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Service Information Bulletin

SUBJECT	DATE
Description and Operation of Gear Train and Related Parts	January 2013

Additions, Revisions, or Updates

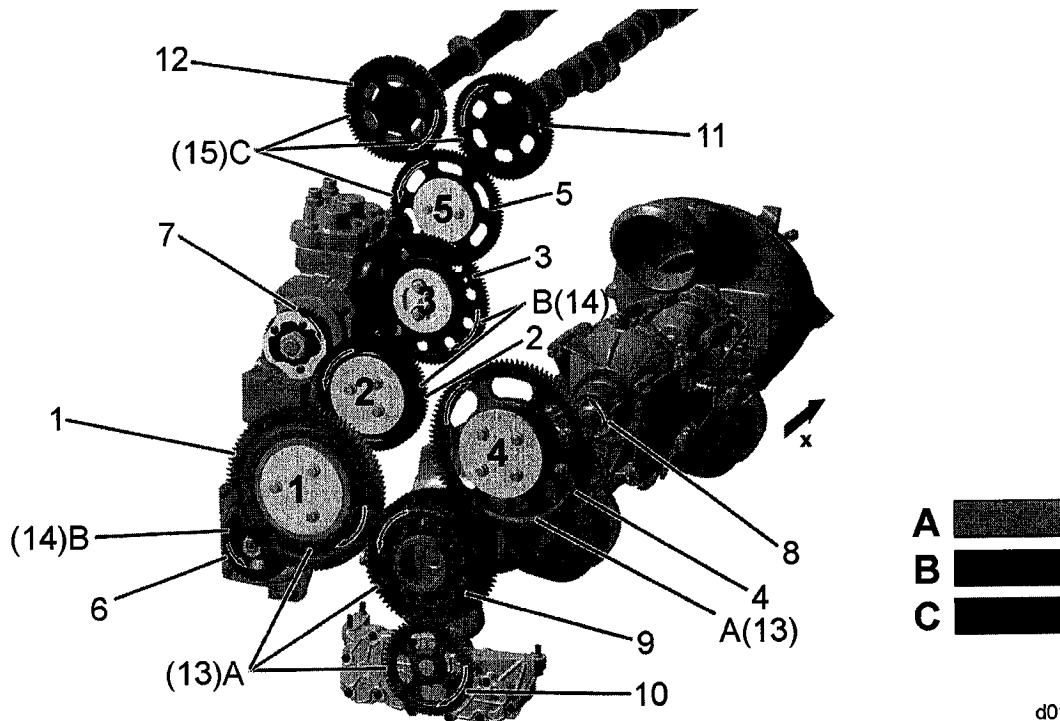
Publication Number / Title	Platform	Section Title	Change
DDC-SVC-MAN-0081	DD Platform	Gear Train and Engine Timing	Added Details for GHG14 DD15 Asymmetrical Turbo Engine.



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2 Description and Operation of Gear Train and Related Parts

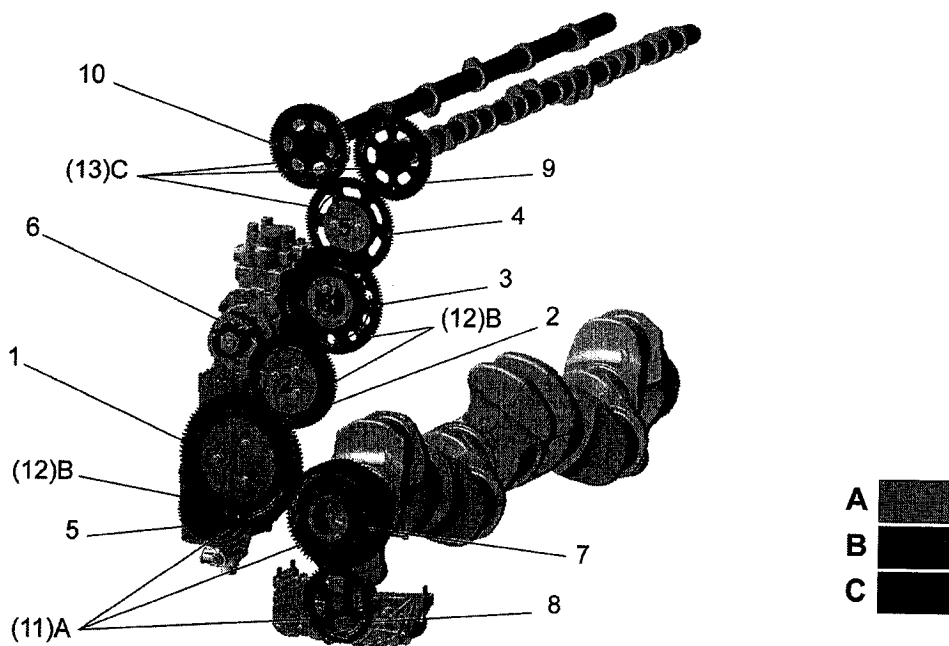
The gear train is located at the rear of the engine. The gear train consists of intake and exhaust camshaft gears, idler gears No. 1, 2, 3, 4, and 5, crankshaft gear, oil pump gear, fuel pump gear, air compressor gear, and Axial Power Turbine (APT) gear.



