



Test Monitoring Center

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MEMORANDUM: 01-062
DATE: May 29, 2001
TO: Wim Van Dam, Acting Chairman, Mack Surveillance Panel
FROM: Jeff Clark
SUBJECT: T-9 Calibration Testing for the April 2001 ASTM Report Period

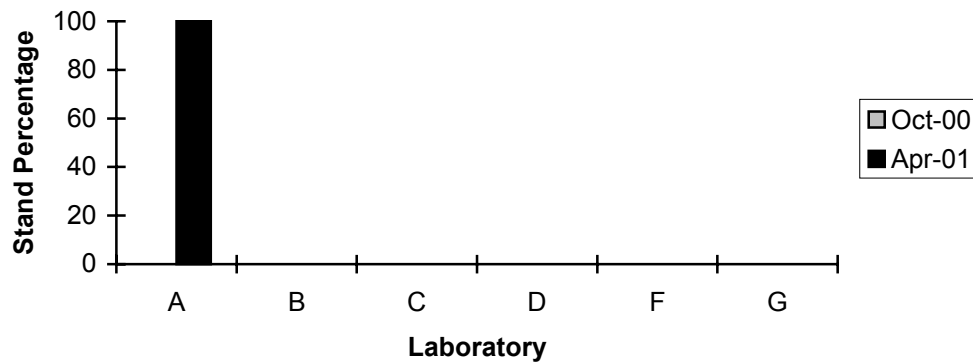
Two T-9 reference oil tests were completed during the April 2001 ASTM report period, which began on October 1, 2000 and ended on March 31, 2001.

Lab / Stand Distribution:

	Reporting Data	Calibrated as of 3/31/01
Number of Laboratories	1	1
Number of Stands	2	2

The following chart shows the laboratory / stand distribution for tests completed this report period:

Laboratory / Stand Distribution

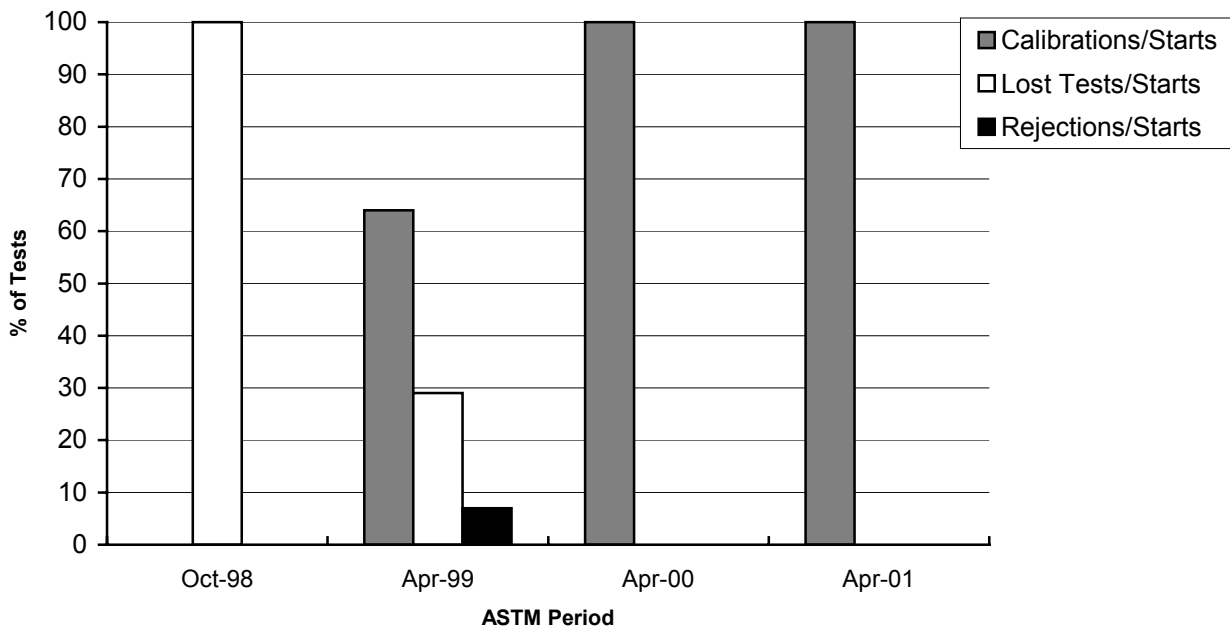


The following summarizes the status of the reference oil tests completed this ASTM report period:

