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
Form 2
Table of Contents

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) 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.

ISB Test Conditions

Parameter	Stage A	Stage B[A]
Time, h	100	250
Injection Timing, °	-14 nominal	Varies
Speed, r/min	1600	Varies
Fuel Flow, kg/h	20	Varies
Inlet Manifold Temp., °C	68	Target 68
Coolant Out Temp., °C	99	Target 99
Fuel In Temp., °C	40	40
Oil Sump Temp., °C	110	Target 110
Intake Air Temp., °C	Record	Record
Intake Air Pressure, kPa (vacuum)	0 – 4	Record
Intake Manifold Pressure, kPa absolute	Record	Record
Exhaust Back Pressure, kPa	7	Wide Open, 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
Fuel Pressure @ Lift Pump, kPa	Record	Record

[A] Conditions indicated are 5 seconds into the peak power step of the transient cycle.

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 TGA Soot % (25 – 350 h)	

	Average Camshaft Wear (µm)	Average Tappet Mass Loss (mg)	Average Crosshead 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 TGA Soot % (25 – 350 h)	

	Average Camshaft Wear (µm)	Average Tappet Mass Loss (mg)	Average Crosshead 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			Stage Target A	Stage Target B	Stage Average A	Stage Average B	Stage B Cycles [A]	System Response[C]	
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 Air	°C			25-35	25-35					
	Intake Manifold	°C			68	68					
	Intake Air Restriction	kPa			1-3	0-4					
	Exhaust	kPa			6-8	4 max					
	Coolant	kPa			99-107	99-107					

	Parameter	Units	Typical Values[B]		Average Stage A	Average Stage B	
Non-controlled Parameters	Torque	N-m	TBD	TBD			
	Intake Manifold Pressure	kPa abs	TBD	TBD			
	Crankcase Pressure	kPa	TBD	TBD			
	Pre-Turbine Front	°C	TBD	TBD			
	Pre-Turbine Rear	°C	TBD	TBD			
	Tailpipe	°C	TBD	TBD			
	Oil Gallery Temperature	°C	TBD	TBD			
	Blowby	L/min	TBD	TBD			
	Main Oil Gallery Press.	kPa	TBD	TBD			
	Fuel Pressure (lift pump)	kPa	TBD	TBD			

[A] Number of Stage B cycles. A minimum of 32,000 cycles is required.
[B] Typical values determined from reference oil test database
[C] Time for the output to reach 63.2% of final value for step change at input

ISB Lubricant Performance Test
Form 6
Tappet Mass Loss Summary

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

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

Tappet Mass Loss Intake / Exhaust Summary (mg)	**Intake**		**Exhaust**	
	As Measured	**Outlier Screened**	**As Measured**	**Outlier Screened**
Average				
Minimum				
Maximum				
Standard Deviation				
Outlier Locations[A]				

[A] Location Designation. Example: 3E

Tappet Mass Loss Overall Summary (mg)	**As Measured**	**Outlier Screened**	**Adjusted to 3.50% Soot**
Average			
Minimum			
Maximum			
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)
1I				
1E				
2I				
2E				
3I				
3E				
4I				
4E				
5I				
5E				
6I				
6E				

Intake / Exhaust Crosshead Mass Loss Summary (mg)	Intake		Exhaust	
	As Measured	Outlier Screened	As Measured	Outlier Screened
Average				
Minimum				
Maximum				
Standard Deviation				
Outlier Locations [A]				

[A] Location Designation. Example: 3E

Crosshead Mass Loss Overall Summary (mg)	As Measured	Outlier Screened	Adjusted to 3.50% Soot
Average			
Minimum			
Maximum			
Standard Deviation			

ISB Lubricant Performance Test
Form 8
Cam Shaft Wear Summary

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

Lobe Number	Intake/Exhaust	Cam Shaft Wear (µm)[A]
1	Intake	
2	Exhaust	
3	Intake	
4	Exhaust	
5	Intake	
6	Exhaust	
7	Intake	
8	Exhaust	
9	Intake	
10	Exhaust	
11	Intake	
12	Exhaust	

[A]Average wear at front, middle, and rear of cam lobe.

Intake / Exhaust Cam Shaft Wear Summary (µm)	Intake		Exhaust	
	As Measured	Outlier Screened	As Measured	Outlier Screened
Average				
Minimum				
Maximum				
Standard Deviation				
Outlier Locations [B]				

[B] Lobe Number.

Cam Shaft Wear Overall Summary (µm)	As Measured	Outlier Screened
Average		
Minimum		
Maximum		
Standard Deviation		

ISB Lubricant Performance Test
Form 9
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 10
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 10a
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 10b
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 11
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.

ISB Lubricant Performance Test
Form 12
American Chemistry Council Code of Practice
Test Laboratory Conformance Statement

Test Laboratory					
Test Sponsor					
Formulation / Stand Code					
Test Number					
Start Date		Start Time		Time Zone	

Declarations

No. 1 All requirements of the ACC Code of Practice for which the test laboratory is responsible were met in the conduct of this test. Yes _____ No_____ *

No. 2 The laboratory ran this test for the full duration following all procedural requirements; and all operational validity requirements of the latest version of the applicable test procedure (ASTM or other), including all updates issued by the organization responsible for the test, were met. Yes _____ No_____*

If the response to this Declaration is "No", does the test engineer consider the deviations from operational validity requirements that occurred to be beyond the control of the laboratory? Yes _____* No_____

No. 3 A deviation occurred for one of the test parameters identified by the organization responsible for the test as being a special case. Yes _____* No_____ *(This currently applies only to specific deviations identified in the ASTM Information Letter System)*

Check the Appropriate Conclusion

	Operational review of this test indicates that the results should be included in the Multiple Test Acceptance Criteria calculations.
	*Operational review of this test indicates that the results should not be included in the Multiple Test Acceptance Criteria calculations.

Note: *Supporting comments are required for all responses identified with an asterisk.*

Comments

_____ _____
Signature Date

_____ _____
Typed Name Title