

**ISM  
Lubricant Performance Test**

**Report Packet Version No.**

ISM VERSION 20040514 BETA

**Method**

METHOD

**Conducted For:**

TSTSPON1

TSTSPON2

LABVALID	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.

TSTOIL	NR = Non-Reference Oil Test
	RO = Reference Oil Test

Stand:	STAND	Engine:	ENGINE	Engine Run No:	ENRUN
End Of Test Date:	DTCOMP	End Of Test Time:	EOTTIME		
Oil Code:	OILCODE				
Formulation / Stand Code:	FORM				
Alternate Codes:	ALTCODE1	ALTCODE2	ALTCODE3		

In my opinion the test OPVALID 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:

SUBLAB

Testing Laboratory

SUBSIGIM

Signature

SUBNAME

Typed Name

SUBTITLE

Title

**ISM Lubricant Performance Test  
Form 2  
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**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, sludge build-up, and top ring weight loss. 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**

<b>Parameter</b>	<b>Stage A</b>	<b>Stage B</b>
Time, h	50	50
Injection Timing, °BTDC	Variable	Variable
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

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

Laboratory: LAB	EOT Date: DTCOMP	EOT Time: EOTTIME
Stand: STAND	Engine: ENGINE	Engine Run No.: ENRUN
Formulation/Stand Code:		FORM
Oil Code: OILCODE	Engine Kit S/N: ENKIT	

Date Test Started	DTSTRT
Start Time	STRTIME
Test Length	TESTLEN
TMC Oil Code <sup>A</sup>	IND
Laboratory Oil Code	LABOCODE
SAE Viscosity	SAEVISC
TGA Soot % At 50 h	TGA050
TGA Soot % At 150 h	TGA150
Average TGA Soot % 0 - 200 h	TGAAVG
Total Oil Consumption, kg	TOTOCON

	Adj. Average Crosshead Mass Loss (mg)	Filter Plugging Delta P (kPa)	Average Sludge Rating (merits)	Avg. Top Ring Weight Loss (mg)
Original Result	ACWL	OILDLP	ASRT	ARWLT
Transformed Result <sup>B</sup>	TRNACWL	TRNODP	TRNASRT	TRNARWLT
Correction Factor <sup>B</sup>	ACWLCF	OILDPCF	ASRTCF	ARWLTCF
Corrected Transformed Result <sup>B</sup>	ACWLCOR	OILDPCOR	ASRTCOR	ARWLTCOR
Severity Adjustment <sup>B</sup>	ACWL_SA	OILDPA_SA	ASRT_SA	ARWL_SA
Final Transformed Result <sup>B</sup>	TACWLFNL	TODPFNL	TASRTFNL	TARWLT
<b>Final Result</b>	ACWLFNL	OILDPFNL	ASRTFNL	ARWTFNL

Last Stand Reference Results			
Stand: STAND	Engine: RENGINE	Engine Run No.: RENRUN	
Oil Code	ROILCODE		
Test Length		RTESTLEN	
TMC Oil Code		RIND	
EOT Date		RDTCOMP	
EOT Time		REOTTIME	
Stand Calibration Expiration Date		DTCALEXP	
TGA Soot % AT 50 h		RTGA050	
TGA Soot % AT 150 h		RTGA150	
Average TGA Soot % 0 - 200 h		RTGAAVG	
Total Oil Consumption, kg		RTOTOCON	

	Adj. Average Crosshead Mass Loss (mg)	Filter Plugging Delta P (kPa)	Average Sludge Rating (merits)	Avg. Top Ring Weight Loss (mg)
Original Result	RACWL	ROILDLP	RASRT	RARWLT
Transformed Result <sup>B</sup>	RTRNACWL	RTRNODP	RTRNASRT	RTRNARWT
Correction Factor <sup>B</sup>	RACWLCF	ROILDPCF	RASRTCF	RARWLTCF
Corrected Transformed Result <sup>B</sup>	RACWLCOR	RTODPCOR	RASRTCOR	RARWTCOR
Final Transformed Result <sup>B</sup>	RTCWLFNL	RTODPFNL	RTSRTFNL	RTARWLT
<b>Final Result</b>	RACWLFNL	RFPDPFNL	RASRTFNL	RARWTFNL

<sup>A</sup> Reference Tests Only

<sup>B</sup> Filter Plugging Delta P Value in Transformed Units

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

Laboratory:	LAB	DTCOMP	EOT Time:	EOTIME
Stand:	STAND	ENGINE	Engine Run No.:	ENRUN
Formulation/Stand Code: FORM				
Oil Code: OILCODE				

Parameter	Units	QI Threshold	EOT QI <sup>A</sup>	Target	Average	Samples <sup>B</sup>	BQD <sup>C</sup>	Over/Under Range <sup>D</sup>
Speed	r/min	0.000	QRPM	1800	ARPM	NRPM	BRPM	ORPM
Fuel Flow	kg/h	0.000	QFLO	58.0	AFFLOA	NFFLO	BFFLO	OFFLO
Coolant Out	°C	0.000	QCLOUT	65.5	ACOLOUT	NCOLOUT	BCOLOUT	OCOLOUT
Fuel In	°C	0.000	QFUELT	40	AFUELT	NFUELT	BFUELT	OFUELT
Oil Gallery	°C	0.000	QOILTEM	115	AOILTEM	NOILTEM	BOILTEM	OILTEM
Intake Manifold	°C	0.000	QINMANT	80.0	AINMANTA	NINMANT	BINMANT	OINMANT
Exhaust	kPa	0.000	QEXHSTP	107	AEXHSTP	NEXHSTP	BEXHSTP	OEXHSTP
<b>Parameter</b>	<b>Units</b>	<b>Typical Values<sup>E</sup></b>	<b>Average</b>					
Torque	N-m	TBD	TBD	ALOADA	ALOADB			
Power	kW	TBD	TBD	APWRA	APWRB			
Intake CO	%	Record	Record	AICO2A	AICO2B			
Blowby	L/min		TBD		ABLOBY			
Coolant In	°C		TBD		ACOLIN			
Intake Air	°C		TBD		AINAIRT			
Pre-Turbine	°C		TBD		APTURT			
Tailpipe	°C		TBD		ATAILPT			
Fuel	kPa		TBD		AFPMP			
Oil Gallery	kPa		TBD		AOILPRS			
Coolant	kPa		99 - 107		ACOLOUP			
Intake Manifold	kPa		TBD		AINMANP			
Crankcase	kPa		TBD		ACCASEP			
Intake Air	kPa		TBD		AINAIRR			

<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

**ISM Lubricant Performance Test  
Form 6  
Crosshead Mass Loss Summary**

Laboratory: LAB	EOT Date: DTCOMP	EOT Time: EOTTIME
<b>Test Number</b>		
Stand: STAND	Engine: ENGINE	Engine Run No.: ENRUN
Formulation / Stand Code:		FORM
Oil Code:		OILCODE

Location	Serial No.	Pretest Mass (g)	EOT Mass (g)	Mass Loss (mg)
1E	CHDSN1E	CHDPTW1E	CHDEW1E	CHDEWL1E
1I	CHDSN1I	CHDPTW1I	CHDEW1I	CHDEWL1I
2I	CHDSN2I	CHDPTW2I	CHDEW2I	CHDEWL2I
2E	CHDSN2E	CHDPTW2E	CHDEW2E	CHDEWL2E
3E	CHDSN3E	CHDPTW3E	CHDEW3E	CHDEWL3E
3I	CHDSN3I	CHDPTW3I	CHDEW3I	CHDEWL3I
4I	CHDSN4I	CHDPTW4I	CHDEW4I	CHDEWL4I
4E	CHDSN4E	CHDPTW4E	CHDEW4E	CHDEWL4E
5E	CHDSN5E	CHDPTW5E	CHDEW5E	CHDEWL5E
5I	CHDSN5I	CHDPTW5I	CHDEW5I	CHDEWL5I
6I	CHDSN6I	CHDPTW6I	CHDEW6I	CHDEWL6I
6E	CHDSN6E	CHDPTW6E	CHDEW6E	CHDEWL6E

Intake / Exhaust Summary	Intake		Exhaust	
	As Measured	Outlier Screened	As Measured	Outlier Screened
Average Crosshead Mass Loss (mg)	ACHDWLI	OACHDWLI	ACHDWLE	OACHDWLE
Minimum Crosshead Mass Loss (mg)	ICHDWLI	OICHDWLI	ICHDWLE	OICHDWLE
Maximum Crosshead Mass Loss (mg)	XCHDWLI	OXCHDWLI	XCHDWLE	OXCHDWLE
Standard Deviation (mg)	SCHDWLI	OSCHDWLI	SCHDWLE	OSCHDWLE
Outlier Crossheads Locations <sup>4</sup>	CHDOUTI		CHDOUTE	

