




Test Monitoring Center

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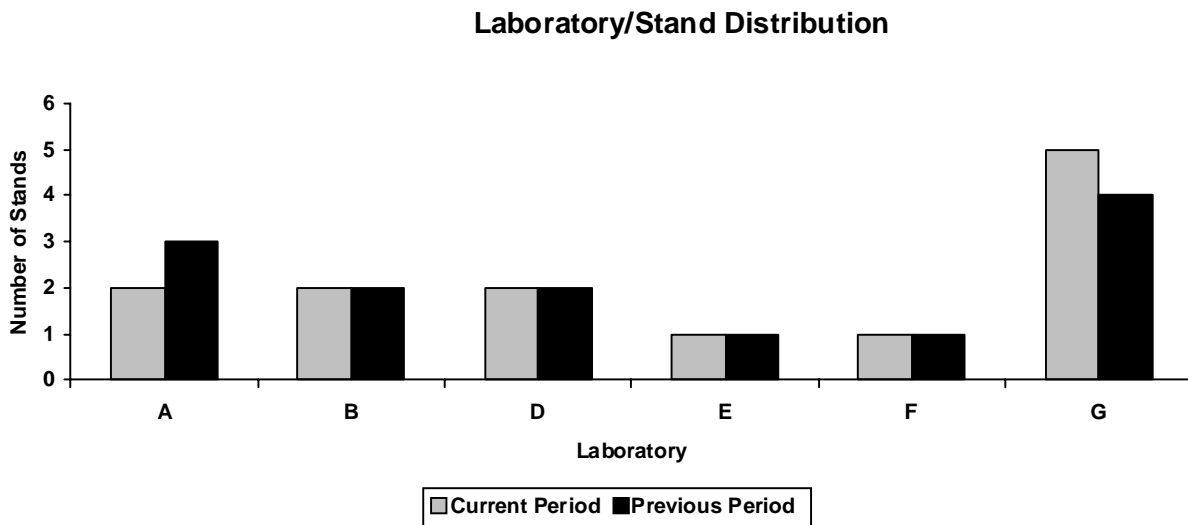
Memorandum: 09-045
Date: October 15, 2009
To: David Glaenzer, Chairman, Sequence III Surveillance Panel
From: Richard E. Grundza 
Subject: Sequence IIIG/AB Semiannual Report: April 1, 2009 through September 30, 2009

The following is a summary of Sequence IIIG reference tests that were reported to the Test Monitoring Center during the period April 1, 2009 through September 30, 2009.

Lab/Stand Distribution

	Reporting Data	Calibrated as of September 30, 2009
Number of Laboratories:	6	6
Number of Test Stands:	13	16

The following chart shows the laboratory/stand distribution:

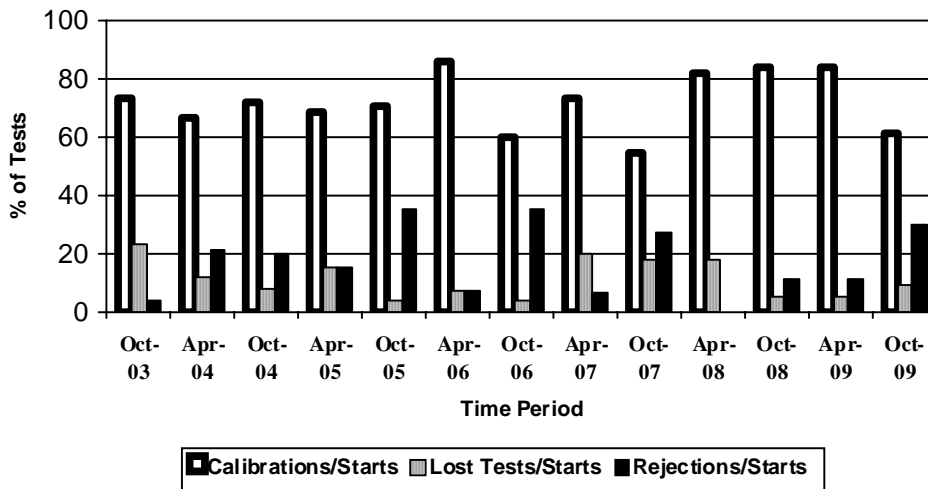


The following summarizes the status of the reference oil tests reported to the TMC:

Calibration Start Outcomes	TMC Validity Codes	No. of Tests
Operationally and Statistically Acceptable	AC	14
Failed Acceptance Criteria	OC	7
Operationally Invalid (Laboratory Judgment)	LC	2
Total		23

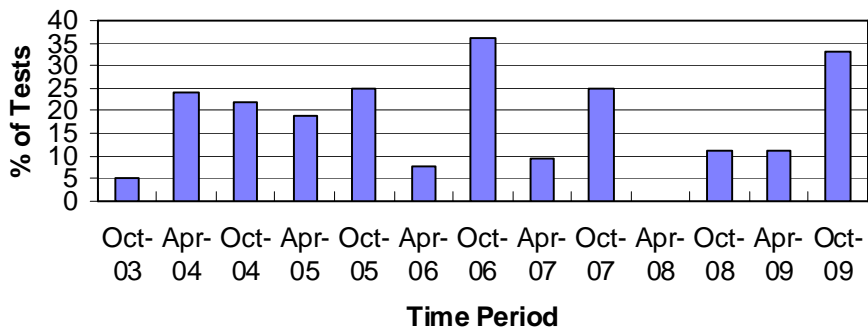
Calibrations per start, lost tests per start and rejection rates are summarized below:

