



Test Monitoring Center

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MEMORANDUM: 06-021
DATE: April 13, 2006
TO: Wim Van Dam, Chairman, Mack Surveillance Panel
FROM: Jeff Clark
SUBJECT: T-11 Calibration Testing for the April 2006 ASTM Report Period

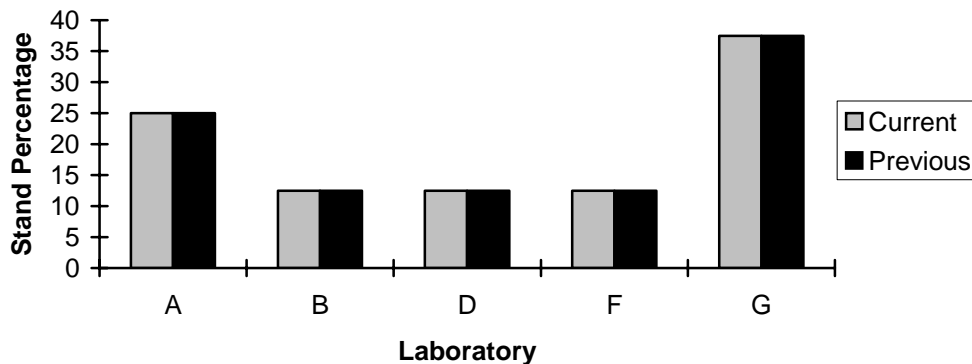
The following is a summary of T-11 reference oil tests completed during the April 2006 ASTM report period, which began on October 1, 2005 and ended on March 31, 2006.

Lab / Stand Distribution:

	Reporting Data	Calibrated as of 3/31/06
Number of Laboratories	5	5
Number of Stands	8	8

The figure below shows the T-11 laboratory / stand distribution for tests completed the current and previous report periods:

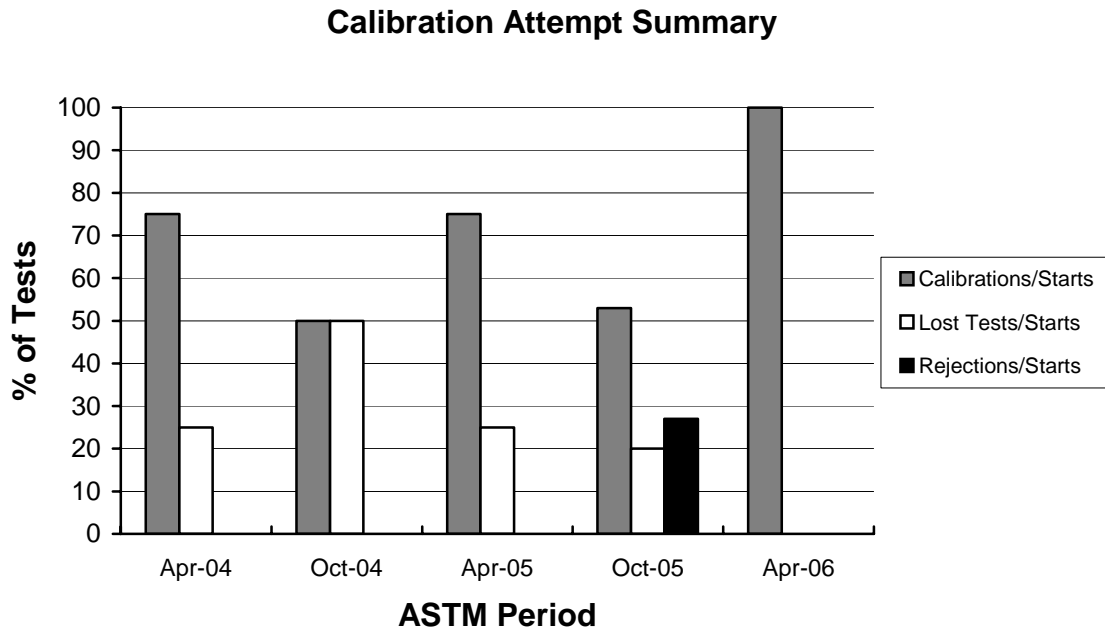
Laboratory / Stand Distribution



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 Tests
Acceptable Calibration Test	AC	11
Failed Calibration Test (LTMS Criteria)	OC	0
Operationally Invalid Calibration Test	LC	0
Aborted Calibration Test	XC	0
Total		11

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).

