

# DD13 Engine Scuffing Test

## Version

## Conducted For

	V = Valid; The Reference Oil/Non-Reference Oil was evaluated in accordance with the test procedure.
	I = Invalid; The Reference Oil/Non-Reference Oil was not evaluated in accordance with the test procedure.
	N = Results Cannot be Interpreted As Representative of Oil Performance (Non-Reference Oil) and shall not be used in determining an average test result using multiple test criteria

	NR = Non-Reference Oil Test
	RO = Reference Oil Test

Test Number			
Stand:	Stand Run:	Engine:	Engine Kit ID:
End of Test Date:		End of Test Time:	
Oil Code:			
Formulation/Stand:			
Alternate Codes:			

In my opinion this test \_\_\_\_\_ been conducted in a valid manner in accordance with the Test Method D XXXX and the appropriate amendments through the information letter system.  
The remarks included in the report describe the anomalies associated with this test.

Submitted By:

\_\_\_\_\_

Testing Laboratory

\_\_\_\_\_

Signature

\_\_\_\_\_

Typed Name

\_\_\_\_\_

Title

## DD13 Engine Scuffing Test

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**Form 3**  
**Summary of Test Method**

# DD13 Engine Scuffing Test

## Form 4 Test Result Summary

Laboratory:	EOT Date:	EOT Time:
Test Number:		Test Length:
Oil Code:		
Formulation Stand Code:		

Lab Oil Code	TMC Oil Code <sup>A</sup>
SAE Viscosity	Number of Tests Since Last Calibration <sup>C</sup>

Start Dates and Times	
Oil Charge Date	Oil Charge Time
Engine Start Date	Engine Start Time
Test Clock Start Date	Test Clock Start Time
Test Length	

	Hours @ 0.5 kPa Increase	Hours @ 2.0 kPa Increase
Original Result		
Transformed Result <sup>B</sup>		
Correction Factor <sup>B</sup>		
Corrected Transformed Result <sup>B</sup>		
Severity Adjustment <sup>B</sup>		
Final Transformed Result <sup>B</sup>		
Final Original Unit Result		

Additional Result	
EOT Iron	

Last Stand Reference Results <sup>B</sup>		
Test Number:		
Oil Code:		
Test Length:	TMC Oil Code:	
EOT Date:	EOT Time:	
Stand Calibration Expiration Date:		
	Hours @ 0.5 kPa Increase	Hours @ 2.0 kPa Increase
Final Original Unit Result		

A - Reference Tests Only

B - Non-Reference Tests Only

C - Operationally Valid Tests Only, including current test

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**Form 5**  
**Operational Summary**  
**Controlled Parameters**

Laboratory:	EOT Date:	EOT Time:
Test Number:	Test Length:	
Oil Code:		
Formulation Stand Code:		

Controlled Parameters	Parameter	Units	QI Threshold	EOT QI A	Target		Stage 1				Stage 2				No of Samples	BQD
					Stage 1	Stage 2	Avg	Std Dev	Max	Min	Avg	Std Dev	Max	Min		
					Speed	r/min	0.000		1800	1800						
Fuel Flow	kg/h	0.000		32	71											
Intake Manifold Temperature	°C	0.000		75	87											
Coolant Jacket Out Temperature	°C	0.000		105	105											
Fuel In Temperature	°C	0.000		38	38											
Oil Gallery Temperature	°C	0.000		118	118											
Intake Air Temperature	°C	0.000		35	35											
Intake Air Restriction	kPaA	0.000		96.4	94.75											
Intake Manifold Pressure	kPaA	0.000		202.5	327.5											
Exhaust Pressure	kPaA	0.000		105.5	125.5											
Coolant Tank Pressure	kPa	0.000		100	100											
Coolant Jacket In Pressure	kPa	0.000		250	250											
Coolant Flow	L/min	0.000		350	350											

A - QI values above the threshold are acceptable by then surveillance panel. QI values below the threshold may not be considered acceptable based on engineer review.

