Mack T-12 EGR Engine Oil Test

Report Packet Version No.
T12 VERSION 20050125
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

Test Number			
Stand: STAND	**Stand Run:** STRUN	**Engine:** ENGINE	**Engine Hours:** ENHOURS
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 this test OPVALID **been conducted in a valid manner in accordance with the Test Method 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

Mack T-12 EGR Engine Oil Test
Form 2

Table of Contents

Mack T-12 EGR Engine Oil Test
Form 3

The Mack T-12 EGR Engine Oil Test is a fuel engine-dynamometer test which evaluates the ability of a lubricant to minimize piston ring wear, cylinder liner wear, lead corrosion, oil consumption, and oxidation. This test is a two-phase, steady state test (constant speed and load), run with heavy EGR. The first phase is 100 h and is run with retarded fuel injection timing to produce elevated soot levels in the oil. The second phase is 200 h and is run under heavy load conditions to induce piston ring and cylinder liner wear.

The test engine is a Mack E-TECH V-MAC III diesel engine with EGR. It is an in-line six-cylinder, four stroke, turbocharged engine. It has electronically controlled fuel injection with six individual electronic pumps. A one h break-in is conducted prior to each test since a new engine build is used for each test.

Mack T-12 Test Conditions

Parameter	Phase I	Phase II
Time, h	100	200
Injection Timing, °BTDC	Variable	21
Speed, r/min	1800	1200
Fuel Flow, kg/h	59.2	63.5
Intake CO_2, %	3.09	1.42
Exhaust CO_2, %	9.25	9.93
Inlet Manifold Temp., °C	90	80
Coolant Out Temp., °C	66	108
Fuel In Temp., °C	40	40
Oil Gallery Temp., °C	88	116
Intake Air Temp., °C	25	25
Intake Air Restriction, kPa	3.5 – 4.0	3.5 – 4.0
Inlet Manifold Pressure, kPa	Tbd	Tbd
Exhaust Back Pressure, kPa	2.7 – 3.5	2.7 – 3.5
Crankcase Pressure, kPa	0.25 – 0.75	0.25 – 0.75
Torque, Nm	Record	Record
Pre-Turbine Exhaust Temp., °C	Record	Record
Tailpipe Exhaust Temp., °C	Record	Record
Oil Sump Temp., °C	Record	Record
EGR Pre-Venturi Temp., °C	Record	Record
Inlet Air Dew Point, °C	Record	Record
EGR Pre-Venturi Press., kPa	Record	Record
Main Gallery Oil Pressure, kPa	Record	Record
Oil Filter Delta P, kPa	Not to exceed 138	Not to exceed 138

Mack T-12 EGR Engine Oil Test
Form 4
Test Results Summary

Laboratory: LAB	**EOT Date:** DTCOMP	**EOT Time:** EOTTIME
Test Number TESTNUM		
Oil Code: OILCODE		
Formulation/Stand Code: FORM		

Test Results		
Date Test Started: DTSTRT	**Start Time:** STRTTIME	**Test Length:** TESTLEN
TMC Oil Code: [A] IND	**Lab Oil Code:** LABOCODE	**SAE Viscosity:** SAEVISC

Average TGA Soot % at 100 h	TGAAVG
Centrifugal Oil Filter Mass Gain, g	MASSG
Oil Filter Delta P, kPa (138 maximum)	XOILDP
EOT TBN	TBNEOT

	Delta Pb@ EOT (ppm)	**Avg Liner Wear (µm)**	**Avg Top Ring Weight Loss (mg)**	**Oil Consumption (g/h)**	**Delta Pb 250-300h (ppm)**
Original Result	DPBEOT	ALW	ATRWL	OILCON	DPB2530
Transformed Result [B]	TRNDPB	TRNALW	TRNATRWL	TRNOC	TRNDPB2
Correction Factor [B]	DPBCF	ALWCF	ATRWLCF	OCCF	DPB2CF
Corrected Transformed Result [B]	DPBCOR	ALWCOR	ATRWLCOR	OCCOR	DPB2COR
Severity Adjustment [B]	DPB_SA	CLW_SA	ATRWL_SA	OC_SA	DPB2_SA
Final Transformed Result [B]	TDPBFNL	TCLWFNL	TTRWLFNL	TOCFNL	TDP2FNL
Final Original Unit Result	DPBFNL	CLWFNL	ATRWLFNL	OCFNL	DPB2FNL
Mack Merits [C]	DPBMER	CLWMER	TRWLMER	OCMER	DPB2MER
Total Mack Merits [C]	MACKMER				

Last Stand Reference Results	
Test Number: RTESTNUM	
Oil Code: ROILCODE	
Test Length: RTESTLEN	**TMC Oil Code:** RIND
EOT Date: RDTCOMP	**EOT Time:** REOTTIME
Stand Calibration Expiration Date: DTCALEXP	
Average TGA Soot % at 100 h	RTGAAVG

	Delta Pb@ EOT (ppm)	**Avg Liner Wear (µm)**	**Avg Top Ring Weight Loss (mg)**	**Oil Consumption (g/h)**	**Delta Pb 250-300h (ppm)**
Final Original Unit Result	RDPBFNL	RCLWFNL	RTRWLFNL	ROCFNL	RDPB2FNL

[A] **Reference Tests only.**
[B] **Transformed Units for Delta Pb only.**
[C] **Non-reference Tests only.**

Mack T-12 EGR Engine Oil Test
Form 5
Operational Summary

Laboratory: LAB	**EOT Date:** DTCOMP	**EOT Time:** EOTTIME
Test Number: TESTNUM	**Oil Code:** OILCODE	
Formulation/Stand Code: FORM		

Controlled Parameters

Parameter	Units	QI Threshold	EOT QI [A]	Target		Average		Samples [B]	BQD [C]	Over/Under Range [D]
Speed	**r/min**	**0.000**	QRPM	**1800**	**1200**	ARPM1	ARPM2	NRPM	BRPM	ORPM
Fuel Flow	**kg/h**	**0.000**	QFFLO	**59.2**	**63.5**	AFFLO1	AFFLO2	NFFLO	BFFLO	OFFLO
Inlet Manifold Temp.	**°C**	**0.000**	QINMANT	**90**	**80**	AINMANT1	AINMANT2	NINMANT	BINMANT	OINMANT
Coolant Out Temp.	**°C**	**0.000**	QCOLOUT	**66**	**108**	ACOLOUT1	ACOLOUT2	NCOLOUT	BCOLOUT	OCOLOUT
Fuel In Temp.	**°C**	**0.000**	QFUELT	**40**		AFUELT		NFUELT	BFUELT	OFUELT
Oil Gallery Temp.	**°C**	**0.000**	QOILGT	**88**	**116**	AOILGT1	AOILGT2	NOILGT	BOILGT	OOILGT
Inlet Air Temp.	**°C**	**0.000**	QINAIRT	**25**		AINAIRT		NINAIRT	BINAIRT	OINAIRT
Inlet Air Restriction	**kPa**			**3.5 – 4.0**		AINAIRR		NINAIRR	BINAIRR	OINAIRR
Inlet Man. Pressure	**kPa**			**tbd**	**Tbd**	AINMANP1	AINMANP2	NINMANP	BINMANP	OINMANP
Exh. Back Pressure	**kPa**			**2.7 – 3.5**		AEXHSTP		NEXHSTP	BEXHSTP	OEXHSTP
Crankcase Pressure	**kPa**			**0.25 – 0.75**		ACCASEP		NCCASEP	BCCASEP	OCCASEP
Intake CO_2	**%**			**3.09±0.05**	**1.42±0.05**	AICO21	AICO22			
Exhaust CO_2	**%**			**9.25±0.15**	**9.93±0.15**	AECO21	AECO22			

