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Service Information Bulletin

SUBJECT	DATE
Cylinder Liner	January 2016

Additions, Revisions, or Updates

Publication Number / Title	Platform	Section Title	Change
DDC-SVC-MAN-0081 DDC-SVC-MAN-0181	DD Platform Euro IV	Removal of the Cylinder Liner	Added information to Step 1 to clarify scope of procedure.
		Cleaning of the Cylinder Liner	Added step to clean top surface of liner flange.
		Inspection of the Cylinder Liner	Complete revision of inspection procedure. Condensed two inspection procedure sections into one.
		Further Analysis of the Cylinder Liner	Removed section.
		Installation of the Cylinder Liner	Added information to Step 10 to clarify scope of procedure.



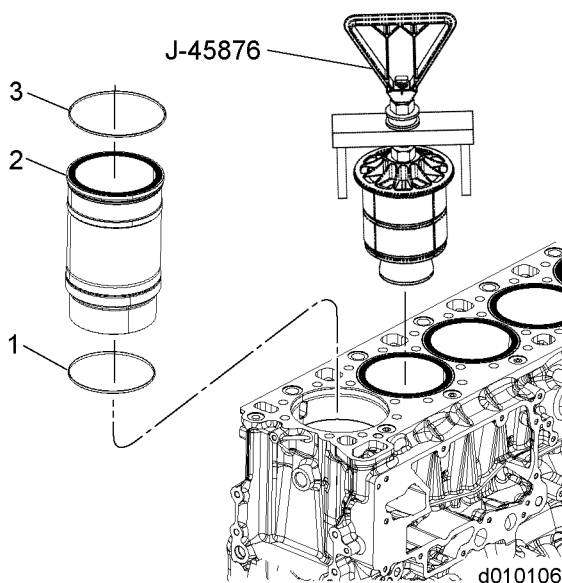
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2 Removal of the Cylinder Liner

Remove as follows:

NOTICE: The proper method must be followed when removing the cylinder liner. Damage to the liner and cylinder block may occur if the proper tools and procedures are not used.

1. Remove the piston and connecting rod. Refer to section "Removal of the Piston and Connecting Rod Assembly". This procedure includes removal of the necessary components to access the cylinder liner.
2. Install cylinder liner removal tool (J-45876) into the cylinder liner.



3. Remove cylinder liner (2).
4. Remove the two seal rings (1, 3) from the cylinder liner (2) and discard them.

NOTICE: Liners left on their side for any length of time can become egg-shaped and distorted, making installation into the cylinder bores difficult or impossible. If the cylinder liners are to be reused, they should also be marked for cylinder location and engine orientation. A paint mark can be used to indicate the front of the engine so they may be installed into the same cylinder from which they were removed.

5. After removing the liners from the engine, store them in an upright position until ready for use.

3 Cleaning of the Cylinder Liner

Clean as follows:

1. For GHG14 engines, remove the carbon scraper ring from the cylinder liner.
2. Ensure the recessed area in the liner for the carbon scraper ring is free of any debris, if applicable.
3. Clean the top surface of the liner flange. This is where the head gasket seals. The area must be clean and flat.
4. Use a clean cloth and clean engine oil to clean both new and used liners.



WARNING: EYE INJURY

To avoid injury from flying debris when using compressed air, wear adequate eye protection (face shield or safety goggles) and do not exceed 276 kPa (40 psi) air pressure.

5. Dry the liner with compressed air.
6. Coat the bore of the liner with clean engine oil.
7. Allow the liner to sit for 10 minutes. This allows the oil to work into the surface finish.
8. Wipe the inside of the liner with white paper towels.
9. If a dark residue appears on the towels, repeat the oiling and wiping process until the dark residue no longer appears.
10. Oil the liner lightly with clean engine oil and store upright in a clean, dry area. Do not let the liner rest on its side and do not store anything on top of the liner.

4 Inspection of the Cylinder Liner

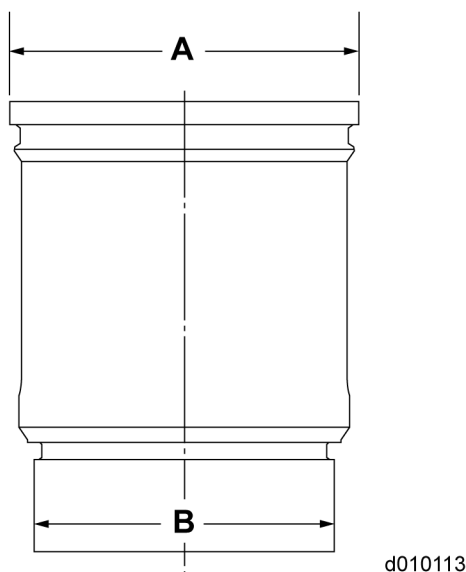
Inspect as follows:

NOTE: When inspecting the cylinder liners while installed in the engine, it is important to inspect all six of the liners. Each liner must be inspected with the piston at Bottom-Dead-Center (BDC). Sometimes a failure can be overlooked if all cylinders are not checked.

