

**Mack T-11
EGR Engine Oil Test**

Report Packet Version No.
T11 VERSION 20031029

Conducted For

CC

CC

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

Stand: CCCCC	Stand Run: CCCC	Engine: CCCCC	Engine Hours: CCCCC
End Of Test Date: YYYYMMDD		End Of Test Time: HH:MM	
Oil Code: CCC			
Formulation/Stand Code: CC-CCCCCCCCC-C-C-CCCCC-CC-CC-CCCC			
Altcode1: CCCCCCCCCCCCCC	Altcode2: CCCCCCCCCCCCCC	Altcode3: CCCCCCCCCCCCCC	

<p>In my opinion this test CCCCCCCC been conducted in a valid manner in accordance with the Test Method Dxxx and the appropriate amendments through the information letter system. The remarks included in this report describe the anomalies associated with this test.</p>

Submitted By: _____
Testing Laboratory

Signature Image
Signature

Typed Name

Title

**Mack T-11
EGR Engine Oil Test
Form 2**

Table of Contents

1.	Final Report Cover Sheet	Form 1
2.	Table of Contents	Form 2
3.	Summary of Test Method	Form 3
4.	Test Results Summary	Form 4
5.	Operational Summary	Form 5
6.	Oil Analysis Summary	Form 6
7.	Oil Analysis Summary	Form 7
8.	Oil Analysis Summary	Form 8
9.	Test Fuel Analysis (Last Batch)	Form 9
10.	Characteristics of the Data Acquisition System	Form 10
11.	Build-up and Hardware Information	Form 11
12.	Unscheduled Downtime & Maintenance Summary	Form 12

**Mack T-11
EGR Engine Oil Test
Form 3
Summary of Test Method**

The Mack T-11 EGR Engine oil Test is a fuel engine-dynamometer test which evaluates diesel engine oils for performance characteristics including viscosity increase and soot concentrations (loading). This test is a single-phase, steady state test (constant speed and load). The test is 252 hours and is run with retarded fuel injection timing to produce elevated soot levels in the oil.

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.

Mack T-11 Test Conditions

Parameter	Value
Time, h	252
Injection Timing, °BTDC	Variable
Speed, r/min	1800
Fuel Flow, kg/h	53.5
Intake CO ₂ , %	1.5
Exhaust CO ₂ , %	Record
Inlet Manifold Temp., °C	70
Coolant Out Temp., °C	66
Fuel In Temp., °C	40
Oil Gallery Temp., °C	88
Intake Air Temp., °C	25
Intake Air Restriction, kPa	3.5 – 4.0
Inlet Manifold Pressure, kPa	Tbd
Exhaust Back Pressure, kPa	2.7 – 3.5
Crankcase Pressure, kPa	0.25 – 0.75
Power, kW	Record
Torque, Nm	Record
Pre-Turbine Exhaust Temp., °C	Record
Tailpipe Exhaust Temp., °C	Record
Oil Sump Temp., °C	Record
EGR Pre-Venturi Temp., °C	Record
Inlet Air Dew Point, °C	Record
Fuel Pressure, kPa	Record
Main Gallery Oil Pressure, kPa	Record
Oil Filter Delta P, kPa	Not to exceed 138

**Mack T-11
EGR Engine Oil Test
Form 4
Test Results Summary**

Laboratory: CC	EOT Date: YYYYMMDD	EOT Time: HH:MM
Test Number: CCCCC CCCC CCCCC CCCC		
Oil Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	
Formulation/Stand Code:	CC-CCCCCCCCC-C-C-CCCCC-CC-CC-CCCC	

