

Illustration 1

g01330221

(1) Etch the cylinder number on the connecting rod and the cap in this location. Mark the connecting rod and the cap with a number 1 through 6. Mark the numbers on the same side of the connecting rod as the bearing retainer notch.

**Note:** Install the connecting rod in the engine with the part number to the rear of the engine.

**Note:** If you replace a connecting rod make sure that you do not combine fractured connecting rods with machined connecting rods. Refer to Special Instruction, REHS3801, "Combining Machined Connecting Rods and Fractured Connecting Rods on C13 Engines" for more instruction.

(2) Tighten the connecting rod bolts. Use the instructions that follow.

1. Tighten the connecting rod bolts.

Tighten the connecting rod bolts to the following torque. ...  $130 \pm 7 \text{ N}\cdot\text{m}$  ( $95 \pm 5 \text{ lb ft}$ )

2. Tighten each connecting rod bolt for an additional amount.

Rotate each connecting rod bolt in the clockwise direction. ...  $60 \pm 5 \text{ degrees}$  (1/6 of a turn)

(A) Bore in the connecting rod for the piston pin bearing ...  $57.810 \pm 0.013 \text{ mm}$  ( $2.2759 \pm 0.0005 \text{ inch}$ )

(B) Bore in the bearing for the piston pin ...  $53.205 \pm 0.008 \text{ mm}$  ( $2.0947 \pm 0.0003 \text{ inch}$ )

Diameter of the piston pin ...  $53.155 \pm 0.005 \text{ mm}$  ( $2.0927 \pm 0.0002 \text{ inch}$ )

Thoroughly lubricate the piston pin with clean engine oil prior to assembly of the piston and connecting rod.

(C) Location of the bearing joint from the horizontal centerline of the pin bore ...  $12.5 \pm 5 \text{ degrees}$

(D) Bore in the connecting rod for the crankshaft bearing ...  $93.800 \pm 0.013 \text{ mm}$  ( $3.6929 \pm 0.0005 \text{ inch}$ )

(E) Distance between the center of the bearings ...  $247.5 \text{ mm}$  ( $9.74 \text{ inch}$ )

**Note:** The connecting rod must be heated for the installation of the piston pin bearing. Do not use a torch.

(F) The connecting rod may be heated from  $175 \text{ }^\circ\text{C}$  to  $260 \text{ }^\circ\text{C}$  ( $347 \text{ }^\circ\text{F}$  to  $500 \text{ }^\circ\text{F}$ ) for the installation of the piston pin bearing. Maximum distance for heating the connecting rod ...  $88 \text{ mm}$  ( $3.5 \text{ inch}$ )

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## Specifications

### C11 and C13 On-highway Engines

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i02719735

## Cylinder Block

### SMCS - 1201

The flatness of the top contact surface of the cylinder block must be within 0.05 mm (0.002 inch) for any 150 mm (5.9 inch) section of the surface.

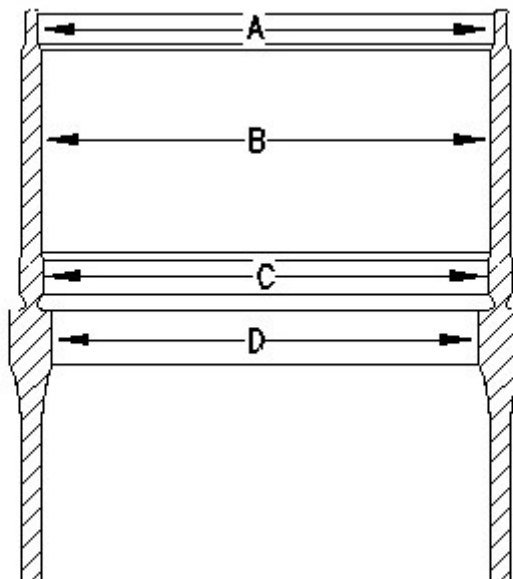


Illustration 1

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Bore diameters in the cylinder block for the cylinder block liners:

Position (A) ...  $151.50 \pm 0.03$  mm ( $5.965 \pm 0.001$  inch)

Position (B) ...  $149.8 \pm 0.3$  mm ( $5.898 \pm 0.012$  inch)

Position (C) ...  $148.00 \pm 0.03$  mm ( $5.827 \pm 0.001$  inch)

Position (D) ...  $141.90 \pm 0.05$  mm ( $5.587 \pm 0.002$  inch)

