Mack T-12 EGR Engine Oil Test

Report Packet Version No.
T12 VERSION 20061215 BETA
Conducted For
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC

CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC

C	**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.**

CC	**NR = Non-Reference Oil Test**
	RO = Reference Oil Test

Test Number			
Stand: CCCCC	**Stand Run:** CCCC	**Engine:** CCCCCC	**Engine Hours:** CCCCC
End Of Test Date: YYYYMMDD		**End Of Test Time:** HH:MM	
Oil Code: CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC			
Formulation/Stand Code: CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC			
Alternate Codes	CCCCCCCCCCCCCCC	CCCCCCCCCCCCCCC	CCCCCCCCCCCCCCC

In my opinion this test CCCCCCCC **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: CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC

Testing Laboratory

CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC

Signature

CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC

Typed Name

CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC

Title

Mack T-12 EGR Engine Oil Test
Form 2

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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	265 Nominal	307
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:	CC	**EOT Date:**	YYYYMMDD	**EOT Time:**	HH:MM
Test Number	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Oil Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Formulation/Stand Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				

Test Results					
Date Test Started:	YYYYMMDD	**Start Time:**	HH:MM	**Test Length:**	S1234
TMC Oil Code: [A]	CCCCCC	**Lab Oil Code:**	CCCCCCCCCCCCCCCCCCCC	**SAE Viscosity:**	CCCCCCC

Average TGA Soot % at 100 h	S123.1
Centrifugal Oil Filter Mass Gain, g	S123.1
Oil Filter Delta P, kPa (138 maximum)	S123
EOT TBN	S123.1

	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	S123	S12.1	S123	S123.1	S1234
Transformed Result [B]	S123.1234	S123.1234	S123.1234	S123.1234	S123.1234
Correction Factor [B]	S123.1234	S123.1234	S123.1234	S123.1234	S123.1234
Corrected Transformed Result [B]	S123.1234	S123.1234	S123.1234	S123.1234	S123.1234
Severity Adjustment [B]	S123.1234	S123.1234	S123.1234	S123.1234	S123.1234
Final Transformed Result [B]	S123.1234	S123.1234	S123.1234	S123.1234	S123.1234
Final Original Unit Result	S123	S12.1	S123	S123.1	S1234
Mack Merits [C]	S1234.1	S1234.1	S1234.1	S1234.1	S1234.1
Total Mack Merits [C]	S1234.1				

Last Stand Reference Results					
Test Number:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Oil Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Test Length:	S1234	**TMC Oil Code:**	CCCCCC		
EOT Date:	YYYYMMDD	**EOT Time:**	HH:MM		
Stand Calibration Expiration Date:	YYYYMMDD				
Average TGA Soot % at 100 h	S123.1				

	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	S123	S12.1	S123	S123.1	S1234

[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: CC	**EOT Date:** YYYYMMDD	**EOT Time:** HH:MM
Test Number: CCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	**Oil Code:** CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	
Formulation/Stand Code: CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC		

	Parameter	Units	QI Threshold	EOT QI [A]	Target		Average		Samples [B]	BQD [C]	Over/Under Range [D]
Controlled Parameters	Speed	r/min	0.000	S12.123	1800	1200	S12345	S12345	S1234	S1234	S1234
	Fuel Flow	kg/h	0.000	S12.123	59.2	63.5	S12.12	S12.12	S1234	S1234	S1234
	Inlet Manifold Temp.	°C	0.000	S12.123	90	80	S1234	S1234	S1234	S1234	S1234
	Coolant Out Temp.	°C	0.000	S12.123	66	108	S1234	S1234	S1234	S1234	S1234
	Fuel In Temp.	°C	0.000	S12.123	40		S1234		S1234	S1234	S1234
	Oil Gallery Temp.	°C	0.000	S12.123	88	116	S1234	S1234	S1234	S1234	S1234
	Inlet Air Temp.	°C	0.000	S12.123	25		S1234		S1234	S1234	S1234
	Inlet Air Restriction	kPa			3.5 – 4.0		S12.12		S1234	S1234	S1234
	Inlet Man. Pressure	kPa			tbd	Tbd	S123	S123	S1234	S1234	S1234
	Exh. Back Pressure	kPa			2.7 – 3.5		S1.1		S1234	S1234	S1234
	Crankcase Pressure	kPa			0.25 – 0.75		S1.12		S1234	S1234	S1234
	Intake CO_2	%			3.09±0.05	1.42±0.05	S12.12	S12.12			
	Exhaust CO_2	%			9.25±0.15	9.93±0.15	S12.12	S12.12			

