



Test Monitoring Center

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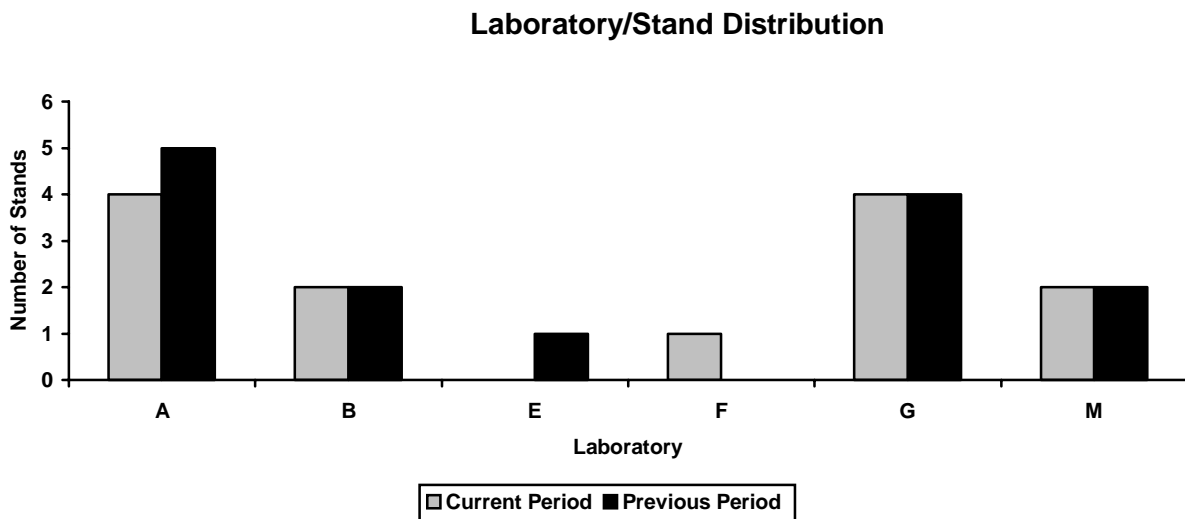
Memorandum: 02-106
Date: October 31, 2002
To: William M. Nahumck, Chairman, Sequence IIIF Surveillance Panel
From: Michael T. Kasimirsky *Michael T. Kasimirsky*
Subject: Sequence IIIF Semiannual Report: April 1, 2002 through September 30, 2002

The following is a summary of Sequence IIIF reference tests that were reported to the Test Monitoring Center during the period April 1, 2002 through September 30, 2002.

Lab/Stand Distribution

	Reporting Data	Calibrated as of September 30, 2002
Number of Laboratories:	5	4
Number of Test Stands:	13	10

The following chart shows the laboratory/stand distribution:



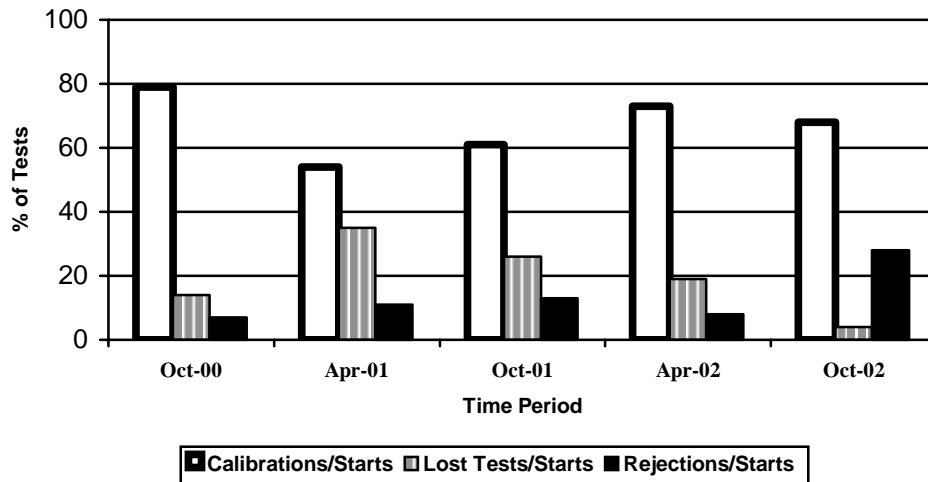
The following summarizes the status of the reference oil tests reported to the TMC:

Calibration Start Outcomes	TMC Validity Codes	No. of Tests
Operationally and Statistically Acceptable	AC	17
Failed Acceptance Criteria	OC	7
Operationally Invalid (Laboratory Judgment)	LC	1
Operationally Invalid (Lab & TMC Judgment)	RC	2
Stand Failed Reference Sequence – data pulled	MC	0
Aborted	XC	0
Total		27

Donated & Industry Support Outcomes	TMC Validity Codes	No. of Tests
Decoded oil for Stand Shakedown	OG	1
Total		1

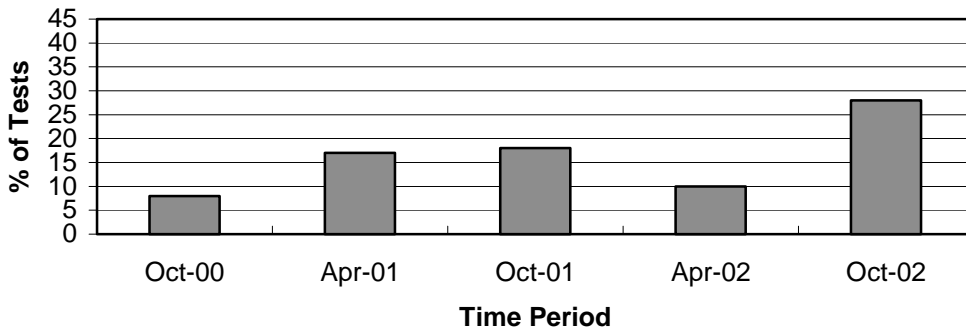
Calibrations per start, lost tests per start and rejection rates are summarized below:

Calibration Attempt Summary



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

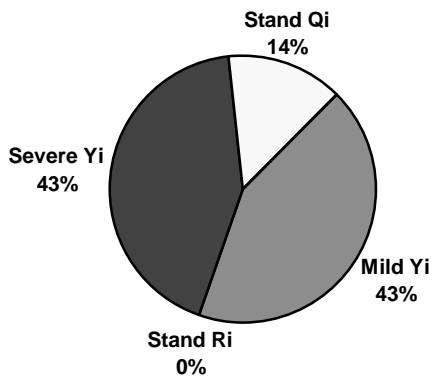
Rejected Test Rate for Operationally Valid Tests



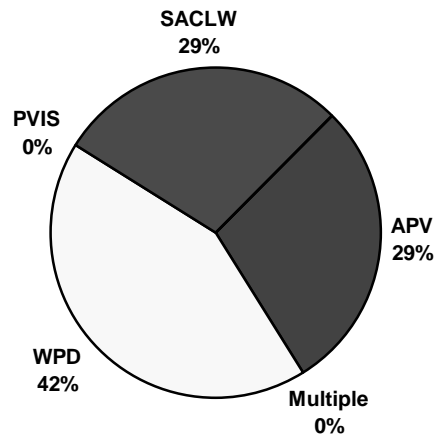
The rate of rejection of operationally valid tests has increased from last period.

There were seven 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 was one LTMS Deviation written this period. There have been three other deviations from the LTMS since its introduction in June of 2000.

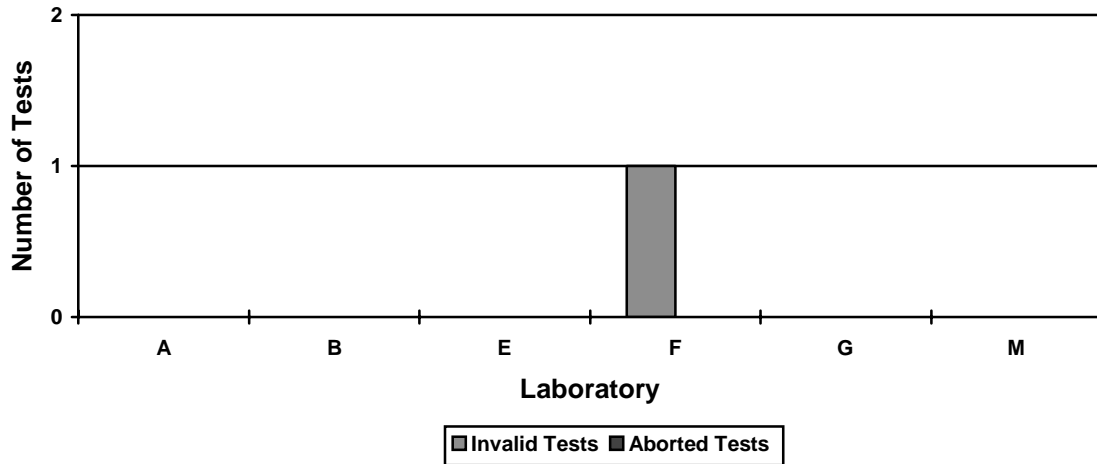
No lab visits were performed during the period.

