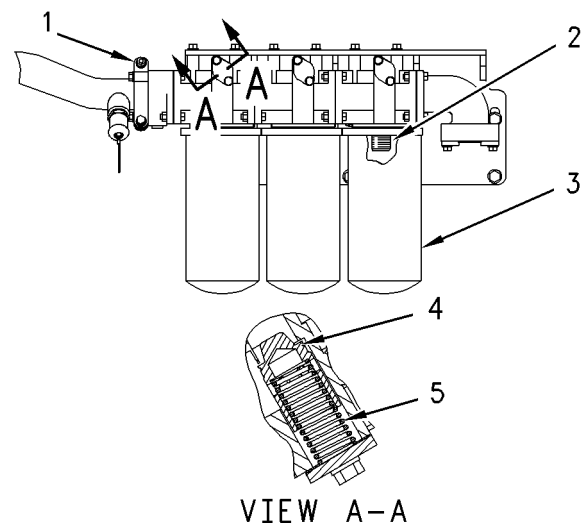


Illustration 86

g00774718

(1) Clamp bolt

Use the following bolt tightening sequence in order to tighten the clamp bolts.

1. Place the clamp assembly so that the clamp assembly is snug against the tube.

2. Tighten the clamp assembly to the adapter.

Torque 47 ± 9 N·m (35 ± 7 lb ft)

3. Tighten the clamp assembly to the tube.

Torque 47 ± 9 N·m (35 ± 7 lb ft)

(2) Stud

Apply 154-9731 Thread Lock Compound to the last 10.2 ± 1.5 mm ($.40 \pm .06$ inch) of the thread at the base end of the stud.

Torque 80 ± 14 N·m (60 ± 10 lb ft)

(3) Oil filter

1. Put clean engine oil on the oil filter seals.
2. Put oil filters (3) in position and tighten the oil filters until the seals make contact with the oil filter bases.
3. Rotate the filters more so that the oil filters are turned 360 degrees in addition to making contact with the oil filter bases.

(4) Oil filter bypass valve

The oil filter bypass valves must open at the following pressure difference: 230 ± 20 kPa
(33 ± 3 psi)

(5) 7G-6713 Spring for the oil filter bypass valves

Length under test force 57.2 mm (2.25 inch)
Test force 109 ± 5 N (24.5 ± 1.1 lb)
Free length after test 99.7 mm (3.93 inch)
Outside diameter 21.23 mm (0.836 inch)
Color code (stripes) one light blue stripe

i01940021

Crankcase Breather

SMCS Code: 1317

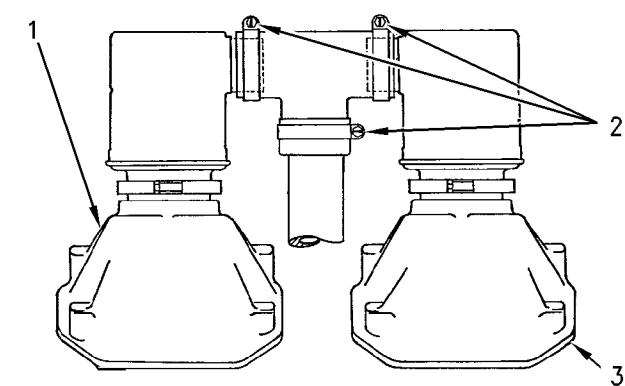


Illustration 87

g00122924

Typical example

(1) Valve cover

(2) Clamp bolts

Torque 3.0 ± 0.5 N·m (27 ± 4 lb in)

(3) Valve cover

Engine Oil Pan

SMCS Code: 1302

i02188673

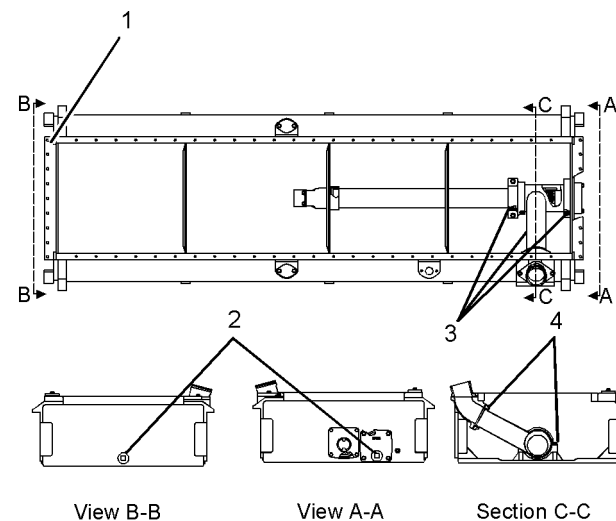


Illustration 88

g01021453

Typical example

(1) Gasket joint

Apply one of the following sealants to the gasket joints prior to assembly:

- 4C-9613 Silicone Sealant
- 138-8436 Liquid Gasket

(2) Plugs

Torque 145 ± 15 N·m (107 ± 11 lb ft)

(3) Seals

Apply 1P-0808 Multipurpose Grease to the bores prior to assembly.

(4) Bolts

In order to prevent stress to the tube assembly, tighten the bolts on the flange before you tighten the bolts on the housing.

Torque 47 ± 9 N·m (35 ± 6 lb ft)

i01929175

Engine Oil Pan

SMCS Code: 1302

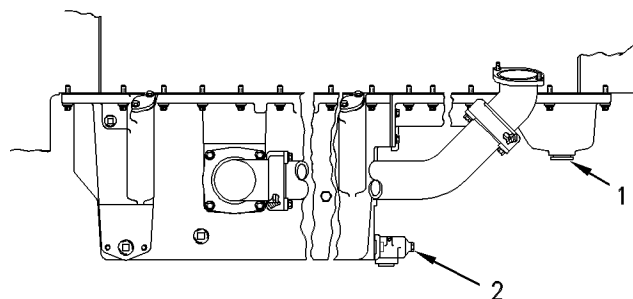


Illustration 89

g00280390

Typical example

(1) Plug

Torque 145 ± 15 N·m (107 ± 11 lb ft)

(2) Plug

Apply 4C-9509 Wicking Sealant to the threads of the plug.

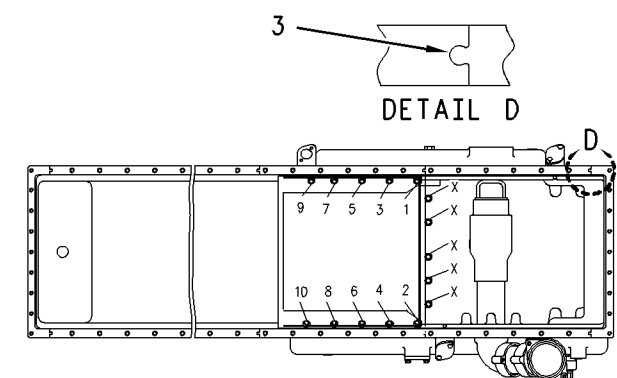
Torque 55 ± 7 N·m (41 ± 5 lb ft)

Illustration 90

g00759972

Typical example

(3) Gasket joint

Apply one of the following sealants to the gasket joints:

- 4C-9613 Silicone Sealant
- 7M-7260 Liquid Gasket

Tighten the bolts that are marked "X" first. Then tighten the bolts according to the numbered sequence.

i01957454

Water Temperature Regulator

SMCS Code: 1355

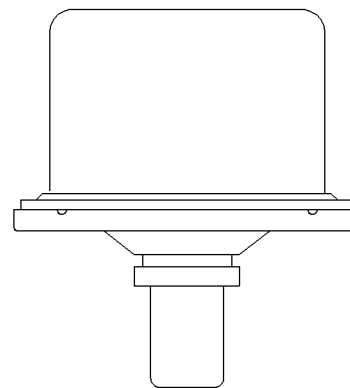


Illustration 91

g00286978

Fully open temperature 92°C (197°F)Minimum opening distance at 92°C (197°F) 10.4 mm (0.41 inch)

i02636978

Water Lines

SMCS Code: 1380

Part No.: 249-2846, 278-7527
S/N: S2A1-UpPart No.: 249-2846, 278-7527
S/N: S2B1-UpPart No.: 249-2846, 278-7527
S/N: S2D1-UpPart No.: 249-2846, 278-7527
S/N: S2E1-UpPart No.: 249-2846, 278-7527
S/N: S2F1-UpPart No.: 249-2846, 278-7527
S/N: B5G1-UpPart No.: 249-2846
S/N: MRG1-UpPart No.: 249-2846, 278-7527
S/N: S2G1-UpPart No.: 249-2846, 278-7527
S/N: MKH1-UpPart No.: 249-2846, 278-7527
S/N: S2H1-UpPart No.: 249-2846, 278-7527
S/N: S2J1-Up

Part No.: 249-2846, 278-7527
S/N: S2K1-Up

Part No.: 249-2846, 278-7527
S/N: S2L1-Up

Part No.: 278-7527
S/N: S2M1-Up

Part No.: 249-2846, 278-7527
S/N: S2N1-Up

Part No.: 249-2846, 278-7527
S/N: S2P1-Up

Part No.: 249-2846, 278-7527
S/N: S2R1-Up

Part No.: 249-2846, 278-7527
S/N: S2S1-Up

Part No.: 249-2846, 278-7527
S/N: S2T1-Up

Part No.: 249-2846, 278-7527
S/N: S2W1-Up

Part No.: 249-2846, 278-7527
S/N: S2X1-Up

Part No.: 278-7527
S/N: S2Y1-Up

Part No.: 249-2846, 278-7527
S/N: S2Z1-Up

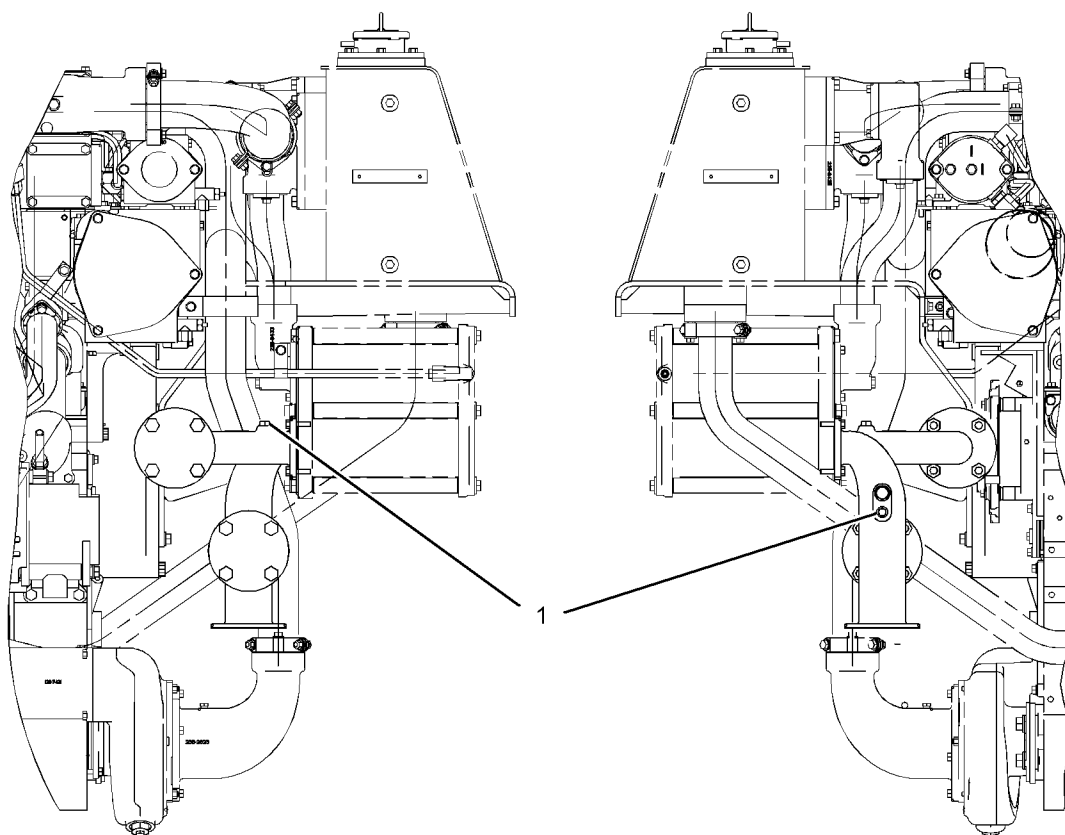


Illustration 92
Zinc rod

g01322263

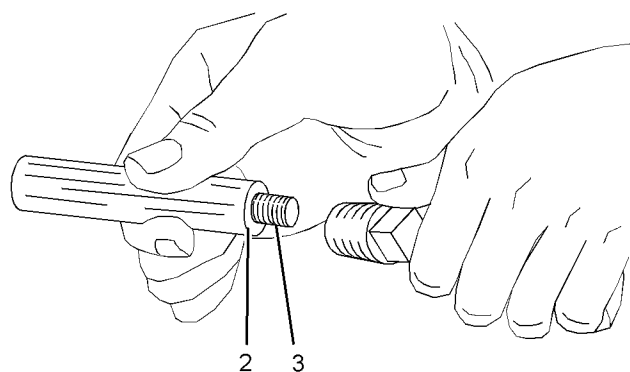


Illustration 93

g01322268

Typical example of zinc rod assembly

1. Apply 9S-3263 Thread Lock Compound to shoulder (2) of a new zinc rod (1). Do not apply sealant to threads (3) of the rod.
2. Lightly lubricate the bores for the zinc rods and the plugs with liquid soap.

Torque for the zinc rod .. $2.25 \pm .25$ N·m (20 ± 2 lb in)

i01980486

Water Pump

SMCS Code: 1361

Type 1

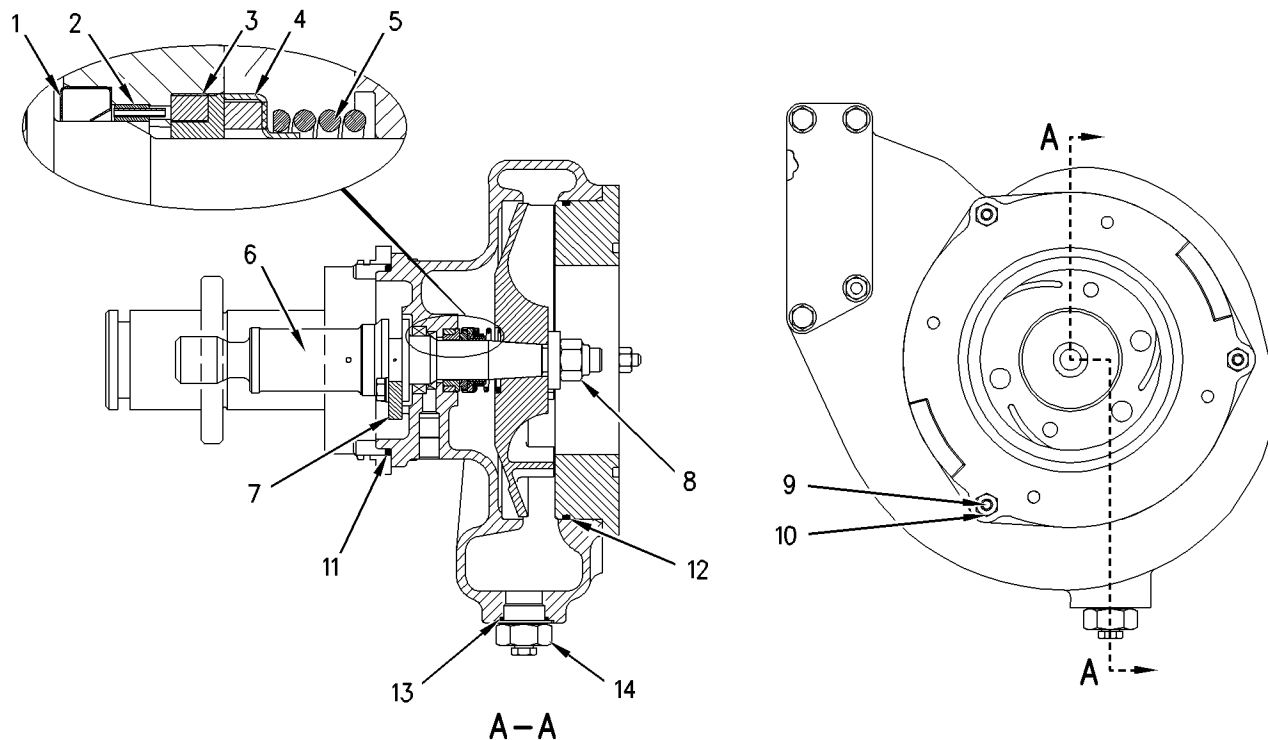


Illustration 94
Typical example

g00993011

- (1) Oil seal
- (2) Ring assembly
- (3) Ceramic ring and rubber seal
- (4) Seal assembly
- (5) Spring

Follow these recommendations for installation of the seals:

Note: The seal installation tool is part of the replacement seal assembly.

1. Install ring assembly (2) and oil seal (1) into the pump housing. Install the oil seal dry. Do not lubricate the sealing lip. Use the correct installation tool and use a slow, even motion to press the seal into the pump housing.
2. Install shaft (6) through the oil seal.

3. Install the shaft's thrust washer (7).
4. Lubricate the outside diameter of the ceramic ring and rubber seal (3) with clean water.
5. Orient the polished face of the ceramic ring toward seal assembly (4). Use the installation tool and hand pressure to seat the ceramic ring and the rubber seal into the pump housing.
6. Remove spring (5) from the seal assembly. Lubricate the inside diameter of the seal assembly with clean water.
7. Use the seal installation tool and hand pressure to install the seal assembly onto the shaft until the face of the seal assembly makes light contact with the face of the ceramic ring and rubber seal.
8. Install the spring onto the seal assembly.
- (6) Shaft

Width of shaft's groove for thrust
washer 8.75 ± 0.05 mm (0.345 ± 0.002 inch)

(7) Thrust washer

Thickness 8.50 ± 0.05 mm
(0.3346 ± 0.0020 inch)

(8) Nut

Torque 200 ± 25 N·m (150 ± 18 lb ft)

(9) Stud

Torque 35 ± 5 N·m (26 ± 4 lb ft)

(10) Nut

Torque 27 ± 4 N·m (20 ± 3 lb ft)

(11) O-ring seal

Lubricate the O-ring seal with clean engine oil.

(12) O-ring seal

Lubricate the O-ring seal with clean engine coolant.

(13) O-ring seal

Lubricate the O-ring seal with glycerin.

(14) Adapter

Torque 100 ± 10 N·m (75 ± 7 lb ft)

Maximum leakage per minute for the water seal at
138 kPa (20 psi) of air pressure 20 cc (1.22 cu in)

Maximum leakage per minute for the oil seal at
138 kPa (20 psi) of air pressure 24 cc (1.46 cu in)

Type 2

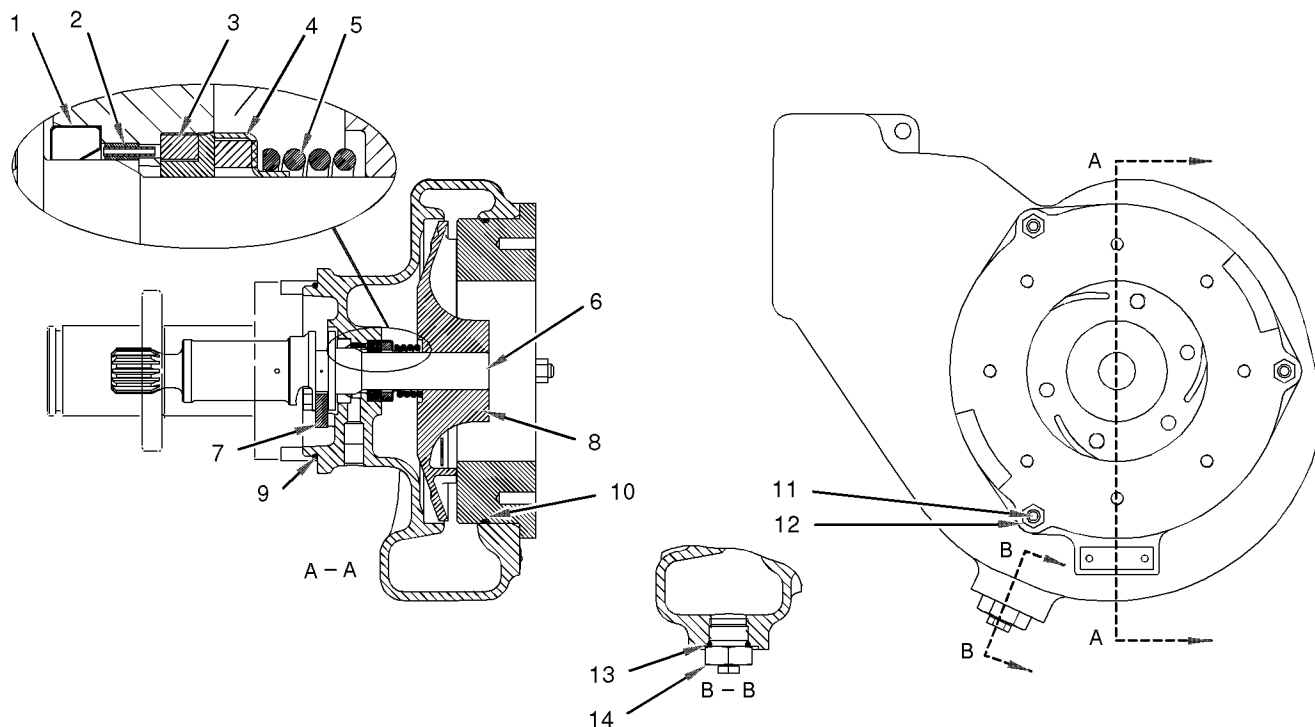


Illustration 95
Typical example

g01026565

(1) Oil seal

(2) Ring assembly

(3) Ceramic ring and rubber seal

(4) Seal assembly

(5) Spring

(6) Shaft

Shaft's outer diameter for
impeller 25.400 ± 0.013 mm
(1.0000 ± 0.0005 inch)

Width of shaft's groove for thrust
washer 8.75 ± 0.05 mm (0.345 ± 0.002 inch)

(7) Thrust washer

Thickness 8.50 ± 0.05 mm
(0.3346 ± 0.0020 inch)

(8) Impeller

Diameter of impeller's bore .. 25.342 ± 0.013 mm
(0.9977 ± 0.0005 inch)

(9) O-ring seal

(10) O-ring seal

(11) Stud

Torque 35 ± 5 N·m (26 ± 4 lb ft)

(12) Nut

Torque 27 ± 4 N·m (20 ± 3 lb ft)

(13) O-ring seal

(14) Adapter

Torque 100 ± 10 N·m (75 ± 7 lb ft)

Assembly Procedure

Follow this procedure for assembly:

Note: The seal installation tool is part of the replacement seal assembly.

1. Install ring assembly (2) and oil seal (1) into the pump housing. Install the oil seal dry. Do not lubricate the sealing lip. Use the correct installation tool and use a slow, even motion to press the seal into the pump housing.

2. Install shaft (6) through the oil seal and through the ring assembly.
3. Install thrust washer (7).
4. Lubricate the outside diameter of the ceramic ring and rubber seal (3) with clean water or with 207 - 1600 Rubber Lubricant.
5. Orient the polished face of the ceramic ring toward seal assembly (4). Use the installation tool and hand pressure to seat the ceramic ring and the rubber seal into the pump housing.
6. Remove spring (5) from the seal assembly. Lubricate the inside diameter of the seal assembly with clean water or with 207 - 1600 Rubber Lubricant.
7. Use the seal installation tool and hand pressure to install the seal assembly onto the shaft until the face of the seal assembly makes light contact with the face of the ceramic ring and rubber seal.
8. Install the spring onto the seal assembly.
9. Lubricate the shaft with clean engine oil. Place the shaft onto a fixture that will absorb the load and press impeller (8) onto the shaft until the face of the impeller is flush with the face of the shaft.
10. Lubricate the bore for O-ring seal (9) with clean engine oil.
11. Lubricate the bore for O-ring seal (10) with clean engine coolant.
12. Tighten studs (11) according to the specified torque.
13. Tighten nuts (12) according to the specified torque.
14. Lubricate the bore for O-ring seal (13) with glycerin.
15. Tighten adapter (14) according to the specified torque.

