

# Specifications Section

i02525081

## Engine Design

i02524923

SMCS Code: 1000

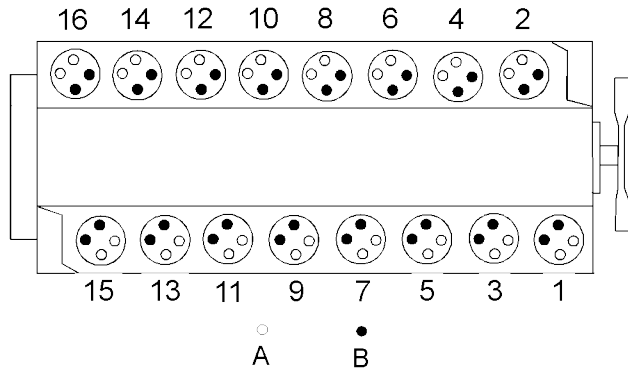


Illustration 1 g01262912

Cylinder and valve location

- (A) Inlet valves
- (B) Exhaust valves

Number and arrangement of cylinders ..... 60 degree V-16

Valves per cylinder ..... 4

Displacement ..... 85 L (5187 cu in)

Bore ..... 175 mm (6.7 inch)

Stroke ..... 220 mm (7.5 inch)

Compression ratio ..... 14:1

Combustion ..... Direct injection

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

Firing order (injection sequence)

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

**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.

## Fuel Filter (Primary)

SMCS Code: 1260

Part No.: 247 - 2696

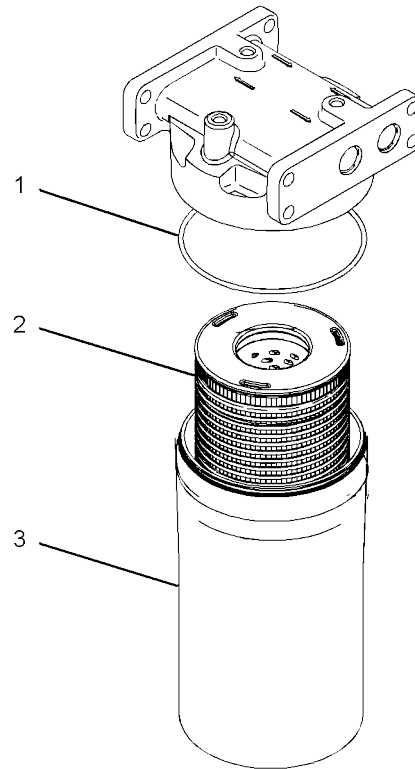


Illustration 2 g01262978

(1) O-ring

Lubricate the O-ring with clean diesel fuel prior to installation.

(2) Element

(3) Filter housing

Do not use an air wrench.

Torque ..... 55 ± 5 N·m (41 ± 4 lb ft)

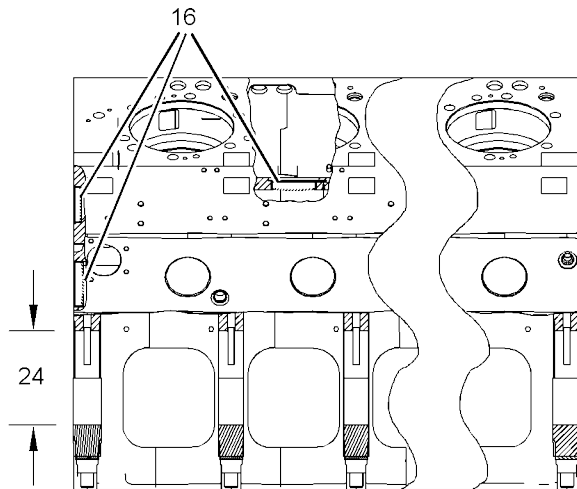


Illustration 46  
Right side view

g01276840

(1) 248 - 7585 Orifice

Orifice (1) must be fully seated in the bore and flush with the head face of the cylinder block. After you start the orifice into the bores, apply 4C-9507 Retaining Compound to the outside diameter of the orifice. Install the outside diameter of the orifice's chamfer toward the cylinder block. Orifice (1) is only for the number eight cylinder (2) through the number three cylinder (6).

