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MEMORANDUM: 02-087

DATE: October 7, 2002

TO: Wim Van Dam, Chairman, Mack Surveillance Panel

FROM: Jeff Clark

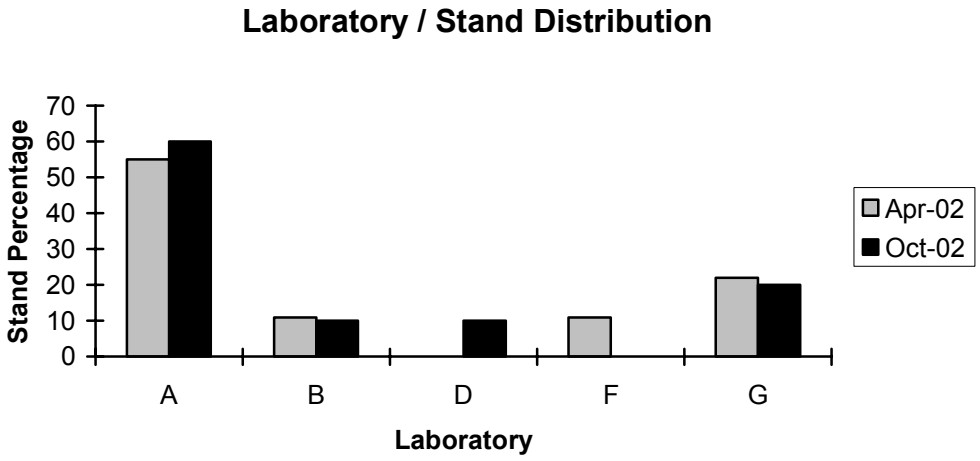
SUBJECT: T-10 Calibration Testing for the October 2002 ASTM Report Period

The following is a summary of T-10 reference oil tests completed during the October 2002 ASTM report period, which began on April 1, 2002 and ended on September 30, 2002.

Lab / Stand Distribution:

	Reporting Data	Calibrated as of 9/30/02
Number of Laboratories	4	4
Number of Stands	10	9

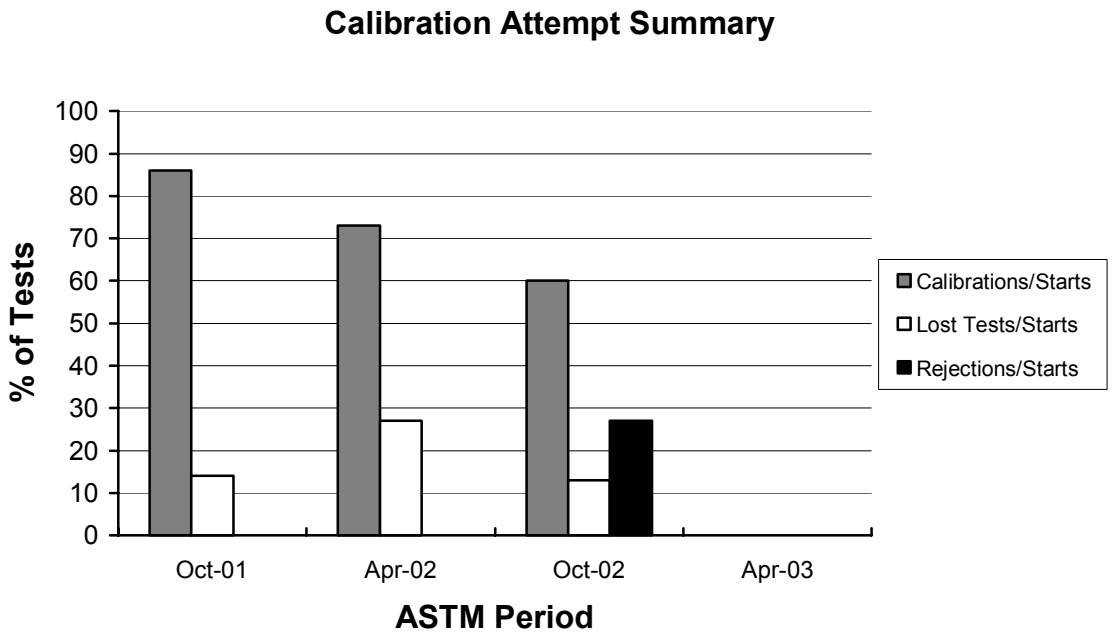
The figure below shows the T-10 laboratory / stand distribution for tests completed the current and previous report periods:



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	9
Failed Calibration Test (LTMS Criteria)	OC	4
Operationally Invalid Calibration Test	LC	1
Aborted Calibration Test	XC	1
Total		15

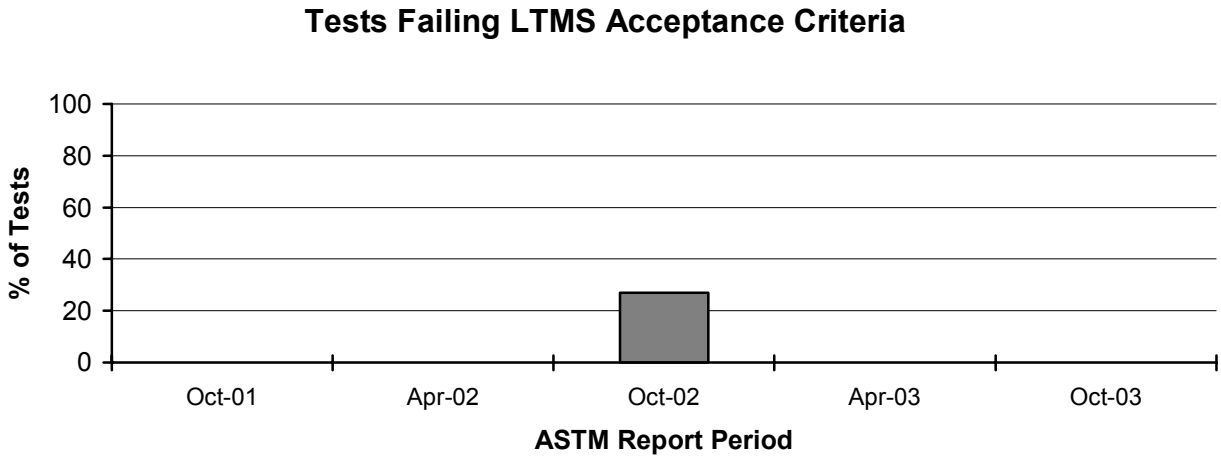
Calibrations per start, lost tests per start and rejections per start rates are summarized in the figure below:



