SENR2373-08 (en-us)
October 2019

Specifications

3500 Marine Engines

96Y 1-UP (Engine)
50Y 1-UP (Engine)
29Z 1-UP (Engine)
69Z 1-UP (Engine)
66Z 1-UP (Engine)
72Z 1-UP (Engine)
4MJ 1-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, including human factors that can affect safety. 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 verify that you are authorized to perform this work, and have read and understood the operation, lubrication, maintenance and repair information.

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

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

⚠ WARNING

The meaning of this safety alert symbol is as follows:

Attention! Become Alert! Your Safety is Involved.

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

A non-exhaustive list of 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. You must not use this product in any manner different from that considered by this manual without first satisfying yourself that you have considered all safety rules and precautions applicable to the operation of the product in the location of use, including site-specific rules and precautions applicable to the worksite. If a tool, procedure, work method or operating technique that is not specifically recommended by Caterpillar is used, you must satisfy yourself that it is safe for you and for others. You should also ensure that you are authorized to perform this work, and that the product will not be damaged or become unsafe by the operation, lubrication, maintenance or repair procedures that you intend to use.

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

⚠ WARNING

When replacement parts are required for this product Caterpillar recommends using Cat replacement parts.

Failure to follow this warning may lead to premature failures, product damage, personal injury or death.

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

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Specifications Section

i01796577

Engine Design

SMCS Code: 1000

S/N: 96Y1–Up

S/N: 69Z1–Up

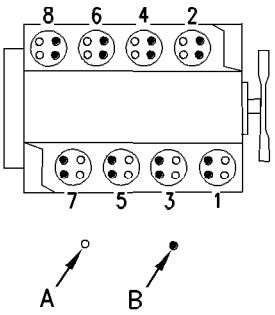

Illustration 1 g00293348

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

One piece piston 13:1

Two-piece piston 13.5:1

Combustion . . . . . Direct injection

On engines with standard rotation, 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 ((.020 inch))

Exhaust . . . . . .1.00 mm ((.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.

i01797228

Engine Design

SMCS Code: 1000

S/N: 50Y1–Up

S/N: 66Z1–Up

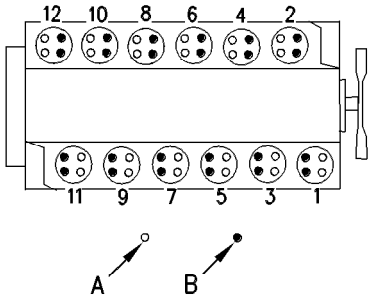

Illustration 2 g00293349

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

One piece piston 13:1

Two-piece piston 13.5:1

Combustion . . . . . Direct injection

On engines with standard rotation, 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 ((.020 inch))

Exhaust . . . . . .1.00 mm ((.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.

i01797237

Engine Design

SMCS Code: 1000

Part No.: 4P-0716
S/N: 4MJ1–Up

S/N: 29Z1–Up

S/N: 72Z1–Up

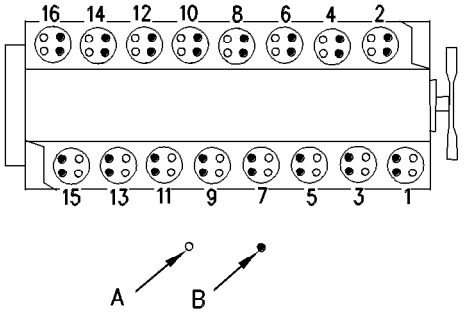

Illustration 3 g00294285

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

One piece piston 13:1

Two-piece piston 13.5:1

Combustion . . . . . Direct injection

On engines with standard rotation, 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

Inlet . . . . . .0.50 mm ((.020 inch))

Exhaust . . . . . .1.00 mm ((.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.

i04369499

Fuel Filter (Primary)

SMCS Code: 1260

Part No.: 8N-6435
S/N: 50Y1–Up

Part No.: 8N-6435
S/N: 96Y1–Up

Part No.: 8N-6435
S/N: 29Z1–Up

Part No.: 8N-6435
S/N: 66Z1–Up

Part No.: 8N-6435
S/N: 69Z1–Up

Part No.: 8N-6435
S/N: 72Z1–Up

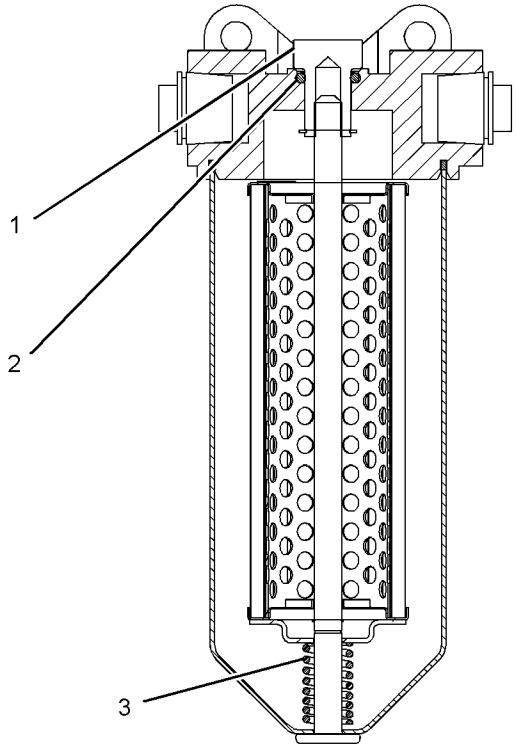

Illustration 4 g02577938

Table 1

Specification for 8N-6435 Primary Fuel Filter Gp, 7E-6719 Primary Fuel Filter Gp, and 2W-6071 Primary Fuel Filter Gp			
Item	**Qty**	**Part**	**Specification Description**
1	1	7N-1628 Nut	Torque to 25 ± 5 N·m (221 ± 44 lb in).

(continued)

(Table 1, contd)

2	1	2J-0157 O-Ring Seal	Lubricate the bore of the O-ring seal and the shaft lightly with clean engine oil.
3	1	7S-9323 Spring	Length under test force is 27.94 mm (1.100 inch). Test force 27.7 to 32.3 N (6.2 to 7.3 lb). Free length after test is 42.67 mm (1.680 inch).

i04369549

Fuel Pressure Regulator

SMCS Code: 1277

Part No.: 114-5477

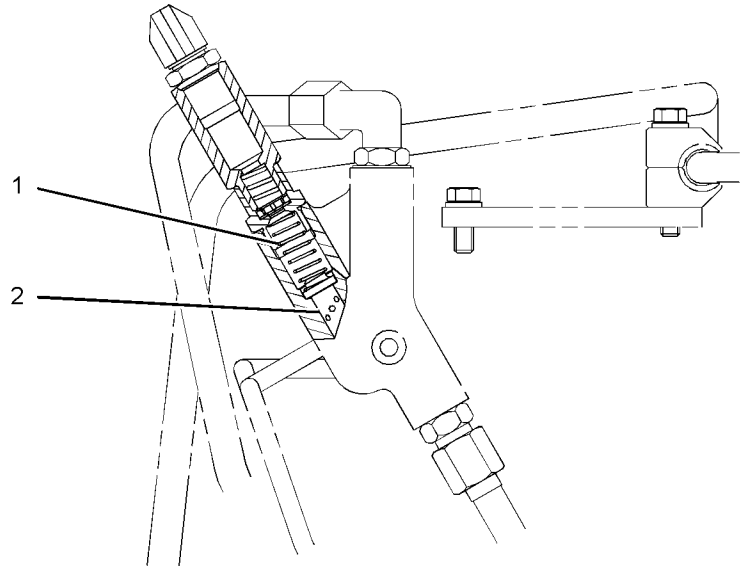

Illustration 5 g02577996

(2) Valve plunger

Table 2

Specification for 114-5477 Valve Plunger			
Item	**Qty**	**Part**	**Specification Description**
1	1	9N-4053 Spring	Length under test force is 28.4 mm (1.12 inch). Test force is 40.79 ± 2.05 N (9.17 ± 0.46 lb). Free length after test force is 57.15 mm (2.250 inch).

i05196360

Fuel Transfer Pump

SMCS Code: 1256

Part No.: 8N-6151

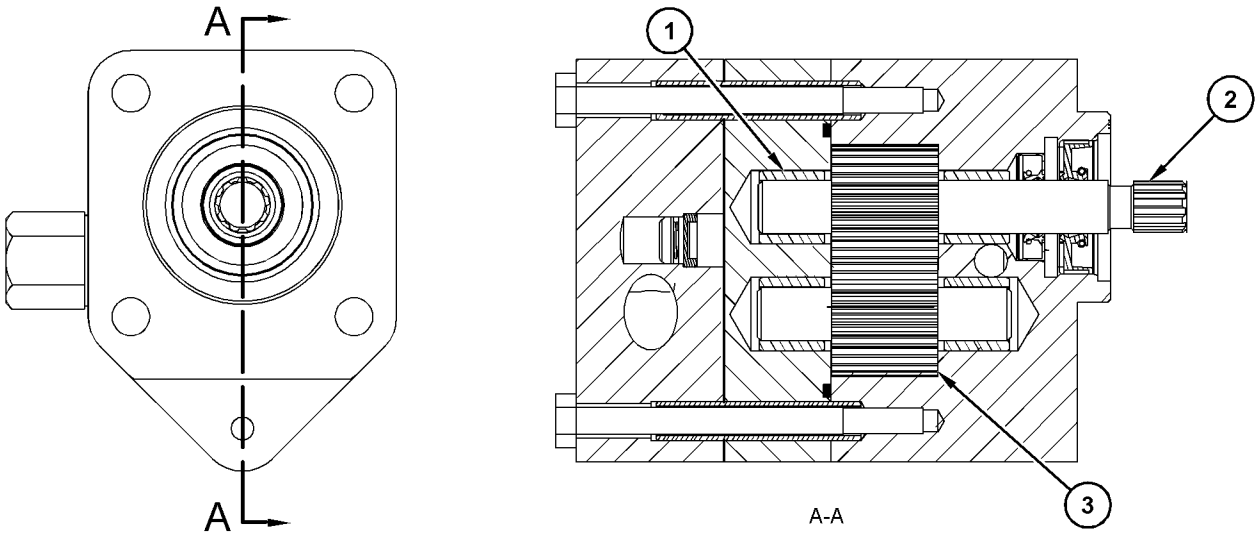

Illustration 6 g03329769

Table 3

Specification for 8N-6151 Fuel Transfer Pump Gp, 332-7928 Fuel Transfer Pump Gp, 313-7770 Fuel Transfer Pump Gp and 377-5900 Fuel Transfer Pump Gp			
Item	**Qty**	**Part**	**Specification Description**
1	4	7C-2870 Terminal Bushing	Before installation, inside diameter of the terminal bushing for gear shaft is 12.783 mm (0.5033 inch). Installation depth of terminal bushing is 1.5 ± 0.5 mm (0.06 ± 0.02 inch).
2	1	268-1903 Drive Shaft As	Diameter of the gear is 29.801 ± 0.006 mm (1.1733 ± 0.0002 inch). Length of the gear is 25.347 ± 0.008 mm (0.9979 ± 0.0003 inch).
3	1	1W-4003 Idler Gear As	Diameter of the idler gear assembly is 29.801 ± 0.006 mm (1.1733 ± 0.0002 inch). Length of the gear is 25.347 ± 0.008 mm (0.9979 ± 0.0003 inch).

i01637512

Fuel Injector Mechanism

SMCS Code: 1102; 1290

Part No.: 4W-1035
S/N: 4MJ1–Up

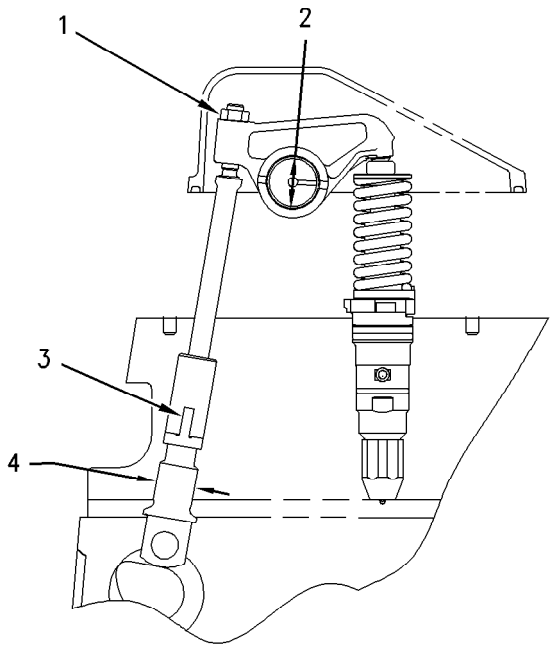

Illustration 7 g00847684

(1) Locknut

Torque . . . . . .70 ± 15 N·m ((50 ± 11 lb ft))

(2) Rocker arm shaft

Diameter . . . . . 37.084 ± 0.013 mm ((1.4600 ± 0.0005 inch))
Bore in bearing for rocker arm shaft . . . . 37.140 ± 0.015 mm ((1.4622 ± 0.0006 inch))

(3) Guide springs

Guide springs must not be used again. Always install new guide springs.

(4) Lifter

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

i04905680

Fuel Injector Mechanism

SMCS Code: 1102; 1290

Part No.: 195-1926
S/N: 50Y1–Up

Part No.: 195-1926
S/N: 96Y1–Up

Part No.: 195-1926
S/N: 29Z1–Up

Part No.: 195-1926
S/N: 66Z1–Up

Part No.: 195-1926
S/N: 69Z1–Up

Part No.: 195-1926
S/N: 72Z1–Up

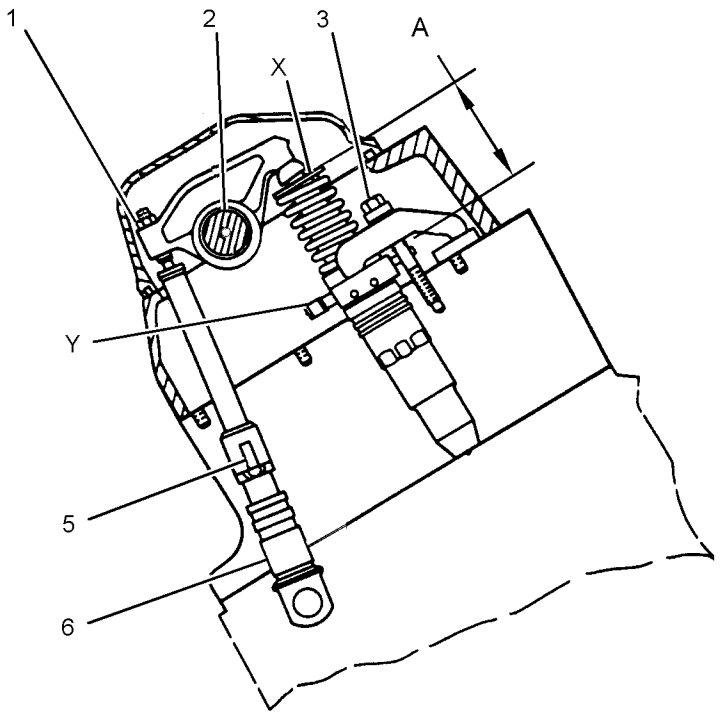

Illustration 8 g03065796

Table 4

Specification for 195-1926 Valve Mechanism Gp and 379-4834 Valve Mechanism Gp			
Item	**Qty**	**Part**	**Specification Description**
1	1	3J-9196 Jam Nut	Torque to 70 ± 15 N·m (52 ± 11 lb ft).

(continued)

(Table 4, contd)

2	1	7C-2377 Arm Shaft Assembly	Diameter is 37.084 ± 0.013 mm (1.4600 ± 0.0005 inch).
			Bore of the bearing is 37.140 ± 0.015 mm (1.4622 ± 0.0006 inch).
-	-	-	Use the following procedure in order to install the fuel injector: 1. Put multipurpose grease in the bore of the cylinder head in order to lubricate the O-ring seals. 2.Put the fuel injector in the bore. Use the bolt and the clamp in order to push the fuel injector into the correct position. **Note:** Do not tap or hit surface “Y” in order to install the injector. 3.Tighten bolt (3) that holds the fuel injector clamp. Torque to 65 ± 7 N·m (48 ± 5 lb ft). 3.After the clamp has been tightened, the fuel injector rack “X” must move freely.
A	-	-	Fuel timing dimension: Refer to TMI (Technical Marketing Information) for the correct timing specifications for the adjustment of the fuel injection pump.
5	3	7N-4782 Lifter Guide Spring	Guide springs must not be used again. Always install new guide springs.
6	3	346-7515 Lifter As	Diameter of new lifter assembly is 29.900 ± 0.010 mm (1.1772 ± 0.0004 inch).
			Bore in head for lifter assembly is 30.000 ± 0.025 mm (1.1811 ± 0.0010 inch).

i04907237

Governor Drive

SMCS Code: 1264

Part No.: 1W-2135

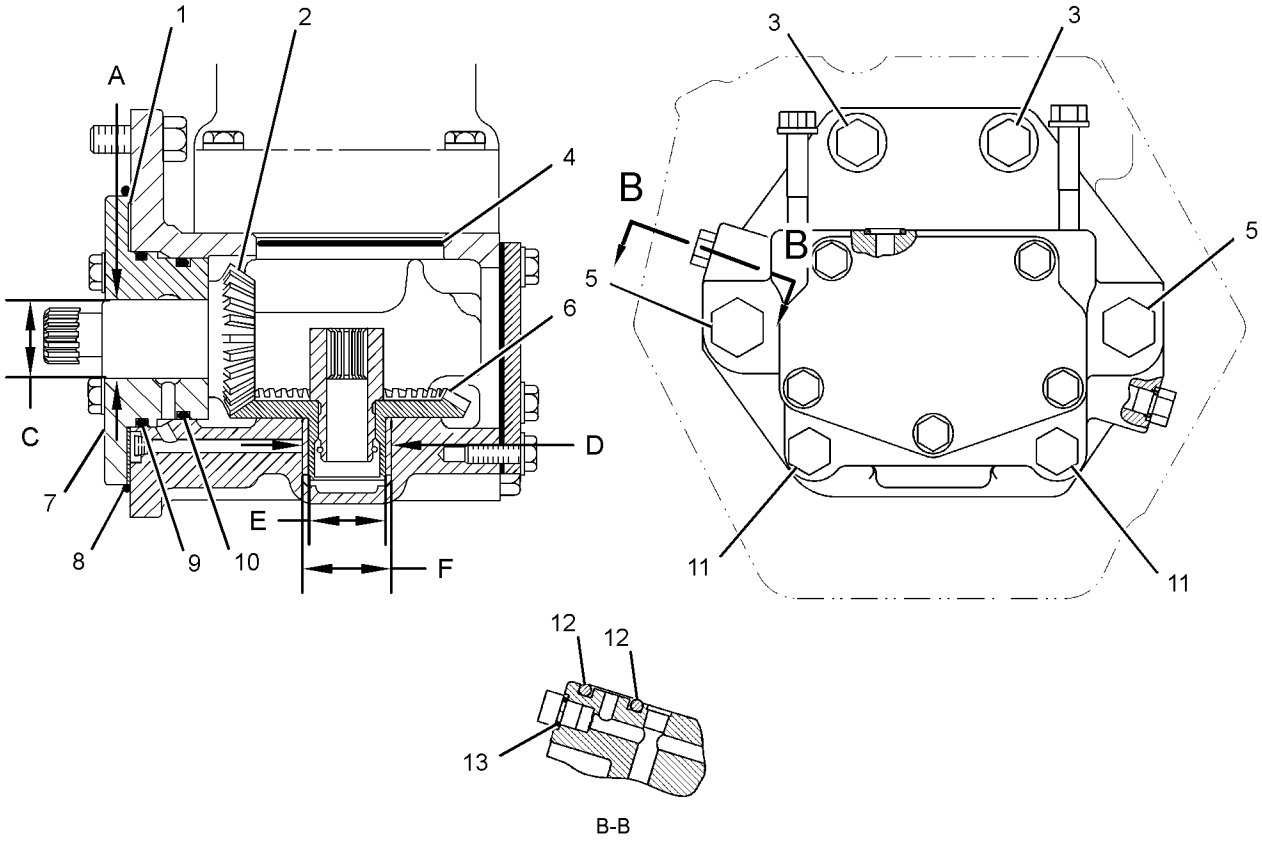

Illustration 9 g03071616

Table 5

Specification for 1W-2135 Governor Drive Gp			
Item	**Qty**	**Part**	**Specification Description**
2	1	7N-5701 Governor Drive Pinion	Diameter (C) is 34.000 ± 0.013 mm (1.3386 ± 0.0005 inch). Use the 7N-5694 Shim (1) to achieve the assembled backlash of the governor drive pinion is 0.075 to 0.150 mm (0.0030 to 0.0059 inch).
3	2	0S-1621 Bolt	Do not tighten the bolt until governor is aligned vertically.
4	1	8C-5197 O-Ring Seal	Lubricate the bore lightly with the lubricant that is being sealed.
5	2	1D-4588 Bolt	Lubricate the bore lightly with the lubricant that is being sealed.
6	1	1N-3409 Bevel Gear	Diameter (E) is 34.000 ± 0.013 mm (1.3386 ± 0.0005 inch).

(continued)

(Table 5, contd)

			Dimensions for the sleeve bearing (F): Outside diameter of the sleeve bearing is 40.545 ± 0.013 mm (1.5963 ± 0.0005 inch). Bore in the sleeve bearing after installation is 34.072 mm (1.3414 inch).
			Bore diameter of drive housing (D) is 40.432 ± 0.025 mm (1.5918 ± 0.0010 inch).
7	1	7N-5700 Adapter	Bore diameter (A) is 34.072 ± 0.025 mm (1.3414 ± 0.0010 inch).
8	1	6V-8260 O-Ring Seal	Lubricate the bore lightly with the lubricant that is being sealed.
9	1	6J-2244 O-Ring Seal	Lubricate the bore lightly with the lubricant that is being sealed.
10	1	061-9457 O-Ring Seal	Lubricate the bore lightly with the lubricant that is being sealed.
11	2	1A-7669 Bolt	Do not tighten the bolt until governor is aligned vertically.
12	2	6V-3348 O-Ring Seal	Lubricate the bore lightly with the lubricant that is being sealed.
13	1	6V-5048 O-Ring Seal	Lubricate the bore lightly with the lubricant that is being sealed.

i03450002

Fuel Injection Control Linkage

SMCS Code: 1298

Part No.: 4W-2967
S/N: 4MJ1–Up

Part No.: 4W-2965, 4W-2966
S/N: 50Y1–Up

Part No.: 4W-2965, 4W-2966
S/N: 96Y1–Up

Part No.: 4W-2965, 4W-2966, 4W-2967
S/N: 29Z1–Up

Part No.: 4W-2965, 4W-2966, 4W-2967
S/N: 66Z1–Up

Part No.: 4W-2965, 4W-2966
S/N: 69Z1–Up

Part No.: 4W-2966, 4W-2967
S/N: 72Z1–Up

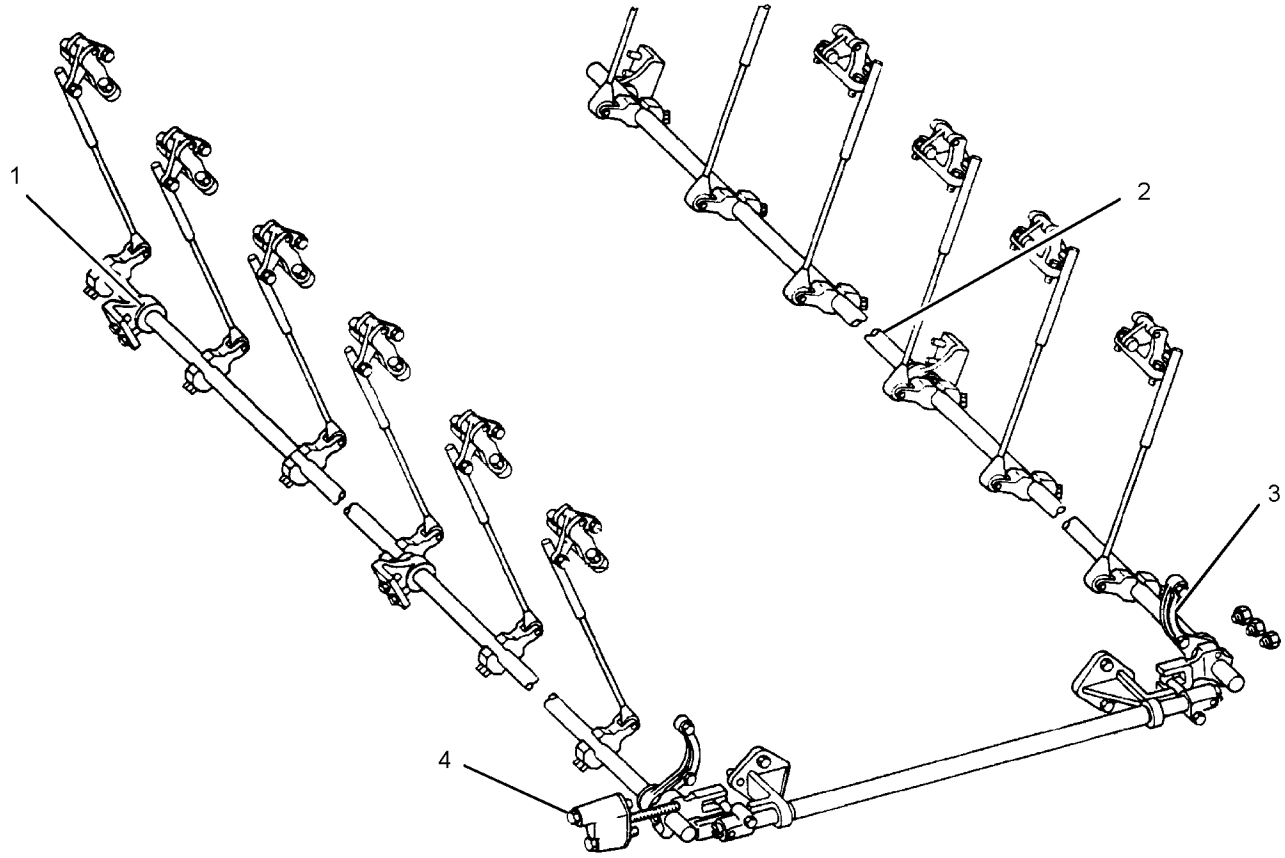

Illustration 10 g01795513

Typical example

(1) Bore of the bearings in the bracket assemblies after installation . . . . . 21.925 ± 0.015 mm ((0.8632 ± 0.0006 inch))

(2) Diameter of the surfaces for the bearings and the rod assemblies on the shafts . . . 21.850 ± 0.015 mm ((0.8602 ± 0.0006 inch))

(3) Bore of the bearings in the two support assemblies after assembly . . . . . 21.925 ± 0.015 mm ((0.8632 ± 0.0006 inch))

(4) Torque for the pin . . . . 10 ± 2 N·m ((90 ± 18 lb in))

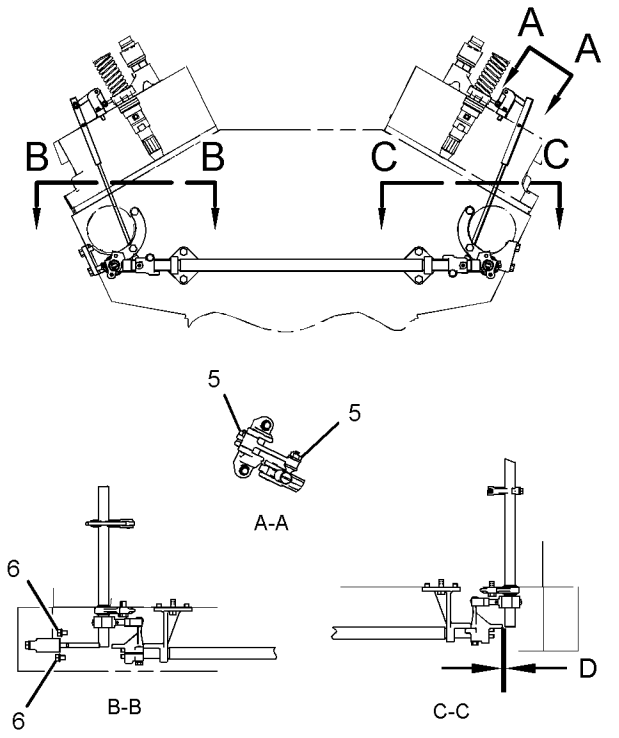

Illustration 11 g01795514

Front view

(5) Torque for the locknuts at each end of the bellcrank . . . . . 8 ± 2 N·m ((70 ± 18 lb in))

(6) Torque for the plugs . . . .25 ± 5 N·m ((18 ± 4 lb ft))

(D) Clearance between the lever assemblies on the front cross shaft and the side shafts . . . . . 0.20 ± 0.10 mm ((0.008 ± 0.004 inch))

i04898184

Governor Linkage

SMCS Code: 1265

Part No.: 4W-5030

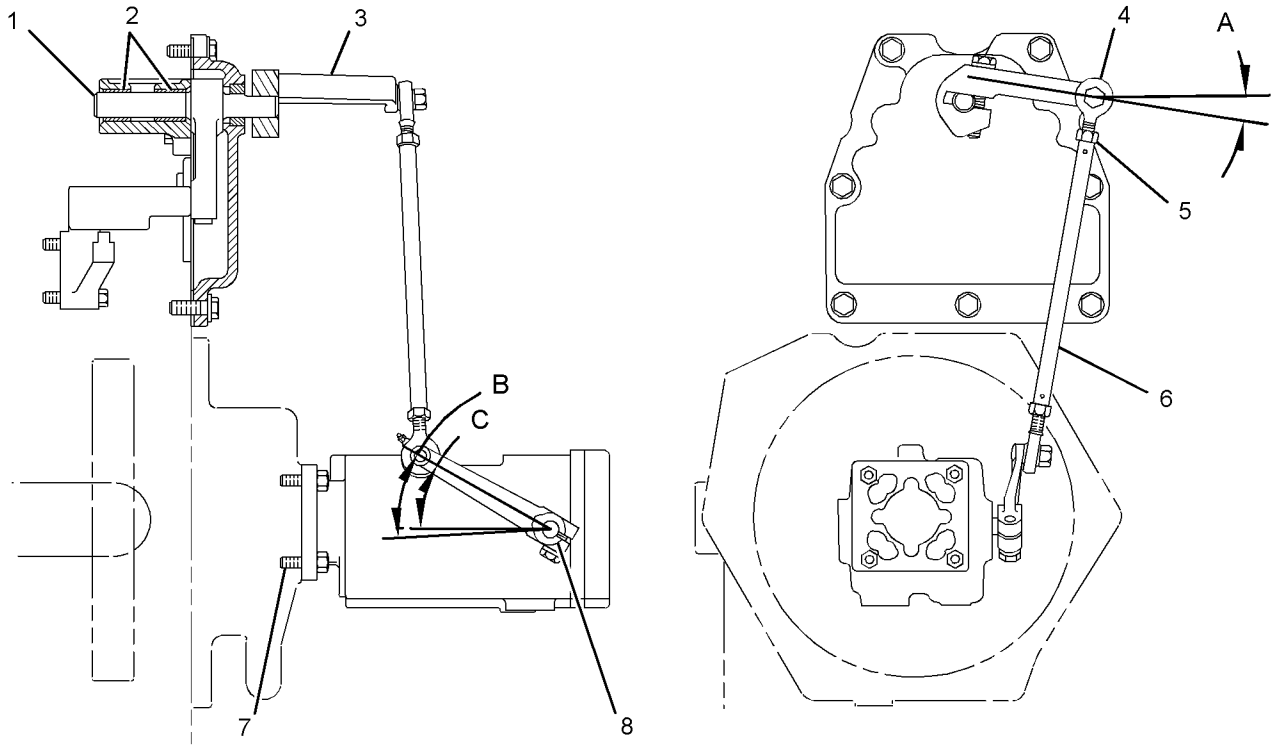

Illustration 12 g03049539

(A) Shutoff position is 8.5 degrees (B) Fuel-on position is 32 degrees (C) Shutoff position is 30 ± 5 degrees

Table 6

Specification for 150-4146 Fuel Injection Pump Fastener			
Item	**Qty**	**Part**	**Specification Description**
1	1	4W-5029 Lever As	Diameter of the shaft is 19.050 ± 0.013 mm (0.7500 ± 0.0005 inch).
2	2	8L-6376 Bushing	Bore in bearing after assembly in the bracket is 19.126 ± 0.038 mm (0.7529 ± 0.0015 inch).
6	1	6V-8186 Full Nut	Torque to 12 ± 4 N·m (106 ± 35 lb in).
8	4	5L-3708 Taperlock Stud	Torque to 17 ± 5 N·m (151 ± 44 lb in).
-	-	-	Use the following procedure in order to adjust the linkage:
			Install lever (3) with the control linkage in the shutoff position against the stop.
			Lever (8) must be installed at the angle that is shown with the actuator lever in the shutoff position against the stop.

(continued)

(Table 6, contd)

			With lever (3) and lever (8) in the shutoff position, adjust rod end (4) and rod assembly (6) to the needed length. Tighten nuts (5) in order to hold the rod ends in position.
			The threads of rod end (4) must be visible through the holes in the rods in order to make sure that there is minimum thread engagement.
			Connect lever (3) and lever (8) together with rod assembly (6).

i04899086

Manual Shutoff

SMCS Code: 1265

Part No.: 7N-4869

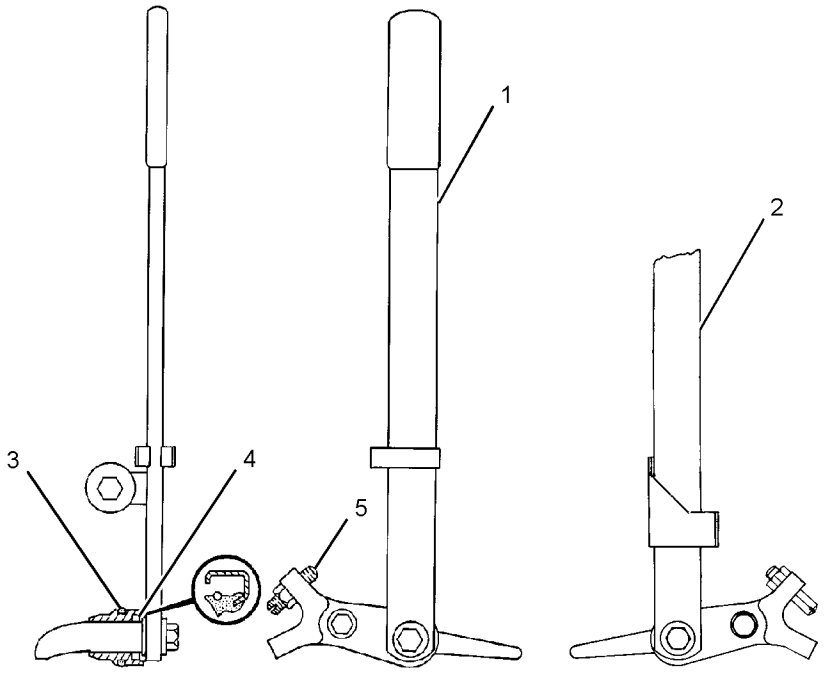

Illustration 13 g03051437

Table 7

Specification for 7N-4869 Manual Shutoff			
Item	**Qty**	**Part**	**Specification Description**
-	-	-	The shutoff group must be installed on the same side of the engine as the governor.
-	-	-	When the shutoff group is right hand mounted,(1) “RH FRONT” should be visible from the front of the engine. When the shutoff group is left hand mounted, (2) “LH FRONT” should be visible from the front of the engine.
3	1	2H-3932 O-Ring Seal	Lubricate the bore lightly with the lubricant that is being sealed.
4	1	3K-2593 Lip Type Seal	Lubricate the sealing lip lightly with the lubricant that is being sealed.
5	1	4B-3643 Setscrew	Pull the shutoff lever until the governor linkage stops against the internal stop. Turn the adjustment setscrew until the adjustment setscrew contacts the lever. Turn the adjustment setscrew by one additional turn. Tighten the locknut.

i03447305

Aftercooler

SMCS Code: 1063

Part No.: 7E-8991
S/N: 4MJ1–Up

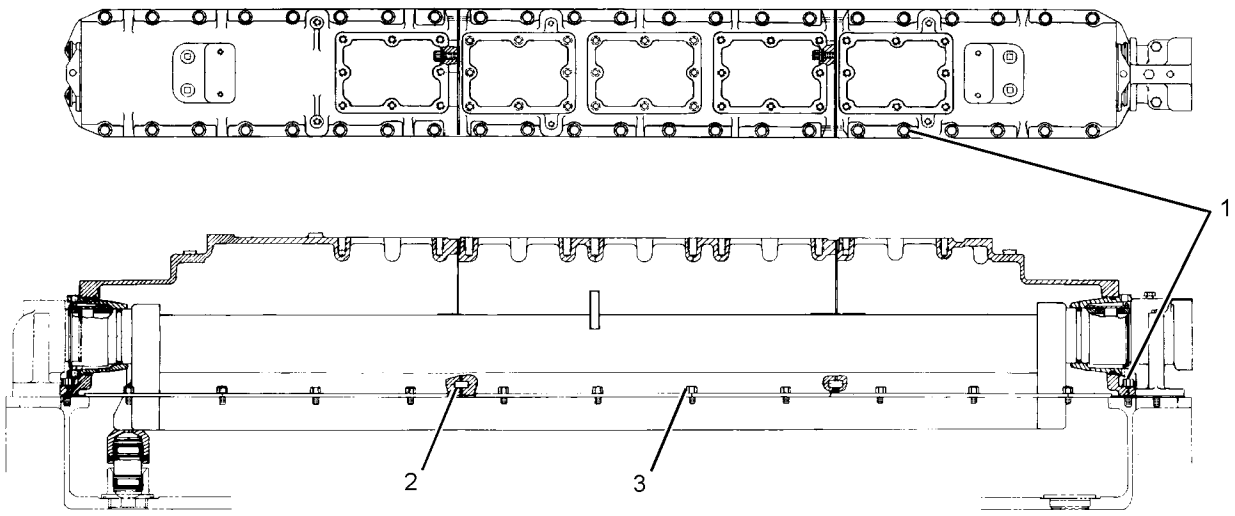

Illustration 14 g01794153

Typical example

Note: Lubricate the bore of the O-ring seals lightly with glycerin.

(1) Torque for the bolts . . . .55 ± 7 N·m ((41 ± 5 lb ft))

(2) Apply 8T-9014 Silicone Sealant at the pin locations on both sides.

(3) Torque for the bolts . . . .32 ± 7 N·m ((24 ± 5 lb ft))

Note: Trim the gaskets with the surface.

i04900927

Aftercooler

SMCS Code: 1063

Part No.: 7N-8722
S/N: 96Y1–Up

Part No.: 7N-8722
S/N: 69Z1–Up

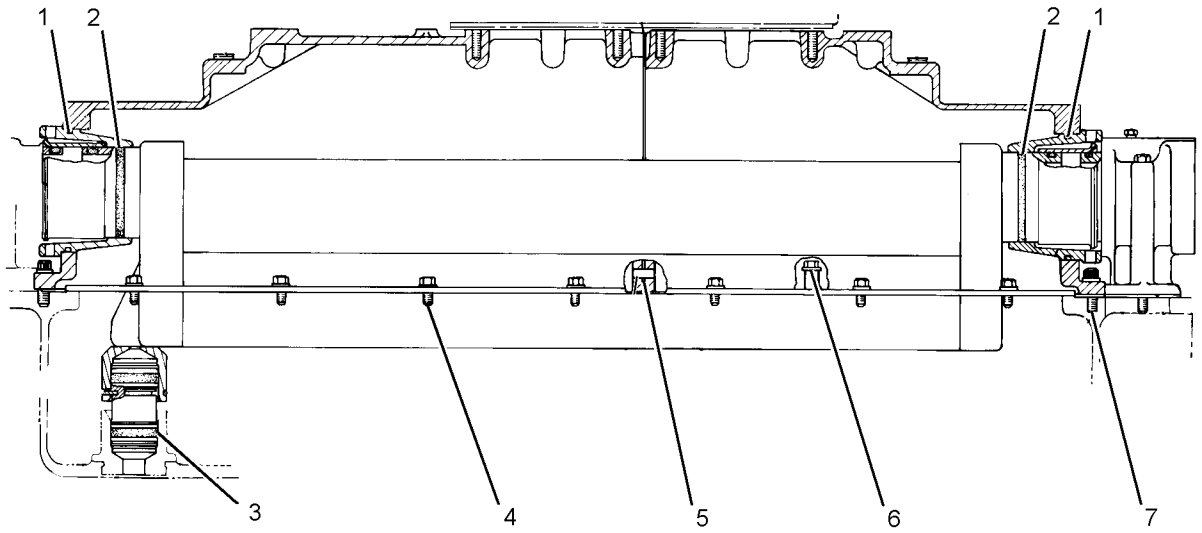

Illustration 15 g03053476
Right side view

Table 8

Specification for 7N-8722 Water Aftercooler Gp			
Item	**Qty**	**Part**	**Specification Description**
1	2	7M-9909 O-Ring Seal	Before assembly, lubricate the bore lightly with glycerin.
2	6	6V-1454 O-Ring Seal	Before assembly, lubricate the bore lightly with glycerin.
3	2	8C-5209 O-Ring Seal	Before assembly, lubricate the bore lightly with glycerin.
4	14	031-4630 Locking Bolt	Torque to 32 ± 7 N·m (283 ± 62 lb in).
5	-	-	Apply Loctite RTV Silicone Clear to the mating surfaces of the housing.
6	28	0L-1143 Bolt	Torque to 55 ± 7 N·m (41 ± 5 lb ft).
7	4	1T-0720 Bolt	Torque to 55 ± 7 N·m (41 ± 5 lb ft).

i04900995

Aftercooler

SMCS Code: 1063

Part No.: 1W-9466
S/N: 50Y1–Up

Part No.: 1W-9466
S/N: 96Y1–Up

Part No.: 1W-9466
S/N: 29Z1–Up

Part No.: 1W-9466
S/N: 66Z1–Up

Part No.: 1W-9466
S/N: 69Z1–Up

Part No.: 1W-9466
S/N: 72Z1–Up

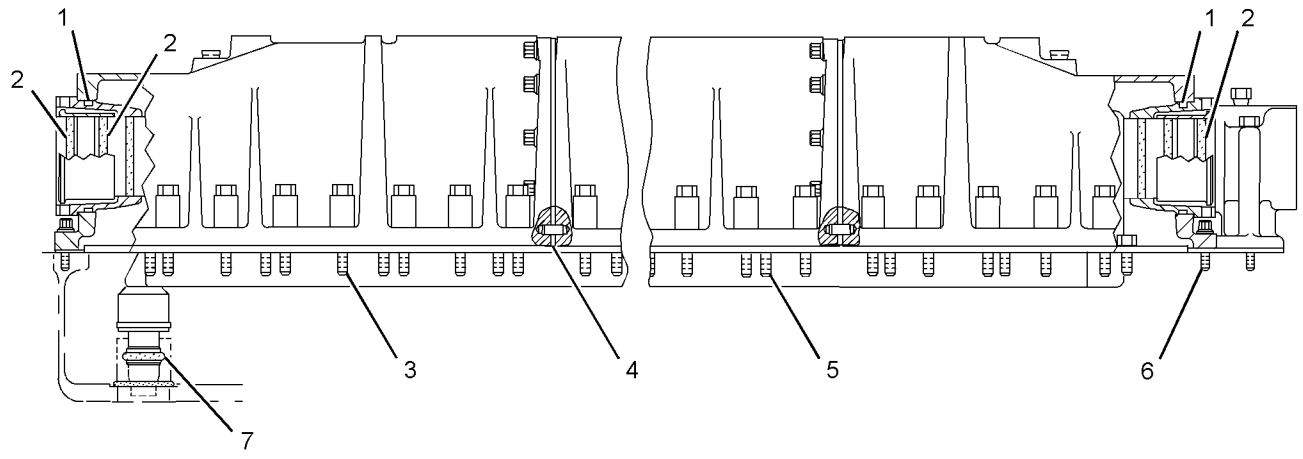

Illustration 16 g03053741

Table 9

Specification for 1W-9466 Water Aftercooler Gp			
Item	**Qty**	**Part**	**Specification Description**
1	2	7M-9909 O-Ring Seal	Before assembly, lubricate the bore lightly with glycerin.
2	6	6V-1454 O-Ring Seal	Before assembly, lubricate the bore lightly with glycerin.
3	44	0L-1143 Bolt	Torque to 55 ± 7 N·m (41 ± 5 lb ft).
4	-	-	Apply Loctite RTV Silicone Clear to the mating surfaces of the housing.
5	22	031-4630 Locking Bolt	Torque to 32 ± 7 N·m (283 ± 62 lb in).
6	4	1T-0720 Bolt	Torque to 55 ± 7 N·m (41 ± 5 lb ft).
7	2	8C-5209 O-Ring Seal	Before assembly, lubricate the bore lightly with glycerin.

i04904102

Aftercooler

SMCS Code: 1063

Part No.: 8N-0358
S/N: 29Z1–Up

Part No.: 8N-0358
S/N: 72Z1–Up

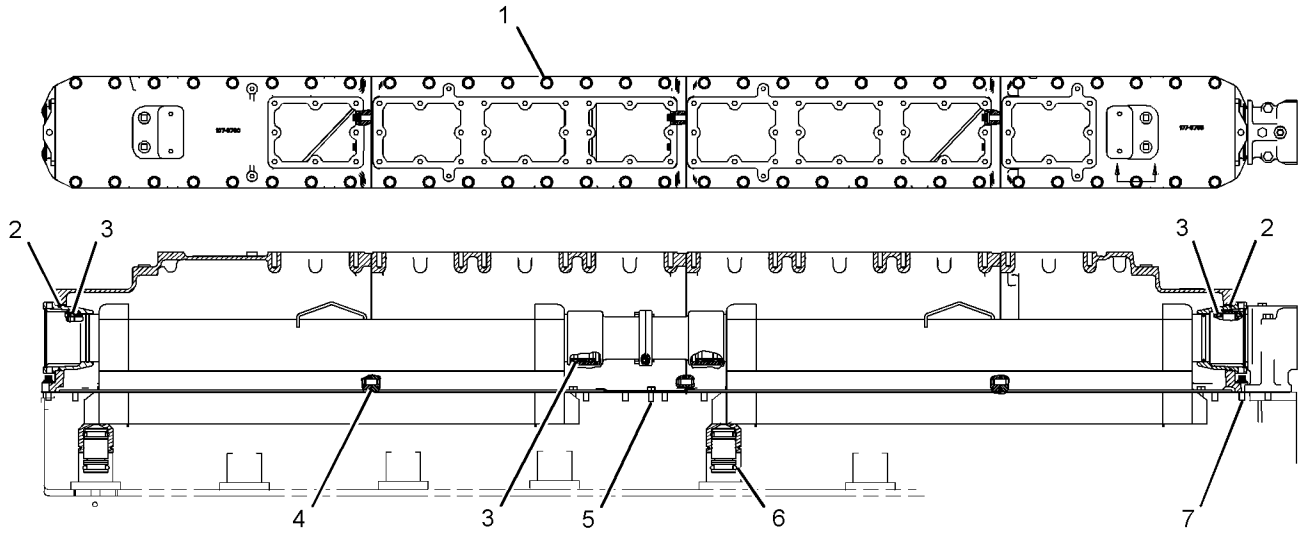

Illustration 17 g03059617

Table 10

Specification for 8N-0358 Water Aftercooler Gp and 380-1710 Water Aftercooler Gp			
Item	**Qty**	**Part**	**Specification Description**
1	60	0L-1143 Bolt	Torque to 55 ± 7 N·m (41 ± 5 lb ft).
2	2	7M-9909 O-Ring Seal	Before assembly, lubricate the bore lightly with glycerin.
3	10	6V-1454 O-Ring Seal	Before assembly, lubricate the bore lightly with glycerin.
4	-	-	Apply Loctite RTV Silicone Clear to the mating surfaces of the housing.
5	30	031-4630 Locking Bolt	Torque to 32 ± 7 N·m (283 ± 62 lb in).
6	4	8C-5209 O-Ring Seal	Before assembly, lubricate the bore lightly with glycerin.
7	4	1T-0720 Bolt	Torque to 55 ± 7 N·m (41 ± 5 lb ft).

i01352368

Camshaft

SMCS Code: 1210

Part No.: 7E-9484
S/N: 4MJ1–Up

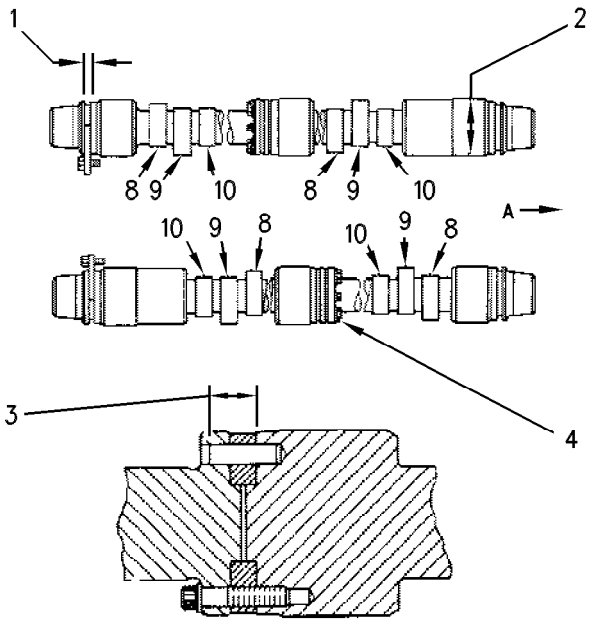

Illustration 18 g00295230

Typical example

(A) Direction toward the front of the engine.

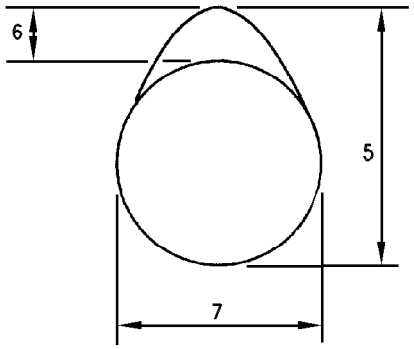

Illustration 19 g00295231

(1) 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))

(2) Journal surface

Diameter of surface (journals) for new camshaft bearings . . . . . 85.88 ± 0.02 mm ((3.381 ± 0.001 inch))

Bore in bearings for camshafts after assembly . . . . . 86.00 ± 0.06 mm ((3.386 ± 0.002 inch))

(3) 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))

(4) 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 procedure that follows:

1. Measure camshaft lobe height (5).

2. Measure base circle (7).

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 (6)

Inlet lobe (8) . . . . . 9.314 mm ((0.3667 inch))

Injector lobe (9) . . . . . 13.731 mm ((0.5406 inch))

Exhaust lobe (10) . . . . . 9.078 mm ((0.3574 inch))

i01463993

Camshaft

SMCS Code: 1210

Part No.: 7E-9484
S/N: 4MJ1–Up

Part No.: 4W-1774
S/N: 66Z1–Up

Part No.: 2W-8879
S/N: 69Z1–Up

Part No.: 4W-0474
S/N: 72Z1–Up

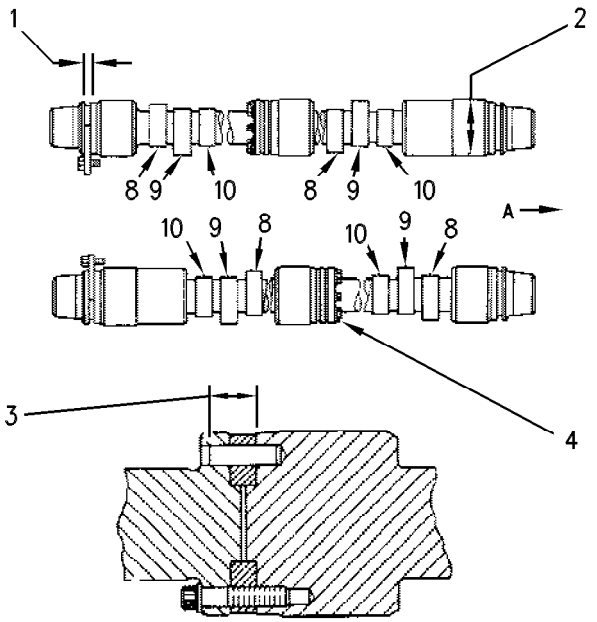

Illustration 20 g00295230

Typical example

(A) Direction toward the front of the engine.

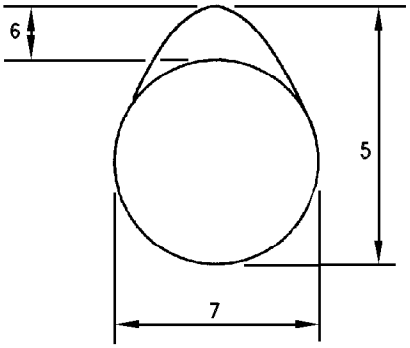

Illustration 21 g00295231

(1) 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))

(2) Journal surface

Diameter of surface (journals) for new camshaft bearings . . . . . 85.88 ± 0.02 mm ((3.381 ± 0.001 inch))
Bore in bearings for camshafts after assembly . . . . . 86.00 ± 0.06 mm ((3.386 ± 0.002 inch))

(3) 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))

(4) 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 procedure that follows:

1. Measure camshaft lobe height (5).

2. Measure base circle (7).

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 (6)

Inlet lobe (8) . . . . . 9.314 mm ((0.3667 inch))

Injector lobe (9) . . . . . 13.574 mm ((0.5344 inch))

Exhaust lobe (10) . . . . . 9.078 mm ((0.3574 inch))

i04929836

Camshaft

SMCS Code: 1210

Part No.: 7W-1255
S/N: 50Y1–Up

Part No.: 7W-1259
S/N: 29Z1–Up

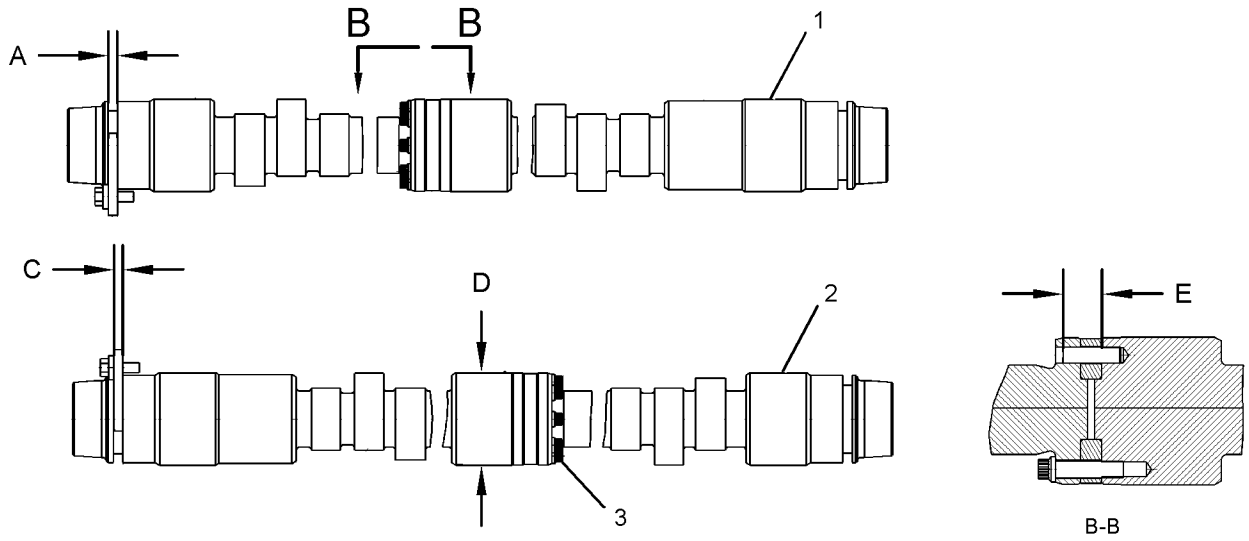

Illustration 22 g03098979

(1) Left-hand camshaft assembly (2) Right-hand camshaft assembly

Table 11

Specification for 7W-1255 Camshaft Gp, 7W-1259 Camshaft Gp, 381-1939 Camshaft Gp, and 382-9238 Camshaft Gp			
Item	**Qty**	**Part**	**Specification Description**
A	-	-	Thickness of the groove in a new camshaft assembly is 8.75 ± 0.05 mm (0.344 ± 0.002 inch).
C	2	7N-3218 Thrust Washer	Thickness of a new thrust washer is 8.50 ± 0.05 mm (0.335 ± 0.002 inch).
D	-	-	Diameter of bearing journals in a new journal camshaft assembly is 85.88 ± 0.02 mm (3.381 ± 0.001 inch).
			Bore in camshaft bearing after installation is 86.00 ± 0.06 mm (3.386 ± 0.002 inch).
-	-	-	End play for a new camshaft assembly is 0.15 to 0.35 mm (0.006 to 0.014 inch).
3	16	5P-0076 Bolt	Torque to 55 ± 7 N·m (41 ± 5 lb ft).
E	2	4N-1650 Dowel	Extension of the dowel is 22.0 ± 0.5 mm (0.87 ± 0.02 inch).