Maximum leakage per minute for the water seal at 138 kPa (20 psi) of air pressure 20 cc (1.22 cu in)

Maximum leakage per minute for the oil seal at 138 kPa (20 psi) of air pressure 24 cc (1.46 cu in)

i01940044

Auxiliary Water Pump (Sea Water)

SMCS Code: 1371

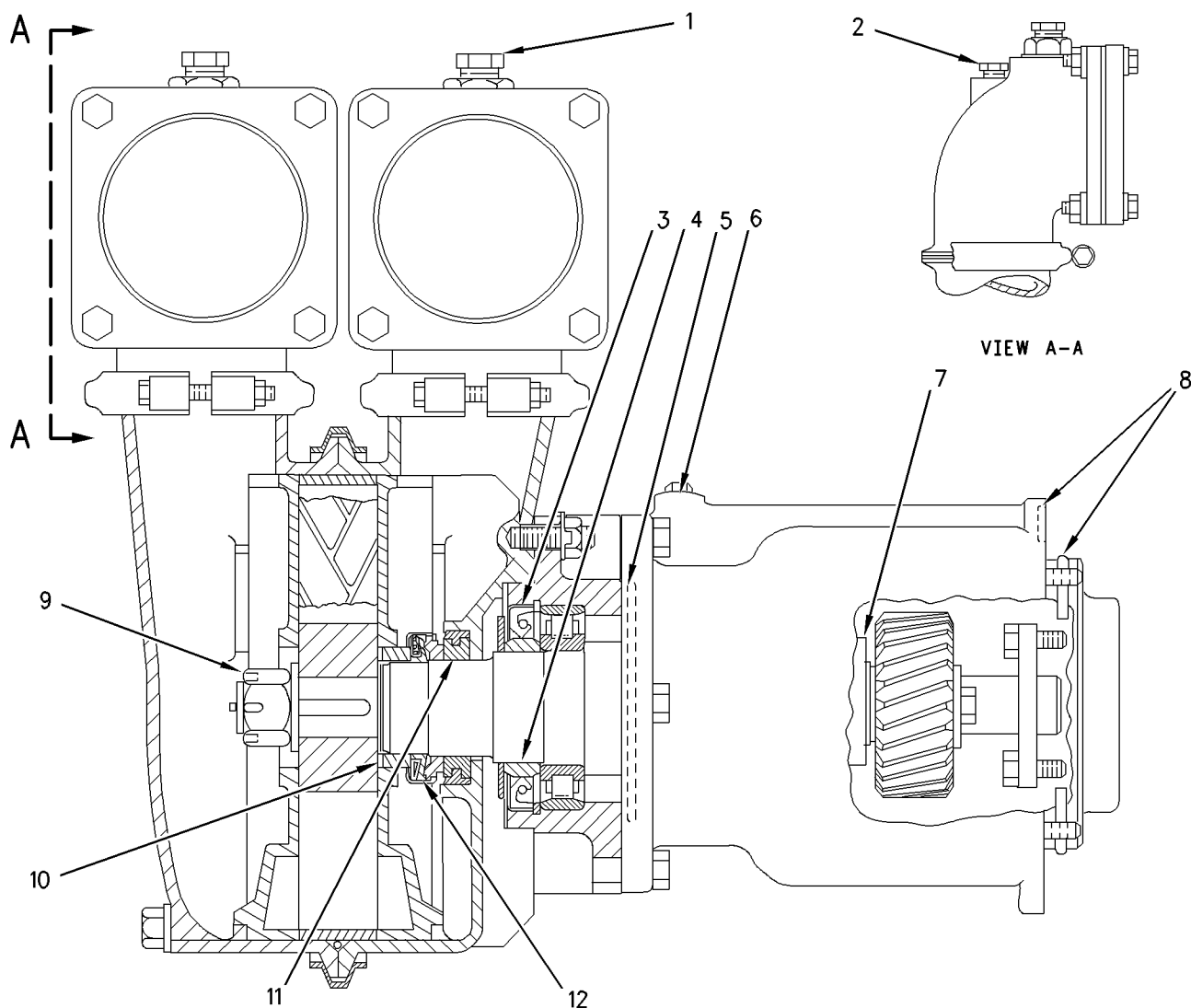


Illustration 96

g00854143

(1) Plug

Remove the plug in order to prime the pump.

(2) Plug

The plug is installed in the water inlet to the pump. The zinc rod and the plug are installed in the water outlet at this location. Assemble the zinc rod in the plug according to the following procedure.

1. Put 9S-3263 Thread Lock Compound on the shoulder of the rod. Do not put the sealant on the threads of the rod.

2. Tighten the rod.

Torque $7 \pm 3 \text{ N}\cdot\text{m}$ ($62 \pm 26 \text{ lb in}$)

(3) Seal

Apply clean engine oil on the lip of the seal. Install the seal as the seal is shown.

(4) Collar

Apply 4C-9507 Retaining Compound between the shaft and the collar.

(5) O-ring seal

Apply clean engine oil to the seal prior to assembly.

(6) O-ring seal

Apply clean engine oil to the seal prior to assembly.

(7) Nut

Torque 135 to 200 N·m (100 to 148 lb ft)

(8) O-ring seals

Apply clean engine oil on the lip of the seal prior to assembly.

(9) Nut

Apply 7M-7456 Compound to the threads of the nut. If the cotter pin cannot be installed, turn the nut clockwise until the nearest slot in the nut is in alignment with the hole in the shaft.

Torque 135 to 175 N·m (100 to 129 lb ft)

(10) Shims

Install the shims in order to get the following clearance between the port plate and the impeller. .. 0.18 to 0.23 mm (0.007 to 0.009 inch)

Table 1

Shim Table	
Shim	Thickness
5N-9015 Shim	0.38 mm (0.015 inch)
5N-9016 Shim	0.25 mm (0.010 inch)

(11) Ring and water seal

1. Put clean water on the seal and the ring.
2. Use hand pressure in order to install the seal assembly on the shaft. Press the seal until the carbon face of the seal assembly makes contact with the shiny face of the ceramic seal.

(12) Seal assembly

1. Put clean water inside the seal assembly.
2. Use hand pressure in order to install the seal assembly on the shaft. Press the seal until the carbon face of the seal assembly makes contact with the shiny face of the ceramic seal.

Auxiliary Water Pump

SMCS Code: 1371

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2D1-Up

S/N: S2E1-Up

S/N: S2F1-Up

S/N: B5G1-Up

S/N: MRG1-Up

S/N: PAG1-Up

S/N: S2G1-Up

S/N: MKH1-Up

S/N: S2H1-Up

S/N: S2J1-Up

S/N: S2K1-Up

S/N: S2L1-Up

S/N: S2M1-Up

S/N: S2N1-Up

S/N: S2P1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2T1-Up

S/N: S2W1-Up

S/N: S2X1-Up

S/N: S2Y1-Up

Type 1

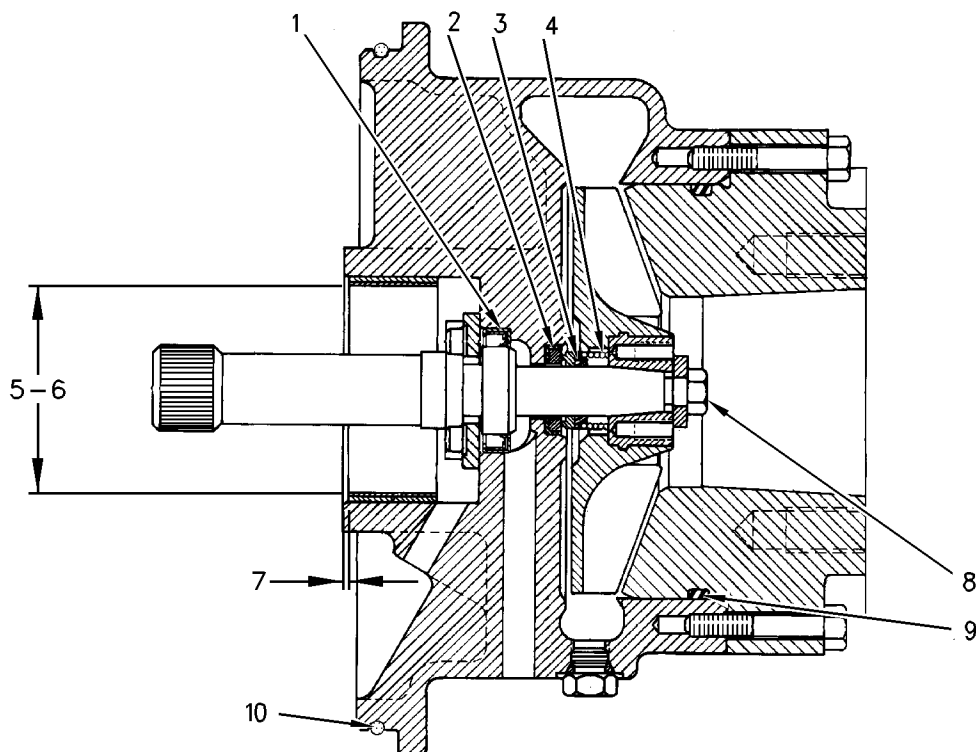


Illustration 97
Typical example

g00992722

- (1) Oil seal
- (2) Ceramic ring and rubber seal
- (3) Seal assembly
- (4) Spring

Follow these recommendations for installation of the seals:

Note: The seal installation tool is part of the replacement seal assembly.

1. Install oil seal (1) dry. Do not lubricate the sealing lip. Use the correct installation tool and use a slow, even motion to press the seal into the pump housing.
2. Install the bearing for the auxiliary drive shaft to the depth that is specified in the pump housing. Make sure that the oil hole in the bearing is aligned with the oil passage in the pump housing.
3. Install the shaft through the oil seal.
4. Install the shaft's thrust washer.

5. Lubricate the outside diameter of the ceramic ring and rubber seal (2) with clean water or with 207 - 1600 Rubber Lubricant.
6. Orient the polished face of the ceramic ring toward seal assembly (3). Use the installation tool and hand pressure to seat the ceramic ring and the rubber seal into the pump housing.
7. Remove spring (4) from the seal assembly. Lubricate the inside diameter of the seal assembly with clean water or with 207 - 1600 Rubber Lubricant.
8. Use the seal installation tool and hand pressure to install the seal assembly onto the shaft until the face of the seal assembly makes light contact with the face of the ceramic ring and rubber seal.
9. Install the spring onto the seal assembly.

- (5) Bearing bore for auxiliary drive shaft 75.000 ± 0.055 mm
(2.9527 $\pm$ 0.0022 inch)
- (6) Diameter of new auxiliary drive shaft (not shown) 74.900 ± 0.015 mm
(2.9488 $\pm$ 0.0006 inch)

(7) Depth of the bearing in the pump housing 1.5 ± 0.5 mm (0.06 ± 0.02 inch)

(8) Bolt

Torque 38 ± 4 N·m (28 ± 3 lb ft)

(9) O-ring seal

Lubricate the bore for O-ring seal (9) with glycerin or with engine oil.

(10) O-ring seal

Lubricate the bore for O-ring seal (10) with engine oil.

The water seal must withstand air pressure of the following value. 240 kPa (35 psi)

The oil seal must withstand air pressure of the following value. 103 kPa (15 psi)

Type 2

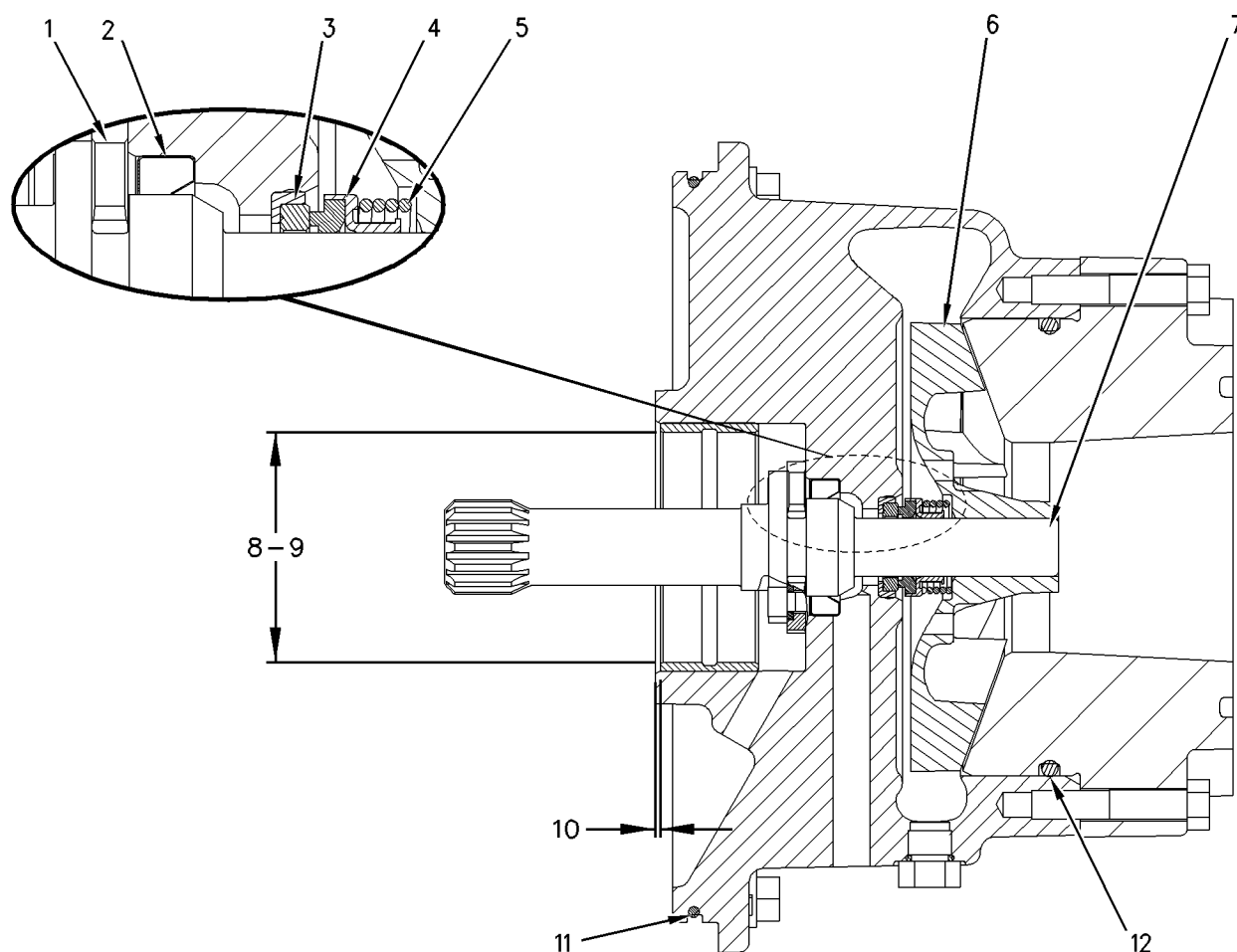


Illustration 98
Typical example

g00983757

(1) Thrust washer

Thickness 6.000 ± 0.050 mm
(0.2362 ± 0.0020 inch)

- (2) Oil seal
- (3) Ceramic ring and rubber seal
- (4) Seal assembly
- (5) Spring
- (6) Impeller
 - Diameter of impeller's bore .. 19.000 ± 0.013 mm
(0.7480 ± 0.0005 inch)
- (7) Shaft
 - Shaft's outer diameter for
impeller 19.050 ± 0.013 mm
(0.7500 ± 0.0005 inch)
 - Width of shaft's groove for thrust
washer 6.250 ± 0.050 mm
(0.2461 ± 0.0020 inch)
- (8) Bearing bore for auxiliary drive
shaft 75.000 ± 0.055 mm
(2.9527 ± 0.0022 inch)
- (9) Diameter of new auxiliary drive shaft (not
shown) 74.900 ± 0.015 mm
(2.9488 ± 0.0006 inch)
- (10) Depth of the bearing in the pump
housing 1.5 ± 0.5 mm (0.06 ± 0.02 inch)
- (11) O-ring seal
- (12) O-ring seal

Assembly Procedure

Follow this procedure for assembly:

Note: The seal installation tool is part of the replacement seal assembly.

1. Install oil seal (2) dry. Do not lubricate the sealing lip. Use the correct installation tool and use a slow, even motion to press the seal into the pump housing.
2. Install the bearing for the auxiliary drive shaft to the depth that is specified in the pump housing. Make sure that the oil hole in the bearing is aligned with the oil passage in the pump housing.
3. Install shaft (7) through the oil seal.
4. Install thrust washer (1).
5. Lubricate the outside diameter of the ceramic ring and rubber seal (3) with clean water or with 207 - 1600 Rubber Lubricant.

6. Orient the polished face of the ceramic ring toward seal assembly (4). Use the installation tool and hand pressure to seat the ceramic ring and the rubber seal into the pump housing.
7. Remove spring (5) from the seal assembly. Lubricate the inside diameter of the seal assembly with clean water or with 207 - 1600 Rubber Lubricant.
8. Use the seal installation tool and hand pressure to install the seal assembly onto the shaft until the face of the seal assembly makes light contact with the face of the ceramic ring and rubber seal.
9. Install the spring onto the seal assembly.
10. Lubricate the shaft with engine oil. Place the shaft onto a fixture that will absorb the load and press impeller (6) onto the shaft until the face of the impeller is flush with the face of the shaft.
11. Lubricate the bore for O-ring seal (11) with engine oil.
12. Lubricate the bore for O-ring seal (12) with engine oil or glycerin or clean water.

Maximum leakage per minute for the water seal at 138 kPa (20 psi) of air pressure 20 cc (1.22 cu in)

Maximum leakage per minute for the oil seal at 138 kPa (20 psi) of air pressure 24 cc (1.46 cu in)

Cooling System Pressure Cap

SMCS Code: 1382; 1392

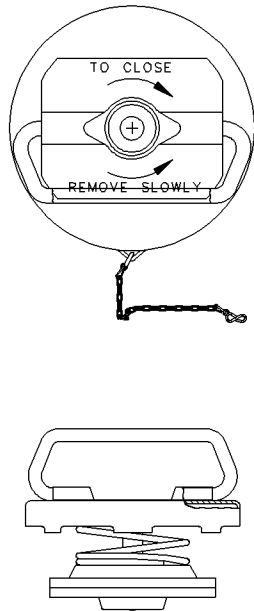


Illustration 99

g00877286

Pressure that opens the cap relief valve 48 kPa
(7 psi)

Maximum vacuum that opens the suction
valve 7 kPa (1 psi)

Cylinder Block

SMCS Code: 1201

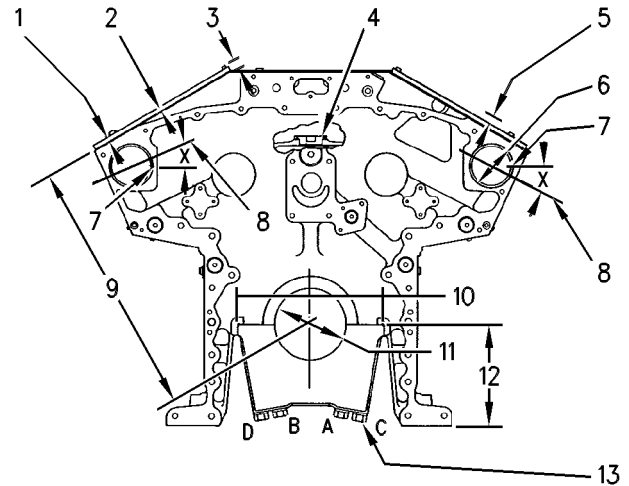


Illustration 100

g00123062

Front view of cylinder block

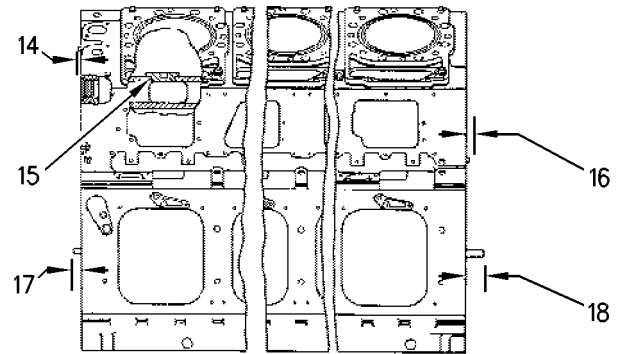


Illustration 101

g00123064

- (1) Spacer plate
Thickness of spacer plates 12.313 mm
(0.4848 inch)
- (2) Gasket
Thickness of gasket between the cylinder block
and spacer plates 0.18 to 0.22 mm
(0.007 to 0.009 inch)
- (3) Dowel
All dowels extend above the face by the following
distance: 21.0 ± 0.5 mm (0.83 ± 0.02 inch)
- (4) Plug
Torque 100 ± 15 N·m (75 ± 11 lb ft)

(5) Height of Cylinder liner

For the correct method of determining height of the liner, refer to Testing And Adjusting, "Cylinder Liner Projection".

(6) Bore

Bore in the block for the camshaft bearings 98.000 ± 0.020 mm
(3.8583 ± 0.0008 inch)

(7) Camshaft bearing junction

(8) Centerline through oil holes in camshaft bearings

Oil holes must be positioned from horizontal at angle (X) to the following angle: .. 20 ± 5 degrees

Note: All centerlines through oil holes in the camshaft bearings (8) and bearing junctions (7) must be in the position that is shown for each side of the cylinder block.

(9) New dimension from centerline of crankshaft bearing bore to the top of the block .. 586.00 mm
(23.071 inch)

(10) Main bearing cap width

Width of main bearing cap .. 340.030 ± 0.015 mm
(13.3870 ± 0.0006 inch)

Width of cylinder block for main bearing cap 339.985 ± 0.015 mm
(13.3852 ± 0.0006 inch)

Tight press fit between the sides of the main bearing cap and the cylinder block 0.075 mm
(0.0030 inch)

Loose press fit between the sides of the main bearing cap and the cylinder block 0.015 mm
(0.0006 inch)

(11) Bore in the block for the main bearings

Standard, original new size 169.742 ± 0.020 mm
(6.6827 ± 0.0008 inch)

0.63 mm (0.025 inch) larger than original size 170.372 ± 0.020 mm
(6.7076 ± 0.0008 inch)

(12) New dimension from the centerline of the crankshaft bearing bore to the bottom of the block (pan rails) 230.00 mm (9.055 inch)

(13) Main bearing cap bolts

Use the following procedure to tighten the main bearing cap bolts:

1. Install main bearing caps with the part number and FRONT toward the front of the block. Each cap has a number. Each cap must be installed in the same position as the correct number on the side of the cylinder block pan rail.

2. Put clean engine oil on the bolts before assembly.

3. Tighten the bolts in the letter sequence.

Torque 190 ± 14 N·m (140 ± 10 lb ft)

4. Tighten the bolts in the letter sequence again.

Rotation 180 ± 5 degrees

(14) Dowel

The dowel extends from the rear face of the block by the following distance: 6.0 ± 0.5 mm
(0.24 ± 0.02 inch)

(15) Plug

Torque 100 ± 15 N·m (75 ± 11 lb ft)

(16) Dowel

The dowels extend from the front face of the block by the following distance: 6.0 ± 0.5 mm
(0.24 ± 0.02 inch)

(17) Dowel

The dowels extend from the rear face of the block by the following distance: 19.0 ± 0.5 mm
(0.75 ± 0.02 inch)

(18) Dowel

The dowels extend from the front face of the block by the following distance: ... 40.0 ± 0.5 mm
(1.58 ± 0.02 inch)

i01323245

Cylinder Liner

SMCS Code: 1216

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2D1-Up

S/N: S2E1-Up

S/N: S2F1-Up

S/N: B5G1-Up

S/N: MRG1-Up

S/N: PAG1-Up**S/N:** S2G1-Up**S/N:** MKH1-Up**S/N:** S2H1-Up**S/N:** S2J1-Up**S/N:** S2K1-Up**S/N:** S2L1-Up**S/N:** S2M1-Up**S/N:** S2N1-Up**S/N:** S2P1-Up**S/N:** S2R1-Up**S/N:** S2S1-Up**S/N:** S2T1-Up**S/N:** S2W1-Up**S/N:** S2X1-Up**S/N:** S2Y1-Up**Part No.:** 211-7826**S/N:** S2Z1-Up

Use the liner again with the original piston if the measurements of the upper bore are in the following range. Use a FLEX-HONE first. 170.000 to 170.229 mm (6.6929 to 6.7019 inch)

(2) Thickness of flange on liner 12.65 ± 0.02 mm (0.498 ± 0.001 inch)

(3) Filler band

Cylinder Liner Installation

1. Put liquid soap on the cylinder block liner bore surface. Also, put liquid soap on the rubber seals on the lower part of the liner.
2. Put the filler band completely in clean engine oil for a moment.
3. Quickly, install filler band (3) in the groove under the liner flange.
4. Install the liner in the block immediately, before the filler band expands.

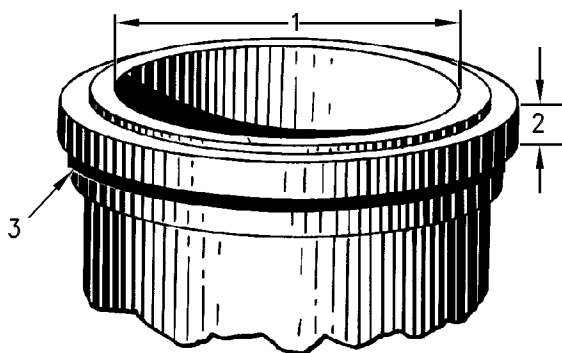


Illustration 102

g00118085

Note: Refer to Guideline For Reusable Parts SEBF8068, "Cylinder Liners".

(1) Bore in new liner 170.025 ± 0.025 mm (6.6939 ± 0.0010 inch)

Use the liner again with any used piston or any new piston if all the measurements are in the following range. Use a FLEX-HONE first. 170.000 to 170.152 mm (6.6929 to 6.6989 inch)

i02425201

Piston and Rings (One-Piece Piston)

SMCS Code: 1214

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2D1-Up

S/N: S2E1-Up

S/N: S2F1-Up

S/N: S2G1-Up

S/N: S2H1-Up

S/N: S2K1-Up

S/N: S2L1-Up

S/N: S2M1-Up

S/N: S2P1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2W1-Up

S/N: S2Y1-Up

This piston has a Keystone type of intermediate ring. Use the 1U-6431 Piston Ring Groove Gauge Gp for measuring the intermediate ring groove. Refer to the instruction card that is with the gauge group.

