

A5. Report Forms
M11 EGR
LUBRICANT PERFORMANCE TEST

VERSION 20011030 BETA

METHOD METHOD

CONDUCTED FOR:

TSTSPON1

TSTSPON2

<i>LABVALID</i>	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 = NOT INTERPRETABLE; THE NON-REFERENCE OIL RESULTS CANNOT BE INTERPRETED AND SHALL NOT BE USED FOR MULTIPLE TEST ACCEPTANCE.

<i>TSTOIL</i>	NR = Non-Reference Oil Test
	RO = Reference Oil Test

STAND: <i>STAND</i>	ENGINE NO.: <i>ENGINE</i>	ENGINE RUN NO.: <i>ENRUN</i>
END OF TEST DATE: <i>DTCOMP</i>	END OF TEST TIME: <i>EOTIME</i>	
OIL CODE: <i>OILCODE</i>		
FORMULATION/STAND CODE: <i>FORM</i>		
ALTCODE1: <i>ALTCODE1</i>	ALTCODE2: <i>ALTCODE2</i>	ALTCODE3: <i>ALTCODE3</i>

In my opinion this test *OPVALID* been conducted in a valid manner in accordance with the Test Procedure 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

Typed Name

**M11 EGR LUBRICANT PERFORMANCE TEST
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**M11 EGR LUBRICANT PERFORMANCE TEST
FORM 3
SUMMARY OF TEST METHOD**

The M11 EGR 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 topping weight loss. This test is a two stage, steady state test (constant speed and load). Stage A is 50 h and is run with retarded fuel injection timing to produce elevated soot levels in the oil. Stage B is 50 h and is run under heavy load conditions to induce wear. The stages are run in sequence (Stage A followed by Stage B) three times for a total test length of 300 h.

The test engine is a Cummins M11 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.

M11 EGR TEST CONDITIONS

Parameter	Stage A	Stage B
Time, h	50	50
Injection Timing, °BTDC	16 min	32
Speed, r/min	1800	1600
Fuel Flow, kg/h	58.0	64.4
EGR Rate, %	Record	8.5 - 9.8
Intake CO ₂ %	0.97 - 1.09	0.78 - 0.85
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

M11 EGR LUBRICANT PERFORMANCE TEST
Test Results Summary
Form 4

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

DATE TEST STARTED	<i>DTSTRT</i>
START TIME	<i>STRTIME</i>
TEST LENGTH	<i>TESTLEN</i>
TMC OIL CODE ^A	<i>IND</i>
LABORATORY OIL CODE	<i>LABOCODE</i>
SAE VISCOSITY	<i>SAEVISC</i>
TGA SOOT % AT 50 h (2.8 minimum)	<i>TGA050</i>
TGA SOOT % AT 250 h (8.0 - 9.5)	<i>TGA250</i>
TOTAL OIL CONSUMPTION, kg	<i>TOTOCON</i>

	Adjusted Average Crosshead Mass Loss (mg)	Filter Plugging Delta P (kPa)	Average Sludge Rating (merits)	Avg. Top Ring Weight Loss (mg)
Original Result	<i>ACWL</i>	<i>OILD P</i>	<i>ASRT</i>	<i>ARWLT</i>
Transformed Result ^B	<i>TRNACWL</i>	<i>TRNODP</i>	<i>TRNASRT</i>	<i>TRNARWLT</i>
Correction Factor ^B	<i>ACWLCF</i>	<i>OILDPCF</i>	<i>ASRTCF</i>	<i>ARWLTCF</i>
Corrected Transformed Result ^B	<i>ACWLCOR</i>	<i>OILDPCOR</i>	<i>ASRTCOR</i>	<i>ARWTCOR</i>
Severity Adjustment ^B	<i>ACWL_SA</i>	<i>OILD P_SA</i>	<i>ASRT_SA</i>	<i>ARWLT_SA</i>
Final Transformed Result ^B	<i>TACWLFNL</i>	<i>TODPFNL</i>	<i>TASRTFNL</i>	<i>TARWLT</i>
Final Result	<i>ACWLFNL</i>	<i>OILD PFNL</i>	<i>ASRTFNL</i>	<i>ARWTFNL</i>

