

Mack T-12A EGR Engine Oil Test

Report Packet Version No.

Conducted For

	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.

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

Test Number			
Stand:	Stand Run:	Engine:	Engine Hours:
End Of Test Date:		End Of Test Time:	
Oil Code:			
Formulation/Stand Code:			
Alternate Codes			

<p>In my opinion this test _____ been conducted in a valid manner in accordance with the Test Method D 7422 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

Typed Name

Title

**Mack T-12A 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.	Unscheduled Downtime & Maintenance Summary	Form 7
8.	Test Fuel Analysis (Last Batch)	Form 8
9.	Characteristics of the Data Acquisition System	Form 9
10.	Build-up and Hardware Information	Form 10

**Mack T-12A EGR Engine Oil Test
Form 3**

The Mack T-12A EGR Engine Oil Test is a fuel engine-dynamometer test which generates an oil sample to be used for MRV Viscosity requirements. This test is a one-phase, steady state test (constant speed and load), run with heavy EGR. The test is 100 h 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-12A Test Conditions

Parameter	Value
Time, h	100
Injection Timing, °BTDC	Variable
Speed, r/min	1800
Fuel Flow, kg/h	59.2
Intake CO₂, %	3.09
Exhaust CO₂, %	9.25
Inlet Manifold Temp., °C	90
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	265 Nominal
Exhaust Back Pressure, kPa	2.7 – 3.5
Crankcase Pressure, kPa	0.25 – 0.75
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
EGR Pre-Venturi Press., kPa	Record
Main Gallery Oil Pressure, kPa	Record
Oil Filter Delta P, kPa	Not to exceed 138

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

Laboratory:	EOT Date:	EOT Time:
Test Number		
Oil Code:		
Formulation/Stand Code:		

Test Results		
Date Test Started:	Start Time:	Test Length:
TMC Oil Code: ^A	Lab Oil Code:	SAE Viscosity:
Average TGA Soot % at 100 h		
		MRV @ 100h, cP
Original Result		
Transformed Result ^B		
Correction Factor ^B		
Corrected Transformed Result ^B		
Severity Adjustment ^B		
Final Transformed Result ^B		
Final Original Unit Result		

Last Stand Reference Results	
Test Number:	
Oil Code:	
Test Length:	TMC Oil Code:
EOT Date:	EOT Time:
Number of Tests Since Stand Calibration^C	
Stand Calibration Expiration Date	
Average TGA Soot % at 100 h	
MRV @ 100h, cP	
Final Original Unit Result	

^A Reference Tests only.

^B Transformed Units.

^C Operationally valid tests only, including current test.

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

Laboratory:	EOT Date:	EOT Time:
Test Number:	Oil Code:	
Formulation/Stand Code:		

Controlled Parameters	Parameter	Units	QI Threshold	EOT QI ^A	Target	Average	Samples ^B	BQD ^C	Over/Under Range ^D
	Speed	r/min	0.000		1800				
Fuel Flow	kg/h	0.000		59.2					
Inlet Manifold Temp.	°C	0.000		90					
Coolant Out Temp.	°C	0.000		66					
Fuel In Temp.	°C	0.000		40					
Oil Gallery Temp.	°C	0.000		88					
Inlet Air Temp.	°C	0.000		25					
Inlet Air Restriction	kPa			3.5 – 4.0					
Inlet Man. Pressure	kPa			265 Nominal					
Exh. Back Pressure	kPa			2.7 – 3.5					
Crankcase Pressure	kPa			0.25 – 0.75					
Intake CO ₂	%			3.09±0.05					
Exhaust CO ₂	%			9.25±0.15					
Non-Controlled Parameters	Parameter	Units	Typical Values ^E		Average				
	Torque	Nm	1232-1397	N/A					
	Brake Specific Fuel Cons.	g/kW-h	212-263	N/A					
	Pre-Turbine Temp. (Front)	°C	482-605	N/A					
	Pre-Turbine Temp. (Rear)	°C	503-567	N/A					
	Tailpipe Temp.	°C	303-354	N/A					
	Oil Sump Temp.	°C	92-105	N/A					
	EGR Pre-Venturi Temp.	°C	138-201	N/A					
	Blowby	L/min	41-176	N/A					
	Inlet Air Dew Point	°C	6-22	N/A					
	EGR Pre-Venturi Pressure	kPa	235-336	N/A					
Main Gallery Oil Pressure	kPa	165-269	N/A						

^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 A5

^B Total number of data points taken. Minimum acceptable value is 1000

^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

Fig A1.5 – Operational Summary

**MACK T-12A EGR Engine Oil Test
Form 6
Oil Analysis Summary**

Laboratory:	EOT Date:	EOT Time:
Test Number:		Oil Code:
Formulation/Stand Code:		

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

Summary	As Measured
MRV @ 100h, cP	
MRV Yield Stress, Pa	

**Mack T-12A EGR Engine Oil Test
Form 8
Test Fuel Analysis (Last Batch)**

Laboratory:	EOT Date:	EOT Time:
Test Number:		
Oil Code:		
Formulation/Stand Code:		
Supplier:		Batch Identifiers:

Measurement	Specs.	Analysis		Test Method
		New	EOT	
Total Sulfur, ppm	7 - 15			D 5453 or equivalent
Gravity, °API	34 - 37			D 4052
Hydrocarbon Composition				
Aromatics % Wt.	26 - 31.5			D 5186
Olefins % Vol.	Report			D 1319
Cetane Index	Report			D 976
Cetane No.	43 - 47			D 613
Copper Strip Corrosion	1 Maximum			D 130
Flash Point, °C	54 Minimum			D 93
Pour Point, °C	-18 Maximum			D 97
Carbon Residue on 10% Residuum, %	0.35 Maximum			D 524 (10% Bottoms)
Water & Sediment, % Vol.	0.05 Maximum			D 2709
Viscosity, cSt @ 40°C	2.0 - 2.6			D 445
Total Acid Number	0.05 Maximum			D 664
Strong Acid Number	0.00 Maximum			D 664
Accelerated Stability	1.5 max			D 2274
Ash, % Wt.	0.005 max			D 482
SLBOCLE, g	3100 min^A			D 6078^A
90% Distillation, °C	293 - 332			D 86

^AMay be altered to be consistent with CARB or ASTM diesel fuel specifications.

**Mack T-12A EGR Engine Oil Test
Form 9
Characteristics of the Data Acquisition System**

Laboratory:	EOT Date:	EOT Time:
Test Number:		
Oil Code:		
Formulation/Stand Code:		

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

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-12A EGR Engine Oil Test
Form 10
Build-up and Hardware Information**

Laboratory:	EOT Date:	EOT Time:
Test Number:		
Oil Code:		
Formulation/Stand Code:		

Injection Timing

Timing Hours	Timing (Deg)
Total Timing Changes	

Hardware

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

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

Bearing Type	Batch ID
Conrod	
Main	