1. Clean the cylinder liner. Refer to section "Cleaning of the Cylinder Liner".
2. Inspect the inside of the cylinder liner.

NOTE: The appearance of small white marks and polished spots in the liner occur during normal operation. This is not a failure.

3. Check the cylinder liner for cracks, scuffing or scoring. If these conditions are present, the liner should be replaced and the associated piston should be inspected. The cause of the failure must be determined to prevent future problems.
Possible causes for cylinder liner scuffing or scoring:
 - Incorrect air fuel ratio
 - Leak in the air system
 - Plugged air filter
 - Improperly fueling injector
 - Incorrect valve lash
 - Incorrect Exhaust Gas Recirculation (EGR) flow
 - Incorrect clearance between the piston skirt and the cylinder liner
 - Poor quality engine oil, incorrect oil viscosity, or engine oil dilution
 - Low engine oil pressure
 - Damaged or plugged piston cooling nozzles
4. Check for excessive bore polishing and wear that would result in an oil consumption issue. If found, all liners should be inspected. This could be a sign of dusting from a leak in the air system or a poorly maintained air filter.
5. For GHG14 engines, check the recessed area at the top of the liner where the carbon scraper ring is positioned. If damaged, replace the liner.
6. Inspect the outside of the cylinder liner.
 - Check the cylinder liner for vertical pitting from cavitation. Cavitation is the result of poor cooling system maintenance. If cavitation is present, replace all of the cylinder liners and correct the coolant maintenance problem.
 - Inspect the two sealing ring areas for damage. Replace the liner if damage is found that will result in a coolant leak.
7. Inspect the top surface of the liner flange for cracks, smoothness and flatness. This is where the head gasket seals against the liner. Replace the liner if this area is damaged.
8. Measure the cylinder liner in two places: at the top of the liner (position A) and at the bottom of the liner (position B). Refer to the specifications below.

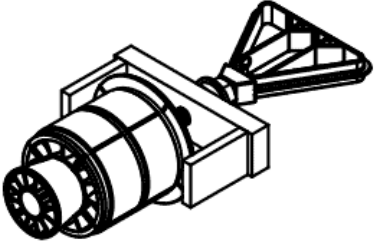

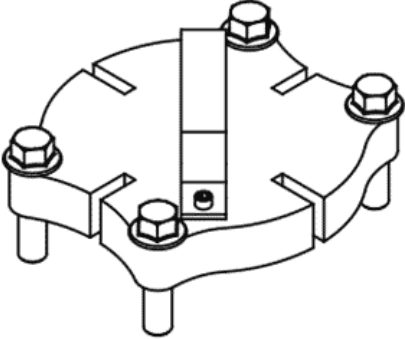
**Table 1.**

Location	DD13	DD15	DD16
A	158.98 to 159 mm (6.2590 to 6.2598 in.)	166.98 to 167 mm (6.5740 to 6.5748 in.)	166.98 to 167 mm (6.5740 to 6.5748 in.)
B	141.97 to 141.95 mm (5.589 to 5.588 in.)	148.95 to 148.97 mm (5.864 to 5.865 in.)	148.95 to 148.97 mm (5.864 to 5.865 in.)

9. Replace the cylinder liner if the measurements are not within the specifications.

5 Installation of the Cylinder Liner

Table 2.

