

MEMORANDUM:	04-030
DATE:	April 19, 2004
TO:	Wim Van Dam, Chairman, Mack Surveillance Panel
FROM:	Jeff Clark
SUBJECT:	T-10 / T-10A Calibration Testing for the April 2004 ASTM Report Period

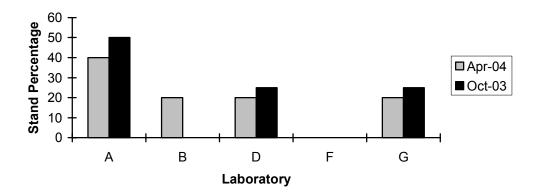
The following is a summary of T-10 reference oil tests completed during the April 2004 ASTM report period, which began on October 1, 2003 and ended on March 31, 2004.

Lab / Stand Distribution:

	Reporting Data	Calibrated as of 3/31/04
Number of Laboratories	4	4
Number of Stands	5	4

The figure below shows the T-10 laboratory / stand distribution for tests completed the current and previous report periods:

# Laboratory / Stand Distribution

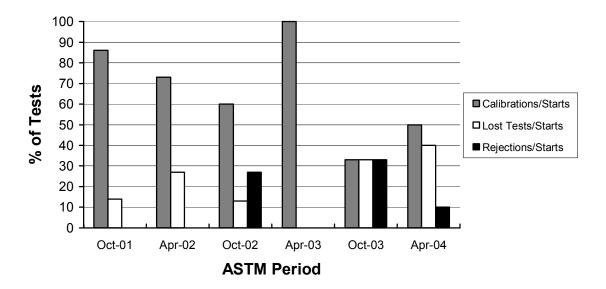


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The table below summarizes the status of the reference oil tests reported to the TMC this ASTM report period:

Test Status	TMC Validity Code	Number of T-10 Tests
Acceptable Calibration Test	AC	5
Failed Calibration Test (LTMS Criteria)	OC	1
Operationally Invalid Calibration Test	LC	3
Aborted Calibration Test	XC	1
Total		10

The calibrations per start, lost tests per start and rejections per start rates are summarized in the figure below:



## **Calibration Attempt Summary**

A detailed list of reasons tests failed the acceptance criteria (OC validity) is shown in Table 1. Table 2 lists the operationally invalid tests (LC validity) and Table 3 lists the aborted tests (XC validity).

### Severity and Precision:

Figures 1 through 5 (attached) show the current industry EWMA severity, EWMA precision, and cusum charts Delta Pb @ EOT (PB), Cylinder Liner Wear (CLW), Top Ring Weight Loss (TRWL), Oil Consumption (OC), and Delta Pb 250-300 Hours (PB2). Note that both PB and PB2 show industry alarms, however, these are due to the use of experimental conrod bearings on reference tests. Both parameters have been temporarily suspended from LTMS for determining stand calibration. Severity adjustments have been suspended for both parameters as well. The combination of low test activity and the experimental bearing tests makes it difficult to offer any meaningful commentary regarding severity trends for any of the parameters.

Precision, as estimated by the pooled standard deviation, is shown in the following table. Precision estimates are presented on an annual basis. However, any conclusions drawn from a comparison between current and previous estimates are of little value due to the reduced number of degrees of freedom. Please note, that the degrees of freedom (df) equals  $\Sigma$ (n observations per oil - 1).

Parameter	2001	2002	2003	2004
df	13	20	3	
PB	0.2660	0.2530	n/a*	
CLW	3.31	4.94	2.78	
TRWL	26.7	17.99	4.58	
OC	6.36	7.02	6.67	
PB2	4.69	3.49	n/a*	

**T-10 Pooled Precision By Year** 

\*Precision estimate not available due to tests being run on experimental conrod bearings.