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**Form 6**  
**Operational Summary**  
**Uncontrolled Parameters**

Laboratory:	EOT Date:	EOT Time:
Test Number:	Test Length:	
Oil Code:		
Formulation Stand Code:		

	Parameter	Units	Target		Stage 1				Stage 2			
			Stage 1	Stage 2	Avg	Std Dev	Max	Min	Avg	Std Dev	Max	Min
			Load	Nm	tbd	tbd						
Engine Coolant Out Temperature	°C	tbd	tbd									
Engine Coolant In Temperature	°C	tbd	tbd									
Coolant Jacket In Temperature	°C	tbd	tbd									
Tailpipe Temperature	°C	tbd	tbd									
Oil Sump Temperature	°C	tbd	tbd									
EGR Gas Temperature	°C	tbd	tbd									
Blowby	L/min	tbd	tbd									
Inlet Air Dew Point Temperature	°C	tbd	tbd									
Centrifuge Speed	r/min	tbd	tbd									
Oil Gallery Pressure	kPa	tbd	tbd									
Engine Charge Air Cooler Inlet Pressure	kPa	tbd	tbd									
EGR Gas Pressure	kPa	tbd	tbd									
Coolant Jacket Out Pressure	kPa	tbd	tbd									
Pre Turbo Front Pressure	kPa	tbd	tbd									
Pre Turbo Rear Pressure	kPa	tbd	tbd									
Crankcase Pressure	kPa	tbd	tbd									
Turbo Out Temperature	°C	tbd	tbd									
Ambient Cell Temperature	°C	tbd	tbd									
Pre Turbo Front Temperature	°C	tbd	tbd									
Pre Turbo Rear Temperature	°C	tbd	tbd									
Engine Charge Air Cooler Outlet Pressure	kPa	tbd	tbd									
EGR Coolant In Temperature	°C	tbd	tbd									
EGR Coolant Out Temperature	°C	tbd	tbd									
Engine Coolant In Pressure	kPa	tbd	tbd									
Engine Coolant Out Pressure	kPa	tbd	tbd									
Atmospheric Pressure	kPaA	tbd	tbd									

Uncontrolled Parameters

# DD13 Engine Scuffing Test

## Form 7 Cylinder Scuffing Summary

Laboratory:	EOT Date:	EOT Time:
Test Number:	Test Length:	
Oil Code:		
Formulation Stand Code:		

Cylinder	1	2	3	4	5	6
Position 1 (%)						
Position 2 (%)						
Position 3 (%)						
Position 4 (%)						
Position 5 (%)						
Position 6 (%)						
Position 7 (%)						
Position 8 (%)						
Position 9 (%)						
Position 10 (%)						
Average (%)						

As Measured	
Average	
Std Deviation	
Minimum	
Maximum	

Additional Liner Deposit and Condition Ratings	
Cylinder	
1	
2	
3	
4	
5	
6	

# DD13 Engine Scuffing Test

## Form 8 Top Ring Scuffing Summary

Laboratory:	EOT Date:	EOT Time:
Test Number:	Test Length:	
Oil Code:		
Formulation Stand Code:		

Cylinder	1	2	3	4	5	6
Position 1 (%)						
Position 2 (%)						
Position 3 (%)						
Position 4 (%)						
Position 5 (%)						
Position 6 (%)						
Position 7 (%)						
Position 8 (%)						
Position 9 (%)						
Position 10 (%)						
Average (%)						
Ring Gap Location						

As Measured	
Average	
Std Deviation	
Minimum	
Maximum	

Additional Liner Deposit and Condition Ratings	
Cylinder	
1	
2	
3	
4	
5	
6	



# DD13 Engine Scuffing Test

## Form 9 2nd Ring Scuffing Summary

Laboratory:	EOT Date:	EOT Time:
Test Number:	Test Length:	
Oil Code:		
Formulation Stand Code:		

Cylinder	1	2	3	4	5	6
Position 1 (%)						
Position 2 (%)						
Position 3 (%)						
Position 4 (%)						
Position 5 (%)						
Position 6 (%)						
Position 7 (%)						
Position 8 (%)						
Position 9 (%)						
Position 10 (%)						
Average (%)						
Ring Gap Location						