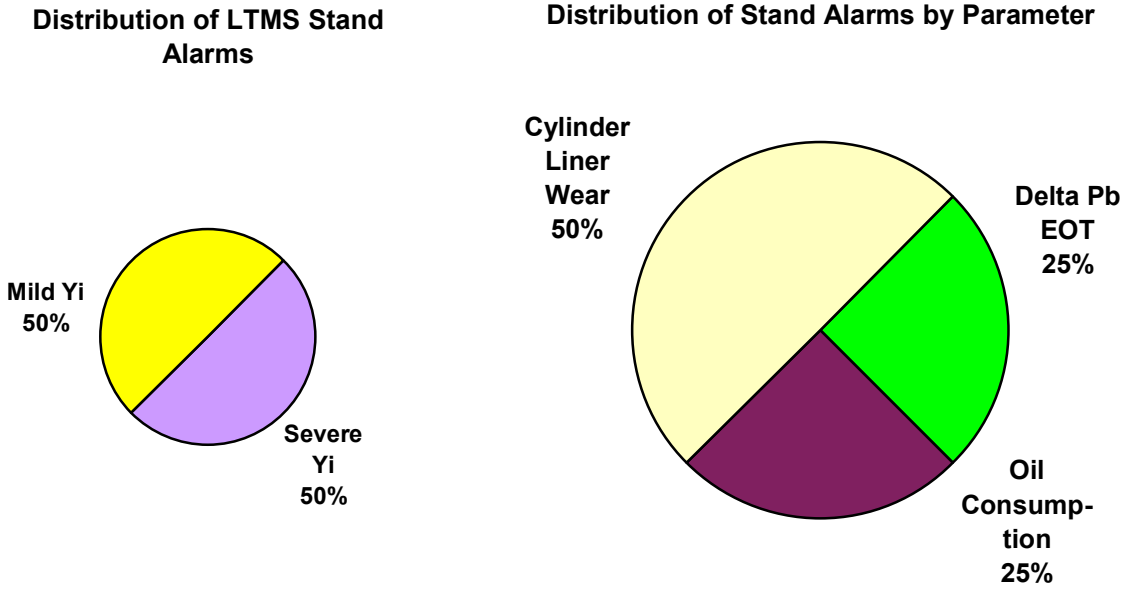
A detailed list of reasons tests failed the acceptance criteria (OC validity) is shown in Table 1. Table 2 lists the operationally invalid tests (LC validity) and Table 3 lists the aborted tests (XC validity).

LTMS Acceptance Criteria / Stand Alarms:

The following figure shows the percentage of operationally valid tests that failed the LTMS acceptance criteria (TMC validity code = OC) for recent ASTM report periods:



There were four LTMS stand alarms for the current period.



Note that of the four alarms, three occurred at one lab. No LTMS deviations were issued this period. No LTMS deviations have been issued during the history of the T-10.

Severity and Precision:

Figure 1 (attached) shows the current industry EWMA severity, EWMA precision, and cusum charts for Delta Pb @ EOT (PB). PB is currently in control. For this period, PB is trending an average of –0.24 Δ/s mild. This is equivalent to 0.06 natural log units or approximately 2 ppm at the proposed CI-4 Merit Rating Anchor value of 30 ppm. For a history of PB industry alarms, refer to the industry alarm log shown in Table 4.

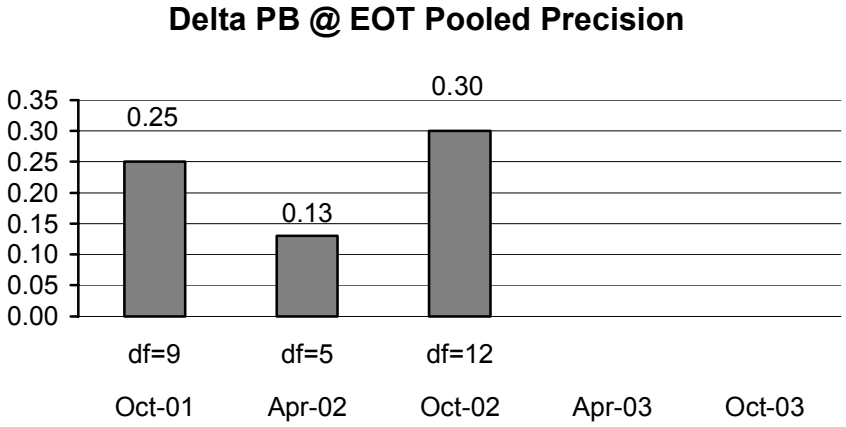
Figure 2 (attached) shows the current industry EWMA severity, EWMA precision, and cusum charts for Cylinder Liner Wear (CLW). CLW is currently in control. For this period, CLW is trending an average of 0.31 Δ/s mild. This is equivalent to 1.3 microns. For a history of CLW industry alarms, refer to the industry alarm log shown in Table 5.

