

**ISB  
Lubricant Performance Test**

**Report Packet Version No.**

**Method**

**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 Serial Number:	Engine Hours:
End Of Test Date:		End Of Test Time:	
Oil Code:			
Formulation / Stand Code:			
Alternate Codes:			

<p>In my opinion the test _____ been conducted in a valid manner in accordance with Test Method Dxxxx and the appropriate amendments through the information letter system. The remarks included in this report describe the anomalies associated with this test.</p>
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Submitted By: \_\_\_\_\_

Testing Laboratory

Signature

Typed Name

Title

**ISB Lubricant Performance Test  
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**ISB Lubricant Performance Test  
Form 3  
Summary Of Test Method**

The ISB Lubricant Performance Test is an engine-dynamometer test which evaluates the ability of a lubricant to minimize valvetrain and camshaft wear. This test is a two-stage test. Stage A is 100 hours, steady state, and is run with retarded fuel injection timing to produce elevated soot levels in the oil. Stage B is 250 hours and is run under quick cyclic speed and load conditions to induce wear. The stages are run in sequence (Stage A followed by Stage B) twice for a total test length of 350 hours.

The test engine is a Cummins ISB diesel engine with EGR. It is an in-line six cylinder, four-stroke, turbocharged engine with electronically controlled fuel injection. The engine is re-used for multiple tests with new valvetrain parts for each test.

**ISM Test Conditions**

<b>Parameter</b>	<b>Stage A</b>	<b>Stage B</b>
Time, h	100	250
Injection Timing, °BTDC	15 nominal	Varies
Speed, r/min	1600	Varies
Fuel Flow, kg/h	20	Varies
Inlet Manifold Temp., °C	68	68
Coolant Out Temp., °C	99	99
Fuel In Temp., °C	40	40
Oil Sump Temp., °C	110	110
Intake Air Temp., °C	Record	Record
Intake Air Pressure, kPa absolute	Record	Record
Intake Manifold Pressure, kPa absolute	Record	Record
Exhaust Back Pressure, kPa absolute	107	Varies
Crankcase Pressure, kPa	Record	Record
Coolant System Pressure, kPa	99 - 107	99 - 107
Power, kW	Record	Record
Torque, Nm	Record	Record
Pre-turbine Exhaust Temp., °C	Record	Record
Tailpipe Exhaust Temp., °C	Record	Record
Oil Gallery Temp., °C	Record	Record
Inlet Air Dew Point, °C	Record	Record
Inlet Air Humidity, kg/kg	Record	Record
Oil Gallery Pressure, kPa	Record	Record
Oil Filter Delta P, kPa	Record	Record

**ISB Lubricant Performance Test  
Test Results Summary  
Form 4**

Laboratory:	EOT Date:	EOT Time:
Test Number:		
Formulation/Stand Code:		
Oil Code:	Engine Kit S/N:	

Date Test Started					
Start Time					
Test Length					
TMC Oil Code <sup>A</sup>					
Laboratory Oil Code					
SAE Viscosity					
TGA Soot % At 100 h					
	<b>Average Camshaft Wear (<math>\mu</math>m)</b>	<b>Average Tappet Height Loss (<math>\mu</math>m)</b>	<b>Average Tappet Mass Loss (mg)</b>	<b>Average Crosshead Mass Loss (mg)</b>	<b>Average Valve Adjusting Screw Mass Loss (mg)</b>
Original Result					
Transformed Result					
Correction Factor					
Corrected Transformed Result					
Severity Adjustment					
Final Transformed Result					
<b>Final Result</b>					

<b>Last Stand Reference Results</b>					
Reference Test Number:					
Oil Code					
Test Length					
TMC Oil Code					
EOT Date					
EOT Time					
Stand Calibration Expiration Date					
TGA Soot % AT 100 h					
	<b>Average Camshaft Wear (<math>\mu</math>m)</b>	<b>Average Tappet Height Loss (<math>\mu</math>m)</b>	<b>Average Tappet Mass Loss (mg)</b>	<b>Average Crosshead Mass Loss (mg)</b>	<b>Average Valve Adjusting Screw Mass Loss (mg)</b>
<b>Final Result</b>					