Non-Controlled Parameters

Parameter	Units	Typical Values[E]		Average	
Torque	**Nm**	**tbd**	**tbd**	ALOAD1	ALOAD2
Brake Specific Fuel Cons.	**g/kW-h**	**tbd**	**tbd**	ABSFC1	ABSFC2
Pre-Turbine Temp. (L)	**°C**	**tbd**	**tbd**	APTURFT1	APTURFT2
Pre-Turbine Temp. (R)	**°C**	**tbd**	**tbd**	APTURRT1	APTURRT2
Tailpipe Temp.	**°C**	**tbd**	**tbd**	ATAILPT1	ATAILPT2
Oil Sump Temp.	**°C**	**tbd**	**tbd**	AOILST1	AOILST2
EGR Pre-Venturi Temp.	**°C**	**tbd**	**tbd**	AEGRPVT1	AEGRPVT2
Blowby	**L/min**	**tbd**	**tbd**	ABLOBY1	ABLOBY2
Inlet Air Dew Point	**°C**	**tbd**	**tbd**	AINADP1	AINADP2
EGR Pre-Venturi Pressure	**kPa**	**tbd**	**tbd**	AEGRPVP1	AEGRPVP2
Main Gallery Oil Pressure	**kPa**	**tbd**	**tbd**	AOILPRS1	AOILPRS2

A Q1 values above the threshold are acceptable by the Mack Surveillance Panel. QI values below the threshold may not be considered acceptable based on an engineering review. Refer to Annex A5
B Total number of data points taken. Minimum acceptable value is 3000
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

Mack T-12 EGR Engine Oil Test
Form 6
Rod Bearing Weight Loss

Laboratory: LAB	**EOT Date:** DTCOMP	**EOT Time:** EOTTIME
Test Number: TESTNUM		
Oil Code: OILCODE		
Formulation/Stand Code: FORM		

Cylinder #	Location	SOT Weight, g	EOT Weight, g	Weight Change, mg
1	**Upper**	BWSOTU1	BWEOTU1	BWLU1
2	**Upper**	BWSOTU2	BWEOTU2	BWLU2
3	**Upper**	BWSOTU3	BWEOTU3	BWLU3
4	**Upper**	BWSOTU4	BWEOTU4	BWLU4
5	**Upper**	BWSOTU5	BWEOTU5	BWLU5
6	**Upper**	BWSOTU6	BWEOTU6	BWLU6

Summary	As Measured	Outlier Screened
Upper Bearing Average Weight Loss, mg	ABWLU	OABWLU
Upper Bearing Weight Loss Std. Dev., mg	SBWLU	OSBWLU
Upper Bearing Minimum Weight Loss, mg	IBWLU	OIBWLU
Upper Bearing Maximum Weight Loss, mg	XBWLU	OXBWLU
Outlier Upper Rod Bearing [A]	BWLOUT	

[A] **Cylinder number**

Cylinder #	Location	SOT Weight, g	EOT Weight, g	Weight Change, mg
1	**Lower**	BWSOTL1	BWEOTL1	BWLL1
2	**Lower**	BWSOTL2	BWEOTL2	BWLL2
3	**Lower**	BWSOTL3	BWEOTL3	BWLL3
4	**Lower**	BWSOTL4	BWEOTL4	BWLL4
5	**Lower**	BWSOTL5	BWEOTL5	BWLL5
6	**Lower**	BWSOTL6	BWEOTL6	BWLL6
Lower Bearing Average Weight Loss, mg				ABWLL
Lower Bearing Weight Loss Std. Dev., mg				SBWLL
Lower Bearing Minimum Weight Loss, mg				IBWLL
Lower Bearing Maximum Weight Loss, mg				XBWLL

Conrod Bearing Batch ID	CRBIDNUM

Mack T-12 EGR Engine Oil Test
Form 7
Ring Weight Loss

Laboratory:	LAB	**EOT Date:**	DTCOMP	**EOT Time:**	EOTTIME
Test Number:	TESTNUM				
Oil Code:	OILCODE				
Formulation/Stand Code:	FORM				

Cylinder No.	Top Ring SOT Weight, g	Top Ring EOT Weight, g	Weight Loss, mg
1	TRWSOT1	TRWEOT1	TRWL1
2	TRWSOT2	TRWEOT2	TRWL2
3	TRWSOT3	TRWEOT3	TRWL3
4	TRWSOT4	TRWEOT4	TRWL4
5	TRWSOT5	TRWEOT5	TRWL5
6	TRWSOT6	TRWEOT6	TRWL6

Summary	As Measured	Outlier Screened
Top Ring Average Weight Loss, mg	AMATRWL	ATRWL
Top Ring Weight Loss Std. Dev., mg	AMSTRWL	STRWL
Top Ring Minimum Weight Loss, mg	AMITRWL	ITRWL
Top Ring Maximum Weight Loss, mg	AMXTRWL	XTRWL
Outlier Ring [B]	OUTTR	

[A] Results calculated without rings with plasma flanking.
[B] Ring number wear results are not currently outlier screened.

Cylinder No.	2nd Ring SOT Weight, g	2nd Ring EOT Weight, g	Weight Loss, mg
1	R2WSOT1	R2WEOT1	R2WL1
2	R2WSOT2	R2WEOT2	R2WL2
3	R2WSOT3	R2WEOT3	R2WL3
4	R2WSOT4	R2WEOT4	R2WL4
5	R2WSOT5	R2WEOT5	R2WL5
6	R2WSOT6	R2WEOT6	R2WL6
2nd Ring Average Weight Loss, mg			AR2WL
2nd Ring Weight Loss Std. Dev., mg			SR2WL
2nd Ring Min. Weight Loss, mg			IR2WL
2nd Ring Max. Weight Loss, mg			XR2WL

Cylinder No.	Oil Ring SOT Weight, g	Oil Ring EOT Weight, g	Weight Loss, mg
1	ORWSOT1	ORWEOT1	ORWL1
2	ORWSOT2	ORWEOT2	ORWL2
3	ORWSOT3	ORWEOT3	ORWL3
4	ORWSOT4	ORWEOT4	ORWL4
5	ORWSOT5	ORWEOT5	ORWL5
6	ORWSOT6	ORWEOT6	ORWL6
Oil Ring Average Weight Loss, mg			AORWL
Oil Ring Weight Loss Std. Dev., mg			SORWL
Oil Ring Minimum Weight Loss, mg			IORWL
Oil Ring Maximum Weight Loss, mg			XORWL

MACK T-12 EGR Engine Oil Test
Form 8
Oil Analysis Summary

Laboratory: LAB	**EOT Date:** DTCOMP	**EOT Time:** EOTTIME
Test Number: TESTNUM	**Oil Code:** OILCODE	
Formulation/Stand Code: FORM		

Hours	Soot Wt.% TGA	Viscosity At 100°C cSt	Viscosity Increase cSt	TBN	TAN	Integrated IR Oxidation	Metal Elements (ppm)								
							Fe	Pb	Cu	Cr	Al	Si	Sn	Na	Ni
TST_H000	TGA_H00(	V100H000		TBN_H00	TAN_H00	IRINH000	EWMH00	BWMH00	UWMH00	RWMH00	LWMH00	IWMH00	NWMH00	AWMH00	IWMH00
TST_H025	TGA_H02:	V100H025	IVISH025	TBN_H02	TAN_H02	IRINH025	EWMH02	BWMH02	UWMH02	RWMH02	LWMH02	IWMH02	NWMH02	AWMH02	IWMH02
TST_H050	TGA_H05(	V100H050	IVISH050	TBN_H05	TAN_H05	IRINH050	EWMH05	BWMH05	UWMH05	RWMH05	LWMH05	IWMH05	NWMH05	AWMH05	IWMH05
TST_H075	TGA_H07:	V100H075	IVISH075	TBN_H07	TAN_H07	IRINH075	EWMH07	BWMH07	UWMH07	RWMH07	LWMH07	IWMH07	NWMH07	AWMH07	IWMH07
TST_H100	TGA_H10(	V100H100	IVISH100	TBN_H10	TAN_H10	IRINH100	EWMH10	BWMH10	UWMH10	RWMH10	LWMH10	IWMH10	NWMH10	AWMH10	IWMH10
100 (2nd)	TGA100_2														
100 Avg.	TGAAVG														
TST_H125	TGA_H12:	V100H125	IVISH125	TBN_H12	TAN_H12	IRINH125	EWMH12	BWMH12	UWMH12	RWMH12	LWMH12	IWMH12	NWMH12	AWMH12	IWMH12
TST_H150	TGA_H15(	V100H150	IVISH150	TBN_H15	TAN_H15	IRINH150	EWMH15	BWMH15	UWMH15	RWMH15	LWMH15	IWMH15	NWMH15	AWMH15	IWMH15
TST_H175	TGA_H17:	V100H175	IVISH175	TBN_H17	TAN_H17	IRINH175	EWMH17	BWMH17	UWMH17	RWMH17	LWMH17	IWMH17	NWMH17	AWMH17	IWMH17
TST_H200	TGA_H20(	V100H200	IVISH200	TBN_H20	TAN_H20	IRINH200	EWMH20	BWMH20	UWMH20	RWMH20	LWMH20	IWMH20	NWMH20	AWMH20	IWMH20
TST_H225	TGA_H22:	V100H225	IVISH225	TBN_H22	TAN_H22	IRINH225	EWMH22	BWMH22	UWMH22	RWMH22	LWMH22	IWMH22	NWMH22	AWMH22	IWMH22
TST_H250	TGA_H25(	V100H250	IVISH250	TBN_H25	TAN_H25	IRINH250	EWMH25	BWMH25	UWMH25	RWMH25	LWMH25	IWMH25	NWMH25	AWMH25	IWMH25
TST_H275	TGA_H27:	V100H275	IVISH275	TBN_H27	TAN_H27	IRINH275	EWMH27	BWMH27	UWMH27	RWMH27	LWMH27	IWMH27	NWMH27	AWMH27	IWMH27
TST_H300	TGA_H30(	V100H300	IVISH300	TBN_H30	TAN_H30	IRINH300	EWMH30	BWMH30	UWMH30	RWMH30	LWMH30	IWMH30	NWMH30	AWMH30	IWMH30

