

**D 6483 MACK T-9
RING/LINER WEAR 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.

STAND:	STAND RUN NO.:	ENGINE NO.:	ENGINE HOURS:
END OF TEST DATE:		END OF TEST TIME:	
OIL CODE/CMIR ^A :			
FORMULATION/STAND CODE:			
ALTCODE1:	ALTCODE2:	ALTCODE3:	

In my opinion this test _____ been conducted in a valid manner in accordance with Test Method D 6483 and the appropriate amendments through the information letter system. The remarks included in this report describe the anomalies associated with this test.

^A CMIR or Non-Reference Oil Code

SUBMITTED BY:

_____ Testing Laboratory

_____ Signature

_____ Typed Name

_____ Title

**D 6483 MACK T-9
RING/LINER WEAR TEST
FORM 1 - NON-REFERENCE OIL TEST SUMMARY**

FORMULATION/STAND CODE			TEST LENGTH	
OIL CODE NO.				
TEST LAB	TEST STAND NO.	TEST STAND RUN NO.	ENGINE BLOCK SERIAL NO.	ENGINE HOURS
DATE TEST STARTED:				
START TIME:				
DATE TEST COMPLETED:				
EOT TIME:				
STAND CALIBRATION EXPIRATION DATE:				
LABORATORY OIL CODE				
SAE VISCOSITY				

AVERAGE TGA SOOT % AT 75 h	
AVERAGE TGA SOOT % 75 – 500 h	
AVERAGE OIL CONSUMPTION (0.304 g/Kw-h max.)	
CENTRIFUGAL OIL FILTER MASS GAIN, g	
OIL FILTER DELTA P, kPa (138 max.)	
EOT TBN	

	DELTA Pb @ EOT (ppm)	ADJUSTED AVG. LINER WEAR (µm)	AVG. TOP RING WEIGHT LOSS (mg)
ORIGINAL RESULT			
TRANSFORMED RESULT A			
CORRECTION FACTOR A			
CORRECTED TRANSFORMED RESULT A			
SEVERITY ADJUSTMENT A			
FINAL TRANSFORMED RESULT A			
FINAL ORIGINAL UNIT RESULT			

^A Delta Pb Value in Transformed Units

**D 6483 MACK T-9
RING/LINER WEAR TEST
FORM 1A - REFERENCE OIL TEST SUMMARY**

CMIR CODE NO.		TEST LENGTH		
TMC OIL NO.				
TEST LAB	TEST STAND NO.	TEST STAND RUN NO.	ENGINE BLOCK SERIAL NO.	ENGINE HOURS
DATE TEST STARTED:				
START TIME:				
DATE TEST COMPLETED:				
EOT TIME:				
STAND CALIBRATION EXPIRATION DATE:				
LABORATORY OIL CODE				
SAE VISCOSITY				

AVERAGE TGA SOOT % AT 75 h	
AVERAGE TGA SOOT % 75 – 500 h	
AVERAGE OIL CONSUMPTION (0.304 g/Kw-h max.)	
CENTRIFUGAL OIL FILTER MASS GAIN, g	
OIL FILTER DELTA P, kPa (138 max.)	
EOT TBN	

	DELTA Pb @ EOT (ppm)	ADJUSTED AVG. LINER WEAR (µm)	AVG. TOP RING WEIGHT LOSS (mg)
ORIGINAL RESULT			
TRANSFORMED RESULT [^]			
CORRECTION FACTOR [^]			
FINAL TRANSFORMED RESULT [^]			
FINAL ORIGINAL UNIT RESULT			