### Reference Oils:

The current reference oil test targets are shown below:

Oil	Ν	Parameter	Mean (cSt)	S
		PB	3.2106	0.2339
		CLW	32.0	4.2
820-2	20	TRWL	109	18
		OC	52.9	7.2
		PB2	9.0	3.5

Once 30 tests on oil 820-2 have been completed, the TMC will provide a target update for surveillance panel consideration.

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### Abbreviated Length Test T-10A:

The TMC monitors the T-10A for the determination of laboratory severity adjustments for MRV viscosity. Figure 6 (attached) shows the current industry EWMA severity, EWMA precision, and CUSUM charts for MRV viscosity.

#### Information Letters:

T-10 Information Letter 03-3, Sequence No. 5 was issued October 28, 2003. This letter dealt with the implementing of an intake manifold pressure specification.

### TMC Laboratory Visits:

No TMC laboratory visits were conducted this ASTM period.

#### Quality Index:

One Quality Index deviation was issued this ASTM report period, for intake manifold and fuel inlet temperatures. For the history of the T-10/T-10A, one QI deviation has been issued.

### Additional Information:

The T-10 and T-10A databases, industry timeline, and industry alarm logs can be accessed on the TMC's homepage. If you have any questions on how to access this information, contact the TMC.

JAC/jac/mem04-030.jac.doc

### Attachments

c: J.L. Zalar, TMC
F.M. Farber, TMC
Mack Surveillance Panel
<u>ftp://ftp.astmtmc.cmu.edu/docs/diesel/mack/semiannualreports/T10-04-2004.pdf</u>

Distribution: Email

Table 1		
Summary of Reasons for Rejected Tests		

	No. of Tests
Mild Top Ring Weight Losss	1

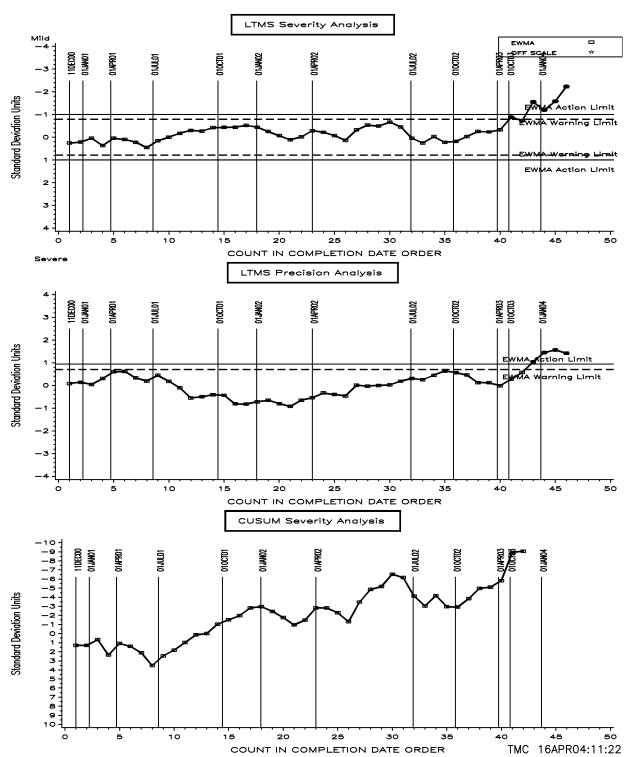
Table 2Summary of Reasons for Invalid Tests

	No. of Tests
Wrong main bearings	1
Intercooler leak	2

Table 3Summary of Reasons for Aborted Tests

	No. of Tests
Failed fuel injector	1

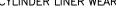
FIGURE 1 T-10 INDUSTRY OPERATIONALLY VALID DATA