(1) Top ring

Install the top ring with the "Up-1" side toward the top of the piston.

When the piston ring is installed in a cylinder liner with a bore size of 170 mm (6.7 inch), the clearance between the ends of the piston ring is the following value. 0.625 ± 0.125 mm (0.025 ± 0.005 inch)

(2) Intermediate ring

Install the intermediate ring with the "Up-2" side toward the top of the piston.

When the piston is installed in a cylinder liner with a bore size of 170 mm (6.7 inch), the clearance between the ends of the piston ring is the following value. 1.00 ± 0.15 mm (0.04 ± 0.006 inch)

(3) Oil control ring

Width of groove in piston for the new oil control ring 4.04 mm to 4.07 mm (0.1591 to 0.1602 inch)

Maximum thickness of new oil control ring .. 4.85 mm (0.1909 inch)

When the oil control ring is installed in a cylinder liner with a bore size of 170 mm (6.7 inch), the clearance between the ends of the piston ring is the following value. 0.5 mm to 0.8 mm (0.0197 to 0.0315 inch)

Install the oil control ring so that the gap in the spring is 180 degrees away from the gap in the ring. The white portion of the spring must be visible at the ring gap.

After all of the piston rings have been installed, rotate the rings so that the end gaps are separated by 120 degrees. The ring gap for the oil ring must be aligned in the plane of the pin bore.

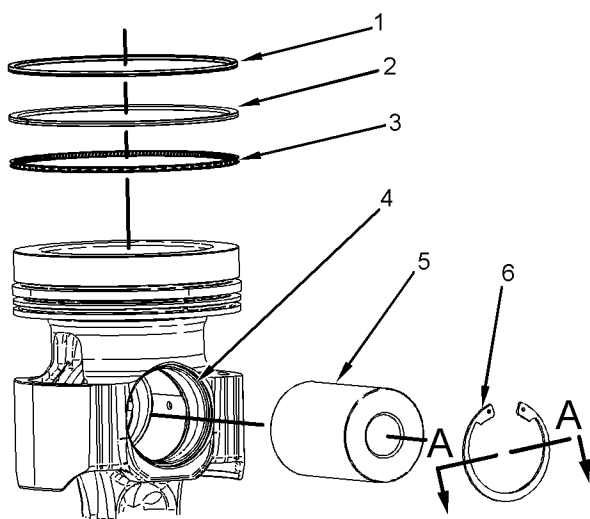


Illustration 103

g01138425

This piston has a square top ring. Use the 246-1176 Piston Ring Groove Gauge Gp for measuring the top ring groove.

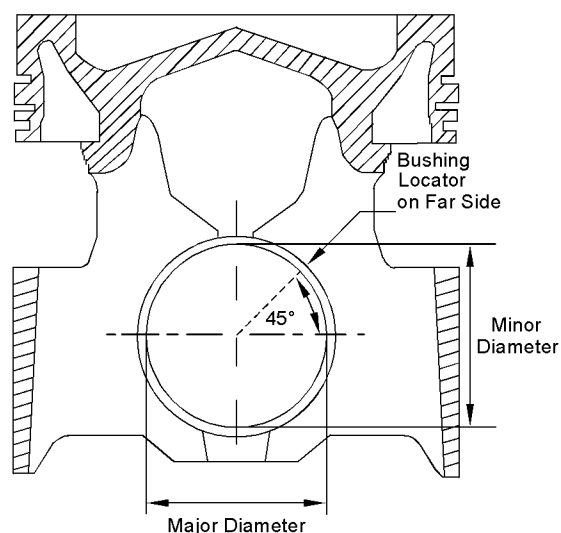


Illustration 104

g01138626

The pin bore is elliptical. The major diameter is approximately 0.04 mm (0.0016 inch) larger than the minor diameter.

(4) Piston pin bore

Measure the pin bore in two places. Take one measurement within the minor diameter. Move laterally and take another measurement within the minor diameter. Take the measurements close to the center of the pin bore. Do not take the measurements on the outside edges.

Minor pin bore diameter $70.0675 \pm .0075$ mm
(2.7586 ± 0.0003 inch)

(5) Pin

Outside diameter 69.962 ± 0.005 mm
(2.7544 ± 0.0002 inch)

Inside diameter 30.5 ± 0.5 mm
(1.2008 ± 0.0197 inch)

Length $101.85 \pm .15$ mm (4.0098 ± 0.0059 inch)

Note: The 197-0560 Piston Pin is not interchangeable with other pistons and connecting rods.

(6) Retainer

Assemble the retainer with the opening above line A-A.

Refer to Table 2 for the part numbers of the tools that are used in servicing the piston.

Table 2

Service Tools	
Pt. No.	Description
6V-4020	Piston Ring Expander Gp
6V-4023	Handle As
6V-4024	Guide Ring
1P-1861	Retaining Ring Pliers
1U-7616	Piston Ring Compressor Gp
246-1176	Piston Ring Groove Gauge Gp ⁽¹⁾
1U-6431	Piston Ring Groove Gauge Gp ⁽²⁾

⁽¹⁾ Only for the top ring groove

⁽²⁾ Only for the intermediate ring groove

i02499082

Piston and Rings (Two-Piece Piston)

SMCS Code: 1214

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2D1-Up

S/N: S2F1-Up

S/N: S2G1-Up

S/N: S2H1-Up

S/N: S2K1-Up

S/N: S2L1-Up

S/N: S2M1-Up

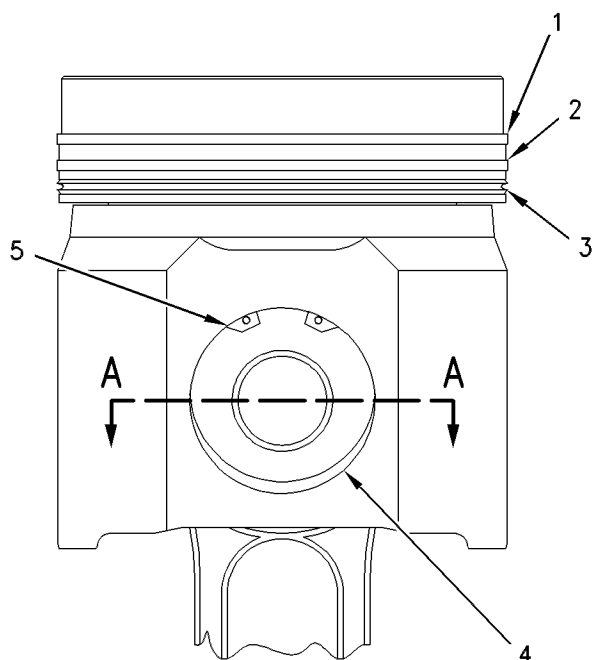
S/N: S2P1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2W1-Up

S/N: S2Y1-Up



This piston has a Keystone top and Keystone intermediate rings. The 1U-6431 Piston Ring Groove Gauge is necessary for measuring the ring grooves in Keystone pistons. For correct use of the gauge group, see the instruction card that is with the gauge group.

(1) Top ring

Install the top ring with the "Up-1" side toward the top of the piston.

When the piston ring is installed in a cylinder liner with a bore size of 170 mm (6.7 inch), the clearance between the ends of the piston ring is the following value. 0.625 ± 0.125 mm (0.0246 ± 0.0049 inch)

The increase in the clearance between the ends of the piston ring for each 0.03 mm (0.001 inch) increase in the cylinder liner bore size is the following value. 0.08 mm (0.003 inch)

(2) Intermediate ring

Install the intermediate ring with the "Up-2" side toward the top of the piston.

When the piston is installed in a cylinder liner with a bore size of 170 mm (6.7 inch), the clearance between the ends of the piston ring is the following value. 1.00 ± 0.15 mm (0.04 ± 0.006 inch)

The increase in the clearance between the ends of the piston ring for each 0.03 mm (0.001 inch) increase in the cylinder liner bore size is the following value. 0.08 mm (0.003 inch)

(3) Oil control ring

Width of groove in piston for the new piston ring 5.050 ± 0.010 mm (0.1988 ± 0.0004 inch)

Thickness of new piston ring 4.954 ± 0.019 mm (0.1950 ± 0.0007 inch)

Clearance between groove and new piston ring 0.067 to 0.125 mm (0.0026 to 0.0049 inch)

When the piston ring is installed in a cylinder liner with a bore size of 170 mm (6.7 inch), the clearance between the ends of the piston ring is the following value. 0.70 ± 0.19 mm (0.028 ± 0.007 inch)

The increase in the clearance between the ends of the piston ring for each 0.03 mm (0.001 inch) increase in the cylinder liner bore size is the following value. 0.08 mm (0.003 inch)

Install the oil control ring so that the gap in the spring is 180 degrees away from the gap in the ring. The white portion of the spring must be visible at the ring gap.

i02617844

After all of the piston rings have been installed, rotate the rings so that the end gaps are separated by 120 degrees. The ring gap for the oil ring must be aligned in the plane of the pin bore.

(4) Piston pin bore

Crown

Measure the pin bore in the bushings in two places for each bushing in a vertical direction.

Bore in bushing 70.035 ± 0.005 mm
(2.7573 ± 0.0002 inch)

Skirt

Measure the pin bore in a vertical direction.

Bore in skirt 69.983 ± 0.005 mm
(2.7552 ± 0.0002 inch)

Pin

Measure the pin diameter on each end in a vertical and horizontal direction.

Pin diameter 69.962 ± 0.005 mm
(2.7544 ± 0.0002 inch)

(5) Retainer

Assemble the retainer with the opening above line A-A.

Piston and Rings (Two-Piece Piston)

SMCS Code: 1214

S/N: B5G1-Up

S/N: MRG1-Up

S/N: PAG1-Up

S/N: MKH1-Up

S/N: S2J1-Up

S/N: S2N1-Up

S/N: S2T1-Up

S/N: S2X1-Up

S/N: S2Z1-Up

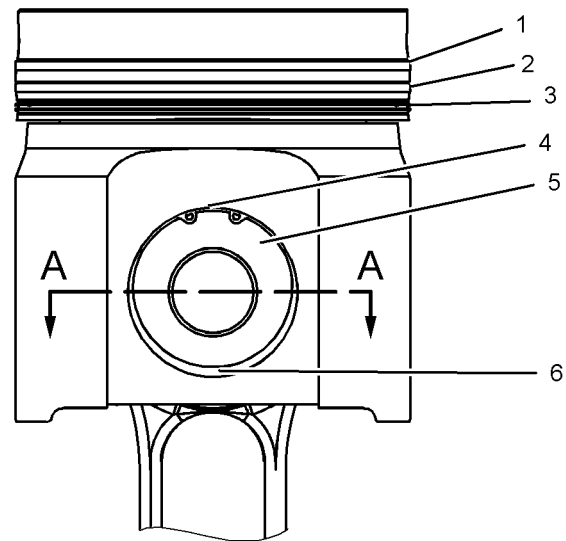


Illustration 106

g01084998

Typical example

This piston has a Keystone top ring. This piston also has Keystone intermediate rings. The 204 - 8041 Piston Ring Groove Gauge Gp is necessary for measuring the ring grooves in the Keystone pistons. For correct use of the gauge group, refer to the instruction card that is with the gauge group.

Note: Prior to the installation of the rings, the ring grooves must be completely lubricated with clean engine oil. After assembly, the mating surfaces of the rings to the cylinder liner must be completely lubricated with clean engine oil.

(1) Top piston ring

Install the piston ring with the "Up-1" side toward the top of the piston.

When the piston ring is installed in a cylinder liner with a bore size of 170 mm (6.7 inch), the clearance between the ends of the piston ring is the following value. 0.625 ± 0.125 mm
(0.0246 ± 0.005 inch)

The increase in the clearance between the ends of the piston ring for each 0.03 mm (0.001 inch) increase in the cylinder liner bore size is the following value. 0.08 mm (0.003 inch)

(2) Intermediate piston ring

Install the piston ring with the "Up-2" side toward the top of the piston.

When the piston ring is installed in a cylinder liner with a bore size of 170 mm (6.7 inch), the clearance between the ends of the piston ring is the following value. 1.00 ± 0.15 mm
(0.039 ± 0.006 inch)

The increase in the clearance between the ends of the piston ring for each 0.03 mm (0.001 inch) increase in the cylinder liner bore size is the following value. 0.08 mm (0.003 inch)

(3) Oil piston ring

Width of groove in piston for the new oil piston ring 4.055 ± 0.015 mm (0.1596 ± 0.0006 inch)
Maximum thickness of new oil piston ring 4.9 mm (0.19 inch)
Clearance between groove and new oil piston ring .. 0.050 to 0.100 mm (0.0020 to 0.0039 inch)
When the piston ring is installed in a cylinder liner with a bore size of 170 mm (6.7 inch), the clearance between the ends of the piston ring is the following value. 0.65 ± 0.15 mm
(0.026 ± 0.006 inch)

The increase in the clearance between the ends of the piston ring for each 0.03 mm (0.001 inch) increase in the cylinder liner bore size is the following value. 0.08 mm (0.003 inch)

Note: Install the oil piston ring so that the gap in the spring is 180 degrees away from the gap in the piston ring. The white portion of the spring must be visible at the ring end gap.

Note: After all of the piston rings have been installed, rotate the piston rings so that the end gaps are separated by 120 degrees. The ring gap for the oil piston ring must be aligned in the plane of the pin bore.

(4) Piston pin bore

Note: Prior to assembly of the piston pin, the piston pin, the piston pin bore, the connecting rod eye, and the connecting rod pin bearing must be completely lubricated with clean engine oil.

Crown as

Measure the pin bore in the bushings in two places for each bushing in a vertical direction.

Bore in bushing 70.0525 ± 0.0075 mm
(2.75796 ± 0.00029 inch)

Piston skirt

Measure the pin bore in a vertical direction.

Bore 69.988 ± 0.005 mm
(2.7554 ± 0.0002 inch)

(5) Piston pin

Measure the pin diameter on each end in a vertical and horizontal direction.

Outside diameter 69.962 ± 0.005 mm
(2.7544 ± 0.0002 inch)

Inside diameter 33.0 ± 0.5 mm
(1.30 ± 0.02 inch)

Length ... 137.55 ± 0.15 mm (5.415 ± 0.006 inch)

(6) Pin retainer Assemble the pin retainer with the opening above line A-A.

i02189073

Connecting Rod

SMCS Code: 1218

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2D1-Up

S/N: S2E1-Up

S/N: S2F1-Up

S/N: S2G1-Up

S/N: S2H1-Up

S/N: S2K1-Up

S/N: S2L1-Up

S/N: S2M1-Up

S/N: S2P1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2W1-Up

S/N: S2Y1-Up

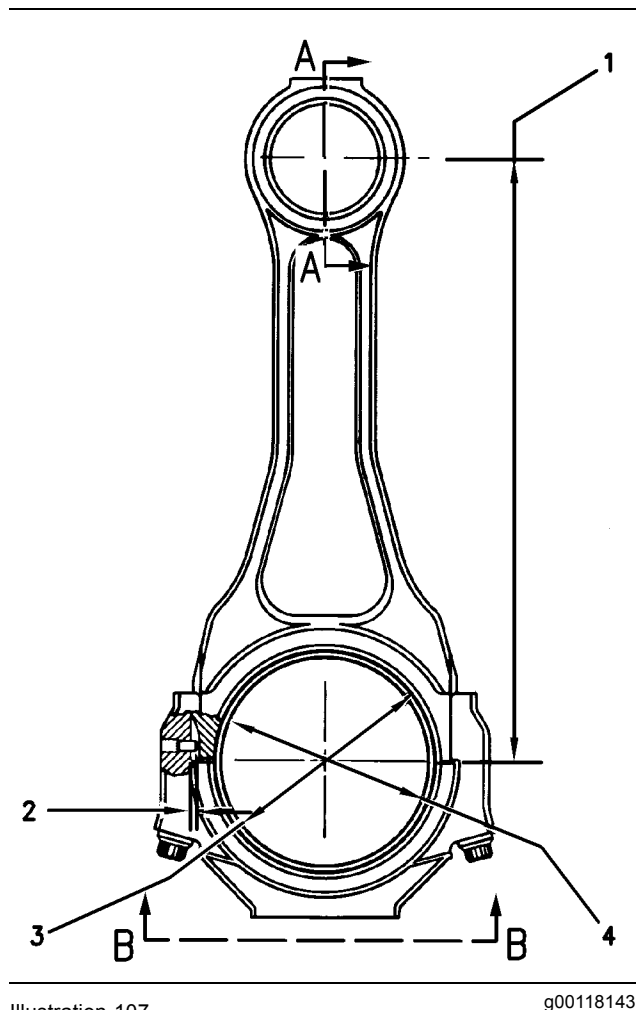


Illustration 107

g00118143

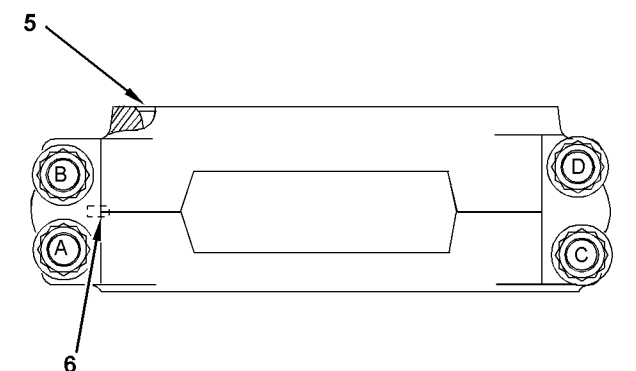


Illustration 108

g01106668

View B-B

- (1) Distance between center of bearings 380.00 mm (14.961 inch)
- (2) The locating pin extends from the rod cap at the following distance. 4.0 ± 0.5 mm (0.16 ± 0.02 inch)

- (3) After the bolts are tightened, the bore in the connecting rod for the bearing is the following dimension. 143.028 ± 0.015 mm (5.6310 ± 0.0006 inch)

- (4) Take the connecting rod bearing measurements on the centerline of the connecting rod bores.

Bore in bearing for crankshaft 135.133 to 135.194 mm (5.3202 to 5.3226 inch)

Clearance between bearing and new crankshaft 0.107 to 0.218 mm (0.0042 to 0.0086 inch)

- (5) Side of connecting rod with chamfer

The chamfer must be adjacent to the crank pin thrust surface when the rod and piston group is assembled in the engine. The opposite side will push the rod that mates on the same crank pin.

- (6) Location pin for correct installation of connecting rod caps

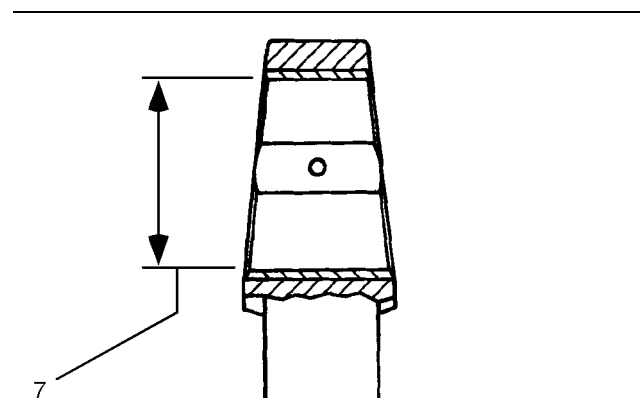


Illustration 109

g01106666

Section A-A

- (7) Bore in bearing for new piston pin ... 70.000 ± 0.008 mm (2.7559 ± 0.0003 inch)

Diameter of new piston pin 69.962 ± 0.005 mm (2.7544 ± 0.0002 inch)

Note: The connecting rod must be heated for the installation of the rod eye bushing. DO NOT use a torch.

Heat the connecting rod to the following temperature. 175 to 260 °C (350 to 500 °F)

The side clearance between two connecting rods on the same new crankshaft pin is the following value. 0.850 ± 0.332 mm (0.0335 ± 0.0131 inch)

Procedure for Tightening Connecting Rod Bolts

Note: Bolts A and B are on the same end of the rod cap that has bearing tabs and location pin (6).

1. Before assembly, put 6V-4876 Lubricant on the bolt threads and all surfaces that make contact between the bolt and the cap.
2. Tighten bolts A and B.
Torque $90 \pm 5 \text{ N}\cdot\text{m}$ ($65 \pm 4 \text{ lb ft}$)
3. Tighten bolts C and D.
Torque $90 \pm 5 \text{ N}\cdot\text{m}$ ($65 \pm 4 \text{ lb ft}$)
4. Tighten bolts C and D again.
Torque $90 \pm 5 \text{ N}\cdot\text{m}$ ($65 \pm 4 \text{ lb ft}$)
5. Tighten each bolt again.
Rotation $90 \pm 5 \text{ degrees}$

Connecting Rod

SMCS Code: 1218

S/N: B5G1-Up

S/N: MRG1-Up

S/N: PAG1-Up

S/N: MKH1-Up

S/N: S2J1-Up

S/N: S2N1-Up

S/N: S2T1-Up

S/N: S2X1-Up

S/N: S2Z1-Up

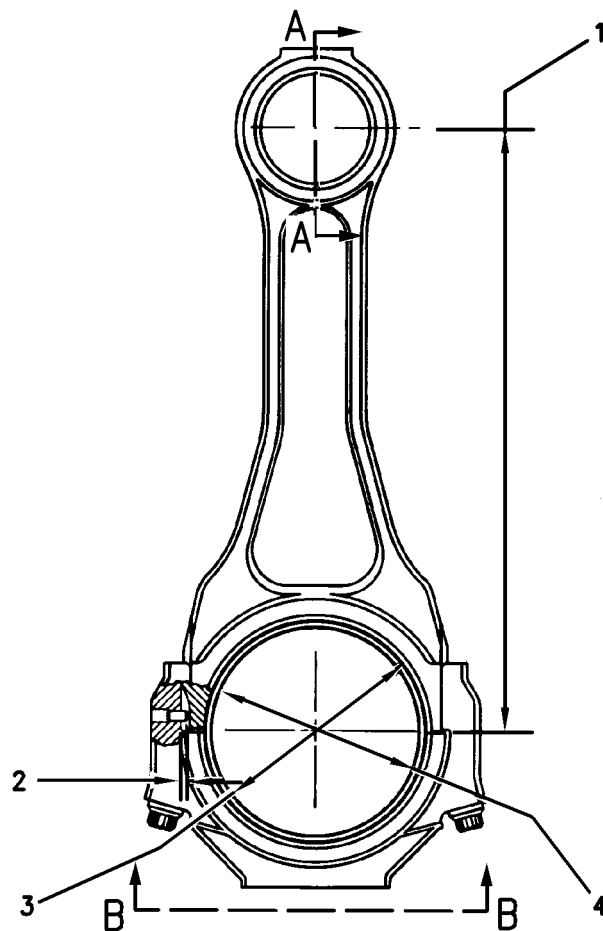


Illustration 110

g00118143

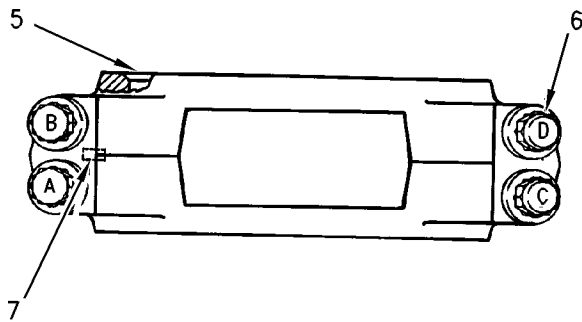


Illustration 111

g00672743

View B-B

(1) Connecting rod length

Distance between center of bearings 392.50 mm (15.453 inch)

(2) Locating pin

The locating pin extends from the rod cap at the following distance. 4.0 ± 0.5 mm
(0.16 ± 0.02 inch)

(3) Bearing bore

When the bolts are tightened to specifications (6), the bore in the connecting rod for the bearing is the following dimension. 143.028 ± 0.015 mm
(5.6310 ± 0.0006 inch)

(4) Connecting rod bearing

Take the connecting rod bearing measurements on the centerline of the connecting rod bores.

Bore in bearing for crankshaft 135.133 to 135.194 mm
(5.3202 to 5.3226 inch)

Clearance between bearing and new crankshaft 0.107 to 0.218 mm
(0.0042 to 0.0086 inch)

(5) Side of connecting rod with chamfer

The chamfer must be adjacent to the crank pin thrust surface when the rod and the piston are assembled in the engine. The opposite side will push the rod that mates on the same crank pin.

(6) Procedure for tightening connecting rod bolts

Note: Bolts A and B are on the same end of the rod cap that has bearing tabs and locating pin (7).

1. Before assembly, put 6V-4876 Lubricant on the bolt threads and all the surfaces that make contact between the bolt and the cap.