^A Delta Pb Value in Transformed Units

**D 6483 MACK T-9
RING/LINER WEAR TEST
Operational Summary
FORM 2**

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	1250					
	Fuel Flow	kg/h	0.000		63.28	55.00					
	Coolant Out	°C	0.000		85						
	Fuel In	°C	0.000		40						
	Oil Gallery	°C	0.000		25						
	Intake Manifold	°C	0.000		43						
	Exhaust	kPa	0.000		3.1						
	Inlet Air Res.	KPa	0.000		2.5						
Non-controlled Parameters	Parameter	Units	Typical Values ^E		Average						
	Torque	N-m	1361 - 1457	2118 - 2208							
	Power	kW	258 - 267	280 - 288							
	Humidity	g/kg	4.2 - 78.6								
	Blowby	L/min	41.2 - 184.3	23.6 - 148.7							
	Coolant In	°C	76 - 82								
	Oil Gallery	°C	101 - 109								
	Pre-Turb. (F)	°C	605 - 658								
	Pre-Turb. (R)	°C	613 - 674								
	Tailpipe	°C	428 - 474	514 - 559							
	Oil Gallery	kPa	365 - 436	227-284							
	Crankcase	kPa	0.27 - 0.60								
	Intake Manifold	kPa	185 - 201	149 - 164							
Compressor Discharge	kPa	193 - 205	152 - 159								
Intercooler Delta	kPa	13.6 Maximum									

^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

**D 6483 MACK T-9
RING/LINER WEAR TEST
Rod Bearing Weight Loss
Form 3**

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

Cylinder #	Location	SOT Weight, g	EOT Weight, g	Weight Change, mg
1	Upper			
2	Upper			
3	Upper			
4	Upper			
5	Upper			
6	Upper			

SUMMARY	As Measured	Outlier Screened
Upper Bearing Average Weight Loss, mg		
Upper Bearing Weight Loss Std. Dev., mg		
Upper Bearing Minimum Weight Loss, mg		
Upper Bearing Maximum Weight Loss, mg		
Outlier Upper Rod Bearing ^A		

^A Cylinder number

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

**D 6483 MACK T-9
RING/LINER WEAR TEST
Ring Weight Loss
Form 4**

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

Cylinder #	Top Ring SOT Weight, g	Top Ring EOT Weight, g	Weight Loss, mg
1			
2			
3			
4			
5			
6			

SUMMARY	As Measured	Outlier Screened
Upper Bearing Average Weight Loss, mg		
Upper Bearing Weight Loss Std. Dev., mg		
Upper Bearing Minimum Weight Loss, mg		
Upper Bearing Maximum Weight Loss, mg		
Outlier Ring ^B		
Top Rings with Plasma Flaking ^C		

^A Results calculated without rings with plasma flanking.
^B Ring number wear results are not currently outlier screened.
^C Ring numbers: 1,2, etc. separated by commas. Example: 2,3,5

Cylinder #	2nd Ring SOT Weight, g	2 nd Ring EOT Weight, g	Weight Loss, mg
1			
2			
3			
4			
5			
6			
			2 nd Ring Average Weight Loss, mg
			2 nd Ring Weight Loss Std. Dev., mg
			2 nd Ring Min. Weight Loss, mg
			2 nd Ring Max. Weight Loss, mg

Cylinder #	2nd Ring SOT Weight, g	2nd Ring EOT Weight, g	Weight Loss, mg
1			
2			
3			
4			
5			
6			
			Oil Ring Average Weight Loss, mg
			Oil Ring Weight Loss Std. Dev., mg
			Oil Ring Minimum Weight Loss, mg
			Oil Ring Maximum Weight Loss, mg

**D 6483 MACK T-9
RING/LINER WEAR TEST
Oil Analysis Summary
Form 5**

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

HOURS	SOOT Wt.% TGA	Viscosity At 100°C cSt	Viscosity Increase cSt	TBN Annex A7	TBN D2896	TAN Annex A8	Metals in Parts per Millions							
							Elements							
							Fe	Pb	Cu	Cr	Al	Si	Sn	Na
NEW														
75 AVG														

Summary	As Measured	Outlier Bearing Adjusted
Delta Pb @ EOT, ppm		

D 6483 MACK T-9
RING/LINER WEAR TEST
Liner Surface Roughness & Bore Diameter
Form 6

