



Test Monitoring Center

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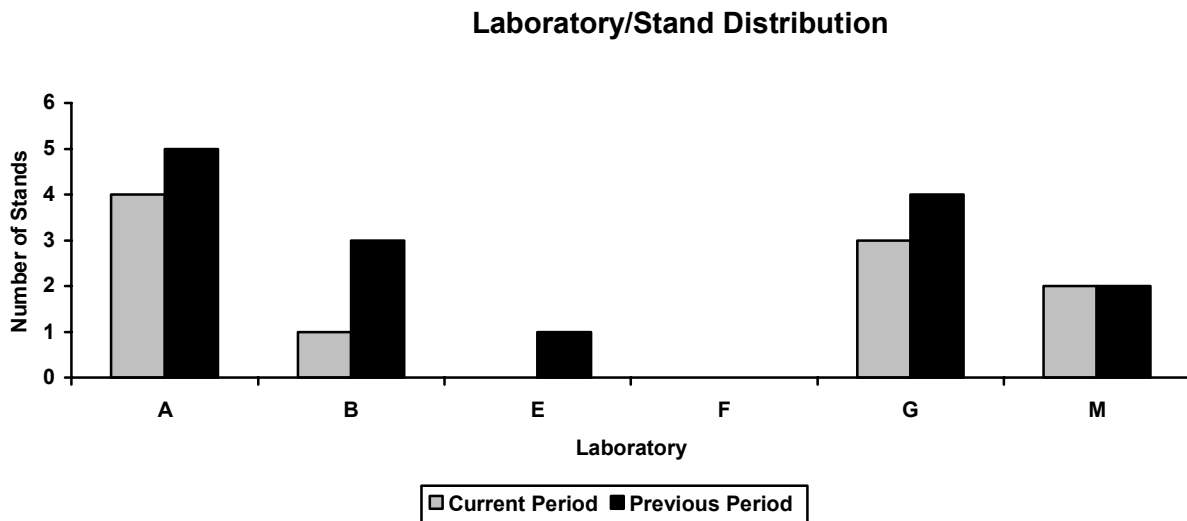
Memorandum: 03-107
Date: October 23, 2003
To: William M. Nahumck, Chairman, Sequence IIIF Surveillance Panel
From: Michael T. Kasimirsky *Michael T. Kasimirsky*
Subject: Sequence IIIF Semiannual Report: April 1, 2003 through September 30, 2003

The following is a summary of Sequence IIIF reference tests that were reported to the Test Monitoring Center during the period April 1, 2003 through September 30, 2003.

Lab/Stand Distribution

	Reporting Data	Calibrated as of September 30, 2003
Number of Laboratories:	4	4
Number of Test Stands:	10	7

The following chart shows the laboratory/stand distribution:



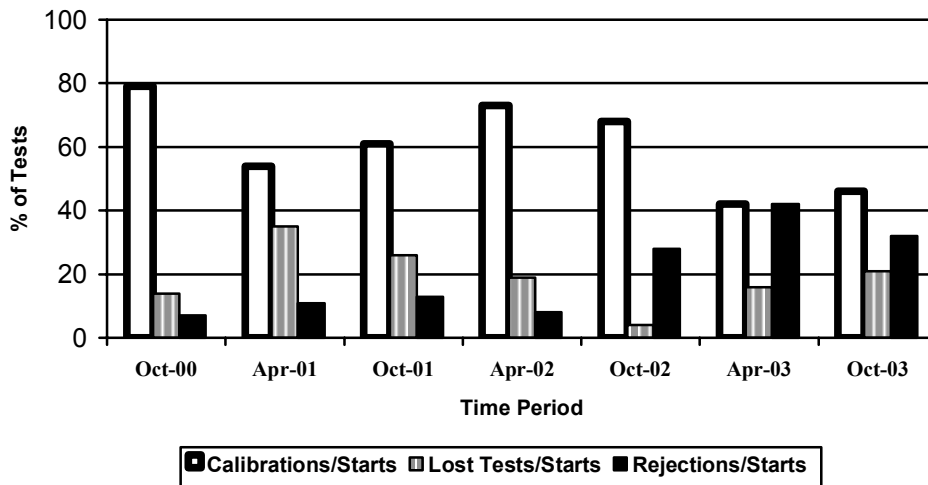
The following summarizes the status of the reference oil tests reported to the TMC:

Calibration Start Outcomes	TMC Validity Codes	No. of Tests
Operationally and Statistically Acceptable	AC	13
Failed Acceptance Criteria	OC	9
Operationally Invalid (Laboratory Judgment)	LC	5
Operationally Invalid (Lab & TMC Judgment)	RC	1
Stand Failed Reference Sequence – data pulled	MC	0
Aborted	XC	0
Total		28

Donated & Industry Support Outcomes	TMC Validity Codes	No. of Tests
Decoded Tests	AG	0
Total		0

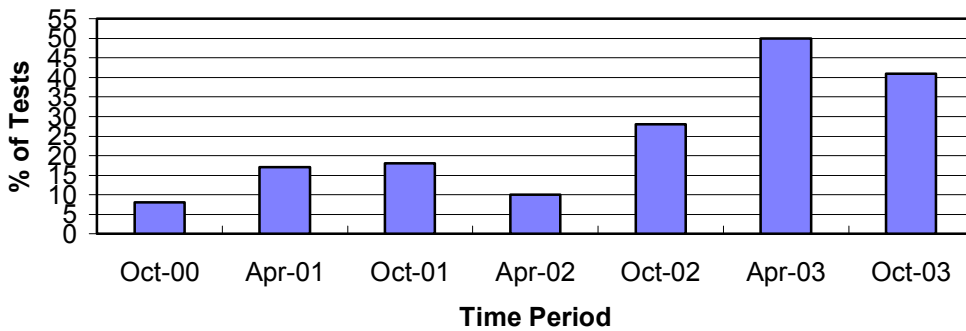
Calibrations per start, lost tests per start and rejection rates are summarized below:

Calibration Attempt Summary



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

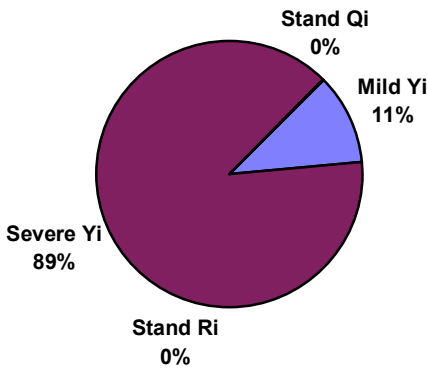
Rejected Test Rate for Operationally Valid Tests



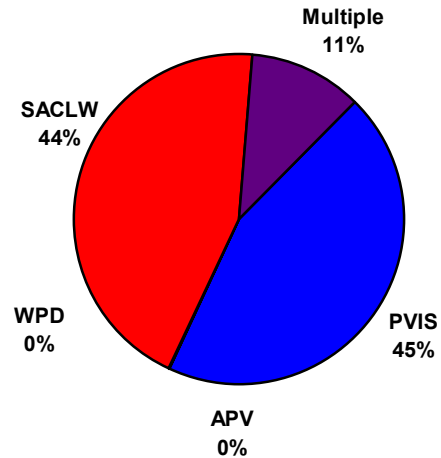
The rate of rejection of operationally valid tests has decreased from last period.

There were nine 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 three other deviations from the LTMS since its introduction in June of 2000.

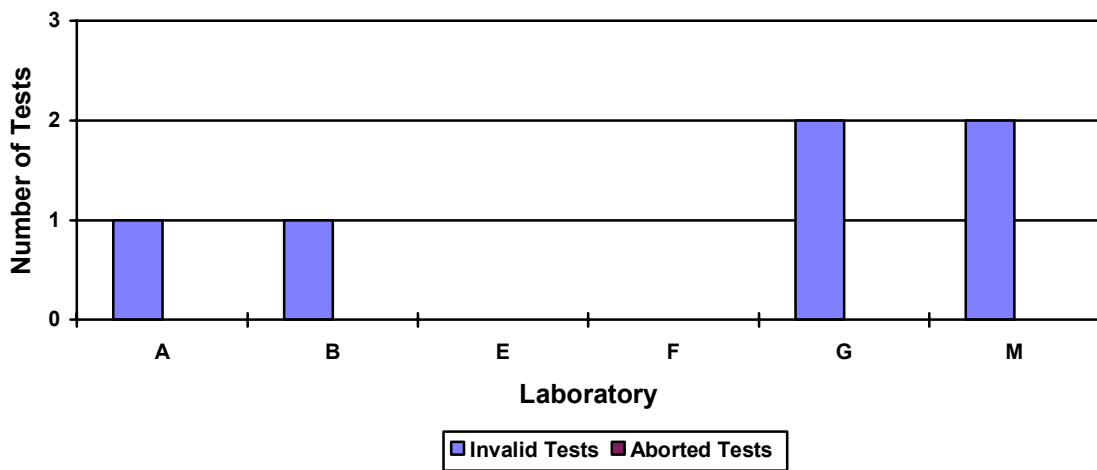
Two Sequence IIF lab visits were performed this period. No significant problems were found.