Severity and Precision:

Figure 1 (attached) shows the current industry EWMA severity, EWMA precision, and cusum charts for Soot at 12 cSt Viscosity Increase (SOOT). SOOT is currently within control chart limits. For this period, SOOT is trending an average of 0.28 Δ/s severe, which is approximately 0.06 % TGA soot. For a history of SOOT industry alarms, refer to the industry alarm log shown in Table 4.

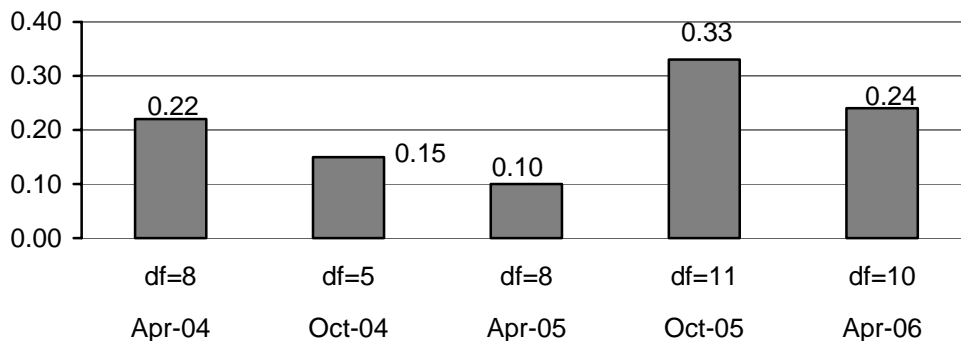
Figure 2 (attached) shows the current industry EWMA severity, EWMA precision, and cusum charts for MRV Viscosity (MRV). MRV is currently within control chart limits. For this period MRV is averaging 0.32 Δ/s severe, which is approximately 351 cP. However, an examination of the charts indicates that while the overall Δ/s is severe for this period, MRV is actually trending mild for the most recent tests. The first 5 tests in this period were severe and the last six tests were mild. For a history of MRV 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 Soot at 4 cSt Viscosity Increase (SOOT4). SOOT4 is currently within control chart limits. For this period, SOOT4 is trending an average of 0.23 Δ/s severe, which is approximately 0.05 % TGA soot. For a history of SOOT4 alarms, refer to the industry alarm log shown in Table 6.

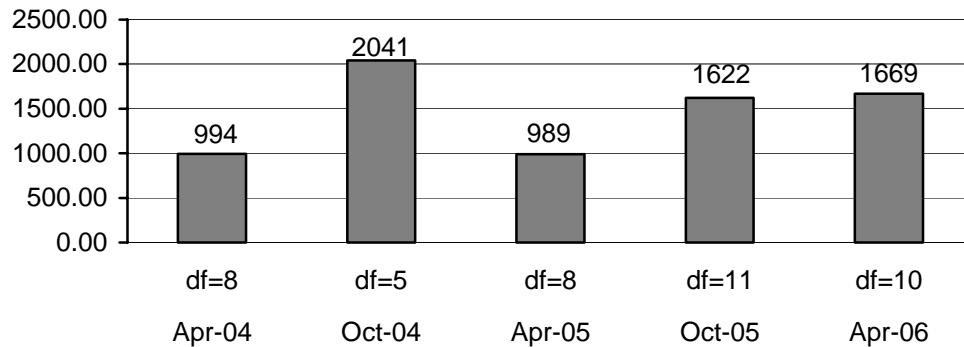
Figure 4 (attached) shows the current industry EWMA severity, EWMA precision, and cusum charts for Soot at 15 cSt Viscosity Increase (SOOT5). SOOT5 is currently within control chart limits and is on target for this period. For a history of SOOT5 alarms, refer to the industry alarm log shown in Table 7.

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. Precision for SOOT shows improvement compared to the previous period. Precision for MRV is within historical levels, and it is comparable to the previous period. Precision estimates for SOOT4 and SOOT5 are available going back to the introduction of the new top ring hardware in May 2005 and are shown as the Oct-05 estimates for SOOT4 and SOOT5. For this period, precision for both SOOT4 and SOOT5 is comparable to the previous period. It should be noted that SOOT4 and SOOT5 were not monitored during the Oct-05 report period.