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

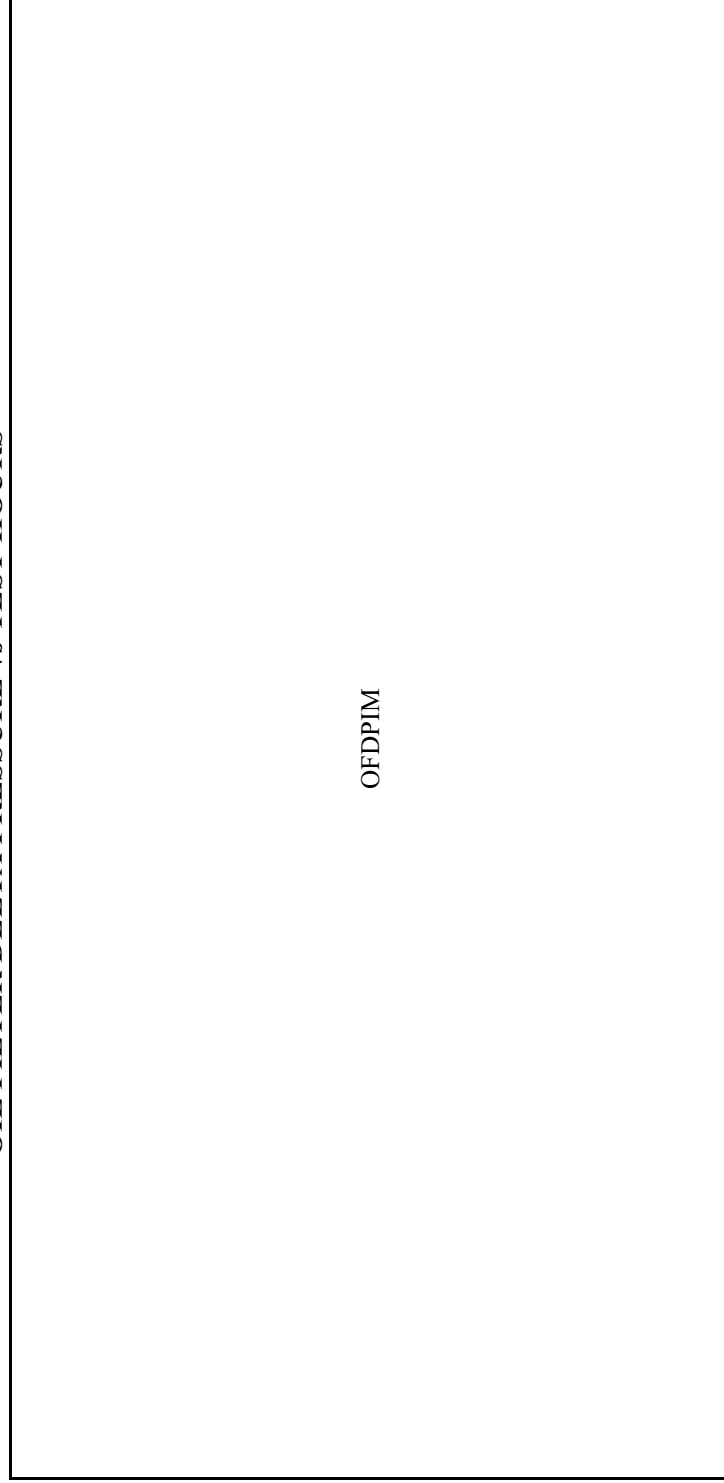
Overall Summary	As Measured	Outlier Screened	Adjusted to 4.6% Soot
Average Crosshead Mass Loss (mg)	AMACAWL	CAWL	ACWL
Minimum Crosshead Mass Loss (mg)	AMICAWL	ICHDEWL	
Maximum Crosshead Mass Loss (mg)	AMXCAWL	XCHDEWL	
Standard Deviation (mg)	AMSCAWL	SCHDEWL	

**ISM Lubricant Performance Test  
Form 7**

**Oil Filter Delta Pressure Plot**

Laboratory:	LAB	EOT Date:	DTCOMP	EOT Time:	EOTTIME
<b>Test Number</b>					
Stand:	STAND	Engine:	ENGINE	Engine Run No.:	ENRUN
Formulation / Stand Code: FORM					
Oil code: OILCODE					

**OIL FILTER DELTA PRESSURE vs TEST HOURS**



OIL FILTER DELTA P (kPa)

OFPDPIM

TEST HOURS

**ISM Lubricant Performance Test  
Form 8  
Sludge Rating Summary**

Laboratory: LAB	EOT Date: DTCOMP	EOT Time: EOTTIME
<b>Test Number</b>		
Stand: STAND	Engine: ENGINE	Engine Run No.: ENRUN
Formulation / Stand Code:		FORM
Oil Code:		OILCODE

**Sludge Rating Summary**

Sludge Depth	Valve Cover % of Area	Valve Cover Volume Factor	Oil Pan % of Area	Oil Pan Volume Factor
1/4A	RCSEA01	RCSEV01	OILPSA01	OILPSV01
1/2A	RCSEA02	RCSEV02	OILPSA02	OILPSV02
3/4A	RCSEA03	RCSEV03	OILPSA03	OILPSV03
A	RCSEA04	RCSEV04	OILPSA04	OILPSV04
AB	RCSEA05	RCSEV05	OILPSA05	OILPSV05
B	RCSEA06	RCSEV06	OILPSA06	OILPSV06
BC	RCSEA07	RCSEV07	OILPSA07	OILPSV07
C	RCSEA08	RCSEV08	OILPSA08	OILPSV08
D	RCSEA09	RCSEV09	OILPSA09	OILPSV09
E	RCSEA10	RCSEV10	OILPSA10	OILPSV10
F	RCSEA11	RCSEV11	OILPSA11	OILPSV11
G	RCSEA12	RCSEV12	OILPSA12	OILPSV12
H	RCSEA13	RCSEV13	OILPSA13	OILPSV13
I	RCSEA14	RCSEV14	OILPSA14	OILPSV14
J	RCSEA15	RCSEV15	OILPSA15	OILPSV15
	Total Volume Factor:	RCSEVT	Total Volume Factor:	OILPSVT
	Merit Rating:	RCSEMRT	Merit Rating:	OILPSMRT
			<b>Average Sludge Rating:</b>	ASRT



**ISM Lubricant Performance Test  
Form 9  
Rod Bearing Mass Loss**

Laboratory:	LAB	EOT Date:	DTCOMP	EOT Time:	EOTTIME
<b>Test Number</b>					
Stand:	STAND	Engine	ENGINE	Engine Run No.:	ENRUN
Formulation / Stand Code:			FORM		
Oil Code:			OILCODE		

Cylinder Number	Bearing Location	Pretest Mass (g)	Post-Test Mass (g)	Mass Loss (mg)
1	Upper	BWCYL1TP	BWCYL1TE	BWL1T
	Lower	BWCYL1BP	BWCYL1BE	BWL1B
2	Upper	BWCYL2TP	BWCYL2TE	BWL2T
	Lower	BWCYL2BP	BWCYL2BE	BWL2B
3	Upper	BWCYL3TP	BWCYL3TE	BWL3T
	Lower	BWCYL3BP	BWCYL3BE	BWL3B
4	Upper	BWCYL4TP	BWCYL4TE	BWL4T
	Lower	BWCYL4BP	BWCYL4BE	BWL4B
5	Upper	BWCYL5TP	BWCYL5TE	BWL5T
	Lower	BWCYL5BP	BWCYL5BE	BWL5B
6	Upper	BWCYL6TP	BWCYL6TE	BWL6T
	Lower	BWCYL6BP	BWCYL6BE	BWL6B

	Bearing Mass Loss
Average (mg)	ASBWL
Minimum (mg)	ISBWL
Maximum (mg)	XSBWL
Standard Deviation (mg)	SSBWL

**ISM Performance Test  
Form 10  
Piston Rating Summary**

Laboratory: LAB	EOT Date: DTCOMP	EOT Time: EOTTIME
<b>Test Number</b>		
Stand: STAND	Engine: ENGINE	Engine Run No.: ENRUN
Formulation / Stand Code:		FORM
Oil Code:		OILCODE

