



A Program of ASTM International

Test Monitoring Center

Carnegie Mellon University
6555 Penn Avenue, Pittsburgh, PA 15206, USA

<http://astmtmc.cmu.edu>
412-365-1000

ASTM Test Monitoring Center Semiannual Report

**ASTM D02.B07 Bench Reference Test Monitoring
From October 1, 2011 through March 31, 2012**

**[D6417](#), [D5800](#), D6335 ([TEOST](#)), D7097 ([MTEOS](#)),
D5133 ([GI](#)), [D6082](#), [D874](#) and D7528 ([ROBO](#))**

Executive Summary Page 1 of 2

Calibrated Labs and Instruments as of 20120331

Test	Labs	Instruments
D6417	5	7
D5800	6	15
GI	5	8
TEOST	4	5
MTEOS	6	24
D6082	3	4
D874	3	---
ROBO	7	20

D5800 Evaporation Loss of Lubricating Oils by the Noack Method

- Long-term severe trend with an unexplained increase in severity since 01JUL06
- Oil 52 continues to perform more than 1 s severe (Attachment 3)
- Since April 1, 2009, 23 of 26 statistically failing tests were severe fails on oil 52
- Surveillance Panel is trying to address severity issue
 - Operational survey issued to participating labs
 - Teleconference scheduled for June 2012

ASTM D02.B07 Bench Reference Test Monitoring From October 1, 2011 through March 31, 2012

Executive Summary Page 2 of 2

D5133: Gelation Index (GI)

- Precision this period is more precise than any prior report period since the TMC began monitoring this test in 1996
- Past two periods show marked improvement in all monitored markers:
 - Improved precision
 - Performance close to targets
 - Greatly decreased fail rate

D7097 MHT-4 TEOST

- Reference Oil 74 has been fully phased out per surveillance panel request
- Catalyst Batch 1201 introduced

D7528: Bench Oxidation of Engine Oils by ROBO Apparatus

- Precision (Pooled s) is much more precise than the prior four report periods

D6417: Estimation of Engine Oil Volatility by Capillary GC

MONITORED TESTING ACTIVITY

TABLE 1

Reference Tests Reported to the TMC This Period (6 labs reporting)

	No. of Tests
Statistically Acceptable and Operationally Valid (AC)	14
Operationally Valid but Statistically Unacceptable (OC)	0
Operationally Invalid (initially reported as) (LC, XC)	0
Operationally Invalid (after informed of failing calibration) (RC)	2
Total	16

Fail Rate of Operationally Valid Tests: 0%

- Two consecutive operationally invalid tests reported on same instrument, initially reported as operationally valid but failed severe. Subsequent inspection found faulty motherboard connection, clogged jets and broken sample inlet. Instrument repaired and passed TMC calibration. Lab reports no client tests were affected.

TABLE 2

Statistically Unacceptable Tests (OC)

Reason for Fail	No. of Tests
Area % Volatized @ 371°C Severe	0
Area % Volatized @ 371°C Mild	0

TMC MEMORANDA

- No D6417 TMC technical updates this period.

D6417 PRECISION AND SEVERITY

TABLE 3
Period Precision and Severity Estimates

Area % Volatized @ 371°C	N	df	Pooled s	Mean Δ/s
Initial Round Robin Study	107	101	0.46	-----
4/1/09 through 9/30/09	15	12	0.34	0.23
10/1/09 through 3/31/10	13	10	0.33	0.08
4/1/10 through 9/30/10	16	13	0.30	0.41
10/1/10 through 3/31/11	20	17	0.38	0.06
4/1/11 through 9/30/11	16	13	0.37	0.21
10/1/11 through 3/31/12	14	11	0.24	0.17

TABLE 4
Current Period Severity Estimates by Lab

	N	Mean Δ/s
Lab A	4	0.52
Lab B	2	0.94
Lab D	4	-0.10
Lab G	1	-0.37
Lab H	1	0.30
Lab S	2	-0.53

- Precision (Pooled s) is more precise than prior periods
 - More precise than the target precision
- Performance (Mean Δ/s) is slightly severe at 0.17 s
- [Figure 1](#) shows a slight severe trend since the 01OCT08 timeline

D5800: Evaporation Loss of Lubricating Oils by the Noack Method

MONITORED TESTING STATUS

TABLE 5

Reference Tests Reported to the TMC This Period (8 labs reporting)

	No. of Tests
Statistically Acceptable and Operationally Valid (AC)	27
Operationally Valid but Statistically Unacceptable (OC)	5
Operationally Invalid (initially reported as) (LC, XC)	0
Operationally Invalid (after informed of failing calibration) (RC)	0
Total	32

Fail Rate of Operationally Valid Tests: 16%

- No operationally invalid tests reported this period.

TABLE 6

Statistically Unacceptable Tests (OC)

Reason for Fail	No. of Tests
Sample Evaporation Loss Severe	5
Sample Evaporation Loss Mild	0

- Four severe OC tests on oil 52, one on oil 58
- Five passing AC results on oil 52 this period

TMC MEMORANDA

- No D5800 TMC technical updates this period.

D5800 PRECISION AND SEVERITY

TABLE 7
Period Precision and Severity Estimates

Sample Evaporation Loss, mass %	n	df	Pooled s	Mean Δ/s
New Targets Effective 7/21/2003	102	99	0.70	-----
4/1/07 through 9/30/07	36	33	0.50	0.92
10/1/07 through 3/31/08	34	31	0.50	0.75
4/1/08 through 9/30/08	36	33	0.54	0.82
10/1/08 through 3/31/09	36	33	0.84	0.51
4/1/09 through 9/30/09	36	33	0.56	0.88
10/1/09 through 3/31/10	35	32	0.69	0.56
4/1/10 through 9/30/10	34	31	0.67	0.64
10/1/10 through 3/31/11	34	31	0.76	0.49
4/1/11 through 9/30/11	39	36	0.59	0.77
10/1/11 through 3/31/12	32	29	0.78	0.54

TABLE 8
Current Period Precision and Severity Estimates by Test Method Procedure

Sample Evaporation Loss, mass %	n	df	Pooled s	Mean Δ/s
Procedure A	0	0	---	---
Procedure B	29	26	0.67	0.71
Procedure C	3	0	---	-1.18

TABLE 9
Current Period Severity Estimates by Lab

	n	Mean Δ/s
Lab A	5	0.52
Lab B	12	0.30
Lab D	2	-1.05
Lab F	2	1.03
Lab G	4	0.95
Lab H	1	-1.11
Lab I	4	1.52
Lab J	2	1.14



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D5800: Evaporation Loss of Lubricating Oils by the Noack Method

- Precision (Pooled s) is less precise than the previous period
 - Slightly less precise than the target precision
- Performance (Mean Δ/s) is severe at 0.54 s
 - Six of eight participating labs performing severe at some level
- [Figure 2A](#) shows a long-term severe trend with an unexplained increase in severity since the 01JUL06 timeline
- Oil 52 continues to perform more than 1 s severe (Attachment 3)
 - Four of five statistically failing results this period were on oil 52
 - Also had five passing results on oil 52
- Since April 1, 2009, 23 of 26 statistically failing tests were on oil 52
 - All failed severe of acceptance bands.

D5133: Gelation Index (GI)

MONITORED TESTING STATUS

TABLE 10

Reference Tests Reported to the TMC This Period (7 labs reporting)

	No. of Tests
Statistically Acceptable and Operationally Valid (AC)	24
Operationally Valid but Statistically Unacceptable (OC)	0
Operationally Invalid (initially reported as) (LC, XC)	1
Operationally Invalid (after informed of failing calibration) (RC)	0
Total	25

Fail Rate of Operationally Valid Tests: 0%

- One test reported aborted (XC) by power failure

TABLE 11

Statistically Unacceptable Tests (OC)

Reason for Fail	No. of Tests
Gelation Index Severe	0
Gelation Index Mild	0

TMC MEMORANDA

- No D5133 (GI) TMC technical updates this period.

