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## Service Information Bulletin

SUBJECT	DATE
Piston and Connecting Rod Assembly	January 2013

### Additions, Revisions, or Updates

Publication Number / Title	Platform	Section Title	Change
DDC-SVC-MAN-0081	DD Platform	Removal of the Piston and Connecting Rod Assembly	Added instructions for GHG14 engines.
		Installation of the Piston and Connecting Rod Assembly	



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## 2 Removal of the Piston and Connecting Rod Assembly



**WARNING: PERSONAL INJURY**

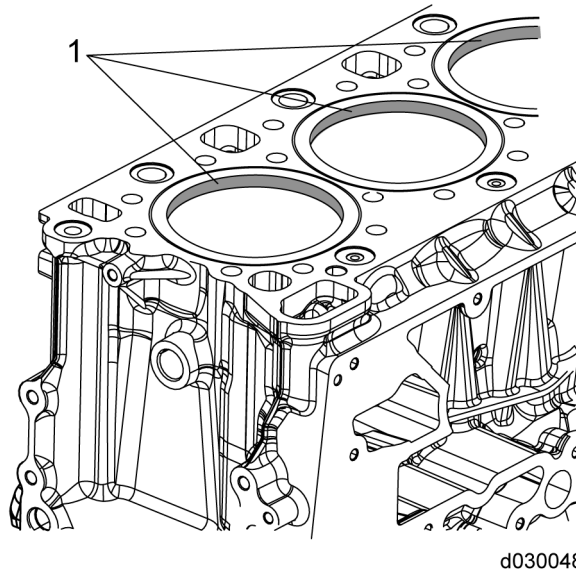
To avoid injury, never remove any engine component while the engine is running.

Remove as follows:

1. Drain the engine cooling system. Refer to section "Cooling System Drain Procedure".
2. Drain the engine oil.
3. Remove the oil pan. Refer to section "Removal of the Oil Pan".
4. Remove the camshaft housing and associated parts. Refer to section "Removal of the Camshaft Housing".
5. Remove the cylinder head and gasket.  
For the DD13: Refer to section "Removal of the DD13 Cylinder Head".  
For the DD15 and DD16: Refer to section "Removal of the DD15 and DD16 Cylinder Head".

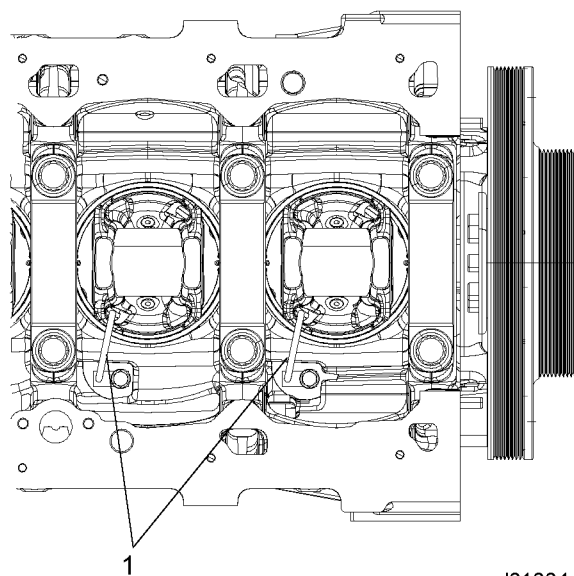
**NOTICE:** Be cautious not to damage the carbon scraper ring. It will be reused unless it is damaged or the cylinder liner is to be replaced.

6. Use Scotch-Brite® pads to remove any carbon deposits from the upper inner surface (1) of the cylinder liner.



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7. For GHG14 engines, remove the Carbon Scraper Ring on the inner diameter of the cylinder liner.
8. Remove the piston oil spray nozzles (1) from the base of the cylinder bores and discard the nozzles.



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9. Position the crankshaft for each piston and connecting rod assembly to be removed at bottom dead center.

**NOTICE:** The connecting rod assembly is a cracked rod design. Ensure when the bearing cap is removed that it is placed on its side. Damage to the bearing cap will occur if it is placed on end; the connecting rod assembly will need to be replaced if the cap is damaged.

