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:			

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.

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

Parameter	Stage A	Stage 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 [A]	
Laboratory Oil Code	
SAE Viscosity	
TGA Soot % At 100 h	

	Average Camshaft Wear (µm)	Average Tappet Height Loss (µm)	Average Tappet Mass Loss (mg)	Average Crosshead Mass Loss (mg)	Average Valve Adjusting Screw Mass Loss (mg)
Original Result					
Transformed Result					
Correction Factor					
Corrected Transformed Result					
Severity Adjustment					
Final Transformed Result					
Final Result					

Last Stand Reference Results	
Reference Test Number:	
Oil Code	
Test Length	
TMC Oil Code	
EOT Date	
EOT Time	
Stand Calibration Expiration Date	
TGA Soot % AT 100 h	

	Average Camshaft Wear (µm)	Average Tappet Height Loss (µm)	Average Tappet Mass Loss (mg)	Average Crosshead Mass Loss (mg)	Average Valve Adjusting Screw Mass Loss (mg)
Final Result					

[A] Reference Tests Only

ISB Lubricant Performance Test
Form 5
Operational Summary

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

	Parameter	Units			Target		Average		Samples [B]	System Response [F]	
Controlled Parameters	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					
	Parameter	**Units**	**Typical Values [E]**				**Average**				
Non-controlled Parameters	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								

[A] 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.
[B] Total number of data points taken
[C] Number of Bad Quality Data points not used in the calculation of the statistical measures
[D] Number of points clipped by over/under range limits
[E] Typical values determined from reference oil test database
[F] 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:		

Tappet Wear						
	Heights			Weights		
Location	SOT Height (mm)	EOT Height (mm)	Height Loss (µm)	SOT Mass (g)	EOT Mass (g)	Mass Loss (mg)
1E						
1I						
2I						
2E						
3E						
3I						
4I						
4E						
5E						
5I						
6I						
6E						

Intake / Exhaust Summary	Heights (µm)		Weights (mg)	
	Intake	Exhaust	Intake	Exhaust
Average Loss				
Minimum Loss				
Maximum Loss				
Standard Deviation				

Overall Summary	Heights (µm)	Weights (mg)
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 [A]				

[A] 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 [A]				

[A] 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 [A]				

[A] 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 [A]				

[A] 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 [A]				

[A] 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 12
Oil Analysis Summary

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

Test Hours	Viscosity @ 100°C, cSt	TGA % Soot	TBN D4739	TAN D664	Copper (ppm)	Iron (ppm)	Lead (ppm)	Aluminum (ppm)	Chromium (ppm)
NEW									

ISB Lubricant Performance Test
Form 13
Unscheduled Downtime & Maintenance Summary

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

Number of Downtime Occurrences			
Test Hours	**Date**	**Downtime**	**Reasons**
			Total Downtime (hours)

Other Comments		
Number of Comment Lines		

ISB Lubricant Performance Test
Form 13a
Unscheduled Downtime & Maintenance Summary

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

Number of Downtime Occurrences			
Test Hours	**Date**	**Downtime**	**Reasons**
			Total Downtime (hours)

Other Comments		
Number of Comment Lines		

ISB Lubricant Performance Test
Form 13b
Unscheduled Downtime & Maintenance Summary

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

Number of Downtime Occurrences			
Test Hours	**Date**	**Downtime**	**Reasons**
			Total Downtime (hours)

Other Comments		
Number of Comment Lines		

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**
Hydrocarbon Composition				
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[A]**			**D 6078[A]**
90% Distillation, °C	**293 - 332**			**D 86**

[A]May be altered to be consistent with CARB or ASTM diesel fuel specifications.