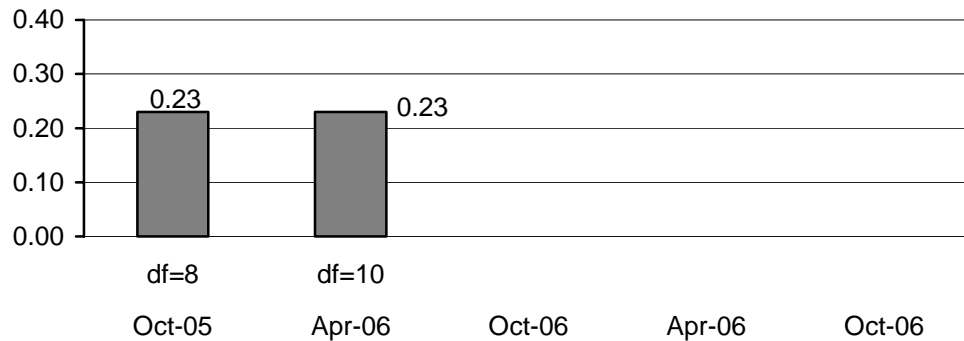
SOOT Pooled Precision



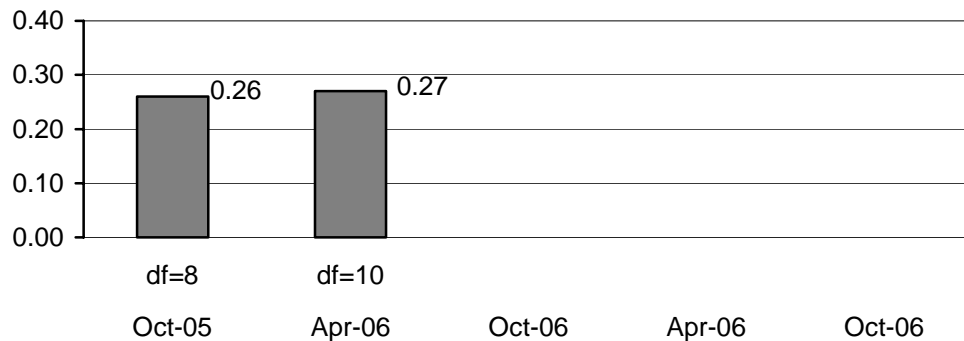
MRV Viscosity Pooled Precision



SOOT4 Pooled Precision



SOOT5 Pooled Precision



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

Reference Oils:

The current reference oil test targets are shown below:

Oil	N	Parameter	Mean (cSt)	s
820-2	32	SOOT	5.78	0.21
		MRV	14969	1097
		SOOT4*	3.81	0.23
		SOOT5*	6.36	0.26

*Targets generated by 16 tests with new top ring hardware. To date 20 tests on the new hardware have been completed.

Hardware:

The change to the part number 349GC3107 top rings has resulted in correction factors for both SOOT (-0.35 %) and MRV (+956 cP). The surveillance panel will review these correction factors as more data becomes available.

Information Letters:

Information Letter 05-1, Sequence No. 1, was issued December 8, 2005. This letter implemented the top ring hardware change, removed rotational viscosity measurements, and implemented correction factors for MRV viscosity and Soot at 12 cSt Viscosity Increase.

Information Letter 06-1, Sequence No. 2, was issued February 14, 2006. This letter added Soot at 4 cSt Viscosity Increase and Soot at 15 cSt Viscosity Increase. It also spelled out the details for running an abbreviated length T-11A test.

Information Letter 06-2, Sequence No. 3, was issued March 30, 2006. The letter updated the correction factors for MRV viscosity and Soot at 12 cSt Viscosity Increase.

TMC Laboratory Visits:

No TMC laboratory visits were conducted this ASTM period.

LTMS Deviations

No LTMS deviations were issued this period. No LTMS deviations have been issued during the history of the T-11.

Quality Index:

No Quality Index deviations were issued this ASTM period. For the history of the T-11, no Quality Index deviations have been issued.

Additional Information:

The T-11 test procedure is now available as ASTM D 7156.

Table 8 contains the T-11 Timeline which details changes to the test since its inception.

The T-11 database can be accessed on the TMC's homepage. If you have any questions on how to access this information, contact the TMC.