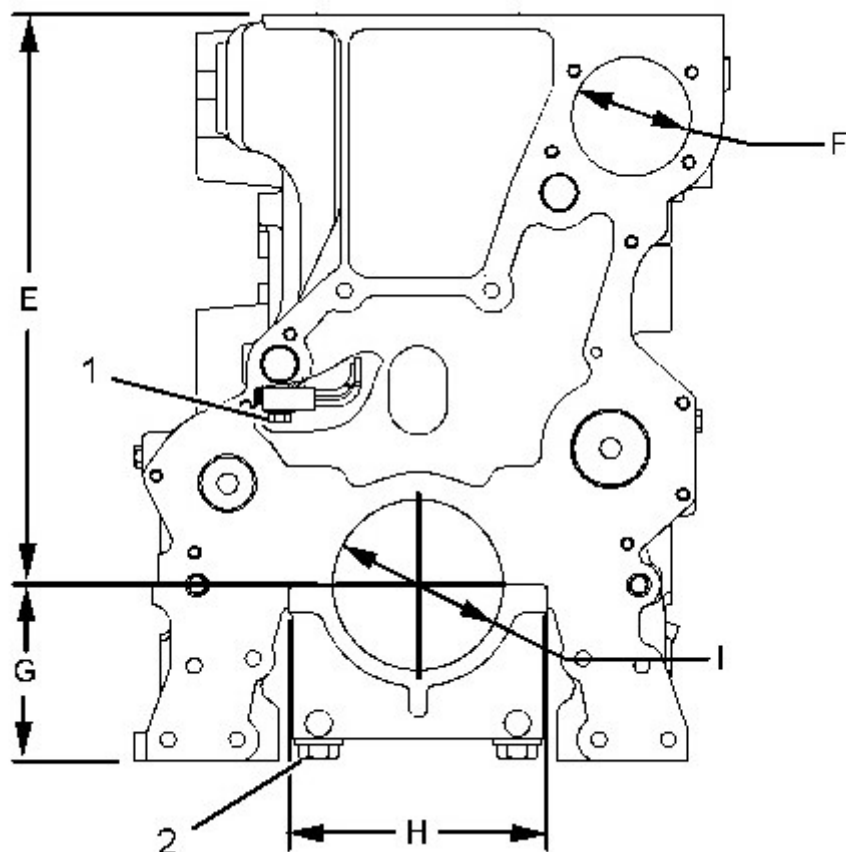


Illustration 2

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(E) Distance from the centerline of the crankshaft bore to the top surface of the cylinder block ...  
387.00 mm  
(15.236 inch)

(F) Diameter of the camshaft bores ...  $85.00 \pm 0.015$  mm  
( $3.3465 \pm 0.0006$  inch)

(G) Distance from the centerline of the crankshaft to the bottom surface of the cylinder block ...  
120.0 mm  
(4.72 inch)

Width in cylinder block for the main bearing cap ...  $178 \pm 0.023$  mm  
( $7.0079 \pm 0.0009$  inch)

(H) Width of the main bearing cap ...  $178 \pm 0.02$  mm  
( $7.008 \pm 0.001$  inch)

(I) Bore in the cylinder block for the seven main bearings ...  $116.000 \pm 0.013$  mm  
( $4.5669 \pm 0.0005$  inch)

(1) Bolts for the piston cooling jets

(2) Main bearing cap bolts

Use the following procedure in order to install the main bearing cap bolts:

1. Orient the main bearing cap correctly. The part number on the main bearing cap must face to the right and to the front face of the block. Also, the tab slots that are in the block and the main bearing caps must be adjacent.

**Note:** The main bearing caps are marked with identification numbers 1 through 7. Install the main bearing caps into the correct positions.

2. Lubricate the main bearing cap bolts. Use "SAE 30W" oil or molybdenum grease to lubricate the threads and the washer face.
3. Tighten the main bearing cap bolts.

Tighten bolts to the following torque. ...  $50 \pm 5 \text{ N}\cdot\text{m}$  ( $37 \pm 3.7 \text{ lb ft}$ )

4. Put an alignment mark on each cap and bolt.

Rotate the bolts in the clockwise direction. ...  $90 \pm 5$  degrees

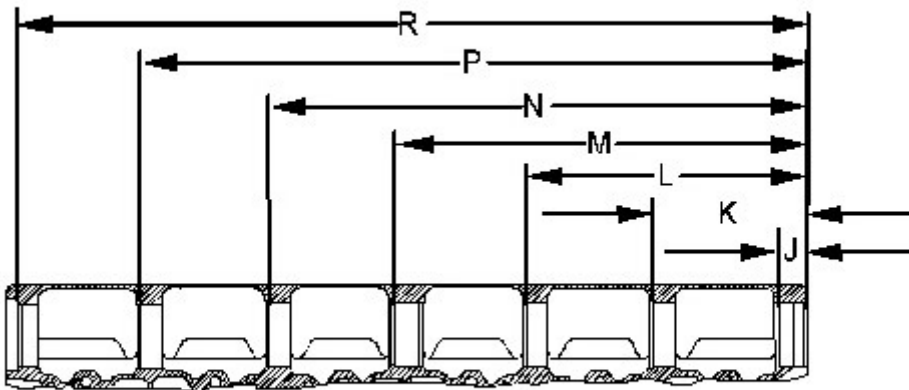


Illustration 3

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The camshaft bearings are installed into the cylinder block at the values that follow.