LAST STAND REFERENCE RESULTS

TEST NUMBER: <i>STAND - ENGINE - RENRUN</i>
OILCODE <i>ROILCODE</i>
TEST LENGTH <i>RTESTLEN</i>
TMC OIL CODE <i>RIND</i>
EOT DATE <i>RDTCOMP</i>
EOT TIME <i>REOTIME</i>
STAND CALIBRATION EXPIRATION DATE <i>DTCALEXP</i>
TGA SOOT % AT 50 h (2.8 minimum) <i>RTGA050</i>
TGA SOOT % AT 250 h (8.5 - 9.5) <i>RTGA250</i>
TOTAL OIL CONSUMPTION, kg <i>RTOTOCON</i>

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

^A Reference Tests Only

^B Filter Plugging Delta P Value in Transformed Units

**M11 EGR LUBRICANT PERFORMANCE TEST
FORM 5
OPERATIONAL SUMMARY**

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

Parameter	Units	QI Threshold	EOT ^A QI	Target	Average	Samples ^B	BQD ^C	Over/Under Range ^D
Speed	r/min	0.000	QRPM	1800	ARPM	NRPM	BRPM	ORPM
Fuel Flow	kg/h	0.000	QFFLO	58.0	AFFLOA	NFFLO	BFFLO	OFFLO
Coolant Out	°C	0.000	QCOLOUT	65.5	ACOLOUT	NCOLOUT	BCOLOUT	OCOLOUT
Fuel In	°C	0.000	QFUEL	40	AFUEL	NFUEL	BFUEL	OFUEL
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

Parameter	Units	Typical Values ^E	Average
Torque	N-m	TBD	ALOADA
Power	kW	TBD	APWRB
EGR Rate	%	Record	EGRB
Intake CO ₂	%	0.97 - 1.09	AICO2A
Blowby	L/min	TBD	ABLOBY
Coolant In	°C	TBD	ACOLIN
Intake Air	°C	TBD	AINAIRT
Pre-Turbine (F)	°C	TBD	APTURFT
Pre-Turbine (R)	°C	TBD	APTURRT
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

^A QI values above the threshold are acceptable by the M11 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 Stage B EGR Rate shall be within specified range for test to be operationally valid.

**M11 EGR LUBRICANT PERFORMANCE TEST
FORM 6
CROSSHEAD MASS LOSS SUMMARY**

Laboratory <i>LAB</i>	EOT Date <i>DTCOMP</i>	EOT Time <i>EOTTIME</i>
Test Number		
STAND: <i>STAND</i>	ENGINE: <i>ENGINE</i>	ENGINE RUN NO.: <i>ENRUN</i>
FORMULATION/STAND CODE: <i>FORM</i>		
OIL CODE: <i>OILCODE</i>		

LOCATION	SERIAL NO.	PRETEST MASS (g)	EOT MASS (g)	MASS LOSS (mg)
1E	<i>CHDSN1E</i>	<i>CHDPTW1E</i>	<i>CHDEW1E</i>	<i>CHDEWL1E</i>
1I	<i>CHDSN1I</i>	<i>CHDPTW1I</i>	<i>CHDEW1I</i>	<i>CHDEWL1I</i>
2I	<i>CHDSN2I</i>	<i>CHDPTW2I</i>	<i>CHDEW2I</i>	<i>CHDEWL2I</i>
2E	<i>CHDSN2E</i>	<i>CHDPTW2E</i>	<i>CHDEW2E</i>	<i>CHDEWL2E</i>
3E	<i>CHDSN3E</i>	<i>CHDPTW3E</i>	<i>CHDEW3E</i>	<i>CHDEWL3E</i>
3I	<i>CHDSN3I</i>	<i>CHDPTW3I</i>	<i>CHDEW3I</i>	<i>CHDEWL3I</i>
4I	<i>CHDSN4I</i>	<i>CHDPTW4I</i>	<i>CHDEW4I</i>	<i>CHDEWL4I</i>
4E	<i>CHDSN4E</i>	<i>CHDPTW4E</i>	<i>CHDEW4E</i>	<i>CHDEWL4E</i>
5E	<i>CHDSN5E</i>	<i>CHDPTW5E</i>	<i>CHDEW5E</i>	<i>CHDEWL5E</i>
5I	<i>CHDSN5I</i>	<i>CHDPTW5I</i>	<i>CHDEW5I</i>	<i>CHDEWL5I</i>
6I	<i>CHDSN6I</i>	<i>CHDPTW6I</i>	<i>CHDEW6I</i>	<i>CHDEWL6I</i>
6E	<i>CHDSN6E</i>	<i>CHDPTW6E</i>	<i>CHDEW6E</i>	<i>CHDEWL6E</i>