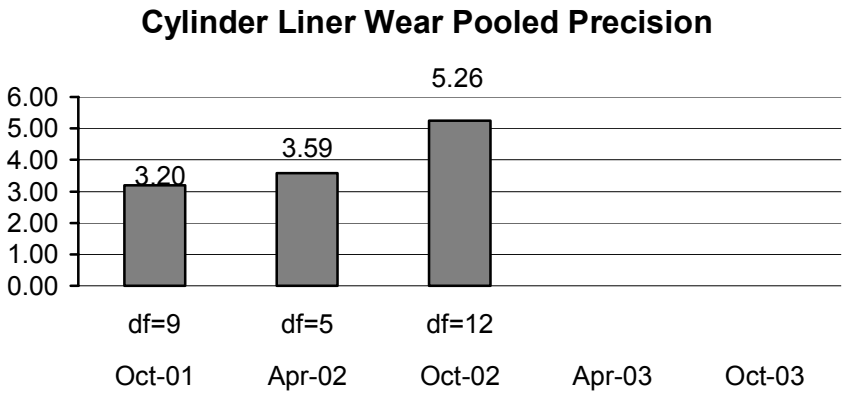
Figure 3 (attached) shows the current industry EWMA severity, EWMA precision, and cusum charts for Top Ring Weight Loss (TRWL). TRWL is currently in control. For this period, TRWL is trending an average of 0.12 Δ/s mild, or approximately 2 mg. For a history of TRWL industry alarms, refer to the industry alarm log shown in Table 6.

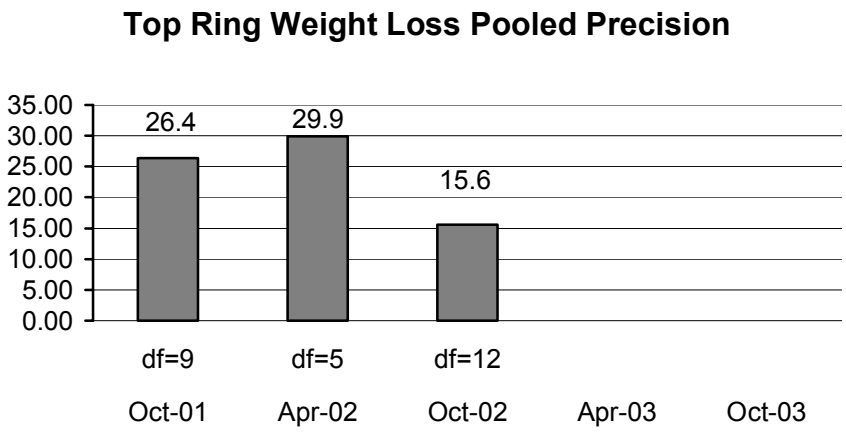
Figure 4 (attached) shows the current industry EWMA severity, EWMA precision, and cusum charts for Oil Consumption (OC). OC is currently in control. For this period, OC is trending an average of 0.22 Δ/s mild. This is equivalent to 1.7 g/hr. For a history of OC industry alarms, refer to the industry alarm log shown in Table 7.

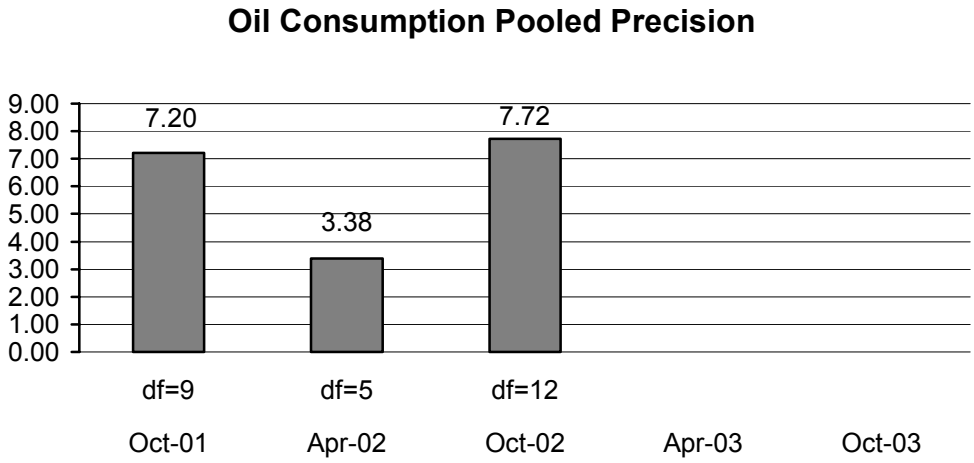
Figure 5 (attached) shows the current industry EWMA severity, EWMA precision, and cusum charts for Delta Pb 250-300 Hours (PB2). PB2 is currently in control. For this period, PB2 is trending an average of 0.23 Δ/s mild. This is approximately 1 ppm. For a history of PB2 industry alarms, refer to the industry alarm log shown in Table 8.

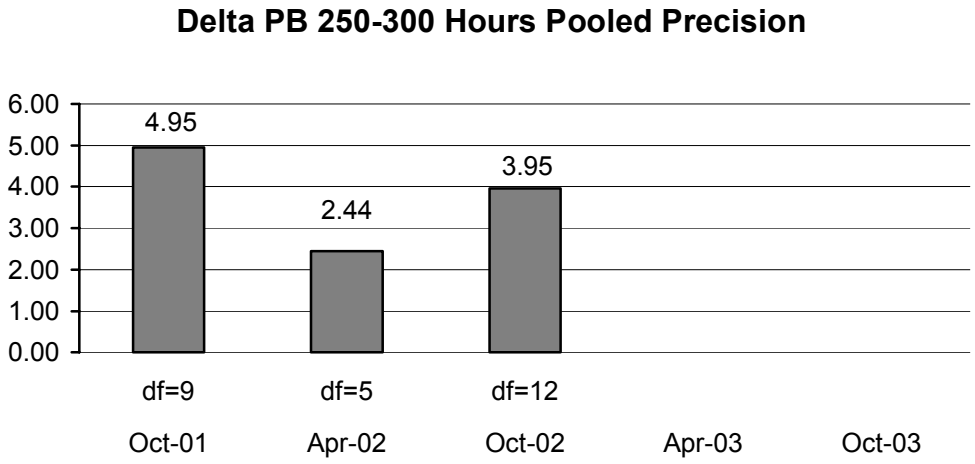
Precision, as estimated by the pooled standard deviation, is shown in the following figures. For comparison purposes, the TMC will continue to report precision by ASTM period.