Test Results		
Date Test Started: YYYYMMDD	Start Time: HH:MM	
SAE Viscosity: CCCCCCC	Test Length: S1234	
TMC Oil Code:^A CCCCC	Laboratory Oil Code: CCCCCCCCCCCCCCCCCC	
TGA Soot % at 96 h	S123.12	
TGA Soot % at 192 h	S123.12	
TGA Soot % at 228 h	S123.12	
TGA Soot % at 252 h	S123.12	
Centrifugal Oil Filter Mass Gain, g	S123.1	
Oil Filter Delta P, kPa	S123	
EOT TBN	S123.1	
Oil Consumption, g/hr	S123.1	
Viscosity Increase at 6.0% Soot, cSt	S123.12	
MRV Yield Stress, cP	S12345	
	Soot at 12 cSt (%)	MRV (cP)
Original Result	AAAAAAAAA	S1234567
Transformed Result	S12.1234	S1234567
Correction Factor	S12.1234	S1234567
Corrected Transformed Result	S12.1234	S1234567
Severity Adjustment	S12.1234	S1234567
Final Transformed Result	S12.1234	S1234567
Final Original Unit Result	AAAAAAAAA	S1234567

Last Stand Reference Results		
Test Number: CCCCC CCCC CCCCC CCCC		
Oil Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	
Test Length: S1234	TMC Oil Code: CCCCC	
EOT Date: YYYYMMDD	EOT Time: HH:MM	
Stand Calibration Expiration Date:	YYYYMMDD	
TGA Soot % at 96 h	S123.12	
TGA Soot % at 192h	S123.12	
TGA Soot % at 228h	S123.12	
TGA Soot % at 252 h	S123.12	
Oil Consumption, g/hr	S123.1	
Viscosity at 6.0% Soot, cSt	S123.12	
	Soot at 12 cSt (%)	MRV
Final Original Unit Result	AAAAAAAAA	S1234567

^A Reference Tests only.

**Mack T-11
EGR Engine Oil Test
Form 5
Operational Summary**

Laboratory: CC	EOT Date: YYYYMMDD	EOT Time: HH:MM
Test Number: CCCCC CCCC CCCCC CCCCC		
Oil Code: CCC		
Formulation/Stand Code: CC-CCCCCCCCC-C-C-CCCCC-CC-CC-CCCC		

	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	S12345	S1234	S1234
Fuel Flow		kg/h	0.000	S12.123	53.5	S12.12	S1234	S1234	S1234
Inlet Manifold Temp.		°C	0.000	S12.123	70	S1234	S1234	S1234	S1234
Coolant Out Temp.		°C	0.000	S12.123	66	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	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	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		%			1.5+0.5	S12.12			
Non-controlled Parameters	Parameter	Units	Typical Values ^E		Average				
	Power	kW	TBD		S12.1				
	Torque	Nm	TBD		S1234				
	Exhaust CO ₂	%	TBD		S12.12				
	Pre-Turbine Temp. (F)	°C	TBD		S1234				
	Pre-Turbine Temp. (R)	°C	TBD		S1234				
	Tailpipe Temp.	°C	TBD		S1234				
	Oil Sump Temp.	°C	TBD		S1234				
	EGR Pre-Venturi Temp.	°C	TBD		S1234				
	Blowby	L/min	TBD		S12.1				
	Inlet Air Dew Point	°C	TBD		S1234				
	Fuel Pressure	kPa	TBD		S1234				
Main Gallery Oil Press.	kPa	TBD		S1234					

^A QI 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 A3

^B Total number of data points taken. Minimum acceptable value is 2520

^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-11
EGR Engine Oil Test
Form 9
Test Fuel Analysis (Last Batch)**

Laboratory: CC	EOT Date: YYYYMMDD	EOT Time: HH:MM
Test Number: CCCCC	CCCC	CCCCC CCCCC
Oil Code:	CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC	
Formulation/Stand Code:	CC-CCCCCCCCC-C-C-CCCCC-CC-CC-CCCC	
Supplier: CCCCCCCCCCCCCCCCCC	Batch Identifiers: CCCCCCCCCCCCCCCC	