Calibration Attempt Summary



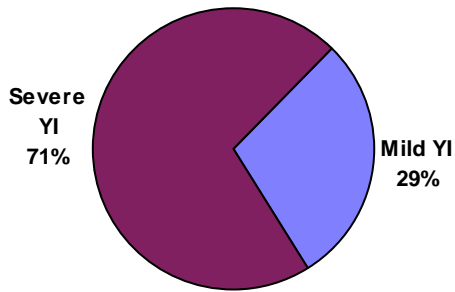
The calibration per start rate has decreased with respect to the previous period, while lost test and rejected test per start rates have increased with respect to the previous period.

Rejected Test Rate for Operationally Valid Tests

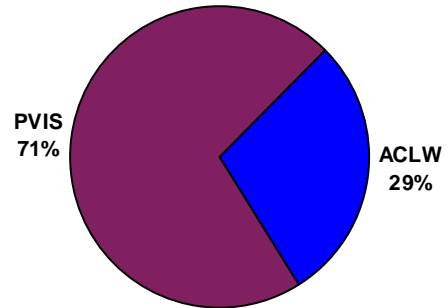


Seven tests failed the acceptance criteria during the period. The following charts summarize the reasons and breakdown by parameter for the failed test:

Distribution of LTMS Stand Alarms



Distribution of Stand Alarms by Parameter

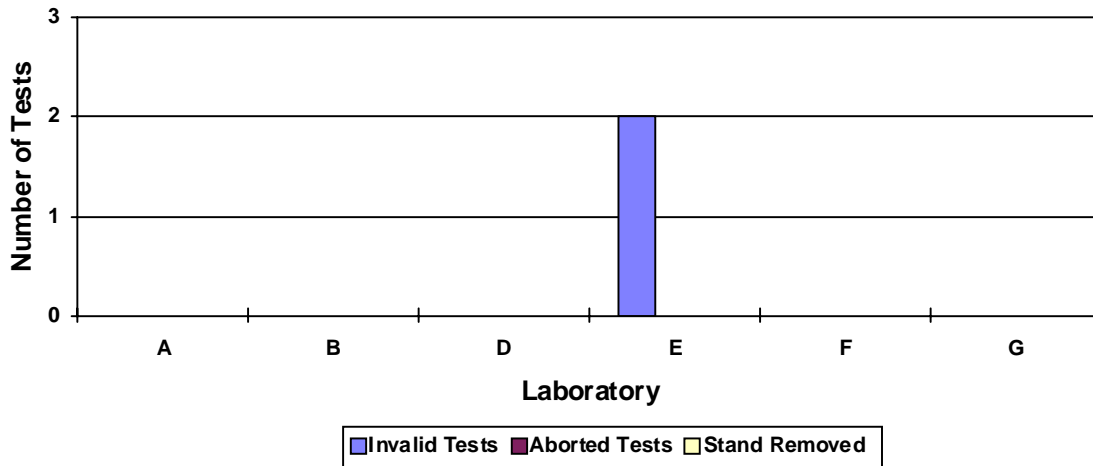


There were no LTMS Deviations written this period. Since its introduction in 2003, there has been one Sequence IIIIG LTMS deviation.

Two 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/MC)
E	O2 sensors connections switched	1	1/0/0/0
E	AFR calibrations not performed	1	1/0/0/0

Lost Test Distribution



Information Letters

There were three information letters issued this report period. Information Letter 09-02, Sequence Number 21 was issued on May 28, 2009. Information Letter 09-3, Sequence Number 22 was issued July 28, 2009. Information Letter 09-4, Sequence Number 23, was issued August 13, 2009. Items changed with these information letters are documented in the IIIG/AB timeline (Figure 13).

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	0.640	0.606 (df=18)	71.1 % Viscosity Increase ¹
WPD	-0.643	0.659 (df=18)	-0.42 Merits
ACLW	-0.779	0.293 (df=18)	-12.2 μm^2
MRV ³	0.100	0.213 (df=10)	N/A (no appropriate baseline) ⁴
PHOS ⁵	-0.164	1.676 (df=18)	N/A (no appropriate baseline) ⁶

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

² At the 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.

⁵ Sequence IIIGB Test Parameter only

⁶ PHOS does not have a specific GF-4 Pass Limit, will be included in GF-5

Average Δ/s Results, by Laboratory					
Laboratory	PVIS	WPD	ACLW	MRV ¹	PHOS
A	2.01	-1.73	0.16	0.973	-0.281
B	-0.16	-0.20	-0.76	-0.060	-0.035
D	2.00	-1.00	-1.26	0.900	0.573
E	0.14	-0.67	0.38	0.553	0.879
F	-0.99	0.00	-0.63	-1.251	-1.203
G	0.79	-0.62	-1.44	-0.510	-0.490

¹ Reference oil 435 data excluded from calculations

Percent Viscosity Increase (PVIS)

PVIS is currently in severity (severe direction) and precision action alarms (see Figure 1). These alarms may be driven by three excessively severe tests which were 4.605, 2.336, and 3.349 Δ/s severe of target (different labs and oils). The average delta/s value for the period is 0.640 severe of target (see Figure 4). The pooled standard deviation for the period, 0.606, has improved slightly since last period, but is still high compared to historical levels.