Unweighted Demerits											
Piston Number	Lands				Grooves			Under Crown	Oil Cooling Gallery	Total Demerits	
	1	2	3	4	1	2	3				
1	L1UWD1	L2UWD1	L3UWD1	L4UWD1	G1UWD1	G2UWD1	G3UWD1	UCUWD1	OGUWD1	UWD1	
2	L1UWD2	L2UWD2	L3UWD2	L4UWD2	G1UWD2	G2UWD2	G3UWD2	UCUWD2	OGUWD2	UWD2	
3	L1UWD3	L2UWD3	L3UWD3	L4UWD3	G1UWD3	G2UWD3	G3UWD3	UCUWD3	OGUWD3	UWD3	
4	L1UWD4	L2UWD4	L3UWD4	L4UWD4	G1UWD4	G2UWD4	G3UWD4	UCUWD4	OGUWD4	UWD4	
5	L1UWD5	L2UWD5	L3UWD5	L4UWD5	G1UWD5	G2UWD5	G3UWD5	UCUWD5	OGUWD5	UWD5	
6	L1UWD6	L2UWD6	L3UWD6	L4UWD6	G1UWD6	G2UWD6	G3UWD6	UCUWD6	OGUWD6	UWD6	
<b>Average Demerits</b>	AL1UWD	AL2UWD	AL3UWD	AL4UWD	AG1UWD	AG2UWD	AG3UWD	AUCUWD	AOGUWD		
									<b>Average Total Unweighted Demerits</b>		TOTUWD

Parameter	Piston Number						Average
	1	2	3	4	5	6	
<b>TGC</b>	TGC1	TGC2	TGC3	TGC4	TGC5	TGC6	ATGC
<b>TLC</b>	TLC1	TLC3	TLC4	TLC4	TLC5	TLC6	ATLC

**ISM Lubricant Performance Test  
Form 11  
PISTON 1 Deposit Ratings**

Laboratory:	LAB	EOT Date:	DTCOMP	EOT Time:	EOTTIME
<b>Test Number</b>					
Stand:	STAND	Engine:	ENGINE	Engine Run No.:	ENRUN
Formulation / Stand Code:	FORM				
Oil Code:	OILCODE				

Total Piston Ratings Summary														
Dep. Factor	Grooves						Dep. Factor	Lands						
	No. 1		No. 2		No. 1			No. 2		No. 3		No. 4		
	A, %	Dem.	A, %	Dem.	A, %	Dem.		A, %	Dem.	A, %	Dem.	A, %	Dem.	
<b>HC -1.0</b>	G1HCAI	G1HCDDI	G2HCAI	G2HCDDI	L1HCAI	L1HCDDI	L2HCAI	L2HCDDI	G3HCAI	G3HCDDI	L3HCAI	L3HCDDI	L4HCAI	L4HCDDI
<b>MC -0.5</b>	G1MCAI	G1MCDI	G2MCAI	G2MCDI	L1MCAI	L1MCDI	L2MCAI	L2MCDI	G3MCAI	G3MCDI	L3MCAI	L3MCDI	L4MCAI	L4MCDI
<b>LC - .25</b>	G1LCAI	G1LCDI	G2LCAI	G2LCDI	L1LCAI	L1LCDI	L2LCAI	L2LCDI	G3LCAI	G3LCDI	L3LCAI	L3LCDI	L4LCAI	L4LCDI
<b>Total</b>	1ACTOT11DCTOT		2ACTOT112DCTOT		1ACTOT11DCTOT		2ACTOT112DCTOT		3ACTOT113DCTOT		4ACTOT114DCTOT		5ACTOT115DCTOT	
<b>8 - 9</b>	G1L9AI	G1L9DI	G2L9AI	G2L9DI	L1L9AI	L1L9DI	L2L9AI	L2L9DI	G3L9AI	G3L9DI	L3L9AI	L3L9DI	L4L9AI	L4L9DI
<b>7 - 7.9</b>	G1L8AI	G1L8DI	G2L8AI	G2L8DI	L1L8AI	L1L8DI	L2L8AI	L2L8DI	G3L8AI	G3L8DI	L3L8AI	L3L8DI	L4L8AI	L4L8DI
<b>6 - 6.9</b>	G1L7AI	G1L7DI	G2L7AI	G2L7DI	L1L7AI	L1L7DI	L2L7AI	L2L7DI	G3L7AI	G3L7DI	L3L7AI	L3L7DI	L4L7AI	L4L7DI
<b>5 - 5.9</b>	G1L6AI	G1L6DI	G2L6AI	G2L6DI	L1L6AI	L1L6DI	L2L6AI	L2L6DI	G3L6AI	G3L6DI	L3L6AI	L3L6DI	L4L6AI	L4L6DI
<b>4 - 4.9</b>	G1L5AI	G1L5DI	G2L5AI	G2L5DI	L1L5AI	L1L5DI	L2L5AI	L2L5DI	G3L5AI	G3L5DI	L3L5AI	L3L5DI	L4L5AI	L4L5DI
<b>3 - 3.9</b>	G1L4AI	G1L4DI	G2L4AI	G2L4DI	L1L4AI	L1L4DI	L2L4AI	L2L4DI	G3L4AI	G3L4DI	L3L4AI	L3L4DI	L4L4AI	L4L4DI
<b>2 - 2.9</b>	G1L3AI	G1L3DI	G2L3AI	G2L3DI	L1L3AI	L1L3DI	L2L3AI	L2L3DI	G3L3AI	G3L3DI	L3L3AI	L3L3DI	L4L3AI	L4L3DI
<b>1 - 1.9</b>	G1L2AI	G1L2DI	G2L2AI	G2L2DI	L1L2AI	L1L2DI	L2L2AI	L2L2DI	G3L2AI	G3L2DI	L3L2AI	L3L2DI	L4L2AI	L4L2DI
<b>&gt;0 - 0.9</b>	G1L1AI	G1L1DI	G2L1AI	G2L1DI	L1L1AI	L1L1DI	L2L1AI	L2L1DI	G3L1AI	G3L1DI	L3L1AI	L3L1DI	L4L1AI	L4L1DI
<b>Clean</b>	0		0		0		0		0		0		0	
<b>Total Rating</b>	1ALTOT11DLTOT		2ALTOT112DLTOT		1ALTOT11DLTOT		2ALTOT112DLTOT		3ALTOT113DLTOT		4ALTOT114DLTOT		5ALTOT115DLTOT	
	G1UWDI	G1UWDI	G2UWDI	G2UWDI	L1UWDI	L1UWDI	L2UWDI	L2UWDI	G3UWDI	G3UWDI	L3UWDI	L3UWDI	L4UWDI	L4UWDI
	<b>Unweighted Deposits</b>						<b>Top Land Carbon</b>						<b>T.L. Flaked Carbon %</b>	
	UWDI						TLCI						TLFCI	

**ISM Lubricant Performance Test  
Form 12  
Piston 2 Deposit Ratings**

Laboratory:	LAB	EOT Date:	DTCOMP	EOT Time:	EOTTIME
<b>Test Number</b>					
Stand:	STAND	Engine:	ENGINE	Engine Run No.:	ENRUN
Formulation / Stand Code:	FORM				
Oil Code:	OILCODE				