Summary	As Measured	Outlier Bearing Adjusted
Delta Pb @ EOT, ppm	AMDPBEOT	DPBEOT
Delta Pb @ 250-300h, ppm	DPB2530	

Mack T-12 EGR Engine Oil Test
Form 9
Liner Surface Roughness & Bore Diameter

Laboratory: LAB	**EOT Date:** DTCOMP	**EOT Time:** EOTTIME
Test Number: TESTNUM		
Oil Code: OILCODE		
Formulation/Stand Code: FORM		

Liner No.	Location	Ra (µm)	Bore Diameter (mm)		Ra (µm)	Dia. (mm)
1	Top Ring Travel @ 0°C	LIN1RAA	LIN1IDA	Avg.	ALIN1RA	ALIN1ID
	Top Ring Travel @ 90°C	LIN1RAB	LIN1IDB	Std. Dev.	SLIN1RA	
	Top Ring Travel @ 180°C	LIN1RAC		Min.	ILIN1RA	
	Top Ring Travel @ 270°C	LIN1RAD		Max.	XLIN1RA	
2	Top Ring Travel @ 0°C	LIN2RAA	LIN2IDA	Avg.	ALIN2RA	ALIN2ID
	Top Ring Travel @ 90°C	LIN2RAB	LIN2IDB	Std.Dev.	SLIN2RA	
	Top Ring Travel @ 180°C	LIN2RAC		Min.	ILIN2RA	
	Top Ring Travel @ 270°C	LIN2RAD		Max.	XLIN2RA	
3	Top Ring Travel @ 0°C	LIN3RAA	LIN3IDA	Avg.	ALIN3RA	ALIN3ID
	Top Ring Travel @ 90°C	LIN3RAB	LIN3IDB	Std. Dev.	SLIN3RA	
	Top Ring Travel @ 180°C	LIN3RAC		Min.	ILIN3RA	
	Top Ring Travel @ 270°C	LIN3RAD		Max.	XLIN3RA	
4	Top Ring Travel @ 0°C	LIN4RAA	LIN4IDA	Avg.	ALIN4RA	ALIN4ID
	Top Ring Travel @ 90°C	LIN4RAB	LIN4IDB	Std.Dev.	SLIN4RA	
	Top Ring Travel @ 180°C	LIN4RAC		Min.	ILIN4RA	
	Top Ring Travel @ 270°C	LIN4RAD		Max.	XLIN4RA	
5	Top Ring Travel @ 0°C	LIN5RAA	LIN5IDA	Avg.	ALIN5RA	ALIN5ID
	Top Ring Travel @ 90°C	LIN5RAB	LIN5IDB	Std. Dev.	SLIN5RA	
	Top Ring Travel @ 180°C	LIN5RAC		Min.	ILIN5RA	
	Top Ring Travel @ 270°C	LIN5RAD		Max.	XLIN5RA	
6	Top Ring Travel @ 0°C	LIN6RAA	LIN6IDA	Avg.	ALIN6RA	ALIN6ID
	Top Ring Travel @ 90°C	LIN6RAB	LIN6IDB	Std. Dev.	SLIN6RA	
	Top Ring Travel @ 180°C	LIN6RAC		Min.	ILIN6RA	
	Top Ring Travel @ 270°C	LIN6RAD		Max.	XLIN6RA	

	Ra (µm)	Bore Diameter (mm)
Average Surface Roughness & Bore Diameter	ALINRA	ALINID
Standard Deviation Surface Roughness & Bore Diameter	SLINRA	SLINID
Minimum Surface Roughness & Bore Diameter	ILINRA	ILINID
Maximum Surface Roughness & Bore Diameter	XLINRA	XLINID

Mack T-12 EGR Engine Oil Test
Form 10
Liner Wear Summary

Laboratory: LAB	**EOT Date:** DTCOMP	**EOT Time:** EOTTIME
Test Number: TESTNUM		
Oil Code: OILCODE		
Formulation/Stand Code: FORM		

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

Summary	As Measured	Outlier Screened
Average, µm	AMACLW	ALW
Std. Dev., µm	AMSCLW	SCLW
Minimum, µm	AMICLW	ICLW
Maximum, µm	AMXCLW	XCLW
Outlier Liners [A]	OUTLIN	

[A] Cylinder Number.

Mack T-12 EGR Engine Oil Test
Form 11
Unscheduled Downtime and Maintenance Summary

Laboratory: LAB	**EOT Date:** DTCOMP	**EOT Time:** EOTTIME
Test Number: TESTNUM		
Oil Code:	OILCODE	
Formulation/Stand Code:	FORM	

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
		TOTLDOWN	**Total Downtime**

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

Mack T-12 EGR Engine Oil Test
Form 11A
Unscheduled Downtime and Maintenance Summary

Laboratory: LAB	**EOT Date:** DTCOMP	**EOT Time:** EOTTIME
Test Number: TESTNUM		
Oil Code:	OILCODE	
Formulation/Stand Code:	FORM	

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**

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

Mack T-12 EGR Engine Oil Test
Form 11B
Unscheduled Downtime and Maintenance Summary

Laboratory: LAB	**EOT Date:** DTCOMP	**EOT Time:** EOTTIME
Test Number: TESTNUM		
Oil Code: OILCODE		
Formulation/Stand Code: FORM		

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
DOWNR030	DDATR040	DTIMR040	DREAR040
DOWNR041	DDATR041	DTIMR041	DREAR041
DOWNR042	DDATR042	DTIMR042	DREAR042
DOWNR043	DDATR043	DTIMR043	DREAR043
DOWNR044	DDATR044	DTIMR044	DREAR044
DOWNR045	DDATR045	DTIMR045	DREAR045
		TOTLDOWN	**Total Downtime**

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

Mack T-12 EGR Engine Oil Test
Form 12
Test Fuel Analysis (Last Batch)

Laboratory: LAB	**EOT Date:** DTCOMP	**EOT Time:** EOTTIME	
Test Number: TESTNUM			
Oil Code: OILCODE			
Formulation/Stand Code: FORM			
Supplier: FUELSUP		**Batch Identifiers:** FUELBTID	

