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MEMORANDUM: 01-144

DATE: November 13, 2001

TO: Mr. Ted Selby, Chairman ASTM D02.B07

FROM: Thomas Schofield & Richard Grundza

SUBJECT: TMC Bench Reference Test Monitoring from April 1, 2001 through September 30, 2001

We respectfully submit the TMC's ASTM D02.B07 Bench Reference Test Monitoring Semiannual Report, with statistical summaries broken down by test area (Attachment 1).

Precision and severity are monitored by comparing a recent period of reference test performance to "target" performance (as determined by the surveillance panels), and to previous periods. The TMC monitors test precision by a pooled standard deviation (pooled s), and test severity by mean Δ/s, where:

Pooled s = Standard deviation pooled across reference oils
(i.e., The pooled precision of the test this period.)
Δ/s = [(Result) - (Target mean)] / (Target s)
(i.e., "How many standard deviations from the target mean is this test?")
Mean Δ/s = [Σ (Δ/s)] / n (across reference oils)
(i.e., "On average, how many standard deviations from the target mean are all the operationally valid calibration tests for each period?")

Notice that the severity estimates (mean Δ/s) are independent of oil performance because they are normalized into (target) standard deviations for each oil. Also, using a pooled s for precision simplifies the interpretation of precision across all reference oil performance levels. These two calculations allow us to combine all calibration performance levels into single precision and severity estimates each period for a general comparison of current test performance to target performance, and to prior periods. Individual oil targets, and current performance summaries by oil**,** are also reported (Attachments 2 and 3).

The tables in Attachment 1 comparing current and previous period precision and severity have become too large to conveniently show all prior report periods. To keep the information succinct some of the older annual comparison periods have been eliminated.

The lab codes in this report are cross-referenced, as they were in previous reports. That is, in this report, Lab A represents the same lab in each section, which is the same as Lab A in previous reports, and should remain the same lab in future reports. (The initial TMC PCEOCP Bench Test Report, of November 8, 1996, did not cross reference the labs.)

Beginning with this report period, we are reporting on consecutive six-month intervals for all test areas, rather than one-year intervals for some test areas and six-month for others. For more information on this decision, please refer to the TMC's web page:

ftp://tmc.astm.cmri.cmu.edu/docs/bench/bo7semiannualreports/mem01-143.pdf

All operationally valid test data and severity plots are available on the TMC's website. Please contact the TMC if you require further information.

Attachments

c: J. Zalar
M. Lane
ftp://tmc.astm.cmri.cmu.edu/docs/bench/bo7semiannualreports/mem01-144.pdf

D02.B07 mailing list contacts notified by e-mail of ftp posting on the TMC's website.

Attachment 1

ASTM Test Monitoring Center

Semiannual Report

ASTM D02.B07 Bench Reference Test Monitoring
From April 1, 2001 through September 30, 2001

RR D02-1393: Volatility by Gas Chromatography (VGC by D 2887 Extended)

STATUS

The TMC stopped monitoring D2887 Extended calibrations as of July 3, 2001 at the direction of D02.B07.

TMC MEMORANDA

There was one TMC technical memorandum issued this report period for the D2887 extended test method:

Memo 01-095, July 3, 2001, End of TMC Monitoring

METHOD UPGRADE

The TMC has been monitoring method D6417 since October 2, 2000. D6417 is expected to replace all references to D2887 Extended in Oil Specification D4485 (including previous API categories).

D6417: Estimation of Engine Oil Volatility by Capillary Gas Chromatography

STATUS

Table 1 summarizes the reference tests reported to the TMC this period (6 labs reporting):

TABLE 1

	No. of Tests
Statistically Acceptable and Operationally Valid	13
Operationally Valid but Failed Acceptance Criteria	3
Total	**16**

Fail Rate of Operationally Valid Tests: 18.8%

Table 2 is a breakdown of the statistically unacceptable tests.

TABLE 2

Reason for Fail	No. of Tests
Sample Area % Volatized Severe	3

INDUSTRY PERFORMANCE

Table 3 shows the current Industry precision and severity for the Sample Area % Volatized @ 371°C test parameter for all operationally valid tests for the report period. (First calibration test completed 10/5/00.)

TABLE 3

Area % Volatized @ 371°C	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study	107	101	0.46	-----
10/5/00 through 3/31/01	18	15	0.50	1.42
4/1/01 through 9/30/01	16	13	0.54	0.65

Table 4 shows the current severity for the Sample Area % Volatized @ 371°C parameter for each lab for all operationally valid tests for the report period.

TABLE 4

	n	Mean Δ/s
Lab A	7	2.11
Lab B	1	-2.03
Lab D	2	-1.45
Lab G	4	-0.09
Lab H	1	1.71
Lab U	1	-0.87

PRECISION AND SEVERITY

Precision is slightly worse than target for the report period. Overall severity is severe of target, but much closer to target than last period. Severity is represented graphically in Figure 1. The figure shows a notable five-test severe trend the first part of the period followed by a four-test mild trend, followed again by more severe results. The intermediate mild trend has the effect of somewhat offsetting the severe trends in the overall severity estimate in Table 3. Figure 1 shows a two test leveling of severity into the next period.

If we were to label the tests in Figure 1 by lab, we find that the majority of the extremely severe results are rather consistently contributed by Lab A. Lab H contributed a single result of considerable severity, while the rest of the labs are, overall, near target or mild (Lab B reported a very mild result).

All three statistically unacceptable tests reported this period were from Lab A. The 18.8% fail rate of the operationally valid tests is exceptionally high; we would expect a 5% fail rate with the acceptance bands we have chosen.

TMC MEMORANDA

There were no TMC technical memoranda issued this report period for the D6417 test method.

D5480: Engine Oil Volatility by Gas Chromatography (VGC by D5480)

STATUS

Table 5 summarizes the reference tests reported to the TMC this period (1 lab reporting):

TABLE 5

	No. of Tests
Statistically Acceptable and Operationally Valid	2
Total	**2**

Fail Rate of Operationally Valid Tests: 0.0%

INDUSTRY PERFORMANCE

Table 6 shows the current Industry precision and severity for the Sample % Volatized @ 371°C test parameter for all operationally valid tests for the report period. (First calibration test completed 5/20/96.)

TABLE 6

% Volatized @ 371°C, mass %	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study	140	135	0.65	-----
5/20/96 through 3/31/97	14	9	0.70	-0.65
4/1/97 through 3/31/98	16	11	0.27	-0.61
*4/1/98 through 3/31/99	15	10	0.63	-0.92
4/1/99 through 3/31/00	11	6	0.50	-0.88
New Targets Effective 12/7/99	52	47	0.49	-----
4/1/00 through 3/31/01	7	2	0.36	0.06
4/1/01 through 9/30/01	2	0	-----	0.56

*Exclusion of test result that was more than 7 standard deviations mild of target (excluded per surveillance panel's recommendation).

Table 7 shows the current severity for the Sample % Volatized @ 371°C parameter for each lab for all operationally valid tests for the report period.

TABLE 7

	n	Mean Δ/s
Lab A	2	0.56

PRECISION AND SEVERITY

Only two tests from one lab (lab A) were received by the TMC in the past six-months. With the introduction of the D6417 GC method, the two other participating laboratories have indicated that they likely will no longer be calibrating with the TMC using the D5480 test method. The TMC has no reason to believe there will be more than one lab calibrating with the TMC in the immediate future. The very limited amount of data this will generate makes the TMC's statistical monitoring of the method rather difficult, if not meaningless.

No significant precision estimates can be made due to the limited data this period. Overall (two-test) severity is somewhat severe of targets. Severity is represented graphically in Figure 2.

TMC MEMORANDA

There were no TMC technical memoranda issued this report period for the D5480 test method.

D5800: Evaporation Loss of Lubricating Oils by the Noack Method

STATUS

Table 8 summarizes the reference tests reported to the TMC this period (9 labs reporting):

TABLE 8

	No. of Tests
Statistically Acceptable and Operationally Valid	27
*Operationally Valid but Failed Acceptance Criteria	8
Operationally Invalid	2
Total	**37**

Fail Rate of Operationally Valid Tests: 22.9%

*All Statistically unacceptable test this period were by Procedure B

Table 9 is a breakdown of the statistically unacceptable tests.

TABLE 9

Reason for Fail	No. of Tests
Sample Evaporation Loss Mild	0
Sample Evaporation Loss Severe	8

INDUSTRY PERFORMANCE

Table 10 shows the current Industry precision and severity for the Sample Evaporation Loss test parameter for all operationally valid tests for the report period. (First calibration test completed 5/1/96.)

TABLE 10

Sample Evaporation Loss, mass %	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study	180	175	0.51	-----
5/1/96 through 3/31/97	31	26	0.68	0.70
4/1/97 through 3/31/98	22	17	0.72	0.75
4/1/98 through 3/31/99	28	23	0.59	0.49
4/1/99 through 3/31/00	33	28	0.42	0.90
New Targets Effective 9/26/00	178	175	0.56	-----
4/1/00 through 3/31/01	47	42	0.69	0.98
4/1/01 through 9/30/01	35	32	0.61	1.21

Table 11 shows statistical comparisons by procedure for all operationally valid tests for the report period.

TABLE 11

Sample Evaporation Loss, mass %	n	df	Pooled s	Mean Δ/s
Procedure A	8	5	0.53	0.48
Procedure B	27	24	0.59	1.42
Procedure C	0	----	-----	-----

D5800: Evaporation Loss of Lubricating Oils by the Noack Method, continued

Table 12 shows the current severity for the Sample Evaporation Loss parameter for each lab for all operationally valid tests for the report period.

TABLE 12

	n	Mean Δ/s
Lab A	4	1.14
Lab B	9	1.70
Lab G	5	0.32
Lab H	2	2.44
Lab I	2	1.14
Lab J	4	0.44
Lab L	2	0.98
Lab R	3	0.57
Lab U	4	2.04

PRECISION AND SEVERITY

Effective September 26, 2000, the TMC began monitoring the three Noack procedures under the newest D5800 test method. Also effective September 26, 2000, new reference oils, targets and acceptance bands were implemented for TMC calibration monitoring. Oils 51, 53 and 54 were dropped, oil 58 was introduced and targets for oils 52 & 55 were revised.

Overall precision is somewhat worse than target precision this period. Overall severity is notably severe of target, with all nine participating labs performing severe for the report period. The severity trend is represented in Figures 3A and 3B. Figure 3B shows that a strong severe trend that started a long time before new targets were established continues right on through the effective date of the new performance targets and up to the present time. A leveling to target would have been expected after the performance targets were updated in September 2000.

The fail rate for tests reported to the TMC as operationally valid is excessive (22.9% compared to an expected fail rate of 5%). In some cases, labs are failing two, and even three, consecutive TMC calibrations on the same instrument before achieving a passing calibration. This cycle is sometimes being repeated at the next 90-day TMC calibration. In conversations with the participating labs, numerous operational discrepancies between the labs have been reported, particularly in setting up the instruments for Procedure B calibrations. These operational differences range from adjusting the temperature ramp-up profiles to discovering the need to replace heater parts. From these discussions, I have the uneasy sense that labs are adjusting their Procedure B instruments to pass TMC blind calibrations while the daily check sample is not helping to isolate problems for the users very well on a daily basis. It may also be possible, in some cases, that the check sample is being used (improperly) to set up the instruments resulting in severe results on the TMC samples. (Indeed, some labs find they need to perform mild on the check samples to achieve barely passing severe results on the TMC samples). An analysis by the TMC indicates that the severe TMC calibration results are likely not a result of any performance changes in the TMC's reference oil samples. The TMC has already stated serious concerns about the operational ambiguities in the test method, and about the different ways the labs appear to be setting up their instruments operating parameters. These concerns have been expressed to the panel chair.

Also, in May 2001, the TMC had reported on a comparison of Procedures A and B. At that time, we had found the TMC blind calibration data indicated equivalent performance between the two procedures (there was too little data collected to include a meaningful comparison of Procedure C). However, the TMC revisited this analysis on all TMC blind calibration data collected through July 19, 2001, and found that a significant (90% confidence) difference between the performances of the two methods ***does*** exist in the TMC calibration data. Specifically:

Procedure A analysis gave a Least Squares Mean of 15.16 mass % volatility loss
Procedure B analysis gave a Least Squares Mean of 15.54 mass % volatility loss

This estimates a real performance *difference* of 0.38 mass % volatility loss between Procedures A & B near a D5800 oil performance of 15 mass % volatility loss.

Clearly, a performance change had occurred since our initial analysis that has caused Procedure B to perform more severely. How much of this perceived difference between the procedures is due to operational ambiguities in running Procedure B and how much is due to a real difference between the procedures is impossible to discern. It is only clear that the recent increased severity in Procedure B data was not observed in the Procedure A data at the time of the analysis.

There appear to be two overriding issues that should be addressed in regard to Procedure B:

1. The adequacy of the daily check samples being used by calibrating labs, and
2. Operational ambiguities between the labs (particularly operating temperature and set-up profiles).

Once conformance issues are addressed and we are satisfied that the participating labs are operating uniformly, dependent issues like adjusting targets, and whether or not Procedures A & B compare, should be reviewed (once more calibration data has been collected).

TMC MEMORANDA

There were no TMC technical memoranda issued this report period for the D5800 test method.

D5133: Low Temperature, Low Shear Rate, Viscosity/Temperature Dependence of Lubricating Oils Using a Temperature Scanning Technique (Gelation Index or GI)

STATUS

Table 13 summarizes the reference tests reported to the TMC this period (9 labs reporting):

TABLE 13
Reference Tests

	No. of Tests
Statistically Acceptable and Operationally Valid	33
Operationally Valid but Failed Acceptance Criteria	0
Operationally Invalid	0
Industry Support (TMC 58 Matrix)	18
Total	**51**

Fail Rate of Operationally Valid Tests: 0.0%

INDUSTRY PERFORMANCE

Table 14 shows the current Industry precision and severity for the Gelation Index and test parameter for all operationally valid tests for the report period. (First calibration test completed 4/20/96.) "Initial Tests" includes reference and donated tests; subsequent listings include only reference tests.

TABLE 14

Gelation Index	n	df	Pooled s	Mean Δ/s
Initial Tests 4/20/96 through 11/27/96	178	173	6.37	-----
4/20/96 through 3/31/97	60	55	5.40	-0.06
4/1/97 through 3/31/98	64	59	5.20	-0.12
4/1/98 through 3/31/99	68	63	6.67	-0.07
4/1/99 through 3/31/00	62	57	6.30	0.09
*4/1/00 through 3/31/01	65	60	5.93	-0.15
4/1/01 through 9/31/01	33	28	2.84	0.13

*Excludes one data point as a rare event. See the TMC's December 2000 report for more information.