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

LINER NO.	LOCATION	Ra (µm)	BORE DIAMETER (mm)		Ra (µm)	DIA. (mm)
1	Top Ring Travel @ 0°C			AVG		
	Top Ring Travel @ 90°C			STD DEV		
	Top Ring Travel @ 180°C			MIN		
	Top Ring Travel @ 270°C			MAX		
2	Top Ring Travel @ 0°C			AVG		
	Top Ring Travel @ 90°C			STD DEV		
	Top Ring Travel @ 180°C			MIN		
	Top Ring Travel @ 270°C			MAX		
3	Top Ring Travel @ 0°C			AVG		
	Top Ring Travel @ 90°C			STD DEV		
	Top Ring Travel @ 180°C			MIN		
	Top Ring Travel @ 270°C			MAX		
4	Top Ring Travel @ 0°C			AVG		
	Top Ring Travel @ 90°C			STD DEV		
	Top Ring Travel @ 180°C			MIN		
	Top Ring Travel @ 270°C			MAX		
5	Top Ring Travel @ 0°C			AVG		
	Top Ring Travel @ 90°C			STD DEV		
	Top Ring Travel @ 180°C			MIN		
	Top Ring Travel @ 270°C			MAX		
6	Top Ring Travel @ 0°C			AVG		
	Top Ring Travel @ 90°C			STD DEV		
	Top Ring Travel @ 180°C			MIN		
	Top Ring Travel @ 270°C			MAX		

	Ra (µm)	BORE DIAMETER (mm)
Average Surface Roughness & Bore Diameter		
Standard Deviation Surface Roughness & Bore Diameter		
Minimum Surface Roughness & Bore Diameter		
Maximum Surface Roughness & Bore Diameter		

**D 6483 MACK T-9
RING/LINER WEAR TEST
Liner Wear Summary
Form 7**

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

POSITION	WEAR STEP (µm)					
	Cylinder Number					
	1	2	3	4	5	6
1:00						
2:00						
3:00 (Thrust)						
4:00						
5:00						
6:00 (Rear)						
7:00						
8:00						
9:00 (Anti-Thrust)						
10:00						
11:00						
12:00 (Front)						
Average						

Summary	As Measured	Outlier Screened	Adjusted to 1.75% Soot
Average, µm			
Std. Dev., µm			
Minimum, µm			
Maximum, µm			
Ring Flaked Outliers ^B			
Outlier Liners ^C			

^A Do not use data from liners with top ring plasma flaking for determining "As Measured" result.

^B Cylinder Number: 1,2, etc. separated by commas. Example: 2,3

^C Cylinder Number.

**D 6483 MACK T-9
RING/LINER WEAR TEST
Test Fuel Analysis (Last Batch)
Form 9**

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

Measurement	Specs.	Analysis		Test Method
		NEW	EOT	
Total Sulfur, % Weight	0.03 – 0.05			D 2622
Gravity, °API	32 – 36			D 287 or D 4052
Hydrocarbon Composition				
Aromatics % Vol.	28 – 35			D 1319
Olefin	Report			D 1319
Saturates	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
Cloud Point, °C	-12 Maximum			D 2500
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
Ash, % Wgt.	0.01 Maximum			D 482
Viscosity, cSt @ 40°C	2.0 – 3.2			D 445
Distillation, °C				
IBP	177-199			D 86
10%	210-232			D 86
50%	249-277			D 86
90%	299-327			D 86
EP	327-360			D 86

D 6483 MACK T-9
RING/LINER WEAR TEST
Characteristics of the Data Acquisition System
Form 10

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

**D 6483 MACK T-9
RING/LINER WEAR TEST
Build-up and Hardware Information
Form 11B**

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

STATIC INJECTION TIMING

Timing Hours	Timing (Deg)
Total Timing Changes	

HARDWARE

Part	Part Number	Serial Number
Injection Pump		
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	

**D 6483 MACK T-9
RING/LINER WEAR 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.*

Comments

Signature

Date

Typed Name

Title