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)
A	Corrupted Data Files – no QI results	1	1/0/0
B1	Unknown viscosity increase problems	1	1/0/0
G	Negative QI on Oil Filter Block Temp	1	1/1/0
G	Downtime	1	
M	Intake Air Humidity Lost	1	2/0/0
	Negative QI on Intake Air	1	

Lost Test Distribution



Information Letters

Sequence IIIF Information Letter No. 03-1, Sequence No. 11, was issued during the period on July 18, 2003, and contained the following topics: New Oil Filter, Revised Front Cover & Oil Filter Housing, New Dip Stick, New Solvent Specifications, Calibrated Flask for Initial Oil Charge Measurement, ACC Registration Information, and Editorial Corrections.

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	-0.476	0.012 (df=17)	60.5 % Viscosity Increase ¹
APV	-0.368	0.184 (df=17)	-0.07 Merits
WPD	-0.206	0.382 (df=17)	-0.08 Merits
PV60 ²	-0.022	0.175 (df=17)	-1.1% 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	-0.32	-0.42	-0.39	0.21
B1	-1.37	-0.48	-0.21	-0.34
E	-	-	-	-
F	-	-	-	-
G	0.04	-0.98	-0.62	0.56
M	0.38	1.02	0.91	-0.78

Percent Viscosity Increase (PVIS)

The industry was within limits for precision during the period (see Figure 1), but is currently experiencing an EWMA Severity Alarm in the severe direction. This alarm appears to be driven by severe results at a single laboratory as three of the last four data points have been from this laboratory and all have been severe of target (-2.33, -1.71, and -1.00 Y_i results respectively), while the remaining fourth point was slightly mild of target (0.21 Y_i result). The industry was on the severe side of target for the period, with an average Δ/s value of -0.476 for the period (see Figure 5), making this the most severe period in history. Precision for the period has degraded slightly this period but is still comparable to the periods of best historical performance (see Figure 9).

Weighted Piston Deposits (WPD)

The industry was within limits on both severity and precision for the period (see Figure 2). The industry was severe for the period, with an average Δ/s value of -0.206, or -0.08 merits (see Figure 6). Precision for the period improved with a pooled standard deviation of 0.382 (see Figure 10) making it the most precise period in history.

Average Piston Skirt Varnish (APV)

The industry began the period in a precision alarm (see Figure 3) which was caused by several severe failing tests on APV in the last period. Subsequent testing has cleared the precision alarm. The industry also experienced a three-point severity alarm during the period. This test was caused by a single failing result on reference oil 1006-2 (-3.05 Y_i result) and subsequent testing has cleared the alarm. The industry was -0.07 Merits severe for the period with an average Δ/s value of -0.368 (see Figure 7), making it the most severe period on record. Precision for the period has improved over last period, with a pooled standard deviation of 0.184, and is in line with historical performance on this parameter (see Figure 11).

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

Four tests failed during the period on SACLW. Three of the four were run on reference oil 433-1 and one on reference oil 1008-1. All four were run on NJ camshafts. Two tests had two lobes with high wear, the other two had eight and eleven high wear lobes on the camshafts. 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 IIIF test and is used only in Sequence IIIFHD 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 IIIF 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

A new oil filter was implemented during the period in an effort to prevent bypass operation in the engine's oil system. An epoxy-impregnated front cover and oil filter housing were also implemented this period to eliminate any chances of casting porosity causing glycol contamination or additive carryover in the test. The longer Sequence IIIG dipstick was introduced into Sequence IIIF testing this period to standardize on one dipstick laboratory wide. A calibrated flask for initial oil charge measurement was also put into place this period to standardize the initial oil charge in the test engine. Finally, a new solvent specification was implemented to standardize the aliphatic naphtha product used to clean Sequence IIIG test parts.

Reference Oils

Oil	TMC Inventory, in gallons	TMC Inventory, in tests (4 gal/test)	Laboratory Inventory, in tests	Estimated life
1006	44	11	8	Not currently used in IIIF ¹
1006-2	4,967	1,241	16	~3+ years ¹
1007	483	120	12	Not currently used in IIIF ²
1008	29	7	8	No longer shipped ¹
1008-1	2,224	556	13	~3+ years ¹
1009	958	239	13	~Not currently used in IIIF ¹
432	118	29	13	Not currently used in IIIF
433	10	2	2	No longer shipped
433-1	618	154	15	~3+ years

¹ Multiple test area reference oil; total TMC inventory shown

² Not reblendable

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 IIIF 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 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.

During the period the TMC received sufficient data to update the test targets for reference oil 1006-2 based upon this data. The updated targets for reference oil 1006-2, based on these 22 data points, are shown in the following table:

<i>Updated Reference Oil 1006-2 Test Targets</i>		
<i>Parameter</i>	<i>Mean</i>	<i>Standard Deviation</i>
PVIS	0.0461786	0.0079007
WPD	4.00	0.459
APV	9.38	0.227
PV60	5.43687	0.171445

These targets will be updated again when the TMC has 30 data points available on this reference oil. These targets are effective for all tests completed on or after July 1, 2003.

MTK/mtk

Attachments

c: F. M. Farber, TMC
 Sequence IIIF Surveillance Panel
<ftp://astmtmc.cmu.edu/docs/gas/sequenceiii/semiannualreports/IIIF-10-2003.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 IIF Timeline.