10. Remove the connecting rod bearing cap with lower bearing shell from the connecting rod.
11. Remove the piston and connecting rod assembly through the top of the cylinder liner.

**NOTE:** When removed, the bearing cap and the bearing shell must be assembled to its original connecting rod before another connecting rod bearing cap is removed.

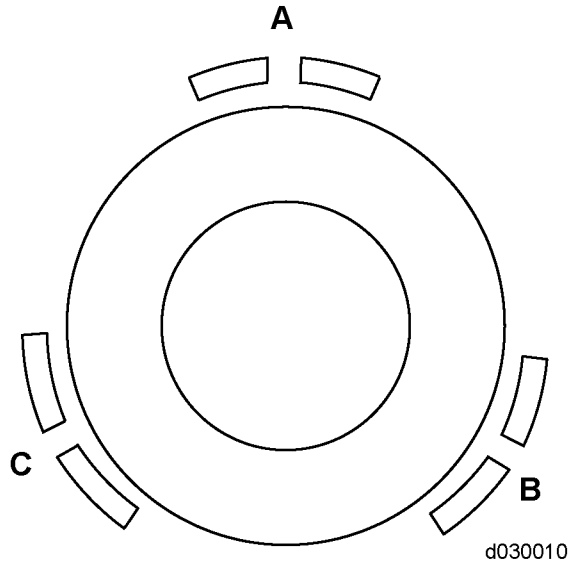
12. Assemble the connecting rod bearing cap and lower bearing shell to the connecting rod after removal. If not already marked, match-mark the rod and cap (on the tang side) with the cylinder number from where they were removed.

### 3 Installation of the Piston and Connecting Rod Assembly

**NOTICE:** DO NOT over-expand the piston rings. Over expansion of the piston rings during installation can lead to hairline cracks resulting in ring failure.

Install as follows:

1. If the rings have been removed, install them into the grooves of the piston and rotate 120° apart as follows:
  - a. Install the oil ring expander in the lowest groove in the piston.
  - b. Install the oil control ring (top label up) in the lowest groove around the oil ring expander.
  - c. Install the compression ring (top label up) in the middle groove.
  - d. Install the fire ring (top label up) in the top groove.



2. Allowable new ring end gaps for (A), (B), and (C) are shown below.

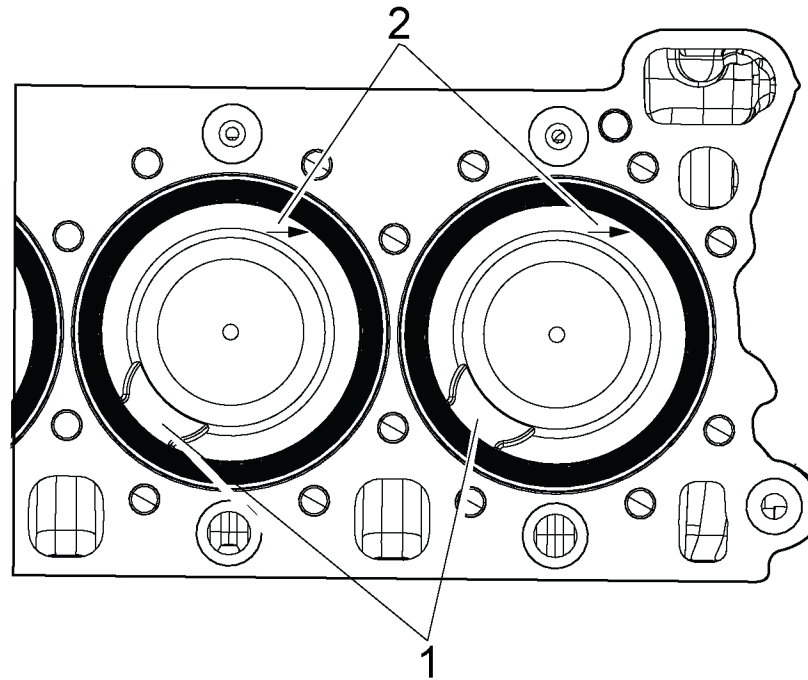
**Table 1.**

Ring	Ring End Gap
Fire Ring (A)	0.35 - 0.75 mm (0.024 - 0.030 in.)
Compression Ring (B)	0.7 - 0.9 mm (0.027 - 0.035 in.)
Oil Control Ring (C)	0.4 - 0.6 mm (0.016 - 0.024 in.)

