

**Mack T-11  
D 7156 - 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:			
Altcode1:	Altcode2:	Altcode3:	

In my opinion this test \_\_\_\_\_ been conducted in a valid manner in accordance with the Test Method D 7156 and the appropriate amendments through the information letter system. The remarks included in this report describe the anomalies associated with this test.

Submitted By: \_\_\_\_\_

Testing Laboratory

Signature

Typed Name

Title

**Mack T-11**  
**D 7156 - 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.	Test Fuel Analysis (Last Batch)	Form 8
9.	Characteristics of the Data Acquisition System	Form 9
10.	Build-up and Hardware Information	Form 10
11.	Unscheduled Downtime & Maintenance Summary	Form 11
12.	ACC Conformance Statement	Form 12

**Mack T-11**  
**D 7156 - 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 <sub>2</sub> , %	1.5
Exhaust CO <sub>2</sub> , %	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  
D 7156 - EGR Engine Oil Test  
Form 4**

**Test Results Summary**

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

Test Results				
<b>Date Test Started:</b>		<b>Start Time:</b>		
<b>SAE Viscosity:</b>		<b>Test Length:</b>		
<b>TMC Oil Code:<sup>A</sup></b>		<b>Laboratory Oil Code:</b>		
<b>TGA Soot % at 96 h</b>				
<b>TGA Soot % at 192 h</b>				
<b>TGA Soot % at 228 h</b>				
<b>TGA Soot % at 252 h</b>				
<b>Centrifugal Oil Filter Mass Gain, g</b>				
<b>Oil Filter Delta P, kPa</b>				
<b>EOT TBN</b>				
<b>Oil Consumption, g/hr</b>				
<b>Viscosity Increase at 6.0% Soot, cSt</b>				
<b>MRV Yield Stress, cP</b>				
	<b>Soot at 4 cSt (%)</b>	<b>Soot at 12 cSt (%)</b>	<b>Soot at 15 cSt (%)</b>	<b>MRV (cP)</b>
<b>Original Result</b>				
<b>Transformed Result</b>				
<b>Correction Factor</b>				
<b>Corrected Transformed Result</b>				
<b>Severity Adjustment</b>				
<b>Final Transformed Result</b>				
<b>Final Original Unit Result</b>				

Last Stand Reference Results				
<b>Test Number:</b>				
<b>Oil Code:</b>				
<b>Test Length:</b>		<b>TMC Oil Code:</b>		
<b>EOT Date:</b>		<b>EOT Time:</b>		
<b>Stand Calibration Expiration Date:</b>				
<b>TGA Soot % at 96 h</b>				
<b>TGA Soot % at 192h</b>				
<b>TGA Soot % at 228h</b>				
<b>TGA Soot % at 252 h</b>				
<b>Oil Consumption, g/hr</b>				
<b>Viscosity at 6.0% Soot, cSt</b>				
	<b>Soot at 4 cSt (%)</b>	<b>Soot at 12 cSt (%)</b>	<b>Soot at 15 cSt (%)</b>	<b>MRV (cP)</b>
<b>Final Original Unit Result</b>				

<sup>A</sup> Reference Tests only.

**Mack T-11**  
**D 7156 - EGR Engine Oil Test**  
**Form 5**  
**Operational Summary**

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

	Parameter	Units	QI Threshold	EOT QI <sup>A</sup>	Target	Average	Samples <sup>B</sup>	BQD <sup>C</sup>	Over/Under Range <sup>D</sup>
	<b>Controlled Parameters</b>	Speed	r/min	0.000		1800			
Fuel Flow		kg/h	0.000		53.5				
Inlet Manifold Temp.		°C	0.000		70				
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			140 minimum				
Exh. Back Pressure		kPa			2.7 – 3.5				
Crankcase Pressure		kPa			0.25 – 0.75				
Intake CO <sub>2</sub>		%			1.5+0.5				
	Parameter	Units	Typical Values <sup>E</sup>		Average				
<b>Non-controlled Parameters</b>	Power	kW	TBD						
	Torque	Nm	TBD						
	Exhaust CO <sub>2</sub>	%	TBD						
	Pre-Turbine Temp. (F)	°C	TBD						
	Pre-Turbine Temp. (R)	°C	TBD						
	Tailpipe Temp.	°C	TBD						
	Oil Sump Temp.	°C	TBD						
	EGR Pre-Venturi Temp.	°C	TBD						
	Blowby	L/min	TBD						
	Inlet Air Dew Point	°C	TBD						
	Fuel Pressure	kPa	TBD						
	Main Gallery Oil Press.	kPa	TBD						

<sup>A</sup> 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

<sup>B</sup> Total number of data points taken. Minimum acceptable value is 2520

<sup>C</sup> Number of Bad Quality Data points not used in the calculation of the statistical measures.

<sup>D</sup> Number of points clipped by over/under range limits.

<sup>E</sup> Typical values determined from reference oil test database

**Mack T-11  
D 7156 - EGR Engine Oil Test  
Form 6  
Oil Analysis Summary**

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

Hours	Soot (Wt. %) D 5967 Annex 4	Viscosity at 100°C (cSt) D 5967 Annex A3	Viscosity Increase (cSt)	TBN D 4739	TAN D 664	Integrated IR Oxidation

<b>D 6278 or D 7109 30-Pass Shear Viscosity (cSt) at 0 h</b>	<b>D 7109 90-Pass Shear Viscosity (cSt) at 0 h</b>	<b>D 6896 MRV Viscosity (cP) at 180 h<sup>A</sup></b>

<sup>A</sup> The maximum reported value allowed is 400,000 cP. Use this value if the results are TVTM or solid.



**Mack T-11**  
**D 7156 - EGR Engine Oil Test**  
**Form 8**  
**Test Fuel Analysis (Last Batch)**

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

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



**Mack T-11  
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Form 9**

**Characteristics of the Data Acquisition System**

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

Parameter (1)	Sensing Device (2)	Calibration Frequency (3)	Record Device (4)	Observation Frequency (5)	Record Frequency (6)	Log Frequency (7)	System Response (8)
<b>Temperatures</b>							
<b>Oil @ Filt.</b>							
<b>Fuel In.</b>							
<b>Intake Air</b>							
<b>Intake Man.</b>							
<b>Pre-Turb.</b>							
<b>Cool. Out</b>							
<b>Other</b>							
<b>Fuel Flow</b>							
<b>Engine RPM</b>							
<b>Load</b>							
<b>Inlet Restr.</b>							
<b>Exh. Press.</b>							
<b>Oil Gal. Press.</b>							

**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  
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Form 10  
Build-up and Hardware Information**

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

**Injection Timing**

Timing Hours	Timing (Deg)
<b>Total Timing Changes</b>	

**Hardware**

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

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







**Mack T-11**  
**D 7156 - EGR Engine Oil Test**  
**Form 12**  
**American Chemistry Council Code of Practice**  
**Test Laboratory Conformance Statement**

Test Laboratory					
Test Sponsor					
Formulation / Stand Code					
Test Number					
Start Date		Start Time		Time Zone	

**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 \_\_\_\_\_ No \_\_\_\_\_\*

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 \_\_\_\_\_ No \_\_\_\_\_\*

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 \_\_\_\_\_\* No \_\_\_\_\_

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

**Check the Appropriate Conclusion**

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

<b>Comments</b>

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Typed Name

\_\_\_\_\_  
Title