Figure 1

SEQUENCE IIIF INDUSTRY OPERATIONALLY VALID DATA

VISCOSITY INCREASE FINAL ORIG UNIT RES

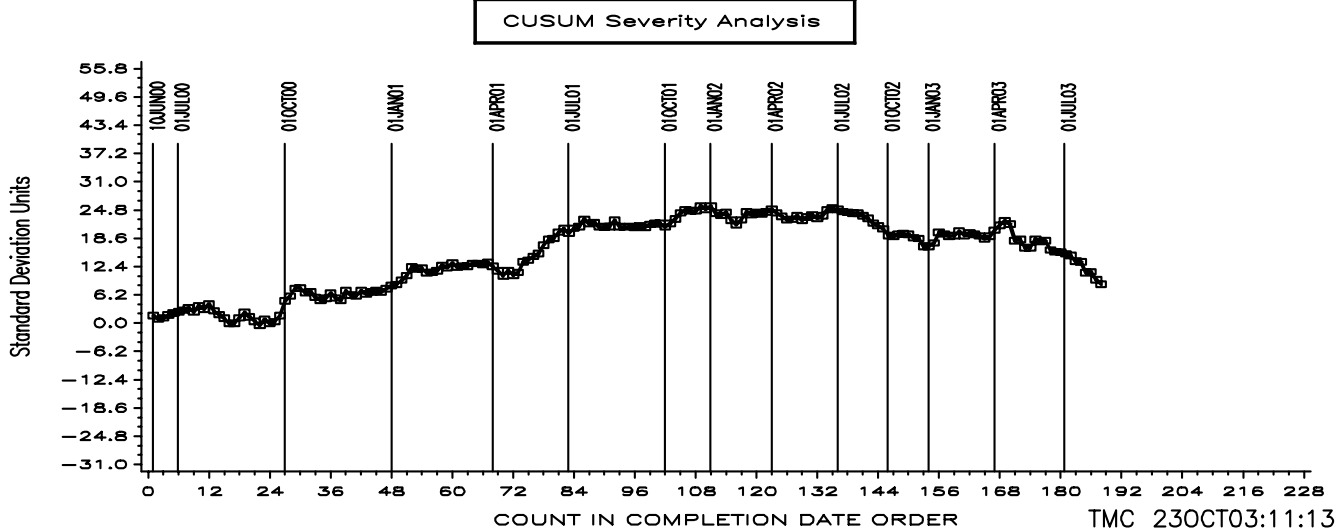
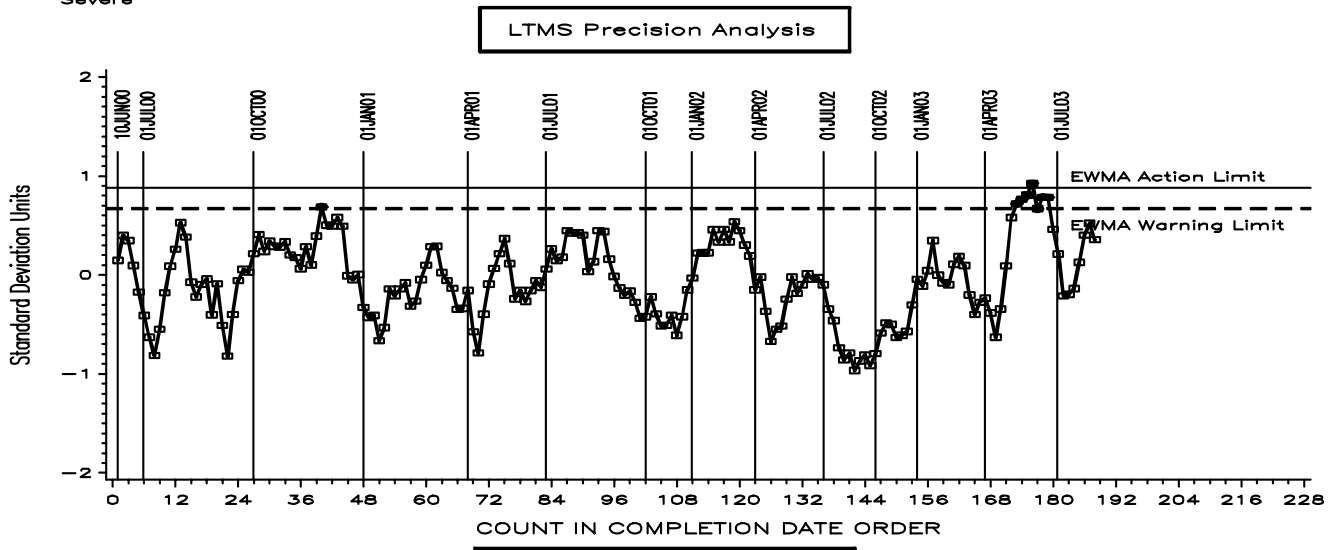
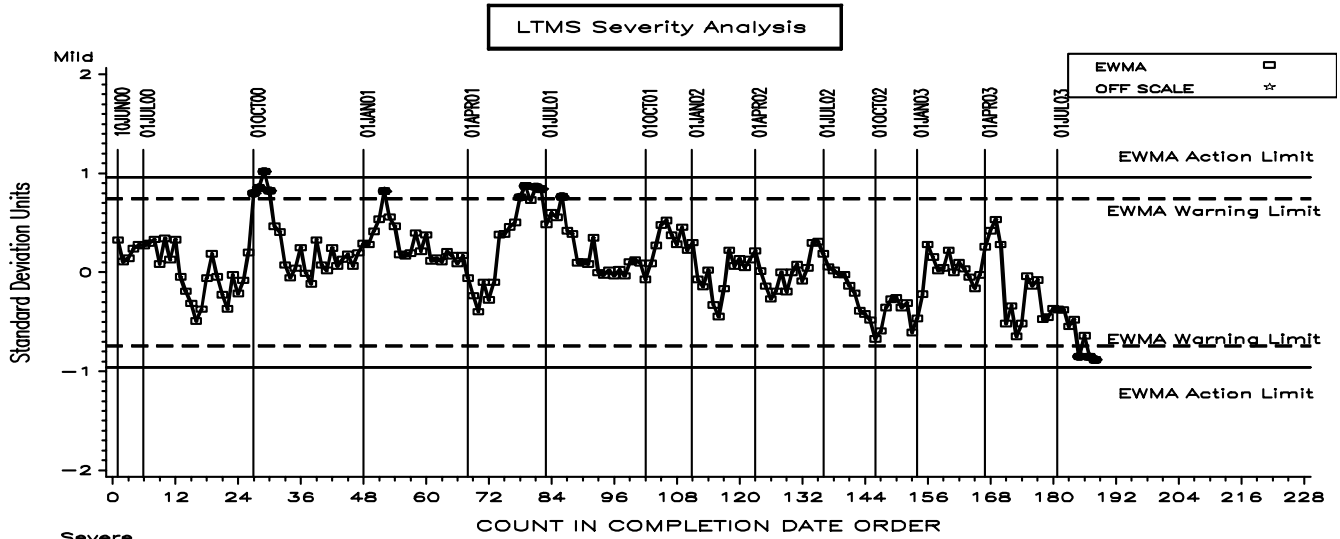


