#### 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.
Results cannot be interpreted as representative of oil performance N = (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

Stand:	<b>Stand Run:</b>		Engine:	<b>Engine Hours:</b>
End Of Test Date:			<b>End Of Test Time:</b>	
Oil Code:				
Formulation/Stand	Code:			
Altcode1:		Altcode2:	A	Altcode3:

In my opinion this test 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.

Submitted By:

**Testing Laboratory** 

Signature

**Typed Name** 

Title

#### Mack T-11 D 7156 - EGR Engine Oil Test Form 2

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#### 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.

Parameter	Value
Time, h	252
Injection Timing, <sup>°</sup> 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

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

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

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

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

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

												ıge												
1800	53.5	70	66	40	88	25	3.5 - 4.0	140 minimum	2.7 - 3.5	0.25 - 0.75	$1.5 \pm .05$	Avera												
												l Values <sup>E</sup>	BD	BD	BD	BD	BD	BD	BD	BD	BD	BD	BD	TBD
0.000	0.000	0.000	0.000	0.000	0.000	0.000						Typica	L	L	L	L	L	L	L	L	L	L	L	L
r/min	kg/h	°C	Ĵ	Ĵ	°C	°C	kPa	kPa	kPa	kPa	%	Units	kW	Nm	%	ç	ç	$^{\circ}C$	$^{\circ}C$	°C	L/min	°C	kPa	kPa
Speed	Fuel Flow	Inlet Manifold Temp.	Coolant Out Temp.			Inlet Air Temp.	Inlet Air Restriction	Inlet Man. Pressure	Exh. Back Pressure	<b>Crankcase Pressure</b>	Intake CO <sub>2</sub>	Parameter	Power	Torque	Exhaust CO <sub>2</sub>	Pre-Turbine Temp. (F)				EGR Pre-Venturi Temp.	Blowby	Inlet Air Dew Point	Fuel Pressure	Main Gallery Oil Press.
	Speed r/min 0.000	Speed         r/min         0.000           Fuel Flow         kg/h         0.000	Speed         r/min         0.000           Fuel Flow         kg/h         0.000           Inlet Manifold Temp.         °C         0.000	Speed         r/min         0.000           Fuel Flow         kg/h         0.000           Inlet Manifold Temp.         °C         0.000           Coolant Out Temp.         °C         0.000	Speed         r/min         0.000           Fuel Flow         kg/h         0.000           Inlet Manifold Temp.         °C         0.000           Coolant Out Temp.         °C         0.000           Fuel In Temp.         °C         0.000	Speed         r/min         0.000           Fuel Flow         kg/h         0.000           Inlet Manifold Temp.         °C         0.000           Coolant Out Temp.         °C         0.000           Fuel In Temp.         °C         0.000           Oil Gallery Temp.         °C         0.000	Speed         r/min         0.000            Fuel Flow         kg/h         0.000            Inlet Manifold Temp.         °C         0.000            Coolant Out Temp.         °C         0.000            Fuel In Temp.         °C         0.000            Fuel In Temp.         °C         0.000            Inlet Air Temp.         °C         0.000	Speed         r/min         0.000         r           Fuel Flow         kg/h         0.000            Inlet Manifold Temp.         °C         0.000            Coolant Out Temp.         °C         0.000             Fuel In Temp.         °C         0.000              Fuel In Temp.         °C         0.000               Oil Gallery Temp.         °C         0.000	Speedr/min0.000Fuel Flowkg/h0.000Inlet Manifold Temp.°C0.000Coolant Out Temp.°C0.000Fuel In Temp.°C0.000Oil Gallery Temp.°C0.000Inlet Air Temp.°C0.000Inlet Air Temp.°C0.000Inlet Air Temp.°C0.000Inlet Air Temp.°C0.000Inlet Air Temp.°C0.000Inlet Air RestrictionkPaInlet Man. PressurekPa	Speedr/min0.000Fuel Flowkg/h0.000Inlet Manifold Temp.°C0.000Coolant Out Temp.°C0.000Fuel In Temp.°C0.000Oil Gallery Temp.°C0.000Inlet Air Temp.°C0.000Inlet Air Temp.°C0.000Inlet Air Temp.°C0.000Inlet Air RestrictionkPaInlet Man. PressurekPaExh. Back PressurekPa	Speedr/min0.000Fuel Flowkg/h0.000Inlet Manifold Temp.°C0.000Coolant Out Temp.°C0.000Fuel In Temp.°C0.000Oil Gallery Temp.°C0.000Inlet Air Temp.°C0.000Inlet Air Temp.