INTAKE/EXHAUST SUMMARY	INTAKE		EXHAUST	
	As Measured	Outlier Screened	As Measured	Outlier Screened
Average Crosshead Mass Loss (mg)	<i>ACHDWLI</i>	<i>OACHDWLI</i>	<i>ACHDWLE</i>	<i>OACHDWLE</i>
Minimum Crosshead Mass Loss (mg)	<i>ICHDWLI</i>	<i>OICHDWLI</i>	<i>ICHDWLE</i>	<i>OICHDWLE</i>
Maximum Crosshead Mass Loss (mg)	<i>XCHDWLI</i>	<i>OXCHDWLI</i>	<i>XCHDWLE</i>	<i>OXCHDWLE</i>
Standard Deviation (mg)	<i>SCHDWLI</i>	<i>OSCHDWLI</i>	<i>SCHDWLE</i>	<i>OSCHDWLE</i>
Outlier Crossheads Locations ^A	<i>CHDOUTI</i>		<i>CHDOUTE</i>	

^A Location Designation. Example: 3E

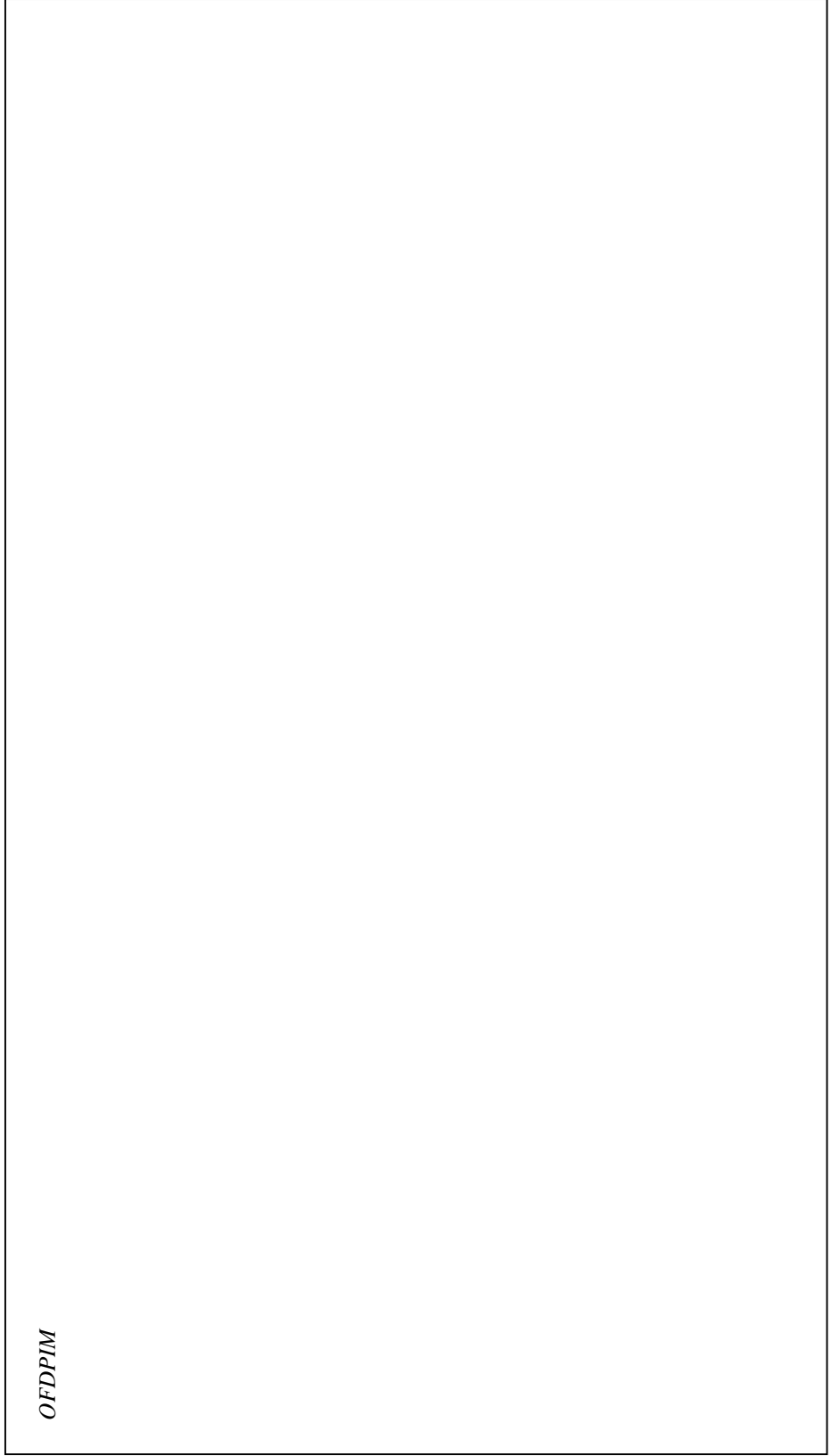
Overall Summary	As Measured	Outlier Screened	Adjusted to X.X% Soot
Average Crosshead Mass Loss (mg)	<i>AMACAWL</i>	<i>CAWL</i>	<i>ACWL</i>
Minimum Crosshead Mass Loss (mg)	<i>AMICAWL</i>	<i>ICHDEWL</i>	
Maximum Crosshead Mass Loss (mg)	<i>AMXCAWL</i>	<i>XCHDEWL</i>	