JAC/jac/mem06-021.jac.doc

Attachments

c: J.L. Zalar, TMC

F.M. Farber, TMC

Mack Surveillance Panel

<ftp://ftp.astmtmc.cmu.edu/docs/diesel/mack/semiannualreports/T11-04-2006.pdf>

Distribution: Email

Table 1
Summary of Reasons for Rejected Tests

	No. of Tests
No rejected tests	-

Table 2
Summary of Reasons for Invalid Tests

	No. of Tests
No invalid tests	-

Table 3
Summary of Reasons for Aborted Tests

	No. of Tests
No aborted tests	-

FIGURE 1 T-11 INDUSTRY OPERATIONALLY VALID DATA

SOOT AT 12 cSt

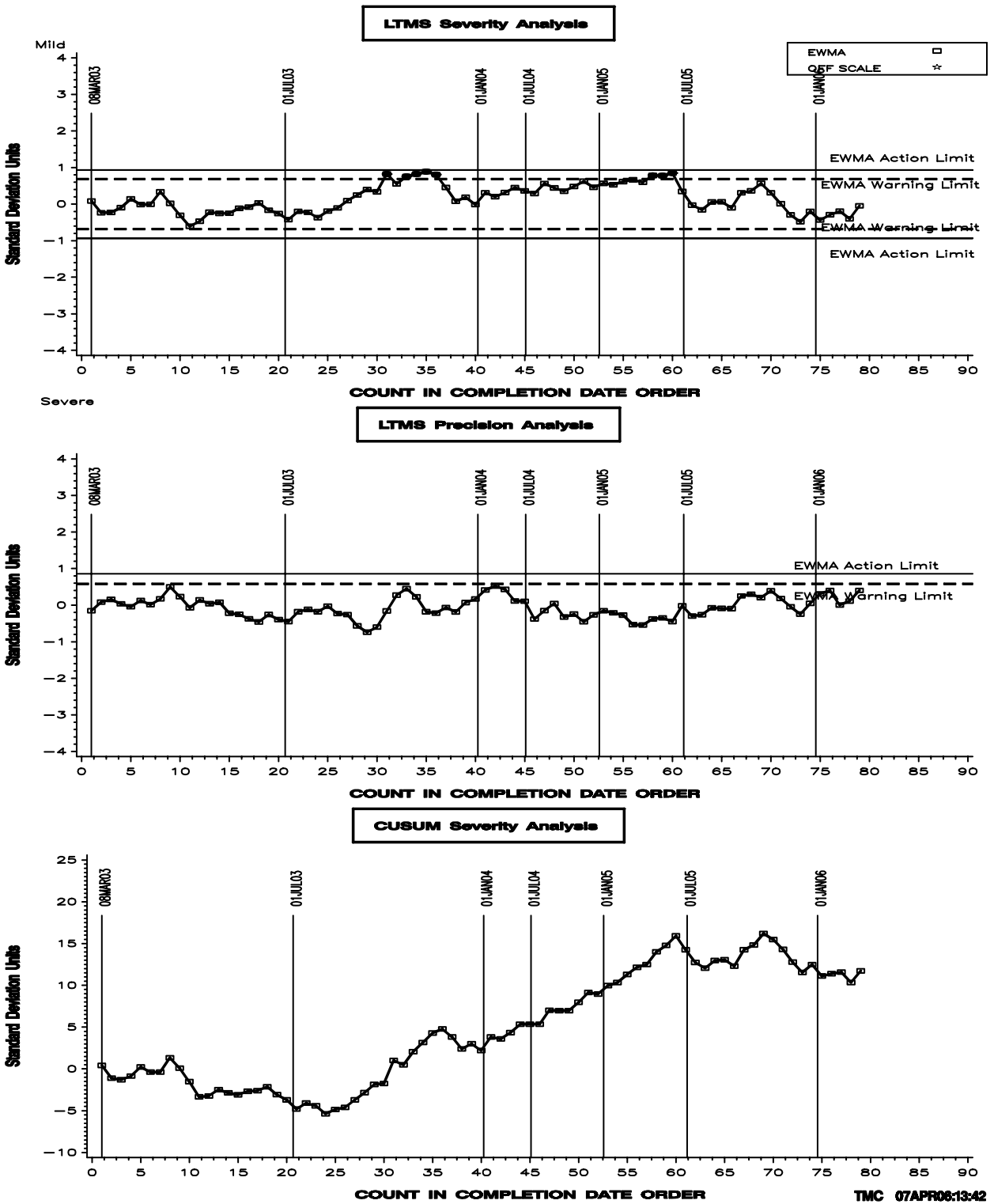


TABLE 4
SOOT AT 12 cSt INDUSTRY ALARM LOG

August 11, 2003 to November 3, 2003 (Severity, Mild direction)

Five of six tests trigger an industry warning alarm. No cause was apparent and the alarm cleared without any action being taken by the surveillance panel.

April 19, 2005 to June 27, 2005 (Severity, Mild direction)

This trend appeared to be the continuation of a long-term mild trend. The surveillance panel investigation found an increase in oil consumption had occurred in the same time frame. A series of tests were run using new top ring hardware (T-12 top rings) and the oil consumption problem was abated. However, a shift in SOOT results occurred with the implementation of the new hardware. Industry-wide correction factors were adopted for tests run with T-12 top rings. The alarm cleared on June 27, 2005. The surveillance panel will continue to evaluate the correction factor as more data becomes available.