°C0.000Inlet Air RestrictionkPaInlet Air RestrictionkPaInlet Man. PressurekPaExh. Back PressurekPaCrankcase PressurekPa	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Speed         r/min         0.000         1800           Fuel Flow         kg/h         0.000         53.5           Inlet Manifold Temp. $^{\circ}$ C         0.000         53.5           Inlet Manifold Temp. $^{\circ}$ C         0.000         53.5           Coolant Out Temp. $^{\circ}$ C         0.000         53.5           Fuel In Temp. $^{\circ}$ C         0.000         40           Oil Gallery Temp. $^{\circ}$ C         0.000         40           Oil Gallery Temp. $^{\circ}$ C         0.000         56           Inlet Air Temp. $^{\circ}$ C         0.000         25           Inlet Air Temp. $^{\circ}$ C         0.000         25           Inlet Air Restriction         kPa         3.5 - 4.0           Inlet Man. Pressure         kPa         2.7 - 3.5           Crankcase Pressure         kPa         2.7 - 3.5           Intake CO2 $^{\circ}$ 0.5 - 0.75	Speed         r/min         0.000         1800           Fuel Flow         kg/h         0.000         53.5           Inlet Manifold Temp. $^{\circ}$ C         0.000         70           Coolant Out Temp. $^{\circ}$ C         0.000         66           Fuel In Temp. $^{\circ}$ C         0.000         66           Fuel In Temp. $^{\circ}$ C         0.000         66           Fuel In Temp. $^{\circ}$ C         0.000         88           Oil Gallery Temp. $^{\circ}$ C         0.000         88           Inlet Air Temp. $^{\circ}$ C         0.000         88           Inlet Air Temp. $^{\circ}$ C         0.000         25           Inlet Air Temp. $^{\circ}$ C         0.000         25           Inlet Air Restriction         kPa         3.5 - 4.0           Inlet Man. Pressure         kPa         3.5 - 4.0           Inlet Man. Pressure         kPa         3.5 - 4.0           Inlet Man. Pressure         kPa         3.5 - 4.0           Inlet Air Restriction         kPa         2.7 - 3.5           Cankcase Pressure         kPa         2.7 - 3.5           Intake CO2 $^{\circ}$ 0.500	Speed         r/min         0.000         1800           Fuel Flow         kg/h         0.000         53.5           Inlet Manifold Temp. $^{\circ}$ C         0.000         70           Coolant Out Temp. $^{\circ}$ C         0.000         66           Fuel In Temp. $^{\circ}$ C         0.000         9           Coolant Out Temp. $^{\circ}$ C         0.000         66           Fuel In Temp. $^{\circ}$ C         0.000         9           Oil Gallery Temp. $^{\circ}$ C         0.000         9           Oil Gallery Temp. $^{\circ}$ C         0.000         9           Oil Gallery Temp. $^{\circ}$ C         0.000         88           Inlet Air Temp. $^{\circ}$ C         0.000         25           Inlet Air Restriction         kPa         3.5 - 4.0           Inlet Air Restriction         kPa         3.5 - 4.0           Inlet Man. Pressure         kPa         3.5 - 4.0           Inlet Man. Pressure         kPa         3.5 - 4.0           Inlet Air Restriction         kPa         3.5 - 4.0           Inlet Man. Pressure         kPa         3.5 - 4.0           Inlet Man. Pressure         kPa         3.5 - 4.0	Speed         r/min         0.000         1800           Fuel Flow         kg/h         0.000         53.5           Inlet Manifold Temp. $\degree$ C         0.000         53.5           Coolant Out Temp. $\degree$ C         0.000         66           Fuel In Temp. $\degree$ C         0.000         55           Inter Air Restriction         kPa         25           Inter Man. Pressure         kPa         25           Inter Man. Pressure         kPa         25           Inter Man. Pressure         kPa         27-3.5           Intake CO2 </td <td>Speed         r/min         0.000         1800           Fuel Flow         kg/h         0.000         53.5           Inlet Manifold Temp.         °C         0.000         53.5           Coolant Out Temp.         °C         0.000         66           Fuel In Temp.         °C         0.000         66           Fuel In Temp.         °C         0.000         66           Oil Gallery Temp.         °C         0.000         88           Inlet Air Temp.         °C         0.000         3.5-4.0           Inlet Man. Pressure         kPa         3.5-4.0         3.5-4.0           Inlet Man. Pressure         <t< td=""><td>Speed         r/min         0.000         r/min         1800           Fuel Flow         kg/h         0.000         53.5           Inlet Manifold Temp.         <math>C</math>         0.000         53.5           Coolant Out Temp.         <math>C</math>         0.000         66           Coolant Out Temp.         <math>C</math>         0.000         66           Fuel In Temp.         <math>C</math>         0.000         66           Oil Gallery Temp.         <math>C</math>         0.000         88           Inlet Air Restriction         kPa         3.5 - 4.0           Inter Air Restriction         kPa         3.5 - 4.0</td><td>Speed         r/min         0.000         1800           Fuel Flow         kg/h         0.000         53.5           Inlet Manifold Temp.         <math>^{\circ}</math>C         0.000         53.5           Coolant Out Temp.         <math>^{\circ}</math>C         0.000         66           Fuel In Temp.         <math>^{\circ}</math>C         0.000         66           Fuel In Temp.         <math>^{\circ}</math>C         0.000         66           Fuel In Temp.         <math>^{\circ}</math>C         0.000         88           Oil Gallery Temp.         <math>^{\circ}</math>C         0.000         88           Inlet Air Temp.         <math>^{\circ}</math>C         0.000         3.5 - 4.0           Inlet Air Temp.         <math>^{\circ}</math>C         0.000         3.5 - 4.0           Inlet Air Temp.         <math>^{\circ}</math>C         0.000         3.5 - 4.0           Inlet Air Temp.         <math>^{\circ}</math>C         9.000         9.5 - 3.5</td></t<><td>Speed         r/min         0.000         1800           Fuel Flow         kg/h         0.000         53.5           Inlet Manifold Temp.         °C         0.000         53.5           Coolant Out Temp.         °C         0.000         66           Fuel In Temp.         °C         0.000         66           Fuel In Temp.         °C         0.000         66           Oil Gallery Temp.         °C         0.000         88           Inlet Air Temp.         °C         0.000         88           Inlet Air Temp.         °C         0.000         25           Inlet Air Temp.         °C         0.000         25           Inlet Air Temp.         °C         0.000         3.5 - 4.0           Inlet Air Temp.         °C         0.000         25           Inlet Air Temp.         °C         0.000         3.5 - 4.0           Intake CO2         &lt;</td><td>Speed         r/min         0.000         r/min         1800           Fuel Flow         kg/h         0.000         53.5           Inlet Manifold Temp.         °C         0.000         53.5           Coolant Out Temp.         °C         0.000         66           Fuel In Temp.         °C         0.000         66           Fuel In Temp.         °C         0.000         66           Fuel In Temp.         °C         0.000         66           Oil Gallery Temp.         °C         0.000         88           Inlet Air Temp.         °C         0.000         25           Inlet Air Temp.         °C         0.000         25           Inlet Air Temp.         °C         0.000         25           Inlet Air Temp.         °C         0.000         3.5 - 4.0           Inlet Man. Pressure         kPa         7.3.5         0.5 - 6.75           <t< td=""><td>Speed         r/min         0.000         r/min         0.000         53.5           Inlet Manifold Temp.         <math>C</math>         0.000         <math>53.5</math>           Inlet Manifold Temp.         <math>C</math>         0.000         <math>53.5</math>           Tuel In Temp.         <math>C</math>         0.000         <math>53.5</math>           Fuel In Temp.         <math>C</math>         0.000         <math>66</math>           Fuel In Temp.         <math>C</math>         0.000         <math>88</math>           Oil Gallery Temp.         <math>C</math>         0.000         <math>88</math>           Inlet Air Temp.         <math>C</math>         0.000         <math>88</math>           Inlet Air Temp.         <math>C</math>         0.000         <math>88</math>           Inlet Air Temp.         <math>C</math> <math>0.000</math> <math>88</math>           Inlet Air Dew Point         <math>kPa</math> <math>3.5 - 4.0</math>           Inter Air Dew Point         <math>kPa</math> <math>3.5 - 4.0</math>           Inter Air Dew Point         <math>kPa</math> <math>3.5 - 4.0</math>           Inter Air Dew Point         <math>kPa</math> <math>7.0</math> <math>3.5 - 4.0</math> <!--</td--><td>Speed         r/min         0.000         r/min         0.000         53.5           Inlet Manifold Temp.         <math>C</math>         0.000         <math>53.5</math>           Inlet Manifold Temp.         <math>C</math>         0.000         <math>53.5</math>           Fuel In Temp.         <math>C</math>         0.000         <math>53.5</math>           Oli Gallery Temp.         <math>C</math>         0.000         <math>66</math>           Fuel In Temp.         <math>C</math>         0.000         <math>88</math>           Inlet Air Temp.         <math>C</math>         0.000         <math>88</math>           Inlet Air Temp.         <math>C</math> <math>0.000</math> <math>88</math>           Inlet Air Temp.         <math>C</math> <math>0.000</math> <math>88</math>           Inlet Air Restriction         <math>RPa</math> <math>3.5 - 4.0</math>           Inlet Air Restriction         <math>RPa</math> <math>3.5 - 4.0</math>           Inlet Air Nessure         <math>RPa</math> <math>3.5 - 4.0</math>           Inlet Air Nessure         <math>RPa</math> <math>3.5 - 4.0</math>           Inter CO<sub>2</sub> <math>\%</math> <math>0.000</math> <math>3.5 - 4.0</math>           Inter Air Nessure         <math>RPa</math> <math>3.5 - 4.0</math> <math>3.5 - 4.0</math>           Inter Air Nessure         <math>RPa</math> <math>7.0</math> <math>3.5 - 4.0</math>           Inter Man. Pressure         <math>RPa</math> <math>7.0</math> <math>3</math></td></td></t<></td></td>	Speed         r/min         0.000         1800           Fuel Flow         kg/h         0.000         53.5           Inlet Manifold Temp.         °C         0.000         53.5           Coolant Out Temp.         °C         0.000         66           Fuel In Temp.         °C         0.000         66           Fuel In Temp.         °C         0.000         66           Oil Gallery Temp.         °C         0.000         88           Inlet Air Temp.         °C         0.000         3.5-4.0           Inlet Man. Pressure         kPa         3.5-4.0         3.5-4.0           Inlet Man. Pressure <t< td=""><td>Speed         r/min         0.000         r/min         1800           Fuel Flow         kg/h         0.000         53.5           Inlet Manifold Temp.         <math>C</math>         0.000         53.5           Coolant Out Temp.         <math>C</math>         0.000         66           Coolant Out Temp.         <math>C</math>         0.000         66           Fuel In Temp.         <math>C</math>         0.000         66           Oil Gallery Temp.         <math>C</math>         0.000         88           Inlet Air Restriction         kPa         3.5 - 4.0           Inter Air Restriction         kPa         3.5 - 4.0</td><td>Speed         r/min         0.000         1800           Fuel Flow         kg/h         0.000         53.5           Inlet Manifold Temp.         <math>^{\circ}</math>C         0.000         53.5           Coolant Out Temp.         <math>^{\circ}</math>C         0.000         66           Fuel In Temp.         <math>^{\circ}</math>C         0.000         66           Fuel In Temp.         <math>^{\circ}</math>C         0.000         66           Fuel In Temp.         <math>^{\circ}</math>C         0.000         88           Oil Gallery Temp.         <math>^{\circ}</math>C         0.000         88           Inlet Air Temp.         <math>^{\circ}</math>C         0.000         3.5 - 4.0           Inlet Air Temp.         <math>^{\circ}</math>C         0.000         3.5 - 4.0           Inlet Air Temp.         <math>^{\circ}</math>C         0.000         3.5 - 4.0           Inlet Air Temp.         <math>^{\circ}</math>C         9.000         9.5 - 3.5</td></t<> <td>Speed         r/min         0.000         1800           Fuel Flow         kg/h         0.000         53.5           Inlet Manifold Temp.         °C         0.000         53.5           Coolant Out Temp.         °C         0.000         66           Fuel In Temp.         °C         0.000         66           Fuel In Temp.         °C         0.000         66           Oil Gallery Temp.         °C         0.000         88           Inlet Air Temp.         °C         0.000         88           Inlet Air Temp.         °C         0.000         25           Inlet Air Temp.         °C         0.000         25           Inlet Air Temp.         °C         0.000         3.5 - 4.0           Inlet Air Temp.         °C         0.000         25           Inlet Air Temp.         °C         0.000         3.5 - 4.0           Intake CO2         &lt;</td> <td>Speed         r/min         0.000         r/min         1800           Fuel Flow         kg/h         0.000         53.5           Inlet Manifold Temp.         °C         0.000         53.5           Coolant Out Temp.         °C         0.000         66           Fuel In Temp.         °C         0.000         66           Fuel In Temp.         °C         0.000         66           Fuel In Temp.         °C         0.000         66           Oil Gallery Temp.         °C         0.000         88           Inlet Air Temp.         °C         0.000         25           Inlet Air Temp.         °C         0.000         25           Inlet Air Temp.         °C         0.000         25           Inlet Air Temp.         °C         0.000         3.5 - 4.0           Inlet Man. Pressure         kPa         7.3.5         0.5 - 6.75           <t< td=""><td>Speed         r/min         0.000         r/min         0.000         53.5           Inlet Manifold Temp.         <math>C</math>         0.000         <math>53.5</math>           Inlet Manifold Temp.         <math>C</math>         0.000         <math>53.5</math>           Tuel In Temp.         <math>C</math>         0.000         <math>53.5</math>           Fuel In Temp.         <math>C</math>         0.000         <math>66</math>           Fuel In Temp.         <math>C</math>         0.000         <math>88</math>           Oil Gallery Temp.         <math>C</math>         0.000         <math>88</math>           Inlet Air Temp.         <math>C</math>         0.000         <math>88</math>           Inlet Air Temp.         <math>C</math>         0.000         <math>88</math>           Inlet Air Temp.         <math>C</math> <math>0.000</math> <math>88</math>           Inlet Air Dew Point         <math>kPa</math> <math>3.5 - 4.0</math>           Inter Air Dew Point         <math>kPa</math> <math>3.5 - 4.0</math>           Inter Air Dew Point         <math>kPa</math> <math>3.5 - 4.0</math>           Inter Air Dew Point         <math>kPa</math> <math>7.0</math> <math>3.5 - 4.0</math> <!--</td--><td>Speed         r/min         0.000         r/min         0.000         53.5           Inlet Manifold Temp.         <math>C</math>         0.000         <math>53.5</math>           Inlet Manifold Temp.         <math>C</math>         0.000         <math>53.5</math>           Fuel In Temp.         <math>C</math>         0.000         <math>53.5</math>           Oli Gallery Temp.         <math>C</math>         0.000         <math>66</math>           Fuel In Temp.         <math>C</math>         0.000         <math>88</math>           Inlet Air Temp.         <math>C</math>         0.000         <math>88</math>           Inlet Air Temp.         <math>C</math> <math>0.000</math> <math>88</math>           Inlet Air Temp.         <math>C</math> <math>0.000</math> <math>88</math>           Inlet Air Restriction         <math>RPa</math> <math>3.5 - 4.0</math>           Inlet Air Restriction         <math>RPa</math> <math>3.5 - 4.0</math>           Inlet Air Nessure         <math>RPa</math> <math>3.5 - 4.0</math>           Inlet Air Nessure         <math>RPa</math> <math>3.5 - 4.0</math>           Inter CO<sub>2</sub> <math>\%</math> <math>0.000</math> <math>3.5 - 4.0</math>           Inter Air Nessure         <math>RPa</math> <math>3.5 - 4.0</math> <math>3.5 - 4.0</math>           Inter Air Nessure         <math>RPa</math> <math>7.0</math> <math>3.5 - 