



Test Monitoring Center

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Memorandum: 03-035
Date: April 16, 2003
To: William M. Nahumck, Chairman, Sequence IIIF Surveillance Panel
From: Michael T. Kasimirsky *Michael T. Kasimirsky*
Subject: Sequence IIIF Semiannual Report: October 1, 2002 through March 31, 2003

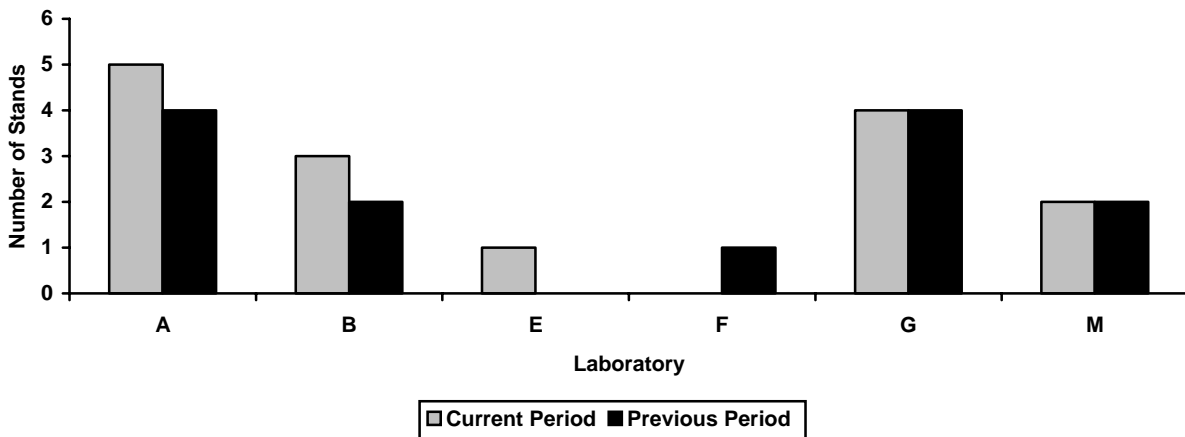
The following is a summary of Sequence IIIF reference tests that were reported to the Test Monitoring Center during the period October 1, 2002 through March 31, 2003.

Lab/Stand Distribution

	Reporting Data	Calibrated as of March 31, 2003
Number of Laboratories:	5	5
Number of Test Stands:	15	9

The following chart shows the laboratory/stand distribution:

Laboratory/Stand Distribution



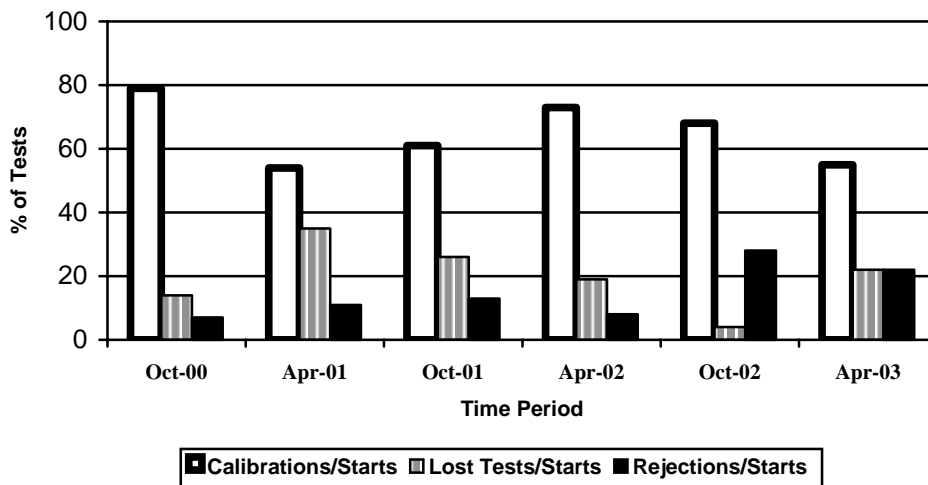
The following summarizes the status of the reference oil tests reported to the TMC:

Calibration Start Outcomes	TMC Validity Codes	No. of Tests
Operationally and Statistically Acceptable	AC	15
Failed Acceptance Criteria	OC	6
Operationally Invalid (Laboratory Judgment)	LC	5
Operationally Invalid (Lab & TMC Judgment)	RC	0
Stand Failed Reference Sequence – data pulled	MC	9
Aborted	XC	1
Total		36

Donated & Industry Support Outcomes	TMC Validity Codes	No. of Tests
Decoded oil for Stand Shakedown	AG	1
Decoded oil for Stand Shakedown	LG	2
Total		3

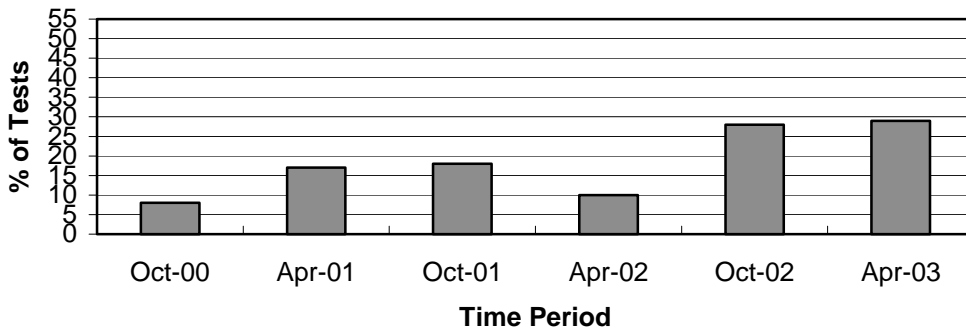
Calibrations per start, lost tests per start and rejection rates are summarized below:

Calibration Attempt Summary



The calibration per start rate is lower than last period. The lost test rate is higher than last period. The rejected test rate is slightly lower than last period.

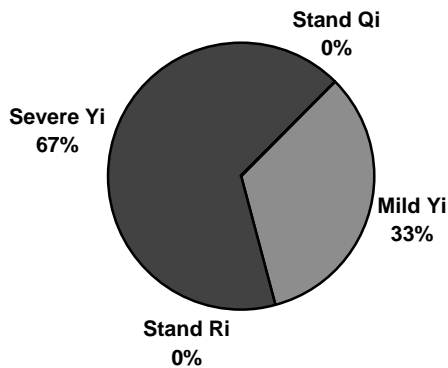
Rejected Test Rate for Operationally Valid Tests



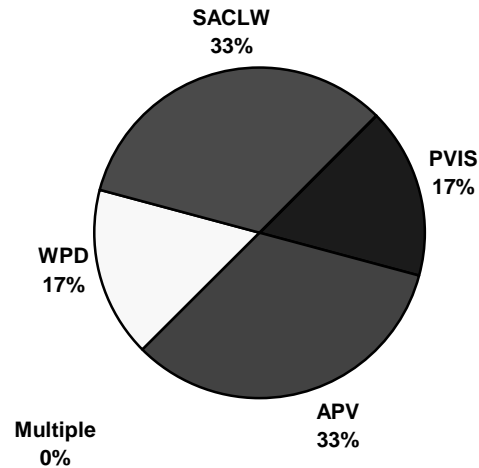
The rate of rejection of operationally valid tests has increased slightly from last period.

There were six failing tests for the period. The following charts summarize the reasons and breakdown by parameter for the failed test:

Distribution of LTMS Stand Alarms



Distribution of Stand Alarms by Parameter



There were no LTMS Deviations written this period. There have been four deviations from the LTMS since its introduction in June of 2000.

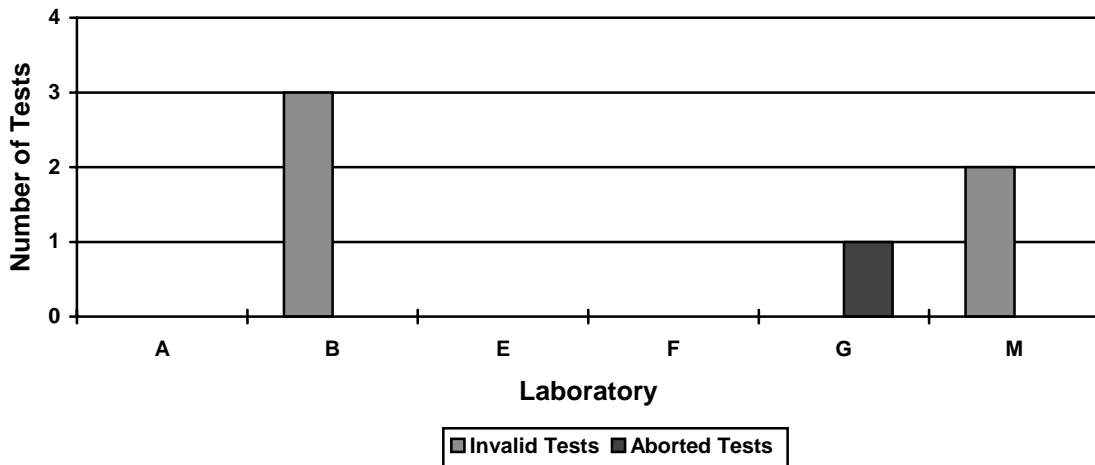
No Sequence III F lab visits were performed this period. However, Sequence III G lab visits were performed at five laboratories during the period in preparation for starting the upcoming Sequence III G GF-4 Matrix. Four of these visits were conducted in conjunction with representation from the Test Developer and one was conducted independently. Any problem areas noted during these visits are being addressed prior to the start of the Matrix.

Lost Test Summary

Six tests were lost this period. The reasons for the lost tests are shown in the following table:

Lab	Reason for Lost Test	Number of Tests	Breakdown of Tests (LC/RC/XC)
B	Negative QI on Speed & Left EBP	1	3/0/0
	Glycol Contamination	1	
	Fuel Dilution	1	
G	Downtime	1	0/0/1
M	Wrong Piston Size	1	2/0/0
	Oil Temperature Control Problem	1	

Lost Test Distribution



Information Letters

Sequence III F Information Letter No. 02-4, Sequence No. 10 was issued during the period, on November 15, 2002, and contained the following topics: External Oil Bypass Valve System & Modified Oil Filter Adapter.