Total Piston Ratings Summary																								
Dep. Factor	Grooves					Dep. Factor	Lands					Groove		Lands		Oil Cooling		Under Crown						
	No. 1		No. 2		No. 1		No. 2		No. 3		No. 4		No. 3	No. 4	A, %	Dem.	A, %	Dem.	A, %	Dem.				
	A, %	Dem.	A, %	Dem.	A, %		Dem.	A, %	Dem.	A, %	Dem.	A, %									Dem.			
<b>HC -1.0</b>	G1HCA2	G1HCD2	G2HCA2	G2HCD2	L1HCA2	L1HCD2	L2HCA2	L2HCD2	L3HCA2	L3HCD2	L4HCA2	L4HCD2	G3HCA2	G3HCD2	L3HCA2	L3HCD2	L4HCA2	L4HCD2						
<b>MC -0.5</b>	G1MCA2	G1MCD2											G3MCA2	G3MCD2										
<b>LC - .25</b>	G1LCA2	G1LCD2	G2LCA2	G2LCD2	L1LCA2	L1LCD2	L2LCA2	L2LCD2	L3LCA2	L3LCD2	L4LCA2	L4LCD2	G3LCA2	G3LCD2	L3LCA2	L3LCD2	L4LCA2	L4LCD2	OG1CA2	OG1CD2				
<b>Total</b>	iACTOT;i1DCTOT;i1DCTOT;i1DCTOT;i1DCTOT		i2ACTOT;i2DCTOT;i2DCTOT;i2DCTOT		iACTOT;i1DCTOT;i1DCTOT;i1DCTOT		i2ACTOT;i2DCTOT;i2DCTOT;i2DCTOT		i3ACTOT;i3DCTOT;i3DCTOT;i3DCTOT		i4ACTOT;i4DCTOT;i4DCTOT;i4DCTOT		i3ACTOT;i3DCTOT;i3DCTOT;i3DCTOT		i4ACTOT;i4DCTOT;i4DCTOT;i4DCTOT		iGACTOT;iGDCTOT;iGACTOT;iGDCTOT		iACTOT;i1DCTOT					
<b>8 - 9</b>	G1L9A2	G1L9D2	G2L9A2	G2L9D2	L1L9A2	L1L9D2	L2L9A2	L2L9D2																
<b>7 - 7.9</b>	G1L8A2	G1L8D2	G2L8A2	G2L8D2	L1L8A2	L1L8D2	L2L8A2	L2L8D2																
<b>6 - 6.9</b>	G1L7A2	G1L7D2	G2L7A2	G2L7D2	L1L7A2	L1L7D2	L2L7A2	L2L7D2																
<b>5 - 5.9</b>	G1L6A2	G1L6D2	G2L6A2	G2L6D2	L1L6A2	L1L6D2	L2L6A2	L2L6D2																
<b>4 - 4.9</b>	G1L5A2	G1L5D2	G2L5A2	G2L5D2	L1L5A2	L1L5D2	L2L5A2	L2L5D2																
<b>3 - 3.9</b>	G1L4A2	G1L4D2	G2L4A2	G2L4D2	L1L4A2	L1L4D2	L2L4A2	L2L4D2																
<b>2 - 2.9</b>	G1L3A2	G1L3D2	G2L3A2	G2L3D2	L1L3A2	L1L3D2	L2L3A2	L2L3D2																
<b>1 - 1.9</b>	G1L2A2	G1L2D2	G2L2A2	G2L2D2	L1L2A2	L1L2D2	L2L2A2	L2L2D2																
<b>&gt;0 - 0.9</b>	G1L1A2	G1L1D2	G2L1A2	G2L1D2	L1L1A2	L1L1D2	L2L1A2	L2L1D2																
<b>Clean</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>Clean</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>				
<b>Total Rating</b>	i1ALTOT;i1DLTOT;i1DLTOT;i1DLTOT		i2ALTOT;i2DLTOT;i2DLTOT;i2DLTOT		i1ALTOT;i1DLTOT;i1DLTOT;i1DLTOT		i2ALTOT;i2DLTOT;i2DLTOT;i2DLTOT		i3ALTOT;i3DLTOT;i3DLTOT;i3DLTOT		i4ALTOT;i4DLTOT;i4DLTOT;i4DLTOT		i3ALTOT;i3DLTOT;i3DLTOT;i3DLTOT		i4ALTOT;i4DLTOT;i4DLTOT;i4DLTOT		iGAVTOT;iGDVTOT;iGAVTOT;iGDVTOT		iALTOT;i1DLTOT					
	G1UWD2	G1UWD2	G2UWD2	G2UWD2	L1UWD2	L1UWD2	L2UWD2	L2UWD2					G3UWD2	G3UWD2	L3UWD2	L3UWD2	L4UWD2	L4UWD2	OGUWD2	OGUWD2				
<b>TGC</b>	UWD2					UWD2					TLC2					TLC2								
	TGC2					UWD2					TLC2					TLC2								
<b>Unweighted Deposits</b>										<b>Top Land Carbon</b>										<b>T.L. Flaked Carbon %</b>				
																				TLFC2				

**ISM Lubricant Performance Test  
Form 13  
Piston 3 Deposit Ratings**

Laboratory:	LAB	EOT Date:	DTCOMP	EOT Time:	EOTTIME
<b>Test Number</b>					
Stand:	STAND	Engine:	ENGINE	Engine Run No.:	ENRUN
Formulation / Stand Code: FORM					
Oil Code: OILCODE					

**Total Piston Ratings Summary**

Dep. Factor	Grooves			Lands			Dep. Factor	Lands			Groove		No. 3		No. 4		Oil Cooling		Under Crown	
	No. 1	A, %	Dem.	No. 2	A, %	Dem.		No. 1	A, %	Dem.	No. 2	A, %	Dem.	No. 3	A, %	Dem.	No. 4	A, %	Dem.	A, %
<b>HC -1.0</b>	G1HCA3	G1HCD3	G2HCA3	G2HCD3	L1HCA3	L1HCD3	L2HCA3	L2HCD3												
<b>MC -0.5</b>	G1MCA3	G1MCD3																		
<b>LC - .25</b>	G1LCA3	G1LCD3	G2LCA3	G2LCD3	L1LCA3	L1LCD3	L2LCA3	L2LCD3												
<b>Total</b>	3ACTOT	3IDCTOT	32ACTOT	32DCTOT	31ACTOT	31DCTOT	32ACTOT	32DCTOT												
<b>8 - 9</b>	G1L9A3	G1L9D3	G2L9A3	G2L9D3	L1L9A3	L1L9D3	L2L9A3	L2L9D3												
<b>7 - 7.9</b>	G1L8A3	G1L8D3	G2L8A3	G2L8D3	L1L8A3	L1L8D3	L2L8A3	L2L8D3												
<b>6 - 6.9</b>	G1L7A3	G1L7D3	G2L7A3	G2L7D3	L1L7A3	L1L7D3	L2L7A3	L2L7D3												
<b>5 - 5.9</b>	G1L6A3	G1L6D3	G2L6A3	G2L6D3	L1L6A3	L1L6D3	L2L6A3	L2L6D3												
<b>4 - 4.9</b>	G1L5A3	G1L5D3	G2L5A3	G2L5D3	L1L5A3	L1L5D3	L2L5A3	L2L5D3												
<b>3 - 3.9</b>	G1L4A3	G1L4D3	G2L4A3	G2L4D3	L1L4A3	L1L4D3	L2L4A3	L2L4D3												
<b>2 - 2.9</b>	G1L3A3	G1L3D3	G2L3A3	G2L3D3	L1L3A3	L1L3D3	L2L3A3	L2L3D3												
<b>1 - 1.9</b>	G1L2A3	G1L2D3	G2L2A3	G2L2D3	L1L2A3	L1L2D3	L2L2A3	L2L2D3												
<b>&gt;0 - 0.9</b>	G1L1A3	G1L1D3	G2L1A3	G2L1D3	L1L1A3	L1L1D3	L2L1A3	L2L1D3												
<b>Clean</b>	0	0	0	0	0	0	0	0												
<b>Total</b>	31ALTOT	31DLTOT	32ALTOT	32DLTOT	31ALTOT	31DLTOT	32ALTOT	32DLTOT												
<b>Rating</b>	GIUWD3		G2UWD3		L1UWD3		L2UWD3													

<b>TGC</b>	UWD3	<b>Top Land Carbon</b>	TLC3
TGC3		<b>T.L. Flaked Carbon %</b>	TLFC3
			UCUWD3

**ISM Lubricant Performance Test  
Form 14  
Piston 4 Deposit Ratings**

Laboratory:	LAB	EOT Date:	DTCOMP	EOT Time:	EOTIME
<b>Test Number</b>					
Stand:	STAND	Engine:	ENGINE	Engine Run No.:	ENRUN
Formulation / Stand Code: FORM					
Oil Code: OILCODE					

Total Piston Ratings Summary																			
Dep. Factor	Grooves				Lands				Dep. Factor	Lands				Oil Cooling		Under Crown			
	No. 1		No. 2		No. 1		No. 2			No. 3		No. 4		A, %	Dem.	A, %	Dem.	A, %	Dem.
	A, %	Dem.	A, %	Dem.	A, %	Dem.	A, %	Dem.		A, %	Dem.	A, %	Dem.	A, %	Dem.	A, %	Dem.	A, %	Dem.
<b>HC -1.0</b>	G1HCA4	G1HCD4	G2HCA4	G2HCD4	L1HCA4	L1HCD4	L2HCA4	L2HCD4		G3HCA4	G3HCD4	L3HCA4	L3HCD4	L4HCA4	L4HCD4				
<b>MC -0.5</b>	G1MCA4	G1MCD4								G3MCA4	G3MCD4								
<b>LC - .25</b>	G1LCA4	G1LCD4	G2LCA4	G2LCD4	L1LCA4	L1LCD4	L2LCA4	L2LCD4		G3LCA4	G3LCD4	L3LCA4	L3LCD4	L4LCA4	L4LCD4	OGLCA4	OGLCD4	U1LCA4	U1LCD4
<b>Total</b>	1ACTOT1 1DCTOT1		2ACTOT2 2DCTOT2		1ACTOT1 1DCTOT1		2ACTOT2 2DCTOT2			3ACTOT3 3DCTOT3		4ACTOT4 4DCTOT4		GACTOT1 GDCTOT1		IACTOT1 IDCTOT1			
<b>8 - 9</b>	G1L9A4	G1L9D4	G2L9A4	G2L9D4	L1L9A4	L1L9D4	L2L9A4	L2L9D4											
<b>7 - 7.9</b>	G1L8A4	G1L8D4	G2L8A4	G2L8D4	L1L8A4	L1L8D4	L2L8A4	L2L8D4											
<b>6 - 6.9</b>	G1L7A4	G1L7D4	G2L7A4	G2L7D4	L1L7A4	L1L7D4	L2L7A4	L2L7D4	7.5	G3L75A4	G3L75D4	L3L75A4	L3L75D4	L4L75A4	L4L75D4	OGV75A-	OGV75D4	U1L75A4	U1L75D4
<b>5 - 5.9</b>	G1L6A4	G1L6D4	G2L6A4	G2L6D4	L1L6A4	L1L6D4	L2L6A4	L2L6D4											
<b>4 - 4.9</b>	G1L5A4	G1L5D4	G2L5A4	G2L5D4	L1L5A4	L1L5D4	L2L5A4	L2L5D4	4.5	G3L45A4	G3L45D4	L3L45A4	L3L45D4	L4L45A4	L4L45D4	OGV45A-	OGV45D4	U1L45A4	U1L45D4
<b>3 - 3.9</b>	G1L4A4	G1L4D4	G2L4A4	G2L4D4	L1L4A4	L1L4D4	L2L4A4	L2L4D4											
<b>2 - 2.9</b>	G1L3A4	G1L3D4	G2L3A4	G2L3D4	L1L3A4	L1L3D4	L2L3A4	L2L3D4											
<b>1 - 1.9</b>	G1L2A4	G1L2D4	G2L2A4	G2L2D4	L1L2A4	L1L2D4	L2L2A4	L2L2D4	1.5	G3L15A4	G3L15D4	L3L15A4	L3L15D4	L4L15A4	L4L15D4	OGV15A-	OGV15D4	U1L15A4	U1L15D4
<b>&gt;0 - 0.9</b>	G1L1A4	G1L1D4	G2L1A4	G2L1D4	L1L1A4	L1L1D4	L2L1A4	L2L1D4	Clean	0	0	0	0	0	0	0	0	0	0
<b>Total Rating</b>	1ALTOT1 1DLTOT1		2ALTOT2 2DLTOT2		1ALTOT1 1DLTOT1		2ALTOT2 2DLTOT2			3ALTOT3 3DLTOT3		4ALTOT4 4DLTOT4		GAVTOT1 GDVTOT1		IALTOT1 IDLTOT1		UCUWD4	
										<b>Top Land Carbon</b>				<b>T.L. Flaked Carbon %</b>					
										TLC4				TLFC4					
										UWD4									