Weighted Piston Deposits (WPD)

WPD is currently in a severity (severe direction) warning alarm, while precision is in control (see Figure 2). The average delta/s for the period, -0.643, is not quite as severe as the previous period (see Figure 5). The pooled standard deviation for the period, 0.659, has degraded compared to recent periods (see Figure 8).

Average Camshaft-plus-Lifter Wear (ACLW)

ACLW is currently within control chart limits (see Figure 3). Severity for the period was mild with an average delta/s value of -0.779 (see Figure 6). The pooled standard deviation for the period, 0.293, is within historical levels (see Figure 9).

Mini Rotary Viscometer (MRV)

The MRV control charts are shown for informational purposes in Figure 10. With the exception of three warning alarms each, the severity and precision control charts have been in control for the period. The average Δ/s value for the period, 0.100, was slightly severe for the period and is shown in Figure 11. The pooled standard deviation for the period, 0.213, has degraded, when compared to the last period and is shown in Figure 12.

Phosphorus Retention (PHOS)

PHOS severity and precision charts were in control for the period (see Figure 13). The average Δ/s value for the period, -0.164, was slightly severe for the period and is shown in Figure 14. The pooled standard deviation for the period, 1.676, has improved, when compared to the last period and is shown in Figure 15.

QI Deviations

There was one QI Deviation written this period. The QI deviation was issued for load control generating a QI value below 0.000. A total of 6 QI deviations have been written to date.

Hardware

No hardware changes were noted this report period.

Reference Oils

Oil	TMC Inventory, in gallons	TMC Inventory, in tests (4 gal/test)	Laboratory Inventory, in tests	Estimated life
434	9	2	4	<1 year
434-1	508	127	3	~10 years
435	36	9	5	~ 2 years
435-1	649	162	0	~10 years
438	462	115	4	~10 years

Three lab visits were conducted during this report period. No significant discrepancies were noted during these visits.

REG/reg

Attachments

- c: F. M. Farber, TMC
J. A. Clark, TMC
Sequence III Surveillance Panel
<ftp://ftp.astmtmc.cmu.edu/docs/gas/sequenceiii/semiannualreports/IIIG-10-2009.pdf>

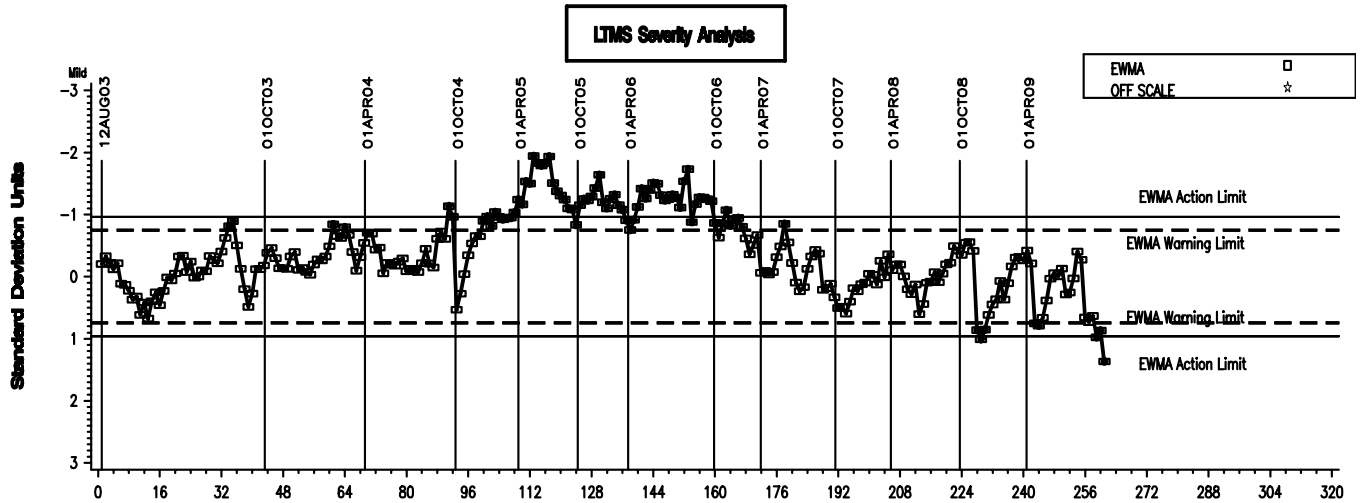
Distribution: Electronic Mail

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 EWMA severity and precision control charts and also the CUSUM Δ/s plots of PHOS, annotated with date lines, using the same data set as the EWMA severity and precision control charts.
- Figure 14 is a bar chart of average Δ/s , by report period, for PHOS.
- Figure 15 is a bar chart of pooled standard deviation, by report period, for PHOS.
- Figure 16 is the Sequence IIIG/AB Timeline.