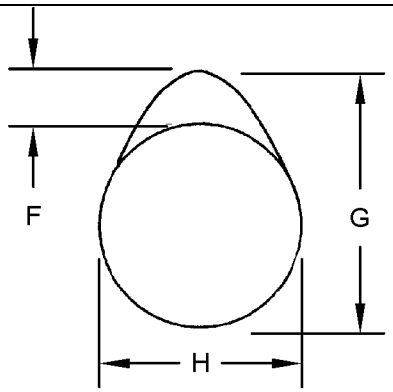

Illustration 23 g03098977

Table 12

Item	Qty	Part	Specification Description
-	-	-	Use the following procedure in order to determine the camshaft lobe lift:
			1. Measure camshaft lobe height (G).
			2. Measure base circle (H).
			3. Subtract the base circle (H) from the camshaft lobe height (G). The difference is the actual camshaft lobe lift.
F	-	-	Specified camshaft lobe lift:
			Inlet lobe is 9.314 mm (0.3667 inch).
			Injector lobe is 13.731 mm (0.5406 inch).
			Exhaust lobe is 9.078 mm (0.3574 inch).

i04929855

Camshaft

SMCS Code: 1210

Part No.: 7W-1256
S/N: 96Y1–Up

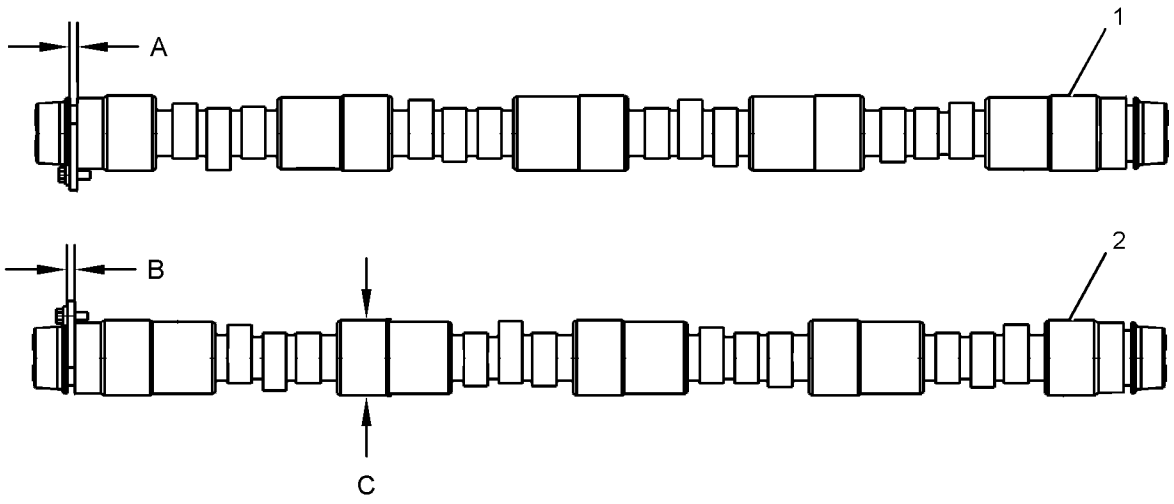

Illustration 24 g03099021

(1) Left-hand camshaft assembly (2) Right-hand camshaft assembly

Table 13

Specification for 7W-1256 Camshaft Gp			
Item	**Qty**	**Part**	**Specification Description**
A	-	-	Thickness of the groove in a new camshaft assembly is 8.75 ± 0.05 mm (0.344 ± 0.002 inch).
B	2	7N-3218 Thrust Washer	Thickness of a new thrust washer is 8.50 ± 0.05 mm (0.335 ± 0.002 inch).
C	-	-	Diameter of bearing journals in a new camshaft assembly is 85.88 ± 0.02 mm (3.381 ± 0.001 inch).
			Bore in camshaft bearing after installation is 86.00 ± 0.06 mm (3.386 ± 0.002 inch).
-	-	-	End play for a new camshaft assembly is 0.15 to 0.35 mm (0.006 to 0.014 inch).

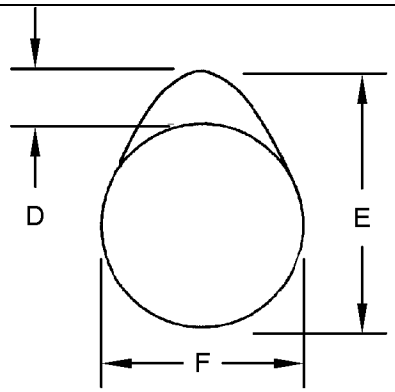

Illustration 25 g03099022

Table 14

Specification for 7W-1256 Camshaft Gp			
Item	**Qty**	**Part**	**Specification Description**
-	-	-	Use the following procedure in order to determine the camshaft lobe lift:
			1. Measure camshaft lobe height (E).
			2. Measure base circle (F).
			3. Subtract the base circle (F) from the camshaft lobe height (E). The difference is the actual camshaft lobe lift.
D	-	-	Specified camshaft lobe lift:
			Inlet lobe is 9.314 mm (0.3667 inch).
			Injector lobe is 13.731 mm (0.5406 inch).
			Exhaust lobe is 9.078 mm (0.3574 inch).

i02890343

Camshaft Bearing Position

SMCS Code: 1211

Part No.: 7C-8147
S/N: 4MJ1–Up

Part No.: 237-7959
S/N: 96Y1–Up

Part No.: 237-7959
S/N: 69Z1–Up

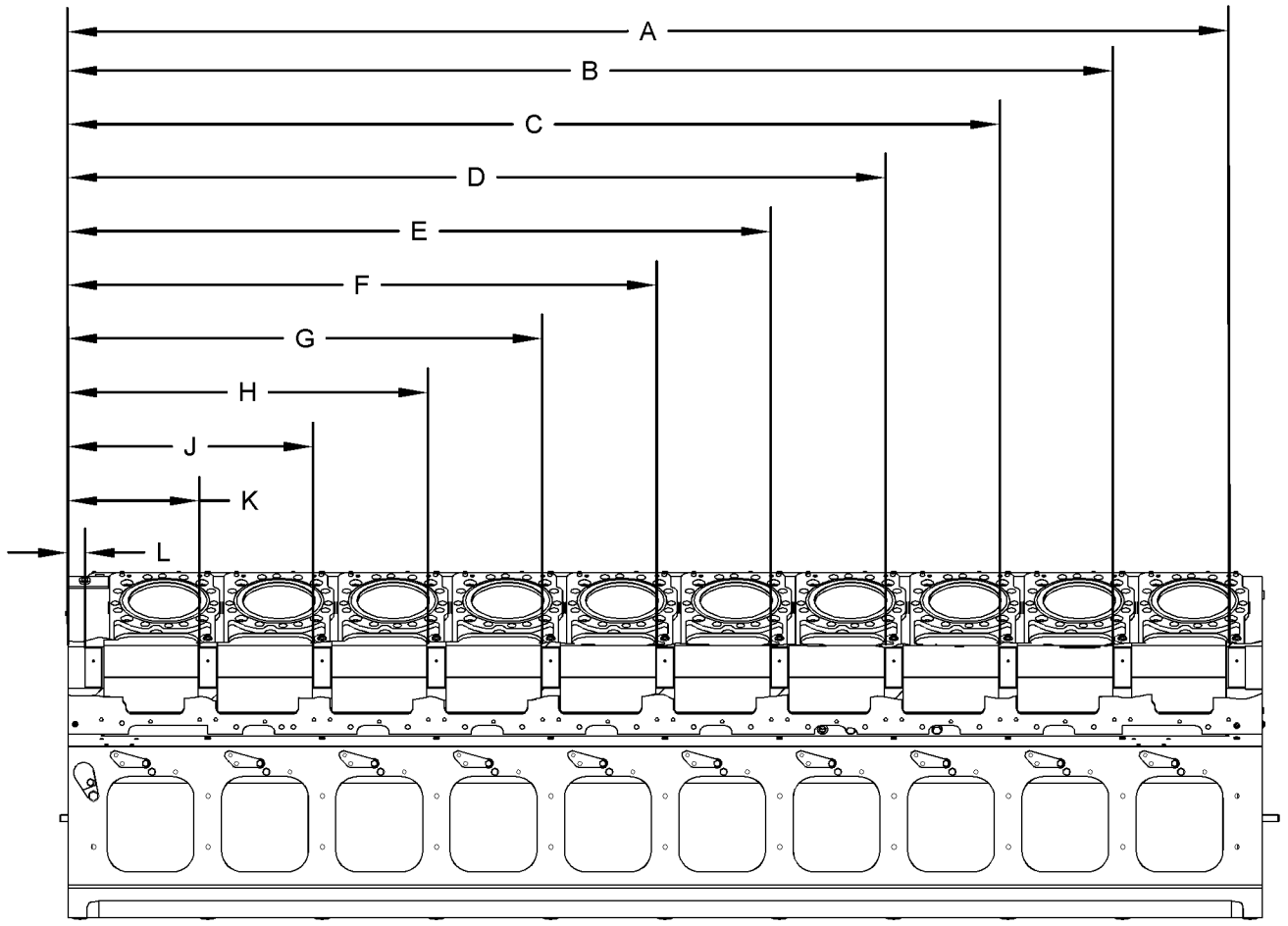

Illustration 26 g01439280
Right side view

The dimensions for installing the camshaft bearings are from the rear face of the cylinder block.

For engines that have 8 cylinders, use dimensions (L), (K), (J), (H), and (G).

For engines that have 12 cylinders, use dimensions (L), (K), (J), (H), (G), (F), and (E).

For engines that have 16 cylinders, use dimensions (L), (K), (J), (H), (G), (F), (E), (D) and (C).

For engines that have 20 cylinders, use all of the dimensions.

Note: The oil holes must be aligned at the correct angle when the bearings are installed. Refer to Specifications, “Cylinder Block” for the correct angle.

Dimensions

(A) . . . . . 2740.0 ± 1.5 mm ((107.87 ± 0.06 inch))
(B) . . . . . 2470.0 ± 1.5 mm ((97.24 ± 0.06 inch))
(C) . . . . . 2200.0 ± 1.5 mm ((86.61 ± 0.06 inch))
(D) . . . . . 1930.0 ± 1.5 mm ((75.98 ± 0.06 inch))
(E) . . . . . 1660.0 ± 1.5 mm ((65.35 ± 0.06 inch))
(F) . . . . . 1390.0 ± 1.5 mm ((54.72 ± 0.06 inch))
(G) . . . . . 1120.0 ± 1.5 mm ((44.09 ± 0.06 inch))
(H) . . . . . 850.0 ± 1.5 mm ((33.46 ± 0.06 inch))
(J) . . . . . 580.0 ± 1.5 mm ((22.83 ± 0.06 inch))
(K) . . . . . 310.0 ± 1.5 mm ((12.20 ± 0.06 inch))
(L) . . . . . 40.0 ± 1.5 mm ((1.57 ± 0.06 inch))

i05319600

Camshaft Bearing Position

SMCS Code: 1211

Part No.: 240-6650
S/N: 66Z1–Up

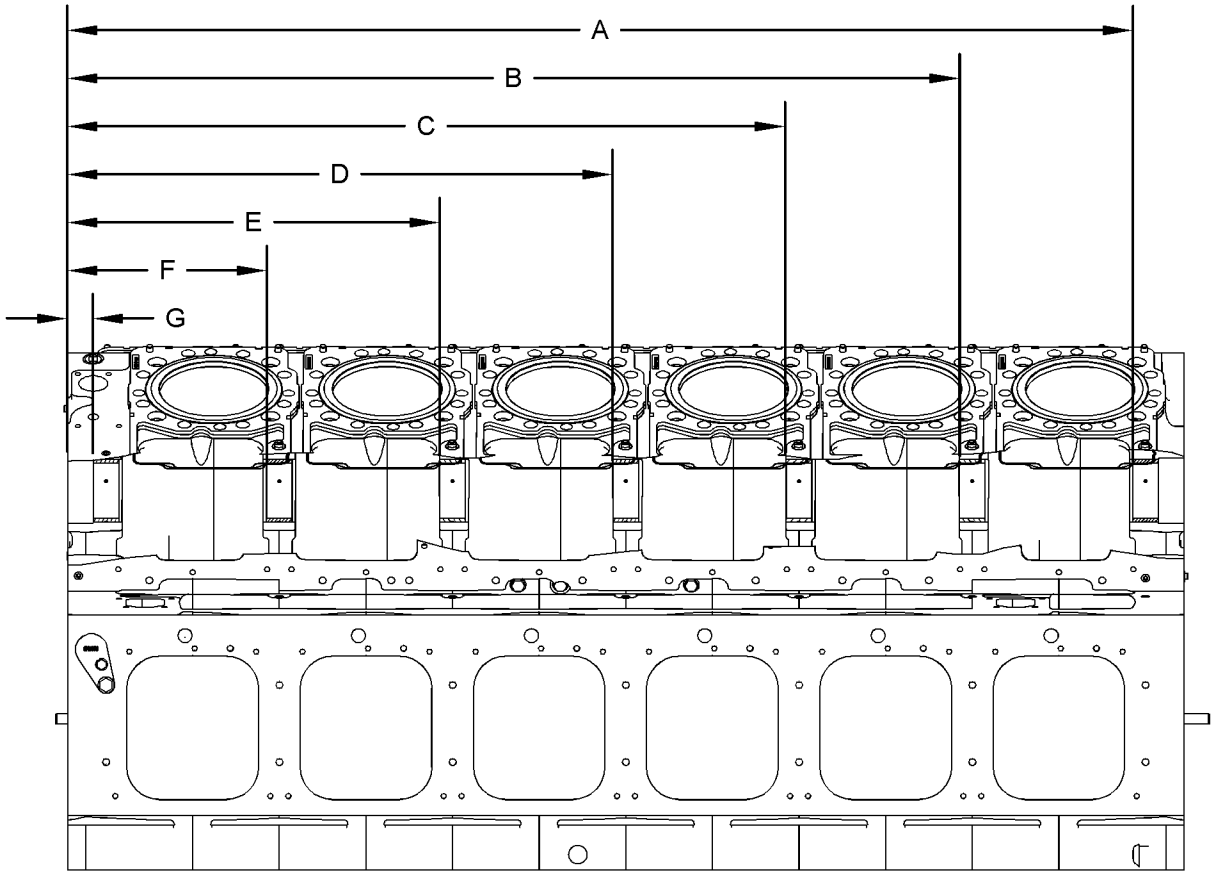

Illustration 27 g03061736
Right side view

Table 15

Specification for 240-6650 Cylinder Block Gp and 373-2260 Cylinder Block Gp			
Item	**Qty**	**Part**	**Specification Description**
The camshaft bearings from the rear surface of the cylinder block are the following dimensions:			
The oil holes must be aligned at the correct angle when the bearings are installed. Refer to Specifications, “Cylinder Block” for the correct angle.			
A	-	-	Distance from rear face of cylinder block is 1660.0 ± 1.5 mm (65.35 ± 0.06 inch).
B	-	-	Distance from rear face of cylinder block is 1390.0 ± 1.5 mm (54.72 ± 0.06 inch).

(continued)

(Table 15, contd)

C	-	-	Distance from rear face of cylinder block is 1120.0 ± 1.5 mm (44.09 ± 0.06 inch).
D	-	-	Distance from rear face of cylinder block is 850.0 ± 1.5 mm (33.46 ± 0.06 inch).
E	-	-	Distance from rear face of cylinder block is 580.0 ± 1.5 mm (22.83 ± 0.06 inch).
F	-	-	Distance from rear face of cylinder block is 310.0 ± 1.5 mm (12.20 ± 0.06 inch).
G	-	-	Distance from rear face of cylinder block is 40.0 ± 1.5 mm (1.58 ± 0.06 inch).

i06177829

Camshaft Bearing Position

SMCS Code: 1211

Part No.: 240-6652
S/N: 29Z1–Up

Part No.: 240-6652
S/N: 72Z1–Up

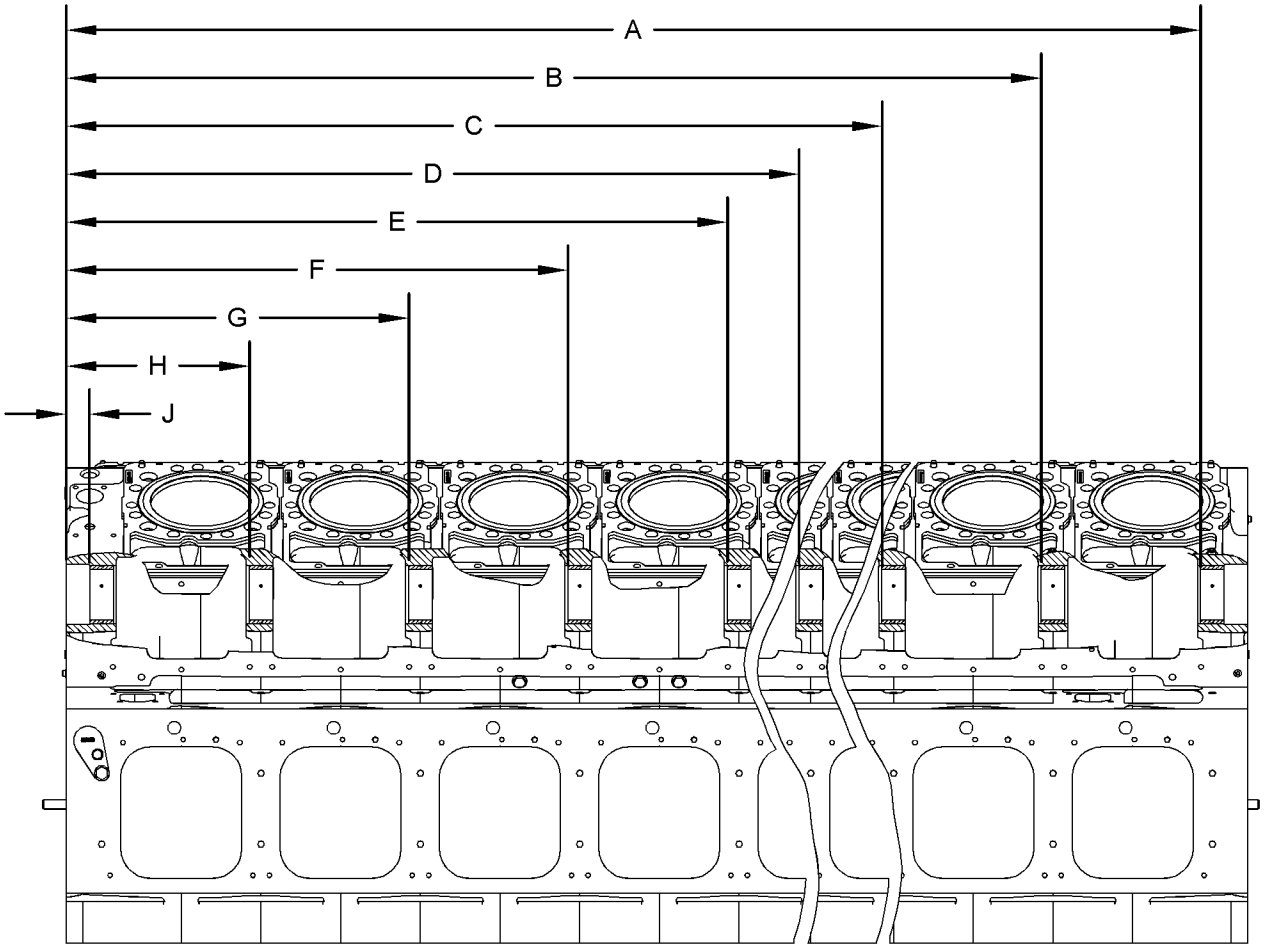

Illustration 28 g03061837

Table 16

Specification for 240-6652 Cylinder Block Gp, 383-2090 Cylinder Block Gp(1), and 383-7226 Cylinder Block Gp			
Item	**Qty**	**Part**	**Specification Description**
The camshaft bearings from the front surface of the cylinder block are the following dimensions:			
The oil holes must be aligned at the correct angle when the bearings are installed. Refer to Specifications, “Cylinder Block” for the correct angle.			
A	-	-	Distance from front face of cylinder block is 2200.0 ± 1.5 mm (86.61 ± 0.06 inch).

(continued)

(Table 16, contd)

Specification for 240-6652 Cylinder Block Gp, 383-2090 Cylinder Block Gp(1), and 383-7226 Cylinder Block Gp			
Item	**Qty**	**Part**	**Specification Description**
B	-	-	Distance from front face of cylinder block is 1930.0 ± 1.5 mm (75.98 ± 0.06 inch).
C	-	-	Distance from front face of cylinder block is 1660.0 ± 1.5 mm (65.35 ± 0.06 inch).
D	-	-	Distance from front face of cylinder block is 1390.0 ± 1.5 mm (54.72 ± 0.06 inch).
E	-	-	Distance from front face of cylinder block is 1120.0 ± 1.5 mm (44.09 ± 0.06 inch).
F	-	-	Distance from front face of cylinder block is 850.0 ± 1.5 mm (33.46 ± 0.06 inch).
G	-	-	Distance from front face of cylinder block is 580.0 ± 1.5 mm (22.83 ± 0.06 inch).
H	-	-	Distance from front face of cylinder block is 310.0 ± 1.5 mm (12.20 ± 0.06 inch).
J	-	-	Distance from front face of cylinder block is 40.0 ± 1.5 mm (1.58 ± 0.06 inch).

(1) Callout (A) and callout (B) not applicable for 12 cylinder engine.

i05089952

Valve Mechanism

SMCS Code: 1102

Part No.: 195-1926
S/N: 50Y1–Up

Part No.: 195-1926
S/N: 96Y1–Up

Part No.: 195-1926
S/N: 29Z1–Up

Part No.: 195-1926
S/N: 66Z1–Up

Part No.: 195-1926
S/N: 69Z1–Up

Part No.: 195-1926
S/N: 72Z1–Up

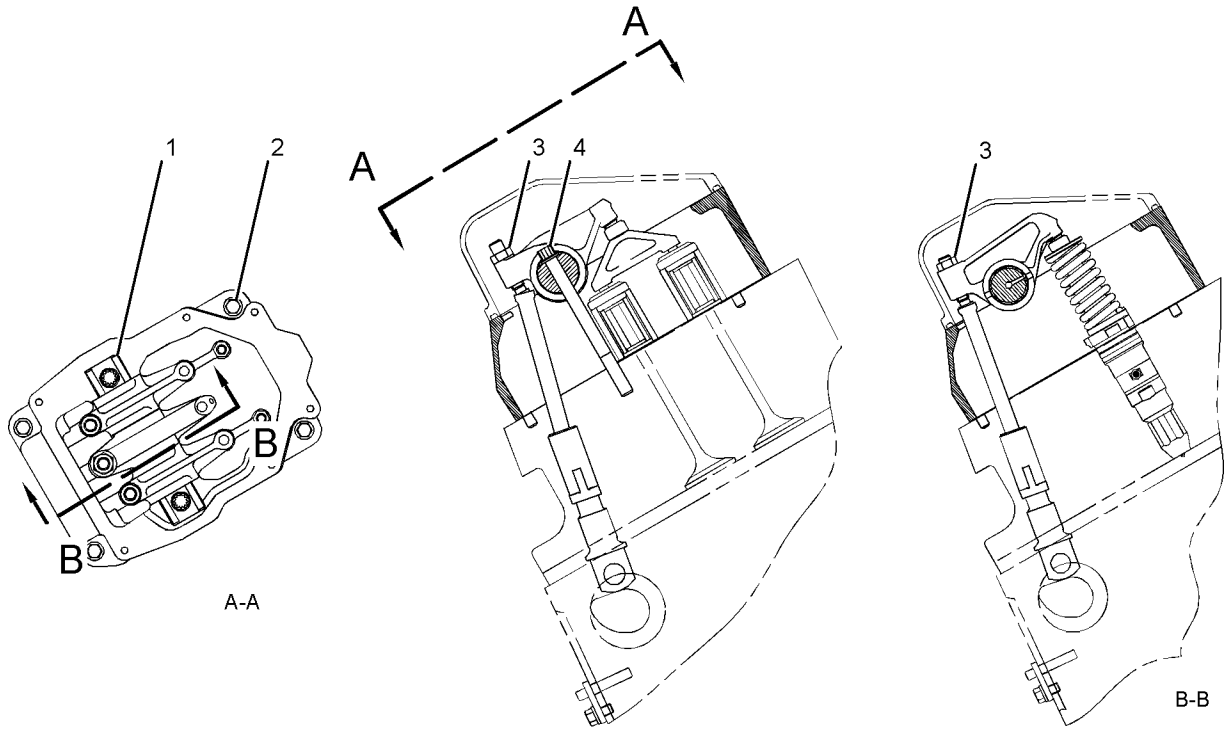

Illustration 29 g03063876

Table 17

Specification for 195-1926 Valve Mechanism Gp and 379-4834 Valve Mechanism Gp			
Item	**Qty**	**Part**	**Specification Description**
1	1	7C-2376 Rocker Arm Shaft	Diameter of the rocker arm shaft is 37.084 ± 0.013 mm (1.4600 ± 0.0005 inch).

(continued)

(Table 17, contd)

2	2	334 - 1626 Bolt	If the bolt is removed for service, apply black Loctite Gasket Maker #2 to the threads.
3	3	3J - 9196 Jam Nut	Torque to 70 ± 15 N·m (52 ± 11 lb ft).
4	2	8T - 7581 Bolt	Torque to 120 ± 20 N·m (89 ± 15 lb ft).
-	-	-	Inlet valve lash is 0.50 mm (0.020 inch).
-	-	-	Exhaust valve lash is 1.00 mm (0.040 inch).

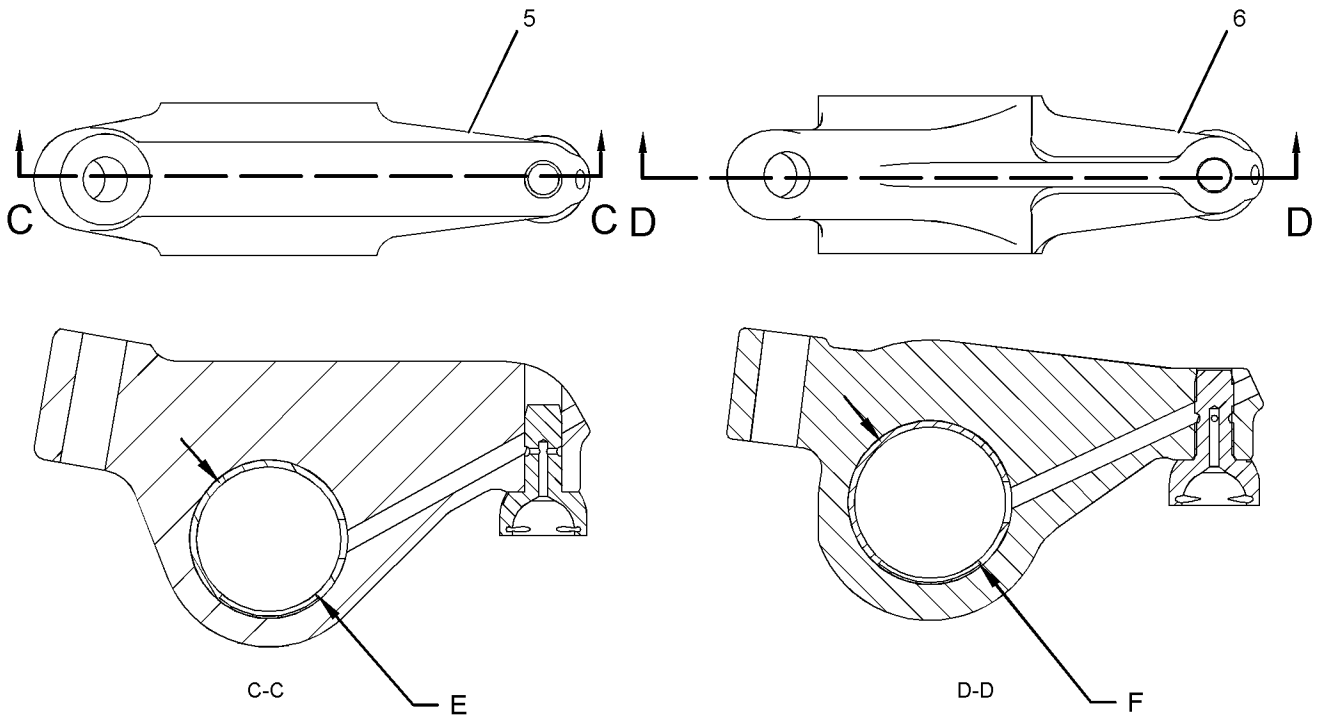

Illustration 30 g03063981

Table 18

Specification for 195 - 1926 Valve Mechanism Gp and 379 - 4834 Valve Mechanism Gp			
Item	**Qty**	**Part**	**Specification Description**
E	1	196 - 4795 Rocker Arm As	After installation, bore of the bushing in the injector rocker arm assembly (5) is 37.140 ± 0.015 mm (1.4622 ± 0.0006 inch).
F	2	9Y - 1741 Rocker Arm As	After installation, bore of the bushing in the injector rocker arm assembly (6) is 37.140 ± 0.015 mm (1.4622 ± 0.0006 inch).

i07942581

Valve Mechanism

SMCS Code: 1102

Part No.: 4W - 1035

Type 1

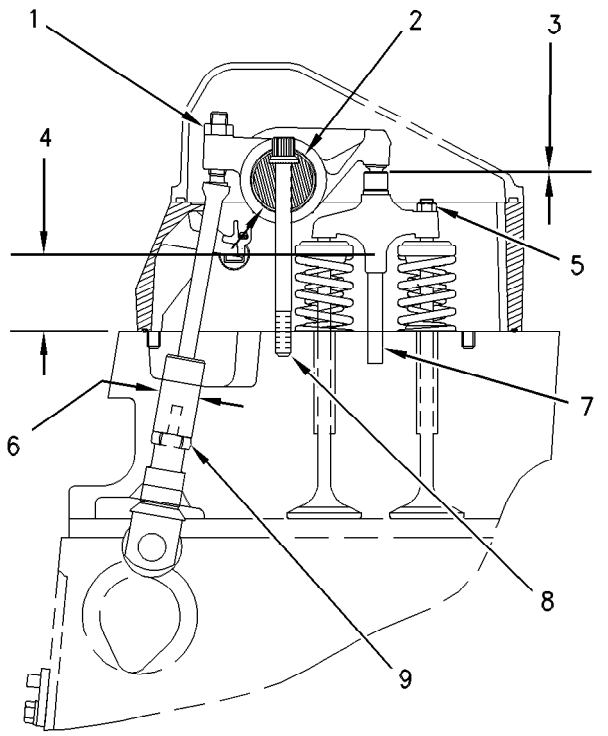

Illustration 31 g00111806

Typical example

(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 bearing is installed in the rocker arm the bearing must be machined to size.
. . . . 37.140 ± 0.015 mm ((1.4622 ± 0.0006 inch))
Maximum roughness average (Ra)
. . . . . 0.8 micrometer ((32 microinch))
Diameter of the rocker arm shaft
. . . . 37.084 ± 0.013 mm ((1.4600 ± 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) 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
. . . . 12.000 ± 0.250 mm ((0.4724 ± 0.0098 inch))
Bore in the head for the dowel
. . . . 10.968 ± 0.020 mm ((0.4318 ± 0.0008 inch))

(8) Mounting bolt

Torque . . . . . .120 ± 20 N·m ((90 ± 15 lb ft))

(9) Guide springs

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

Type 2

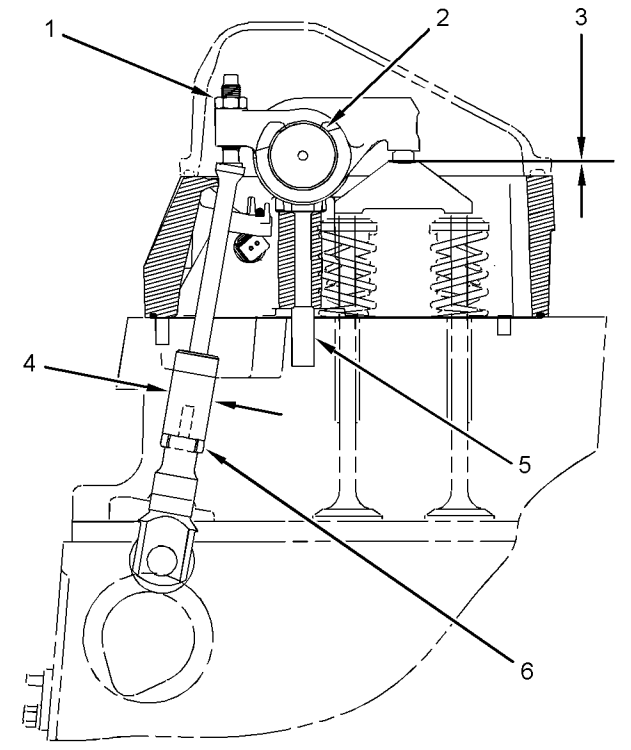

Illustration 32 g01172129

Typical example

(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 bearing is installed in the rocker arm the bearing must be machined to size.
. . . . 37.140 ± 0.015 mm ((1.4622 ± 0.0006 inch))
Maximum roughness average (Ra)
. . . . . 0.8 micrometer ((32 microinch))
Diameter of the rocker arm shaft
. . . . 37.084 ± 0.013 mm ((1.4600 ± 0.0005 inch))

(3) Valve lash

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

(4) 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) Mounting bolt

Torque . . . . . .120 ± 20 N·m ((90 ± 15 lb ft))

(6) Guide springs

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

i04905712

Cylinder Head

SMCS Code: 1100

Part No.: 4W-0095
S/N: 50Y1–Up

Part No.: 4W-0095
S/N: 96Y1–Up

Part No.: 4W-0095
S/N: 29Z1–Up

Part No.: 4W-0095
S/N: 66Z1–Up

Part No.: 4W-0095
S/N: 69Z1–Up

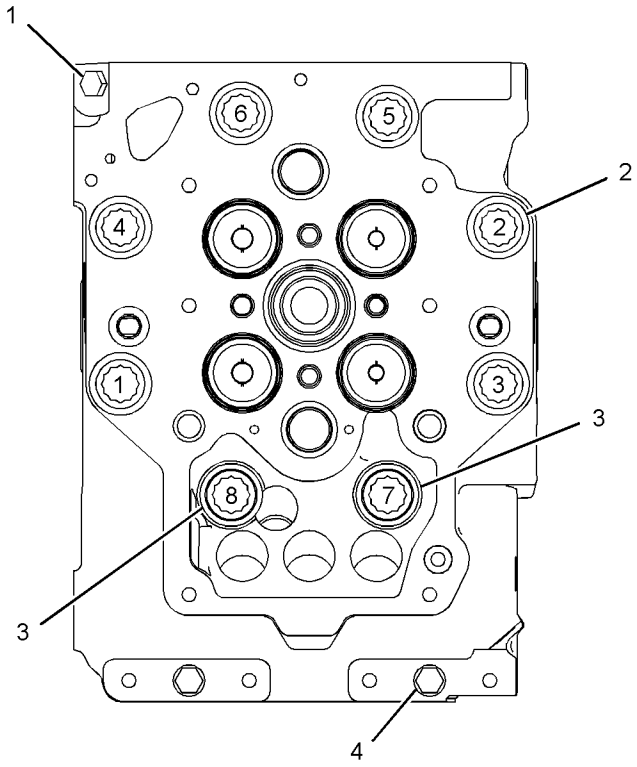

Illustration 33 g03066037

Table 19

Specification for 4W-0095 Cylinder Head Gp			
Item	**Qty**	**Part**	**Specification Description**
1	1	5B-7890 Pipe Plug	Before assembly, apply Loctite C5A Copper Anti-Seize to the threads.

(continued)

(Table 19, contd)

2	6	131 - 0420 Cylinder Head Fastener Gp	Before assembly, apply engine oil to cylinder head bolt threads. Use the following procedure in order to tighten the cylinder head bolts. Refer to Illustration 33 for the tightening sequence: 1. Tighten bolt (1) through bolt (8) in the numerical sequence to 30 ± 5 N·m (22 ± 4 lb ft). 2. Again tighten bolt (1) through bolt (8) in the numerical sequence to 270 ± 35 N·m (200 ± 26 lb ft). 3. Again tighten bolt (1) through bolt (8) in the numerical sequence to 450 ± 20 N·m (332 ± 15 lb ft). 4. Tighten two bolts (4) only after bolt 1 through bolt 8 have been given the final torque. Tighten two bolts (4) to 55 ± 10 N·m (41 ± 7 lb ft).
3	2	131 - 0421 Cylinder Head Fastener Gp	
4	2	5B - 0213 Bolt	

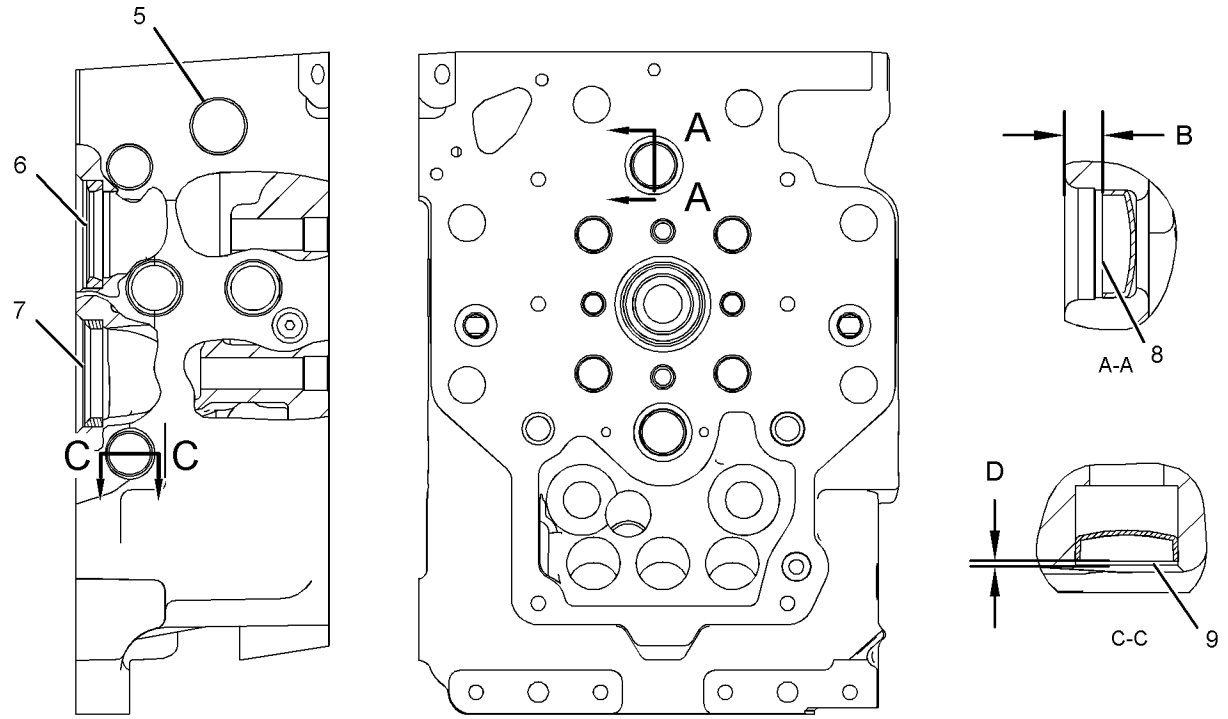

Illustration 34 g03066177

Table 20

Item	Qty	Part	Specification Description
5	5	3B - 0645 Cup Plug	Before assembly, apply high strength or high temperature anaerobic flange sealant to the bore.
6	2	130 - 2607 Valve Seat Insert	During installation, shrunk the valve seat insert and ress the insert into the cylinder heads counterbore.
7	2	130 - 2608 Valve Seat Insert	During installation, shrunk the valve seat insert and ress the insert into the cylinder heads counterbore.
8	2	3B - 0623 Cup Plug	Before assembly, apply high strength or high temperature anaerobic flange sealant to the bore. Installation depth (B) of the cup plugs from the top surface of the cylinder head is 9.0 ± 0.5 mm (0.35 ± 0.02 inch).
9	3	3B - 0623 Cup Plug	Before assembly, apply high strength or high temperature anaerobic flange sealant to the bore. Installation depth (D) is 1.0 ± 0.5 mm (0.04 ± 0.02 inch).

i04993350

Cylinder Head

SMCS Code: 1100

Part No.: 2W-5803, 8N-7173
S/N: 50Y1–Up

Part No.: 2W-1512, 2W-5803, 8N-7173
S/N: 96Y1–Up

Part No.: 2W-5803, 8N-7173
S/N: 29Z1–Up

Part No.: 2W-5803, 8N-7173
S/N: 66Z1–Up

Part No.: 2W-1512, 2W-5803, 8N-7173
S/N: 69Z1–Up

Part No.: 2W-5803, 7E-8758, 8N-7173
S/N: 72Z1–Up

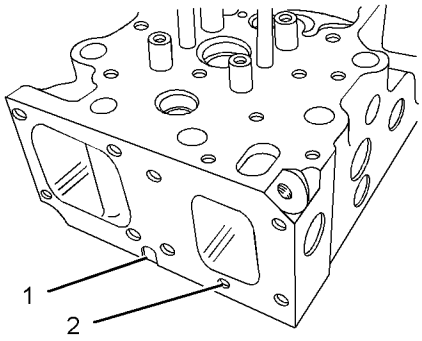

Illustration 35 g01429899

Typical example

(1) Locating pad

NOTICE
The pipe plug at location (2) is installed in the cylinder head for engines with dry exhaust manifolds. If the pipe plug is not installed into the water passage, the coolant will leak and engine damage will result. For engines with dry exhaust manifolds, make sure that the pipe plug is installed.

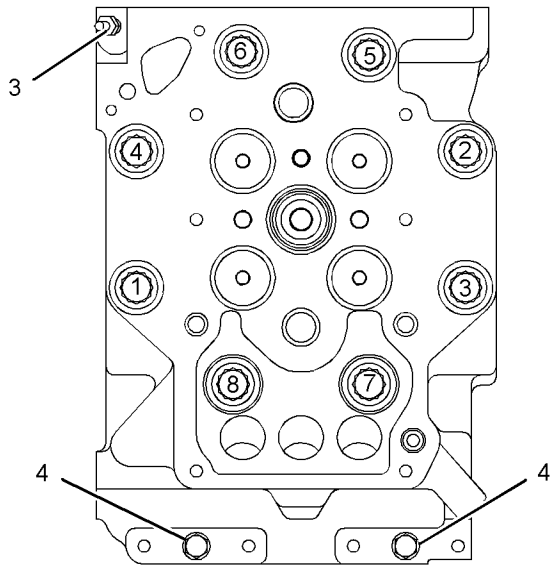

Illustration 36 g01611158

(3) Before assembly, lubricate the thread of the pipe plug with Loctite C5A Copper Anti-Seize.

Use the following procedure to tighten the bolts of the cylinder head that is shown in Illustration 36 :

Note: Before assembly, coat the threads of the bolt with clean engine oil.

1. Tighten the bolt 1 through bolt 8 in the numerical sequence to 30 ± 5 N·m (22 ± 4 lb ft).

2. Tighten the bolt 1 through bolt 8 in the numerical sequence to 270 ± 35 N·m (200 ± 26 lb ft).

3. Again tighten the bolt 1 through bolt 8 in the numerical sequence to 450 ± 20 N·m (330 ± 15 lb ft).

Note: Tighten the bolts (4) only after the cylinder head bolts have been given final torque.

(4) Torque for two bolts . . .55 ± 10 N·m ((41 ± 7 lb ft))

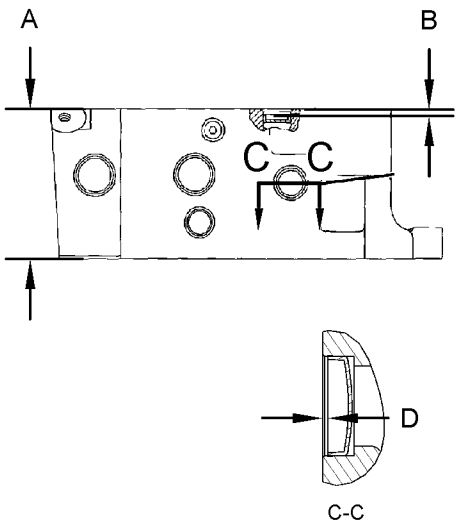

Illustration 37 g01413732
Typical example

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

Note: Before assembly, apply 6V-6640 Sealant to the bore of the cup plugs.

(B) Installation depth of the cup plugs from the top surface of the cylinder head . . . . . .9.0 ± 0.5 mm ((0.35 ± 0.02 inch))

(D) Installation depth of the cup plugs from the top surface of the cylinder head . . . . . .1.0 ± 0.5 mm ((0.04 ± 0.02 inch))

i07144469

Cylinder Head

SMCS Code: 1100

Part No.: 101-0830
S/N: 50Y1–Up

Part No.: 101-0830
S/N: 29Z1–Up

Part No.: 101-0830
S/N: 66Z1–Up

Part No.: 101-0830
S/N: 69Z1–Up

Part No.: 101-0830
S/N: 72Z1–Up

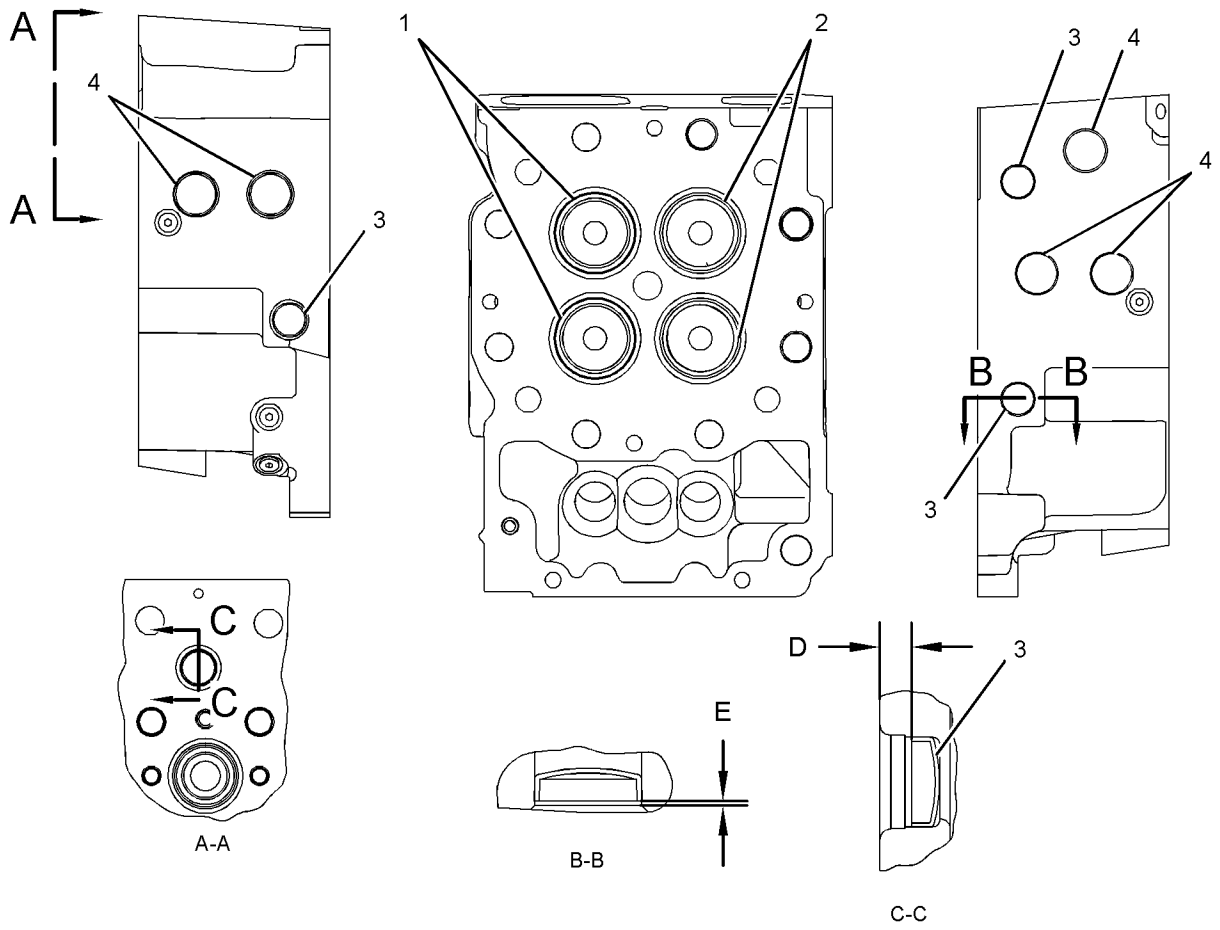

Illustration 38 g02823736

Table 21

Specification for 285 - 3086 Cylinder Head Gp, and 101 - 0830 Cylinder Head Gp			
Item	**Qty**	**Part**	**Specification Description**
1	2	130 - 2607 Valve Seat Insert	During installation, shrunk the valve seat insert with reduced temperature (Reference temperature : −60° C (−76° F)) and ress the insert into the cylinder heads counterbore.
2	2	130 - 2608 Valve Seat Insert	During installation, shrunk the valve seat insert with reduced temperature (Reference temperature : −60° C (−76° F)) and ress the insert into the cylinder heads counterbore.
3	5	3B - 0623 Cup Plug	Apply Loctite 11358 to the bores for the cup plugs prior to the installation.
4	5	3B - 0645 Cup Plug	Apply Loctite 11358 to the bores for the cup plugs prior to the installation.
D	-	-	Installation depth for cup plug is 9.0 ± 0.5 mm (0.35 ± 0.02 inch).
E	-	-	Installation depth for cup plug is 1.0 ± 0.5 mm (0.04 ± 0.02 inch).