2. Tighten bolts A and B.

Torque 90 ± 5 N·m (65 ± 4 lb ft)

3. Tighten bolts C and D.

Torque 90 ± 5 N·m (65 ± 4 lb ft)

4. Again, tighten bolts C and D.

Torque 90 ± 5 N·m (65 ± 4 lb ft)

5. Again, tighten each bolt.

Angle 90 ± 5 degrees

(7) Location pin for correct installation of connecting rod caps

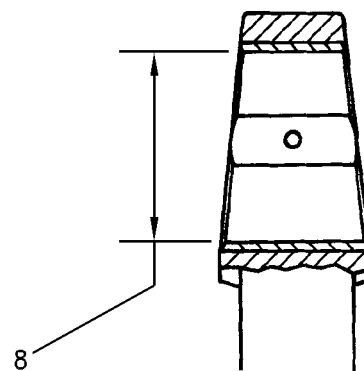


Illustration 112

g00118166

Section A-A

(8) Bearing bore

Bore in bearing for new piston pin ... 70.000 ± 0.008 mm (2.7559 ± 0.0003 inch)
Diameter of new piston pin .. 69.962 ± 0.005 mm
(2.7544 ± 0.0002 inch)

Note: The connecting rod must be heated for the installation of the rod eye bushing. DO NOT use a torch.

Heat the connecting rod to the following temperature. 175 to 260 °C (350 to 500 °F)

The side clearance between two connecting rods on the same new crankshaft pin is the following value. 0.850 ± 0.332 mm (0.0335 ± 0.0131 inch)

i01359201

Connecting Rod and Main Bearing Journals

SMCS Code: 1230

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2D1-Up

S/N: S2E1-Up

S/N: S2F1-Up

S/N: B5G1-Up

S/N: MRG1-Up

S/N: PAG1-Up

S/N: S2G1-Up

S/N: MKH1-Up

S/N: S2H1-Up

S/N: S2J1-Up

S/N: S2K1-Up

S/N: S2L1-Up

S/N: S2M1-Up

S/N: S2N1-Up

S/N: S2P1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2T1-Up

S/N: S2W1-Up

S/N: S2X1-Up

S/N: S2Y1-Up

Part No.: 107-7330, 149-6031

S/N: S2Z1-Up

Refer to Guidelines For Reusable Parts, SEBF8009, "Main Bearings And Connecting Rod Bearings" for more information.

Connecting Rod Bearing Journals

Table 3

Diameter Of Crankshaft Journal (Bearing Surface) For Connecting Rod Bearings	
Original Size Journal	135.000 ± 0.025 mm (5.3150 ± 0.0010 inch)
Undersize Journal 0.63 mm (0.025 inch)	134.370 ± 0.025 mm (5.2902 ± 0.0010 inch)
Undersize Journal 1.27 mm (0.050 inch)	133.730 ± 0.025 mm (5.2650 ± 0.0010 inch)

Clearance between bearing and new journal ... 0.107 to 0.218 mm (0.0042 to 0.0086 inch)

Main Bearing Journals

Table 4

Diameter Of Crankshaft Journal (Bearing Surface) For Main Bearings	
Original Size Journal	160.000 ± 0.025 mm (6.2992 ± 0.0010 inch)
Undersize Journal 0.63 mm (0.025 inch)	159.370 ± 0.025 mm (6.2744 ± 0.0010 inch)
Undersize Journal 1.27 mm (0.050 inch)	158.730 ± 0.025 mm (6.2492 ± 0.0010 inch)

Clearance between bearing and new journal ... 0.122 to 0.241 mm (0.0048 to 0.0095 inch)

i01940047

Crankshaft

SMCS Code: 1202

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2D1-Up

S/N: S2E1-Up

S/N: S2F1-Up

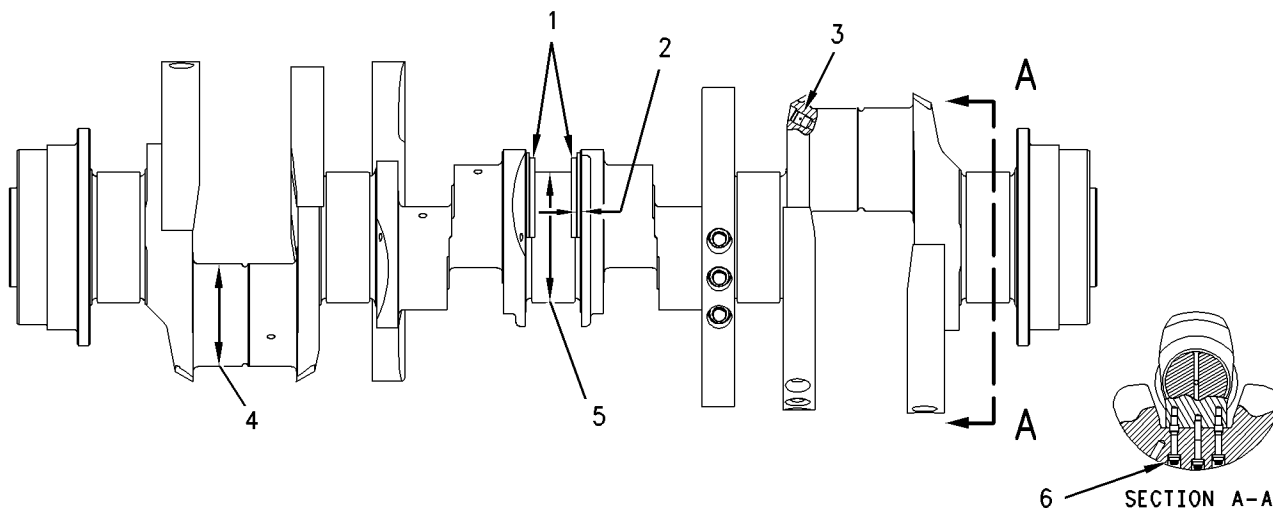


Illustration 113

g00718091

(1) Thrust plates for center main bearing

(2) End play for a new crankshaft

End play .. 0.17 to 0.63 mm (0.007 to 0.025 inch)

(3) Plug

Torque 50 ± 7 N·m (37 ± 5 lb ft)

(4) Connecting rod journal

Refer to Specifications, "Connecting Rod And Main Bearing Journals".

(5) Main bearing journal

Refer to Specifications, "Connecting Rod And Main Bearing Journals".

(6) Bolts

Note: Do not reuse counterweight bolts.

Use the following procedure to tighten the counterweight bolts:

1. Prior to assembly, put 6V-4876 Lubricant on the bolt threads, the shank, and the underside of bolt head.

2. Tighten the bolts evenly.

Torque 200 ± 5 N·m (145 ± 4 lb ft)

3. Loosen the bolts.

4. Tighten the bolts evenly.

Torque 70 ± 5 N·m (50 ± 4 lb ft)

5. Tighten each bolt again to the following rotation.

Rotation 120 ± 5 degrees

i01940068

Crankshaft

SMCS Code: 1202

S/N: B5G1-Up

S/N: MRG1-Up

S/N: PAG1-Up

S/N: S2G1-Up

S/N: MKH1-Up

S/N: S2H1-Up

S/N: S2J1-Up

S/N: S2K1-Up

S/N: S2L1-Up

S/N: S2M1-Up

S/N: S2N1-Up

S/N: S2P1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2T1-Up

S/N: S2X1-Up

S/N: S2Y1-Up

S/N: S2Z1-Up

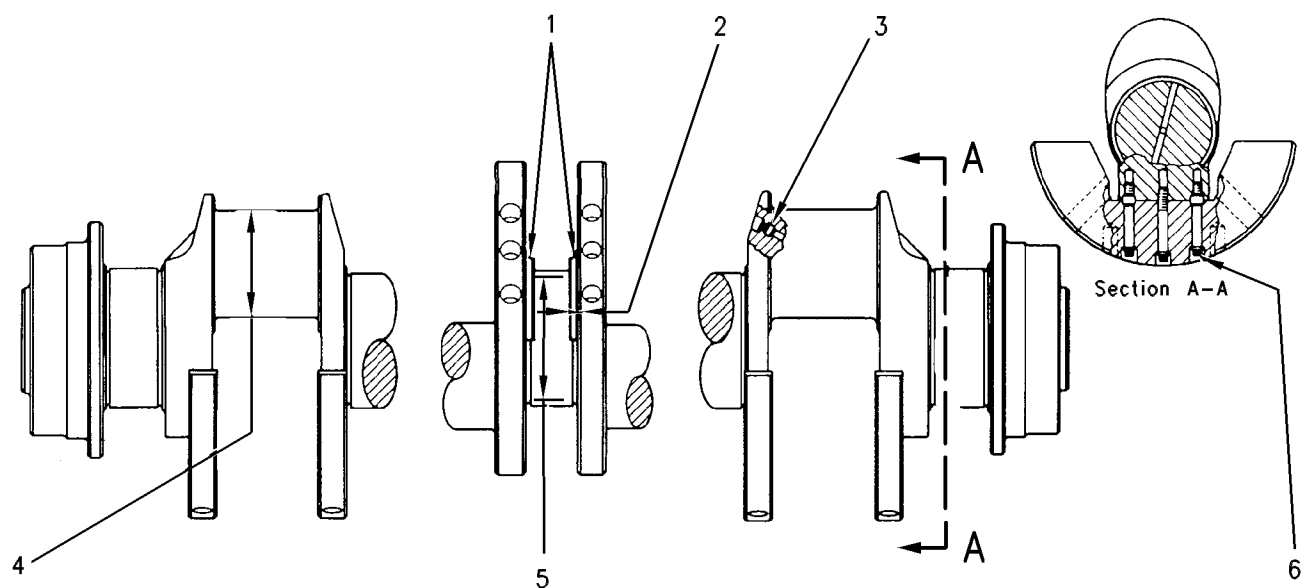


Illustration 114

g00122952

(1) Thrust plates for center main bearing

(2) End play for a new crankshaft

End play .. 0.17 to 0.63 mm (0.007 to 0.025 inch)

(3) Plug

Torque $50 \pm 7 \text{ N}\cdot\text{m}$ ($37 \pm 5 \text{ lb ft}$)

(4) Connecting rod journal

Refer to Specifications, "Connecting Rod And Main Bearing Journals".

(5) Main bearing journal

Refer to Specifications, "Connecting Rod And Main Bearing Journals".

(6) Bolts

Note: Do not reuse counterweight bolts.

Use the following procedure to tighten the counterweight bolts:

1. Prior to assembly, put 6V-4876 Lubricant on the bolt threads, on the shank, and on the underside of the bolt head.

2. Tighten the bolts evenly.

Torque $70 \pm 5 \text{ N}\cdot\text{m}$ ($50 \pm 4 \text{ lb ft}$)

3. Tighten each bolt again to the following rotation.

Rotation $120 \pm 5 \text{ degrees}$

i02195618

Crankshaft Wear Sleeves and Seals

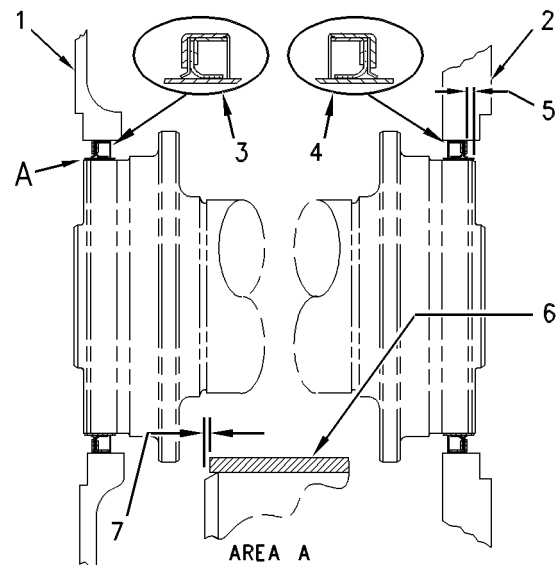
SMCS Code: 1160**S/N:** S2A1-Up**S/N:** S2B1-Up**S/N:** S2D1-Up**S/N:** S2E1-Up**S/N:** S2F1-Up**S/N:** B5G1-Up**S/N:** MRG1-Up**S/N:** PAG1-Up**S/N:** S2G1-Up**S/N:** MKH1-Up**S/N:** S2H1-Up**S/N:** S2J1-Up**S/N:** S2K1-Up**S/N:** S2L1-Up**S/N:** S2M1-Up**S/N:** S2N1-Up**S/N:** S2P1-Up**S/N:** S2R1-Up**S/N:** S2S1-Up**S/N:** S2T1-Up**S/N:** S2W1-Up**S/N:** S2X1-Up**S/N:** S2Y1-Up**Part No.:** 7W-3813**S/N:** S2Z1-Up

Illustration 115

g00115310

View of the crankshaft seals that are installed on a standard rotation engine

(1) Flywheel housing

(2) Front housing

Make sure that the correct seal is installed on each end of the crankshaft.

(3) 113-8433 Crankshaft Seal Group

Install the 113-8433 Crankshaft Seal Group in the flywheel housing on a standard rotation engine.

Install the 113-8433 Crankshaft Seal Group in the front housing on a reverse rotation engine.

(4) 113-8432 Crankshaft Seal Group

Install the 113-8432 Crankshaft Seal Group in the front housing on a standard rotation engine.

Install the 113-8432 Crankshaft Seal Group in the flywheel housing on a reverse rotation engine.

(5) Crankshaft seal depth

The crankshaft seal is installed from both ends of the crankshaft at the following distance. 8.0 ± 0.5 mm (0.315 ± 0.020 inch)

(6) Wear sleeve

(7) Wear sleeve depth

The wear sleeve is installed from both ends of the crankshaft at the following distance.. 0.5 ± 0.5 mm (0.020 ± 0.020 inch)

Removal

1. Remove the seal from each end of the engine.

Note: Seals and wear sleeves cannot be used again, after the seals and the wear sleeves are separated.

2. Remove the wear sleeves with the 5P-7409 Sleeve Distorter and the 6V-3143 Distorter Adapter.

Installation

1. DO NOT separate wear sleeve (6) from crankshaft seals (3) and (4). Once the wear sleeves and crankshaft seals are separated, the crankshaft seals cannot be used again.

Note: For a complete procedure with illustrations, refer to the Disassembly And Assembly Manual.

2. Install the sleeve and the seal assembly with the correct tools.
3. Clean the outer surface of the crankshaft and the inner surface of wear sleeve (6) with 169-5464 Quick Cure Primer (Aerosol Spray).
4. Carefully, put a thin coat of 4C-9507 Retaining Compound on the inner surface of wear sleeve (6) and on the crankshaft surface.
5. Install crankshaft seals (3) and (4) with wear sleeve (6) as a unit. Install the unit on the end of the crankshaft with the correct tools.

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2D1-Up

S/N: S2E1-Up

S/N: S2F1-Up

S/N: B5G1-Up

S/N: MRG1-Up

S/N: PAG1-Up

S/N: S2G1-Up

S/N: MKH1-Up

S/N: S2H1-Up

S/N: S2J1-Up

S/N: S2K1-Up

S/N: S2L1-Up

S/N: S2M1-Up

S/N: S2N1-Up

S/N: S2P1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2T1-Up

S/N: S2W1-Up

S/N: S2X1-Up

S/N: S2Y1-Up

Part No.: 4P-5426

S/N: S2Z1-Up

i02625314

Housing (Front)

SMCS Code: 1162

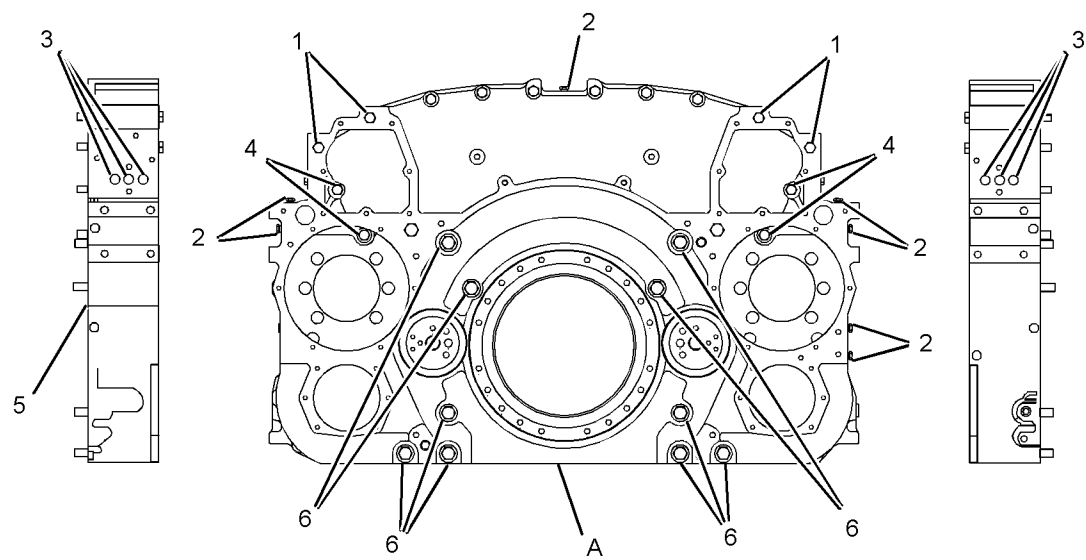


Illustration 116

g01315898

Refer to Table 5 for the correct position of the fasteners.

Note: Use a standard torque for the fasteners that are listed in Table 5.

Table 5

Front Housing Fastener Installation Chart			Length	
Diameter inch	Location	Part	mm	inch
1/2	1	9H-8260 Bolts	158.75	6.250
1/4	2	8T-6765 Pipe Plugs	14.2	0.56
1/2	4	0S-1587 Bolts	44.45	1.750
5/8	6	1D-4593 Bolts	139.7	5.50

(3) Torque for the drain plugs $25 \pm 5 \text{ N}\cdot\text{m}$
($18 \pm 4 \text{ lb ft}$)

Trim gasket (5) even with face (A) after installation.

i01752096

Gear Group (Front)

SMCS Code: 1206

S/N: S2A1-Up

S/N: S2D1-Up

S/N: S2G1-Up

S/N: S2K1-Up

S/N: S2N1-Up

S/N: S2P1-Up

S/N: S2T1-Up

S/N: S2W1-Up

Part No.: 122-9281

S/N: S2Z1-Up

Thickness of new thrust washer .. 8.50 ± 0.05 mm

(0.335 $\pm$ 0.002 inch)

Width of groove in new shaft .. 8.750 ± 0.025 mm

(0.3445 $\pm$ 0.0010 inch)

End play for shaft 0.175 to 0.325 mm

(0.0069 to 0.0128 inch)

(5) Crankshaft gear

(6) Shaft

Bore in bearing after

machining 105.970 ± 0.010 mm

(4.1720 $\pm$ 0.0004 inch)

Diameter of new shaft 105.880 ± 0.020 mm

(4.1685 $\pm$ 0.0008 inch)

Note: After the bearing is installed in the gear the bearing must be machined to size.

Maximum roughness average (Ra) .. 0.8 micrometer

(32 microinch)

i02546019

Gear Group (Front)

SMCS Code: 1206

S/N: S2B1-Up

S/N: S2E1-Up

S/N: S2F1-Up

S/N: B5G1-Up

S/N: MRG1-Up

S/N: PAG1-Up

S/N: MKH1-Up

S/N: S2H1-Up

S/N: S2J1-Up

S/N: S2L1-Up

S/N: S2M1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2X1-Up

S/N: S2Y1-Up

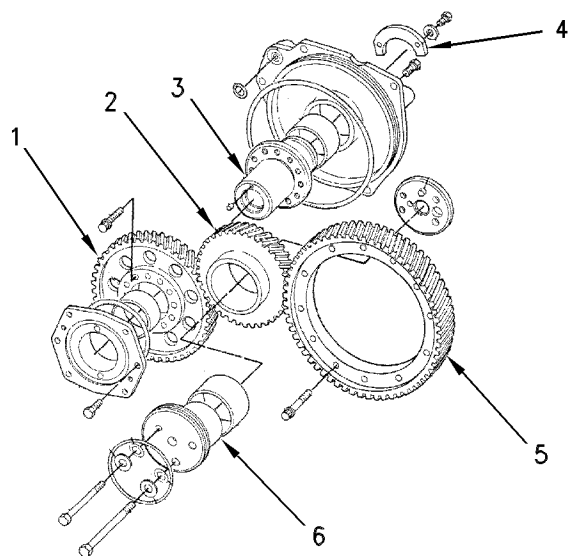


Illustration 117

g00280301

Typical example

(1) Drive gear for jacket water pump and oil pump

(2) Idler gear

(3) Shaft

Bore in bearings after

assembly 75.000 ± 0.055 mm

(2.9528 $\pm$ 0.0022 inch)

Diameter of new shaft 74.900 ± 0.015 mm

(2.9488 $\pm$ 0.0006 inch)

(4) Thrust washer

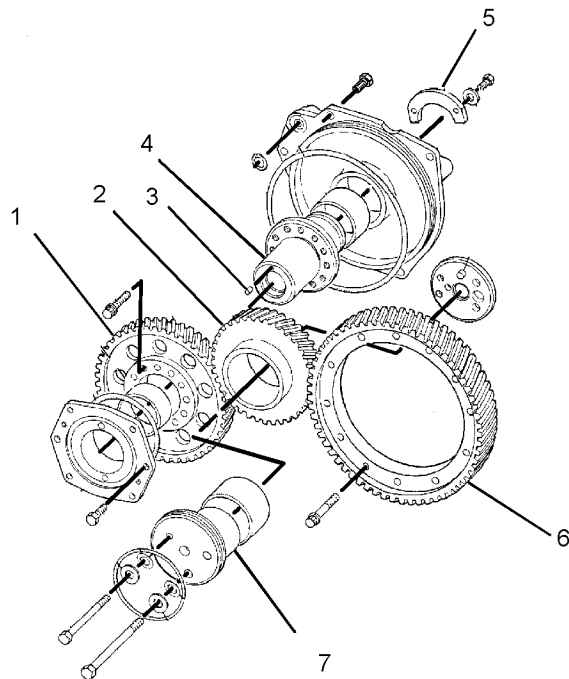


Illustration 118

g01274117

Front gear train

- (1) Drive gear for water pump
- (2) Idler gear
- (3) Install the setscrew to the bottom of the threaded hole. Torque the setscrew to the following. $6 \pm 1 \text{ N}\cdot\text{m}$ ($53 \pm 9 \text{ lb in}$)
- (4) Shaft

Diameter of new shaft $74.900 \pm 0.015 \text{ mm}$
($2.9488 \pm 0.0006 \text{ inch}$)

Bore in bearings after assembly $75.000 \pm 0.055 \text{ mm}$
($2.9528 \pm 0.0022 \text{ inch}$)
- (5) Thrust washer

Thickness of new thrust washer .. $8.50 \pm 0.05 \text{ mm}$
($0.335 \pm 0.002 \text{ inch}$)

Width of groove in new shaft .. $8.750 \pm 0.025 \text{ mm}$
($0.3445 \pm 0.0010 \text{ inch}$)

End play for shaft $0.250 \pm 0.075 \text{ mm}$
($0.0098 \pm 0.0030 \text{ inch}$)
- (6) Crankshaft gear
- (7) Shaft

Diameter of new shaft $89.880 \pm 0.020 \text{ mm}$
($3.5386 \pm 0.0008 \text{ inch}$)

Bore in bearing after machining $90.000 \pm 0.010 \text{ mm}$
($3.5433 \pm 0.0004 \text{ inch}$)

Note: After the bearing is installed in the gear the bearing must be machined to size.

Maximum roughness average (Ra) .. 0.8 micrometer
(32 microinch)

i02619763

Gear Group (Rear)

SMCS Code: 1206

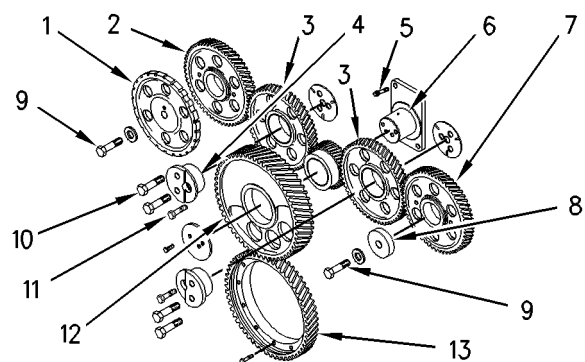


Illustration 119

g00838615

Typical example

- (1) Ring
- (2) Left Camshaft Drive Gear
- (3) Idler Gear As
- (4) Idler Shaft

Refer to Disassembly and Assembly for the installation procedure for the camshaft drive gear.

After the bearing is installed in the gear the bearing must be machined to size.

Diameter $81.000 \pm 0.010 \text{ mm}$
($3.1890 \pm 0.0004 \text{ inch}$)

The bore in the bearings after machining is the following value: $81.060 \pm 0.010 \text{ mm}$
($3.1913 \pm 0.0004 \text{ inch}$)

Maximum roughness average (Ra) 0.8 micrometer (32 microinch)

- (5) Bolts

Torque $140 \pm 10 \text{ N}\cdot\text{m}$ ($105 \pm 7 \text{ lb ft}$)
- (6) Gear Shaft

After the bearing is installed in the gear the bearing must be machined to size.

