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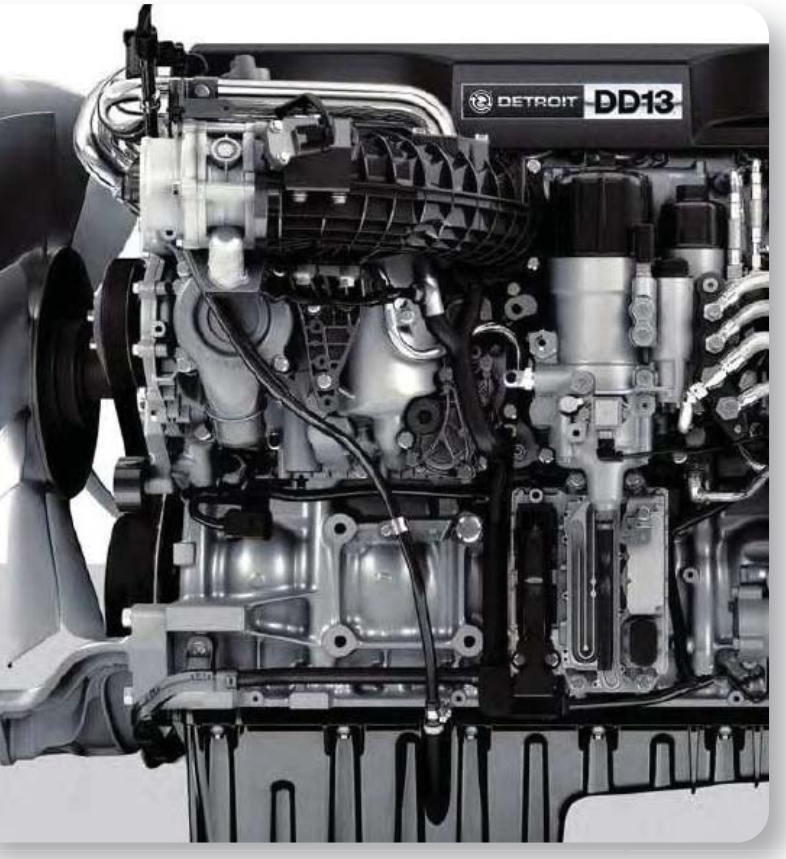
Daimler North America DD13 Engine Scuffing Test (ASTM D8074)



Test Engine

The test uses a 2010 Detroit Diesel DD13 (OM471LA in Europe), 12.8 L, in-line six cylinder diesel engine with ACRS (amplified common rail system), asymmetrical turbocharger with waste-gate, and cooled EGR (exhaust gas recirculation). The top piston rings use a non-coated ring for testing purposes.

Test Operation

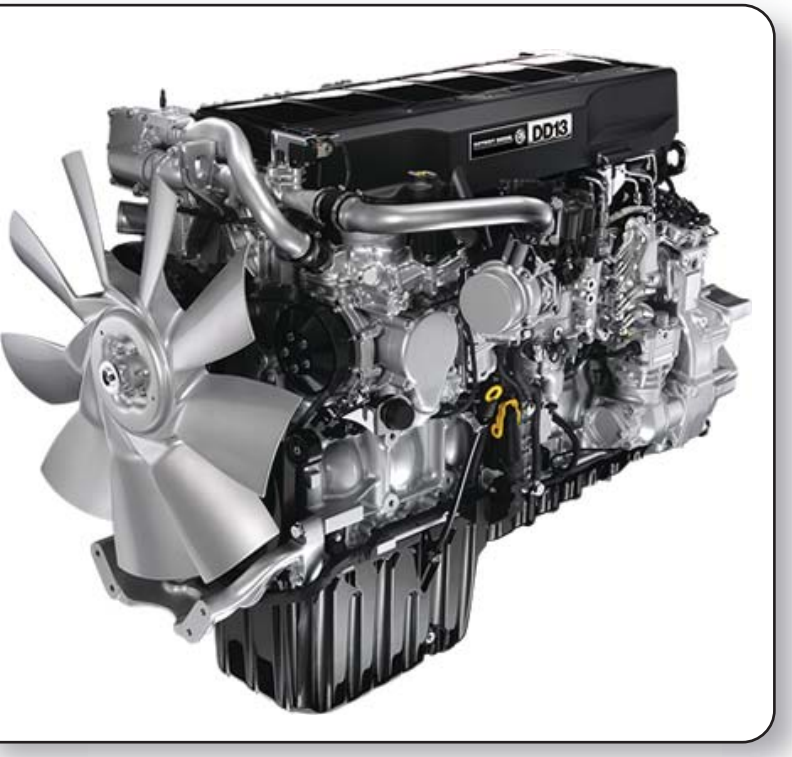
Test evaluates an oil formulation's resistance to adhesive wear by measuring piston ring to cylinder liner scuffing if any occurs. The test operates for 200 hours at 1800 RPM steady state conditions with a 4 hour soak period after every 20 hours operation or scuffing occurs. ULSD (ultra-low sulfur diesel) fuel is used.