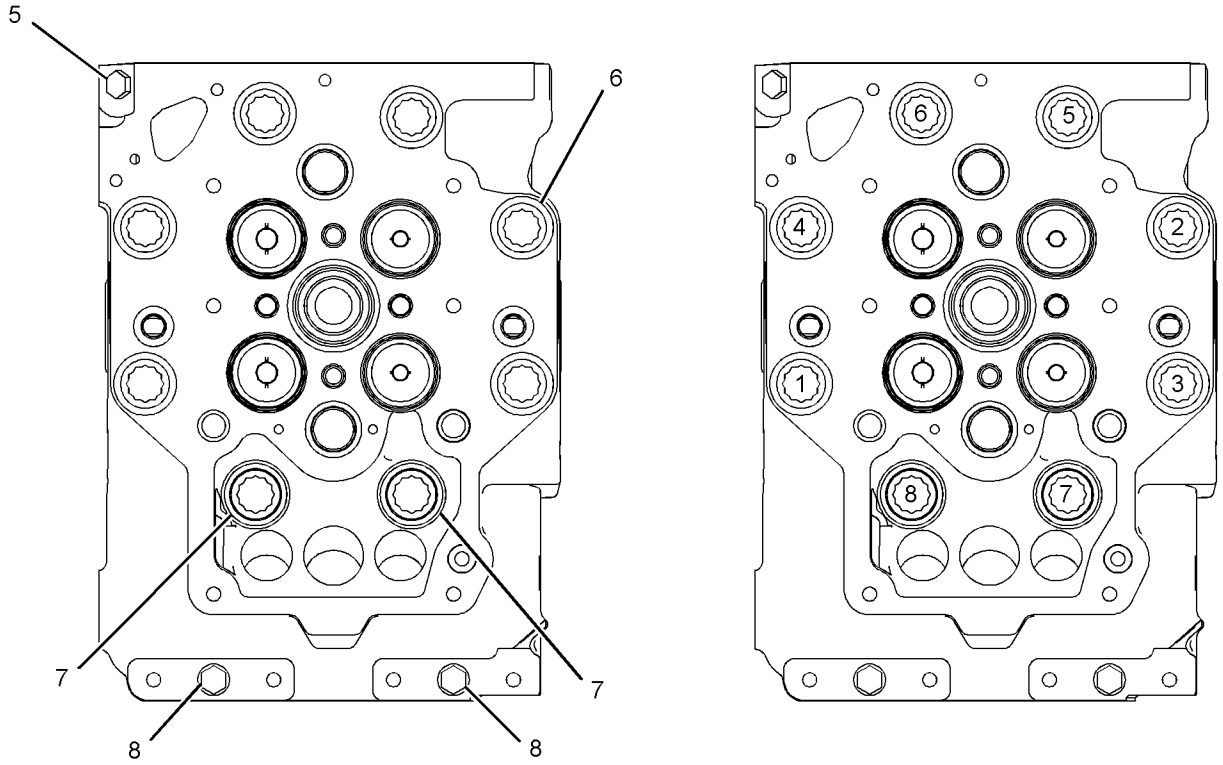

Illustration 39 g02823737

Table 22

Item	Qty	Part	Specification Description
5	1	5B-7890 Pipe Plug	Before assembly, lubricate the threads with Loctite C5A Copper Anti-Seize.
6	6	131-0420 Cylinder Head Fastener Gp	Use the following procedure to tighten the bolts for the cylinder head: 1. Before assembly, apply clean engine oil to the threads of the bolts. 2. Tighten bolt 1 through bolt 8 in the numerical sequence as shown in Illustration 39 to a torque of 30 ± 5 N·m (22 ± 4 lb ft). 3. Again, tighten bolt 1 through bolt 8 in the numerical sequence as shown in Illustration 39 to a torque of 200 ± 15 N·m (148 ± 11 lb ft). 4. Again, retighten bolt 1 through bolt 8 in the numerical sequence as shown in Illustration 39 to a torque of 200 ± 15 N·m (148 ± 11 lb ft). 5. Turn bolt 1 through bolt 8 in the numerical sequence to an angle of 180 ± 5 degrees as shown in Illustration 39 . 6. Tighten two bolts (8) only after bolt 1 through bolt 8 have been given the final torque. 7. Tighten two bolts (8) to 55 ± 10 N·m (41 ± 7 lb ft).
7	2	131-0421 Cylinder Head Fastener Gp	
8	2	5B-0213 Bolt	
-	-	362-8264 Cylinder Head Gasket	Refer to Disassembly and assembly manual for the alternate tightening procedure of cylinder head using Cylinder Head Gasket (MLS).

i07832543

Cylinder Head

SMCS Code: 1100

Part No.: 7E-8758
S/N: 4MJ1–Up

Part No.: 7E-8758
S/N: 96Y1–Up

Part No.: 7E-8758
S/N: 72Z1–Up

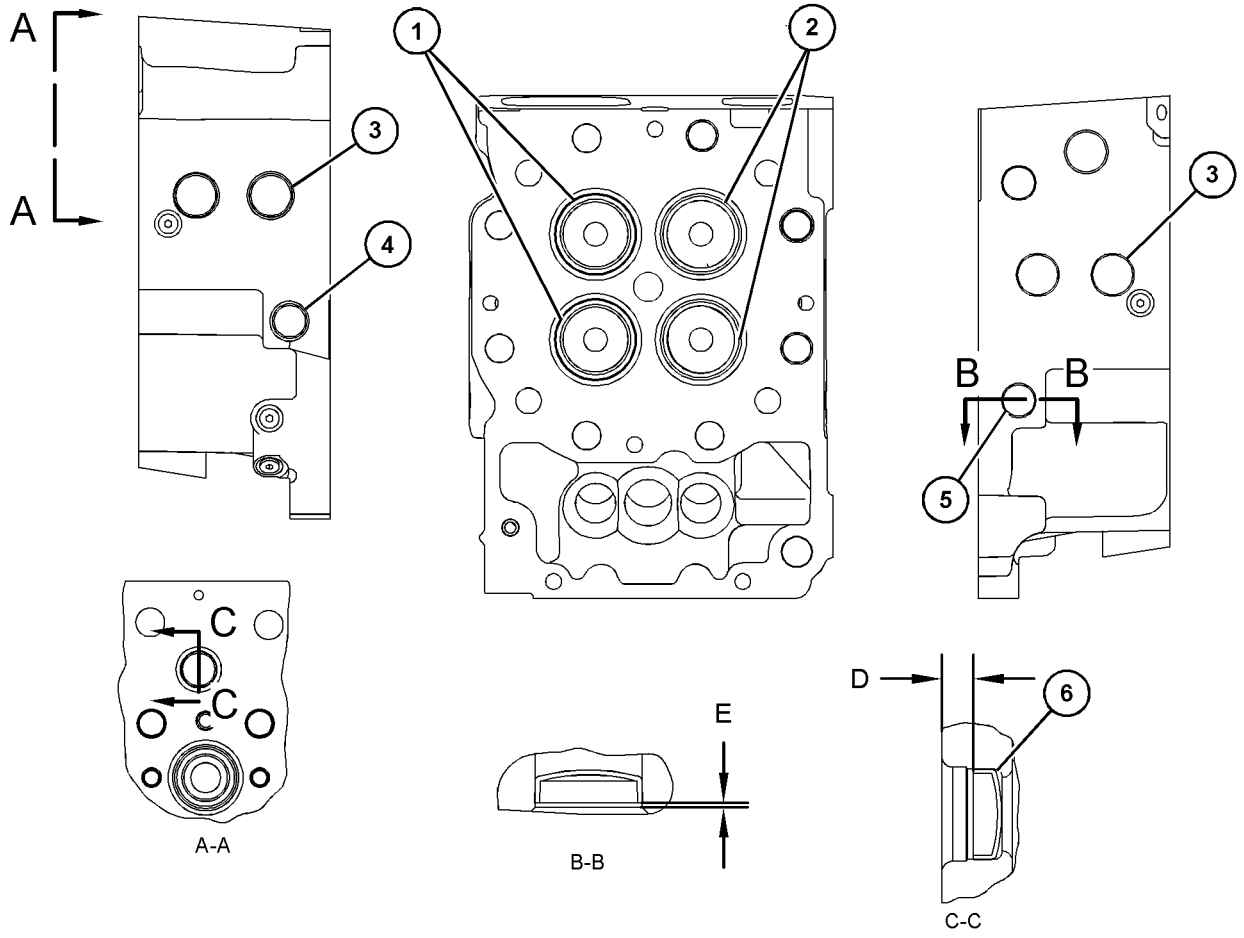

Illustration 40 g06341337

Table 23

Specifications for 7E-8758 Cylinder Head Gp, 203-2169 Cylinder Head Gp, 203-2170 Cylinder Head Gp, 242-5326 Cylinder Head As and 350-5202 Cylinder Head Gp			
Item	**Qty**	**Part**	**Specification Description**
1	2	130-2607 Valve Seat Insert	During installation, shrink the valve seat insert with reduced temperature (Reference temperature: −60° C (−76° F)) and press the insert into the cylinder head counterbore.
2	2	130-2608 Valve Seat Insert	During installation, shrink the valve seat insert with reduced temperature (Reference temperature: −60° C (−76° F)) and press the insert into the cylinder head counterbore.
3	5	3B-0645 Cup Plug	Before assembly, apply high strength or high temperature Anaerobic Flange sealant to the bores.
4	1	3B-0623 Cup Plug	Before assembly, apply high strength or high temperature Anaerobic Flange sealant to the bores.
5	2	3B-0623 Cup Plug	Before assembly, apply high strength or high temperature Anaerobic Flange sealant to the bores. Installation depth (E) is 1.0 ± 0.5 mm (0.04 ± 0.02 inch)
6	2	3B-0623 Cup Plug	Before assembly, apply high strength or high temperature Anaerobic Flange sealant to the bores. Installation depth (D) is 9.0 ± 0.5 mm (0.35 ± 0.02 inch)

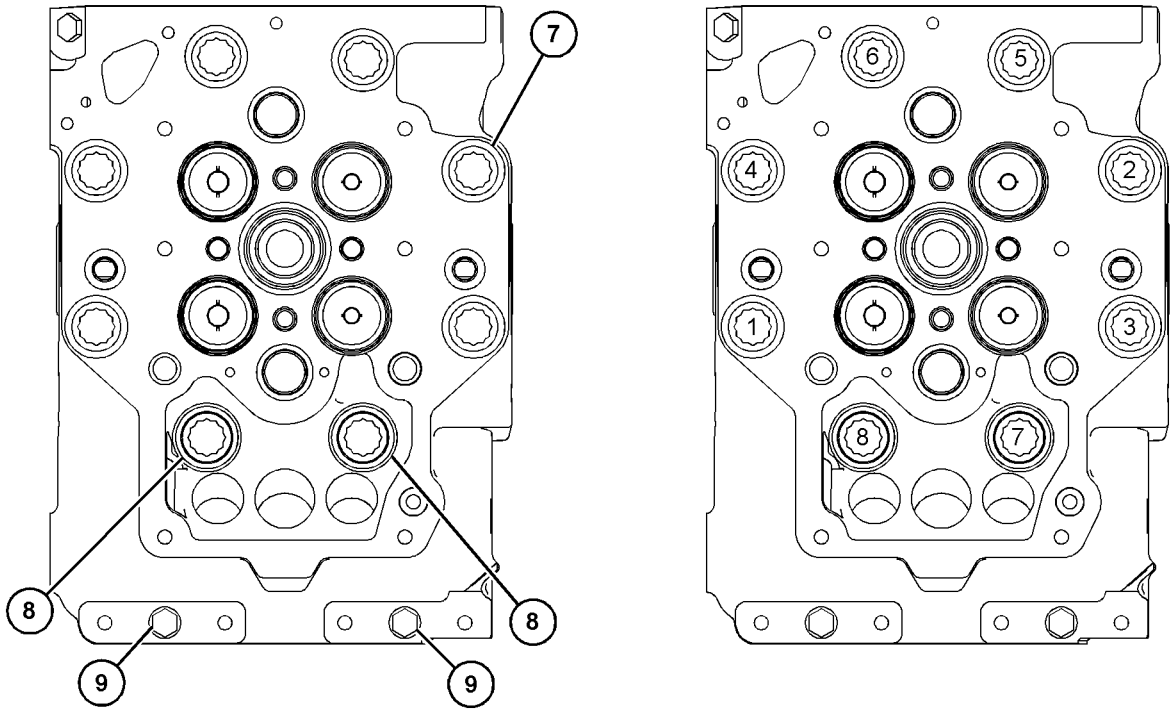

Illustration 41 g06341342

Table 24

Bolt Tightening Procedure with the 110-6991 Cylinder Head Gasket			
Item	**Qty**	**Part**	**Specification Description**
Note: Bolt Tightening Procedure with the 110-6991 Cylinder Head Gasket (Cellulose) and 110-6994 Spacer Plate (Aluminum) or 362-9677 Spacer Plate (Aluminum).			
7	6	131-0420 Cylinder Head Fastener Gp	Use the following procedure in order to tighten the bolts for the cylinder head: Refer to Illustration 41 for bolt tightening sequence. 1. Before assembly, apply clean engine oil to the bolt threads. 2. Tighten bolt 1 through 8 in the numerical sequence to 30 ± 5 N·m (22 ± 4 lb ft). 3. Again, retighten bolts 1 through 8 in the numerical sequence to 200 ± 15 N·m (148 ± 11 lb ft). 4. Again, retighten bolts 1 through 8 in numerical sequence to 200 ± 15 N·m (148 ± 11 lb ft). 5. Turn bolt 1 through 8 in numerical sequence to an angle of 180 ± 5 degrees. **Note: Tighten bolts 9 only after bolts 1 through 8 have been turned 180 ± 5 degrees.** 6. Tighten bolts (9) to 55 ± 10 N·m (41 ± 7 lb ft).
8	2	131-0421 Cylinder Head Fastener Gp	
9	2	5B-0213 Bolt	

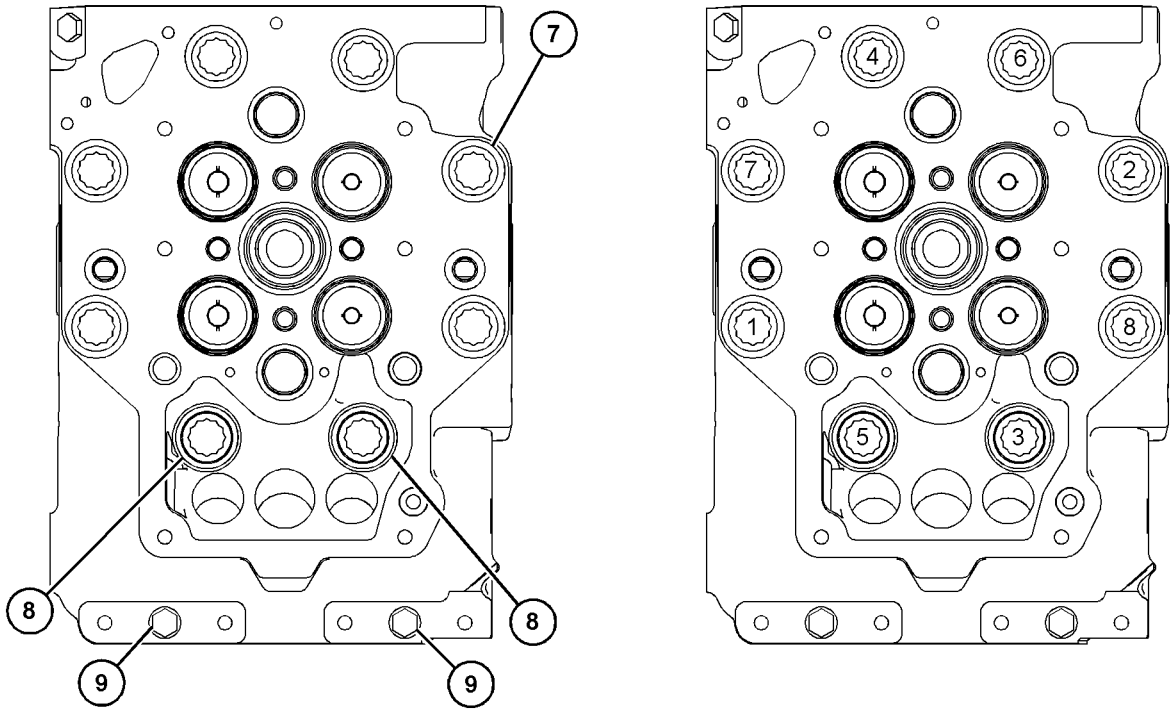

Illustration 42 g06341366

Table 25

Bolt Tightening Procedure with the 362-8264 Cylinder Head Gasket			
Item	**Qty**	**Part**	**Specification Description**
Note: Bolt Tightening Procedure with the 362-8264 Cylinder Head Gasket (MLS) and 519-7297 Spacer Plate (Iron). Note: Refer to Disassembly and assembly manual for the alternate tightening procedure of cylinder head using 362-8264 Cylinder Head Gasket (MLS) with 110-6994 Spacer Plate (Aluminum) or 362-9677 Spacer Plate (Aluminum).			
7	6	131-0420 Cylinder Head Fastener Gp	Use the following procedure in order to tighten the bolts for the cylinder head: Refer to Illustration 42 for bolt tightening sequence. 1. Before assembly, apply clean engine oil to the bolt threads. 2. Tighten bolt 1 through 8 in the numerical sequence to 30 ± 5 N·m (22 ± 4 lb ft). 3. Again, retighten bolts 1 through 8 in the numerical sequence to 145 ± 15 N·m (107 ± 11 lb ft). 4. Again, retighten bolts 1 through 8 in the numerical sequence to 145 ± 15 N·m (107 ± 11 lb ft). 5. Turn bolts 1 through 8 in the numerical sequence to an angle of 180 ± 5 degrees. **Note: Tighten bolts 9 only after bolts 1 through 8 have been given the final torque.** 7. Tighten bolts 9 to 55 ± 10 N·m (40 ± 7 lb ft).
8	2	131-0421 Cylinder Head Fastener Gp	
9	2	5B-0213 Bolt	

i01461317

Cylinder Head Valves

SMCS Code: 1105

Part No.: 172-0837
S/N: 4MJ1–Up

Part No.: 4W-0095
S/N: 50Y1–Up

Part No.: 4W-0095
S/N: 96Y1–Up

Part No.: 4W-0095
S/N: 29Z1–Up

Part No.: 4W-0095
S/N: 66Z1–Up

Part No.: 4W-0095
S/N: 69Z1–Up

Part No.: 172-0837
S/N: 72Z1–Up

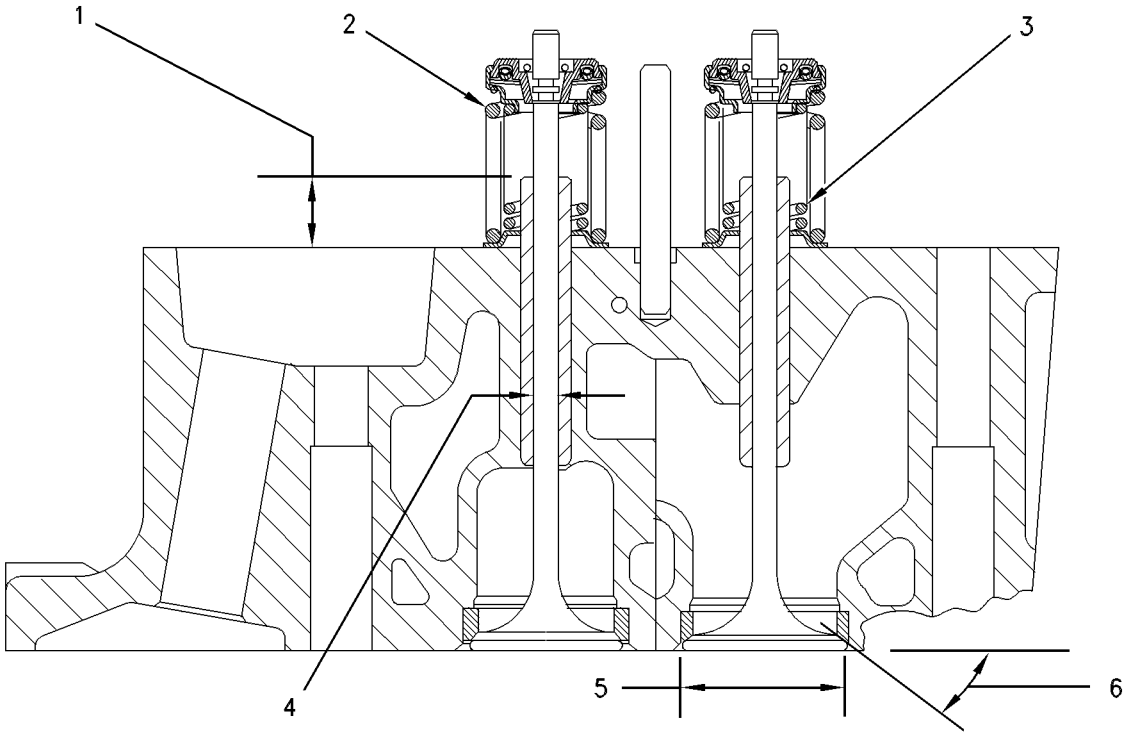

Illustration 43 g00114735

Typical example

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

(2) 7N-1904 Spring

Length under test force . . .56.4 mm ((2.22 inch))
Test force . . . . . 254 ± 25 N ((57.1 ± 5.6 lb))
Free length after test . . . . .62.5 mm ((2.46 inch))
Outside diameter . . . . . 43.96 mm ((1.731 inch))

(3) 7N-1903 Spring

Length under test force . . .45.5 mm ((1.79 inch))
Test force . . . . . .125 ± 12 N ((28 ± 2.7 lb))
Free length after test . . . . .51.5 mm ((2.03 inch))
Outside diameter . . . . . 29.24 mm ((1.151 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

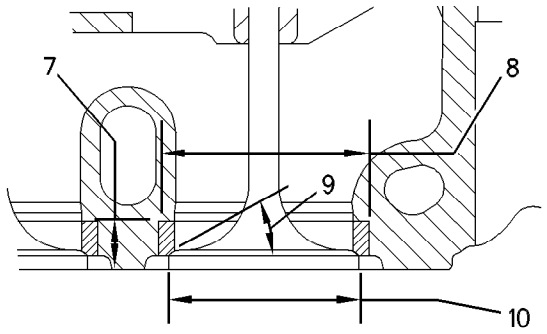

Illustration 44 g00122935
Typical example

(7) Depth of bore in head for valve seat inserts . . . . . 14.00 ± 0.15 mm ((0.551 ± 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))

i04351433

Cylinder Head Valves

SMCS Code: 1105

Part No.: 7E-8758
S/N: 4MJ1–Up

Part No.: 7E-8758
S/N: 72Z1–Up

Type 1

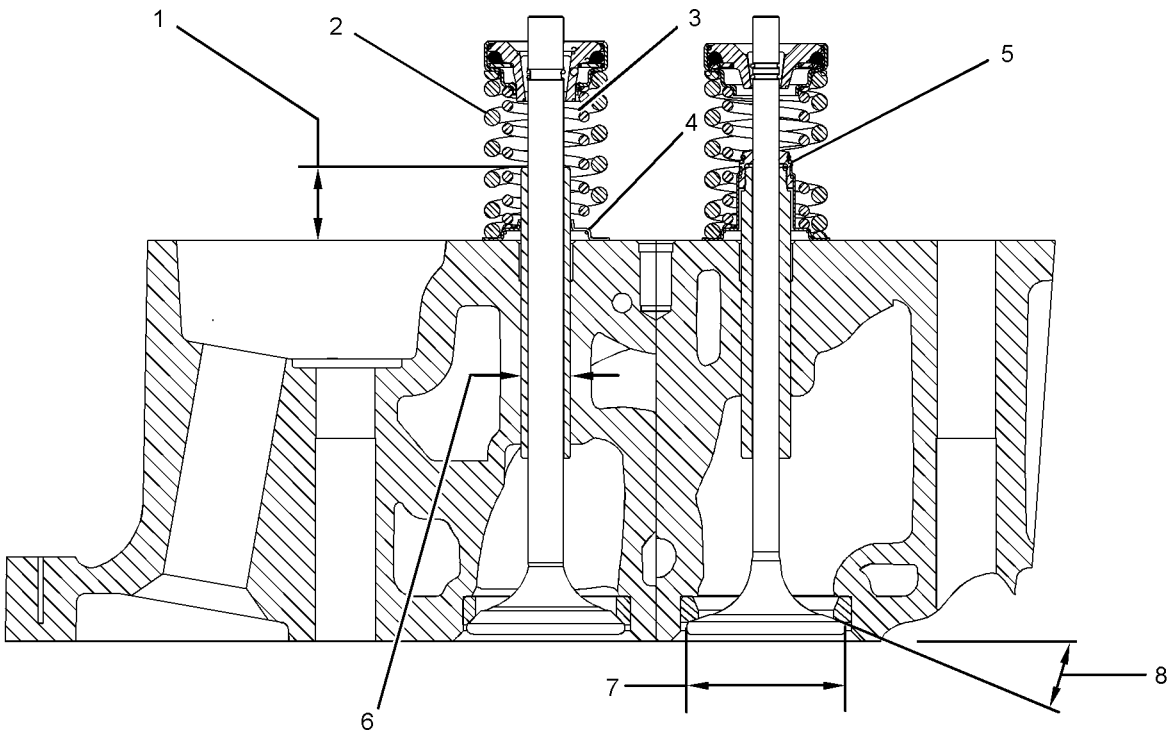

Illustration 45 g01021601

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))
Bore for intake valve guide . . 9.487 ± 0.025 mm ((0.3735 ± 0.0010 inch))
Bore for exhaust valve guide
. . . . 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

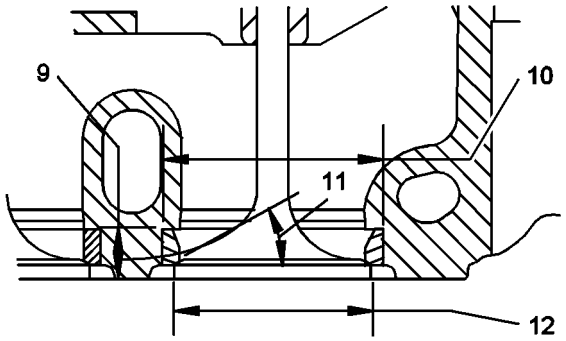

Illustration 46 g01127866
Typical example

(9) Depth of bore in head for valve seat inserts . . . . . .14 ± 0.15 mm ((0.551 ± 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

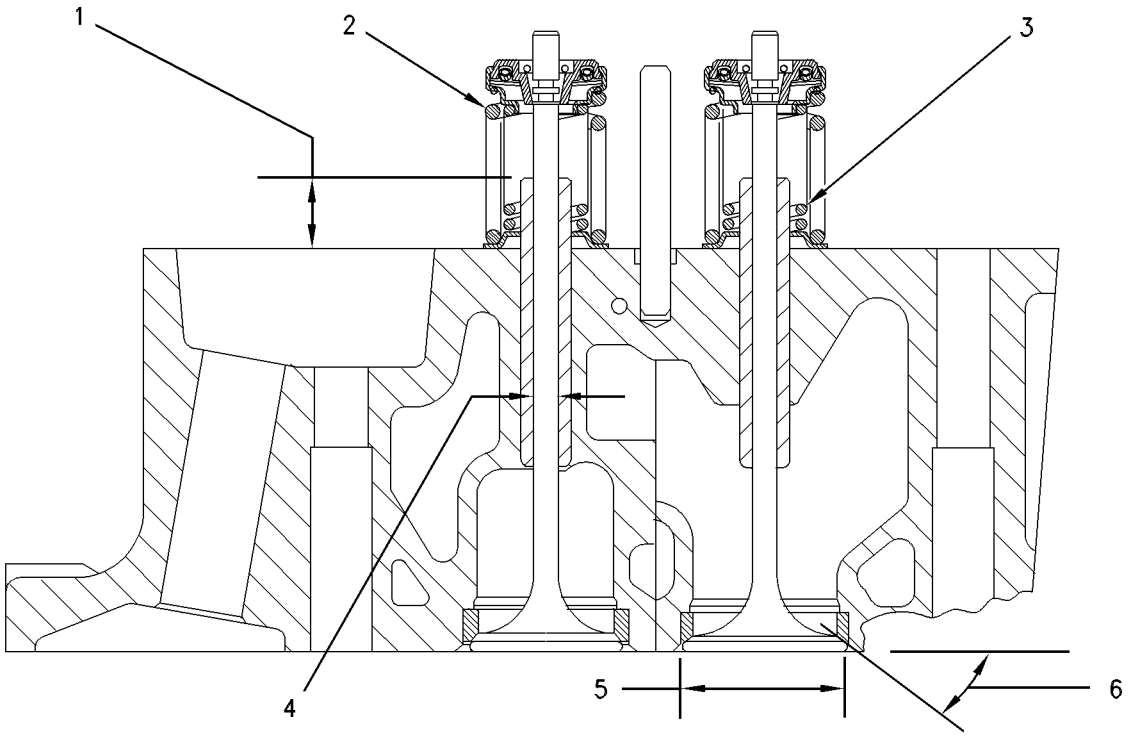

Illustration 47 g00114735

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 . . . . . 57.36 mm ((2.258 inch))
Test force . . . . . 450 ± 23 N ((101 ± 5 lb))
Free length after test . . 70.55 mm ((2.778 inch))
Outside diameter . . . . . 43.66 mm ((1.719 inch))

(2) 316 - 5976 Spring

Length under test force . . . . . 60.29 mm ((2.374 inch))
Test force . . . . . 460 ± 23 N ((103 ± 5 lb))
Free length after test . . . . .74.8 mm ((2.94 inch))
Outside diameter . . . . . .43.47 mm ((1.711 inch))

(3) 101 - 1177 Spring

Length under test force . . . . . 46.49 mm ((1.830 inch))
Test force . . . . . 133 ± 7 N ((30 ± 2 lb))
Free length after test . . 55.54 mm ((2.187 inch))
Outside diameter . . . . . 28.68 mm ((1.129 inch))

(3) 316 - 5977 Spring

Length under test force . . .57.5 mm ((2.26 inch))
Test force . . . . . 248 ± 12.4 N ((56 ± 2.79 lb))
Free length after test . . . . .71.4 mm ((2.81 inch))
Outside diameter . . . . . .30.7 mm ((1.21 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))
Bore in the valve guides . . . . . 9.487 ± 0.025 mm ((0.3735 ± 0.0010 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

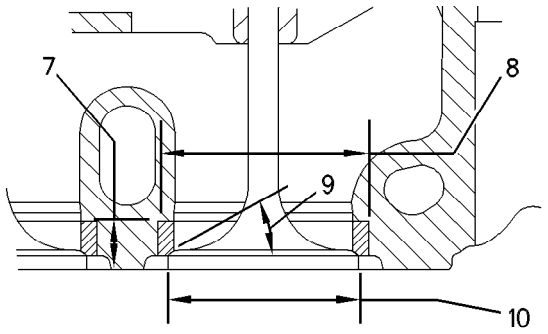

Illustration 48 g00122935

Typical example

(7) Depth of bore in head for valve seat inserts . . . . . .14 ± 0.15 mm ((0.551 ± 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))

i05770195

Cylinder Head Valves

SMCS Code: 1105

Part No.: 317-2440
S/N: 50Y1–Up

Part No.: 317-2440
S/N: 96Y1–Up

Part No.: 317-2440
S/N: 29Z1–Up

Part No.: 317-2440
S/N: 66Z1–Up

Part No.: 317-2440
S/N: 69Z1–Up

Part No.: 317-2440
S/N: 72Z1–Up

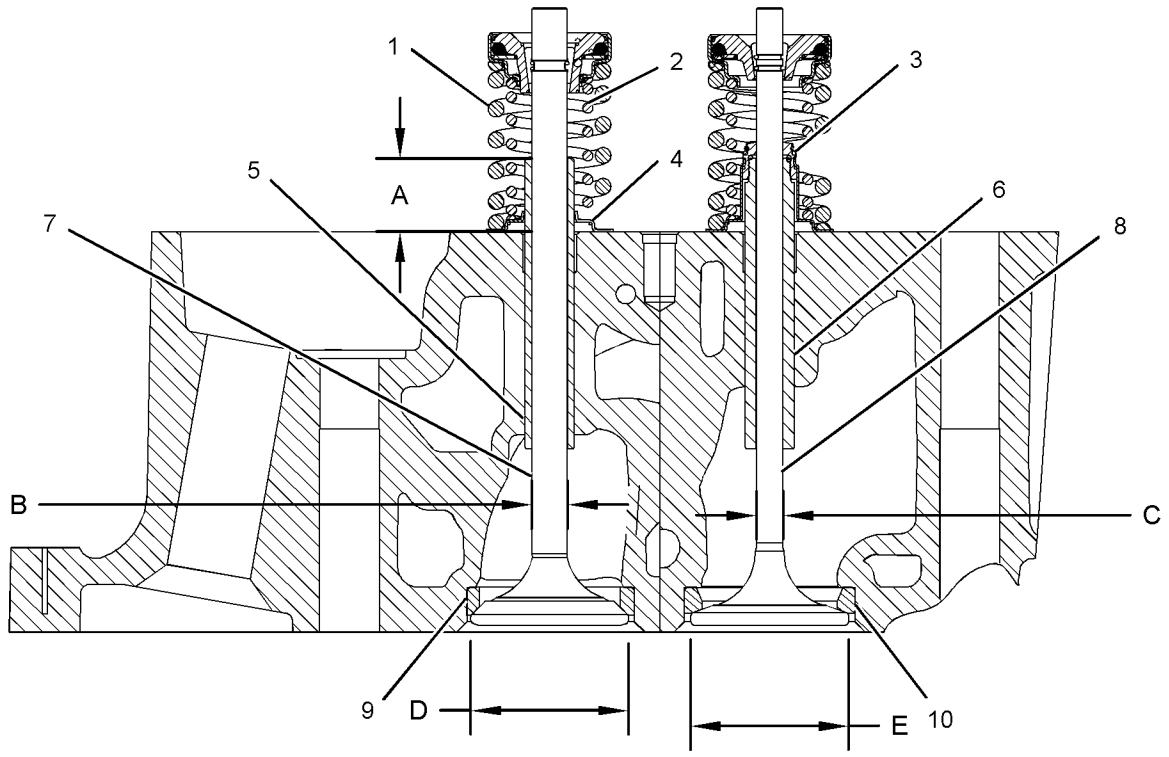

Illustration 49 g02829216

Table 26

Specification for 338-8671 Cylinder Head Gp, 338-8672 Cylinder Head Gp, and 317-2440 Cylinder Head Gp			
Item	**Qty**	**Part**	**Specification Description**

(continued)

(Table 26, contd)

1	4	316-5976 Spring	Length under test force is 60.29 mm (2.374 inch). Test force is 460 ± 23 N (103 ± 5 lb). Free length after test is 74.8 mm (2.94 inch).
2	4	316-5977 Spring	Length under test force is 57.5 mm (2.26 inch). Test force is 248.0 ± 12.4 N (55.8 ± 2.8 lb). Free length after test is 71.4 mm (2.81 inch).
3	2	316-5980 Valve Stem Seal	Install the valve stem seal to the inlet valves. Before assembly, coat with engine oil.
4	2	316-5981 Washer	Install the washer to the exhaust valves.
A	-	-	Height from the top of the cylinder head to the top of the valve guides is 26.0 ± 1.0 mm (1.02 ± 0.04 inch).
5	2	197-6995 Valve Guide	Bore of the exhaust valve guide after installation is 12.619 ± 0.025 mm (0.4968 ± 0.0010 inch).
6	2	133-9306 Valve Guide	Bore of the inlet valve guide after installation is 9.487 ± 0.025 mm (0.3735 ± 0.0010 inch).
7	2	443-2712 Exhaust Valve	Before assembly, coat the exhaust valve stems with clean engine oil. Stem diameter (B) is 12.573 ± 0.01mm (0.4950 0.0004 inch). Valve diameter (D) is 56.00 ± 0.15 mm (2.205 ± 0.006 inch). Face angle is 44.40 ± 0.25 degrees.
8	2	210-2542 Inlet Valve	Before assembly, coat the inlet valve stems with clean engine oil. Stem diameter (C) is 9.441 ± 0.010 mm (0.3717 ± 0.0004 inch). Valve diameter (E) is 56.00 ± 0.15 mm (2.205 ± 0.006 inch). Face angle is 19.40 ± 0.25 degrees.
9	2	130-2608 Valve Seat Insert	Diameter of exhaust valve seat insert is 60.119 ± 0.015 mm (2.3669 ± 0.0006 inch). Bore in the cylinder head is 60.000 ± 0.025 mm (2.3622 ± 0.0010 inch). Face angle is 45.00 ± 0.25 degrees.
10	2	130-2607 Valve Seat Insert	Diameter of inlet valve seat insert is 60.627 ± 0.015 mm (2.3869 ± 0.0006 inch). Bore in the cylinder head is 60.508 ± 0.025 mm (2.3822 ± 0.0010 inch). Face angle is 20.00 ± 0.25 degrees.

i01909990

Turbocharger

SMCS Code: 1052

Part No.: 4P-2581
S/N: 4MJ1–Up

Part No.: 141-2522
S/N: 96Y1–Up

Part No.: 141-2522
S/N: 66Z1–Up

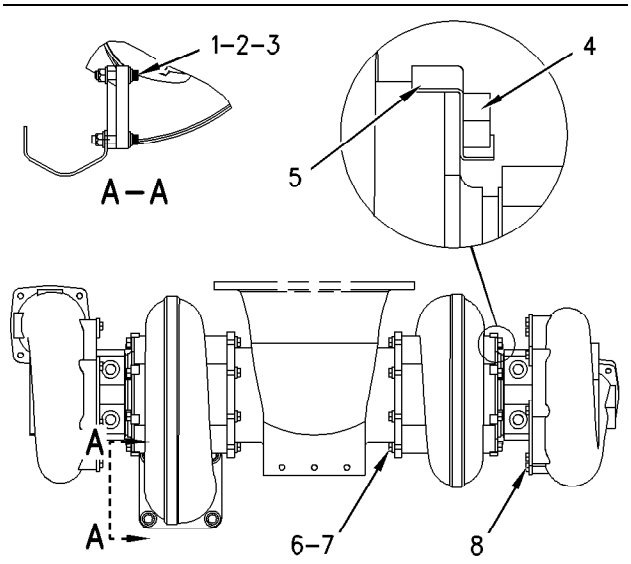

Illustration 50 g00976451

(1) Bolt

(2) Washers

(3) Nut

Lubricate the bearing surfaces of bolt (1), washers (2), and nut (3) and lubricate the threads of the bolt and the nut with 4C-5597 Anti-Seize Compound.

(4) Bolt

Torque . . . . . .55 ± 10 N·m ((41 ± 7 lb ft))

(5) Lock

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.

(6) Washer

Lubricate the bearing surfaces of washer (6) with 4C-5597 Anti-Seize Compound.

(7) Bolt

Lubricate the bolt's bearing surfaces and threads with 4C-5597 Anti-Seize Compound.
Torque . . . . . .45 ± 10 N·m ((33 ± 7 lb ft))

(8) Bolt

Torque . . . . . .55 ± 10 N·m ((41 ± 7 lb ft))

i02010644

Turbocharger

SMCS Code: 1052

Part No.: 135-0178, 9Y-5596
S/N: 96Y1–Up

Part No.: 135-0178, 9Y-5596
S/N: 66Z1–Up

Part No.: 2W-9603
S/N: 69Z1–Up

Part No.: 135-0178, 9Y-5596
S/N: 72Z1–Up

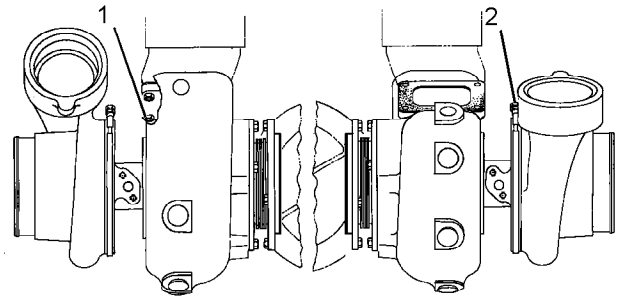

Illustration 51 g01039760
Typical example

(1) Bolts that hold the turbocharger to the exhaust manifold

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))

(2) Turbocharger clamps

1. Tighten the turbocharger clamps.

Torque . . . . . .14.0 ± 1.5 N·m ((10 ± 1 lb ft))

2. Gently hit around the turbocharger clamps with a soft faced hammer.

3. Again tighten the turbocharger clamps.

Torque . . . . . .14.0 ± 1.5 N·m ((10 ± 1 lb ft))

i02011655

Turbocharger

SMCS Code: 1052

Part No.: 9Y-5598
S/N: 50Y1–Up

Part No.: 9Y-5598
S/N: 96Y1–Up

Part No.: 9Y-5589
S/N: 66Z1–Up

Part No.: 9Y-5598
S/N: 72Z1–Up

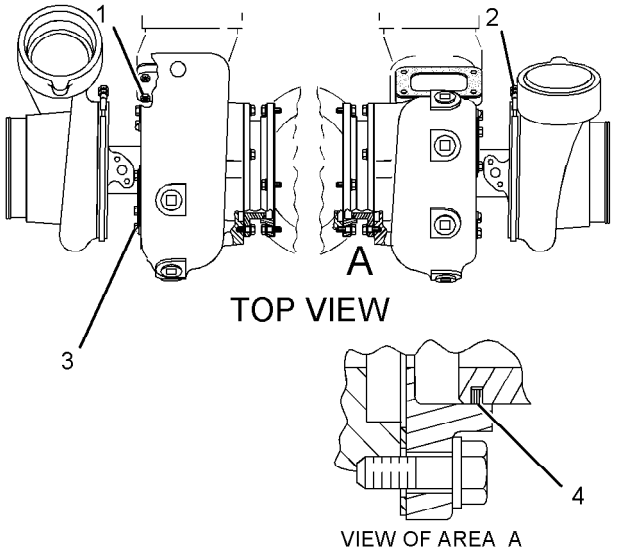

Illustration 52 g01040207
Typical example

(1) Bolts that hold the turbocharger to the exhaust manifold

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))

(1) Bolts that hold the turbocharger to the exhaust manifold

(2) Turbocharger clamps

1. Tighten the turbocharger clamps.

Torque . . . . . .14.0 ± 1.5 N·m ((10 ± 1 lb ft))

2. Gently hit around the turbocharger clamps with a soft faced hammer.

3. Again tighten the turbocharger clamps.

Torque . . . . . .14.0 ± 1.5 N·m ((10 ± 1 lb ft))

(3) Bolts

After tightening the bolts, close the ends of the lock plates. Replace the lock plates if the lock plates have been opened.
Torque . . . . . .20.0 ± 1.5 N·m ((15 ± 1 lb ft))

(4) Seal

Install the rings so that the gaps in the rings are not aligned.
Angle of rotation between the gaps . . . . . .90°

i02012073

Turbocharger

SMCS Code: 1052

Part No.: 1W-5933
S/N: 29Z1–Up

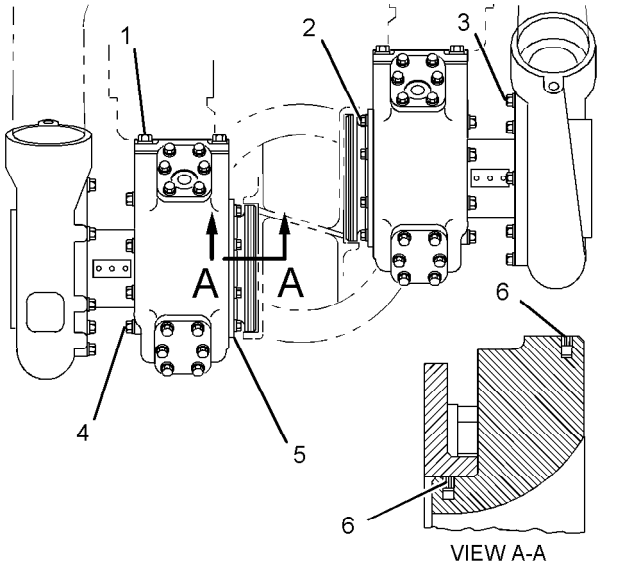

Illustration 53 g01040480

Typical example

(1) Bolts that hold the turbocharger to the exhaust manifold

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))

(2) Turbocharger clamps

1. Tighten the turbocharger clamps.

Torque . . . . . .14.0 ± 1.5 N·m ((10 ± 1 lb ft))

2. Gently hit around the turbocharger clamps with a soft faced hammer.

3. Again tighten the turbocharger clamps.

Torque . . . . . .14.0 ± 1.5 N·m ((10 ± 1 lb ft))

(3) Bolts

After tightening the bolts, close the ends of the lock plates. Replace the lock plates if the lock plates have been opened.
Torque . . . . . .20.0 ± 1.5 N·m ((15 ± 1 lb ft))

(4) Seal

Install the rings so that the gaps in the rings are not aligned.
Angle of rotation between the gaps . . . . . .90°

i07724321

Turbocharger

SMCS Code: 1052

Part No.: 343-5703, 528-9753
S/N: 29Z1–Up

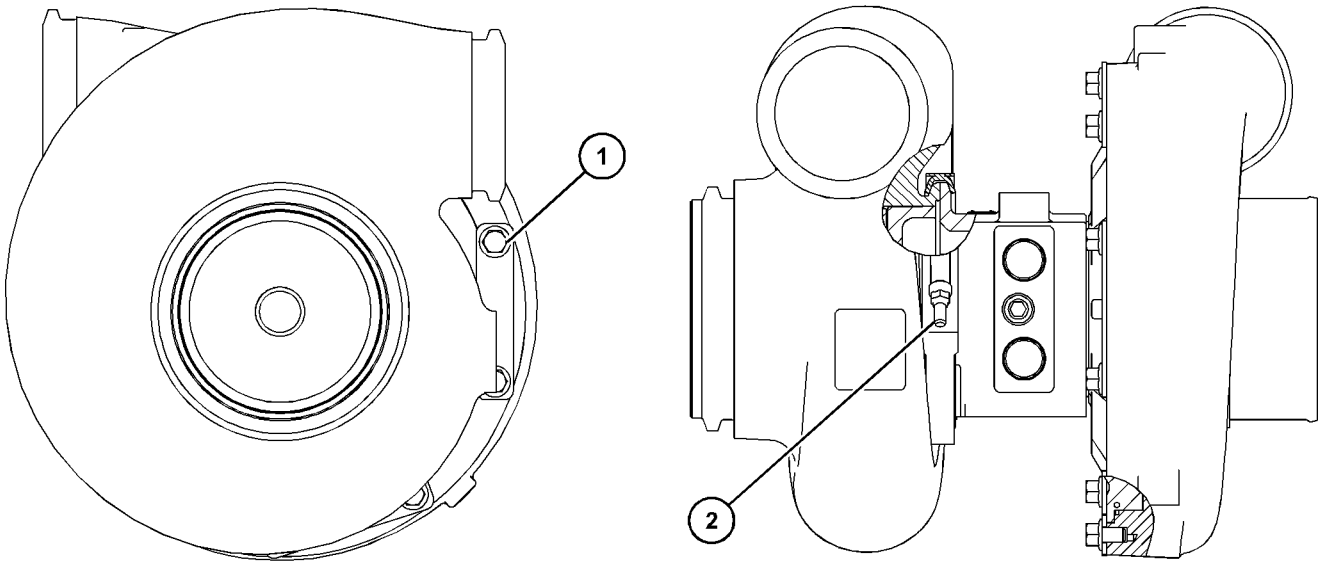

Illustration 54 g06412179

Table 27

Item	Qty	Part	Specification Description
Before assembly. lubricate the threads of the bolts and the threads of the clamp assembly with Loctite C5A Copper Anti-Seize.			
1	10	8T-4191 Bolt	Torque to 40 ± 3 N·m (30 ± 2 lb ft).
2	1	283-4294 Clamp As	Use the following procedure to tighten the clamp assembly: 1. Tighten the nut to 20 N·m (177 lb in). 2. Gently hit around the turbine clamp assembly with a soft hammer. 3. Again, tighten the nut to 30 ± 2 N·m (266 ± 18 lb in). 4. Gently hit around the turbine clamp assembly with a soft hammer. 5. Again, tighten the nut to 30 ± 2 N·m (266 ± 18 lb in).

i07728625

Turbocharger

SMCS Code: 1052

Part No.: 343-5684, 352-3459
S/N: 50Y1–Up

Part No.: 343-5682
S/N: 72Z1–Up

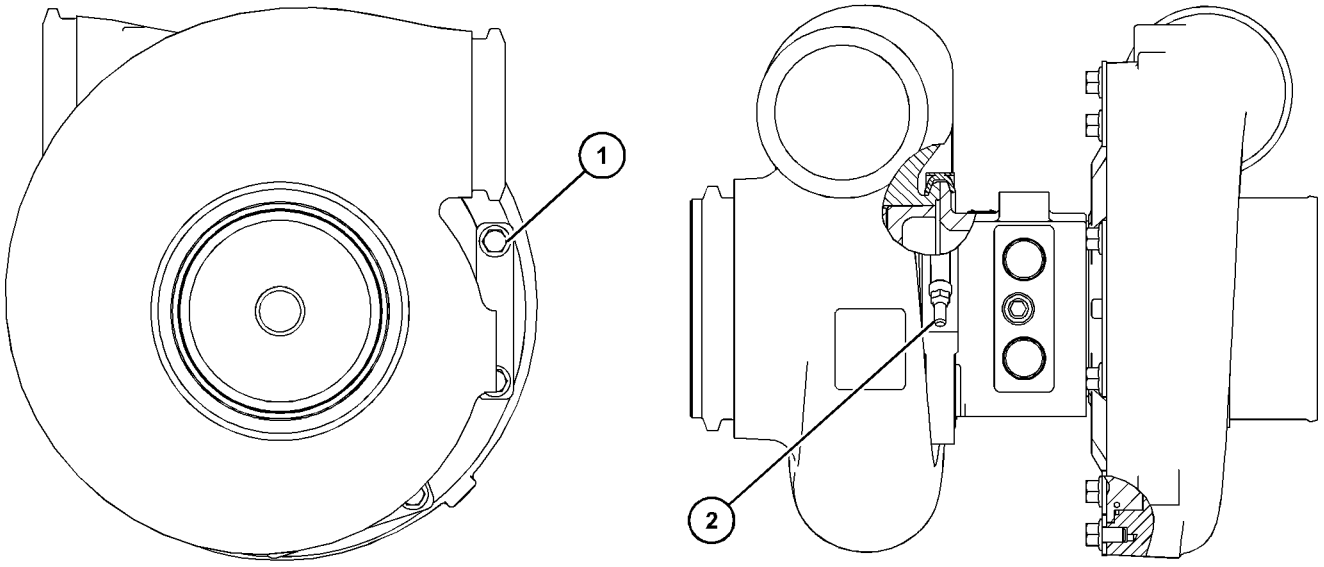

Illustration 55 g06412179

Table 28

Item	Qty	Part	Specification Description
Before assembly. lubricate the threads of the bolts and the threads of the clamp assembly with Loctite C5A Copper Anti-Seize.			
1	10	287-7200 Bolt	Torque to 40 ± 3 N·m (30 ± 2 lb ft).
2	1	283-4294 Clamp As	Use the following procedure to tighten the clamp assembly:
			1. Tighten the nut to 20 N·m (177 lb in).
			2. Gently hit around the turbine clamp assembly with a soft hammer.
			3. Again, tighten the nut to 30 ± 2 N·m (266 ± 18 lb in).
			4. Gently hit around the turbine clamp assembly with a soft hammer.
			5. Again, tighten the nut to 30 ± 2 N·m (266 ± 18 lb in).

i07728663

Turbocharger

SMCS Code: 1052

Part No.: 519-8019
S/N: 50Y1–Up

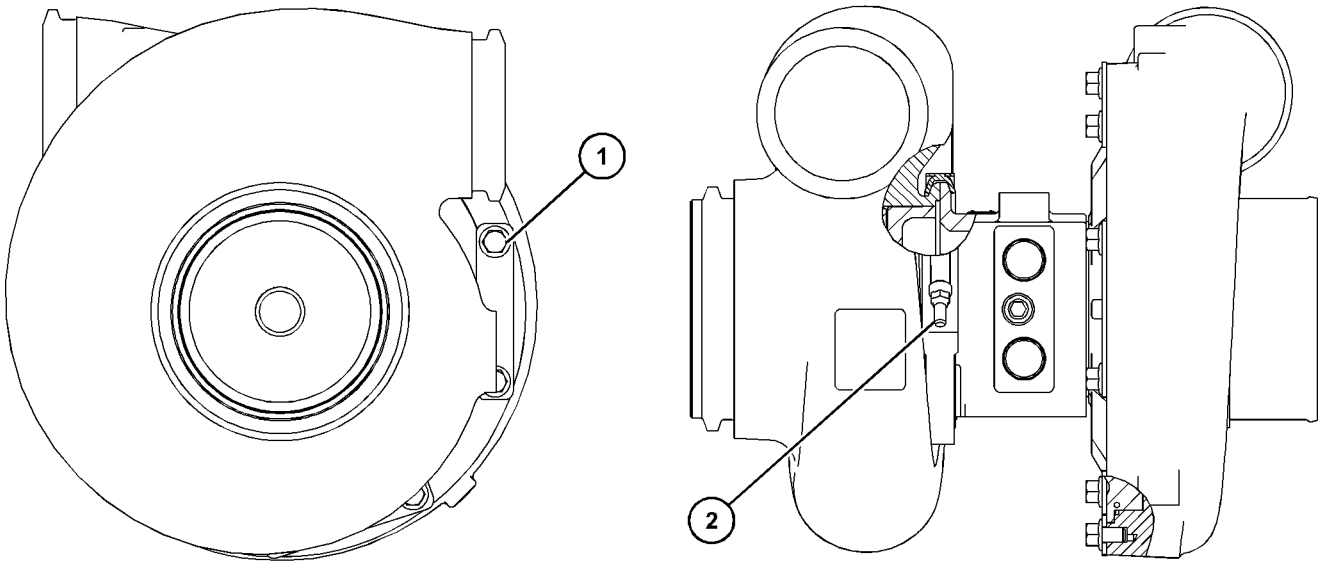

Illustration 56 g06412179

Table 29

Item	Qty	Part	Specification Description
Before assembly. lubricate the threads of the bolts and the threads of the clamp assembly with Loctite C5A Copper Anti-Seize.			
1	10	8T-4191 Bolt	Torque to 40 ± 3 N·m (30 ± 2 lb ft).
2	1	283-4294 Clamp As	Use the following procedure to tighten the clamp assembly:
			1. Tighten the nut to 20 N·m (177 lb in).
			2. Gently hit around the turbine clamp assembly with a soft hammer.
			3. Again, tighten the nut to 30 ± 2 N·m (266 ± 18 lb in).
			4. Gently hit around the turbine clamp assembly with a soft hammer.
			5. Again, tighten the nut to 30 ± 2 N·m (266 ± 18 lb in).

i07728669

Turbocharger

SMCS Code: 1052

Part No.: 327-7739
S/N: 66Z1–Up

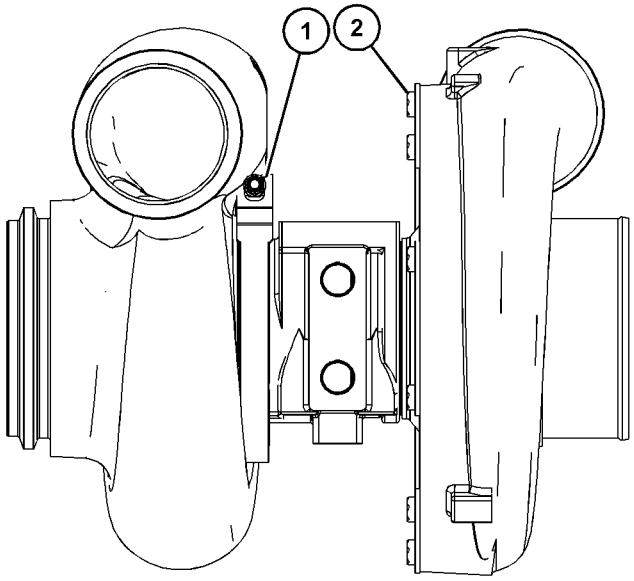

Illustration 57 g06480556

Table 30

Specification for 327-7739 Turbocharger Gp			
Item	**Qty**	**Part**	**Specification Description**
1	1	283-4294 Clamp As	Before assembly, lubricate the threads, bearing surfaces with Loctite C5A copper anti seize. Use the following procedure to tighten the clamp assembly : 1. Tighten to 20 N·m (177 lb in). 2. Gently hit around the clamp assembly with a soft hammer. 3. Again, tighten 30 ± 2 N·m (266 ± 18 lb in). 4. Gently hit around the clamp assembly with a soft hammer. 5. Again, tighten the nut to 30 ± 2 N·m (266 ± 18 lb in).
2	8	287-7200 Bolt	Before assembly, lubricate the threads, bearing surfaces with Loctite C5A copper anti seize. Torque to the clamp plate bolts to 40 ± 3 N·m (30 ± 2 lb ft).

i07728790

Turbocharger

SMCS Code: 1052

Part No.: 528-8390
S/N: 50Y1–Up

Part No.: 528-8390
S/N: 72Z1–Up

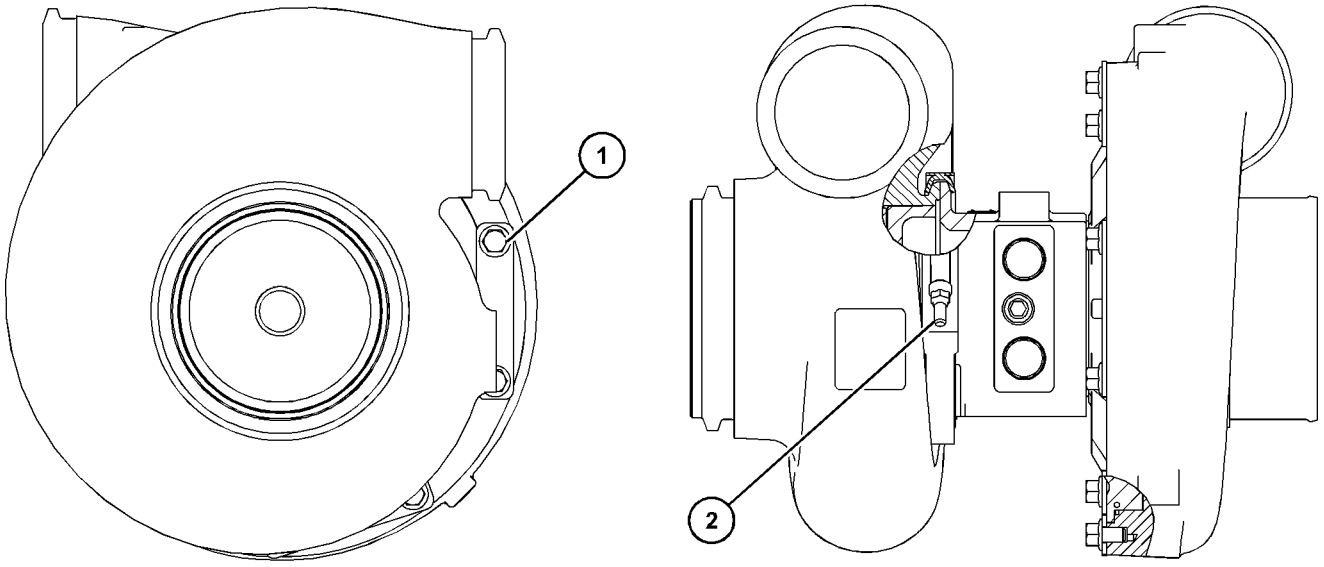

Illustration 58 g06412179

Table 31

Item	Qty	Part	Specification Description
Before assembly. lubricate the threads of the bolts and the threads of the clamp assembly with Loctite C5A Copper Anti-Seize.			
1	10	8T-4191 Bolt	Torque to 40 ± 3 N·m (30 ± 2 lb ft).
2	1	283-4294 Clamp As	Use the following procedure to tighten the clamp assembly:
			1. Tighten the nut to 20 N·m (177 lb in).
			2. Gently hit around the turbine clamp assembly with a soft hammer.
			3. Again, tighten the nut to 30 ± 2 N·m (266 ± 18 lb in).
			4. Gently hit around the turbine clamp assembly with a soft hammer.
			5. Again, tighten the nut to 30 ± 2 N·m (266 ± 18 lb in).

i07729807

Turbocharger

SMCS Code: 1052

Part No.: 343-5687
S/N: 29Z1–Up

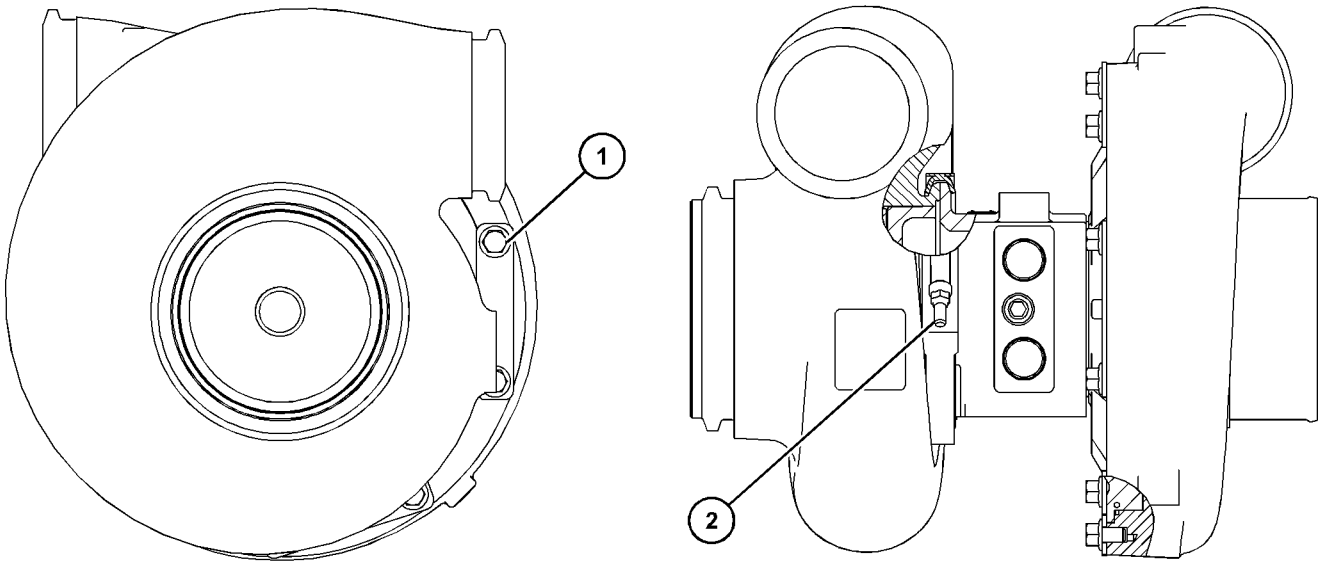

Illustration 59 g06412179

Table 32

Item	Qty	Part	Specification Description
Before assembly. lubricate the threads of the bolts and the threads of the clamp assembly with Loctite C5A Copper Anti-Seize.			
1	10	283-7200 Bolt	Torque to 40 ± 3 N·m (30 ± 2 lb ft).
2	1	283-4294 Clamp As	Use the following procedure to tighten the clamp assembly:
			1. Tighten the nut to 20 N·m (177 lb in).
			2. Gently hit around the turbine clamp assembly with a soft hammer.
			3. Again, tighten the nut to 30 ± 2 N·m (266 ± 18 lb in).
			4. Gently hit around the turbine clamp assembly with a soft hammer.
			5. Again, tighten the nut to 30 ± 2 N·m (266 ± 18 lb in).