	Parameter	Units	Typical Values [E]		Average		
Non-Controlled Parameters	Torque	Nm	tbd	tbd	S1234	S1234	
	Brake Specific Fuel Cons.	g/kW-h	tbd	tbd	S123.1	S123.1	
	Pre-Turbine Temp. (L)	°C	tbd	tbd	S1234	S1234	
	Pre-Turbine Temp. (R)	°C	tbd	tbd	S1234	S1234	
	Tailpipe Temp.	°C	tbd	tbd	S1234	S1234	
	Oil Sump Temp.	°C	tbd	tbd	S1234	S1234	
	EGR Pre-Venturi Temp.	°C	tbd	tbd	S1234	S1234	
	Blowby	L/min	tbd	tbd	S12.1	S12.1	
	Inlet Air Dew Point	°C	tbd	tbd	S1234	S1234	
	EGR Pre-Venturi Pressure	kPa	tbd	tbd	S1234	S1234	
	Main Gallery Oil Pressure	kPa	tbd	tbd	S1234	S1234	

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:	CC	**EOT Date:**	YYYYMMDD	**EOT Time:**	HH:MM
Test Number:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Oil Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Formulation/Stand Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				

Cylinder #	Location	SOT Weight, g	EOT Weight, g	Weight Change, mg
1	**Upper**	S12.1234	S12.1234	S123.1
2	**Upper**	S12.1234	S12.1234	S123.1
3	**Upper**	S12.1234	S12.1234	S123.1
4	**Upper**	S12.1234	S12.1234	S123.1
5	**Upper**	S12.1234	S12.1234	S123.1
6	**Upper**	S12.1234	S12.1234	S123.1

Summary	As Measured	Outlier Screened
Upper Bearing Average Weight Loss, mg	S123.1	S123.1
Upper Bearing Weight Loss Std. Dev., mg	S123.1	S123.1
Upper Bearing Minimum Weight Loss, mg	S123.1	S123.1
Upper Bearing Maximum Weight Loss, mg	S123.1	S123.1
Outlier Upper Rod Bearing [A]	CCCCC	

[A] Cylinder number

Cylinder #	Location	SOT Weight, g	EOT Weight, g	Weight Change, mg
1	**Lower**	S12.1234	S12.1234	S123.1
2	**Lower**	S12.1234	S12.1234	S123.1
3	**Lower**	S12.1234	S12.1234	S123.1
4	**Lower**	S12.1234	S12.1234	S123.1
5	**Lower**	S12.1234	S12.1234	S123.1
6	**Lower**	S12.1234	S12.1234	S123.1
Lower Bearing Average Weight Loss, mg				S123.1
Lower Bearing Weight Loss Std. Dev., mg				S123.1
Lower Bearing Minimum Weight Loss, mg				S123.1
Lower Bearing Maximum Weight Loss, mg				S123.1

Conrod Bearing Batch ID	CCCCCCCCCCCC

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

Laboratory:	CC	**EOT Date:**	YYYYMMDD	**EOT Time:**	HH:MM
Test Number:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Oil Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Formulation/Stand Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				

Cylinder No.	Top Ring SOT Weight, g	Top Ring EOT Weight, g	Weight Loss, mg
1	S12.1234	S12.1234	S123.1
2	S12.1234	S12.1234	S123.1
3	S12.1234	S12.1234	S123.1
4	S12.1234	S12.1234	S123.1
5	S12.1234	S12.1234	S123.1
6	S12.1234	S12.1234	S123.1

Summary	As Measured	Outlier Screened
Top Ring Average Weight Loss, mg	S123	S123
Top Ring Weight Loss Std. Dev., mg	S123.1	S123.1
Top Ring Minimum Weight Loss, mg	S123.1	S123.1
Top Ring Maximum Weight Loss, mg	S123.1	S123.1
Outlier Ring [B]	CCCCC	

[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	S12.1234	S12.1234	S123.1
2	S12.1234	S12.1234	S123.1
3	S12.1234	S12.1234	S123.1
4	S12.1234	S12.1234	S123.1
5	S12.1234	S12.1234	S123.1
6	S12.1234	S12.1234	S123.1
2nd Ring Average Weight Loss, mg			S123.1
2nd Ring Weight Loss Std. Dev., mg			S123.1
2nd Ring Min. Weight Loss, mg			S123.1
2nd Ring Max. Weight Loss, mg			S123.1

Cylinder No.	Oil Ring SOT Weight, g	Oil Ring EOT Weight, g	Weight Loss, mg
1	S12.1234	S12.1234	S123.1
2	S12.1234	S12.1234	S123.1
3	S12.1234	S12.1234	S123.1
4	S12.1234	S12.1234	S123.1
5	S12.1234	S12.1234	S123.1
6	S12.1234	S12.1234	S123.1
Oil Ring Average Weight Loss, mg			S123.1
Oil Ring Weight Loss Std. Dev., mg			S123.1
Oil Ring Minimum Weight Loss, mg			S123.1
Oil Ring Maximum Weight Loss, mg			S123.1

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

Laboratory:	CC	**EOT Date:**	YYYYMMDD	**EOT Time:**	HH:MM
Test Number:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	**Oil Code:**	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC		
Formulation/Stand Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				

