




Test Monitoring Center

6555 Penn Avenue
Pittsburgh, PA 15206-4489
(412) 365-1000

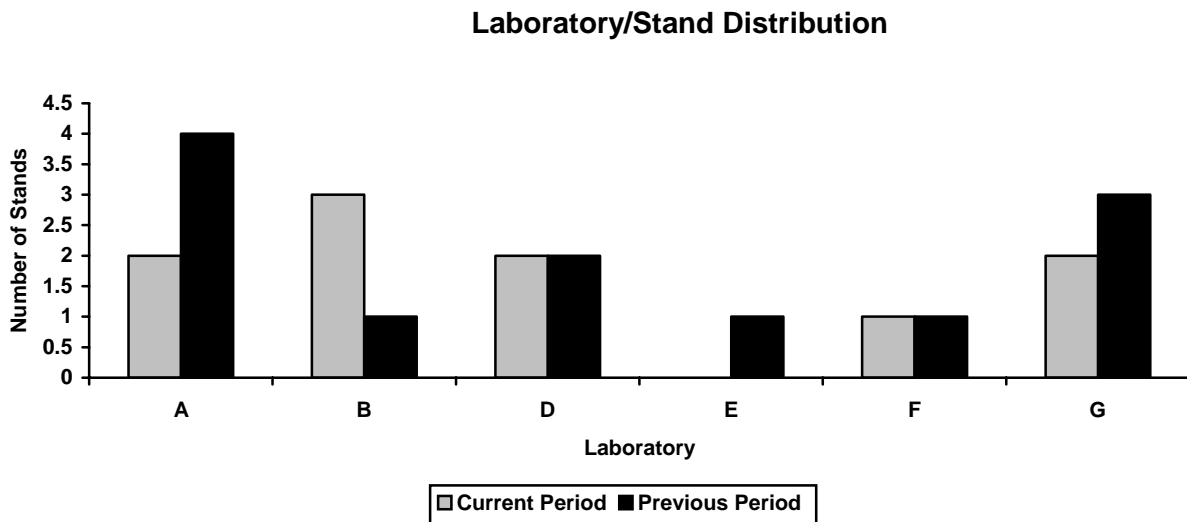
Memorandum: 05-065
Date: October 3, 2005
To: William M. Nahumck, Chairman, Sequence III Surveillance Panel
From: Richard E. Grundza 
Subject: Sequence IIIG/IIIGA Semiannual Report: April 1, 2005 through September 30, 2005

The following is a summary of Sequence IIIG reference tests that were reported to the Test Monitoring Center during the period April 1, 2005 through September 30, 2005.

Lab/Stand Distribution

	Reporting Data	Calibrated as of September 30, 2005
Number of Laboratories:	5	5
Number of Test Stands:	10	15

The following chart shows the laboratory/stand distribution:



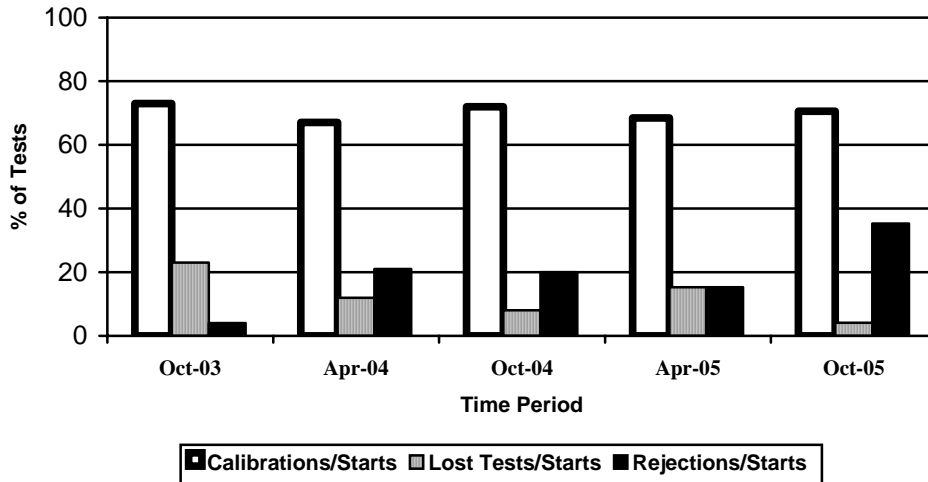
The following summarizes the status of the reference oil tests reported to the TMC:

Calibration Start Outcomes	TMC Validity Codes	No. of Tests
Operationally and Statistically Acceptable	AC	12
Failed Acceptance Criteria	OC	4
Operationally Invalid (Laboratory Judgment)	LC	1
Total		17

Donated & Industry Support Outcomes	TMC Validity Codes	No. of Tests
Decoded Oil – Ring gap Investigation	NI	1
Total		1

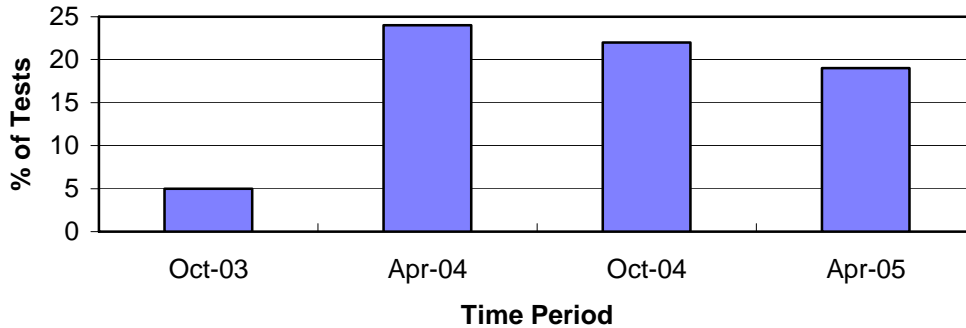
Calibrations per start, lost tests per start and rejection rates are summarized below:

Calibration Attempt Summary



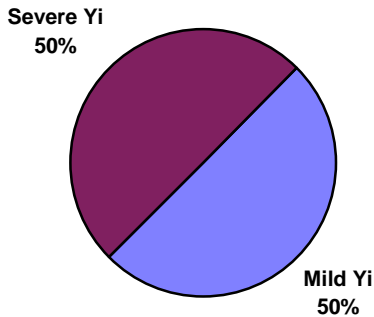
The calibration per start rate is slightly higher than last period. The lost test per start rate has decreased and the rejected test per start rate has increased with respect to the previous period.

Rejected Test Rate for Operationally Valid Tests

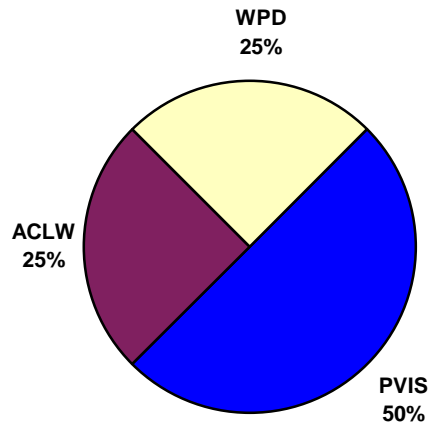


There were four failing tests for the period. The following charts summarize the reasons and breakdown by parameter for the failed test:

Distribution of LTMS Stand Alarms



Distribution of Stand Alarms by Parameter



There were no LTMS Deviations written this period. There have been no deviations from the LTMS since its introduction in August of 2003.