i07908053

Turbocharger

SMCS Code: 1052

Part No.: 528-8383
S/N: 66Z1–Up

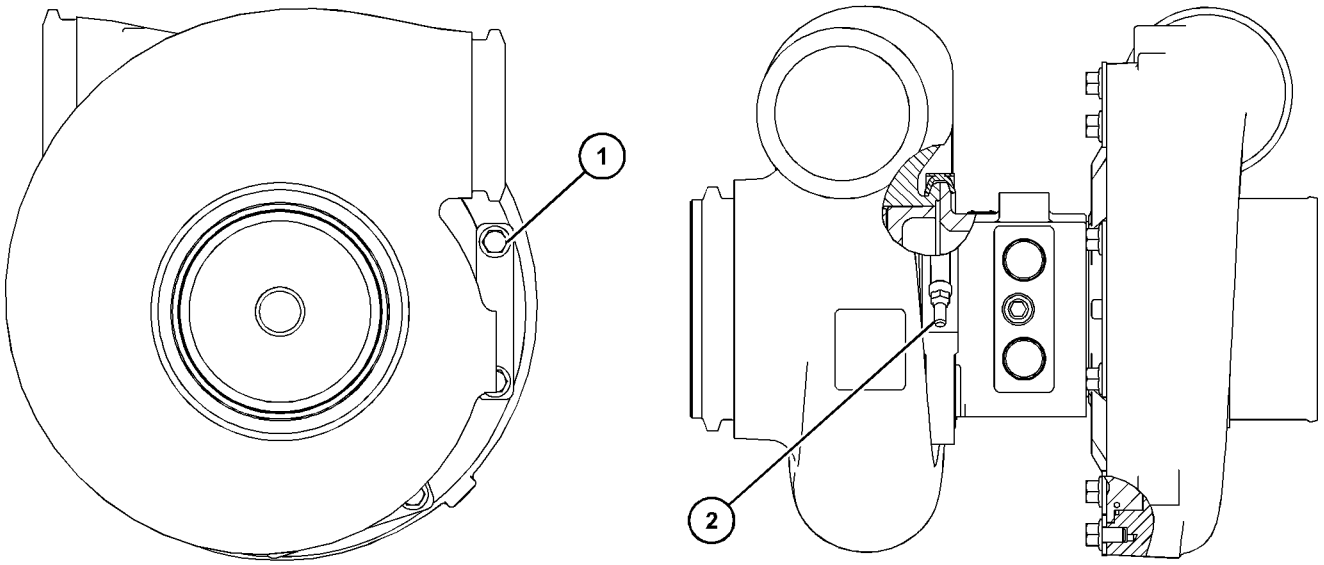

Illustration 60 g06412179
Typical Example

Table 33

Item	Qty	Part	Specification Description
Before assembly. lubricate the threads of the bolts and the threads of the clamp assembly with Loctite C5A Copper Anti-Seize.			
1	10	8T-4191 Bolt	Torque to 40 ± 3 N·m (30 ± 2 lb ft).
2	1	283-4294 Clamp As	Use the following procedure to tighten the clamp assembly:
			1. Tighten the nut to 20 N·m (177 lb in).
			2. Gently hit around the turbine clamp assembly with a soft hammer.
			3. Again, tighten the nut to 30 ± 2 N·m (266 ± 18 lb in).
			4. Gently hit around the turbine clamp assembly with a soft hammer.
			5. Again, tighten the nut to 30 ± 2 N·m (266 ± 18 lb in).

i02835300

Accumulator

SMCS Code: 1320

S/N: 29Z1–Up

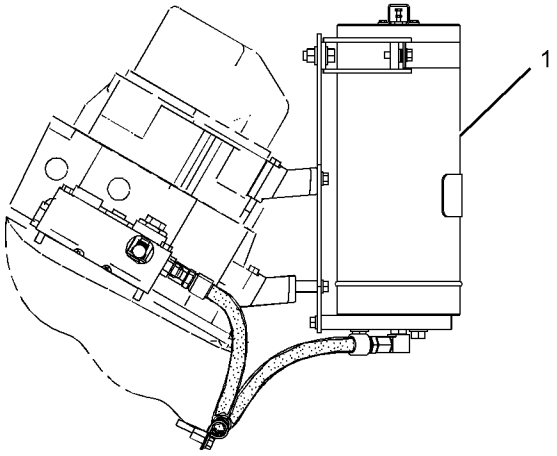

Illustration 61 g01433346

(1) Accumulator assembly

Charging medium . . . . . Dry nitrogen
Internal volume of compartment for gas
. . . . . .3786 mL ((231 in^3))
Charged pressure . . . . . .138 kPa ((20 psi))
Service pressure . . . . . .138 kPa ((20 psi))
Bursting pressure . . . . . 34500 kPa ((5000 psi))

i01535814

Exhaust Manifold

SMCS Code: 1059

Part No.: 6I-0042
S/N: 50Y1–Up

Part No.: 6I-0041
S/N: 96Y1–Up

S/N: 29Z1–Up

Part No.: 6I-0042
S/N: 66Z1–Up

Part No.: 6I-0041
S/N: 69Z1–Up

Part No.: 6I-0043
S/N: 72Z1–Up

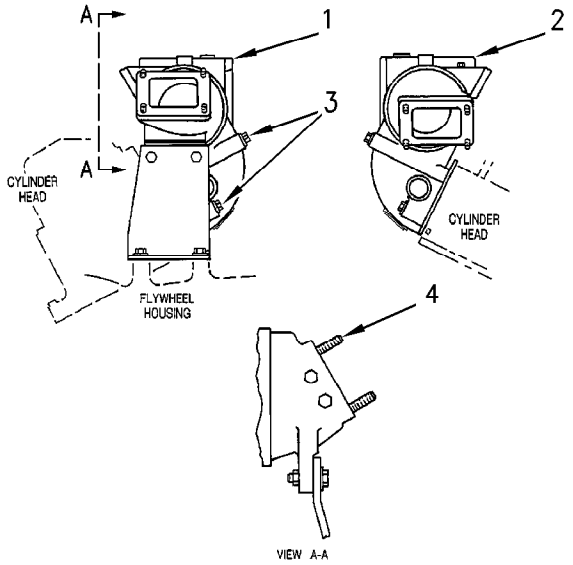

Illustration 62 g00797647

(1) Left manifold

(2) Right manifold

(3) Bolt

1. Put 5P-3931 Anti-Seize Compound on the threads of the bolts.

2. Tighten the bolts to the following torque:

Torque . . . . . .55 ± 10 N·m ((41 ± 7 lb ft))

(4) Stud

1. Put 5P-3931 Anti-Seize Compound on the threads of the studs.

2. Tighten the studs to the following torque:

Torque . . . . . .30 ± 5 N·m ((22 ± 4 lb ft))

i04935858

Exhaust Manifold

SMCS Code: 1059

Part No.: 8N-7721
S/N: 50Y1–Up

Part No.: 7N-8641, 8N-7721
S/N: 96Y1–Up

Part No.: 8N-0367, 8N-7721
S/N: 29Z1–Up

Part No.: 8N-0367, 8N-7721
S/N: 66Z1–Up

Part No.: 7N-8641, 8N-7721
S/N: 69Z1–Up

Part No.: 8N-0367, 8N-7721
S/N: 72Z1–Up

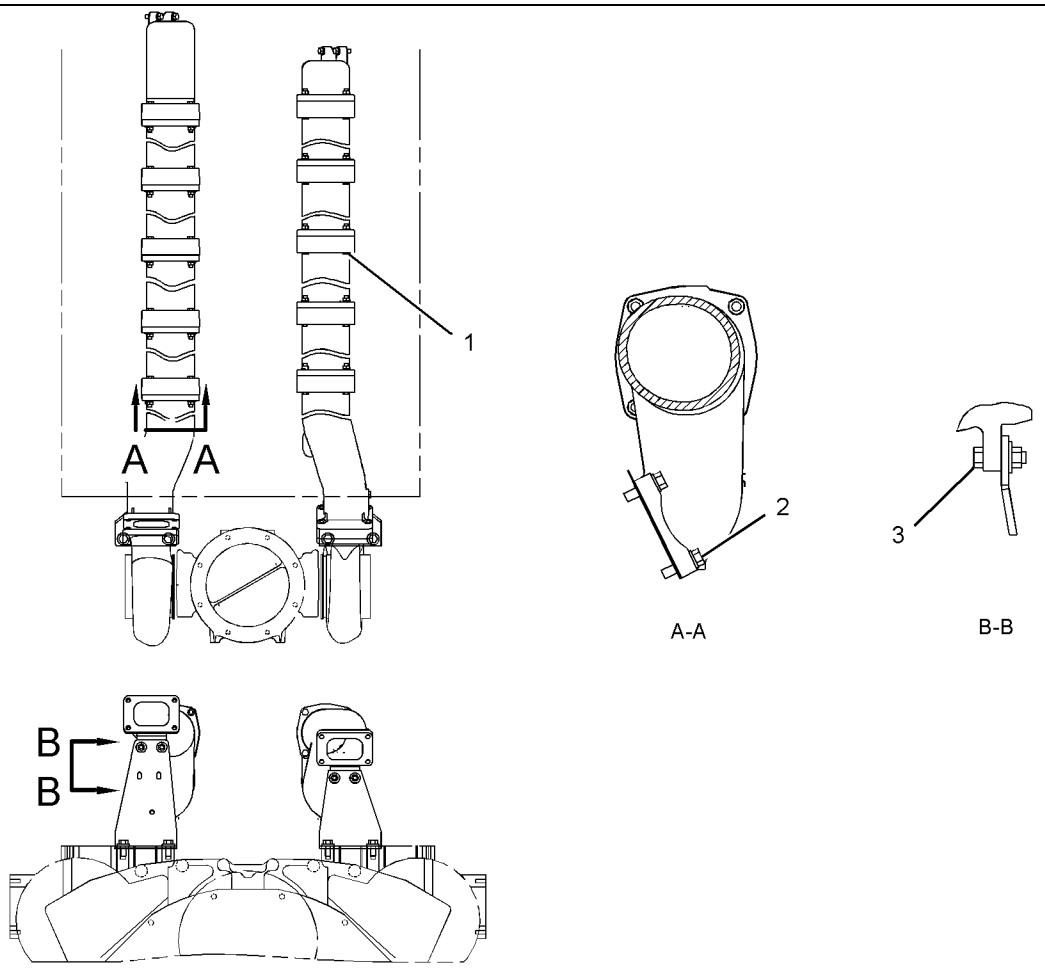

Illustration 63 g03111304

Table 34

Specification for 8N-7721 Exhaust Manifold Gp , 8N-0367 Exhaust Manifold Gp , and 7N-8641 Exhaust Manifold Gp			
Item	**Qty**	**Part**	**Specification Description**
1	40	5P-2755 High Temperature Bolt	Before assembly, apply Loctite C5A Copper Anti-Seize to threads and bearing surfaces.
			Torque to 55 ± 5 N·m (41 ± 4 lb ft).
2	48	3B-1915 Bolt	Before assembly, apply Loctite C5A Copper Anti-Seize to threads and bearing surfaces.
			Torque to 50 ± 5 N·m (37 ± 4 lb ft).
3	4	3B-1915 Bolt	Before assembly, apply Loctite C5A Copper Anti-Seize to threads and bearing surfaces.

i05263404

Exhaust Manifold

SMCS Code: 1059

Part No.: 100-3144
S/N: 4MJ1–Up

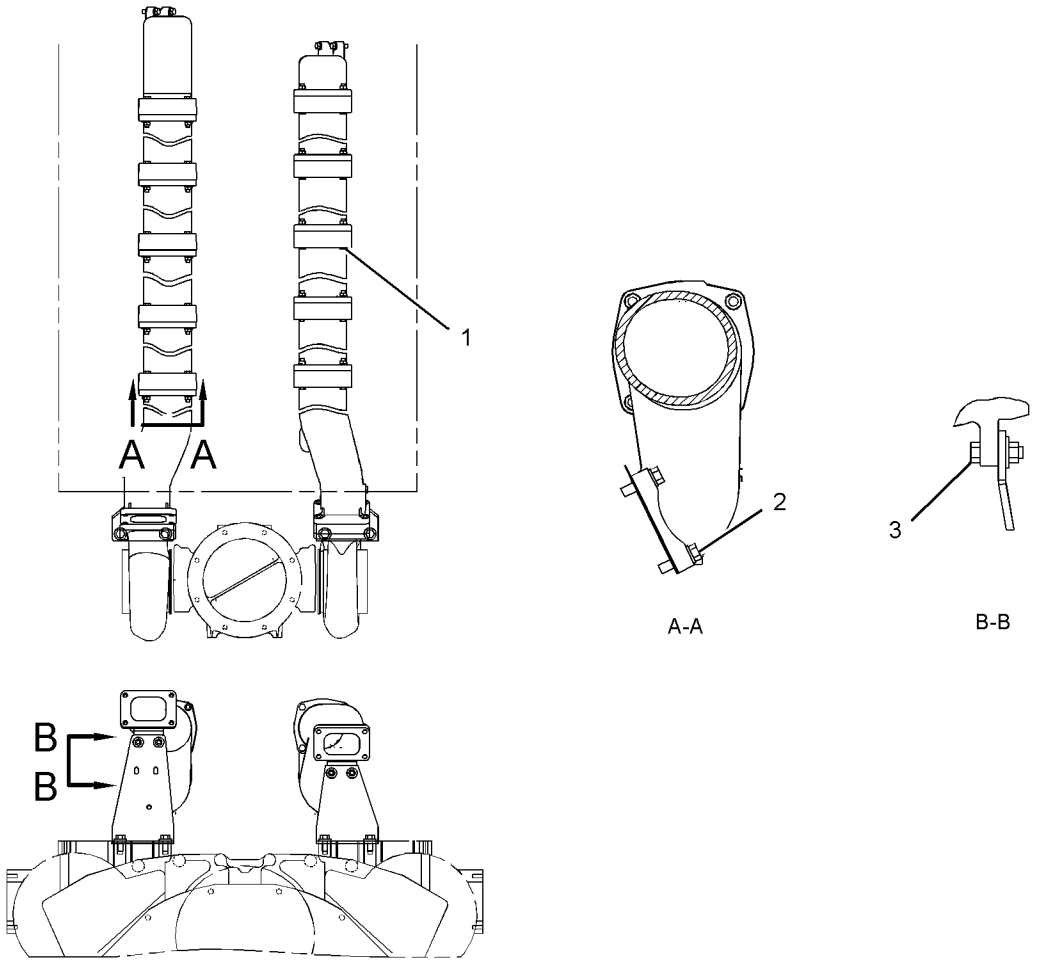

Illustration 64 g03350549

Table 35

Specifications for 100-3144 Exhaust Manifold Gp, 129-5488 Exhaust Manifold Gp, 154-3123 Exhaust Manifold Gp, and 188-8616 Exhaust Manifold Gp			
Item	**Qty**	**Part**	**Specification Description**
1	80	7L-6443 High Temperature Bolt	Before assembly, apply Loctite C5A Copper Anti-Seize to threads and bearing surfaces. Torque to 55 ± 5 N·m (40.56580 ± 3.68780 lb ft)
2	48	9L-7373 High Temperature Bolt	Before assembly, apply Loctite C5A Copper Anti-Seize to threads and bearing surfaces. Torque to 55 ± 5 N·m (40.56580 ± 3.68780 lb ft).
3	4	9L-7373 High Temperature Bolt	Torque to 55 ± 5 N·m (40.56580 ± 3.68780 lb ft).

i02188615

Air Inlet and Exhaust Lines

SMCS Code: 1058; 1061

Part No.: 4P-3696
S/N: 4MJ1–Up

Part No.: 9Y-6500
S/N: 50Y1–Up

Part No.: 9Y-5601
S/N: 96Y1–Up

Part No.: 7C-9931
S/N: 29Z1–Up

Part No.: 9Y-5600
S/N: 66Z1–Up

Part No.: 4W-0711
S/N: 69Z1–Up

Part No.: 9Y-5599
S/N: 72Z1–Up

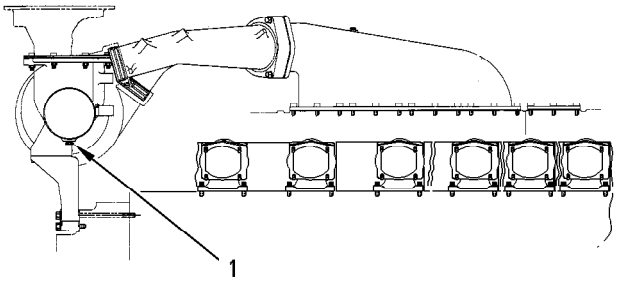

Illustration 65 g00296783

Typical example

(1) Plug

Apply 4C-5597 Anti-Seize Compound to the plugs.
Torque . . . . . .20 ± 5 N·m ((15 ± 4 lb ft))

i02393889

Air Shutoff

SMCS Code: 1078

Part No.: 6I-2986
S/N: 4MJ1–Up

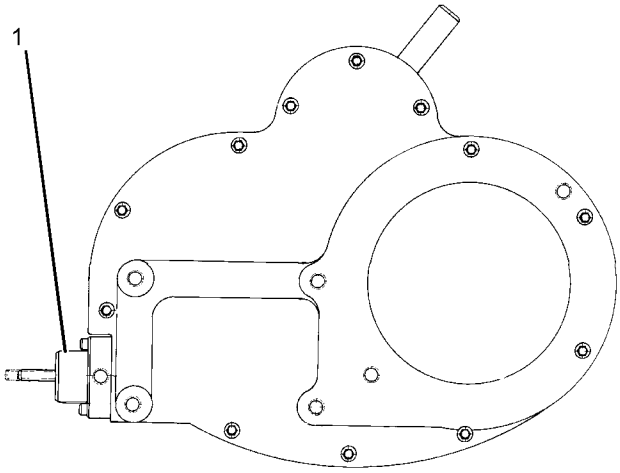

Illustration 66 g01195382

(1) Cylinder assembly

Pressure that is required to activate the cylinder assembly . . . . . .172 kPa ((25 psi))
Maximum pressure for the cylinder assembly . . . . . 1378 kPa ((200 psi))

i04906833

Air Shutoff

SMCS Code: 1078

Part No.: 144-8275
S/N: 50Y1–Up

Part No.: 144-8275
S/N: 96Y1–Up

Part No.: 144-8275
S/N: 29Z1–Up

Part No.: 144-8275
S/N: 66Z1–Up

Part No.: 144-8275
S/N: 69Z1–Up

Part No.: 144-8275
S/N: 72Z1–Up

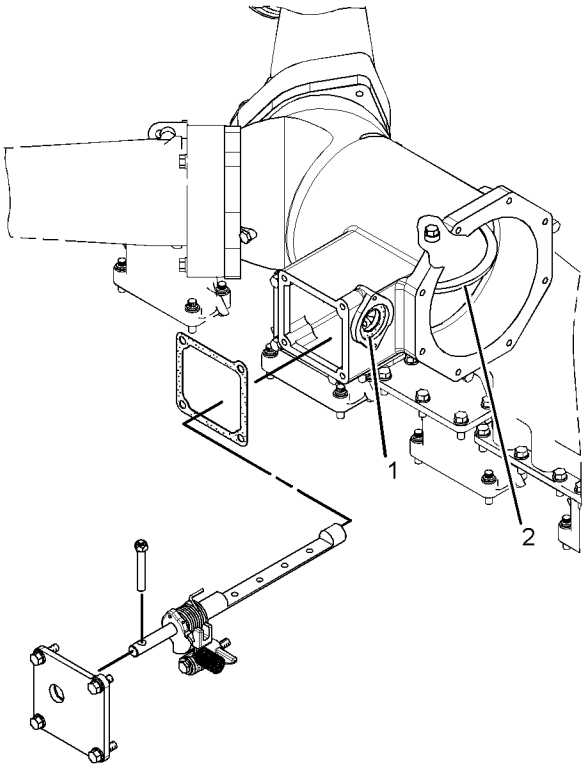

Illustration 67 g03069577

Table 36

Specification for 144-8275 Air Shutoff Gp			
Item	**Qty**	**Part**	**Specification Description**
1	1	129-3021 Ring	Before assembly, apply Loctite 411 to the housing.
2	1	2W-4880 Plate As	A 0.8 mm (0.03 inch) feeler gauge must not pass between the plate and the housing at any point when the plate is in the closed position.

i04912024

Engine Oil Pump

SMCS Code: 1304

Part No.: 7W-0053
S/N: 50Y1–Up

Part No.: 7W-0053
S/N: 96Y1–Up

Part No.: 7W-0053
S/N: 66Z1–Up

Part No.: 7W-0053
S/N: 69Z1–Up

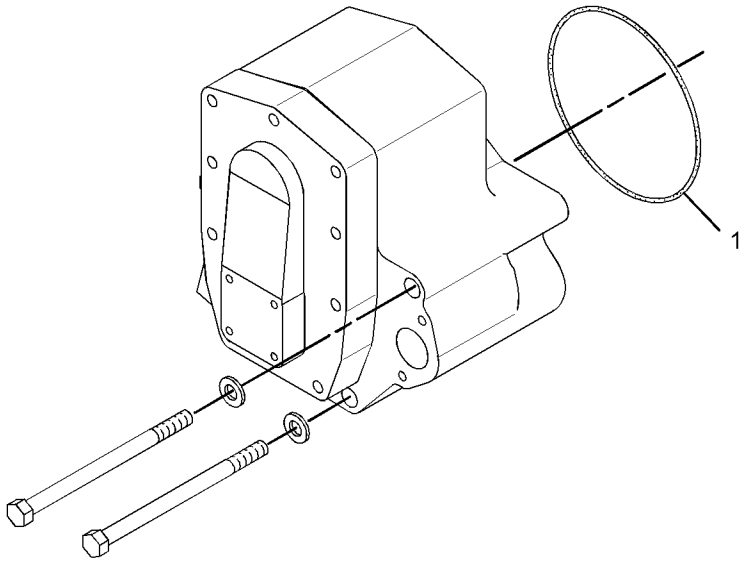

Illustration 68 g03079576

Table 37

Specification for 7N-8715 Engine Oil Pump Gp			
Item	**Qty**	**Part**	**Specification Description**
The rotation of the drive gear is clockwise when you view the engine oil pump from the drive end.			
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.			
1	1	298-6387 O-Ring Seal	Before assembly, lubricate the bore lightly with 5P-3975 Rubber Lubricant.

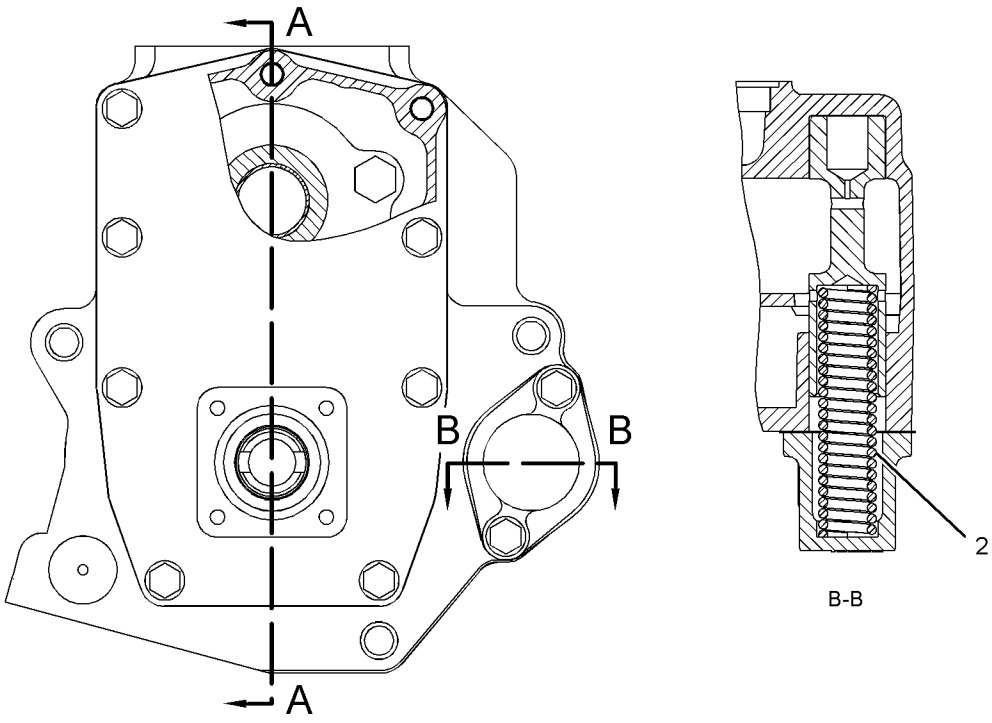

Illustration 69 g03079678

Table 38

Specification for 7N-8715 Engine Oil Pump Gp			
Item	**Qty**	**Part**	**Specification Description**
2	1	2S-2760 Spring	Length under test force is 117.14 mm (4.612 inch).
			Test force is 499 ± 24 N (112 ± 5 lb).
			Free length after test is 152.91 mm (6.020 inch).

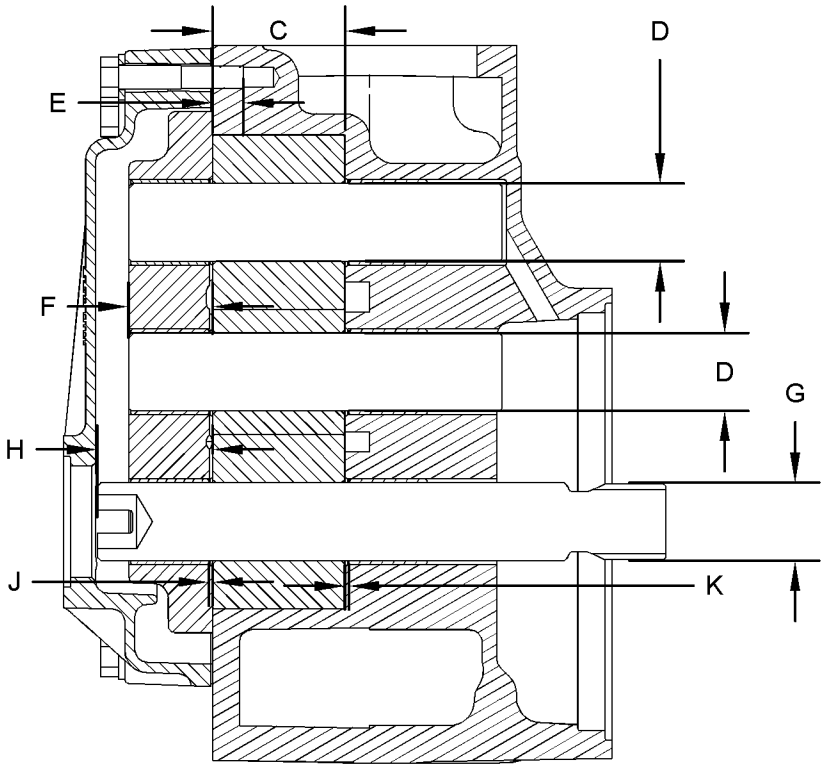

Illustration 70 g03079836

Section A-A

Table 39

Specification for 7N-8715 Engine Oil Pump Gp			
Item	**Qty**	**Part**	**Specification Description**
C	2	7N-6733 Gear	Length of new gear is 54.000 ± 0.015 mm (2.1260 ± 0.0006 inch).
			Depth of the bore in the oil pump body for the new gear is 54.15 ± 0.02 mm (2.132 ± 0.001 inch).
D	2	7W-1017 Shaft	Diameter is 31.742 ± 0.008 mm (1.2497 ± 0.0003 inch).
			After assembly, bore in the 7W-0060 Bushing for the new shaft assembly is 31.811 ± 0.013 mm (1.2524 ± 0.0005 inch).
E	2	4M-3248 Hollow Dowel	Extension from the oil pump cover is 6.0 ± 0.5 mm (0.24 ± 0.02 inch).
F	-	-	Distance from the end of the idler shaft to the gear face is 34.0 ± 0.5 mm (1.34 ± 0.02 inch).
G	1	7N-5058 Pump Drive Shaft	Diameter is 31.742 ± 0.008 mm (1.2497 ± 0.0003 inch).
			After assembly, bore in the 7W-0060 Bushing for the new shaft assembly is 31.811 ± 0.013 mm (1.2524 ± 0.0005 inch).
H	-	-	Distance from the end of the shaft to the gear face is 47.0 ± 0.5 mm (1.85 ± 0.02 inch).
J	1	7W-0050 Pump Cover	Installation depth of 7W-0060 Bushing in the pump cover is 1.5 ± 0.5 mm (0.06 ± 0.02 inch).
K	1	7W-0051 Oil Pump Body As	Installation depth of 7W-0060 Bushing in the oil pump body assembly is 1.5 ± 0.5 mm (0.06 ± 0.02 inch).

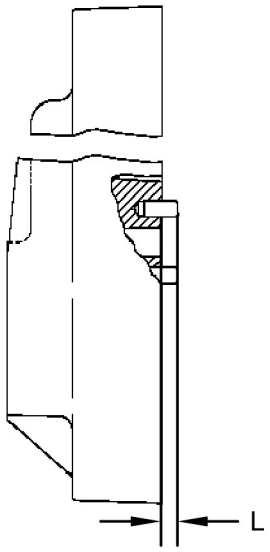

Illustration 71 g03079878

Table 40

Specification for 7N-8715 Engine Oil Pump Gp			
Item	**Qty**	**Part**	**Specification Description**
L	2	7N-2043 Dowel	Extension from the oil pump cover is 6.0 ± 1.0 mm (0.24 ± 0.04 inch).

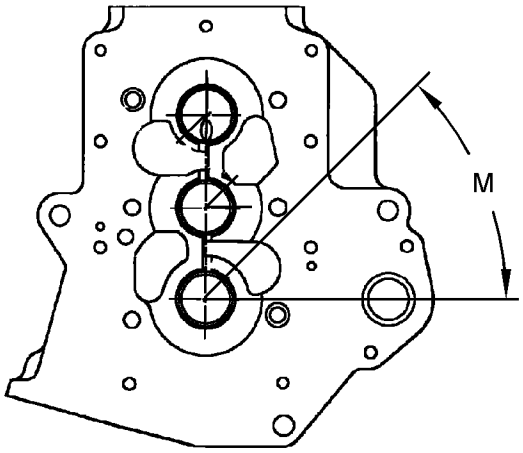

Illustration 72 g03079902

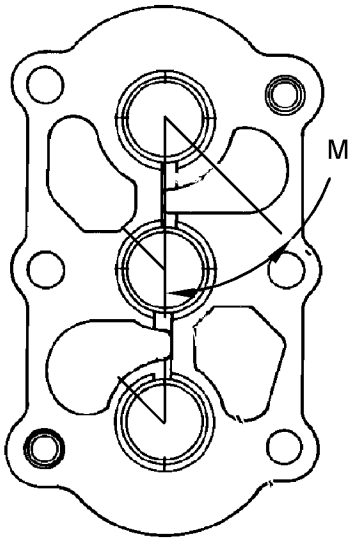

Illustration 73 g03079958

Table 41

Specification for 7N-8715 Engine Oil Pump Gp			
Item	**Qty**	**Part**	**Specification Description**
M	-	-	Position of 7W-0060 Bushing joints from the centerline through the bearing bores is 45 ± 15 degrees.

i04921863

Engine Oil Pump

SMCS Code: 1304

Part No.: 8N-6152

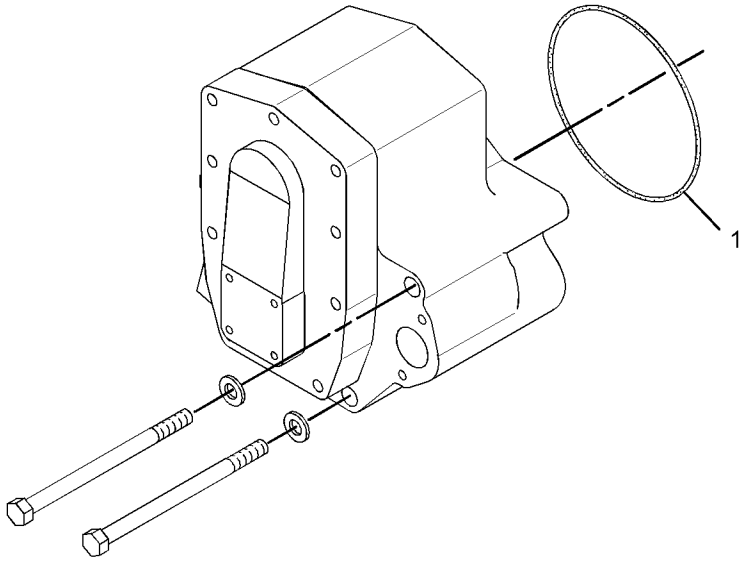

Illustration 74 g03104511

Table 42

Specification for 8N-6152 Engine Oil Pump Gp			
Item	**Qty**	**Part**	**Specification Description**
The rotation of the drive gear is clockwise when you view the engine oil pump from the drive end.			
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.			
1	1	298-6387 O-Ring Seal	Before assembly, lubricate the O-ring seal lightly with 5P-3975 Rubber Lubricant.

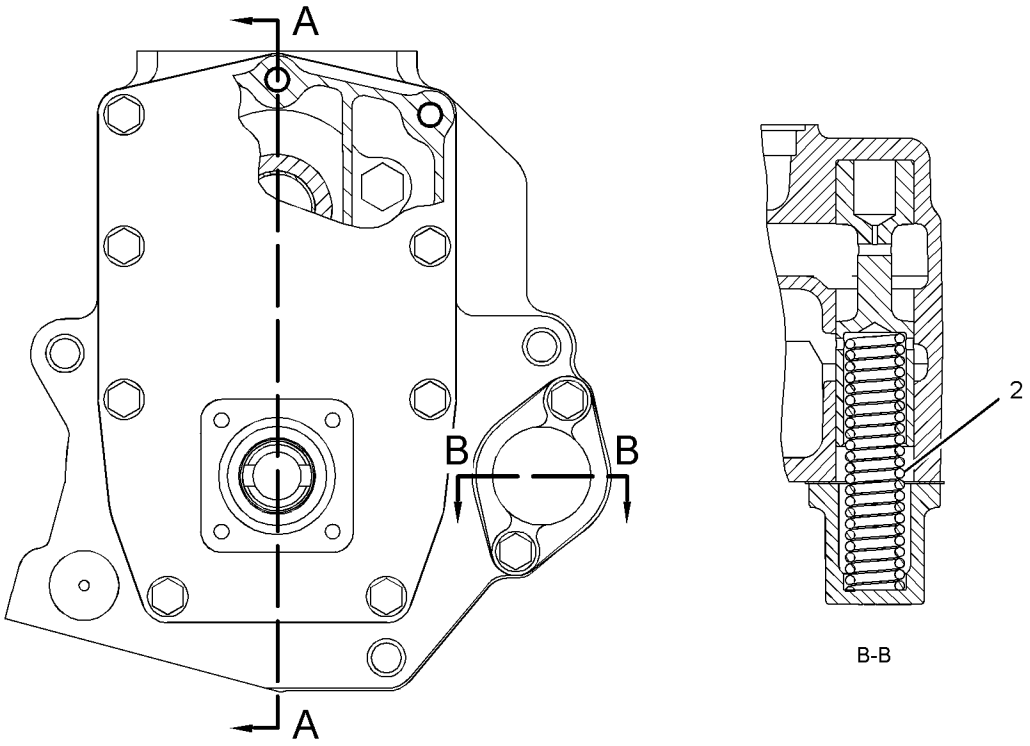

Illustration 75 g03088657

Table 43

Specification for 8N-6152 Engine Oil Pump Gp			
Item	**Qty**	**Part**	**Specification Description**
2	1	2S-2760 Spring	Length under test force is 117.14 mm (4.612 inch).
			Test force is 499 ± 24 N (112 ± 5 lb).
			Free length after test is 152.91 mm (6.020 inch).

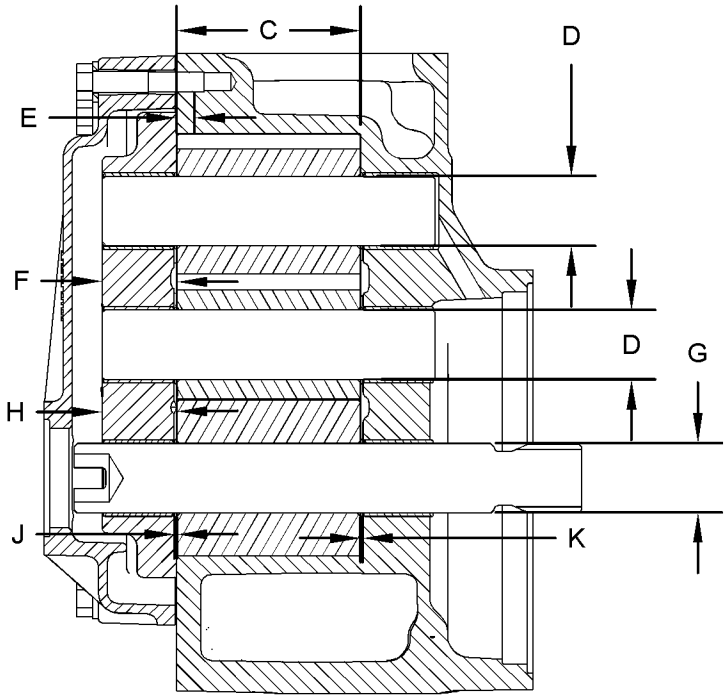

Illustration 76 g03088658

Section A-A

Table 44

Specification for 8N-6152 Engine Oil Pump Gp			
Item	**Qty**	**Part**	**Specification Description**
C	2	7N-5052 Gear	Length of the new gear is 84.000 ± 0.015 mm (3.3071 ± 0.0006 inch).
			Depth of the bore in the oil pump body for the new gear is 84.15 ± 0.02 mm (3.313 ± 0.001 inch).
D	2	7W-1017 Shaft	Diameter of the new shaft is 31.742 ± 0.008 mm (1.2497 ± 0.0003 inch).
			Bore in the sleeve bearing for the new shaft assembly is 31.811 ± 0.013 mm (1.2524 ± 0.0005 inch).
E	2	4M-3248 Hollow Dowel	Extension of the hollow dowel from the oil pump cover is 6.0 ± 0.5 mm (0.24 ± 0.02 inch).
F	-	-	Distance from the end of the idler shaft to the gear face is 34.0 ± 0.5 mm (1.34 ± 0.02 inch).
G	1	7W-1017 Shaft	Diameter of the new shaft is 31.742 ± 0.008 mm (1.2497 ± 0.0003 inch).
			Bore in the sleeve bearing for the new shaft after assembly is 31.811 ± 0.013 mm (1.2524 ± 0.0005 inch).
H	-	-	Distance from the end of the shaft to the gear face is 47.0 ± 0.5 mm (1.85 ± 0.02 inch).
J	1	7W-0050 Pump Cover	Installation depth of the sleeve bearing in the pump cover is 1.5 ± 0.5 mm (0.06 ± 0.02 inch).
K	1	4P-5637 Oil Pump Body As	Installation depth of the sleeve bearing in the oil pump body assembly is 1.5 ± 0.5 mm (0.06 ± 0.02 inch).

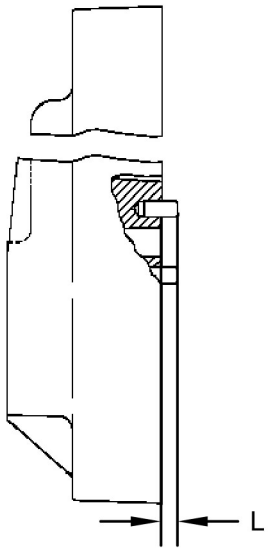

Illustration 77 g03088699

Table 45

Specification for the 8N-6152 Engine Oil Pump Gp			
Item	**Qty**	**Part**	**Specification Description**
L	2	7N-2043 Dowel	Extension of hollow dowel from the oil pump cover is 6.0 ± 1.0 mm (0.24 ± 0.04 inch).

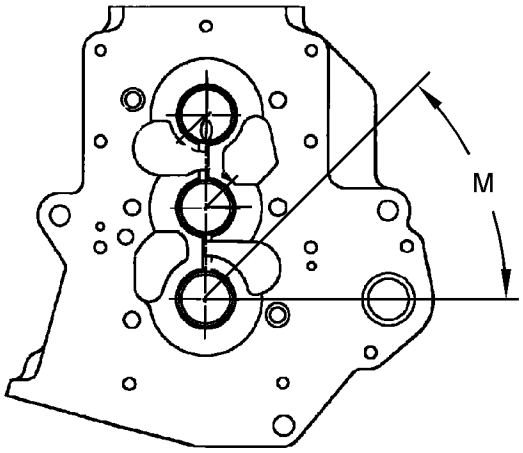

Illustration 78 g03106577

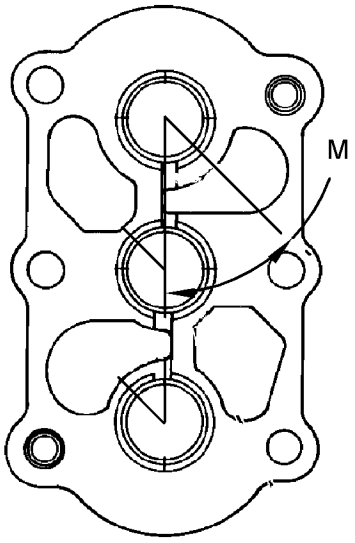

Illustration 79 g03106578

Table 46

Specification for the 8N-6152 Engine Oil Pump Gp			
Item	**Qty**	**Part**	**Specification Description**
M	-	-	Position of bearing joints from the centerline through the bearing bores is 45 ± 15 degrees.

i06167059

Engine Oil Pump

SMCS Code: 1304

Part No.: 106-9872

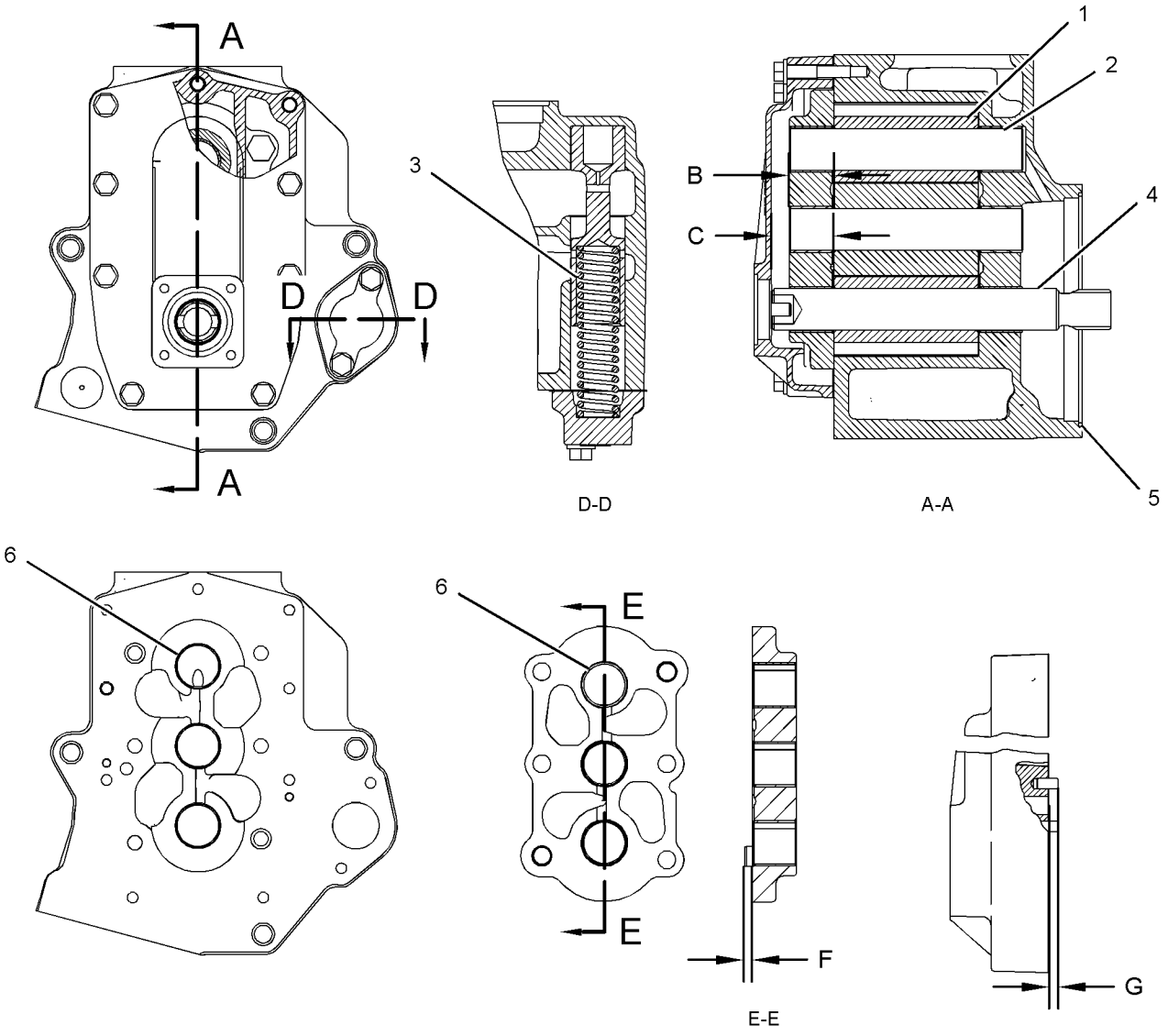

Illustration 80 g03836625

Table 47

Specification for the 106-9872 Engine Oil Pump Gp			
Item	**Qty**	**Part**	**Specification Description**
1	2	106-9866 Gear	Length of the new gear is 110.000 ± 0.015 mm (4.3307 ± 0.0006 inch).

(continued)

(Table 47, contd)

Specification for the 106-9872 Engine Oil Pump Gp			
Item	**Qty**	**Part**	**Specification Description**
			Depth of the bore in the oil pump body for the new gear is 110.15 ± 0.02 mm (4.337 ± 0.001 inch).
2	2	106-9867 Idler Shaft Assembly	Diameter of the 106-9865 Idler Shaft is 31.742 ± 0.008 mm (1.2497 ± 0.0003 inch).
			Distance (B) from the end of the shaft to the gear face is 34.0 ± 0.5 mm (1.34 ± 0.02 inch).
			Bore in the bushing for idler shaft assembly is 31.811 ± 0.013 mm (1.2524 ± 0.0005 inch).
3	1	107-7175 Spring	Length under test force is 107.16 mm (4.219 inch).
			Test force is 555.6 ± 20.0 N (124.9 ± 4.5 lb).
			Free length after test is 144.5 mm (5.69 inch).
4	1	106-9869 Oil Pump Drive Shaft As	Diameter of the new 106-9868 Shaft is 31.742 ± 0.008 mm (1.2497 ± 0.0003 inch).
			Bore in the bushing for oil pump drive shaft assembly is 31.811 ± 0.013 mm (1.2524 ± 0.0005 inch).
			Distance (C) from the end of the shaft to the gear face is 47.0 ± 0.5 mm (1.85 ± 0.02 inch).
5	1	298-6387 O-Ring Seal	Lubricate the bore lightly with the fluid that is being sealed.
6	6	7W-0060 Bushing	Installation depth is 1.5 ± 0.5 mm (0.06 ± 0.02 inch).
			Position of bushing joints from the centerline through the bearing bores is 45 ± 15 degrees.
F	2	4M-3248 Hollow Dowel	Extension of the hollow dowel from the oil pump cover is 6.0 ± 0.5 mm (0.24 ± 0.02 inch).
G	2	7N-2043 Dowel	Extension of the dowel from the oil pump cover is 6.0 ± 1.0 mm (0.24 ± 0.04 inch).
The rotation of the drive gear is clockwise when you view the engine oil pump from the drive end.			
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.			

i02617863

Engine Oil Cooler Bypass and Cooling Jet Sequence Valves

SMCS Code: 1314; 1331

Part No.: 4W-6062, 7E-9252
S/N: 4MJ1–Up

Part No.: 4W-6062
S/N: 50Y1–Up

Part No.: 4W-6062
S/N: 96Y1–Up

Part No.: 4W-6062
S/N: 29Z1–Up

Part No.: 4W-6062
S/N: 66Z1–Up

Part No.: 4W-6062
S/N: 69Z1–Up

Part No.: 4W-6062
S/N: 72Z1–Up

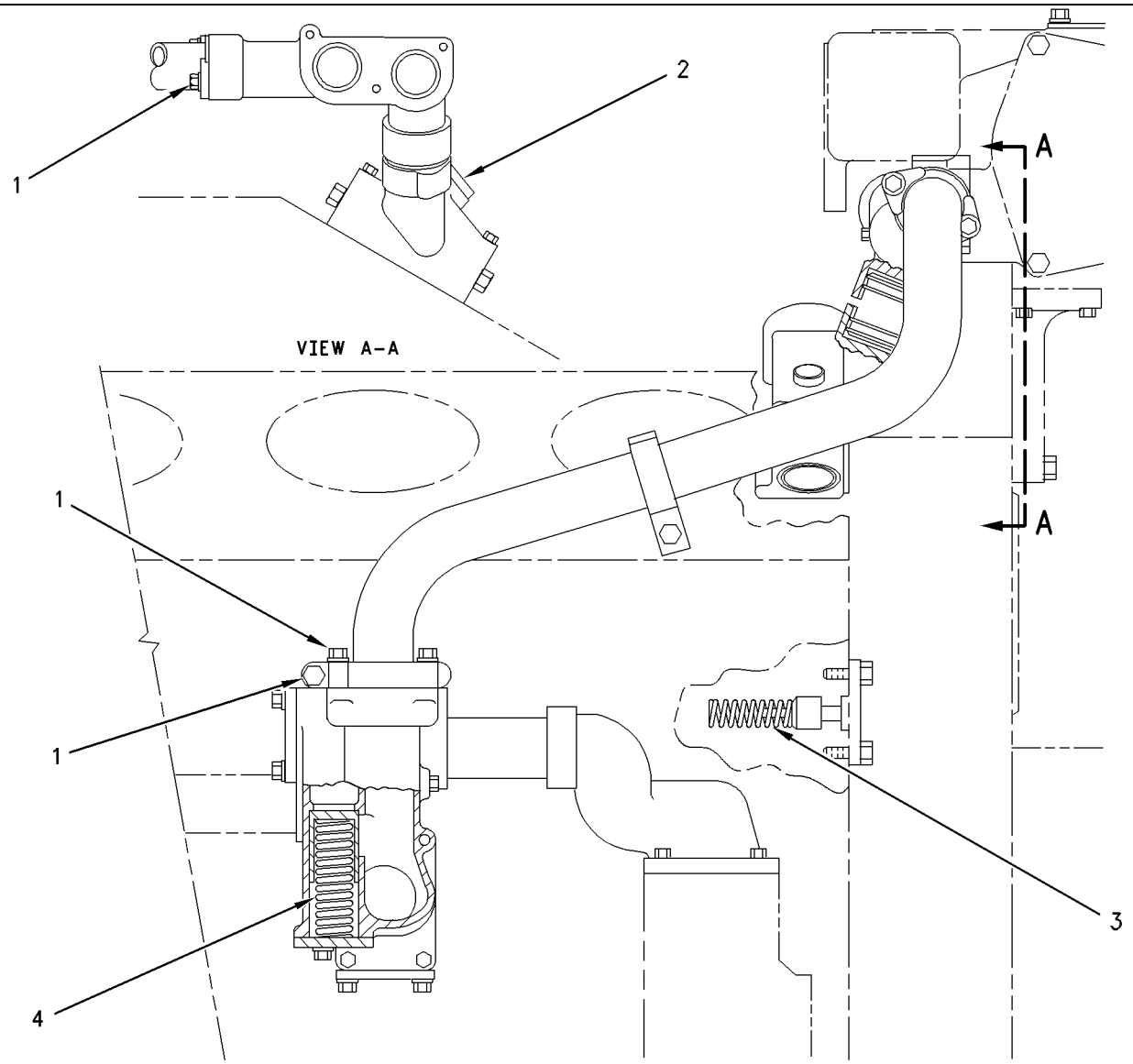

Illustration 81 g00277849

Typical example

(1) Clamp bolts

Torque . . . . . .47 ± 9 N·m ((35 ± 7 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 ± 15 N·m ((75 ± 11 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 ± 30 kPa ((19 ± 4 psi))

Both of the cooling jet sequence valves must be fully open at the following pressure difference:
. . . . . 200 ± 30 kPa ((29 ± 4 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))

i03139927

Engine Oil Cooler Bypass and Cooling Jet Sequence Valves

SMCS Code: 1314; 1331

Part No.: 115-7860
S/N: 4MJ1–Up

Part No.: 115-7860
S/N: 50Y1–Up

Part No.: 115-7860
S/N: 29Z1–Up

Part No.: 115-7860
S/N: 66Z1–Up

Part No.: 115-7860
S/N: 69Z1–Up

Part No.: 115-7860
S/N: 72Z1–Up

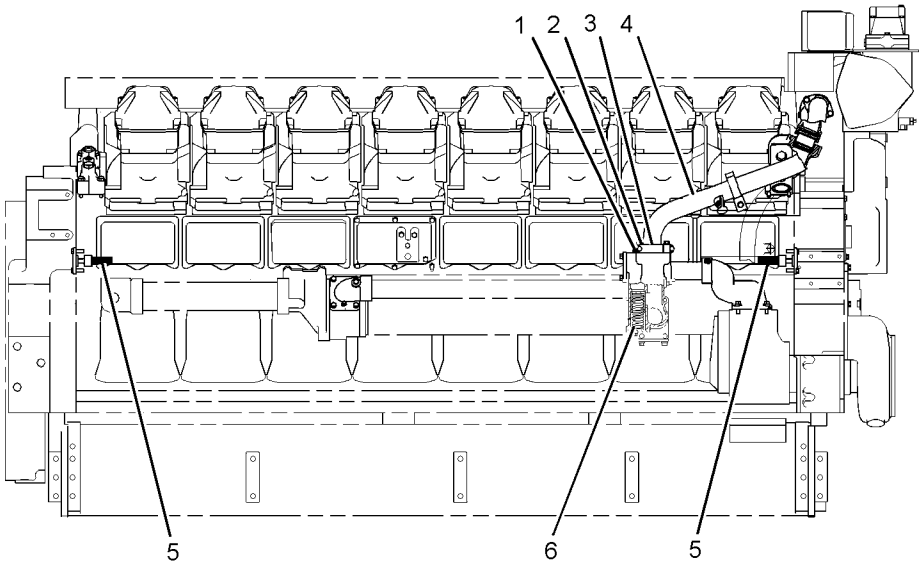

Illustration 82 g01616336

Right side view
Typical example

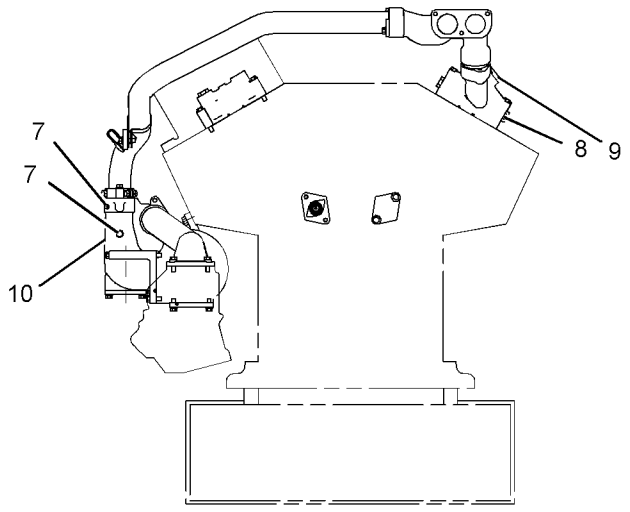

Illustration 83 g01616353
Front view
Typical example

Use the following tightening sequence for the clamp bolts:

1. Snugly tighten the clamp assembly (3) to the tube (4).

2. Tighten two bolts (2) of the clamp assembly to the elbow (10) to 47 ± 9 N·m (35 ± 7 lb ft).

3. Tighten two bolts (1) of the clamp assembly to the tube (4) to 47 ± 9 N·m (35 ± 7 lb ft).

Note: The cooling jet sequence valves must start to open at a pressure difference of 130 ± 30 kPa (19.0 ± 4.5 psi).