D5133 (GI) PRECISION AND SEVERITY

TABLE 12
Period Precision and Severity Estimates

Gelation Index	n	df	Pooled s	Mean Δ/s
Revised Targets Effective 20030715	68	65	2.86	-----
10/1/06 through 3/31/07	29	26	3.23	-0.68
4/1/07 through 9/30/07	24	21	3.35	-0.28
10/1/07 through 3/31/08	26	23	4.13	-0.31
4/1/08 through 9/30/08	27	24	3.54	0.18
10/1/08 through 3/31/09	24	21	2.32	0.10
4/1/09 through 9/30/09	33	30	2.79	-0.10
10/1/09 through 3/31/10	31	28	2.37	-0.15
4/1/10 through 9/30/10	24	21	3.89	0.12
10/1/10 through 3/31/11	33	30	3.17	-0.53
4/1/11 through 9/30/11	23	20	1.70	-0.25
10/1/11 through 3/31/12	24	21	1.36	0.06

TABLE 13
Current Period Severity Estimates by Lab

	n	GI Mean Δ/s
Lab A	6	-0.34
Lab B	6	-0.32
Lab D	2	0.44
Lab G	3	0.58
Lab H	1	0.14
Lab I	2	0.90
Lab S	4	0.23



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D5133: Gelation Index (GI)

- Precision (Pooled s) is more precise than the previous period
 - More precise than the target precision
 - **Precision this period is more precise than any prior report period since the TMC began monitoring this test in 1996**
- Severity (Mean Δ/s) is on target at 0.06 s
- [Figure 3A](#) shows a shift to mild since the JAN11 timeline with recent leveling to on-target performance
- Past two periods show marked improvement in all monitored markers:
 - Improved precision
 - Performance close to targets
 - Greatly decreased fail rate

D6335: TEOST-33C

MONITORED TESTING STATUS

TABLE 14

Reference Tests Reported to the TMC This Period (5 labs reporting)

	No. of Tests
Statistically Acceptable and Operationally Valid (AC)	11
Operationally Valid but Statistically Unacceptable (OC)	5
Operationally Invalid (initially reported as) (LC, XC)	0
Operationally Invalid (after informed of failing calibration) (RC)	0
Total	16

Fail Rate of Operationally Valid Tests: 31%

- No operationally invalid tests reported this period

TABLE 15

Statistically Unacceptable Tests (OC)

Reason for Fail	No. of Tests
Total Deposits Severe	3
Total Deposits Mild	2

TMC MEMORANDA

- No D6335 (TEOST-33C) TMC technical updates this period.



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D6335 (TEOST-33C) PRECISION AND SEVERITY

TABLE 16
Period Precision and Severity Estimates

Total Deposits	n	df	Pooled s	Mean Δ/s
Initial Round Robin Study	54	52	4.18	-----
4/1/08 through 9/30/08	15	13	6.99	0.20
10/1/08 through 3/31/09	18	16	4.90	0.98
4/1/09 through 9/30/09*	14	10	8.24	0.32
4/1/09 through 9/30/09*	13	9	3.71	0.68
10/1/09 through 3/31/10*	12	8	14.36	0.85
10/1/09 through 3/31/10*	11	7	6.46	0.18
4/1/10 through 9/30/10	16	12	4.70	0.16
10/1/10 through 3/31/11	14	10	6.25	0.14
4/1/11 through 9/30/11	19	15	6.52	-0.27
10/1/11 through 3/31/12	16	12	8.60	0.37

*Period statistics with and without a single very severe result included

TABLE 17
Current Period Severity Estimates by Lab

	n	Mean Δ/s
Lab A	5	0.41
Lab B	4	2.13
Lab D	2	-0.51
Lab G	2	-0.11
Lab V	3	-1.17

D6335: TEOST-33C

- Precision (Pooled s) is significantly less precise than recent prior periods
 - Remains less precise than the target precision
- Performance (Mean Δ/s) is severe at 0.37 s
 - Three results over 3 s from target
 - Two severe, lab B
 - One mild, lab A
 - Most extreme was 4.4 s severe
- [Figure 4](#) shows a severity CUSUM plot
- All tests this period reported using Rod Batch J

D7097: MHT-4 TEOST

MONITORED TESTING STATUS

TABLE 18

Reference Tests Reported to the TMC This Period (7 labs reporting)

	No. of Tests
Statistically Acceptable and Operationally Valid (AC)	51
Operationally Valid but Statistically Unacceptable (OC)	5
Operationally Invalid (initially reported as) (LC, XC)	1
Operationally Invalid (after informed of failing calibration) (RC)	1
Non-Reference Shakedown (NN), excluded from statistics	1
Total	59

Fail Rate of Operationally Valid Tests: 9%

- One test aborted (XC) because of spilled test sample during setup
- One test declared invalid by TMC (RC) because catalyst mass was not in compliance with test method
- One sample requested decoded (NN) to tune instrument after severe fail and before successfully re-calibrating

TABLE 19

Statistically Unacceptable Tests (OC)

Reason for Fail	No. of Tests
Total Deposits Severe	4
Total Deposits Mild	1

- All four severe failing results on severe performing reference oil 432
- One mild failing result on reference oil 434

TMC MEMORANDA

- No D7097 (MHT-4 TEOST) TMC technical updates this period.

D7097 (MHT-4 TEOST) PRECISION AND SEVERITY

TABLE 20
Period Precision and Severity Estimates

Total Deposits	n	df	Pooled s	Mean Δ/s
Updated Targets Effective 7/31/06	90	87	5.62	-----
4/1/07 through 9/30/07	48	45	7.68	0.32
10/1/07 through 3/31/08	46	43	7.41	-0.21
4/1/08 through 9/30/08	46	43	6.09	0.01
10/1/08 through 3/31/09	53	50	5.25	0.73
4/1/09 through 9/30/09	48	45	4.35	-0.08
10/1/09 through 3/31/10	43	40	5.46	-0.19
4/1/10 through 9/30/10	55	52	4.45	-0.12
10/1/10 through 3/31/11	55	52	7.59	0.27
4/1/11 through 9/30/11	46	43	6.00	0.03
10/1/11 through 3/31/12	56	54	5.88	0.09

TABLE 21
Current Period Severity Estimates by Lab

	n	Mean Δ/s
Lab A	15	0.33
Lab AK	1	0.95
Lab B	17	-0.51
Lab D	6	-0.45
Lab G	13	0.51
Lab J	3	1.86
Lab V	1	-1.48

D7097 MHT-4 TEOST

- Precision (Pooled s) is more precise than the previous period
 - Slightly less precise than the target precision
- Performance (Mean Δ/s) is on target again this period at 0.09 s
 - [Figure 5](#) shows severity CUSUM Plot with nearly on-target performance
- All tests this period reported using Rod Batch J
- 39 operationally valid tests reported using catalyst batch 1011
- 17 operationally valid tests reported using catalyst batch 1201
- First report period with all oils 432 and 434 runs, no oil 74, which has been phased out

D6082: High Temperature Foaming Characteristics of Oils

MONITORED TESTING STATUS

TABLE 22

Reference Tests Reported to the TMC This Period (3 labs reporting)

	No. of Tests
Statistically Acceptable and Operationally Valid (AC)	8
Acceptable Discrimination (AS)	3
Operationally Valid but Statistically Unacceptable (OC)	0
Operationally Invalid (initially reported as) (LC, XC)	0
Operationally Invalid (after informed of failing calibration) (RC)	0
Total	11

Fail Rate of Operationally Valid Tests: 0%

- No operationally invalid tests reported this period

TABLE 23

Statistically Unacceptable Tests (OC)

Reason for Fail	No. of Tests
Foam Tendency Severe	0
Foam Tendency Mild	0

TMC MEMORANDA

- No D6082 TMC technical updates this period

D6082 PRECISION AND SEVERITY

TABLE 24
Period Precision and Severity Estimates

1007 Foam Tendency, ml	n	Mean	s	Mean Δ/s
Initial Round Robin Study (targets)	28	65.71	19.28	-----
4/1/09 through 9/30/09	10	61	10	-0.26
10/1/09 through 3/31/10	8	59	10	-0.38
4/1/10 through 9/30/10	8	65	16	-0.05
10/1/10 through 3/31/11	8	61	10	-0.25
4/1/11 through 9/30/11	9	80	26	0.74
10/1/11 through 3/31/12	8	65	13	-0.05

TABLE 25
Period Precision and Severity Estimates

1007 Foam Stability @ 1 min., ml	n	Mean	s
Initial Round Robin Study	28	0.00	0.00
4/1/09 through 9/30/09	10	No non-zero occurrences	
10/1/09 through 3/31/10	8	No non-zero occurrences	
4/1/10 through 9/30/10	8	No non-zero occurrences	
10/1/10 through 3/31/11	8	No non-zero occurrences	
4/1/11 through 9/30/11	9	No non-zero occurrences	
10/1/11 through 3/31/12	8	No non-zero occurrences	

TABLE 26
Current Period Severity Estimates by Lab
TMC 1007

	n	Foam Tendency Mean Δ/s
Lab A	2	0.74
Lab B	4	-0.58
Lab G	2	0.21

D6082: High Temperature Foaming Characteristics of Oils

- Foam Tendency Precision (Pooled s) is more precise than last period
 - More precise than target precision
 - Last period had unusually poor precision, back on track this period
- Foam Tendency performance (Mean Δ/s) is on-target at -0.05 s
 - [Figure 6](#) shows a severity CUSUM plot for Foam Tendency
- There were no non-zero occurrences of Foam Stability on 1007
 - Suggests Foam Stability precision is as expected
- All operationally valid discrimination tests reported this period meet the acceptance criteria (that is, all reporting labs could discriminate oil 66 as a GF-5/SN failing oil for Foam Tendency).

D874: Sulfated Ash from Lubricating Oils and Additives

MONITORED TESTING STATUS

TABLE 27

Reference Tests Reported to the TMC This Period (3 labs reporting)

	No. of Tests
Statistically Acceptable and Operationally Valid (AC)	6
Operationally Valid but Statistically Unacceptable (OC)	0
Operationally Invalid (initially reported as) (LC, XC)	0
Operationally Invalid (after informed of failing calibration) (RC)	0
Total	6

Fail Rate of Operationally Valid Tests: 0%

- No operationally invalid tests reported this period

TABLE 28

Statistically Unacceptable Tests (OC)

Reason for Fail	No. of Tests
Sulfated Ash Severe	0
Sulfated Ash Mild	0

TMC MEMORANDA

- No D874 TMC technical updates this period.