Four Sequence IIIG lab visits were performed this period. Discrepancies noted during these visits include:

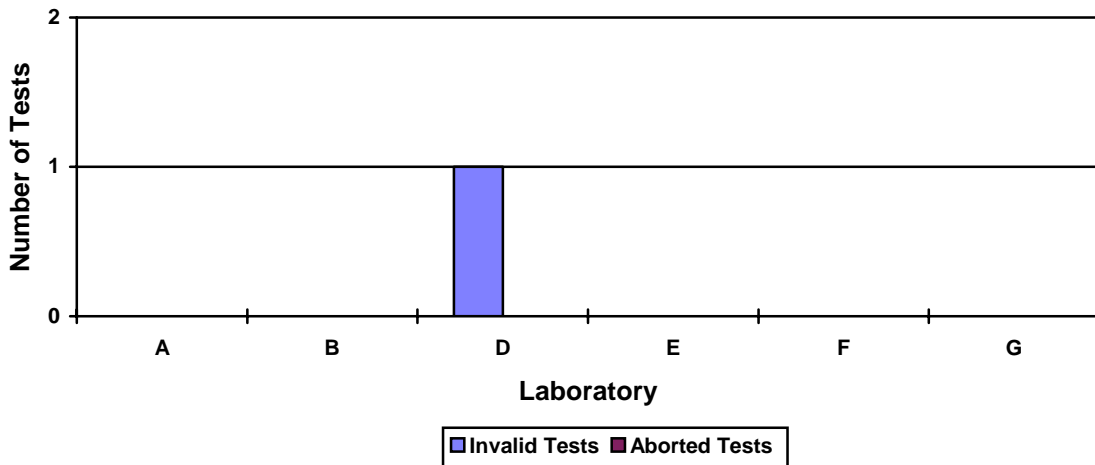
- 1) Main bearing bolts not torqued to 70 N-m and backed off 360 degrees
- 2) Calibration records not available for AFR and Engine Coolant Flow

Lost Test Summary

One test was lost this period. The reason for the lost test is shown in the following table:

Lab	Reason for Lost Test	Number of Tests	Breakdown of Tests (LC/RC/XC)
D	Incorrect oil charge	1	1/0/0

Lost Test Distribution



Information Letters

No information letters or engine assembly manual updates were issued during this report 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	-1.402	0.277 (df=15)	-48.3 % Viscosity Increase ¹
WPD	-0.828	0.279 (df=15)	-0.23 Merits
ACLW	-0.600	0.401 (df=15)	-12.8.0 μm^2
MRV ³	-0.757	0.104 (df=10)	N/A (no appropriate baseline) ⁴

¹ At the proposed GF-4 Pass Limit of 150% Viscosity Increase

² At the proposed GF-4 Pass Limit of 60 μm

³ Sequence IIIGA Test Parameter only; Reference Oil 435 data excluded from calculations

⁴ MRV does not have a specific GF-4 Pass Limit; Pass Limit is lack of Yield Stress.

Average Δ/s Results, by Laboratory				
Laboratory	PVIS	WPD	ACLW	MRV ¹
A	-0.60	-1.56	-0.080	-0.76
B	-1.83	-0.37	-1.88	-1.18
D	-1.06	-1.67	-0.27	-0.91
E	-	-	-	-
F	-1.86	-0.10	0.32	-0.13
G	-1.08	-0.91	-1.43	-0.73

¹ Reference oil 435 data excluded from calculations

Percent Viscosity Increase (PVIS)

The industry has been in severity warning or action alarm for the entire period. Precision has been in control the entire period (see Figure 1). The average Δ/s value for the period, -1.402 is much milder than the previous period and is the mildest reported to date (see Figure 4). The pooled standard deviation for the period, 0.277, has improved significantly with respect to the previous period (see Figure 7).

Weighted Piston Deposits (WPD)

The industry severity began the period in alarm, sounding a warning, two action and one warning alarm. The charts clear for eight tests, then sound a warning and three action alarms, ending the period in action alarm. The average Δ/s value for the period, -0.828 is more severe than last period and is the most severe period on record (see Figure 5). The pooled standard deviation for the period, 0.279, is better than last period and is the best precision estimate on record for WPD in the Sequence IIIG test (see Figure 8).

Average Camshaft-plus-Lifter Wear (ACLW)

ACLW severity exceeded control limits three times. A warning alarm sounded at the beginning of the period, a second warning sounded mid-way through the period. Two warning alarms sounded at the end of the period. The industry control chart for precision began the period with two action and a warning alarm. The charts clear for six tests, before an action alarm and two warning alarms occur. The charts clear for a test before ending the period with two warning alarms (see Figure 3). These alarms appear to be at least partially laboratory related. Two of the three severity alarms were caused by results of -1.945 and -2.859 Δ/s from target. Another laboratory reported a result -2.41 Δ/s from target, also causing one of the alarms. Precision alarms also appear to emanate from these results also. The average Δ/s value for the period, -0.601, is milder than the previous period and is shown in Figure 6. The pooled standard deviation for the period, 0.401, has degraded somewhat when compared to the last period and is shown in Figure 9.

Mini Rotary Viscometer (MRV)

The MRV control charts are shown for informational purposes in Figure 10. Industry has exceeded the EWMA mild warning limit the entire period, while precision has been in control the entire period. The average Δ/s value for the period, -0.757, is not as mild as the previous period and is shown in Figure 11. The pooled standard deviation for the period, 0.158, is better than last period and is shown in Figure 12.

QI Deviations

No QI Deviations were written this period. There has been a total of one QI Deviation written since the test was introduced in August of 2003.

Hardware

Powdered metal connecting rods were used exclusively during this period. Ring Code BC-4 was the predominate ring batch run this period, accounting for fourteen of the sixteen operationally valid tests this period. The remaining two operationally valid tests this period were run on BC-3A and BC-5 rings batches.

Reference Oils

Oil	TMC Inventory, in gallons	TMC Inventory, in tests (4 gal/test)	Laboratory Inventory, in tests	Estimated life
434	234	59	6	~ 4 years
435	273	68	11	~ 5 years
438	721	180	6	~10 years

REG/reg

Attachments

c: F. M. Farber, TMC
Sequence III Surveillance Panel
<ftp://ftp.astmtmc.cmu.edu/docs/gas/sequenceiii/semiannualreports/IIIG-10-2005.pdf>