Lost Test Summary

One test was 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	AFR Control Problems	1	1/0/0

Lost Test Distribution



Information Letters

No Sequence III F Information Letters were issued this period.

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	-0.128	0.016 (df=19)	19.7 % Viscosity Increase ¹
APV	0.454	0.136 (df=19)	0.06 Merits
WPD	0.367	0.512 (df=19)	0.19 Merits
PV60 ²	0.881	0.132 (df=19)	36.4% Viscosity Increase ³

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

² Not a pass/fail parameter in the Sequence III F test; Sequence III FHD use only

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

Average Δ/s Results, by Laboratory				
Laboratory	PVIS	APV	WPD	PV60
A	0.03	0.43	-0.604	0.96
B	0.42	0.49	2.20	0.06
E	-	-	-	-
F	-	-	-	-
G	-0.61	0.37	0.28	1.49
M	0.37	0.85	-0.40	-0.36

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 -0.128 for the period (see Figure 5), reversing the long-standing industry mild trend. Precision for the period, however, has improved this period and is again comparable to historical performance (see Figure 9).

Weighted Piston Deposits (WPD)

The industry exceeded the EWMA Severity Warning twice during the period (see Figure 2). Both of these warnings were caused by a laboratory problem related to a single test stand and two tests on reference oil 433-1. These two tests caused an EWMA Precision Alarm of four data points (see Figure 2). The industry is currently in an EWMA Precision Warning due to a third failing test on reference oil 433-1 at the laboratory mentioned above. At this time the EWMA alarms appear to be laboratory-related. The industry was 0.19 Merits mild overall for the period, with an average Δ/s value of 0.367, reversing the long-standing severe trend.(see Figure 6). Precision for the period improved to the best level on record with a pooled standard deviation of 0.512 (see Figure 10).

Average Piston Skirt Varnish (APV)

With the exception of a single-point severity warning, the industry was within EWMA limits for both severity and precision during the period (see Figure 3). The industry was 0.06 Merits mild for the period with an average Δ/s value of $+0.454$ (see Figure 7). Precision for the period has improved, with a pooled standard deviation of 0.136, compared to historical performance and is the best on record (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 on a single test stand and both were run on reference oil 1008 using MK camshafts. The first had two lobes with high wear and the second had six lobes with high wear. Lifter wear ranged from 5-15 μm on the first test and 5-17 μm on the second. 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 been consistently severe of target on this parameter since its introduction into the test. As a result, the Surveillance Panel may wish to consider a revision of the test targets used for this parameter.