Hours	Soot Wt.% TGA	Viscosity At 100°C cSt	Viscosity Increase cSt	TBN	TAN	IR Oxidation		Metal Elements (ppm)								
						Inte-grated	Peak Height	Fe	Pb	Cu	Cr	Al	Si	Sn	Na	Ni
CCCCCC	S123.1	S123.12		S123.1	S123.1	S1234.1	S1234.1	S12345	S12345	S12345	S12345	S12345	S12345	S12345	S12345	S12345
CCCCCC	S123.1	S123.12	S12.12	S123.1	S123.1	S1234.1	S1234.1	S12345	S12345	S12345	S12345	S12345	S12345	S12345	S12345	S12345
CCCCCC	S123.1	S123.12	S12.12	S123.1	S123.1	S1234.1	S1234.1	S12345	S12345	S12345	S12345	S12345	S12345	S12345	S12345	S12345
CCCCCC	S123.1	S123.12	S12.12	S123.1	S123.1	S1234.1	S1234.1	S12345	S12345	S12345	S12345	S12345	S12345	S12345	S12345	S12345
CCCCCC	S123.1	S123.12	S12.12	S123.1	S123.1	S1234.1	S1234.1	S12345	S12345	S12345	S12345	S12345	S12345	S12345	S12345	S12345
100 (2nd)	S123.1															
100 Avg.	S123.1															
CCCCCC	S123.1	S123.12	S12.12	S123.1	S123.1	S1234.1	S1234.1	S12345	S12345	S12345	S12345	S12345	S12345	S12345	S12345	S12345
CCCCCC	S123.1	S123.12	S12.12	S123.1	S123.1	S1234.1	S1234.1	S12345	S12345	S12345	S12345	S12345	S12345	S12345	S12345	S12345
CCCCCC	S123.1	S123.12	S12.12	S123.1	S123.1	S1234.1	S1234.1	S12345	S12345	S12345	S12345	S12345	S12345	S12345	S12345	S12345
CCCCCC	S123.1	S123.12	S12.12	S123.1	S123.1	S1234.1	S1234.1	S12345	S12345	S12345	S12345	S12345	S12345	S12345	S12345	S12345
CCCCCC	S123.1	S123.12	S12.12	S123.1	S123.1	S1234.1	S1234.1	S12345	S12345	S12345	S12345	S12345	S12345	S12345	S12345	S12345
CCCCCC	S123.1	S123.12	S12.12	S123.1	S123.1	S1234.1	S1234.1	S12345	S12345	S12345	S12345	S12345	S12345	S12345	S12345	S12345
CCCCCC	S123.1	S123.12	S12.12	S123.1	S123.1	S1234.1	S1234.1	S12345	S12345	S12345	S12345	S12345	S12345	S12345	S12345	S12345
CCCCCC	S123.1	S123.12	S12.12	S123.1	S123.1	S1234.1	S1234.1	S12345	S12345	S12345	S12345	S12345	S12345	S12345	S12345	S12345

Summary	As Measured	Outlier Bearing Adjusted
Delta Pb @ EOT, ppm	S123	S123
Delta Pb @ 250-300h, ppm	S1234	

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

Laboratory: CC	**EOT Date:** YYYYMMDD	**EOT Time:** HH:MM
Test Number: CCCCCCCCCCCCCCCCCCCCCCCCCCCCCC		
Oil Code: CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC		
Formulation/Stand Code: CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC		

Liner No.	Location	Ra (µm)	Bore Diameter (mm)		Ra (µm)	Dia. (mm)
1	Top Ring Travel @ 0°C	S1.12	S123.123	Avg.	S1.12	S123.123
	Top Ring Travel @ 90°C	S1.12	S123.123	Std. Dev.	S1.12	
	Top Ring Travel @ 180°C	S1.12		Min.	S1.12	
	Top Ring Travel @ 270°C	S1.12		Max.	S1.12	
2	Top Ring Travel @ 0°C	S1.12	S123.123	Avg.	S1.12	S123.123
	Top Ring Travel @ 90°C	S1.12	S123.123	Std.Dev.	S1.12	
	Top Ring Travel @ 180°C	S1.12		Min.	S1.12	
	Top Ring Travel @ 270°C	S1.12		Max.	S1.12	
3	Top Ring Travel @ 0°C	S1.12	S123.123	Avg.	S1.12	S123.123
	Top Ring Travel @ 90°C	S1.12	S123.123	Std. Dev.	S1.12	
	Top Ring Travel @ 180°C	S1.12		Min.	S1.12	
	Top Ring Travel @ 270°C	S1.12		Max.	S1.12	
4	Top Ring Travel @ 0°C	S1.12	S123.123	Avg.	S1.12	S123.123
	Top Ring Travel @ 90°C	S1.12	S123.123	Std.Dev.	S1.12	
	Top Ring Travel @ 180°C	S1.12		Min.	S1.12	
	Top Ring Travel @ 270°C	S1.12		Max.	S1.12	
5	Top Ring Travel @ 0°C	S1.12	S123.123	Avg.	S1.12	S123.123
	Top Ring Travel @ 90°C	S1.12	S123.123	Std. Dev.	S1.12	
	Top Ring Travel @ 180°C	S1.12		Min.	S1.12	
	Top Ring Travel @ 270°C	S1.12		Max.	S1.12	
6	Top Ring Travel @ 0°C	S1.12	S123.123	Avg.	S1.12	S123.123
	Top Ring Travel @ 90°C	S1.12	S123.123	Std. Dev.	S1.12	
	Top Ring Travel @ 180°C	S1.12		Min.	S1.12	
	Top Ring Travel @ 270°C	S1.12		Max.	S1.12	