Test Status	TMC Validity Code	Number of Tests
Operationally and Statistically Acceptable	AC	2
Failed LTMS Acceptance Criteria	OC	0
Operationally Invalid	LC	0
Aborted	XC	0
Total		2

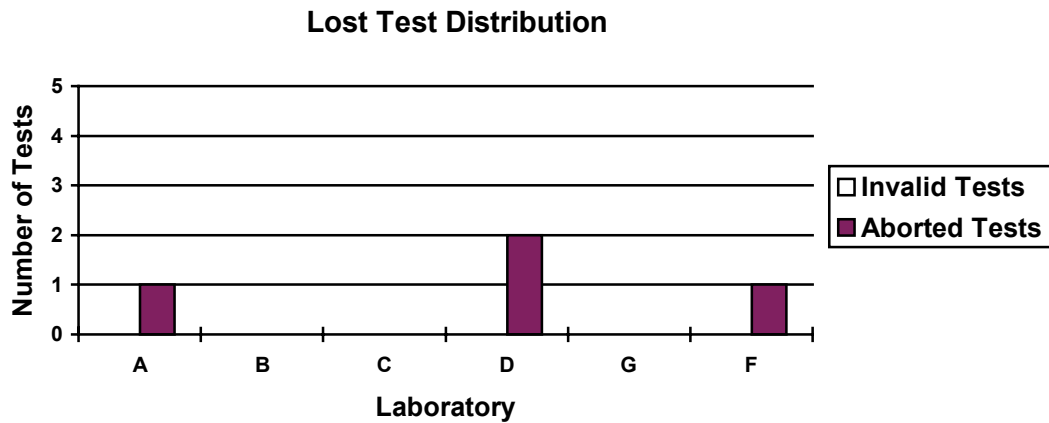
Calibrations per start, lost tests per start and rejections per start rates are summarized below:

Calibration Attempt Summary



“Engineering Judgment” was not applied in the interpretation of LTMS guidelines during this report period. A total of three LTMS deviations have been issued in the history of the T-9 test.

Table 1 lists the reasons any test failed the acceptance criteria. A detailed list of reasons for operationally invalid tests is shown in Table 2. Table 3 lists the reasons for aborted tests during this report period. No aborted or operationally invalid tests have been reported for the past two periods during which reference testing occurred. Aborted and operationally invalid tests by laboratory for the April '99 report period are summarized with the following chart:



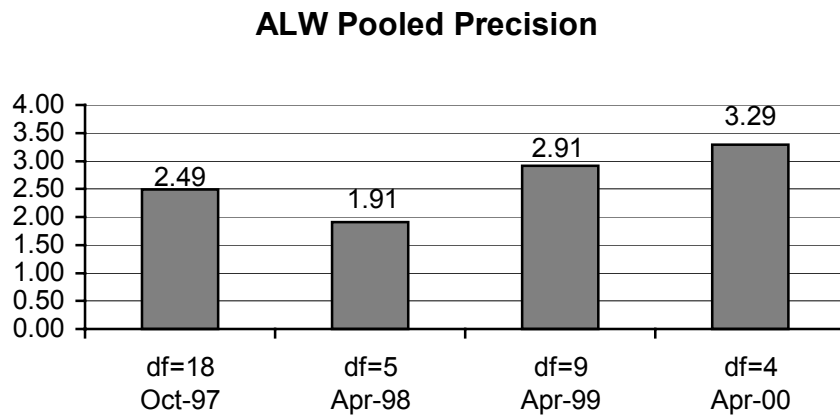
Severity and Precision:

Figure 1 shows the current industry EWMA severity, EWMA precision, and cusum charts for Adjusted Liner Wear (ALW). ALW is currently in an industry warning alarm for severity, in the mild direction. Since January 1, 2000, ALW is trending an average of 1.15 \square /s mild. This is equivalent to 3.34 microns. For a history of ALW industry alarms, refer to the industry alarm log shown in Table 4.