Diameter 74.990 ± 0.010 mm
(2.9524 ± 0.0004 inch)

The bore in the bearings after machining is the following value: 75.060 ± 0.010 mm
(2.9551 ± 0.0004 inch)

Maximum roughness average
(Ra) 0.8 micrometer (32 microinch)

(7) Right Camshaft Drive Gear

Refer to Disassembly and Assembly for the installation procedure for the camshaft drive gear.

(8) Plate

(9) Bolt

Use the following procedure to tighten the bolt for the camshaft drive gear.

Note: It is critical that the taper of the camshaft and the tapered bore of the camshaft gear are clean, dry, and free of residue before assembly.

1. Tighten the retaining bolt for the camshaft gear.

Torque 360 ± 40 N·m (270 ± 30 lb ft)

2. Mark a vertical line on the head of the bolt for the camshaft gear. Refer to Illustration 120.

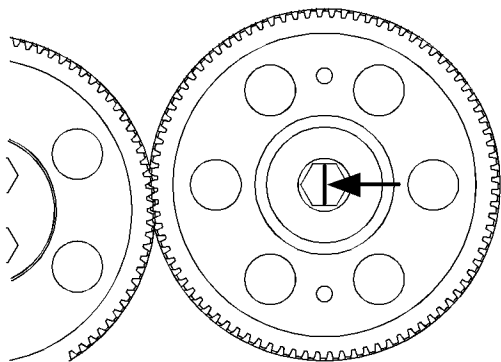


Illustration 120

g01256372

Vertical line

3. Place a driver against the retaining plate of the camshaft gear. Strike the driver solidly with a hammer 3 to 4 times.

4. Tighten the retaining bolt for the camshaft gear again.

Torque 360 ± 40 N·m (270 ± 30 lb ft)

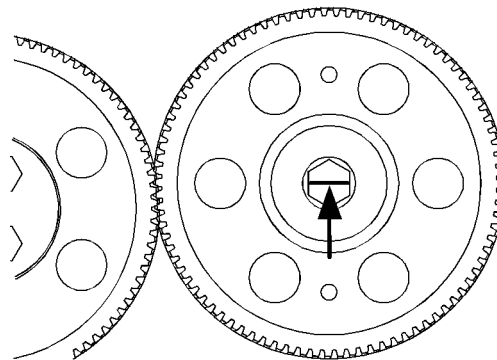


Illustration 121

g01256393

5. Repeat Steps 3 and 4 until the mark on the bolt turns a minimum of 90 degrees. Refer to Illustration 121.

(10) Bolts

Torque 240 ± 20 N·m (175 ± 15 lb ft)

(11) Bolts

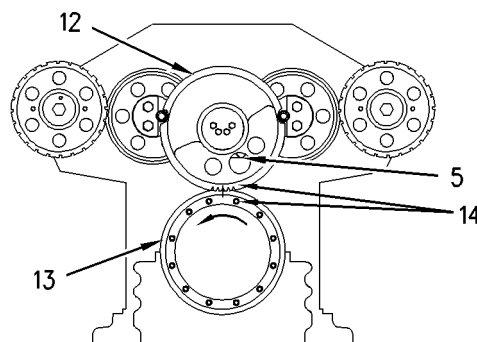


Illustration 122

g00898095

(12) Idler Gear As

(13) Crankshaft Gear

(14) Alignment marks

The mark on Idler Gear As (12) must be in alignment with the mark on the crankshaft gear.

i01940092

Balancer Group (Front)

SMCS Code: 1220

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2D1-Up

S/N: S2E1-Up

S/N: S2F1-Up

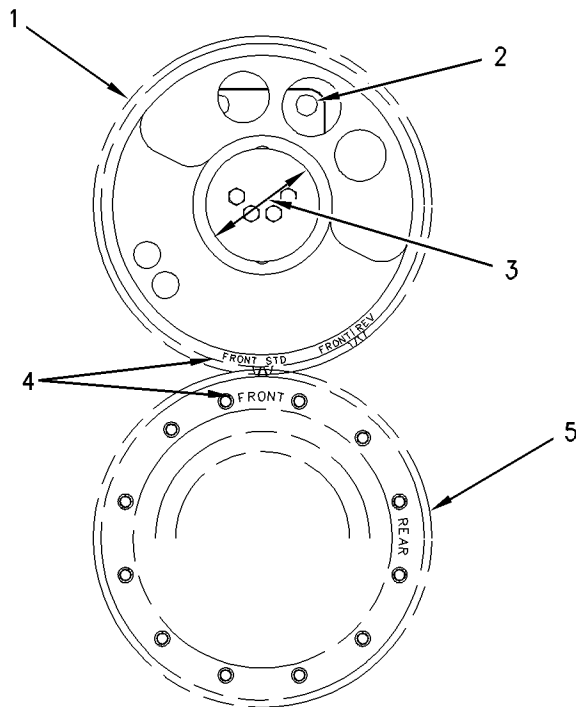


Illustration 123

g00886937

Front view (standard rotation)

(1) Balancer gear

(2) Bolt

Torque $140 \pm 10 \text{ N}\cdot\text{m}$ ($103 \pm 7 \text{ lb ft}$)

(3) Shaft

The diameter of a new shaft is the following value: $74.900 \pm 0.015 \text{ mm}$
($2.9488 \pm 0.0006 \text{ inch}$)

The bore in the bearing after assembly is the following value: $75.000 \pm 0.053 \text{ mm}$
($2.9528 \pm 0.0021 \text{ inch}$)

The bearing joint must be in the center of the heavy section in the gear at assembly.

(4) Balancer gear mark

The balancer gear mark must be in alignment with the crankshaft gear mark.

(5) Crankshaft gear

i01915691

Accessory Drive (Lower Left Hand)

SMCS Code: 1207

S/N: S2A1-Up

S/N: S2D1-Up

S/N: S2G1-Up

S/N: S2K1-Up

S/N: S2N1-Up

S/N: S2P1-Up

S/N: S2T1-Up

S/N: S2W1-Up

Part No.: 179 - 1511

S/N: S2Z1-Up

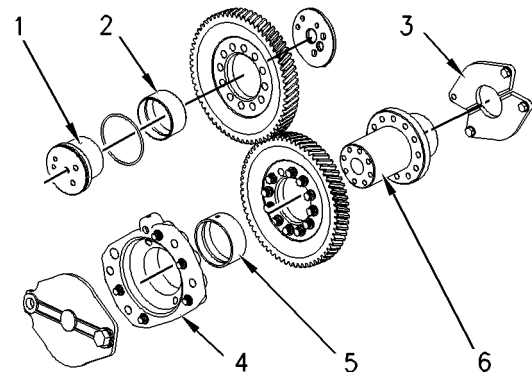


Illustration 124

g00997773

(1) Shaft

Diameter of new shaft $105.88 \pm 0.02 \text{ mm}$
($4.1685 \pm 0.0008 \text{ inch}$)

(2) Bearing

After the bearing is installed in the gear the bearing must be machined to size.

Bore in the idler gear bearing after assembly $105.97 \pm 0.01 \text{ mm}$
($4.1720 \pm 0.0004 \text{ inch}$)

Maximum roughness average (Ra) 0.8 micrometer (32 microinch)

(3) Thrust washer

Thickness of new thrust washer .. 8.50 ± 0.05 mm
(0.335 ± 0.002 inch)

i02617106

(4) Adapter assembly

(5) Bearing

Bore in the bearing after
assembly 75.000 ± 0.055 mm
(2.9527 ± 0.0022 inch)

(6) Shaft

Diameter of shaft 74.900 ± 0.015 mm
(2.9488 ± 0.0006 inch)

Width of groove in new shaft .. 8.750 ± 0.025 mm
(0.3445 ± 0.0010 inch)

Accessory Drive (Lower Left Hand)

SMCS Code: 1207

S/N: S2B1-Up

S/N: S2E1-Up

S/N: B5G1-Up

S/N: MRG1-Up

S/N: PAG1-Up

S/N: MKH1-Up

S/N: S2H1-Up

S/N: S2J1-Up

S/N: S2L1-Up

S/N: S2M1-Up

S/N: S2N1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2X1-Up

S/N: S2Y1-Up

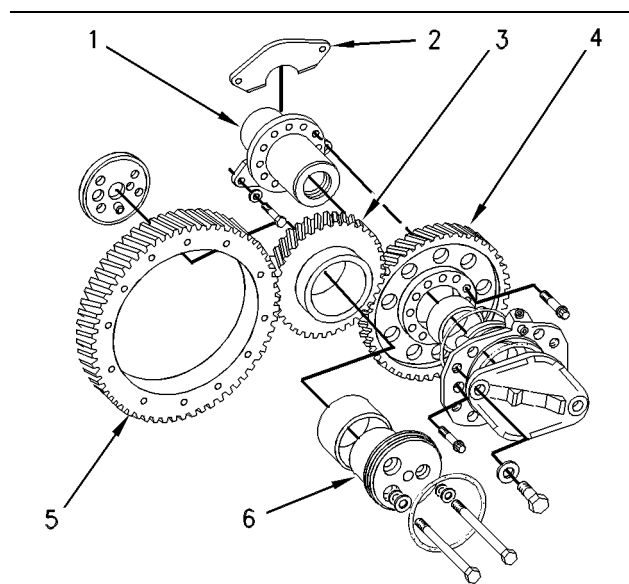


Illustration 125

g00280046

(1) Auxiliary drive shaft

Diameter of new shaft 74.900 ± 0.015 mm
(2.9488 ± 0.0006 inch)

Width of groove in new shaft .. 8.750 ± 0.025 mm
(0.3445 ± 0.0010 inch)
End play for shaft 0.175 to 0.325 mm
(0.0069 to 0.0128 inch)
Bore in the bearings after
assembly 75.000 ± 0.055 mm
(2.9528 ± 0.0022 inch)

(2) Thrust washer

Thickness of new thrust washer .. 8.50 ± 0.05 mm
(0.335 ± 0.002 inch)

(3) Idler gear as

After the bearing is installed in the gear the bearing must be machined to size.

Bore in the bearing after assembly 90.000 ± 0.010 mm
(3.5433 ± 0.0004 inch)

Maximum roughness average
(Ra) 0.8 micrometer (32 microinch)

(4) Water pump drive gear

(5) Crankshaft gear

(6) Shaft

Diameter of new shaft 89.880 ± 0.020 mm
(3.5386 ± 0.0008 inch)

i01533416

Accessory Drive (Upper Right Hand)

SMCS Code: 1207

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2D1-Up

S/N: S2E1-Up

S/N: S2F1-Up

S/N: S2G1-Up

S/N: S2H1-Up

S/N: S2J1-Up

S/N: S2K1-Up

S/N: S2L1-Up

S/N: S2M1-Up

S/N: S2N1-Up

S/N: S2P1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2T1-Up

S/N: S2W1-Up

S/N: S2X1-Up

S/N: S2Y1-Up

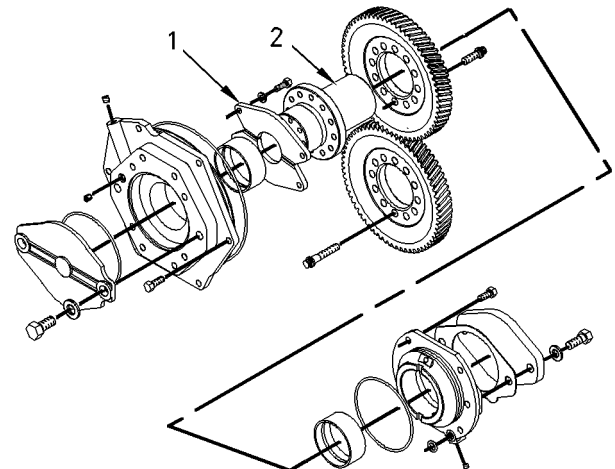


Illustration 126

g00796086

(1) Thrust washer

Thickness of new thrust washer .. 8.50 ± 0.05 mm
(0.335 ± 0.002 inch)
Width of groove in new shaft .. 8.750 ± 0.025 mm
(0.3445 ± 0.0010 inch)

(2) Shaft

Bore in the bearings after
assembly 75.000 ± 0.055 mm
(2.9528 ± 0.0022 inch)
Diameter of new shaft 74.900 ± 0.015 mm
(2.9488 ± 0.0006 inch)

i01446176

Accessory Drive (Upper Right Hand)

SMCS Code: 1207

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2D1-Up

S/N: S2E1-Up

S/N: S2F1-Up

S/N: S2G1-Up

S/N: S2H1-Up

S/N: S2J1-Up

S/N: S2K1-Up

S/N: S2L1-Up

S/N: S2M1-Up

S/N: S2N1-Up

S/N: S2P1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2T1-Up

S/N: S2W1-Up

S/N: S2X1-Up

S/N: S2Y1-Up

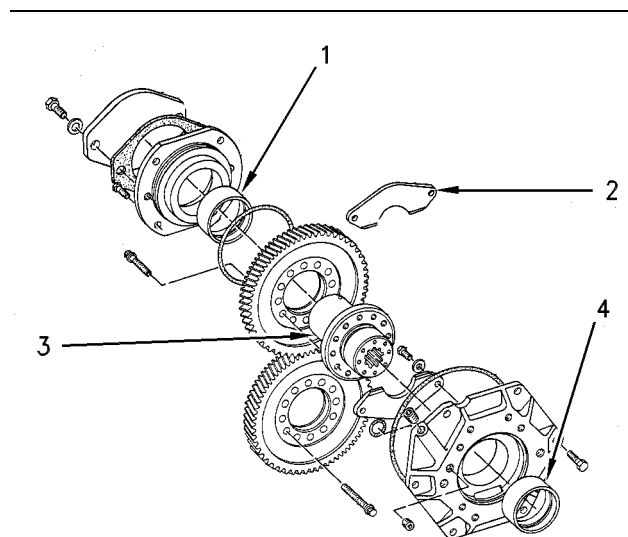


Illustration 127

g00279960

(1) Bearing bore

Bore in the bearings after
assembly 75.000 ± 0.055 mm
(2.9528 ± 0.0022 inch)
Diameter of new shaft 74.900 ± 0.015 mm
(2.9488 ± 0.0006 inch)

(2) Thrust washer

Thickness of new thrust washer .. 8.50 ± 0.05 mm
(0.335 ± 0.002 inch)
Width of groove in new shaft .. 8.750 ± 0.025 mm
(0.3445 ± 0.0010 inch)
End play for shaft 0.175 to 0.325 mm
(0.0069 to 0.0128 inch)

(3) Shaft

(4) Bearing bore

Bore in the bearings after
assembly 75.000 ± 0.055 mm
(2.9528 ± 0.0022 inch)
Diameter of new shaft 74.900 ± 0.015 mm
(2.9488 ± 0.0006 inch)

i01534957

Accessory Drive (Upper Right Hand)

SMCS Code: 1207

S/N: S2B1-Up

S/N: S2E1-Up

S/N: S2F1-Up

S/N: MRG1-Up

S/N: S2H1-Up

S/N: S2J1-Up

S/N: S2L1-Up

S/N: S2M1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2X1-Up

S/N: S2Y1-Up

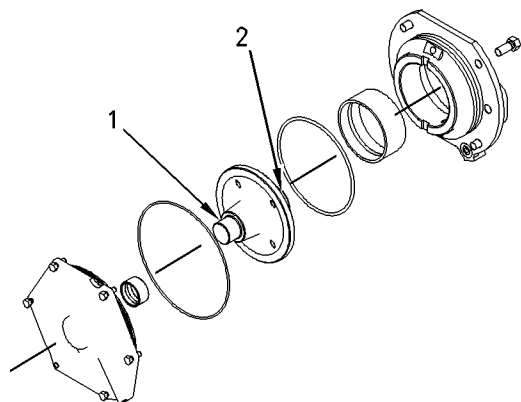


Illustration 128

g00797119

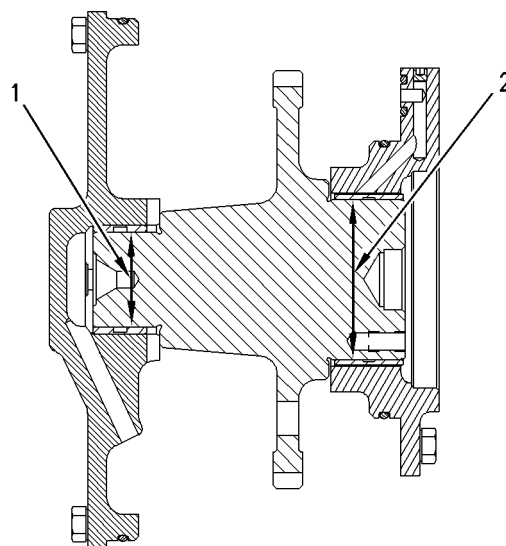


Illustration 129

g00797131

(1) Bearing bore

Bore in bearings after assembly	44.475 ± 0.025 mm (1.7510 ± 0.0010 inch)
Diameter of new shaft	44.400 ± 0.015 mm (1.7480 ± 0.0006 inch)

(2) Bearing bore

Bore in bearings after assembly	75.000 ± 0.055 mm (2.9528 ± 0.0022 inch)
Diameter of gear	74.900 ± 0.015 mm (2.9488 ± 0.0006 inch)

i01446296

Accessory Drive (Upper Left Hand)

SMCS Code: 1207

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2D1-Up

S/N: S2E1-Up

S/N: S2F1-Up

S/N: S2G1-Up

S/N: S2H1-Up

S/N: S2J1-Up

S/N: S2K1-Up

S/N: S2L1-Up

S/N: S2M1-Up

S/N: S2N1-Up

S/N: S2P1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2T1-Up

S/N: S2W1-Up

S/N: S2X1-Up

S/N: S2Y1-Up

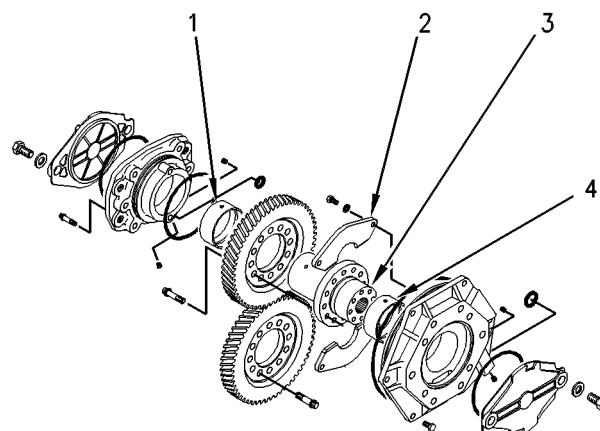


Illustration 130

g00279964

(1) Bearing bore

Bore in the bearings after assembly 75.000 ± 0.055 mm
(2.9528 ± 0.0022 inch)
Diameter of new shaft 74.900 ± 0.015 mm
(2.9488 ± 0.0006 inch)

(2) Thrust washer

Thickness of new thrust washer .. 8.50 ± 0.05 mm
(0.335 ± 0.002 inch)
Width of groove in new shaft .. 8.750 ± 0.025 mm
(0.3445 ± 0.0010 inch)
End play for shaft 0.175 to 0.325 mm
(0.0069 to 0.0128 inch)

(3) Shaft

(4) Bearing bore

Bore in the bearings after assembly 75.000 ± 0.055 mm
(2.9528 ± 0.0022 inch)
Diameter of new shaft 74.900 ± 0.015 mm
(2.9488 ± 0.0006 inch)

i01940098

i01955987

Flywheel

SMCS Code: 1156

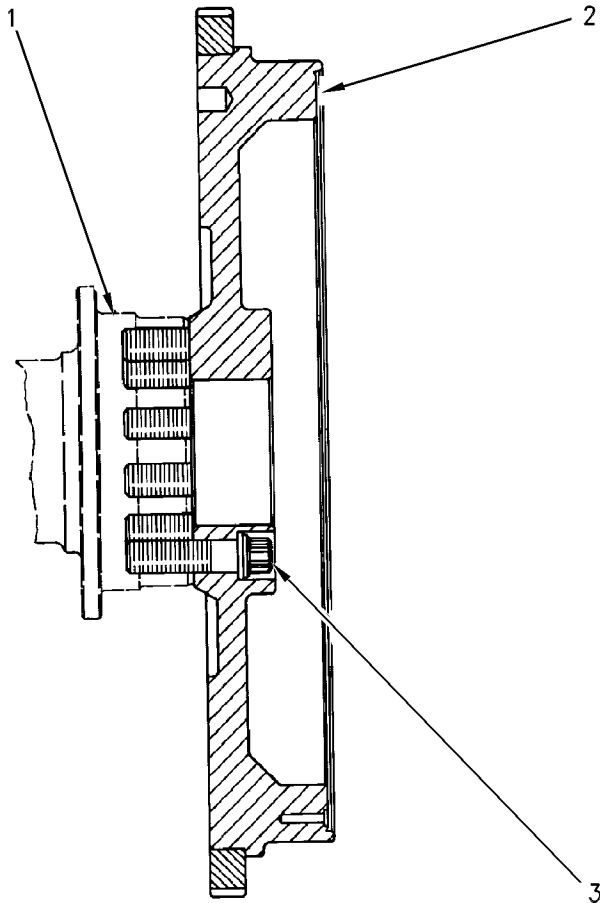


Illustration 131

g00278683

Typical example

Refer to Testing And Adjusting, "Flywheel - Inspect" for the correct method of flywheel inspection.

- (1) Crankshaft
- (2) Flywheel
- (3) Bolts

Put clean engine oil on the threads of all the bolts that hold the flywheel to the crankshaft.

Torque 1150 ± 60 N·m (840 ± 44 lb ft)

Note: When the flywheel is installed, put the dash mark on the flywheel near the pilot bore in alignment with the dash mark on the crankshaft.

Flywheel Housing

SMCS Code: 1157

S/N: S2A1-Up

S/N: S2B1-Up

S/N: B5G1-Up

S/N: MRG1-Up

S/N: PAG1-Up

S/N: S2G1-Up

S/N: MKH1-Up

S/N: S2H1-Up

S/N: S2J1-Up

S/N: S2K1-Up

S/N: S2L1-Up

S/N: S2M1-Up

S/N: S2N1-Up

S/N: S2P1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2T1-Up

S/N: S2W1-Up

S/N: S2X1-Up

S/N: S2Y1-Up

S/N: S2Z1-Up

For information on inspecting the flywheel housing, refer to Systems Operation/Testing and Adjusting.

Note: Before installation of the flywheel housing, inspect the front face of the flywheel housing and the rear face of the cylinder block. The components must be free of the following substances: oil, fuel, water, gasket adhesive, assembly compounds, and any other foreign material.

To seal the joint between the flywheel housing and the cylinder block, apply 4C-5300 Gasket Sealant to the front face of the flywheel housing.

Tighten the bolts that hold the flywheel housing to the engine block evenly. Refer to Illustration 132 and Table 6 for the locations and for identification of the bolts.

Torque for the 1/2 inch diameter bolts .. 135 ± 20 N·m
(100 ± 15 lb ft)

Torque for the 5/8 inch diameter bolts .. 270 ± 40 N·m
(200 ± 30 lb ft)

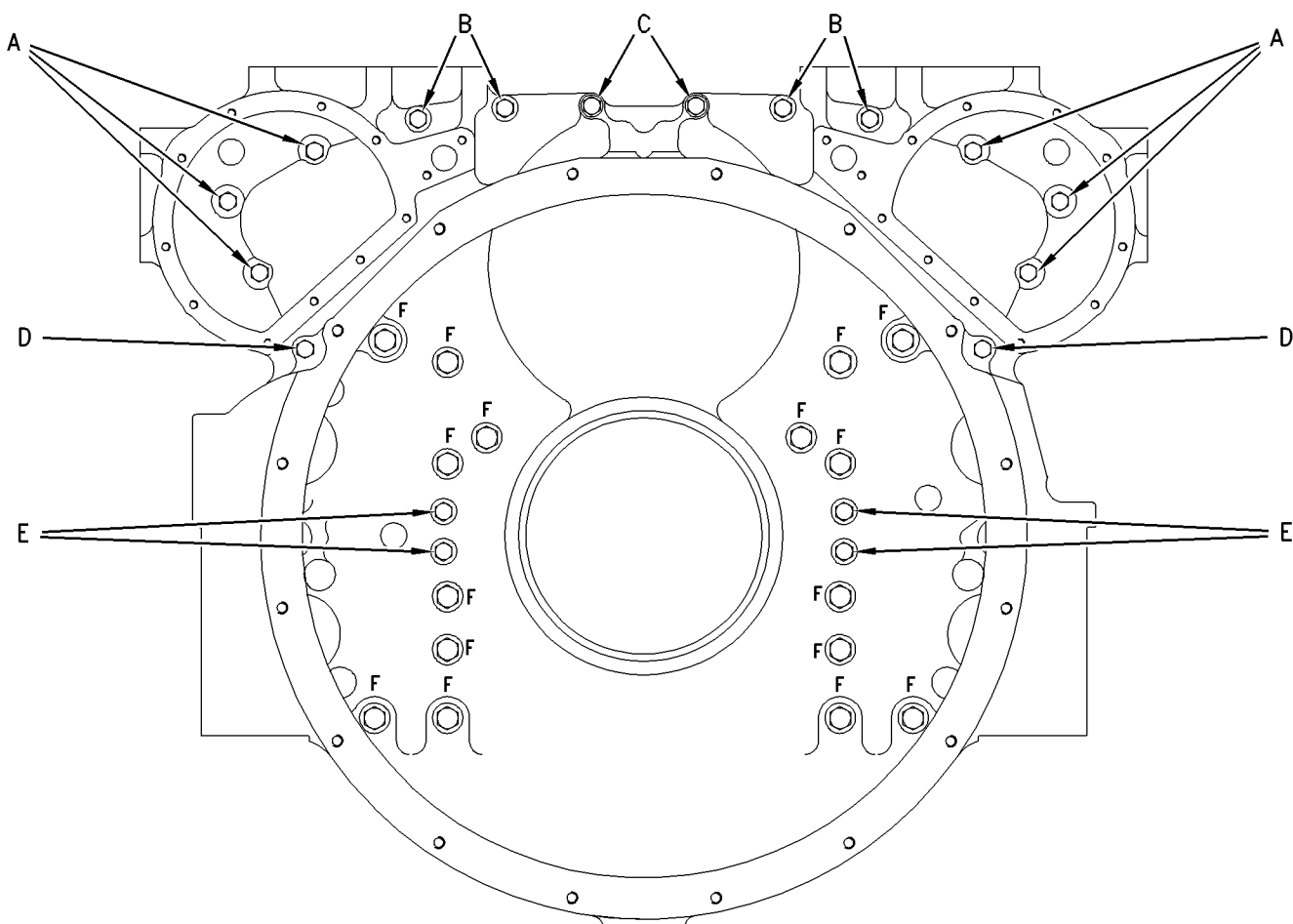


Illustration 132

g00947457

Bolt locations

Table 6

Identification of the Flywheel Housing Bolts				
Bolt	Diameter	Pt. No.	Length	Qty
A	1/2 inch	9X-8873	57.2 mm (2 1/4 inch)	6
B	1/2 inch	9X-8875	88.9 mm (3 1/2 inch)	4
C	1/2 inch	9M-7269 ⁽¹⁾	171.5 mm (6 3/4 inch)	2
		6M-9613 ⁽²⁾	228.6 mm (9 inch)	
D	1/2 inch	9S-1374	203.2 mm (8 inch)	2
E	1/2 inch	8S-9089	114.3 mm (4 1/2 inch)	4
F	5/8 inch	1D-4590	120.7 mm (4 3/4 inch)	16

⁽¹⁾ This bolt is used if the engine is not equipped with a support bracket for the air lines.