	Ra (µm)	Bore Diameter (mm)
Average Surface Roughness & Bore Diameter	S1.12	S123.123
Standard Deviation Surface Roughness & Bore Diameter	S1.12	S123.123
Minimum Surface Roughness & Bore Diameter	S1.12	S123.123
Maximum Surface Roughness & Bore Diameter	S1.12	S123.123

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

Laboratory: CC	**EOT Date:** YYYYMMDD	**EOT Time:** HH:MM
Test Number: CCCCCCCCCCCCCCCCCCCCCCCCCCCCCC		
Oil Code: CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC		
Formulation/Stand Code: CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC		

Position	Wear Step (µm) Cylinder Number					
	1	2	3	4	5	6
1:00	S123.1	S123.1	S123.1	S123.1	S123.1	S123.1
2:00	S123.1	S123.1	S123.1	S123.1	S123.1	S123.1
3:00 (Thrust)	S123.1	S123.1	S123.1	S123.1	S123.1	S123.1
4:00	S123.1	S123.1	S123.1	S123.1	S123.1	S123.1
5:00	S123.1	S123.1	S123.1	S123.1	S123.1	S123.1
6:00 (Rear)	S123.1	S123.1	S123.1	S123.1	S123.1	S123.1
7:00	S123.1	S123.1	S123.1	S123.1	S123.1	S123.1
8:00	S123.1	S123.1	S123.1	S123.1	S123.1	S123.1
9:00 (Anti-Thrust)	S123.1	S123.1	S123.1	S123.1	S123.1	S123.1
10:00	S123.1	S123.1	S123.1	S123.1	S123.1	S123.1
11:00	S123.1	S123.1	S123.1	S123.1	S123.1	S123.1
12:00 (Front)	S123.1	S123.1	S123.1	S123.1	S123.1	S123.1
Average	S123.1	S123.1	S123.1	S123.1	S123.1	S123.1

Summary	As Measured	Outlier Screened
Average, µm	S123.1	S12.1
Std. Dev., µm	S123.1	S123.1
Minimum, µm	S123.1	S123.1
Maximum, µm	S123.1	S123.1
Outlier Liners [A]	CCCCC	

[A] **Cylinder Number**.

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

Laboratory: CC	**EOT Date:** YYYYMMDD	**EOT Time:** HH:MM
Test Number: CCCCCCCCCCCCCCCCCCCCCCCCCCCCCC		
Oil Code: CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC		
Formulation/Stand Code: CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC		

Number of Downtime Occurrences			S12
Test Hours	**Date**	**Downtime**	**Reasons**
HHH:MM	YYYYMMDD	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
HHH:MM	YYYYMMDD	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
HHH:MM	YYYYMMDD	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
HHH:MM	YYYYMMDD	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
HHH:MM	YYYYMMDD	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
HHH:MM	YYYYMMDD	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
HHH:MM	YYYYMMDD	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
HHH:MM	YYYYMMDD	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
HHH:MM	YYYYMMDD	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
HHH:MM	YYYYMMDD	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
HHH:MM	YYYYMMDD	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
HHH:MM	YYYYMMDD	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
HHH:MM	YYYYMMDD	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
HHH:MM	YYYYMMDD	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
HHH:MM	YYYYMMDD	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
		HHH:MM	**Total Downtime**

Other Comments	
Number of Comment Lines	S12
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	
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Mack T-12 EGR Engine Oil Test
Form 11A
Unscheduled Downtime and Maintenance Summary

Laboratory:	CC	**EOT Date:**	YYYYMMDD	**EOT Time:**	HH:MM
Test Number:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Oil Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Formulation/Stand Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				

Number of Downtime Occurrences			S12
Test Hours	**Date**	**Downtime**	**Reasons**
HHH:MM	YYYYMMI	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
HHH:MM	YYYYMMI	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
HHH:MM	YYYYMMI	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
HHH:MM	YYYYMMI	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
HHH:MM	YYYYMMI	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
HHH:MM	YYYYMMI	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
HHH:MM	YYYYMMI	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
HHH:MM	YYYYMMI	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
HHH:MM	YYYYMMI	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
HHH:MM	YYYYMMI	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
HHH:MM	YYYYMMI	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
HHH:MM	YYYYMMI	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
HHH:MM	YYYYMMI	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
HHH:MM	YYYYMMI	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
HHH:MM	YYYYMMI	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
		HHH:MM	**Total Downtime**

Other Comments	
Number of Comment Lines	S12
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	
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Mack T-12 EGR Engine Oil Test
Form 11B
Unscheduled Downtime and Maintenance Summary

Laboratory:	CC	**EOT Date:**	YYYYMMDD	**EOT Time:**	HH:MM
Test Number:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Oil Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Formulation/Stand Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				