QI Deviations

There were two QI Deviations written this period. There have been a total of 25 QI Deviations written since the test was introduced in June of 2000.

The first deviation written this period was on a test with negative Engine Speed QI results. This was due to problem with fuel pressure and flow control which were diagnosed during the test. The problems could not be diagnosed and corrected in time to allow the QI results to return above zero. However, corrective actions were taken in a timely manner and the TMC agreed with the laboratory that the negative QI results did not adversely affect the test results.

The second deviation written this period was on a test with negative Left Exhaust Back Pressure control. The test was run a relatively new stand in the laboratory and the problem was traced to

condensate in the exhaust sample lines. After an analysis of the data, the TMC agreed that the deviation did not adversely affect the test results.

Hardware

No hardware changes were made this period.

Reference Oils

Oil	TMC Inventory, in gallons	TMC Inventory, in tests (4 gal/test)	Laboratory Inventory, in tests	Estimated life
1006	45	11	12	No longer shipped ¹
1006-2	5,154	1,288	16	~3+ years ¹
1007	3,763	940	11	not currently used in IIIF ²
1008	29	7	10	No longer shipped ¹
1009	1,015	253	13	~3+ years ¹
432	118	29	13	not currently used in IIIF
433	10	2	2	No longer shipped
433-1	725	181	15	~3+ years

¹ Multiple test area reference oil; total TMC inventory shown

² Not reblendable

At the May 16, 2002, meeting of the Sequence IIIF Surveillance Panel, the panel approved a motion to introduce reference oil 1008-1 using the existing test targets for reference oil 1008. The preliminary targets for reference oil 1008-1 are shown below:

Preliminary Reference Oil 1008 test targets		
Parameter	Mean	Standard Deviation
PVIS	0.0167362	0.0086503
APV	9.23	0.213
WPD	3.32	0.327
PV60	5.41732	0.230855

The targets for this reference oil will be updated when the TMC has obtained 10, 20, and 30 data points on the oil. Currently the TMC has four data points on this oil.

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	4.04	0.407
WPD	9.46	0.203
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.

MTK/mtk

Attachments

c: F. M. Farber, TMC
Sequence IIIIF Surveillance Panel
<ftp://astmtmc.cmu.edu/docs/gas/sequenceiii/semiannualreports/IIIIF-10-2002.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

IIIF INDUSTRY OPERATIONALLY VALID DATA

VISCOSITY INCREASE FINAL ORIG UNIT RES

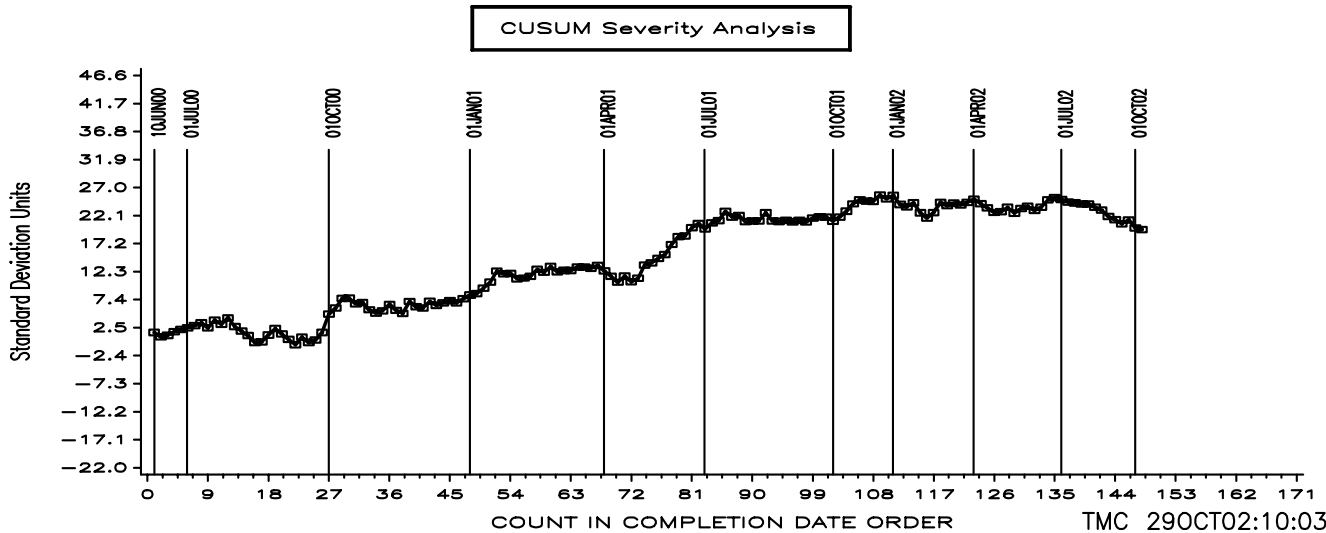
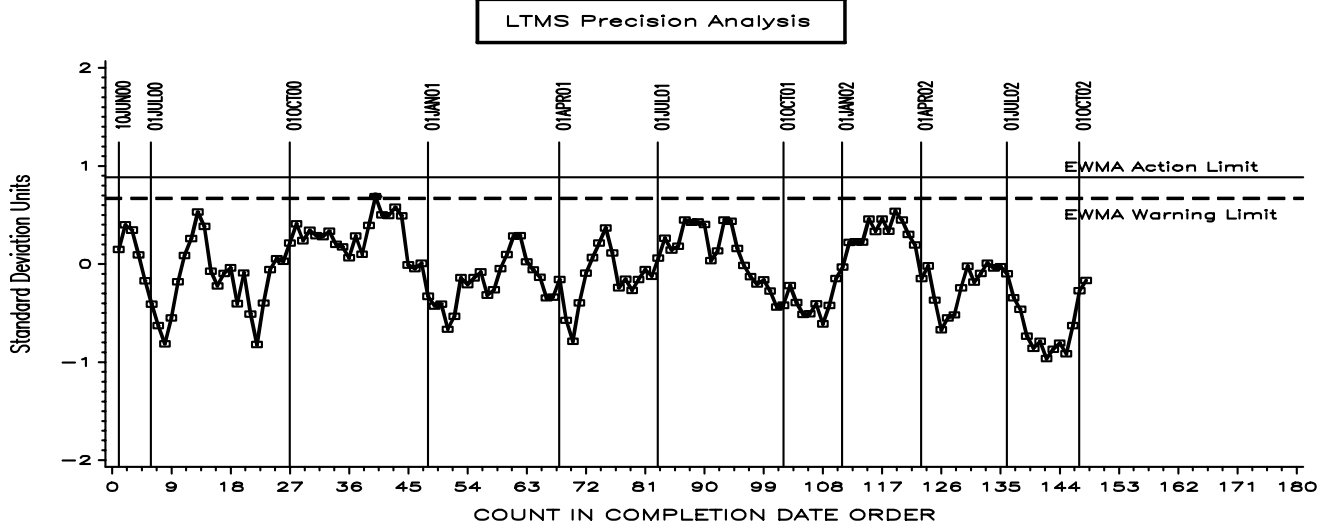
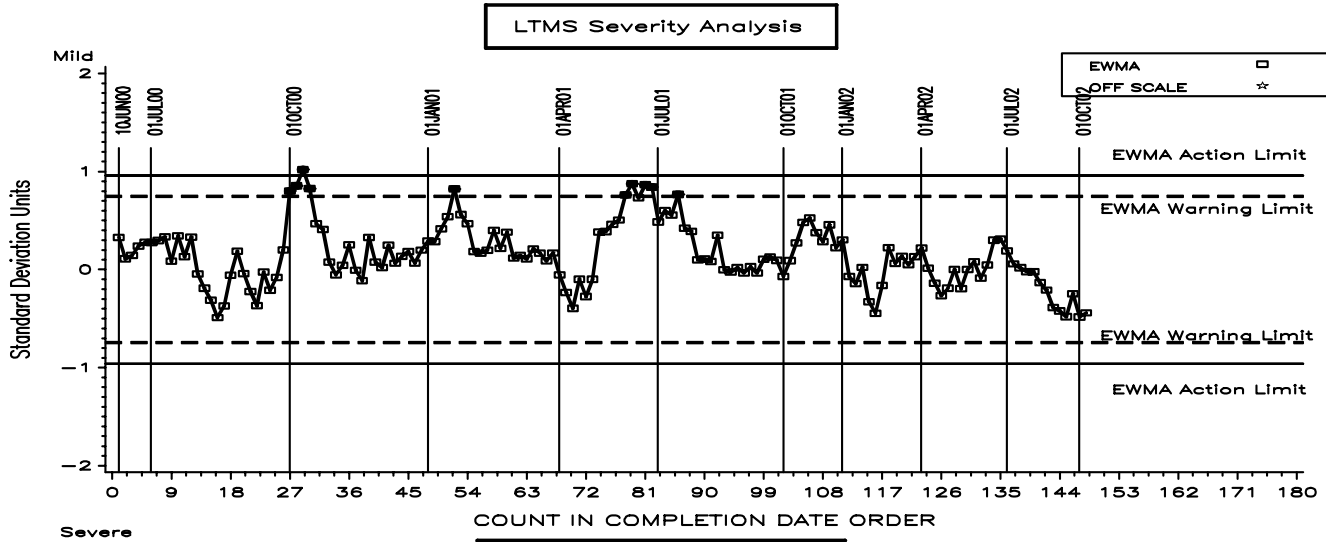