Figure 2

SEQUENCE IIIF INDUSTRY OPERATIONALLY VALID DATA

AVERAGE WEIGHTED PISTON DEPOSITS FNL ORIG UNIT RES

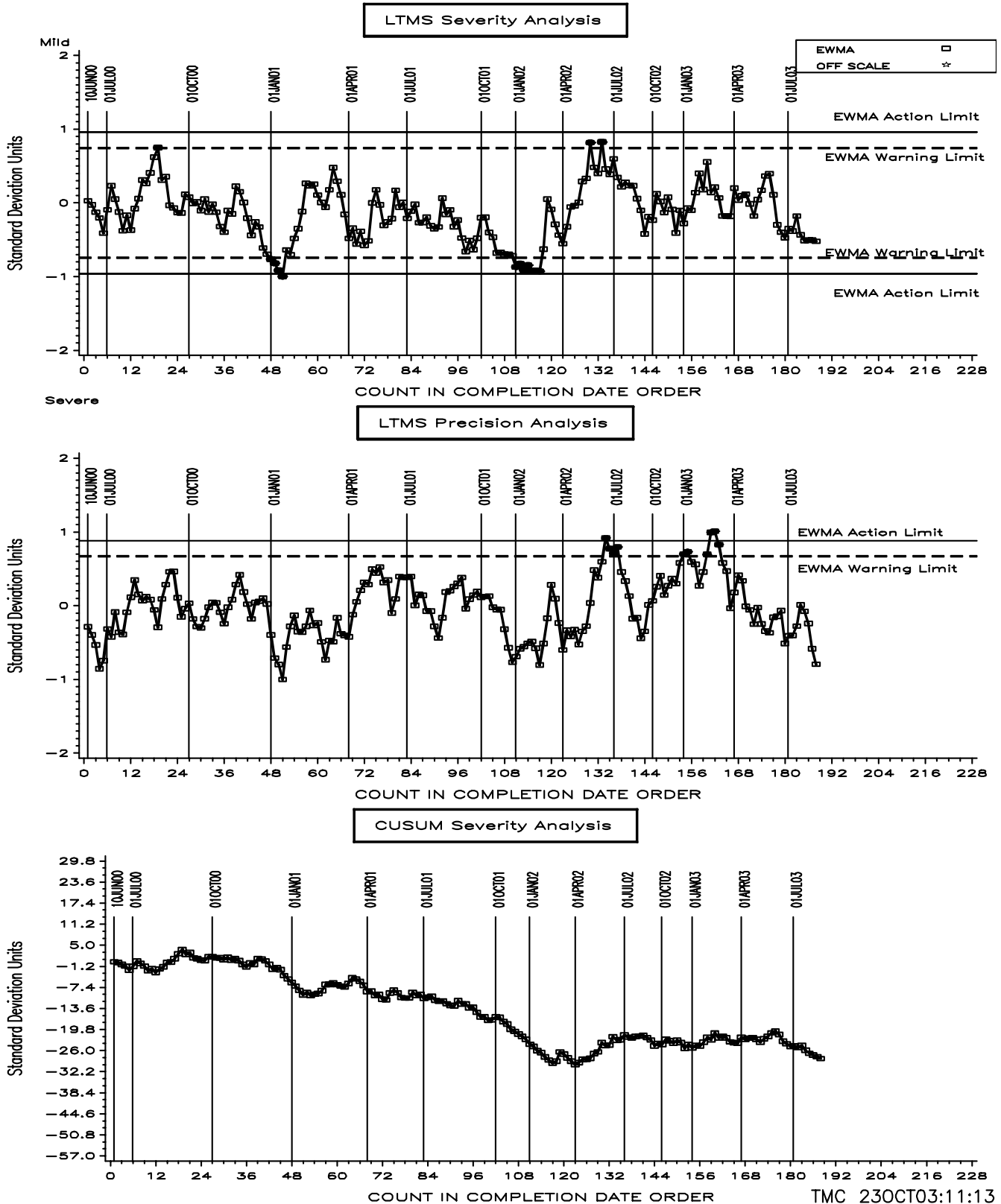


Figure 3

SEQUENCE IIIF INDUSTRY OPERATIONALLY VALID DATA

AVERAGE PISTON SKIRT VARNISH FINAL ORIG UNIT RES