Updated 4/13/06

FIGURE 2
T-11 INDUSTRY OPERATIONALLY VALID DATA

MRV VISCOSITY

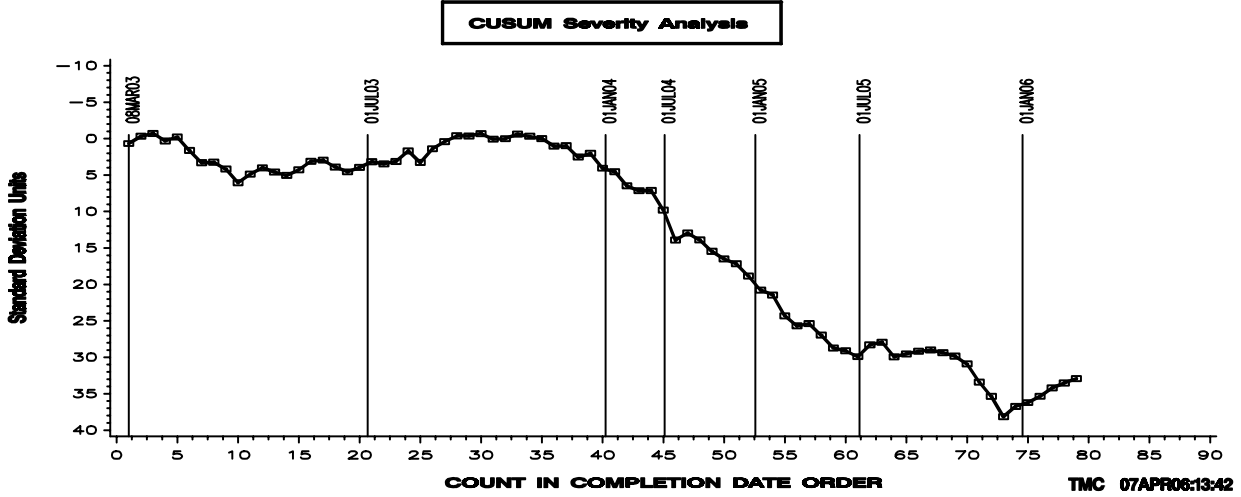