Number of Downtime Occurrences			S12	▩
Test Hours	**Date**	**Downtime**	**Reasons**	
HHH:MM	YYYYMMD	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	
HHH:MM	YYYYMMD	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	
HHH:MM	YYYYMMD	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	
HHH:MM	YYYYMMD	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	
HHH:MM	YYYYMMD	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	
HHH:MM	YYYYMMD	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	
HHH:MM	YYYYMMD	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	
HHH:MM	YYYYMMD	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	
HHH:MM	YYYYMMD	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	
HHH:MM	YYYYMMD	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	
HHH:MM	YYYYMMD	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	
HHH:MM	YYYYMMD	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	
HHH:MM	YYYYMMD	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	
HHH:MM	YYYYMMD	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	
HHH:MM	YYYYMMD	HHH:MM	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	
		HHH:MM	**Total Downtime**	

Other Comments		
Number of Comment Lines	S12	▩
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC		
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC		
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC		
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC		
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CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC		
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC		

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

Laboratory:	CC	**EOT Date:**	YYYYMMDD	**EOT Time:**	HH:MM
Test Number:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Oil Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Formulation/Stand Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Supplier:	CCCCCCCCCCCCCCCCCCC	**Batch Identifiers:**	CCCCCCCCCCCCCCC		

Measurement	Specs.	Analysis		Test Method
		New	EOT	
Total Sulfur, ppm	**7 - 15**	S12.12	S12.12	**D 5453 or equivalent**
Gravity, °API	**34 – 37**	S12.1	S12.1	**D 4052**
Hydrocarbon Composition				
Aromatics % Wt.	**26 – 31.5**	S12.1		**D 5186**
Olefins % Vol.	**Report**	S12.1		**D 1319**
Cetane Index	**Report**	S12.1		**D 976**
Cetane No.	**43 – 47**	S12.1		**D 613**
Copper Strip Corrosion	**1 Maximum**	CCCC		**D 130**
Flash Point, °C	**54 Minimum**	S123		**D 93**
Pour Point, °C	**-18 Maximum**	S123		**D 97**
Carbon Residue on 10% Residuum, %	**0.35 Maximum**	S12.12		**D 524 (10% Bottoms)**
Water & Sediment, % Vol.	**0.05 Maximum**	S12.12		**D 2709**
Viscosity, cSt @ 40°C	**2.0 – 2.6**	S12.1		**D 445**
Total Acid Number	**0.05 Maximum**	S1.12		**D 664**
Strong Acid Number	**0.00 Maximum**	S1.12		**D 664**
Accelerated Stability	**1.5 max**	S12.1		**D 2274**
Ash, % Wt.	**0.005 max**	S123.123		**D 482**
SLBOCLE, g	**3100 min[A]**	S1234567		**D 6078[A]**
90% Distillation, °C	**293 - 332**	S1234		**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:	CC	**EOT Date:**	YYYYMMDD	**EOT Time:**	HH:MM
Test Number:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Oil Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Formulation/Stand Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				

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.	CCCCCCCCCC	CCCCCCCCCC	CCC	CCCCCCCCCC	CCCCCCCCCC	CCCCCCCCC	CCCCCCCC
Fuel In.	CCCCCCCCCC	CCCCCCCCCC	CCC	CCCCCCCCCC	CCCCCCCCCC	CCCCCCCCC	CCCCCCCC
Intake Air	CCCCCCCCCC	CCCCCCCCCC	CCC	CCCCCCCCCC	CCCCCCCCCC	CCCCCCCCC	CCCCCCCC
Intake Man.	CCCCCCCCCC	CCCCCCCCCC	CCC	CCCCCCCCCC	CCCCCCCCCC	CCCCCCCCC	CCCCCCCC
Pre-Turb.	CCCCCCCCCC	CCCCCCCCCC	CCC	CCCCCCCCCC	CCCCCCCCCC	CCCCCCCCC	CCCCCCCC
Cool. Out	CCCCCCCCCC	CCCCCCCCCC	CCC	CCCCCCCCCC	CCCCCCCCCC	CCCCCCCCC	CCCCCCCC
Other							
Fuel Flow	CCCCCCCCCC	CCCCCCCCCC	CCC	CCCCCCCCCC	CCCCCCCCCC	CCCCCCCCC	CCCCCCCC
Engine RPM	CCCCCCCCCC	CCCCCCCCCC	CCC	CCCCCCCCCC	CCCCCCCCCC	CCCCCCCCC	CCCCCCCC
Load	CCCCCCCCCC	CCCCCCCCCC	CCC	CCCCCCCCCC	CCCCCCCCCC	CCCCCCCCC	CCCCCCCC
Inlet Restr.	CCCCCCCCCC	CCCCCCCCCC	CCC	CCCCCCCCCC	CCCCCCCCCC	CCCCCCCCC	CCCCCCCC
Exh. Press.	CCCCCCCCCC	CCCCCCCCCC	CCC	CCCCCCCCCC	CCCCCCCCCC	CCCCCCCCC	CCCCCCCC
Oil Gal. Press.	CCCCCCCCCC	CCCCCCCCCC	CCC	CCCCCCCCCC	CCCCCCCCCC	CCCCCCCCC	CCCCCCCC