Service Tools Used in the Procedure		
Tool Number	Tool Name	Graphic
J-45876	Cylinder Liner Puller/Installer	 d580078
J-47407 J-47407-128	Cylinder Liner Installer	 d580013
J-47415	Liner Protrusion Plate	 d580017

Install as follows:

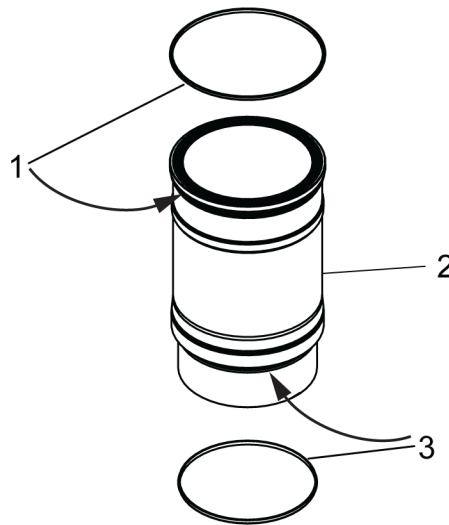
NOTICE: Thoroughly clean the cylinder block, cylinder liner, and counter bores to remove any foreign material. Foreign material in the cylinder liner counter bores (upper or lower) can cause the liner to improperly seat. Clean with a wire brush.

1. Wipe the inside and outside of the liner clean.
2. Lubricate the seal rings with clean engine oil.

NOTICE:

Ensure that the seal rings are fully seated in the proper grooves on the liner when installed.

3. Install the two seal rings (1, 3) onto the cylinder liner (2).

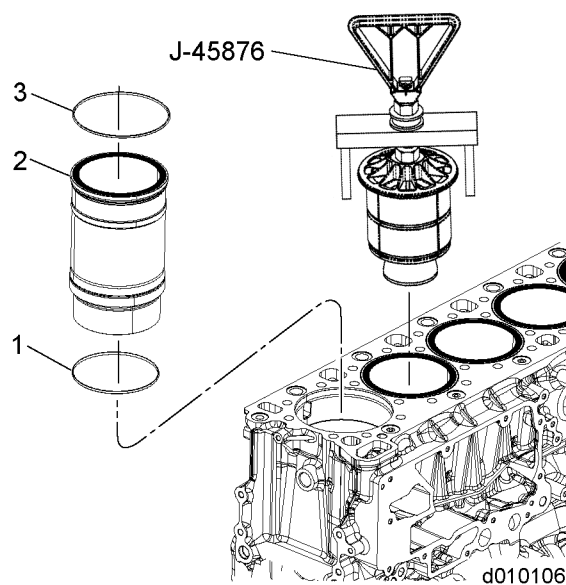


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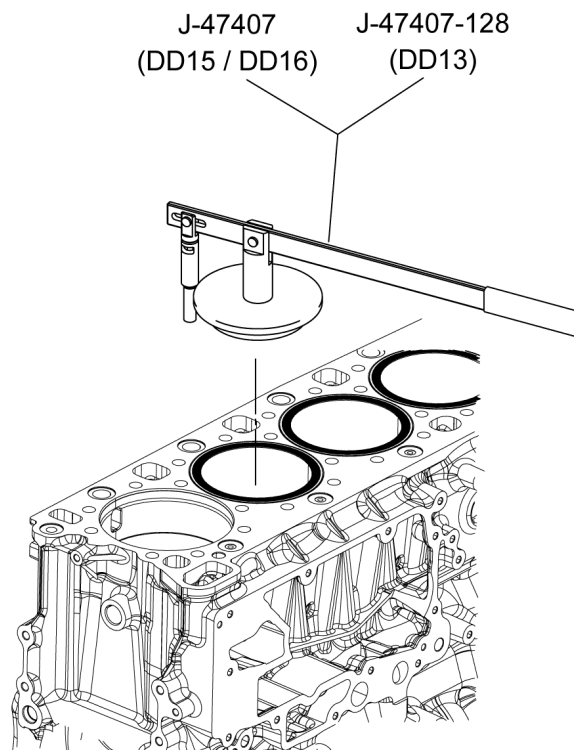
4. Lubricate the seal rings with clean engine oil again to ease liner installation into the cylinder block.

NOTICE: If the cylinder liner is being reused, it must be installed into the same location in the cylinder block and be oriented in the same manner as when it was removed.

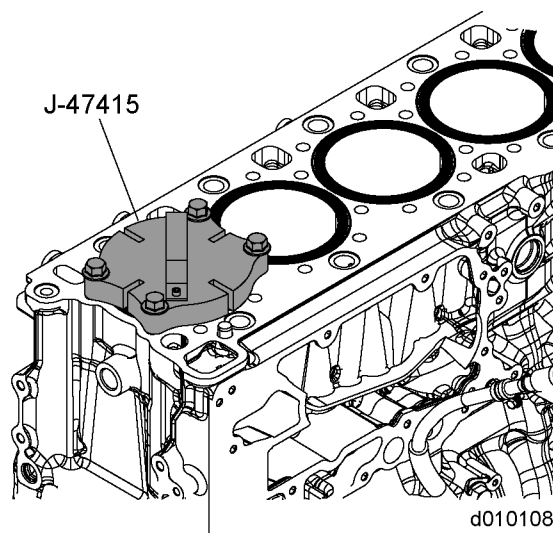
5. Use cylinder liner installation tool J-45876 to install the cylinder liner in cylinder block bore.