**ISM Lubricant Performance Test  
Form 15  
Piston 5 Deposit Ratings**

Laboratory:	LAB	EOT Date:	DTCOMP	EOT Time:	EOTIME
<b>Test Number</b>					
Stand:	STAND	Engine:	ENGINE	Engine Run No.:	ENRUN
Formulation / Stand Code: FORM					
Oil Code: OILCODE					

Total Piston Ratings Summary														
Dep. Factor	Grooves			Lands			Dep. Factor	Lands			Oil			Under Crown
	No. 1		No. 2	No. 1		No. 2		No. 3		No. 4	Cooling		Dem.	
	A,%	Dem.	A,%	Dem.	A,%	Dem.		A,%	Dem.	A,%	A,%			
<b>HC -1.0</b>	G1HCA5	G1HCD5	G2HCA5	G2HCD5	L1HCA5	L1HCD5	L2HCA5	L2HCD5	G3HCA5	G3HCD5	L3HCA5	L3HCD5	L4HCA5	L4HCD5
<b>MC -0.5</b>	G1MCA5	G1MCD5	G2MCA5	G2MCD5	L1MCA5	L1MCD5	L2MCA5	L2MCD5	G3MCA5	G3MCD5	L3MCA5	L3MCD5	L4MCA5	L4MCD5
<b>LC - .25</b>	G1LCA5	G1LCD5	G2LCA5	G2LCD5	L1LCA5	L1LCD5	L2LCA5	L2LCD5	G3LCA5	G3LCD5	L3LCA5	L3LCD5	L4LCA5	L4LCD5
<b>Total</b>	1ACTOT;1IDCTOT;1ACTOT;1IDCTOT		2ACTOT;2IDCTOT		1ACTOT;1IDCTOT		2ACTOT;2IDCTOT		3ACTOT;3IDCTOT		4ACTOT;4IDCTOT		5ACTOT;5IDCTOT	
<b>8 - 9</b>	G1L9A5	G1L9D5	G2L9A5	G2L9D5	L1L9A5	L1L9D5	L2L9A5	L2L9D5	G3L9A5	G3L9D5	L3L9A5	L3L9D5	L4L9A5	L4L9D5
<b>7 - 7.9</b>	G1L8A5	G1L8D5	G2L8A5	G2L8D5	L1L8A5	L1L8D5	L2L8A5	L2L8D5	G3L8A5	G3L8D5	L3L8A5	L3L8D5	L4L8A5	L4L8D5
<b>6 - 6.9</b>	G1L7A5	G1L7D5	G2L7A5	G2L7D5	L1L7A5	L1L7D5	L2L7A5	L2L7D5	G3L7A5	G3L7D5	L3L7A5	L3L7D5	L4L7A5	L4L7D5
<b>5 - 5.9</b>	G1L6A5	G1L6D5	G2L6A5	G2L6D5	L1L6A5	L1L6D5	L2L6A5	L2L6D5	G3L6A5	G3L6D5	L3L6A5	L3L6D5	L4L6A5	L4L6D5
<b>4 - 4.9</b>	G1L5A5	G1L5D5	G2L5A5	G2L5D5	L1L5A5	L1L5D5	L2L5A5	L2L5D5	G3L5A5	G3L5D5	L3L5A5	L3L5D5	L4L5A5	L4L5D5
<b>3 - 3.9</b>	G1L4A5	G1L4D5	G2L4A5	G2L4D5	L1L4A5	L1L4D5	L2L4A5	L2L4D5	G3L4A5	G3L4D5	L3L4A5	L3L4D5	L4L4A5	L4L4D5
<b>2 - 2.9</b>	G1L3A5	G1L3D5	G2L3A5	G2L3D5	L1L3A5	L1L3D5	L2L3A5	L2L3D5	G3L3A5	G3L3D5	L3L3A5	L3L3D5	L4L3A5	L4L3D5
<b>1 - 1.9</b>	G1L2A5	G1L2D5	G2L2A5	G2L2D5	L1L2A5	L1L2D5	L2L2A5	L2L2D5	G3L2A5	G3L2D5	L3L2A5	L3L2D5	L4L2A5	L4L2D5
<b>&gt;0 - 0.9</b>	G1L1A5	G1L1D5	G2L1A5	G2L1D5	L1L1A5	L1L1D5	L2L1A5	L2L1D5	G3L1A5	G3L1D5	L3L1A5	L3L1D5	L4L1A5	L4L1D5
<b>Clean</b>	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Total Rating</b>	1ALTOT;1IDLTOT;1ALTOT;1IDLTOT		2ALTOT;2IDLTOT		1ALTOT;1IDLTOT		2ALTOT;2IDLTOT		3ALTOT;3IDLTOT		4ALTOT;4IDLTOT		5ALTOT;5IDLTOT	
	G1UWD5	G1UWD5	G2UWD5	G2UWD5	L1UWD5	L1UWD5	L2UWD5	L2UWD5	G3UWD5	G3UWD5	L3UWD5	L3UWD5	L4UWD5	L4UWD5
	<b>Unweighted Deposits</b>			<b>Top Land Carbon</b>			<b>T.L. Flaked Carbon %</b>							
	UWD5			TLC5			TLFC5			TLFC5				

**ISM Lubricant Performance Test  
Form 16  
Piston 6 Deposit Ratings**

Laboratory:	LAB	EOT Date:	DTCOMP	EOT Time:	EOTIME
<b>Test Number</b>					
Stand:	STAND	Engine:	ENGINE	Engine Run No.:	ENRUN
Formulation / Stand Code: FORM					
Oil Code: OILCODE					