Measurement	Specs.	Analysis		Test Method
		New	EOT	
Total Sulfur, ppm	**7 - 15**	FUELSNEW	FUELSEOT	**D 5453**
Gravity, °API	**34 – 37**	APIGRNEW	APIGREOT	**D 4052**
Hydrocarbon Composition				
Aromatics % Wt.	**26 – 31.5**	FUELAROM		**D 5186**
Olefins % Vol.	**Report**	FUELOLEF		**D 1319**
Cetane Index	**Report**	CETANEIN		**D 976**
Cetane No.	**43 – 47**	CETANENO		**D 613**
Copper Strip Corrosion	**1 Maximum**	FUELCU		**D 130**
Flash Point, °C	**54 Minimum**	FLASHPT		**D 93**
Pour Point, °C	**-18 Maximum**	FUELPOUR		**D 97**
Carbon Residue on 10% Residuum, %	**0.35 Maximum**	FUELCRES		**D 524 (10% Bottoms)**
Water & Sediment, % Vol.	**0.05 Maximum**	FUELH2O		**D 2709**
Viscosity, cSt @ 40°C	**2.0 – 2.6**	KINVIS		**D 445**
Total Acid Number	**0.05 Maximum**	FUELTAN		**D 664**
Strong Acid Number	**0.00 Maximum**	FUELSAN		**D 664**
Accelerated Stability	**1.5 max**	FUELACS		**D 2274**
Ash, % Wt.	**0.005 max**	FUELASH		**D 482**
SLBOCLE, g	**3100 min[A]**	SLBOCLE		**D 6078[A]**
90% Distillation, °C	**293 - 332**	FUEL90		**D 86**

[A] ***May be altered to be consistent with CARB or ASTM diesel fuel specifications.***

Mack T-12 EGR Engine Oil Test
Form 13
Characteristics of the Data Acquisition System

Laboratory:	LAB	**EOT Date:**	DTCOMP	**EOT Time:**	EOTTIME
Test Number:	TESTNUM				
Oil Code:	OILCODE				
Formulation/Stand Code:	FORM				

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.	OTEMSENS	OTEMCALF	OTEMRECD	OTEMOBSF	OTEMRECF	OTEMLOGF	OTEMSYSR
Fuel In.	FTEMSENS	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
Other							
Fuel Flow	FFLOSENS	FFLOCALF	FFLORECD	FFLOOBSF	FFLORECF	FFLOLOGF	FFLOSYSR
Engine RPM	RPMSENS	RPMCALF	RPMRECD	RPMOBSF	RPMRECF	RPMLOGF	RPMSYSR
Load	LOADSENS	LOADCALF	LOADRECD	LOADOBSF	LOADRECF	LOADLOGF	LOADSYSR
Inlet Restr.	INRESENS	INRECALF	INRERECD	INREOBSF	INRERECF	INRELOGF	INRESYSR
Exh. Press.	EXPRSENS	EXPRCALF	EXPRRECD	EXPROBSF	EXPRRECF	EXPRLOGF	EXPRSYSR
Oil Gal. Press.	OILGSENS	OILGCALF	OILGRECD	OILGOBSF	OILGRECF	OILGLOGF	OILGSYSR

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
- **LG - Handlog Sheet**
- **DL - Automatic Data Logger**
- **SC - Strip Chart Recorder**
- **C/M - Computer, Using Manual Data Entry**
- **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 for the output to reach 63.2% of final value for step change at input

Mack T-12 EGR Engine Oil Test
Form 14
Build-up and Hardware Information

Laboratory: LAB	**EOT Date:** DTCOMP	**EOT Time:** EOTTIME
Test Number: TESTNUM		
Oil Code: OILCODE		
Formulation/Stand Code: FORM		

Injection Timing

Timing Hours	Timing (Deg)
SITHR001	SIT_R001
SITHR002	SIT_R002
SITHR003	SIT_R003
SITHR004	SIT_R004
SITHR005	SIT_R005
SITHR006	SIT_R006
SITHR007	SIT_R007
SITHR008	SIT_R008
TOTSIT	**Total Timing Changes**

Hardware

Part	Part Number	Serial Number
Primary Turbocharger	TRBCHPPN	
Secondary Charger	TRBCHSPN	
Cylinder Head (front)	CYLHFRPN	CYLHFRSN
Cylinder Head (rear)	CYLHRRPN	CYLHRRSN
Pistons	PISTONPN	
Injection Nozzles	INJNOZPN	
Rod Bearings	RODBRGPN	
Liners	LINERPN	
Ring Set	RINGSTPN	

Cylinder Kit Location	CPD ID Number
Cylinder 1	CPDIDC1
Cylinder 2	CPDIDC2
Cylinder 3	CPDIDC3
Cylinder 4	CPDIDC4
Cylinder 5	CPDIDC5
Cylinder 6	CPDIDC6

Mack T-12 EGR Engine Oil Test
Form 15
Rating Summary: Piston #1

Laboratory:	LAB	**EOT Date:**	DTCOMP	**EOT Time:**	EOTTIME
Test Number:	TESTNUM				
Oil Code:	OILCODE				
Formulation/Stand Code:	FORM				
Date Rated:	DTRATE	**Rater Initials:**	RINIT	**Verified By:**	VRINIT

Total Piston Ratings Summary

	Dep. Factor	Grooves No. 1 A, %	Grooves No. 1 Dem.	Grooves No. 2 A, %	Grooves No. 2 Dem.	Lands No. 1 A, %	Lands No. 1 Dem.	Lands No. 2 A, %	Lands No. 2 Dem.	Dep. Factor	Groove No. 3 A, %	Groove No. 3 Dem.	Lands No. 3 A, %	Lands No. 3 Dem.	Lands No. 4 A, %	Lands No. 4 Dem.	Oil Cooling A, %	Oil Cooling Dem.	Under Crown A, %	Under Crown Dem.
Carbon																				
	HC-1.0	G1HCA1	G1HCD1	G2HCA1	G2HCD1	L1HCA1	L1HCD1	L2HCA1	L2HCD1		G3HCA1	G3HCD1	L3HCA1	L3HCD1	L4HCA1	L4HCD1				
	MC-0.5	G1MCA1	G1MCD1								G3MCA1	G3MCD1								
	LC-.25	G1LCA1	G1LCD1	G2LCA1	G2LCD1	L1LCA1	L1LCD1	L2LCA1	L2LCD1		G3LCA1	G3LCD1	L3LCA1	L3LCD1	L4LCA1	L4LCD1	OGLCA1	OGLCD1	UCLCA1	UCLCD1
	Total	G1ACTOT	G1DCTOT	G2ACTOT	G2DCTOT	L1ACTOT	L1DCTOT	L2ACTOT	L2DCTOT		G3ACTOT	G3DCTOT	L3ACTOT	L3DCTOT	L4ACTOT	L4DCTOT	OGACTOT	OGDCTOT	UCACTOT	UCDCTOT
Varnish	**8 – 9**	G1V9A1	G1V9D1	G2V9A1	G2V9D1	L1V9A1	L1V9D1	L2V9A1	L2V9D1											
	7 – 7.9	G1V8A1	G1V8D1	G2V8A1	G2V8D1	L1V8A1	L1V8D1	L2V8A1	L2V8D1	**7.5**	G3V75A1	G3V75D1	L3V75A1	L3V75D1	L4V75A1	L4V75D1	OGV75A1	OGV75D1	UCV75A1	UCV75D1
	6 – 6.9	G1V7A1	G1V7D1	G2V7A1	G2V7D1	L1V7A1	L1V7D1	L2V7A1	L2V7D1											
	5 – 5.9	G1V6A1	G1V6D1	G2V6A1	G2V6D1	L1V6A1	L1V6D1	L2V6A1	L2V6D1											
	4 – 4.9	G1V5A1	G1V5D1	G2V5A1	G2V5D1	L1V5A1	L1V5D1	L2V5A1	L2V5D1	**4.5**	G3V45A1	G3V45D1	L3V45A1	L3V45D1	L4V45A1	L4V45D1	OGV45A1	OGV45D1	UCV45A1	UCV45D1
	3 – 3.9	G1V4A1	G1V4D1	G2V4A1	G2V4D1	L1V4A1	L1V4D1	L2V4A1	L2V4D1											
	2 – 2.9	G1V3A1	G1V3D1	G2V3A1	G2V3D1	L1V3A1	L1V3D1	L2V3A1	L2V3D1											
	1 – 1.9	G1V2A1	G1V2D1	G2V2A1	G2V2D1	L1V2A1	L1V2D1	L2V2A1	L2V2D1	**1.5**	G3V15A1	G3V15D1	L3V15A1	L3V15D1	L4V15A1	L4V15D1	OGV15A1	OGV15D1	UCV15A1	UCV15D1
	>0 – 0.9	G1V1A1	G1V1D1	G2V1A1	G2V1D1	L1V1A1	L1V1D1	L2V1A1	L2V1D1											
	Clean	G1VCLNA	**0**	G2VCLNA	**0**	L1VCLNA	**0**	L2VCLNA	**0**	**Clean**	G3VCLNA	**0**	L3VCLNA	**0**	L4VCLNA	**0**	OGVCLNA	**0**	UCVCLNA	**0**
	Total	G1AVTOT	G1DVTOT	G2AVTOT	G2DVTOT	L1AVTOT	L1DVTOT	L2AVTOT	L2DVTOT		G3AVTOT	G3DVTOT	L3AVTOT	L3DVTOT	L4AVTOT	L4DVTOT	OGAVTOT	OGDVTOT	UCAVTOT	UCDVTOT
Rating		G1UWD1		G2UWD1		L1UWD1		L2UWD1			G3UWD1		L3UWD1		L4UWD1		OGUWD1		UCUWD1	
Location Factor		**2**		**3**		**1**		**3**			**20**		**20**		**60**		**0.5**		**1**	
Ind Rating		G1WD1		G2WD1		L1WD1		L2WD1			G3WD1		L3WD1		L4WD1		OGWD1		UCWD1	