D5133: Low Temperature, Low Shear Rate, Viscosity/Temperature Dependence of Lubricating Oils Using a Temperature Scanning Technique (Gelation Index or GI), continued

Table 15 shows the current severity for the Gelation Index for each lab for all operationally valid tests for the report period.

TABLE 15

	N	GI Mean Δ/s
Lab A	6	-0.04
Lab B	6	0.17
Lab D	4	0.25
Lab G	4	0.14
Lab H	1	0.72
Lab I	2	0.75
Lab R	2	0.06
Lab S	6	0.09
Lab U	2	-0.53

PRECISION AND SEVERITY

On June 18, 2001, the section decided to drop TMC oils 51 and 55 as GI reference oils, and add TMC oil 58. An industry-supported matrix was run to establish performance targets and acceptance bands on TMC oil 58. The matrix was completed after the end of this report period and a TMC summary was issued separately from this report. Because oils 51 and 55 were dropped early in the report period, and 58 was introduced after the period, the majority of the reference tests for the period were run on oils 52, 53 and 62.

Overall precision is considerably improved over previous periods and much better than the target precision. Overall Gelation Index severity is only slightly severe of target. Severity is graphically represented in Figure 4 (attached). The figure shows a short-term mild trend from November 2000 to February 2001 that has leveled back to target. Last period had a high number of failing runs (unusual given the good overall performance of the test), and one extreme result reported as operationally valid. This period, however, there were no failing calibrations reported and the period data shows unusually good overall performance.

TMC MEMORANDA

There were two TMC technical memoranda issued this report period for the D5133 test method:

Memo 01-093, July 2, 2001, Reference Oil Changes
Memo 01-136, October 24, 2001, Reference Oil 58 Targets

D6335: Determination of High Temperature Deposits by Thermo-oxidation Engine Oil Simulation Test (TEOST)

STATUS

Table 16 summarizes the reference tests reported to the TMC this period (3 labs reporting):

TABLE 16

	No. of Tests
Statistically Acceptable and Operationally Valid	5
Operationally Valid but Failed Acceptance Criteria	0
Operationally Invalid	1
Total	**6**

Fail Rate of Operationally Valid Tests: 0.0%

INDUSTRY PERFORMANCE

Table 17 shows the current Industry precision and severity for the Total Deposits test parameter for all operationally valid tests for the report period. (First calibration test completed 2/13/96.)

TABLE 17

Total Deposits	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study	54	52	4.18	-----
4/1/96 through 3/31/97	44	42	6.22	0.28
4/1/97 through 3/31/98	41	39	4.24	-0.10
4/1/98 through 3/31/99	36	34	5.68	-0.49
4/1/99 through 3/31/00	30	28	5.67	0.14
4/1/00 through 3/31/01	18	16	8.45	0.40
4/1/01 through 9/30/01	5	3	2.04	0.48

Table 18 shows the current severity for the Total Deposits parameter for each lab for all operationally valid tests in the report period.

TABLE 18

	n	Mean Δ/s
Lab A	2	0.61
Lab B	2	0.31
Lab G	1	0.57

D6335: Determination of High Temperature Deposits by Thermo-Oxidation Engine Oil Simulation Test (TEOST), continued

PRECISION AND SEVERITY

Calibration testing has dropped significantly with the introduction of the MHT TEOST to replace TEOST-33C for GF-3/SL.

Overall precision is exceptionally good for the calibration tests this period and overall severity is moderately severe of target. The severity trends are graphically represented in Figure 5 (attached). The plot shows some leveling and less erratic results since October 2000.

TMC MEMORANDA

There was one TMC technical memorandum issued this report period for the D6335 test method:

Memo 01-097, July 24, 2001, Cross Referencing of Instruments

TEOST MHT-4, Draft 17, 00.08.11: Determination of Moderately High Temperature Piston Deposits by Thermo-oxidation Engine Oil Simulation Test (MTEOS)

STATUS

Table 19 summarizes the reference tests reported to the TMC this period (7 labs reporting):

TABLE 19

	No. of Tests
Statistically Acceptable and Operationally Valid	31
Operationally Valid but Failed Acceptance Criteria	3
Operationally Invalid	2
Total	**36**

Fail Rate of Operationally Valid Tests: 8.8%

Table 20 is a breakdown of the statistically unacceptable tests.

TABLE 20

Reason for Fail	No. of Tests
Total Deposits Mild	2
Total Deposits Severe	1

INDUSTRY PERFORMANCE

Table 21 shows the current Industry precision and severity for the Total Deposits test parameter for all operationally valid tests for the report period. (First calibration test completed 9/6/00.)

TABLE 21

Total Deposits	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study (1st half)	28	24	5.50	-----
9/6/00 through 3/31/01	52	48	6.67	-0.46
Updated Targets Effective 6/1/01	80	76	5.40	-----
4/1/01 through 9/30/01	34	30	5.61	-0.47

Table 22 shows the current severity for the Total Deposits parameter for each lab for all operationally valid tests in the report period.

TABLE 22

	n	Mean Δ/s
Lab A	11	-0.63
Lab AB	1	-0.89
Lab B	10	0.02
Lab D	2	0.07
Lab G	8	-1.17
Lab I	1	1.26
Lab V	1	-0.57

TEOST MHT-4, Draft 17, 00.08.11: Determination of Moderately High Temperature Piston Deposits by Thermo-oxidation Engine Oil Simulation Test (MTEOS), continued

PRECISION AND SEVERITY

Note that performance targets were updated during this period. Statistical analyses of the calibration data was performed using the targets that were in place at the time each test was completed.

Overall precision is directionally worse than the new, pooled target. Severity is trending moderately mild of target, the same as last period. Severity is presented graphically in Figure 6 where an overall mild slope is observed.

TMC MEMORANDA

There were two TMC technical memoranda issued this report period for the MTEOS test method:

Memo 01-059, May 24, 2001, Updated MTEOS Reference Oil Performance Targets and Acceptance Bands

Memo 01-097, July 24, 2001, Cross Referencing of Instruments

D6082: High Temperature Foaming Characteristics of Lubricating Oils

The TMC has chosen to break down the D6082 calibration statistical analysis by oil. The reasons for doing so are:

1. The two reference oils (1002 and 1007) perform very differently, both in mean performance and precision. There are no other oils providing "intermediate" performance to provide continuity over the entire performance range for an analysis of performance that combines all the reference oils.

2. TMC 1007 has a Foam Stability (one minute after disconnect) target mean performance of zero ml and a target precision (standard deviation) of zero ml. Any negative (mild) result for this parameter is unlikely and any positive result would be "infinitely" severe in standard deviations (Δ/s). For Foam Stability, it is preferable to simply note the number of non-zero occurrences in order to flag any severity trends, and use the 1002 Foam Stability results to both verify and quantify the trend.

3. Introducing a combined 1002 & 1007 statistical analysis for any given period will make it very difficult to make a meaningful comparison to earlier calibration periods which were based only on 1002 calibration data.

Note that in June 2000, the High Temperature Foam Surveillance Panel had given approval for the TMC to stop collecting data for Total Volume Increase.

STATUS

Table 23 summarizes the reference tests reported to the TMC this period (5 labs reporting):

TABLE 23

	No. of Tests
Statistically Acceptable and Operationally Valid	12
Operationally Valid but Failed Acceptance Criteria	2
Operationally Invalid	0
Total	**14**

Fail Rate of Operationally Valid Tests: 14.3%

Table 24 is a breakdown of the statistically unacceptable tests.

TABLE 24

Reason for Fail	No. of Tests
Foam Tendency Severe & Foam Stability Severe (1002)	2

D6082: High Temperature Foaming Characteristics of Lubricating Oils, continued

TMC 1002 INDUSTRY PERFORMANCE

Tables 25 and 26 show the current industry precision and severity for the Foam Tendency and Foam Stability test parameters for all operationally valid tests on oil 1002 for the report period. (First calibration test completed 5/14/96.)

TABLE 25

1002 Foam Tendency, ml	n	Mean	s	Mean Δ/s
Initial Round Robin Study (targets)	32	410.63	58.78	-----
5/14/96 through 3/31/97	32	368.2	106.67	-0.72
4/1/97 through 3/31/98	28	411.6	77.78	0.02
4/1/98 through 3/31/99	29	386.9	71.38	-0.40
4/1/99 through 3/31/00	9	422.2	78.86	0.20
4/1/00 through 3/31/01	17	495.6	232.46	1.45
4/1/01 through 9/30/01	5	514.0	159.31	1.76

TABLE 26

1002 Foam Stability @ 1 min., ml	n	Mean	s	Mean Δ/s
Initial Round Robin Study (targets)	32	37.81	45.41	-----
5/14/96 through 3/31/97	32	32.7	70.73	-0.11
4/1/97 through 3/31/98	28	43.6	76.27	0.13
4/1/98 through 3/31/99	29	19.7	48.88	-0.40
4/1/99 through 3/31/00	9	37.8	62.80	0.00
4/1/00 through 3/31/01	17	182.9	225.47	3.20
4/1/01 through 9/30/01	5	128.0	182.13	1.99

Table 27 shows the current **1002** severity for the monitored result parameter for each lab for all operationally valid tests reported for the report period.

TABLE 27
TMC 1002

	n	Foam Tendency Mean Δ/s	Foam Stability Mean Δ/s
Lab A	2	4.58	6.21
Lab B	2	-0.27	-0.83
Lab I	1	0.16	-0.83

D6082: High Temperature Foaming Characteristics of Lubricating Oils, continued

TMC 1007 INDUSTRY PERFORMANCE

Tables 28 and 29 show the current industry precision and severity for the Foam Tendency and Foam Stability test parameters for all operationally valid tests on oil 1007 for the report period. (First calibration test on TMC 1007 completed 4/12/99.)

TABLE 28

1007 Foam Tendency, ml	n	Mean	s	Mean Δ/s
Initial Round Robin Study (targets)	28	65.71	19.28	-----
4/12/99 through 3/31/00	17	65.3	18.41	-0.02
4/1/00 through 3/31/01	14	67.5	11.22	0.09
4/1/01 through 9/30/01	9	71.1	14.53	0.28

TABLE 29

1007 Foam Stability @ 1 min., ml	n	Mean	s	
Initial Round Robin Study	28	0.00	0.00	
4/12/99 through 3/31/00	17	No non-zero occurrences		
4/1/00 through 3/31/01	17	No non-zero occurrences		
4/1/01 through 9/30/01	9	No non-zero occurrences		

Table 30 shows the current **1007** severity for the monitored result parameter for each lab for all operationally valid tests reported for the report period.

TABLE 30
TMC 1007

	n	Foam Tendency Mean Δ/s
Lab A	2	1.00
Lab B	2	-0.56
Lab D	2	1.00
Lab G	2	-0.30
Lab I	1	0.22

D6082: High Temperature Foaming Characteristics of Lubricating Oils, continued

PRECISION AND SEVERITY

Due to ongoing calibration precision and severity problems, on June 18, 2001, the section agreed to suspend the use of TMC oil 1002 as a D6082 reference oil. It is unlikely that 1002 will be reintroduced into the monitoring system as the expected performance is extremely severe compared to GF-3/SL performance limits for this test method. A search for a more suitable replacement oil has been initiated. Because of the suspension of oil 1002 early in this report period, our discussion will focus on oil 1007 calibration results only.

Foam Tendency precision on 1007 (s, Table 28) is somewhat worse than last period, but still better than the target precision. Severity is somewhat severe of target. There were no non-zero occurrences of Foam Stability on 1007. This would suggest Foam Stability precision is as expected. Severity is graphically represented in Figures 7, 8 and 9. Figures 7 and 9 show strong severity trends for oil 1002 (resulting in the suspension). Figure 8 shows foam tendency severity for oil 1007 with a slight severe slope.

TMC MEMORANDA

There was one TMC technical memorandum issued this report period for the D6082 test method:

Memo 01-094, July 3, 2001, Suspension of Reference Oil 1002

D6557: Ball Rust Test (BRT)

Note that, for BRT, a positive Δ/s is mild, not severe (a higher AGV result is considered to be a more mild result while a lower AGV result is considered to be a more severe result.)

STATUS

Table 31 summarizes the reference tests reported to the TMC this period (4 labs reporting):

TABLE 31

	No. of Tests
Statistically Acceptable and Operationally Valid	152
Operationally Valid but Failed Acceptance Criteria	4
Operationally Invalid	1
Aborted	2
Total	**159**

Fail Rate of Operationally Valid Tests: 2.6%

Table 32 is a breakdown of the statistically unacceptable tests.

TABLE 32

Reason for Fail	No. of Tests
Average AGV Mild	3
Average AGV Severe	1

INDUSTRY PERFORMANCE

Table 33 shows the current Industry precision and severity for the Average AGV test parameter for all operationally valid tests for the report period. (First calibration test completed 8/15/00.)

TABLE 33

Average AGV	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study (targets)	48	44	9.43	-----
8/15/00 through 9/30/00	28	25	10.50	0.38
10/1/00 through 3/31/01	112	109	8.48	0.42
4/1/01 through 9/30/01	156	153	8.90	0.36

Table 34 shows the current severity for the Average AGV parameter for each lab for all operationally valid tests for the report period.

TABLE 34

	n	Mean Δ/s
Lab A	68	0.51
Lab B	50	0.45
Lab G	32	0.04
Lab D	6	-0.31

D6557: Ball Rust Test (BRT), continued

PRECISION AND SEVERITY

Precision this report period is better when compared to the target matrix and somewhat worse when compared to the previous period. Overall severity is trending mild of target with Labs A and B trending mild, while lab D trended severe this period. Lab G was on or near target this report period. Severity is graphically represented in Figure 10 (attached).

TMC MEMORANDA

There was one technical memorandum issued this report period: Memo 01-101, July 27, 2001, was issued to advise the panel that a new batch of hardware was approved. As of the end of this report period, no tests had been reported on the new hardware.

Engine Oil Filterability Test (EOFT)

STATUS

Table 35 summarizes the reference tests reported to the TMC this period (3 labs reporting):
Note that due to reference volume, the report period is from October 1, 2000 through March 31, 2001.

TABLE 35

	No. of Tests
Statistically Acceptable and Operationally Valid	103
Operationally Valid but Failed Acceptance Criteria	0
Operationally Invalid	5
Total	**108**

Fail Rate of Operationally Valid Tests: 0.0%

Table 36 is a breakdown of the statistically unacceptable tests.