Cylinder Liner Wear Pooled Precision
6.00
5.00
4.00
3.00
2.00
1.00
0.00
3.20
3.59
5.26
df=9
df=5
df=12
Oct-01
Apr-02
Oct-02
Apr-03
Oct-03


Top Ring Weight Loss Pooled Precision
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
26.4
29.9
15.6
df=9
df=5
df=12
Oct-01
Apr-02
Oct-02
Apr-03
Oct-03


Oil Consumption Pooled Precision
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
7.20
3.38
7.72
df=9
df=5
df=12
Oct-01
Apr-02
Oct-02
Apr-03
Oct-03



PB, CLW, OC, and PB2 all show some degradation in precision compared with the previous period, and only PB2 is still within historical levels. TRWL shows significant improvement in precision compared with historical levels. Please note, that the degrees of freedom (df) equals Σ(n observations per oil - 1).

Reference Oils:

The current reference oil test targets are shown below:

Oils	Parameter	N	Mean (cSt)	S
820-2	PB	16	3.2422	0.2457
	CLW	16	31.6	4.1
	TRWL	16	108	20
	OC	16	52.1	7.7
	PB2	16	9.3	3.9

Once 20 tests on oil 820-2 have been completed, the TMC will provide a target update for surveillance panel consideration.

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. MRV viscosity is currently in control. For this period, MRV is trending an average of 0.18 Δ/s severe. This is equivalent to 89 cP. For a history of MRV viscosity industry alarms, refer to the industry alarm log shown in Table 9.

Information Letters:

T-10 Information Letter 02-1, Sequence No.1 was issued April 19, 2002. Topics included injector opening pressure, engine calibration requirements, mrv measurement and sample handling.

T-10 Information Letter 02-2, Sequence No. 2 was issued on September 27, 2002. Topics included injector opening pressure, T-10A rebuild frequency, safety precautions, and outlier criteria.

TMC Laboratory Visits:

No TMC laboratory visits were conducted this ASTM period.

Quality Index:

Quality Index has not yet been implemented for the T-10. The T-10 O&H group has reviewed industry capability for the T-10 control parameters. Based on this review, the TMC will be submitting a Quality Index proposal for surveillance panel consideration.

Additional Information:

Table 10 contains the T-10 / T-10A Timeline which details changes to the test since its inception.

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

JAC/jac/mem02-087.jac.doc

Attachments

c: J.L. Zalar, TMC
F.M. Farber, TMC
Mack Surveillance Panel
ftp://ftp.astmtmc.cmu.edu/docs/diesel/mack/semiannualreports/T10-10-2002.pdf

Distribution: Email

Table 1
Summary of Reasons for Rejected Tests

	No. of Tests
Cylinder Liner Wear, mild	2
Delta Pb @ EOT, severe	1
Oil Consumption, severe	1

Table 2
Summary of Reasons for Invalid Tests

	No. of Tests
Test ran with wrong camshaft	1

Table 3
Summary of Reasons for Aborted Tests

	No. of Tests
Fuel injector failure	1

FIGURE 1

T10 INDUSTRY OPERATIONALLY VALID DATA

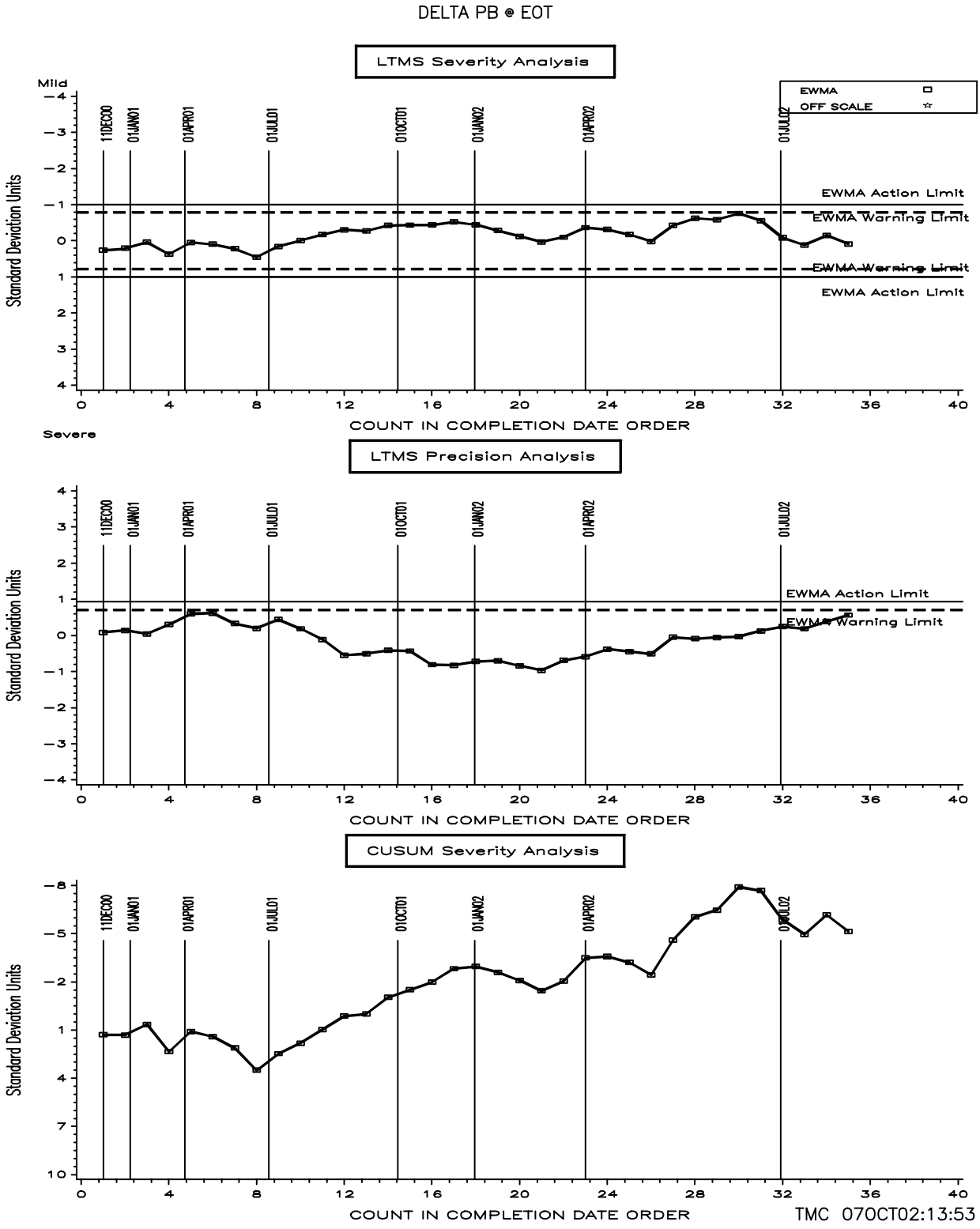


TABLE 4
DELTA PB @ EOT INDUSTRY ALARM LOG

No alarms have occurred.

