D 7468 - ISM
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:	Engine:		Stand Run No.:
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 D 7468 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

D 7468 - ISM Lubricant Performance Test
Form 2
Table of Contents

D 7468 - ISM Lubricant Performance Test
Form 3
Summary Of Test Method

The ISM Lubricant Performance Test is an engine-dynamometer test which evaluates the ability of a lubricant to minimize crosshead wear, filter plugging and sludge build-up. This test is a two-stage, steady state test (constant speed and load). Stage A is 50 hours and is run with retarded fuel injection timing to produce elevated soot levels in the oil. Stage B is 50 hours and is run under heavy load conditions to induce wear. The stages are run in sequence (Stage A followed by Stage B) twice for a total test length of 200 hours.

The test engine is a Cummins ISM diesel engine with EGR. It is an in-line six cylinder, four-stroke, turbocharged engine with electronically controlled fuel injection. A two-h break-in is conducted prior to each test since a new engine build is used for each test.

ISM Test Conditions

Parameter	Stage A	Stage B
Time, h	50	50
Injection Timing, °BTDC	Variable	Fixed
Speed, r/min	1800	1600
Fuel Flow, kg/h	58.0	64.4
Intake CO_2, %	0.97 - 1.09	0.97 - 1.09
Inlet Manifold Temp., °C	80	65.5
Coolant Out Temp., °C	65.5	65.5
Fuel In Temp., °C	40	40
Oil Gallery Temp., °C	115	115
Intake Air Temp., °C	Record	Record
Intake Air Pressure, kPa absolute	Record	Record
Intake Manifold Pressure, kPa absolute	300 Minimum	320 Minimum
Exhaust Back Pressure, kPa absolute	107	107
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 Sump 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

D 7468 - ISM 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	
Number of Valid Tests Since Stand Calibration [B]			
SAE Viscosity			
TGA Soot % At 50 h			
TGA Soot % At 150 h			
Average TGA Soot % 0 - 200 h			
Total Oil Consumption, kg			

	Crosshead Mass Loss Adjusted to 3.9% Soot (mg)	**Filter Plugging Delta P (kPa)**	**Average Sludge Rating (merits)**	**Injector Adjusting Screw Mass Loss Adjusted to 3.9% Soot (mg)**	**Top Ring Mass Loss (mg)**
Original Result					
Transformed Result					
Correction Factor					
Corrected Transformed Result					
Final Transformed Result					
Final Result[C]					
Merits					
Total Merits					

Last Stand Reference Results			
Test Number			
Oil Code			
Test Length		TMC Oil Code	
EOT Date		EOT Time	
Stand Calibration Expiration Date			
TGA Soot % At 50 h			
TGA Soot % At 150 h			
Average TGA Soot % 0 - 200 h			
Total Oil Consumption, kg			

	Crosshead Mass Loss Adjusted to 3.9% Soot (mg)	**Filter Plugging Delta P (kPa)**	**Average Sludge Rating (merits)**	**Injector Adjusting Screw Mass Loss Adjusted to 3.9% Soot (mg)**	**Top Ring Mass Loss (mg)**
Final Result					

[A] Reference Tests Only
[B] Non-Reference Tests Only, includes current test if valid.
[C] The ISM does not use severity adjusted results.

D 7468 - ISM Lubricant Performance Test
Form 5
Operational Summary

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

	Parameter	Units	QI Threshold	EOT QI [A]	Target		Average		Samples [B]	BQD [C]	Over/Under Range [D]
Controlled Parameters	Speed	r/min	0.000		1800	1600					
	Fuel Flow	kg/h	0.000		58.0	64.4					
	Coolant Out	°C	0.000		65.5						
	Fuel In	°C	0.000		40						
	Oil Gallery	°C	0.000		115						
	Intake Manifold	°C	0.000		80.0	65.5					
	Exhaust	kPa	0.000		107						

	Parameter	Units	Typical Values [E]		Average			
			Stage A	Stage B	Stage A1 (A)	Stage B1 (B)	Stage A2 (C)	Stage B2 (D)
Non-controlled Parameters	Torque	N-m	TBD	TBD				
	Power	kW	TBD	TBD				
	Intake CO_2	%	0.97 – 1.09	0.97 – 1.09				
	Blowby	L/min	TBD	TBD				
	Coolant In	°C	TBD	TBD				
	Intake Air	°C	TBD	TBD				
	Pre-Turbine	°C	TBD	TBD				
	Tailpipe	°C	TBD	TBD				
	Fuel	kPa	TBD	TBD				
	Oil Gallery	kPa	TBD	TBD				
	Coolant	kPa	99 - 107	99 - 107				
	Intake Manifold	kPa	TBD	TBD				
	Crankcase	kPa	TBD	TBD				
	Intake Air	kPa	TBD	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