Note: The cooling jet sequence valves must be fully open at a pressure difference of 200 ± 30 kPa (29.0 ± 4.5 psi).

(5) 6B-9202 Spring for the cooling jet sequence valve

Quantity 2
Length under test force . . .68.3 mm ((2.69 inch))
Test force . . . . . 85 to 102 N ((19 to 23 lb))
Free length after test . . . .112.7 mm ((4.44 inch))
Outside diameter . . . . . 24.60 mm ((0.969 inch))

Note: The oil cooler bypass valve must open with a pressure difference of 180 ± 20 kPa (26 ± 3 psi).

(6) 2W-1635 Spring for oil cooler bypass valve

Length under test force . 102.0 mm ((4.02 inch))
Test force . . . . . 518 ± 26 N ((115.0 ± 5.8 lb))
Free length after test . . . 143.4 mm ((5.65 inch))
Outside diameter . . . 37.251 mm ((1.4666 inch))

(7) Lubricate the bore of the O-ring seals lightly with the clean engine oil.

(8) Lubricate the bore of two O-ring plugs lightly with the clean engine oil.

(9) Torque for the plug . . . . . 100 ± 15 N·m ((75 ± 11 lb ft))

i05343582

Crankcase Breather

SMCS Code: 1317

Part No.: 124-5513
S/N: 50Y1–Up

S/N: 96Y1–Up

Part No.: 124-5513
S/N: 29Z1–Up

Part No.: 124-5513
S/N: 66Z1–Up

Part No.: 124-5513
S/N: 69Z1–Up

Part No.: 124-5513
S/N: 72Z1–Up

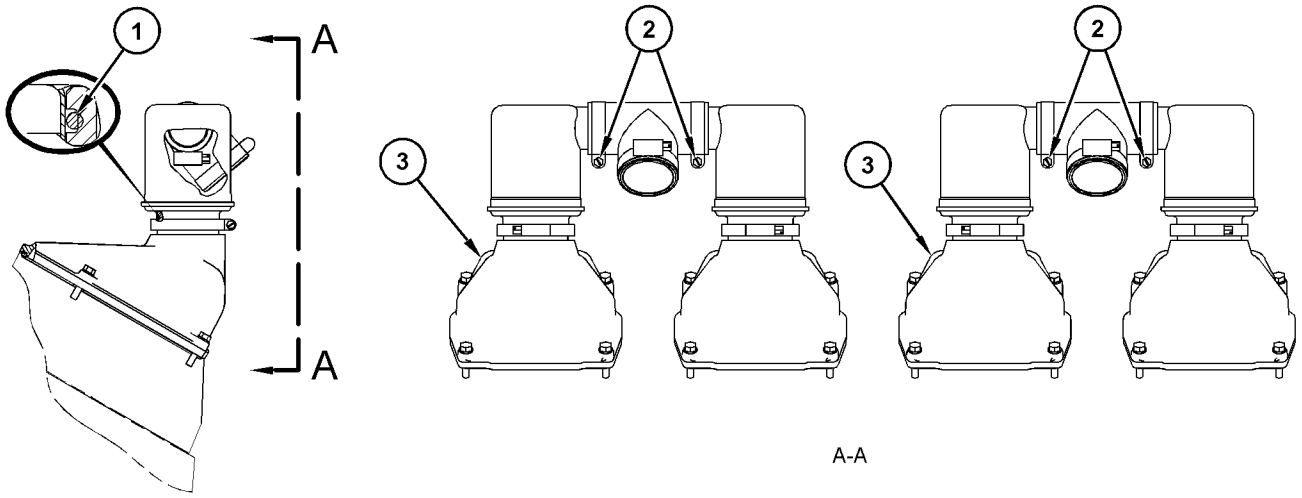

Illustration 84 g03384812

Typical example

Front view

Table 48

Specification for the 124-5513 Breather Gp and 247-4696 Breather Gp			
Item	**Qty**	**Part**	**Specification Description**
1	4	033-6031 O-Ring Seal	Lubricate the bore of O-ring seals lightly with clean engine oil.
2	4	5P-0597 Hose Clamp	Torque to 3.0 ± 0.5 N·m (27.0 ± 4.4 lb in).
3	4	101-4199 Cover As	Apply green Loctite 620 to the joint surfaces.
			Seat the shoulder of 4W-1287 Adapter against the cover.
			Apply green Loctite 290 to 4W-1287 Adapter after assembly.

i06170688

Crankcase Breather

SMCS Code: 1317

Part No.: 124-5512
S/N: 50Y1–Up

Part No.: 124-5512
S/N: 96Y1–Up

Part No.: 124-5512
S/N: 29Z1–Up

Part No.: 124-5512
S/N: 66Z1–Up

Part No.: 124-5512
S/N: 69Z1–Up

Part No.: 124-5512
S/N: 72Z1–Up

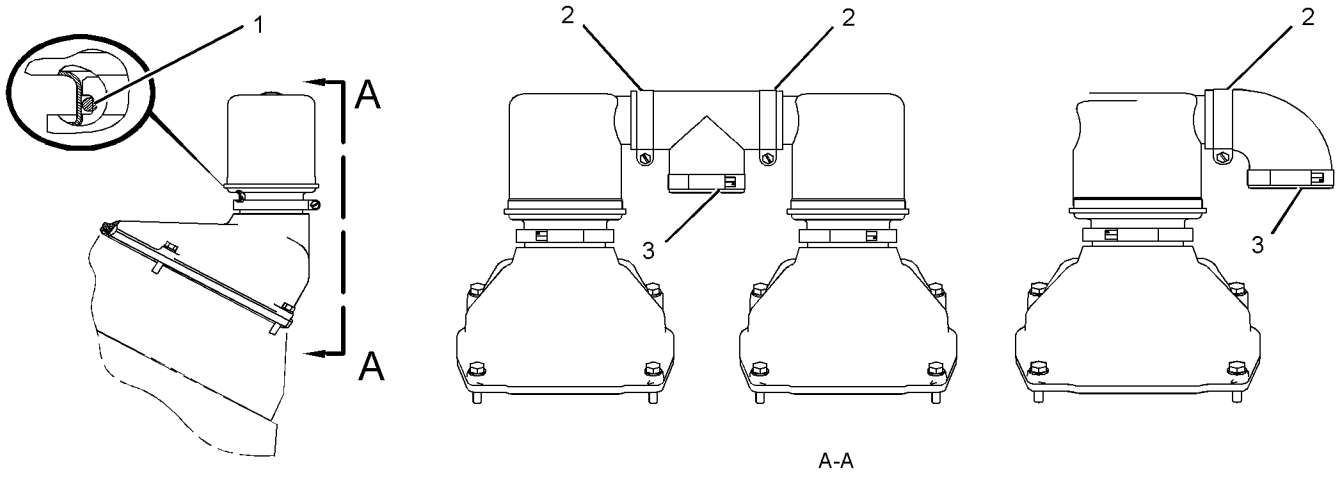

Illustration 85 g03835234

Table 49

Specification for 124-5512 Breather Gp			
Item	**Qty**	**Part**	**Specification Description**
1	3	033-6031 O-Ring Seal	Before assembly, lubricate the bore lightly with 5P-3975 Rubber Lubricant.
2	3	5P-0597 Hose Clamp	Torque to 3.0 ± 0.5 N·m (26.6 ± 4.4 lb in).
3	2	5P-4868 Hose Clamp	Torque to 3.0 ± 0.5 N·m (26.6 ± 4.4 lb in).

i07317885

Crankcase Breather

SMCS Code: 1317

Part No.: 144-5688, 4W-1449
S/N: 4MJ1–Up

Part No.: 144-2890, 4W-1449
S/N: 50Y1–Up

Part No.: 144-2890, 4W-0473, 4W-1449
S/N: 96Y1–Up

Part No.: 144-2890, 144-5688, 4W-1449
S/N: 29Z1–Up

Part No.: 144-2890, 4W-1449
S/N: 66Z1–Up

Part No.: 144-2890, 4W-0473
S/N: 69Z1–Up

Part No.: 144-2890, 144-5688, 4W-1449
S/N: 72Z1–Up

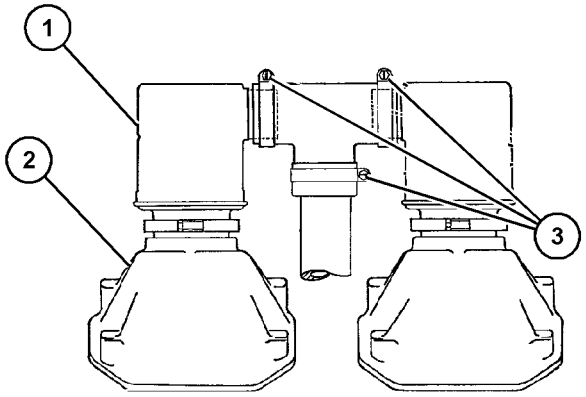

Illustration 86 g06281400

(1) Breather assembly (2) Cover assembly

Table 50

Item	Qty	Part	Specification Description
3	2	Hose Clamp	Torque to 3.0 ± 0.5 N·m (27 ± 4 lb in).

i04908574

Engine Oil Pan

SMCS Code: 1302

Part No.: 7C-7178

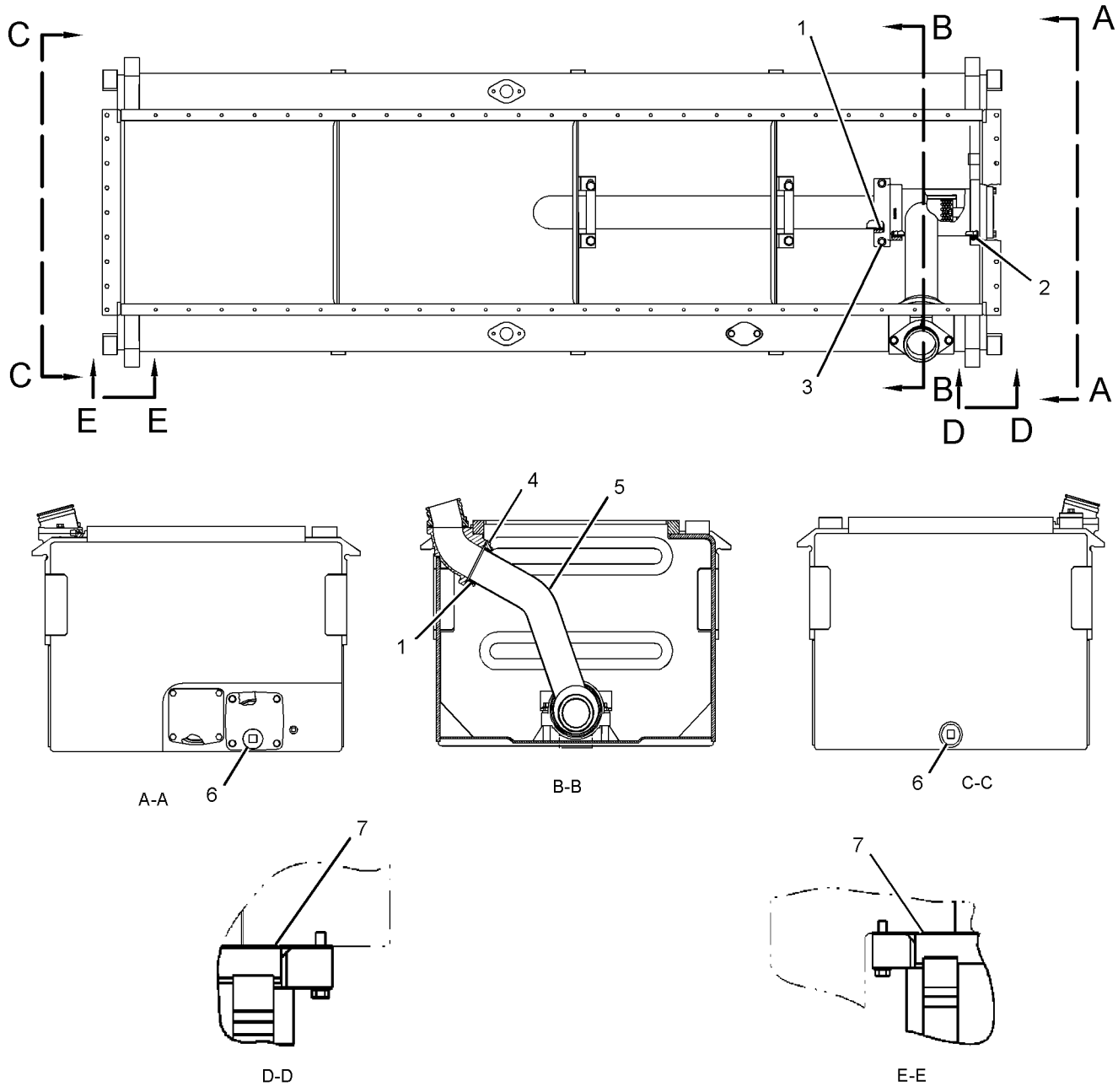

Illustration 87 g02843996

Top view

Table 51

Specification for 7C-7178 Oil Pan Gp			
Item	**Qty**	**Part**	**Specification Description**
1	3	3P-0654 O-Ring Seal	Before assembly, apply 1P-0808 Multipurpose Grease in order to lubricate the bores.
2	2	7X-1547 O-Ring Seal	Before assembly, apply 1P-0808 Multipurpose Grease in order to lubricate the bores.
3	2	0S-1590 Bolt	In order to prevent stress on the tube assembly (5), use the following tightening procedure during assembly: 1. Tighten two bolts (4) to 47 ± 9 N·m (35 ± 7 lb ft). 2. Then tighten two bolts (3) to 47 ± 9 N·m (35 ± 7 lb ft).
4	2	0S-1588 Bolt	
6	2	4B-2363 Oil Drain Plug	Torque to 145 ± 15 N·m (107 ± 11 lb ft).
7	-	-	As required, apply Loctite RTV Silicone Clear to the joints of the gasket.

i04923806

Engine Oil Pan

SMCS Code: 1302

Part No.: 7C-6887
S/N: 96Y1–Up

Part No.: 7C-6887
S/N: 69Z1–Up

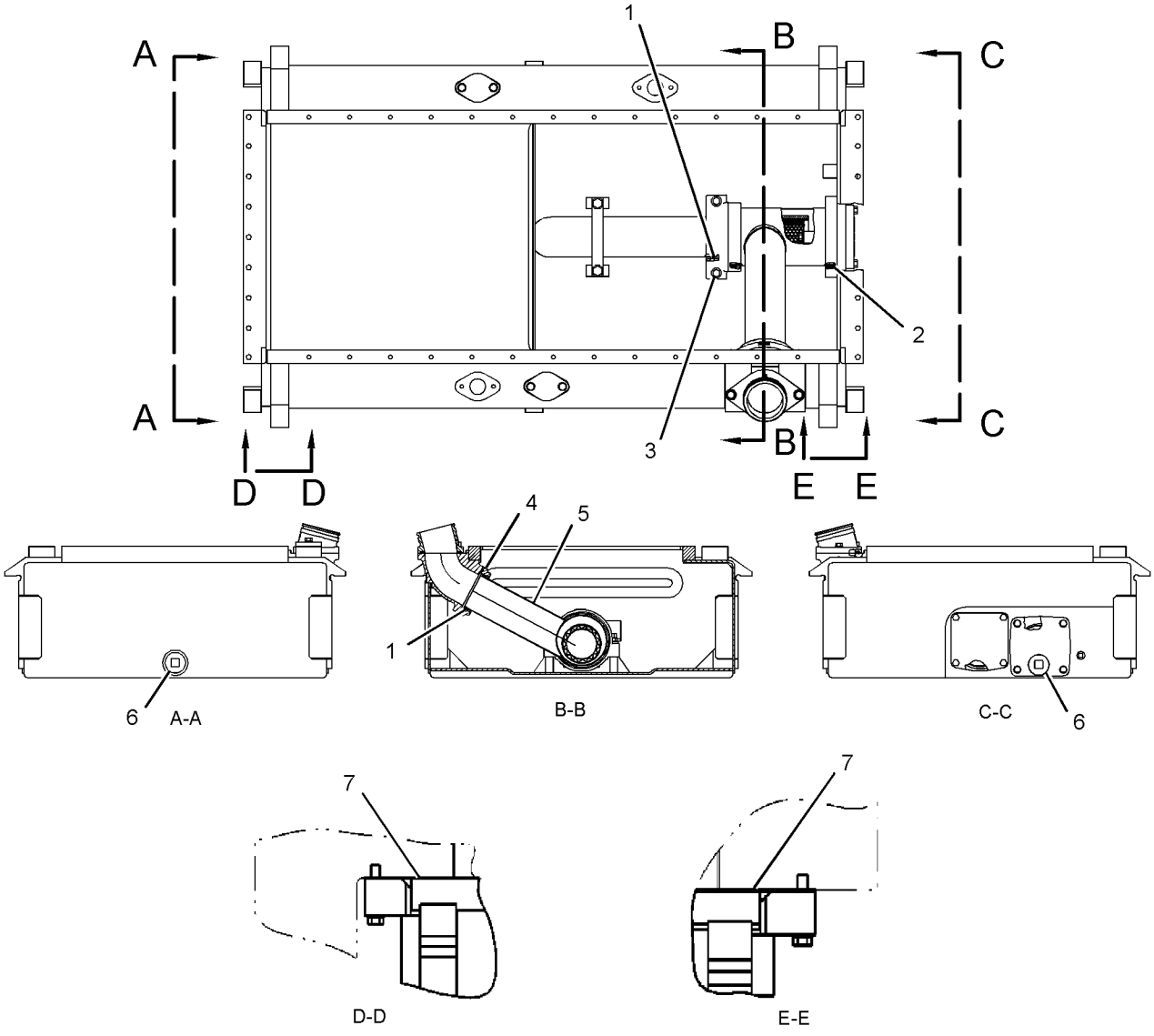

Illustration 88 g03090816
Top view

Table 52

Specification for 7C-6887 Oil Pan Gp			
Item	**Qty**	**Part**	**Specification Description**
1	2	3P-0654 O-Ring Seal	Before assembly, apply 1P-0808 Multipurpose Grease in order to lubricate the bores.
2	2	7X-1547 O-Ring Seal	Before assembly, apply 1P-0808 Multipurpose Grease in order to lubricate the bores.
3	2	0S-1590 Bolt	In order to prevent stress on the tube assembly (5), use the following tightening procedure during assembly: 1. Tighten two bolts (4) to 47 ± 9 N·m (35 ± 7 lb ft). 2. Then tighten two bolts (3) to 47 ± 9 N·m (35 ± 7 lb ft).
4	2	0S-1588 Bolt	
6	2	4B-2363 Oil Drain Plug	Torque to 145 ± 15 N·m (107 ± 11 lb ft).
7	-	-	As required, apply Loctite RTV Silicone Clear to the joints of the gasket.

i04924021

Engine Oil Pan

SMCS Code: 1302

Part No.: 7C-4711

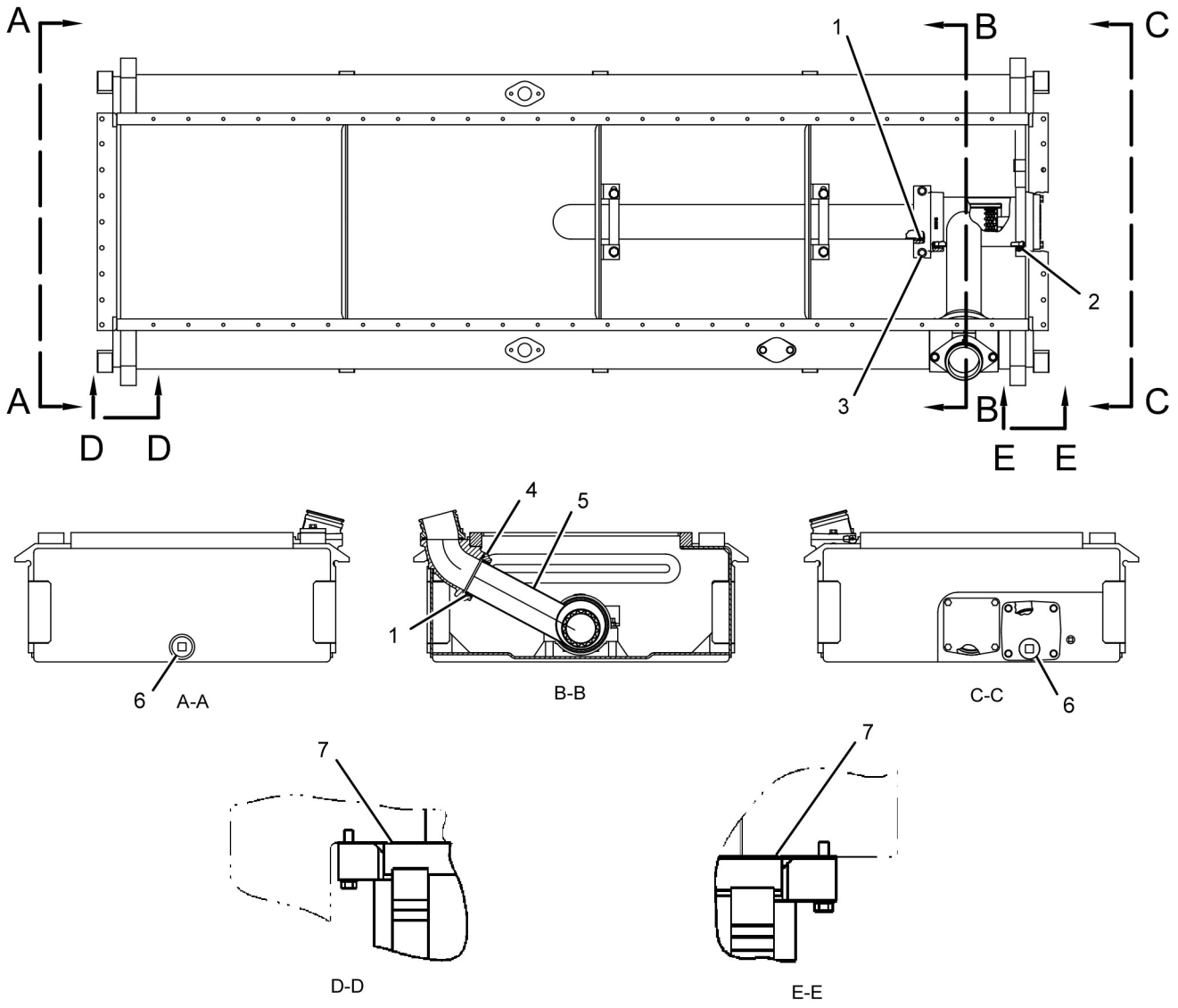

Illustration 89 g03093076

Top view

Table 53

Specification for 7C-4711 Oil Pan Gp			
Item	**Qty**	**Part**	**Specification Description**
1	2	3P-0654 O-Ring Seal	Before assembly, apply 1P-0808 Multipurpose Grease in order to lubricate the bores.

(continued)

(Table 53, contd)

2	2	7X-1547 O-Ring Seal	Before assembly, apply 1P-0808 Multipurpose Grease in order to lubricate the bores.
3	2	0S-1590 Bolt	In order to prevent stress on the tube assembly (5), use the following tightening procedure during assembly: 1. Tighten two bolts (4) to 47 ± 9 N·m (35 ± 7 lb ft). 2. Then tighten two bolts (3) to 47 ± 9 N·m (35 ± 7 lb ft).
4	2	0S-1588 Bolt	
6	2	4B-2363 Oil Drain Plug	Torque to 145 ± 15 N·m (107 ± 11 lb ft).
7	-	-	As required, apply Loctite RTV Silicone Clear, Permatex No # 2, or Red Loctite High Tack GS S to the joints of the gasket.

i05770017

Engine Oil Pan

SMCS Code: 1302

Part No.: 8N-7236

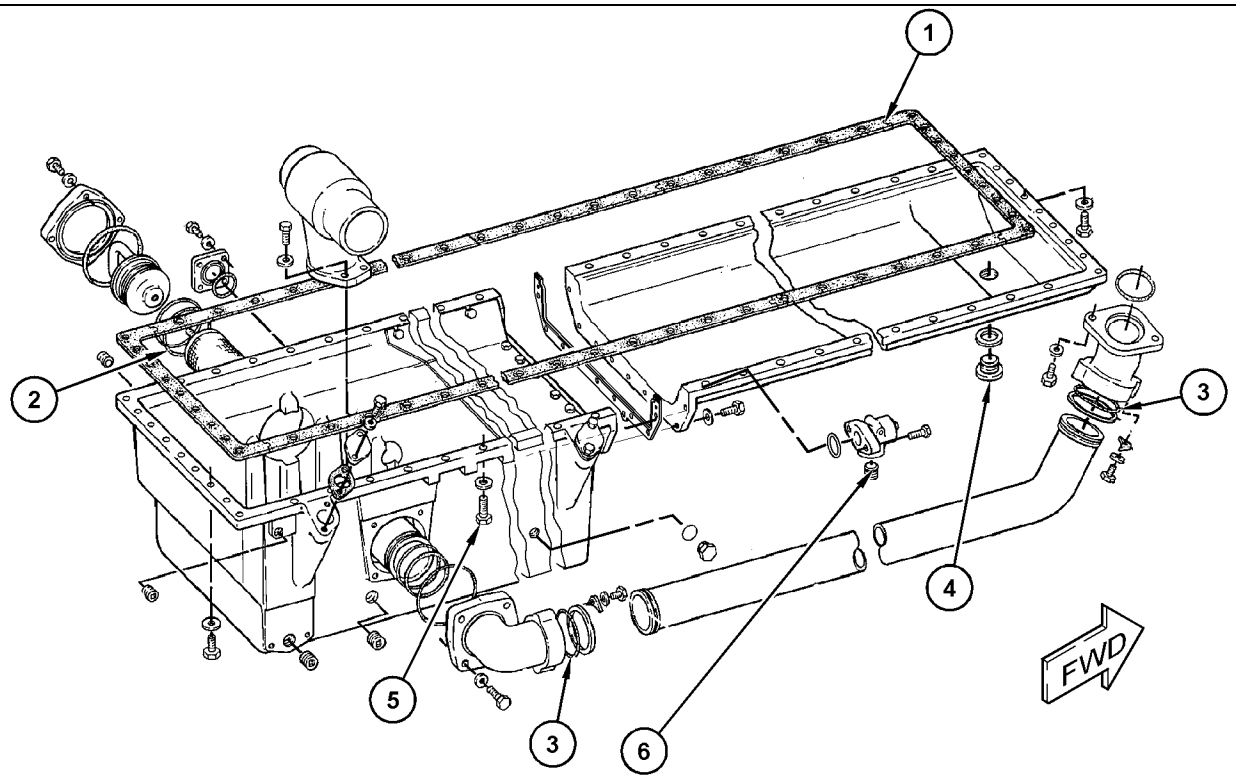

Illustration 90 g03660706

Table 54

Specification for 8N-7236 Oil Pan Gp			
Item	**Qty**	**Part**	**Specification Description**
1	-	-	Before assembly, as required apply red Loctite 596 to the surface.
2	2	6V-4315 O-Ring Seal	Lubricate the bore lightly with the lubricant that is being sealed.
3	2	3P-0654 O-Ring Seal	Lubricate the bore lightly with the lubricant that is being sealed.
4	1	4B-2363 Oil Drain Plug	Torque to 145 ± 15 N·m (107 ± 11 lb ft).
5	50	5P-5855 Bolt	After assembly, as required apply red Loctite LV Core Plug Sealant to threads.
6	1	6I-0723 Oil Drain Plug	Lubricate the bore lightly with the lubricant that is being sealed. Torque to 55 ± 7 N·m (41 ± 5 lb ft).

i04404587

Water Temperature Regulator

SMCS Code: 1355

Part No.: 6I-4950

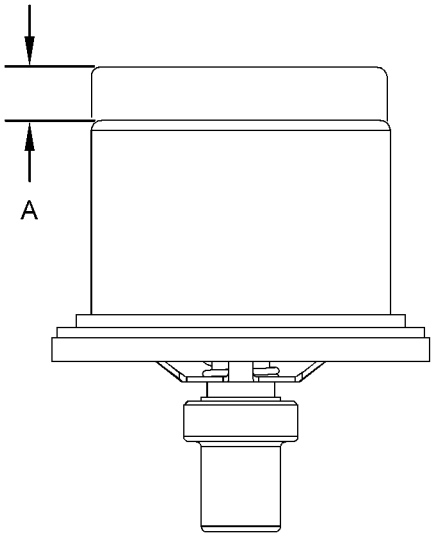

Illustration 91 g02595056

Table 55

Specification for 6I-4950 Water Temperature Regulator			
Item	**Qty**	**Part**	**Specification Description**
A	-	-	Minimum opening distance at fully open temperature is 10.4 mm (0.41 inch).
Start to open temperature is 81 to 84 °C (178 to 183 °F).			
Fully open temperature is 92 °C (198 °F).			

i01980486

Water Pump

SMCS Code: 1361

Part No.: 212-8176
S/N: 96Y1–Up

Part No.: 212-8176
S/N: 66Z1–Up

Part No.: 212-8176
S/N: 69Z1–Up

Type 1

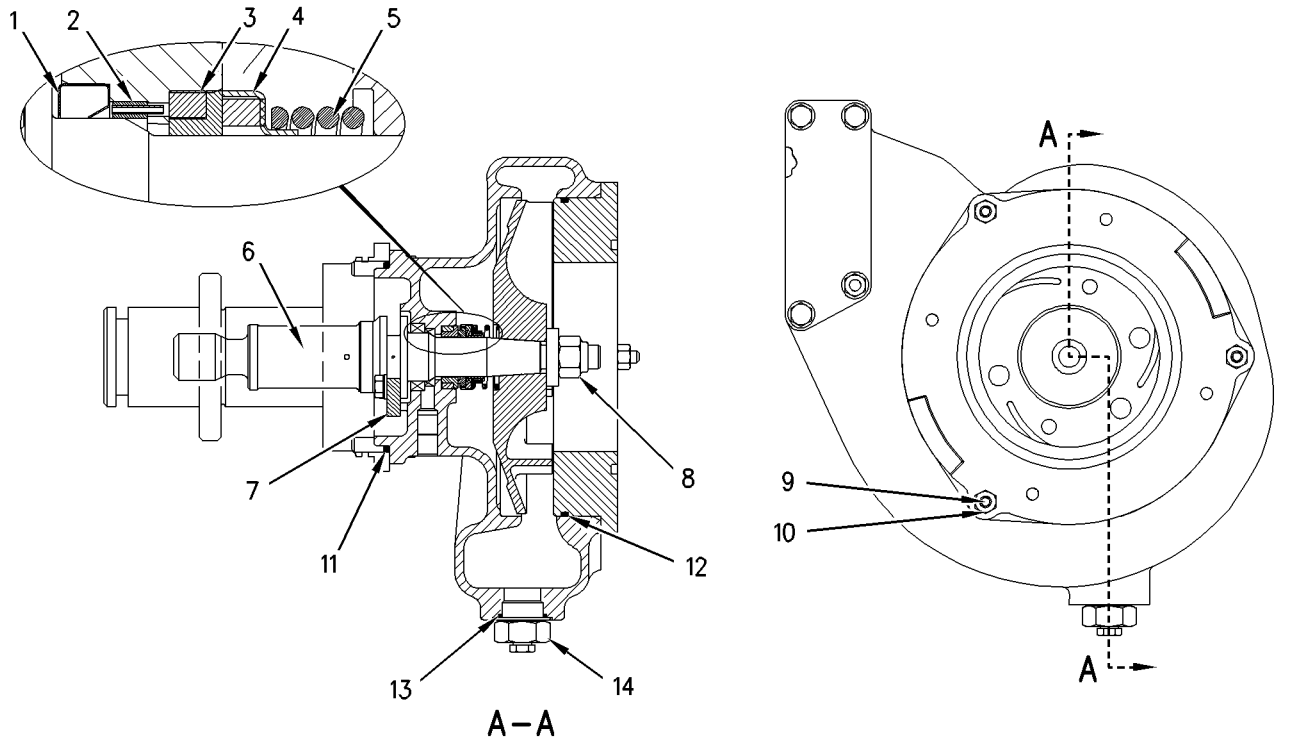

Illustration 92 g00993011

Typical example

(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

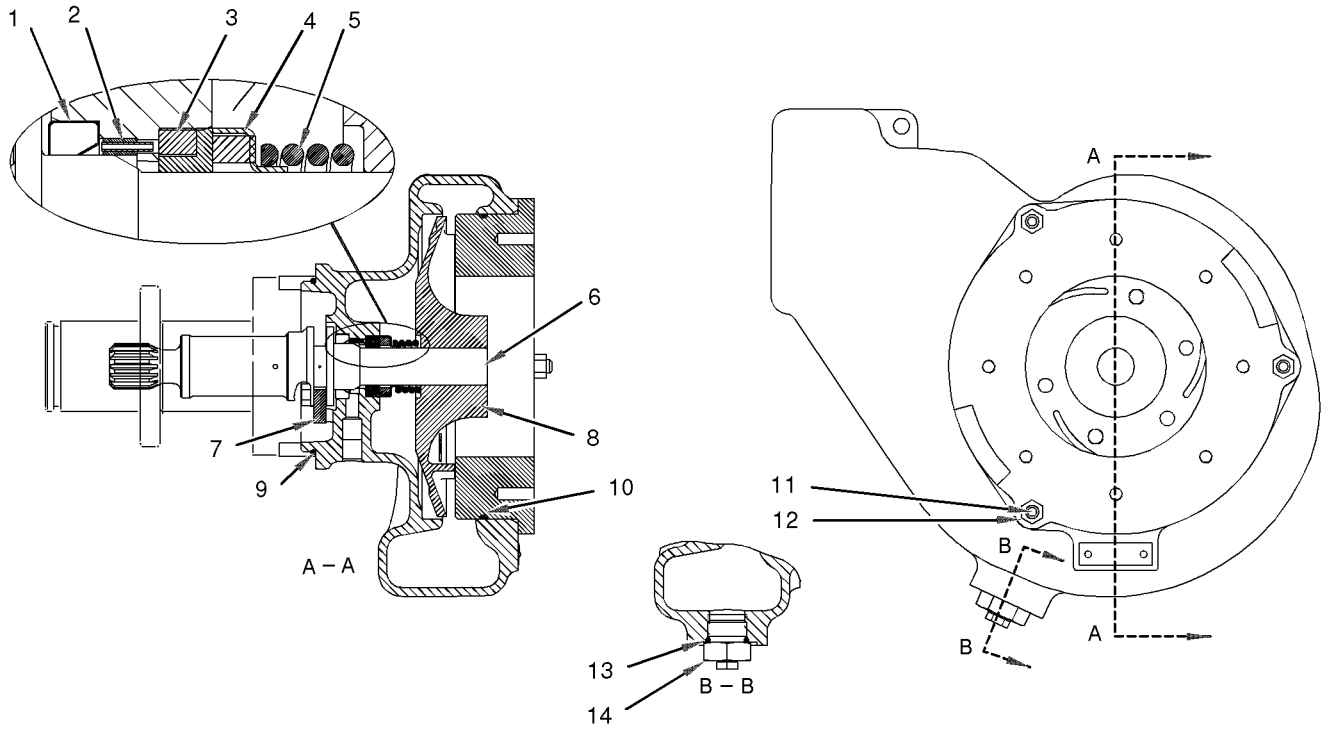

Illustration 93 g01026565

Typical example

(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))

i04395597

Water Pump

SMCS Code: 1361

Part No.: 2W-9726
S/N: 96Y1–Up

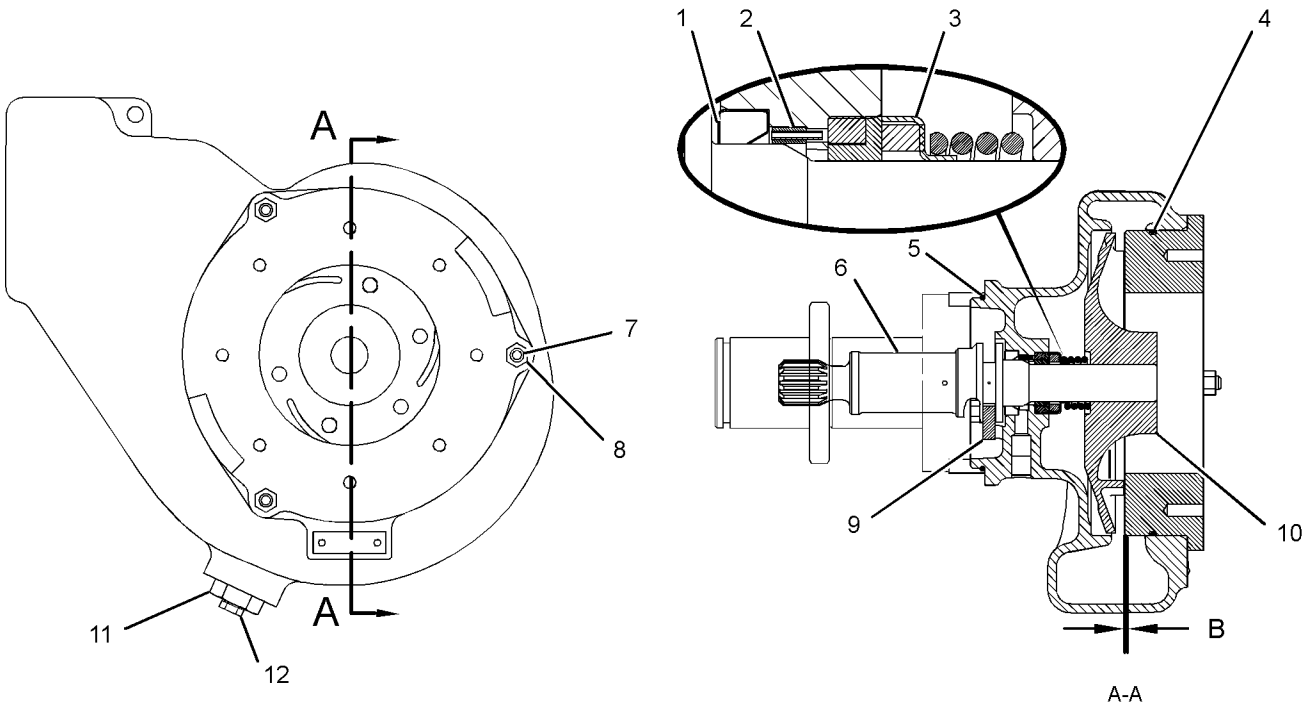

Illustration 94 g02847239

(2) Ring assembly

(3) Water pump seal group

Table 56

Specification for 2W-9726 Water Pump Gp			
Item	**Qty**	**Part**	**Specification Description**
1	1	8C-5236 Lip Type Seal	Do not lubricate the sealing lip of the lip type seal.
4	1	149-5462 O-Ring Seal	Lubricate the bore of the O-ring seals with glycerin or an approved equivalent.
5	1	5H-6734 O-Ring Seal	Lubricate the bore of the O-ring seals with glycerin or an approved equivalent.
6	1	212-8180 Pump Drive Shaft As	Lubricate the shaft with a thin film of clean engine oil before pressing the impeller onto the shaft. The end of the shaft must be flush with the face of the impeller within 0.15 mm (0.006 inch). Diameter of the shaft to the impeller seating is 25.400 to 25.413 mm (1.0000 to 1.0005 inch).
7	3	9M-2151 Taperlock Stud	Torque to 35 ± 5 N·m (26 ± 4 lb ft).
8	3	9S-8752 Full Nut	Torque to 27 ± 4 N·m (239 ± 35 lb in).

(continued)

(Table 56, contd)

9	1	7N-4758 Thrust Washer	Thickness of new thrust washer is 8.5 mm (0.33 inch). Width of the groove for thrust washer is 8.75 ± 0.05 mm (0.344 ± 0.002 inch).
10	1	212-8187 Impeller	Bore of the impeller for new shaft is 25.342 ± 0.013 mm (0.9977 ± 0.0005 inch). Clearance between the impeller and the cover is 0.5000 ± 0.4925 mm (0.01968 ± 0.01939 inch).
B			
11	1	3D-2824 O-Ring Seal	Lubricate the bore of the O-ring seals with glycerin or an approved equivalent.
12	1	7G-8478 Adapter	Torque to 100 ± 10 N·m (74 ± 7 lb ft).

i05188702

Water Pump

SMCS Code: 1361

Part No.: 2W-9729

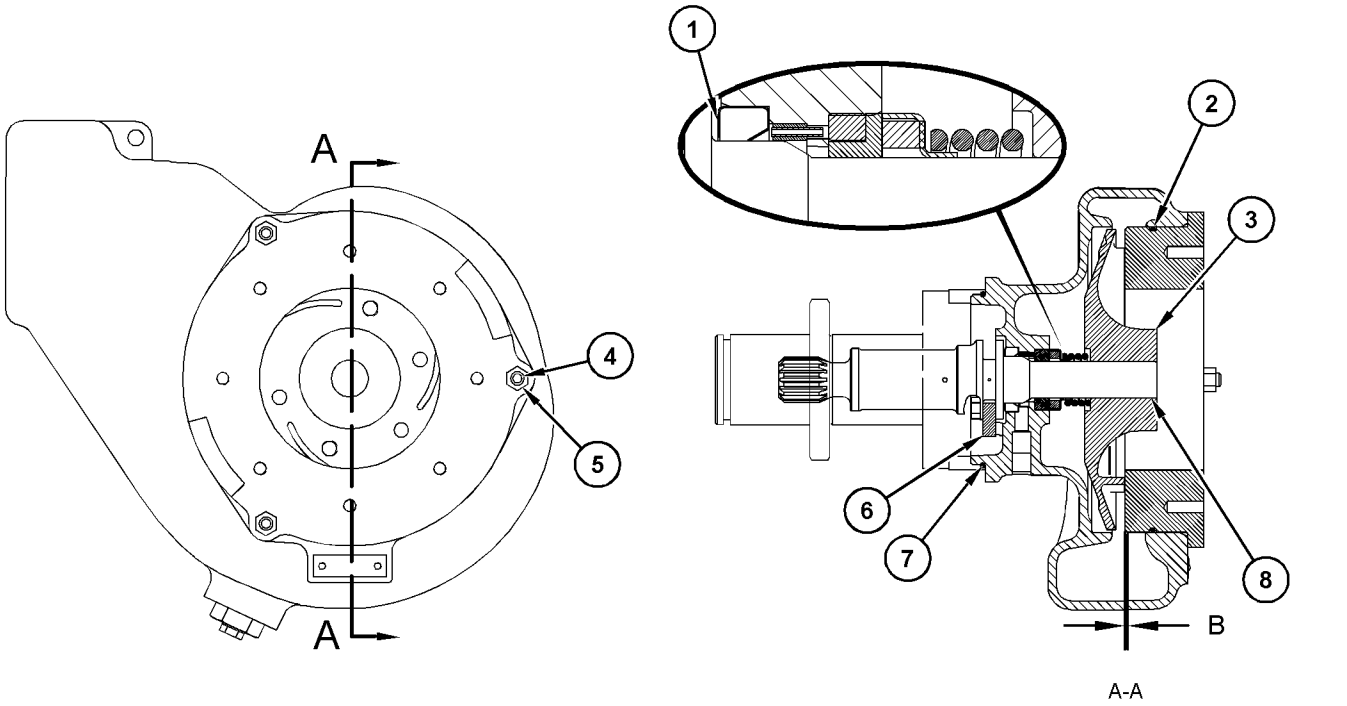

Illustration 95 g03325370

Table 57

Specification for 2W-9729 Water Pump Gp			
Item	**Qty**	**Part**	**Specification Description**
1	1	8C-5236 Lip Type Seal	Do not lubricate the sealing lip of the lip type seal.
2	1	149-5462 O-Ring Seal	Lubricate the bore of the O-ring seals with glycerin or an approved equivalent.
3	1	212-8184 Impeller	Bore of the impeller for new shaft is 25.342 ± 0.013 mm (0.9977 ± 0.0005 inch).
4	3	9M-2151 Taperlock Stud	Torque to 35 ± 5 N·m (26 ± 4 lb ft).
5	3	9S-8752 Full Nut	Torque to 27 ± 4 N·m (239 ± 35 lb in).
6	1	7N-4758 Thrust Washer	Thickness of new thrust washer is 8.5 mm (0.33 inch). Width of the groove for thrust washer is 8.75 ± 0.05 mm (0.344 ± 0.002 inch).
7	1	5H-6734 O-Ring Seal	Lubricate the bore of the O-ring seals with glycerin or an approved equivalent.

(continued)

(Table 57, contd)

8	1	212-8180 Pump Drive Shaft As	Lubricate the shaft with a thin film of clean engine oil before pressing the impeller onto the shaft. The end of the shaft must be flush with the face of the impeller within 0.15 mm (0.006 inch). Diameter of the shaft for impeller seating is 25.400 to 25.413 mm (1.0000 to 1.0005 inch).
B	-	-	Clearance between the impeller and the cover is 0.5000 ± 0.4925 mm (0.01968 ± 0.01939 inch).

i02399798

Cylinder Block

SMCS Code: 1201

Part No.: 7C-8147
S/N: 4MJ1–Up

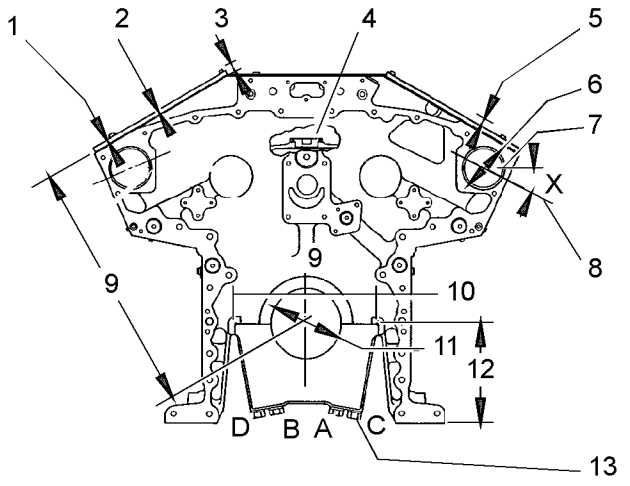

Illustration 96 g01198641

Front view of cylinder block

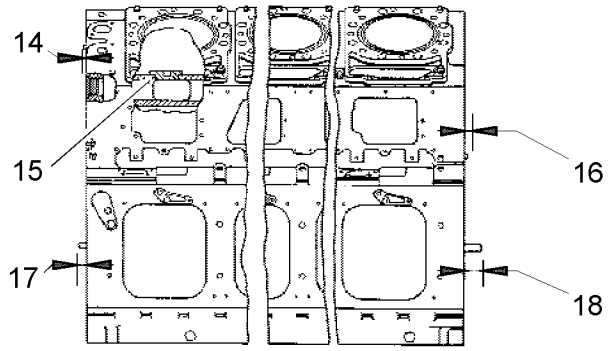

Illustration 97 g01198675

(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 . . . . . 0.208 ± 0.025 mm ((0.0082 ± 0.0010 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 . . . . . .92 ± 0.020 mm ((3.6220 ± 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 . . . 0.060 mm ((0.0024 inch))
Loose press fit between the sides of the main bearing cap and the cylinder block . . . 0.000 mm ((0.0000 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))

i02909403

Cylinder Block

SMCS Code: 1201

Part No.: 100-8027, 115-3505
S/N: 50Y1–Up

Part No.: 100-8027, 115-3505
S/N: 96Y1–Up

Part No.: 100-8027, 115-3505
S/N: 29Z1–Up

Part No.: 100-8027, 115-3505
S/N: 66Z1–Up

Part No.: 100-8027, 115-3505
S/N: 69Z1–Up

Part No.: 100-8027, 115-3505
S/N: 72Z1–Up

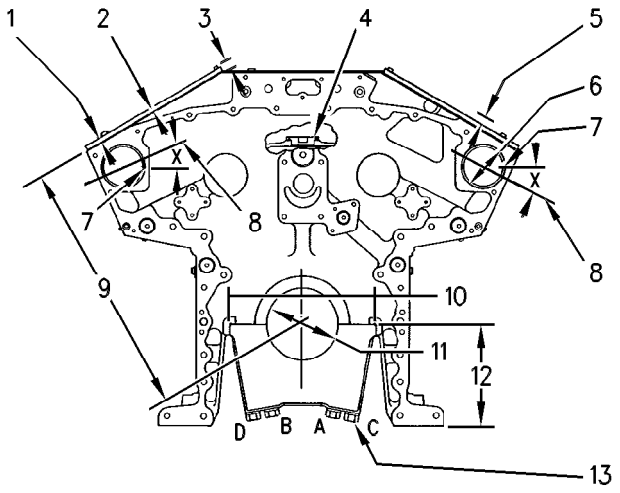

Illustration 98 g00123062

Front view of cylinder block

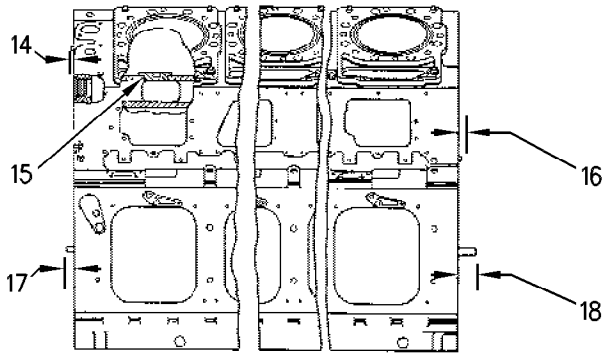

Illustration 99 g00123064

(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

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.

Note: The procedure to tighten the main bearing cap bolts depends on the diameter of the bolts. There is a different procedure for 3/4 inch bolts and for 7/8 inch bolts.

Procedure for Tightening 3/4 Inch Diameter Bolts (5P-8288 Bolt)

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

2. Tighten the bolts in the letter sequence.

Torque . . . . . 136 ± 14 N·m ((100 ± 10 lb ft))

3. Tighten the bolts in the letter sequence again.

Rotation . . . . . 210 ± 5 degrees

Procedure for Tightening 7/8 Inch Diameter Bolts (7X-7925 Bolt)

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

2. Tighten the bolts in the letter sequence.

Torque . . . . . 190 ± 14 N·m ((140 ± 10 lb ft))

3. 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))

i04935311

Cylinder Block

SMCS Code: 1201

Part No.: 240-6652
S/N: 72Z1–Up

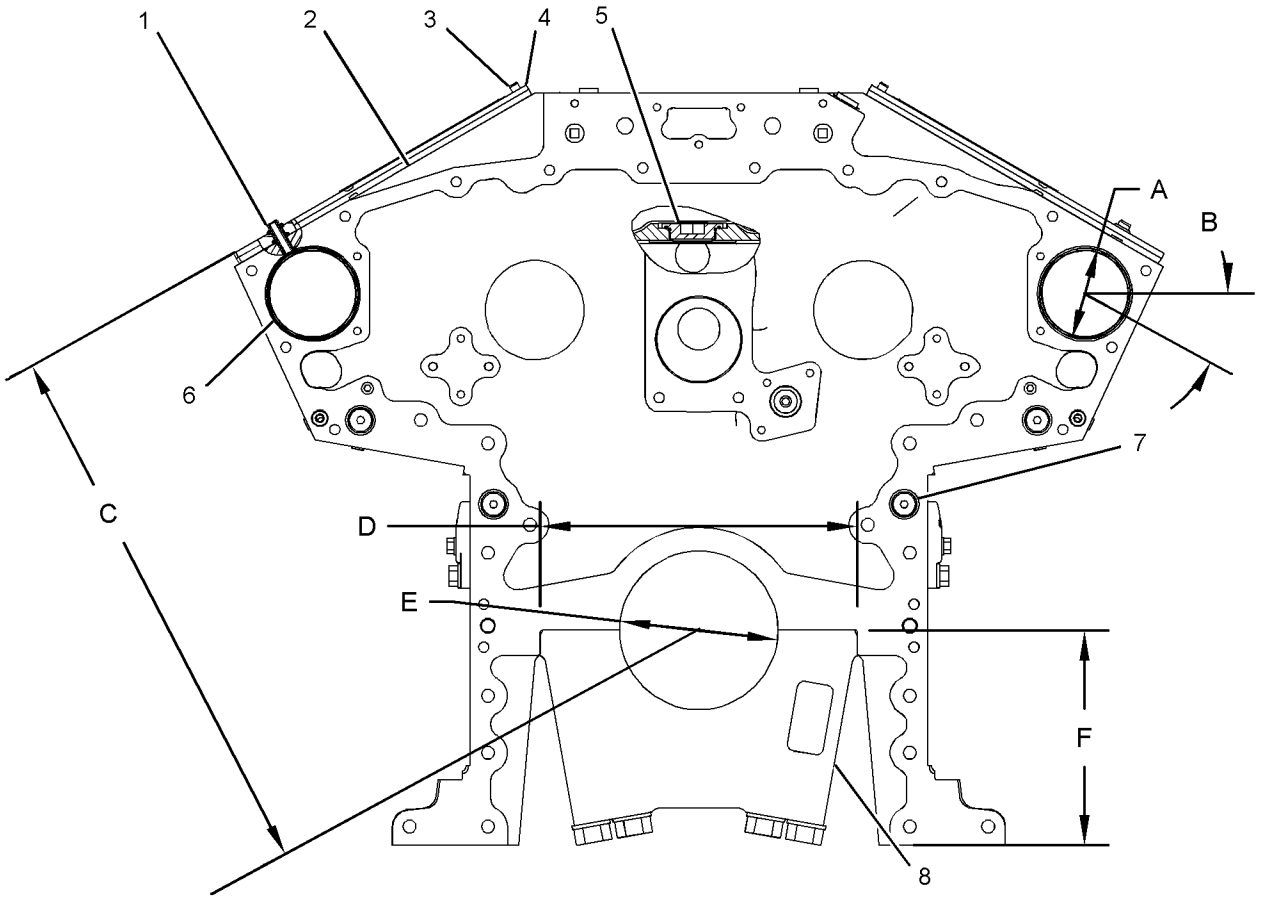

Illustration 100 g03109442

Front view

Table 58

Specification for 240-6652 Cylinder Block Gp and 383-7223 Cylinder Block Gp			
Item	**Qty**	**Part**	**Specification Description**
The top face of the cylinder block, bottom surface of spacer plate (4) and both sides of plate gasket (2) must be free of fuel, oil, water, gasket adhesives, assembly compounds and any other contaminants during assembly.			
1	16	197-7008 Dowel	Extension of the dowel is 21.0 ± 0.5 mm (0.83 ± 0.02 inch).
2	16	144-5692 Plate Gasket	Thickness of plate gasket that is between cylinder block and spacer plate is 0.194 to 0.218 mm (0.0076 to 0.0086 inch).
3	32	8T-0099 Dowel	Extension of the dowel is 21.0 ± 0.5 mm (0.83 ± 0.02 inch).