Figure 1
SEQUENCE III G INDUSTRY OPERATIONALLY VALID DATA

VISCOSITY INCREASE



Severe

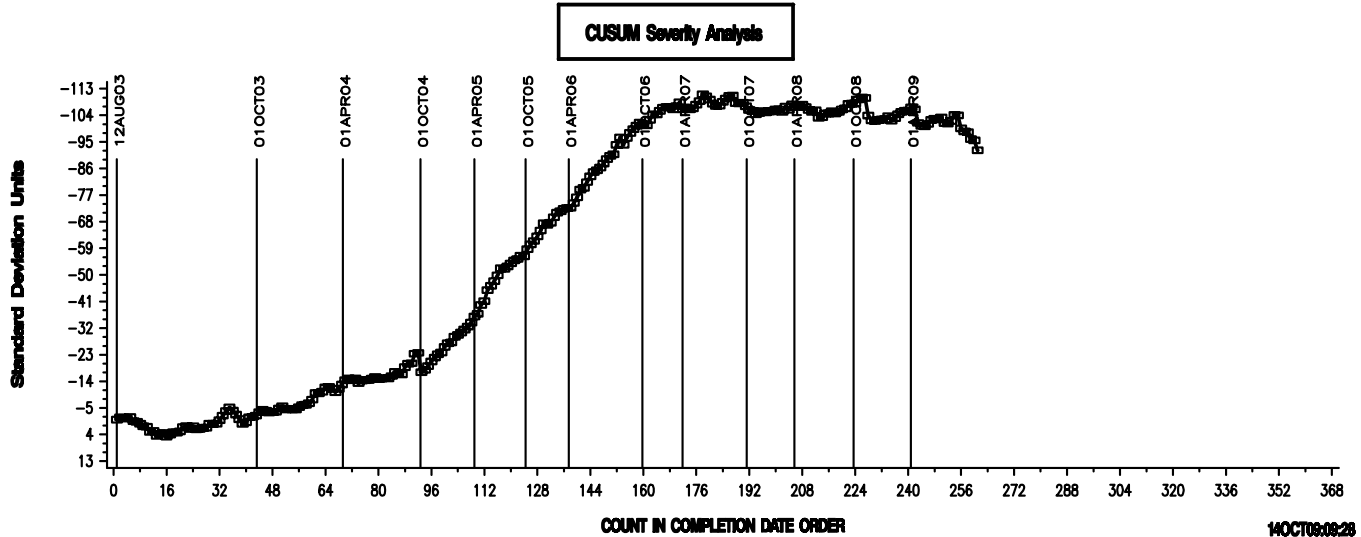
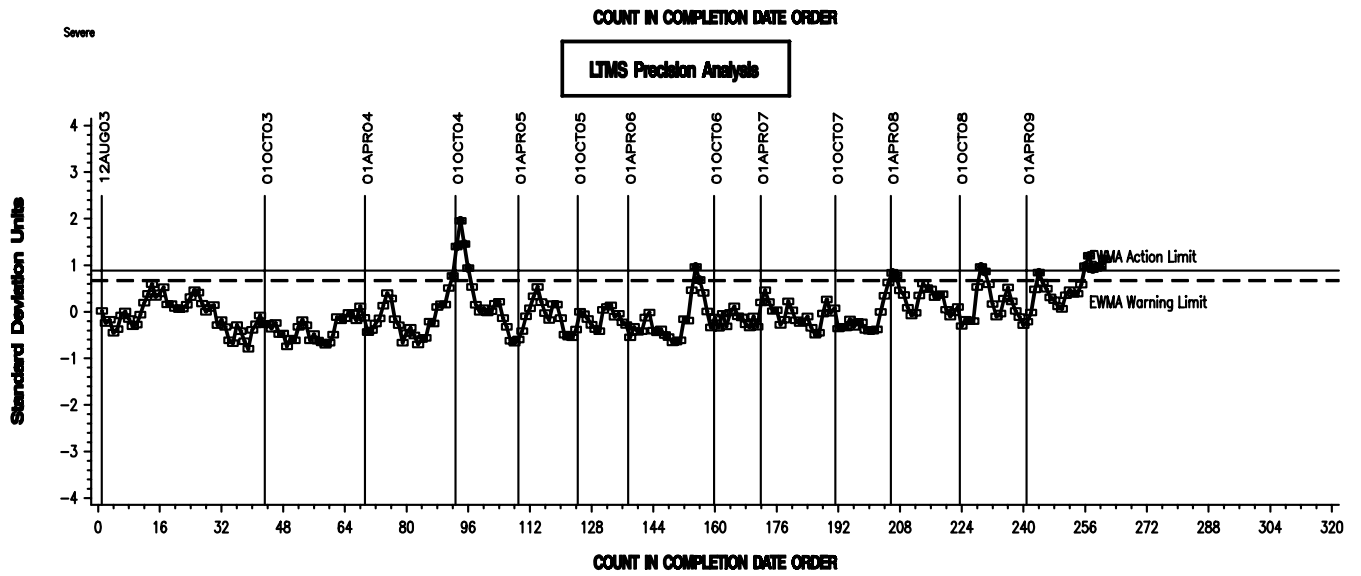