D874 PRECISION AND SEVERITY

TABLE 29
Period Precision and Severity Estimates

Gelation Index	n	df	Pooled s	Mean Δ/s
Initial Round Robin Targets	81	79	0.07	-----
4/1/07 through 9/30/07	2	1	0.01	-0.50
10/1/07 through 3/31/08	5	2	0.11	-0.41
4/1/08 through 9/30/08	6	3	0.04	-0.62
10/1/08 through 3/31/09	6	3	0.07	-1.23
4/1/09 through 9/30/09	7	4	0.03	-0.41
10/1/09 through 3/31/10	7	4	0.04	-0.23
4/1/10 through 9/30/10	5	2	0.03	0.11
10/1/10 through 3/31/11	6	3	0.05	0.11
4/1/11 through 9/30/11	6	3	0.01	-0.28
10/1/11 through 3/31/12	6	4	0.02	0.25

TABLE 30
Current Period Severity Estimates by Lab

	n	Mean Δ/s
Lab A	2	0.46
Lab B	2	0.31
Lab G	2	-0.04

- Precision (Pooled s) is more precise than the target precision
- Performance (Mean Δ/s) is severe at 0.25 s
- [Figure 7](#) shows a CUSUM severity plot

D7528: Bench Oxidation of Engine Oils by ROBO Apparatus

MONITORED TESTING STATUS

TABLE 31

Reference Tests Reported to the TMC This Period (8 labs reporting)

	No. of Tests
Statistically Acceptable and Operationally Valid (AC)	87
Operationally Valid but Statistically Unacceptable (OC)	6
Operationally Invalid (initially reported as) (LC, XC)	11
Operationally Invalid (after informed of failing calibration) (RC)	1
Non-reference Rig Shakedown, excluded from statistics	12
Total	117

Fail Rate of Operationally Valid Tests: 6%

- 5 tests invalid or aborted due to vacuum leak
- 2 tests invalid because of incorrect airflow
- 1 test aborted due to TMC assignment error
- 1 test aborted because heating time exceeded test specification
- 1 test aborted due to heating mantle failure
- 1 test aborted by power failure
- 1 test aborted due to excessive EOT volatiles (MRV not completed)

TABLE 32

Statistically Unacceptable Tests (OC)

Reason for Fail	No. of Tests
Natural Log MRV Viscosity Severe	2
Natural Log MRV Viscosity Mild	4

TMC MEMORANDA

- No D7528 ROBO TMC technical updates this period.

D7528 ROBO PRECISION AND SEVERITY

TABLE 33
Period Precision and Severity Estimates

Natural Log (MRV Viscosity)	n	df	Pooled s	Mean Δ/s
Initial Round Robin Targets	42	39	0.2309	-----
8/31/08 through 3/31/09	22	19	0.2302	-0.47
4/1/09 through 9/30/09	26	23	0.1872	-0.58
10/1/09 through 3/31/10	59	56	0.3989	-0.24
4/1/10 through 9/30/10	114	110	0.5134	-0.26
10/1/10 through 3/31/11*	121	118	0.7092	0.29
10/1/10 through 3/31/11*	120	117	0.4628	0.05
4/1/11 through 9/30/11	96	92	0.2593	-0.69
10/1/11 through 3/31/12	93	90	0.2068	-0.39

*Period results with a result of more than 29 s severe included and excluded.

TABLE 34
Current Period Severity Estimates by Lab

	n	Mean Δ/s
Lab A	23	-0.50
Lab AM	16	-0.37
Lab AN	4	-1.13
Lab AO	3	-0.30
Lab AQ	3	-0.50
Lab B	15	-0.85
Lab D	4	0.17
Lab G	25	0.01

D7528: Bench Oxidation of Engine Oils by ROBO Apparatus

- Precision (Pooled s) is more precise than the target precision
 - Much more precise than the prior four report periods
- Performance (Mean Δ/s) is mild at -0.39 s
 - Six of eight calibrating labs performing mild to some extent
 - Lab G on target with 25 tests for the report period
 - All three reference oils performing mild (Attachment 3)
- Severity is graphically represented in [Figure 8](#)



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D6922: Determination of Homogeneity and Miscibility in Automotive Engine Oils

The TMC distributes six reference oils for D6922 testing. The TMC does not collect data or monitor any test results for this test at this time.

D7563: Evaluation of the Ability of Engine Oil to Emulsify Water and Simulated Ed85 Fuel

The TMC distributes two reference oils for D7563 testing. The TMC does not collect data or monitor any test results for this test at this time.

REFERENCE OIL SUPPLIES

There is adequate supply of B0.07 Bench Test reference oils at the TMC.

Table 35A
Current Reference Oils

Oil	For Tests	Quantity Left (gallons)	Quantity Used Last 12 Months (gallons)
52	D6417, D5800	62.9	0.8
55	D6417, D5800	68.3	0.5
58	D6417, D5800, GI	119.1	0.6
62	GI	1.7	0.1
66	D6082	92.7	1.2
71-1	TEOST	12 samples	0.0
72-1	TEOST	4 samples	0.0
75	MTEOS	7.9	1.1
90	D874 & D874 Daily	37.0	1.1
91	D874	4.6	0.0
**432	MTEOS	Adequate	-----
434	MTEOS	5.2	0.3
820-2	D874	10.6	0.0
**1007	D6082	15.2	-----
**1009	GI	Adequate	-----
*434-1	ROBO	Adequate	-----
*435-1	ROBO	Adequate	-----
*435-2	ROBO/MTEOS	Adequate	-----
*438	ROBO	Adequate	-----

*One drum of oil is set aside for bench calibration testing; the TMC has a larger supply of this oil.

**Multi-Test Oil, estimated aliquot set aside for bench testing.

REFERENCE OIL SUPPLIES, continued

Table 35B
Obsolete or Test Development Reference Oils

Oil	For Tests	Quantity Left (gallons)	Quantity Used Last 12 Months (gallons)
^51	Obsolete Vol. & GI	94.6	0.0
^53	Obsolete Vol. & GI	96.8	0.0
^54	Obsolete Volatility	97.8	0.0
71	Obsolete TEOST	4 Samples	-----
72	Obsolete TEOST	2 Samples	-----
74	Obsolete MTEOS	0.2	0.1
^83	Obsolete ROBO	47.3	0.0
^84	Obsolete ROBO	3.3	0.0
^85	Obsolete ROBO	3.3	0.0
^**433	Obsolete MTEOS	Adequate	-----
435	Obsolete ROBO	7 Samples	-----

^Test development oil; holding for instructions from Surveillance Panel.

**Multi-Test Oil, estimated aliquot set aside for bench testing.

Table 35C
Homogeneity and Miscibility Reference Oils

Oil	For Tests	Quantity Left (gallons)	Quantity Used Last 12 Months (gallons)
HMA	H&M (D6922)	162.9	6.1
HMB	H&M (D6922)	166.9	6.1
HMC	H&M (D6922)	152.9	6.1
HMD	H&M (D6922)	160.7	6.1
HME	H&M (D6922)	146.7	6.1
HMF	H&M (D6922)	169.2	6.1



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REFERENCE OIL SUPPLIES, continued

Table 35D
Emulsion Retention Reference Oils

Oil	For Tests	Quantity Left (gallons)	Quantity Used Last 12 Months (gallons)
EM2	Emulsion Retention	8.7	0.3
EM2-	Emulsion Retention	25.0	0.0
EM5	Emulsion Retention	8.7	0.3
EM5-	Emulsion Retention	25.0	0.0

SHIPPING ALIQUOTS

D6417 1 ml
D6417QC 118 ml
D5800 100 ml
GI 25 ml
MTEOS 17 ml
TEOST 125 ml
D6082 525 ml
D874 32 ml
D874QC 1000 ml
ROBO 300 ml
ROBOQC 1000 ml
H&M 1000 ml
D7563 1000 ml