⁽²⁾ This bolt is used if the engine is equipped with a support bracket for the air lines.

i02625305

Flywheel Housing

SMCS Code: 1157

S/N: S2D1-Up

S/N: S2E1-Up

S/N: S2F1-Up

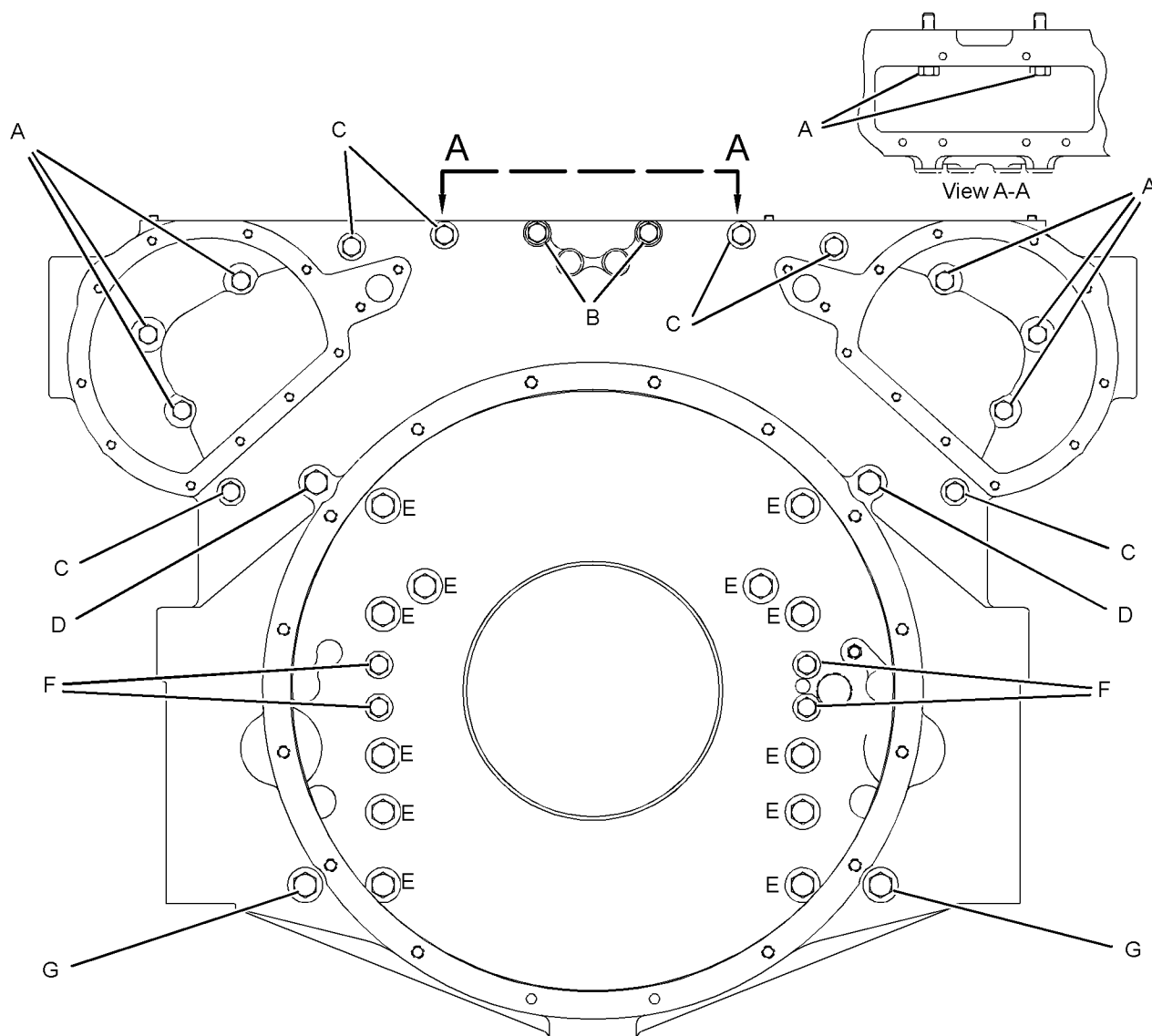


Illustration 133

g01257843

For information on inspecting the flywheel housing, refer to Systems Operation/Testing and Adjusting.

Note: Before installation of the flywheel housing, inspect the front face of the flywheel housing and the rear face of the cylinder block. The components must be free of the following substances: oil, fuel, water, gasket adhesive, assembly compounds, and any other foreign material.

To seal the joint between the flywheel housing and the cylinder block, apply a 6.35 mm (0.250 inch) of 4C-5300 Gasket Sealant to the mating surface of the flywheel housing.

During assembly, use the hard washers that are listed in Table 8.

Tighten the bolts that hold the flywheel housing to the engine block evenly. Refer to Table 7 for the correct position.

Torque

1/2 - 13 NC		135 ± 20 N·m (100 ± 15 lb ft)
5/8 - 11 NC		270 ± 40 N·m (200 ± 30 lb ft)

Table 7

Flywheel Housing Bolt Installation Chart			Bolt Length	
Bolt	Diameter inch	Part Number	mm	inch
A	1/2	9X-8873	57.15	2.250
B	1/2	9X-8874	76.2	3.00
C	1/2	1D-4574	152.4	6.00
D	5/8	1D-4597	165.1	6.50
E	5/8	1D-4593	139.7	5.50
F	1/2	9X-8878	133.35	5.250
G	5/8	1D-4602	241.30	9.500

Table 8

Diameter inch	Hard Washer
1/2	5P-8245
5/8	5P-8247

i00562148

Flexible Coupling

SMCS Code: 3279

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2G1-Up

S/N: S2H1-Up

S/N: S2P1-Up

S/N: S2R1-Up

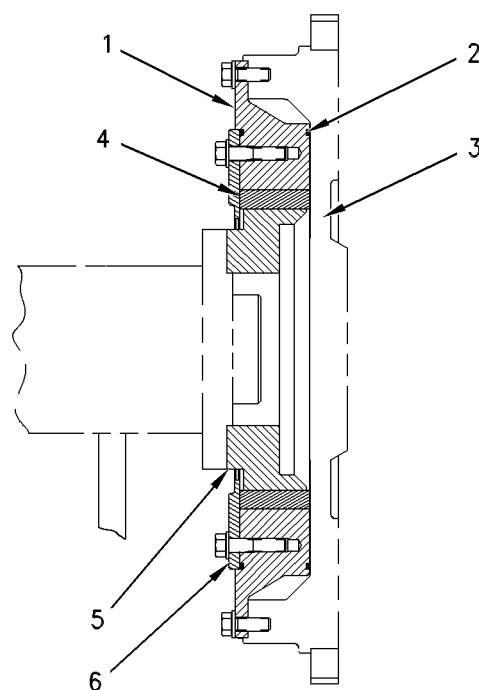


Illustration 134

g00278467

1. Insert the O-ring seal (2) in the groove of the outer coupling (1).
2. Install outer coupling (1) in the cavity of flywheel (3).
3. Place the boots (4) in the outer coupling (1).
4. Position the inner coupling (5) in the cavity left by boots (4).
5. Attach the seal and the retaining plate (6).
6. Fill the inner coupling (5) with 679.2 g (24 oz) of 5N-5561 Silicone Lubricant.

i01691646

Engine Mount (Front) (Hydraulic Pump Drive or PTO Clutch)

SMCS Code: 1152**S/N:** S2A1-Up**S/N:** S2B1-Up**S/N:** S2G1-Up**S/N:** S2H1-Up**S/N:** S2J1-Up**S/N:** S2K1-Up**S/N:** S2L1-Up**S/N:** S2N1-Up**S/N:** S2P1-Up**S/N:** S2R1-Up**S/N:** S2S1-Up**S/N:** S2T1-Up**S/N:** S2W1-Up**S/N:** S2X1-Up

(2) Adapter

(3) Damper adapter

Torque $1125 \pm 100 \text{ N}\cdot\text{m}$ ($820 \pm 75 \text{ lb ft}$)

(4) Coupling

Put a dash mark on the coupling in alignment with the marks on the damper adapter and the crankshaft.

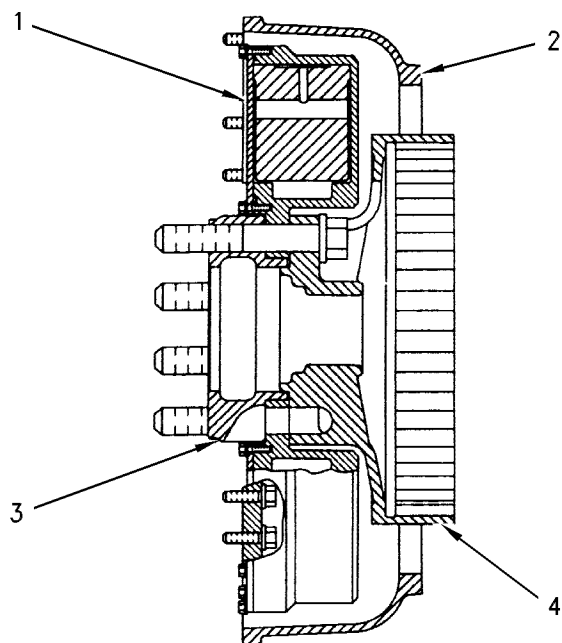


Illustration 135

g00280831

(1) Damper

i01940116

i02306827

Engine Trunnion

SMCS Code: 1153

S/N: S2D1-Up

S/N: S2E1-Up

S/N: S2F1-Up

S/N: PAG1-Up

S/N: MKH1-Up

S/N: S2J1-Up

S/N: S2K1-Up

S/N: S2L1-Up

S/N: S2M1-Up

S/N: S2N1-Up

S/N: S2S1-Up

S/N: S2T1-Up

S/N: S2W1-Up

S/N: S2X1-Up

S/N: S2Y1-Up

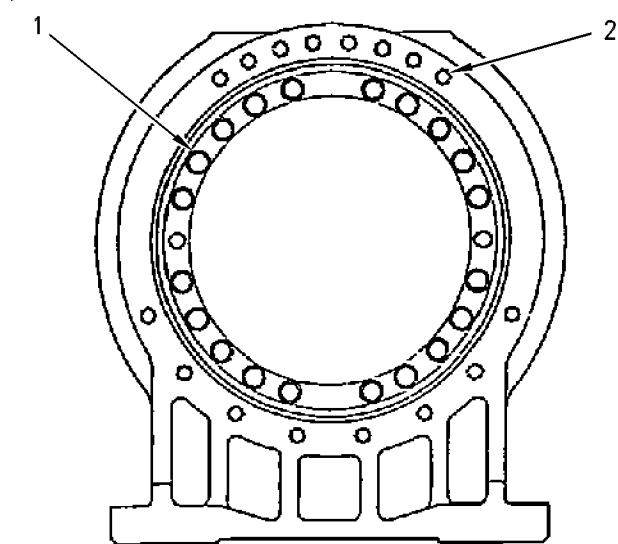


Illustration 136

g00277218

(1) Bolt

Torque 135 ± 20 N·m (100 ± 15 lb ft)

(2) Bolt

Torque 190 ± 30 N·m (140 ± 22 lb ft)

Vibration Damper

SMCS Code: 1205

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2G1-Up

S/N: S2H1-Up

S/N: S2J1-Up

S/N: S2K1-Up

S/N: S2L1-Up

S/N: S2N1-Up

S/N: S2P1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2T1-Up

S/N: S2W1-Up

S/N: S2X1-Up

S/N: S2Z1-Up

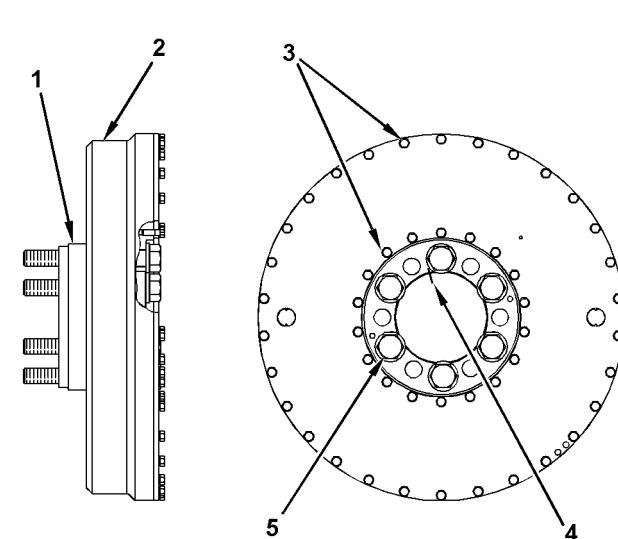


Illustration 137

g01155358

Typical example

(1) Adapter

(2) Damper

(3) Bolts

Apply 4C-4030 Thread Lock Compound to the threads of the bolts.

Torque $55 \pm 7 \text{ N}\cdot\text{m}$ ($40 \pm 5 \text{ lb ft}$)

(4) Alignment mark

Note: The alignment mark on the crankshaft must be aligned with the mark on the adapter. The mark on the damper group must be aligned with the mark on the adapter.

(5) Bolts

Torque $1125 \pm 100 \text{ N}\cdot\text{m}$ ($830 \pm 75 \text{ lb ft}$)

i02389623

Vibration Damper

SMCS Code: 1205

S/N: S2B1-Up

S/N: S2E1-Up

S/N: MRG1-Up

S/N: MKH1-Up

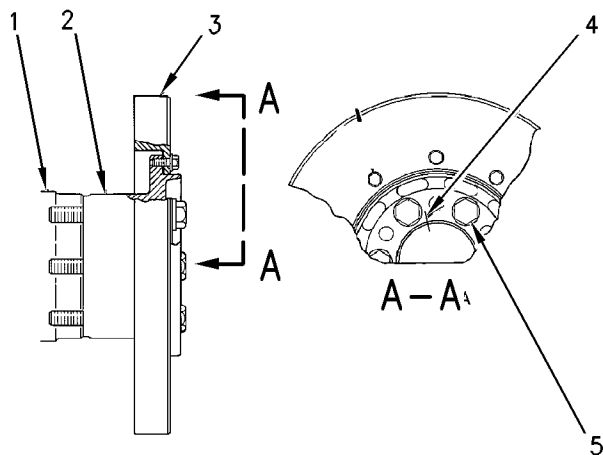


Illustration 138
Typical example

g00984521

(1) Crankshaft

(2) Adapter

(3) Damper

(4) Alignment mark

The alignment mark on the crankshaft must be aligned with the mark on the adapter. The mark on the damper group must be aligned with the mark on the adapter.

(5) Bolts

Torque $1150 \pm 150 \text{ N}\cdot\text{m}$ ($850 \pm 110 \text{ lb ft}$)

i01891380

Vibration Damper

SMCS Code: 1205

S/N: S2F1-Up

S/N: S2M1-Up

S/N: S2Y1-Up

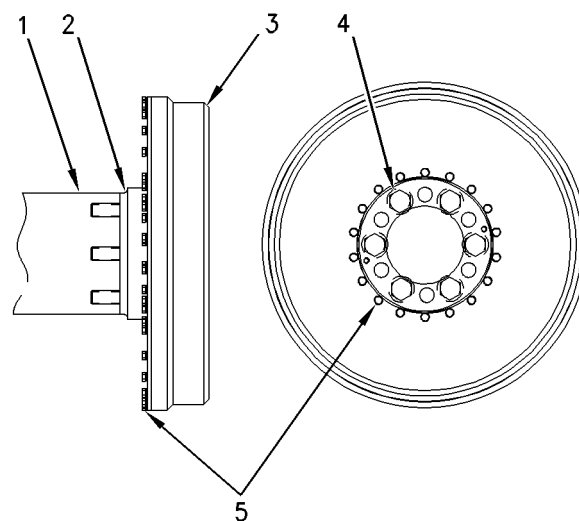


Illustration 139

g00643202

(1) Crankshaft

(2) Adapter

The alignment mark on the crankshaft must be aligned with the mark on the adapter. The mark on the damper must also be aligned with the mark on the adapter.

(3) Damper

(4) Bolts

Torque $1125 \pm 100 \text{ N}\cdot\text{m}$ ($830 \pm 75 \text{ lb ft}$)

(5) Bolts

Apply 4C-4030 Thread Lock Compound to the bolt threads.

Torque $55 \pm 7 \text{ N}\cdot\text{m}$ ($40 \pm 5 \text{ lb ft}$)

i02154280

Vibration Damper

SMCS Code: 1205

S/N: PAG1-Up

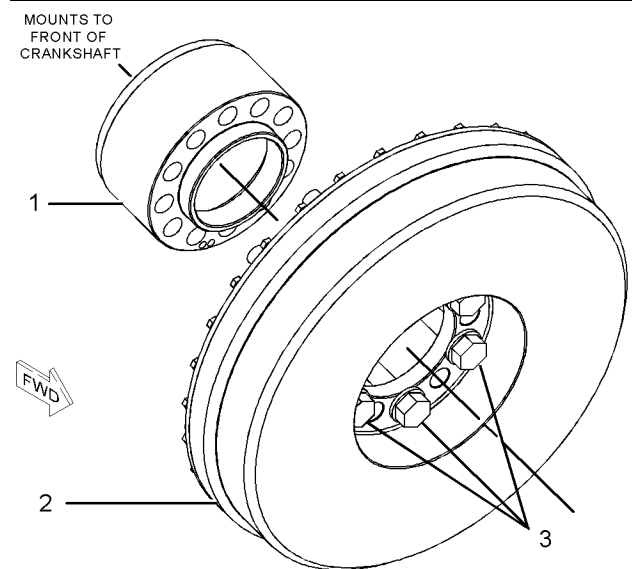


Illustration 140

g01082200

(1) Adapter

(2) Damper

The alignment mark on the crankshaft must be aligned with the mark on the adapter. The mark on the damper group must be aligned with the mark on the adapter.

(3) Bolts

Torque 1125 ± 100 N·m (830 ± 75 lb ft)

i02503909

Vibration Damper Guard

SMCS Code: 1205

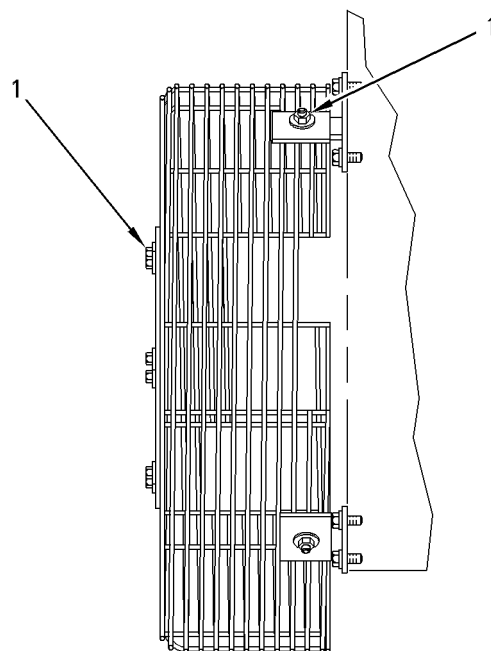


Illustration 141

g00130733

Typical example

(1) Bolts

Torque 15 ± 3 N·m (133 ± 27 lb in)

i02326298

Stub Shaft (Front)

SMCS Code: 1237

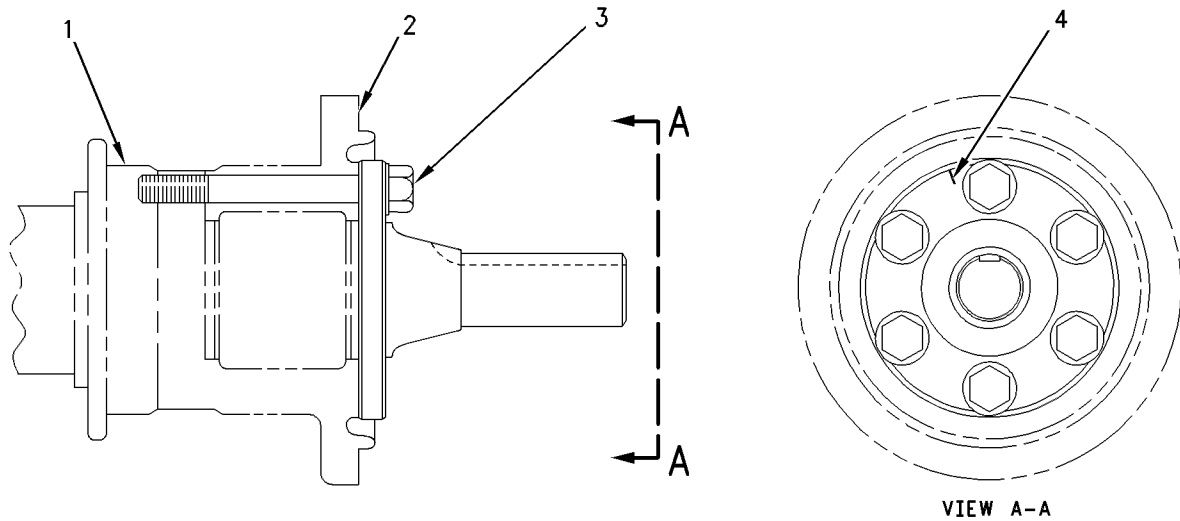


Illustration 142

g00278463

Low kW (HP) attachments

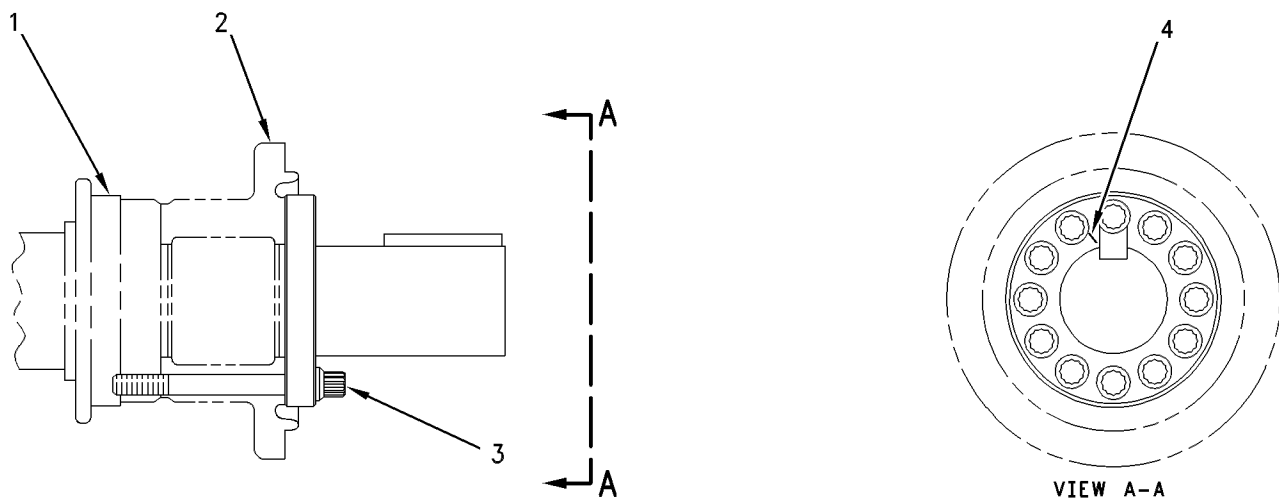


Illustration 143

g00278464

High kW (HP) attachments

(1) Crankshaft

(2) Adapter

(3) Bolts

Torque 1150 ± 150 N·m (840 ± 110 lb ft)

(4) Alignment mark

Align the alignment mark on the stub shaft with the alignment mark on the adapter.