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: CC	**EOT Date:** YYYYMMDD	**EOT Time:** HH:MM
Test Number: CCCCCCCCCCCCCCCCCCCCCCCCCCCCCC		
Oil Code: CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC		
Formulation/Stand Code: CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC		

Injection Timing

Timing Hours	Timing (Deg)
S12	S12.12
S12	S12.12
S12	S12.12
S12	S12.12
S12	S12.12
S12	S12.12
S12	S12.12
S12	S12.12
S1	**Total Timing Changes**

Hardware

Part	Part Number	Serial Number
Primary Turbocharger	CCCCCCCCCCCCCCCCCCC	
Secondary Charger	CCCCCCCCCCCCCCCCCCC	
Cylinder Head (front)	CCCCCCCCCCCCCCCCCCC	CCCCCCCCCCCCCCCCCCC
Cylinder Head (rear)	CCCCCCCCCCCCCCCCCCC	CCCCCCCCCCCCCCCCCCC
Pistons	CCCCCCCCCCCCCCCCCCC	
Injection Nozzles	CCCCCCCCCCCCCCCCCCC	
Rod Bearings	CCCCCCCCCCCCCCCCCCC	
Liners	CCCCCCCCCCCCCCCCCCC	
Ring Set	CCCCCCCCCCCCCCCCCCC	

Cylinder Kit Location	CPD ID Number
Cylinder 1	CCCCCCCCCCCCCCCCCCC
Cylinder 2	CCCCCCCCCCCCCCCCCCC
Cylinder 3	CCCCCCCCCCCCCCCCCCC
Cylinder 4	CCCCCCCCCCCCCCCCCCC
Cylinder 5	CCCCCCCCCCCCCCCCCCC
Cylinder 6	CCCCCCCCCCCCCCCCCCC

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

Laboratory:	CC	**EOT Date:**	YYYYMMDD	**EOT Time:**	HH:MM
Test Number:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Oil Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Formulation/Stand Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Date Rated:	YYYYMMDD	**Rater Initials:**	CCC	**Verified By:**	CCC

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	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12		S123	S123.12	S123	S123.12	S123	S123.12				
	MC-0.5	S123	S123.12								S123	S123.12								
	LC-.25	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12		S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
	Total	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12		S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
Varnish	8 – 9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	7 – 7.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	7.5	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
	6 – 6.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	5 – 5.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	4 – 4.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	4.5	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
	3 – 3.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	2 – 2.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	1 – 1.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	1.5	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
	>0 – 0.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	Clean	S123	0	S123	0	S123	0	S123	0	Clean	S123	0	S123	0	S123	0	S123	0	S123	0
	Total	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12		S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
Rating		S123.12		S123.12		S123.12		S123.12			S123.12		S123.12		S123.12		S123.12		S123.12	
Location Factor		2		3		1		3			20		20		60		0.5		1	
Ind Rating		S123.12		S123.12		S123.12		S123.12			S123.12		S123.12		S123.12		S123.12		S123.12	

WDP	TGC	TLC	Unweighted Deposits	T. L. Flaked Carbon %
S1234.1	S12.12	S12.12	S1234.1	S123456

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

Laboratory:	CC	**EOT Date:**	YYYYMMDD	**EOT Time:**	HH:MM
Test Number:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Oil Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Formulation/Stand Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Date Rated:	YYYYMMDD	**Rater Initials:**	CCC	**Verified By:**	CCC

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	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12		S123	S123.12	S123	S123.12	S123	S123.12				
	MC-0.5	S123	S123.12								S123	S123.12								
	LC-.25	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12		S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
	Total	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12		S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
Varnish	8 – 9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	7 – 7.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	7.5	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
	6 – 6.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	5 – 5.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	4 – 4.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	4.5	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
	3 – 3.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	2 – 2.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	1 – 1.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	1.5	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
	>0 – 0.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	Clean	S123	0	S123	0	S123	0	S123	0	Clean	S123	0	S123	0	S123	0	S123	0	S123	0
	Total	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12		S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
Rating		S123.12		S123.12		S123.12		S123.12			S123.12		S123.12		S123.12		S123.12		S123.12	
Location Factor		**2**		**3**		**1**		**3**			**20**		**20**		**60**		**0.5**		**1**	
Ind Rating		S123.12		S123.12		S123.12		S123.12			S123.12		S123.12		S123.12		S123.12		S123.12	

WDP	TGC	TLC	Unweighted Deposits	T. L. Flaked Carbon %
S1234.1	S12.12	S12.12	S1234.1	S123456

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

Laboratory:	CC	**EOT Date:**	YYYYMMDD	**EOT Time:**	HH:MM
Test Number:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Oil Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Formulation/Stand Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Date Rated:	YYYYMMDD	**Rater Initials:**	CCC	**Verified By:**	CCC