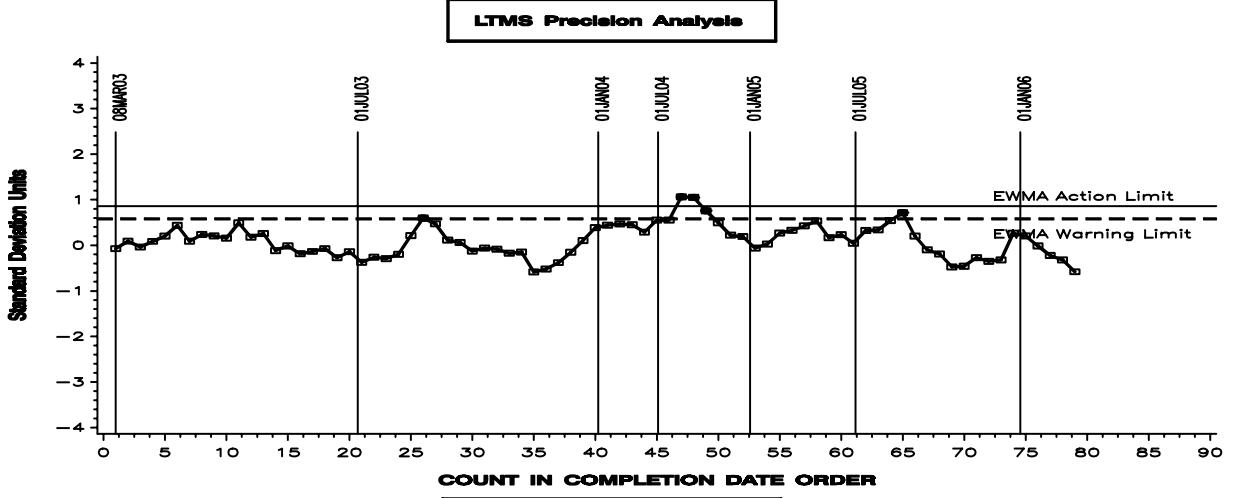
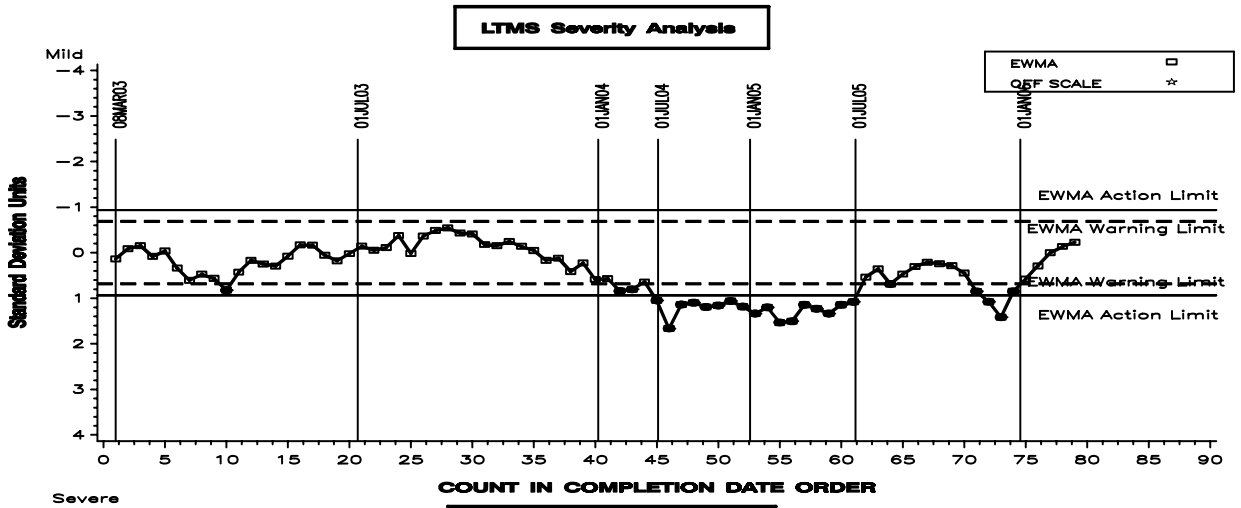