TABLE 36

Reason for Fail	No. of Tests
Average % Change in Flow Mild (Oil 77)	0
Average % Change in Flow Mild (Oil 78)	0

INDUSTRY PERFORMANCE

Table 37 shows the current Industry precision and severity for the Average % Change in Flow (CIF) test parameter for all operationally valid tests for the report period. (First calibration test completed 5/4/00.)

TABLE 37

Average % CIF	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study (targets)	24	22	5.76	-----
5/4/00 through 9/30/00	53	51	7.47	1.64
10/1/00 through 3/31/01	79	78	4.79	0.30
4/1/01 through 9/30/01	103	102	6.69	-0.08

Table 38 shows the current severity for the Average % CIF parameter for each lab for all operationally valid tests for the report period.

TABLE 38

	n	Mean Δ/s
Lab A	35	-0.14
Lab B	20	-0.66
Lab G	48	0.19

Engine Oil Filterability Test (EOFT), continued

PRECISION AND SEVERITY

Precision this report period is worse when compared to the previous period and the target matrix. Overall severity is on or near target. Labs A and B are trending mild, while Lab G is trending severe. Severity is graphically represented in Figure 11 (attached).

All labs have had problems passing on TMC Oil 77. During the previous period, the Surveillance Panel agreed to suspend the use of TMC 77. Performance with reference oil TMC 78 was mild at labs A and B, while lab G was slightly severe. Precision in all labs with TMC 78 compares well with the test target matrix precision. At this time, only TMC 78 is being assigned as a TMC calibration oil. Because of this, we do not have a truly blind referencing system at the present time. However, at the June 2001 meeting, the panel agreed to pursue obtaining another reference oil

TMC MEMORANDA

There were no technical memoranda issued this report period nor were there any information letters issued this report period.

Engine Oil Water Tolerance Test (EOWT): 0.6% Water Treat Level

STATUS

Table 39 summarizes the reference tests reported to the TMC this period (3 labs reporting):

TABLE 39

	No. of Tests
Statistically Acceptable and Operationally Valid	120
Operationally Valid but Failed Acceptance Criteria	3
Operationally Invalid	3
Total	**126**

Fail Rate of Operationally Valid Tests: 2.0%

Table 40 is a breakdown of the statistically unacceptable tests.

TABLE 40

Reason for Fail	No. of Tests
Average % Change in Flow Mild (Oil 77)	1
Average % Change in Flow Mild (Oil 78)	1
Average % Change in Flow severe (Oil 78)	1

INDUSTRY PERFORMANCE

Table 41 shows the current Industry precision and severity for the Average % Change in Flow (CIF) test parameter for all operationally valid tests for the report period. (First calibration test completed 5/4/00.)

TABLE 41

Average % CIF	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study (targets)	24	22	5.93	-----
5/4/00 through 9/30/00	34	32	6.25	-0.039
10/1/00 through 3/31/01	101	99	5.61	-0.173
4/1/01 through 9/30/01	123	121	6.28	0.047

Table 42 shows the current severity for the Average % CIF parameter for each lab for all operationally valid tests for the report period.

TABLE 42

	n	Mean Δ/s
Lab A	59	-0.41
Lab B	17	-0.95
Lab G	47	0.98

PRECISION AND SEVERITY

Precision is worse when compared with the previous period and the target matrix. Severity is on or near target. Severity is graphically represented in Figure 12 (attached). Lab G is trending severe, while labs A and B are trending mild.

Engine Oil Water Tolerance Test (EOWT): 1.0% Water Treat Level

STATUS

Table 43 summarizes the reference tests reported to the TMC this period (3 labs reporting):

TABLE 43

	No. of Tests
Statistically Acceptable and Operationally Valid	115
Operationally Valid but Failed Acceptance Criteria	0
Operationally Invalid	3
Total	**118**

Fail Rate of Operationally Valid Tests: 0.0%

INDUSTRY PERFORMANCE

Table 44 shows the current Industry precision and severity for the Average % Change in Flow (CIF) test parameter for all operationally valid tests for the report period. (First calibration test completed 5/4/00.)

TABLE 44

Average % CIF	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study (targets)	24	22	5.81	-----
5/4/00 through 9/30/00	33	31	6.98	0.12
10/1/00 through 3/31/01	99	97	5.85	-0.19
4/1/01 through 9/30/01	115	113	5.79	0.26

Table 45 shows the current severity for the Average % CIF parameter for each lab for all operationally valid tests for the report period.

TABLE 45

	n	Mean Δ/s
Lab A	53	0.03
Lab B	17	-0.92
Lab G	45	0.98

PRECISION AND SEVERITY

Precision is essentially unchanged when compared to the previous period and with historical rates. Industry data is trending severe. Lab G is trending severe, lab B is trending mild and lab A was on target this period. Severity is graphically represented in Figure 13 (attached).

Engine Oil Water Tolerance Test (EOWT): 2.0% Water Treat Level

STATUS

Table 46 summarizes the reference tests reported to the TMC this period (3 labs reporting):

TABLE 46

	No. of Tests
Statistically Acceptable and Operationally Valid	111
Operationally Valid but Failed Acceptance Criteria	3
Operationally Invalid	3
Total	**117**

Fail Rate of Operationally Valid Tests: 2.6%

Table 47 is a breakdown of the statistically unacceptable tests.

TABLE 47

Reason for Fail	No. of Tests
Average % Change in Flow Mild (Oil 78)	3

INDUSTRY PERFORMANCE

Table 48 shows the current Industry precision and severity for the Average % Change in Flow (CIF) test parameter for all operationally valid tests for the report period. (First calibration test completed 5/4/00.)

TABLE 48

Average % CIF	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study (targets)	24	22	7.08	-----
5/4/00 through 9/30/00	31	29	5.63	-0.07
10/1/00 through 3/31/01	100	98	6.25	-0.16
4/1/01 through 9/30/01	114	112	6.57	0.22

Table 49 shows the current severity for the Average % CIF parameter for each lab for all operationally valid tests for the report period.

TABLE 49

	n	Mean Δ/s
Lab A	26	-0.39
Lab B	46	-0.67
Lab G	28	0.88

PRECISION AND SEVERITY

Precision for this period is worse when compared to the previous period and has improved when compared to the target estimates. Severity is trending severe of target. Lab G was severe, while labs A and B were mild. Severity is graphically represented in Figure 14 (attached).

Engine Oil Water Tolerance Test (EOWT): 3.0% Water Treat Level

STATUS

Table 50 summarizes the reference tests reported to the TMC this period (3 labs reporting):

TABLE 50

	No. of Tests
Statistically Acceptable and Operationally Valid	114
Operationally Valid but Failed Acceptance Criteria	8
Operationally Invalid	2
Total	**124**

Fail Rate of Operationally Valid Tests: 6.6%

Table 51 is a breakdown of the statistically unacceptable tests.

TABLE 51

Reason for Fail	No. of Tests
Average % Change in Flow Mild (Oil 77)	1
Average % Change in Flow Severe (Oil 78)	1
Average % Change in Flow Mild (Oil 78)	6

INDUSTRY PERFORMANCE

Table 52 shows the current Industry precision and severity for the Average % Change in Flow (CIF) test parameter for all operationally valid tests for the report period. (First calibration test completed 5/4/00.)

TABLE 52

Average % CIF	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study (targets)	24	22	5.79	-----
5/4/00 through 9/30/00	32	30	5.71	0.23
10/1/00 through 3/31/01	98	96	5.71	-0.01
4/1/01 through 9/30/01	122	120	6.46	0.34

Table 53 shows the current severity for the Average % CIF parameter for each lab for all operationally valid tests for the report period.

TABLE 53

	n	Mean Δ/s
Lab A	57	0.33
Lab B	18	-1.22
Lab G	47	0.95

PRECISION AND SEVERITY

Precision is worse when compared to the previous period and the target matrix. Severity trended severe of target for the period. Severity is graphically represented in Figure 15 (attached). Laboratories A and G are trending severe while B is trending mild for the period.

REFERENCE OIL SUPPLIES

There is adequate supply of PCEOCP Bench Test reference oils on hand at the TMC. Table 54 lists the PCEOCP bench test reference oils currently on hand at the TMC.

Table 54

Oil	For Tests	Quantity Left (gallons)	Quantity Used Last 12 Months (gallons)
5A-3	BRT	1787.8	0.5
51	VGC, EVLO, GI	94.6	0.1
52	VGC, EVLO, GI	88.6	0.9
53	VGC, EVLO, GI	97.1	0.2
54	VGC, EVLO	97.8	0.0
55	VGC, EVLO, GI	93.3	0.8
^56	VGC, EVLO	51.2	0.0
^57	VGC, EVLO	51.2	0.0
58	VGC, EVLO	146.6	1.6
62	GI	16.2	0.2
71	TEOST	5.8	0.1
72	TEOST	5.0	0.1
74	MTEOS	2.7	0.1
77	EOFT, EOWT	213.2	37.4
78	EOFT, EOWT	225.4	34.3
^80	BRT	26.5	0.0
81	BRT	20.9	1.3
**432	MTEOS	Adequate Supply	-----
**433	MTEOS	Adequate Supply	-----
*1002	FOAM	51.3	-----
*1006	BRT, MTEOS	46.4	-----
*1007	FOAM	15.8	-----

^Not selected as reference oil; TMC holding for further instructions from Surveillance Panel.
*One drum of oil is set aside for bench calibration testing; the TMC has a larger supply of this oil.
**Five gallon aliquot set aside for bench testing; hard to get an inventory reading on amount set aside.

REFERENCE OIL SUPPLIES, continued

Shipping aliquots are:

D6417	1 ml
D5480	4 ml
D5800	100 ml
GI	25 ml
MTEOS	17 ml
TEOST	125 ml
D6082	525 ml
EOFT	290 ml
EOWT	290 ml
BRT	30 ml

MISCELLANEOUS

The TMC posts monitored bench test calibration data on the Internet. Selected parameters from all operationally valid reference tests are posted on the TMC's World-Wide-Web page in real time (that is, as the tests are reported to the TMC, and a validity designation is assigned). Lab identifications are coded as they are on the previous pages of this report. Also posted are statistics, CUSUM plots, reporting forms and data dictionaries and data from various matrix programs (like GF-3 test development and reference oil selection matrix programs). The TMC encourages all interested parties to access and download the data, statistics and plots for individual studies and analyses. Likewise, you are encouraged to access the web site to download the most recent test reporting forms and data dictionaries. The TMC's web site address is http://www.tmc.astm.cmri.cmu.edu/

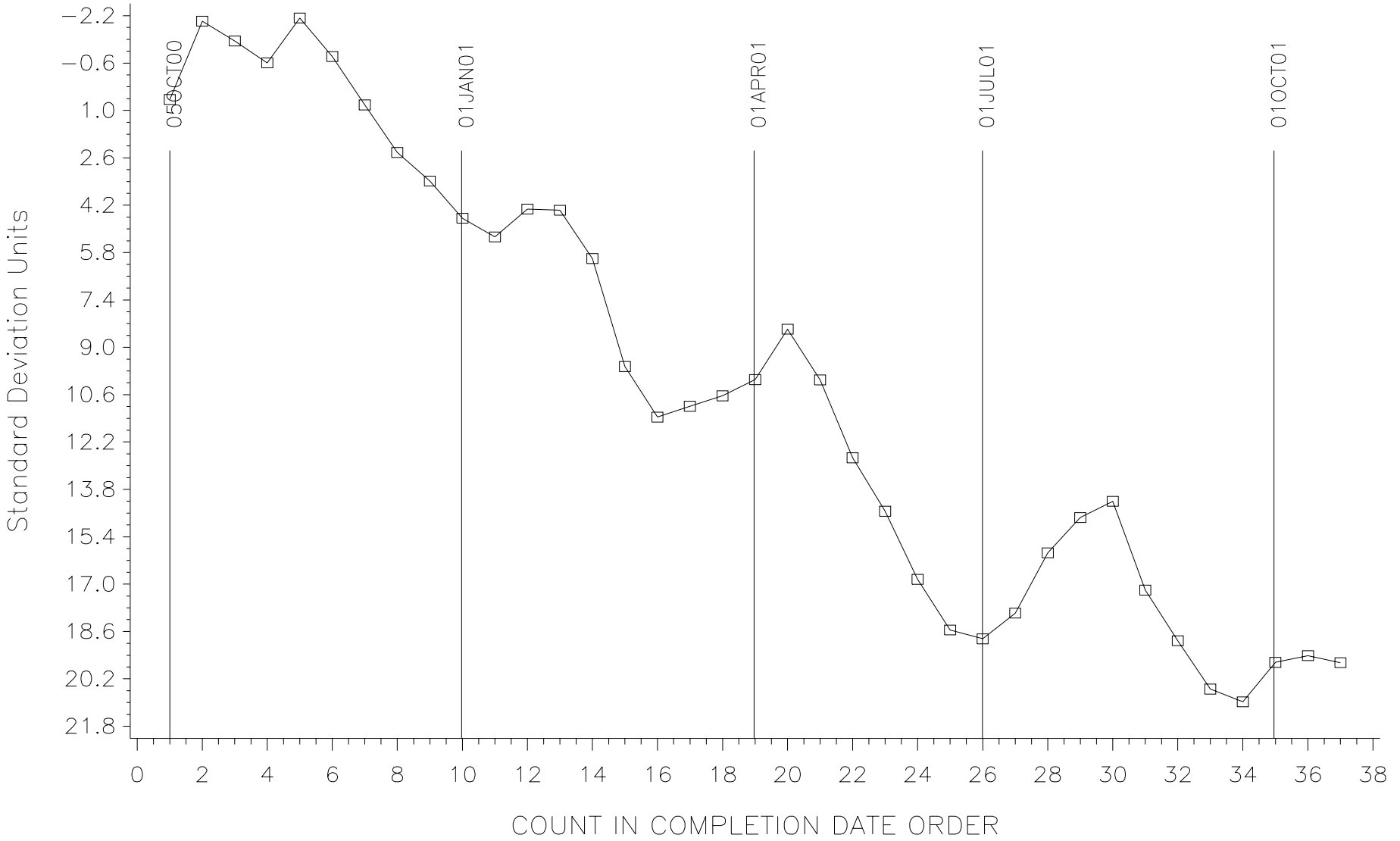
All currently monitored bench test data dictionaries and report form packages have been beta tested and approved by the Data Communications Committee (DCC) for electronic data transfer. TMC Memo 98-210 (September 16, 1998) was issued explaining the TMC's electronic data transmission protocols. In that memo, the TMC strongly encourages participating laboratories to use electronic data transfer for reporting reference test data to the TMC. If your lab should require additional information on this type of data reporting, please contact Tom Schofield at (412) 365-1011 or Rich Grundza at (412) 365-1031.