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	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12		S123	S123.12	S123	S123.12	S123	S123.12				
	MC-0.5	S123	S123.12								S123	S123.12								
	LC-.25	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12		S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
	Total	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12		S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
Varnish	8 – 9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	7 – 7.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	7.5	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
	6 – 6.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	5 – 5.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	4 – 4.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	4.5	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
	3 – 3.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	2 – 2.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	1 – 1.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	1.5	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
	>0 – 0.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	Clean	S123	0	S123	0	S123	0	S123	0	Clean	S123	0	S123	0	S123	0	S123	0	S123	0
	Total	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12		S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
Rating		S123.12		S123.12		S123.12		S123.12			S123.12		S123.12		S123.12		S123.12		S123.12	
Location Factor		2		3		1		3			20		20		60		0.5		1	
Ind Rating		S123.12		S123.12		S123.12		S123.12			S123.12		S123.12		S123.12		S123.12		S123.12	

WDP	TGC	TLC	Unweighted Deposits	T. L. Flaked Carbon %
S1234.1	S12.12	S12.12	S1234.1	S123456

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

Laboratory:	CC	**EOT Date:**	YYYYMMDD	**EOT Time:**	HH:MM
Test Number:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Oil Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Formulation/Stand Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Date Rated:	YYYYMMDD	**Rater Initials:**	CCC	**Verified By:**	CCC

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	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12		S123	S123.12	S123	S123.12	S123	S123.12				
	MC-0.5	S123	S123.12								S123	S123.12								
	LC-.25	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12		S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
	Total	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12		S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
Varnish	8 – 9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	7 – 7.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	7.5	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
	6 – 6.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	5 – 5.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	4 – 4.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	4.5	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
	3 – 3.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	2 – 2.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	1 – 1.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	1.5	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
	>0 – 0.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	Clean	S123	0	S123	0	S123	0	S123	0	Clean	S123	0	S123	0	S123	0	S123	0	S123	0
	Total	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12		S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
Rating		S123.12		S123.12		S123.12		S123.12			S123.12		S123.12		S123.12		S123.12		S123.12	
Location Factor		2		3		1		3			20		20		60		0.5		1	
Ind Rating		S123.12		S123.12		S123.12		S123.12			S123.12		S123.12		S123.12		S123.12		S123.12	

WDP	TGC	TLC	Unweighted Deposits	T. L. Flaked Carbon %
S1234.1	S12.12	S12.12	S1234.1	S123456

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

Laboratory:	CC	**EOT Date:**	YYYYMMDD	**EOT Time:**	HH:MM
Test Number:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Oil Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Formulation/Stand Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Date Rated:	YYYYMMDD	**Rater Initials:**	CCC	**Verified By:**	CCC

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	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12		S123	S123.12	S123	S123.12	S123	S123.12				
	MC-0.5	S123	S123.12								S123	S123.12								
	LC-.25	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12		S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
	Total	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12		S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
Varnish	8 – 9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	7 – 7.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	7.5	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
	6 – 6.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	5 – 5.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	4 – 4.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	4.5	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
	3 – 3.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	2 – 2.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	1 – 1.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	1.5	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
	>0 – 0.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	Clean	S123	0	S123	0	S123	0	S123	0	Clean	S123	0	S123	0	S123	0	S123	0	S123	0
	Total	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12		S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
Rating		S123.12		S123.12		S123.12		S123.12			S123.12		S123.12		S123.12		S123.12		S123.12	
Location Factor		2		3		1		3			20		20		60		0.5		1	
Ind Rating		S123.12		S123.12		S123.12		S123.12			S123.12		S123.12		S123.12		S123.12		S123.12	

WDP	TGC	TLC	Unweighted Deposits	T. L. Flaked Carbon %
S1234.1	S12.12	S12.12	S1234.1	S123456

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

Laboratory:	CC	**EOT Date:**	YYYYMMDD	**EOT Time:**	HH:MM
Test Number:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Oil Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Formulation/Stand Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Date Rated:	YYYYMMDD	**Rater Initials:**	CCC	**Verified By:**	CCC

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	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12		S123	S123.12	S123	S123.12	S123	S123.12				
	MC-0.5	S123	S123.12								S123	S123.12								
	LC-.25	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12		S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
	Total	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12		S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
Varnish	8 – 9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	7 – 7.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	7.5	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
	6 – 6.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	5 – 5.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	4 – 4.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	4.5	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
	3 – 3.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	2 – 2.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	1 – 1.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	1.5	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
	>0 – 0.9	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12											
	Clean	S123	0	S123	0	S123	0	S123	0	Clean	S123	0	S123	0	S123	0	S123	0	S123	0
	Total	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12		S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12	S123	S123.12
Rating		S123.12		S123.12		S123.12		S123.12			S123.12		S123.12		S123.12		S123.12		S123.12	
Location Factor		2		3		1		3			20		20		60		0.5		1	
Ind Rating		S123.12		S123.12		S123.12		S123.12			S123.12		S123.12		S123.12		S123.12		S123.12	