Distribution: Electronic Mail

List of Figures

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

Figure 2

SEQUENCE IIIIG INDUSTRY OPERATIONALLY VALID DATA

AVERAGE WEIGHTED PISTON DEPOSITS

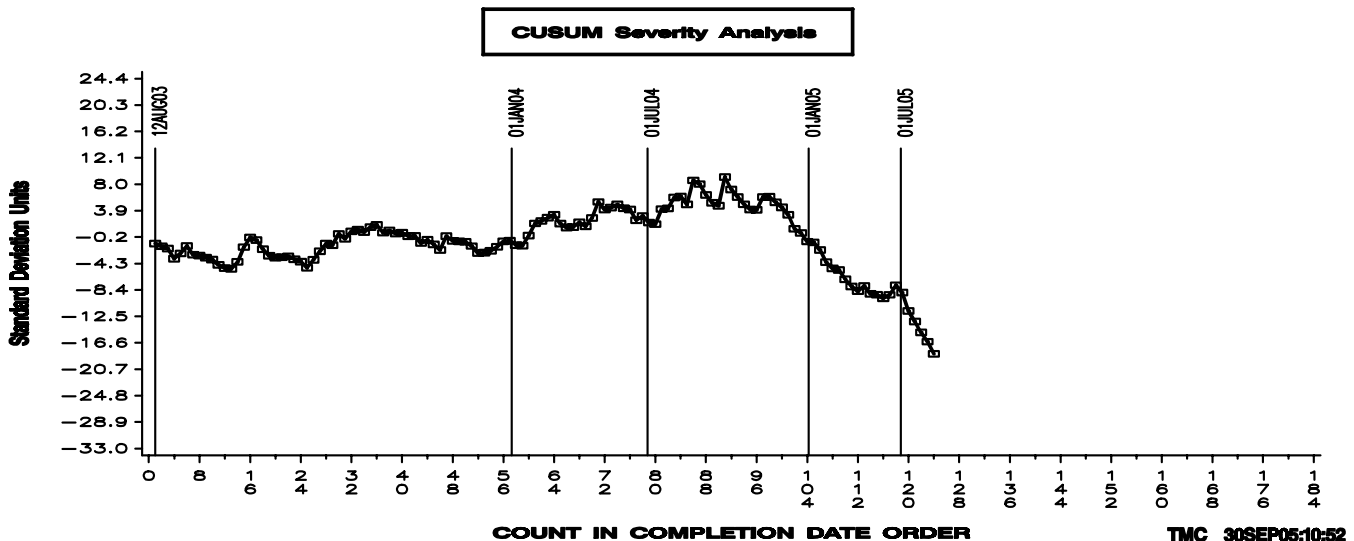
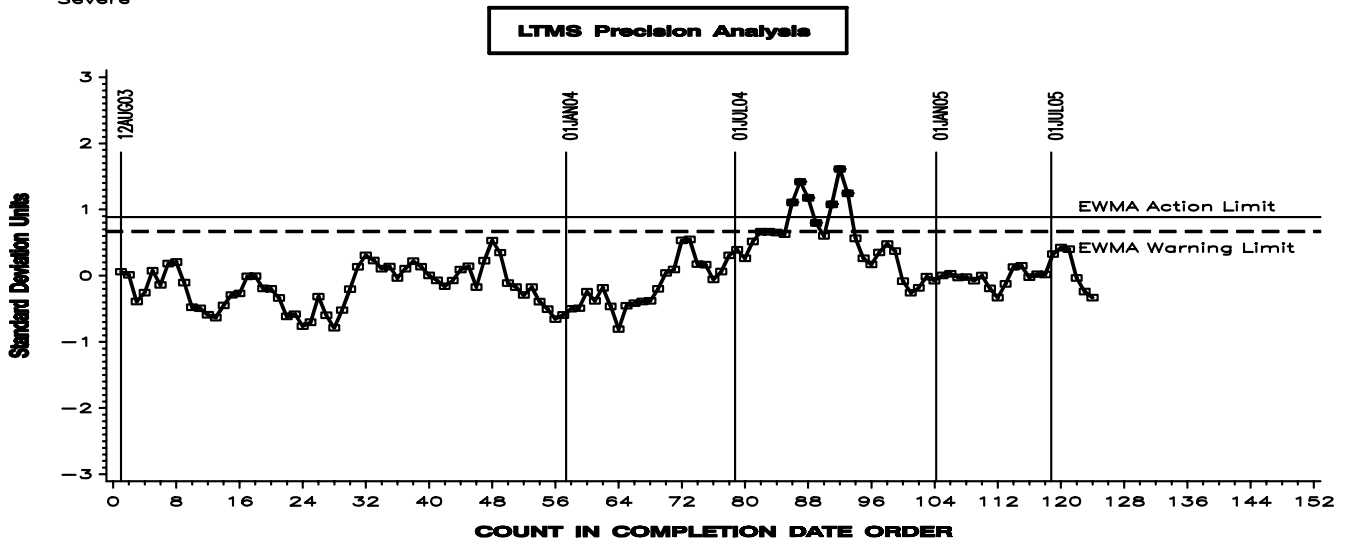
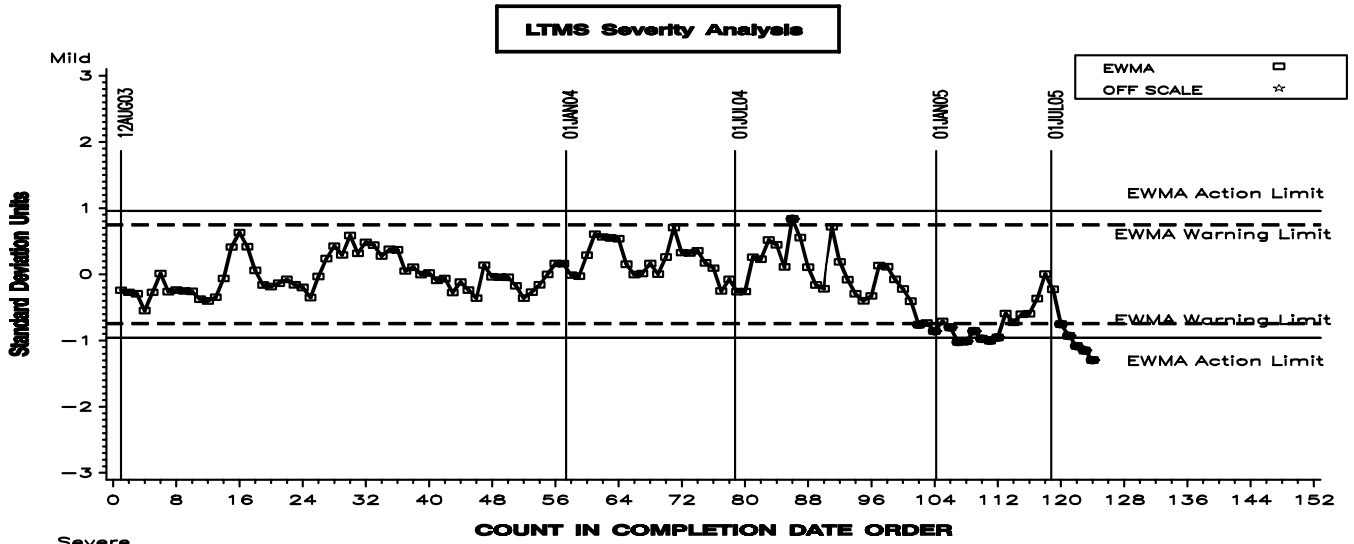