Updated 10/7/02

FIGURE 2

T10 INDUSTRY OPERATIONALLY VALID DATA

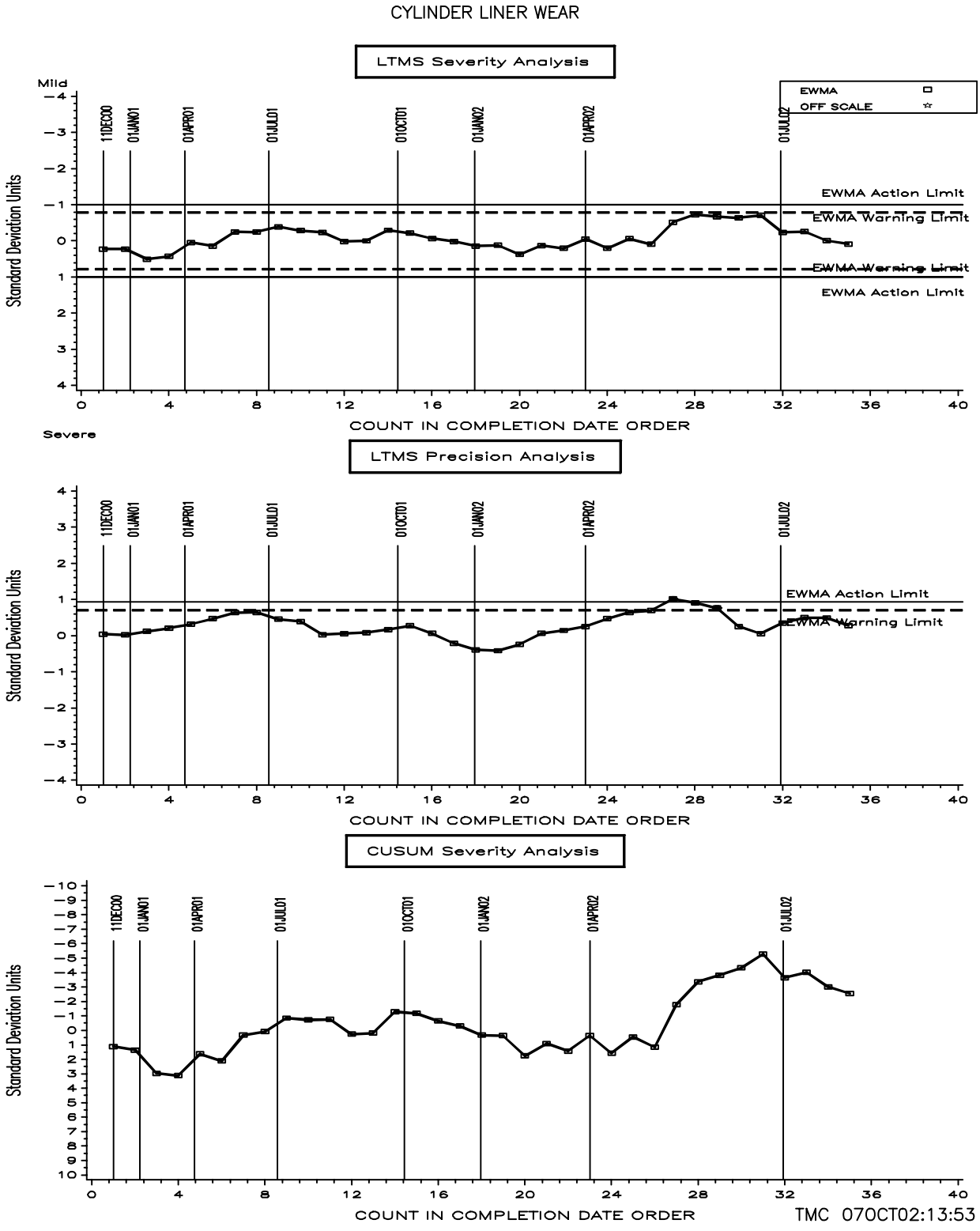


TABLE 5
CYLINDER LINER WEAR INDUSTRY ALARM LOG

May 1, 2002 to June 2, 2002 (Precision)

A three-test excursion occurs. No indication of a true industry alarm.