D6417 INDUSTRY OPERATIONALLY VALID DATA

Figure 1

SAMPLE AREA % VOLATIZED @ 371'C ... 700'F (Area %

CUSUM Severity Analysis



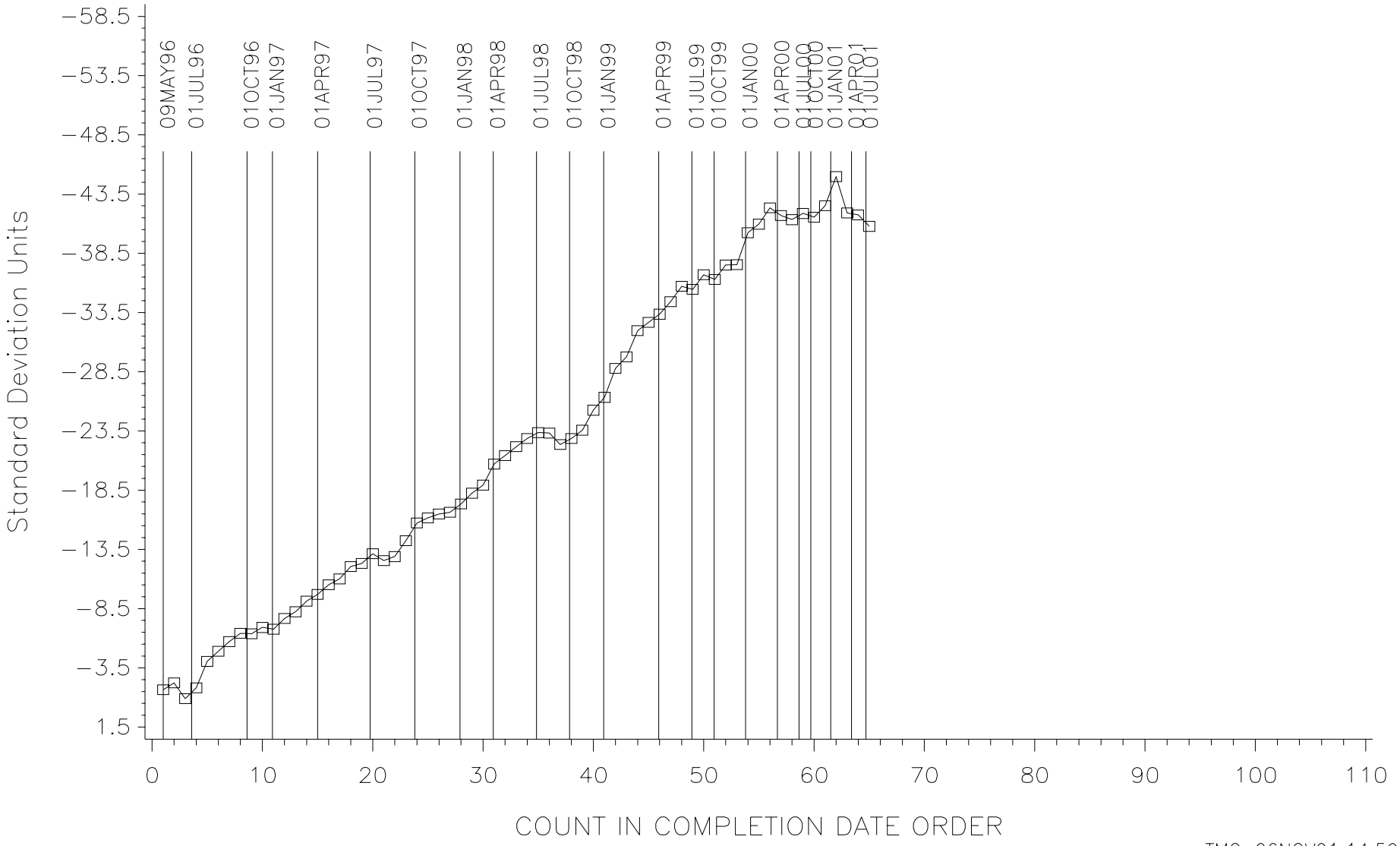
TMC 30OCT01:10:05

VGC-D5480 INDUSTRY OPERATIONALLY VALID DATA

Figure 2

SAMPLE MASS % VOLATIZED @ 371'C ... 700'F (MASS %)

CUSUM Severity Analysis



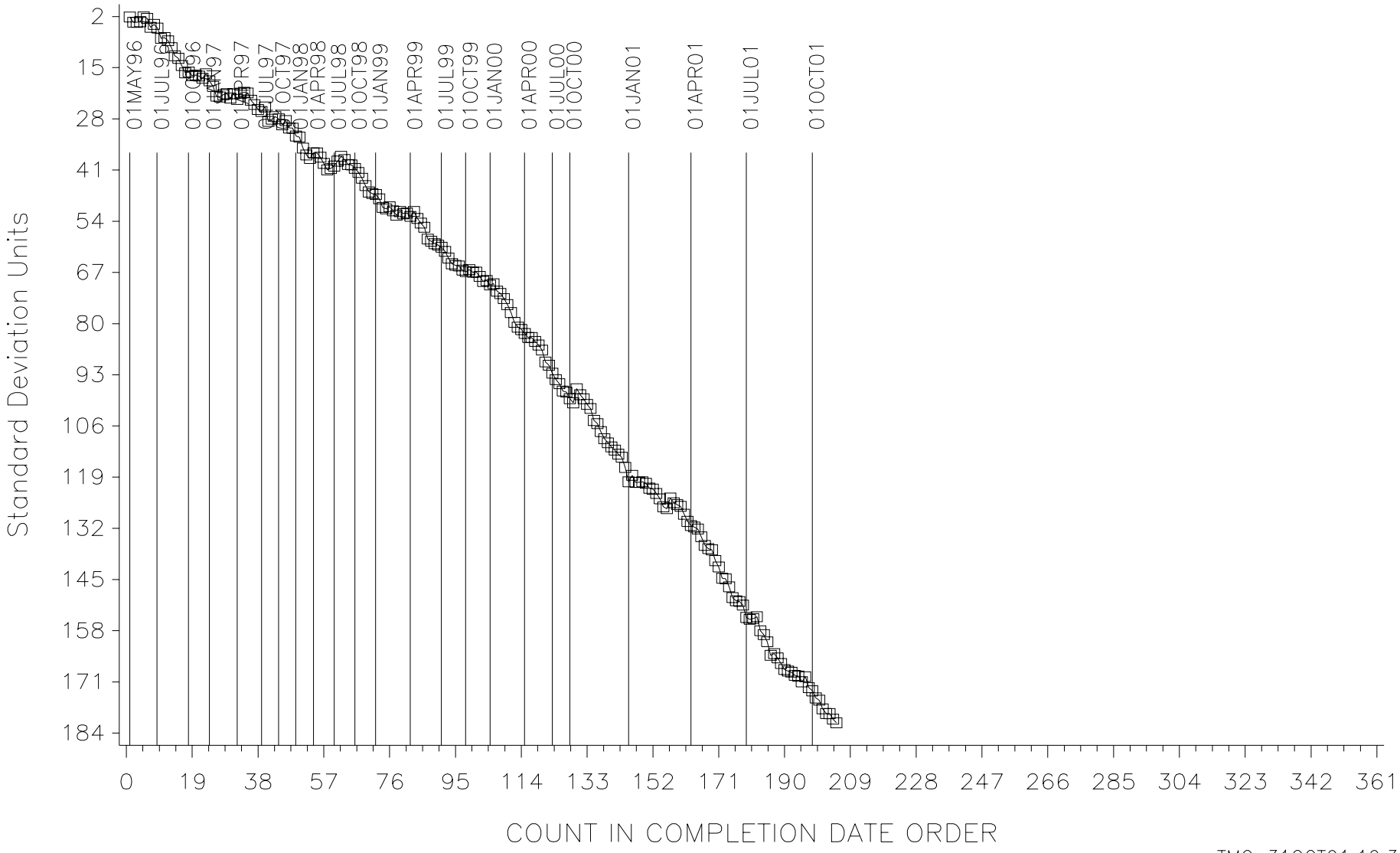
TMC 06NOV01:14:59

D5800 INDUSTRY OPERATIONALLY VALID DATA

Figure 3A

TEST OIL SAMPLE EVAPORATION LOSS (MASS %)

CUSUM Severity Analysis



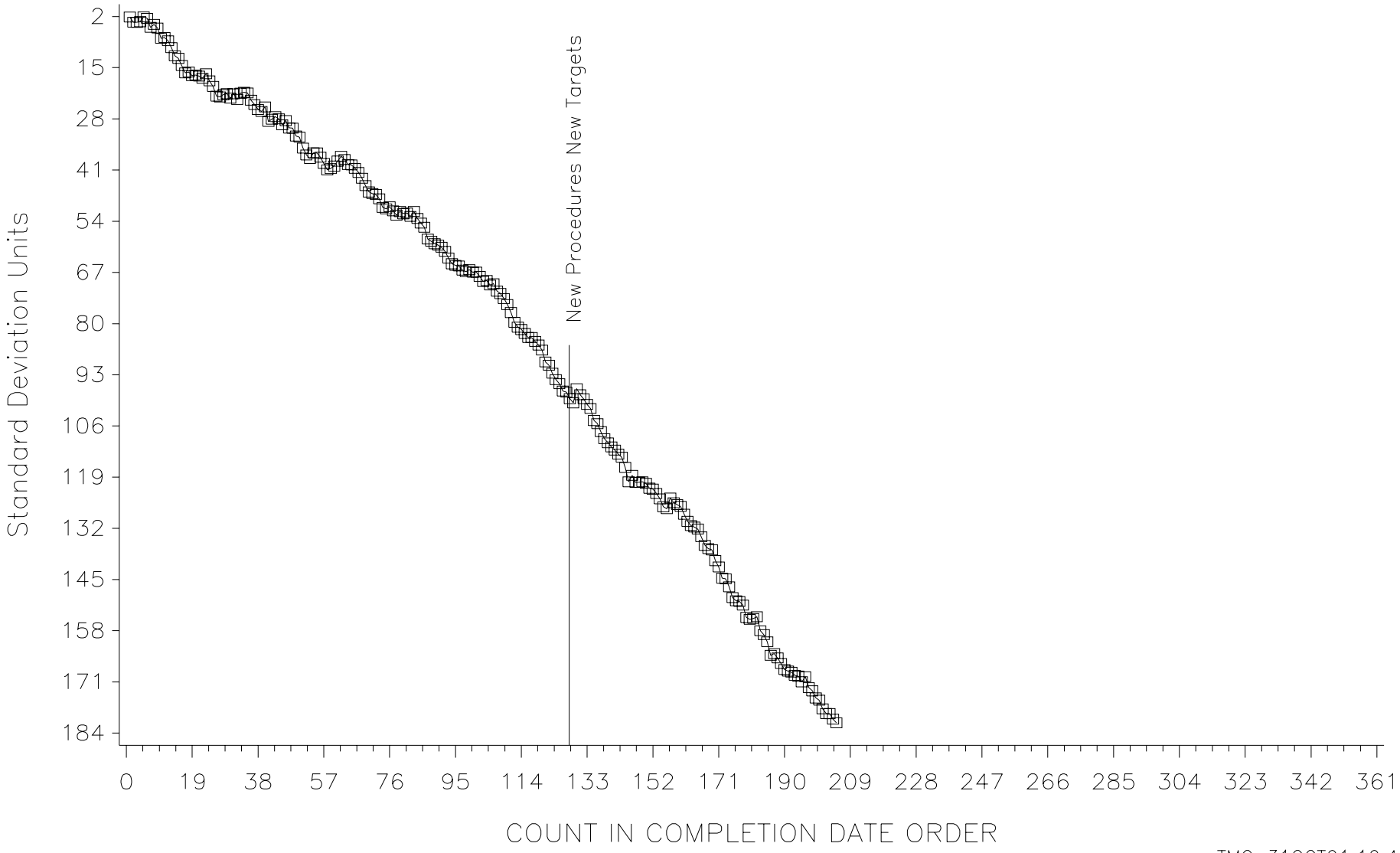
TMC 31OCT01:10:31

D5800 INDUSTRY OPERATIONALLY VALID DATA

Figure 3B

TEST OIL SAMPLE EVAPORATION LOSS (MASS %)