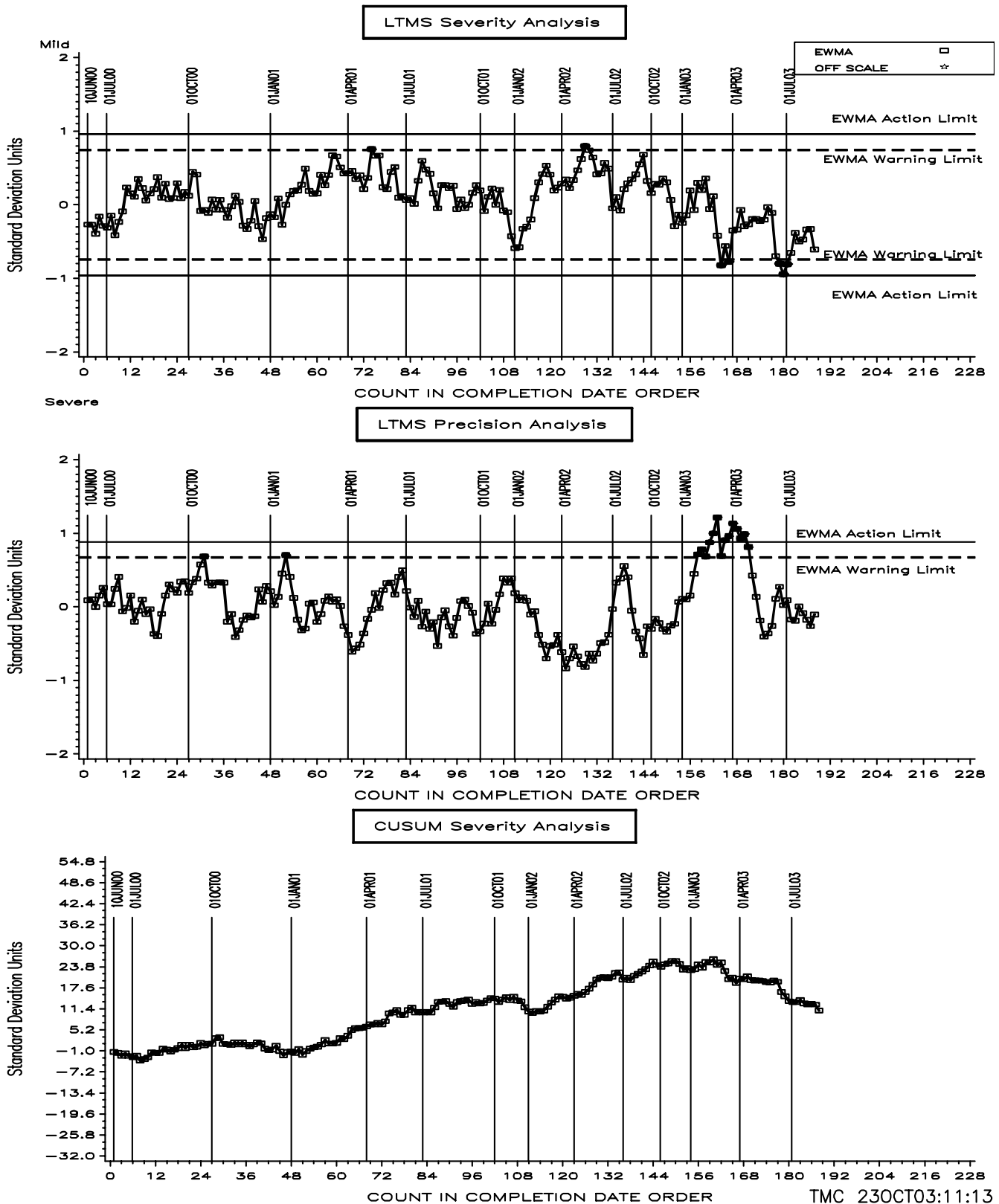


Figure 4

SEQUENCE IIIF INDUSTRY OPERATIONALLY VALID DATA

% VISCOSITY INCREASE @ 060 HOURS

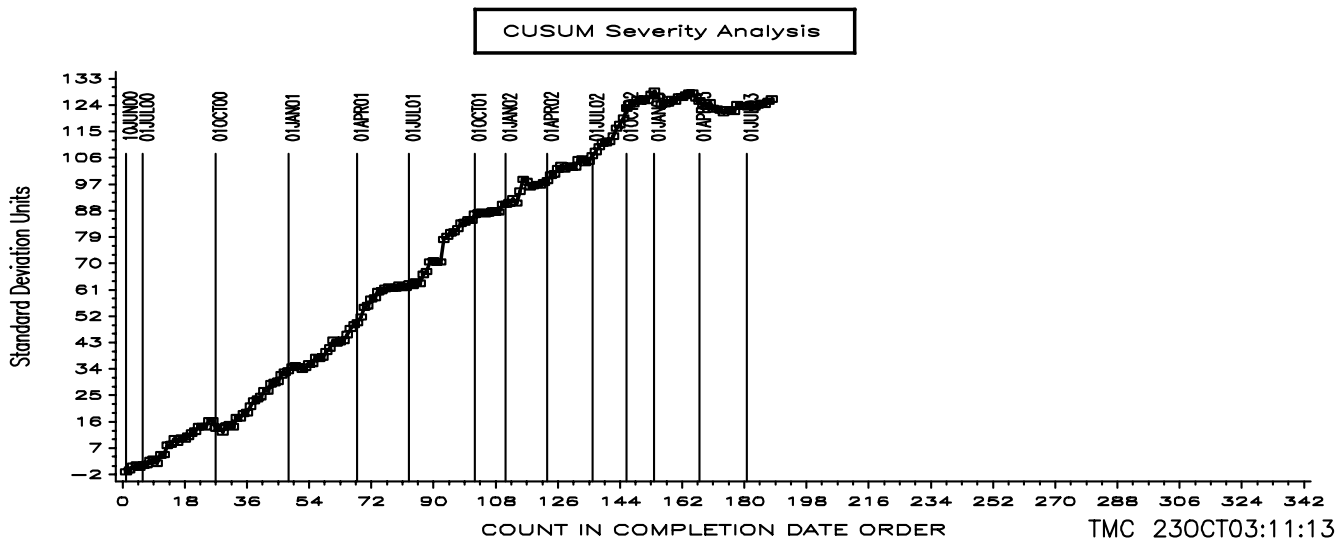
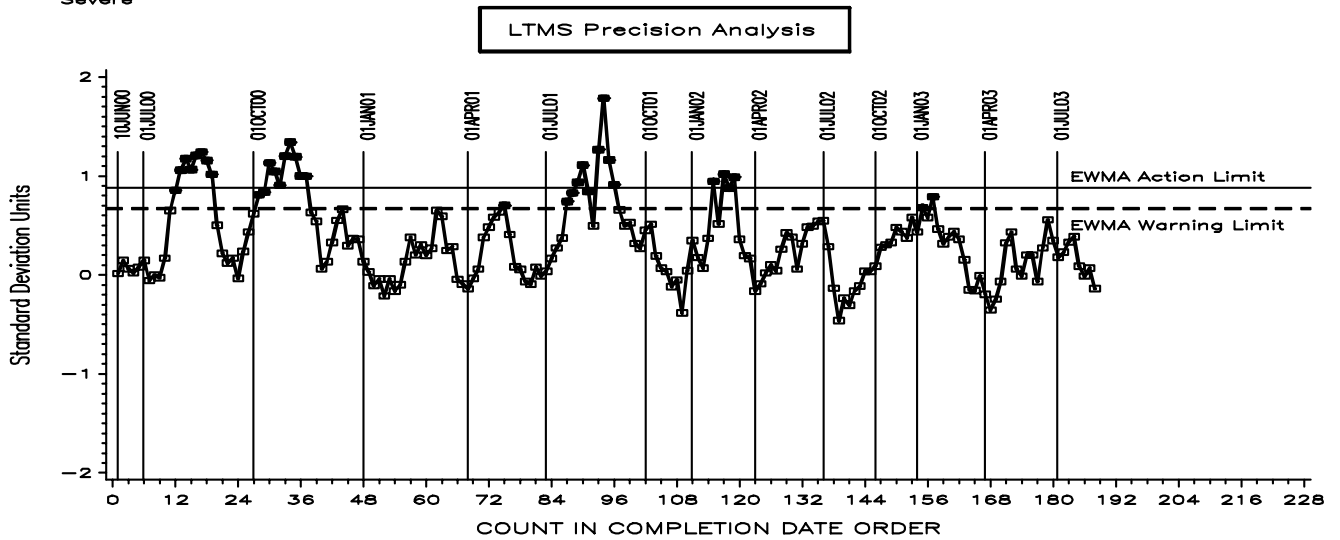
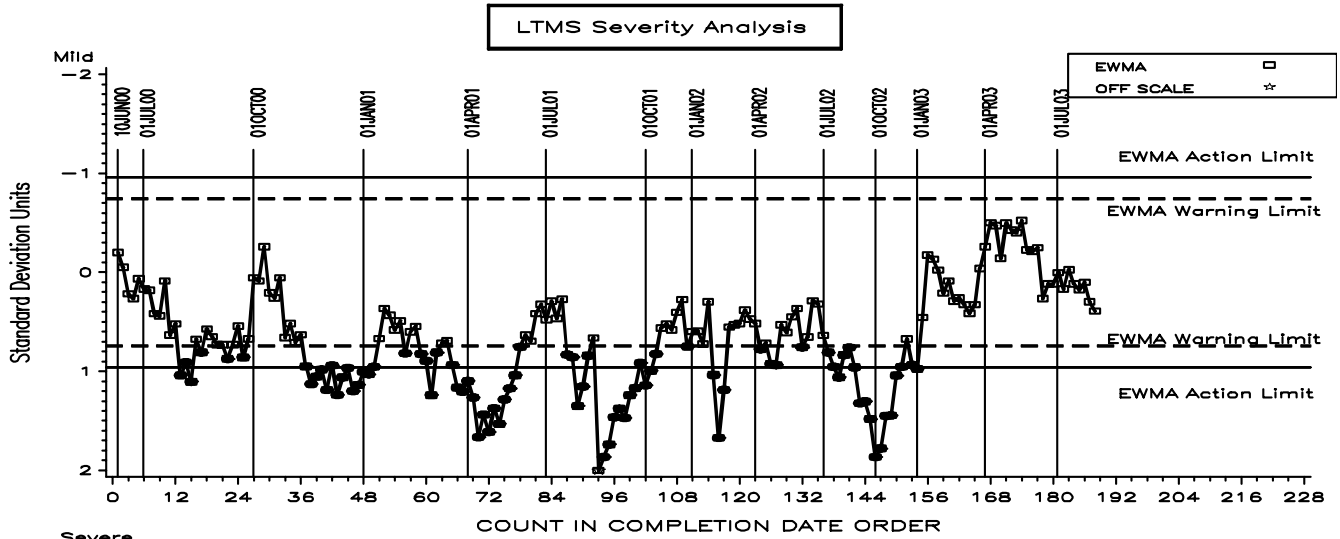