Total Piston Ratings Summary																	
Dep. Factor	Grooves						Dep. Factor	Lands									
	No. 1		No. 2		No. 1			No. 2		No. 3		No. 4		Oil Cooling		Under Crown	
	A,%	Dem.	A,%	Dem.	A,%	Dem.		A,%	Dem.	A,%	Dem.	A,%	Dem.	A,%	Dem.	A,%	Dem.
<b>HC -1.0</b>	G1HCA6	G1HCD6	G2HCA6	G2HCD6	L1HCA6	L1HCD6	L2HCA6	L2HCD6	G3HCA6	G3HCD6	L3HCA6	L3HCD6	L4HCA6	L4HCD6			
<b>MC -0.5</b>	G1MCA6	G1MCD6							G3MCA6	G3MCD6							
<b>LC - .25</b>	G1LCA6	G1LCD6	G2LCA6	G2LCD6	L1LCA6	L1LCD6	L2LCA6	L2LCD6	G3LCA6	G3LCD6	L3LCA6	L3LCD6	L4LCA6	L4LCD6	OG1CA6	OG1CD6	
<b>Total</b>	1ACTOT11DCTOT1		2ACTOT12DCTOT2		1ACTOT11DCTOT1		2ACTOT12DCTOT2		3ACTOT13DCTOT3		4ACTOT14DCTOT4		GACTOT1GDCTOT1		1ACTOT11DCTOT1		
<b>8 - 9</b>	G1L9A6	G1L9D6	G2L9A6	G2L9D6	L1L9A6	L1L9D6	L2L9A6	L2L9D6									
<b>7 - 7.9</b>	G1L8A6	G1L8D6	G2L8A6	G2L8D6	L1L8A6	L1L8D6	L2L8A6	L2L8D6									
<b>6 - 6.9</b>	G1L7A6	G1L7D6	G2L7A6	G2L7D6	L1L7A6	L1L7D6	L2L7A6	L2L7D6	G3L75A6	G3L75D6	L3L75A6	L3L75D6	L4L75A6	L4L75D6	OGV75A6	OGV75D6	
<b>5 - 5.9</b>	G1L6A6	G1L6D6	G2L6A6	G2L6D6	L1L6A6	L1L6D6	L2L6A6	L2L6D6									
<b>4 - 4.9</b>	G1L5A6	G1L5D6	G2L5A6	G2L5D6	L1L5A6	L1L5D6	L2L5A6	L2L5D6	G3L45A6	G3L45D6	L3L45A6	L3L45D6	L4L45A6	L4L45D6	OGV45A6	OGV45D6	
<b>3 - 3.9</b>	G1L4A6	G1L4D6	G2L4A6	G2L4D6	L1L4A6	L1L4D6	L2L4A6	L2L4D6									
<b>2 - 2.9</b>	G1L3A6	G1L3D6	G2L3A6	G2L3D6	L1L3A6	L1L3D6	L2L3A6	L2L3D6									
<b>1 - 1.9</b>	G1L2A6	G1L2D6	G2L2A6	G2L2D6	L1L2A6	L1L2D6	L2L2A6	L2L2D6	G3L15A6	G3L15D6	L3L15A6	L3L15D6	L4L15A6	L4L15D6	OGV15A6	OGV15D6	
<b>&gt;0 - 0.9</b>	G1L1A6	G1L1D6	G2L1A6	G2L1D6	L1L1A6	L1L1D6	L2L1A6	L2L1D6									
<b>Clean</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	
<b>Total Rating</b>	11ALTOT11DLTOT1		22ALTOT12DLTOT2		11ALTOT11DLTOT1		22ALTOT12DLTOT2		33ALTOT13DLTOT3		44ALTOT14DLTOT4		GAVTOT1GADVTOT1		1ALTOT11DLTOT1		
	G1UWD6	G1UWD6	G2UWD6	G2UWD6	L1UWD6	L1UWD6	L2UWD6	L2UWD6	G3UWD6	G3UWD6	L3UWD6	L3UWD6	L4UWD6	L4UWD6	OGUWD6	UCUWD6	
<b>TGC</b>	UWD6						Unweighted Deposits						T.L. Flaked Carbon %				
	TGC6						TLC6						TLFC6				



**ISM Lubricant Performance Test  
Form 17  
Ring Mass Loss Summary**

Laboratory:	LAB	EOT Date:	DTCOMP	EOT Time:	EOTTIME
<b>Test Number</b>					
Stand:	STAND	Engine:	ENGINE	Engine Run No.:	ENRUN
Formulation / Stand Code:	FORM				
Oil Code:	OILCODE				

Cylinder	Top Ring			Second Ring			Oil Ring		
	Mass (g)		Mass Loss (mg)	Mass (g)		Mass Loss (mg)	Mass (g)		Mass Loss (mg)
	Pretest	EOT		Pretest	EOT		Pretest	EOT	
<b>1</b>	RWCYL1PT	RWCYL1ET	RWLCYL1T	RWCYL1PS	RWCYL1ES	RWLCYL1S	RWCYL1PO	RWCYL1EO	RWLCYL1O
<b>2</b>	RWCYL2PT	RWCYL2ET	RWLCYL2T	RWCYL2PS	RWCYL2ES	RWLCYL2S	RWCYL2PO	RWCYL2EO	RWLCYL2O
<b>3</b>	RWCYL3PT	RWCYL3ET	RWLCYL3T	RWCYL3PS	RWCYL3ES	RWLCYL3S	RWCYL3PO	RWCYL3EO	RWLCYL3O
<b>4</b>	RWCYL4PT	RWCYL4ET	RWLCYL4T	RWCYL4PS	RWCYL4ES	RWLCYL4S	RWCYL4PO	RWCYL4EO	RWLCYL4O
<b>5</b>	RWCYL5PT	RWCYL5ET	RWLCYL5T	RWCYL5PS	RWCYL5ES	RWLCYL5S	RWCYL5PO	RWCYL5EO	RWLCYL5O
<b>6</b>	RWCYL6PT	RWCYL6ET	RWLCYL6T	RWCYL6PS	RWCYL6ES	RWLCYL6S	RWCYL6PO	RWCYL6EO	RWLCYL6O
<b>As Measured Results</b>									
<b>Average Mass Loss (mg)</b>	AMARWLT			ARWLS			ARWLO		
<b>Std. Dev. Mass Loss (mg)</b>	SRWLT			SRWLS			SRWLO		
<b>Maximum Mass Loss (mg)</b>	XRWLT			XRWLS			XRWLO		
<b>Minimum Mass Loss (mg)</b>	IRWLT			IRWLS			IRWLO		
<b>Outlier Top Ring (cylinder number)</b>	RINGOUT								
<b>Outlier Screened Results</b>									
<b>Average Mass Loss (mg)</b>	ARWLT								

**ISM Lubricant Performance Test  
Form 18  
Oil Analysis Summary**

Laboratory:	LAB	EOT Date:	DTCOMP	EOT Time:	EOTIME
<b>Test Number</b>					
Stand:	STAND	Engine:	ENGINE	Engine Run No.:	ENRUN
Formulation / Stand Code: FORM					
Oil Code: OILCODE					

Test Hours	Viscosity @ 100°C, cSt	TGA % Soot	TBN D4739	TAN D664	Copper (ppm)	Iron (ppm)	Lead (ppm)	Aluminum (ppm)	Chromium (ppm)
NEW	V100NEW	TGANEW	TBNNEW	TANNEW	CUWMNEW	FEWMNEW	PBWNEW	ALWNEW	CRWNEW
TST_H025	V100H025	TGA_H025	TBN_H050	TAN_H050	CUWMH025	FEWMH025	PBWMH025	ALWMH025	CRWMH025
TST_H050	V100H050	TGA050	TBN_H050	TAN_H050	CUWMH050	FEWMH050	PBWMH050	ALWMH050	CRWMH050
TST_H075	V100H075	TGA_H075	TBN_H075	TAN_H075	CUWMH075	FEWMH075	PBWMH075	ALWMH075	CRWMH075
TST_H100	V100H100	TGA_H100	TBN_H100	TAN_H100	CUWMH100	FEWMH100	PBWMH100	ALWMH100	CRWMH100
TST_H125	V100H125	TGA_H125	TBN_H125	TAN_H125	CUWMH125	FEWMH125	PBWMH125	ALWMH125	CRWMH125
TST_H150	V100H150	TGA150	TBN_H150	TAN_H150	CUWMH150	FEWMH150	PBWMH150	ALWMH150	CRWMH150
TST_H175	V100H175	TGA_H175	TBN_H175	TAN_H175	CUWMH175	FEWMH175	PBWMH175	ALWMH175	CRWMH175
TST_H200	V100H200	TGA_H200	TBN_H200	TAN_H200	CUWMH200	FEWMH200	PBWMH200	ALWMH200	CRWMH200

**ISM Lubricant Performance Test  
Form 19  
Test Fuel Analysis (Last Batch)**

Laboratory:	LAB	EOT Date:	DTCOMP	EOT Time:	EOTTIME
<b>Test Number</b>					
Stand:	STAND	Engine:	ENGINE	Engine Run No.:	ENRUN
Formulation / Stand Code:			FORM		
Oil Code:			OILCODE		

<b>Fuel Supplier</b>	<b>Fuel Batch Identifier</b>
FUELSUP	FUELBTID

Measurement	Specifications	Analysis		Test Method
		New	EOT	
Total Sulfur, % Weight	0.04 - 0.05	FUELSNEW	FUELSEOT	D 2662
Gravity, °API	34.5 - 36.5	APIGRNEW	APIGREOT	D 1298
<b>Hydrocarbon Composition</b>				
Aromatics % Volume	28 – 33	FUELAROM		D 1319
Olefin	Report	FUELOLEF		D 1319
Cetane Index	Report	CETANEIN		D 4737
Cetane Number	42 – 48	CETANENO		D 613
Copper Strip Corrosion	1 Maximum	FUELUCU		D 130
Flash Point, °C	54 Maximum	FLASHPT		D 93
Pour Point, °C	-18 Maximum	FUELPOUR		D 97
Carbon Residue on 10% Residuum, %	0.35 Maximum	FUELGRES		D 524 (10% Bottoms)
Water & Sediment, % Volume	0.05 Maximum	FUELH2O		D 2709
Viscosity, cSt @ 40 °C	2.4 - 3.0	KINVIS		D 445
Total Acid Number	0.05 Maximum	FUELTAN		D 664
Strong Acid Number	0.00 Maximum	FUELSAN		D 664
Accelerated Stability	Tbd	FUELACS		D 2274
Saturates, %	Report	FUELSATU		D 1319
Cloud Point, °C	Report	FUELCLOU		D 2500
<b>Distillation, °C</b>				
IBP	Report	FUELIBP		D 86
10%	Report	FUEL10		D 86
50%	Report	FUEL50		D 86
90%	282 – 338	FUEL90		D 86
EP	Report	FUELEP		D 86