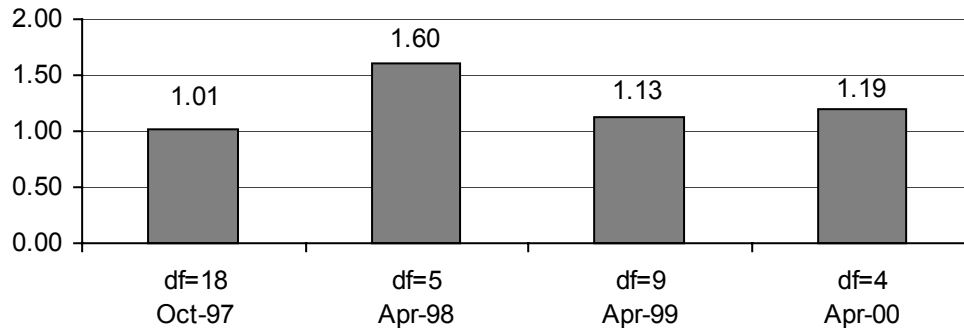
Figure 2 shows the current industry EWMA severity, EWMA precision, and cusum charts for Delta Pb. Delta Pb is currently within control chart limits. For a history of Delta Pb industry alarms, refer to the industry alarm log shown in Table 5.

Figure 3 shows the current industry EWMA severity, EWMA precision, and cusum charts for Top Ring Weight Loss (TRWL). TRWL is currently within control chart limits. However, since January 1, 2000, TRWL is trending an average of 0.84 \square /s severe. This is equivalent to 14.0 mg. For a history of TRWL industry alarms, refer to the industry alarm log shown in Table 6.

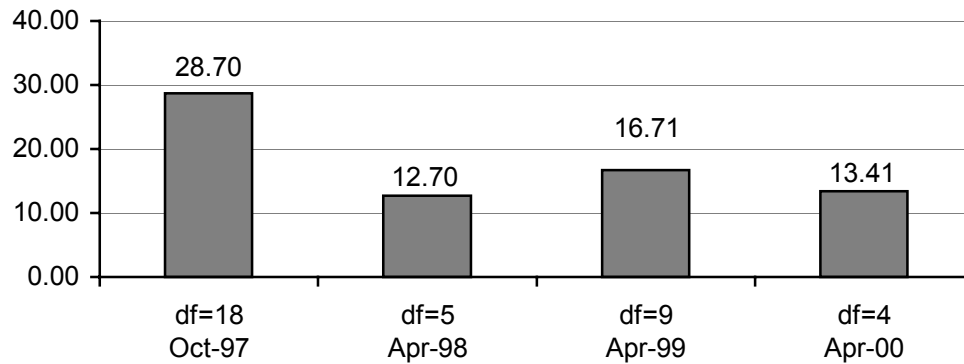
Precision, as estimated by the pooled standard deviation, is shown in the following figures. Due to low test volume, no estimate is available for the April '01 and October '00 periods. The April '00 ALW precision estimate shows some degradation compared to historical levels. The Delta Pb precision estimate is comparable to historical levels. The precision estimate for TRWL is comparable to recent levels. For future comparison purposes, the TMC will continue to report precision by ASTM period.



Delta Pb Pooled Precision



TRWL Pooled Precision



Please note, that the degrees of freedom (df) equals $\Sigma(n \text{ observations per oil} - 1)$.