Severity and Precision Analysis

Below is a summary of the average Δ/s , pooled standard deviation, and average Δ in reported units for the tests reported during this period. Also below is a summary of the average Δ/s value, by parameter, for all laboratories reporting data during this period.

Industry Severity Summary			
Parameter	Average Δ/s	Pooled standard deviation (degrees of freedom)	Average Δ , in reported units
PVIS	-0.077	0.010 (df=17)	7.2 % Viscosity Increase ¹
APV	-0.252	0.238 (df=17)	-0.06 Merits
WPD	0.001	0.654 (df=17)	0.001 Merits
PV60 ²	0.339	0.157 (df=17)	16.1% Viscosity Increase ³

¹ At the GF-3 Pass Limit of 275% Viscosity Increase

² Not a pass/fail parameter in the Sequence IIIF test; Sequence IIIFHD use only

³ At the CH-4 Pass Limit of 295% Viscosity Increase @ 60 Hours; Sequence IIIFHD use only.

Average Δ/s Results, by Laboratory				
Laboratory	PVIS	APV	WPD	PV60
A	-0.42	-0.41	-0.51	1.22
B1	0.36	0.49	0.95	-0.34
E	0.76	0.28	0.76	-1.62
F	-	-	-	-
G	-0.45	-1.08	-0.53	0.64
M	0.61	0.82	0.75	-0.61

Percent Viscosity Increase (PVIS)

The industry was within limits for both severity and precision during the period (see Figure 1). The industry was on the severe side of target for the period, with an average Δ/s value of -0.077 (see Figure 5). Precision for the period has again improved this period and is comparable to the periods of best historical performance (see Figure 9).

Weighted Piston Deposits (WPD)

The industry was within limits on EWMA Severity for the period but exceeded the EWMA Precision limit on two occasions for periods of two and four data points respectively (see Figure 2). Both of these precision warnings were caused by tests on reference oil 1008-1. The first EWMA Precision Warning of two data points on WPD was caused by a passing result on reference oil 1008-1 and cleared with subsequent testing. The second EWMA Precision Warning of four data points on WPD was caused by a reference oil test on 1008-1 that generated mild failing results on WPD. Subsequent testing on that stand generated passing WPD results and subsequent testing cleared the industry EWMA Precision Warning. The industry was on target for the period, with an average Δ/s value of 0.001, or 0.001 merits (see Figure 6). Precision for the period degraded slightly with a pooled standard deviation of 0.654 (see Figure 10) but is still in line with historical performance on this parameter.

Average Piston Skirt Varnish (APV)

During the period, the industry experienced two single-point EWMA Severity Warnings (see Figure 3). These two alarms were caused by two failing reference oil tests on reference oil 1006-2, both of which were run on the same test stand. This stand is still in the middle of a calibration sequence and has not generated passing results at this time. The industry is also currently experiencing an EWMA Precision Alarm that has been in effect for ten data points. No cause for this alarm has been found at this time. The industry was -0.006 Merits severe for the period with an average Δ/s value of -0.252 (see Figure 7). Precision for the period has degraded, with a pooled standard deviation of 0.238, but is still in line with historical performance on this parameter (see Figure 11).

Average Camshaft-plus-Lifter Wear (ACLW)/Screened Average Camshaft-plus-Lifter Wear (SACLW)

Two tests failed during the period on SACLW. Both tests were run on reference oil 433-1 with one test using a NF camshaft and the other test using a MK camshaft. The first had eight lobes with high wear and the second had seven lobes with high wear. No cause for either failure has been found at this time.

Percent Viscosity Increase at 60 Hours

The industry control chart for PV60 is shown in Figure 4. The average Δ/s and pooled standard deviation for this period, and previous report periods, are shown in Figures 8 and 12 respectively. This parameter is not a pass-fail parameter in the Sequence III F test and is used only in Sequence III FHD testing. Therefore, the industry control charts are presented for information purposes only and any alarms shown on those charts do not require action by the Sequence III F Surveillance Panel. A review of Figure 4 shows that the industry has recently returned within limits after being consistently severe of target on this parameter.

QI Deviations

There were no QI Deviations written this period. There have been a total of 25 QI Deviations written since the test was introduced in June of 2000.

Hardware

The external oil bypass valve system and modified oil filter adapter were introduced into Sequence III F testing during the period. These changes were made to try and eliminate the loss of oil temperature control related to bypass valve operation within the test engine.

Reference Oils

Oil	TMC Inventory, in gallons	TMC Inventory, in tests (4 gal/test)	Laboratory Inventory, in tests	Estimated life
1006	45	11	8	No longer shipped ¹
1006-2	5,070	1,267	13	~3+ years ¹
1007	478	119	12	Not currently used in III F ²
1008	29	7	9	No longer shipped ¹
1008-1	2,472	618	11	~3+ years ¹
1009	988	247	13	~3+ years ¹
432	118	29	13	Not currently used in III F
433	10	2	2	No longer shipped
433-1	622	155	19	~3+ years

¹ Multiple test area reference oil; total TMC inventory shown

² Not reblendable

During the period the TMC received sufficient data to update the Reference Oil 1006-2 test targets. The initial test targets for this oil are shown in the table below:

Initial Reference Oil 1006-2 Test Targets		
Parameter	Mean	Standard Deviation
PVIS	0.0496678	0.0090039
APV	9.35	0.283
WPD	4.18	0.417
PV60	5.30933	0.168340

The 14 data points on this reference oil were adjusted using any applicable severity adjustments and then new test targets were calculated. The new targets are shown below:

Updated Reference Oil 1006-2 Test Targets		
Parameter	Mean	Standard Deviation
PVIS	0.0490642	0.0065297
APV	9.46	0.203
WPD	4.04	0.407
PV60	5.41527	0.160503

These targets will be updated again when the TMC has 20 and 30 data points available on this reference oil. These new targets are effective for all tests completed on or after November 1, 2002.

The GF-3 Category Reference Oil, 1009, is awaiting a matrix of five simultaneous reference oil tests so that test targets may be generated. A plan for this matrix has not been finalized at this time. This issue was discussed at the November 2002 meeting of the Sequence IIIIF Surveillance Panel but was tabled at that time. No further action has been taken on this reference oil to date.

During the period the TMC received sufficient data to update the Reference Oil 433-1 test targets. The previous test targets for this oil are shown in the table below:

<i>Previous Reference Oil 433-1 Test Targets</i>		
Parameter	Mean	Standard Deviation
PVIS	0.1684402	0.0402156
APV	9.27	0.281
WPD	4.27	0.557
PV60	3.55682	0.298299

The 22 data points on this reference oil were adjusted using any applicable severity adjustments and then new test targets were calculated. The new targets are shown below:

<i>Updated Reference Oil 433-1 Test Targets</i>		
Parameter	Mean	Standard Deviation
PVIS	0.1643104	0.0321605
APV	9.30	0.306
WPD	4.57	0.760
PV60	3.59344	0.227054

These targets will be updated one final time when the TMC has 30 data points available on this reference oil. These new targets are effective for all tests completed on or after February 23, 2003.

During the period the TMC also received sufficient data to generate initial test targets on Reference Oil 1008-1. This oil was originally introduced into the LTMS using the final test targets for Reference Oil 1008, which are shown in the table below:

<i>Final Reference Oil 1008 Test Targets</i>		
<i>Parameter</i>	<i>Mean</i>	<i>Standard Deviation</i>
PVIS	0.0899551	0.009667
APV	9.74	0.100
WPD	4.52	0.773
PV60	4.21605	0.122356

The 10 data points on this reference oil were adjusted using any applicable severity adjustments and then new test targets were calculated. The new targets are shown below:

<i>Initial Reference Oil 1008-1 Test Targets</i>		
<i>Parameter</i>	<i>Mean</i>	<i>Standard Deviation</i>
PVIS	0.0911968	0.006381
APV	9.75	0.099
WPD	4.75	0.823
PV60	4.34110	0.139270

These targets will be updated again when the TMC has 20 and 30 data points available on this reference oil. These new targets are effective for all tests completed on or after April 21, 2003.

MTK/mtk

Attachments

c: F. M. Farber
J. L. Zalar
Sequence IIIIF Surveillance Panel
<ftp://ftp.astmtmc.cmu.edu/docs/gas/sequenceiii/semiannualreports/IIIIF-04-2003.pdf>

Distribution: Electronic Mail

List of Figures

- Figures 1, 2, 3, and 4 are EWMA severity and precision control charts and also the CUSUM Δ/s plots of PVIS, WPD, APV, and PV60, annotated with date lines, using the same data set as the EWMA severity and precision control charts. Transformed units are used, when appropriate.
- Figures 5, 6, 7, and 8 are bar charts of average Δ/s , by report period, for PVIS, WPD, APV, and PV60.
- Figures 9, 10, 11, and 12 are bar charts of pooled standard deviation, by report period, for PVIS, WPD, APV, and PV60.
- Figure 13 is the Sequence IIIIF Timeline.