**ISM Lubricant Performance Test  
Form 20  
Injector Adjusting Screw Mass Loss**

Laboratory:	LAB	EOT Date:	DTCOMP	EOT Time:	EOTTIME
<b>Test Number</b>					
Stand:	STAND	Engine:	ENGINE	Engine Run No.:	ENRUN
Formulation / Stand Code:			FORM		
Oil Code:			OILCODE		

Screw #	Evidence of Scuffing?	Pretest Mass, g	Post-Test Mass, g	Mass Loss, mg
<b>1</b>	IASSCUF1	BOTIAS1	EOTIAS1	IASWL1
<b>2</b>	IASSCUF2	BOTIAS2	EOTIAS2	IASWL2
<b>3</b>	IASSCUF3	BOTIAS3	EOTIAS3	IASWL3
<b>4</b>	IASSCUF4	BOTIAS4	EOTIAS4	IASWL4
<b>5</b>	IASSCUF5	BOTIAS5	EOTIAS5	IASWL5
<b>6</b>	IASSCUF6	BOTIAS6	EOTIAS6	IASWL6
			<b>Total</b>	IASWLTOT
			<b>Average</b>	AVGIAS

**ISM Lubricant Performance Test  
Form 21  
Unscheduled Downtime & Maintenance Summary**

Laboratory: LAB	EOT Date: DTCOMP	EOT Time: EOTTIME
<b>Test Number</b>		
Stand: STAND	Engine:	Engine Run No.: ENRUN
Formulation / Stand Code:		FORM
Oil Code:		OILCODE

Number of Downtime Occurrences			DWNOCR
Test Hours	Date	Downtime	Reasons
DOWNR001	DDATR001	DTIMR001	DREAR001
DOWNR002	DDATR002	DTIMR002	DREAR002
DOWNR003	DDATR003	DTIMR003	DREAR003
DOWNR004	DDATR004	DTIMR004	DREAR004
DOWNR005	DDATR005	DTIMR005	DREAR005
DOWNR006	DDATR006	DTIMR006	DREAR006
DOWNR007	DDATR007	DTIMR007	DREAR007
DOWNR008	DDATR008	DTIMR008	DREAR008
DOWNR009	DDATR009	DTIMR009	DREAR009
DOWNR010	DDATR010	DTIMR010	DREAR010
DOWNR011	DDATR011	DTIMR011	DREAR011
DOWNR012	DDATR012	DTIMR012	DREAR012
DOWNR013	DDATR013	DTIMR013	DREAR013
DOWNR014	DDATR014	DTIMR014	DREAR014
DOWNR015	DDATR015	DTIMR015	DREAR015
<b>TOTLDOWN</b>			Total Downtime (hours)

Other Comments	
Number of Comment Lines	TOTCOM
	OCOMR001
	OCOMR002
	OCOMR003
	OCOMR004
	OCOMR005
	OCOMR006
	OCOMR007
	OCOMR008
	OCOMR009
	OCOMR010
	OCOMR011
	OCOMR012
	OCOMR013
	OCOMR014
	OCOMR015

**ISM Lubricant Performance Test  
Form 21a  
Unscheduled Downtime & Maintenance Summary**

Laboratory: LAB	EOT Date: DTCOMP	EOT Time: EOTTIME
<b>Test Number</b>		
Stand: STAND	Engine:	Engine Run No.: ENRUN
Formulation / Stand Code:		FORM
Oil Code:		OILCODE

Number of Downtime Occurrences			DWNOCR
Test Hours	Date	Downtime	Reasons
DOWNR016	DDATR016	DTIMR016	DREAR016
DOWNR017	DDATR017	DTIMR017	DREAR017
DOWNR018	DDATR018	DTIMR018	DREAR018
DOWNR019	DDATR019	DTIMR019	DREAR019
DOWNR020	DDATR020	DTIMR020	DREAR020
DOWNR021	DDATR021	DTIMR021	DREAR021
DOWNR022	DDATR022	DTIMR022	DREAR022
DOWNR023	DDATR023	DTIMR023	DREAR023
DOWNR024	DDATR024	DTIMR024	DREAR024
DOWNR025	DDATR025	DTIMR025	DREAR025
DOWNR026	DDATR026	DTIMR026	DREAR026
DOWNR027	DDATR027	DTIMR027	DREAR027
DOWNR028	DDATR028	DTIMR028	DREAR028
DOWNR029	DDATR029	DTIMR029	DREAR029
DOWNR030	DDATR030	DTIMR030	DREAR030
TOTLDOWN			Total Downtime (hours)

Other Comments	
Number of Comment Lines	TOTCOM
	OCOMR016
	OCOMR017
	OCOMR018
	OCOMR019
	OCOMR020
	OCOMR021
	OCOMR022
	OCOMR023
	OCOMR024
	OCOMR025
	OCOMR026
	OCOMR027
	OCOMR028
	OCOMR029
	OCOMR030

**ISM Lubricant Performance Test  
Form 21b  
Unscheduled Downtime & Maintenance Summary**

Laboratory: LAB	EOT Date: DTCOMP	EOT Time: EOTIME
<b>Test Number</b>		
Stand: STAND	Engine:	Engine Run No.: ENRUN
Formulation / Stand Code:		FORM
Oil Code:		OILCODE

Number of Downtime Occurrences			DWNOCR
Test Hours	Date	Downtime	Reasons
DOWNR031	DDATR031	DTIMR031	DREAR031
DOWNR032	DDATR032	DTIMR032	DREAR032
DOWNR033	DDATR033	DTIMR033	DREAR033
DOWNR034	DDATR034	DTIMR034	DREAR034
DOWNR035	DDATR035	DTIMR035	DREAR035
DOWNR036	DDATR036	DTIMR036	DREAR036
DOWNR037	DDATR037	DTIMR037	DREAR037
DOWNR038	DDATR038	DTIMR038	DREAR038
DOWNR039	DDATR039	DTIMR039	DREAR039
DOWNR040	DDATR040	DTIMR040	DREAR040
DOWNR041	DDATR041	DTIMR041	DREAR041
DOWNR042	DDATR042	DTIMR042	DREAR042
DOWNR043	DDATR043	DTIMR043	DREAR043
DOWNR044	DDATR044	DTIMR044	DREAR044
DOWNR045	DDATR045	DTIMR045	DREAR045
<b>TOTLDOWN</b>			Total Downtime (hours)

Other Comments	
Number of Comment Lines	TOTCOM
	OCOMR031
	OCOMR032
	OCOMR033
	OCOMR034
	OCOMR035
	OCOMR036
	OCOMR037
	OCOMR038
	OCOMR039
	OCOMR040
	OCOMR041
	OCOMR042
	OCOMR043
	OCOMR044
	OCOMR045

**ISM Lubricant Performance Test  
Form 22  
Characteristics Of The Data Acquisition System**

Laboratory:	LAB	EOT Date:	DTCOMP	EOT Time:	EOTTIME
<b>Test Number</b>					
Stand:	STAND	Engine:	ENGINE	Engine Run No.:	ENRUN
Formulation / Stand Code:			FORM		
Oil Code:			OILCODE		

Parameter (1)	Sensing Device (2)	Calibration Frequency (3)	Record Device (4)	Observation Frequency (5)	Record Frequency (6)	Log Frequency (7)	System Response (8)
<b>Temperatures</b>							
Oil @ Filt.	OTEMSENS	OTEMCALF	OTEMRECD	OTEMOBSF	OTEMRECF	OTEMLOGF	OTEMSYSR
Fuel In.	FTEMSSENS	FTEMCALF	FTEMRECD	FTEMOBSF	FTEMRECF	FTEMLOGF	FTEMSYSR
Intake Air	AITSENS	AITCALF	AITRECD	AITOBSF	AITRECF	AITLOGF	AITSYSR
Intake Man.	IMANSENS	IMANCALF	IMANRECD	IMANOBSF	IMANRECF	IMANLOGF	IMANSYSR
Pre-Turb.	PTURSENS	PTURCALF	PTURRECD	PTUROBSF	PTURRECF	PTURLOGF	PTURSYSR
Cool. Out	COTSENS	COTCALF	COTRECD	COTOBSF	COTRECF	COTLOGF	COTSYSR
<b>Pressure</b>							
Inlet Air	INRESENS	INRECALF	INRERECD	INREOBSF	INRERECF	INRELOGF	INRESYSR
Exhaust	EXPRSENS	EXPRCALF	EXPRECD	EXPROBSF	EXPRECF	EXPRLOGF	EXPRSYSR
Oil Gallery	OILGSENS	OILGCALF	OILGRECD	OILGOBSF	OILGRECF	OILGLOGF	OILGSYSR
<b>Other</b>							
Fuel Flow	FFLOSENS	FFLOCALF	FFLORECD	FFLOOBSF	FFLORECF	FFLOLOGF	FFLOSYSR
Speed	RPMSSENS	RPMCALF	RPMRECD	RPMOBSF	RPMRECF	RPMLOGF	RPMSYSR
Load	LOADSENS	LOADCALF	LOADRECD	LOADOBSF	LOADRECF	LOADLOGF	LOADSYSR

