

**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>
---

Submitted By: \_\_\_\_\_

\_\_\_\_\_  
Testing Laboratory

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Typed Name

\_\_\_\_\_  
Title

**ISB Lubricant Performance Test  
Form 2  
Table of Contents**

1.	Final Report Cover Sheet	Form 1
2.	Table of Contents	Form 2
3.	Summary of Test Method	Form 3
4.	Test Results Summary	Form 4
5.	Operational Summary	Form 5
6.	Tappet Mass Loss Summary	Form 6
7.	Crosshead Mass Loss Summary	Form 7
8.	Valve Adjusting Screw Mass Loss Summary	Form 8
9.	Rocker Lever Socket Mass Loss Summary	Form 9
10.	Valve Rocker Shaft Mass Loss Summary	Form 10
11.	Valve Push Rod Mass Loss Summary	Form 11
12.	Oil Analysis Summary	Form 12
13.	Unscheduled Downtime & Maintenance Summary	Form 13
14.	Test Fuel Analysis (Last Batch)	Form 14
15.	ACC Conformance Statement	Form 15

**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**

<b>Parameter</b>	<b>Stage A</b>	<b>Stage B<sup>4</sup></b>
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

<sup>4</sup> 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 <sup>A</sup>				
Laboratory Oil Code				
SAE Viscosity				
TGA Soot % At 100 h				
	<b>Average Camshaft Wear (µm)</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 (µm)</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	Stage Target		Stage Average		Stage B Cycles <sup>A</sup>	System Response <sup>C</sup>
			A	B	A	B		
			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	7	varies					
Non-controlled Parameters	Parameter	Units	Typical Values <sup>B</sup>		Average Stage A	Average Stage B		
	Torque	N-m	TBD	TBD				
	Intake Air Temperature	°C	TBD	TBD				
	Intake Air Restriction	kPa (vac.)	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				
	Coolant Pressure	kPa	99-107	99-107				
	Main Oil Gallery Press.	kPa	TBD	TBD				
	Fuel Inlet Restriction	kPa	TBD	TBD				
Fuel Return Restriction	kPa	TBD	TBD					

<sup>A</sup> Number of Stage B cycles. A minimum of 32,000 cycles is required.  
<sup>B</sup> Typical values determined from reference oil test database  
<sup>C</sup> 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:		

<b>Tappet Wear</b>			
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 <sup>4</sup>				

<sup>4</sup> Location Designation. Example: 3E

Tappet Mass Loss Overall Summary (mg)	As Measured	Outlier Screened	Adjusted to X.X% 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 <sup>A</sup>				

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

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

**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)
1I			
1E			
2I			
2E			
3I			
3E			
4I			
4E			
5I			
5E			
6I			
6E			

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

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

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



**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)
1I			
1E			
2I			
2E			
3I			
3E			
4I			
4E			
5I			
5E			
6I			
6E			

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

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

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

**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)
1I			
1E			
2I			
2E			
3I			
3E			
4I			
4E			
5I			
5E			
6I			
6E			

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

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

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

**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)
1I			
1E			
2I			
2E			
3I			
3E			
4I			
4E			
5I			
5E			
6I			
6E			

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

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

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









**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.



**ISB Lubricant Performance Test  
Form 15  
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