Figure 2
SEQUENCE III G INDUSTRY OPERATIONALLY VALID DATA

AVERAGE WEIGHTED PISTON DEPOSITS

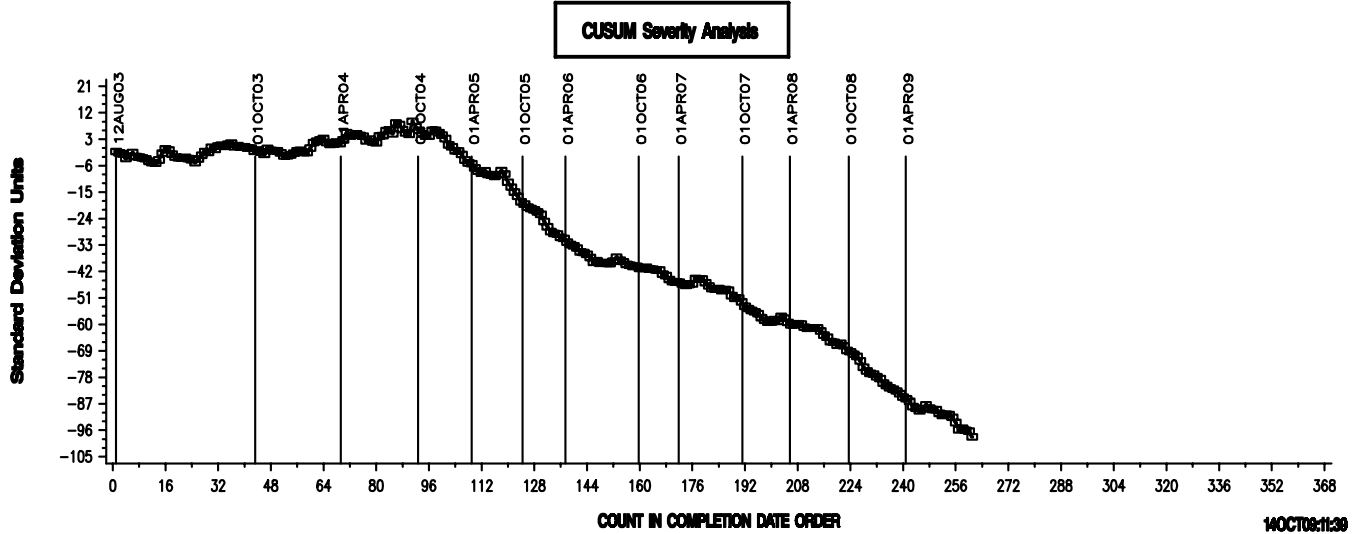
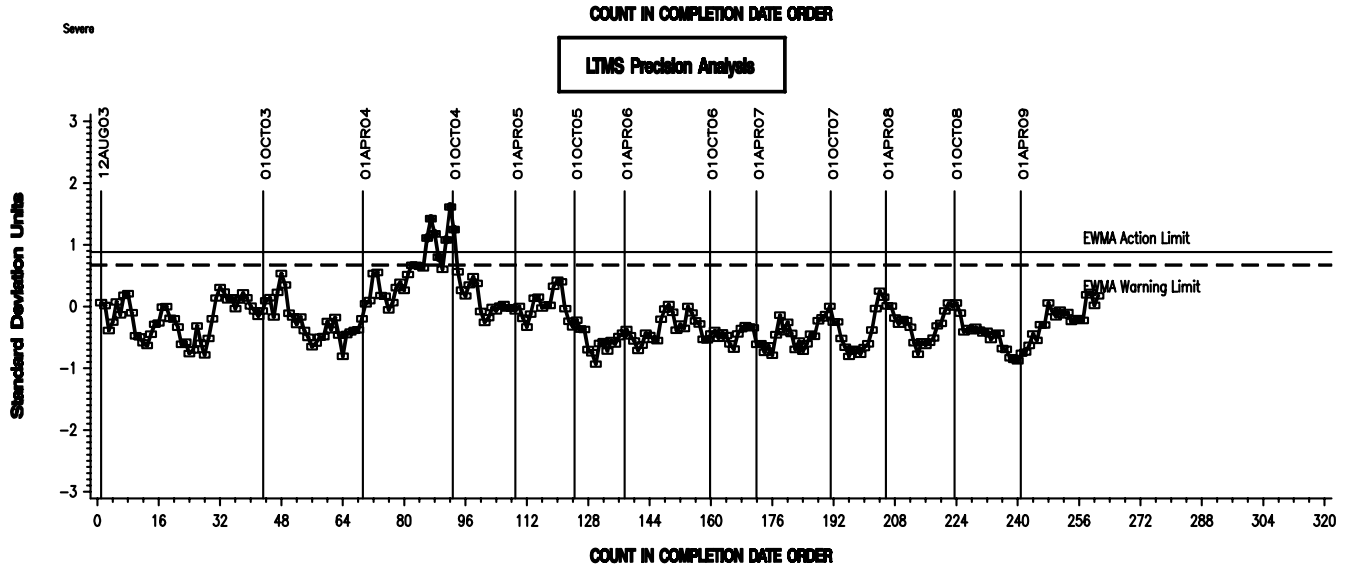
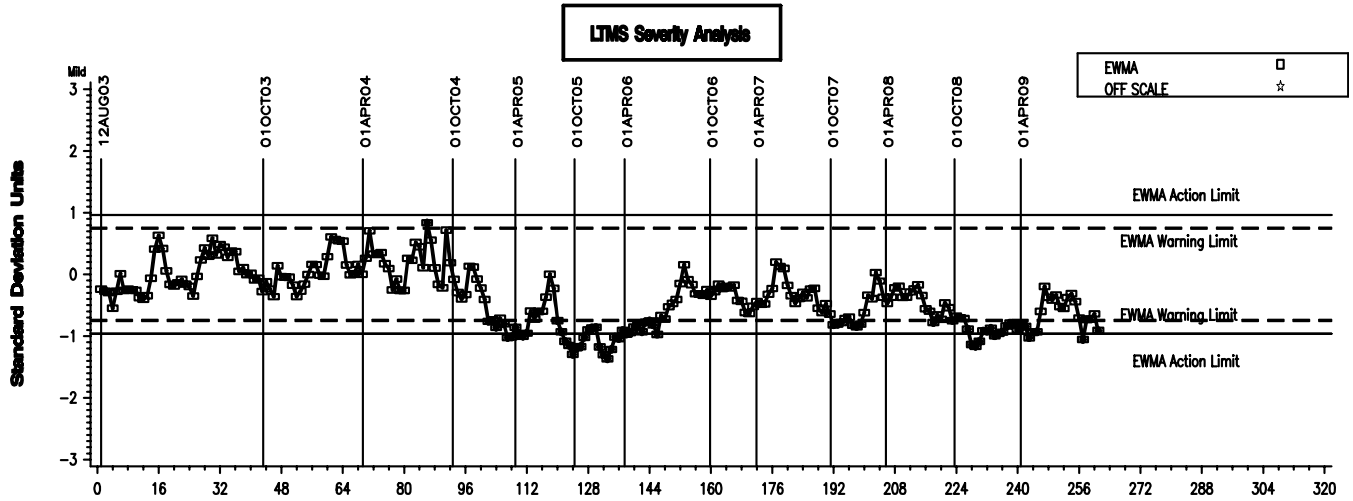