(2) Cylinder 8

(3) Cylinder 7

(4) Cylinder 4

(5) Cylinder 6

(6) Cylinder 3

(7) Cylinder 4

(8) 248 - 7584 Orifice

Orifice (8) must be fully seated in the bore and flush with the head face of the cylinder block. After you start the orifice into the bores, apply 4C-9507 Retaining Compound to the outside diameter of the orifice. Install the outside diameter of the orifice's chamfer toward the cylinder block. Orifice (8) is only for the number one cylinder (9) and for the number two cylinder (10).

(9) Cylinder 1

(10) Cylinder 2

(11) O-ring seal

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

(12) Dowel

The dowels extend from the face by the following distance: .....  $16 \pm 1$  mm ( $0.6299 \pm 0.0394$  inch)

(13) Centerline through the oil holes in the camshaft bearings

Install the camshaft bearings so the oil holes are horizontal.

(14) O-ring seal

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

(15) Dowel

The dowels extend from the face by the following distance: .....  $19 \pm 1$  mm ( $0.7480 \pm 0.0394$  inch)

(16) Cup Plug

Apply 6v - 6640 Sealant to the outside diameter of the cup plug prior to assembly.

(17) New dimension from centerline of crankshaft bearing bore to the top of the block ..... 650 mm (25.5905 inch)

(18) Depth of all cup plugs from the face of the holes for the cup plugs. ....  $3.4 \pm 1.8$  mm ( $0.1339 \pm 0.0709$  inch)

(19) Main bearing cap

(20) Washer

(21) Bolt

(22) Nut

(23) Stud

(24) Bore in the block for the main bearings

Standard, original new size .....  $210 \pm 0.02$  mm ( $8.2677 \pm 0.0008$  inch)

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

1. Tighten studs (23) again.

Torque .....  $100 \pm 20$  N·m ( $74 \pm 15$  lb ft)

i02550061

2. Assemble main bearing caps (19) with the part number toward the front of the cylinder block.
3. Lubricate the treads of studs (23) and the face of nuts (22). Assemble and hand tighten the nuts.
4. Lubricate the threads of bolts (21) and both sides of washers (20). Assemble and hand tighten the bolts and the washers in the side of the cylinder block.
5. Start at the front of the engine (number one main bearing cap). Tighten all the side bolts on the right hand side (same side as the bearing tab slots) of the cylinder block.

Torque .....  $100 \pm 20 \text{ N}\cdot\text{m}$  ( $74 \pm 15 \text{ lb ft}$ )

6. Use the 249-6717 Stud Tensioner Tool Group.

Start at the front of the engine (number one main bearing cap). Tension both studs (23) simultaneously.

Pressure ...  $135000 \pm 1000 \text{ kPa}$  ( $19580 \pm 145 \text{ psi}$ )

7. Hand tighten both nuts (22) with the use of the gear drives on the tensioner.
8. Release the hydraulic pressure on the tensioner.
9. Repeat Step 6 through Step 8 for main bearing caps 2 through 9.
10. Repeat Step 6 through Step 8 again for all the main bearing caps.
11. Start at the front of the engine (number one main bearing). Tighten all the side bolts on the left hand side (opposite side as the bearing tab slots) of the cylinder block.

Torque .....  $100 \pm 20 \text{ N}\cdot\text{m}$  ( $74 \pm 15 \text{ lb ft}$ )

12. Start at the front of the engine (number one main bearing cap). Tighten all the side bolts on the right hand side (same side as the bearing tab slots) of the cylinder block.

Torque ...  $530 \pm 70 \text{ N}\cdot\text{m}$  ( $390.9068 \pm 51.6292 \text{ lb ft}$ )

13. Start at the front of the engine (number one main bearing). Tighten all the side bolts on the left hand side (opposite side as the bearing tab slots) of the cylinder block.

Torque ...  $530 \pm 70 \text{ N}\cdot\text{m}$  ( $390.9068 \pm 51.6292 \text{ lb ft}$ )