Figure 5 - Percent Viscosity Increase, Average Delta/s

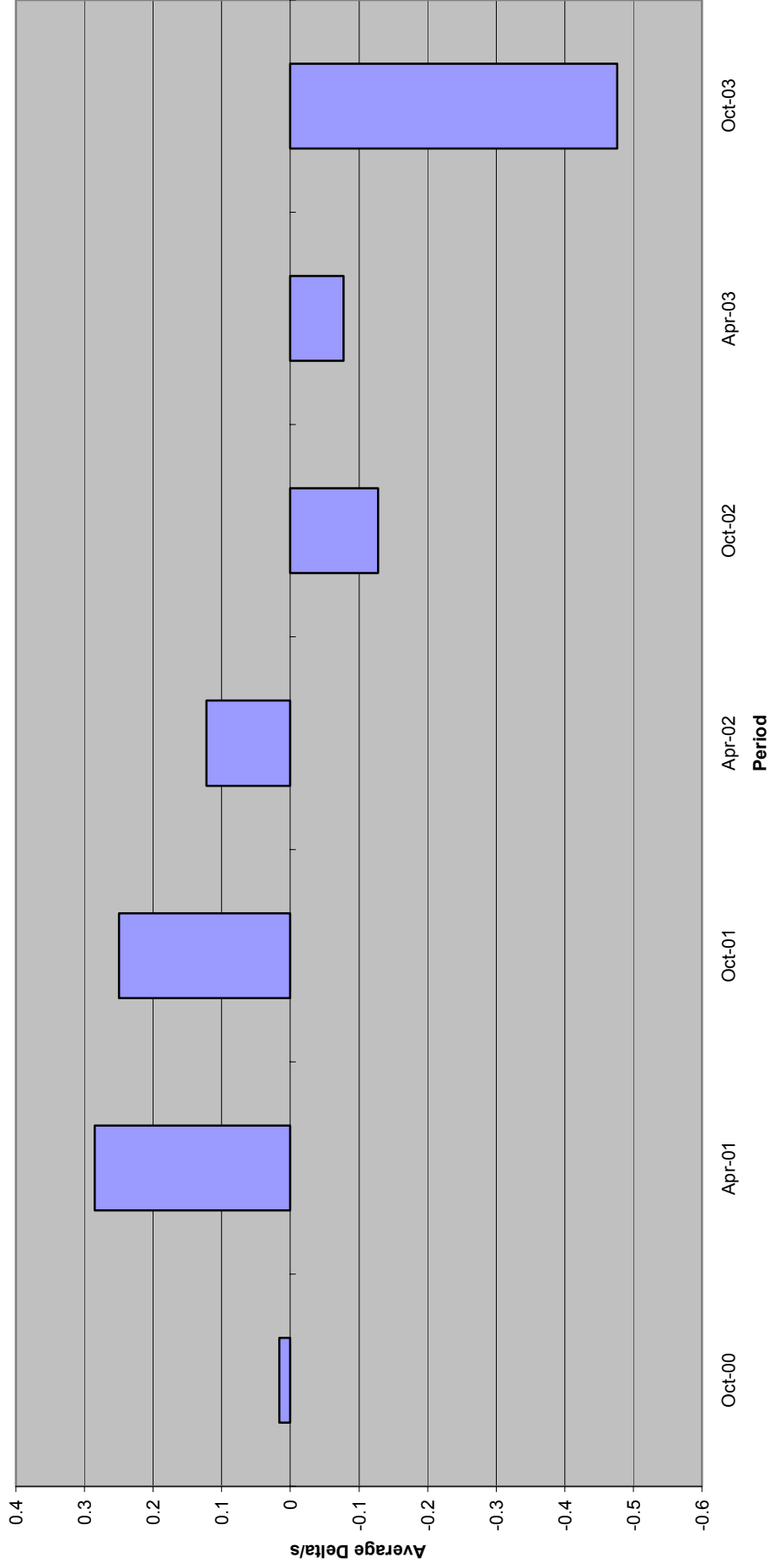


Figure 6 - Weighted Piston Deposits, Average Deltas/s

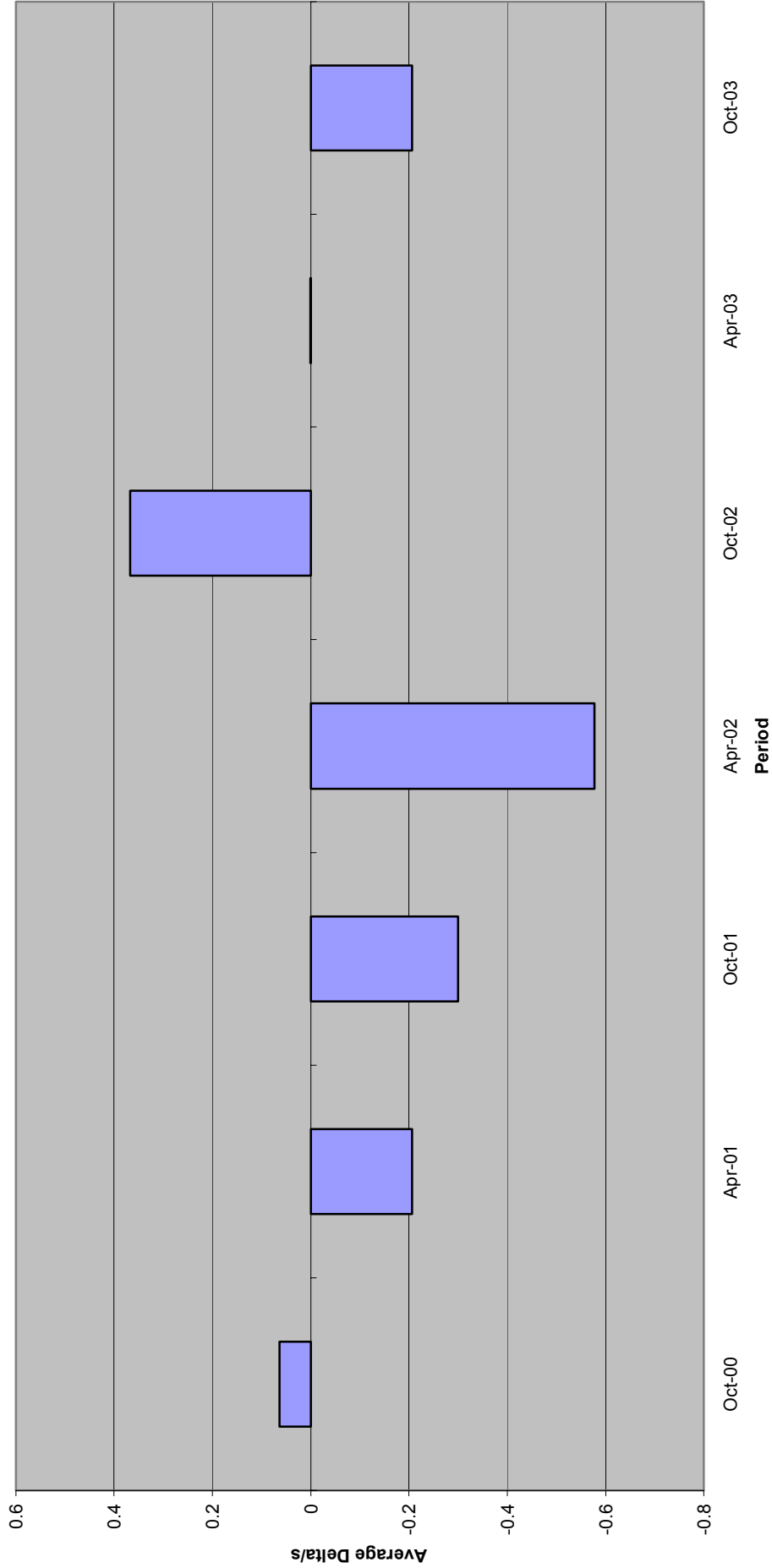


Figure 7 - Average Piston Varnish, Average Deltas

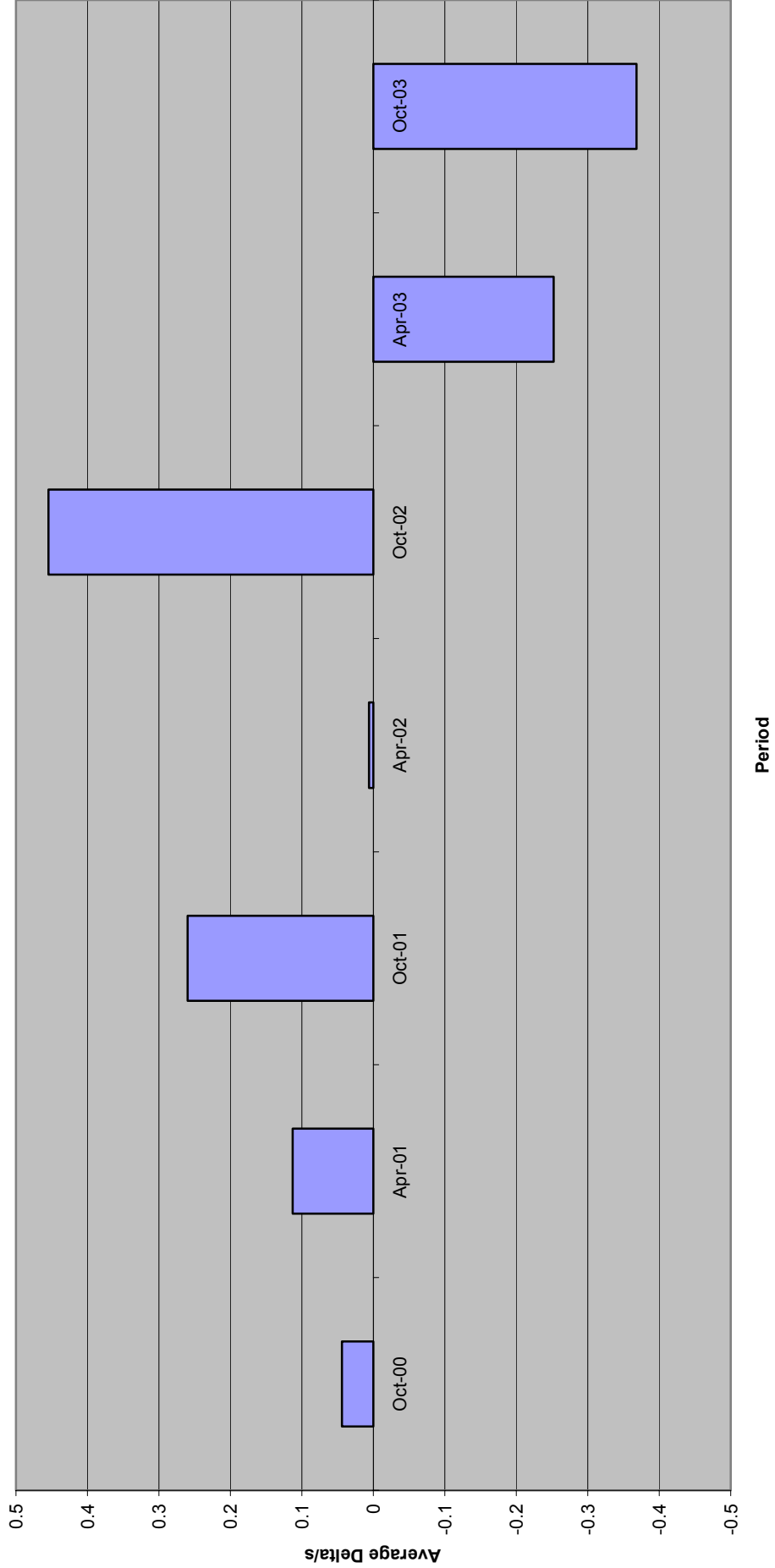


Figure 8 - Percent Viscosity Increase @ 60 Hours (Sequence IIFHD), Average Deltas/s