Figure 2

IIIF INDUSTRY OPERATIONALLY VALID DATA
AVERAGE WEIGHTED PISTON DEPOSITS FNL ORIG UNIT RES

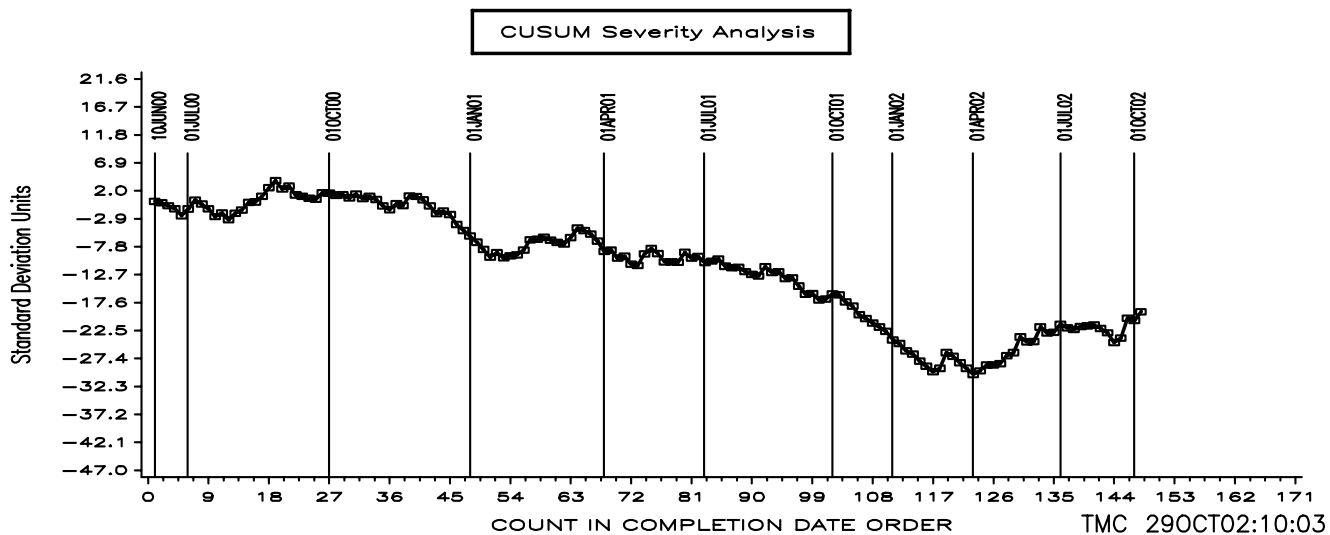
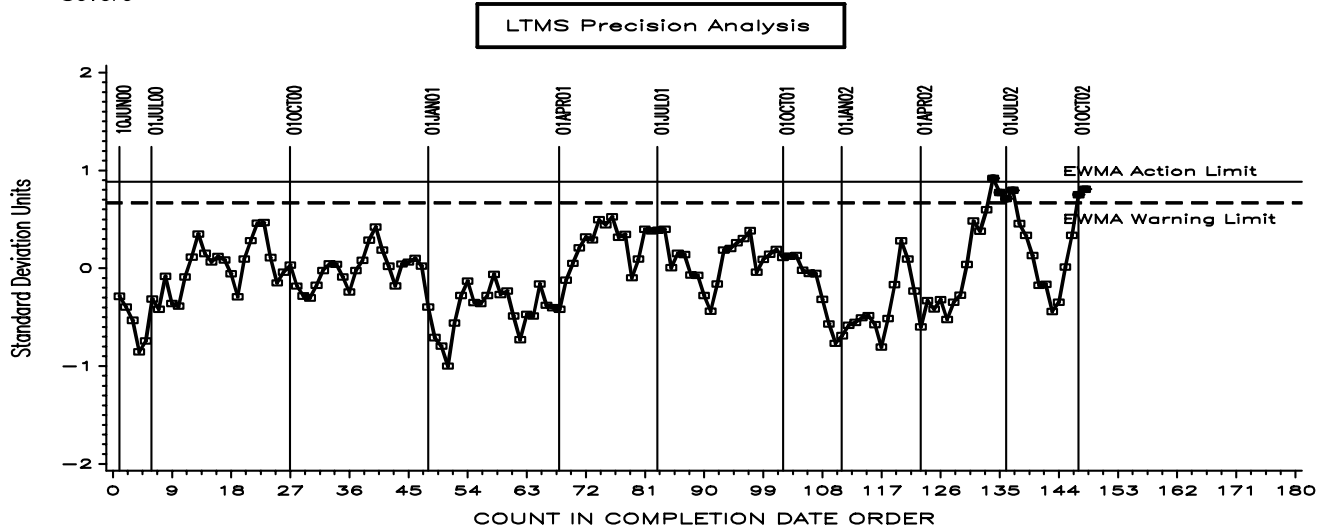
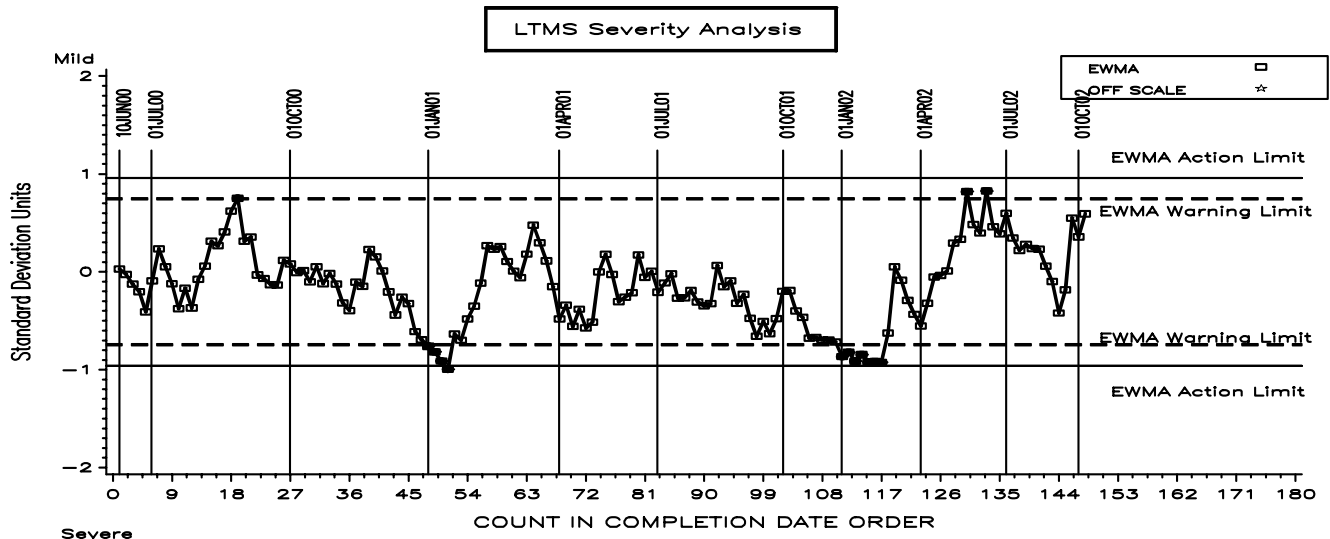