TABLE 5

MRV VISCOSITY INDUSTRY ALARM LOG

April 26, 2003 to April 29, 2003 (Severity, Severe direction)

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

July 19, 2003 to July 21, 2003 (Precision)

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

March 12, 2004 to August 22, 2005 (Severity, Severe direction; Precision)

This trend appeared to be the continuation of a long-term severe trend. The surveillance panel investigation found an increase in oil consumption had occurred in the same time frame. A series of tests were run using new top ring hardware (T-12 top rings) and the oil consumption problem was abated. However, a mild shift in MRV results occurred with the implementation of the new hardware. An industry-wide correction factor was adopted for tests run with T-12 top rings. The alarm cleared on August 22, 2005. The surveillance panel will continue to evaluate the correction factor as more data becomes available.

November 6, 2005 to January 10, 2006 (Severity, Severe direction)

A string of five consecutive severe tests trips an action alarm. The alarm clears when a subsequent string of six consecutive mild tests occurs. While it should be noted that the MRV correction factor (T-12 top ring hardware) was updated during this period, it does not directly correspond to the change from the severe to the mild trend. Also, the difference between the two CFs (561 cP) is not completely responsible for changing test results from severe to mild.

Updated 4/13/06

FIGURE 3 T-11 INDUSTRY OPERATIONALLY VALID DATA

SOOT @ 4 cSt - FINAL RESULT

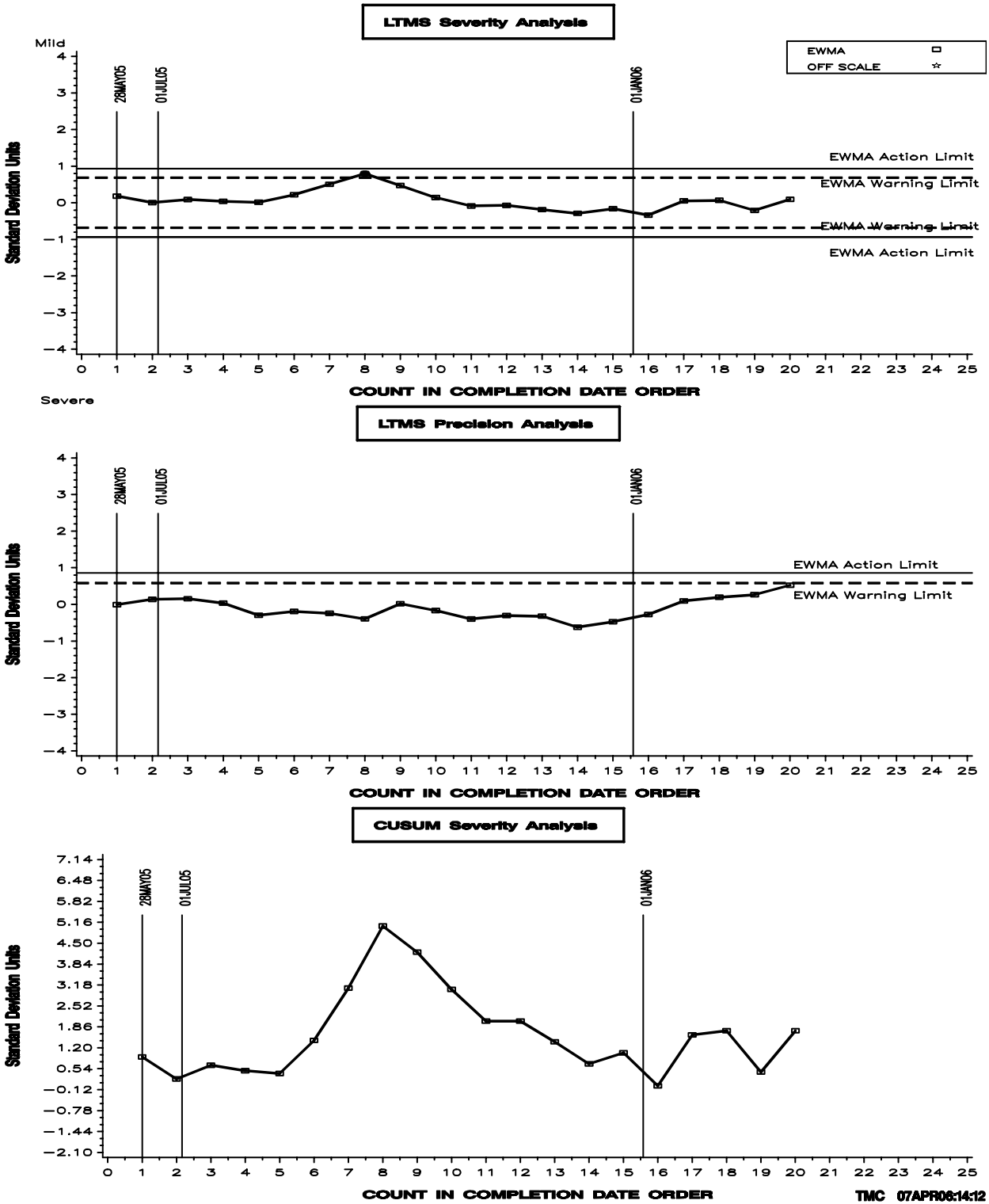


TABLE 6
SOOT AT 4 cSt INDUSTRY ALARM LOG

September 10, 2005 to September 30, 2005 (Severity, Mild direction)