WDP	**TGC**	**TLC**	**Unweighted Deposits**	**T. L. Flaked Carbon %**
WD1	TGC1	TLC1	UWD1	TLFC1

Mack T-12 EGR Engine Oil Test
Form 16
Rating Summary: Piston #2

Laboratory:	LAB	**EOT Date:**	DTCOMP	**EOT Time:**	EOTTIME
Test Number:	TESTNUM				
Oil Code:	OILCODE				
Formulation/Stand Code:	FORM				
Date Rated:	DTRATE	**Rater Initials:**	RINIT	**Verified By:**	VRINIT

Total Piston Ratings Summary

		Grooves				Lands					Groove		Lands				Oil		Under	
	Dep.	No. 1		No. 2		No. 1		No. 2		Dep.	No. 3		No. 3		No. 4		Cooling		Crown	
	Factor	A, %	Dem.	A, %	Dem.	A, %	Dem.	A, %	Dem.	Factor	A, %	Dem.	A, %	Dem.	A, %	Dem.	A, %	Dem.	A, %	Dem.
Carbon																				
	HC-1.0	G1HCA2	G1HCD2	G2HCA2	G2HCD2	L1HCA2	L1HCD2	L2HCA2	L2HCD2		G3HCA2	G3HCD2	L3HCA2	L3HCD2	L4HCA2	L4HCD2				
	MC-0.5	G1MCA2	G1MCD2								G3MCA2	G3MCD2								
	LC-.25	G1LCA2	G1LCD2	G2LCA2	G2LCD2	L1LCA2	L1LCD2	L2LCA2	L2LCD2		G3LCA2	G3LCD2	L3LCA2	L3LCD2	L4LCA2	L4LCD2	OGLCA2	OGLCD2	UCLCA2	UCLCD2
	Total	G1ACTOT	G1DCTOT	G2ACTOT	G2DCTOT	L1ACTOT	L1DCTOT	L2ACTOT	L2DCTOT		G3ACTOT	G3DCTOT	L3ACTOT	L3DCTOT	L4ACTOT	L4DCTOT	OGACTOT	OGDCTOT	UCACTOT	UCDCTOT
Varnish	**8 – 9**	G1V9A2	G1V9D2	G2V9A2	G2V9D2	L1V9A2	L1V9D2	L2V9A2	L2V9D2											
	7 – 7.9	G1V8A2	G1V8D2	G2V8A2	G2V8D2	L1V8A2	L1V8D2	L2V8A2	L2V8D2	**7.5**	G3V75A2	G3V75D2	L3V75A2	L3V75D2	L4V75A2	L4V75D2	OGV75A2	OGV75D2	UCV75A2	UCV75D2
	6 – 6.9	G1V7A2	G1V7D2	G2V7A2	G2V7D2	L1V7A2	L1V7D2	L2V7A2	L2V7D2											
	5 – 5.9	G1V6A2	G1V6D2	G2V6A2	G2V6D2	L1V6A2	L1V6D2	L2V6A2	L2V6D2											
	4 – 4.9	G1V5A2	G1V5D2	G2V5A2	G2V5D2	L1V5A2	L1V5D2	L2V5A2	L2V5D2	**4.5**	G3V45A2	G3V45D2	L3V45A2	L3V45D2	L4V45A2	L4V45D2	OGV45A2	OGV45D2	UCV45A2	UCV45D2
	3 – 3.9	G1V4A2	G1V4D2	G2V4A2	G2V4D2	L1V4A2	L1V4D2	L2V4A2	L2V4D2											
	2 – 2.9	G1V3A2	G1V3D2	G2V3A2	G2V3D2	L1V3A2	L1V3D2	L2V3A2	L2V3D2											
	1 – 1.9	G1V2A2	G1V2D2	G2V2A2	G2V2D2	L1V2A2	L1V2D2	L2V2A2	L2V2D2	**1.5**	G3V15A2	G3V15D2	L3V15A2	L3V15D2	L4V15A2	L4V15D2	OGV15A2	OGV15D2	UCV15A2	UCV15D2
	>0 – 0.9	G1V1A2	G1V1D2	G2V1A2	G2V1D2	L1V1A2	L1V1D2	L2V1A2	L2V1D2											
	Clean	G1VCLNA	**0**	G2VCLNA	**0**	L1VCLNA	**0**	L2VCLNA	**0**	**Clean**	G3VCLNA	**0**	L3VCLNA	**0**	L4VCLNA	**0**	OGVCLNA	**0**	UCVCLNA	**0**
	Total	G1AVTOT	G1DVTOT	G2AVTOT	G2DVTOT	L1AVTOT	L1DVTOT	L2AVTOT	L2DVTOT		G3AVTOT	G3DVTOT	L3AVTOT	L3DVTOT	L4AVTOT	L4DVTOT	OGAVTOT	OGDVTOT	UCAVTOT	UCDVTOT
Rating		G1UWD2		G2UWD2		L1UWD2		L2UWD2			G3UWD2		L3UWD2		L4UWD2		OGUWD2		UCUWD2	
Location Factor		**2**		**3**		**1**		**3**			**20**		**20**		**60**		**0.5**		**1**	
Ind Rating		G1WD2		G2WD2		L1WD2		L2WD2			G3WD2		L3WD2		L4WD2		OGWD2		UCWD2	

WDP	**TGC**	**TLC**	**Unweighted Deposits**	**T. L. Flaked Carbon %**
WD2	TGC2	TLC2	UWD2	TLFC2

Mack T-12 EGR Engine Oil Test
Form 17
Rating Summary: Piston #3

Laboratory:	LAB	**EOT Date:**	DTCOMP	**EOT Time:**	EOTTIME
Test Number:	TESTNUM				
Oil Code:	OILCODE				
Formulation/Stand Code:	FORM				
Date Rated:	DTRATE	**Rater Initials:**	RINIT	**Verified By:**	VRINIT