Pass/Fail Determination

Refer to Detroit Diesel Corporation, Daimler Company for any applicable limits

Oil Specifications

Detroit Diesel



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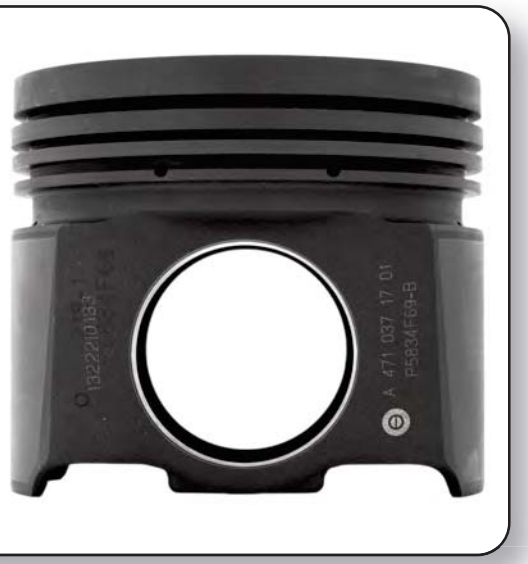

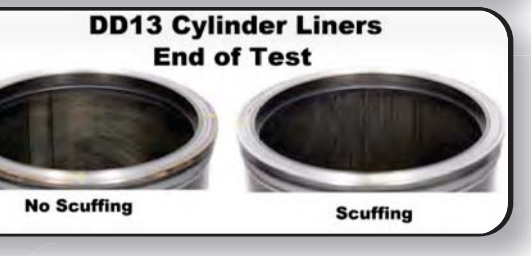

Engine Test DD13

Manufacturer Detroit Diesel Corporation, Daimler Company
Bore X Stroke, 132.0 mm x 156.0 mm
12.8L, 2010 Inline six Cylinder
Single Piece Steel Monotherm Piston

Total Piston Height 113.0 mm

Top Crown to Center Pin Bore 74.07 mm

Crownland Configuration Radial Crownland to Liner Clearance 0.658mm

Piston Rings	**Type**	**Groove Widths**
Top Ring	Keystone, uncoated surface	3.60mm
Second Ring	Negative Twist Rectangular w/ Inside Step	2.56mm
Oil Ring	Rectangular	3.52mm

Land Widths	
Crownland	10.00mm
Second	5.35mm
Third	3.60mm

Parameters	Operating Conditions		Units
	Stage1	Stage2	
Test Duration*	30	170[A]	Hours
Speed	1800	1800	r/min
Fuel Flow	32	71	kg/h
Temperatures			
Intake Air	35 ± 1	35 ± 1	DegC
Water Jacket Out	105 ± 1	105 ± 1	DegC
Oil Gallery	118 ± 1	118 ± 1	DegC
Fuel In	38 ± 1	38 ± 1	DegC
Intake Manifold	75 ± 1	87 ± 1	DegC
Pressures			
Inlet Air	96.4	94.8	kPaA
Exhaust	105.5	125.5	kPaA
Intake Manifold	202.5	327.5	kPaA
Water Jacket In	250 ± 5	250 ± 5	kPa
Crankcase	2[B] max.	2[B] max.	kPa
Flow			
Coolant Flow	340 - 360	340 - 360	LPM

**4 hour soak period after every 20 test hour interval*

[A] *170 hrs is standard test length. Test hours may exceed 200 hrs and considered a valid test.*

[B] *If crankcase pressure exceeds 2 kPa for 5 s or longer, allow normal shutdown of engine and perform liner borescope inspection. If inspection confirms any cylinder liner scuffing, test is considered an EOT.*

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