Figure 3

SEQUENCE IIIIG INDUSTRY OPERATIONALLY VALID DATA

AVERAGE CAM + LIFTER WEAR

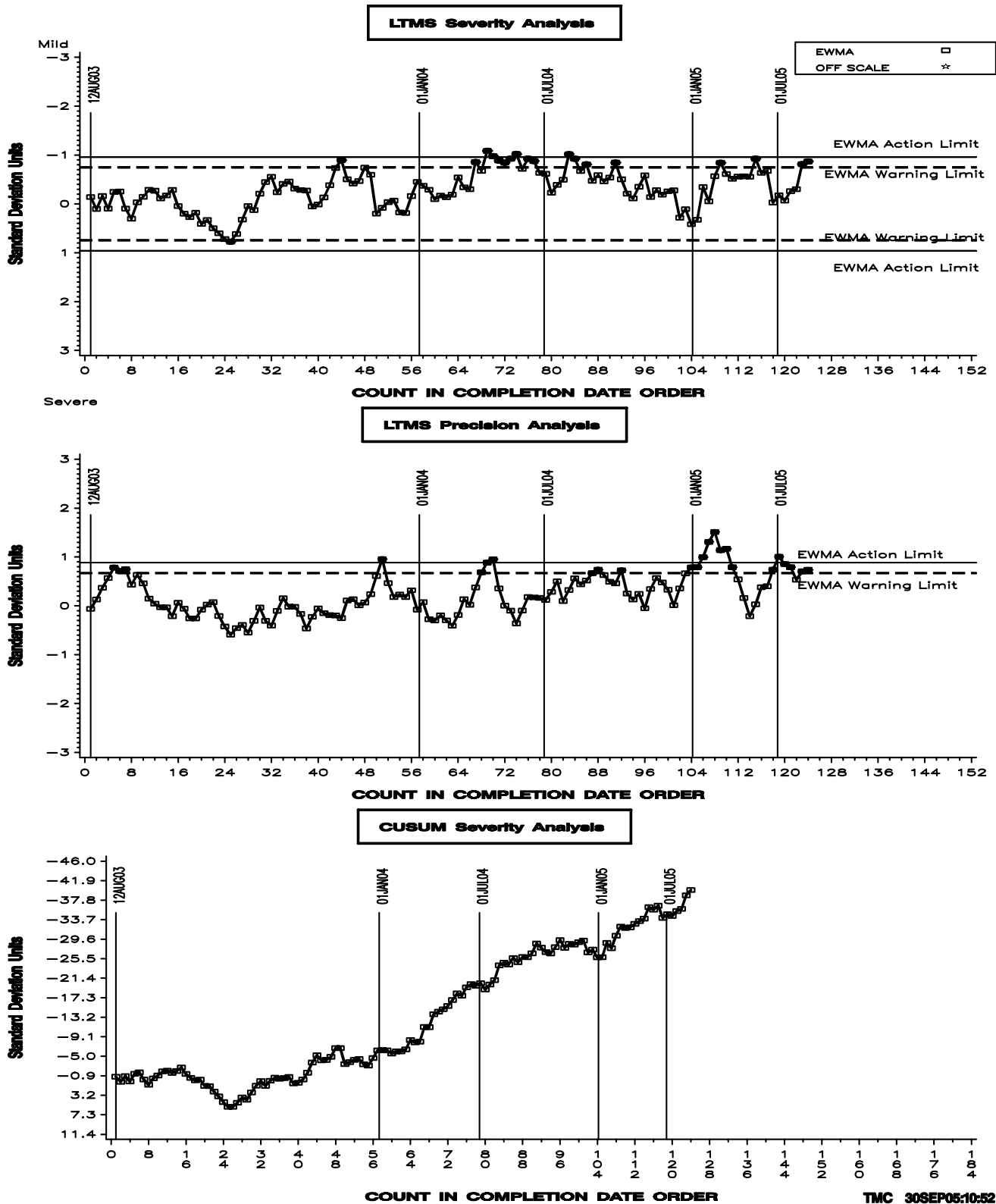


Figure 4 - Percent Viscosity Increase, Average Delta/s

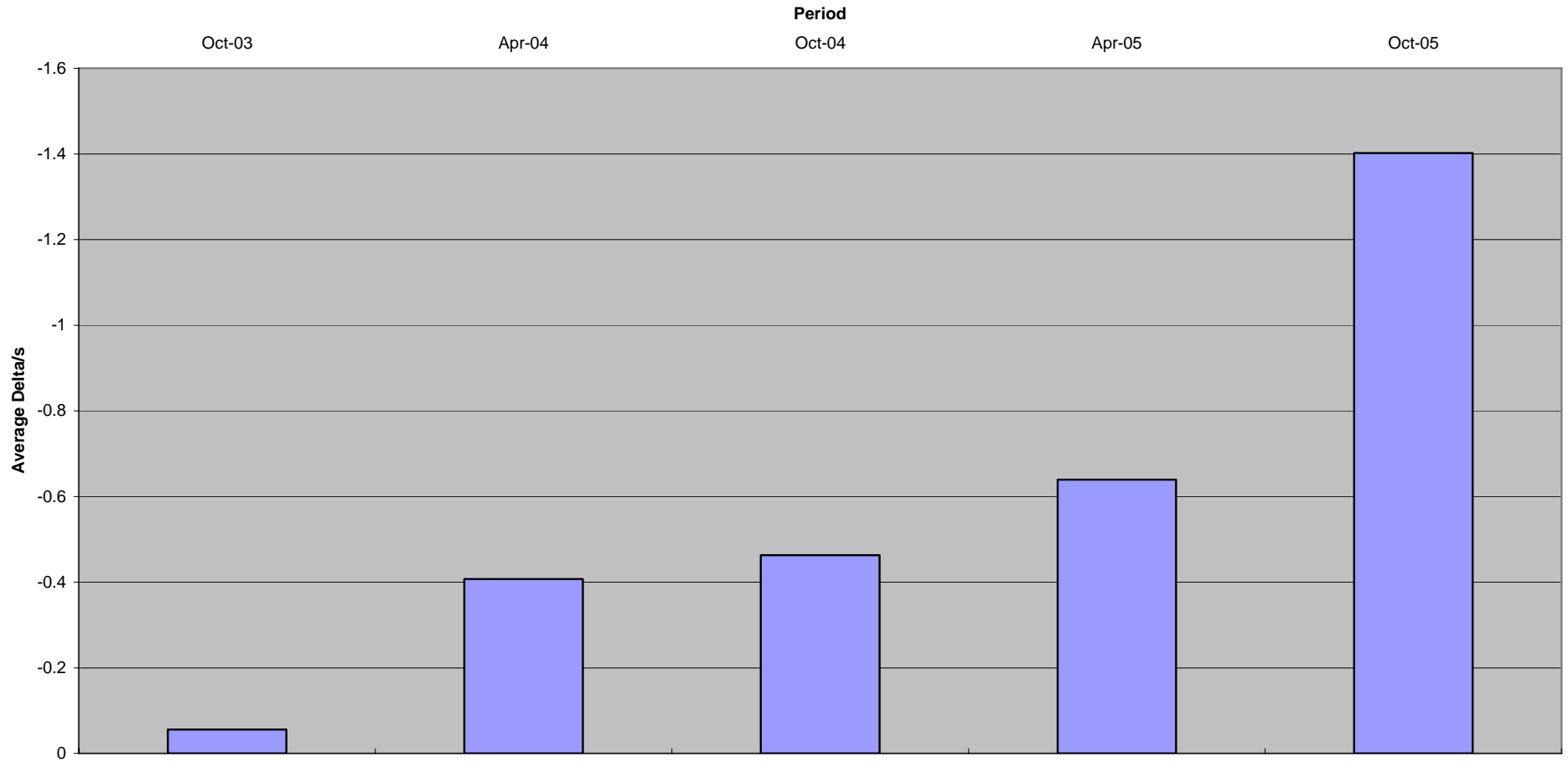


Figure 5 - Weighted Piston Deposits, Average Delta/s

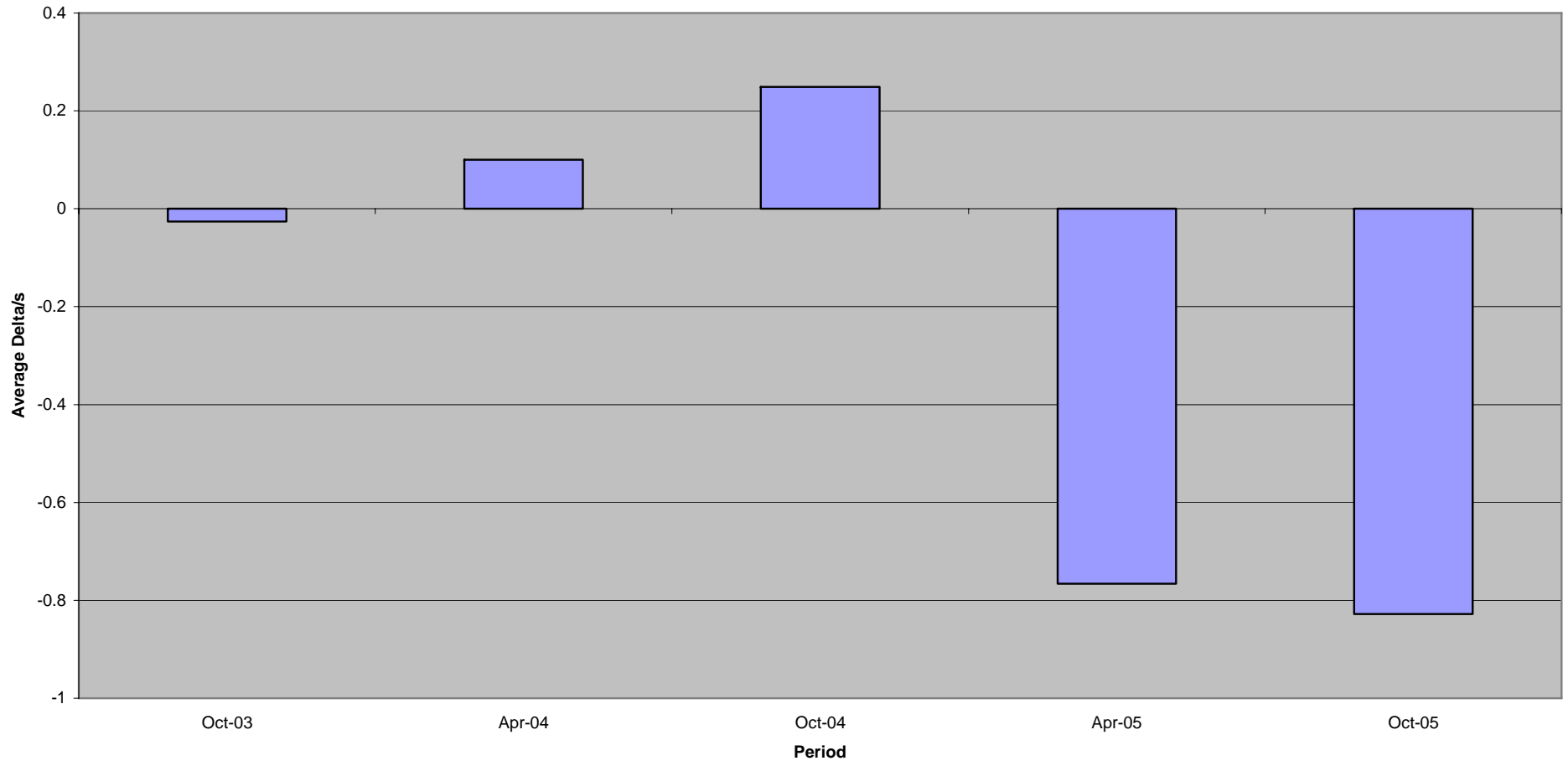


Figure 6 - Average Camshaft plus Lifter Wear, Average Delta/s

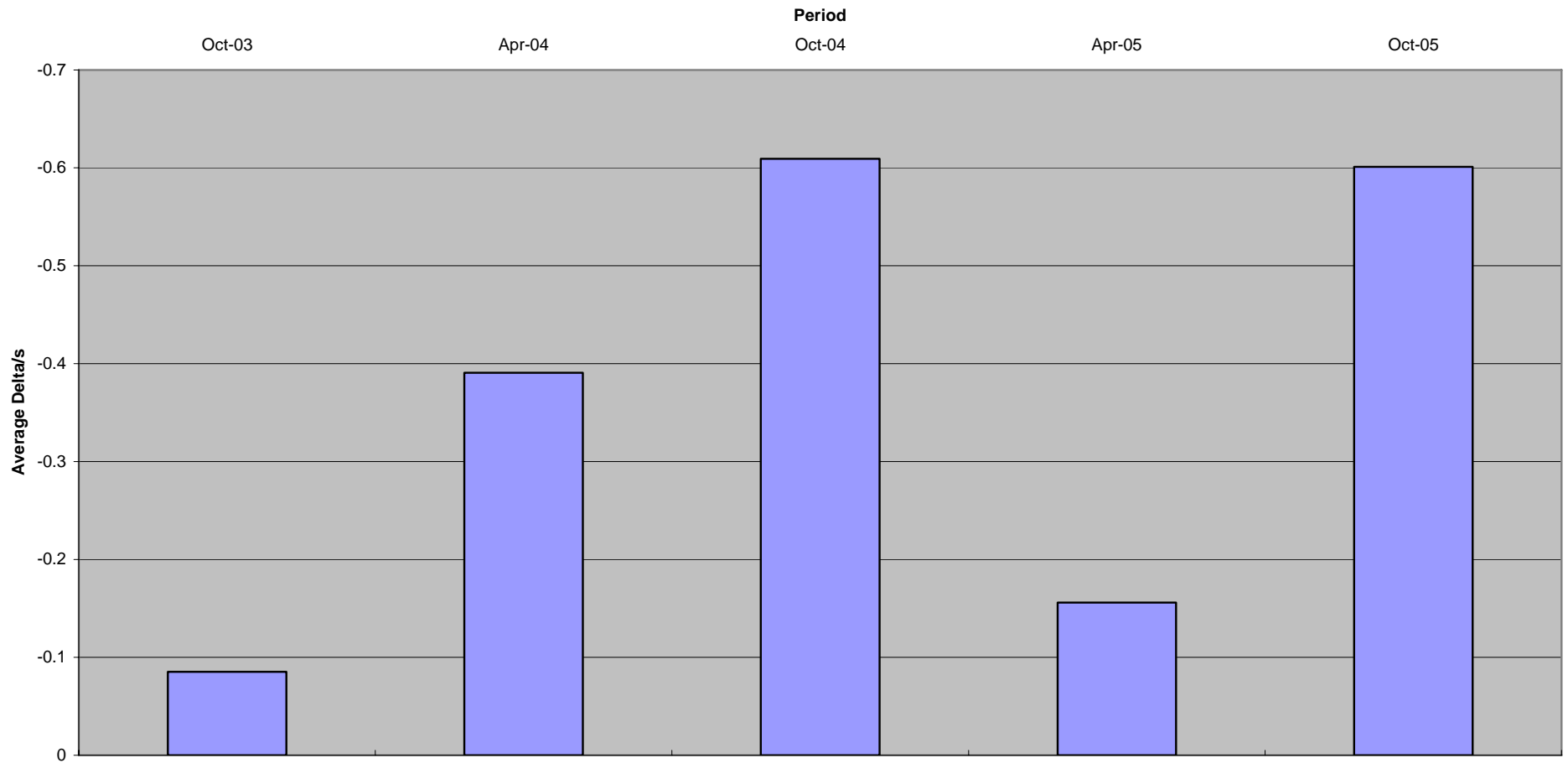


Figure 7 - Percent Viscosity Increase, Pooled Standard Deviation

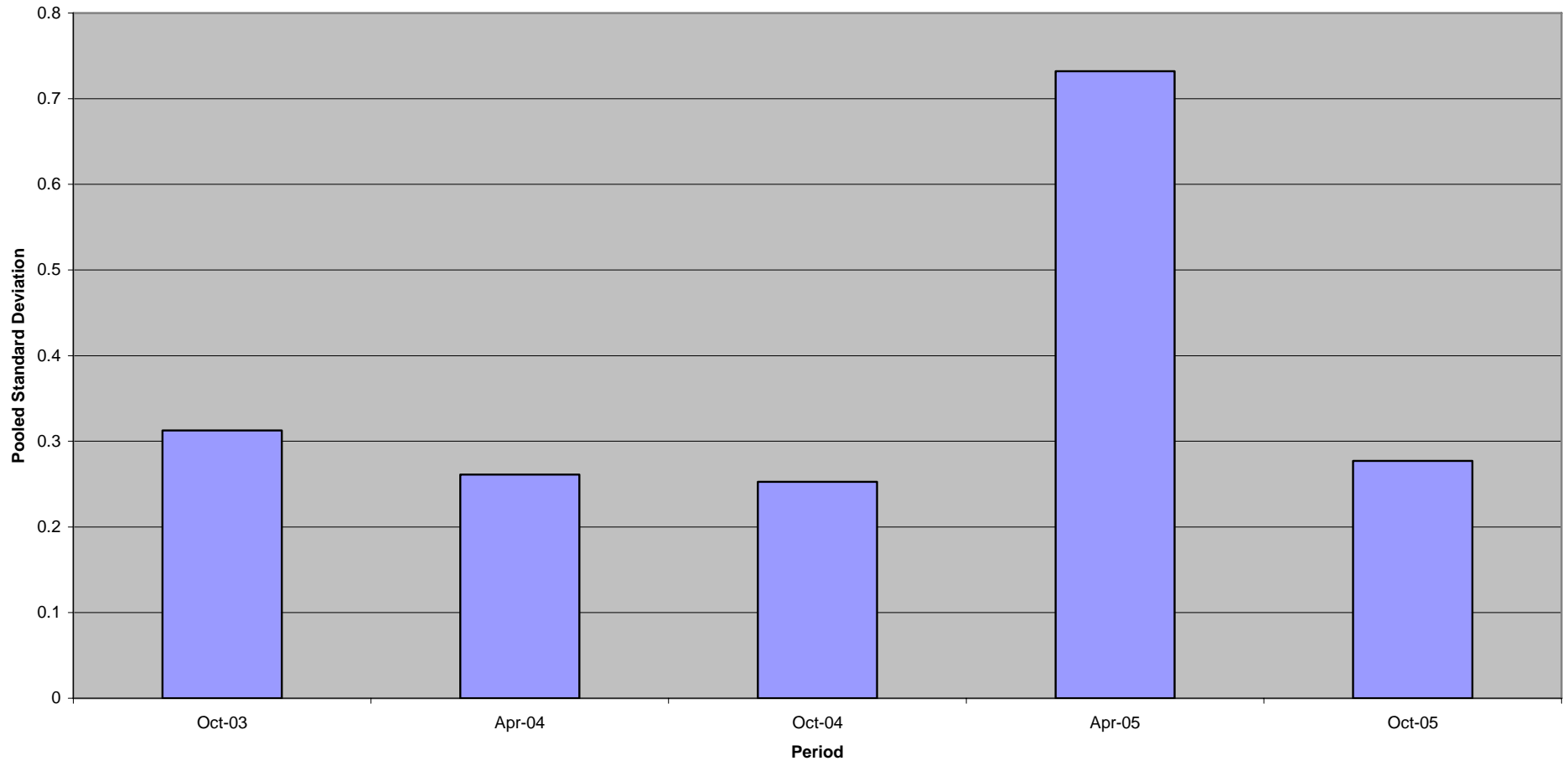


Figure 8 - Weighted Piston Deposits, Pooled Standard Deviation

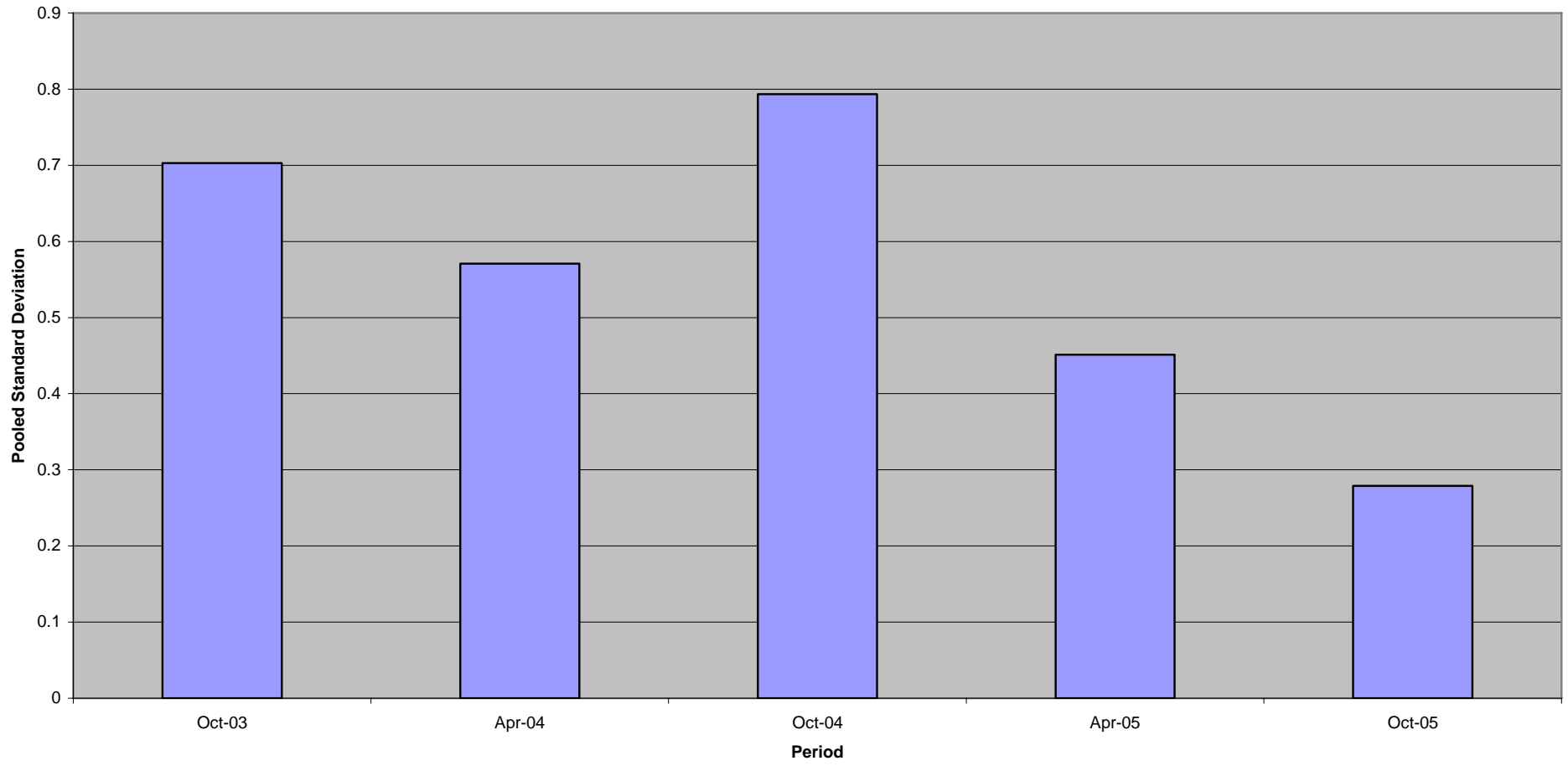


Figure 9 - Average Camshaft plus Lifter Wear, Pooled Standard Deviation