4.0</math>           Inter Man. Pressure         <math>RPa</math> <math>7.0</math> <math>3</math></td></td></t<></td>	Speed         r/min         0.000         r/min         1800           Fuel Flow         kg/h         0.000         53.5           Inlet Manifold Temp. $C$ 0.000         53.5           Coolant Out Temp. $C$ 0.000         66           Coolant Out Temp. $C$ 0.000         66           Fuel In Temp. $C$ 0.000         66           Oil Gallery Temp. $C$ 0.000         88           Inlet Air Restriction         kPa         3.5 - 4.0           Inter Air Restriction         kPa         3.5 - 4.0	Speed         r/min         0.000         1800           Fuel Flow         kg/h         0.000         53.5           Inlet Manifold Temp. $^{\circ}$ C         0.000         53.5           Coolant Out Temp. $^{\circ}$ C         0.000         66           Fuel In Temp. $^{\circ}$ C         0.000         66           Fuel In Temp. $^{\circ}$ C         0.000         66           Fuel In Temp. $^{\circ}$ C         0.000         88           Oil Gallery Temp. $^{\circ}$ C         0.000         88           Inlet Air Temp. $^{\circ}$ C         0.000         3.5 - 4.0           Inlet Air Temp. $^{\circ}$ C         0.000         3.5 - 4.0           Inlet Air Temp. $^{\circ}$ C         0.000         3.5 - 4.0           Inlet Air Temp. $^{\circ}$ C         9.000         9.5 - 3.5	Speed         r/min         0.000         1800           Fuel Flow         kg/h         0.000         53.5           Inlet Manifold Temp.         °C         0.000         53.5           Coolant Out Temp.         °C         0.000         66           Fuel In Temp.         °C         0.000         66           Fuel In Temp.         °C         0.000         66           Oil Gallery Temp.         °C         0.000         88           Inlet Air Temp.         °C         0.000         88           Inlet Air Temp.         °C         0.000         25           Inlet Air Temp.         °C         0.000         25           Inlet Air Temp.         °C         0.000         3.5 - 4.0           Inlet Air Temp.         °C         0.000         25           Inlet Air Temp.         °C         0.000         3.5 - 4.0           Intake CO2         <	Speed         r/min         0.000         r/min         1800           Fuel Flow         kg/h         0.000         53.5           Inlet Manifold Temp.         °C         0.000         53.5           Coolant Out Temp.         °C         0.000         66           Fuel In Temp.         °C         0.000         66           Fuel In Temp.         °C         0.000         66           Fuel In Temp.         °C         0.000         66           Oil Gallery Temp.         °C         0.000         88           Inlet Air Temp.         °C         0.000         25           Inlet Air Temp.         °C         0.000         25           Inlet Air Temp.         °C         0.000         25           Inlet Air Temp.         °C         0.000         3.5 - 4.0           Inlet Man. Pressure         kPa         7.3.5         0.5 - 6.75 <t< td=""><td>Speed         r/min         0.000         r/min         0.000         53.5           Inlet Manifold Temp.         <math>C</math>         0.000         <math>53.5</math>           Inlet Manifold Temp.         <math>C</math>         0.000         <math>53.5</math>           Tuel In Temp.         <math>C</math>         0.000         <math>53.5</math>           Fuel In Temp.         <math>C</math>         0.000         <math>66</math>           Fuel In Temp.         <math>C</math>         0.000         <math>88</math>           Oil Gallery Temp.         <math>C</math>         0.000         <math>88</math>           Inlet Air Temp.         <math>C</math>         0.000         <math>88</math>           Inlet Air Temp.         <math>C</math>         0.000         <math>88</math>           Inlet Air Temp.         <math>C</math> <math>0.000</math> <math>88</math>           Inlet Air Dew Point         <math>kPa</math> <math>3.5 - 4.0</math>           Inter Air Dew Point         <math>kPa</math> <math>3.5 - 4.0</math>           Inter Air Dew Point         <math>kPa</math> <math>3.5 - 4.0</math>           Inter Air Dew Point         <math>kPa</math> <math>7.0</math> <math>3.5 - 4.0</math> <!