Figure 1

SEQUENCE IIIF INDUSTRY OPERATIONALLY VALID DATA

VISCOSITY INCREASE FINAL ORIG UNIT RES

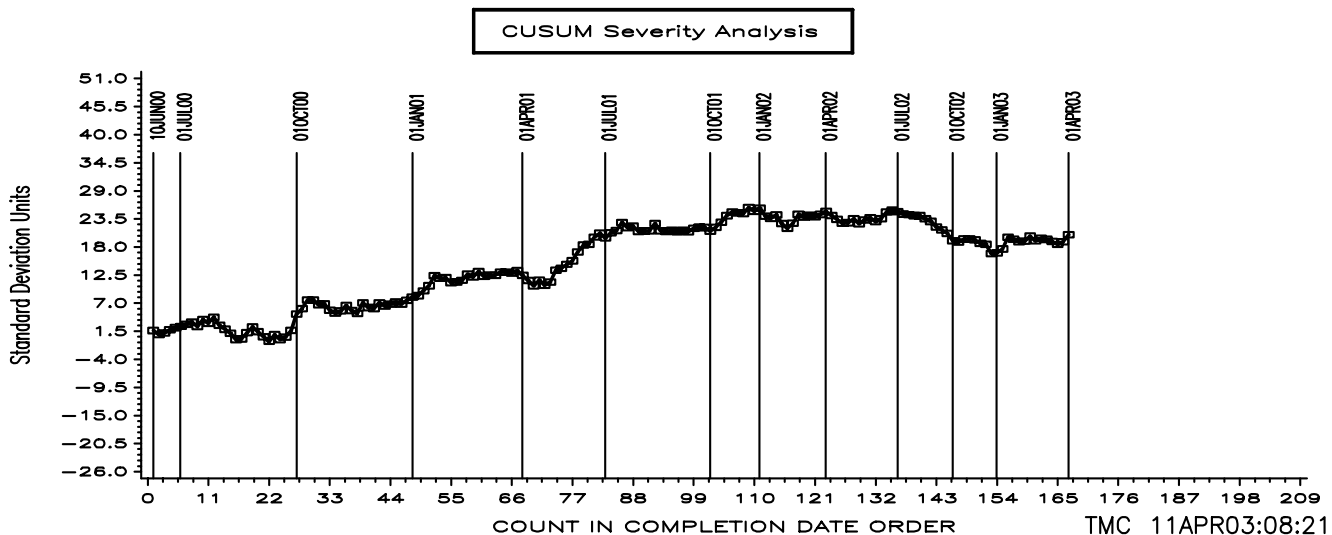
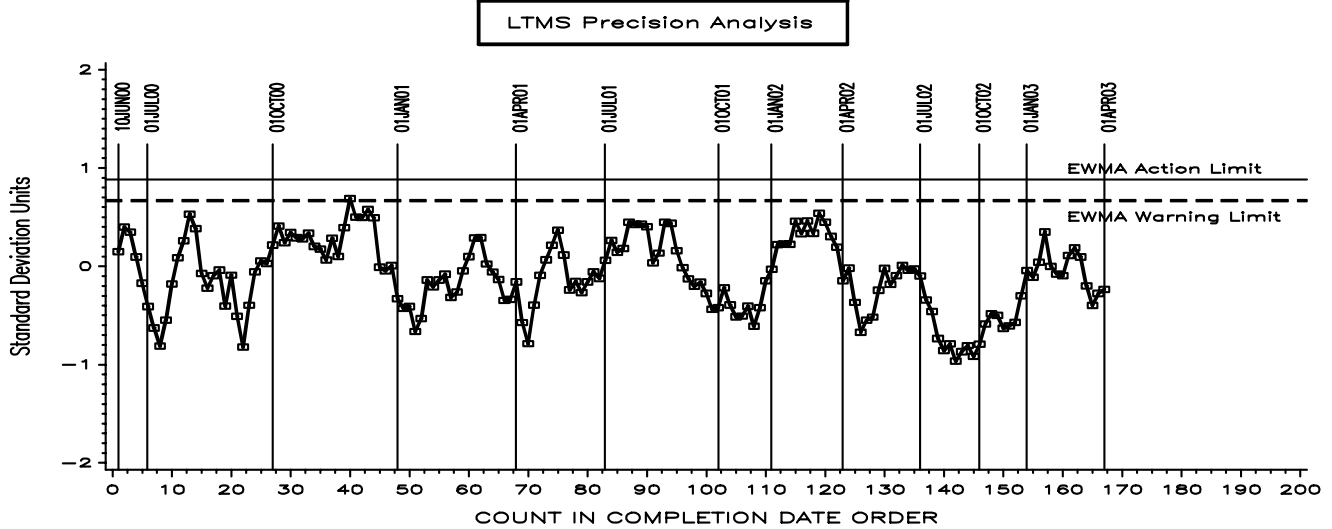
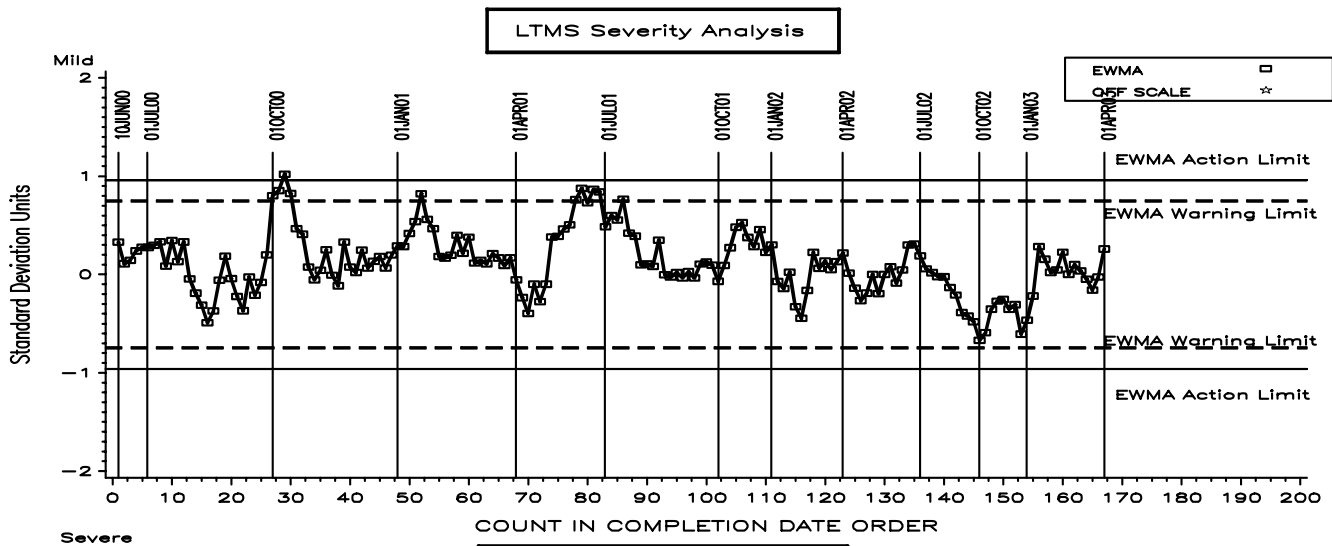


Figure 2

SEQUENCE IIIF INDUSTRY OPERATIONALLY VALID DATA

AVERAGE WEIGHTED PISTON DEPOSITS FNL ORIG UNIT RES

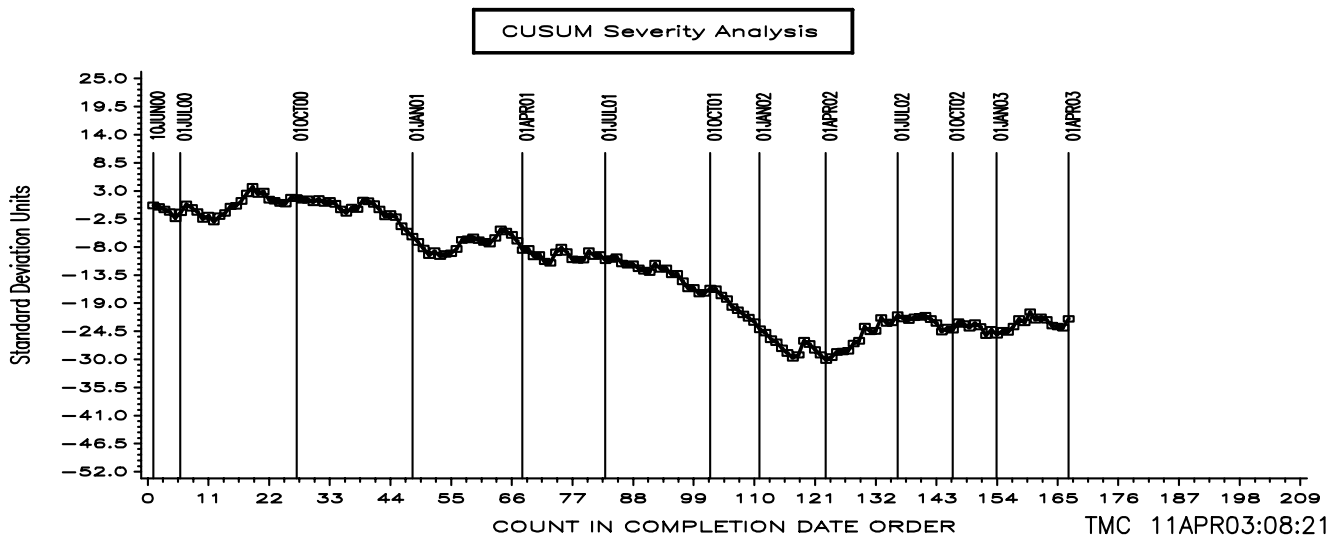
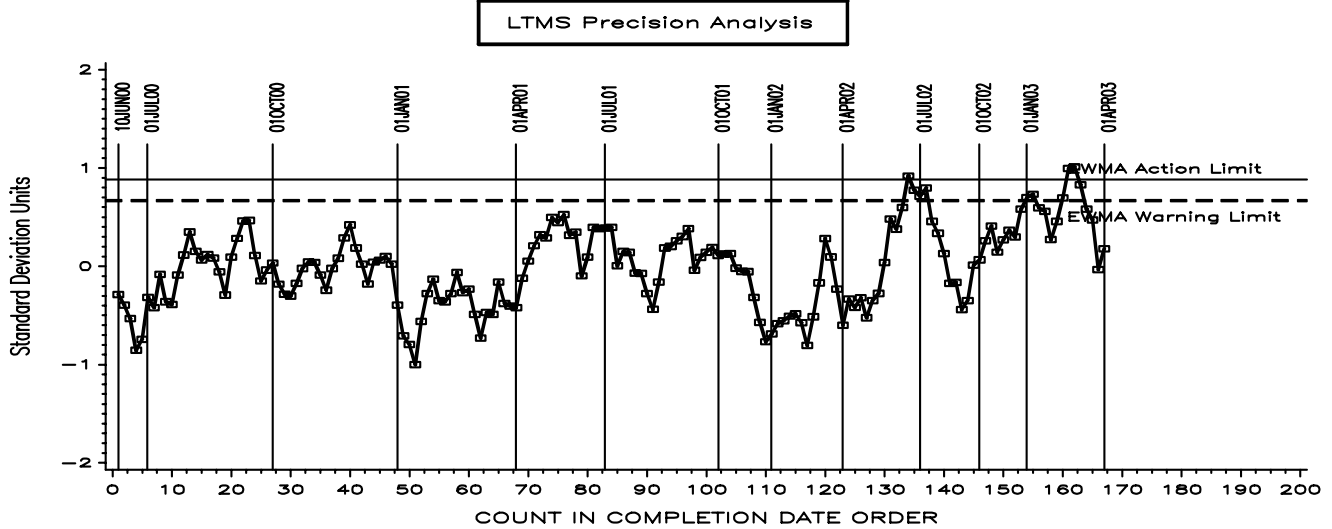
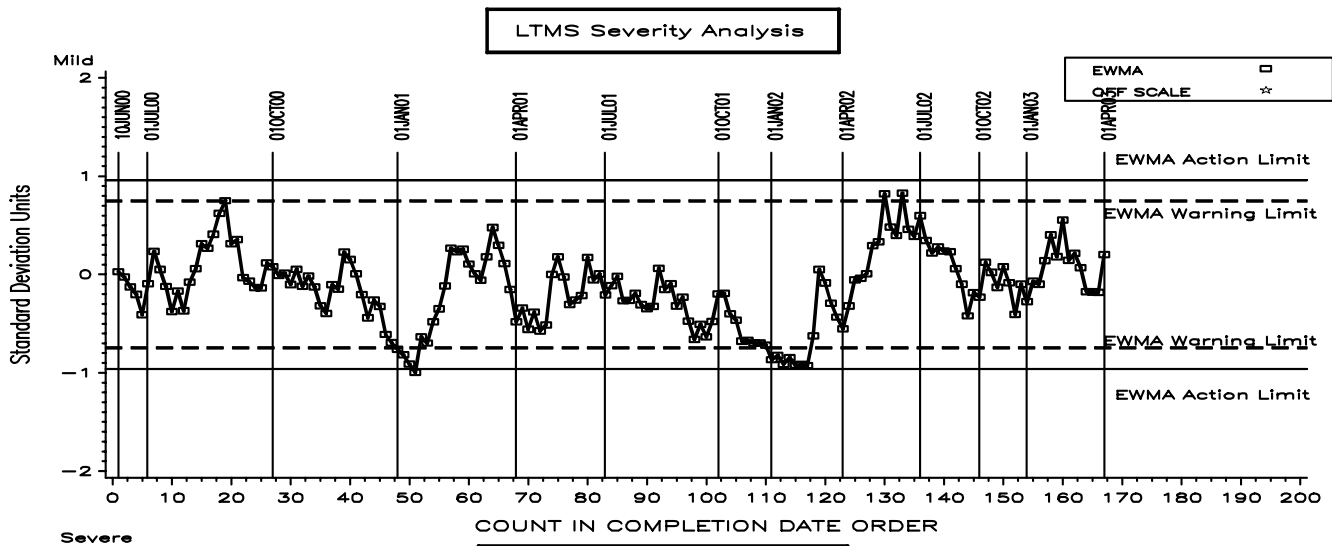