Updated 10/7/02

FIGURE 3

T10 INDUSTRY OPERATIONALLY VALID DATA

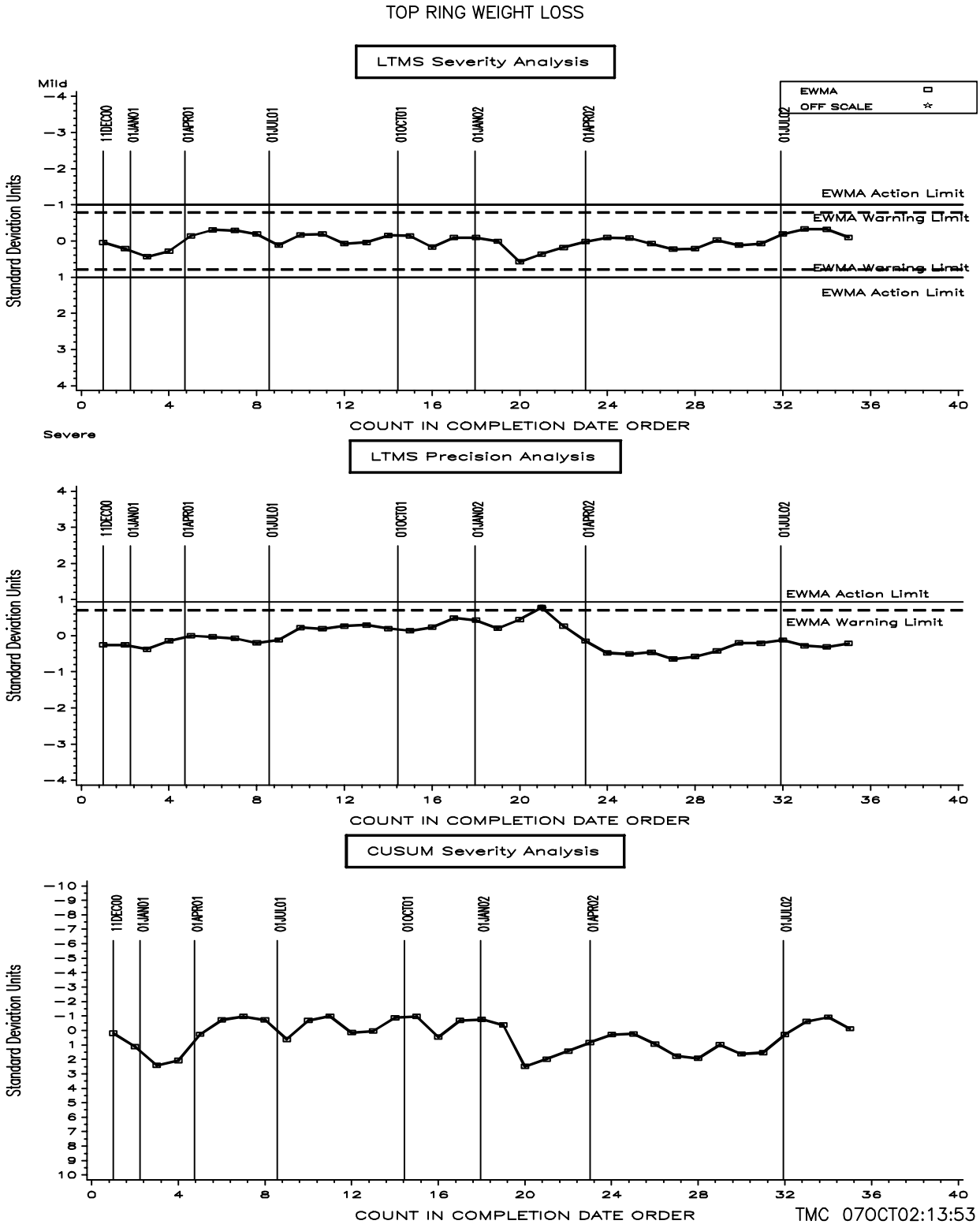


TABLE 6
TOP RING WEIGHT LOSS INDUSTRY ALARM LOG

March 20, 2002 to March 26, 2002 (Precision)