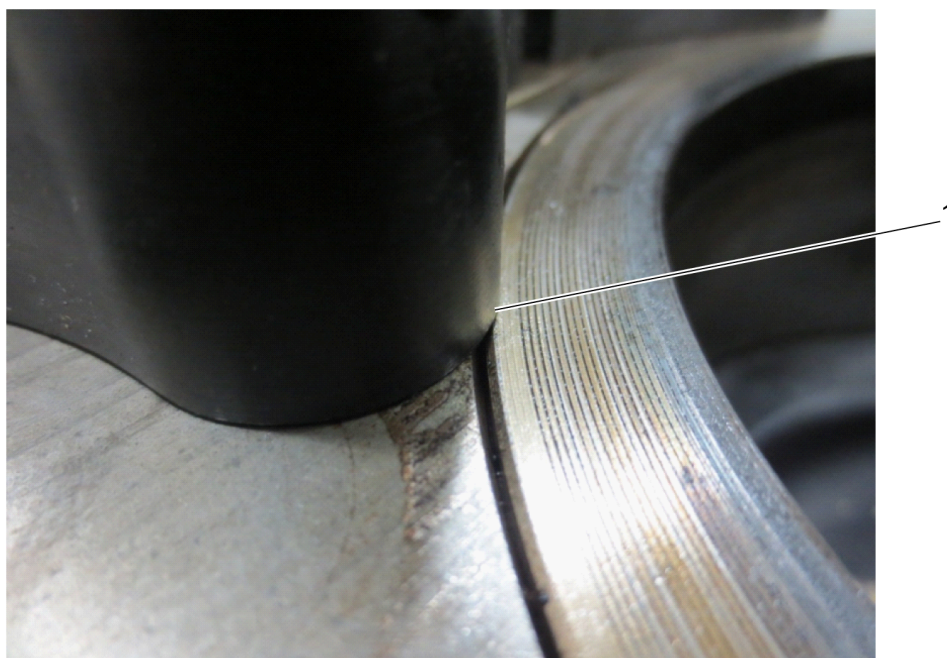
6. Use the appropriate cylinder liner installation tool to fully seat the liner into the cylinder block.
For DD15 and DD16, use J-47407.
For DD13, use J-47407-128.



7. Install the cylinder liner protrusion tool J-47415 onto the cylinder block. Thread four bolts through the tool and into the head bolt locations. Alternately torque the four bolts to 10 N·m (88.5 lb·in.).

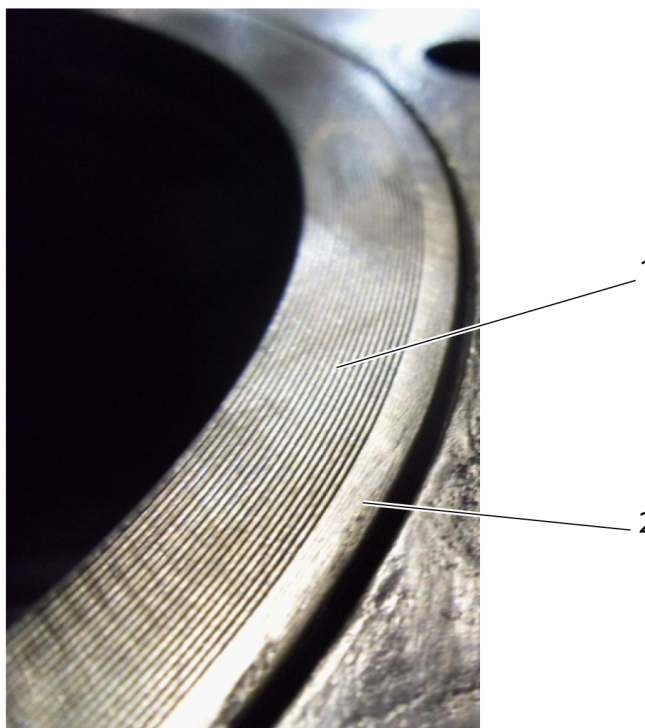


- a. On the DD13, ensure the liner protrusion tool does not come in contact with an adjacent liner (1). See figure below.