Figure 3
SEQUENCE IIG INDUSTRY OPERATIONALLY VALID DATA

AVERAGE CAM + LIFTER WEAR

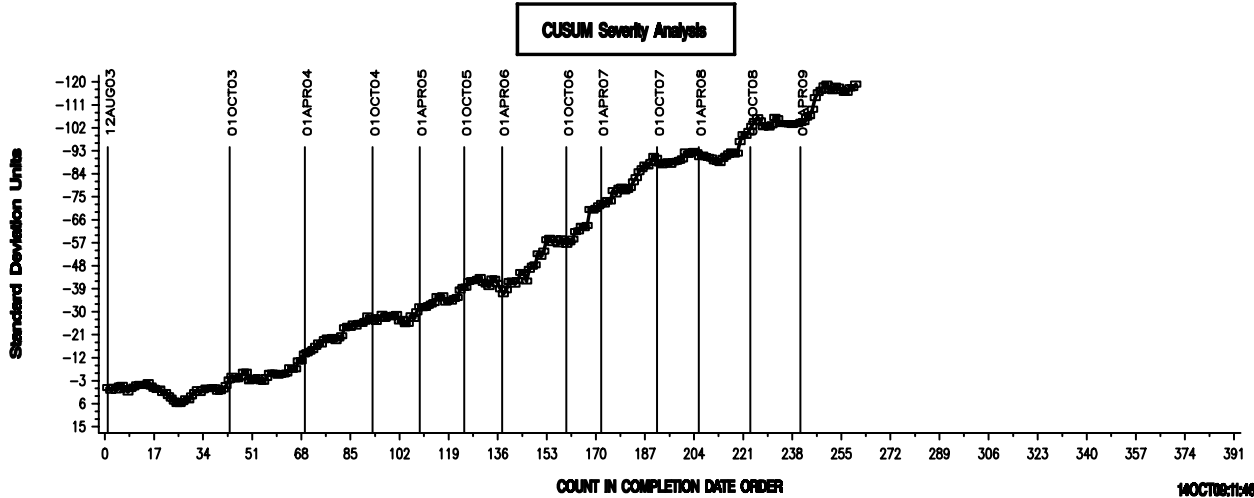
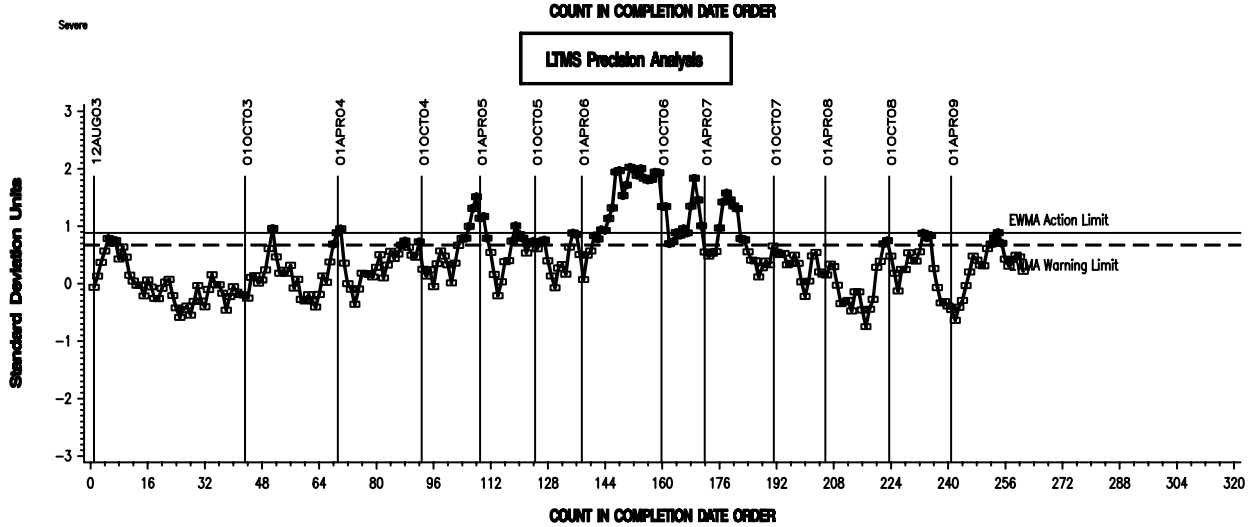
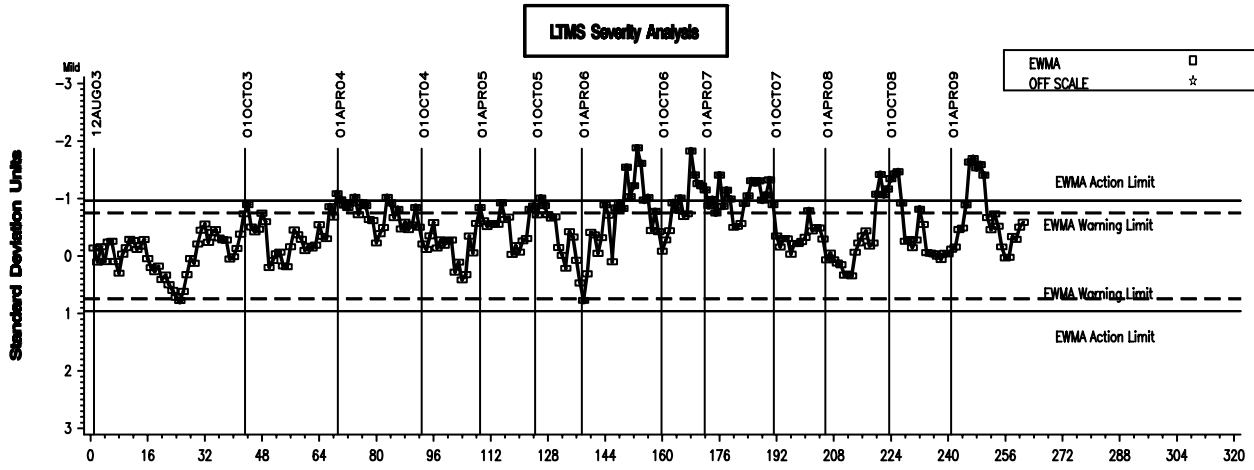