Reference Oils and Hardware:

The following table shows the current T-9 reference oil test targets:

Parameter	Oil	N	Mean (cSt)	s
ALW (microns)	1005	-	24.4700	2.3500
	1005-1	10	24.6400	2.9064
Delta Pb (trans. Units)	1005	-	5.7970	1.2030
	1005-1	10	7.2980	1.1251
TRWL (mg)	1005	-	84.3400	29.2900
	1005-1	10	93.7000	16.7136

As previously reported, a correction factor for TRWL has been implemented due to a severity shift associated with a new top piston ring design that was introduced into the T-9 test in December 1998. The correction factor was introduced May 1, 1999 and was updated effective January 1, 2000. The

correction factor applies to all tests, both candidate and calibration, run on the new top piston ring hardware. To date, ten tests have been completed on the new top piston ring design. A proposed ten-test update to the correction factor is shown below. Implementation of this correction factor should be discussed at the next Mack Surveillance Panel meeting.

Parameter	N	Correction Factor (mg)	Effective Date
TRWL	3	34.1769	19990501
TRWL	5	36.9000	20000101
TRWL**	10	31.4000	-

**Proposed.

Information Letters:

No information letters were issued this ASTM period.

Quality Index:

No Quality Index deviations were issued this ASTM period. For the history of the T-9 test, no Quality Index deviations have been issued.

TMC Laboratory Visits:

No TMC laboratory visits were conducted this ASTM period.

Additional Information:

Table 7 contains the T-9 Timeline which details changes to the test since January 1, 1997.

The T-9 database, for operationally valid calibration tests, can be accessed on the TMC's homepage. If you have any questions on how to access this information, contact the TMC.

JAC/jac/mem01-062.jac.doc

Attachments

c: J.L. Zalar, TMC
 F.M. Farber, TMC
 Mack Surveillance Panel
<ftp://tmc.astm.cmri.cmu.edu/docs/diesel/mack/semiannualreports/T9-04-2001.pdf>