Figure 1

D6417 VOLATILITY BY GC INDUSTRY OPERATIONALLY VALID DATA



SAMPLE AREA % VOLATIZED

CUSUM Severity Analysis



Figure 2A

D5800 VOLATILITY BY NOACK INDUSTRY OPERATIONALLY VALID DATA



EVAPORATION LOSS, MASS%

CUSUM Severity Analysis

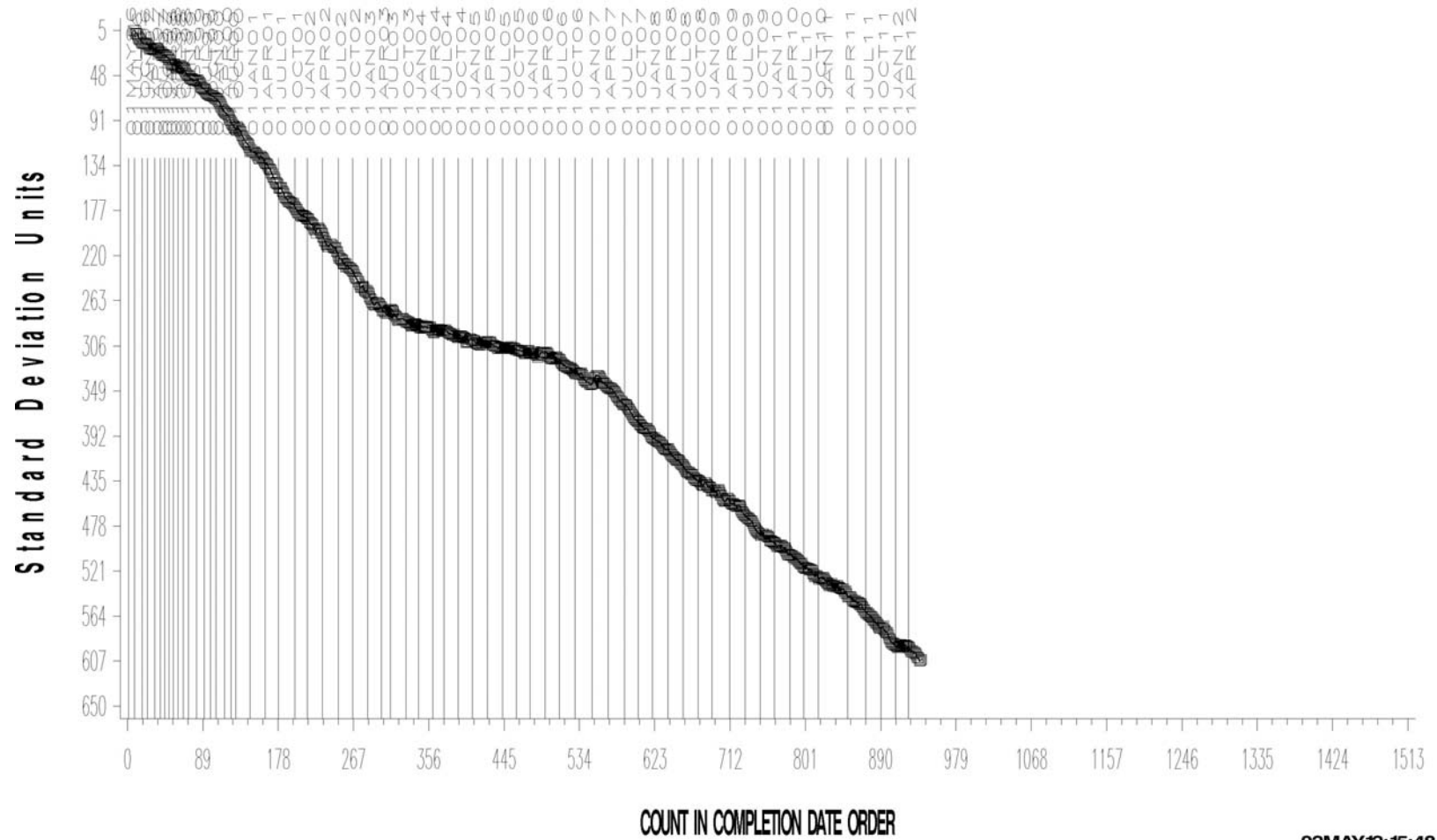


Figure 2B

D5800 VOLATILITY BY NOACK INDUSTRY OPERATIONALLY VALID DATA



EVAPORATION LOSS, MASS%

CUSUM Severity Analysis