Apply a molybdenum disulfide grease under the shoulder of the bolt heads and to the threads before assembly.

i01940304

Auxiliary Drive Pulley

SMCS Code: 1205

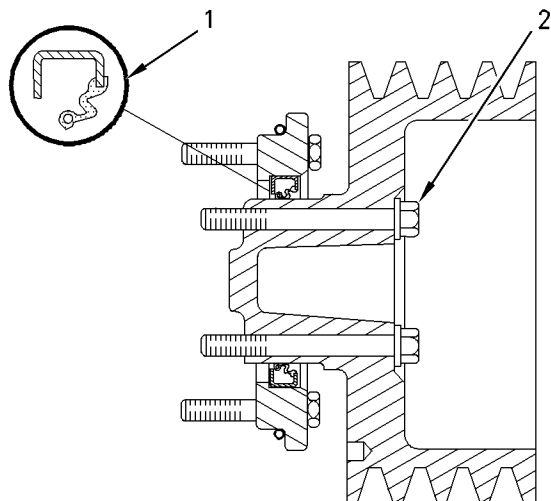


Illustration 144

g00672026

(1) Seal

1. Put clean engine oil on the lip of the seal.
2. Install the seal as the seal is shown.

(2) Bolt

Torque $55 \pm 7 \text{ N}\cdot\text{m}$ ($40 \pm 5 \text{ lb ft}$)

i01940316

Auxiliary Drive Shaft

SMCS Code: 1165; 1207

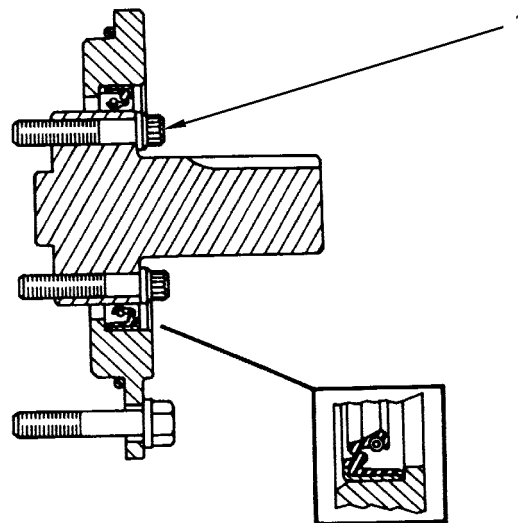


Illustration 145

g00280784

(1) Bolt

Torque $47 \pm 9 \text{ N}\cdot\text{m}$ ($35 \pm 6 \text{ lb ft}$)

Install the seal as the seal is shown. Lubricate the sealing lip with the lubricant that is being sealed.

i01617888

Belt Tension Chart

SMCS Code: 1357

Note: Do not use the belt tension charts for belts with tensioners that are spring loaded.

Table 9

Belt Tension Chart					
Size of Belt	Width of Belt	Gauge Reading		Kent-Moore Gauge Numbers	
		Belt Tension "Initial" ⁽¹⁾	Belt Tension "Used" ⁽²⁾⁽³⁾	Number of the Old Gauge	Number of the New Gauge
3/8	10.72 mm (0.422 inch)	534 ± 111 N (120 ± 25 lb)	400 ± 22 N (90 ± 5 lb)	BT-33-97	BT 3397
1/2	13.89 mm (0.547 Inch)	578 ± 111 N (130 ± 25 lb)	445 ± 44 N (100 ± 10 lb)	BT-33-97	BT 3397
5V	15.88 mm (0.626 Inch)	712 ± 111 N (160 ± 25 lb)	445 ± 44 N (100 ± 10 lb)	BT-33-72C	BT 3372C
11/16	17.48 mm (0.688 Inch)	712 ± 111 N (160 ± 25 lb)	445 ± 44 N (100 ± 10 lb)	BT-33-72C	BT 3372C
3/4	19.05 mm (0.750 Inch)	712 ± 111 N (160 ± 25 lb)	445 ± 44 N (100 ± 10 lb)	BT-33-72C	BT 3372C
15/16	23.83 mm (0.938 Inch)	712 ± 111 N (160 ± 25 lb)	445 ± 44 N (100 ± 10 lb)	BT-33-77	BT 3372C
8PK	27.82 mm (1.095 inch)	1068 ± 111 N (240 ± 25 lb)	890 ± 44 N (200 ± 10 lb)	BT-33-109	BT 33109
6PK	20.94 mm (0.824 Inch)	801 ± 111 N (180 ± 25 lb)	667 ± 44 N (150 ± 10 lb)	BT-33-109	BT 33109
Measure the tension of the belt that is farthest from the engine.					

(1) Belt tension "Initial" is for a new belt.

(2) Belt tension "Used" is for a belt that has operated for 30 minutes or more of operation at the rated speed.

(3) If a belt falls below the "Used" belt tension, the belt should be tightened again to the high side of the "Used" belt tension.

Table 10

For DAYCO Supplied Belts Only		
Size of Belt	Belt Tension "Initial" ⁽¹⁾	Belt Tension "Used" ⁽²⁾⁽⁴⁾
.380 (V-Belt)	623 ± 22 N (140 ± 5 lb)	245 - 534 N (100 ± 5 lb)
.440 (V-Belt)	667 ± 22 N (150 ± 5 lb)	245 - 534 N (100 ± 5 lb)
.500 (V-Belt)	712 ± 22 N (160 ± 5 lb)	245 - 534 N (100 ± 5 lb)
.600 (V-Belt)	779 ± 22 N (175 ± 5 lb)	245 - 534 N (100 ± 5 lb)
.660 (V-Belt)	890 ± 22 N (200 ± 5 lb)	245 - 534 N (100 ± 5 lb)
.790 (V-Belt)	890 ± 22 N (200 ± 5 lb)	245 - 534 N (100 ± 5 lb)
4 - RIB PVK	623 ± 22 N (140 ± 5 lb)	267 - 445 N (90 ± 5 lb)
5 - RIB PVK	779 ± 22 N (175 ± 5 lb)	334 - 556 N (100 ± 5 lb)
6 - RIB PVK	934 ± 22 N (210 ± 5 lb)	400 - 667 N (130 ± 5 lb)
8 - RIB PVK	1157 ± 22 N (260 ± 5 lb)	534 - 890 N (180 ± 5 lb)
10 - RIB PVK	1557 ± 22 N (350 ± 5 lb)	667 - 1112 N (230 ± 5 lb)
12 - RIB PVK	1869 ± 22 N (420 ± 5 lb)	800 - 1335 N (270 ± 5 lb)
15 - RIB PVK	2336 ± 22 N (525 ± 5 lb)	1000 - 1669 N (350 ± 5 lb)

(1) Belt tension "Initial" is for a new belt.

(2) Belt tension "Used" is for a belt that has operated for 30 minutes or more of operation at the rated speed.

(4) If a belt falls below the "Used" belt tension, the belt should be tightened again to the "Initial" belt tension.

i01940319

Alternator and Regulator

SMCS Code: 1405

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2D1-Up

S/N: S2E1-Up

S/N: S2F1-Up

S/N: B5G1-Up

S/N: MRG1-Up

S/N: PAG1-Up

S/N: S2G1-Up

S/N: MKH1-Up

S/N: S2H1-Up

S/N: S2J1-Up

S/N: S2K1-Up

S/N: S2L1-Up

S/N: S2M1-Up

S/N: S2N1-Up

S/N: S2P1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2T1-Up

S/N: S2W1-Up

S/N: S2X1-Up

S/N: S2Y1-Up

Part No.: 4N-3986

S/N: S2Z1-Up

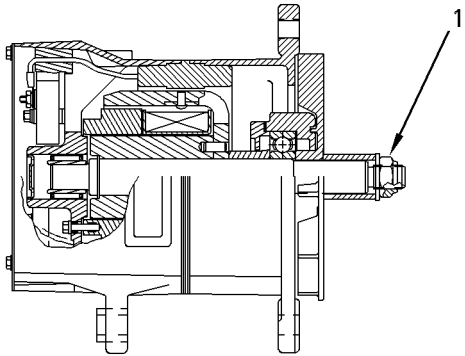


Illustration 146

g00278495

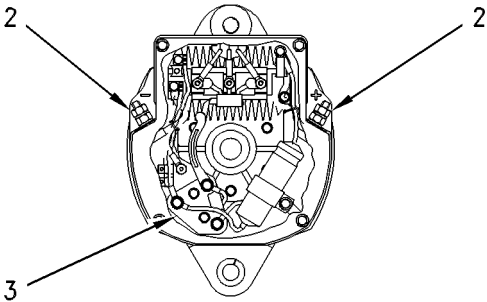


Illustration 147

g00278496

Voltage 24 V

Amperage 60 Amp

Note: Load the battery with a carbon pile 4C-4911 Battery Load Tester in order to get the maximum alternator output.

Polarity Negative ground

Rotation Either direction

Minimum full load current at 5000 rpm 54 Amp

Minimum full load current at 1500 rpm 19 Amp

Output voltage 28 ± 1 V

(1) Shaft nut

Torque 102 ± 7 N·m (75 ± 5 lb ft)

(2) Terminal nuts

Torque 7.1 ± 0.8 N·m (60 ± 7 lb in)

(3) Regulator

Voltage setting No adjustment

Permissible voltage range 27 to 29 V

i02618539

Alternator Mounting

SMCS Code: 1405

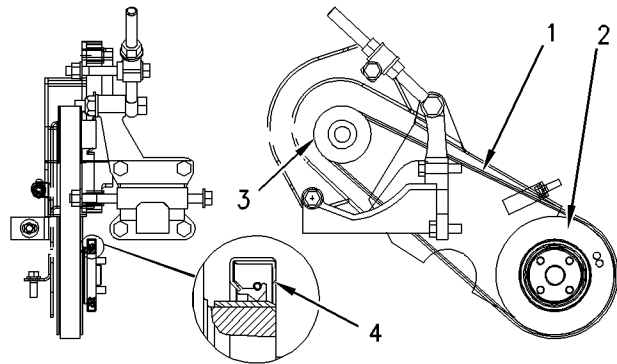


Illustration 148

g00984731

(1) Serpentine belt

Tension for a new belt 800 ± 22 N (180 ± 5 lb)
Tension for a used belt .. 489 ± 44 N (110 ± 10 lb)

(2) Pulley assembly

(3) Pulley

Torque for the pulley's retaining
nut 110 ± 10 N·m (81 ± 7 lb ft)
Maximum misalignment between the pulley and
the pulley assembly 0.4 degrees

(4) Lip type seal Lubricate the
sealing lip lightly with clean engine oil.

i02619193

Electric Starting Motor

SMCS Code: 1453

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2D1-Up

S/N: S2E1-Up

S/N: S2F1-Up

S/N: B5G1-Up

S/N: MRG1-Up

S/N: PAG1-Up

S/N: S2G1-Up

S/N: MKH1-Up

S/N: S2H1-Up

S/N: S2J1-Up

S/N: S2K1-Up

S/N: S2L1-Up

S/N: S2M1-Up

S/N: S2N1-Up

S/N: S2P1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2T1-Up

S/N: S2W1-Up

S/N: S2X1-Up

S/N: S2Y1-Up

Part No.: 207 - 1562

S/N: S2Z1-Up

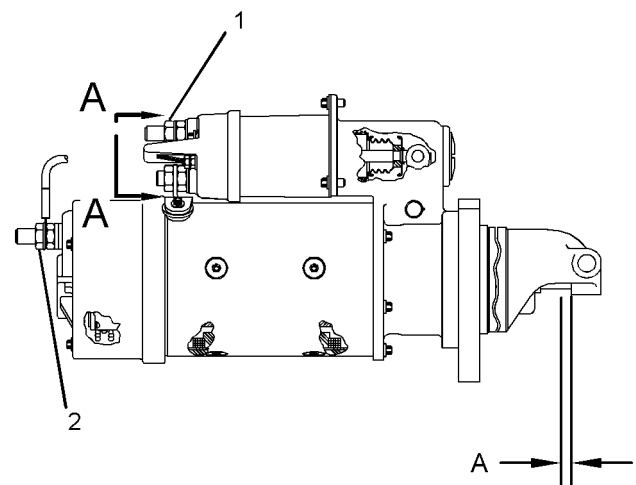


Illustration 149

g01312290

Typical example

When the electric starting motor is viewed from
the drive end, the motor rotates in the following
direction. Clockwise

Pull-in current at 25 °C (77 °F) 57 Amp at 20 V

Hold-in current at 25 °C (77 °F) 16 Amp at 20 V

No load conditions at 25 °C (77 °F)

Speed 7643 ± 1683 rpm

Current draw 76.5 ± 14.5 Amp

Voltage 23 V

- (A) Clearance between the extended pinion and the housing 9.1 mm (0.36 inch)

(1) Battery terminal nut

A maximum of three cable terminals or wire terminals may be used with the nut. A maximum of two of the terminals may be equal to or greater than 0 AWG.

Torque 30.5 ± 3.5 N·m (23 ± 3 lb ft)

(2) Ground terminal nut

Torque 30.5 ± 3.5 N·m (23 ± 3 lb ft)

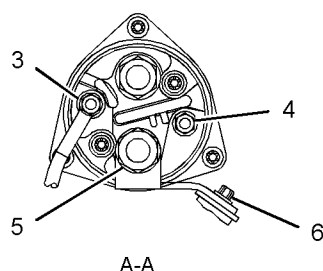


Illustration 150

g01312658

Typical example

(3) Ground terminal nut

Torque 2.25 ± 0.25 N·m (20 ± 2 lb in)

(4) Switch terminal nut

The terminal must be insulated with heat shrink tubing. Do not use molded terminals.

Torque 2.25 ± 0.25 N·m (20 ± 2 lb in)

(5) Motor terminal nut

Torque 30.5 ± 3.5 N·m (23 ± 3 lb ft)

(6) Motor frame terminal nut

Torque 8 ± 3 N·m (70 ± 27 lb in)

Air Starting Motor

SMCS Code: 1451

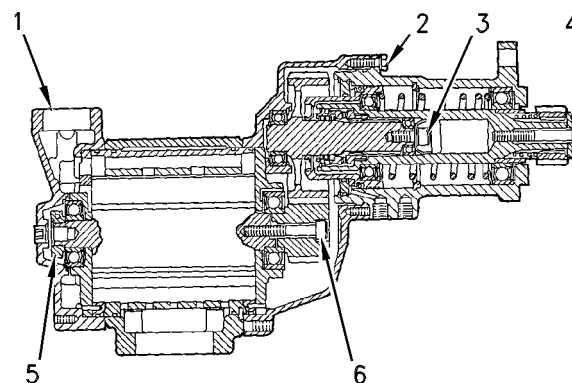


Illustration 151

g00281423

Typical example

(1) Cover

Tighten the bolts evenly in small increases until the following torque is reached: 80 N·m (60 lb ft)

(2) Bolt

Torque 36 N·m (26 lb ft)

(3) Bolt

Torque 78 N·m (55 lb ft)

(4) Bolt (pinion)

Torque 110 N·m (80 lb ft)

(5) Rotor clamp nut

Tighten the rotor clamp nut until the following clearance between the rear end plate and the rotor is reached: 0.03 to 0.08 mm (0.001 to 0.003 inch)

Check the clearance again after the bolt for the rotor clamp nut is tightened.

(6) Rotor retainer bolt

Torque 120 N·m (90 lb ft)

i01540339

i01668691

Air Starting Motor Pressure Regulating Valve

SMCS Code: 1462

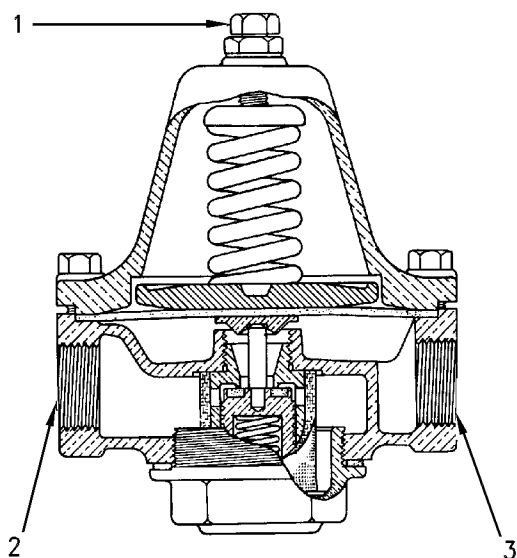


Illustration 152

g00281476

(1) Adjusting screw

(2) Inlet port

Inlet pressure 1725 kPa (250 psi)
 Maximum inlet pressure 3100 kPa (450 psi)

(3) Outlet port

Outlet pressure ... 620 to 758 kPa (90 to 110 psi)

Jacket Water Heater

SMCS Code: 1383

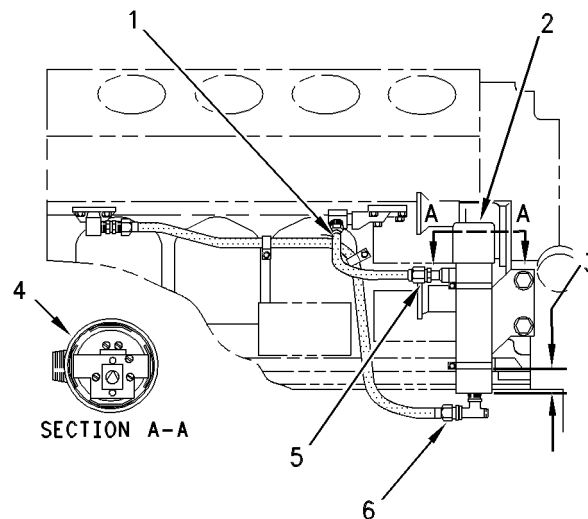


Illustration 153

g00279581

Typical example

Power 6000 Watts

Voltage 240/480 V

(1) Hose

Assemble the hose in order to maintain a gradual rise from the heater outlet to the engine.

(2) Jacket water heater

(3) Reference dimension .. 60 ± 6 mm ($2.4 \pm .2$ inch)

(4) Thermostat

(5) Coolant outlet

(6) Coolant inlet

i01668530

Jacket Water Heater

SMCS Code: 1383

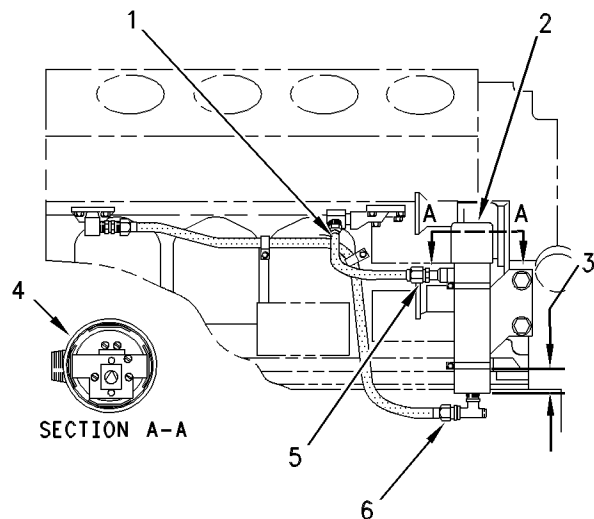


Illustration 154
Typical example

g00279581

Power 3000 Watts

Voltage 120/240 V

(1) Hose

Assemble the hose in order to maintain a gradual rise from the heater outlet to the engine.

(2) Jacket water heater

(3) Reference dimension .. 60 ± 6 mm ($2.4 \pm .2$ inch)

(4) Thermostat

(5) Coolant outlet

(6) Coolant inlet

i02053647

Engine Harness (Rigid Wiring Harness)

SMCS Code: 1408

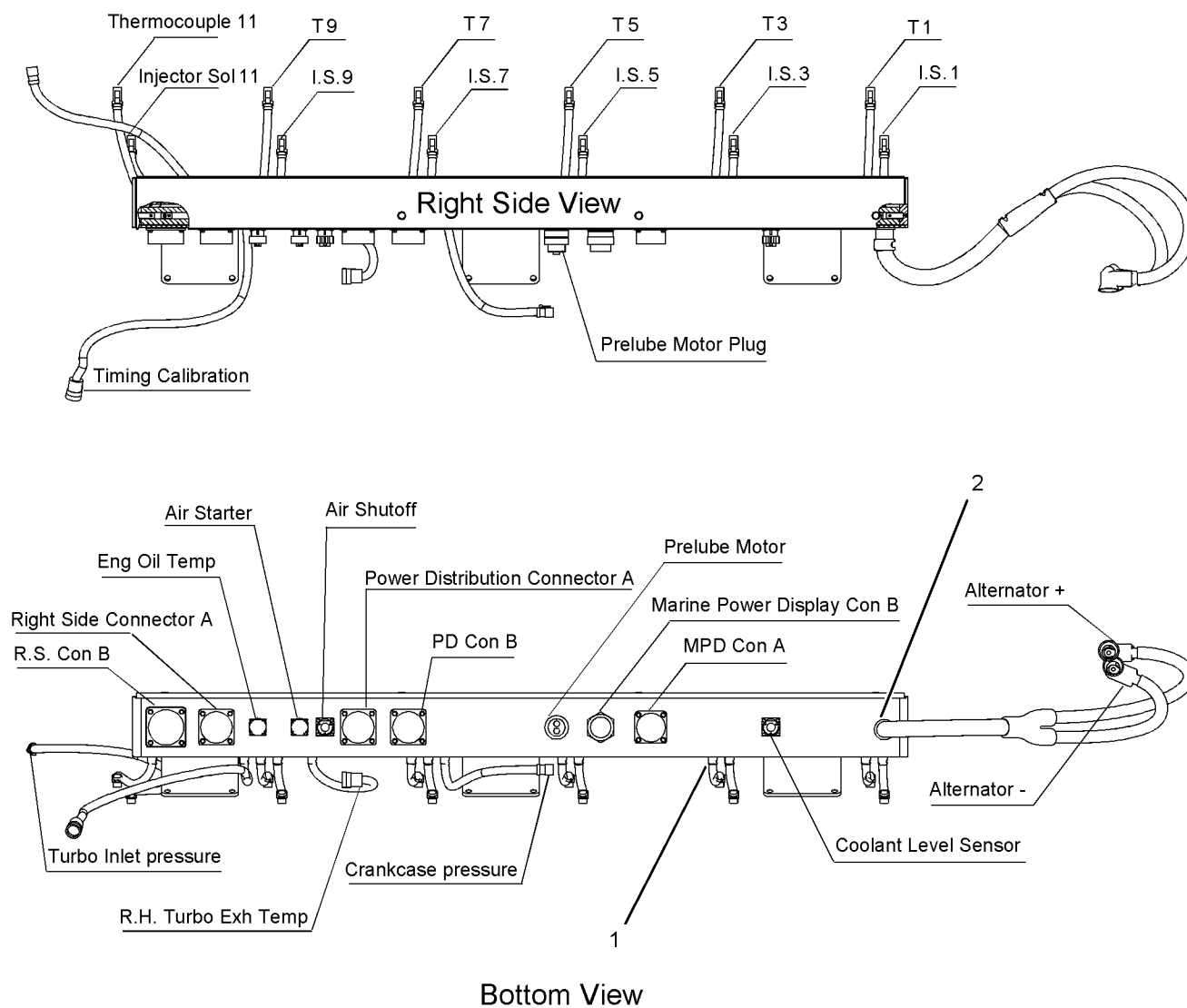


Illustration 155
Typical example

g01053142

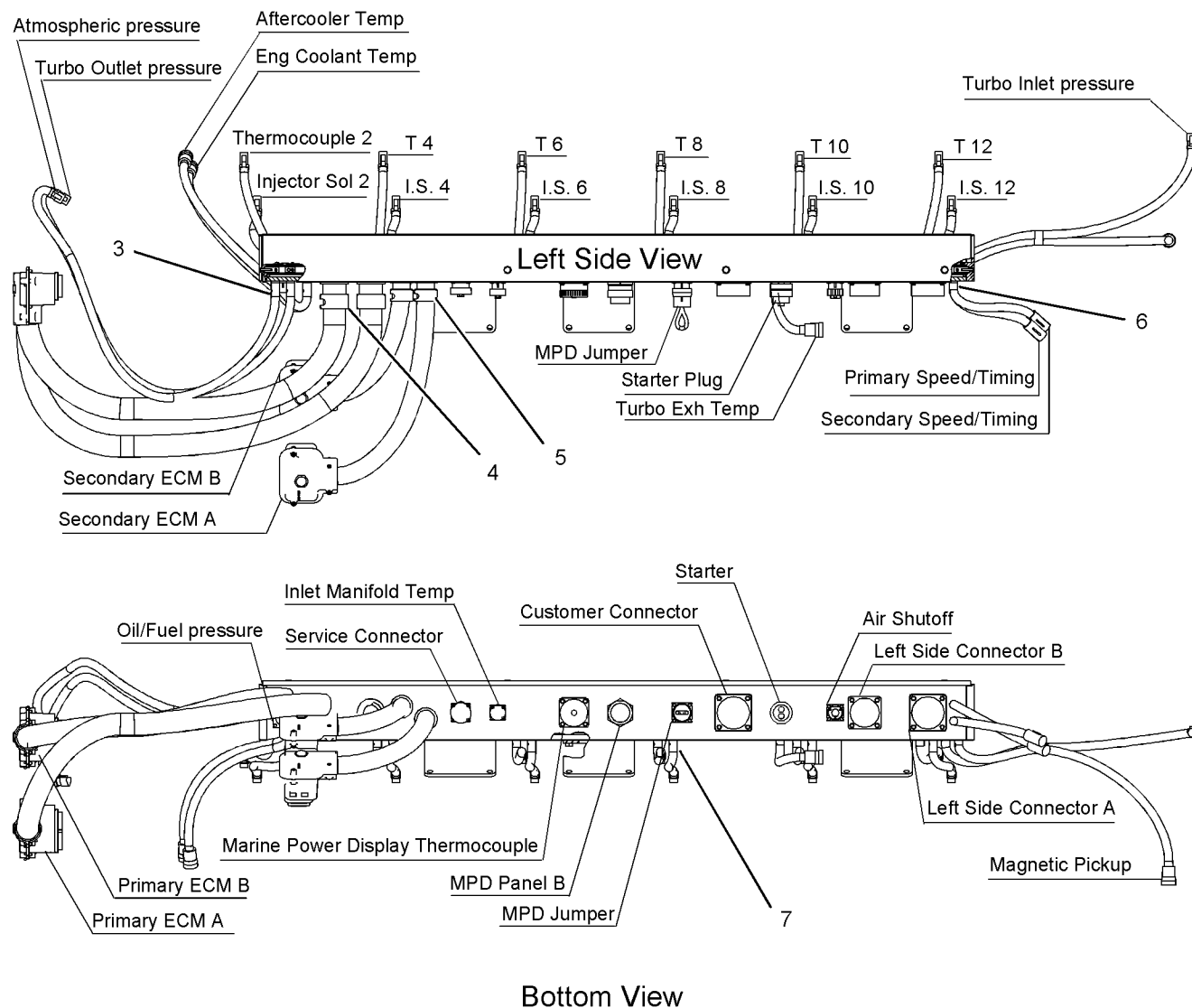


Illustration 156
Typical example

g01053143

- | | |
|---------------------------------|---------------------------------|
| (1) Nut | Torque 10 N·m (7 lb ft) |
| Torque 2.5 N·m (22 lb in) | (6) Nut |
| (2) Nut | Torque 2.5 N·m (22 lb in) |
| Torque 8 N·m (70 lb in) | (7) Nut |
| (3) Nut | Torque 2.5 N·m (22 lb in) |
| Torque 2.5 N·m (22 lb in) | |
| (4) Nut | |
| Torque 15 N·m (11 lb ft) | |
| (5) Nut | |

i00579870

i02051798

Coolant Level Switch

SMCS Code: 1395; 7422

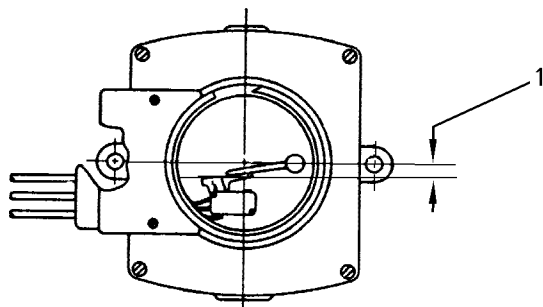


Illustration 157

g00281194

Note: The switch is shown in the high level position.