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

Updated 10/7/02

FIGURE 4

T10 INDUSTRY OPERATIONALLY VALID DATA

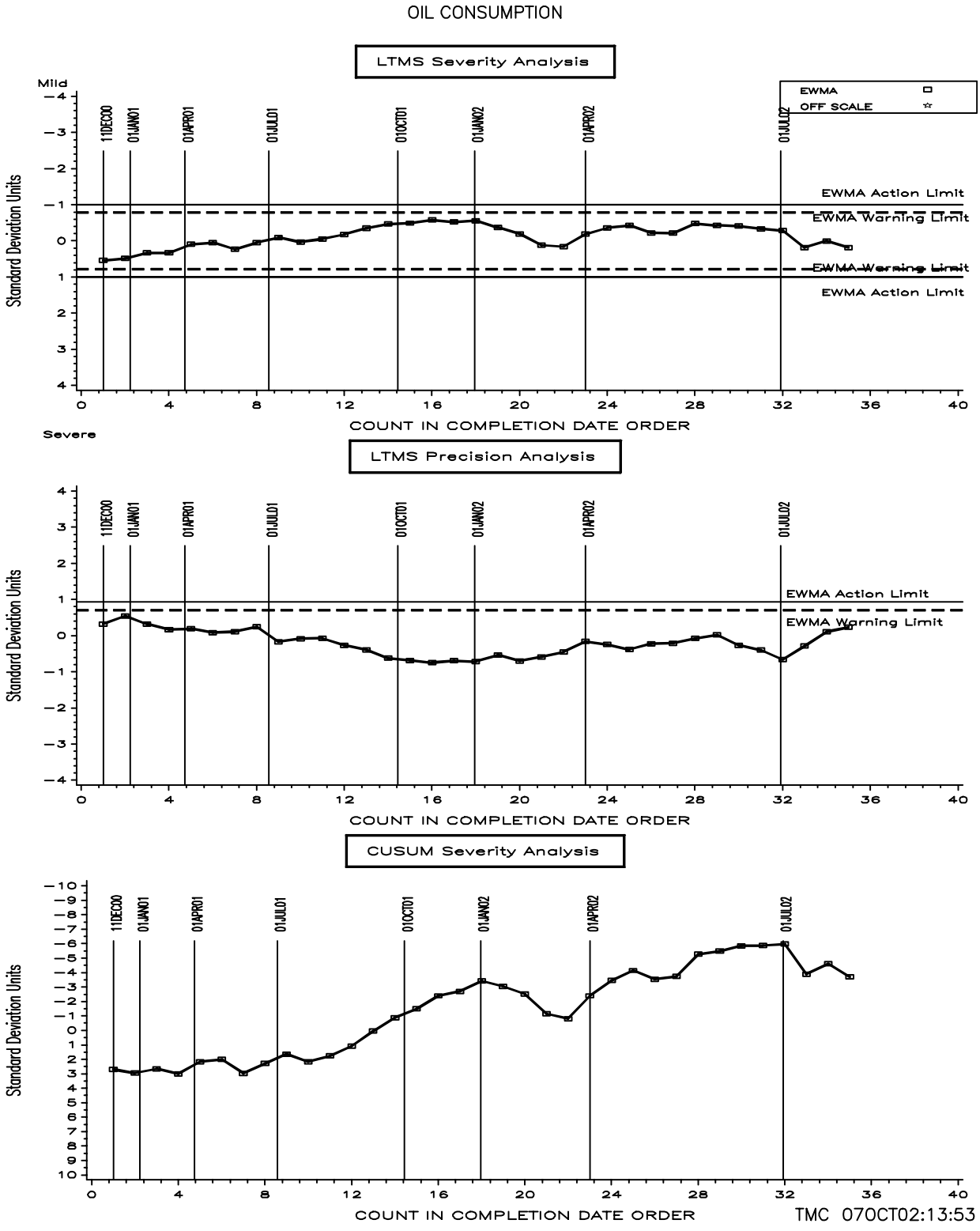


TABLE 7
OIL CONSUMPTION INDUSTRY ALARM LOG

No alarms have occurred.

Updated 10/7/02

FIGURE 5

T10 INDUSTRY OPERATIONALLY VALID DATA

DELTA PB 250–300 HOURS

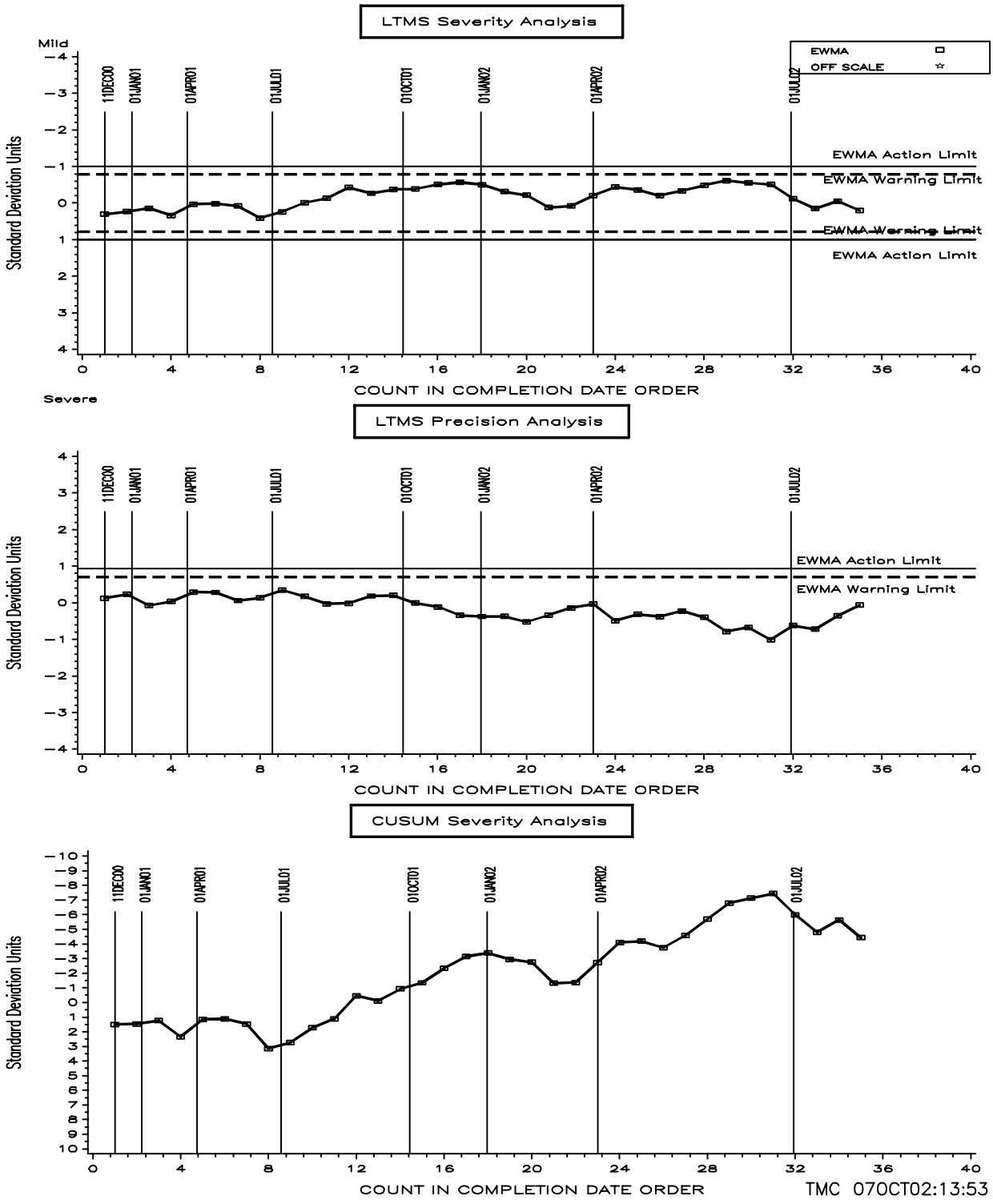


TABLE 8
DELTA PB 250-300 HOURS INDUSTRY ALARM LOG

No alarms have occurred.