--</td--><td>Speed         r/min         0.000         r/min         0.000         53.5           Inlet Manifold Temp.         <math>C</math>         0.000         <math>53.5</math>           Inlet Manifold Temp.         <math>C</math>         0.000         <math>53.5</math>           Fuel In Temp.         <math>C</math>         0.000         <math>53.5</math>           Oli Gallery Temp.         <math>C</math>         0.000         <math>66</math>           Fuel In Temp.         <math>C</math>         0.000         <math>88</math>           Inlet Air Temp.         <math>C</math>         0.000         <math>88</math>           Inlet Air Temp.         <math>C</math> <math>0.000</math> <math>88</math>           Inlet Air Temp.         <math>C</math> <math>0.000</math> <math>88</math>           Inlet Air Restriction         <math>RPa</math> <math>3.5 - 4.0</math>           Inlet Air Restriction         <math>RPa</math> <math>3.5 - 4.0</math>           Inlet Air Nessure         <math>RPa</math> <math>3.5 - 4.0</math>           Inlet Air Nessure         <math>RPa</math> <math>3.5 - 4.0</math>           Inter CO<sub>2</sub> <math>\%</math> <math>0.000</math> <math>3.5 - 4.0</math>           Inter Air Nessure         <math>RPa</math> <math>3.5 - 4.0</math> <math>3.5 - 4.0</math>           Inter Air Nessure         <math>RPa</math> <math>7.0</math> <math>3.5 - 4.0</math>           Inter Man. Pressure         <math>RPa</math> <math>7.0</math> <math>3</math></td></td></t<>	Speed         r/min         0.000         r/min         0.000         53.5           Inlet Manifold Temp. $C$ 0.000 $53.5$ Inlet Manifold Temp. $C$ 0.000 $53.5$ Tuel In Temp. $C$ 0.000 $53.5$ Fuel In Temp. $C$ 0.000 $66$ Fuel In Temp. $C$ 0.000 $88$ Oil Gallery Temp. $C$ 0.000 $88$ Inlet Air Temp. $C$ 0.000 $88$ Inlet Air Temp. $C$ 0.000 $88$ Inlet Air Temp. $C$ $0.000$ $88$ Inlet Air Dew Point $kPa$ $3.5 - 4.0$ Inter Air Dew Point $kPa$ $3.5 - 4.0$ Inter Air Dew Point $kPa$ $3.5 - 4.0$ Inter Air Dew Point $kPa$ $7.0$ $3.5 - 4.0$ </td <td>Speed         r/min         0.000         r/min         0.000         53.5           Inlet Manifold Temp.         <math>C</math>         0.000         <math>53.5</math>           Inlet Manifold Temp.         <math>C</math>         0.000         <math>53.5</math>           Fuel In Temp.         <math>C</math>         0.000         <math>53.5</math>           Oli Gallery Temp.         <math>C</math>         0.000         <math>66</math>           Fuel In Temp.         <math>C</math>         0.000         <math>88</math>           Inlet Air Temp.         <math>C</math>         0.000         <math>88</math>           Inlet Air Temp.         <math>C</math> <math>0.000</math> <math>88</math>           Inlet Air Temp.         <math>C</math> <math>0.000</math> <math>88</math>           Inlet Air Restriction         <math>RPa</math> <math>3.5 - 4.0</math>           Inlet Air Restriction         <math>RPa</math> <math>3.5 - 4.0</math>           Inlet Air Nessure         <math>RPa</math> <math>3.5 - 4.0</math>           Inlet Air Nessure         <math>RPa</math> <math>3.5 - 4.0</math>           Inter CO<sub>2</sub> <math>\%</math> <math>0.000</math> <math>3.5 - 4.0</math>           Inter Air Nessure         <math>RPa</math> <math>3.5 - 4.0</math> <math>3.5 - 4.0</math>           Inter Air Nessure         <math>RPa</math> <math>7.0</math> <math>3.5 - 4.0</math>           Inter Man. Pressure         <math>RPa</math> <math>7.0</math> <math>3</math></td>	Speed         r/min         0.000         r/min         0.000         53.5           Inlet Manifold Temp. $C$ 0.000 $53.5$ Inlet Manifold Temp. $C$ 0.000 $53.5$ Fuel In Temp. $C$ 0.000 $53.5$ Oli Gallery Temp. $C$ 0.000 $66$ Fuel In Temp. $C$ 0.000 $88$ Inlet Air Temp. $C$ 0.000 $88$ Inlet Air Temp. $C$ $0.000$ $88$ Inlet Air Temp. $C$ $0.000$ $88$ Inlet Air Restriction $RPa$ $3.5 - 4.0$ Inlet Air Restriction $RPa$ $3.5 - 4.0$ Inlet Air Nessure $RPa$ $3.5 - 4.0$ Inlet Air Nessure $RPa$ $3.5 - 4.0$ Inter CO <sub>2</sub> $\%$ $0.000$ $3.5 - 4.0$ Inter Air Nessure $RPa$ $3.5 - 4.0$ $3.5 - 4.0$ Inter Air Nessure $RPa$ $7.0$ $3.5 - 4.0$ Inter Man. Pressure $RPa$ $7.0$ $3$