Figure 3

IIIF INDUSTRY OPERATIONALLY VALID DATA

AVERAGE PISTON SKIRT VARNISH FINAL ORIG UNIT RES

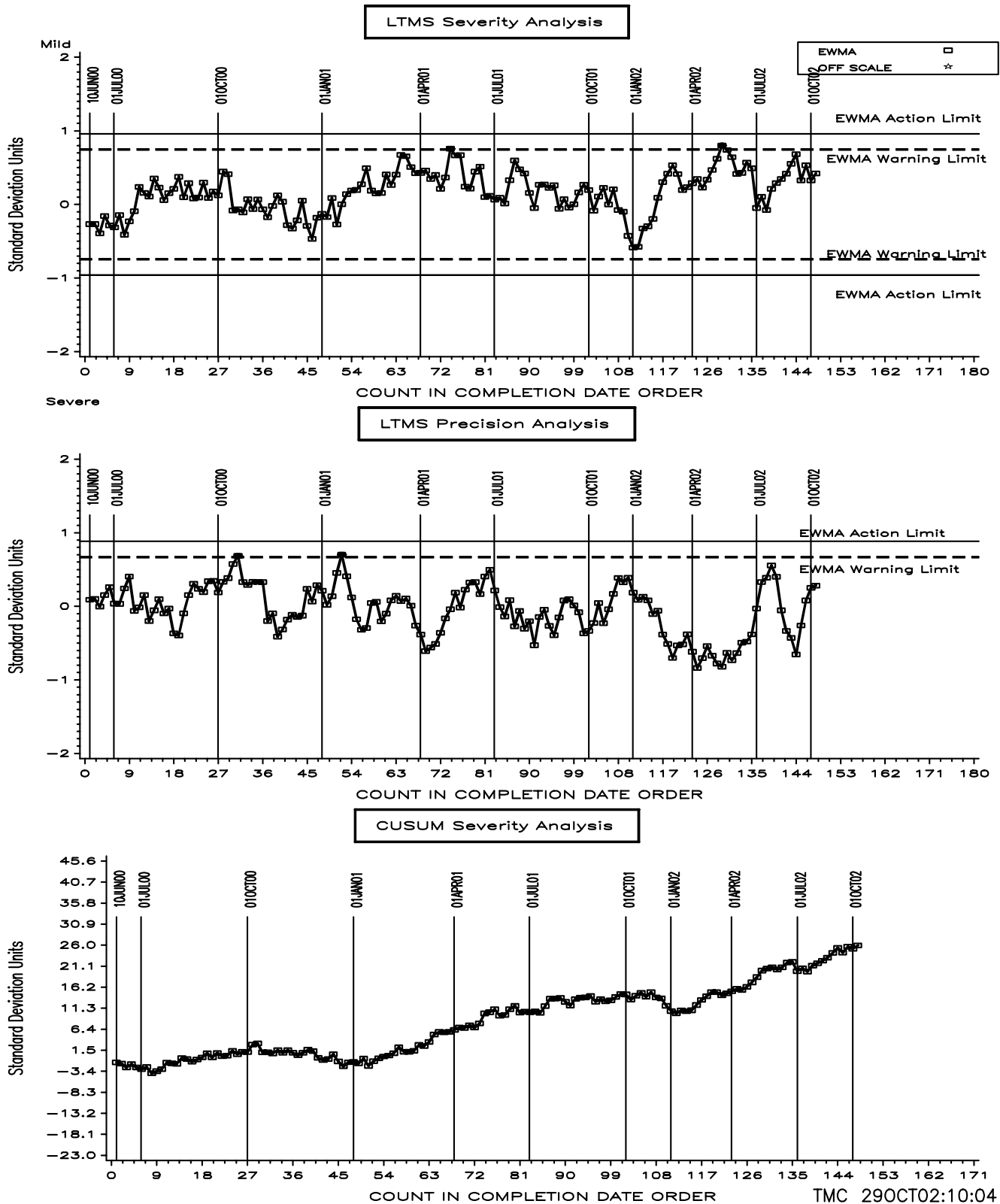


Figure 4

IIIF INDUSTRY OPERATIONALLY VALID DATA

‰ VISCOSITY INCREASE @ 060 HOURS

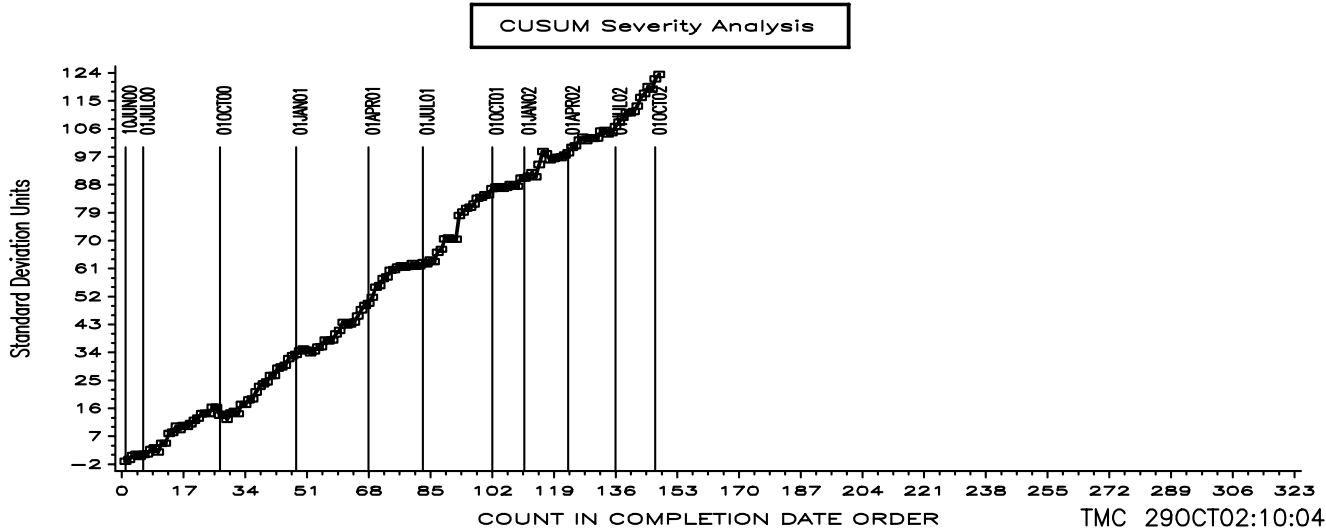
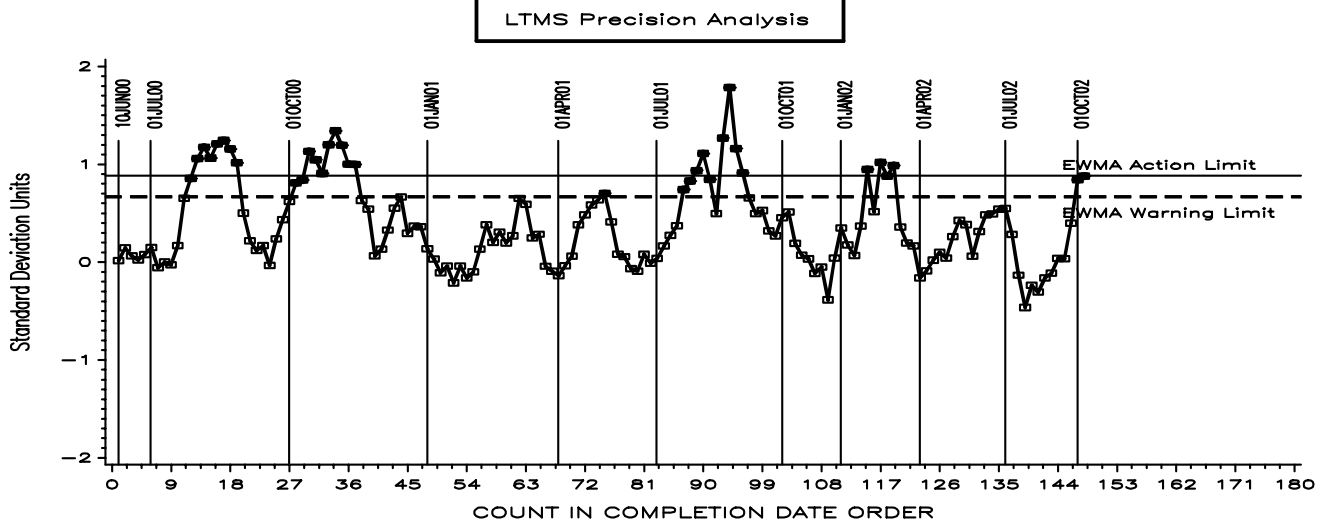
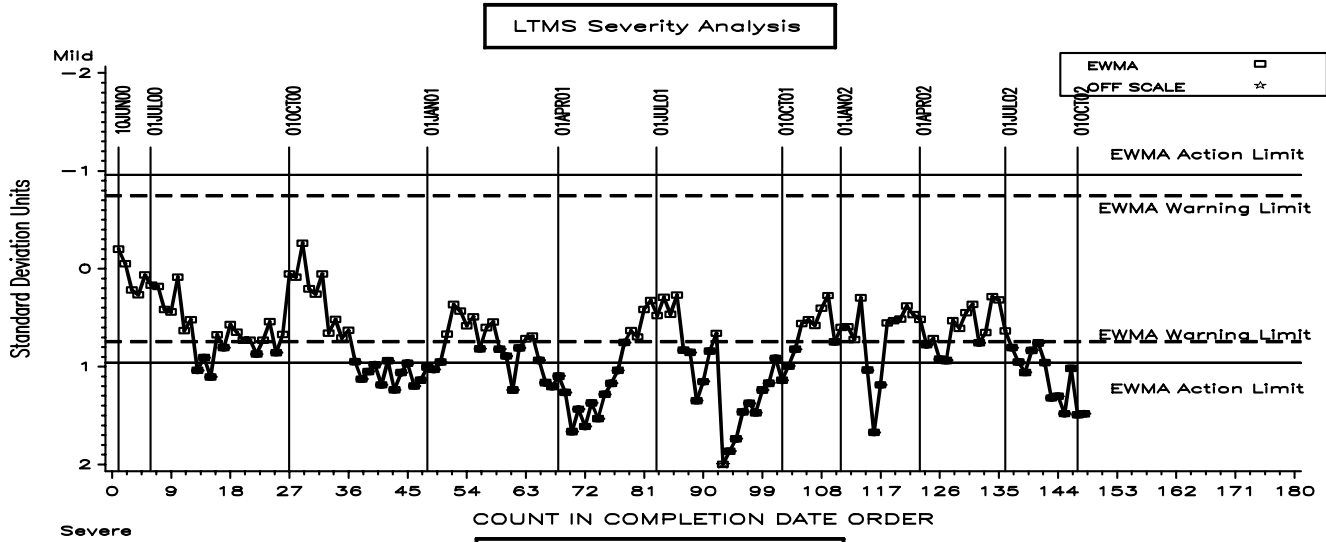