3. Add clean engine oil to a clean pan at least 305 mm (12 in.) in diameter, until the level reaches approximately 76 mm (3 in.).
4. Place the piston and connecting rod assembly into the pan, with the combustion dome of the piston on the bottom of the pan.
5. Coat the upper connecting rod bearing shell with clean engine oil.
6. Coat the piston skirt liberally with the engine oil, saturating the piston rings and ring lands.
7. Coat the inside diameter of the piston ring compressor tool with clean engine oil.  
For the DD13: use piston ring compressor tool (W470589005900).  
For the DD15 and DD16: use piston ring compressor tool (J-47386).  
For the DD15 and DD16: piston ring compressor tool (W470589015900) may also be used.
8. Place piston on a bench with dome side down; install piston ring compressor tool.
9. Once the ring compressor is clamped, ensure the piston can rotate freely. If rotation is hindered, remove the compressor and reposition the dome and rings, or inspect for ring damage.
10. Lubricate the inside of the cylinder liner with clean engine oil.
11. On GHG14 engines, position the carbon scraper sleeve tool into the recessed area of the cylinder liner.
  - a. For DD13: use tool part number W470589011400.
  - b. For DD15 and DD16: use tool part number W470589021400.

**NOTICE:** Failure to orient the piston and connecting rod assembly properly during piston installation may result in the bearing end of the rod striking the nozzle, causing damage to the nozzle or loosening it from the block. A damaged, bent, or loosened nozzle may cause a loss of main gallery pressure. In these cases, piston overheating or lack of adequate lubrication may result in severe engine damage.

12. Position the throw of the crankshaft to bottom dead center for the cylinder being installed with the piston and connecting rod assembly.
13. Ensure the valve relief (1) located on the top of the piston is orientated towards the exhaust side of the engine during installation. The piston also has an arrow (2) that should face the front of the engine. The connecting rod has a serial number printing that must also face towards the exhaust side of the engine.



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14. Align the ring compressor guide pins (if equipped) over the two bolt holes on the top of the cylinder block.

**NOTICE:** DO NOT force the piston into the liner. Considerable force on the piston could scratch or otherwise damage the inside of the cylinder liner. Therefore, care must be taken during the installation of the piston to prevent damage.

15. With care and moderate pressure, press the piston into the liner.
16. Remove the ring compressor.
17. Push or tap the piston and connecting rod within the liner until the upper rod bearing is firmly seated on the appropriate crankshaft journal.
18. For GHG14 engines, remove the carbon scraper sleeve tool.
19. Lubricate the lower bearing shell with clean engine oil.

**NOTICE:** Install the connecting rod bearing cap bolts by hand to prevent damage to the connecting rod bolt threads.

20. With the number on the cap and rod on the same side and the arrow facing forward, install the bearing cap.
21. Torque the connecting rod bolts alternately to the following:
  - For the DD13: 190 N·m (140 lb·ft) + 90° torque turn
  - For the DD15: 115 N·m (85 lb·ft) + 180° torque turn
  - For the DD16: 115 N·m (85 lb·ft) + 180° torque turn

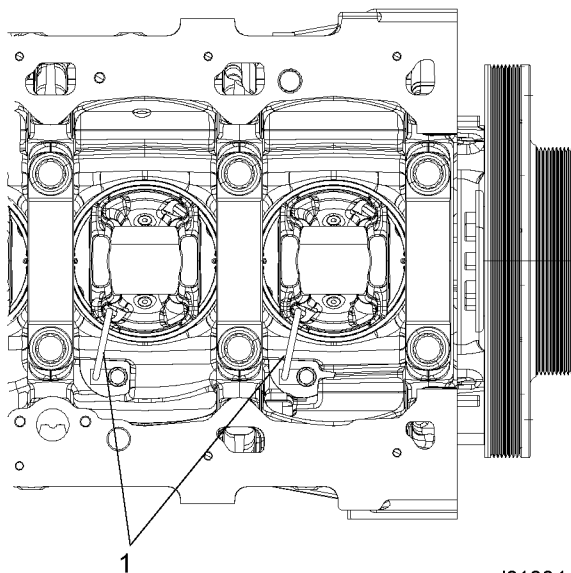
**Table 2.**

Bearing Cap to Rod Bolt Cap Bolt Maximum Length		
DD13	DD15	DD16
79 mm (3.11 in.)	82.3 mm (3.240 in.)	82.3 mm (3.240 in.)