Standard Deviation (mg)	<i>AMSCAWL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

M11 EGR LUBRICANT PERFORMANCE TEST
FORM 7

OIL FILTER DELTA PRESSURE PLOT

Laboratory	LAB	EOT Date	DTCOMP	EOT Time	EOTTIME
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)

TEST HOURS

**M11 EGR LUBRICANT PERFORMANCE TEST
FORM 8
SLUDGE RATING SUMMARY**

Laboratory: <i>LAB</i>	EOT Date: <i>DTCOMP</i>	EOT Time: <i>EOTTIME</i>
TEST NUMBER		
STAND: <i>STAND</i>	ENGINE: <i>ENGINE</i>	ENGINE RUN NO.: <i>ENRUN</i>
FORMULATION/STAND CODE: <i>FORM</i>		
OIL CODE: <i>OILCODE</i>		

SLUDGE RATING SUMMARY

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

**M11 EGR LUBRICANT PERFORMANCE TEST
FORM 9
ROD BEARING MASS LOSS**

Laboratory <i>LAB</i>	EOT Date <i>DTCOMP</i>	EOT Time <i>EOTTIME</i>
Test Number		
STAND: <i>STAND</i>	ENGINE: <i>ENGINE</i>	ENGINE RUN NO.: <i>ENRUN</i>
FORMULATION/STAND CODE: <i>FORM</i>		
OIL CODE: <i>OILCODE</i>		