Total Piston Ratings Summary

	Dep. Factor	Grooves No. 1 A, %	Grooves No. 1 Dem.	Grooves No. 2 A, %	Grooves No. 2 Dem.	Lands No. 1 A, %	Lands No. 1 Dem.	Lands No. 2 A, %	Lands No. 2 Dem.	Dep. Factor	Groove No. 3 A, %	Groove No. 3 Dem.	Lands No. 3 A, %	Lands No. 3 Dem.	Lands No. 4 A, %	Lands No. 4 Dem.	Oil Cooling A, %	Oil Cooling Dem.	Under Crown A, %	Under Crown Dem.
Carbon																				
	HC-1.0	G1HCA3	G1HCD3	G2HCA3	G2HCD3	L1HCA3	L1HCD3	L2HCA3	L2HCD3		G3HCA3	G3HCD3	L3HCA3	L3HCD3	L4HCA3	L4HCD3				
	MC-0.5	G1MCA3	G1MCD3								G3MCA3	G3MCD3								
	LC-.25	G1LCA3	G1LCD3	G2LCA3	G2LCD3	L1LCA3	L1LCD3	L2LCA3	L2LCD3		G3LCA3	G3LCD3	L3LCA3	L3LCD3	L4LCA3	L4LCD3	OGLCA3	OGLCD3	UCLCA3	UCLCD3
	Total	G1ACTOT	G1DCTOT	G2ACTOT	G2DCTOT	L1ACTOT	L1DCTOT	L2ACTOT	L2DCTOT		G3ACTOT	G3DCTOT	L3ACTOT	L3DCTOT	L4ACTOT	L4DCTOT	OGACTOT	OGDCTOT	UCACTOT	UCDCTOT
Varnish	8 – 9	G1V9A3	G1V9D3	G2V9A3	G2V9D3	L1V9A3	L1V9D3	L2V9A3	L2V9D3											
	7 – 7.9	G1V8A3	G1V8D3	G2V8A3	G2V8D3	L1V8A3	L1V8D3	L2V8A3	L2V8D3	7.5	G3V75A3	G3V75D3	L3V75A3	L3V75D3	L4V75A3	L4V75D3	OGV75A3	OGV75D3	UCV75A3	UCV75D3
	6 – 6.9	G1V7A3	G1V7D3	G2V7A3	G2V7D3	L1V7A3	L1V7D3	L2V7A3	L2V7D3											
	5 – 5.9	G1V6A3	G1V6D3	G2V6A3	G2V6D3	L1V6A3	L1V6D3	L2V6A3	L2V6D3											
	4 – 4.9	G1V5A3	G1V5D3	G2V5A3	G2V5D3	L1V5A3	L1V5D3	L2V5A3	L2V5D3	4.5	G3V45A3	G3V45D3	L3V45A3	L3V45D3	L4V45A3	L4V45D3	OGV45A3	OGV45D3	UCV45A3	UCV45D3
	3 – 3.9	G1V4A3	G1V4D3	G2V4A3	G2V4D3	L1V4A3	L1V4D3	L2V4A3	L2V4D3											
	2 – 2.9	G1V3A3	G1V3D3	G2V3A3	G2V3D3	L1V3A3	L1V3D3	L2V3A3	L2V3D3											
	1 – 1.9	G1V2A3	G1V2D3	G2V2A3	G2V2D3	L1V2A3	L1V2D3	L2V2A3	L2V2D3	1.5	G3V15A3	G3V15D3	L3V15A3	L3V15D3	L4V15A3	L4V15D3	OGV15A3	OGV15D3	UCV15A3	UCV15D3
	>0 – 0.9	G1V1A3	G1V1D3	G2V1A3	G2V1D3	L1V1A3	L1V1D3	L2V1A3	L2V1D3											
	Clean	G1VCLNA	0	G2VCLNA	0	L1VCLNA	0	L2VCLNA	0	Clean	G3VCLNA	0	L3VCLNA	0	L4VCLNA	0	OGVCLNA	0	UCVCLNA	0
	Total	G1AVTOT	G1DVTOT	G2AVTOT	G2DVTOT	L1AVTOT	L1DVTOT	L2AVTOT	L2DVTOT		G3AVTOT	G3DVTOT	L3AVTOT	L3DVTOT	L4AVTOT	L4DVTOT	OGAVTOT	OGDVTOT	UCAVTOT	UCDVTOT
Rating		G1UWD3		G2UWD3		L1UWD3		L2UWD3			G3UWD3		L3UWD3		L4UWD3		OGUWD3		UCUWD3	
Location Factor		**2**		**3**		**1**		**3**			**20**		**20**		**60**		**0.5**		**1**	
Ind Rating		G1WD3		G2WD3		L1WD3		L2WD3			G3WD3		L3WD3		L4WD3		OGWD3		UCWD3	

WDP	TGC	TLC	Unweighted Deposits	T. L. Flaked Carbon %
WD3	TGC3	TLC3	UWD3	TLFC3

Mack T-12 EGR Engine Oil Test
Form 18
Rating Summary: Piston #4

Laboratory:	LAB	**EOT Date:**	DTCOMP	**EOT Time:**	EOTTIME
Test Number:	TESTNUM				
Oil Code:			OILCODE		
Formulation/Stand Code:			FORM		
Date Rated:	DTRATE	**Rater Initials:**	RINIT	**Verified By:**	VRINIT

Total Piston Ratings Summary

		Grooves				Lands					Groove		Lands				Oil Cooling		Under Crown	
	Dep. Factor	No. 1		No. 2		No. 1		No. 2		Dep. Factor	No. 3		No. 3		No. 4					
		A, %	Dem.	A, %	Dem.	A, %	Dem.	A, %	Dem.		A, %	Dem.	A, %	Dem.	A, %	Dem.	A, %	Dem.	A, %	Dem.
Carbon																				
	HC-1.0	G1HCA4	G1HCD4	G2HCA4	G2HCD4	L1HCA4	L1HCD4	L2HCA4	L2HCD4		G3HCA4	G3HCD4	L3HCA4	L3HCD4	L4HCA4	L4HCD4				
	MC-0.5	G1MCA4	G1MCD4								G3MCA4	G3MCD4								
	LC-.25	G1LCA4	G1LCD4	G2LCA4	G2LCD4	L1LCA4	L1LCD4	L2LCA4	L2LCD4		G3LCA4	G3LCD4	L3LCA4	L3LCD4	L4LCA4	L4LCD4	OGLCA4	OGLCD4	UCLCA4	UCLCD4
	Total	G1ACTOT4	G1DCTOT4	G2ACTOT4	G2DCTOT4	L1ACTOT4	L1DCTOT4	L2ACTOT4	L2DCTOT4		G3ACTOT4	G3DCTOT4	L3ACTOT4	L3DCTOT4	L4ACTOT4	L4DCTOT4	OGACTOT4	OGDCTOT4	UCACTOT4	UCDCTOT4
Varnish	8 – 9	G1V9A4	G1V9D4	G2V9A4	G2V9D4	L1V9A4	L1V9D4	L2V9A4	L2V9D4											
	7 – 7.9	G1V8A4	G1V8D4	G2V8A4	G2V8D4	L1V8A4	L1V8D4	L2V8A4	L2V8D4	7.5	G3V75A4	G3V75D4	L3V75A4	L3V75D4	L4V75A4	L4V75D4	OGV75A4	OGV75D4	UCV75A4	UCV75D4
	6 – 6.9	G1V7A4	G1V7D4	G2V7A4	G2V7D4	L1V7A4	L1V7D4	L2V7A4	L2V7D4											
	5 – 5.9	G1V6A4	G1V6D4	G2V6A4	G2V6D4	L1V6A4	L1V6D4	L2V6A4	L2V6D4											
	4 – 4.9	G1V5A4	G1V5D4	G2V5A4	G2V5D4	L1V5A4	L1V5D4	L2V5A4	L2V5D4	4.5	G3V45A4	G3V45D4	L3V45A4	L3V45D4	L4V45A4	L4V45D4	OGV45A4	OGV45D4	UCV45A4	UCV45D4
	3 – 3.9	G1V4A4	G1V4D4	G2V4A4	G2V4D4	L1V4A4	L1V4D4	L2V4A4	L2V4D4											
	2 – 2.9	G1V3A4	G1V3D4	G2V3A4	G2V3D4	L1V3A4	L1V3D4	L2V3A4	L2V3D4											
	1 – 1.9	G1V2A4	G1V2D4	G2V2A4	G2V2D4	L1V2A4	L1V2D4	L2V2A4	L2V2D4	1.5	G3V15A4	G3V15D4	L3V15A4	L3V15D4	L4V15A4	L4V15D4	OGV15A4	OGV15D4	UCV15A4	UCV15D4
	>0 – 0.9	G1V1A4	G1V1D4	G2V1A4	G2V1D4	L1V1A4	L1V1D4	L2V1A4	L2V1D4											
	Clean	G1VCLNA4	0	G2VCLNA4	0	L1VCLNA4	0	L2VCLNA4	0	Clean	G3VCLNA4	0	L3VCLNA4	0	L4VCLNA4	0	OGVCLNA4	0	UCVCLNA4	0
	Total	G1AVTOT4	G1DVTOT4	G2AVTOT4	G2DVTOT4	L1AVTOT4	L1DVTOT4	L2AVTOT4	L2DVTOT4		G3AVTOT4	G3DVTOT4	L3AVTOT4	L3DVTOT4	L4AVTOT4	L4DVTOT4	OGAVTOT4	OGDVTOT4	UCAVTOT4	UCDVTOT4
Rating		G1UWD4		G2UWD4		L1UWD4		L2UWD4			G3UWD4		L3UWD4		L4UWD4		OGUWD4		UCUWD4	
Location Factor		**2**		**3**		**1**		**3**			**20**		**20**		**60**		**0.5**		**1**	
Ind Rating		G1WD4		G2WD4		L1WD4		L2WD4			G3WD4		L3WD4		L4WD4		OGWD4		UCWD4	