Figure 3

SEQUENCE IIIF INDUSTRY OPERATIONALLY VALID DATA

AVERAGE PISTON SKIRT VARNISH FINAL ORIG UNIT RES

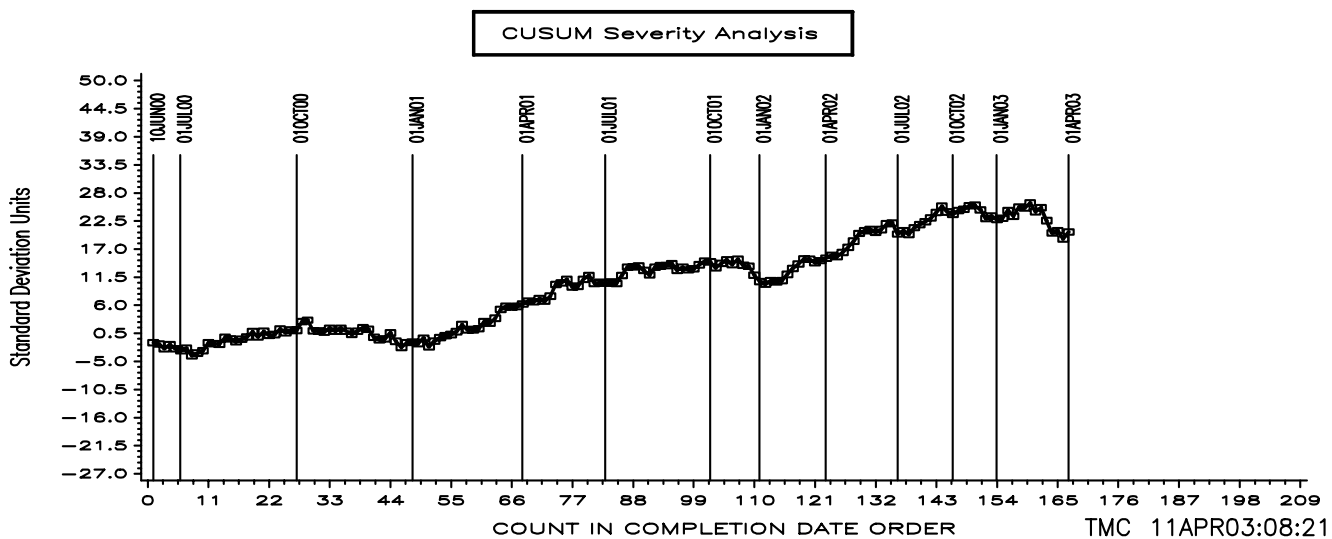
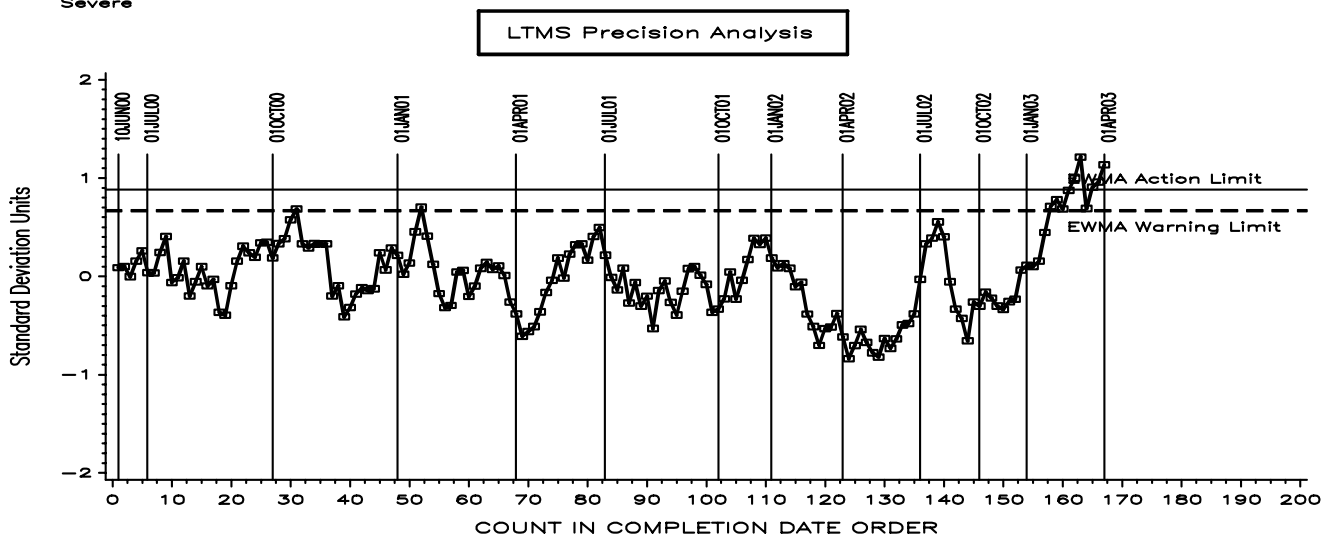
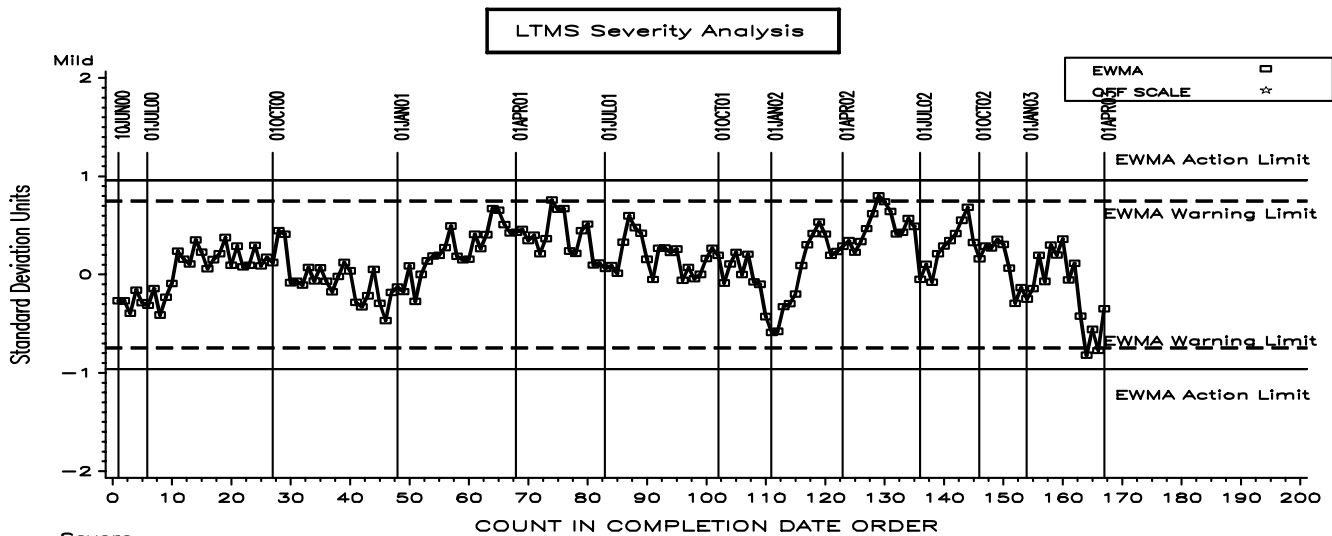