CYLINDER NUMBER	BEARING LOCATION	PRE-TEST MASS (g)	POST-TEST MASS (g)	MASS LOSS (mg)
1	UPPER	<i>BWCYL1TP</i>	<i>BWCYL1TE</i>	<i>BWL1T</i>
	LOWER	<i>BWCYL1BP</i>	<i>BWCYL1BE</i>	<i>BWL1B</i>
2	UPPER	<i>BWCYL2TP</i>	<i>BWCYL2TE</i>	<i>BWL2T</i>
	LOWER	<i>BWCYL2BP</i>	<i>BWCYL2BE</i>	<i>BWL2B</i>
3	UPPER	<i>BWCYL3TP</i>	<i>BWCYL3TE</i>	<i>BWL3T</i>
	LOWER	<i>BWCYL3BP</i>	<i>BWCYL3BE</i>	<i>BWL3B</i>
4	UPPER	<i>BWCYL4TP</i>	<i>BWCYL4TE</i>	<i>BWL4T</i>
	LOWER	<i>BWCYL4BP</i>	<i>BWCYL4BE</i>	<i>BWL4B</i>
5	UPPER	<i>BWCYL5TP</i>	<i>BWCYL5TE</i>	<i>BWL5T</i>
	LOWER	<i>BWCYL5BP</i>	<i>BWCYL5BE</i>	<i>BWL5B</i>
6	UPPER	<i>BWCYL6TP</i>	<i>BWCYL6TE</i>	<i>BWL6T</i>
	LOWER	<i>BWCYL6BP</i>	<i>BWCYL6BE</i>	<i>BWL6B</i>

	BEARING MASS LOSS
AVERAGE (mg)	<i>ASBWL</i>
MINIMUM (mg)	<i>ISBWL</i>
MAXIMUM (mg)	<i>XSBWL</i>
STANDARD DEVIATION (mg)	<i>SSBWL</i>

**M11 EGR LUBRICANT PERFORMANCE TEST
FORM 10
PISTON RATING SUMMARY**

Laboratory <i>LAB</i>	EOT Date <i>DTCOMP</i>	EOT Time <i>EOTTIME</i>
TEST NUMBER		
STAND: <i>STAND</i>	ENGINE: <i>ENGINE</i>	ENGINE RUN NO.: <i>ENRUN</i>
FORMULATION/STAND CODE: <i>FORM</i>		
OILCODE: <i>OILCODE</i>		

UNWEIGHTED DEMERITS										
PISTON NUMBER	Lands				Grooves			Under Crown	Oil Cooling Gallery	Total Demerits
	1	2	3	4	1	2	3			
1	<i>LIUWD1</i>	<i>L2UWD1</i>	<i>L3UWD1</i>	<i>L4UWD1</i>	<i>G1UWD1</i>	<i>G2UWD1</i>	<i>G3UWD1</i>	<i>UCUWD1</i>	<i>OGUWD1</i>	<i>UWD1</i>
2	<i>LIUWD2</i>	<i>L2UWD2</i>	<i>L3UWD2</i>	<i>L4UWD2</i>	<i>G1UWD2</i>	<i>G2UWD2</i>	<i>G3UWD2</i>	<i>UCUWD2</i>	<i>OGUWD2</i>	<i>UWD2</i>
3	<i>LIUWD3</i>	<i>L2UWD3</i>	<i>L3UWD3</i>	<i>L4UWD3</i>	<i>G1UWD3</i>	<i>G2UWD3</i>	<i>G3UWD3</i>	<i>UCUWD3</i>	<i>OGUWD3</i>	<i>UWD3</i>
4	<i>LIUWD4</i>	<i>L2UWD4</i>	<i>L3UWD4</i>	<i>L4UWD4</i>	<i>G1UWD4</i>	<i>G2UWD4</i>	<i>G3UWD4</i>	<i>UCUWD4</i>	<i>OGUWD4</i>	<i>UWD4</i>
5	<i>LIUWD5</i>	<i>L2UWD5</i>	<i>L3UWD5</i>	<i>L4UWD5</i>	<i>G1UWD5</i>	<i>G2UWD5</i>	<i>G3UWD5</i>	<i>UCUWD5</i>	<i>OGUWD5</i>	<i>UWD5</i>
6	<i>LIUWD6</i>	<i>L2UWD6</i>	<i>L3UWD6</i>	<i>L4UWD6</i>	<i>G1UWD6</i>	<i>G2UWD6</i>	<i>G3UWD6</i>	<i>UCUWD6</i>	<i>OGUWD6</i>	<i>UWD6</i>
Average Demerits	<i>AL1UWD</i>	<i>AL2UWD</i>	<i>AL3UWD</i>	<i>AL4UWD</i>	<i>AG1UWD</i>	<i>AG2UWD</i>	<i>AG3UWD</i>	<i>AUCUWD</i>	<i>AOGUWD</i>	
Average Total Unweighted Demerits										<i>TOTUWD</i>