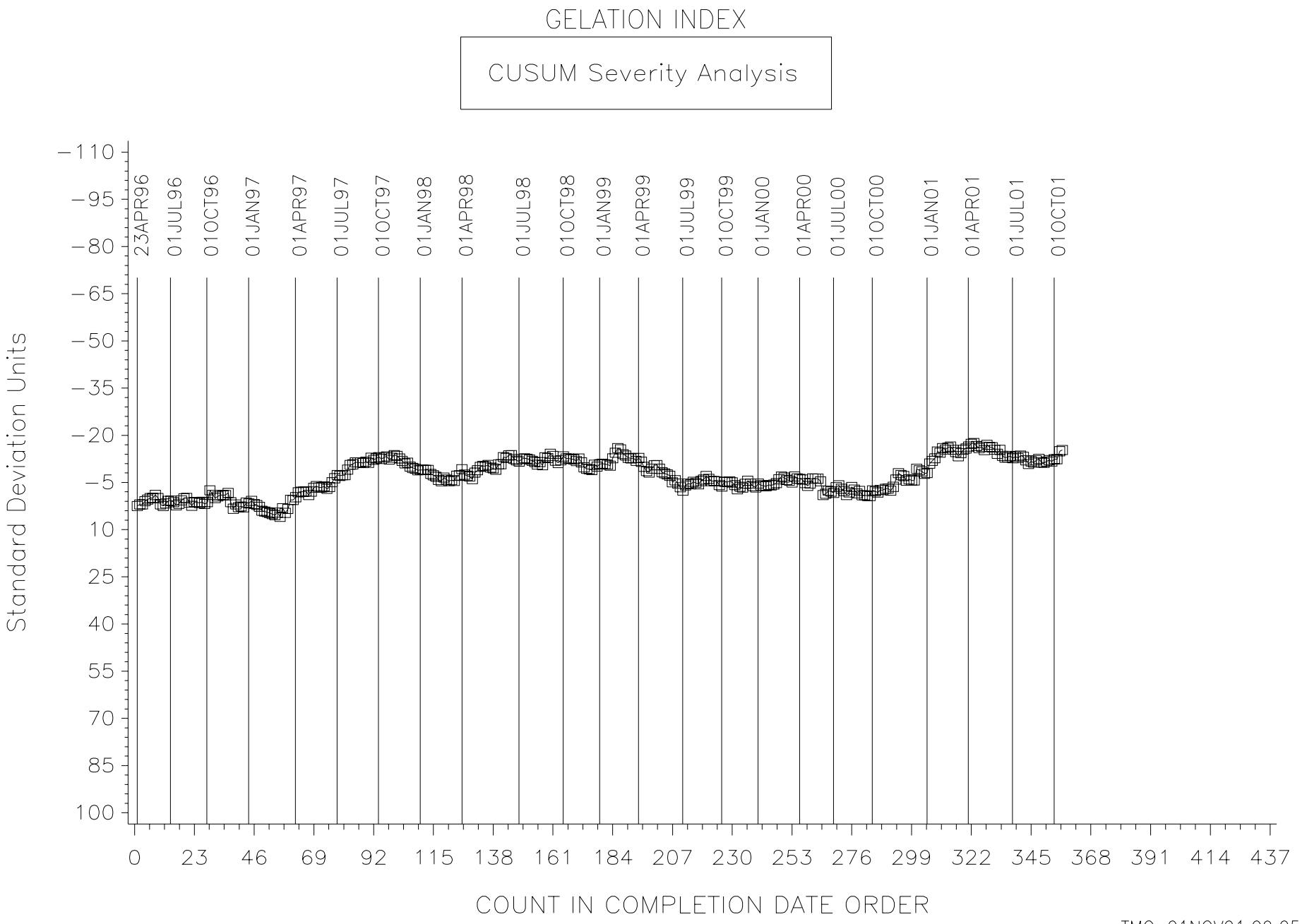
CUSUM Severity Analysis



TMC 31OCT01:10:46

GELATION INDEX INDUSTRY OPERATIONALLY VALID DATA

Figure 4



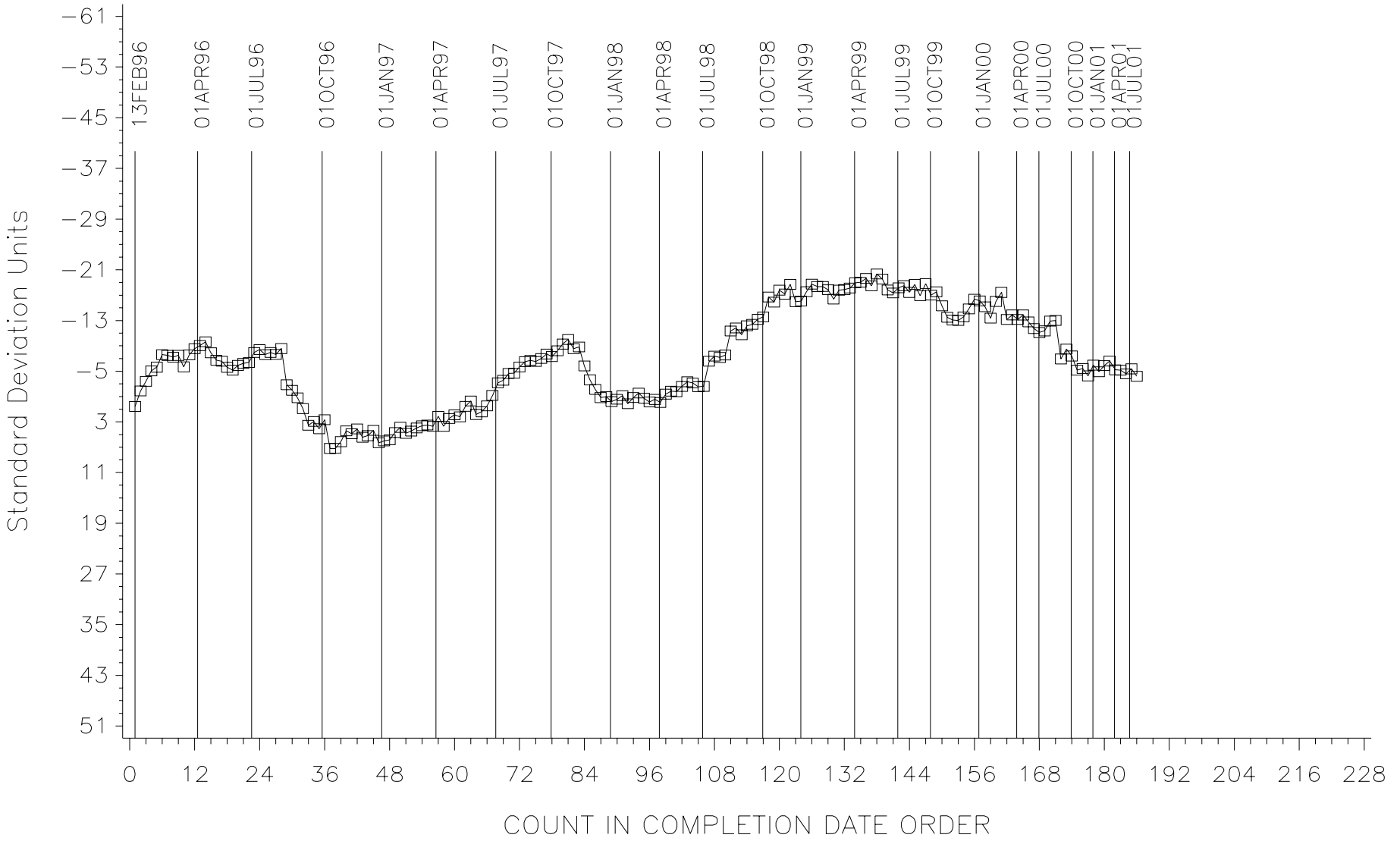
TMC 01NOV01:09:05

TEOST INDUSTRY OPERATIONALLY VALID DATA

Figure 5

TOTAL DEPOSITS (mg)