Figure 5 - Percent Viscosity Increase, Average Delta/s

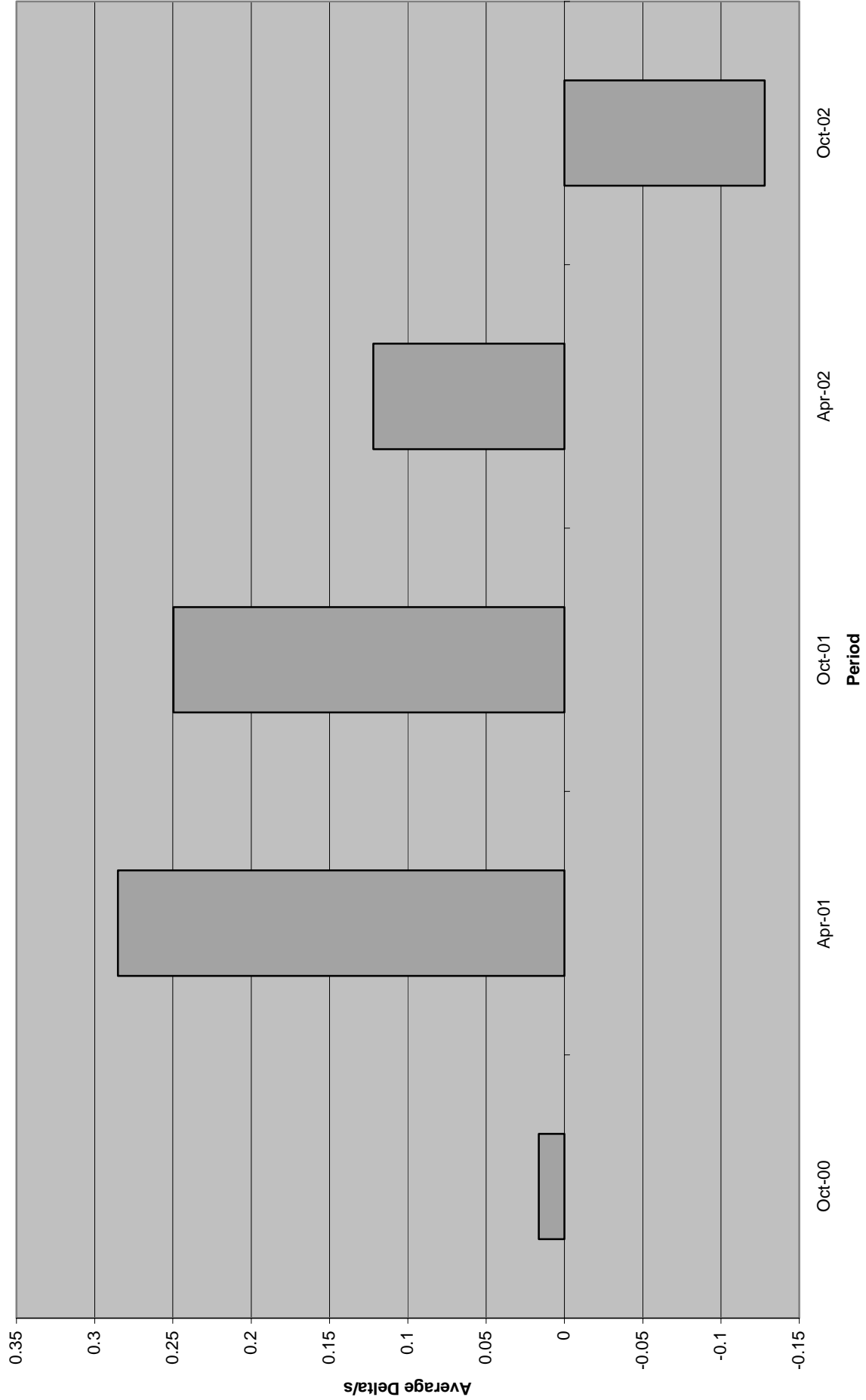


Figure 6 - Weighted Piston Deposits, Average Delta/s

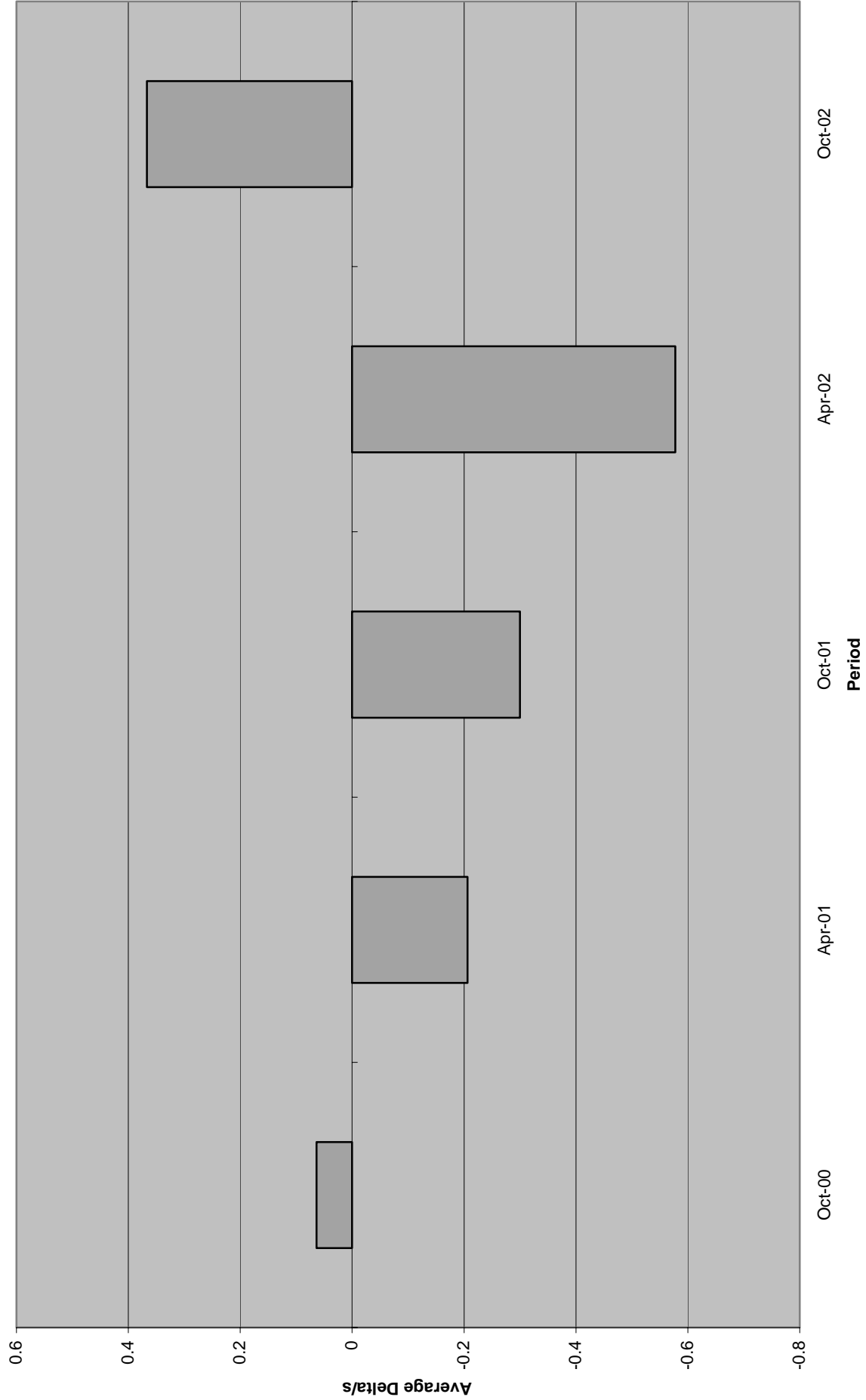


Figure 7 - Average Piston Varnish, Average Delta/s

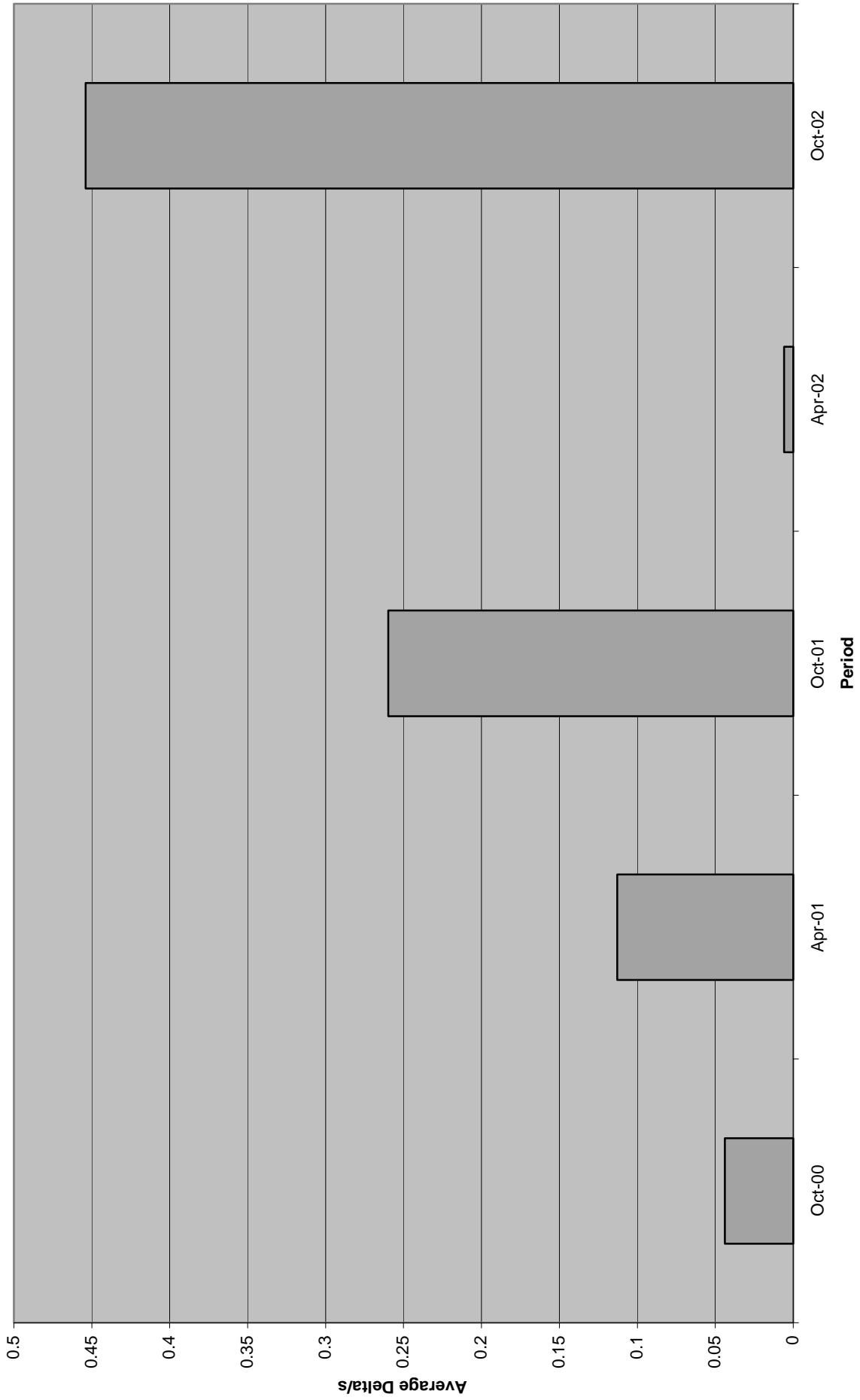


Figure 8 - Percent Viscosity Increase @ 60 Hours (Sequence IIIFHD), Average Delta/s