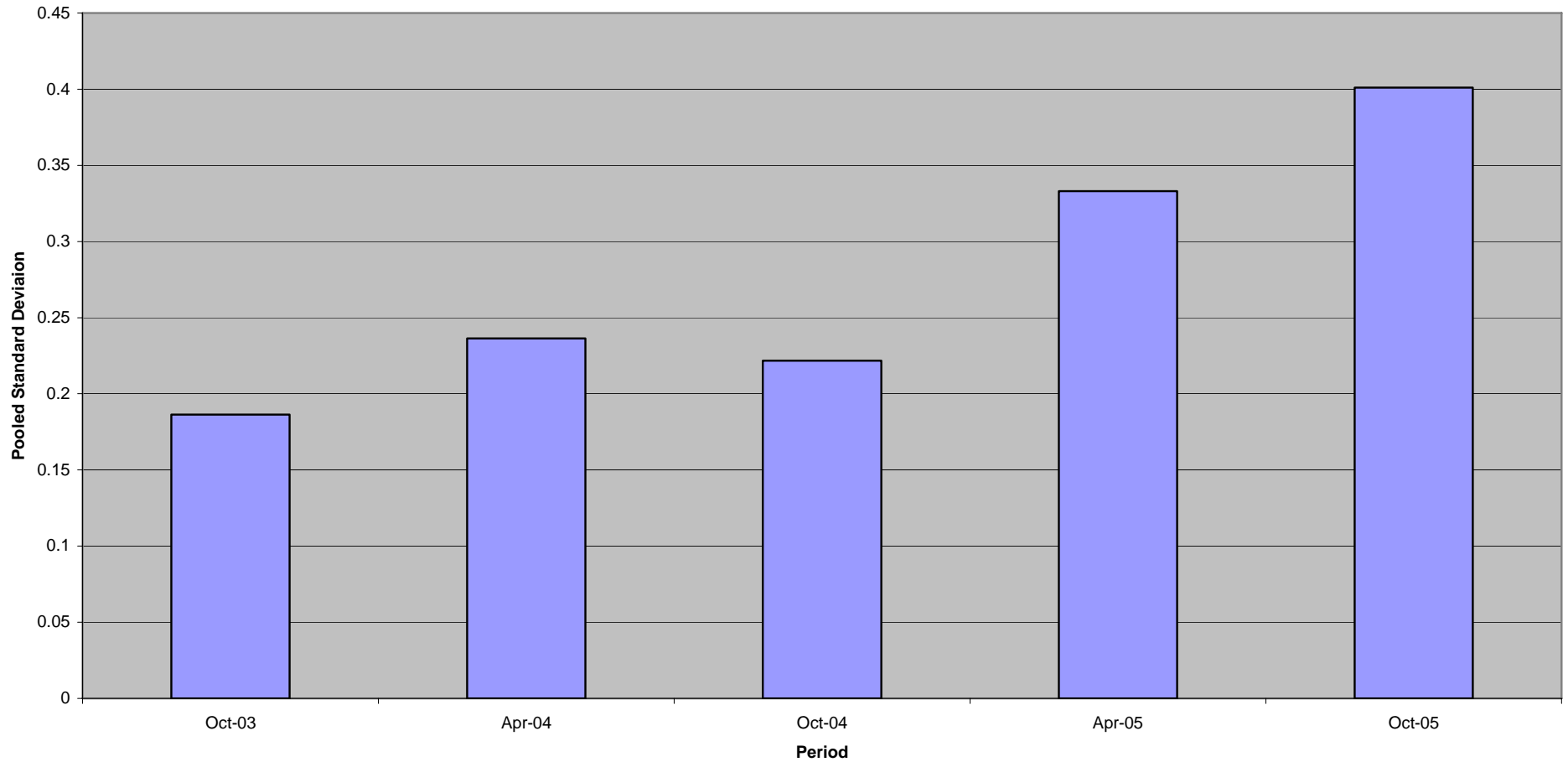


Figure 10

SEQUENCE IIIIGA INDUSTRY OPERATIONALLY VALID DATA

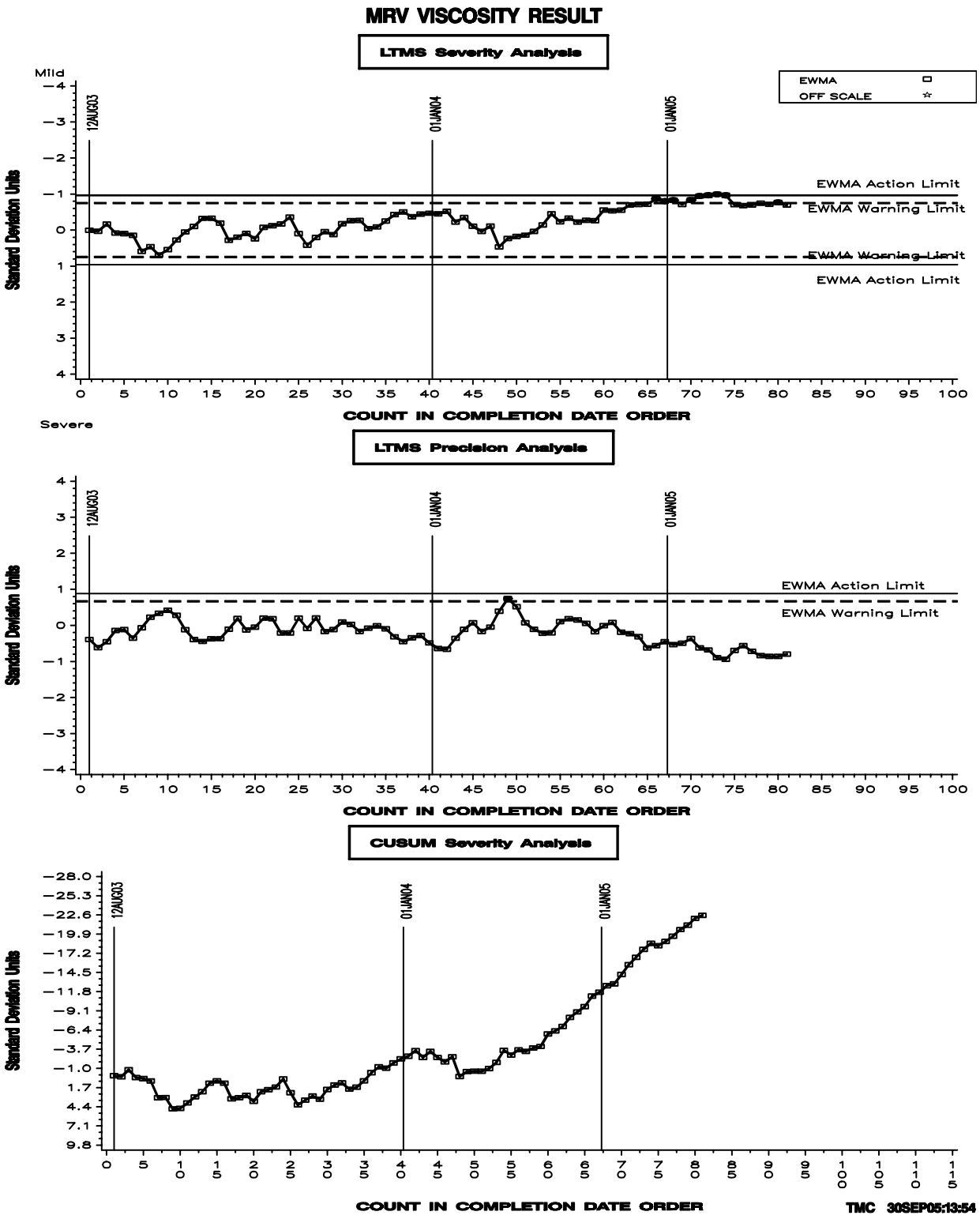


Figure 11 - Mini Rotary Viscometer result, Average Delta/s

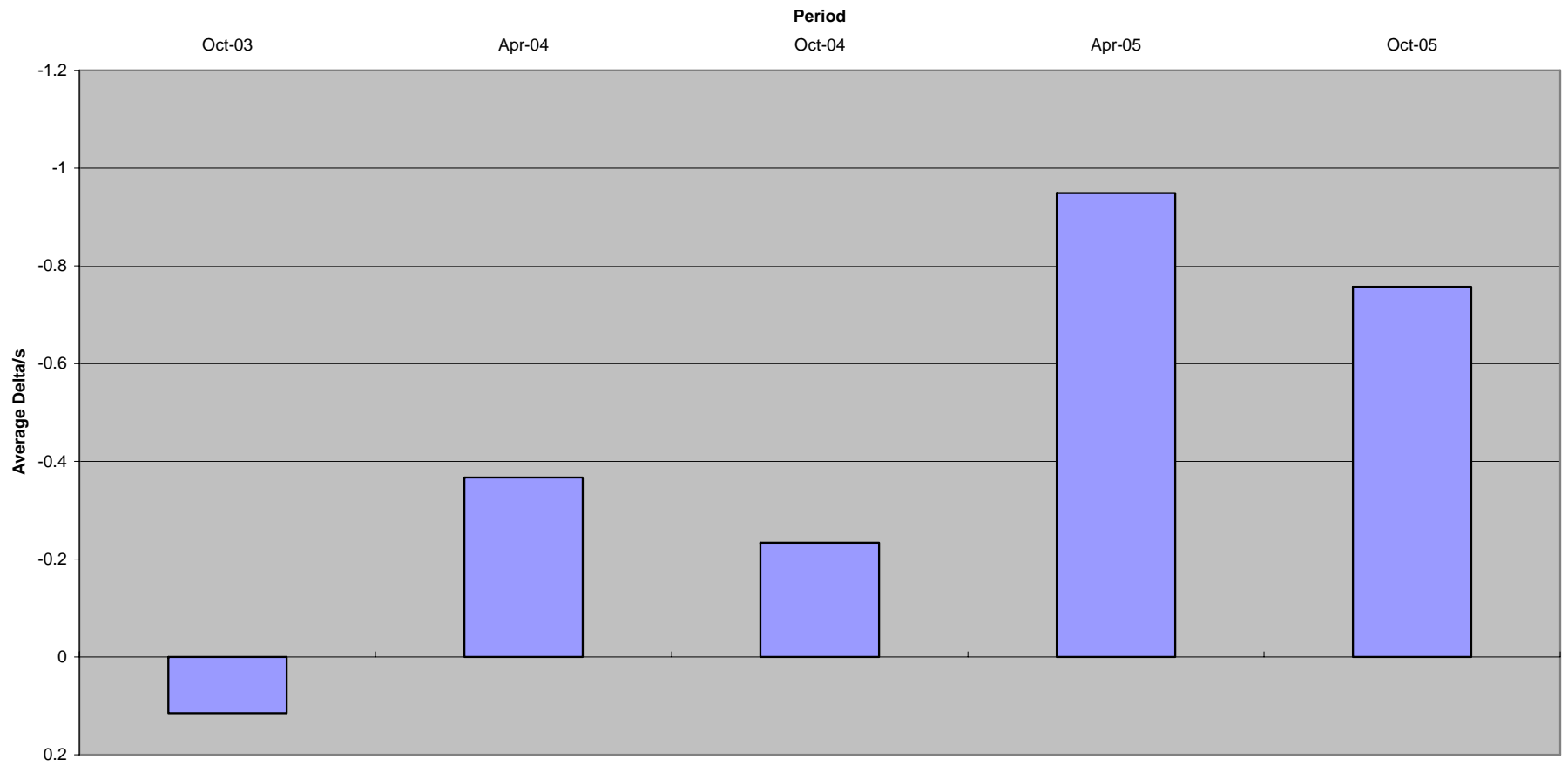


Figure 12 -Mini Rotary Viscometer result, Pooled Standard Deviation

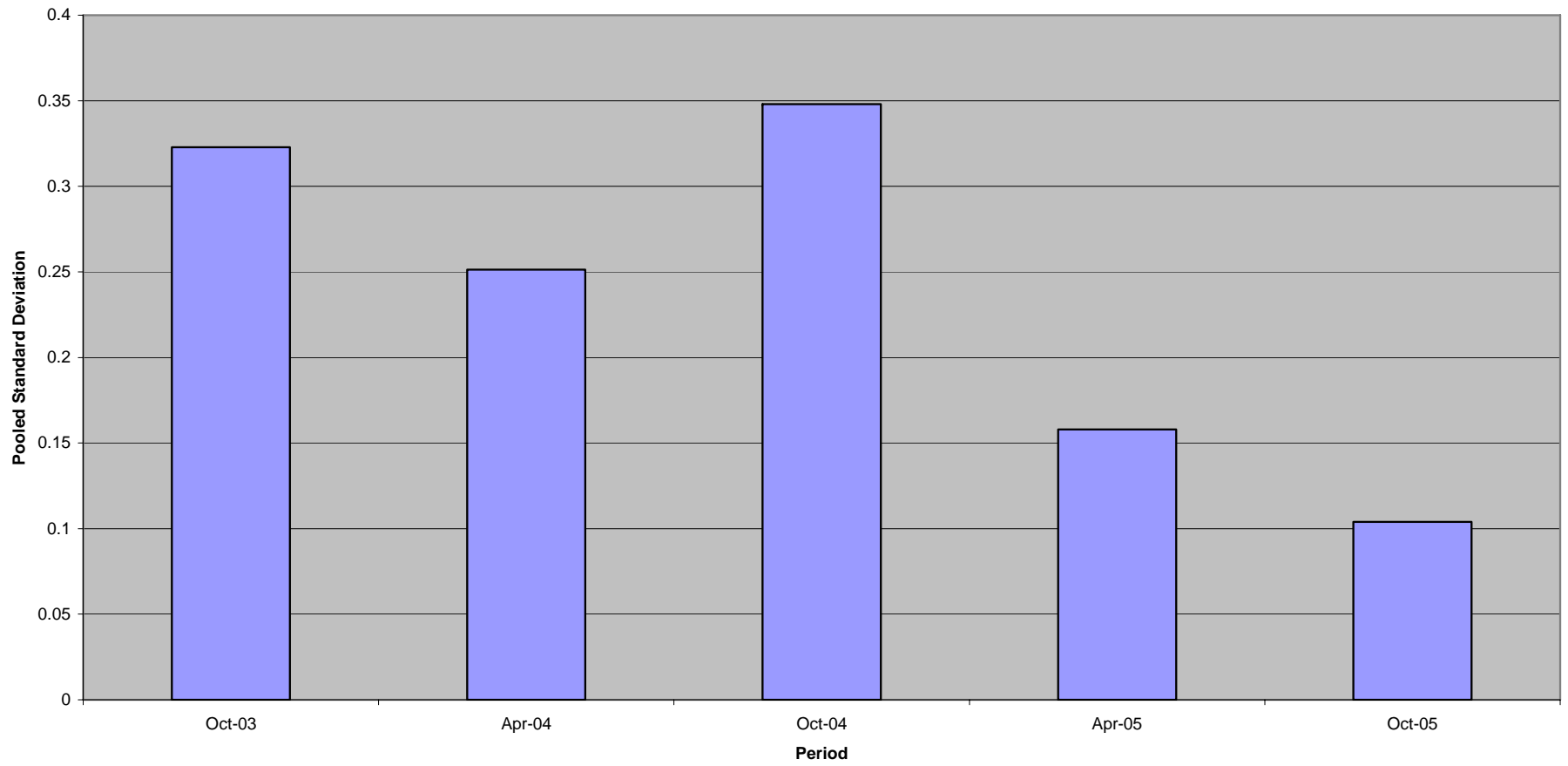


Figure 13 – Sequence IIIG/IIIGA Timeline

Effective Date	Topic	Info Letter
8/19/2003	Draft Sequence IIIG Test Procedure Issued	03-1
9/9/2003	Revised Valve Spring Load Specifications	03-2
9/23/2003	Revised Test Numbering Methodology	03-3
10/29/2003	Revised Fuel Pressure Specification	03-4