(continued)

(Table 58, contd)

4	16	110-6994 Spacer Plate	Thickness is 12.313 mm (0.4848 inch).
5	2	4W-4813 Plug	Torque to 100 ± 15 N·m (74 ± 11 lb ft).
A	18	116-1359 Camshaft Bearing	Bore of the bearing after installation is 86.00 ± 0.06 mm (3.386 ± 0.002 inch).
B	-	-	All centerlines through oil holes in the camshaft bearings and the camshaft bearing junctions (6) must be positioned as shown in Illustration 100 on each side of the cylinder block.
			Oil holes must be positioned from horizontal at an angle of 20.0 ± 0.5 degrees.
C	-	-	New dimension from centerline of crankshaft bearing bore to the top of the block is 586 mm (23.1 inch).
7	8	6V-3348 O-Ring Seal	Lubricate the bore lightly with sealant that is being sealed.
8	9	223-1696 Crankshaft Bearing Cap	Install crankshaft 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. Width (D) of crankshaft bearing cap is 340.030 ± 0.015 mm (13.3858 ± 0.0006 inch). Width in the cylinder block for crankshaft bearing cap is 339.985 ± 0.015 mm (13.3852 ± 0.0006 inch).
E	-	-	Bore in the block for the crankshaft bearings is 169.742 ± 0.020 mm (6.6827 ± 0.0008 inch).
F	-	-	New dimension from centerline of crankshaft bearing bore to bottom of block (pan rails) is 230.00 mm (9.055 inch).

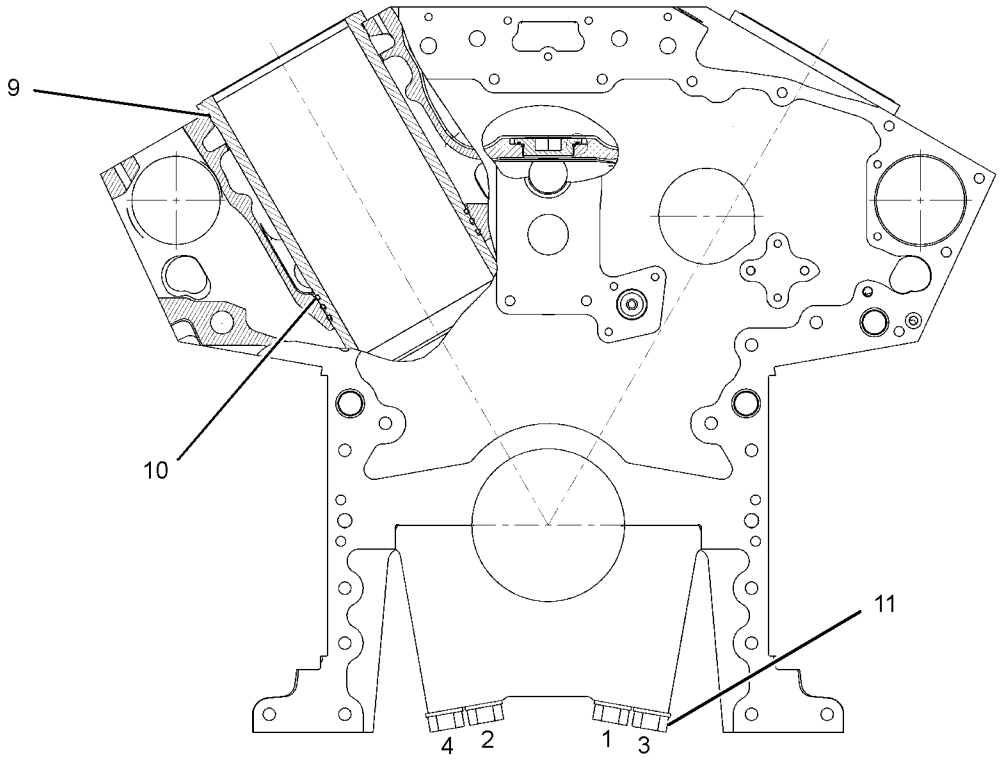

Illustration 101 g03109443

Table 59

Item	Qty	Part	Specification Description
9	16	352-6061 Liner Seal	Assemble dry seals on clean and dry liner grooves.
			Before assembly, cover seals with either P-80 Rubber Lubricant Emulsion or liquid soap.
10	48	7N-2046 O-Ring Seal	Before assembly, cover seals with either P-80 Rubber Lubricant Emulsion or liquid soap.
11	36	7X-7925 Bolt	Use the following procedure in order to tighten the crankshaft bearing cap bolts. 1. Before assembly, Lubricate the threads with clean engine oil . 2. Tighten the bolts by hand. Tighten the bolts in the numerical sequence as shown in Illustration 101 to 190 ± 14 N·m (140 ± 10 lb ft). Again tighten the bolts to an additional angle of 180 ± 5 degrees

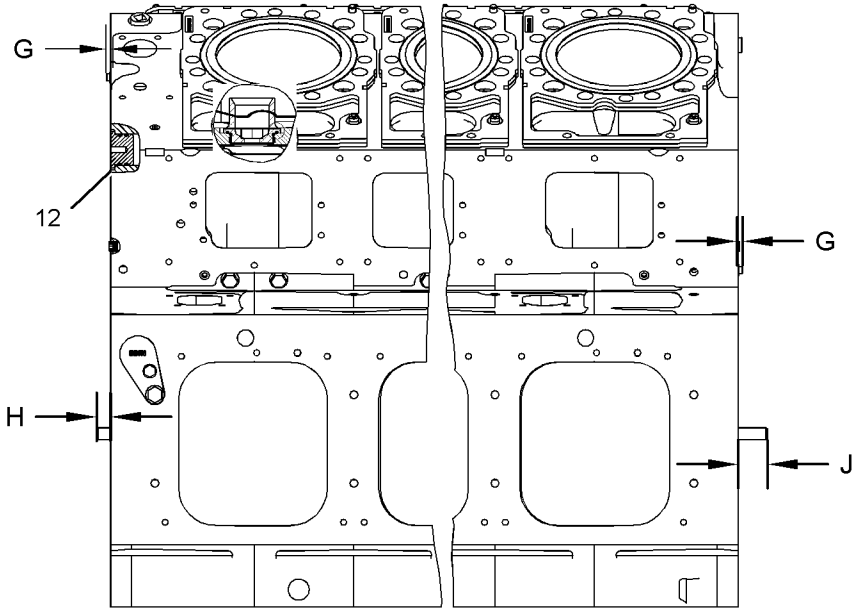

Illustration 102 g03109445

Right side view

Table 60

Item	Qty	Part	Specification Description
G	3	7N-2047 Dowel	Extension of the dowel is 6.0 ± 0.5 mm (0.24 ± 0.02 inch).
12	4	5F-9657 O-Ring Seal	Lubricate the bore lightly with sealant that is being sealed.
H	2	4N-0683 Dowel	Extension of the dowel is 19.0 ± 0.5 mm (0.75 ± 0.02 inch).
J	2	7N-2044 Dowel	Extension of the dowel is 40.0 ± 0.5 mm (1.58 ± 0.02 inch).

i05236458

Cylinder Block

SMCS Code: 1201

Part No.: 237-7957
S/N: 96Y1–Up

Part No.: 237-7957
S/N: 69Z1–Up

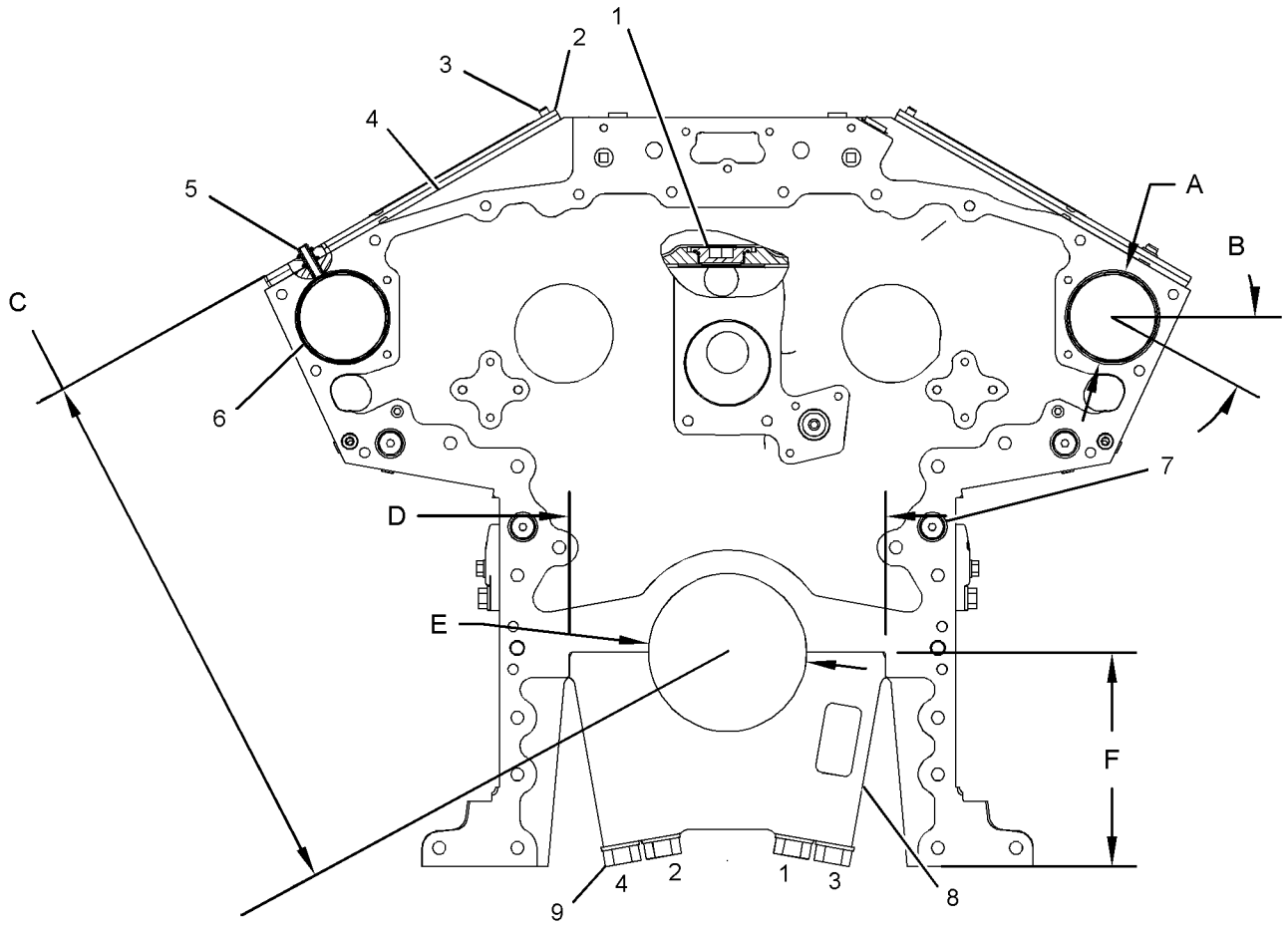

Illustration 103 g02848764
Front view

Table 61

Specification for 237-7957 Cylinder Block Gp			
Item	**Qty**	**Part**	**Specification Description**
The top face of the cylinder block, bottom surface of spacer plate (2) and both sides of plate gasket (4) must be free of fuel, oil, water, gasket adhesives, assembly compounds and any other contaminants during assembly.			
1	2	4W-4813 Plug	Torque to 100 ± 15 N·m (74 ± 11 lb ft).

(continued)

(Table 61, contd)

2	8	110-6994 Spacer Plate	Thickness is 12.313 mm (0.4848 inch).
3	16	8T-0099 Dowel	Extension of the dowel from the top face of the cylinder block is 20.0 ± 0.5 mm (0.79 ± 0.02 inch).
4	8	144-5692 Plate Gasket	Thickness of plate gasket that is between cylinder block and spacer plate is 0.194 to 0.218 mm (0.0076 to 0.0086 inch).
5	8	197-7008 Dowel	Extension of the dowel from the top face of the cylinder block is 21.0 ± 0.5 mm (0.83 ± 0.02 inch).
A	10	101-1198 Camshaft Bearing	Bore in the block for the camshaft bearing is 98.000 ± 0.020 mm (3.8583 ± 0.0008 inch).
B	-	-	All centerlines through oil holes in the camshaft bearings and the camshaft bearing junctions (6) are shown for each side of the cylinder block.
			Oil holes must be positioned from horizontal at an angle of 20 ± 5 degrees.
C	-	-	New dimension from centerline of crankshaft bearing bore to the top of the block is 586.0 mm (23.07 inch).
7	8	6V-3348 O-Ring Seal	Lubricate the bore lightly with sealant that is being sealed.
8	5	223-1696 Crankshaft Bearing Cap	Install crankshaft 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.
D	-	-	Width of crankshaft bearing cap (8) is 340.030 ± 0.015 mm (13.3870 ± 0.0006 inch).
			Width of cylinder block for crankshaft bearing cap is 339.985 ± 0.015 mm (13.3852 ± 0.0006 inch).
			Tight press fit between the sides of the crankshaft bearing cap and the cylinder block is 0.075 mm (0.0030 inch).
			Loose press fit between the sides of the crankshaft bearing cap and the cylinder block is 0.015 mm (0.0006 inch).
E	-	-	Bore in the block for the crankshaft bearings: Standard, original new size is 169.742 ± 0.020 mm (6.6827 ± 0.0008 inch). 0.63 mm (0.025 inch) larger than original size is 170.372 ± 0.020 mm (6.7076 ± 0.0008 inch).
F	-	-	New dimension from centerline of crankshaft bearing bore to bottom of block (pan rails) is 230.00 mm (9.055 inch).
9	20	7X-7925 Bolt	Use the following procedure to tighten the bolts. 1. Lubricate the threads with clean engine oil before assembly. 2. Tighten the bolts by hand. 2. Tighten the bolts in the numerical sequence as shown in Illustration 103 to 190 ± 14 N·m (140 ± 10 lb ft). 3. Again tighten the bolts in the numerical sequence as shown in Illustration 103 to an angle of 180 ± 5 degrees.

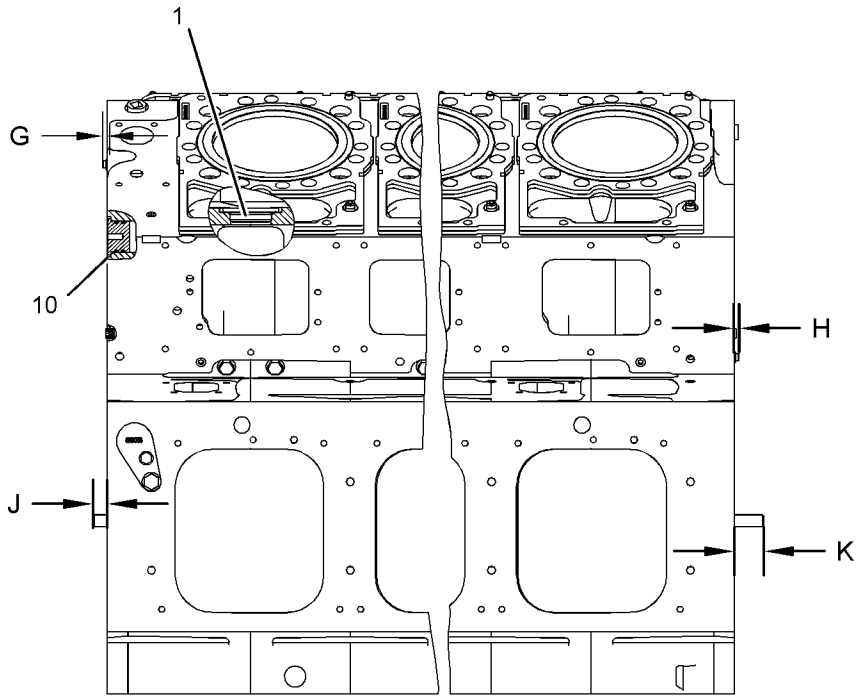

Illustration 104 g02848765

Right side view

Table 62

Specification for 237-7957 Cylinder Block Gp			
Item	**Qty**	**Part**	**Specification Description**
G	1	7N-2047 Dowel	Extension of the dowel from the rear face of the cylinder block is 6.0 ± 0.5 mm (0.24 ± 0.02 inch).
H	2	7N-2047 Dowel	Extension of the dowel from the front face of the cylinder block is 6.0 ± 0.5 mm (0.24 ± 0.02 inch).
J	2	4N-0683 Dowel	Extension of the dowel from the rear face of the cylinder block is 19.0 ± 0.5 mm (0.75 ± 0.02 inch).
K	2	7N-2044 Dowel	Extension of the dowel from the front face of the cylinder block is 40.0 ± 0.5 mm (1.58 ± 0.02 inch).
10	4	5F-9657 O-Ring Seal	Lubricate the bore lightly with sealant that is being sealed.

i05241908

Cylinder Block

SMCS Code: 1201

Part No.: 240-6650
S/N: 72Z1–Up

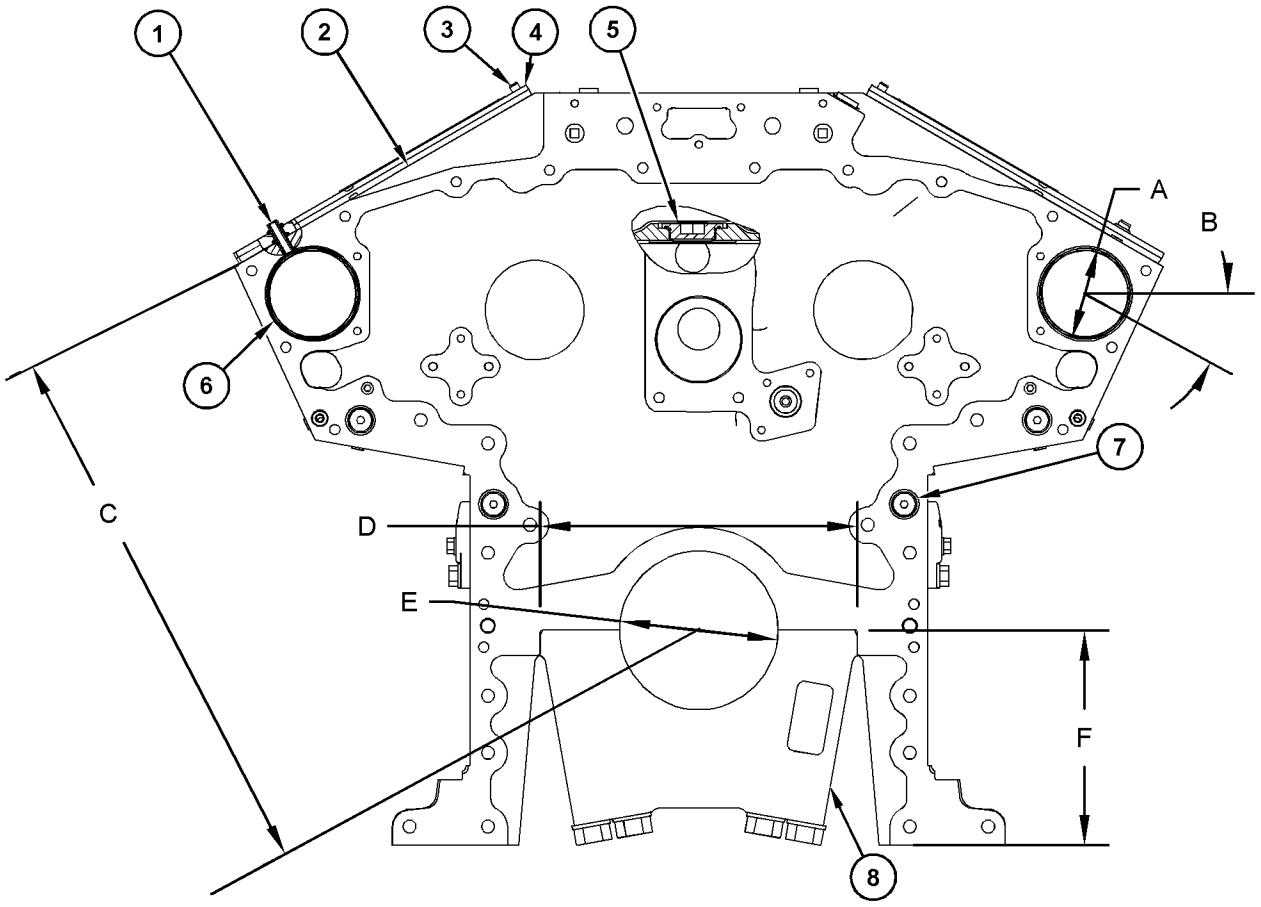

Illustration 105 g03343105
Front view

Table 63

Specification for 240-6650 Cylinder Block Gp and 383-2090 Cylinder Block Gp			
Item	**Qty**	**Part**	**Specification Description**
The top face of the cylinder block, bottom surface of spacer plate (4) and both sides of plate gasket (2) must be free of fuel, oil, water, gasket adhesives, assembly compounds and any other contaminants during assembly.			
1	12	197-7008 Dowel	Extension of the dowel is 21.0 ± 0.5 mm (0.83 ± 0.02 inch).
2	12	144-5692 Plate Gasket	Thickness of plate gasket that is between cylinder block and spacer plate is 0.194 to 0.218 mm (0.0076 to 0.0086 inch).
3	24	8T-0099 Dowel	Extension of the dowel is 21.0 ± 0.5 mm (0.83 ± 0.02 inch).

(continued)

(Table 63, contd)

4	12	110-6994 Spacer Plate	Thickness is 12.313 mm (0.4848 inch).
5	3	4W-4813 Plug	Torque to 100 ± 15 N·m (74 ± 11 lb ft).
A	14	116-1359 Camshaft Bearing	Bore of the bearing after installation is 86.00 ± 0.06 mm (3.386 ± 0.002 inch).
B	-	-	All centerlines through oil holes in the camshaft bearings and the camshaft bearing junctions (6) must be positioned as shown in Illustration 105 on each side of the cylinder block. Oil holes must be positioned from horizontal at an angle of 20 ± 5 degrees.
C	-	-	New dimension from centerline of crankshaft bearing bore to the top of the block is 586 mm (23.1 inch).
7	8	6V-3348 O-Ring Seal	Lubricate the bore lightly with sealant that is being sealed.
8	7	223-1696 Crankshaft Bearing Cap	Install crankshaft 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. Width (D) of crankshaft bearing cap is 340.030 ± 0.015 mm (13.3858 ± 0.0006 inch). Width in the cylinder block for crankshaft bearing cap is 339.985 ± 0.015 mm (13.3852 ± 0.0006 inch).
E	-	-	Bore in the block for the crankshaft bearings is 169.742 ± 0.020 mm (6.6827 ± 0.0008 inch).
F	-	-	New dimension from centerline of crankshaft bearing bore to bottom of block (pan rails) is 230.00 mm (9.055 inch).

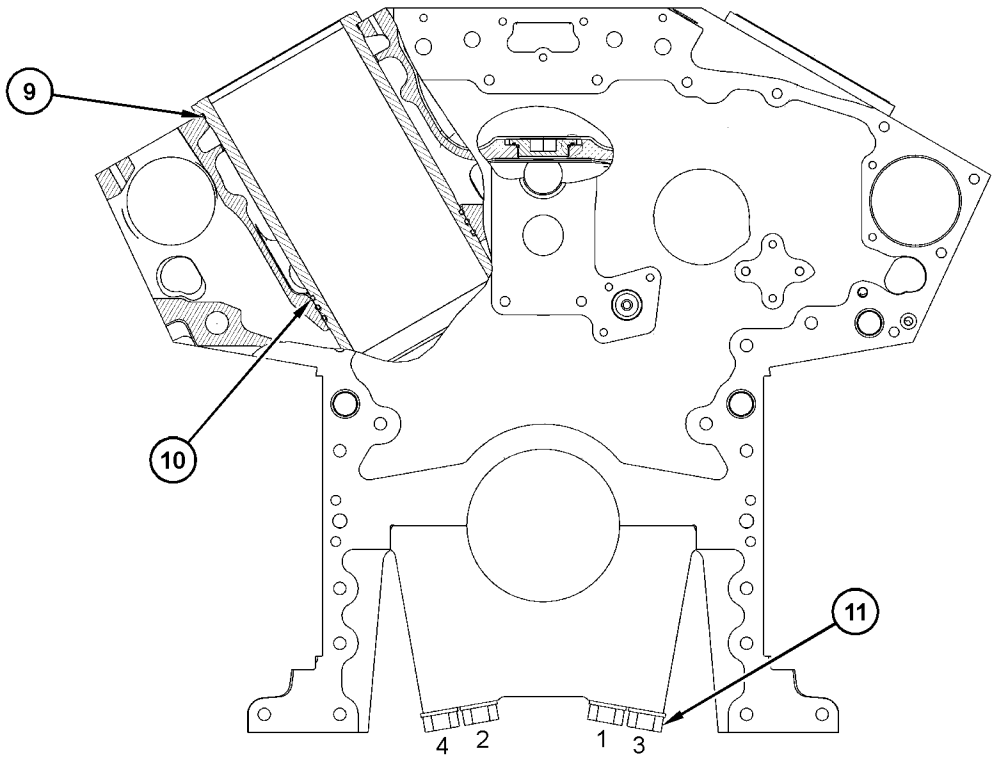

Illustration 106 g03343107

350-1413 Cylinder Block

Table 64

Item	Qty	Part	Specification Description
9	12	352-6061 Liner Seal	Assemble dry seals on clean and dry liner grooves. Before assembly, cover seals with either P-80 Rubber Lubricant Emulsion or liquid soap.
10	36	7N-2046 O-Ring Seal	Before assembly, cover seals with either P-80 Rubber Lubricant Emulsion or liquid soap.
11	28	7X-7925 Bolt	Use the following procedure in order to tighten the crankshaft bearing cap bolts. 1. Before assembly, Lubricate the threads with clean engine oil . 2. Tighten the bolts by hand. Tighten the bolts in the numerical sequence as shown in Illustration 106 to 190 ± 14 N·m (140 ± 10 lb ft). Again tighten the bolts to an additional angle of 180 ± 5 degrees

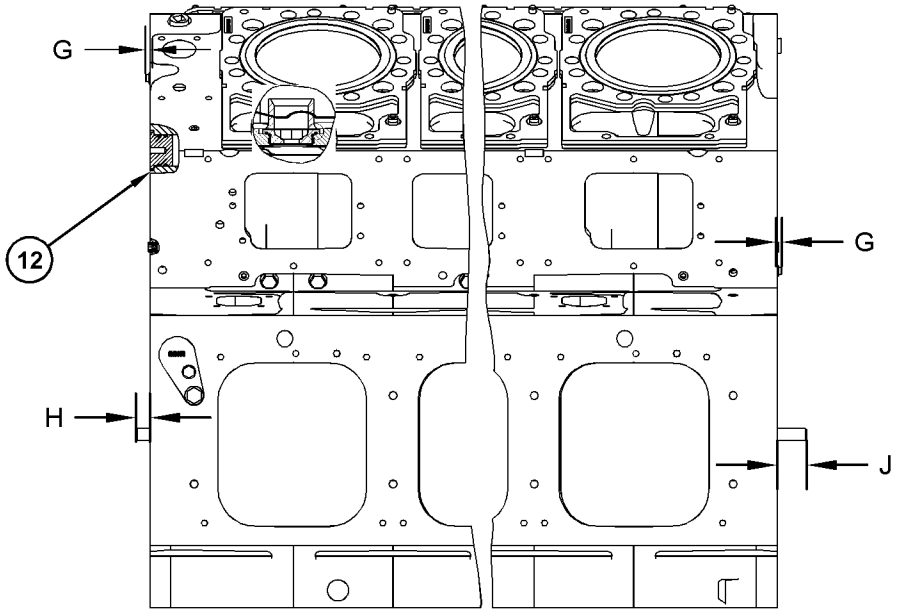

Illustration 107 g03343110

Right side view

Table 65

Item	Qty	Part	Specification Description
G	3	7N-2047 Dowel	Extension of the dowel is 6.0 ± 0.5 mm (0.24 ± 0.02 inch).
12	4	5F-9657 O-Ring Seal	Lubricate the bore lightly with sealant that is being sealed.
H	2	4N-0683 Dowel	Extension of the dowel is 19.0 ± 0.5 mm (0.75 ± 0.02 inch).
J	2	7N-2044 Dowel	Extension of the dowel is 40.0 ± 0.5 mm (1.58 ± 0.02 inch).

i07119200

Cylinder Liner

SMCS Code: 1216

Part No.: 118-9494, 211-7826

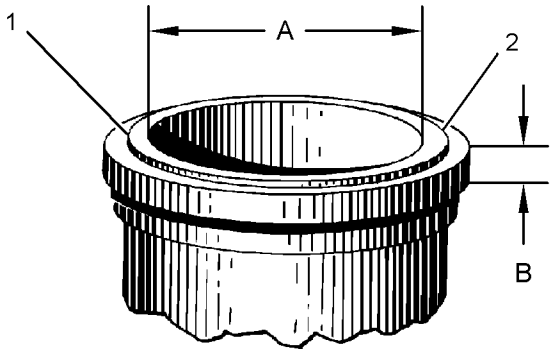

Illustration 108 g03789456

Table 66

Specification for 211-7826 Cylinder Block Liner, 8N-6861 Cylinder Block Liner, 118-9494 Cylinder Block Liner, and 350-0074 Cylinder Liner			
Item	**Qty**	**Part**	**Specification Description**
1	-	-	Bore (A) in new cylinder liner is 170.025 ± 0.025 mm (6.6939 ± 0.0010 inch).
2	-	-	Thickness (B) of flange on cylinder liner is 12.65 ± 0.02 mm (0.498 ± 0.001 inch).

i02604994

Piston and Rings

SMCS Code: 1214

Part No.: 7W-1988, 8N-6224
S/N: 50Y1–Up

Part No.: 8N-6224
S/N: 96Y1–Up

Part No.: 7W-1988, 8N-6224
S/N: 29Z1–Up

Part No.: 7W-1988, 8N-6224
S/N: 66Z1–Up

Part No.: 7W-1988, 8N-6224
S/N: 69Z1–Up

Part No.: 7W-1988, 8N-6224
S/N: 72Z1–Up

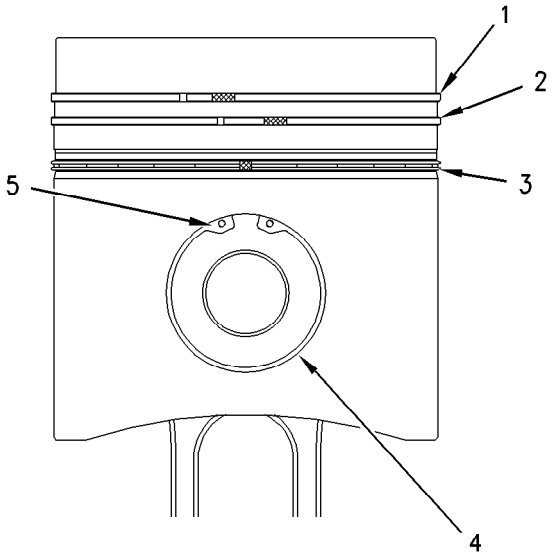

Illustration 109 g00896277

This piston has a Keystone style top and Keystone style intermediate rings. The 1U-6431 Keystone Piston Ring Groove Gauge is necessary for measuring the ring grooves. 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. . . . . 0.80 ± 0.20 mm ((0.031 ± 0.008 inch))

There is an increase in the clearance between the ends of the piston ring. For each 0.03 mm (0.001 inch) increase in the ring clearance, the cylinder liner bore size increases by the following value. . . . . 0.08 mm ((0.003 inch))

(2) Intermediate ring

Install the intermediate ring with the “Up” 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. . . . . 0.80 ± 0.20 mm ((0.031 ± 0.008 inch))

There is an increase in the clearance between the ends of the piston ring. For each 0.08 mm (0.003 inch) increase in the ring clearance, the cylinder liner bore increases by the following value. . . . . 0.08 mm ((0.003 inch))

(3) Oil control ring

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 end gap.

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))

There is an increase in the clearance between the ends of the piston ring. For each 0.03 mm (0.001 inch) increase in ring clearance, the cylinder liner bore increases by the following value. . . . . 0.08 mm ((0.003 inch))

(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 . . . . . 70.003 ± 0.005 mm ((2.7560 ± 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.

i03132941

Piston and Rings
(Two-Piece Piston)

SMCS Code: 1214

Part No.: 6I-2861
S/N: 4MJ1–Up

Part No.: 101-0829, 6I-2861
S/N: 50Y1–Up

Part No.: 101-0829, 6I-2861
S/N: 96Y1–Up

Part No.: 101-0829, 6I-2861
S/N: 29Z1–Up

Part No.: 101-0829, 6I-2861
S/N: 66Z1–Up

Part No.: 101-0829, 6I-2861
S/N: 69Z1–Up

Part No.: 101-0829, 6I-2861
S/N: 72Z1–Up

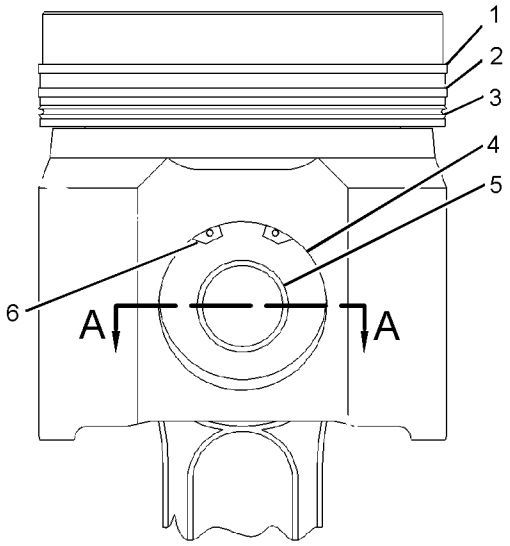

Illustration 110 g01611477

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.

Top Piston Ring (1)

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

Thickness of new top piston ring . . . . . 3.91 mm ((0.154 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. . . . 0.625 ± 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))

Intermediate Piston Ring (2)

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

Thickness of new intermediate piston ring . . . . . 3.785 mm ((0.1490 inch))

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 ((0.039 ± 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))

Oil Control Piston Ring (3)

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.

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.

Piston Pin Bore (4)

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

Bore diameter in the crown assembly for piston pin . . . . . 70.035 ± 0.005 mm ((2.7573 ± 0.0002 inch))

Bore diameter in the piston skirts for piston pin . . . . . 69.983 ± 0.005 mm ((2.7552 ± 0.0002 inch))

Piston Pin (5)

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

Inside diameter of the piston pin . . . . . 35.0 ± 0.5 mm ((1.38 ± 0.02 inch))

Outside diameter of the piston pin . . . . . 69.962 ± 0.005 mm ((2.7544 ± 0.0002 inch))

Length of the piston pin . . . . . 133.00 ± 0.13 mm ((5.236 ± 0.005 inch))

Pin Retainer (6)

Assemble the retainer with the opening toward the top of the piston.

i04930033

Piston and Rings
(One-Piece Piston)

SMCS Code: 1214

Part No.: 223-6362, 223-6363
S/N: 50Y1–Up

Part No.: 223-6362, 223-6363
S/N: 96Y1–Up

Part No.: 223-6362, 223-6363
S/N: 29Z1–Up

Part No.: 223-6362, 223-6363
S/N: 66Z1–Up

Part No.: 223-6362, 223-6363
S/N: 69Z1–Up

Part No.: 223-6362, 223-6363
S/N: 72Z1–Up

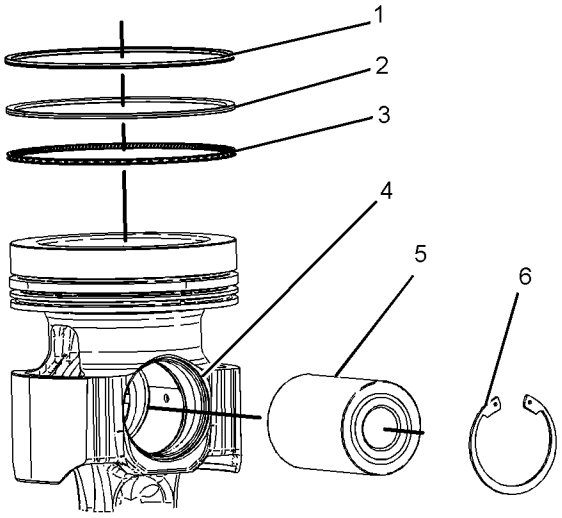

Illustration 111 g03099656

Table 67

Specification for 223-6362 Piston and Rod Gp and 223-6363 Piston and Rod Gp			
Item	**Qty**	**Part**	**Specification Description**
-	-	-	Refer to Guideline for Reusable Parts for information on the pistons, the piston pins, and the retaining rings. This piston has a square top piston ring. Use the 246-1176 Piston Ring Groove Gauge Gp for measuring the top piston ring groove.

(continued)

(Table 67, contd)

-	-	-	This piston has a keystone type of intermediate piston ring. Use the 1U-6431 Piston Ring Groove Gauge Gp for measuring the intermediate piston ring groove. For correct use of the piston ring groove gauge group, refer to the instruction card that is with the piston ring groove gauge group.
-	-	-	Before assembly of the piston rings, lubricate the ring grooves with clean engine oil. After assembly, lubricate the mating surfaces of the rings to the cylinder liner with clean engine oil.
1	1	214-6066 Top Piston Ring	Install the top piston ring with the “UP-1” side toward the top of the piston.
			When the new top 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 0.625 ± 0.125 mm (0.0246 ± 0.0049 inch).
			Thickness of new top piston ring is 3.88 mm (0.153 inch).
2	1	144-5695 Intermediate Piston Ring	Install the intermediate piston ring with the “UP-2” side toward the top of the piston.
			When the new intermediate 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 1.00 ± 0.15 mm (0.039 ± 0.006 inch).
			Thickness intermediate piston ring is 3.785 mm (0.1490 inch).
3	1	223-6361 Oil Control Piston Ring	The ends of the oil control piston ring should be a distance of 180 degrees from the ring end gap when the oil control piston ring is assembled.
			Width of groove in new piston for the oil control piston ring is 4.04 to 4.07 mm (0.159 to 0.160 inch).
			Thickness oil Control piston ring is 3.97 to 3.99 mm (0.156 to 0.157 inch).
			When the new oil control 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 0.5 to 0.8 mm (0.02 to 0.03 inch).
			After the piston rings have been installed, rotate the piston rings so that the end gaps are 120 degrees from each other.
4	-	-	Bore diameter for piston pin is 70.060 to 70.075 mm (2.7583 to 2.7589 inch).
5	1	197-0560 Piston Pin	Before assembly, lubricate the piston pin, the piston pin bore, the connecting rod eye, and the connecting rod pin bearing with clean engine oil.
			Outside diameter is 69.962 ± 0.005 mm (2.7544 ± 0.0002 inch).
			Length is 101.85 ± 0.15 mm (4.010 ± 0.006 inch).
6	2	253-1238 Pin Retainer	Assemble the pin retainer with the gap towards the top of the piston. Thickness is 2.36 ± 0.08 mm (0.093 ± 0.003 inch).
-	-	-	Refer to Table 68 for the part numbers of the tools that are used in servicing the piston.

Table 68

Service Tools			
Item	**Qty**	**Part**	**Specification Description**
-	-	6V-4020	Piston Ring Expander Gp
-	-	6V-4023	Handle As
-	-	6V-4024	Guide Ring
-	-	1P-1861	Retaining Ring Pliers

(continued)

(Table 68, contd)

-	-	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

i07729754

Connecting Rod

SMCS Code: 1218

Part No.: 6I-2861
S/N: 4MJ1–Up

Part No.: 101-0829, 6I-2861
S/N: 50Y1–Up

Part No.: 101-0829, 6I-2861
S/N: 96Y1–Up

Part No.: 101-0829, 6I-2861
S/N: 29Z1–Up

Part No.: 101-0829, 6I-2861
S/N: 66Z1–Up

Part No.: 101-0829, 6I-2861
S/N: 69Z1–Up

Part No.: 101-0829, 6I-2861
S/N: 72Z1–Up

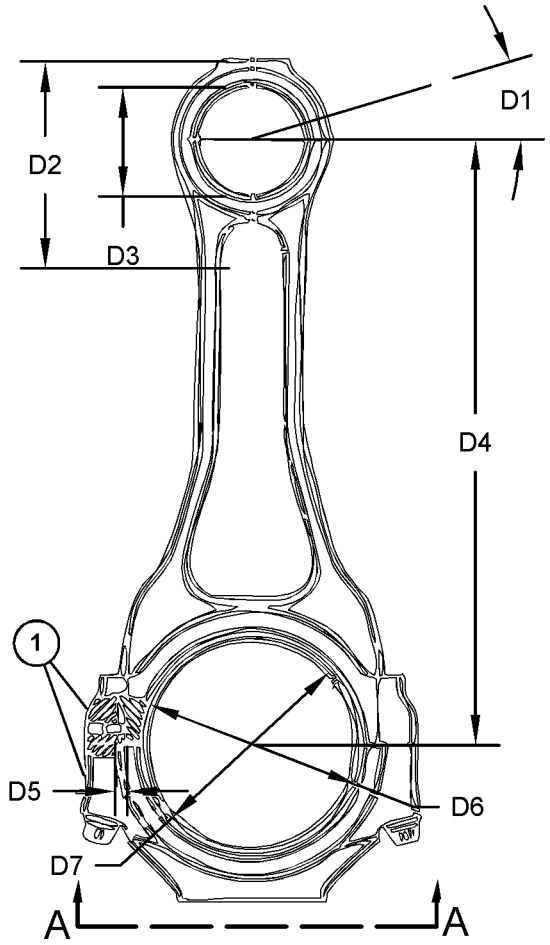

Illustration 112 g06412872

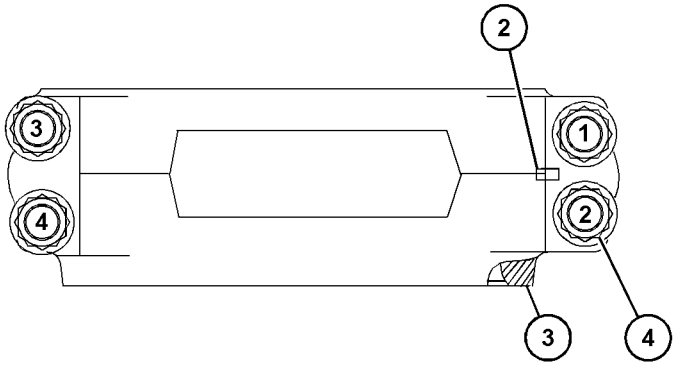

Illustration 113 g06412885

Section A-A
Tightening sequence

Table 69

Item	Qty	Part	Specification Description
D1	-	-	Angle above the centerline on either side of the bearing joint for the sleeve bearing for the piston pin is 10 degrees.
D2	-	-	The connecting rod may be heated from 175 to 260 °C (347 to 500 °F) for the installation of the bushing for the piston pin. Minimum length for heating the connecting rod is 105 mm (4.1 inch). Do not use a torch to heat the connecting rod.
D3	1	118-1655 Bushing	Thoroughly lubricate the piston pin with clean engine oil prior to assembly of the piston and the connecting rod. Bore in the bushing for the piston pin after installation of the bushing is 70.000 ± 0.008 mm (2.7559 ± 0.0003 inch). Bore in the connecting rod for the bushing is 75.760 ± 0.015 mm (2.9827 ± 0.0006 inch).
D4	-	-	Distance between the center of the bearings is 380 mm (14.961 inch).
D5	1	7N-2043 Dowel	Protrusion of the dowel from the connecting rod cap is 4.0 ± 0.5 mm (0.16 ± 0.02 inch).
D6	-	-	Bore in the connecting rod for the bearing for the crankshaft connecting rod journal after applying final torque to the connecting rod bolts is 143.028 ± 0.015 mm (5.6310 ± 0.0006 inch).
D7	-	-	Bore in the connecting rod bearing for crankshaft is 135.133 to 135.194 mm (5.3202 to 5.3226 inch).
1	-	-	Etch the cylinder number on the connecting rod and the cap in this location. Mark the connecting rod and the cap with numbers. Mark the numbers on the same side of the connecting rod as the bearing retainer notch.
2	-	-	Location pin for correct installation of connecting rod caps.
3	-	-	The chamfer side must be next to the crank pin thrust surface when the connecting rod and piston group is assembled in the engine.
4	4	7N-2405 Bolt	Use the following procedure for tightening the connecting rod bolts: Bolt 1 and bolt 2 must be on the same end of the connecting rod cap that has bearing tabs and location pin (2). 1. Before assembly, apply Bel-Ray Molylube 67700 on the bolt threads, the bolt shank, and the bolt seat. 2. Sequentially tighten the bolt 1 and bolt 2 to 90 ± 5 N·m (66 ± 4 lb ft). 3. Sequentially tighten the bolt 3 and bolt 4 to 90 ± 5 N·m (66 ± 4 lb ft). 4. Again, sequentially tighten the bolt 3 and bolt 4 to 90 ± 5 N·m (66 ± 4 lb ft). 5. Tighten each bolt for an additional 90 ± 5 degrees.
Side clearance between two connecting rods on the same new crankshaft pin is 0.850 ± 0.332 mm (0.0335 ± 0.0131 inch).			

i01359201

Connecting Rod and Main Bearing Journals

SMCS Code: 1230

Part No.: 8N-7103
S/N: 50Y1–Up

Part No.: 7N-8707
S/N: 96Y1–Up

Part No.: 8N-7103
S/N: 66Z1–Up

Part No.: 7N-8707
S/N: 69Z1–Up

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

Connecting Rod Bearing Journals

Table 70

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 71

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))

i05770054

Connecting Rod and Main Bearing Journals

SMCS Code: 1230

Part No.: 8N-0337
S/N: 4MJ1–Up

Part No.: 8N-0337
S/N: 29Z1–Up

Part No.: 8N-0337
S/N: 72Z1–Up

Connecting Rod Bearing Journals

Table 72

Specification for 161-6928 Crankshaft Gp, 4P-2612 Crankshaft, and 8N-0337 Crankshaft Gp			
Item	**Qty**	**Part**	**Specification Description**
Refer to Guidelines For Reusable Parts, SEBF8009, "Main Bearings And Connecting Rod Bearings" for more information.			
-	-	-	Diameter of crankshaft journal (Bearing Surface) for connecting rod bearings:
			Original size journal is 135.000 ± 0.025 mm (5.3149 ± 0.0010 inch).
-	-	-	Clearance between bearing and new journal is 0.107 to 0.218 mm (0.0042 to 0.0086 inch).

Main Bearing Journals

Table 73

Specification for 161-6928 Crankshaft Gp, 4P-2612 Crankshaft, and 8N-0337 Crankshaft Gp			
Item	**Qty**	**Part**	**Specification Description**
Refer to Guidelines For Reusable Parts, SEBF8009, “Main Bearings And Connecting Rod Bearings” for more information.			
-	-	-	Diameter of crankshaft journal (Bearing Surface) for main bearings:
			Original size journal is 160.000 ± 0.025 mm (6.2992 ± 0.0010 inch).
-	-	-	Clearance between bearing and new journal is 0.122 to 0.241 mm (0.0048 to 0.0095 inch).

i05207486

Crankshaft

SMCS Code: 1202

Part No.: 128-6786

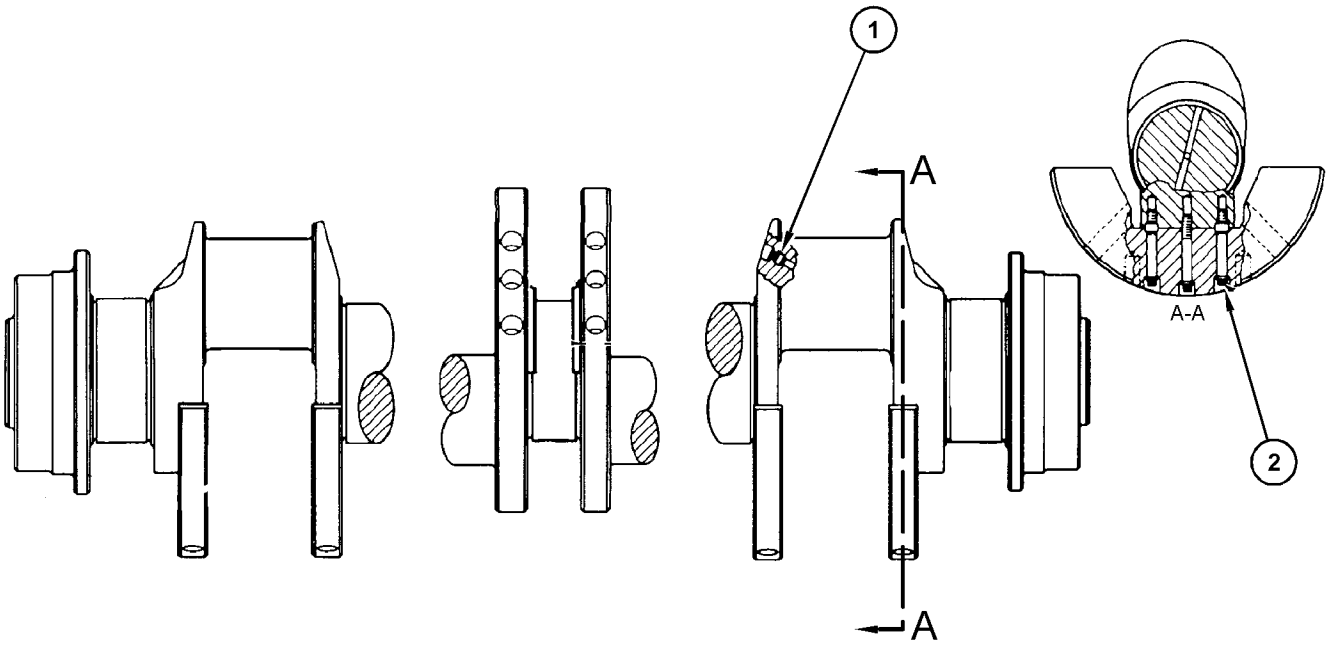

Illustration 114 g03334513

Refer to Specifications, “Connecting Rod And Main Bearing Journals” for more information.

Table 74

Specification for 128-6786 Crankshaft, and 201-4250 Crankshaft			
Item	**Qty**	**Part**	**Specification Description**
1	6	2W-2288 Plug	Torque to 50 ± 7 N·m (37 ± 5 lb ft).
2	36	128-4845 Bolt As	Use the following procedure to tighten the bolts: 1. Before assembly, lubricate the threads of the bolts, the bolt shank, the washers, and the contact surface under the bolt head with molylube. 2. Tighten the bolts evenly to 70 ± 5 N·m (52 ± 4 lb ft). 3. Rotate each bolt for an additional 120 ± 5 degrees.

i05212350

Crankshaft

SMCS Code: 1202

Part No.: 128-6788

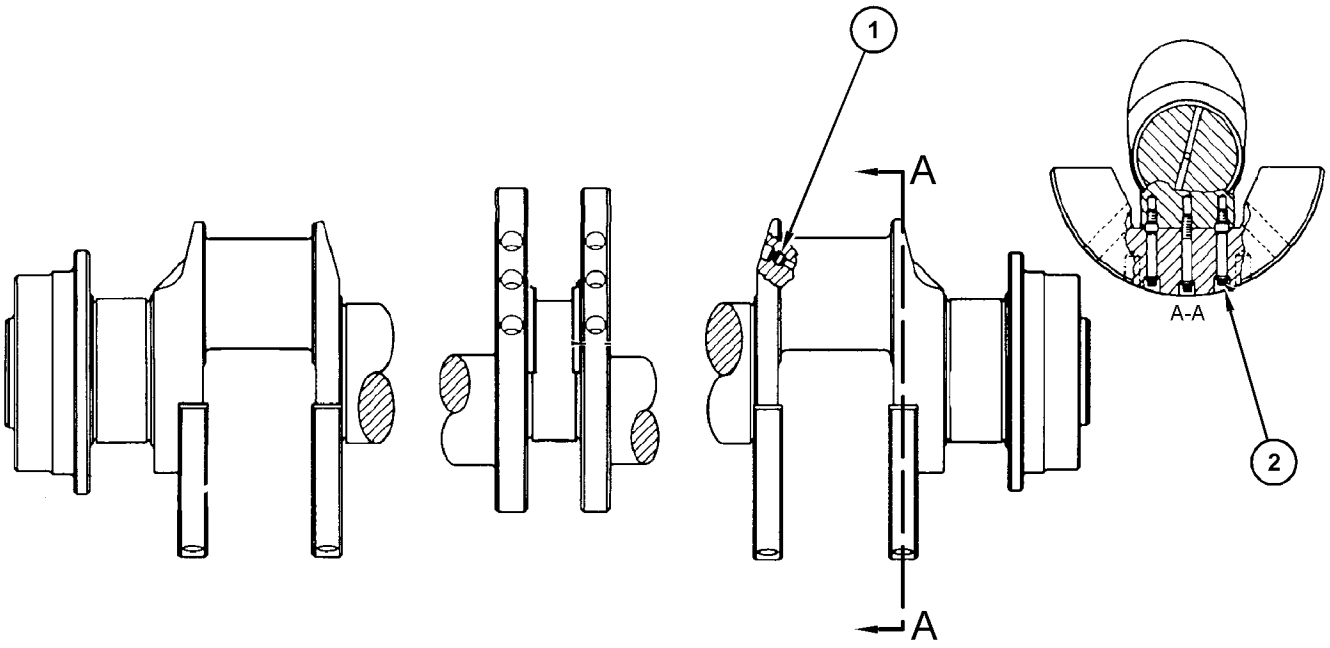

Illustration 115 g03335580

Refer to Specifications, “Connecting Rod And Main Bearing Journals” for more information.

Table 75

Specification for 128-6788 Crankshaft			
Item	**Qty**	**Part**	**Specification Description**
1	8	2W-2288 Plug	Torque to 50 ± 7 N·m (37 ± 5 lb ft).
2	48	128-4845 Bolt As	Use the following procedure to tighten the bolts: 1. Before assembly, lubricate the threads of the bolts, the bolt shank, the washers, and the contact surface under the bolt head with molylube. 2. Tighten the bolts evenly to 70 ± 5 N·m (52 ± 4 lb ft). 3. Rotate each bolt for an additional 120 ± 5 degrees.

i02871012

Crankshaft

SMCS Code: 1202

Part No.: 152-4994
S/N: 96Y1–Up

Part No.: 152-4994
S/N: 69Z1–Up

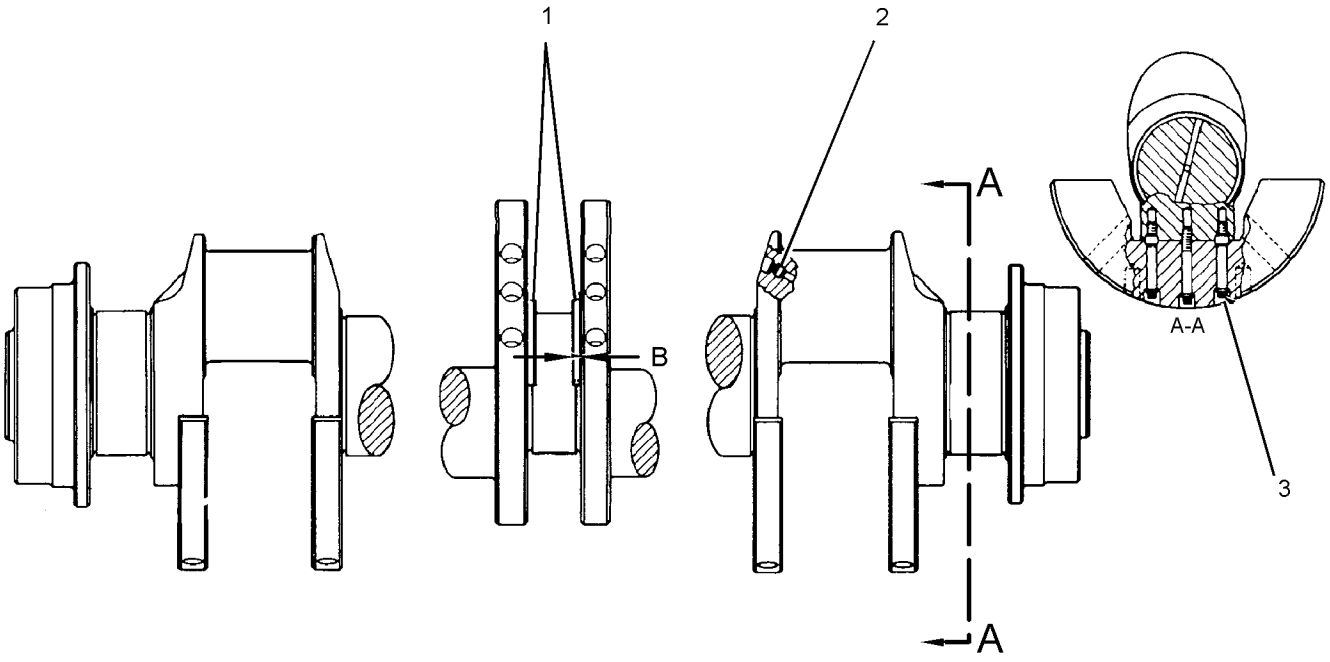

Illustration 116 g01419944

(1) Thrust plates

Refer to Specifications, “Connecting Rod And Main Bearing Journals” for more information.