- Position (J) ... 36.50 mm  
(1.437 inch)
- Position (K) ... 192.50 mm  
(7.578 inch)
- Position (L) ... 348.50 mm  
(13.720 inch)
- Position (M) ... 504.50 mm  
(19.862 inch)
- Position (N) ... 660.50 mm  
(26.004 inch)



## Specifications

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## Cylinder Head

SMCS - 1100

S/N - JAM1-UP

S/N - KCA1-UP

S/N - KCB1-UP

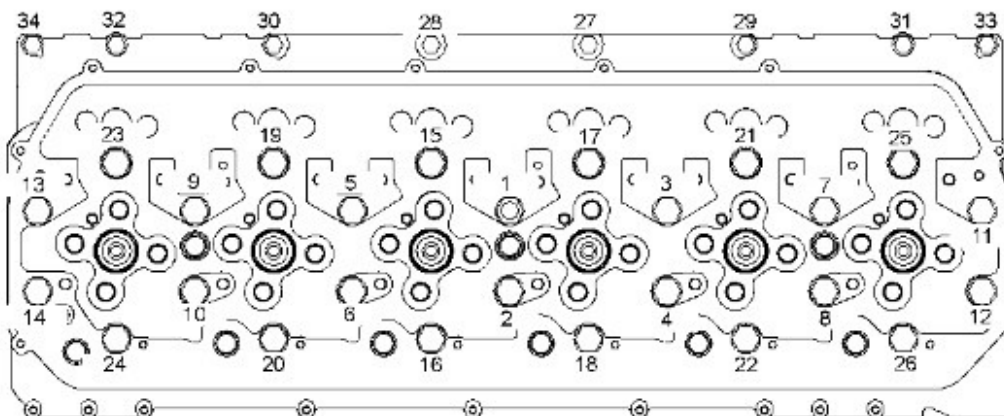


Illustration 1

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Top view of cylinder head

**Note:** The top surface of the cylinder block for the gasket, the cylinder liners, and the bottom surface of the cylinder head for the gasket must be free of oil, fuel, water, and other contaminants before assembly.

**Note:** The cylinder head bolts should not be reused after disassembly.

**Note:** Before assembly, lubricate the threads of the bolts and both sides of the washers with Loctite #51084 Graphite-50 Anti-Seize Lubricant.

Use the following procedure in order to tighten the cylinder head bolts:

1. Tighten bolt 1 through bolt 26 in a numerical sequence to  $170 \pm 10$  N·m ( $125 \pm 7$  lb ft).
2. Again tighten the bolt 1 through bolt 26 in a numerical sequence to  $170 \pm 10$  N·m ( $125 \pm 7$  lb ft).
3. Place a mark on bolt 1 through bolt 26. Rotate bolt 1 through bolt 26 in a numerical sequence to an additional  $120 \pm 5$  degrees ( $1/3$  turn).
4. Loosen bolt 1 through bolt 26 to 0 N·m (0 lb ft).
5. Tighten bolt 1 through bolt 26 in a numerical sequence to  $170 \pm 10$  N·m ( $125 \pm 7$  lb ft).
6. Again tighten the bolt 1 through bolt 26 in a numerical sequence to  $170 \pm 10$  N·m ( $125 \pm 7$  lb ft).
7. Place a mark on bolt 1 through bolt 26. Rotate bolt 1 through bolt 26 in a numerical sequence to an additional  $120 \pm 5$  degrees ( $1/3$  turn).
8. Tighten bolt 27 through bolt 34 in a numerical sequence to  $55 \pm 10$  N·m ( $41 \pm 7$  lb ft).