Table 1
Summary of Reasons for Rejected Tests

	No. of Tests
No statistically rejected tests this ASTM period	-

Table 2
Summary of Reasons for Invalid Tests

	No. of Tests
No invalid tests this ASTM report period	-

Table 3
Summary of Reasons for Aborted Tests

	No. of Tests
No aborted tests this ASTM report period	-

FIGURE 1
 T-9 INDUSTRY OPERATIONALLY VALID DATA
 ADJUSTED LINER WEAR

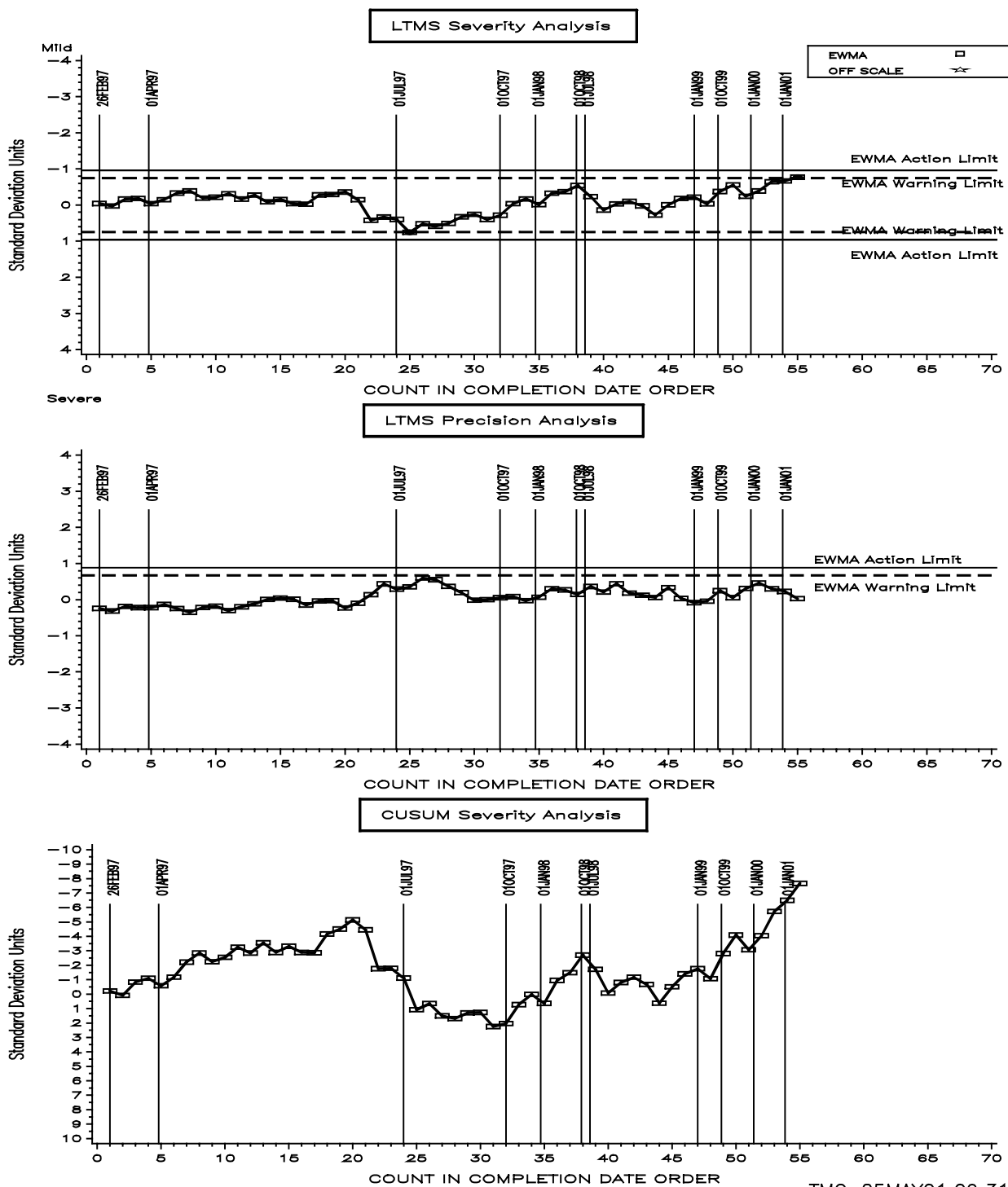


TABLE 4
T-9 AVERAGE LINER WEAR INDUSTRY ALARM LOG

July 6, 1997 to July 10, 1997 (Severity, Severe direction)

A one-test excursion occurs. No industry related problem.

March 30, 2001 to Date (Severity, Mild direction)

An industry warning alarm occurs. No indication yet if this is a true industry alarm.