D 7468 - ISM Lubricant Performance Test
Form 6
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

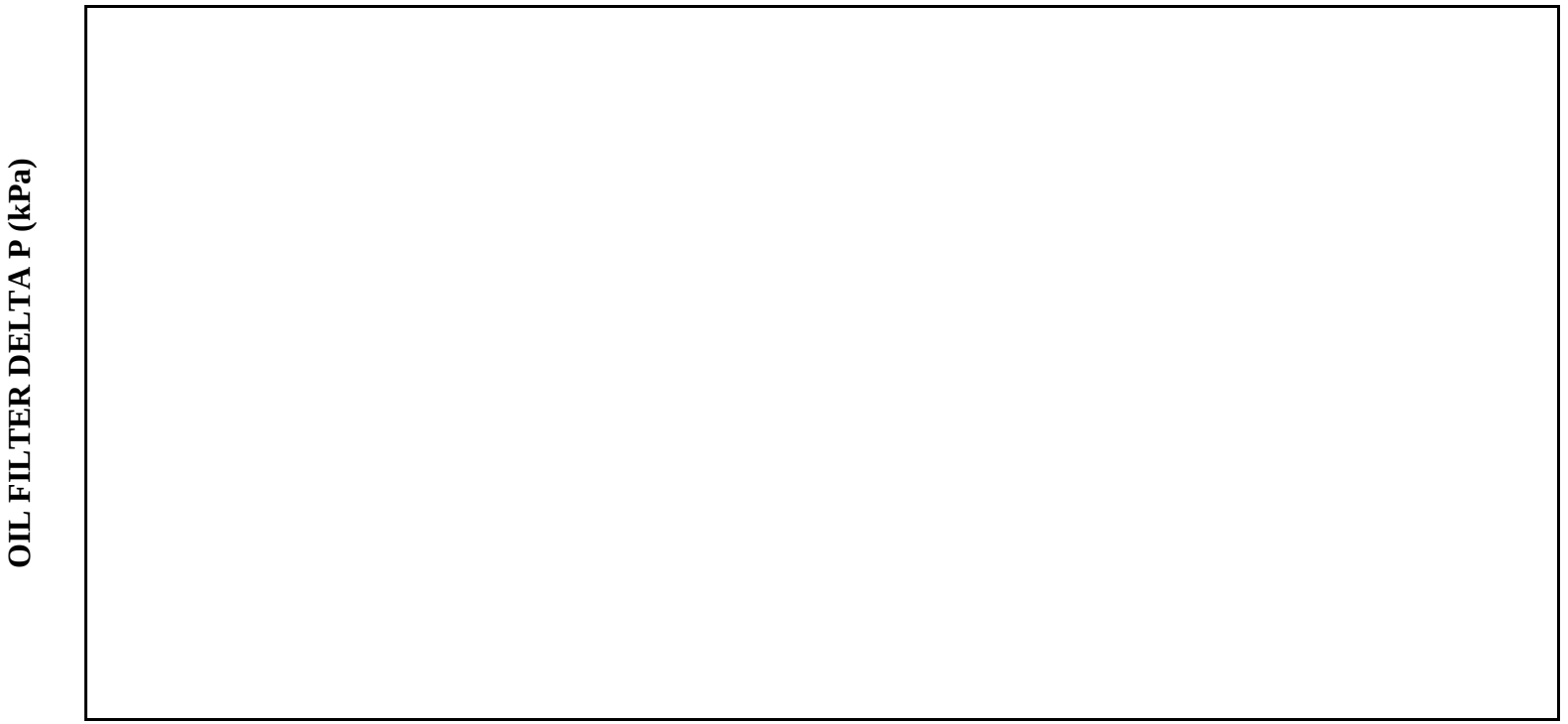
Overall Summary	As Measured	Outlier Screened	Adjusted to 3.9% Soot
Average Crosshead Mass Loss (mg)			
Minimum Crosshead Mass Loss (mg)			
Maximum Crosshead Mass Loss (mg)			
Standard Deviation (mg)			