**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



**ISM Lubricant Performance Test  
Form 23  
Valve Adjusting Screw Mass Loss Summary**

Laboratory:	LAB	EOT Date:	DTCOMP	EOT Time:	EOTTIME
<b>Test Number</b>					
Stand:	STAND	Engine:	ENGINE	Engine Run No.:	ENRUN
Formulation / Stand Code:			FORM		
Oil Code:		OILCODE			

Location	Evidence of Scuffing?	Pretest Mass (g)	EOT Mass (g)	Mass Loss (mg)
1E	VSSCUF1E	VASPTW1E	VASEW1E	VASEWL1E
1I	VSSCUF1I	VASPTW1I	VASEW1I	VASEWL1I
2I	VSSCUF2I	VASPTW2I	VASEW2I	VASEWL2I
2E	VSSCUF2E	VASPTW2E	VASEW2E	VASEWL2E
3E	VSSCUF3E	VASPTW3E	VASEW3E	VASEWL3E
3I	VSSCUF3I	VASPTW3I	VASEW3I	VASEWL3I
4I	VSSCUF4I	VASPTW4I	VASEW4I	VASEWL4I
4E	VSSCUF4E	VASPTW4E	VASEW4E	VASEWL4E
5E	VSSCUF5E	VASPTW5E	VASEW5E	VASEWL5E
5I	VSSCUF5I	VASPTW5I	VASEW5I	VASEWL5I
6I	VSSCUF6I	VASPTW6I	VASEW6I	VASEWL6I
6E	VSSCUF6E	VASPTW6E	VASEW6E	VASEWL6E

Intake / Exhaust Summary	Intake		Exhaust	
	As Measured	Outlier Screened	As Measured	Outlier Screened
Average Mass Loss (mg)	AVASWLI	OAVASWLI	AVASWLE	OAVASWLE
Minimum Mass Loss (mg)	IVASWLI	OIVASWLI	IVASWLE	OIVASWLE
Maximum Mass Loss (mg)	XVASWLI	OXVASWLI	XVASWLE	OXVASWLE
Standard Deviation (mg)	SVASWLI	OSVASWLI	SVASWLE	OSVASWLE
Outlier Locations <sup>A</sup>	VASOUTI		VASOUTE	

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

Overall Summary	As Measured	Outlier Screened	Adjusted to 4.6% Soot
Average Mass Loss (mg)	AMAVSWL	OVSWL	VSWL
Minimum Mass Loss (mg)	AMIVSWL	IVASWL	
Maximum Mass Loss (mg)	AMXVSWL	XVASWL	
Standard Deviation (mg)	AMSVSWL	SVASWL	

**ISM Lubricant Performance Test  
Form 24  
Rocker Hat Mass Loss Summary**

Laboratory:	LAB	EOT Date:	DTCOMP	EOT Time:	EOTTIME
<b>Test Number</b>					
Stand:	STAND	Engine:	ENGINE	Engine Run No.:	ENRUN
Formulation / Stand Code:			FORM		
Oil Code:	OILCODE				

Location	Evidence of Scuffing?	Pretest Mass (g)	EOT Mass (g)	Mass Loss (mg)
1E	RHSCUF1E	RHTPTW1E	RHTEW1E	RHTEWL1E
1I	RHSCUF1I	RHTPTW1I	RHTEW1I	RHTEWL1I
2I	RHSCUF2I	RHTPTW2I	RHTEW2I	RHTEWL2I
2E	RHSCUF2E	RHTPTW2E	RHTEW2E	RHTEWL2E
3E	RHSCUF3E	RHTPTW3E	RHTEW3E	RHTEWL3E
3I	RHSCUF3I	RHTPTW3I	RHTEW3I	RHTEWL3I
4I	RHSCUF4I	RHTPTW4I	RHTEW4I	RHTEWL4I
4E	RHSCUF4E	RHTPTW4E	RHTEW4E	RHTEWL4E
5E	RHSCUF5E	RHTPTW5E	RHTEW5E	RHTEWL5E
5I	RHSCUF5I	RHTPTW5I	RHTEW5I	RHTEWL5I
6I	RHSCUF6I	RHTPTW6I	RHTEW6I	RHTEWL6I
6E	RHSCUF6E	RHTPTW6E	RHTEW6E	RHTEWL6E

Intake / Exhaust Summary	Intake		Exhaust	
	As Measured	Outlier Screened	As Measured	Outlier Screened
Average Mass Loss (mg)	ARHTWLI	OARHTWLI	ARHTWLE	OARHTWLE
Minimum Mass Loss (mg)	IRHTWLI	OIRHTWLI	IRHTWLE	OIRHTWLE
Maximum Mass Loss (mg)	XRHTWLI	OXRHTWLI	XRHTWLE	OXRHTWLE
Standard Deviation (mg)	SRHTWLI	OSRHTWLI	SRHTWLE	OSRHTWLE
Outlier Locations <sup>4</sup>	RHTOUTI		RHTOUTE	

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

Overall Summary	As Measured	Outlier Screened	Adjusted to 4.6% Soot
Average Mass Loss (mg)	AMARHWL	ORHWL	RHWL
Minimum Mass Loss (mg)	AMIRHWL	IRHTWL	
Maximum Mass Loss (mg)	AMXRHWL	XRHTWL	
Standard Deviation (mg)	AMSRHWL	SRHTWL	

**ISM Lubricant Performance Test  
Form 25  
Liner Wear Summary**

Laboratory:	LAB	EOT Date:	DTCOMP	EOT Time:	EOTTIME
<b>Test Number</b>					
Stand:	STAND	Engine:	ENGINE	Engine Run No.:	ENRUN
Formulation / Stand Code:			FORM		
Oil Code:	OILCODE				

Position	Wear Step ( $\mu\text{m}$ )					
	Cylinder Number					
	1	2	3	4	5	6
<b>1:00</b>	C1LW1	C2LW1	C3LW1	C4LW1	C5LW1	C6LW1
<b>2:00</b>	C1LW2	C2LW2	C3LW2	C4LW2	C5LW2	C6LW2
<b>3:00 (Thrust)</b>	C1LW3	C2LW3	C3LW3	C4LW3	C5LW3	C6LW3
<b>4:00</b>	C1LW4	C2LW4	C3LW4	C4LW4	C5LW4	C6LW4
<b>5:00</b>	C1LW5	C2LW5	C3LW5	C4LW5	C5LW5	C6LW5
<b>6:00 (Rear)</b>	C1LW6	C2LW6	C3LW6	C4LW6	C5LW6	C6LW6
<b>7:00</b>	C1LW7	C2LW7	C3LW7	C4LW7	C5LW7	C6LW7
<b>8:00</b>	C1LW8	C2LW8	C3LW8	C4LW8	C5LW8	C6LW8
<b>9:00 (Anti-Thrust)</b>	C1LW9	C2LW9	C3LW9	C4LW9	C5LW9	C6LW9
<b>10:00</b>	C1LW10	C2LW10	C3LW10	C4LW10	C5LW10	C6LW10
<b>11:00</b>	C1LW11	C2LW11	C3LW11	C4LW11	C5LW11	C6LW11
<b>12:00 (Front)</b>	C1LW12	C2LW12	C3LW12	C4LW12	C5LW12	C6LW12
<b>Average</b>	C1ALW	C2ALW	C3ALW	C4ALW	C5ALW	C6ALW

Summary	As Measured	Outlier Screened
<b>Average, <math>\mu\text{m}</math></b>	AMACLW	ALW
<b>Std. Dev., <math>\mu\text{m}</math></b>	AMSCLW	SCLW
<b>Minimum, <math>\mu\text{m}</math></b>	AMICLW	ICLW
<b>Maximum, <math>\mu\text{m}</math></b>	AMXCLW	XCLW
<b>Outlier Liners <sup>A</sup></b>	OUTLIN	

<sup>A</sup> Cylinder Number.