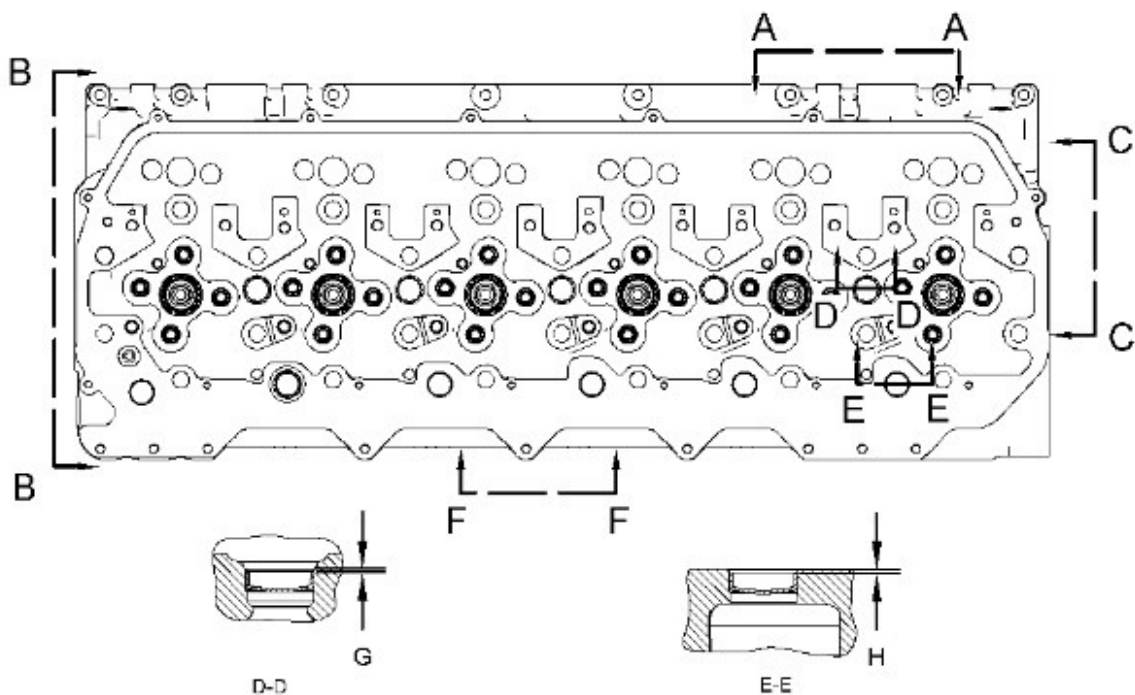


Illustration 2

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Top view of cylinder head

(D-D) five cup plugs

(E-E) six cup plugs



## Specifications

### C11 and C13 On-highway Engines

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i02165970

## Engine Design

SMCS - 1201

S/N - KCA1-UP

## C11

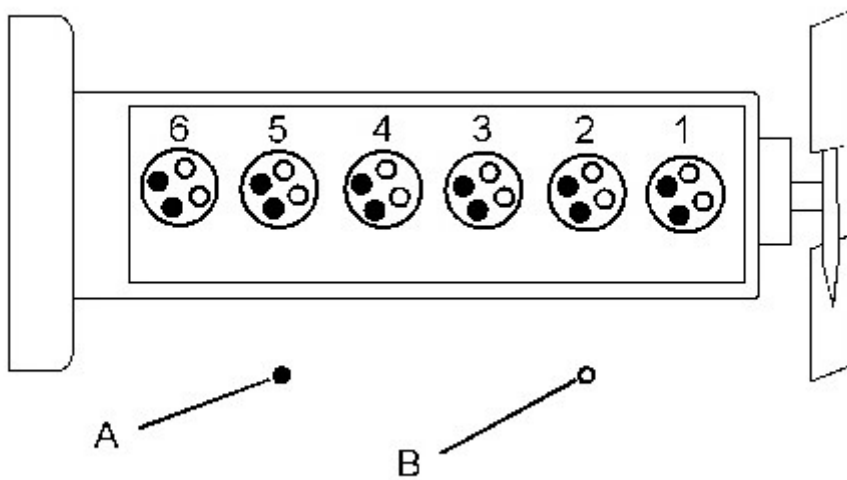


Illustration 1

g01098200

(A) Exhaust valves

(B) Inlet valves

Bore ... 130 mm (5.12 inch)



Stroke ... 140 mm (5.51 inch)

Displacement ... 11.1 L (680 cu in)

Cylinder arrangement ... In-line

Valves per cylinder ... 4

In order to check the engine valve lash setting, the engine must be cold and the engine must be stopped.

Engine valve lash

Inlet ...  $0.38 \pm 0.08$  mm ( $0.015 \pm 0.003$  inch)

Exhaust ...  $0.64 \pm 0.08$  mm ( $0.025 \pm 0.003$  inch)

Variable valve actuator ...  $0.610 \pm 0.075$  mm ( $0.0240 \pm 0.0030$  inch)

Compression brake ...  $0.864 \pm 0.050$  mm ( $0.0340 \pm 0.0020$  inch)

Type of combustion ... Direct injection

Firing order ... 1-5-3-6-2-4

The crankshaft rotation is viewed from the flywheel end of the engine. Crankshaft rotation ... Counterclockwise

**Note:** The front of the engine is opposite of the flywheel end of the engine. The left side of the engine and the right side of the engine are viewed from the flywheel end of the engine. The No. 1 cylinder is the front cylinder.

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