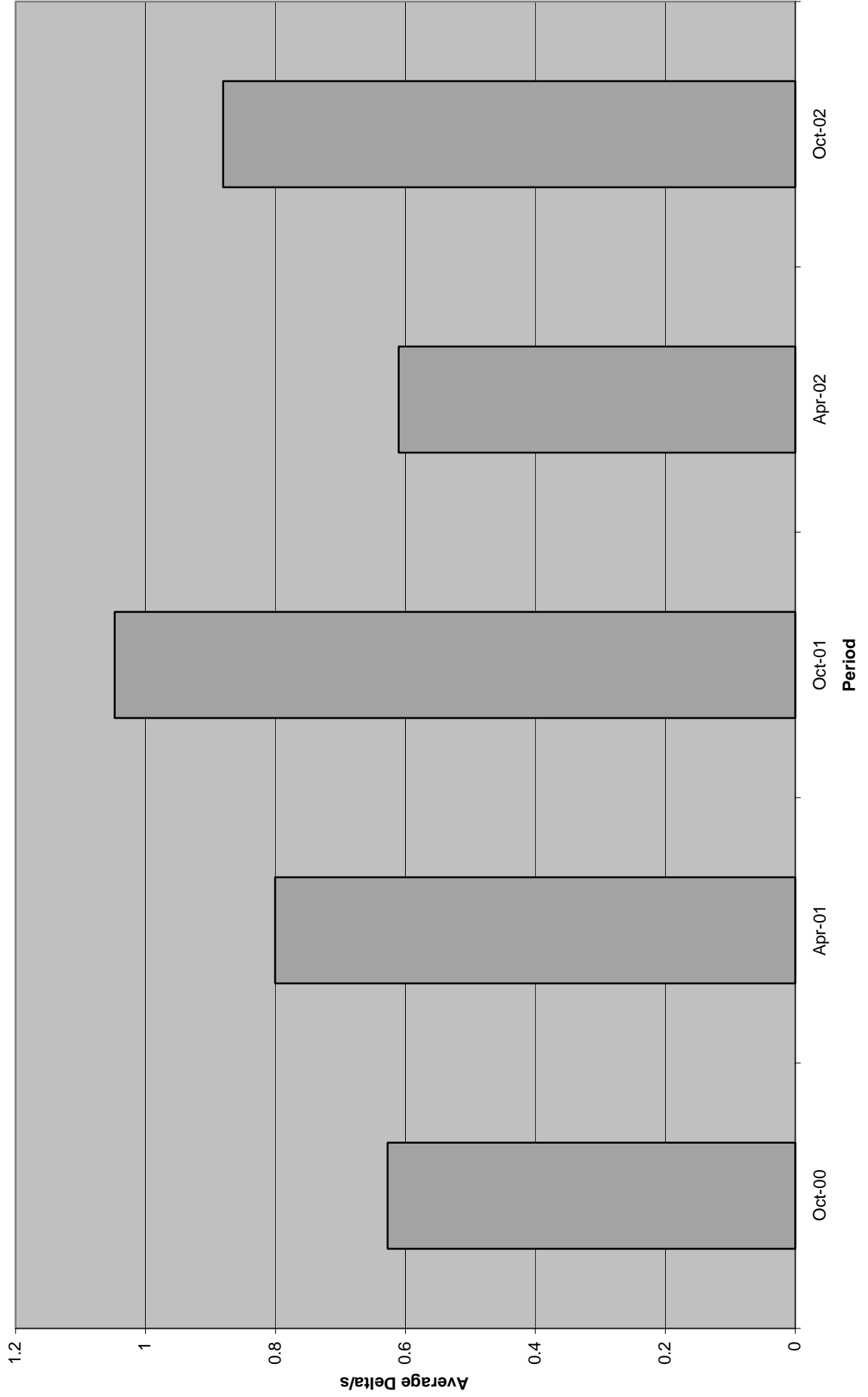


Figure 9 - Percent Viscosity Increase, Pooled Standard Deviation

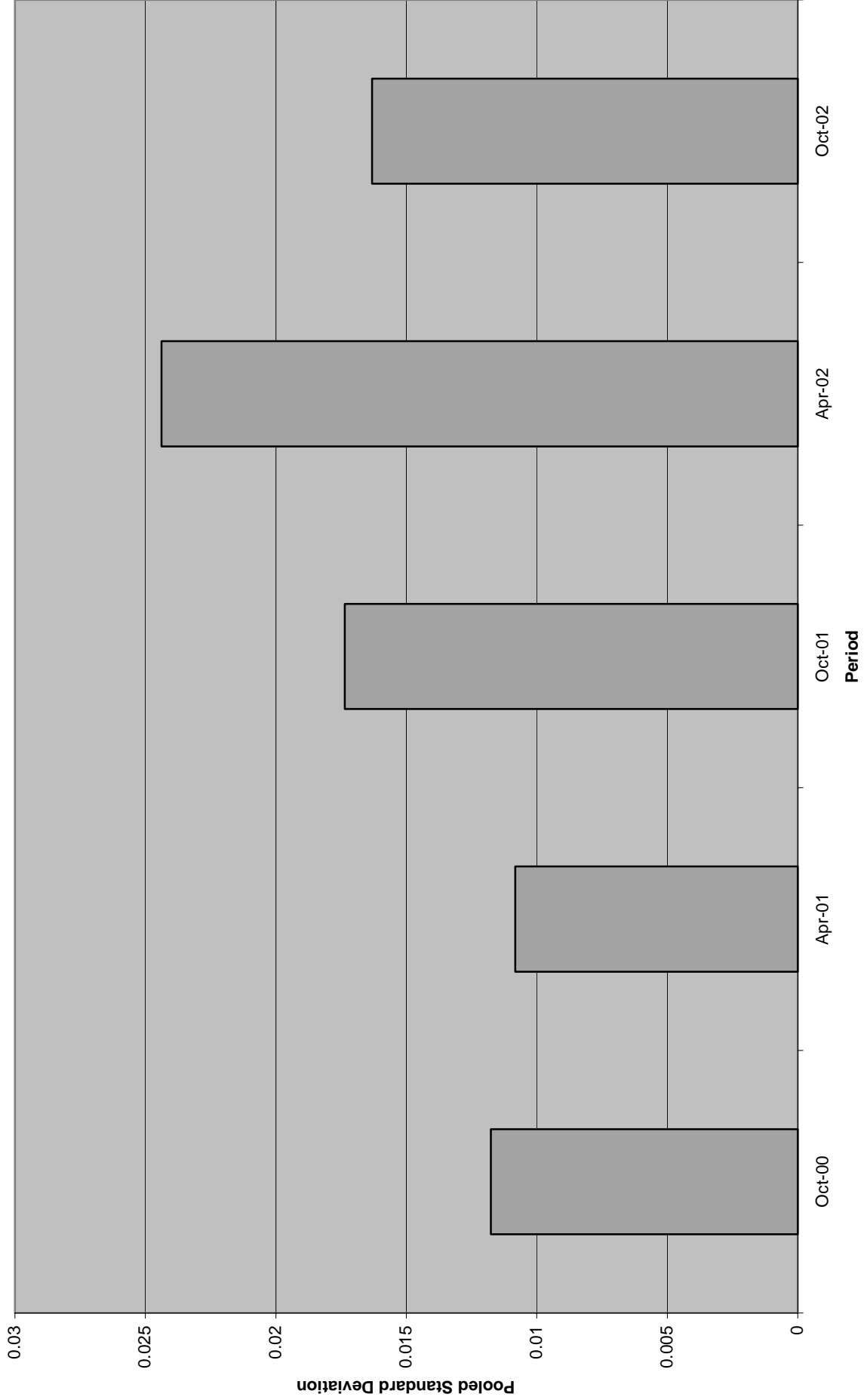


Figure 10 - Weighted Piston Deposits, Pooled Standard Deviation

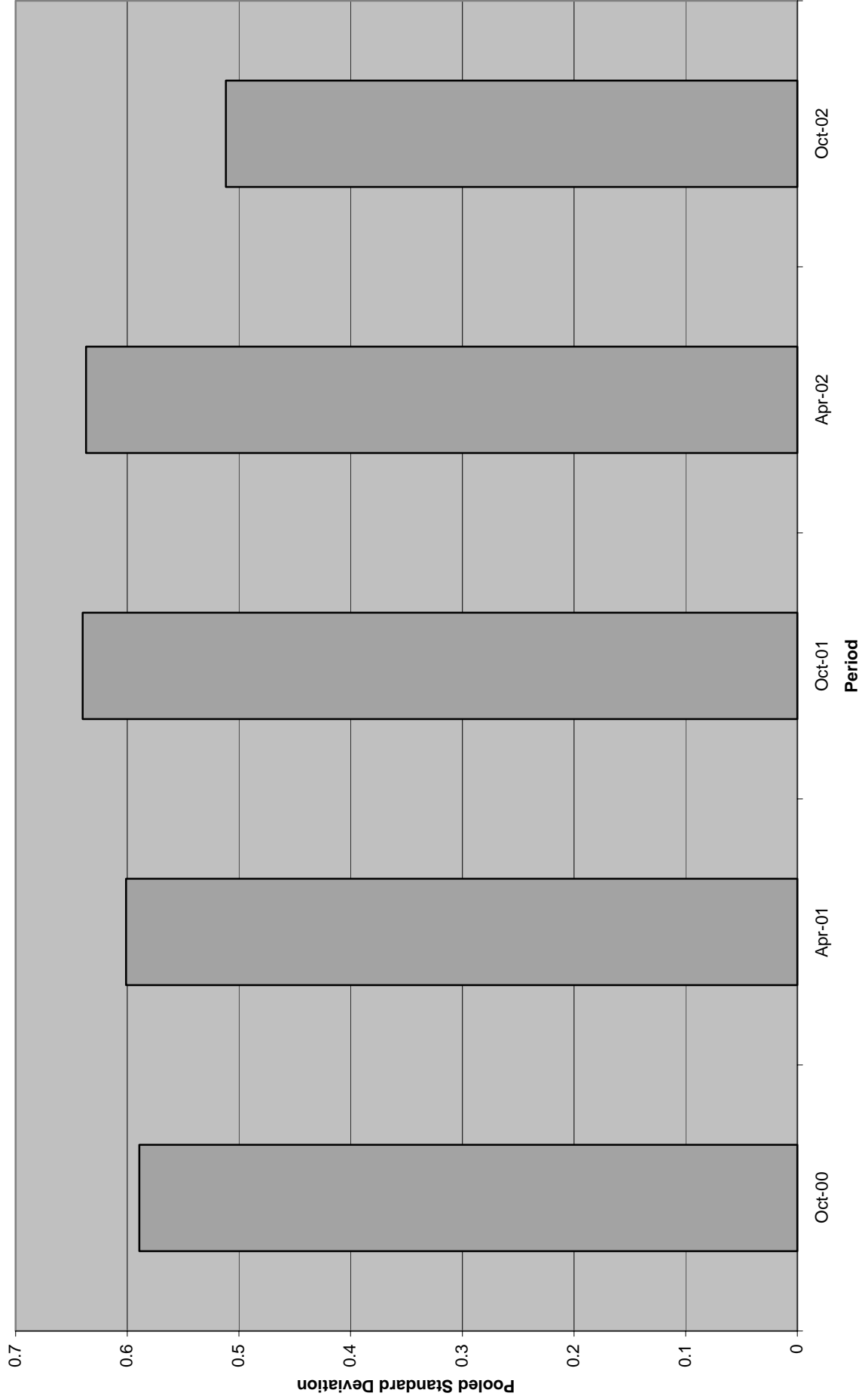


Figure 11 - Average Piston Skirt Varnish, Pooled Standard Deviation