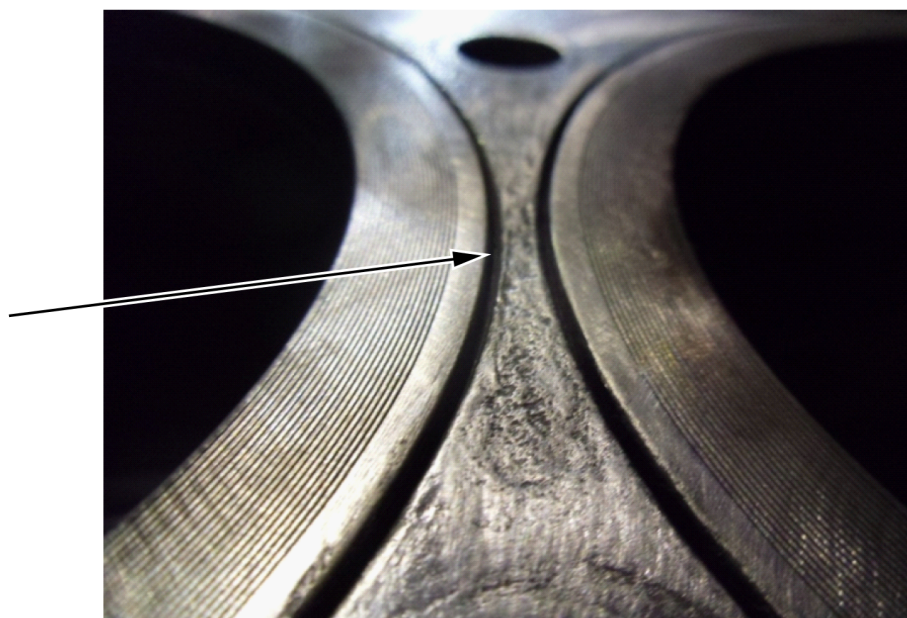
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- b. The measurement must be taken from the correct area (1) and not the edge (2) of the liner. See figure below.



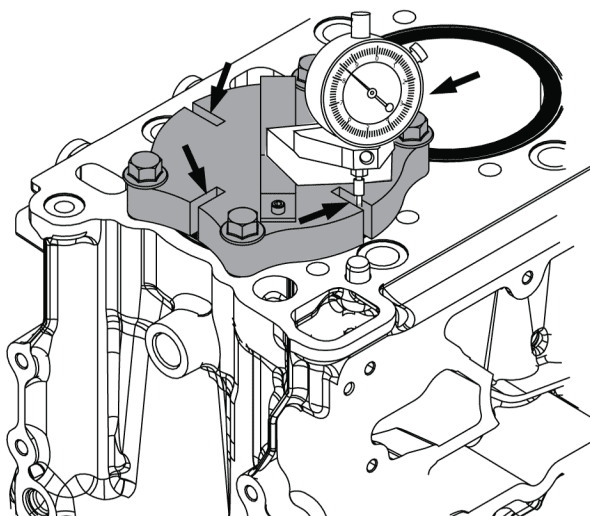
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- c. Do not measure liner protrusion between the liners if there is erosion present, as shown in figure below.



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8. Install a dial indicator and zero it out on the cylinder block fire deck.



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9. Measure the distance from the top of the liner flange to the top of the cylinder block fire deck in all four locations (see arrows). Allowable average liner protrusion is 0.1397 to 0.2692 mm (0.0055 to 0.0106 in.).

Table 3.

DD Platform Engine Liner Protrusion Specifications							
Minimum value		Maximum value		Max. deviation per cylinder (4 measuring points)		Max. deviation per engine (all 6 cylinders)	
0.1397 mm	(0.0055 in.)	0.26924 mm	(0.0106 in.)	0.0889 mm	(0.0035 in.)	0.0889 mm	(0.0035 in.)

- a. Add the four measurements together for each liner and divide by four. This will give you the average liner protrusion.
 - b. If the average liner protrusion for a cylinder exceeds the allowable maximum value, remove the liner to check for debris under the liner flange or at the bottom stop area.
 - c. If the liner protrusion average is below the minimum value, replace the liner and measure the liner protrusion again.
10. Install the piston and connecting rod. Refer to section "Installation of the Piston and Connecting Rod Assembly". This procedure includes installation of the necessary components to complete the repair.