Figure 4

SEQUENCE IIIF INDUSTRY OPERATIONALLY VALID DATA

⊘ VISCOSITY INCREASE ⊙ 060 HOURS

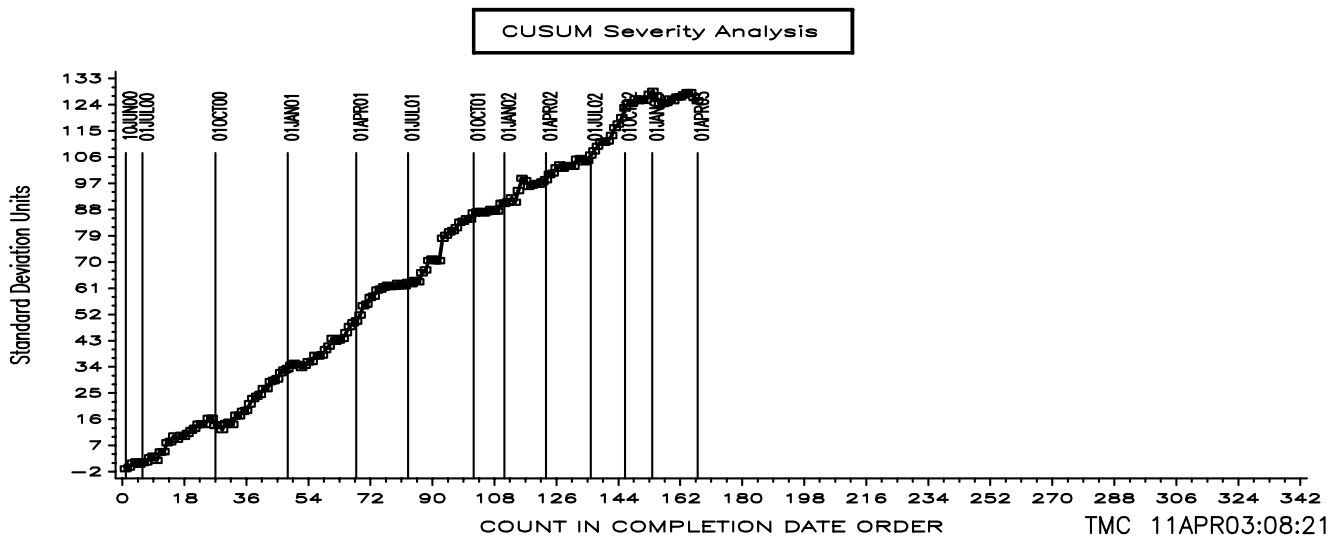
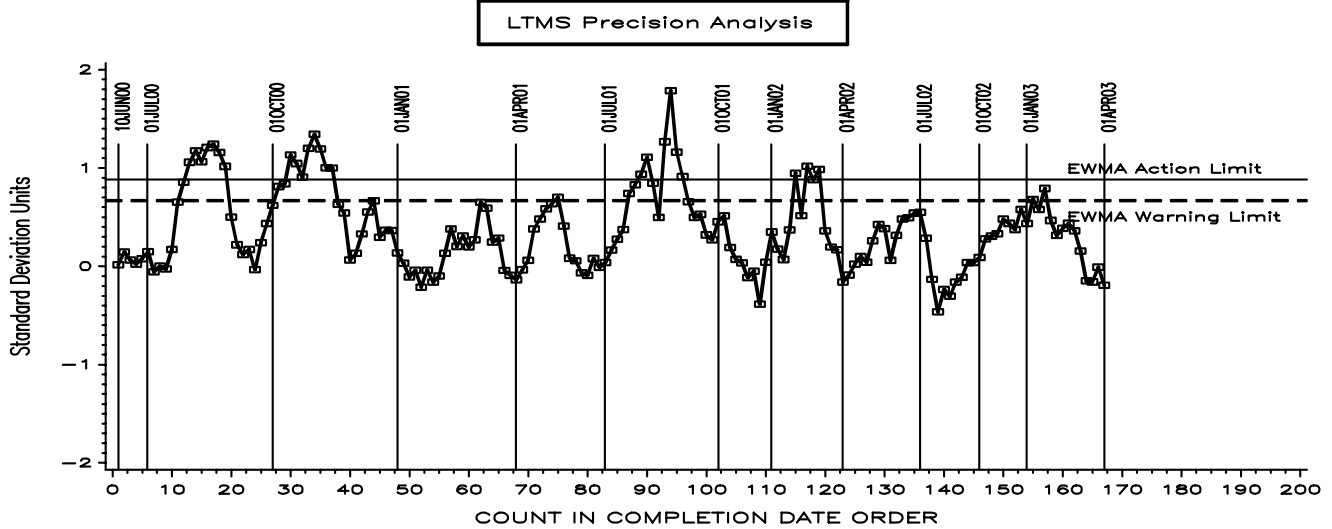
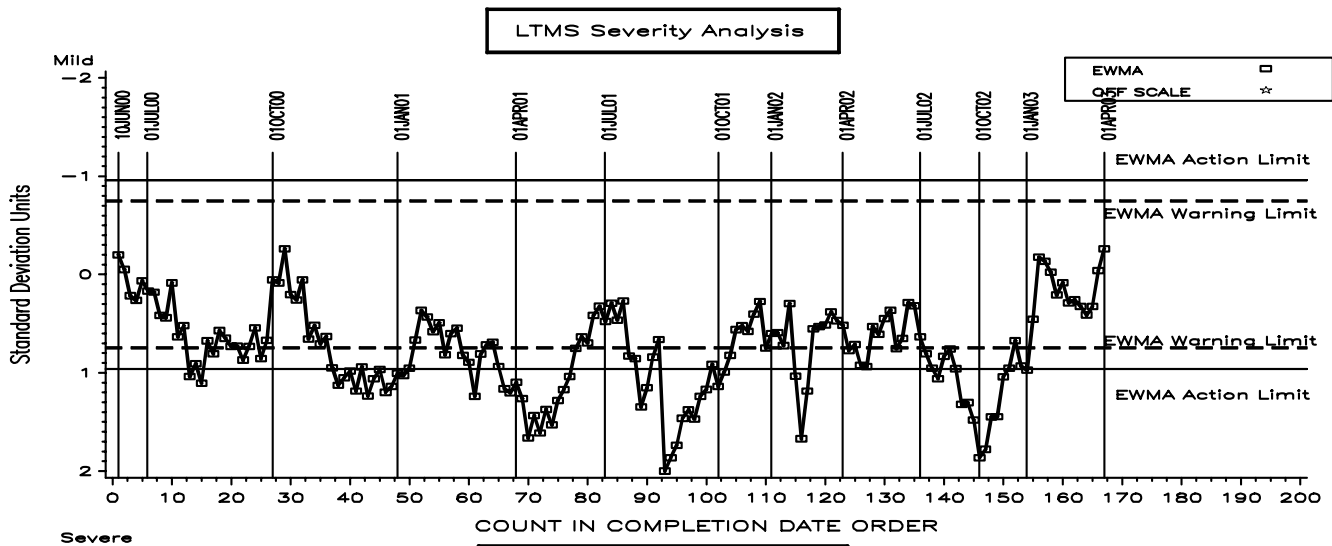