Measurement	Specs.	Analysis		Test Method
		NEW	EOT	
Total Sulfur, % Weight	0.04 – 0.05	S1.12	S1.12	D 2622
Gravity, °API	34.5 – 36.5	S1.1	S1.1	D 287 or D 4052
Hydrocarbon Composition				
Aromatics % Vol.	28 – 33	S1.1		D 1319
Olefin	Report	S12.1		D 1319
Cetane Index	Report	S1.1		D 976 & D 4737
Cetane No.	42 – 48	S1.1		D 613
Copper Strip Corrosion	1 Maximum	AAAA		D 130
Flash Point, °C	54 Minimum	S123		D 93
Pour Point, °C	-18 Maximum	S123		D 97
Carbon Residue on 10% Residuam, %	0.35 Maximum	S1.12		D 524 (10% Bottoms)
Water & Sediment, % Vol.	0.05 Maximum	AAAAAA		D 2709
Viscosity, cSt @ 40°C	2.4 – 5.0	S1.1		D 445
Total Acid Number	0.05 Maximum	S1.1		D 664
Strong Acid Number	0.00 Maximum	S1.1		D 664
Accelerated Stability	tbd	S1.1		D 2274
Distillation, °C				
IBP	Report	S1234		D 86
10%	Report	S1234		D 86
50%	Report	S1234		D 86
90%	282 – 338	S1234		D 86
EP	Report	S1234		D 86

**Mack T-11
EGR Engine Oil Test
Form 10**

Characteristics of the Data Acquisition System

Laboratory:	CC	EOT Date:	YYYYMMDD	EOT Time:	HH:MM
Test Number:	CCCCC	CCCC	CCCCCC	CCCCC	
Oil Code:	CC				
Formulation/Stand Code:	CC-CCCCCCCCC-C-C-CCCCC-CC-CC-CCCC				

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.	CCCCCCCC	CCCCCCCC	CCC	CCCCCCCC	CCCCCCCC	CCCCCCCC	CCCCCCCC
Fuel In.	CCCCCCCC	CCCCCCCC	CCC	CCCCCCCC	CCCCCCCC	CCCCCCCC	CCCCCCCC
Intake Air	CCCCCCCC	CCCCCCCC	CCC	CCCCCCCC	CCCCCCCC	CCCCCCCC	CCCCCCCC
Intake Man.	CCCCCCCC	CCCCCCCC	CCC	CCCCCCCC	CCCCCCCC	CCCCCCCC	CCCCCCCC
Pre-Turb.	CCCCCCCC	CCCCCCCC	CCC	CCCCCCCC	CCCCCCCC	CCCCCCCC	CCCCCCCC
Cool. Out	CCCCCCCC	CCCCCCCC	CCC	CCCCCCCC	CCCCCCCC	CCCCCCCC	CCCCCCCC
Other							
Fuel Flow	CCCCCCCC	CCCCCCCC	CCC	CCCCCCCC	CCCCCCCC	CCCCCCCC	CCCCCCCC
Engine RPM	CCCCCCCC	CCCCCCCC	CCC	CCCCCCCC	CCCCCCCC	CCCCCCCC	CCCCCCCC
Load	CCCCCCCC	CCCCCCCC	CCC	CCCCCCCC	CCCCCCCC	CCCCCCCC	CCCCCCCC
Inlet Restr.	CCCCCCCC	CCCCCCCC	CCC	CCCCCCCC	CCCCCCCC	CCCCCCCC	CCCCCCCC
Exh. Press.	CCCCCCCC	CCCCCCCC	CCC	CCCCCCCC	CCCCCCCC	CCCCCCCC	CCCCCCCC
Oil Gal. Press.	CCCCCCCC	CCCCCCCC	CCC	CCCCCCCC	CCCCCCCC	CCCCCCCC	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-11
EGR Engine Oil Test
Form 11
Build-up and Hardware Information**

Laboratory: CC	EOT Date: YYYYMMDD	EOT Time: HH:MM
Test Number: CCCCC	CCCC	CCCCCC
Oil Code:	CC	
Formulation/Stand Code:	CC-CCCCCCCCC-C-C-CCCCC-CC-CC-CCCC	

Injection Timing

Timing Hours	Timing (Deg)
CCC	CCCCC
CCC	CCCCC
CCC	CCCCC
CCC	CCCCC
CCC	CCCCC
CCC	CCCCC
CCC	CCCCC
CCC	CCCCC
CCC	CCCCC
CCC	CCCCC
CCC	CCCCC
CCC	CCCCC
CCC	CCCCC
CCC	CCCCC
CCC	CCCCC
CCC	CCCCC
CCC	CCCCC
CCC	CCCCC
CCC	CCCCC
CCC	CCCCC
S12	Total Timing Changes

Hardware

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

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