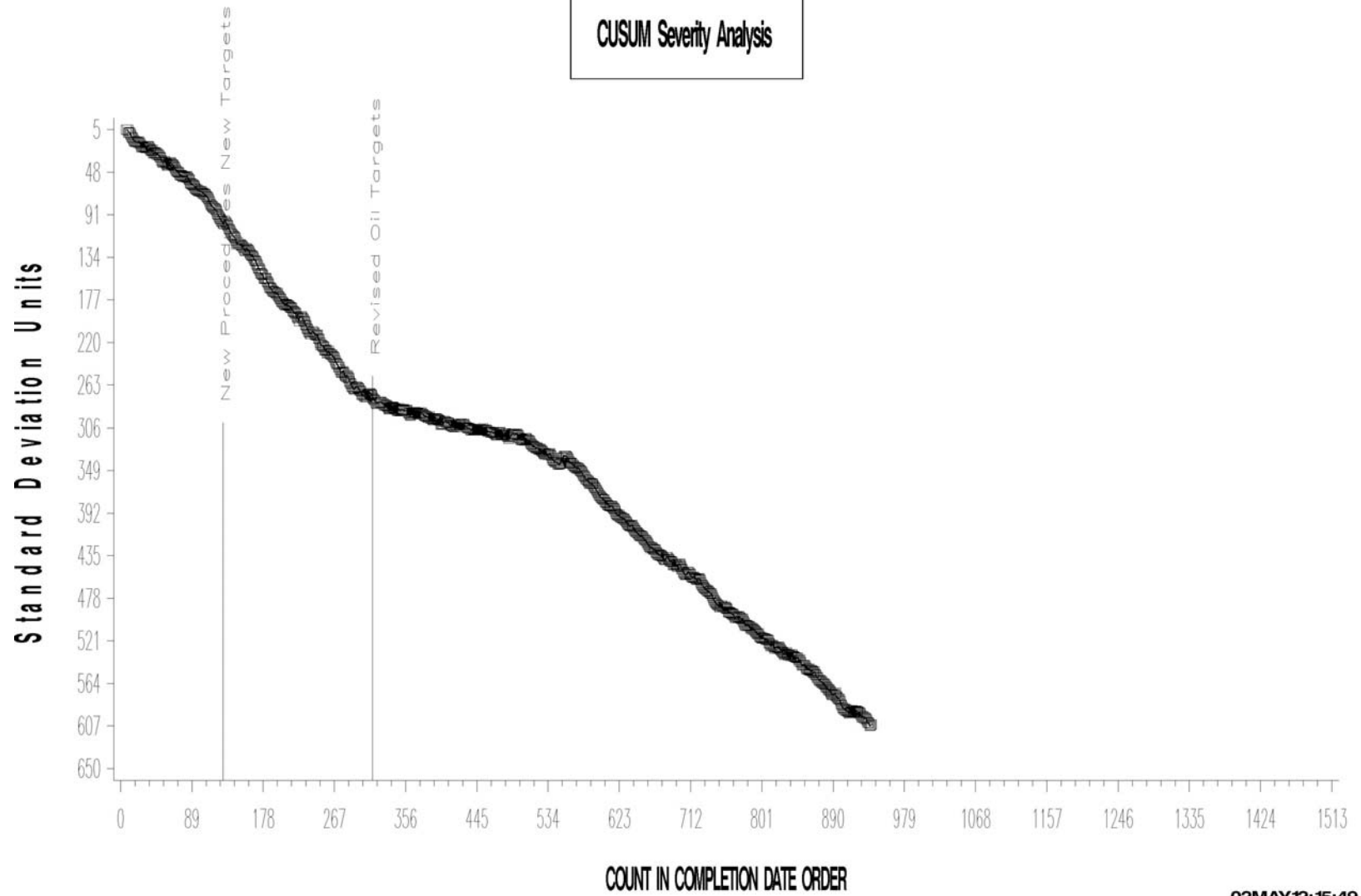


Figure 3A

D5133 GELATION INDEX INDUSTRY OPERATIONALLY VALID DATA



GELATION INDEX

CUSUM Severity Analysis

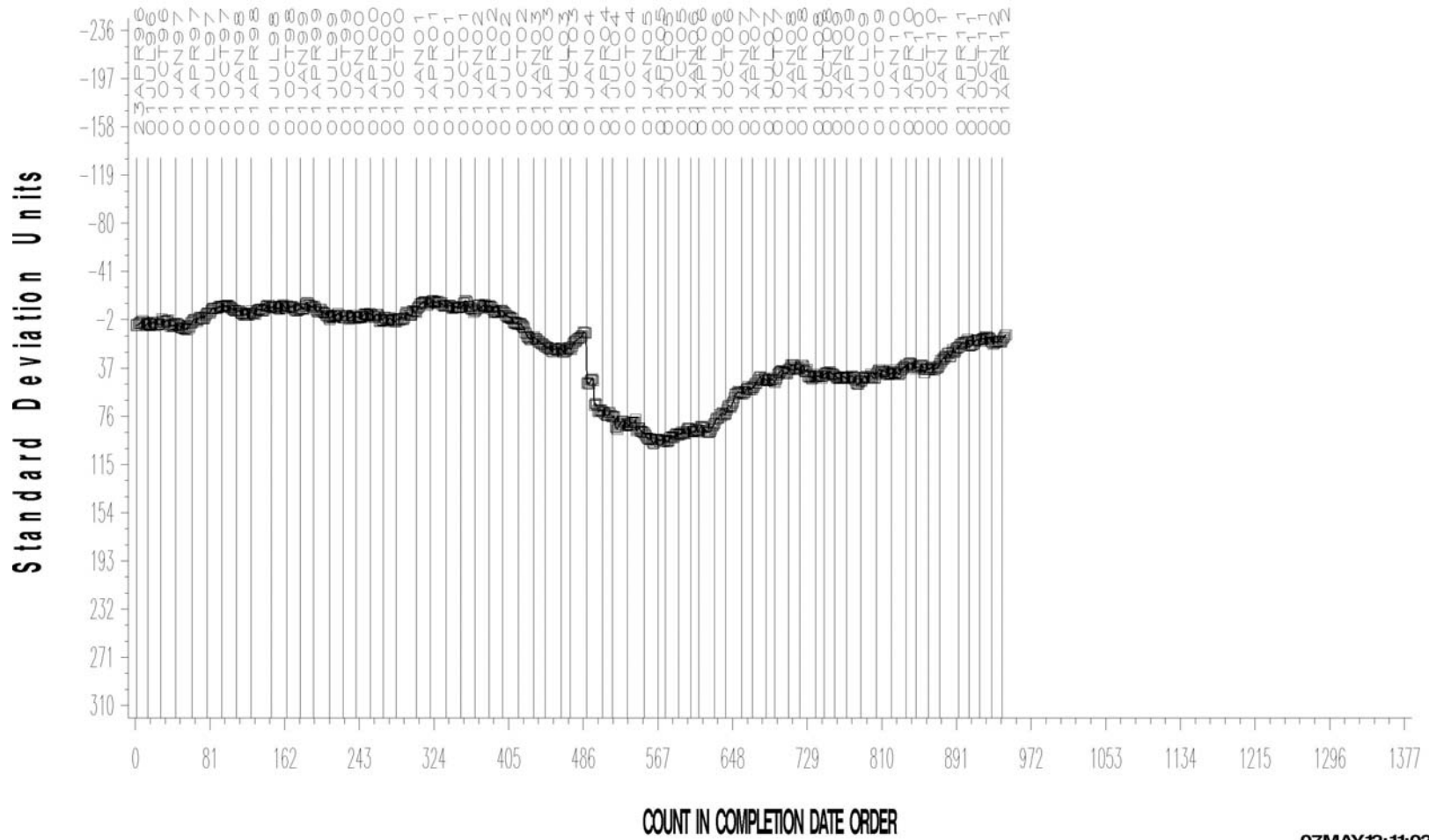
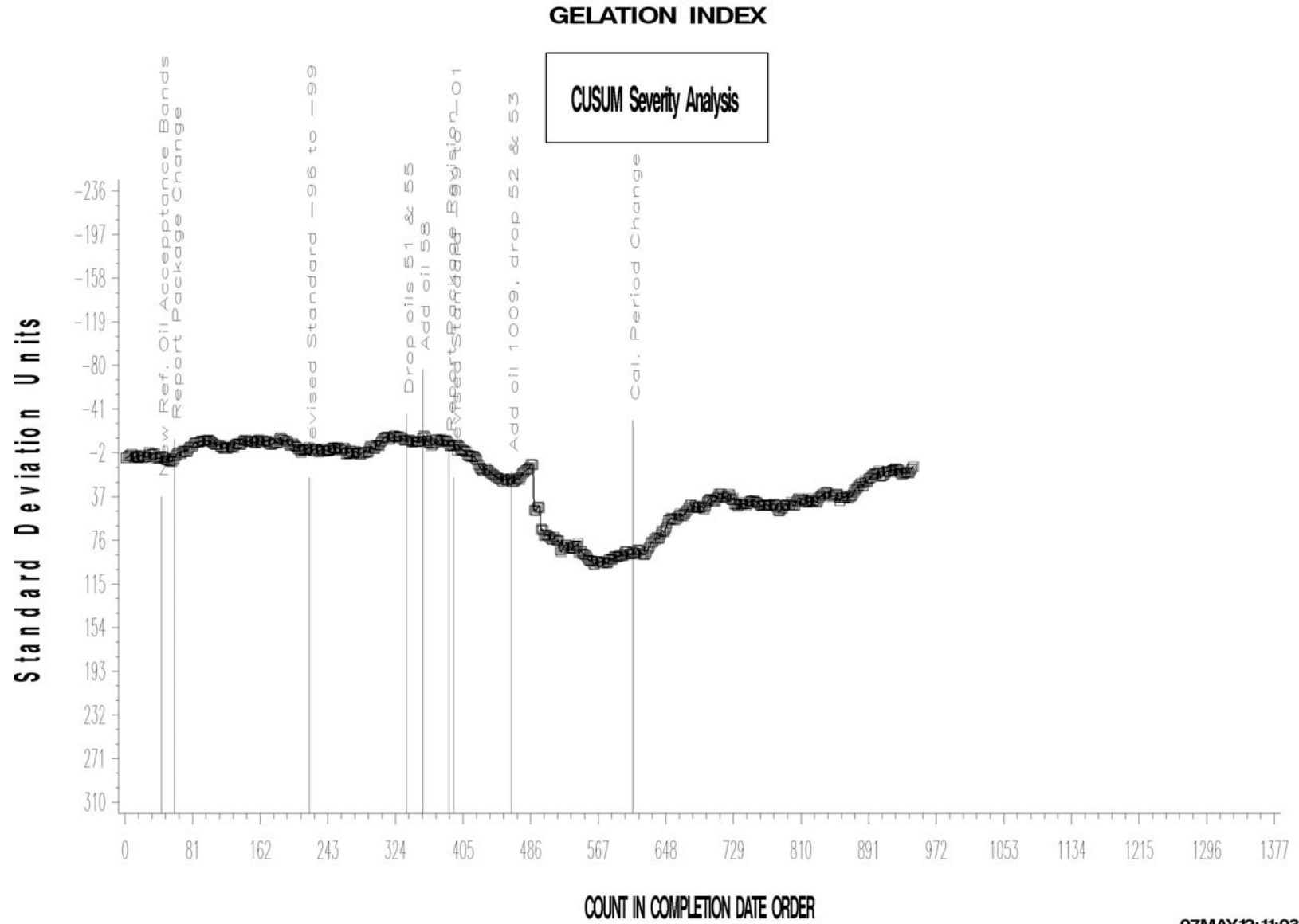


Figure 3B

D5133 GELATION INDEX INDUSTRY OPERATIONALLY VALID DATA



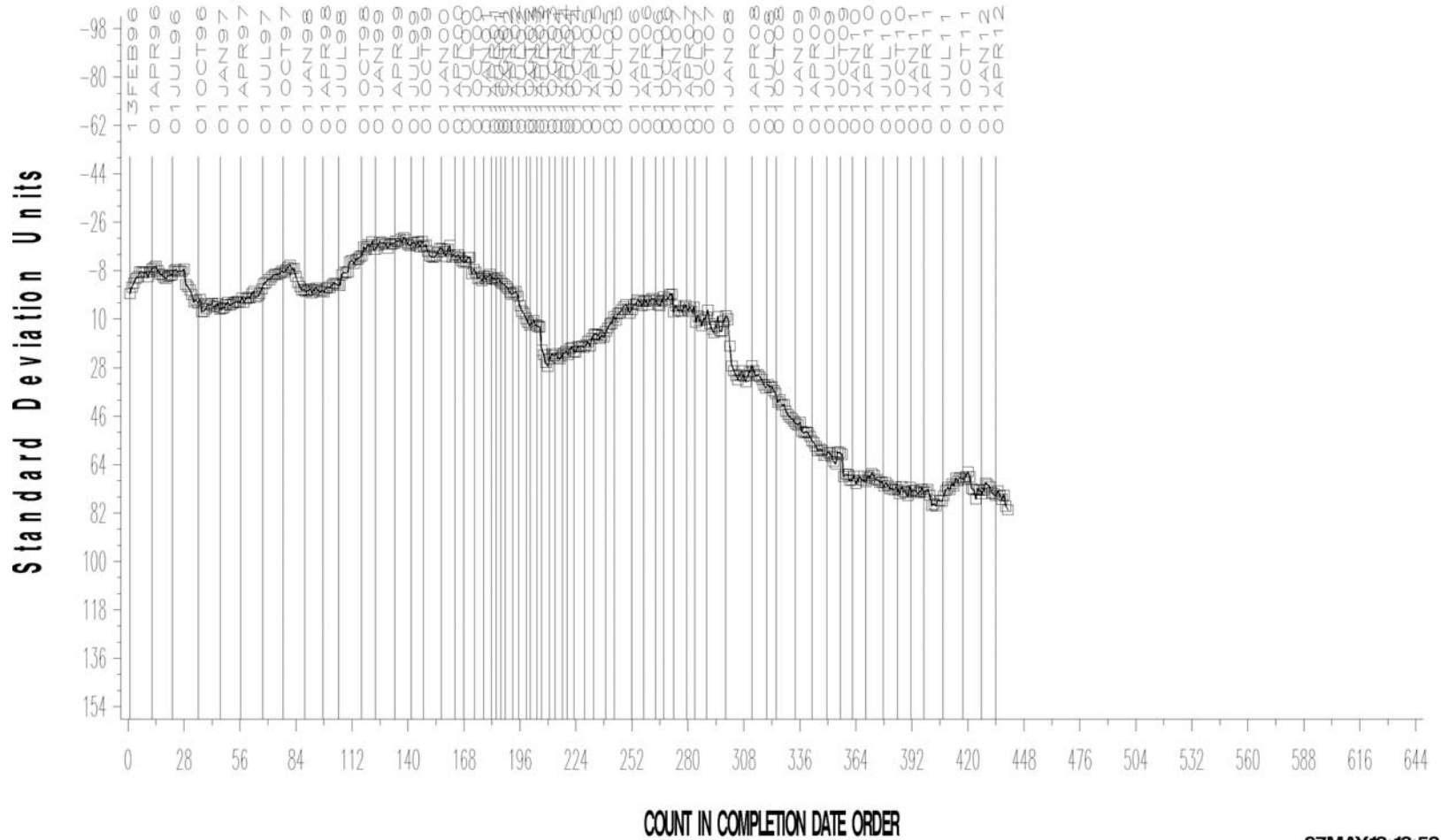
TEOST-33C INDUSTRY OPERATIONALLY VALID DATA