WDP	**TGC**	**TLC**	**Unweighted Deposits**	**T. L. Flaked Carbon %**
WD4	TGC4	TLC4	UWD4	TLFC4

Mack T-12 EGR Engine Oil Test
Form 19
Rating Summary: Piston #5

Laboratory:	LAB	**EOT Date:**	DTCOMP	**EOT Time:**	EOTTIME
Test Number:	TESTNUM				
Oil Code:	OILCODE				
Formulation/Stand Code:	FORM				
Date Rated:	DTRATE	**Rater Initials:**	RINIT	**Verified By:**	VRINIT

Total Piston Ratings Summary

	Dep. Factor	Grooves No. 1 A, %	Grooves No. 1 Dem.	Grooves No. 2 A, %	Grooves No. 2 Dem.	Lands No. 1 A, %	Lands No. 1 Dem.	Lands No. 2 A, %	Lands No. 2 Dem.	Dep. Factor	Groove No. 3 A, %	Groove No. 3 Dem.	Lands No. 3 A, %	Lands No. 3 Dem.	Lands No. 4 A, %	Lands No. 4 Dem.	Oil Cooling A, %	Oil Cooling Dem.	Under Crown A, %	Under Crown Dem.
Carbon																				
	HC-1.0	G1HCA5	G1HCD5	G2HCA5	G2HCD5	L1HCA5	L1HCD5	L2HCA5	L2HCD5		G3HCA5	G3HCD5	L3HCA5	L3HCD5	L4HCA5	L4HCD5				
	MC-0.5	G1MCA5	G1MCD5								G3MCA5	G3MCD5								
	LC-.25	G1LCA5	G1LCD5	G2LCA5	G2LCD5	L1LCA5	L1LCD5	L2LCA5	L2LCD5		G3LCA5	G3LCD5	L3LCA5	L3LCD5	L4LCA5	L4LCD5	OGLCA5	OGLCD5	UCLCA5	UCLCD5
	Total	G1ACTOT	G1DCTOT	G2ACTOT	G2DCTOT	L1ACTOT	L1DCTOT	L2ACTOT	L2DCTOT		G3ACTOT	G3DCTOT	L3ACTOT	L3DCTOT	L4ACTOT	L4DCTOT	OGACTOT	OGDCTOT	UCACTOT	UCDCTOT
Varnish	**8 – 9**	G1V9A5	G1V9D5	G2V9A5	G2V9D5	L1V9A5	L1V9D5	L2V9A5	L2V9D5											
	7 – 7.9	G1V8A5	G1V8D5	G2V8A5	G2V8D5	L1V8A5	L1V8D5	L2V8A5	L2V8D5	**7.5**	G3V75A5	G3V75D5	L3V75A5	L3V75D5	L4V75A5	L4V75D5	OGV75A5	OGV75D5	UCV75A5	UCV75D5
	6 – 6.9	G1V7A5	G1V7D5	G2V7A5	G2V7D5	L1V7A5	L1V7D5	L2V7A5	L2V7D5											
	5 – 5.9	G1V6A5	G1V6D5	G2V6A5	G2V6D5	L1V6A5	L1V6D5	L2V6A5	L2V6D5											
	4 – 4.9	G1V5A5	G1V5D5	G2V5A5	G2V5D5	L1V5A5	L1V5D5	L2V5A5	L2V5D5	**4.5**	G3V45A5	G3V45D5	L3V45A5	L3V45D5	L4V45A5	L4V45D5	OGV45A5	OGV45D5	UCV45A5	UCV45D5
	3 – 3.9	G1V4A5	G1V4D5	G2V4A5	G2V4D5	L1V4A5	L1V4D5	L2V4A5	L2V4D5											
	2 – 2.9	G1V3A5	G1V3D5	G2V3A5	G2V3D5	L1V3A5	L1V3D5	L2V3A5	L2V3D5											
	1 – 1.9	G1V2A5	G1V2D5	G2V2A5	G2V2D5	L1V2A5	L1V2D5	L2V2A5	L2V2D5	**1.5**	G3V15A5	G3V15D5	L3V15A5	L3V15D5	L4V15A5	L4V15D5	OGV15A5	OGV15D5	UCV15A5	UCV15D5
	>0 – 0.9	G1V1A5	G1V1D5	G2V1A5	G2V1D5	L1V1A5	L1V1D5	L2V1A5	L2V1D5											
	Clean	G1VCLNA	**0**	G2VCLNA	**0**	L1VCLNA	**0**	L2VCLNA	**0**	**Clean**	G3VCLNA	**0**	L3VCLNA	**0**	L4VCLNA	**0**	OGVCLNA	**0**	UCVCLNA	**0**
	Total	G1AVTOT	G1DVTOT	G2AVTOT	G2DVTOT	L1AVTOT	L1DVTOT	L2AVTOT	L2DVTOT		G3AVTOT	G3DVTOT	L3AVTOT	L3DVTOT	L4AVTOT	L4DVTOT	OGAVTOT	OGDVTOT	UCAVTOT	UCDVTOT
Rating		G1UWD5		G2UWD5		L1UWD5		L2UWD5			G3UWD5		L3UWD5		L4UWD5		OGUWD5		UCUWD5	
Location Factor		**2**		**3**		**1**		**3**			**20**		**20**		**60**		**0.5**		**1**	
Ind Rating		G1WD5		G2WD5		L1WD5		L2WD5			G3WD5		L3WD5		L4WD5		OGWD5		UCWD5	

WDP	**TGC**	**TLC**	**Unweighted Deposits**	**T. L. Flaked Carbon %**
WD5	TGC5	TLC5	UWD5	TLFC5

Mack T-12 EGR Engine Oil Test
Form 20
Rating Summary: Piston #6

Laboratory:	LAB	**EOT Date:**	DTCOMP	**EOT Time:**	EOTTIME
Test Number:	TESTNUM				
Oil Code:	OILCODE				
Formulation/Stand Code:	FORM				
Date Rated:	DTRATE	**Rater Initials:**	RINIT	**Verified By:**	VRINIT