Updated 5/25/01

FIGURE 2
 T-9 INDUSTRY OPERATIONALLY VALID DATA
 DELTA PB

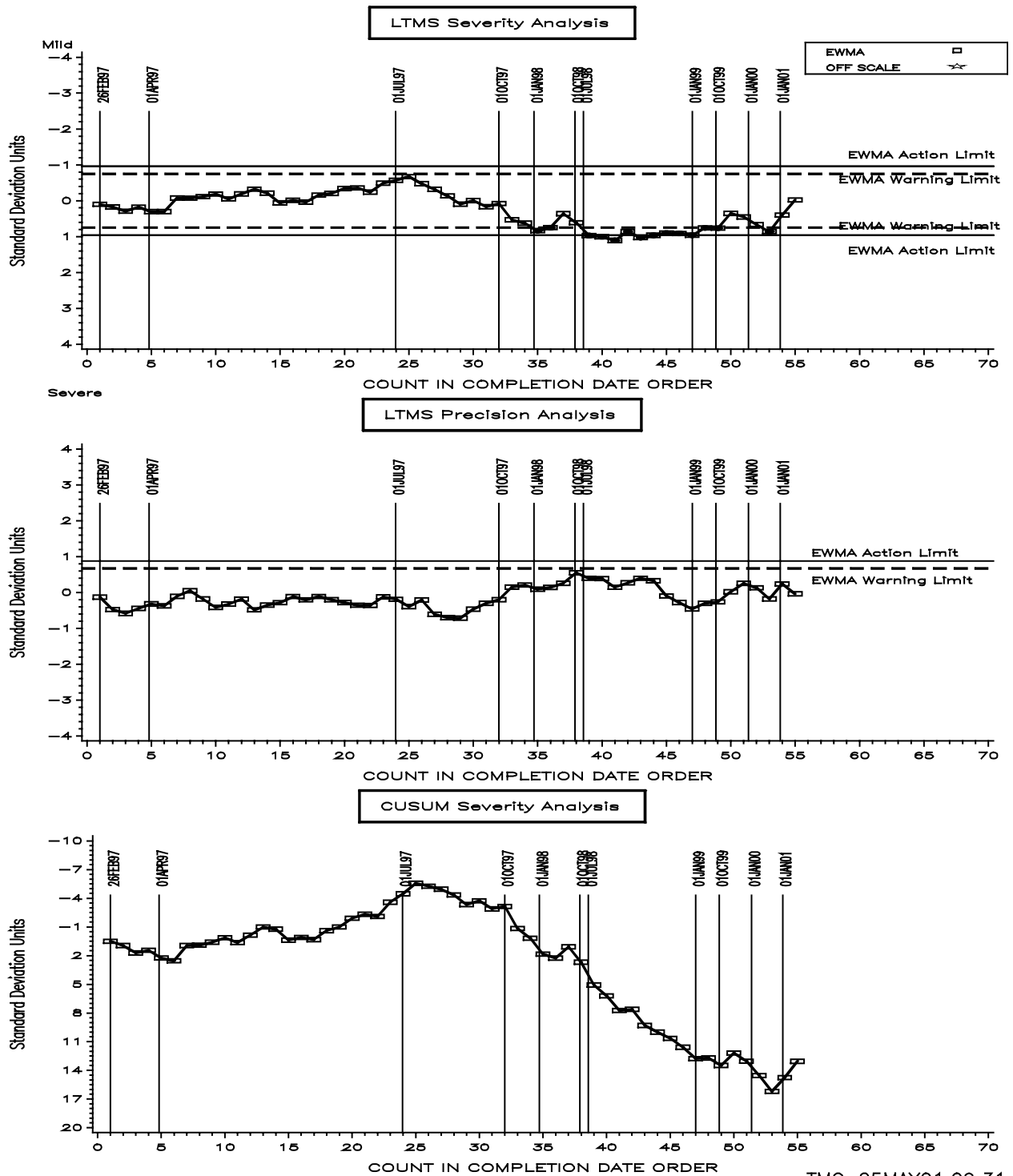


TABLE 5
T-9 DELTA PB INDUSTRY ALARM LOG

February 5, 1998 to March 6, 1998 (Severity, Severe direction)

A two-test excursion occurs. No industry related problem.

October 23, 1998 to November 25, 1999 (Severity, Severe direction)

A series of warning and action alarms occur. Due to eighty percent of the data being generated from one lab, it is difficult to determine if this is a true industry trend or a laboratory trend. The Mack Surveillance Panel has investigated the trend. Items investigated include potential differences between reference oil reblends and possible effects of conrod bearing batch changes. No causes were found.

March 25, 2000 to March 1, 2001 (Severity, Severe direction)

A one-test excursion occurs. No industry related problem.