## Cylinder Liner

SMCS Code: 1216

Part No.: 286-4564

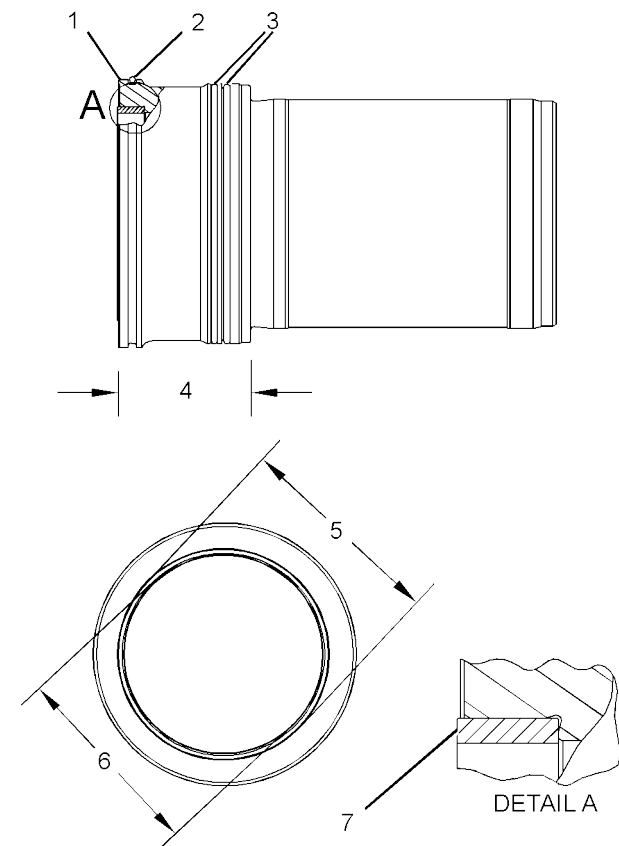


Illustration 47

g01276565

i02560298

Careful handling of the connecting rod is required at all times. The fracture face of the connecting rod and the fracture face of the connecting rod cap must not make contact with any surface. The connecting rod and the connecting rod cap must be laid flat on the sides. When possible, the rod assembly should be kept together in order to protect the fracture face when the connecting rod is out of the engine.

The connecting rod and the connecting rod cap must be marked only with a mechanical etcher with the number of the cylinder. The cylinder number must be etched on the same surface as the part number and the serial number for the connecting rod.

## Procedure for Tightening Connecting Rod Bolts

1. Before assembly, put 6V-4876 Lubricant on the threads of bolt (5), spacer (6) and all surfaces that make contact between the bolt and the cap.
2. Install the spacers and the bolts. Hand tighten the bolts.
3. Tighten bolts A and B.  
Torque .....  $80 \pm 5$  N·m ( $59 \pm 4$  lb ft)
4. Tighten bolts C and D.  
Torque .....  $80 \pm 5$  N·m ( $59 \pm 4$  lb ft)
5. Tighten bolts E and F.  
Torque .....  $80 \pm 5$  N·m ( $59 \pm 4$  lb ft)
6. Repeat Step 9 through Step 6.
7. Tighten bolts C and D.  
Torque .....  $180 \pm 5$  degrees
8. Tighten bolts E and F.  
Torque .....  $180 \pm 5$  degrees
9. Tighten bolts A and B.  
Torque .....  $180 \pm 5$  degrees

## Connecting Rod and Main Bearing Journals

**SMCS Code:** 1230

**Part No.:** 286-5799, 286-5801

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

### Connecting Rod Bearing Journals

Table 2

Diameter Of Crankshaft Journal (Bearing Surface) For Connecting Rod Bearings	
Original Size Journal	150 mm (5.9055 inch)
Undersize Journal 0.63 mm (0.025 inch)	149.37 mm (5.8807 inch)
Undersize Journal 1.27 mm (0.050 inch)	148.73 mm (5.8555 inch)

Clearance between bearing and new journal .... 0.172 to 0.295 mm (0.0068 to 0.0116 inch)

### Main Bearing Journals

Table 3

Diameter Of Crankshaft Journal (Bearing Surface) For Main Bearings	
Original Size Journal	200 mm (7.8740 inch)
Undersize Journal 0.63 mm (0.025 inch)	199.37 mm (7.8492 inch)
Undersize Journal 1.27 mm (0.050 inch)	198.73 mm (7.8240 inch)