PARAMETER	PISTON NUMBER						AVERAGE
	1	2	3	4	5	6	
TGC	<i>TGC1</i>	<i>TGC2</i>	<i>TGC3</i>	<i>TGC4</i>	<i>TGC5</i>	<i>TGC6</i>	<i>ATGC</i>
TLC	<i>TLC1</i>	<i>TLC2</i>	<i>TLC3</i>	<i>TLC4</i>	<i>TLC5</i>	<i>TLC6</i>	<i>ATLC</i>

**M11 EGR LUBRICANT PERFORMANCE TEST
FORM 15
PISTON 5 DEPOSIT RATINGS**

Laboratory	LAB	EOT Date	DTCOMP	EOT Time	EOTIME
TEST NUMBER					
STAND:	STAND	ENGINE: ENGINE		ENGINE RUN NO.: ENRUN	
FORMULATION/STAND CODE: FORM					
OILCODE: OILCODE					

DEP. FACTOR	GROOVES			LANDS			DEP FACTOR	GROOVES			LANDS			OIL COOLING GALLERY (2)			UNDER CROWN (1)		
	NO. 1	NO. 2		NO. 1	NO. 2			NO. 3	NO. 3		NO. 4	NO. 4		A, %	DEM.	A, %	DEM.	A, %	DEM.
		A, %	DEM.		A, %	DEM.			A, %	DEM.		A, %	DEM.						
CARBON																			
HC-1.0	G1HCA5	G1HCD5	G1HCA5	G1HCD5	G1HCA5	G1HCD5		G1HCA5	G1HCD5	G1HCA5	G1HCD5								
MC-0.5	G1MCA5	G1MCD5						G1MCA5	G1MCD5										
LC-.25	G1LCA5	G1LCD5	G1LCA5	G1LCD5	G1LCA5	G1LCD5		G1LCA5	G1LCD5	G1LCA5	G1LCD5								
TOTAL	G1ACT5	G1G2ACT5	G1ACT5	G1G2ACT5	G1ACT5	G1G2ACT5		G3ACT5	G3G2ACT5	G3ACT5	G3G2ACT5								
VARNISH																			
8 - 9	G1L9A5	G1L9D5	G1L9A5	G1L9D5	G1L9A5	G1L9D5													
7 - 7.9	G1L8A5	G1L8D5	G1L8A5	G1L8D5	G1L8A5	G1L8D5	7.5	G3L75A5	G3L75D5	G3L75A5	G3L75D5								
6 - 6.9	G1L7A5	G1L7D5	G1L7A5	G1L7D5	G1L7A5	G1L7D5													
5 - 5.9	G1L6A5	G1L6D5	G1L6A5	G1L6D5	G1L6A5	G1L6D5													
4 - 4.9	G1L5A5	G1L5D5	G1L5A5	G1L5D5	G1L5A5	G1L5D5	4.5	G3L45A5	G3L45D5	G3L45A5	G3L45D5								
3 - 3.9	G1L4A5	G1L4D5	G1L4A5	G1L4D5	G1L4A5	G1L4D5													
2 - 2.9	G1L3A5	G1L3D5	G1L3A5	G1L3D5	G1L3A5	G1L3D5													
1 - 1.9	G1L2A5	G1L2D5	G1L2A5	G1L2D5	G1L2A5	G1L2D5	1.5	G3L15A5	G3L15D5	G3L15A5	G3L15D5								
>0 - 0.9	G1L1A5	G1L1D5	G1L1A5	G1L1D5	G1L1A5	G1L1D5													
TOTAL	G1ACT5	G1G2ACT5	G1ACT5	G1G2ACT5	G1ACT5	G1G2ACT5		G3ACT5	G3G2ACT5	G3ACT5	G3G2ACT5								
Rating	G1UWD5	G2UWD5	G1UWD5	G2UWD5	G1UWD5	G2UWD5		G3UWD5	G3UWD5	G3UWD5	G3UWD5								
TGC %							UNWEIGHTED DEP.						T.T. CARBON				T.T. FLAKED CARBON %		
TGC5							UWD5						TLC5				TLC5		