As Measured	
Average	
Std Deviation	
Minimum	
Maximum	

Additional Liner Deposit and Condition Ratings	
Cylinder	
1	
2	
3	
4	
5	
6	

# DD13 Engine Scuffing Test

## Form 10 Oil Ring Scuffing Summary

Laboratory:	EOT Date:	EOT Time:
Test Number:	Test Length:	
Oil Code:		
Formulation Stand Code:		

Cylinder	1	2	3	4	5	6
Position 1 (%)						
Position 2 (%)						
Position 3 (%)						
Position 4 (%)						
Position 5 (%)						
Position 6 (%)						
Position 7 (%)						
Position 8 (%)						
Position 9 (%)						
Position 10 (%)						
Average (%)						
Ring Gap Location						

As Measured	
Average	
Std Deviation	
Minimum	
Maximum	

Additional Liner Deposit and Condition Ratings	
Cylinder	
1	
2	
3	
4	
5	
6	

# DD13 Engine Scuffing Test

## Form 11 Piston Top Groove Rating

Laboratory:	EOT Date:	EOT Time:
Test Number:	Test Length:	
Oil Code:		
Formulation Stand Code:		

Cylinder		1	2	3	4	5	6
<b>HC</b>	<b>Area</b>						
	<b>Demerit</b>						
<b>MC</b>	<b>Area</b>						
	<b>Demerit</b>						
<b>LC</b>	<b>Area</b>						
	<b>Demerit</b>						
<b>Total</b>	<b>Area</b>						
	<b>Demerit</b>						

<b>TGF %</b>						
--------------	--	--	--	--	--	--

<b>Additional Liner Deposit and Condition Ratings</b>	
Cylinder	
1	
2	
3	
4	
5	
6	

# DD13 Engine Scuffing Test

## Form 12 Ring Weight Measurements

Laboratory:	EOT Date:	EOT Time:
Test Number:	Test Length:	
Oil Code:		
Formulation Stand Code:		

Cylinder	Top Ring Weight, mg		
	SOT, g	EOT, g	Weight Loss, mg
1			
2			
3			
4			
5			
6			
	Top Ring Weight Average, mg		
	Top Ring Weight Std Deviation, mg		
	Top Ring Weight Minimum, mg		
	Top Ring Weight Maximum, mg		

Cylinder	2nd Ring Weight, mg		
	SOT, g	EOT, g	Weight Loss, mg
1			
2			
3			
4			
5			
6			
	2nd Ring Weight Average, mg		
	2nd Ring Weight Std Deviation, mg		
	2nd Ring Weight Minimum, mg		
	2nd Ring Weight Maximum, mg		

Cylinder	Oil Ring Weight, mg		
	SOT, g	EOT, g	Weight Loss, mg
1			
2			
3			
4			
5			
6			
	Oil Ring Weight Average, mg		
	Oil Ring Weight Std Deviation, mg		
	Oil Ring Weight Minimum, mg		
	Oil Ring Weight Maximum, mg		

# DD13 Engine Scuffing Test

## Form 13 Ring Gap Measurements

Laboratory:	EOT Date:	EOT Time:
Test Number:	Test Length:	
Oil Code:		
Formulation Stand Code:		

Cylinder	Top Ring Gap, mm		
	SOT	EOT	Delta (EOT - SOT)
1			
2			
3			
4			
5			
6			
	Top Ring Gap Average, mm		
	Top Ring Gap Std Deviation, mm		
	Top Ring Gap Minimum, mm		
	Top Ring Gap Maximum, mm		

Cylinder	2nd Ring Gap, mm		
	SOT	EOT	Delta (EOT - SOT)
1			
2			
3			
4			
5			
6			
	2nd Ring Gap Average, mm		
	2nd Ring Gap Std Deviation, mm		
	2nd Ring Gap Minimum, mm		
	2nd Ring Gap Maximum, mm		

Cylinder	Oil Ring Gap, mm		
	SOT	EOT	Delta (EOT - SOT)
1			
2			
3			
4			
5			
6			
	Oil Ring Gap Average, mm		
	Oil Ring Gap Std Deviation, mm		
	Oil Ring Gap Minimum, mm		
	Oil Ring Gap Maximum, mm		









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**Form 17**  
**Crankcase Pressure Plot**

Laboratory:	EOT Date:	EOT Time:
Test Number:	Test Length:	
Oil Code:		
Formulation Stand Code:		