Figure 5 - Percent Viscosity Increase, Average Delta/s

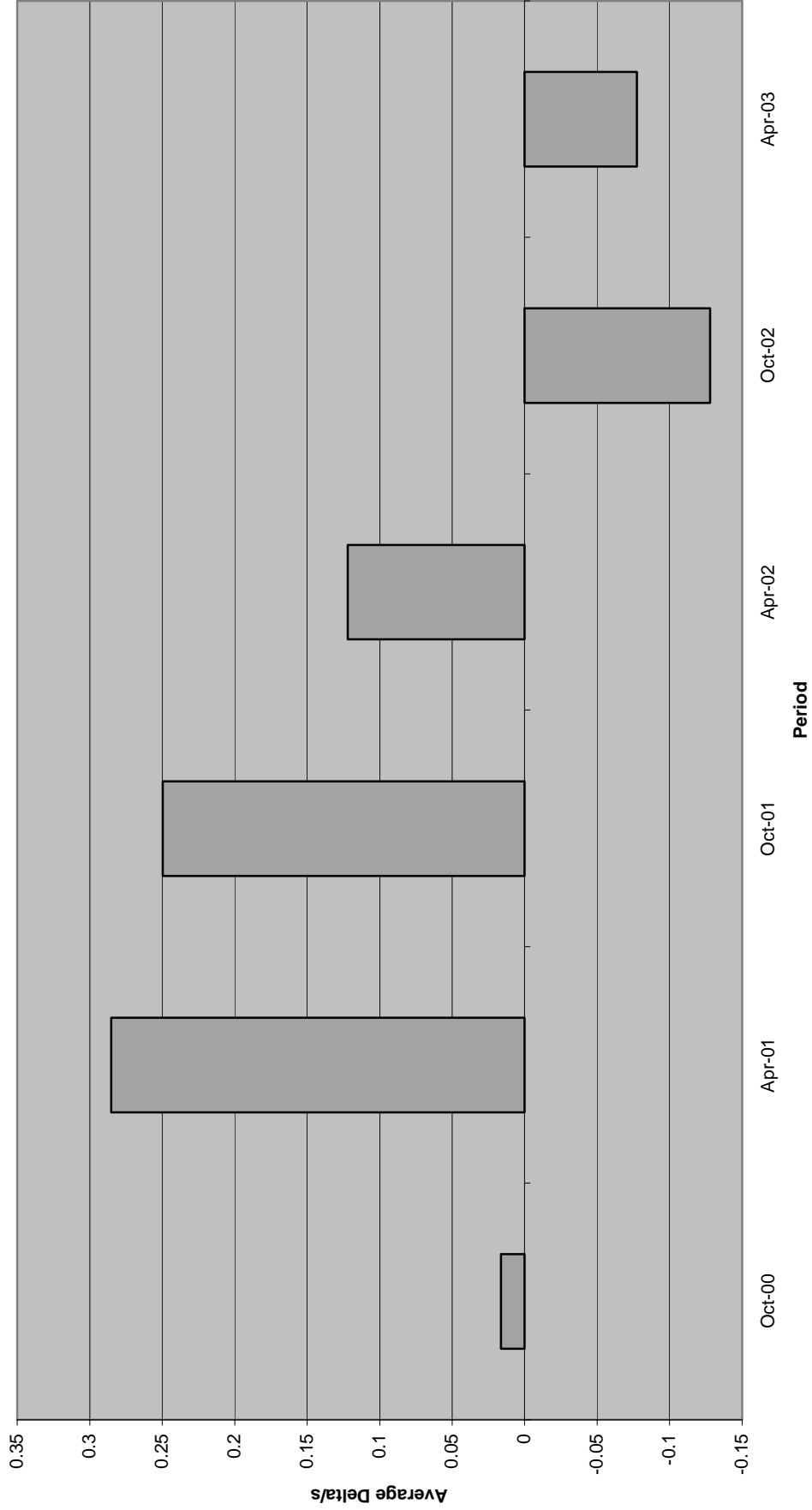


Figure 6 - Weighted Piston Deposits, Average Delta/s

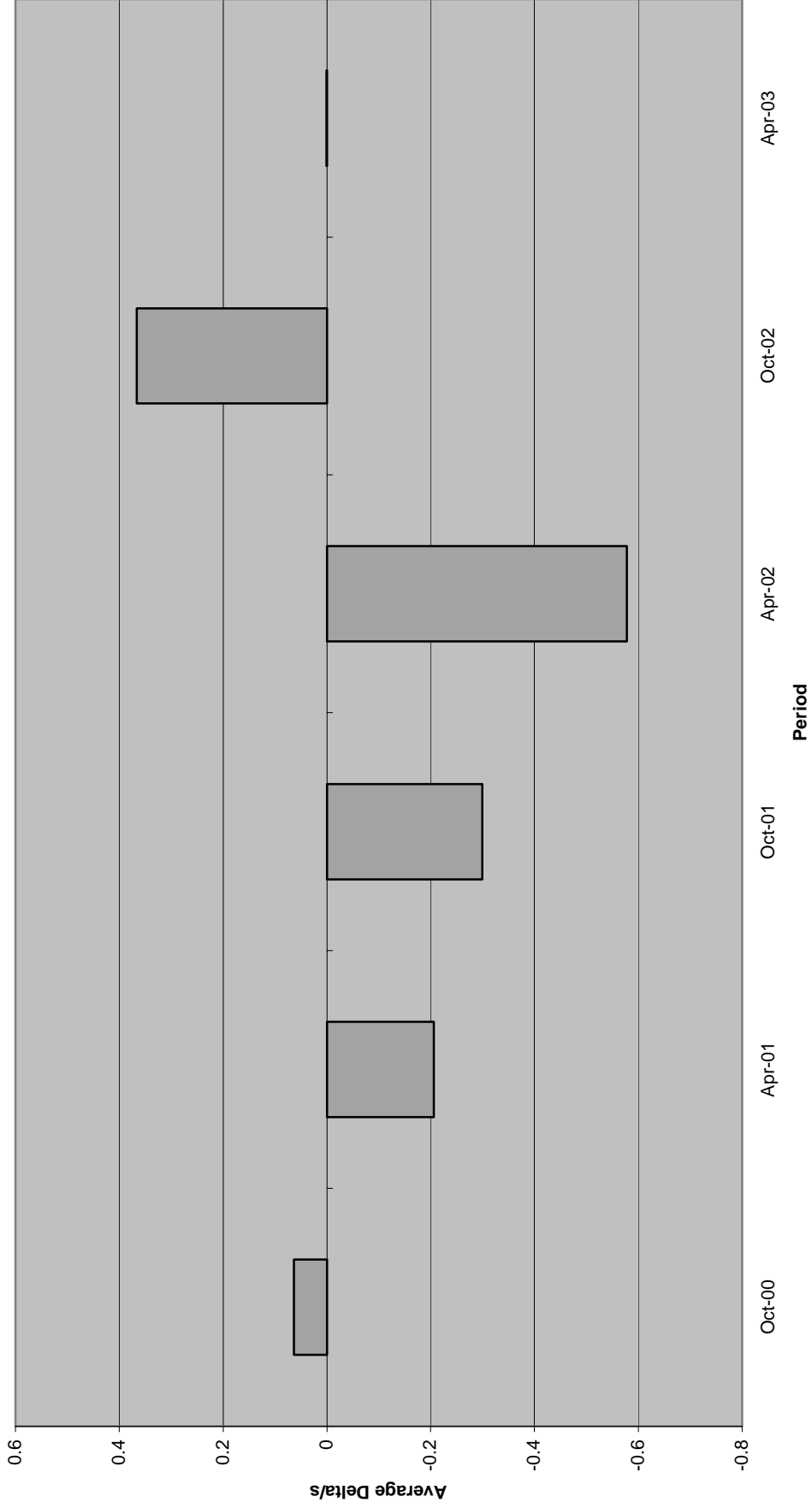


Figure 7 - Average Piston Varnish, Average Delta/s

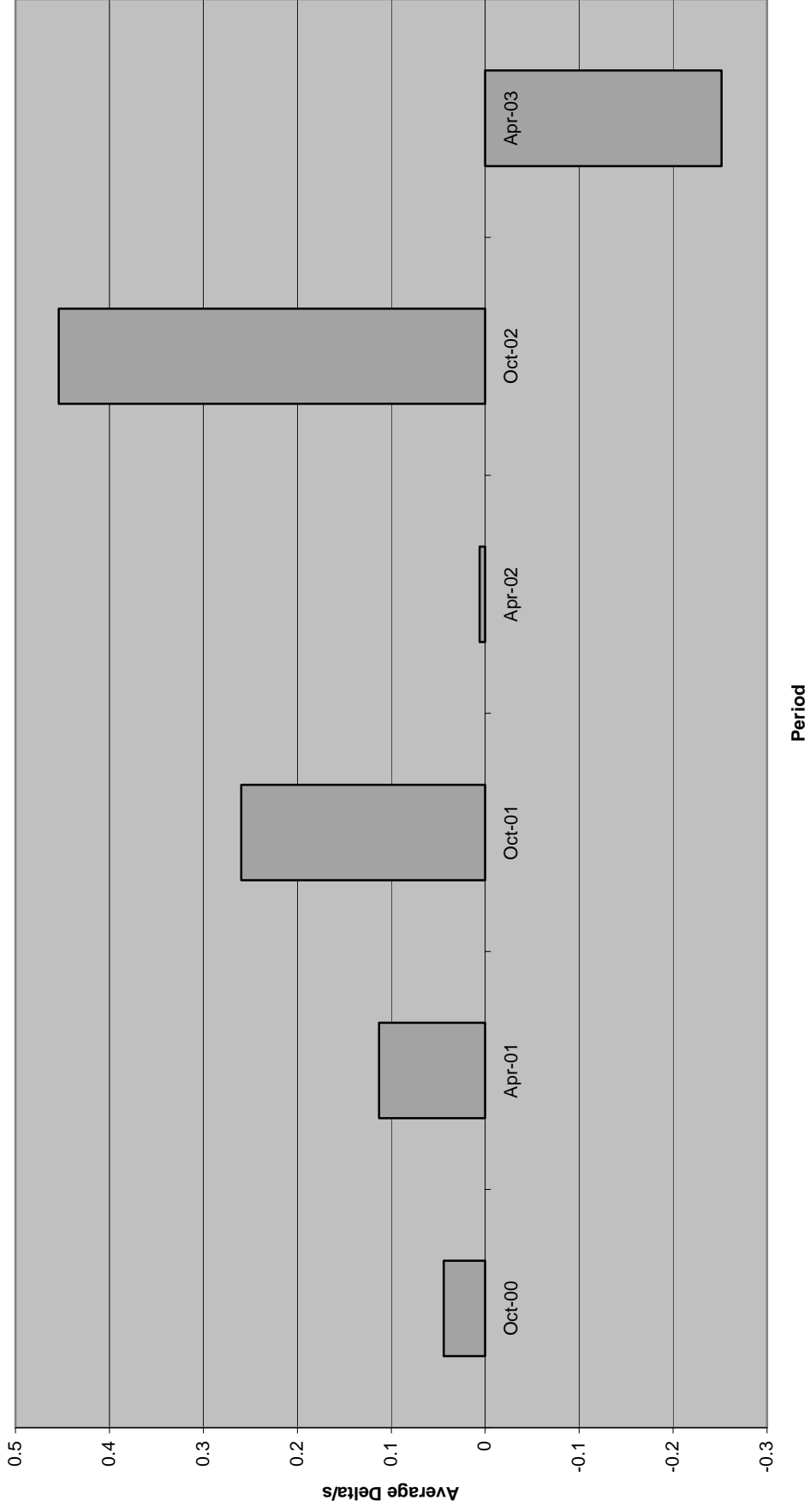


Figure 8 - Percent Viscosity Increase @ 60 Hours (Sequence IIFHD), Average Delta/s