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 D 7156 - EGR Engine Oil Test Form 6 Oil Analysis Summary

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

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

## Mack T-11 D 7156 - EGR Engine Oil Test Form 7 Oil Analysis Summary

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

Hours	Shear Viscosity (cSt)	Shear Viscosity (cSt)	MRV Viscosity		Viscosity at (mPa-s)		l Viscosity Index
liours	D 6278 30 Pass	90 Pass	(cP) D 6896	Increasing	Decreasing	Increasing	Decreasing
-							
Rotati	onal Viscosity	y of DIN 30 P	ass Sample				
		y of DIN 90 P					

## Mack T-11 D 7156 - EGR Engine Oil Test Form 8 Oil Analysis Summary

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

Hours	Fuel Dilution		Metal Elements (ppm) D 5185						
	D 3524	Fe	Pb	Cu	Cr	Al	Si	Sn	Na
<u> </u>									

## Mack T-11 D 7156 - EGR Engine Oil Test Form 9 Test Fuel Analysis (Last Batch)

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

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

## Mack T-11 D 7156 - EGR Engine Oil Test Form 10 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)
(1)	(-)		Temper		(0)	(')	(0)
Oil @ Filt.			•				
Fuel In.							
Intake Air							
Intake Man.							
Pre-Turb.							
Cool. Out							
			Oth	er			
<b>Fuel Flow</b>							
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-11 D 7156 - EGR Engine Oil Test Form 11 Build-up and Hardware Information

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

# 

## 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	<b>CPD ID Number</b>
Cylinder 1	
Cylinder 2	
Cylinder 3	
Cylinder 4	
Cylinder 5	
Cylinder 6	

## Mack T-11 D 7156 - EGR Engine Oil Test Form 12 Unscheduled Downtime and Maintenance Summary

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

Number o Occurren		ne	
Test Hours	Date	Downtime	Reasons
L	1		Total Downtime

	<b>Other Comments</b>	
Number of Comment Lines		

## Mack T-11 D 7156 - EGR Engine Oil Test Form 12A Unscheduled Downtime and Maintenance Summary

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

Number o Occurren		ne	
Test Hours	Date	Downtime	Reasons
			Total Downtime

	<b>Other Comments</b>	
Number of Comment Lines		

## Mack T-11 D 7156 - EGR Engine Oil Test Form 12B Unscheduled Downtime and Maintenance Summary

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

Number o Occurren		ne	
Test Hours	Date	Downtime	Reasons
			Total Downtime

	<b>Other Comments</b>	
Number of Comment Lines		