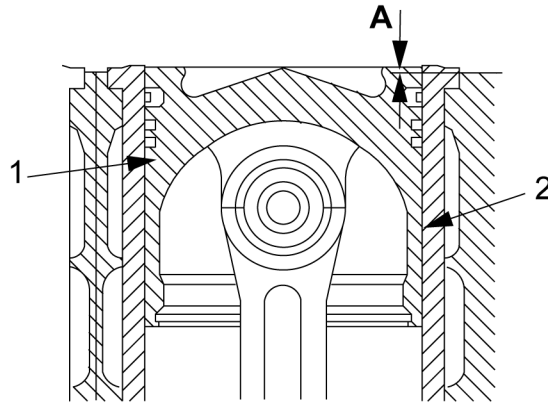
22. Check connecting rod axial clearance by moving the rod from side to side on the crank journal. If there is no clearance, check for proper bearing cap installation.

**NOTICE:** Ensure when installing the piston oil spray nozzles that damage to the nozzle does not occur. Damaged oil spray nozzles could result in a loss of oil pressure to cool the pistons, which may cause engine damage.

23. Install the remaining piston and rod assemblies in the same manner.  
 24. Install new piston oil spray nozzles (1) at the base of the cylinder bores. Torque each piston spray nozzle bolt to 30 N·m (22 lb·ft).



25. Set the piston to top dead center. Using a dial gauge and holder, measure piston protrusion relative to the cylinder block. Repeat this measurement for each piston.  
 26. Allowable piston protrusion (A) is in the table below:



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**Table 3.**

Engine	Minimum	Maximum
DD13	-0.201 mm (-0.0079 in.)	0.2215 mm (0.0087 in.)
DD15	-0.213 mm (-0.0090 in.)	0.2075 mm (0.0081 in.)
DD16	-0.213 mm (-0.0090 in.)	0.2075 mm (0.0081 in.)

27. If piston protrusion is not between minimum and maximum specifications, check the following:
- Inspect piston, piston pin boss, and piston pin for wear or damage. If damaged, repair as necessary.
  - Inspect connecting rod, checking for bent rod, piston pin bore wear or damage. If damaged, repair as necessary.
  - Inspect connecting rod bearings for wear or damage. If damage is found, replace rod bearings.
  - Inspect crankshaft for damage to rod journal or evidence of spun bearing. If damaged, repair as necessary.

**NOTICE:** Bending or warping the carbon scraper ring before or during installation can cause the ring to lose its effectiveness while the engine is running.

- For GHG14 engines, install the carbon scraper ring into the recession on the top of the cylinder liner.
- Install a new cylinder head gasket and the cylinder head.  
For the DD13: Refer to section "Installation of the DD13 Cylinder Head".  
For the DD15 and DD16: Refer to section "Installation of the DD15 and DD16 Cylinder Head".

**NOTICE:** Debris from a failed bearing can damage the internal components of the oil pump. If debris is found in the oil pan, replace the oil pump as necessary.

- Install the lubricating oil pump inlet pipe and screen assembly, and the lubricating oil pump. Refer to section "Installation of the Oil Pump, Oil Suction Manifold, and Oil Lines".
- Install the oil pan. Refer to section "Installation of the Oil Pan".
- Complete any other engine assembly as necessary.
- After the engine has been completely assembled, refill the oil pan to the proper oil level on the dipstick.
- Prime engine lubrication system. Refer to section "Priming the Engine Lubrication System".

**NOTICE:** Coolant system maintenance is very important. Bleed off all the air from the system and top off.

- Close the drain cocks and fill the engine with the recommended coolant.
- Verify repairs made to the piston and connecting rod assembly. If new parts such as pistons, rings, cylinder liners or bearings were installed, operate the engine on the run-in schedule.