Clearance between bearing and new journal ... 0.145 to 0.262 mm (0.0057 to 0.0103 inch)

i02530414

i02531323

## Valve Mechanism

SMCS Code: 1102

Part No.: 273-1225

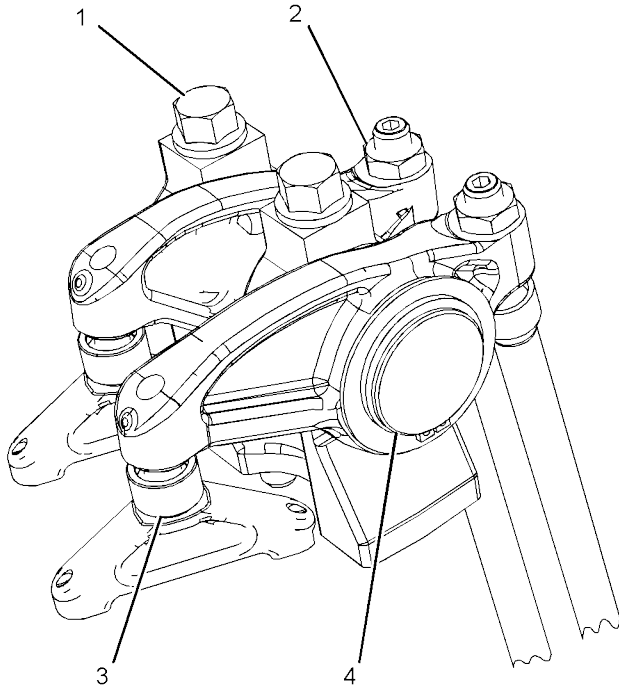


Illustration 17

g01265938

- (1) Bolt  
Torque ..... 240 ± 40 N·m (177 ± 30 lb ft)
- (2) Locknut  
Torque ..... 120 ± 15 N·m (89 ± 11 lb ft)
- (3) Valve lash  
Inlet ..... 0.8 mm (0.0315 inch)  
Exhaust ..... 1.3 mm (0.0512 inch)
- (4) Rocker arm shaft  
Bore in the bearings for the rocker arm shaft  
After the 254-5922 Bushing is installed in the rocker arm the bearing must be machined to size. .. 50.086 ± 0.015 mm (1.972 ± 0.0006 inch)  
Maximum roughness average (Ra) ..... 0.8 micrometer (32 microinch)  
Diameter of the rocker arm shaft .. 50 ± 0.013 mm (1.9685 ± 0.0005 inch)  
Maximum roughness average (Ra) ..... 0.125 micrometer (4.875 microinch)

## Cylinder Head

SMCS Code: 1100

Part No.: 273-1221

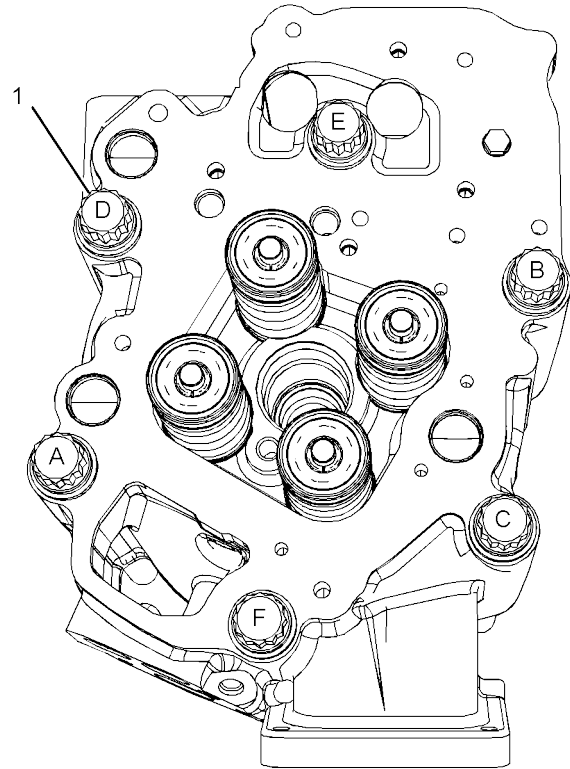


Illustration 18

g01266761

- Use the following procedure to tighten cylinder head bolts (1).
1. Coat the threads of the cylinder head bolts with clean engine oil.
  2. Tighten bolts A through F in the lettered sequence that is pictured in Illustration 18.  
Torque ..... 30 ± 5 N·m (22 ± 4 lb ft)
  3. Tighten bolts A through F again in the lettered sequence.  
Torque ..... 190 ± 15 N·m (140 ± 11 lb ft)
  4. Tighten bolts A through F again in the lettered sequence.  
Torque ..... 190 ± 15 N·m (140 ± 11 lb ft)
  5. Tighten bolts A through F again to the following rotation.  
Rotation for bolts ..... 180 ± 5 degrees