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

Updated 4/13/06

FIGURE 4 T-11 INDUSTRY OPERATIONALLY VALID DATA

SOOT @ 15 cSt - FINAL RESULT

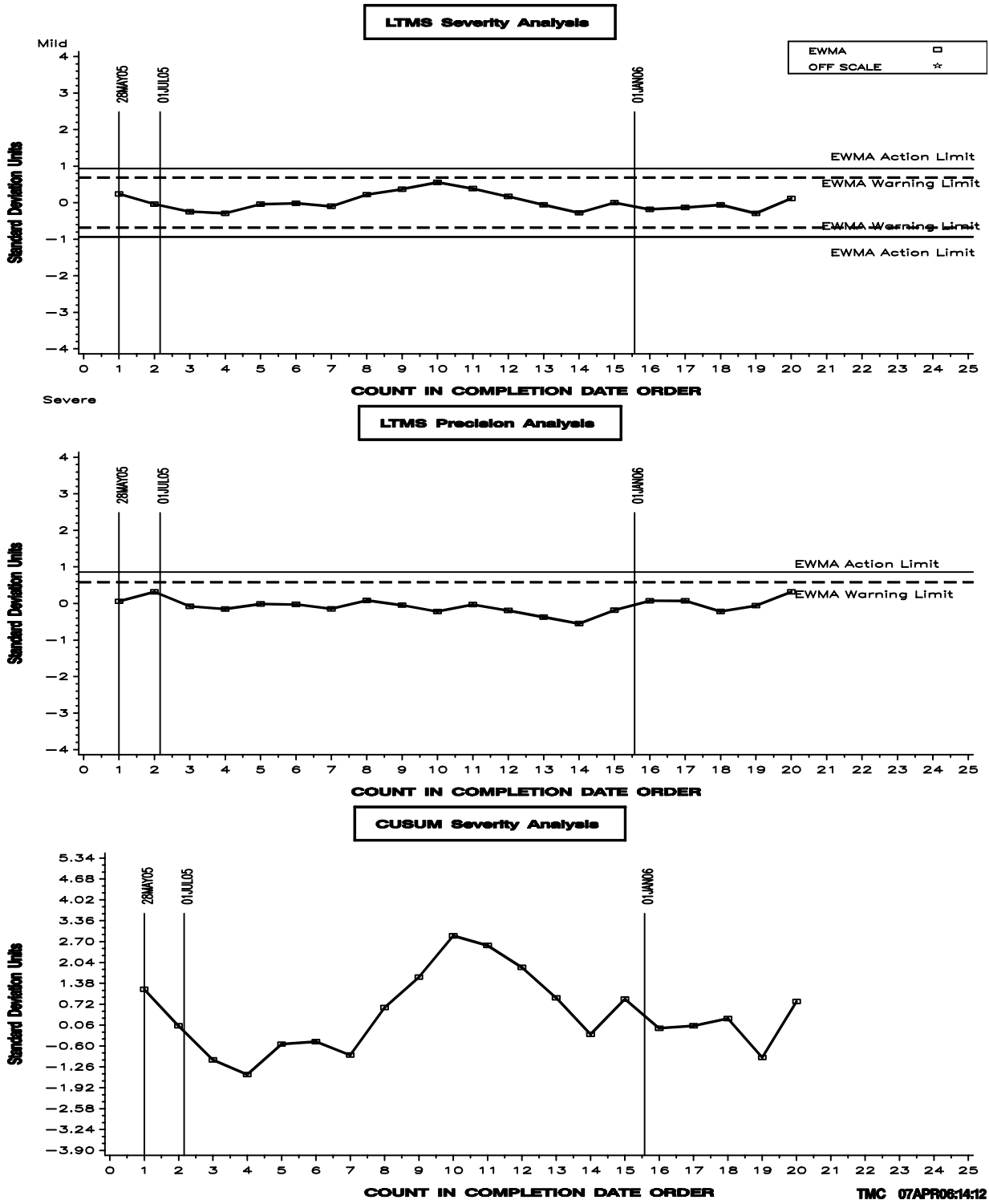


TABLE 7
SOOT AT 15 cSt INDUSTRY ALARM LOG

No alarms have occurred.

Updated 4/13/06

TABLE 8*T11 Timeline*

11:26 Wednesday, March 29, 2006 1

Obs	effective_date	info_letter_number	event
1	20030221		Draft 1 of test procedure issued
2	20030303		Oil sump configuration specified
3	20030313		Draft 2 of test procedure issued
4	20030422		Oil sample location specified as the pre-oil filter pressure port
5	20030709		Draft 3 of test procedure issued
6	20030714		Calibration period set to six months or six tests (1512 test hours)
7	20030717		Draft 4 of test procedure issued
8	20030821		Oil consumption limit of 65 g/hr maximum, using 25-h to EOT regression slope
9	20030821		LTMS implemented
10	20030905		Third soot window moved from EOT to 228 hours
11	20030918		Draft 5 of test procedure issued
12	20030923		Report Forms and Data Dictionary Version 20030819
13	20031205		Report Forms and Data Dictionary Version 20031029
14	20040415		Intake Manifold Pressure specification set to 140 kPa minimum.
15	20040504		Draft 6 of test procedure issued
16	20041215		USE OF DYED FUEL ACCEPTED
17	20050511		GB3133 VALVE GUIDES INTRODUCED
18	20050528		349GC3107 TOP RINGS INTRODUCED (T-12 RINGS)
19	20050603		Test procedure available as ASTM D 7156
20	20050803	05-1	349GC3107 TOP RINGS APPROVED FOR ALL TESTS
21	20050909	05-1	Rotational Viscosity measurements dropped from test method.
22	20050914	05-1	Correction factors adopted for SOOT (-0.39) and MRV (+1274) for all tests run with 349GC3107 top rings
23	20051206	05-1	Correction factors updated for SOOT (-0.36) and MRV (+713) for all tests run with 349GC3107 top rings
24	20060123	06-1	Protocol for running T-11A abbreviated test added to test method.
25	20060123	06-1	Soot at 4 cSt Viscosity Increase and Soot at 15 cSt Viscosity Increase added to test method.
26	20060324	06-2	Correction factors updated for SOOT (-0.35) and MRV (+956) for all tests run with 349GC3107 top rings