Crosshead Batch ID	

D 7468 - ISM Lubricant Performance Test
Form 7
Oil Filter Delta Pressure Plot

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

OIL FILTER DELTA PRESSURE vs TEST HOURS



D 7468 - ISM Lubricant Performance Test
Form 8
Sludge Rating Summary

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

Sludge Rating Summary

Sludge Depth	Valve Cover % of Area	Valve Cover Volume Factor	Oil Pan % of Area	Oil Pan Volume Factor
1/4A				
1/2A				
3/4A				
A				
AB				
B				
BC				
C				
D				
E				
F				
G				
H				
I				
J				
	Total Volume Factor:		Total Volume Factor:	
	Merit Rating:		Merit Rating:	
			Average Sludge Rating:	

D 7468 - ISM Lubricant Performance Test
Form 9
Ring Mass Loss Summary

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

	Top Ring			Second Ring			Oil Ring		
	Mass (g)		Mass Loss (mg)	Mass (g)		Mass Loss (mg)	Mass (g)		Mass Loss (mg)
Cylinder	Pretest	EOT		Pretest	EOT		Pretest	EOT	
1									
2									
3									
4									
5									
6									
As Measured Results									
Average Mass Loss (mg)									
Std. Dev. Mass Loss (mg)									
Maximum Mass Loss (mg)									
Minimum Mass Loss (mg)									
Outlier Top Ring (cylinder number)									
Outlier Screened Results									
Average Mass Loss (mg)									

D 7468 - ISM Lubricant Performance Test
Form 10
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									

D 7468 - ISM 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	Specifications	Analysis		Test Method
		New	EOT	
Total Sulfur, % Weight	0.04 - 0.05			D 2662
Gravity, °API	34.5 - 36.5			D 1298
Hydrocarbon Composition				
Aromatics % Volume	28 – 33			D 1319
Olefin	Report			D 1319
Cetane Index	Report			D 4737
Cetane Number	42 – 48			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, % Volume	0.05 Maximum			D 2709
Viscosity, cSt @ 40 °C	2.4 - 3.0			D 445
Total Acid Number	0.05 Maximum			D 664
Strong Acid Number	0.00 Maximum			D 664
Accelerated Stability	Tbd			D 2274
Saturates, %	Report			D 1319
Cloud Point, °C	Report			D 2500
Distillation, °C				
IBP	Report			D 86
10%	Report			D 86
50%	Report			D 86
90%	282 – 338			D 86
EP	Report			D 86

D 7468 - ISM Lubricant Performance Test
Form 12
Injector Adjusting Screw Mass Loss

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

Screw #	Pretest Mass, g	Post-Test Mass, g	Mass Loss, mg
1			
2			
3			
4			
5			
6			
		Total Mass Loss, mg	
Injector Adjusting Screw Mass Loss Summary		**As Measured**	**Outlier Screened**
Average			
Standard Deviation			
Minimum			
Maximum			
Outlier Inj. Adj. Screw[A]			
Average Adjusted to 3.9% Soot			

[A] Location Designation. Example: 3

Injector Adjusting Screw Batch ID	
Injector Pushrod Batch ID	

D 7468 - ISM 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		

D 7468 - ISM 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		

D 7468 - ISM 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		

D 7468 - ISM Lubricant Performance Test
Form 14
Characteristics Of The Data Acquisition System

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

Parameter (1)	Sensing Device (2)	Calibration Frequency (3)	Record Device (4)	Observation Frequency (5)	Record Frequency (6)	Log Frequency (7)	System Response (8)
Temperatures							
Oil @ Filt.							
Fuel In.							
Intake Air							
Intake Man.							
Pre-Turb.							
Cool. Out							
Pressure							
Inlet Air							
Exhaust							
Oil Gallery							
Other							
Fuel Flow							
Speed							
Load							

Legend:
(1) Operating Parameter
(2) The type of device used to measure temperature, pressure, or flow
(3) Frequency at which the measurement system is calibrated
(4) The type of device where data is recorded
DL – Automatic data logger
C/D – Computer, using direct I/O entry
(5) Data are observed but only recorded if off spec.
(6) Data are recorded but are not retained at EOT
(7) Data are logged as permanent record, note specify if:
SS – snapshot taken at specified frequency
AG/X – Average of X data points at specified frequency
(8) Time for the output to reach 63.2% of final value for step change at input

D 7468 - ISM 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