WDP	TGC	TLC	Unweighted Deposits	T. L. Flaked Carbon %
S1234.1	S12.12	S12.12	S1234.1	S123456

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

Laboratory: CC	**EOT Date:** YYYYMMDD	**EOT Time:** HH:MM
Test Number: CCCCCCCCCCCCCCCCCCCCCCCCCCCCCC		
Oil Code: CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC		
Formulation/Stand Code: CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC		

Position No.	Location	SOT Weight, g	EOT Weight, g	Weight Change, mg
1	Upper	S12.1234	S12.1234	S123.1
2	Upper	S12.1234	S12.1234	S123.1
3	Upper	S12.1234	S12.1234	S123.1
4	Upper	S12.1234	S12.1234	S123.1
5	Upper	S12.1234	S12.1234	S123.1
6	Upper	S12.1234	S12.1234	S123.1
7	Upper	S12.1234	S12.1234	S123.1
Upper Bearing Average Weight Loss, mg				S123.1
Upper Bearing Weight Loss Std. Dev., mg				S123.1
Upper Bearing Minimum Weight Loss, mg				S123.1
Upper Bearing Maximum Weight Loss, mg				S123.1

Position No.	Location	SOT Weight, g	EOT Weight, g	Weight Change, mg
1	Lower	S12.1234	S12.1234	S123.1
2	Lower	S12.1234	S12.1234	S123.1
3	Lower	S12.1234	S12.1234	S123.1
4	Lower	S12.1234	S12.1234	S123.1
5	Lower	S12.1234	S12.1234	S123.1
6	Lower	S12.1234	S12.1234	S123.1
7	Lower	S12.1234	S12.1234	S123.1
Lower Bearing Average Weight Loss, mg				S123.1
Lower Bearing Weight Loss Std. Dev., mg				S123.1
Lower Bearing Minimum Weight Loss, mg				S123.1
Lower Bearing Maximum Weight Loss, mg				S123.1

Main Bearing Batch ID	CCCCCCCCCCCC

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

Laboratory:	CC	**EOT Date:**	YYYYMMDD	**EOT Time:**	HH:MM
Test Number:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Oil Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Formulation/Stand Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				

Cylinder No.	Top Ring Gap, mm		
	SOT	**EOT**	**Delta (EOT-SOT)**
1	S12.123	S12.123	S12.123
2	S12.123	S12.123	S12.123
3	S12.123	S12.123	S12.123
4	S12.123	S12.123	S12.123
5	S12.123	S12.123	S12.123
6	S12.123	S12.123	S12.123
Average			S12.123

Cylinder No.	2nd Ring Gap, mm		
	SOT	**EOT**	**Delta (EOT-SOT)**
1	S12.123	S12.123	S12.123
2	S12.123	S12.123	S12.123
3	S12.123	S12.123	S12.123
4	S12.123	S12.123	S12.123
5	S12.123	S12.123	S12.123
6	S12.123	S12.123	S12.123
Average			S12.123

Cylinder No.	Oil Ring Gap, mm		
	SOT	**EOT**	**Delta (EOT-SOT)**
1	S12.123	S12.123	S12.123
2	S12.123	S12.123	S12.123
3	S12.123	S12.123	S12.123
4	S12.123	S12.123	S12.123
5	S12.123	S12.123	S12.123
6	S12.123	S12.123	S12.123
Average			S12.123

Mack T-12 EGR Engine Oil Test
Form 23
T-10 Merits Calculated with T-12 Results

Laboratory:	CC	**EOT Date:**	YYYYMMDD	**EOT Time:**	HH:MM
Test Number	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Oil Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				
Formulation/Stand Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC				

	Delta Pb@ EOT (ppm)	Avg Liner Wear (µm)	Avg Top Ring Weight Loss (mg)	Oil Consumption (g/h)	Delta Pb 250-300h (ppm)
T-12 Final Original Unit Result	S123	S12.1	S123	S123.1	S1234
T-10 Mack Merits [A]	S1234.1	S1234.1	S1234.1	S1234.1	S1234.1
Total T-10 Mack Merits [A]	S1234.1				

[A] **Non-reference Tests only.**

Mack T-12 EGR Engine Oil Test
Form 24
American Chemistry Council Code of Practice
Test Laboratory Conformance Statement

Test Laboratory		CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC			
Test Sponsor		CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC			
Formulation / Stand Code		CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC			
Test Number		CCCCCCCCCCCCCCCCCCCCCCCCCCCCCC			
Start Date	YYYYMMDD	Start Time	HH:MM	Time Zone	CCC

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 C No C *

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 C No C *

If the response to this Declaration is “No”, does the test engineer consider the deviations from operational validity requirements that occurred to be beyond the control of the laboratory? Yes C * No C

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

Check The Appropriate Conclusion

C	Operational review of this test indicates that the results should be included in the Multiple Test Acceptance Criteria calculations.
C	*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
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
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CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC

CCCCCCCCCCCCCCCCCCCCCCCCC — YYYYMMDD
Signature — Date

CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC — CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
Typed Name — Title