**M11 EGR LUBRICANT PERFORMANCE TEST
FORM 17
RING MASS LOSS SUMMARY**

Laboratory	LAB	EOT Date	DTCOMP	EOT Time	EOTTIME
TEST NUMBER					
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	PRETEST	EOT		
1	RWCYL1PT	RWCYL1ET	RWLCYL1T	RWCYL1PS	RWCYL1ES	RWLCYL1S	RWCYL1EO	RWCYL1PO	RWCYL1EO	RWLCYL1O	
2	RWCYL2PT	RWCYL2ET	RWLCYL2T	RWCYL2PS	RWCYL2ES	RWLCYL2S	RWCYL2EO	RWCYL2PO	RWCYL2EO	RWLCYL2O	
3	RWCYL3PT	RWCYL3ET	RWLCYL3T	RWCYL3PS	RWCYL3ES	RWLCYL3S	RWCYL3EO	RWCYL3PO	RWCYL3EO	RWLCYL3O	
4	RWCYL4PT	RWCYL4ET	RWLCYL4T	RWCYL4PS	RWCYL4ES	RWLCYL4S	RWCYL4EO	RWCYL4PO	RWCYL4EO	RWLCYL4O	
5	RWCYL5PT	RWCYL5ET	RWLCYL5T	RWCYL5PS	RWCYL5ES	RWLCYL5S	RWCYL5EO	RWCYL5PO	RWCYL5EO	RWLCYL5O	
6	RWCYL6PT	RWCYL6ET	RWLCYL6T	RWCYL6PS	RWCYL6ES	RWLCYL6S	RWCYL6EO	RWCYL6PO	RWCYL6EO	RWLCYL6O	
AVERAGE MASS LOSS (mg)			ARWLT				ARWLS				ARWLO
STD. DEV. MASS LOSS (mg)			SRWLT				SRWLS				SRWLO
MAXIMUM MASS LOSS (mg)			XRWLT				XRWLS				XRWLO
MINIMUM MASS LOSS (mg)			IRWLT				IRWLS				IRWLO

**M11 EGR LUBRICANT PERFORMANCE TEST
FORM 18
OIL ANALYSIS SUMMARY**

Laboratory: LAB	EOT Date: DTCOMP	EOT Time: EOTTIME
TEST NUMBER		
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)	ALUMINIUM (ppm)	CHROMIUM (ppm)
NEW	V100NEW	TGANEW	TBNNEW	TANNEW	CUWMNEW	FEWMNEW	PBWNEW	ALWNEW	CRWNEW
TST_H025	V100H025	TGA_H025			CUWMH025	FEWMH025	PBWMH025	ALWMH025	CRWMH025
TST_H050	V100H050	TGA050	TBN_H050	TAN_H050	CUWMH050	FEWMH050	PBWMH050	ALWMH050	CRWMH050
TST_H075	V100H075	TGA_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	TGA_H150	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
TST_H225	V100H225	TGA_H225	TBN_H225	TAN_H225	CUWMH225	FEWMH225	PBWMH225	ALWMH225	CRWMH225
TST_H250	V100H250	TGA250	TBN_H250	TAN_H250	CUWMH250	FEWMH250	PBWMH250	ALWMH250	CRWMH250
TST_H275	V100H275	TGA_H275	TBN_H275	TAN_H275	CUWMH275	FEWMH275	PBWMH275	ALWMH275	CRWMH275
TST_H300	V100H300	TGA_H300	TBN_H300	TAN_H300	CUWMH300	FEWMH300	PBWMH300	ALWMH300	CRWMH300