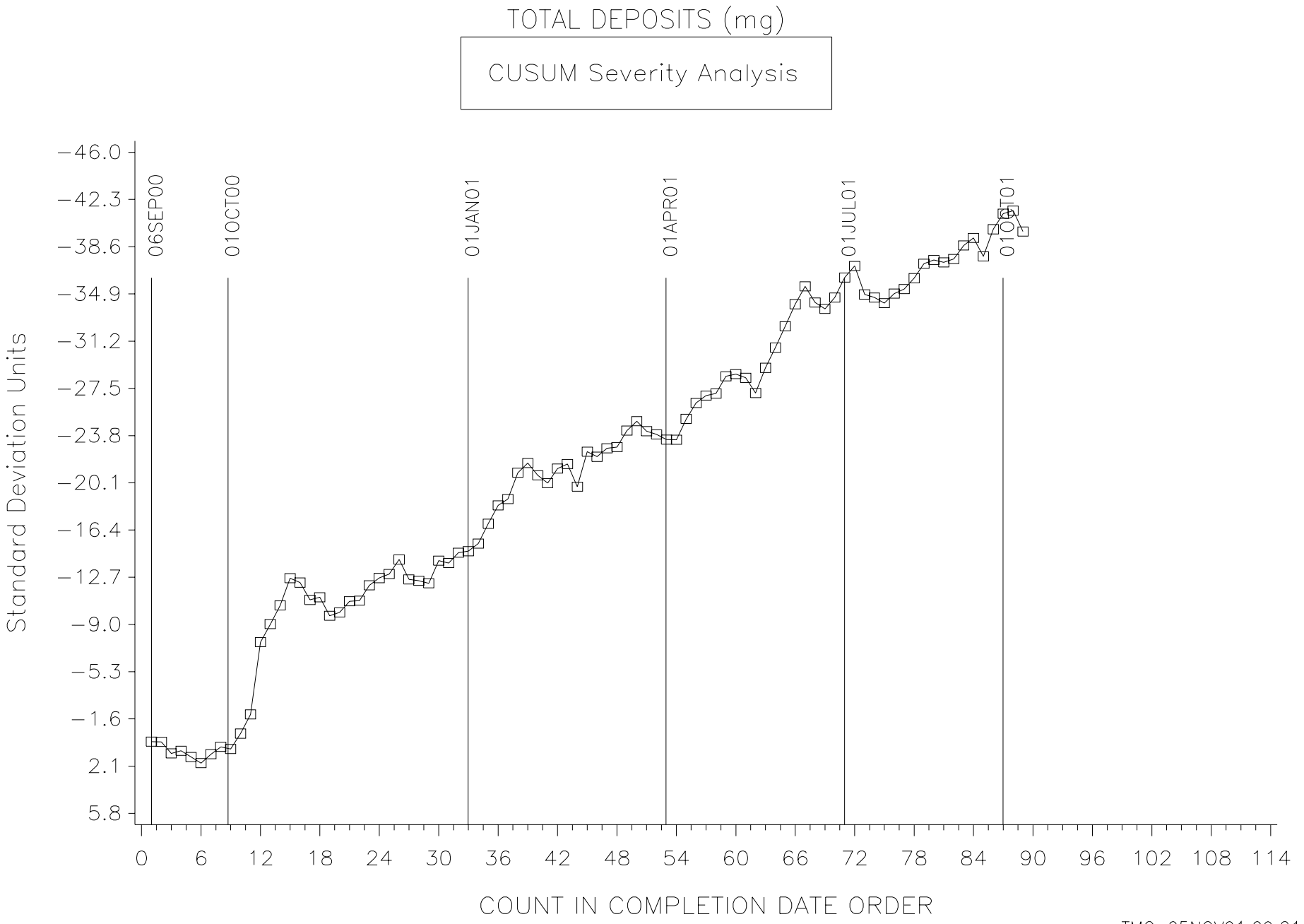
CUSUM Severity Analysis



TMC 01NOV01:10:45

MHT TEOST INDUSTRY OPERATIONALLY VALID DATA

Figure 6



TMC 05NOV01:09:21

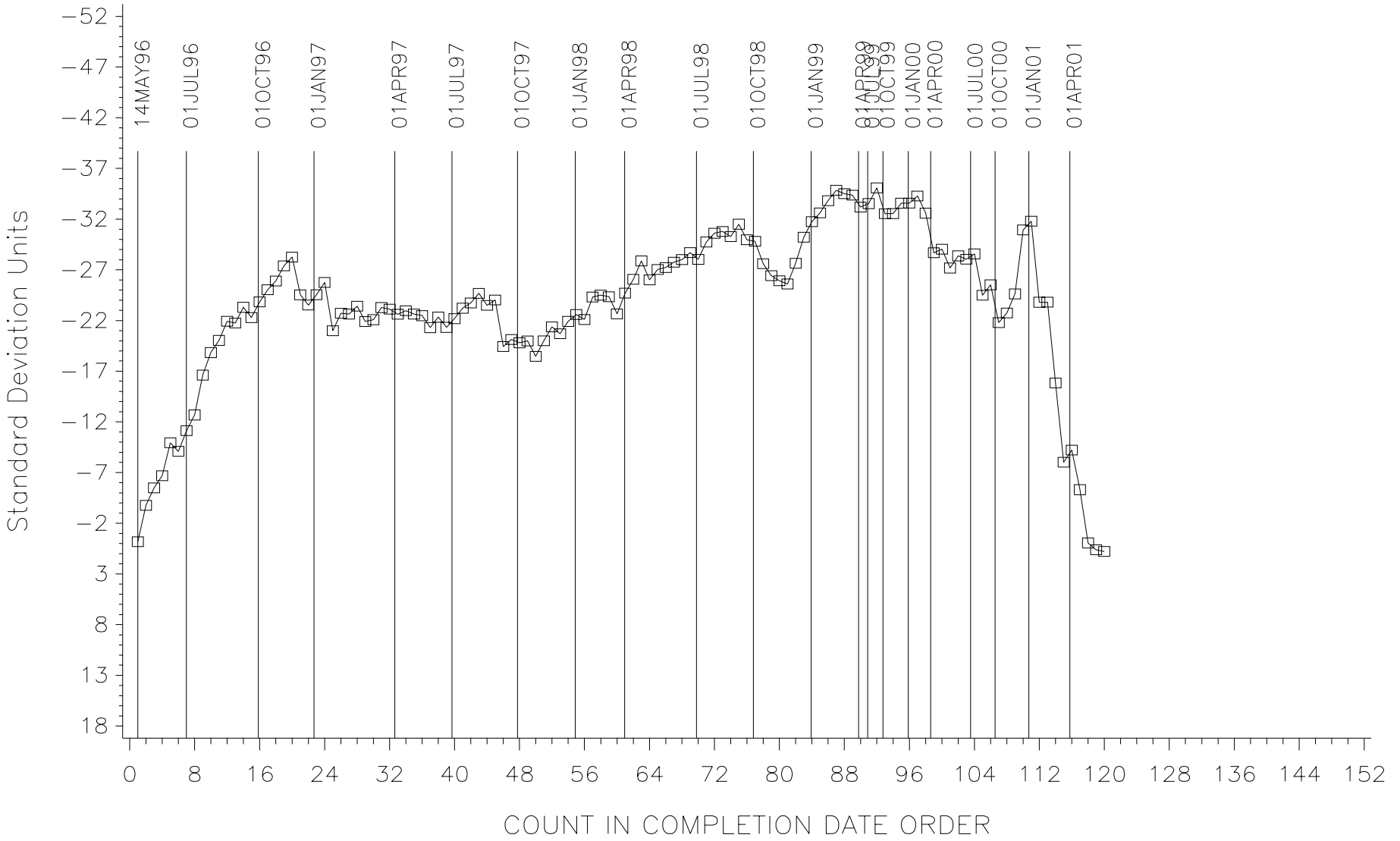
D6082 INDUSTRY OPERATIONALLY VALID DATA

TMC Oil 1002

FOAM TENDENCY, IMMEDIATELY BEFORE DISCONNECT STATI

Figure 7

CUSUM Severity Analysis



TMC 05NOV01:09:27

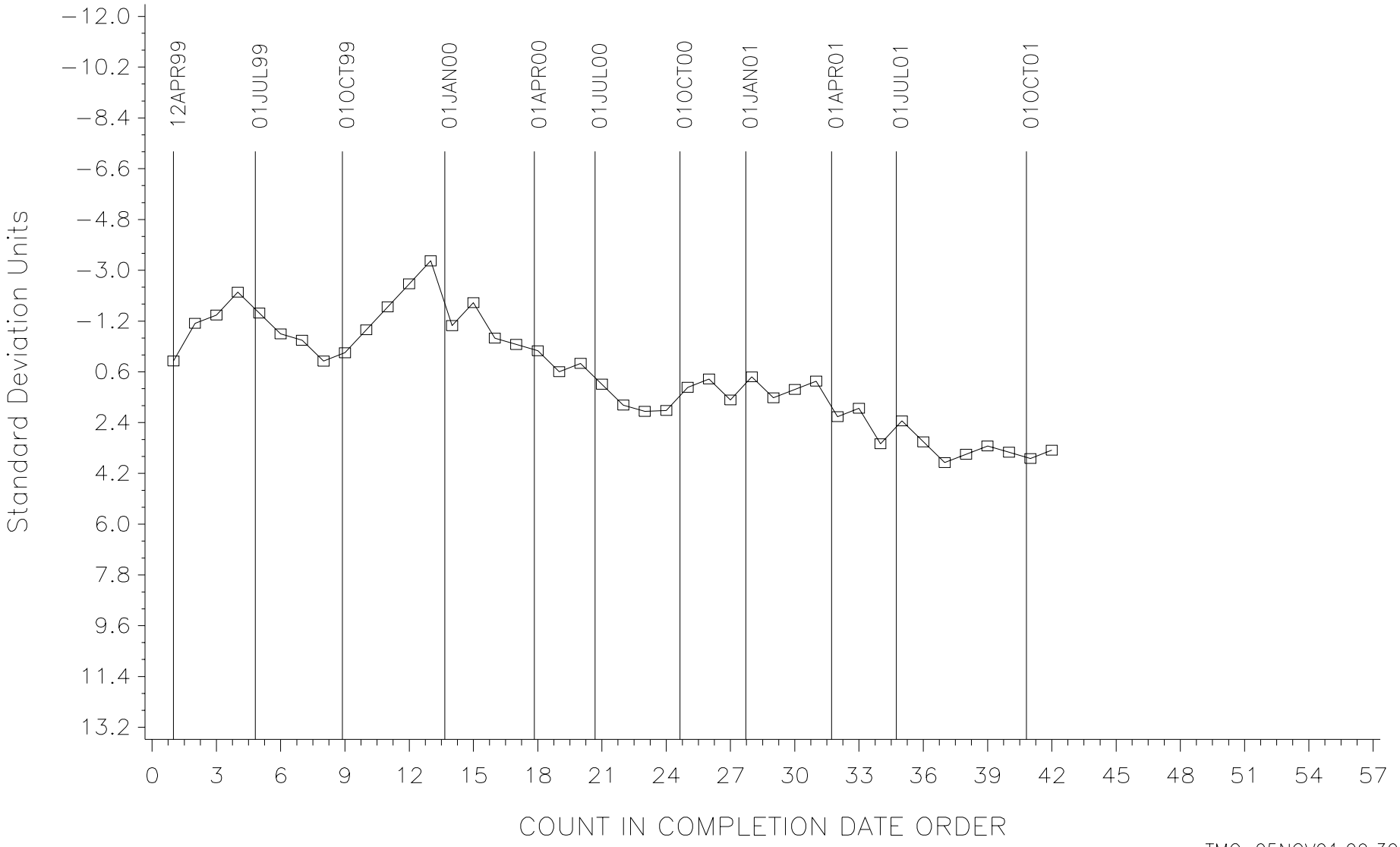
D6082 INDUSTRY OPERATIONALLY VALID DATA

TMC Oil 1007

FOAM TENDENCY, IMMEDIATELY BEFORE DISCONNECT STATI

Figure 8

CUSUM Severity Analysis



TMC 05NOV01:09:30

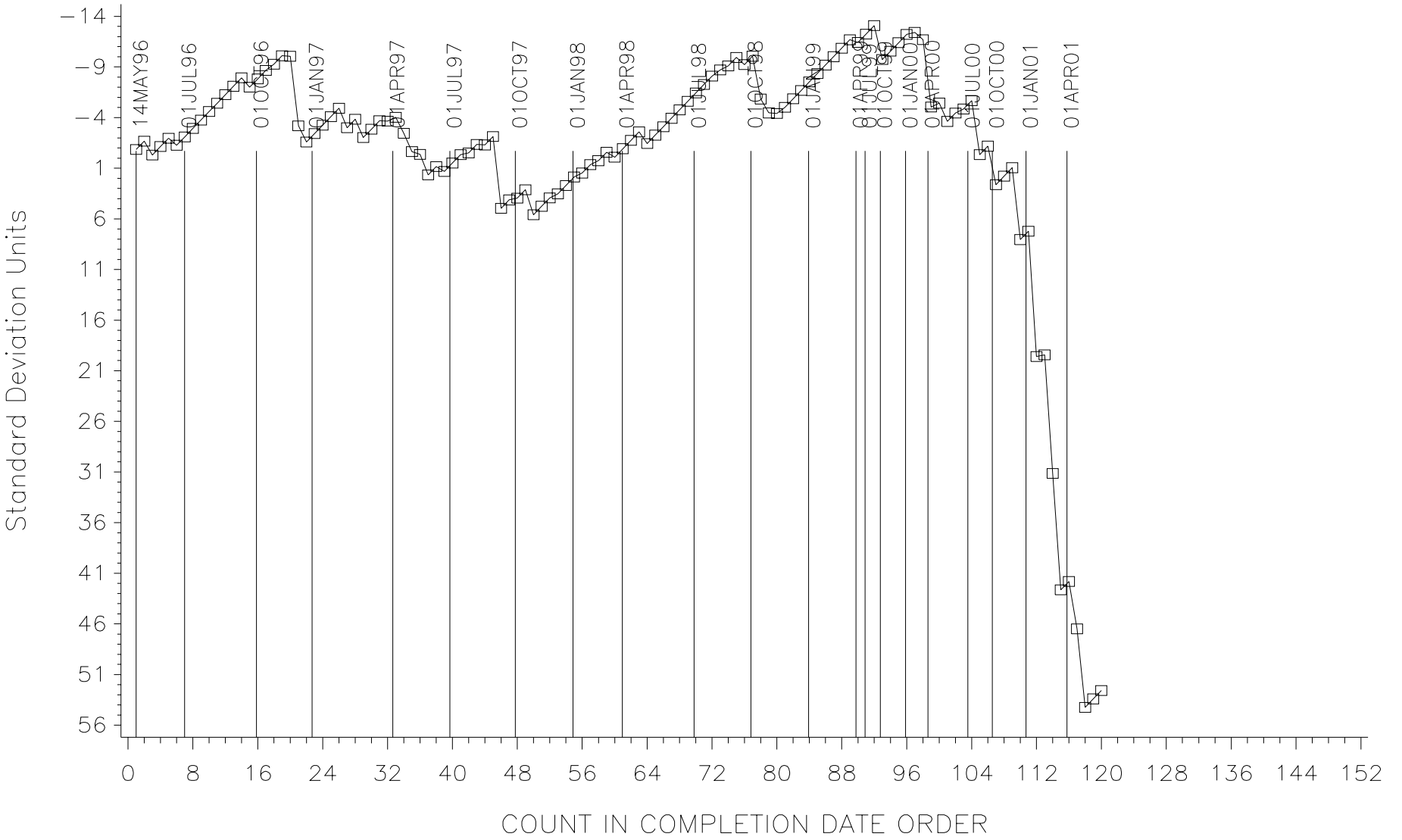
D6082 INDUSTRY OPERATIONALLY VALID DATA

TMC Oil 1002

FOAM STABILITY, 1 MINUTE AFTER DISCONNECT STATIC F

Figure 9

CUSUM Severity Analysis



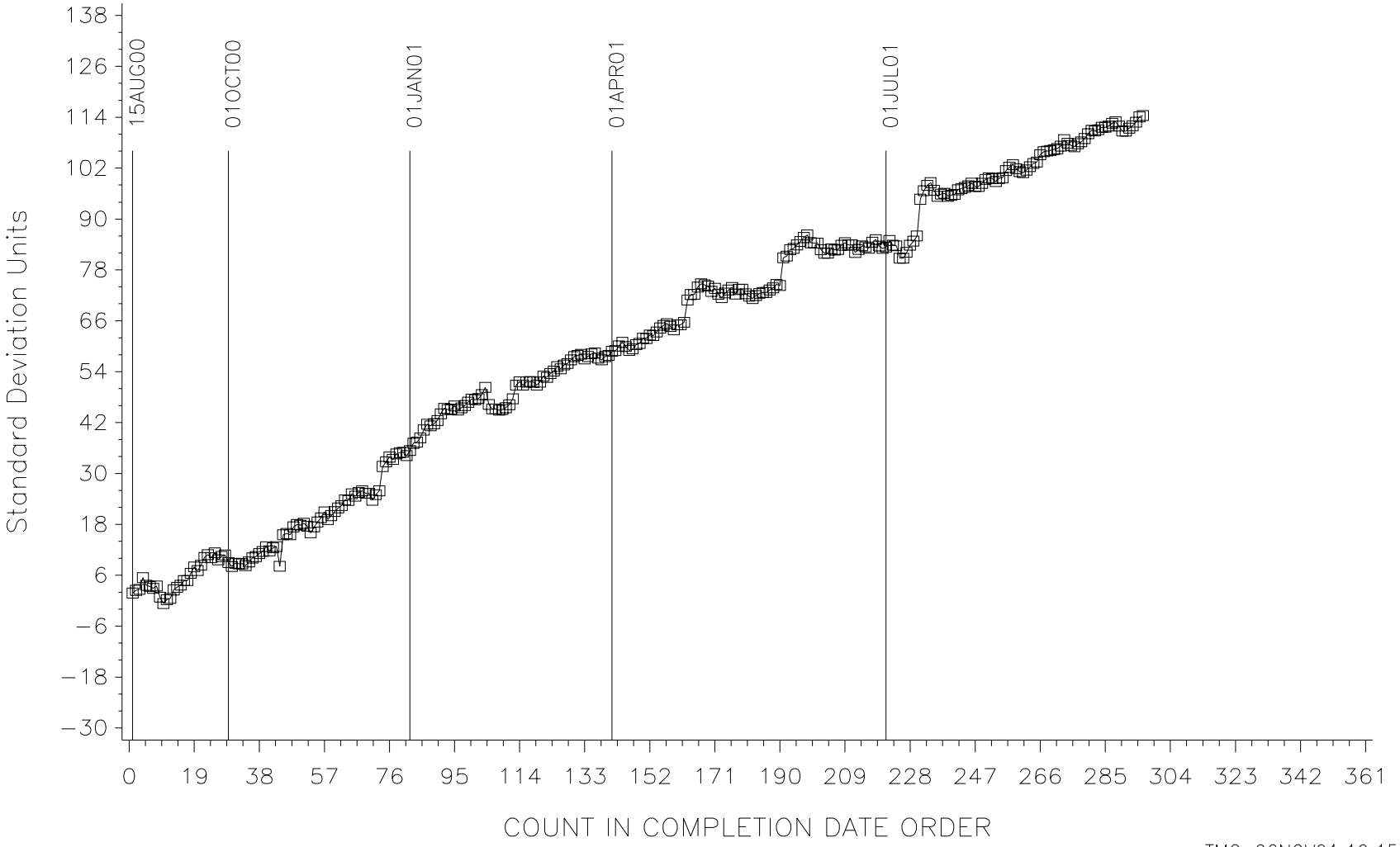
TMC 05NOV01:09:28

BALL RUST TEST INDUSTRY OPERATIONALLY VALID DATA

Figure 10

REFERENCE AVERAGE GRAY VALUE AVERAGE

CUSUM Severity Analysis



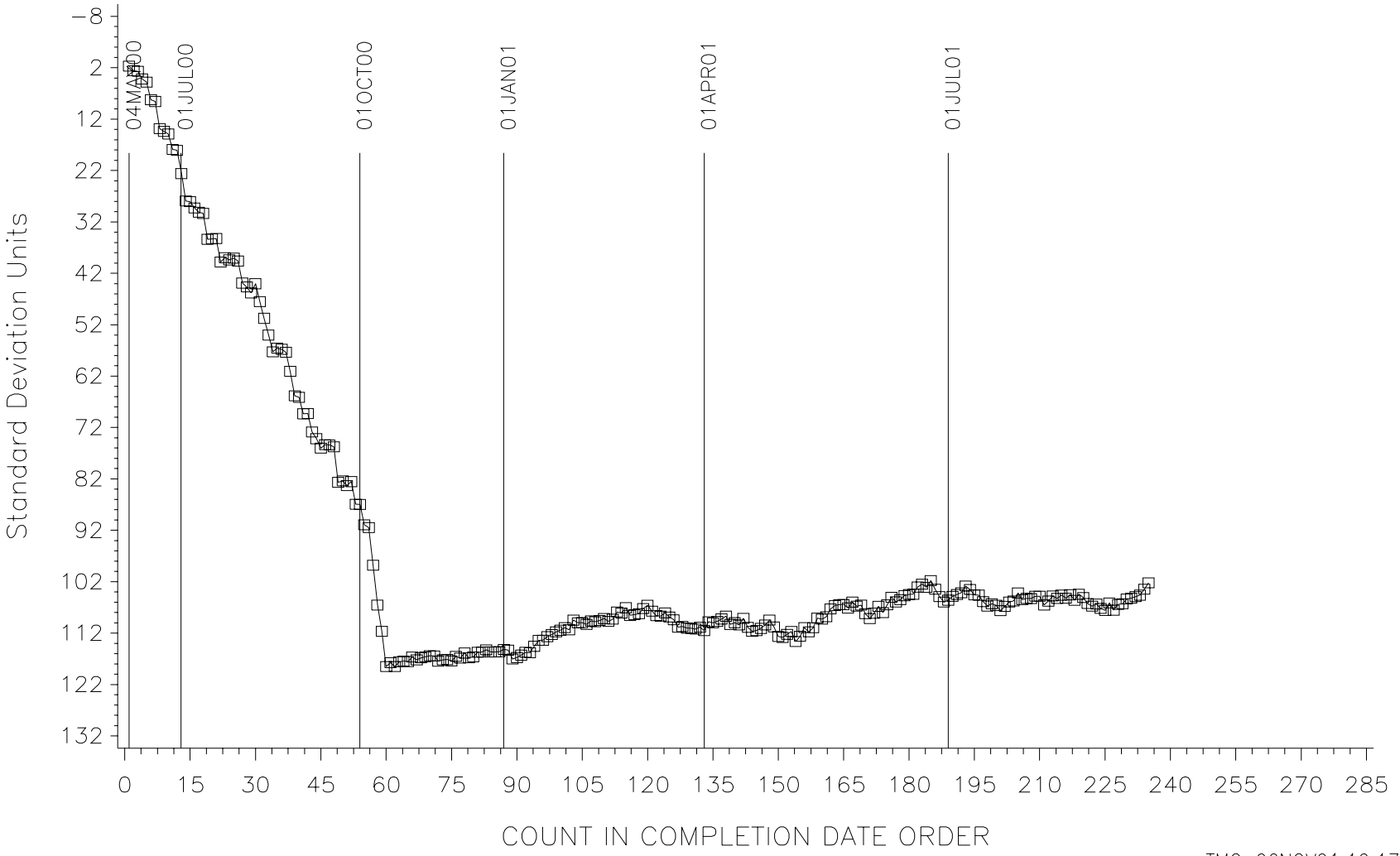
TMC 06NOV01:10:15

EOFT INDUSTRY OPERATIONALLY VALID DATA

Figure 11

20 – 25 ML CHANGE IN FLOWRATE AVERAGE (%)