(B) End play for the new crankshaft
. . . 0.17 mm to 0.63 mm ((0.007 inch to 0.025 inch))

(2) Torque for the plug . . . . .50 ± 7 N·m ((37 ± 5 lb ft))

Note: Do not reuse counterweight bolts.

(3) Use the following procedure to tighten the bolts:

1. Prior to assembly, lubricate the bolt threads, the bolt shank, the washer, and the underside of the bolt head with 6V-4876 Lubricant.

Note: Torque the outside bolts first, then torque the inner bolt.

2. Torque the bolts evenly to 200 ± 5 N·m (145 ± 4 lb ft).

3. Loosen the bolts.

4. Again, torque the bolts evenly to 70 ± 5 N·m (50 ± 4 lb ft).

5. Rotate each bolt for an additional 120 ± 5 degrees.

i06540066

Crankshaft

SMCS Code: 1202

Part No.: 7N-8707
S/N: 96Y1–Up

Part No.: 7N-8707
S/N: 69Z1–Up

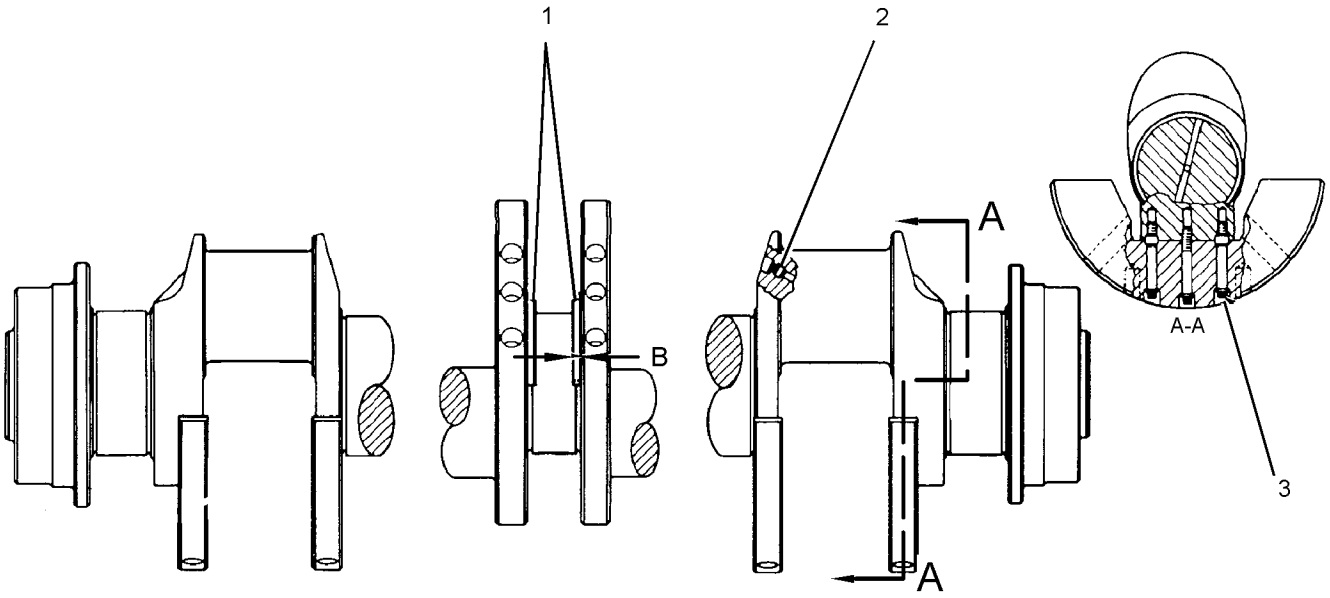

Illustration 117 g03099036

Table 76

Specification for 7N-8707 Crankshaft Gp			
Item	**Qty**	**Part**	**Specification Description**
-	-	-	Refer to Specifications, “Connecting Rod And Main Bearing Journals” for more information.
1	2	7C-6209 Thrust Plate	Use only on the center main bearing as shown in the Illustration
B	-	-	End play for the new crankshaft is 0.17 mm to 0.63 mm (0.007 inch to 0.025 inch).

(continued)

(Table 76, contd)

2	8	2W-2288 Plug	Torque to 50 ± 7 N·m (37 ± 5 lb ft). **Note:** Do not reuse counterweight bolts.
3	18	128-4845 Bolt As	Use the following procedure to tighten the bolts: 1. Prior to assembly, lubricate the bolt threads, the bolt shank, the washer, and the underside of the bolt head with 6V-4876 Lubricant. **NOTE:** Torque the outside bolts first, then torque the inner bolt. 2. Torque the bolts evenly to 200 ± 5 N·m (145 ± 4 lb ft). 3. Loosen the bolts. 4. Again, torque the bolts evenly to 70 ± 5 N·m (50 ± 4 lb ft). 5. Rotate each bolt for an additional 120 ± 5 degrees.

i06568282

Crankshaft

SMCS Code: 1202

Part No.: 8N-7103
S/N: 66Z1–Up

Part No.: 8N-7103
S/N: 69Z1–Up

Part No.: 8N-7103
S/N: 72Z1–Up

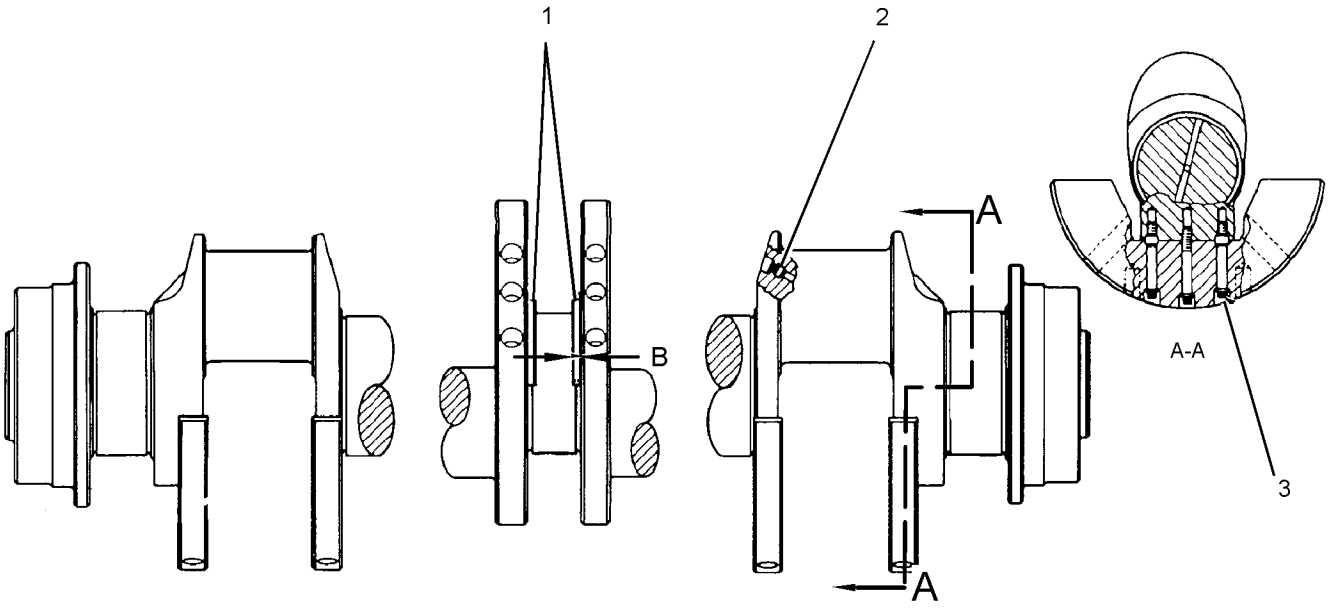

Illustration 118 g03110979
Typical example

Table 77

Specification for 8N-7103 Crankshaft Gp, 161-6926 Crankshaft Gp, and 379-4851 Crankshaft Gp			
Item	**Qty**	**Part**	**Specification Description**
Refer to Specifications, “Connecting Rod And Main Bearing Journals” for more information.			
1	2	7C-6209 Thrust Plate	Use only on the center main bearing as shown in the Illustration
B	-	-	End play for the new crankshaft is 0.17 to 0.63 mm (0.007 to 0.025 inch).

(continued)

(Table 77, contd)

Specification for 8N-7103 Crankshaft Gp, 161-6926 Crankshaft Gp, and 379-4851 Crankshaft Gp			
Item	**Qty**	**Part**	**Specification Description**
2	6	2W-2288 Plug	Torque to 50 ± 7 N·m (37 ± 5 lb ft).
3	36	128-4845 Bolt As	Use the following procedure to tighten the bolts: 1. Before assembly, lubricate the threads, the shank, the washer, and the underside of the bolt head with Molylube lubricant. **NOTE:** Torque outer bolts first, then torque inner bolt. 2. Torque the bolts evenly to 70 ± 5 N·m (50 ± 4 lb ft). 3. Rotate each bolt for an additional 120 ± 5 degrees. Do not reuse counterweight bolts.

i07863241

Crankshaft Wear Sleeves and Seals

SMCS Code: 1160

Part No.: 7W-3813

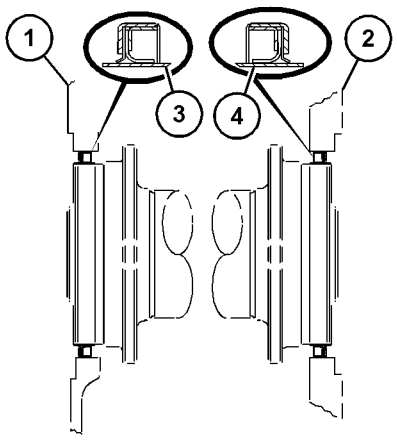

Illustration 119 g06236891

Typical example

Table 78

Item	Qty	Part	Specification Description
The crankshaft seal group cannot be used once the seal has been separated from the wear sleeve.			
Make sure that the correct crankshaft seal group is installed on each end of the crankshaft.			
3	1	569-7728 Crankshaft Seal Gp	Install the crankshaft seal group in the flywheel housing group (1) on standard rotation engine. Install the crankshaft seal group in the front housing group (2) on reverse rotation engine.
4	1	569-7729 Crankshaft Seal Gp	Install the crankshaft seal group in the flywheel housing group (1) on reverse rotation engine. Install the crankshaft seal group in the front housing group (2) on standard rotation engine.
-	-	-	The wear sleeve is installed from both ends of the crankshaft at the distance of 0.5 ± 0.5 mm (0.02 ± 0.02 inch). The crankshaft seal is installed from both ends of the crankshaft at the distance of 8.0 ± 0.5 mm (0.31 ± 0.02 inch).

i03668141

Gear Group (Front)

SMCS Code: 1206

Part No.: 122-9281

S/N: 66Z1–Up

Part No.: 122-9281
S/N: 69Z1–Up

Part No.: 122-9281
S/N: 72Z1–Up

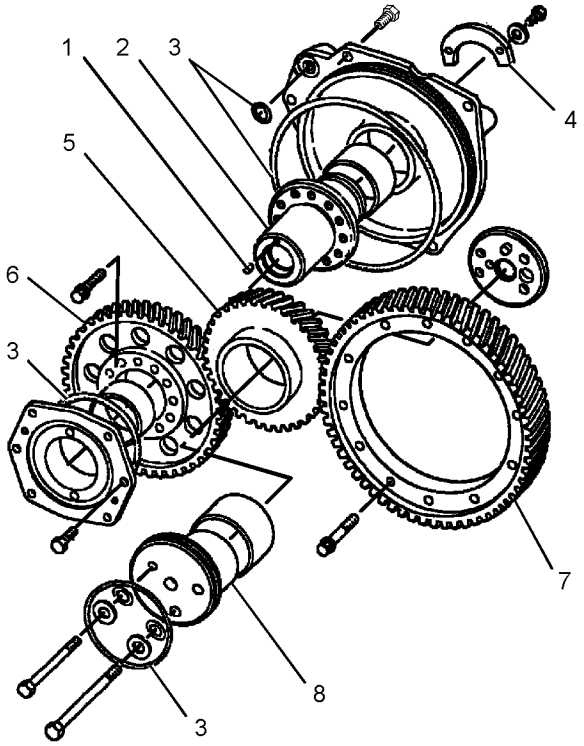

Illustration 120 g01428397

Typical example

(5) Idler gear assembly
(6) Water pump drive gear
(7) Crankshaft gear

Note: Install the socket setscrew to the bottom of the threaded hole.

(1) Torque for the socket setscrew . . . . . 6 ± 1 N·m ((53 ± 9 lb in))

(2) Pump drive shaft assembly

Bore in sleeve bearing after assembly . . . . 75.000 ± 0.055 mm ((2.9527 ± 0.0022 inch))
Diameter of new pump drive shaft assembly. . . . . 74.900 ± 0.015 mm ((2.9488 ± 0.0006 inch))

(3) Lubricate the bore of the O-ring seals lightly with lubricant that is being sealed.

(4) Thrust washer

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

(8) Idler shaft

Diameter of the idler shaft . . . 105.88 ± 0.02 mm ((4.168 ± 0.001 inch))
Bore in the sleeve bearing for idler shaft . . . 105.970 ± 0.010 mm ((4.1720 ± 0.0004 inch))

i05188688

Gear Group (Front)

SMCS Code: 1206

Part No.: 8N-7174
S/N: 4MJ1–Up

Part No.: 8N-7174
S/N: 50Y1–Up

Part No.: 8N-7174
S/N: 96Y1–Up

Part No.: 8N-7174
S/N: 29Z1–Up

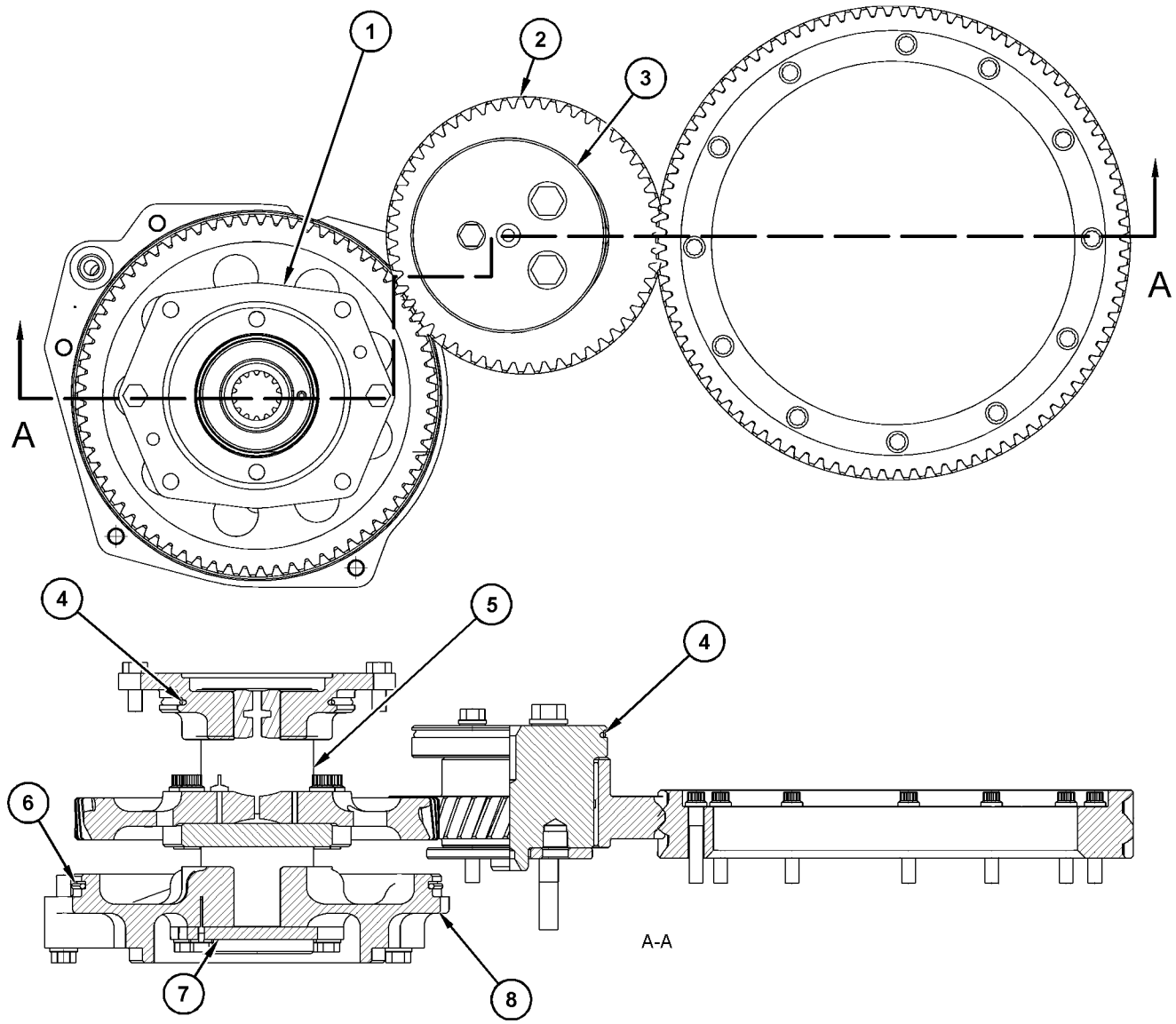

Illustration 121 g03325358
Front view of engine

Table 79

Specification for 8N-7174 Front Gear Gp			
Item	**Qty**	**Part**	**Specification Description**
1	1	7N-5245 Pump Adapter	After installation, bore of 127-5400 Bushing is 75.000 ± 0.055 mm (2.9528 ± 0.0022 inch).
2	1	144-8263 Idler Gear As	After installation, bore of 140-9597 Bushing is 90.000 ± 0.010 mm (3.5433 ± 0.0004 inch). Installation depth is 2.3 ± 0.5 mm (0.09 ± 0.02 inch).
3	1	7C-3260 Shaft	Diameter is 89.880 ± 0.020 mm (3.5386 ± 0.0008 inch).
4	2	259-4598 O-Ring Seal	Before assembly, lightly lubricate the bores with the lubricant that is being sealed.
5	1	7N-5239 Pump Drive Shaft As	Diameter is 74.900 ± 0.015 mm (2.9488 ± 0.0006 inch). Install the 8T-2153 Socket Setscrew to the bottom of the threaded hole and tighten to 6 ± 1 N·m (53 ± 9 lb in).
6	1	235-3546 O-Ring Seal	Before assembly, lightly lubricate the bores with the lubricant that is being sealed.
7	2	7N-5246 Thrust Washer	Thickness is 8.50 ± 0.05 mm (0.335 ± 0.002 inch). Width of groove in new pump drive shaft assembly is 8.75 ± 0.10 mm (0.344 ± 0.004 inch). End play for the pump drive shaft assembly is 0.250 ± 0.075 mm (0.0098 ± 0.0030 inch).
8	1	278-4287 Pump Adapter	After installation, bore of 127-5400 Bushing is 75.000 ± 0.055 mm (2.9528 ± 0.0022 inch). During assembly, flush the bushing with the pump adapter surface. Oil hole in the bushing must be aligned with the hole in the bore.

i04931602

Gear Group (Rear)

SMCS Code: 1206

Part No.: 116-9854
S/N: 96Y1–Up

Part No.: 116-9854
S/N: 66Z1–Up

Part No.: 116-9854
S/N: 69Z1–Up

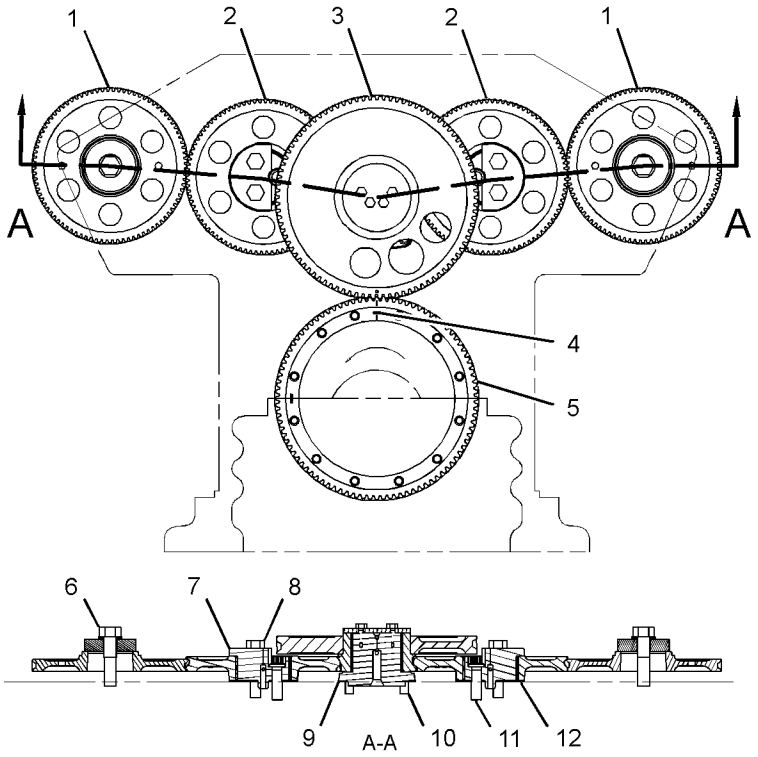

Illustration 122 g03109317

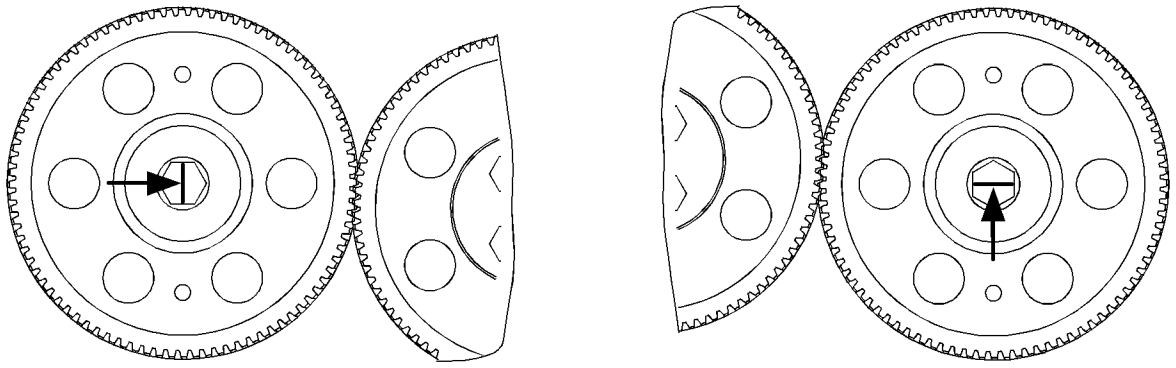

Illustration 123 g03109339

Table 80

Specification for 116-9854 Rear Gear Gp			
Item	**Qty**	**Part**	**Specification Description**
1	2	7E-3897 Camshaft Drive Gear	Before assembly, clean the taper of the camshaft and the tapered bore of the camshaft drive gear with lint free cloth saturated with cleaning solvent to remove excess oil. Clean with alcohol wipe.
2	2	112-1554 Idler Gear As	Bore of 125-9751 Bushing after installation is 81.060 ± 0.010 mm (3.1913 ± 0.0004 inch).
			Installation depth is 1.00 ± 0.25 mm (0.039 ± 0.010 inch).

(continued)

(Table 80, contd)

3	1	4P-5459 Balancer Gear Assembly	Bore of 4P-5438 Bushing after installation is 75.060 ± 0.010 mm (2.9551 ± 0.0004 inch).
			Installation depth is 1.50 ± 0.50 mm (0.059 ± 0.020 inch).
4	-	-	The mark on the cluster idler gear (3) must be in alignment with the mark on the crankshaft gear (5).
6	2	9X-8887 Bolt	Use the following procedure to tighten the bolt for the camshaft drive gears:
			1. Tighten the bolt for the camshaft drive gear to 360 ± 40 N·m (266 ± 30 lb ft). 2. Mark a vertical line on the head of the bolt for the camshaft drive gear. Refer to Illustration 123 . 3. Place a driver against the retaining plate of the camshaft drive gear. Strike the driver solidly with a hammer 3 to 4 times. 4. Again, tighten the bolt for the camshaft drive gear to 360 ± 40 N·m (266 ± 30 lb ft). 5. Repeat Step 3 and Step 4 until the mark on the bolt turns a minimum of 90 degrees. Refer to Illustration 123 .
7	2	112-1552 Idler Shaft	Diameter is 81.000 ± 0.010 mm (3.1890 ± 0.0004 inch).
8	4	1B-4367 Bolt	Torque to 240 ± 20 N·m (177 ± 15 lb ft).
9	1	4P-5437 Gear Shaft	Diameter is 74.990 ± 0.010 mm (2.9524 ± 0.0004 inch).
10	4	8M-2530 Bolt	Torque to 140 ± 10 N·m (103 ± 7 lb ft).
11	2	8S-2331 Bolt	Torque to 240 ± 20 N·m (177 ± 15 lb ft).
12	2	101-1368 Thrust Washer	Thickness is 1.90 ± 0.10 mm (0.075 ± 0.004 inch).

i04936888

Gear Group (Rear)

SMCS Code: 1206

Part No.: 116-9856
S/N: 50Y1–Up

Part No.: 116-9856
S/N: 96Y1–Up

Part No.: 116-9856
S/N: 29Z1–Up

Part No.: 116-9856
S/N: 66Z1–Up

Part No.: 116-9856
S/N: 69Z1–Up

Part No.: 116-9856
S/N: 72Z1–Up

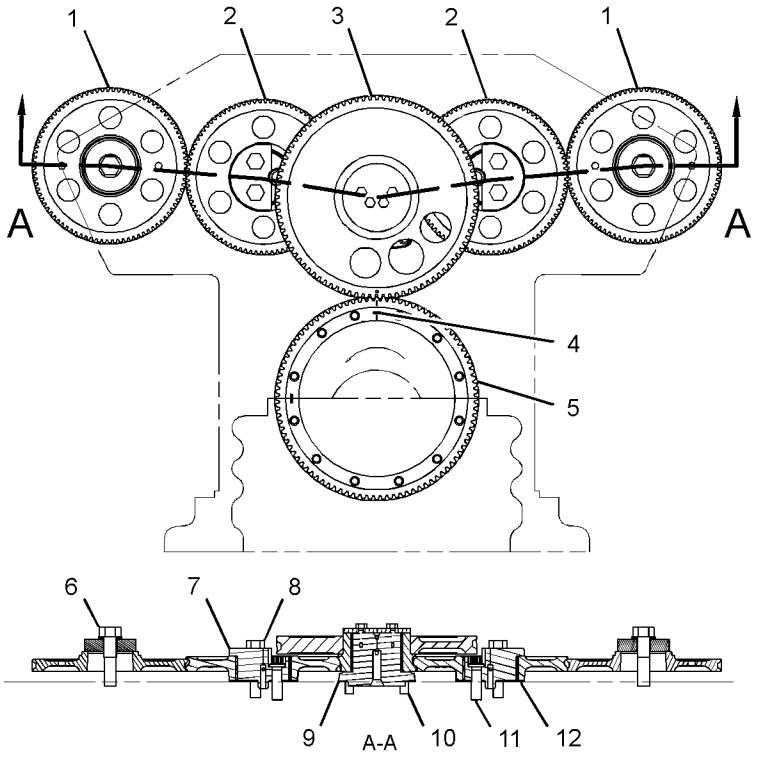

Illustration 124 g03113536

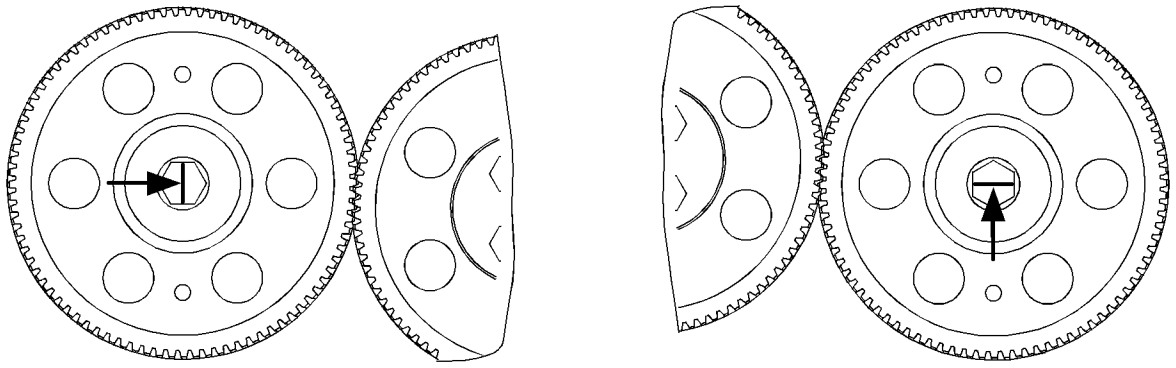

Illustration 125 g03113537

Table 81

Specification for 116-9856 Rear Gear Gp			
Item	**Qty**	**Part**	**Specification Description**
1	2	7E-3897 Camshaft Drive Gear	Before assembly, clean the taper of the camshaft and the tapered bore of the camshaft drive gear with lint free cloth saturated with cleaning solvent to remove excess oil. Clean with alcohol wipe.
2	2	112-1554 Idler Gear As	Bore of 125-9751 Bushing after installation is 81.060 ± 0.010 mm (3.1913 ± 0.0004 inch).
			Installation depth is 1.00 ± 0.25 mm (0.039 ± 0.010 inch).

(continued)

(Table 81, contd)

3	1	107-2477 Idler Gear As	Bore of 4P-5438 Bushing after installation is 75.060 ± 0.010 mm (2.9551 ± 0.0004 inch).
			Installation depth is 1.50 ± 0.50 mm (0.059 ± 0.020 inch).
4	-	-	The mark on the cluster idler gear (3) must be in alignment with the mark on the crankshaft gear (5).
6	2	9X-8887 Bolt	Use the following procedure to tighten the bolt for the camshaft drive gears:
			1. Tighten the bolt for the camshaft drive gear to 360 ± 40 N·m (266 ± 30 lb ft). 2. Mark a vertical line on the head of the bolt for the camshaft drive gear. Refer to Illustration 125 . 3. Place a driver against the retaining plate of the camshaft drive gear. Strike the driver solidly with a hammer 3 to 4 times. 4. Again, tighten the bolt for the camshaft drive gear to 360 ± 40 N·m (266 ± 30 lb ft). 5. Repeat Step 3 and Step 4 until the mark on the bolt turns a minimum of 90 degrees. Refer to Illustration 125 .
7	2	112-1552 Idler Shaft	Diameter is 81.000 ± 0.010 mm (3.1890 ± 0.0004 inch).
8	4	1B-4367 Bolt	Torque to 240 ± 20 N·m (177 ± 15 lb ft).
9	1	4P-5437 Gear Shaft	Diameter is 74.990 ± 0.010 mm (2.9524 ± 0.0004 inch).
10	4	8M-2530 Bolt	Torque to 140 ± 10 N·m (103 ± 7 lb ft).
11	2	8S-2331 Bolt	Torque to 240 ± 20 N·m (177 ± 15 lb ft).
12	2	101-1368 Thrust Washer	Thickness is 1.90 ± 0.10 mm (0.075 ± 0.004 inch).

i07358753

Gear Group (Rear)

SMCS Code: 1206

Part No.: 100-8310
S/N: 4MJ1–Up

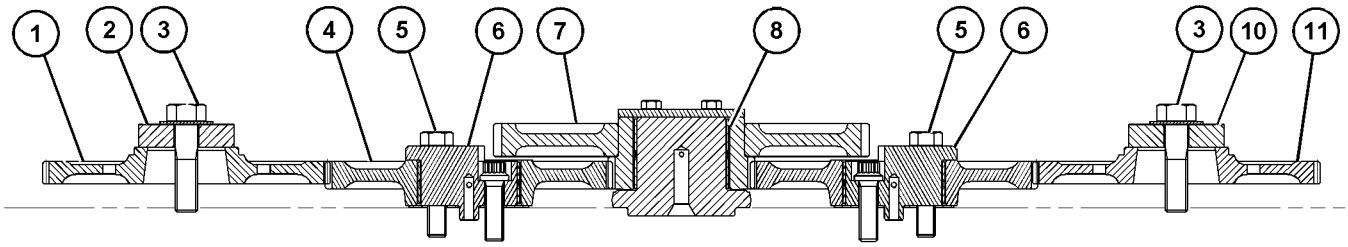

Illustration 126 g06293877

Typical example

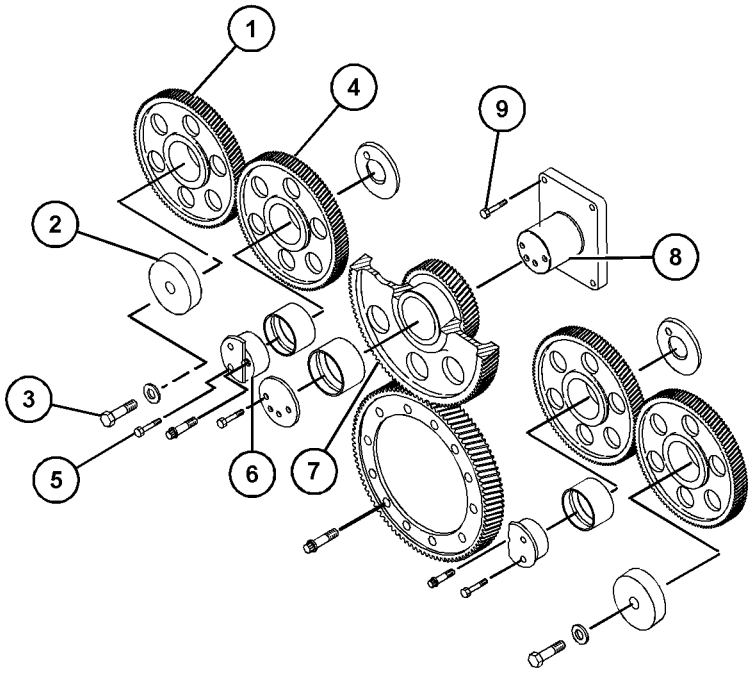

Illustration 127 g06293895

(1) Camshaft drive gear (2) Plate (3) Bolt

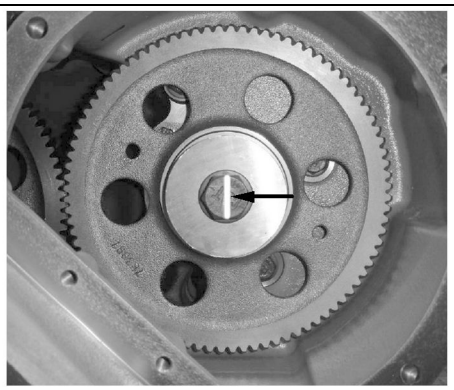

Illustration 128 g06294424

Vertical Line

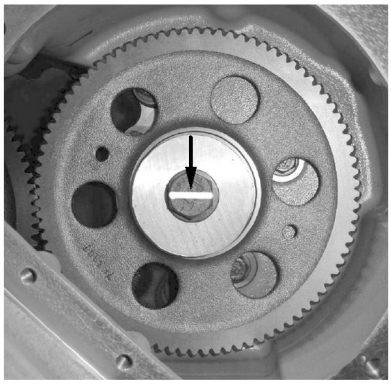

Illustration 129 g06294427

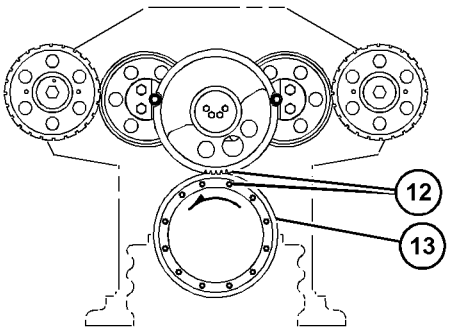

Illustration 130 g06293919

(12) Alignment mark (13) Crankshaft gear

Table 82

Item	Qty	Part	Specification Description
1	2	100-6518 Camshaft Drive Gear	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 (3) of the camshaft gear (1) to 360 N·m (265 lb ft). 2. Mark a vertical line on the head of the bolt for the camshaft gear. Refer to Illustration 128 . 3. Place a driver against the retaining plate of the camshaft gear. Strike the drive solidly with a hammer 3 to 4 times. 4. Tighten the retaining bolt for the camshaft gear again to 360 N·m (265 lb ft). 5. Repeat step 3 and step 4 until the mark on the bolt turns a minimum of 90 degrees. Refer to Illustration 129 . 6. Tighten the bolt (5) to 240 ± 20 N·m (175 ± 15 lb ft).
2	2	4W-4586 Plate	
3	2	1D-4609 Bolt	
4	2	4P-5440 Idler Gear As	
5	4	1B-4367 Bolt	
6	2	4P-5090 Idler Shaft	After, the bearing is installed in the gear the bearing must be machined to below size: 1. Diameter of shaft is 81.000 ± 0.010 mm (3.1890 ± 0.0004 inch). 2. The bore in the bearings after machining is 81.060 ± 0.010 mm (3.1913 ± 0.0004 inch). 3. Maximum roughness average (“Ra”) is 0.8 micrometer (32 microinch).
7	1	4P-5441 Idler Gear As	After, the bearing is installed in the gear the bearing must be machined to below size: 1. Diameter of shaft is 74.990 ± 0.010 mm (2.9524 ± 0.0004 inch). 2. The bore in the bearings after machining is 75.060 ± 0.010 mm (2.9551 ± 0.0004 inch). 3. Maximum roughness average (“Ra”) is 0.8 micrometer (32 microinch).
8	1	4P-5437 Gear Shaft	
9	4	0S-1595 Bolt	Tighten the bolt to 140 ± 10 N·m (105 ± 5 lb ft).
-	-	-	The mark on the idler gear must be in alignment with the mark (12) on the crankshaft gear (13). Refer to Illustration 130 .

i04929854

Balancer Group (Front)

SMCS Code: 1220

Part No.: 7N-8711
S/N: 96Y1–Up

Part No.: 7N-8711
S/N: 69Z1–Up

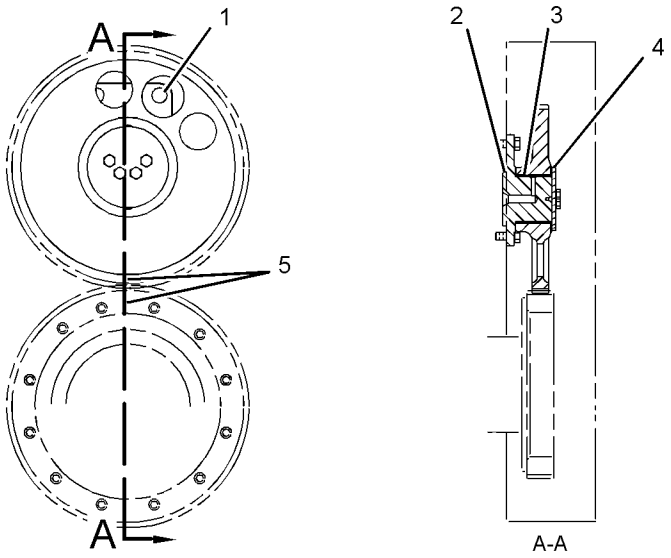

Illustration 131 g03099018

Table 83

Specification for 7N-8711 Balancer Gp			
Item	**Qty**	**Part**	**Specification Description**
1	4	8M-2530 Bolt	Torque to 140 ± 10 N·m (105 ± 7 lb ft).
2	1	4W-4998 Gear Shaft	Diameter is 74.900 ± 0.015 mm (2.9488 ± 0.0006 inch).
3	1	7N-6983 Bushing	Bore of the bushing after assembly is 75.000 ± 0.053 mm (2.9528 ± 0.0021 inch).
4	1	101-1365 Thrust Plate	Thickness is 6.35 ± 0.25 mm (0.250 ± 0.010 inch)
5	-	-	The mark on the balancer gear must be in alignment with the mark on the crankshaft gear.

i04403947

Accessory Drive (Lower Left Hand)

SMCS Code: 1207

Part No.: 8N-5678

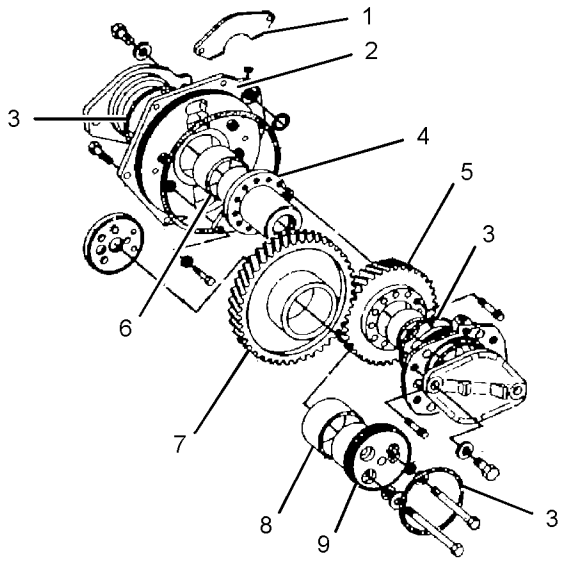

Illustration 132 g02592836

(2) 7N-5279 Adapter As (5) 2W-7320 Accessory Drive Gear (7) 116-3242 Idler Gear As

Table 84

Specification for 8N-5678 Accessory Drive Gp			
Item	**Qty**	**Part**	**Specification Description**
1	2	7N-7539 Thrust Washer	Thickness of one new thrust washer is 8.50 ± 0.05 mm (0.335 ± 0.002 inch).
3	3	-	Before assembly, lightly lubricate the bore for the O-ring seals with the fluid that is being sealed.
4	1	7N-5874 Auxiliary Drive Shaft	Diameter is 74.900 ± 0.015 mm (2.9488 ± 0.0006 inch).
			Width of groove for thrust washer is 8.75 ± 0.10 mm (0.344 ± 0.004 inch).
6	1	127-5400 Bushing	After assembly, bore is 75.000 ± 0.055 mm (2.9527 ± 0.0022 inch).
8	1	116-1365 Bearing	After assembly, bore is 105.970 ± 0.010 mm (4.1720 ± 0.0004 inch).
			Installation depth is 2.3 ± 0.5 mm (0.09 ± 0.02 inch).
9	1	7C-3259 Shaft	Diameter is 105.880 ± 0.020 mm (4.1685 ± 0.0008 inch).

i06177756

Accessory Drive (Lower Left Hand)

SMCS Code: 1207

Part No.: 8N-9167
S/N: 4MJ1–Up

Part No.: 8N-9167
S/N: 50Y1–Up

Part No.: 8N-9167
S/N: 96Y1–Up

Part No.: 8N-9167
S/N: 29Z1–Up

Part No.: 152-4986, 8N-9167
S/N: 66Z1–Up

Part No.: 152-4986, 8N-9167
S/N: 69Z1–Up

Part No.: 8N-9167
S/N: 72Z1–Up

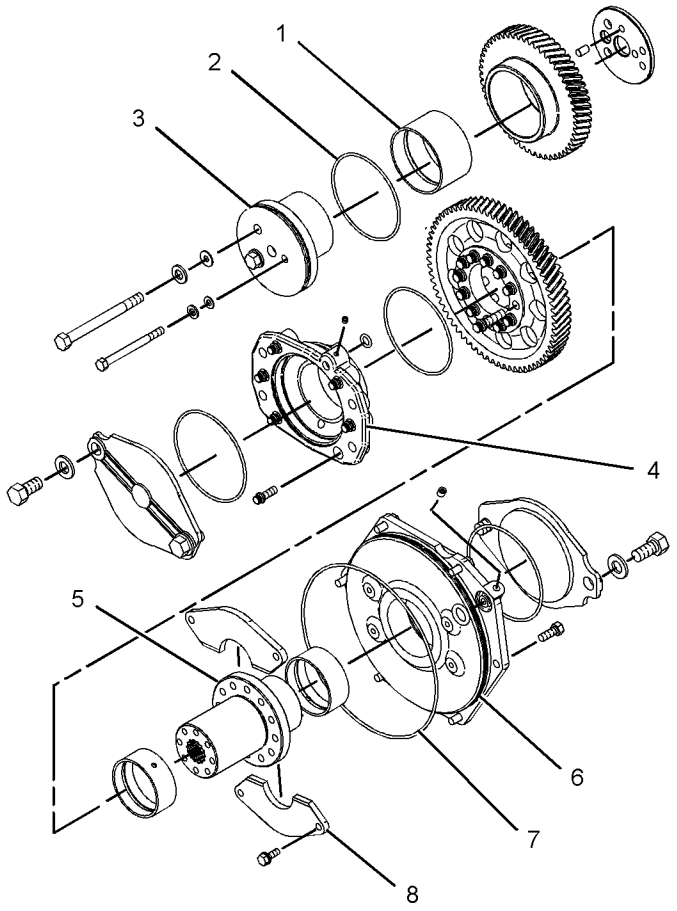

Illustration 133 g03838262

Typical example

Table 85

Specification for 8N-9167 Accessory Drive Gp and 152-4986 Accessory Drive Gp			
Item	**Qty**	**Part**	**Specification Description**
1	1	140-9597 Bushing	Bore in the bushing after assembly is 90.000 ± 0.010 mm (3.5433 ± 0.0004 inch).
			After, the bearing is installed in the gear the bearing must be machined to size.
2	2	259-4598 O-Ring Seal	Lubricate the bore lightly with the fluid that is being sealed.
3	1	7C-3260 Shaft	Diameter of new shaft is 89.880 ± 0.020 mm (3.5386 ± 0.0008 inch).
4	1	441-3369 Adapter As	Bore of 127-5400 Bushing after assembly is 75.140 ± 0.055 mm (2.9583 ± 0.0022 inch).
			Installation depth is 1.5 mm (0.06 inch)
5	1	7N-5874 Auxiliary Drive Shaft	Diameter of new shaft is 74.900 ± 0.015 mm (2.9488 ± 0.0006 inch).
			Width of groove in new shaft is 8.75 ± 0.10 mm (0.344 ± 0.004 inch).
6	1	7N-5279 Adapter As	Bore of 127-5400 Bushing after assembly is 75.000 ± 0.055 mm (2.9527 ± 0.0022 inch).
7	1	235-3546 O-Ring Seal	Lubricate the bore lightly with the fluid that is being sealed.
8	2	7N-7539 Thrust Washer	Thickness of new thrust washer is 8.50 ± 0.05 mm (0.335 ± 0.002 inch).

i04407612

Accessory Drive (Upper Right Hand)

SMCS Code: 1207

Part No.: 147-3175, 7C-4113
S/N: 50Y1–Up

Part No.: 147-3175, 7C-4113
S/N: 96Y1–Up

Part No.: 147-3175, 7C-4113
S/N: 29Z1–Up

Part No.: 147-3175, 7C-4113
S/N: 66Z1–Up

Part No.: 147-3175, 7C-4113
S/N: 69Z1–Up

Part No.: 147-3175, 7C-4113
S/N: 72Z1–Up

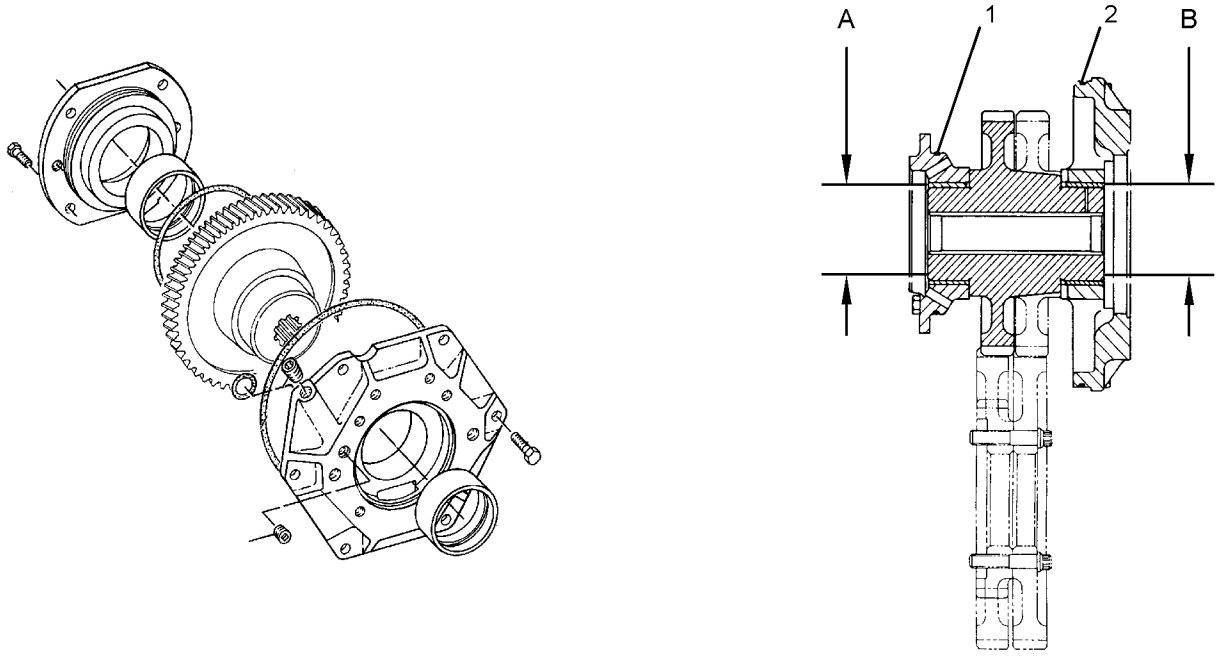

Illustration 134 g02603577
Typical example

Table 86

Specification for 4P-0853 Accessory Drive Gp, 147-3175 Accessory Drive Gp, and 7C-4113 Accessory Drive Gp			
Item	**Qty**	**Part**	**Specification Description**
1	1	259-4598 O-Ring Seal	Lubricate the bore lightly with lubricant that is being sealed.
2	1	235-3546 O-Ring Seal	Lubricate the bore lightly with lubricant that is being sealed.
A	1	7C-4165 Adapter As	Bore in 127-5400 Bushing after assembly is 75.000 ± 0.055 mm (2.9527 ± 0.0022 inch).
			Diameter of 7W-1102 Accessory Drive Gear Shaft is 74.900 ± 0.015 mm (2.9488 ± 0.0006 inch).
B	1	7C-4164 Adapter As	Bore in 127-5400 Bushing after assembly is 75.000 ± 0.055 mm (2.9528 ± 0.0022 inch).
			Diameter of 7W-1102 Accessory Drive Gear Shaft is 74.900 ± 0.015 mm (2.9488 ± 0.0006 inch).

i06177650

Accessory Drive (Upper Right Hand)

SMCS Code: 1207

Part No.: 7N-4871
S/N: 4MJ1–Up

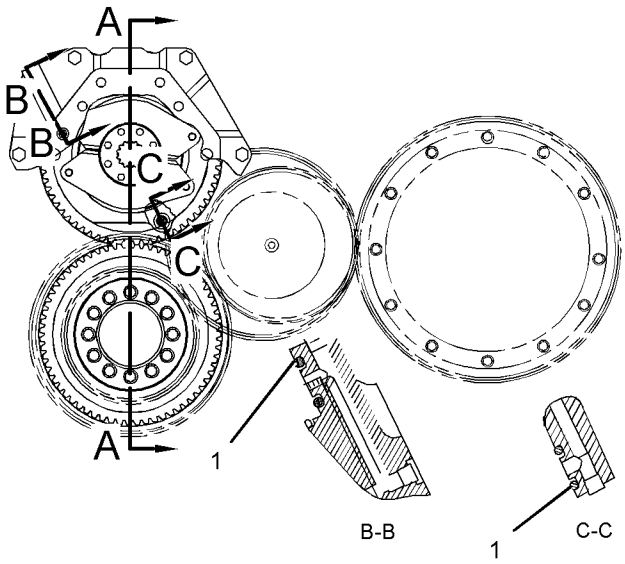

Illustration 135 g03838176

Front view

Table 87

Specification for 7N-4871 Accessory Drive Gp and 7C-0264 Accessory Drive Gp			
Item	**Qty**	**Part**	**Specification Description**
1	-	-	Lightly lubricate the bore of the O-ring seals with the lubricant that is being sealed.

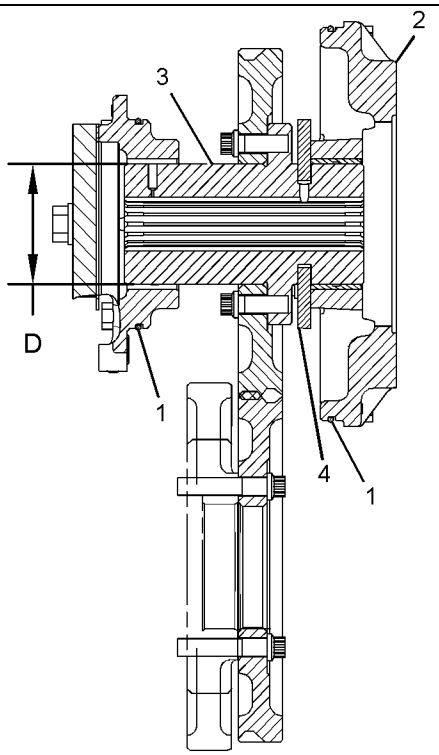

Illustration 136 g03838177

Section A-A

Table 88

Item	Qty	Part	Specification Description
2	1	7N-5279 Adapter As	Bore in the 127-5400 Bushing of the adapter assembly after installation is 75.000 ± 0.055 mm (2.9527 ± 0.0022 inch).
3	1	7N-5874 Auxiliary Drive Shaft	Diameter of the new auxiliary drive shaft is 74.900 ± 0.015 mm (2.9488 ± 0.0006 inch).
			Width of groove in the new auxiliary drive shaft for the thrust washer is 8.75 ± 0.10 mm (0.344 ± 0.004 inch).
4	2	7N-7539 Thrust Washer	Thickness of the new thrust washer is 8.50 ± 0.05 mm (0.335 ± 0.002 inch).
D	1	7C-4165 Adapter As	Bore in the 127-5400 Bushing of the adapter assembly after installation is 75.000 ± 0.055 mm (2.9527 ± 0.0022 inch).

i06178634

Accessory Drive (Upper Left Hand)

SMCS Code: 1207

Part No.: 8N-9166

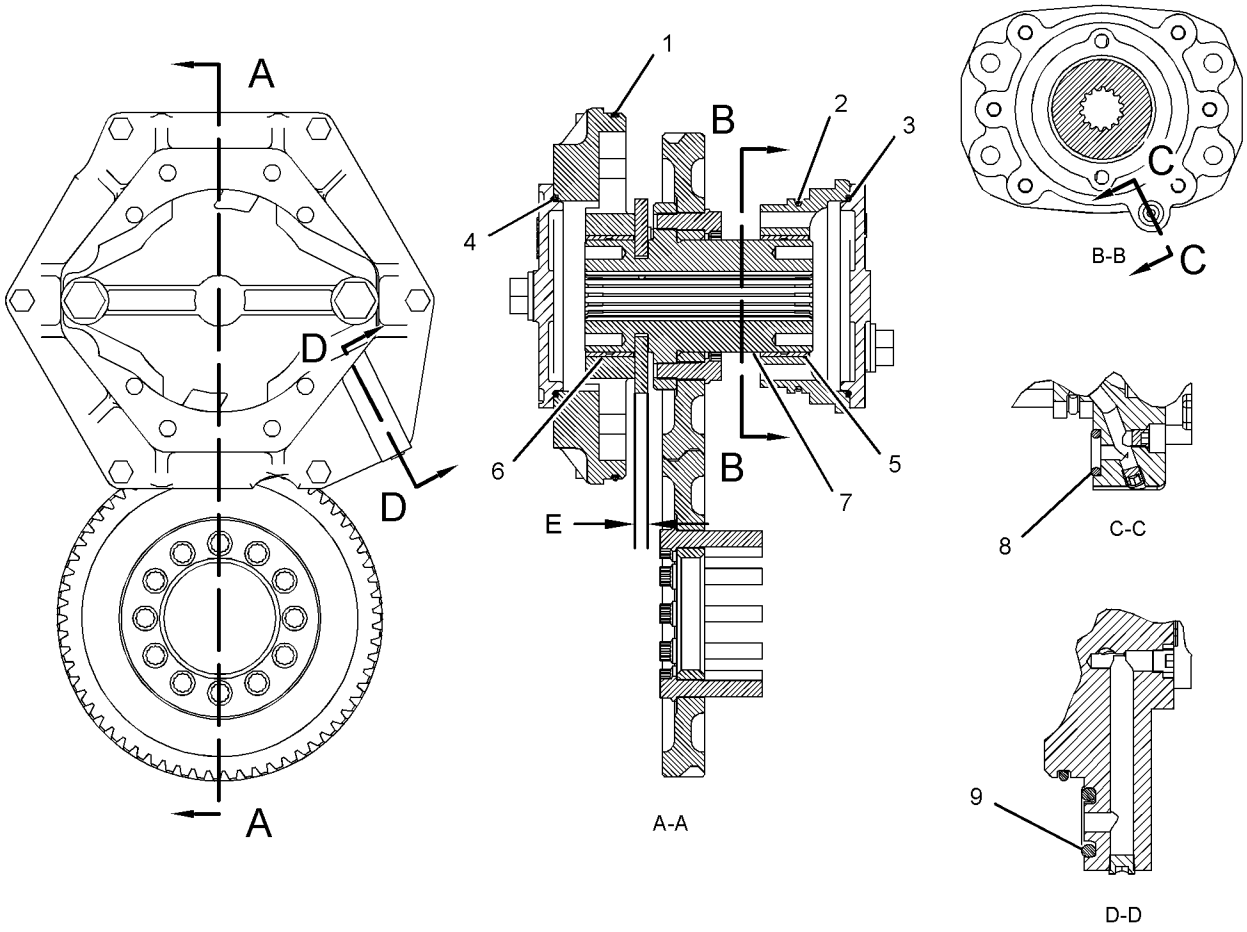

Illustration 137 g03838796

Table 89

Specification for 8N-9166 Accessory Drive Gp			
Item	**Qty**	**Part**	**Specification description**
1	1	235-3546 O-Ring Seal	Lightly lubricate the bore with the lubricant that is being sealed.
2	1	259-4598 O-Ring Seal	Lightly lubricate the bore with the lubricant that is being sealed.
3	1	6V-8260 O-Ring Seal	Lightly lubricate the bore with the lubricant that is being sealed.
4	1	9X-7371 O-Ring Seal	Lightly lubricate the bore with the lubricant that is being sealed.