Figure 4 - Percent Viscosity Increase, Average Delta/s

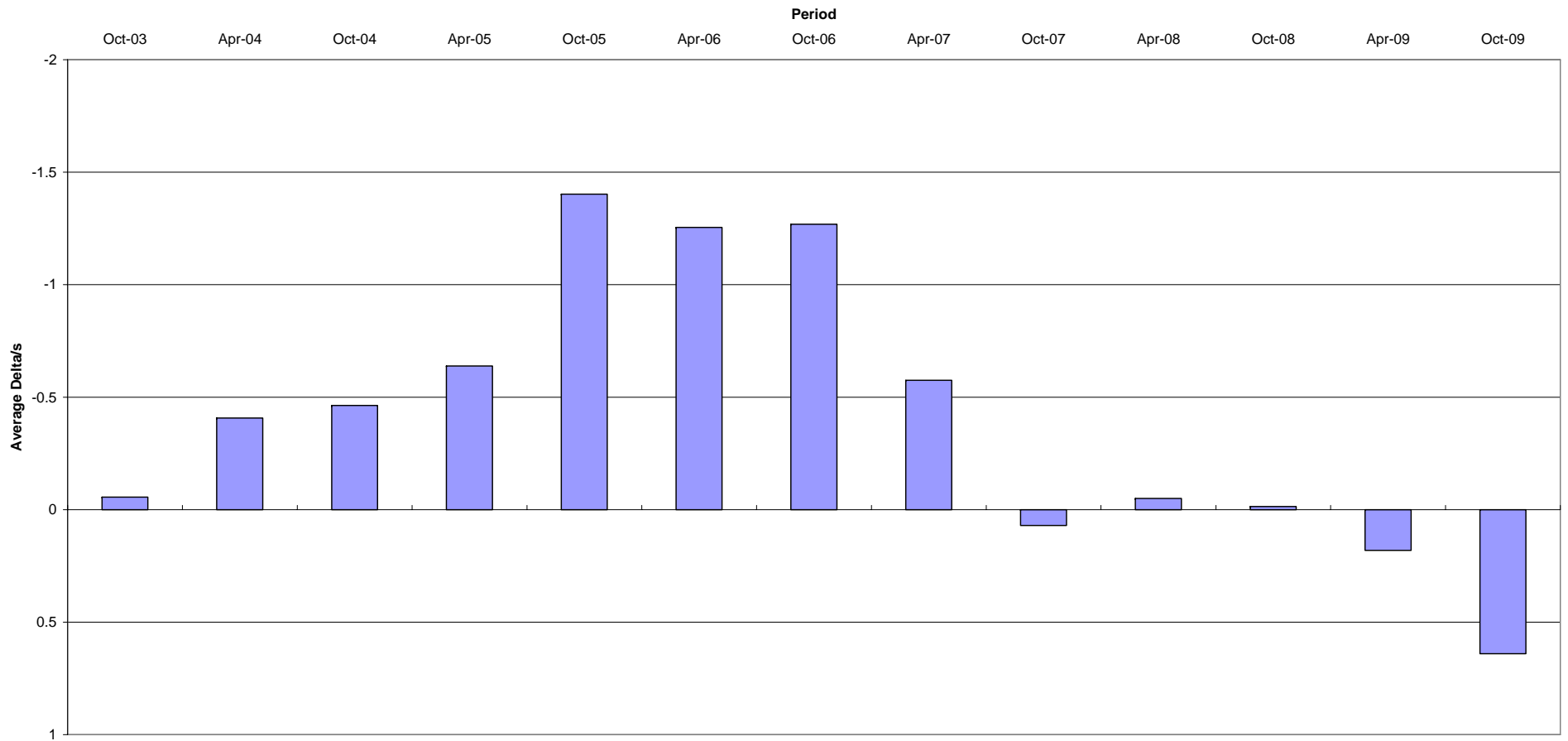


Figure 5 - Weighted Piston