Figure 4

TOTAL DEPOSITS MG

CUSUM Severity Analysis



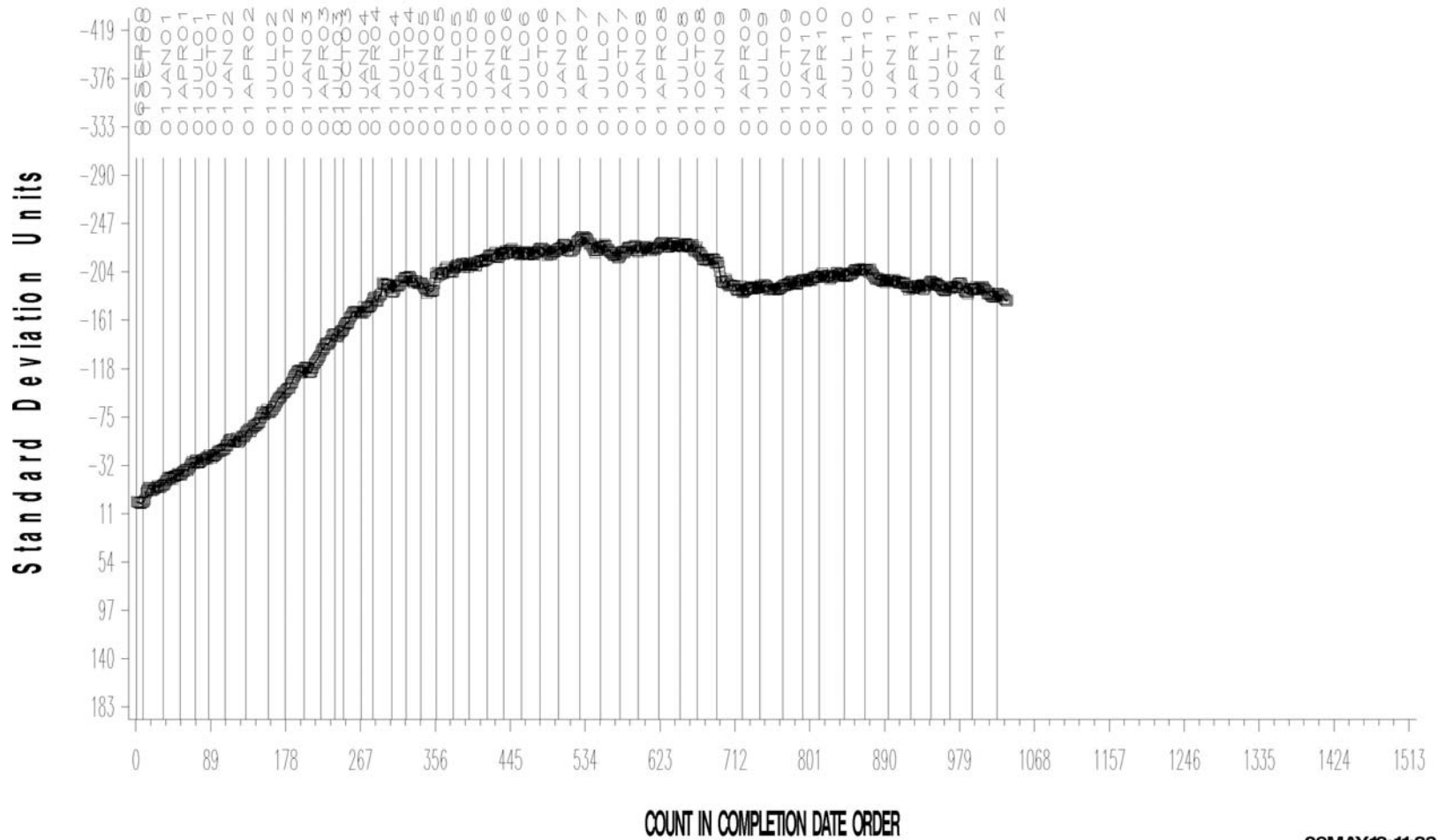
MHT-4 TEOST INDUSTRY OPERATIONALLY VALID DATA