Updated 10/7/02

FIGURE 6

T10A INDUSTRY OPERATIONALLY VALID DATA

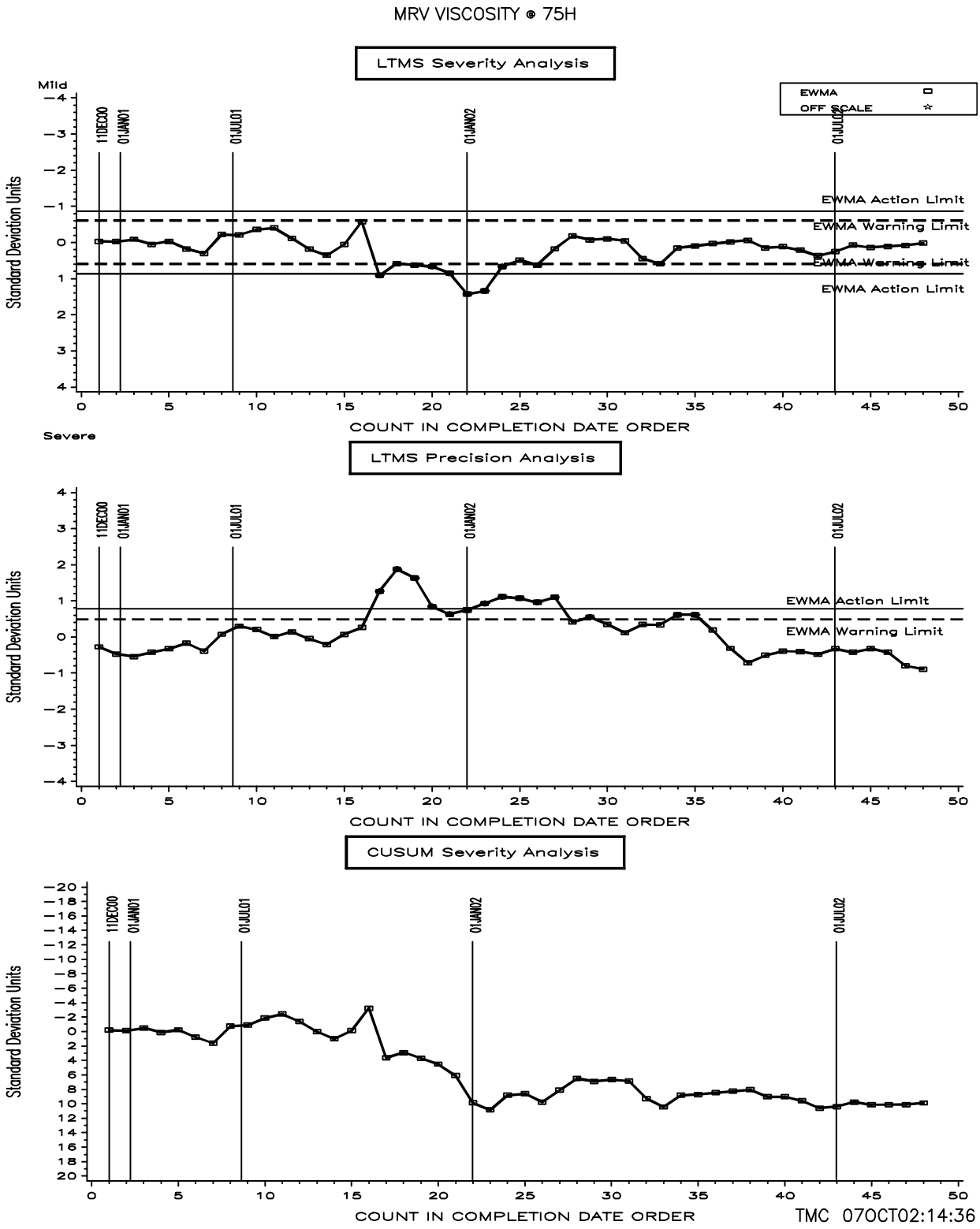


TABLE 9

MRV VISCOSITY INDUSTRY ALARM LOG

November 13, 2001 to March 26, 2002 (Severity, severe direction; Precision action)

A series of seven tests sounds industry warning and action alarms. Thought to be caused by a single result that was extremely severe (6.9 standard deviations). No industry related problem.

April 22, 2002 to May 1, 2002 to date (Precision warning)

A two-test excursion occurs. No indication of a true industry problem.

Updated 10/7/02

TABLE 10
T-10/ T-10A TIMELINE

Date	Info. Letter	Event
20000524		PROCEDURE PRELIMINARY DRAFT ISSUED
20000831		PROCEDURE DRAFT NO.1 ISSUED
20001127		BEGINNING OF PC-9 MATRIX
20010703		COMPLETION OF PC-9 MATRIX
20010710		LABS EXPERIMENT WITH CONTROLLING EGR BASED ON CO2 INTAKE
20010809		EGR CONTROL SET WITH CO2 INTAKE; EXHAUST O2 USED FOR REPORT ONLY
20010816		INTAKE MANIFOLD TEMPERATURE SPEC FOR PHASE 1 CHANGED TO 70 DEG C
20010820		LTMS IMPLEMENTED
20010906		PROCEDURE DRAFT NO.2 ISSUED
20011024		ABBREVIATED TEST T-10A APPROVED
20011029		PROCEDURE DRAFT NO. 3 ISSUED
20011105		REFERENCE OIL 820-1 INTRODUCED FOR TESTING
20011126		PROCEDURE DRAFT NO.4 ISSUED
20011127		PROCEDURE DRAFT NO. 5 ISSUED
20020122		REFERENCE OIL 820-2 INTRODUCED FOR TESTING
20020305	02-1	ENGINE CALIBRATION REQUIREMENT DROPPED; CALIBRATION DETERMINED BY STAND ONLY
20020305	02-1	MRV VISCOSITY TO BE MEASURED BY MODIFIED METHOD ONLY; SAMPLE HANDLING PER T-8 PROCEDURE
20020419	02-1	PROCEDURE DRAFT NO. 6 ISSUED
20020517		T-10A TARGETS UPDATED; 14 TESTS ON OIL 820-2
20020617		T-10 TARGETS UPDATED; 12 TESTS ON OIL 820-2
20020722	02-2	T-10A FLUSH-N-RUN REBUILD SET AT THREE CALIBRATION PERIODS OR 1350 TEST HOURS
20020722	02-2	INJECTOR OPENING PRESSURE TO BE CHECKED EACH CALIBRATION PERIOD (AT REBUILD FOR T-10A)
20020925		T-10A TARGETS UPDATED; 26 TESTS ON OIL 820-2
20020925		T-10 TARGETS UPDATED; 16 TESTS ON OIL 820-2
20020925		PHASE-IN APPROVED FOR NEW INTAKE MANIFOLD DESIGN AND STAINLESS STEEL VENTURI
20020925	02-2	OUTLIER SCREENING PROFILES UPDATED FOR CLW AND TRWL