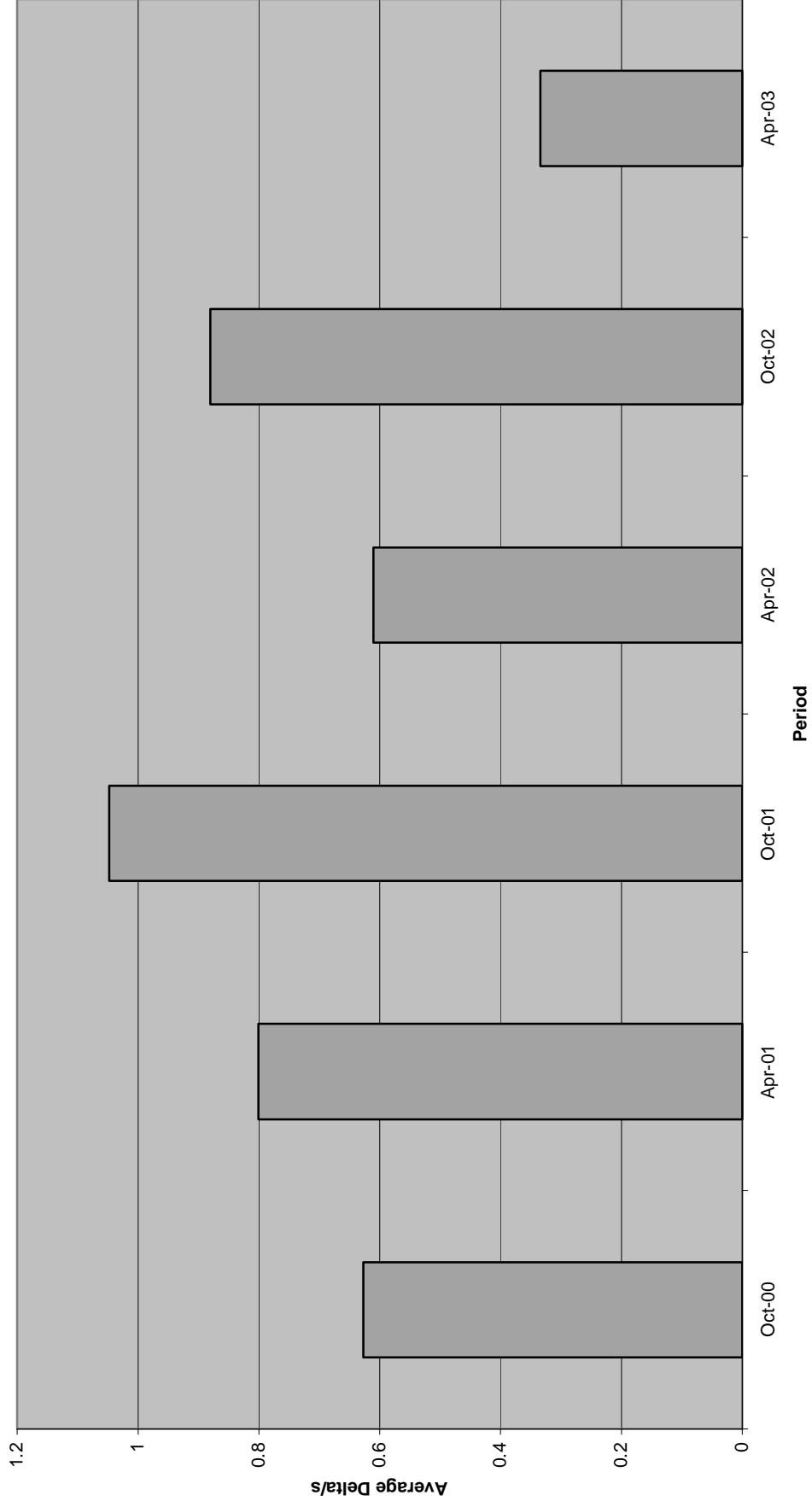


Figure 9 - Percent Viscosity Increase, Pooled Standard Deviation

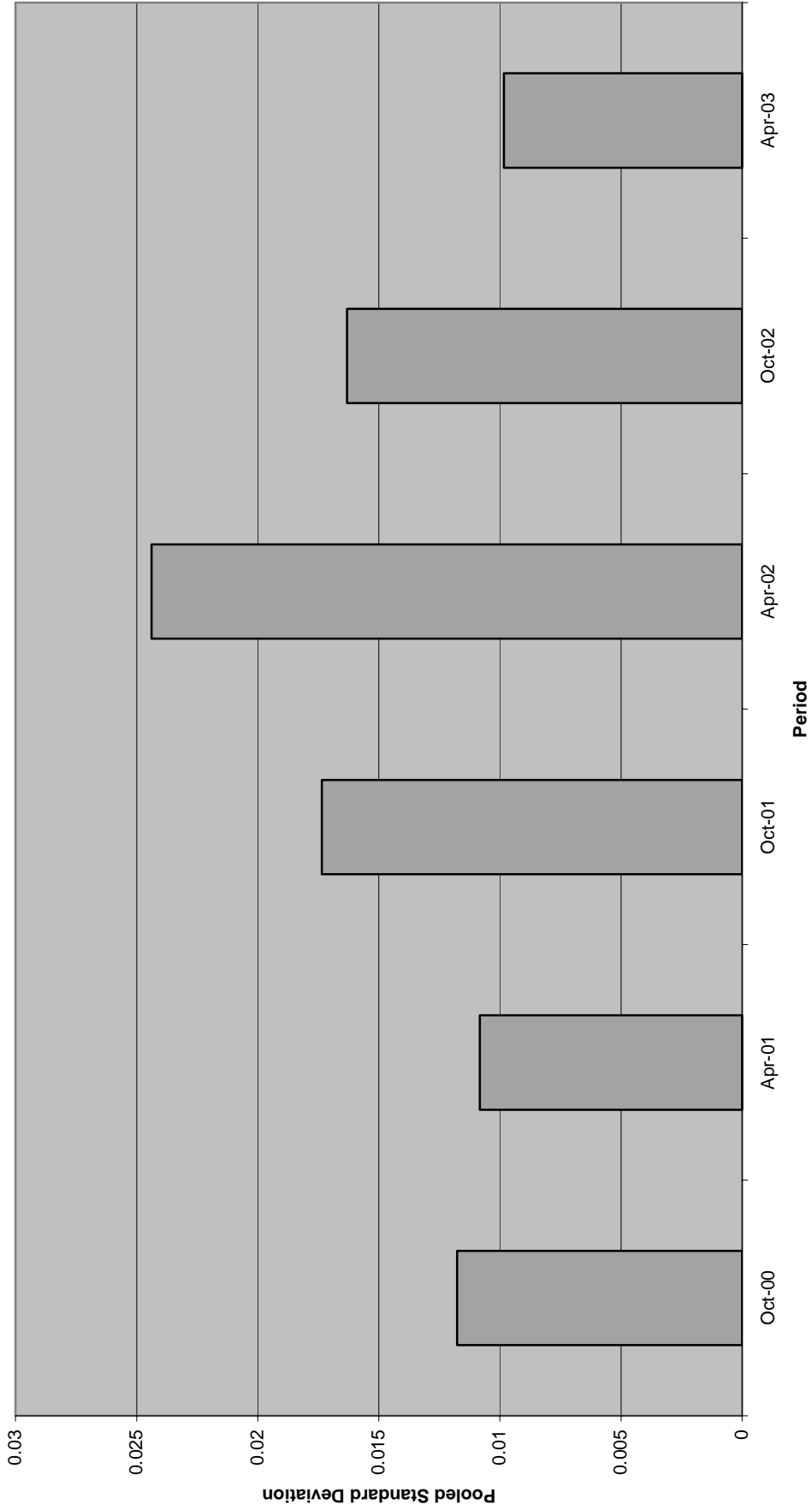


Figure 10 - Weighted Piston Deposits, Pooled Standard Deviation

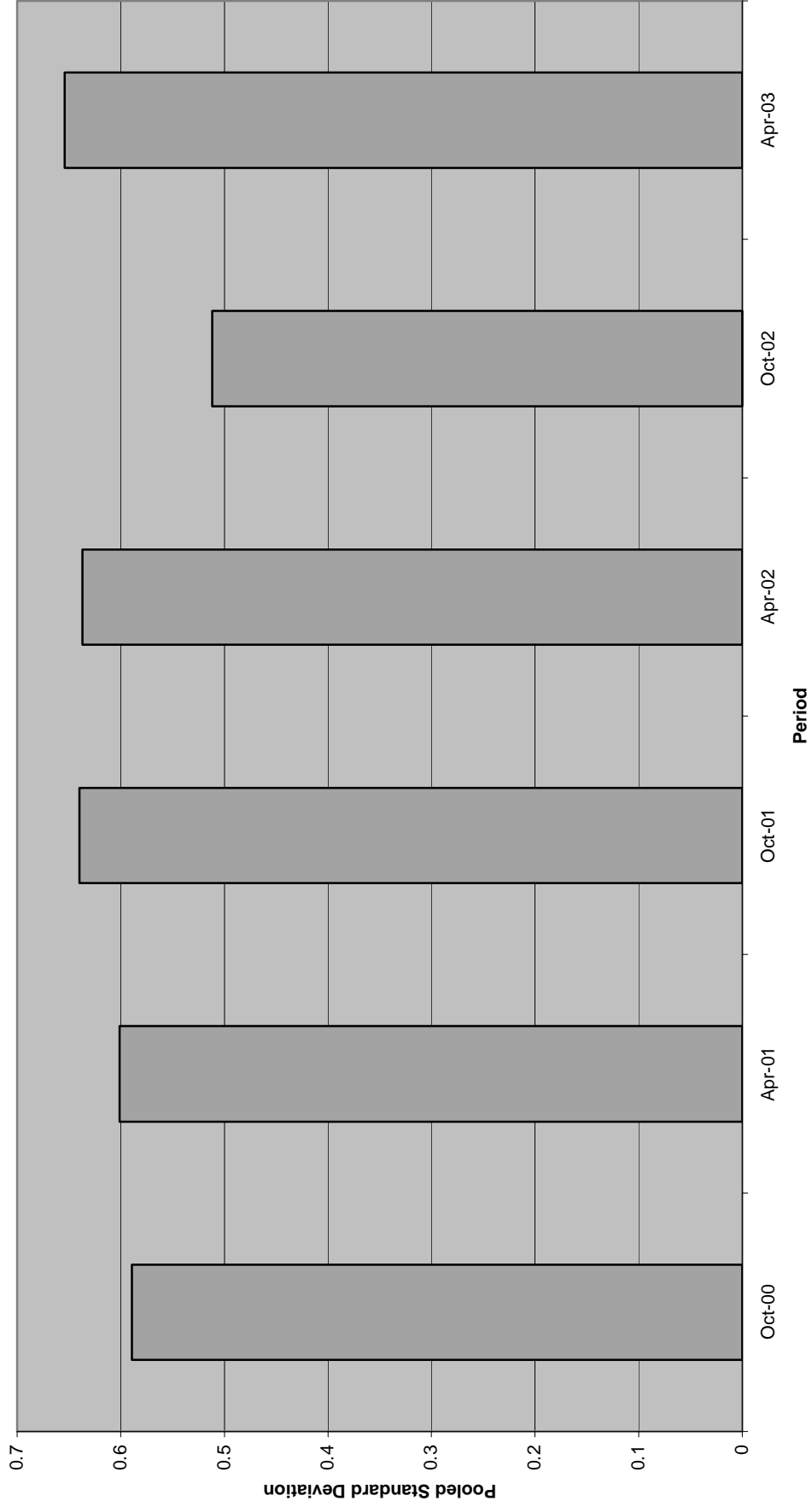


Figure 11 - Average Piston Skirt Varnish, Pooled Standard Deviation

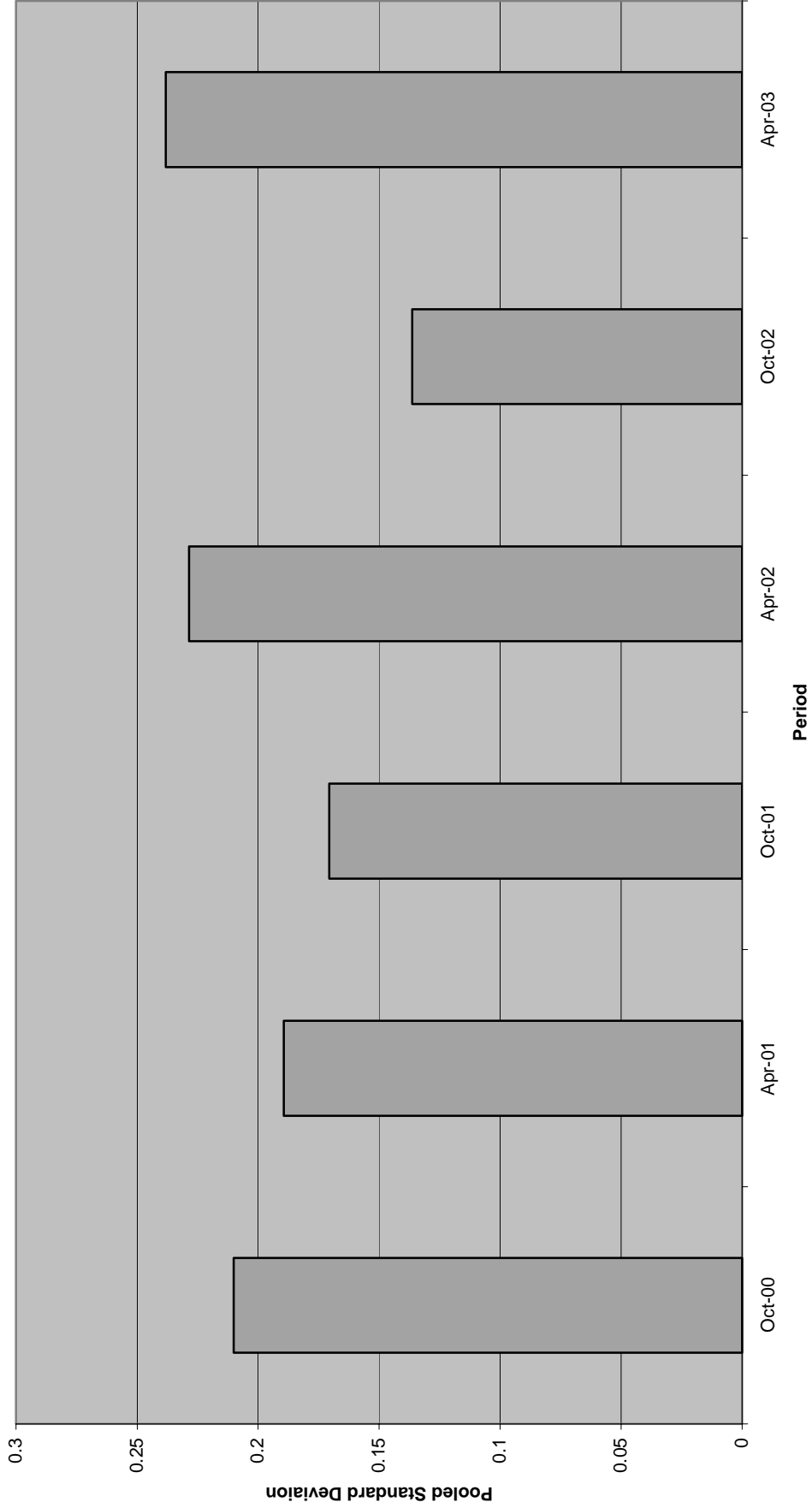


Figure 12 - Percent Viscosity Increase @ 60 Hours (Sequence III FHD), Pooled Standard Deviation

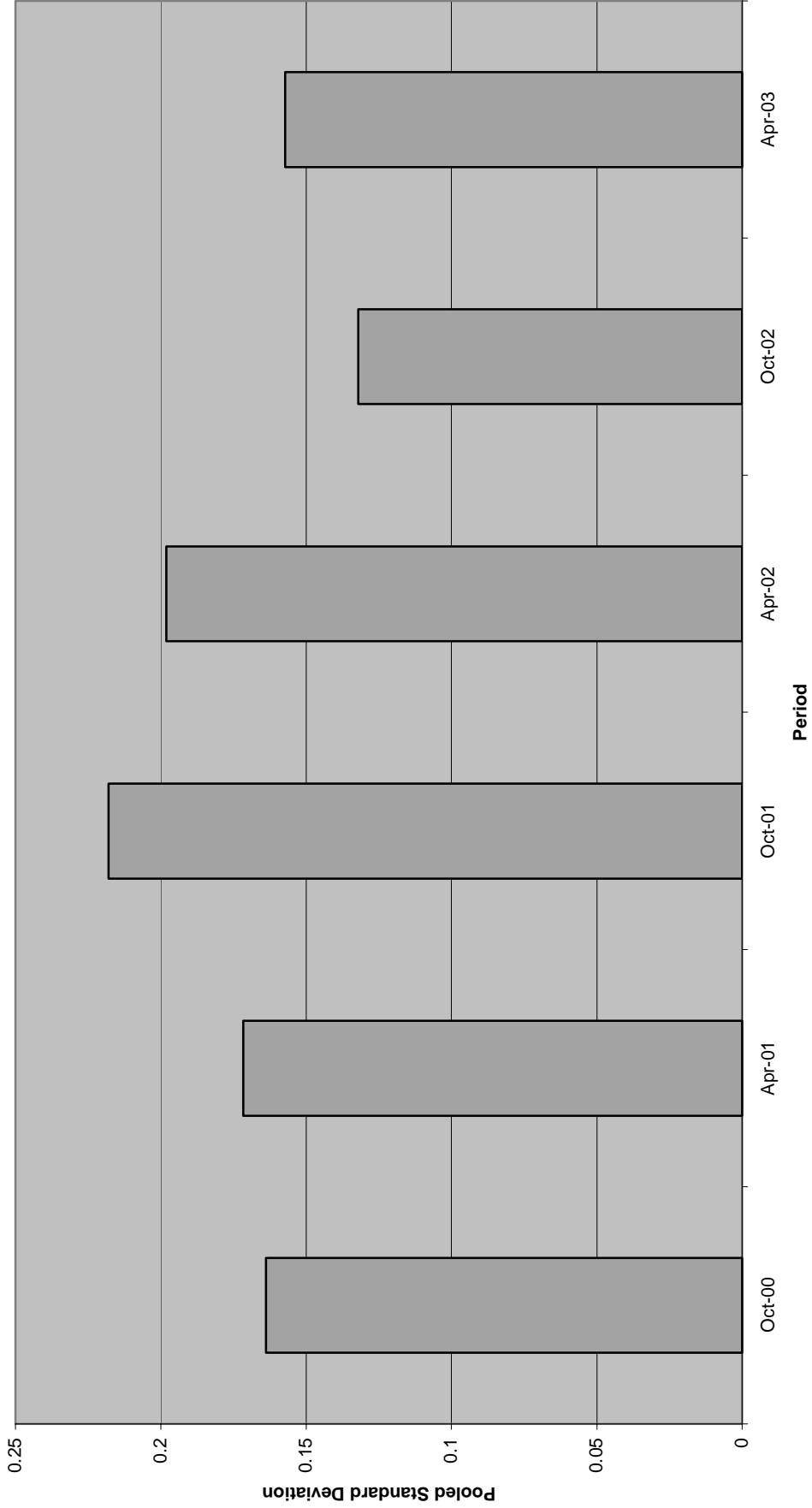


Figure 13 – Sequence IIIF Timeline

Date	Topic	Information Letter
6/10/2000	IIIF Test Released from Redevelopment	
9/8/2000	Draft 3 of the Sequence IIIF Test Procedure released	00-1
9/27/2000	MRV & CCS Testing of used oil samples added	00-2
10/4/2000	New QI U&L Values implemented	00-2
6/10/2000	Revised Ring Sticking definitions implemented	00-2
7/25/2000	Oil Consumption as a test validity criteria dropped	00-2
9/27/2000	Valve train assembly using build up oil implemented	00-2
10/8/2000	First occurrence of Valve train assembly using build up oil in LTMS	00-2
12/6/2000	Oil Consumption as a test interpretability criteria added	00-3
8/28/2000	First occurrence of LC camshafts in LTMS data	