Updated 5/25/01

FIGURE 3
 T-9 INDUSTRY OPERATIONALLY VALID DATA
 AVERAGE TOP RING WEIGHT LOSS

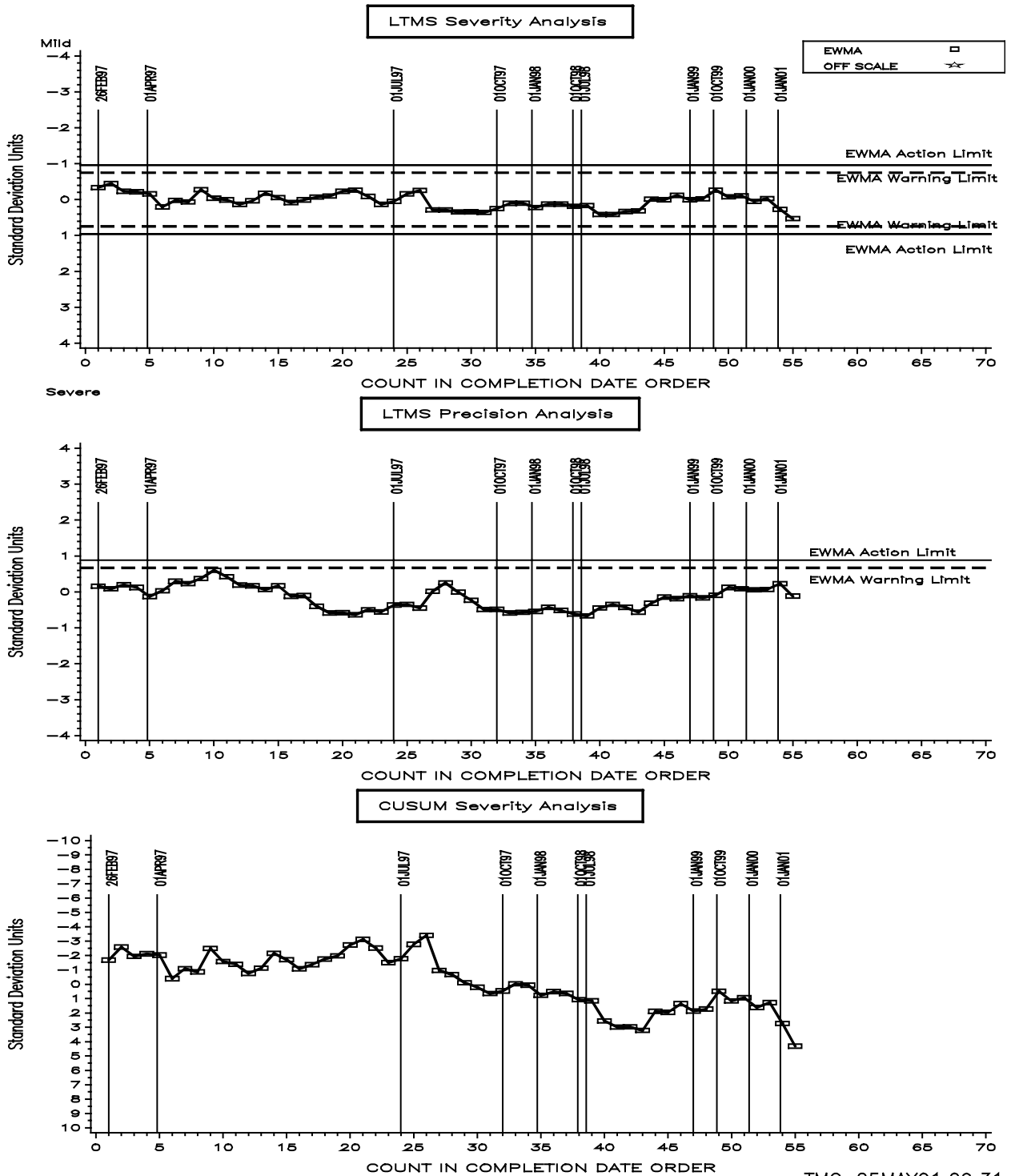


TABLE 6
T-9 TOP RING WEIGHT LOSS INDUSTRY ALARM LOG

No industry alarms have occurred.