CUSUM Severity Analysis



TMC 06NOV01:10:17

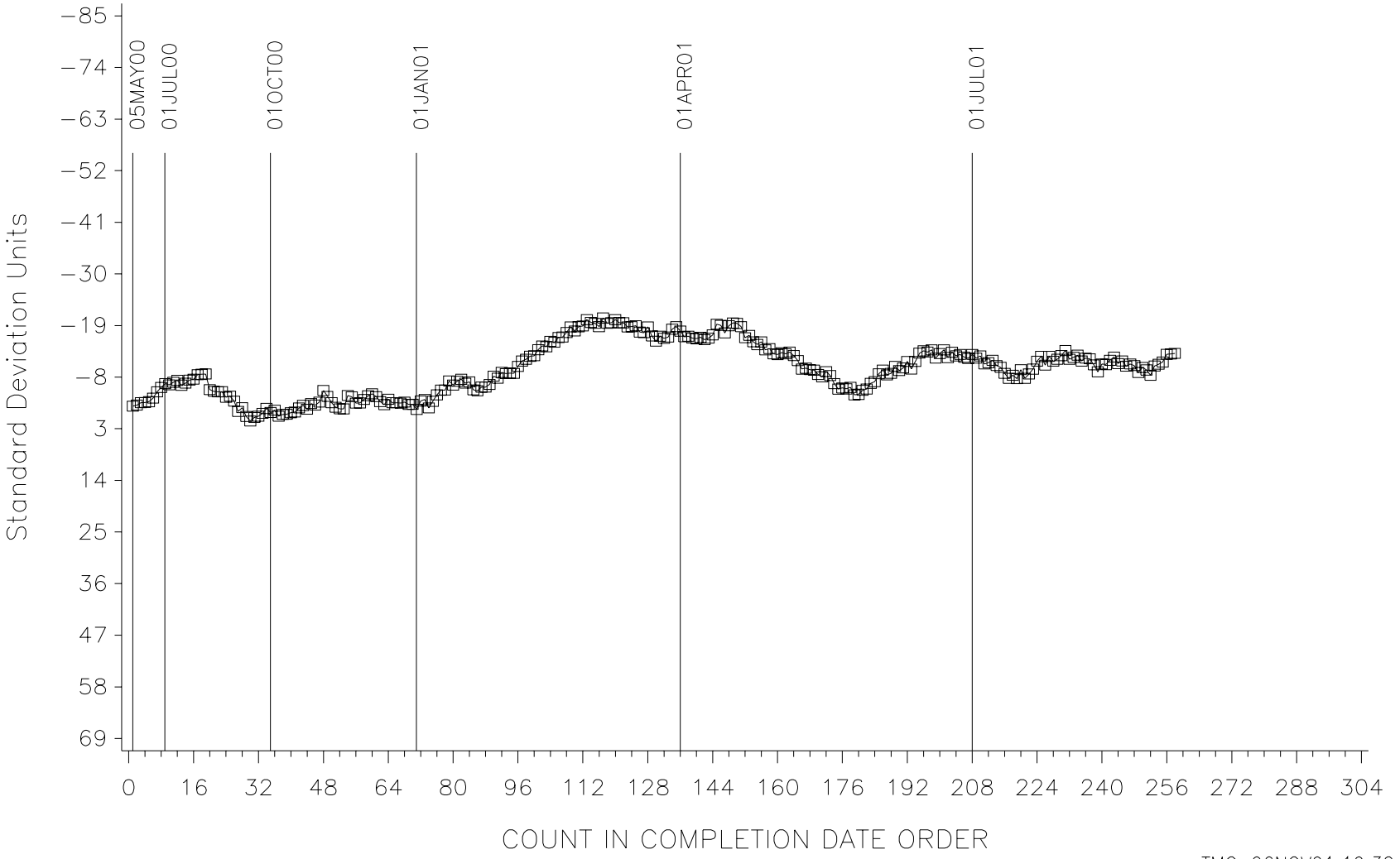
Figure 12

EOWT INDUSTRY OPERATIONALLY VALID DATA

0.6% Treat Rate

TEST RUN 20 – 25 ML CHANGE IN FLOWRATE AVERAGE (%)

CUSUM Severity Analysis



TMC 06NOV01:10:32

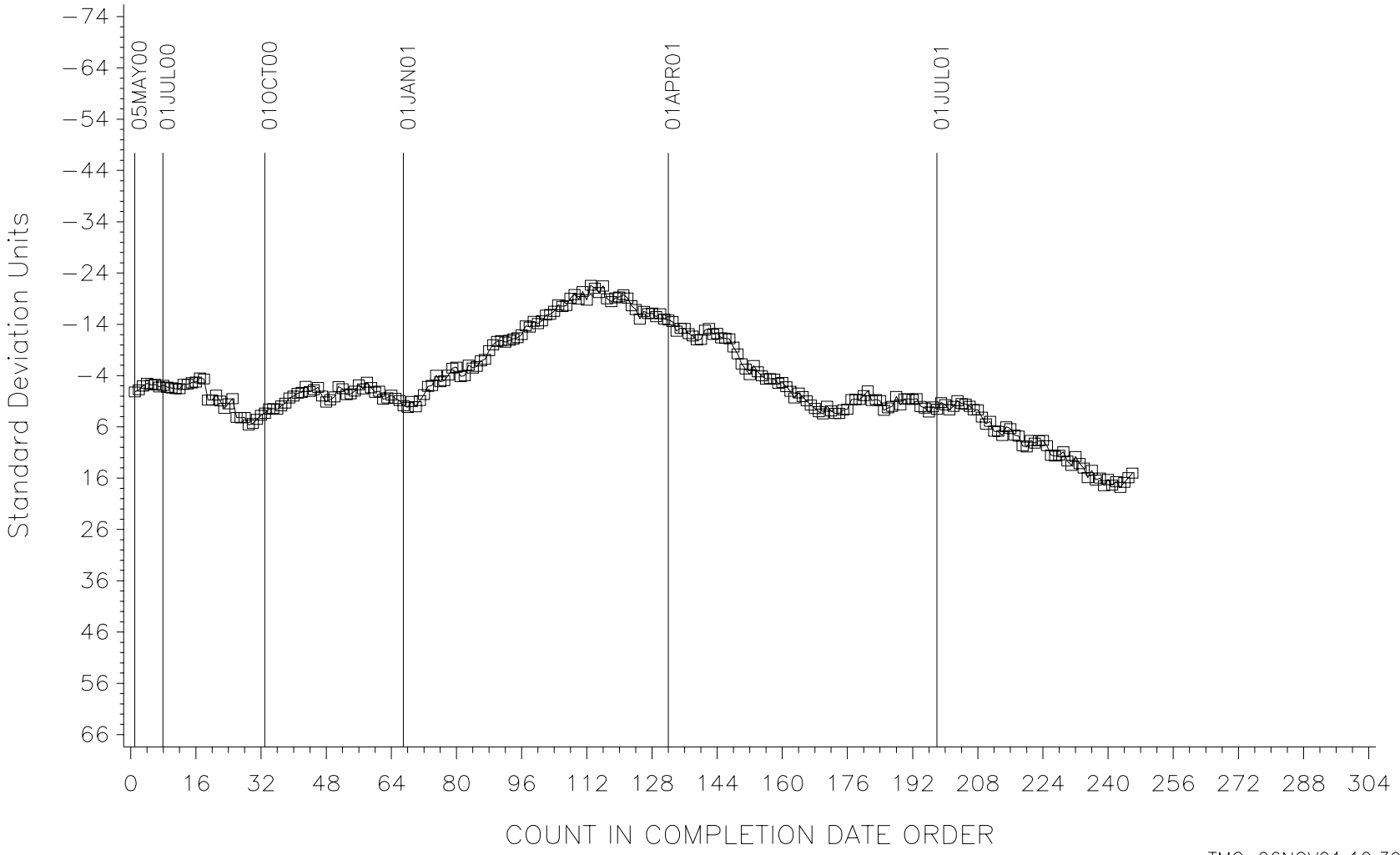
EOWT INDUSTRY OPERATIONALLY VALID DATA

Figure 13

1.0% Treat Level

TEST RUN 20 – 25 ML CHANGE IN FLOWRATE AVERAGE (%)

CUSUM Severity Analysis



TMC 06NOV01:10:39

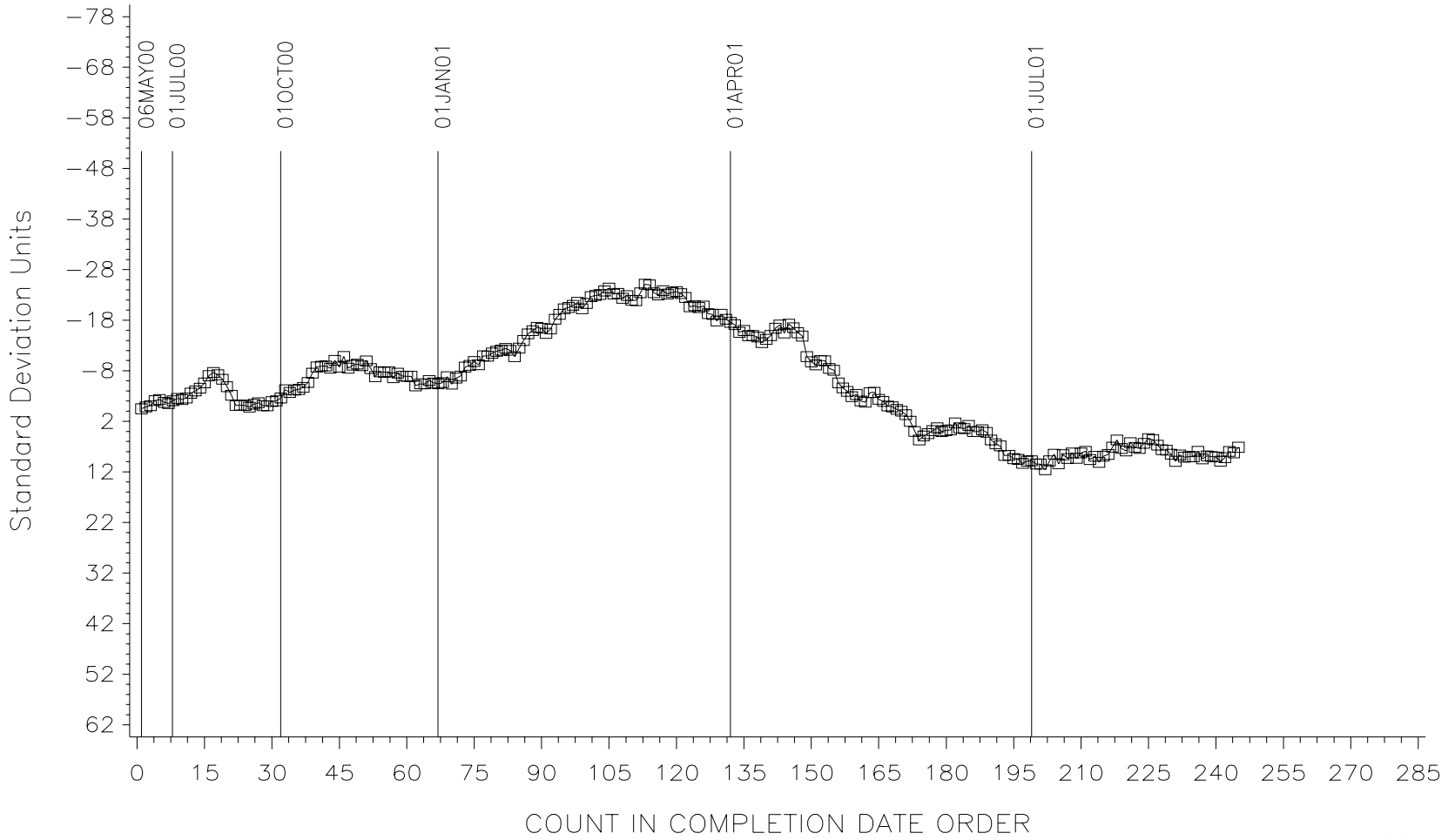
Figure 14

EOWT INDUSTRY OPERATIONALLY VALID DATA

2.0 % Treat Rate

TEST RUN 20 – 25 ML CHANGE IN FLOWRATE AVERAGE (%)