Figure 5A

TOTAL DEPOSITS MG

CUSUM Severity Analysis



MHT-4 TEOST INDUSTRY OPERATIONALLY VALID DATA



Figure 5B

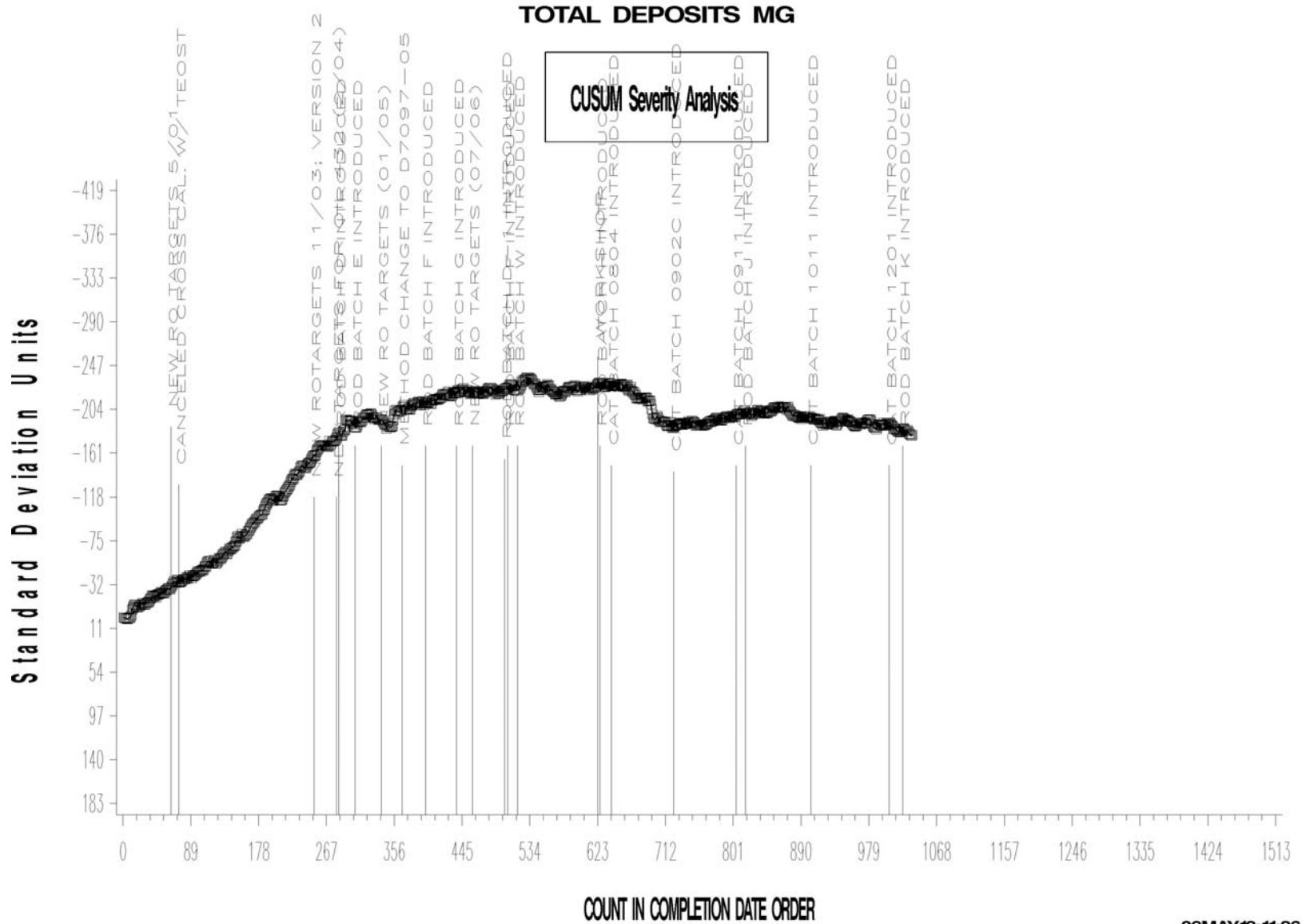


Figure 6

D6082 HIGH TEMPERATURE FOAM INDUSTRY OPERATIONALLY VALID DATA



FOAM TENDENCY

CUSUM Severity Analysis

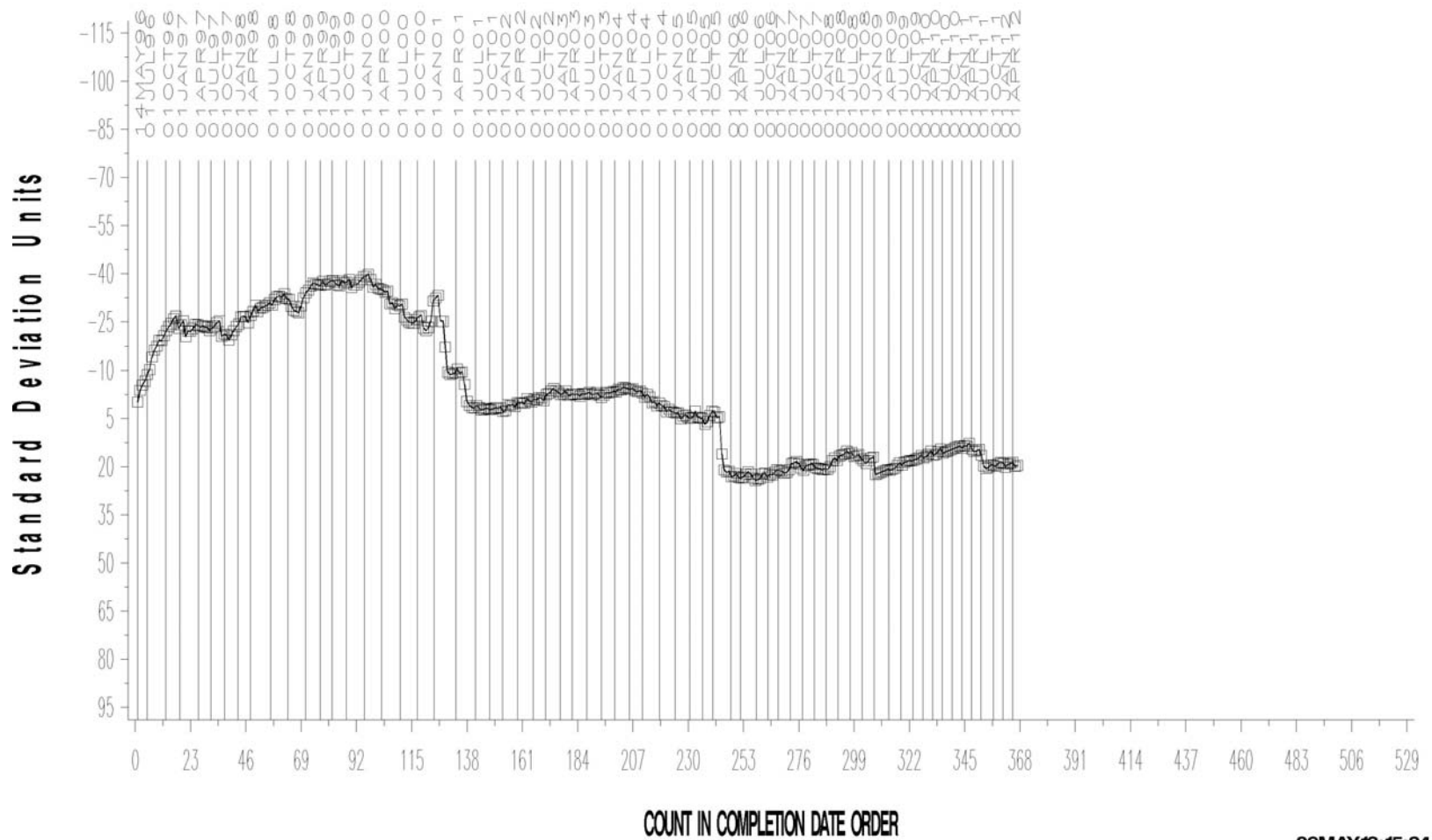


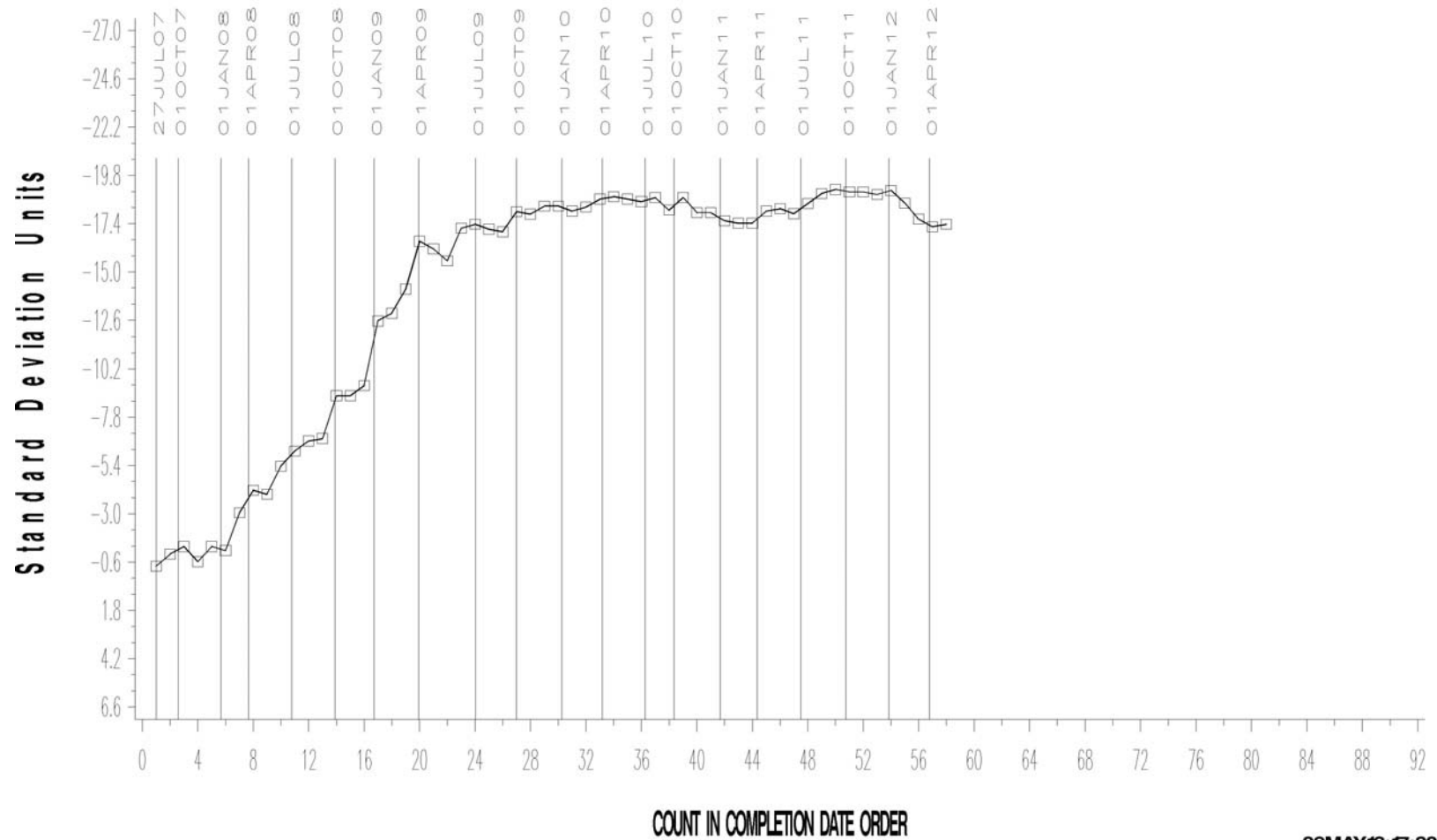
Figure 7

D874 INDUSTRY OPERATIONALLY VALID DATA



TEST SAMPLE PERCENT SULFATED ASH

CUSUM Severity Analysis



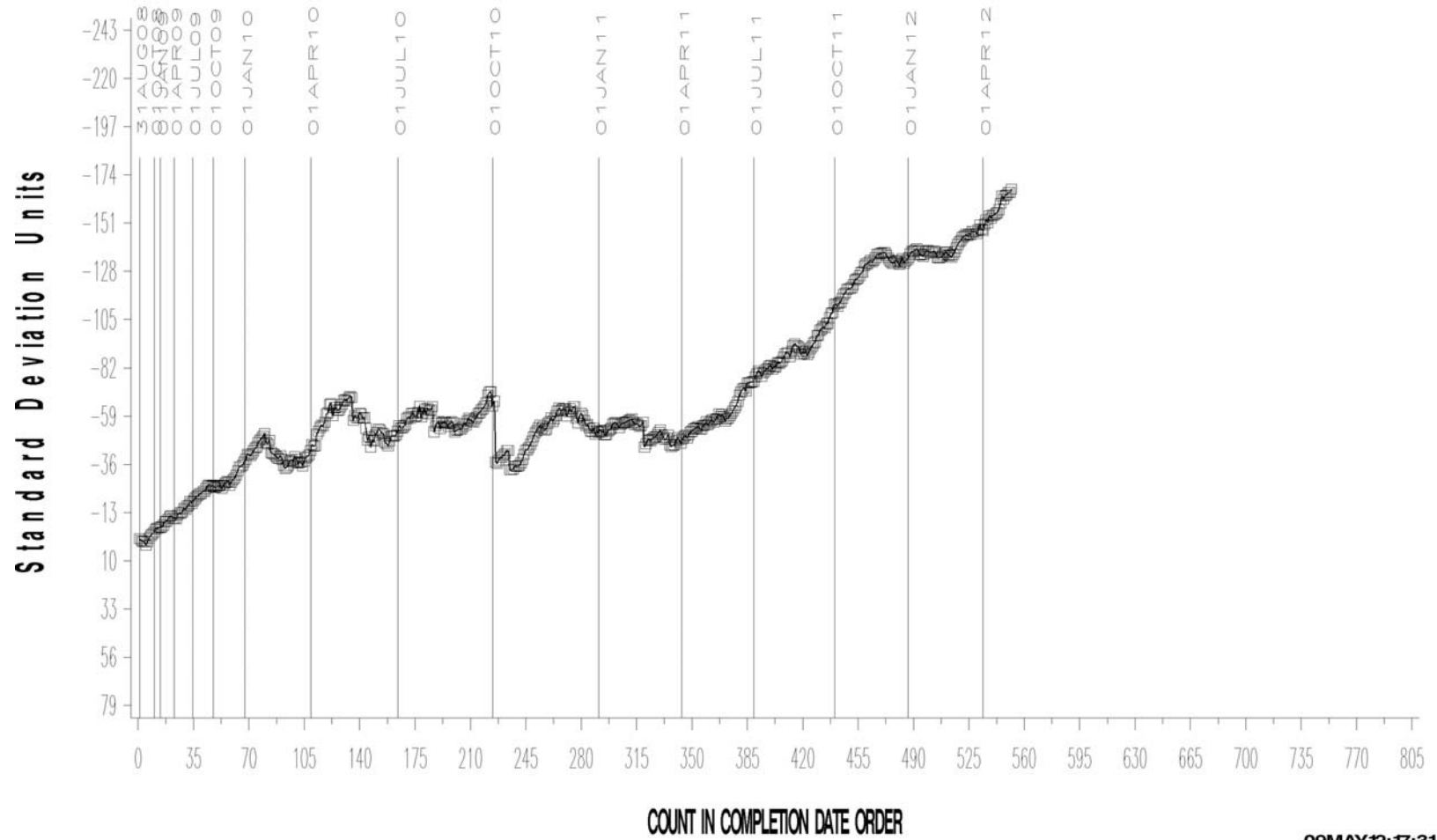
ROBO TEST INDUSTRY OPERATIONALLY VALID DATA



Figure 8

AGED OIL MRV APPARENT VISCOSITY

CUSUM Severity Analysis



**TMC Monitored Bench Tests
Reference Oil Test Targets and Acceptance Bands**

Acceptance Bands

*

Test	Oil Code	Parameter	n	Mean	sR	95%	
						Lower	Upper
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
D5800	52	mass % volatility loss	33	13.75	0.61	12.6	14.9
	55	mass % volatility loss	32	17.09	0.76	15.6	18.6
	58	mass % volatility loss	37	15.20	0.72	13.8	16.6
TEOST by D6335	71-1	Total Deposit wt. (mg)	27	51.79	4.79	42.4	61.2
	72-1	Total Deposit wt. (mg)	27	26.72	3.46	19.9	33.5
	75	Total Deposit wt. (mg)	14	55.16	5.68	44.0	66.3
	435-2	Total Deposit wt. (mg)	15	26.95	2.86	21.3	32.6
MTEOS by D7097	432	Total Deposit wt. (mg)	30	47.04	4.50	38.2	55.9
	434	Total Deposit wt. (mg)	30	27.37	6.57	14.5	40.2
GI by D5133	58	Gelation Index	17	5.8	0.69	4.4	7.2
	62	Gelation Index	35	17.0	3.90	9.4	24.6
	1009	Gelation Index	16	7.3	0.68	6.0	8.6
D6082	1007	Tendency (ml)	28	66	19	29	103
	1007	Stability (ml)	28	0	0	0	0
D6082	66	Tendency (ml)	--	-----	-----	>100	-----
	66	Stability (ml)	--	-----	-----	0	0
D874	90	mass % Sulfated Ash	27	1.07	0.08	0.91	1.23
	91	mass % Sulfated Ash	27	0.82	0.05	0.72	0.92
	820-2	mass % Sulfated Ash	27	1.57	0.08	1.40	1.73
ROBO D7528	434-1	ln MRV, ln(mPa-s)	13	10.6599 (42612)	0.1672	10.3322 (30706)	10.9875 (59130)
	435	ln MRV, ln(mPa-s)	15	11.4895 (97685)	0.2932	11.0021 (60000)	12.0642 (173546)
	435-1	ln MRV, ln(mPa-s)	22	11.0416 (62420)	0.20295	10.7048 (44570)	11.4394 (92910)
	438	ln MRV, ln(mPa-s)	14	10.2676 (28785)	0.2037	9.8683 (19308)	10.6669 (42912)

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

Test	Oil Code	Parameter	Targets			10/1/10 - 3/31/11				4/1/11 - 9/30/11				10/1/11 - 3/31/12			