<sup>A</sup> Reference Tests Only

**ISB Lubricant Performance Test  
Form 5  
Operational Summary**

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

Controlled Parameters	Parameter	Units	Target		Average		Samples <sup>B</sup>	System Response <sup>F</sup>
	Speed	r/min	1600	Varies				
	Fuel Flow	kg/h	20	Varies				
	Coolant Out	°C	99	99				
	Fuel In	°C	40	40				
	Oil Sump	°C	110	110				
	Intake Manifold	°C	68	68				
	Exhaust	kPa	107	varies				
Non-controlled Parameters	Parameter	Units	Typical Values <sup>E</sup>		Average			
	Torque	N-m	TBD	TBD				
	Intake Air Temperature	°C	TBD	TBD				
	Intake Air Restriction	kPa	TBD	TBD				
	Intake Manifold Pressure	kPa	TBD	TBD				
	Crankcase Pressure	Kpa	TBD	TBD				
	Pre-Turbine Front	°C	TBD	TBD				
	Pre-Turbine Rear	°C	TBD	TBD				
	Tailpipe	°C	TBD					
	Oil Gallery Temperature	°C	TBD					
	Blowby	L/min	TBD					
	Coolant Pressure	kPa	99 - 107					
	Main Oil Gallery Press.	kPa	TBD					
Fuel Inlet Restriction	kPa	TBD						
Fuel Return Restriction	kPa	TBD						

<sup>A</sup> QI values above the threshold are acceptable by the Cummins Surveillance Panel. QI values below the threshold may not be considered acceptable based on an engineering review. See the comments section of this report.

<sup>B</sup> Total number of data points taken

<sup>C</sup> Number of Bad Quality Data points not used in the calculation of the statistical measures

<sup>D</sup> Number of points clipped by over/under range limits

<sup>E</sup> Typical values determined from reference oil test database

<sup>F</sup> Time for the output to reach 63.2% of final value for step change at input

**ISB Lubricant Performance Test  
Form 6  
Tappet Loss Summary**

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

<b>Tappet Wear</b>						
<b>Location</b>	<b>Heights</b>			<b>Weights</b>		
	<b>SOT Height (mm)</b>	<b>EOT Height (mm)</b>	<b>Height Loss (<math>\mu\text{m}</math>)</b>	<b>SOT Mass (g)</b>	<b>EOT Mass (g)</b>	<b>Mass Loss (mg)</b>
1E						
1I						
2I						
2E						
3E						
3I						
4I						
4E						
5E						
5I						
6I						
6E						

<b>Intake / Exhaust Summary</b>	<b>Heights (<math>\mu\text{m}</math>)</b>		<b>Weights (mg)</b>	
	<b>Intake</b>	<b>Exhaust</b>	<b>Intake</b>	<b>Exhaust</b>
Average Loss				
Minimum Loss				
Maximum Loss				
Standard Deviation				

<b>Overall Summary</b>	<b>Heights (<math>\mu\text{m}</math>)</b>	<b>Weights (mg)</b>
Average Loss		
Minimum Loss		
Maximum Loss		
Standard Deviation		

**ISB Lubricant Performance Test  
Form 7  
Crosshead Mass Loss Summary**

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

Location	Serial No.	Pretest Mass (g)	EOT Mass (g)	Mass Loss (mg)
1E				
1I				
2I				
2E				
3E				
3I				
4I				
4E				
5E				
5I				
6I				
6E				

Intake / Exhaust Summary	Intake		Exhaust	
	As Measured	Outlier Screened	As Measured	Outlier Screened
Average Crosshead Mass Loss (mg)				
Minimum Crosshead Mass Loss (mg)				
Maximum Crosshead Mass Loss (mg)				
Standard Deviation (mg)				
Outlier Crossheads Locations <sup>A</sup>				

<sup>A</sup> Location Designation. Example: 3E

Overall Summary	As Measured	Outlier Screened	Adjusted to x.x% Soot
Average Crosshead Mass Loss (mg)			
Minimum Crosshead Mass Loss (mg)			
Maximum Crosshead Mass Loss (mg)			
Standard Deviation (mg)			

**ISB Lubricant Performance Test  
Form 8  
Valve Adjusting Screw Mass Loss Summary**

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

Location	Pretest Mass (g)	EOT Mass (g)	Mass Loss (mg)
1E			
1I			
2I			
2E			
3E			
3I			
4I			
4E			
5E			
5I			
6I			
6E			

Intake / Exhaust Summary	Intake		Exhaust	
	As Measured	Outlier Screened	As Measured	Outlier Screened
Average Mass Loss (mg)				
Minimum Mass Loss (mg)				
Maximum Mass Loss (mg)				
Standard Deviation (mg)				
Outlier Locations <sup>A</sup>				