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|---------------------------------|---------------------------|
| 1. Idler Gear No. 1 | 9. Crankshaft Gear |
| 2. Idler Gear No. 2 | 10. Oil Pump Gear |
| 3. Idler Gear No. 3 | 11. Camshaft Gear Exhaust |
| 4. Idler Gear No. 4 | 12. Camshaft Gear Intake |
| 5. Idler Gear No. 5 | 13. A. Level A |
| 6. Air Compressor Gear | 14. B. Level B |
| 7. High Pressure Fuel Pump Gear | 15. C. Level C |
| 8. Axial Power Turbine Gear | 16. X. To Front of Engine |

Figure 1. EPA07/EPA10/GHG14 Turbo Compound (TC) DD15 and DD16 Engine Gear Train

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|---------------------------------|--------------------------|
| 1. Idler Gear No. 1 | 8. Oil Pump Gear |
| 2. Idler Gear No. 2 | 9. Camshaft Gear Exhaust |
| 3. Idler Gear No. 3 | 10. Camshaft Gear Intake |
| 4. Idler Gear No. 5 | 11. A. Level A |
| 5. Air Compressor Gear | 12. B. Level B |
| 6. High Pressure Fuel Pump Gear | 13. C. Level C |
| 7. Crankshaft Gear | |

Figure 2. GHG14 DD15 Asymmetrical Turbo (AT) Engine Gear Train

The gear train on the DD Platform engines is located at the rear of the engine and has three levels. Level A consists of the outermost gears (closest to the flywheel), Level B consists of the middle gears, and Level C consists of the innermost gears (closest to the block). The gears in the gear train are both directly and indirectly driven by the crankshaft gear.

- Level A: The outermost gears include the crankshaft gear which drives the outer idler gear No. 1 and the oil pump gear. Idler gear No. 4 (if applicable) is on the crankshaft gear and the Axial Power Turbine (APT) drives the idler gear No. 4 when the APT is creating power. The APT can add additional torque to the crankshaft through idler gear No. 4 up to 260 N·m (192 lb·ft). These gears are all helical-cut.

NOTE: On the DD13 and DD15 (AT) engines, there is no Axial Power Turbine (APT) and no Idler gear No. 4. The position of the idler gear No. 4 is covered by a plate, and sealed with an O-ring.

- Level B: The middle gears include idler gear No. 1, which drives the air compressor gear and the idler gear No. 2. Idler gear No. 2 drives the high pressure fuel pump and idler gear No. 3. These gears are all straight-cut.
- Level C: The innermost gears include inner idler gear No. 3 which drives idler gear No. 5. Idler gear No. 5 drives both intake and exhaust camshafts. These gears are all straight-cut.

Gear train noise is an indication of excessive gear lash, chipped or burred gear teeth. A rattling noise usually indicates excessive gear lash. A whining noise indicates too little gear lash. Therefore, when noise develops in a gear train, the gear train needs to be inspected.

Table 1.

Multiply Crankshaft Speed by Effective Ratio to Attain Individual Component Speed		
Component	Effective Ratio	Speed
Crankshaft		RPM
Camshafts	0.50	RPM
Idler #1	0.79	RPM
Idler #2	0.86	RPM
Idler #3	0.75	RPM
(TC) DD15 & DD16 Idler #4	1.33	RPM
Idler #5	0.45	RPM
Water Pump	2.22	RPM
Air Compressor	1.41	RPM
Fuel Pump	1.50	RPM
Oil Pump	1.33	RPM
(TC) DD15 & DD16 Axial Power Turbine Gearbox Drive	4.00	RPM
(TC) DD15 & DD16 Axial Power Turbine Shaft	26.64	RPM

The power steering pump can be mounted in two places. If the engine is equipped with a single-cylinder air compressor, it will be mounted to the front of the air compressor. If the engine is equipped with a dual-cylinder air compressor, then the power steering pump will be mounted on the back of the gear case to the fuel pump.