DELTA PB @ EOT

FIGURE 2 T-10 INDUSTRY OPERATIONALLY VALID DATA

CYLINDER LINER WEAR LTMS Severity Analysis Mild —4 EWMA ŵ 11DECOO 01JANO1 01JUL02 01APR01 01APR02 010CT02 OIULOI 01JAN02 0100701 01APRG <u>s</u> 0100 -3 -2 Standard Deviation Units EWMA Action Limit - 1 WMA Warning Limit o Warning Limit 1 EWIA Action Limit 2 з. 4 10 30 45 ò 5 15 20 25 35 40 COUNT IN COMPLETION DATE ORDER Severe LTMS Precision Analysis 4 -11DECO0 01JAN01 01APR01 01/101 01APR02 01JUL02 0100702 01APR03 010CT03 010CT01 01JAN02 01.JAN04 3-2 EWMA Action Limit 1 ning Limit 0 - 1 -2 -3 зо ò 5 10 15 20 25 35 40 45 COUNT IN COMPLETION DATE ORDER CUSUM Severity Analysis -8



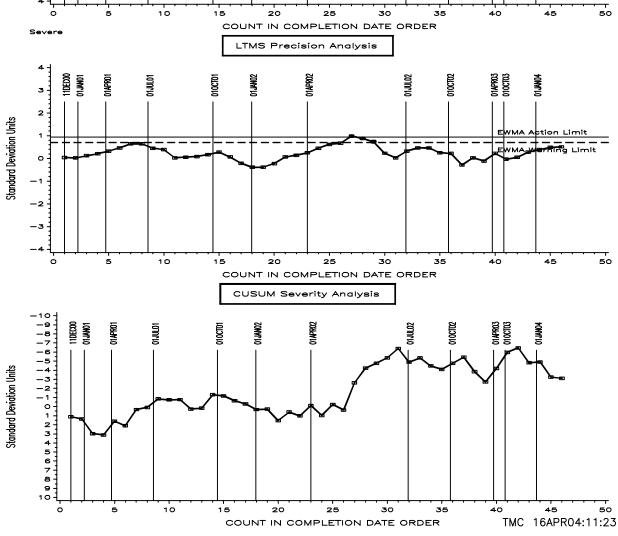


FIGURE 3 T-10 INDUSTRY OPERATIONALLY VALID DATA

TOP RING WEIGHT LOSS

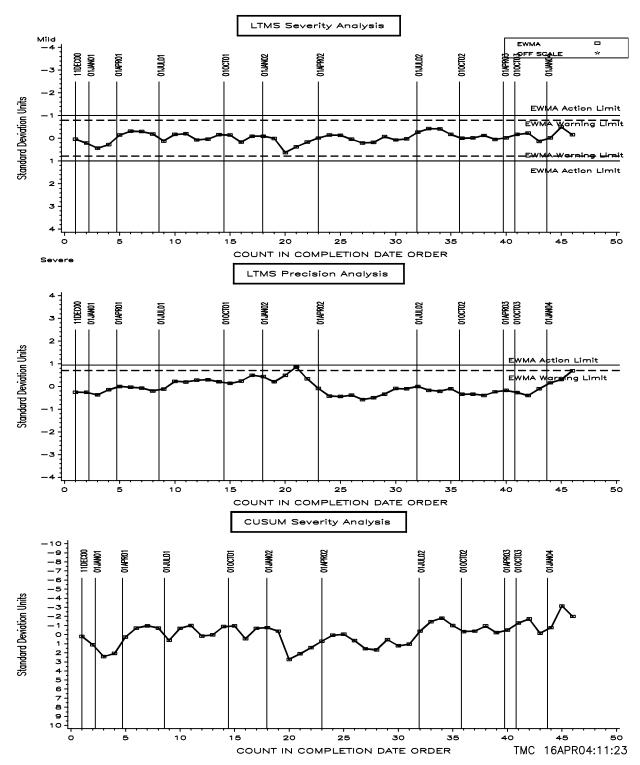


FIGURE 4 T-10 INDUSTRY OPERATIONALLY VALID DATA

LTMS Severity Analysis Mild —4 EWMA τ¢r 11DECOO 01JANO1 01JUL02 01APR01 01APR02 010CT02 OIULOI 01JAN02 0100701 <u>s</u> <u>100</u> -3 -2 Standard Deviation Units EWMA Action Limit - 1 EWMA Warning Limit o <mark>eraing Limi</mark>t 1 EWIA Action Limit 2 з. 4 50 10 30 ò 5 15 20 25 35 40 45 COUNT IN COMPLETION DATE ORDER Severe LTMS Precision Analysis 4 -11DECOO 01JAND1 01APR01 01/101 01APR02 01JUL02 01APR03 010CT03 01.JAN04 010CT01 01.JAND2 0100702 3-2 Standard Deviation Units EWMA Action Limit 1 EWMA Warning Limit ο - 1 -2 -3 50 зо ò 5 10 15 20 25 35 40 45 COUNT IN COMPLETION DATE ORDER CUSUM Severity Analysis 11DECOO 01JAN01 OlJULO 01JAN02 01APR02 0100702 01APR03 010CT03 01APR01 010CT01 8 IAN04 -8 Standard Deviation Units 10ò 5 10 20 25 30 35 45 50 15 40 TMC 16APR04:11:23 COUNT IN COMPLETION DATE ORDER