<sup>A</sup> Location Designation. Example: 3E

Overall Summary	As Measured	Outlier Screened	Adjusted to x.x% Soot
Average Mass Loss (mg)			
Minimum Mass Loss (mg)			
Maximum Mass Loss (mg)			
Standard Deviation (mg)			



**ISB Lubricant Performance Test  
Form 9  
Rocker Lever Socket Mass Loss Summary**

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

Location	Pretest Mass (g)	EOT Mass (g)	Mass Loss (mg)
1E			
1I			
2I			
2E			
3E			
3I			
4I			
4E			
5E			
5I			
6I			
6E			

Intake / Exhaust Summary	Intake		Exhaust	
	As Measured	Outlier Screened	As Measured	Outlier Screened
Average Mass Loss (mg)				
Minimum Mass Loss (mg)				
Maximum Mass Loss (mg)				
Standard Deviation (mg)				
Outlier Locations <sup>A</sup>				

<sup>A</sup> Location Designation. Example: 3E

Overall Summary	As Measured	Outlier Screened	Adjusted to x.x% Soot
Average Mass Loss (mg)			
Minimum Mass Loss (mg)			
Maximum Mass Loss (mg)			
Standard Deviation (mg)			

**ISB Lubricant Performance Test  
Form 10  
Valve Rocker Shaft Mass Loss Summary**

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

Location	Pretest Mass (g)	EOT Mass (g)	Mass Loss (mg)
1E			
1I			
2I			
2E			
3E			
3I			
4I			
4E			
5E			
5I			
6I			
6E			

Intake / Exhaust Summary	Intake		Exhaust	
	As Measured	Outlier Screened	As Measured	Outlier Screened
Average Mass Loss (mg)				
Minimum Mass Loss (mg)				
Maximum Mass Loss (mg)				
Standard Deviation (mg)				
Outlier Locations <sup>A</sup>				

<sup>A</sup> Location Designation. Example: 3E

Overall Summary	As Measured	Outlier Screened	Adjusted to x.x% Soot
Average Mass Loss (mg)			
Minimum Mass Loss (mg)			
Maximum Mass Loss (mg)			
Standard Deviation (mg)			

**ISB Lubricant Performance Test  
Form 11  
Valve Push Rods Mass Loss Summary**

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

Location	Pretest Mass (g)	EOT Mass (g)	Mass Loss (mg)
1E			
1I			
2I			
2E			
3E			
3I			
4I			
4E			
5E			
5I			
6I			
6E			

Intake / Exhaust Summary	Intake		Exhaust	
	As Measured	Outlier Screened	As Measured	Outlier Screened
Average Mass Loss (mg)				
Minimum Mass Loss (mg)				
Maximum Mass Loss (mg)				
Standard Deviation (mg)				
Outlier Locations <sup>A</sup>				

<sup>A</sup> Location Designation. Example: 3E

Overall Summary	As Measured	Outlier Screened	Adjusted to x.x% Soot
Average Mass Loss (mg)			
Minimum Mass Loss (mg)			
Maximum Mass Loss (mg)			
Standard Deviation (mg)			









**ISB Lubricant Performance Test  
Form 14  
Test Fuel Analysis (Last Batch)**

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

Fuel Supplier		Fuel Batch Identifier		
Measurement	Specs.	Analysis		Test Method
		New	EOT	
Total Sulfur, ppm	7 - 15			D 5453
Gravity, °API	34 - 37			D 4052
<b>Hydrocarbon Composition</b>				
Aromatics % Wt.	26 - 31.5			D 5186
Olefins % Vol.	Report			D 1319
Cetane Index	Report			D 976
Cetane No.	43 - 47			D 613
Copper Strip Corrosion	1 Maximum			D 130
Flash Point, °C	54 Minimum			D 93
Pour Point, °C	-18 Maximum			D 97
Carbon Residue on 10% Residuum, %	0.35 Maximum			D 524 (10% Bottoms)
Water & Sediment, % Vol.	0.05 Maximum			D 2709
Viscosity, cSt @ 40°C	2.0 - 2.6			D 445
Total Acid Number	0.05 Maximum			D 664
Strong Acid Number	0.00 Maximum			D 664
Accelerated Stability	1.5 max			D 2274
Ash, % Wt.	0.005 max			D 482
SLBOCLE, g	3100 min <sup>A</sup>			D 6078 <sup>A</sup>
90% Distillation, °C	293 - 332			D 86

<sup>A</sup>May be altered to be consistent with CARB or ASTM diesel fuel specifications.