Total Piston Ratings Summary

	Dep. Factor	Grooves No. 1 A, %	Grooves No. 1 Dem.	Grooves No. 2 A, %	Grooves No. 2 Dem.	Lands No. 1 A, %	Lands No. 1 Dem.	Lands No. 2 A, %	Lands No. 2 Dem.	Dep. Factor	Groove No. 3 A, %	Groove No. 3 Dem.	Lands No. 3 A, %	Lands No. 3 Dem.	Lands No. 4 A, %	Lands No. 4 Dem.	Oil Cooling A, %	Oil Cooling Dem.	Under Crown A, %	Under Crown Dem.
Carbon	HC-1.0	G1HCA6	G1HCD6	G2HCA6	G2HCD6	L1HCA6	L1HCD6	L2HCA6	L2HCD6		G3HCA6	G3HCD6	L3HCA6	L3HCD6	L4HCA6	L4HCD6				
	MC-0.5	G1MCA6	G1MCD6								G3MCA6	G3MCD6								
	LC-.25	G1LCA6	G1LCD6	G2LCA6	G2LCD6	L1LCA6	L1LCD6	L2LCA6	L2LCD6		G3LCA6	G3LCD6	L3LCA6	L3LCD6	L4LCA6	L4LCD6	OGLCA6	OGLCD6	UCLCA6	UCLCD6
	Total	G1ACTOT	G1DCTOT	G2ACTOT	G2DCTOT	L1ACTOT	L1DCTOT	L2ACTOT	L2DCTOT		G3ACTOT	G3DCTOT	L3ACTOT	L3DCTOT	L4ACTOT	L4DCTOT	OGACTOT	OGDCTOT	UCACTOT	UCDCTOT
Varnish	8 – 9	G1V9A6	G1V9D6	G2V9A6	G2V9D6	L1V9A6	L1V9D6	L2V9A6	L2V9D6											
	7 – 7.9	G1V8A6	G1V8D6	G2V8A6	G2V8D6	L1V8A6	L1V8D6	L2V8A6	L2V8D6	7.5	G3V75A6	G3V75D6	L3V75A6	L3V75D6	L4V75A6	L4V75D6	OGV75A6	OGV75D6	UCV75A6	UCV75D6
	6 – 6.9	G1V7A6	G1V7D6	G2V7A6	G2V7D6	L1V7A6	L1V7D6	L2V7A6	L2V7D6											
	5 – 5.9	G1V6A6	G1V6D6	G2V6A6	G2V6D6	L1V6A6	L1V6D6	L2V6A6	L2V6D6											
	4 – 4.9	G1V5A6	G1V5D6	G2V5A6	G2V5D6	L1V5A6	L1V5D6	L2V5A6	L2V5D6	4.5	G3V45A6	G3V45D6	L3V45A6	L3V45D6	L4V45A6	L4V45D6	OGV45A6	OGV45D6	UCV45A6	UCV45D6
	3 – 3.9	G1V4A6	G1V4D6	G2V4A6	G2V4D6	L1V4A6	L1V4D6	L2V4A6	L2V4D6											
	2 – 2.9	G1V3A6	G1V3D6	G2V3A6	G2V3D6	L1V3A6	L1V3D6	L2V3A6	L2V3D6											
	1 – 1.9	G1V2A6	G1V2D6	G2V2A6	G2V2D6	L1V2A6	L1V2D6	L2V2A6	L2V2D6	1.5	G3V15A6	G3V15D6	L3V15A6	L3V15D6	L4V15A6	L4V15D6	OGV15A6	OGV15D6	UCV15A6	UCV15D6
	>0 – 0.9	G1V1A6	G1V1D6	G2V1A6	G2V1D6	L1V1A6	L1V1D6	L2V1A6	L2V1D6											
	Clean	G1VCLNA	0	G2VCLNA	0	L1VCLNA	0	L2VCLNA	0	Clean	G3VCLNA	0	L3VCLNA	0	L4VCLNA	0	OGVCLNA	0	UCVCLNA	0
	Total	G1AVTOT	G1DVTOT	G2AVTOT	G2DVTOT	L1AVTOT	L1DVTOT	L2AVTOT	L2DVTOT		G3AVTOT	G3DVTOT	L3AVTOT	L3DVTOT	L4AVTOT	L4DVTOT	OGAVTOT	OGDVTOT	UCAVTOT	UCDVTOT
Rating		G1UWD6		G2UWD6		L1UWD6		L2UWD6			G3UWD6		L3UWD6		L4UWD6		OGUWD6		UCUWD6	
Location Factor		**2**		**3**		**1**		**3**			**20**		**20**		**60**		**0.5**		**1**	
Ind Rating		G1WD6		G2WD6		L1WD6		L2WD6			G3WD6		L3WD6		L4WD6		OGWD6		UCWD6	

WDP	TGC	TLC	Unweighted Deposits	T. L. Flaked Carbon %
WD6	TGC6	TLC6	UWD6	TLFC6

Mack T-12 EGR Engine Oil Test
Form 21
Main Bearing Weight Loss

Laboratory: LAB	**EOT Date:** DTCOMP	**EOT Time:** EOTTIME
Test Number: TESTNUM		
Oil Code: OILCODE		
Formulation/Stand Code: FORM		

Position No.	Location	SOT Weight, g	EOT Weight, g	Weight Change, mg
1	Upper	MBWSOTU1	MBWEOTU1	MBWLU1
2	Upper	MBWSOTU2	MBWEOTU2	MBWLU2
3	Upper	MBWSOTU3	MBWEOTU3	MBWLU3
4	Upper	MBWSOTU4	MBWEOTU4	MBWLU4
5	Upper	MBWSOTU5	MBWEOTU5	MBWLU5
6	Upper	MBWSOTU6	MBWEOTU6	MBWLU6
7	Upper	MBWSOTU7	MBWEOTU7	MBWLU7
Upper Bearing Average Weight Loss, mg				AMBWLU
Upper Bearing Weight Loss Std. Dev., mg				SMBWLU
Upper Bearing Minimum Weight Loss, mg				IMBWLU
Upper Bearing Maximum Weight Loss, mg				XMBWLU

Position No.	Location	SOT Weight, g	EOT Weight, g	Weight Change, mg
1	Lower	MBWSOTL1	MBWEOTL1	MBWLL1
2	Lower	MBWSOTL2	MBWEOTL2	MBWLL2
3	Lower	MBWSOTL3	MBWEOTL3	MBWLL3
4	Lower	MBWSOTL4	MBWEOTL4	MBWLL4
5	Lower	MBWSOTL5	MBWEOTL5	MBWLL5
6	Lower	MBWSOTL6	MBWEOTL6	MBWLL6
7	Lower	MBWSOTL7	MBWEOTL7	MBWLL7
Lower Bearing Average Weight Loss, mg				AMBWLL
Lower Bearing Weight Loss Std. Dev., mg				SMBWLL
Lower Bearing Minimum Weight Loss, mg				IMBWLL
Lower Bearing Maximum Weight Loss, mg				XMBWLL

Main Bearing Batch ID	MBBIDNUM

Mack T-12 EGR Engine Oil Test
Form 22
Ring Gap Measurements

Laboratory:	LAB	**EOT Date:**	DTCOMP	**EOT Time:**	EOTTIME
Test Number:	TESTNUM				
Oil Code:		OILCODE			
Formulation/Stand Code:		FORM			

Cylinder No.	Top Ring Gap, mm		
	SOT	**EOT**	**Delta (EOT-SOT)**
1	TRGSOT1	TRGEOT1	TRGD1
2	TRGSOT2	TRGEOT2	TRGD2
3	TRGSOT3	TRGEOT3	TRGD3
4	TRGSOT4	TRGEOT4	TRGD4
5	TRGSOT5	TRGEOT5	TRGD5
6	TRGSOT6	TRGEOT6	TRGD6
Average			ATRGD

Cylinder No.	2nd Ring Gap, mm		
	SOT	**EOT**	**Delta (EOT-SOT)**
1	R2GSOT1	R2GEOT1	R2GD1
2	R2GSOT2	R2GEOT2	R2GD2
3	R2GSOT3	R2GEOT3	R2GD3
4	R2GSOT4	R2GEOT4	R2GD4
5	R2GSOT5	R2GEOT5	R2GD5
6	R2GSOT6	R2GEOT6	R2GD6
Average			AR2GD

Cylinder No.	Oil Ring Gap, mm		
	SOT	**EOT**	**Delta (EOT-SOT)**
1	ORGSOT1	ORGEOT1	ORGD1
2	ORGSOT2	ORGEOT2	ORGD2
3	ORGSOT3	ORGEOT3	ORGD3
4	ORGSOT4	ORGEOT4	ORGD4
5	ORGSOT5	ORGEOT5	ORGD5
6	ORGSOT6	ORGEOT6	ORGD6
Average			AORGD

Mack T-12 EGR Engine Oil Test
Form 23
American Chemistry Council Code of Practice
Test Laboratory Conformance Statement

Test Laboratory		SUBLAB			
Test Sponsor		TSTSPON1			
Formulation / Stand Code		FORM			
Test Number		TESTNUM			
Start Date	DTSTRT	Start Time	STRTTIME	Time Zone	TZONE

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 YESRQMET No NORQMET*

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 YESFULL No NOFULL *

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? YesYESNODEC* No NONODEC

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 YESDEV * No NODEV *(This currently applies only to specific deviations identified in the ASTM Information Letter System)*

Check The Appropriate Conclusion

INCLUDE	Operational review of this test indicates that the results should be included in the Multiple Test Acceptance Criteria calculations.
DONOTINC	*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
ACCCOMM1
ACCCOMM2
ACCCOMM3
ACCCOMM4

SUBSIGIM
Signature

SUBDATE
Date

SUBNAME
Typed Name

SUBTITLE
Title