OIL CONSUMPTION

FIGURE 5 T-10 INDUSTRY OPERATIONALLY VALID DATA

LTMS Severity Analysis Mild —4 EWMA ŵ 11DECOO 01JANO1 01APR01 01APR02 01JUL02 010CT02 OIULOI 01JAN02 0100701 01APRG <u>s</u> 0100 -3 -2 Standard Deviation Units EWMA Action Limit - 1 WNA warning Limit o /arning Limit 1 EWIA Action Limit 2 з. 4 50 10 30 45 ò 5 15 20 25 35 40 COUNT IN COMPLETION DATE ORDER Severe LTMS Precision Analysis 4 -11DECOO 01JAND1 01APR03 010CT03 01APR01 01/101 01APR02 01JUL02 0100702 010CT01 01.JAND2 01.JAN04 3-2 Standard Deviation Units EWMA Action Limit 1 arning Limit 0 - 1 -2 -3 50 зо ò 5 10 15 20 25 35 40 45 COUNT IN COMPLETION DATE ORDER CUSUM Severity Analysis 0100702 11DECOO 01JAN01 OlJULO 01JAN02 01APR02 01JUL02 01APR03 010CT03 01APR01 010CT01 -8 Standard Deviation Units 10 ò 5 10 20 25 30 35 45 50 15 40

DELTA PB 250-300 HOURS

COUNT IN COMPLETION DATE ORDER TMC 16APR04:11:23

FIGURE 6 T10A INDUSTRY OPERATIONALLY VALID DATA

LTMS Severity Analysis Mild —4 EWMA ÷ OFF SCALE 11DECOO 01JAN02 01JUL03 OIJULOI 01JUL02 -3 -2 Standard Deviation Units EWMA Action Limit - 1 EWMA Warning Limit o EWMA-Warning Limit 1 EWMA Action Limit 2 з 4 ---75 5 70 ò 10 15 20 25 30 35 40 45 50 55 60 65 COUNT IN COMPLETION DATE ORDER Severe LTMS Precision Analysis 11DECOO 01JUL03 01.JAN04 01JUL01 01JAN02 01JUL02 2 · Standard Deviation Units EWMA Action Limit 1 EWMA Warning Limit 0 - 1 -2 -3 5 75 ò 10 15 20 25 30 35 40 45 50 55 60 65 70 COUNT IN COMPLETION DATE ORDER CUSUM Severity Analysis 01JULD3 11DECO0 01/101 01JAN02 01JUL02 01JAN04 Standard Deviation Units 20 75 5 10 15 25 30 40 45 65 70 ò 20 35 50 55 60 TMC 16APR04:16:11 COUNT IN COMPLETION DATE ORDER

MRV VISCOSITY @ 75H