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**Form 18**  
**Blow-By Flow Plot**

Laboratory:	EOT Date:	EOT Time:
Test Number:	Test Length:	
Oil Code:		
Formulation Stand Code:		



## DD13 Engine Scuffing Test

### Form 19 Hardware

Laboratory:	EOT Date:	EOT Time:
Test Number:	Test Length:	
Oil Code:		
Formulation Stand Code:		

Part	Part Number	Serial Number
Blowby Meter		
Piston Assembly		
Piston Skirt		
Piston Crown		
Uncoated Top Ring		
2nd Ring		
Oil Ring		
Wrist Pin		
Wrist Pin Retainer		
Connecting Rod		
Connecting Rod Bearings - Upper		
Connecting Rod Bearings - Lower		
Main Bearing - Upper		
Main Bearing - Lower		
Carbon Scrapper Ring		
Piston Cooling Nozzle		
Intake Rocker Arm		
Exhaust Rocker Arm - A		
Exhaust Rocker Arm - B		
Exhaust Rocker Arm - C		
Intake Camshaft		
Exhaust Camshaft		
Oil Pump		
Number of Runs on Oil Pump		
Engine Kit ID		

# DD13 Engine Scuffing Test

## Form 20 Supplemental Hardware

Laboratory:	EOT Date:	EOT Time:
Test Number:	Test Length:	
Oil Code:		
Formulation Stand Code:		

Position	Upper Main Serial No.	Lower Main Serial No.	Upper Main DateCode	Lower Main DateCode
1				
2				
3				
4				
5				
6				
7				

Cylinder	Connecting Rod Serial No.	Upper Connecting Rod Bearing Serial No.	Lower Connecting Rod Bearing Serial No.	Upper Connecting Rod Bearing Date Code	Lower Connecting Rod Bearing Date Code
1					
2					
3					
4					
5					
6					

Cylinder	Liner Serial No.	Liner Part No.	Liner Date Code	Liner Source
1				
2				
3				
4				
5				
6				

Cylinder	Piston Serial No.	Piston Part No.	Piston Date Code	Piston Other
1				
2				
3				
4				
5				
6				

Cylinder	Piston Cooling Nozzle SN	Top Ring Batch ID
1		
2		
3		
4		
5		
6		

# DD13 Engine Scuffing Test

## Form 21 Engine Kit Results Summary

Laboratory:	EOT Date:	EOT Time:
Test Number:	Test Length:	
Oil Code:		
Formulation Stand Code:		

Top Ring										
Cyl	Serial Number	Rpk			Rvk			Rz		
		1" Before Gap	180° From Gap	1" After Gap	1" Before Gap	180° From Gap	1" After Gap	1" Before Gap	180° From Gap	1" After Gap
1										
2										
3										
4										
5										
6										

Top Ring										
Cyl	Ring Tension @132	Peak Height Location			Back of Ring Height			Ring Thickness (Front to Rear)		
		1" Before Gap	180° From Gap	1" After Gap	1" Before Gap	180° From Gap	1" After Gap	1" Before Gap	180° From Gap	1" After Gap
1										
2										
3										
4										
5										
6										

2d Ring		
Cyl	Serial Number	Ring Tension @132
1		
2		
3		
4		
5		
6		

Oil Ring					
Cyl	Serial Number	Ring Tension @132	Rail Height Differential		
			1" Before Gap	180° From Gap	1" After Gap
1					
2					
3					
4					
5					
6					

Liners			
Cyl	Rpk	Rvk	Crosshatch Angle
1			
2			
3			
4			
5			
6			





DD13 Engine Scuffing Test

**Form 24**  
**Test Fuel Analysis (Last Batch)**

Laboratory:	EOT Date:	EOT Time:
Test Number:	Test Length:	
Oil Code:		
Formulation Stand Code:		
Fuel Supplier:	Fuel Batch ID:	

Measurement	Specs.	Analysis		Test Method
		New	EOT	
Total Sulfur <sup>A</sup> , ppm	7 - 15			D 5453
Gravity <sup>A</sup> , °API	34 - 37			D 4052

<sup>A</sup> Measurements are stand samples.