(continued)

(Table 89, contd)

Specification for 8N-9166 Accessory Drive Gp			
Item	**Qty**	**Part**	**Specification description**
5	1	441-3369 Adapter As	Inside diameter of the 127-5400 Bushing after assembly is 75.140 ± 0.055 mm (2.9583 ± 0.0022 inch).
6	1	7N-5279 Adapter As	Inside diameter of the 127-5400 Bushing after assembly is75.000 ± 0.055 mm (2.9528 ± 0.0022 inch).
7	1	7N-5874 Auxiliary Drive Shaft	Diameter is 74.900 ± 0.015 mm (2.9488 ± 0.0006 inch).
			Width of the groove in the new auxiliary drive shaft for the thrust washer is 8.75 ± 0.10 mm (0.344 ± 0.004 inch).
E	2	7N-7539 Thrust Washer	Thickness of the new thrust washer is 8.50 ± 0.05 mm (0.335 ± 0.002 inch).
8	1	5P-0840 O-Ring Seal	Lightly lubricate the bore with the lubricant that is being sealed.
9	1	6V-3348 O-Ring Seal	Lightly lubricate the bore with the lubricant that is being sealed.

i04398458

Flywheel

SMCS Code: 1156

Part No.: 7N-4851, 7N-7784
S/N: 4MJ1–Up

Part No.: 7N-4851, 7N-7784, 8N-6038
, 8N-6439
S/N: 50Y1–Up

Part No.: 7N-4851, 7N-7784, 8N-6038
, 8N-6439
S/N: 96Y1–Up

Part No.: 7N-4851, 7N-7784, 8N-6038
, 8N-6439
S/N: 29Z1–Up

Part No.: 7N-4851, 7N-7784, 8N-6038
, 8N-6439
S/N: 66Z1–Up

Part No.: 7N-4851, 7N-7784, 8N-6038
, 8N-6439
S/N: 69Z1–Up

Part No.: 7N-4851, 7N-7784, 8N-6038
, 8N-6439
S/N: 72Z1–Up

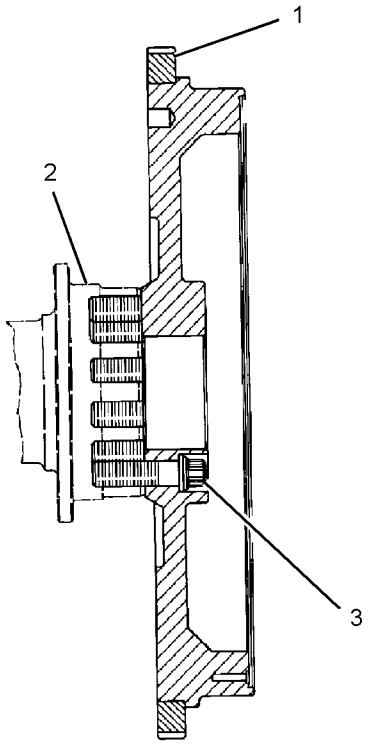

Illustration 138 g02578197

Typical example

(1) Flywheel gear (2) Crankshaft

Table 90

Specification for the 7N-4851 Flywheel Gp, 7N-7784 Flywheel Gp, 7W-0968 Flywheel Gp, 286-0244 Flywheel Gp, 333-3742 Flywheel Gp, 8N-6038 Flywheel Gp, 8N-6439 Flywheel Gp, 2W-8772 Flywheel Gp, 333-3743 Flywheel Gp, 336-9989 Flywheel Gp, 336-9990 Flywheel Gp, and 317-4398 Flywheel Gp			
Item	**Qty**	**Part**	**Specification Description**
When the flywheel assembly is installed, align the dash mark on the flywheel assembly with the dash mark on the crankshaft.			
3	12	9S-8893 Bolt	Before assembly, lubricate the threads of the bolts with clean engine oil, molybdenum disulfide, or graphite base lubricant.
			Torque to 1150 ± 60 N·m (840 ± 44 lb ft).

i04934580

Flywheel Housing

SMCS Code: 1157

Part No.: 7W-3722
S/N: 4MJ1–Up

Part No.: 7W-3722
S/N: 50Y1–Up

Part No.: 7W-3722
S/N: 96Y1–Up

Part No.: 7W-3722
S/N: 29Z1–Up

S/N: 66Z1–Up

Part No.: 7W-3722
S/N: 69Z1–Up

Part No.: 7W-3722
S/N: 72Z1–Up

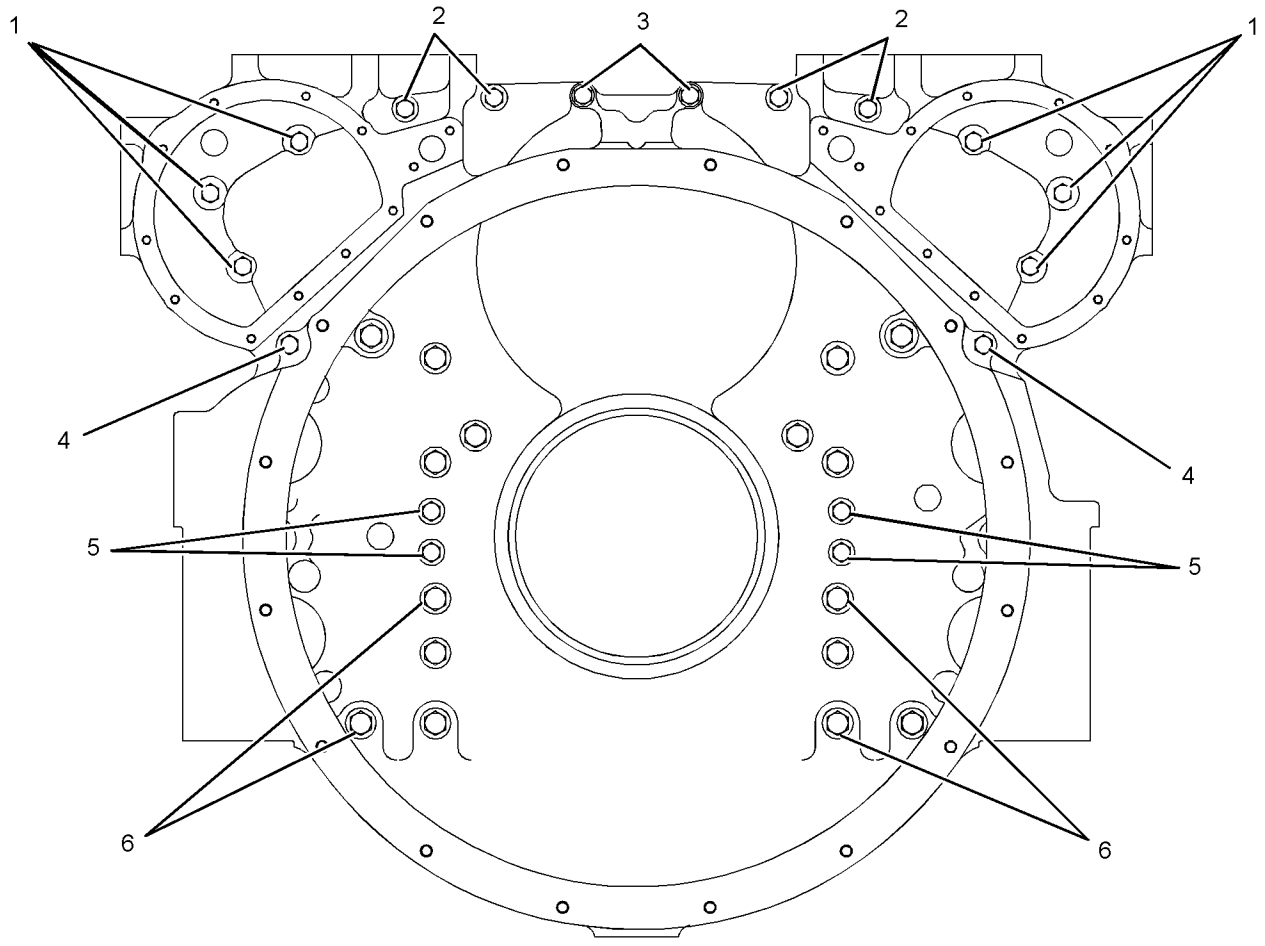

Illustration 139 g02188476
Bolt locations

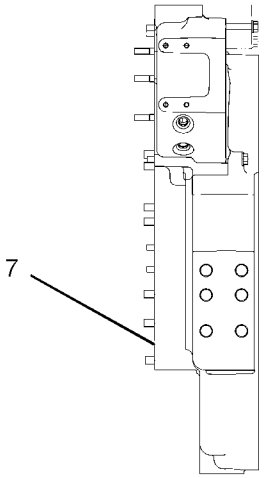

Illustration 140 g02589876

Left side view

Table 91

Specification for 101-0836 Flywheel Housing Gp, 297-7000 Flywheel Housing Gp, 383-6541 Flywheel Housing Gp, 384-8033 Flywheel Housing Gp, and 7W-3722 Flywheel Housing Gp			
Item	**Qty**	**Part**	**Specification Description**
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 materials.			
To seal the joint between the flywheel housing and the cylinder block, apply Loctite High Flex GM to the front face of the flywheel housing.			
1	6	9X-8873 Bolt	Length of 1/2 inch diameter bolt is 57.15 mm (2.250 inch). Torque to 135 ± 20 N·m (100 ± 15 lb ft).
2	4	9X-8875 Bolt	Length of 1/2 inch diameter bolt is 88.90 mm (3.500 inch). Torque to 135 ± 20 N·m (100 ± 15 lb ft).
3	2	9M-7269 (1)	Length of 1/2 inch diameter bolt is 171.5 mm (6.75 inch). Torque to 135 ± 20 N·m (100 ± 15 lb ft).
		6M-9613 (2)	Length of 1/2 inch diameter bolt is 228.6 mm (9.00 inch). Torque to 135 ± 20 N·m (100 ± 15 lb ft).
4	2	9S-1374 Bolt	Length of 1/2 inch diameter bolt is 203.20 mm (8.000 inch). Torque to 135 ± 20 N·m (100 ± 15 lb ft).
5	4	8S-9089 Bolt	Length of 1/2 inch diameter bolt is 114.30 mm (4.500 inch). Torque to 135 ± 20 N·m (100 ± 15 lb ft).
6	16	1D-4590 Bolt	Length of 5/8 inch diameter bolt is 120.65 mm (4.750 inch). Torque to 270 ± 40 N·m (199 ± 30 lb ft).
7	-	-	Apply blue Loctite High Flex GM to the surface of the gasket before assembly.

(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.

i05187263

Flywheel Housing

SMCS Code: 1157

Part No.: 102-3540
S/N: 50Y1–Up

Part No.: 102-3540
S/N: 66Z1–Up

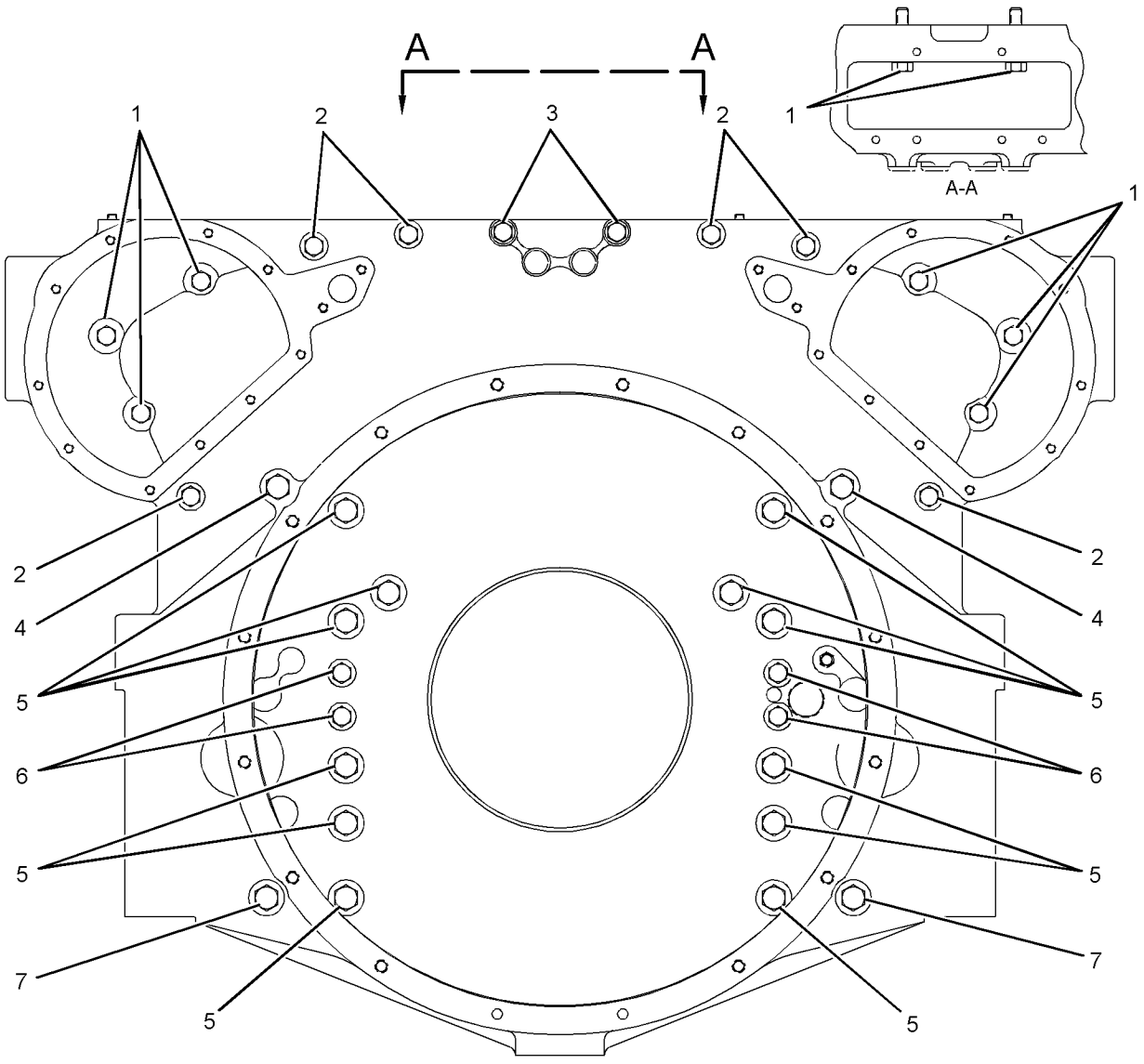

Illustration 141 g01513774
Rear view of the engine

Table 92

Specification for 107-7177 Flywheel Housing Gp and 102-3540 Flywheel Housing Gp			
Item	**Qty**	**Part**	**Specification Description**
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 materials.			
To seal the joint between the flywheel housing and the cylinder block, apply Loctite High Flex GM to the front face of the flywheel housing.			
1	8	9X-8873 Bolt	Length of 1/2 inch diameter bolt is 57.15 mm (2.250 inch). Torque to 135 ± 20 N·m (100 ± 15 lb ft).
2	6	1D-4574 Bolt	Length of 1/2 inch diameter bolt is 152.40 mm (6.000 inch). Torque to 135 ± 20 N·m (100 ± 15 lb ft).
3	2	9X-8874 Bolt	Length of 1/2 inch diameter bolt is 76.20 mm (3.000 inch). Torque to 135 ± 20 N·m (100 ± 15 lb ft).
4	2	1D-4597 Bolt	Length of 5/8 inch diameter bolt is 165.10 mm (6.500 inch). Torque to 270 ± 40 N·m (199 ± 30 lb ft).
5	12	1D-4593 Bolt	Length of 5/8 inch diameter bolt is 139.70 mm (5.500 inch). Torque to 270 ± 40 N·m (199 ± 30 lb ft).
6	4	9X-8878 Bolt	Length of 1/2 inch diameter bolt is 133.35 mm (5.250 inch). Torque to 135 ± 20 N·m (100 ± 15 lb ft).
7	2	1D-4602 Bolt	Length of 5/8 inch diameter bolt is 241.30 mm (9.500 inch). Torque to 270 ± 40 N·m (199 ± 30 lb ft).
-	-	-	Before assembly, apply Loctite High Flex GM to the sealing surfaces of the gasket.

i06052791

Flywheel Housing

SMCS Code: 1157

Part No.: 415-7108
S/N: 50Y1–Up

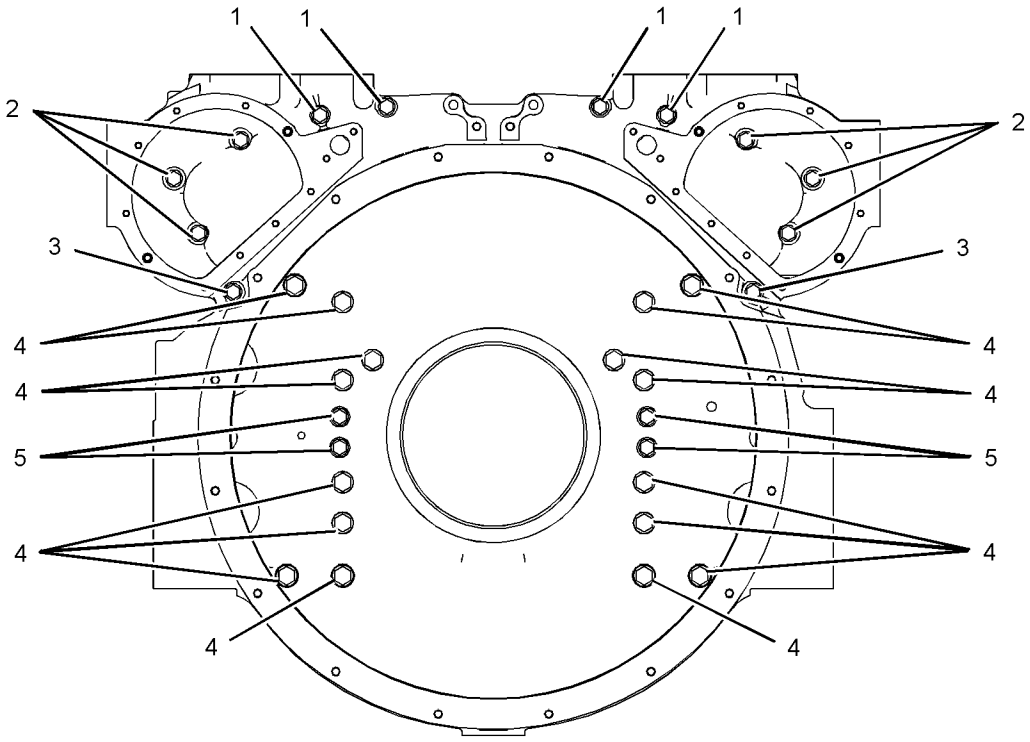

Illustration 142 g03106844

Rear view

Table 93

Specification for 415-7108 Flywheel Housing Gp			
Item	**Qty**	**Part**	**Specification Description**
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 materials.			
1	4	9X-8875 Bolt	Length of 1/2 inch bolt is 88.90 mm (3.500 inch). Torque to 135 ± 20 N·m (100 ± 15 lb ft).
2	6	9X-8873 Bolt	Length of 1/2 inch bolt is 57.15 mm (2.250 inch). Torque to 135 ± 20 N·m (100 ± 15 lb ft).
3	2	9S-1374 Bolt	Length of 1/2 inch bolt is 203.20 mm (8.000 inch). Torque to 135 ± 20 N·m (100 ± 15 lb ft).
4	16	1D-4590 Bolt	Length of 5/8 inch bolt is 120.65 mm (4.750 inch). Torque to 270 ± 40 N·m (199 ± 30 lb ft).
5	4	8S-9089 Bolt	Length of 1/2 inch bolt is 114.30 mm (4.500 inch). Torque to 135 ± 20 N·m (100 ± 15 lb ft).

i06170832

Flywheel Housing

SMCS Code: 1157

Part No.: 101-1269
S/N: 4MJ1–Up

Part No.: 101-1269
S/N: 50Y1–Up

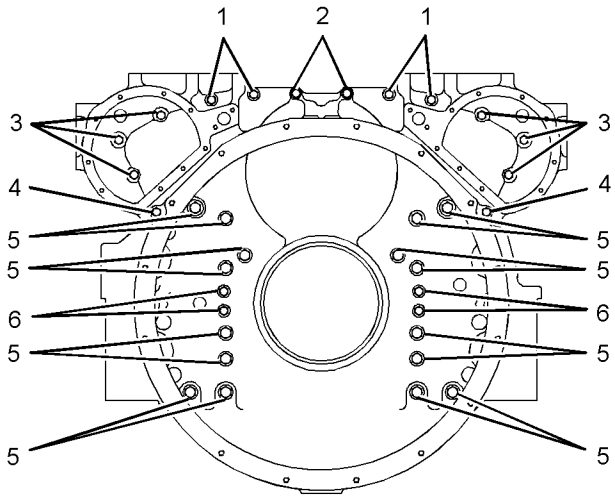

Illustration 143 g03835284

Table 94

Specification for 101-1269 Flywheel Housing Gp			
Item	**Qty**	**Part**	**Specification Description**
-	-	-	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 materials.
1	4	9X-8875 Bolt	Length of 1/2 inch diameter bolt is 88.90 mm (3.500 inch). Torque to 135 ± 20 N·m (100 ± 15 lb ft).
2	2	6M-9613 Bolt	Length of 1/2 inch diameter bolt is 228.60 mm (9.000 inch). Torque to 135 ± 20 N·m (100 ± 15 lb ft).
3	6	9X-8873 Bolt	Length of 1/2 inch diameter bolt is 57.15 mm (2.250 inch). Torque to 135 ± 20 N·m (100 ± 15 lb ft).
4	2	9S-1374 Bolt	Length of 1/2 inch diameter bolt is 203.20 mm (8.000 inch). Torque to 135 ± 20 N·m (100 ± 15 lb ft).
5	16	1D-4590 Bolt	Length of 5/8 inch diameter bolt is 120.65 mm (4.750 inch). Torque to 270 ± 40 N·m (199 ± 30 lb ft).
6	4	8S-9089 Bolt	Length of 1/2 inch diameter bolt is 114.30 mm (4.500 inch). Torque to 135 ± 20 N·m (100 ± 15 lb ft).

i05351608

Vibration Damper

SMCS Code: 1205

Part No.: 4W-0278

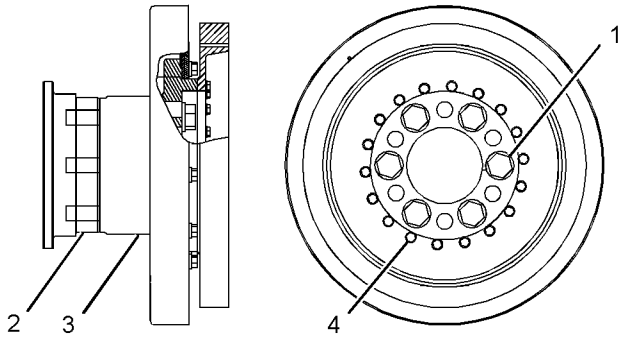

Illustration 144 g03389884

Table 95

Specification for 4W-0278 Damper Gp			
Item	**Qty**	**Part**	**Specification Description**
The alignment mark on the crankshaft (2) must be aligned with the alignment mark on the damper adapter (3).			
1	6	8S-4757 Bolt	Before assembly, lubricate the threads with molybdenum disulfide base lubricant.
			Torque to 1150 ± 60 N·m (848 ± 44 lb ft).
4	18	3B-1915 Bolt	Torque to 55 ± 7 N·m (41 ± 5 lb ft).

i04888963

Vibration Damper Guard

SMCS Code: 1205-GD

Part No.: 102-8616, 8N-9639
S/N: 4MJ1–Up

Part No.: 102-8616, 8N-9639
S/N: 50Y1–Up

Part No.: 102-8616, 8N-9639
S/N: 96Y1–Up

Part No.: 8N-9639
S/N: 29Z1–Up

Part No.: 8N-9639
S/N: 66Z1–Up

Part No.: 8N-9639
S/N: 69Z1–Up

Part No.: 8N-9639
S/N: 72Z1–Up

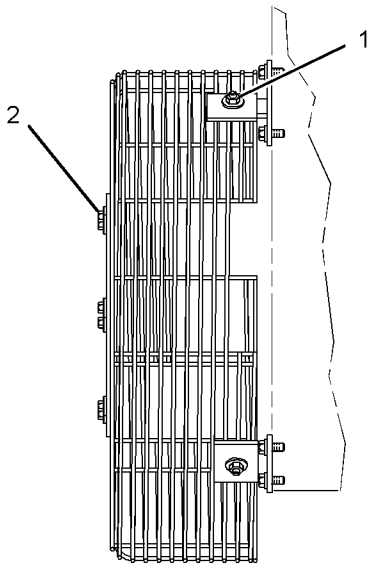

Illustration 145 g03017277
Typical example

Table 96

Specification for 102-8616 Damper Guard Gp and 4P-1602 Damper Guard Gp			
Item	**Qty**	**Part**	**Specification Description**
1	4	0S-1591 Bolt	Torque to 15 ± 3 N·m (133 ± 27 lb in).
2	6	030-8535 Locking Bolt	Torque to 15 ± 3 N·m (133 ± 27 lb in).

i07142159

Belt Tension Chart

SMCS Code: 1357

S/N: 50Y1–Up

S/N: 29Z1–Up

S/N: 66Z1–Up

S/N: 69Z1–Up

S/N: 72Z1–Up

Table 97

Specification for the 7N-9693 Tension Chart			
Item	**Qty**	**Part**	**Specification Description**
-	-	-	The new belt tension chart has been standardized. The belt tension chart eliminates confusion about the correct belt tension to use. Studies were completed with different belt suppliers and the information that was gathered from the studies was developed into a new belt tension for each belt size. The chart does not apply to belts that use a spring loaded tensioner. For more accurate results, a Clavis frequency gauge should be used in order to measure the natural frequency of the belt. By the use of a formula, the natural frequency is converted into the belt tension force. If the Clavis frequency gauge cannot be used, then use the appropriate Kent-Moore belt tension gauge to measure the belt tension force. When matched sets of belts are used, check the tension of all the belts in order to verify that the lowest belt is in the acceptable tolerance range. Variations in tension between the belts can vary by as much as 65 lbs. In order to determine the tension of a “banded” belt, refer to the chart above. Multiply the tension value of the belt by the number of belts that are banded together.Two 1/2 inch belts would require a used belt tension equal to twice the value of the used belt tension for one 1/2 inch belt (2 X 80 = 160 lb).

Table 98

Belt Tension Chart								Field Service Tension Check	
SAE or RMA Belt Size		**Width of Belt (Reference)**		**Setting Tension of New Belt**		**Setting Tension of Used(1) Belts**		**Reset Belt Tension if Tension Falls Below**	
IN	**MM**	**IN**	**MM**	**LB**	**N**	**LB**	**N**	**LB**	**N**
3/8 (0.380)	10A	0.42	10.72	145±10	645±44	115±10	512±44	70±10	311±44
7/16 (0.440)	11A	0.46	11.68	155±10	689±44	125±10	556±44	75±10	333±44
1/2 (0.500)	13A	0.55	13.89	165±10	734±44	130±10	578±44	80±10	356±44
5V/5VX	5V	0.63	15.88	180±10	801±44	145±10	645±44	85±10	378±44
11/16 (0.600)	15A	0.69	17.48	180±10	801±44	145±10	645±44	85±10	378±44
3/4 (0.660)	17A	0.75	19.05	205±10	912±44	165±10	734±44	95±10	423±44
7/8 (0.790)	20A	0.88	22.23	205±10	912±44	165±10	734±44	95±10	423±44
15/16	N/A	0.98	23.83	205±10	912±44	165±10	734±44	95±10	423±44
4K	4PK	0.54	13.72	145±10	645±44	115±10	512±44	60±10	267±44
6K	6PK	0.82	20.94	215±10	956±44	170±10	756±44	90±10	400±44
8K	8PK	1.1	27.82	285±10	1179±44	230±10	1023±44	115±10	512±44
10K	10PK	1.38	35.05	355±10	1579±44	285±10	1268±44	145±10	645±44

(continued)

(Table 98, contd)

12K	12PK	1.66	42.16	425±10	1891±44	340±10	1512±44	175±10	778±44
14K	14PK	1.94	49.28	495±10	2202±44	395±10	1757±44	205±10	912±44
15K	15PK	2.08	52.83	530±10	2358±44	425±10	1891±44	215±10	956±44

(1) Belt tension with less than 10 hours of operation

i04557209

Alternator and Regulator

SMCS Code: 1405

Part No.: 4N-3986

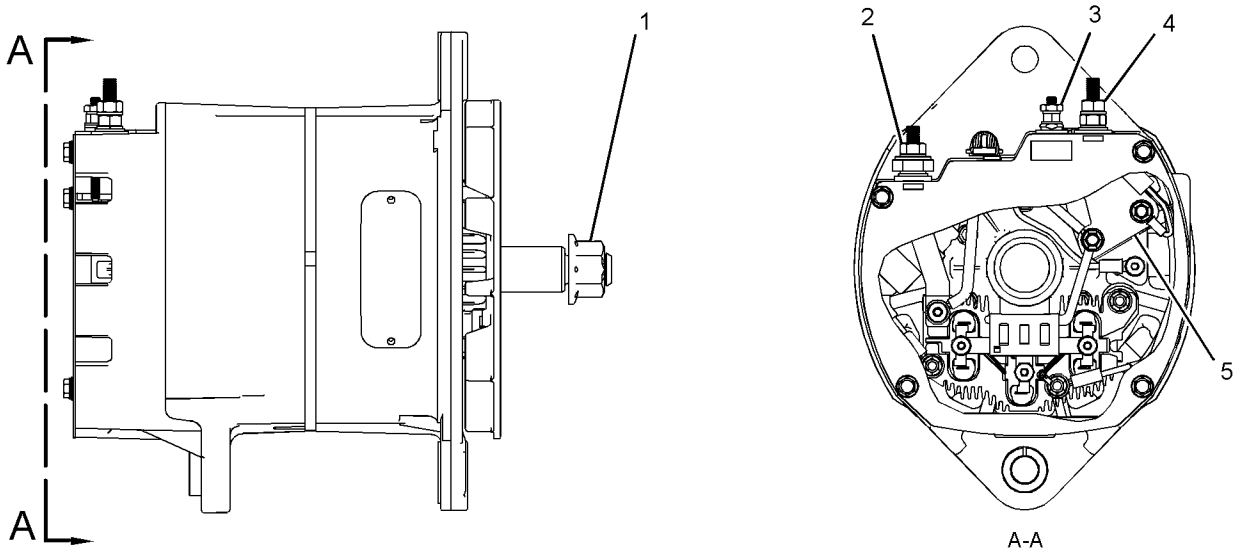

Illustration 146 g02559997

Table 99

Specification for 4N-3986 Charging Alternator Gp			
Item	**Qty**	**Part**	**Specification Description**
-	-	-	Load the battery with a carbon pile 4C-4911 Battery Load Tester in order to get the maximum alternator output.
1	1	187-2034 Flange Nut	Torque to 102 ± 7 N·m (75 ± 5 lb ft).
2	-	6V-8187 Nut	Use a 7/16 ring terminal for (B+) terminal. (B+) terminal. Torque to 6.75 ± 1.50 N·m (59.74 ± 13.28 lb in).
3	1	4B-2047 Nut	Torque to 2.25 ± 0.25 N·m (20.00 ± 2.00 lb in)
4	-	6V-8187 Nut	(B-) terminal. Torque to 6.75 ± 1.50 N·m (59.74 ± 13.28 lb in).
5	1	3T-6354 Voltage Regulator As	Voltage setting is not adjustable.
			Permissible voltage range is 27 to 29 V.
-	-	-	Voltage is 24 V.
-	-	-	Amperage is 60 amp.
-	-	-	Polarity is negative ground.
-	-	-	Rotation is either direction.
-	-	-	Maximum turn on speed is 2000 rpm.
-	-	Alternator performance at 25 °C (77 °F).	

(continued)

(Table 99, contd)

-	-	-	Minimum full load current at 5000 rpm is 68 amp.
-	-	-	Minimum full load current at 2000 rpm is 42 amp.
-	-	-	Output voltage is 28 ± 1 V.

i05770011

Alternator Mounting

SMCS Code: 1405

Part No.: 7E-4839
S/N: 50Y1–Up

Part No.: 7E-4839
S/N: 96Y1–Up

Part No.: 7E-4839
S/N: 72Z1–Up

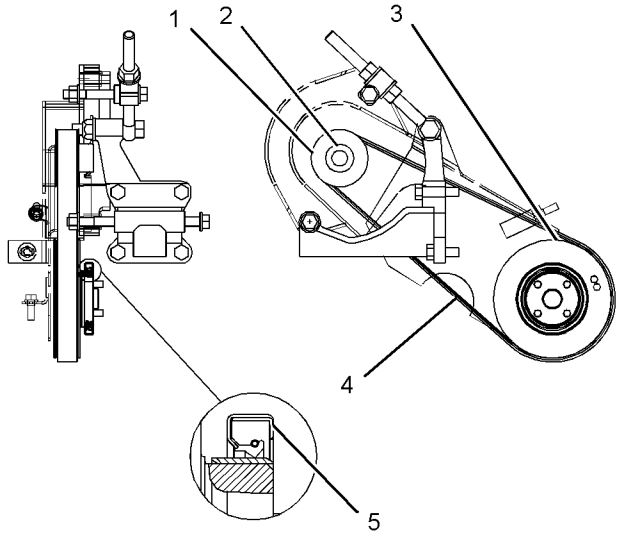

Illustration 147 g03660699

Table 100

Specification for 210-1228 Alternator Mounting Gp, and 335-4161 Alternator Mounting Gp			
Item	**Qty**	**Part**	**Specification Description**
2	-	-	Tighten the pulley retaining nut to 110 ± 10 N·m (81 ± 7 lb ft). Maximum misalignment between pulley assembly (3) and pulley (1) is 0.4 degrees.
4	1	-	Adjust the belt tension according to the 197-9087 Tension Chart.
5	1	235-2484 Lip Type Seal	Lubricate the sealing lip lightly with the lubricant that is being sealed.

197-9087 Belt Tension Chart

Table 101

Specification for 197-9087 Belt Tension Chart						
Size of Belt	**Width of Belt**	**Gauge Reading**	**Gauge (Force)**	**Belt Tension (Frequency) "Initial"(1)**	**Belt Tension (Frequency) "Used"(2) (3)**	**Gauge (Frequency)**

(continued)

(Table 101, contd)

		Belt Tension (Force) "Initial" (1)	Belt Tension (Force) "Used" (2)(3)	Basic Gauge Number			Gauge Number
8 - RIB POLY - RIB	27.82 mm (1.095 inch)	800 ± 22 N (180 ± 5 lb)	489 ± 44 N (110 ± 10 lb)	BT-33-109	98 ± 10 HZ	76 ± 8 HZ	Clavis Type 14
Do not use the belt tension chart for belts with tensioners that are spring loaded.							
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.

i06176851

Alternator Mounting

SMCS Code: 1405

Part No.: 7E-4836
S/N: 4MJ1–Up

Part No.: 7E-4836
S/N: 29Z1–Up

Part No.: 7E-4836
S/N: 66Z1–Up

Part No.: 7E-4836
S/N: 69Z1–Up

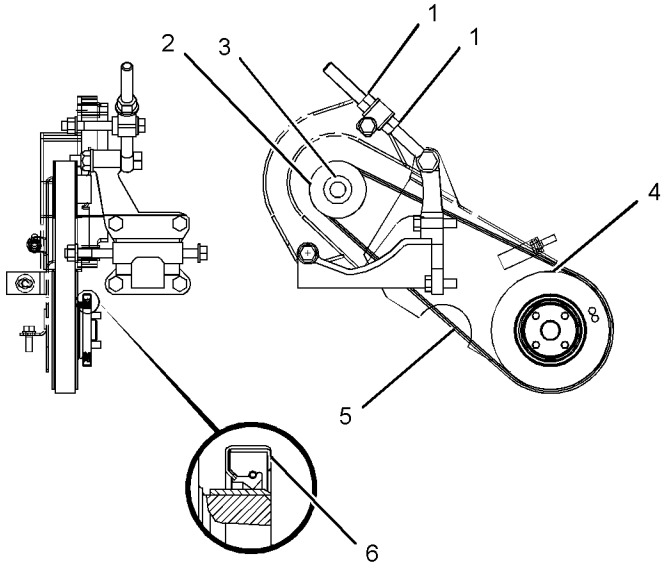

Illustration 148 g03837628

Table 102

Specification for 7E-4836 Alternator Mounting Gp			
Item	**Qty**	**Part**	**Specification Description**
1	2	2J-3506 Full Nut	Torque to 200 ± 20 N·m (148 ± 15 lb ft).
3	-	-	Tighten the pulley retaining nut to 110 ± 10 N·m (81 ± 7 lb ft). Misalignment between pulley assembly (4) and pulley (2) should not be exceed to 0.4 degrees.
5	1	141-7116 Serpentine Belt	Adjust the belt tension of the serpentine belt according to the 197-9087 Tension Chart.
6	1	235-2484 Lip Type Seal	Lubricate the sealing lip lightly with the lubricant that is being sealed.

197-9087 Belt Tension Chart

Table 103

Specification for 197-9087 Belt Tension Chart

(continued)

(Table 103, contd)

Size of Belt	Width of Belt	Gauge Reading		Gauge (Force)	Belt Tension (Frequency) "Initial"(1)	Belt Tension (Frequency) "Used"(2) (3)	Gauge (Frequency)
		Belt Tension (Force) "Initial" (1)	Belt Tension (Force) "Used" (2)(3)	Basic Gauge Number			Gauge Number
8 - RIB POLY - RIB	27.82 mm (1.100 inch)	800 ± 22 N (180 ± 5 lb)	489 ± 44 N (110 ± 10 lb)	BT-33-109	98 ± 10 HZ	76 ± 8 HZ	Clavis Type 14
Do not use the belt tension chart for belts with tensioners that are spring loaded.							
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.

i04394042

Electric Starting Motor

SMCS Code: 1453

Part No.: 6V-0927

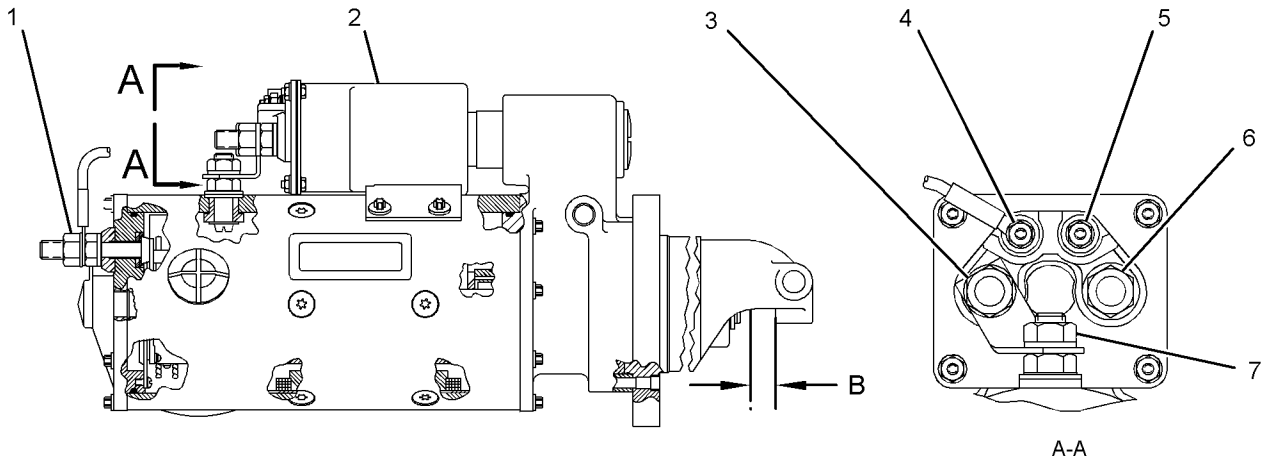

Illustration 149 g02565437

Table 104

Specification for 6V-0927 Electric Starting Motor Gp			
Item	**Qty**	**Part**	**Specification Description**
B	-	-	The clearance between the pinion and the housing is 9.1 mm (0.36 inch).
1	2	6V-8188 Nut	Torque to 30.5 ± 3.5 N·m (270.0 ± 30.0 lb in).
2	1	338-3453 Starting Motor Solenoid	Current consumption at 20V and 25 °C (77 °F): 1. For Pull-in windings is 49.3 ± 3.3 amp 2. For Hold-in windings is 6.8 amp max
3	1	6V-8188 Nut	Torque to 30.5 ± 3.5 N·m (270.0 ± 30.0 lb in).
4	1	4B-2049 Nut	Torque to 2.25 ± 0.25 N·m (20.00 ± 2.00 lb in).
5	1	4B-2049 Nut	The switch terminal must be insulated with heat shrink tubing. Do not use molded terminals. Torque to 2.25 ± 0.25 N·m (20.00 ± 2.00 lb in).
6	1	6V-8188 Nut	A maximum of three cable terminals or wire terminals may be used with the battery terminal nut (5). A maximum of two of the terminals may be equal to or greater than 0 AWG. 30.5 ± 3.5 N·m (270.0 ± 30.0 lb in)
7	1	6V-8188 Nut	30.5 ± 3.5 N·m (270.0 ± 30.0 lb in)
-	-	-	When the electric starting motor is viewed from the pinion end, the motor rotates in the clockwise direction. No load performance at 25 °C (77 °F) 1. Speed is 6950 ± 1650 rpm 2. Current draw is 115 ± 25 Amp 3. Voltage is 23 VDC

i06111211

Electric Starting Motor

SMCS Code: 1453

Part No.: 6V-0511

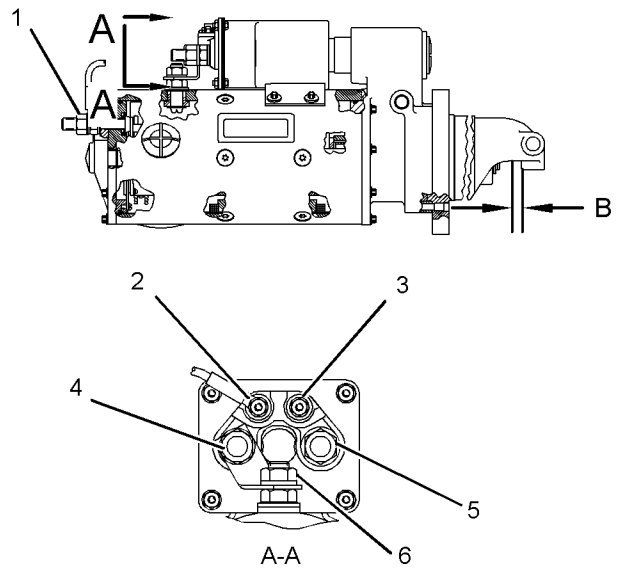

Illustration 150 g01501613

When the electric starting motor is viewed from the pinion end, the motor rotates in the following direction. . . . . .Counterclockwise

(B) The clearance between the pinion and the housing . . . . . .9.1 mm ((0.36 inch))

(1) Final installation torque for the nut for ground terminal . . . . . .30.5 ± 3.5 N·m ((269.9 ± 31.0 lb in))

(2) Final installation torque for the nut for ground terminal . . . . . .2.25 ± 0.25 N·m ((19.91 ± 2.21 lb in))

(3) Final installation torque for the nut for switch terminal . . . . . .2.25 ± 0.25 N·m ((19.91 ± 2.21 lb in))

(4) Final installation torque for the nut for motor terminal . . . . . .30.5 ± 3.5 N·m ((269.9 ± 31.0 lb in))

Note: 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.

(5) Final installation torque for the nut for battery terminal . . . . . .30.5 ± 3.5 N·m ((269.9 ± 31.0 lb in))

(6) Final installation torque for the nut for motor frame terminal . . . . . .30.5 ± 3.5 N·m ((269.9 ± 31.0 lb in))

Solenoid

Current consumption (draw) at 32 V and at 25 °C (77 °F)

Pull-in windings . . . . . 41 ± 3 Amp
Hold-in windings . . . . . 6.3 Amp
Operating temperature . . . . . −25 to 121 °C ((−13 to 250 °F))

i02787858

Air Starting Motor

SMCS Code: 1451

Part No.: 7C-3371, 7C-3373
S/N: 4MJ1–Up

Part No.: 7C-3371, 7C-3373, 8N-8476, 8N-8478
S/N: 50Y1–Up

Part No.: 133-5963, 7C-3371, 7C-3373, 8N-8476, 8N-8478
S/N: 96Y1–Up

Part No.: 7C-3371, 7C-3373
S/N: 29Z1–Up

Part No.: 7C-3371, 7C-3373, 8N-8476, 8N-8478
S/N: 66Z1–Up

Part No.: 133-5963, 7C-3371, 7C-3373, 8N-8476, 8N-8478
S/N: 69Z1–Up

Part No.: 7C-3371, 7C-3373
S/N: 72Z1–Up

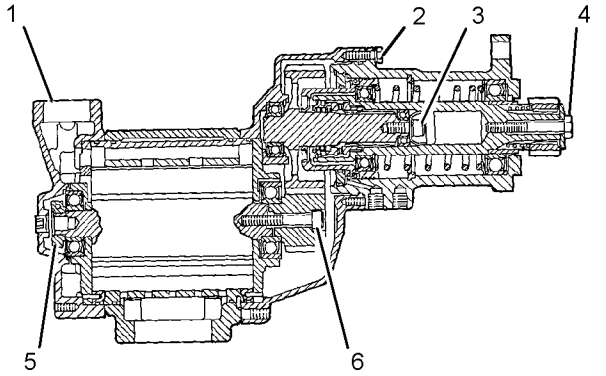

Illustration 151 g01392582
Typical example

(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 ((27 lb ft))

(3) Bolt

Torque . . . . . 78 N·m ((60 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))

i04907197

Air Starting Motor Pressure Regulating Valve

SMCS Code: 1462

Part No.: 1L-2073

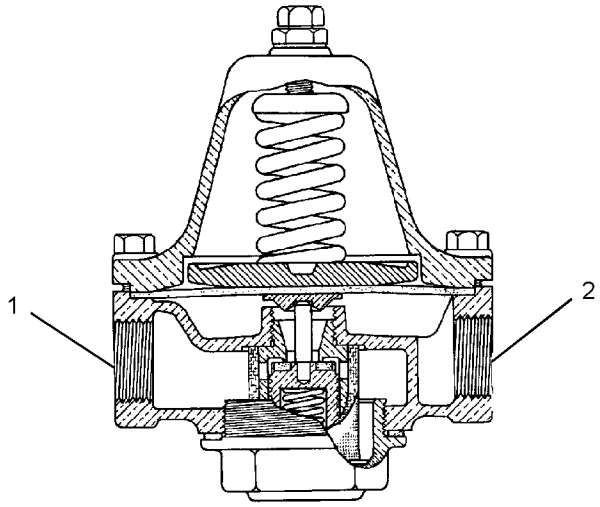

Illustration 152 g03071456

Table 105

Specification for 1L-2073 Pressure Reducing Valve			
Item	**Qty**	**Part**	**Specification Description**
1	-	-	Inlet pressure is 1723 kPa (250 psi). Maximum inlet pressure is 3103 kPa (450 psi).
2	-	-	Outlet pressure at outlet port is 621 ± 758 kPa (90 ± 110 psi).

i04905171

Coolant Temperature Switch

SMCS Code: 1395

Part No.: 3E-7298

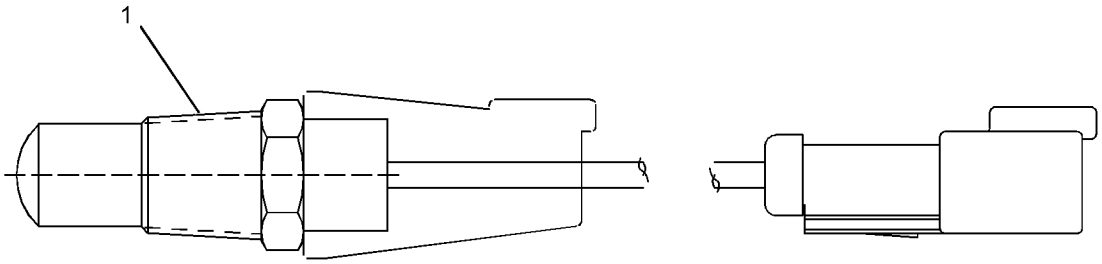

Illustration 153 g03063936

Table 106

Specification for 3E-7298 Temperature Switch			
Item	**Qty**	**Part**	**Specification Description**
1	1	-	Torque to 40 ± 5 N·m (30 ± 4 lb ft).
-		-	Operating range is −40 to 150 °C (−40 to 302 °F).
-	-	-	Actuation temperature to open at 21 ± 3 °C (70 ± 5 °F).
-	-	-	Minimum deactuation temperature is 13 °C (55 °F).
-	-	-	Contact position is normally closed below deactuation temperature.

i02210087

Engine Oil Pressure Sensor

SMCS Code: 1924

Part No.: 145-2362
S/N: 4MJ1–Up

Part No.: 145-2362
S/N: 50Y1–Up

Part No.: 145-2362
S/N: 96Y1–Up

Part No.: 145-2362
S/N: 29Z1–Up

Part No.: 145-2362
S/N: 66Z1–Up

Part No.: 145-2362
S/N: 69Z1–Up

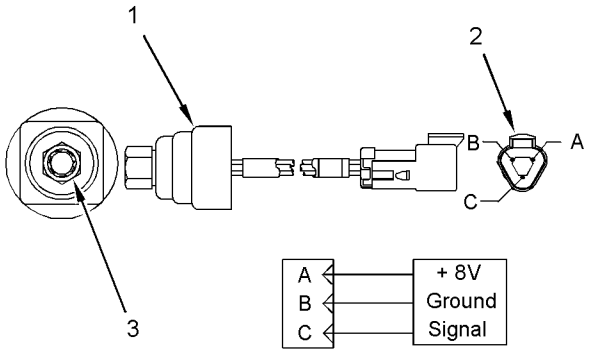

Illustration 154 g01115794

(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 range . . −40° to 125 °C ((−40° to 257 °F))

Maximum pressure . . . . . .839 kPa ((122 psi))

Voltage Supply . . . . . .8.0 ± 0.5 VDC

Maximum supply current . . . . . 20 mA

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

i04402182

Engine Coolant Temperature Sensor

SMCS Code: 1395

Part No.: 102-2240

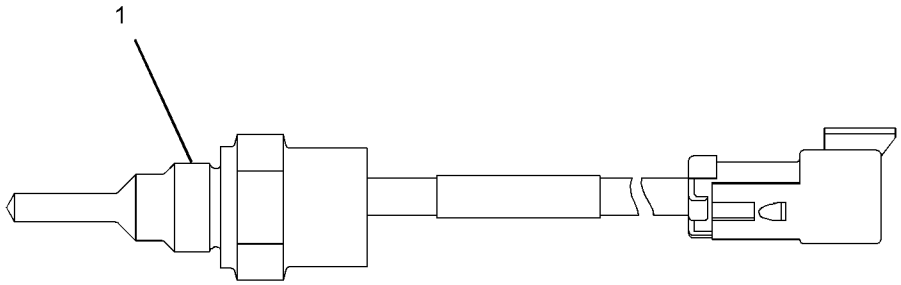

Illustration 155 g02587296

Table 107

Specification for 102-2240 Engine Coolant Temperature Sensor Gp			
Item	**Qty**	**Part**	**Specification Description**
1	1	102-2240 Engine Coolant Temperature Sensor Gp	Torque to 20 ± 3 N·m (177 ± 27 lb in).
			Operating voltage is 4.75 to 8.50 VDC.

i04402277

Engine Speed Sensor

SMCS Code: 1907

Part No.: 189-5746

Illustration 156 g02587736

Table 108

Specification for the 189-5746 Engine Speed Sensor Gp and 116-6680 Engine Speed Sensor			
Item	**Qty**	**Part**	**Specification Description**
1	-	-	Torque to 25 ± 5 N·m (18 ± 4 lb ft).
			Resistance at 25 °C (77 °F) is 142 Ω.

i04921883

Engine Speed Sensor

SMCS Code: 1907

Part No.: 4P-7610, 6V-2455
S/N: 4MJ1–Up

Part No.: 4P-7610, 6V-2455
S/N: 50Y1–Up

Part No.: 206-2588, 4P-7610, 6V-2455
S/N: 96Y1–Up

Part No.: 4P-7610, 6V-2455
S/N: 29Z1–Up

Part No.: 4P-7610, 6V-2455
S/N: 66Z1–Up

Part No.: 4P-7610, 6V-2455
S/N: 69Z1–Up

Part No.: 4P-7610, 6V-2455
S/N: 72Z1–Up

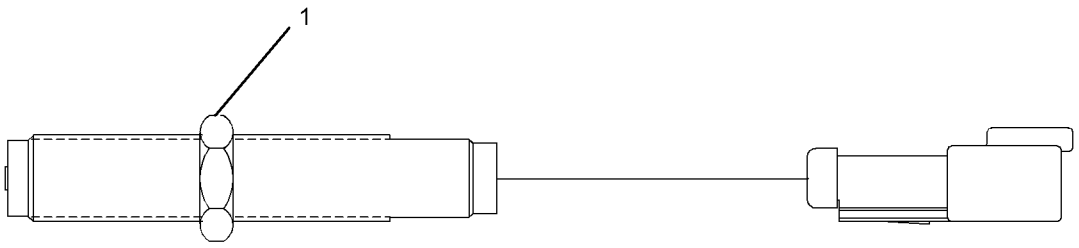

Illustration 157 g03088677

Table 109

Specification for 6V-2455 Speed Sensor Gp			
Item	**Qty**	**Part**	**Specification Description**
-	-	-	Use the following procedure to tighten the engine speed sensor:
-	-	-	1. Install the engine speed sensor into the 5/8 threaded hole and turn until the magnetic core contact with a tooth of the flywheel ring gear.
-	-	-	2. Back out 180 degrees and tighten the locknut (1).
-	-	-	Tighten the locknut (1) to 25 ± 5 N·m (19 ± 4 lb ft).
-	-	-	The clearance between the engine speed sensor and the flywheel ring gear is 0.56 to 0.84 mm (0.022 to 0.033 inch).

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