- (1) When the switch activates, the approximate level of the liquid is the following dimension. ... 6.4 mm (.25 inch)

The contact position is normally closed.

i01705913

Coolant Temperature Switch

SMCS Code: 1395

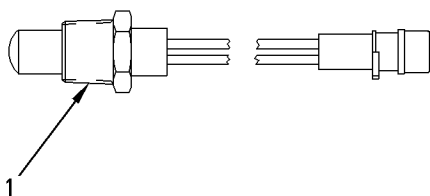


Illustration 158

g00877952

- (1) Switch assembly

Torque 53 ± 8 N·m (39 ± 6 lb ft)

Contact position Normally closed

Actuation temperature 27 ± 3 °C (81 ± 5 °F)

Deactuation temperature 20 °C (68 °F)

Fuel Pressure Sensor

SMCS Code: 7414

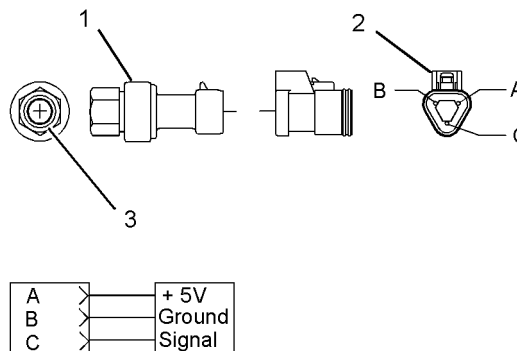


Illustration 159

g01052436

Typical example

- (1) Sensor assembly

- (2) Plug with socket A, socket B, and socket C

- (3) Port fitting

Torque 10 ± 2 N·m (90 ± 18 lb in)

Operating temperature -40 to 125 °C
(-40 to 257 °F)

Maximum input pressure (absolute pressure) 1135 kPa (165 psi)

Input supply voltage 5 ± 0.25 VDC

Maximum supply current 20 mA

Install the sensor so that the pressure port is lower than the wire end. Mount the sensor as close to vertical as possible.

i01958232

Magnetic Switch

SMCS Code: 7499

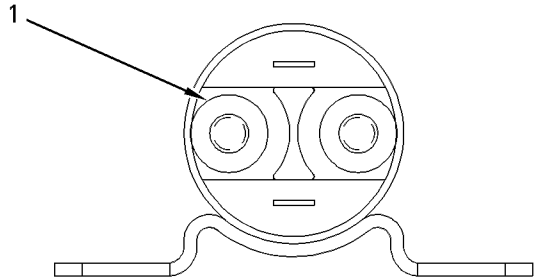


Illustration 160

g00295201

(1) Nut

Torque 5.5 ± 0.5 N·m (49.00 ± 4.00 lb in)

Operating temperature range -60 to 121 °C
(-76 to 250 °F)

System voltage 24 VDC

Pull-in voltage at 25°C (77°F) 16 V max

Hold-in voltage at 25°C (77°F) 8 V max

Coil resistance at 20 °C (68 °F) 27.5 ± 0.28 Ohms

Maximum current draw 1.25 Amp

Contacts Normally open

i01966016

Coolant Level Sensor

SMCS Code: 7470

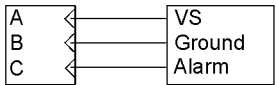
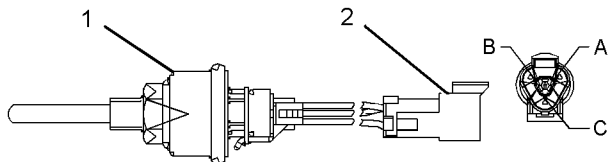


Illustration 161

g01020959

(1) Sensor assembly

Torque 22 ± 3 N·m (16 ± 2 lb ft)

(2) The plug has socket A, socket B, and socket C.

Operating temperature -40 to 125 °C
(-40 to 257 °F)

Input supply voltage 8 ± 0.4 VDC

i02030238

Engine Oil Pressure Sensor

SMCS Code: 1924

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2D1-Up

S/N: S2E1-Up

S/N: S2F1-Up

S/N: B5G1-Up

S/N: MRG1-Up

S/N: PAG1-Up

S/N: S2G1-Up

S/N: MKH1-Up

S/N: S2H1-Up

S/N: S2J1-Up

S/N: S2K1-Up

S/N: S2L1-Up

S/N: S2M1-Up

S/N: S2N1-Up

S/N: S2P1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2T1-Up

S/N: S2W1-Up

S/N: S2X1-Up

S/N: S2Y1-Up

Part No.: 194-6725

S/N: S2Z1-Up

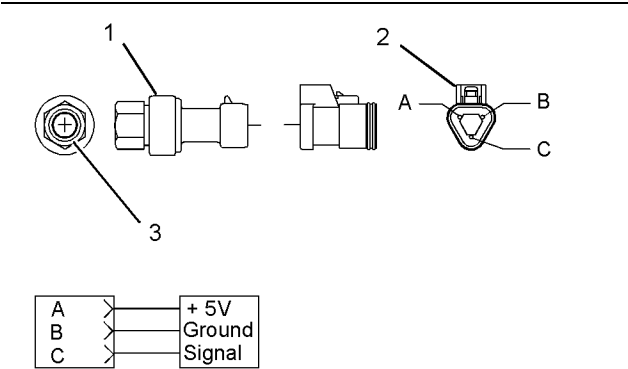


Illustration 162 g01046769

Typical example

- (1) Sensor assembly
 - (2) Plug with socket A, socket B, and socket C
 - (3) Port fitting
- Torque 10 ± 2 N·m (90 ± 18 lb in)
- Operating temperature -40 to 125 °C
(-40 to 257 °F)

Maximum input pressure (absolute pressure) 1135 kPa (165 psi)

Input supply voltage 5 ± 0.25 VDC

Maximum supply current 20 mA

Install the sensor so that the pressure port is lower than the wire end. Mount the sensor as close to vertical as possible.

i02030244

Turbocharger Inlet Pressure Sensor

SMCS Code: 1052

- S/N:** S2A1-Up
- S/N:** S2B1-Up
- S/N:** S2D1-Up
- S/N:** S2E1-Up
- S/N:** S2F1-Up
- S/N:** B5G1-Up
- S/N:** MRG1-Up
- S/N:** PAG1-Up
- S/N:** S2G1-Up

- S/N:** MKH1-Up
 - S/N:** S2H1-Up
 - S/N:** S2J1-Up
 - S/N:** S2K1-Up
 - S/N:** S2L1-Up
 - S/N:** S2M1-Up
 - S/N:** S2N1-Up
 - S/N:** S2P1-Up
 - S/N:** S2R1-Up
 - S/N:** S2S1-Up
 - S/N:** S2T1-Up
 - S/N:** S2W1-Up
 - S/N:** S2X1-Up
 - S/N:** S2Y1-Up
- Part No.:** 161 - 9926
- S/N:** S2Z1-Up

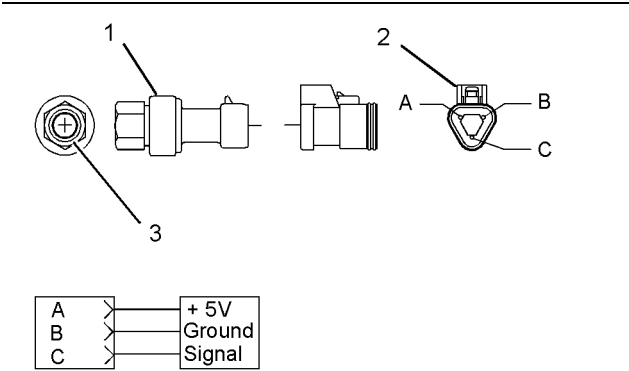


Illustration 163 g01046775

Typical example

- (1) Sensor assembly
 - (2) Plug with socket A, socket B, and socket C
 - (3) Port fitting
- Torque 10 ± 2 N·m (90 ± 18 lb in)
- Operating temperature -40 to 125 °C
(-40 to 257 °F)
- Maximum input pressure (absolute pressure) 116 kPa (17 psi)
- Input supply voltage 5 ± 0.25 VDC
- Maximum supply current 20 mA

Install the sensor so that the pressure port is lower than the wire end. Mount the sensor as close to vertical as possible.

i02030255

Turbocharger Outlet Pressure Sensor

SMCS Code: 1052; 1917; 1919

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2D1-Up

S/N: S2E1-Up

S/N: S2F1-Up

S/N: B5G1-Up

S/N: MRG1-Up

S/N: PAG1-Up

S/N: S2G1-Up

S/N: MKH1-Up

S/N: S2H1-Up

S/N: S2J1-Up

S/N: S2K1-Up

S/N: S2L1-Up

S/N: S2M1-Up

S/N: S2N1-Up

S/N: S2P1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2T1-Up

S/N: S2W1-Up

S/N: S2X1-Up

S/N: S2Y1-Up

Part No.: 194-6724

S/N: S2Z1-Up

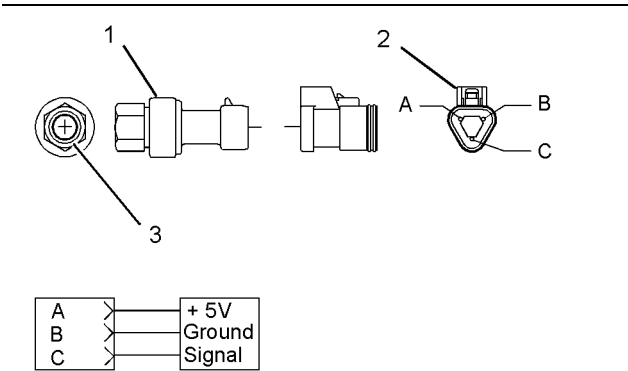


Illustration 164

g01046779

Typical example

(1) Sensor assembly

(2) Plug with socket A, socket B, and socket C

(3) Port fitting

Torque 10 ± 2 N·m (90 ± 18 lb in)

Operating temperature -40 to 125 °C
(-40 to 257 °F)

Maximum input pressure (absolute pressure) 472 kPa (68 psi)

Input supply voltage 5 ± 0.25 VDC

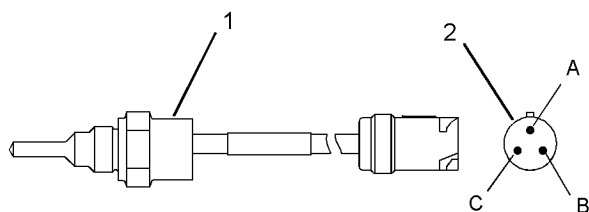
Maximum supply current 20 mA

Install the sensor so that the pressure port is lower than the wire end. Mount the sensor as close to vertical as possible.

i02052071

Aftercooler Coolant Temperature Sensor

SMCS Code: 1063; 1395



A	VS
B	GND
C	SIG

Illustration 165

g01052447

(1) Sensor assembly

Torque 20 ± 5 N·m (15 ± 4 lb ft)

(2) Plug with socket A, socket B, and socket C

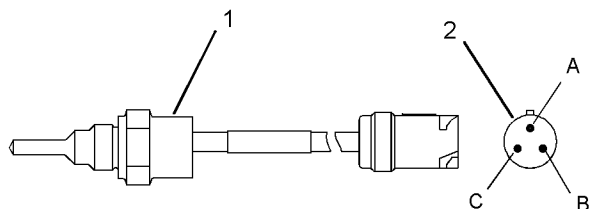
Operating temperature -40 to 120 °C
(-40 to 248 °F)

Supply voltage 4.75 to 8.5 volts

i02051841

Engine Coolant Temperature Sensor

SMCS Code: 1395



A	VS
B	GND
C	SIG

Illustration 166

g01052447

(1) Sensor assembly

Torque 20 ± 5 N·m (15 ± 4 lb ft)

(2) Plug with socket A, socket B, and socket C

Operating temperature -40 to 120 °C
(-40 to 248 °F)

Supply voltage 4.75 to 8.5 volts

i02052043

Turbocharger Exhaust Temperature Sensor

SMCS Code: 1052; 1919

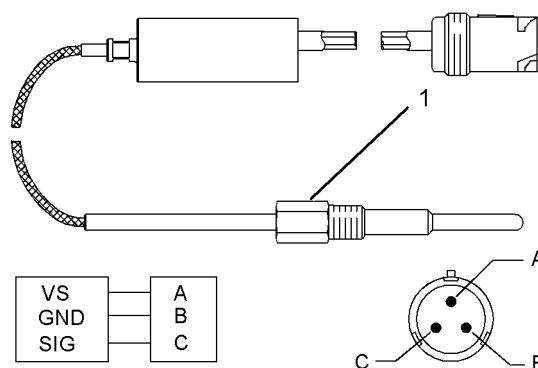


Illustration 167

g01052549

(1) Sensor assembly

Torque 25 ± 5 N·m (18 ± 4 lb ft)

(2) Plug with socket A, socket B, and socket C

i02604881

Engine Speed/Timing Sensor

SMCS Code: 1905; 1907

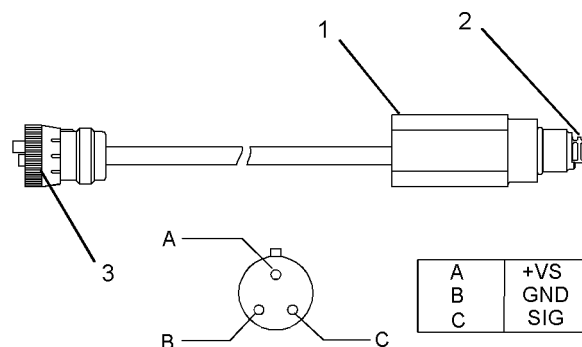


Illustration 168

g01303884

(1) Sensor assembly

Before installation, coat the sensor assembly's threads with 5P-3931 Anti-Seize Compound.

Torque 40 ± 5 N·m (30 ± 4 lb ft)

Operating temperature -40 to 121 °C
(-40 to 250 °F)

Supply voltage 12 to 14 V

(2) Sliphead

Before installation, make sure that the sliphead is fully extended.

(3) Plug with socket A, socket B, and socket C

i02565364

Engine Speed/Timing Sensor

SMCS Code: 1905; 1907

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2D1-Up

S/N: S2E1-Up

S/N: S2F1-Up

S/N: B5G1-Up

S/N: MRG1-Up

S/N: PAG1-Up

S/N: S2G1-Up

S/N: MKH1-Up

S/N: S2H1-Up

S/N: S2J1-Up

S/N: S2K1-Up

S/N: S2L1-Up

S/N: S2M1-Up

S/N: S2N1-Up

S/N: S2P1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2T1-Up

S/N: S2W1-Up

S/N: S2X1-Up

S/N: S2Y1-Up

Part No.: 129-6628

S/N: S2Z1-Up

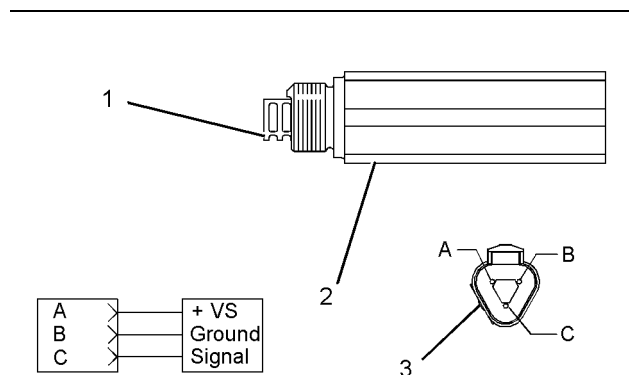


Illustration 169

g01046790

Typical example

(1) Sensor slip head

1. Extend the sensor slip head to a minimum distance of 4 mm (.16 inch) prior to installation.

(2) Control assembly

Put 4C-5597 Anti-Seize Compound on the threads.

Torque 40 ± 5 N·m (30 ± 4 lb ft)

Operating temperature -40 °C to 121 °C
(-40 °F to 250 °F)

Input supply voltage 12 - 14 VDC

(3) Plug with socket A, socket B, and socket C.

i02030286

Crankcase Pressure Sensor

SMCS Code: 1916

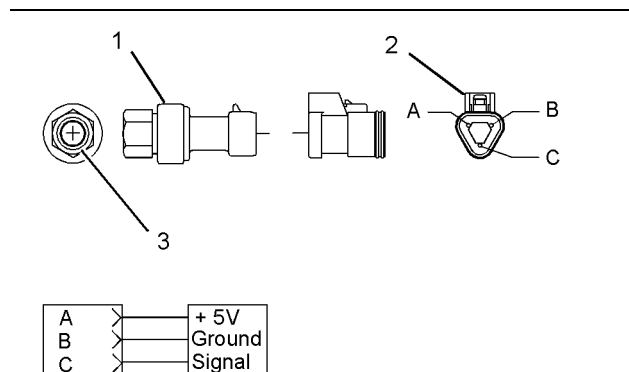


Illustration 170

g01046797

Typical example

(1) Sensor assembly

(2) Plug with socket A, socket B, and socket C

(3) Port fitting

Torque 10 ± 2 N·m (88 ± 18 lb in)

Operating temperature -40 to 125 °C
(-40 to 257 °F)

Maximum input pressure (absolute pressure) 116 kPa (17 psi)

Input supply voltage 5 ± 0.25 VDC

Maximum supply current 20 mA

Install the sensor so that the pressure port is lower than the wire end. Mount the sensor as close to vertical as possible.

i02030287

Atmospheric Pressure Sensor

SMCS Code: 1923

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2D1-Up

S/N: S2E1-Up

S/N: S2F1-Up

S/N: B5G1-Up

S/N: MRG1-Up

S/N: PAG1-Up

S/N: S2G1-Up

S/N: MKH1-Up

S/N: S2H1-Up

S/N: S2J1-Up

S/N: S2K1-Up

S/N: S2L1-Up

S/N: S2M1-Up

S/N: S2N1-Up

S/N: S2P1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2T1-Up

S/N: S2W1-Up

S/N: S2X1-Up

S/N: S2Y1-Up

Part No.: 161 -9926
S/N: S2Z1-Up

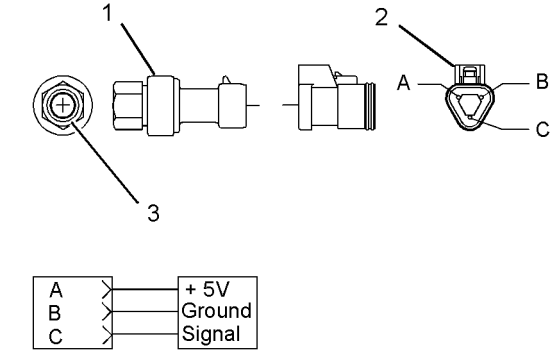


Illustration 171

g01046769

Typical example

(1) Sensor assembly

(2) Plug with socket A, socket B, and socket C

(3) Port fitting

Torque 10 ± 2 N·m (88 ± 18 lb in)

Operating temperature -40 to 125 °C
(-40 to 257 °F)

Maximum input pressure (absolute pressure) 116 kPa (17 psi)

Input supply voltage 5 ± 0.25 VDC

Maximum supply current 20 mA

Install the sensor so that the pressure port is lower than the wire end. Mount the sensor as close to vertical as possible.

i02052012

Engine Speed Sensor

SMCS Code: 1907

S/N: S2A1-Up

S/N: S2B1-Up

S/N: S2D1-Up

S/N: S2E1-Up

S/N: S2F1-Up

S/N: B5G1-Up

S/N: MRG1-Up

S/N: PAG1-Up

S/N: S2G1-Up

S/N: MKH1-Up

S/N: S2H1-Up

S/N: S2J1-Up

S/N: S2K1-Up

S/N: S2L1-Up

S/N: S2M1-Up

S/N: S2N1-Up

S/N: S2P1-Up

S/N: S2R1-Up

S/N: S2S1-Up

S/N: S2T1-Up

S/N: S2W1-Up

S/N: S2X1-Up

S/N: S2Y1-Up

Part No.: 189-5746

S/N: S2Z1-Up

(1) Nut

1. Install the engine speed sensor into the 5/8 threaded hole and turn until the magnetic core makes contact with a tooth of the flywheel ring gear.

2. Back out 180 degrees and tighten the locknut.

Torque 25 ± 5 N·m (18 ± 4 lb ft)

The clearance between the engine speed sensor and the flywheel ring gear is the following value: 0.56 to 0.84 mm (0.022 to 0.033 inch)

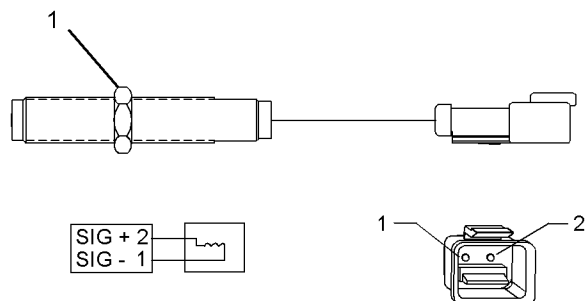


Illustration 172

g01052524

Typical example

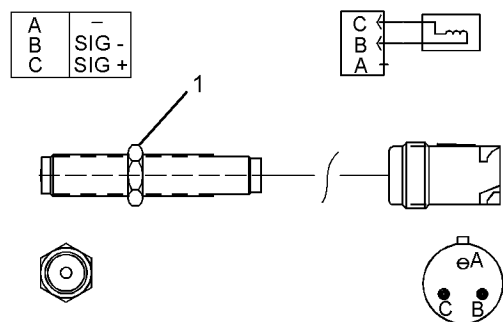


Illustration 173

g01031847

Typical example

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