CUSUM Severity Analysis



TMC 06NOV01:10:46

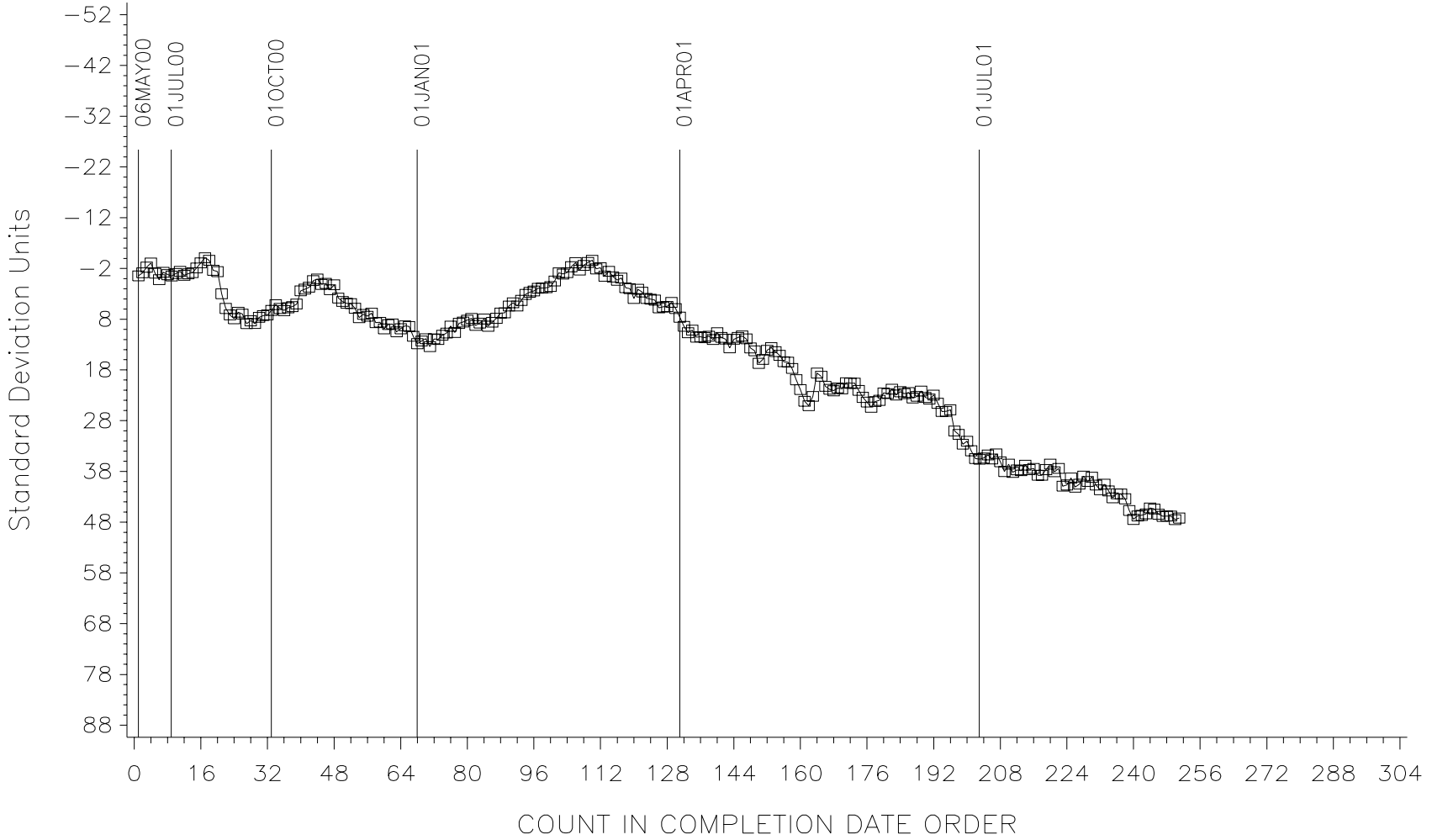
Figure 15

EOWT INDUSTRY OPERATIONALLY VALID DATA

3.0% Treat Rate

TEST RUN 20 – 25 ML CHANGE IN FLOWRATE AVERAGE (%)

CUSUM Severity Analysis



TMC 06NOV01:10:55

Attachment 2

TMC Monitored Bench Tests
Reference Oil Test Targets and Acceptance Bands

Test	Oil Code	Parameter	n	Mean	sR	Acceptance Bands * 95% Lower	95% Upper
VGC by	51	area % volatility loss	48	13.07	0.66	11.8	14.4
D2887	52	area % volatility loss	48	6.88	0.43	6.0	7.7
Extended	53	area % volatility loss	48	17.92	0.76	16.4	19.4
	54	area % volatility loss	48	19.16	0.87	17.5	20.9
	55	area % volatility loss	48	11.56	0.71	10.2	13.0
D6417	52	area % volatility loss	18	6.97	0.31	6.4	7.6
	55	area % volatility loss	18	11.68	0.51	10.7	12.7
	58	area % volatility loss	18	5.61	0.30	5.0	6.2
VGC by	51	mass % volatility loss	10	11.85	0.47	10.9	12.8
D5480	52	mass % volatility loss	11	6.22	0.23	5.8	6.7
(New Targets	53	mass % volatility loss	10	16.74	0.66	15.4	18.0
Effective	54	mass % volatility loss	10	17.89	0.68	16.6	19.2
12/7/1999)	55	mass % volatility loss	11	10.71	0.29	10.1	11.3
D5800	52	mass % volatility loss	59	13.61	0.49	12.6	14.6
New Targets	55	mass % volatility loss	60	16.39	0.66	15.1	17.7
9/26/00	58	mass % volatility loss	59	14.46	0.52	13.4	15.5
TEOST by	71	Total Deposit wt. (mg)	27	51.79	4.79	42.4	61.2
D6335	72	Total Deposit wt. (mg)	27	26.72	3.46	19.9	33.5
MTEOS by	74	Total Deposit wt. (mg)	20	16.84	5.28	6.5	27.2
Draft 17 00.08.11	432	Total Deposit wt. (mg)	18	50.13	4.88	40.6	59.7
New Targets	433	Total Deposit wt. (mg)	18	50.28	5.26	40.0	60.6
6/1/01	1006	Total Deposit wt. (mg)	24	34.53	5.93	22.9	46.2
	~~51~~	~~Gelation Index~~	~~35~~	~~63.3~~	~~12.01~~	~~39.8~~	~~86.8~~
GI by	52	Gelation Index	35	4.5	0.24	4.0	5.0
D5133	53	Gelation Index	37	44.7	4.64	35.6	53.8
	~~55~~	~~Gelation Index~~	~~36~~	~~22.3~~	~~4.84~~	~~12.8~~	~~31.8~~
	58	Gelation Index	17	5.8	0.69	4.4	7.2
	62	Gelation Index	35	17.0	3.90	9.4	24.6
~~D6082~~	~~1002~~	~~Tendency (ml)~~	~~32~~	~~410.63~~	~~58.78~~	~~295~~	~~526~~
~~(HT FOAM)~~	~~1002~~	~~Stability (ml)~~	~~32~~	~~37.81~~	~~45.41~~	~~0~~	~~127~~
D6082	1007	Tendency (ml)	28	65.71	19.28	28	103
(HT FOAM)	1007	Stability (ml)	28	0.00	0.00	0	0
BRT by	81	Average AGV	12	112	14.00	85	140
D02-1483	1006	Average AGV	12	128	7.21	114	142
(D6557)	5A-3	Average AGV	12	76	6.47	63	89
EOFT by	77	Δ Flowrate (%)	12	-45.55	4.36	-54.10	-37.00
(Draft 6)	78	Δ Flowrate (%)	12	15.74	6.87	2.27	29.21
EOWT by	77	0.6% H20 Δ Flowrate (%)	12	-24.90	5.68	-36.03	-13.77
(Draft 5)	77	1.0% H20 Δ Flowrate (%)	12	-17.94	5.45	-28.62	-7.26
	77	2.0% H20 Δ Flowrate (%)	12	-17.96	8.47	-34.56	-1.36
	77	3.0% H20 Δ Flowrate (%)	12	-18.23	6.83	-31.62	-4.84
EOWT by	78	0.6% H20 Δ Flowrate (%)	12	10.87	6.16	-1.20	22.94
(Draft 5)	78	1.0% H20 Δ Flowrate (%)	12	7.54	6.15	-4.51	19.59
	78	2.0% H20 Δ Flowrate (%)	12	5.17	5.33	-5.27	15.62
	78	3.0% H20 Δ Flowrate (%)	12	-0.54	4.52	-9.40	8.32

Attachment 3A

TMC Monitored Bench Tests – Individual Reference Oil Statistics
(Operationally Valid tests Only)

Test	Oil Code	Parameter	Targets			4/1/99 - 3/31/00			4/1/00 - 3/31/01			4/1/01 - 9/30/01		
			n	Mean	sR	n	Mean	sR	n	Mean	sR	n	Mean	sR
D6417	52	Area % Volatized	18	6.97	0.31	-----	-----	-----	6	7.1	0.71	8	7.2	0.49
	55	Area % Volatized	18	11.68	0.51	-----	-----	-----	5	11.8	0.50	2	12.2	0.49
	58	Area % Volatized	18	5.61	0.30	-----	-----	-----	7	5.9	0.21	6	5.8	0.61
VGC by	51	% volatility loss	10	11.85	0.47	3	11.9	0.75	1	10.7	-----	1	12.3	-----
D5480	52	% volatility loss	11	6.22	0.23	2	5.8	0.28	2	6.2	0.14	-----	-----	-----
*	53	% volatility loss	10	16.74	0.66	2	16.4	0.00	1	16.1	-----	-----	-----	-----
	54	% volatility loss	10	17.89	0.68	2	18.2	0.35	1	18.1	-----	1	18.0	-----
	55	% volatility loss	11	10.71	0.29	2	10.8	0.42	2	11.2	0.49	-----	-----	-----
D5800	~~51~~	~~% volatility loss~~	~~36~~	~~18.13~~	~~0.42~~	~~7~~	~~18.3~~	~~0.23~~	-----	-----	-----	-----	-----	-----
**	52	% volatility loss	59	13.61	0.49	6	13.8	0.51	13	14.2	0.58	12	14.0	0.60
	~~53~~	~~% volatility loss~~	~~36~~	~~22.30~~	~~0.55~~	~~2~~	~~22.6~~	~~0.21~~	~~2~~	~~22.6~~	~~0.35~~	-----	-----	-----
	~~54~~	~~% volatility loss~~	~~36~~	~~23.54~~	~~0.67~~	~~8~~	~~24.4~~	~~0.46~~	~~3~~	~~24.5~~	~~0.36~~	-----	-----	-----
	55	% volatility loss	60	16.39	0.66	10	16.6	0.45	15	16.9	0.73	10	17.1	0.54
	58	% volatility loss	59	14.46	0.52	-----	-----	-----	15	14.8	0.80	13	15.4	0.67
TEOST	71	Deposit wt. (mg)	27	51.79	4.79	16	49.1	6.38	9	52.4	11.36	2	50.0	2.83
(D6335)	72	Deposit wt. (mg)	27	26.72	3.46	14	30.0	4.73	9	29.1	3.69	3	30.4	1.50
MTEOS	1006	Deposit wt. (mg)	24	34.53	5.93	-----	-----	-----	17	34.0	6.13	5	35.7	8.97
***	432	Deposit wt. (mg)	18	50.13	4.88	-----	-----	-----	13	46.5	9.87	8	46.8	6.26
	433	Deposit wt. (mg)	18	50.28	5.26	-----	-----	-----	11	47.4	5.63	11	46.2	4.91
	74	Deposit wt. (mg)	20	16.84	5.28	-----	-----	-----	11	15.0	2.20	10	15.1	3.43
GI	~~51~~	~~Gelation Index~~	~~35~~	~~63.3~~	~~12.01~~	~~16~~	~~62.3~~	~~10.90~~	~~12~~	~~60.3~~	~~6.22~~	~~2~~	~~66.0~~	~~7.99~~
(D5133)	52	Gelation Index	35	4.5	0.24	12	4.4	0.19	9	4.4	0.12	12	4.4	0.15
****	53	Gelation Index	37	44.7	4.64	12	47.6	2.26	13	47.7	6.88	10	48.1	3.43
	~~55~~	~~Gelation Index~~	~~36~~	~~22.3~~	~~4.84~~	~~12~~	~~23.0~~	~~5.34~~	~~15~~	~~20.2~~	~~7.46~~	~~2~~	~~16.8~~	~~3.61~~
	58	Gelation Index	17	5.8	0.69	-----	-----	-----	-----	-----	-----	-----	-----	-----
	62	Gelation Index	35	17.0	3.90	10	18.1	3.48	16	16.2	4.71	7	18.4	2.67
~~D6082~~	~~1002~~	~~Tendency (ml)~~	~~32~~	~~410.63~~	~~58.78~~	~~9~~	~~422.2~~	~~78.86~~	~~17~~	~~495.6~~	~~232.46~~	~~5~~	~~514.0~~	~~159.31~~
	~~1002~~	~~Stability (ml)~~	~~32~~	~~37.81~~	~~45.41~~	~~9~~	~~37.8~~	~~62.80~~	~~17~~	~~182.9~~	~~225.47~~	~~5~~	~~128.0~~	~~182.13~~
D6082	1007	Tendency (ml)	28	65.71	19.28	17	65.3	18.41	14	67.5	11.22	9	71.1	14.53

* D5480 Targets Adjusted 12/7/99 per direction of the Volatility Surveillance Panel
**D5800 Targets Adjusted 10/2/00; new oils selected; new procedures approved
***MTEOS Targets Adjusted 6/1/01 per direction of TEOST Surveillance Panel (based on completed Matrix 6 data)
****GI Added new oil 58 10/24/01; dropped oils 51 & 55 7/2/01

Attachment 3B

TMC Monitored Bench Tests – Individual Reference Oil Statistics
(Operationally Valid tests Only)

Test	Oil Code	Parameter	Targets			4/1/00 - 9/30/00			10/1/00 - 3/31/01			4/1/01 - 9/30/01		
			n	Mean	sR	n	Mean	sR	n	Mean	sR	n	Mean	sR
BRT	1006	Average AGV	12	128	7.21	7	123.1	5.30	26	123.7	6.79	39	124.4	5.77
	5A-3	Average AGV	12	76	6.47	7	82.0	12.03	31	81.6	13.72	38	83.4	12.60
	81	Average AGV	12	112	14.00	14	121.0	11.50	55	121.0	6.06	79	117.8	7.99
EOFT	77	Avg. % CF	12	-45.55	4.36	26	-32.4	8.56	5	-18.5	7.03	0	-----	-----
	78	Avg. % CF	12	15.74	6.87	27	17.9	6.24	74	15.1	4.64	103	15.2	6.67
EOWT	77	0.6 H2O Avg. %CF	12	-24.90	5.68	18	-25.6	6.19	53	-23.8	4.71	63	-24.8	5.64
	77	1.0 H2O Avg. %CF	12	-17.94	5.45	15	-17.4	6.72	45	-17.8	5.25	59	-16.3	5.71
	77	2.0 H2O Avg. %CF	12	-17.96	8.47	17	-18.1	6.26	50	-17.0	6.72	56	-16.1	6.25
	77	3.0 H2O Avg. %CF	12	-18.23	6.83	16	-21.7	4.96	48	-18.4	6.19	60	-17.7	6.44
EOWT	78	0.6 H2O Avg. %CF	12	10.87	6.16	16	11.2	6.32	48	8.6	6.46	60	11.4	6.90
	78	1.0 H2O Avg. %CF	12	7.54	6.15	17	8.4	7.21	54	5.3	6.30	56	8.9	5.87
	78	2.0 H2O Avg. %CF	12	5.17	5.33	14	4.5	4.74	50	2.8	5.75	58	6.4	6.85
	78	3.0 H2O Avg. %CF	12	-0.54	4.52	16	3.8	6.37	50	-0.6	5.22	62	2.2	6.48