10/29/2003	Automatic Parts Cleaning Machine Maintenance Requirements Added	03-4
10/29/2003	Main Bearing Bore Mandrel Made Optional	03-4
10/29/2003	Piston Ring Cleaning Requirements	03-4
10/29/2003	Additional Allowable RTV Sealing Compound Allowed	03-4
10/29/2003	Main Bearing Cap Bolt Replacement Specifications	03-4
10/29/2003	Revised Camshaft Measurement Procedure	03-4
10/29/2003	Revised Camshaft Lubrication & Installation Procedure	03-4
10/29/2003	Revised Oil Consumption Reporting Procedure	03-4
10/29/2003	Fluid Conditioning Module Equipment Specifications	03-4
10/29/2003	Revised Camshaft Measurement Equipment Specifications	03-4
10/29/2003	Rating Workshop Attendance Requirement	03-4
11/4/2003	Elimination of CCS & MRV from IIIG test (creation of IIIGA test)	03-4
12/15/2003	New Honing Technique approved and added to Assembly Manual	
1/20/2004	Elimination of transform from ACLW results on oil 438 in LTMS; other oils still transformed	
1/20/2004	New Pooled s for ACLW SA calculation, based upon 434 and 435 only	
3/23/2004	Transform put back on 438 ACLW results, for all data. Control charts recalculated and effective today	
4/2/2004	Revised Intake Manifold Gasket	04-1
4/2/2004	Additional Allowable Sealing Materials	04-1
5/12/2004	Undercrown Rating Area Definition Clarification	04-2
5/12/2004	Flow Meter Specifications	04-2
5/12/2004	Editorial Corrections to Draft 2D	04-2
5/12/2004	MRV Reporting	04-2
5/12/2004	Amount of Oil Used for Camshaft & Lifter Lubrication	04-2
8/4/2004	First Occurrence of Powdered Metal Rods	
8/22/2004	First Occurrence of BC-4 rings	
11/4/2004	Powdered Metal Connecting Rod Torque Specifications	04-3
11/4/2004	New Front and Rear Main Seals	04-3
11/4/2004	New Oil Pan Gaskets	04-3
11/4/2004	New Exhaust Valves	04-3
11/4/2004	Editorial Change to Precision Statements	04-3
1/7/2005	Updated Precision Statements	05-1
1/7/2005	Engine Build Worksheets	05-1
1/7/2005	Clarification of Solvent Specifications	05-1
1/7/2005	Provisions for Adjustment to Calibration Period for Donated Oil Test Programs	05-1
20050808	First occurrence of BC-5 rings	