**M11 EGR LUBRICANT PERFORMANCE TEST
FORM 19
TEST FUEL ANALYSIS (LAST BATCH)**

Laboratory <i>LAB</i>	EOT Date <i>DTCOMP</i>	EOT Time <i>EOTTIME</i>
TEST NUMBER		
STAND: <i>STAND</i>	ENGINE: <i>ENGINE</i>	ENGINE RUN NO.: <i>ENRUN</i>
FORMULATION/STAND CODE: <i>FORM</i>		
OILCODE: <i>OILCODE</i>		

FUEL SUPPLIER	FUEL BATCH IDENTIFIER
<i>FUELSUP</i>	<i>FUELBTID</i>

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

**M11 EGR LUBRICANT PERFORMANCE TEST
FORM 20
INJECTOR ADJUSTING SCREW MASS LOSS**

Laboratory <i>LAB</i>	EOT Date <i>DTCOMP</i>	EOT Time <i>EOTTIME</i>
TEST NUMBER		
STAND: <i>STAND</i>	ENGINE: <i>ENGINE</i>	ENGINE RUN NO.: <i>ENRUN</i>
FORMULATION/STAND CODE: <i>FORM</i>		
OILCODE: <i>OILCODE</i>		

SCREW #	PRE-TEST MASS, g	POST-TEST MASS, g	MASS LOSS, mg
1	<i>BOTIAS1</i>	<i>EOTIAS1</i>	<i>IASWL1</i>
2	<i>BOTIAS2</i>	<i>EOTIAS2</i>	<i>IASWL2</i>
3	<i>BOTIAS3</i>	<i>EOTIAS3</i>	<i>IASWL3</i>
4	<i>BOTIAS4</i>	<i>EOTIAS4</i>	<i>IASWL4</i>
5	<i>BOTIAS5</i>	<i>EOTIAS5</i>	<i>IASWL5</i>
6	<i>BOTIAS6</i>	<i>EOTIAS6</i>	<i>IASWL6</i>
TOTAL			<i>IASWLTOT</i>
AVERAGE			<i>AVGIAS</i>

**M11 EGR LUBRICANT PERFORMANCE TEST
FORM 21
UNSCHEDULED DOWNTIME & MAINTENANCE SUMMARY**

Laboratory <i>LAB</i>	EOT Date <i>DTCOMP</i>	EOT Time <i>EOTTIME</i>
TEST NUMBER		
STAND: <i>STAND</i>	ENGINE: <i>ENGINE</i>	ENGINE RUN NO.: <i>ENRUN</i>
FORMULATION/STAND CODE: <i>FORM</i>		
OILCODE: <i>OILCODE</i>		

Number of Downtime Occurrences			<i>DWNOCR</i>
Test Hours	Date	Downtime	Reasons
<i>DOWNR001</i>	<i>DDATR001</i>	<i>DTIMR001</i>	<i>DREAR001</i>
<i>TOTLDOWN</i>			Total Downtime (hours)

Other Comments		
Number of Comment Lines	<i>TOTCOM</i>	
<i>OCOMR001</i>		

**M11 EGR LUBRICANT PERFORMANCE TEST
FORM 22
CHARACTERISTICS OF THE DATA ACQUISITION SYSTEM**

Laboratory <i>LAB</i>	EOT Date <i>DTCOMP</i>	EOT Time <i>EOTTIME</i>
TEST NUMBER		
STAND: <i>STAND</i>	ENGINE: <i>ENGINE</i>	ENGINE RUN NO.: <i>ENRUN</i>
FORMULATION/STAND CODE: <i>FORM</i>		
OIL CODE: <i>OILCODE</i>		

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

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
DL - AUTOMATIC DATA LOGGER
C/D - COMPUTER, USING DIRECT I/O ENTRY
- (5) DATA ARE OBSERVED BUT ONLY IF RECORDED 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 IN SECONDS FOR THE OUTPUT TO REACH 63.2% OF FINAL VALUE FOR STEP CHANGE AT INPUT