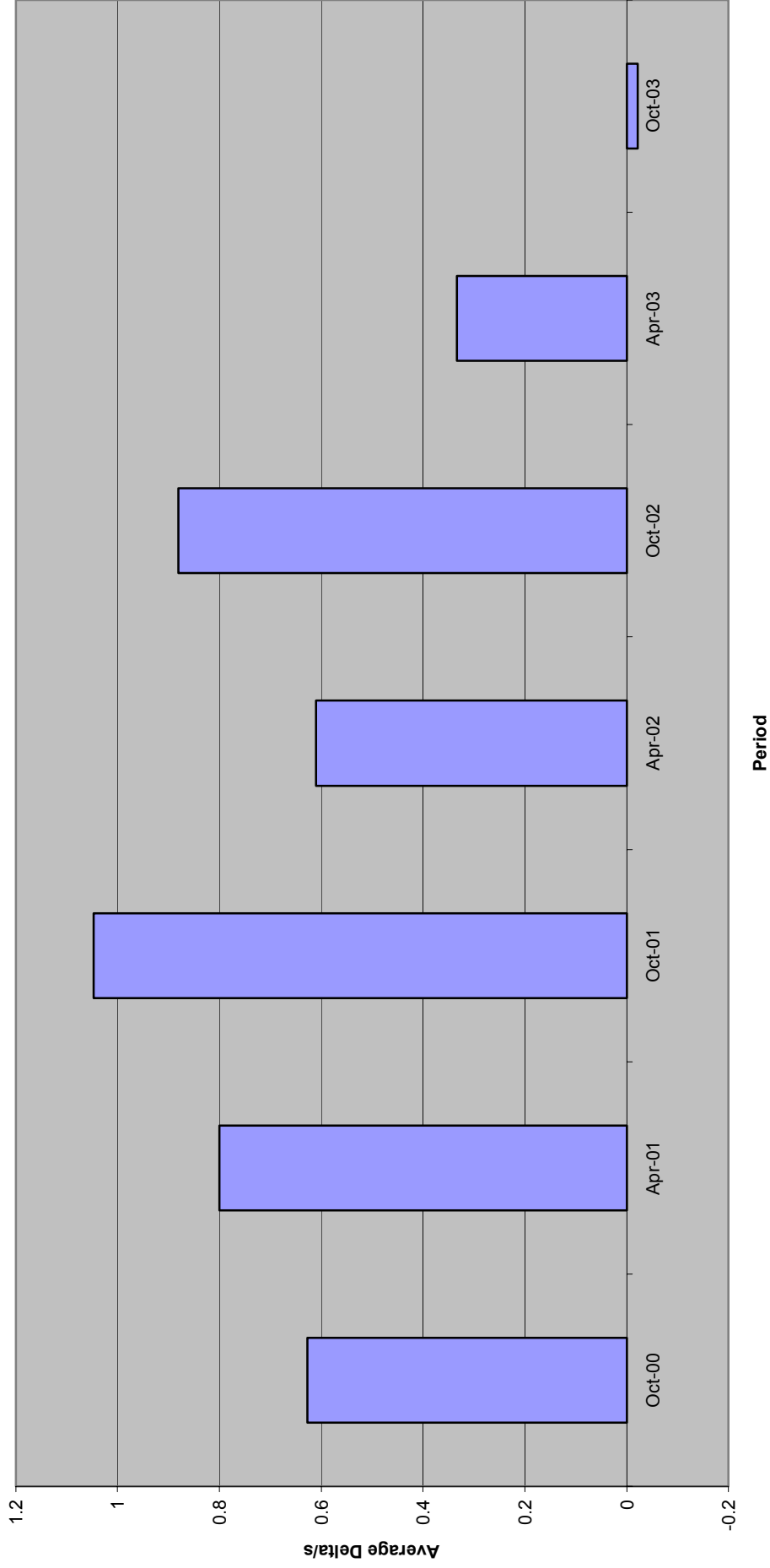


Figure 9 - Percent Viscosity Increase, Pooled Standard Deviation

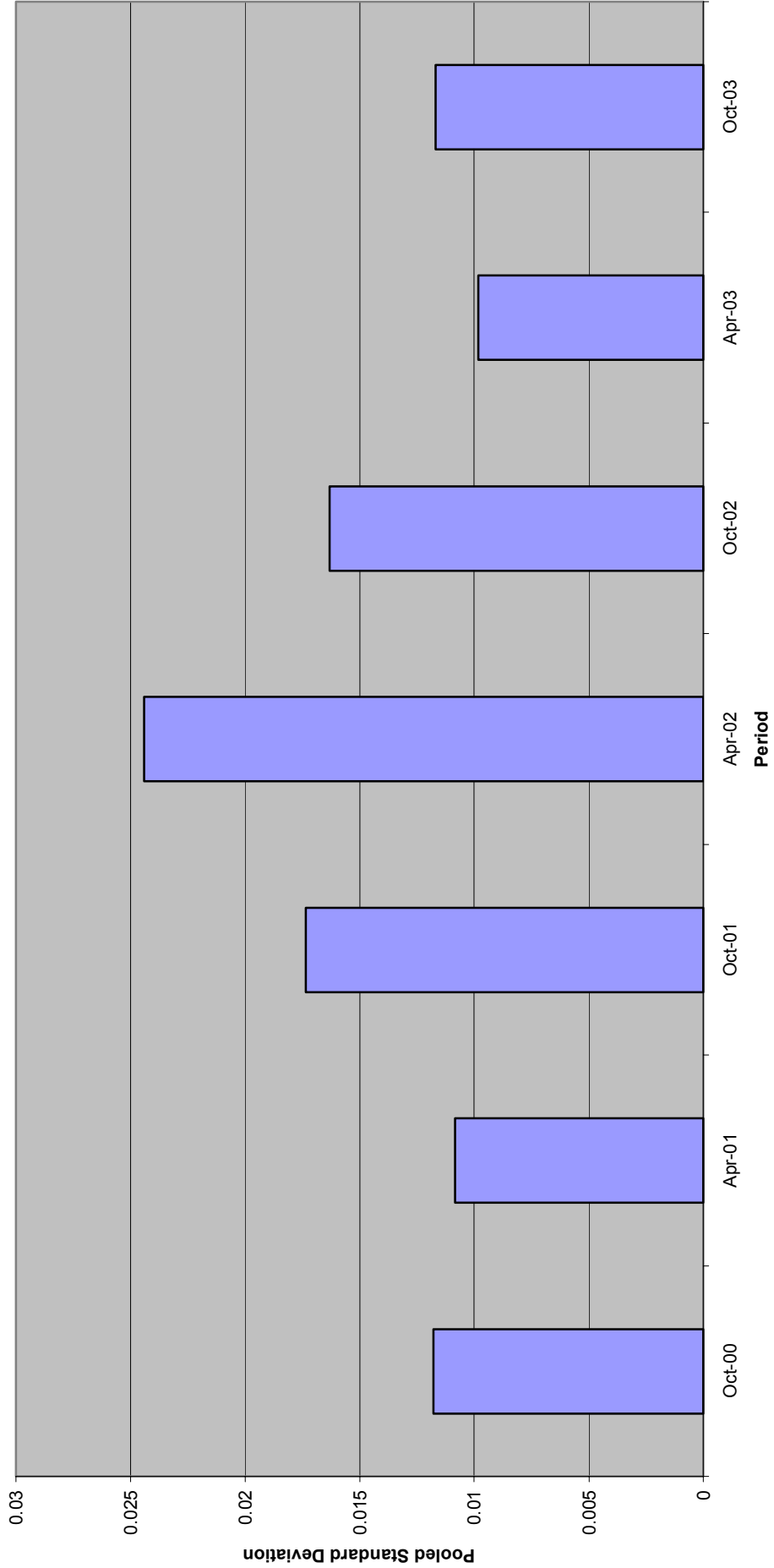


Figure 10 - Weighted Piston Deposits, Pooled Standard Deviation

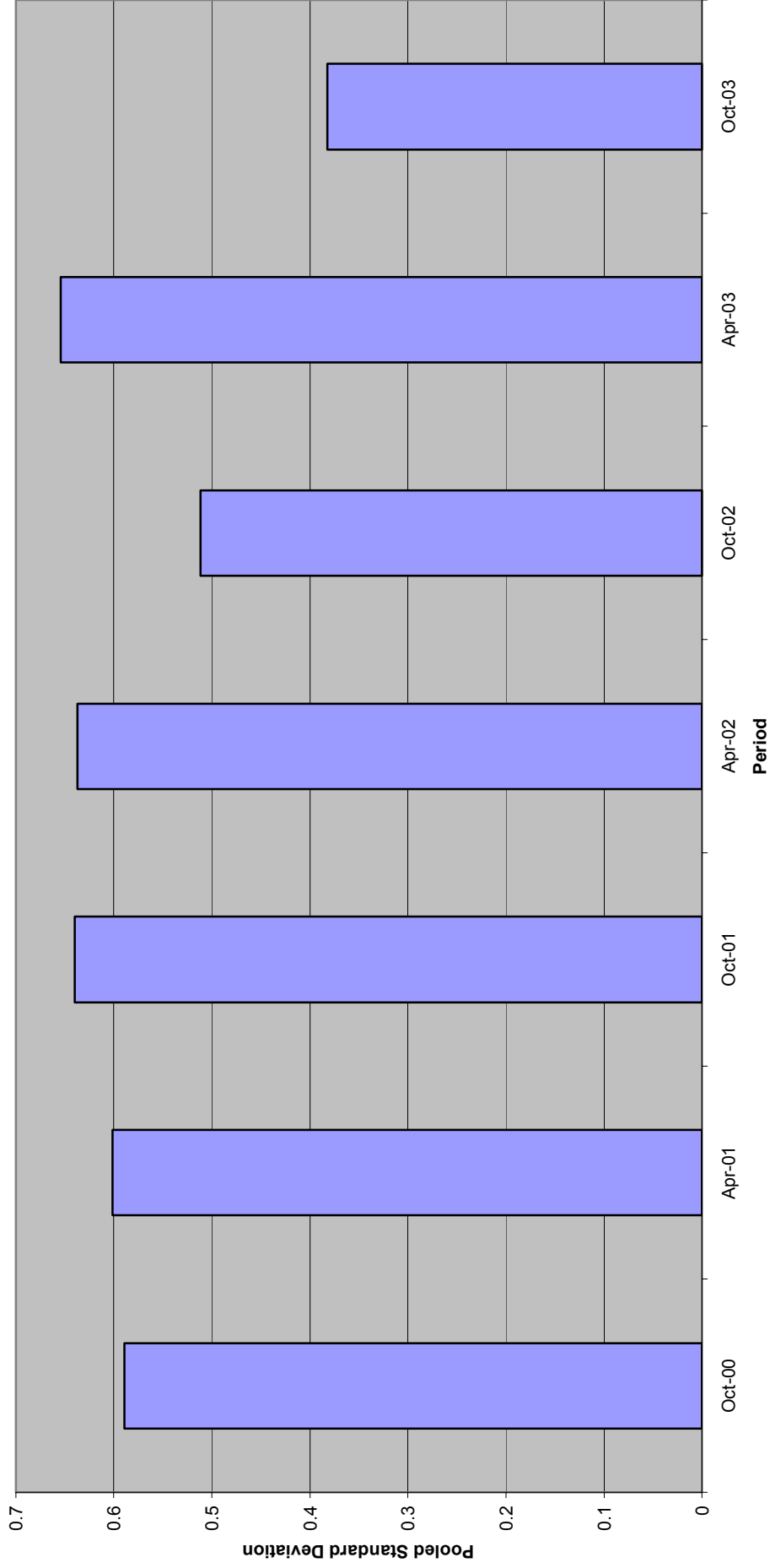


Figure 11 - Average Piston Skirt Varnish, Pooled Standard Deviation

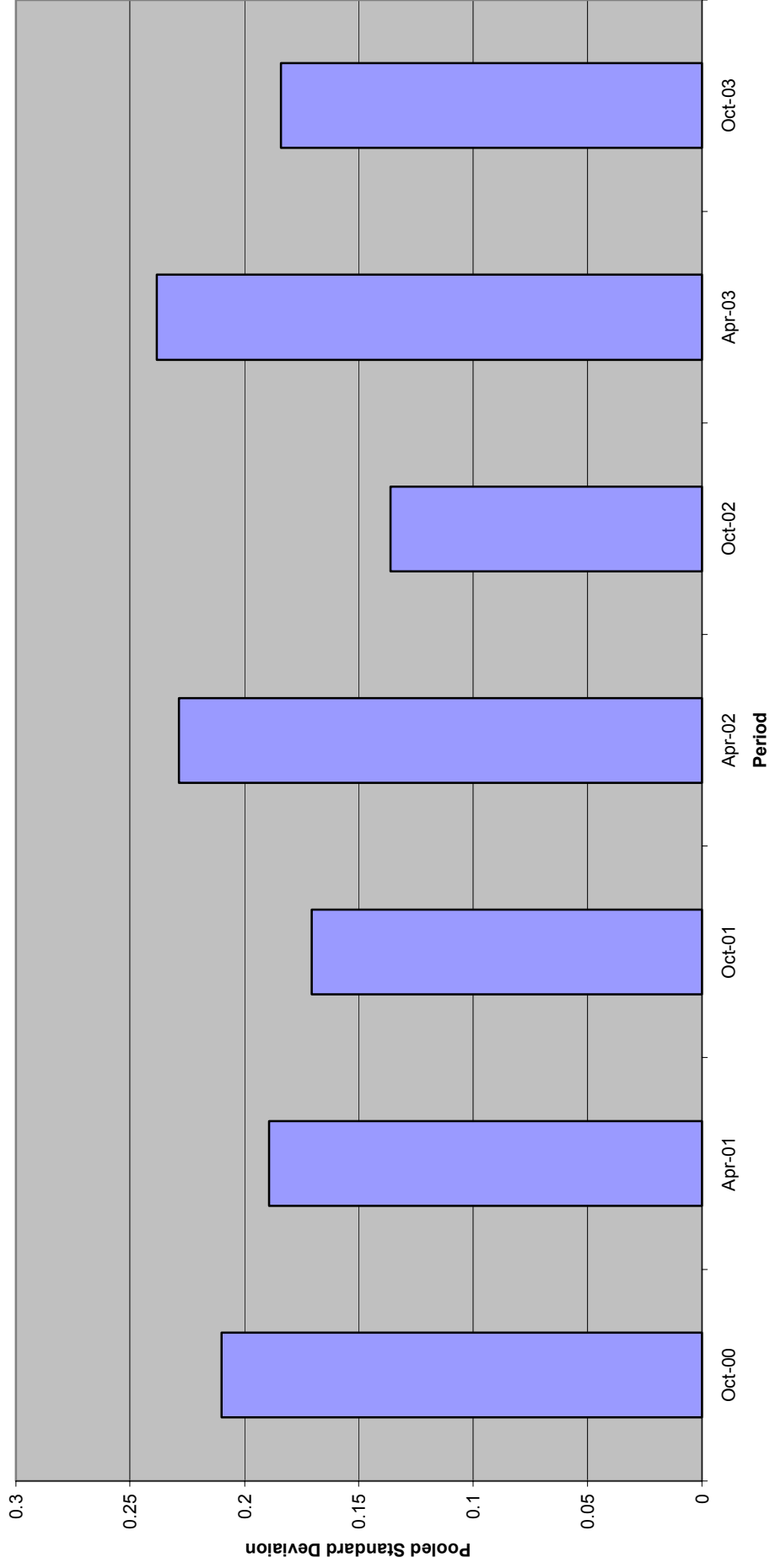


Figure 12 - Percent Viscosity Increase @ 60 Hours (Sequence III(FHD), Pooled Standard Deviation

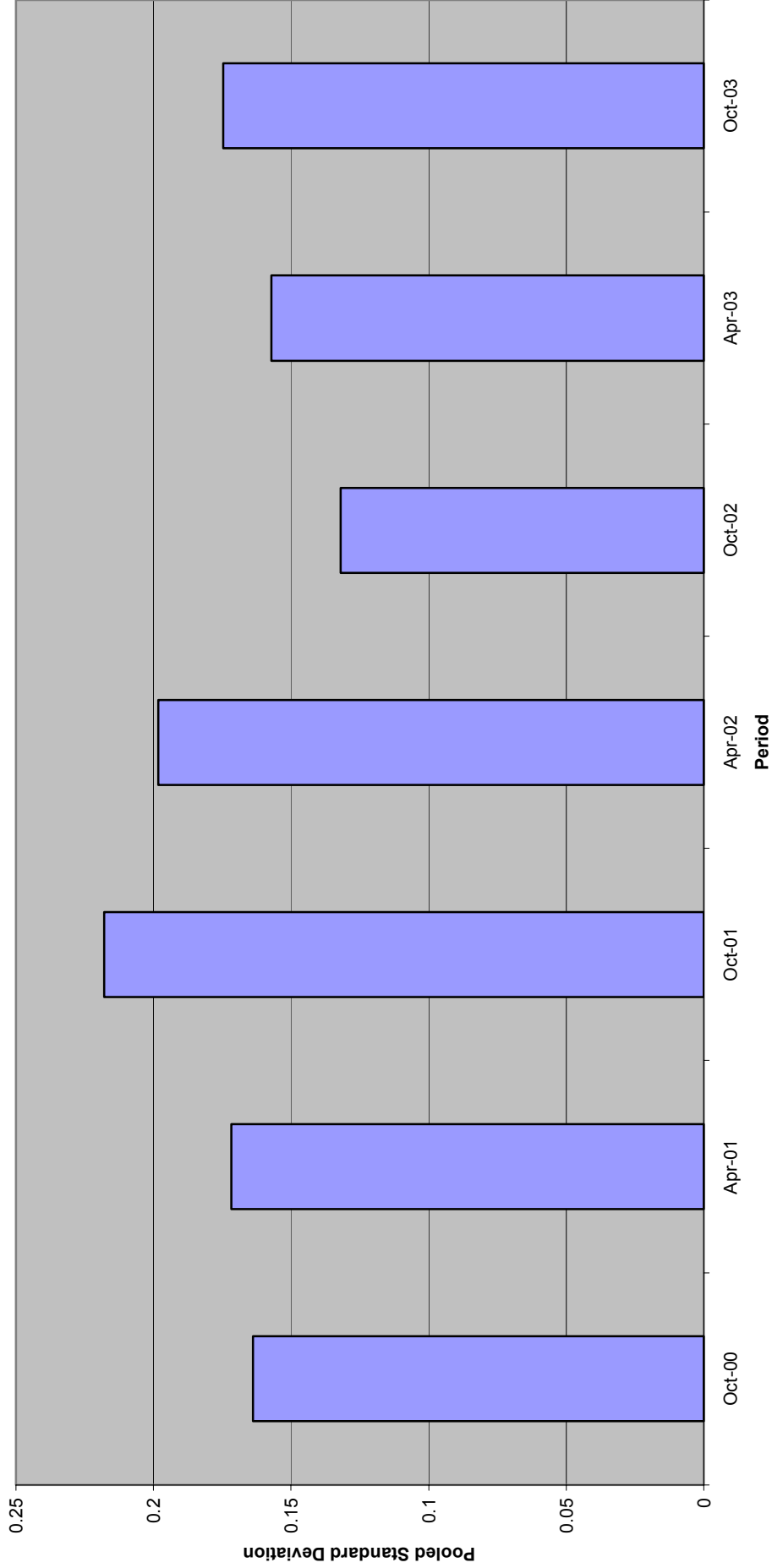


Figure 13 – Sequence IIIF Timeline

Date	Topic	Information Letter
6/10/2000	IIIF Test Released from Redevelopment	
6/10/2000	Revised Ring Sticking definitions implemented	00-2
7/25/2000	Oil Consumption as a test validity criteria dropped	00-2
8/28/2000	First occurrence of LC camshafts in LTMS data	
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
9/27/2000	Valve train assembly using build up oil implemented	00-2
10/4/2000	New QI U&L Values 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
4/25/2001	First occurrence of MB camshafts in LTMS data	
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
9/12/2001	First occurrence of engine builds using test oil for valvetrain lubrication in LTMS	
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
5/30/2003	New Oil Filter	03-1
6/30/2003	Revised Front Cover and Oil Filter Housing	03-1
6/30/2003	Sequence IIIG Dipstick	03-1
6/30/2003	Calibrated Flask for Initial Oil Charge	03-1
12/31/2003	New Solvent Specifications	03-1