			n	Mean	sR	n	Mean	sR	Mean Δ/s	n	Mean	sR	Mean Δ/s	n	Mean	sR	Mean Δ/s
D6417	52	Area % Volatized	18	6.97	0.31	7	6.9	0.49	-0.32	6	7.1	0.37	0.37	3	7.1	0.17	0.42
	55	Area % Volatized	18	11.68	0.51	5	11.7	0.37	0.08	5	11.7	0.42	0.08	6	11.8	0.27	0.17
	58	Area % Volatized	18	5.61	0.30	8	5.7	0.28	0.38	5	5.7	0.30	0.17	5	5.6	0.24	0.03
D5800	52	% volatility loss	33	13.75	0.61	10	14.5	0.52	1.18	17	14.7	0.68	1.52	9	14.7	0.84	1.52
	55	% volatility loss	32	17.09	0.76	15	17.5	0.91	0.49	10	17.4	0.54	0.42	9	17.7	0.78	0.76
	58	% volatility loss	37	15.20	0.72	9	15.0	0.70	-0.27	12	15.2	0.50	0.01	14	15.0	0.74	-0.24
TEOST D6335	435-2	Deposit wt. (mg)	15	26.95	2.86	--	----	----	----	--	----	----	----	4	30.3	10.19	1.18
	71-1	Deposit wt. (mg)		51.79	4.79	6	47.7	7.99	-0.85	9	48.6	7.27	-0.68	1	45.0	----	-1.42
	72-1	Deposit wt. (mg)		26.72	3.46	5	29.8	3.00	0.88	7	29.3	5.78	0.73	4	28.5	4.06	0.52
	75	Deposit wt. (mg)	14	55.16	5.68	--	----	----	----	1	47.9	----	-1.28	7	55.5	9.36	0.06
MTEOS D7097	432	Deposit wt. (mg)	30	47.04	4.50	25	49.8	4.56	0.60	23	49.2	4.96	0.49	29	49.8	5.19	0.61
	434	Deposit wt. (mg)	30	27.37	6.57	24	26.9	9.90	-0.07	21	24.0	6.89	-0.51	27	24.3	6.55	-0.46
	74	Deposit wt. (mg)	30	12.85	5.59	6	14.2	6.93	0.24	2	15.8	7.35	0.53	--	----	----	----
GI D5133	58	Gelation Index	17	5.8	0.69	12	5.9	1.27	0.10	8	6.0	1.09	0.27	10	6.2	0.69	0.61
	62	Gelation Index	35	17.0	3.90	12	13.1	5.06	-1.00	7	16.3	2.79	-0.17	7	15.4	2.33	-0.40
	1009	Gelation Index	16	7.30	0.68	9	6.8	0.58	-0.72	8	6.72	0.60	-0.85	7	7.1	0.55	-0.25
D6082	1007	Tendency (ml)	28	65	19	8	61	10	-0.25	9	80	26	0.74	8	65	13	-0.05
D874	820-2	Sulfated Ash m%	27	1.57	0.08	1	1.58	----	0.12	2	1.58	0.02	0.06	3	1.59	0.02	0.29
	90	Sulfated Ash m%	27	1.07	0.08	3	1.07	0.06	0.04	2	1.03	0.00	-0.50	--	----	----	----
	91	Sulfated Ash m%	27	0.82	0.05	2	0.83	0.01	0.20	2	0.80	0.01	-0.40	3	0.83	0.03	0.20
ROBO	434-1	ln (MRV Vis)	13	10.6599	0.1672	34	10.5785	0.1904	-0.49	29	10.5920	0.2124	-0.41	26	10.5899	0.2214	-0.42
	435	ln (MRV Vis)	15	11.4895	0.2932	0	---	---	---	17	11.0559	0.3189	-1.48	--	----	----	----
	435-1	ln (MRV Vis)	22	11.0416	0.20295	54	11.1361	0.9054	0.47	32	10.9091	0.2601	-0.65	42	10.6853	0.2191	-0.28
	438	ln (MRV Vis)	14	10.2676	0.2037	33	10.4293	0.6779	0.79	18	10.1724	0.2656	-0.47	25	10.1563	0.1654	-0.55