Updated 5/25/01

Table 7
T-9 Timeline

Date	Info. Letter	Topic
19970226,		INTAKE VALVE SWITCH FROM 20 DEGREE TRW TO 30 DEGREE EATON
19970226,		VALVE LASH CHECK FREQUENCY CHANGED FROM EVERY 200 HOURS TO EVERY 125 HOURS
19970407,		DATA ACQUISITION MINIMUM FREQUENCY CHANGED FROM 2 MINUTES TO 6 MINUTES
19970407,		CRANKCASE PRESSURE CHANGED FROM A CONTROL PARAMETER TO A NON-CONTROLLED PARAMETER
19970701,		MACK AIR FILTER AND MACK FILTER HOUSING SPECIFIED
19970701,		CRANKCASE ASPIRATION (BLOWBY) CONFIGURATION SPECIFIED
19970808,		PROCEDURE DRAFT NO. 3 ISSUED
19970904,		MAXIMUM SHUTDOWN LIMITS OF 200 HOURS AND 10 SHUTDOWNS SPECIFIED
19970904,		MAXIMUM 5 DEGREE INJECTION TIMING DIFFERENCE SPECIFIED FOR STAGE 1
19971007,		NEW STAND CALIBRATION WITH 1 TEST APPROVED
19971020,		OUTLIER SCREENING FOR IMPLEMENTED FOR LINER WEAR
19971020,		REPLACEMENT OF MAIN BEARINGS AT EVERY TEST SPECIFIED
19971208,		MAXIMUM SHUTDOWN LIMIT INCREASED TO 15 SHUTDOWNS
19980121,		NEW STAND CALIBRATION REQUIRES TWO ACCEPTABLE TESTS
19980202,		PROCEDURE DRAFT NO. 4 ISSUED
19980204,		OIL 1004-3 REMOVED AS REFERENCE OIL
19980408,	98-1	OUTLIER SCREENING IMPLEMENTED FOR TOP RING WEIGHT LOSS
19980408,	98-1	PB ADJUSTMENT FOR OUTLIER CONROD BEARING IMPLEMENTED
19980408,		OIL 1005-1 INTIAL TARGETS, BASED ON 1005 RESULTS
19980408,	98-1	MACK PRIMARY AND SECONDARY FILTERS SPECIFIED FOR FUEL SYSTEM
19980408,	98-1	TMC MAY EXTEND CALIBRATION PERIODS AT ITS DISCRETION
19980622,	98-2	SCREENING FOR TOP RING FLAKING IMPLEMENTED FOR TOP RING WEIGHT LOSS AND LINER WEAR
19980622,	98-2	PENCOOL 3000 COOLANT ADDITIVE MAY BE USED IN THE ENGINE COOLING SYSTEM
19980803,	98-1	VISCOSITY MEASUREMENTS MAY BE DONE ACCORDING TO EITHER D 445 OR D 5967, ANNEX A3
19980911,	99-1	REPORT FORMS AND DATA DICTIONARY VERSION 19980601
19981001,	99-1	TWO ENGINES MAY BE CALIBRATED IN A STAND, ENGINE CAL PERIOD IS TWO YEARS, STAND CAL PERIOD IS ONE YEAR
19981026,	98-2	LEAD CONTENT TO BE MEASURED AT LEAST TWICE AT 400 AND 500 HOURS
19981204,		REPORT FORMS AND DATA DICTIONARY VERSION 19980804
19981207,		NEW TOP PISTON RING DESIGN INTRODUCED
19990323,		NEW INTAKE VALVE DESIGN INTRODUCED
19990501,	99-1	REPORT FORMS AND DATA DICTIONARY VERSION 19981110
VALVES		CORRECTION FACTOR OF +34.1769 MG ADDED TO TRWL RESULTS FOR TESTS USING NEW PISTON RINGS AND NEW VALVES
19990501,		OIL 1005-1 TEN TEST TARGETS
19990819,	99-1	QUALITY INDEX USED TO JUDGE TEST OPERATIONAL VALIDITY
20000101,		TRWL CORRECTION FACTOR UPDATED: +36.9 MG ADDED TO TRWL RESULTS FOR TESTS USING NEW PISTON RINGS
AND NEW VALVES		