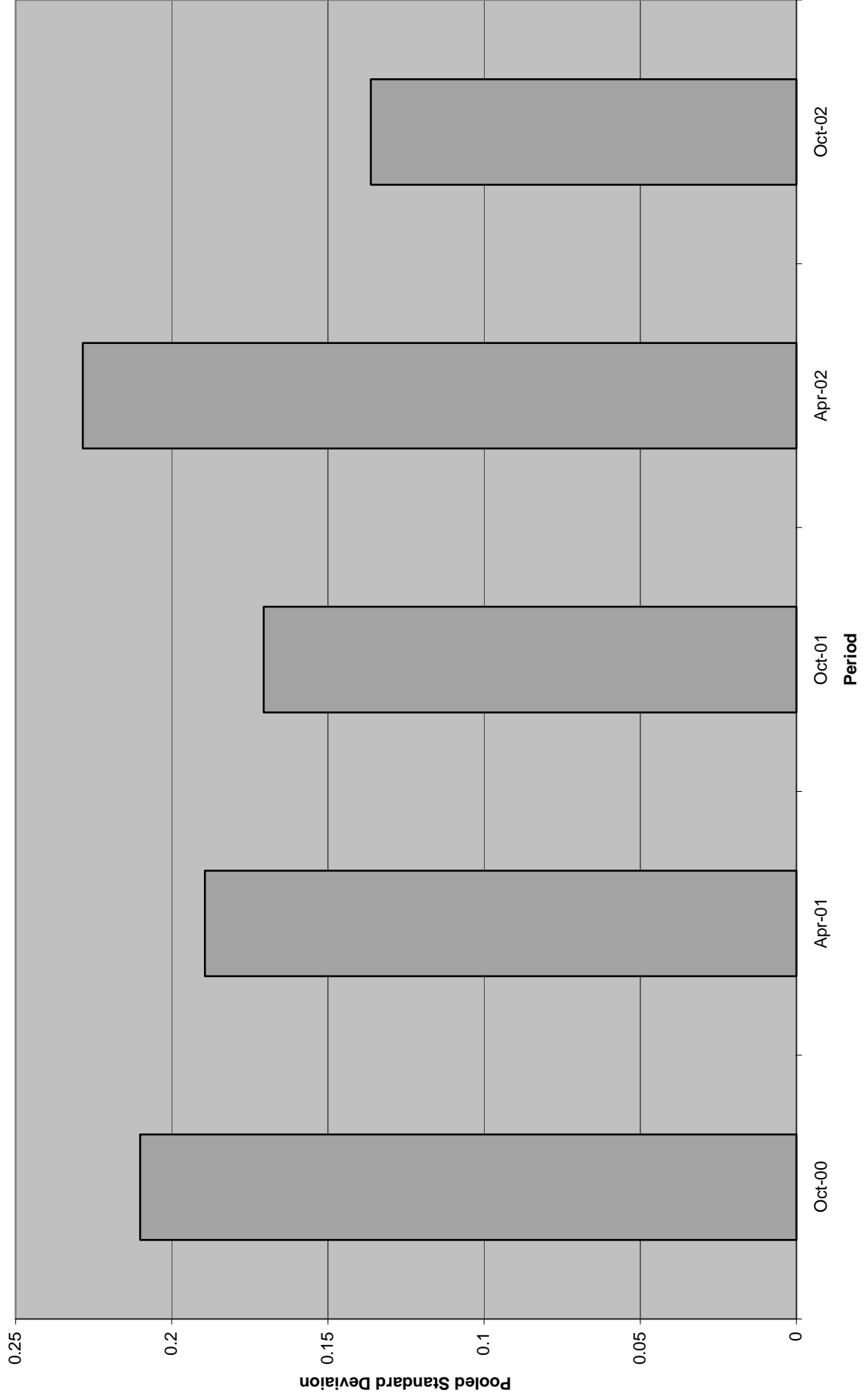


Figure 12 - Percent Viscosity Increase @ 60 Hours (Sequence IIIIFHD), Pooled Standard Deviation

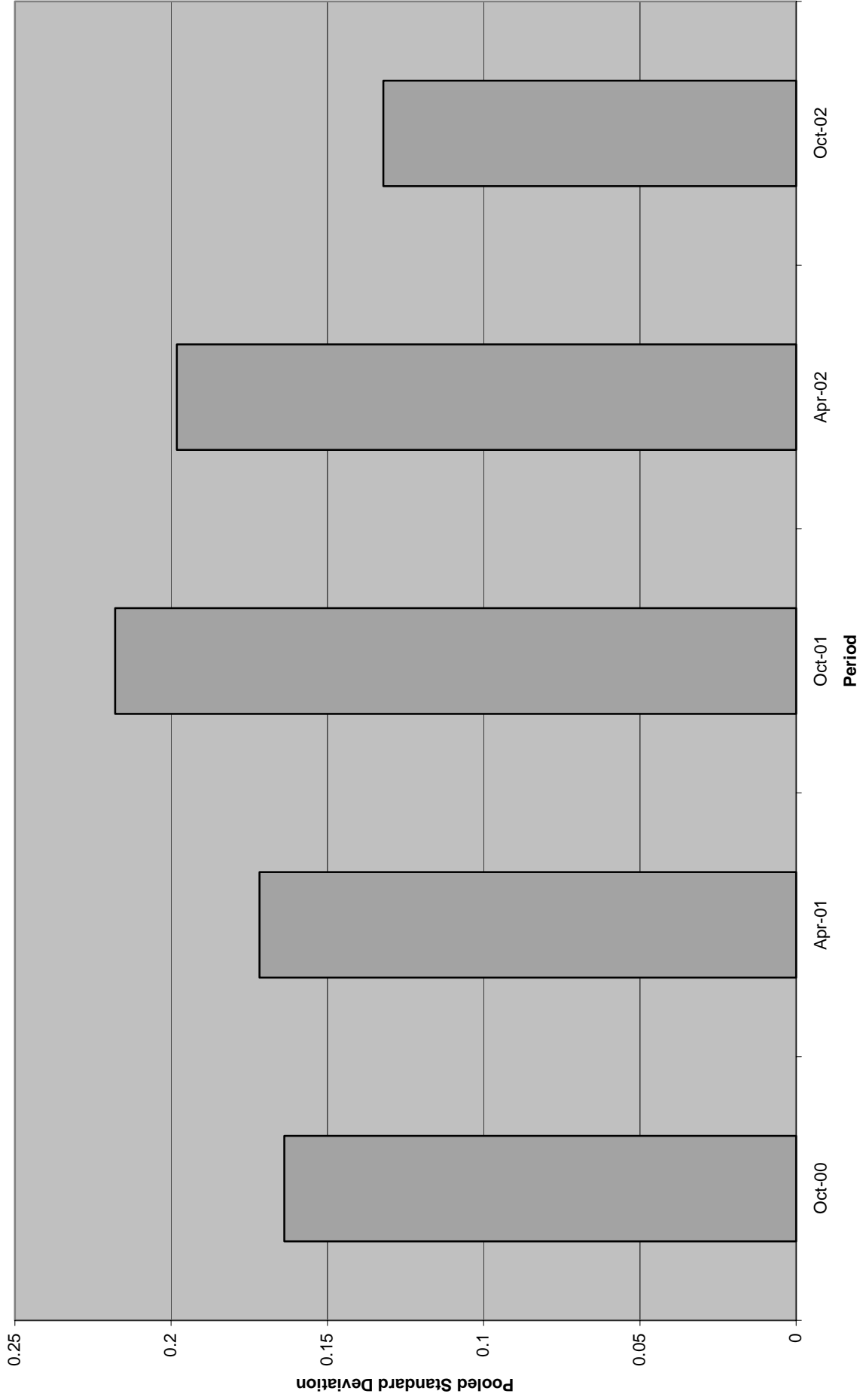


Figure 13 – Sequence IIIF Timeline

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