4/25/2001	First occurrence of MB camshafts in LTMS data	
9/12/2001	First occurrence of engine builds using test oil for valvetrain lubrication in LTMS	
5/23/2001	Condenser Flow QI requirements dropped	01-1
5/23/2001	New oil addition at EOT dropped	01-1
5/23/2001	Condenser part number corrected	01-1
5/23/2001	Revised dipstick calibration curve implemented	01-1
5/23/2001	Revised MRV & CCS test procedures	01-1
5/23/2001	Upper limit of 8000cSt for viscosity measurements established	01-1
5/23/2001	Reexamination of Engine Speed and Condenser Coolant Out Temperature QI U&L values performed; no changes made	01-1
9/8/2001	Screened Average Cam-plus-lifter Wear (SACLW) replaces Average Cam-plus-lifter Wear (ACLW) as pass/fail parameter	01-2
9/8/2001	Valve train assembly using test oil reintroduced into IIIF test	01-2
11/28/2001	Sequence IIIF-HD Test Procedure Published	01-3
3/1/2002	Revised Sequence IIIF Test Procedure Published	02-1
3/15/2002	Sequence IIIFHD Test Procedure added to Revised Sequence IIIF Test Procedure. Editorial changes to IIIF Test Procedure also made and document republished	02-2
4/23/2002	Oil Filter and Oil Cooler Replacement Guidelines issued	02-3
6/1/2002	External Oil Bypass Valve System & Modified Oil Filter Adapter.	02-4