Deposits, Average Delta/s

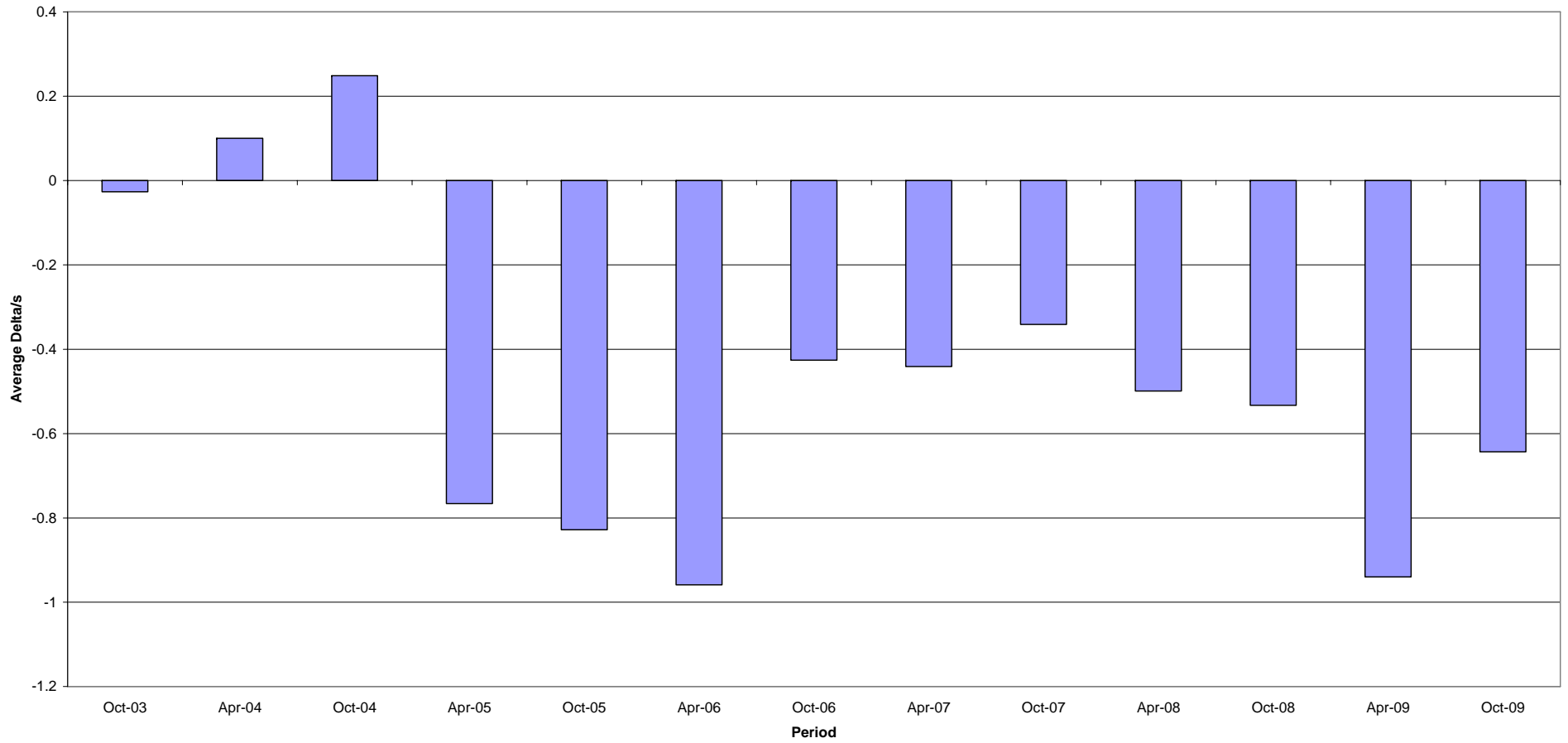


Figure 6 - Average Camshaft plus Lifter Wear, Average Delta/s

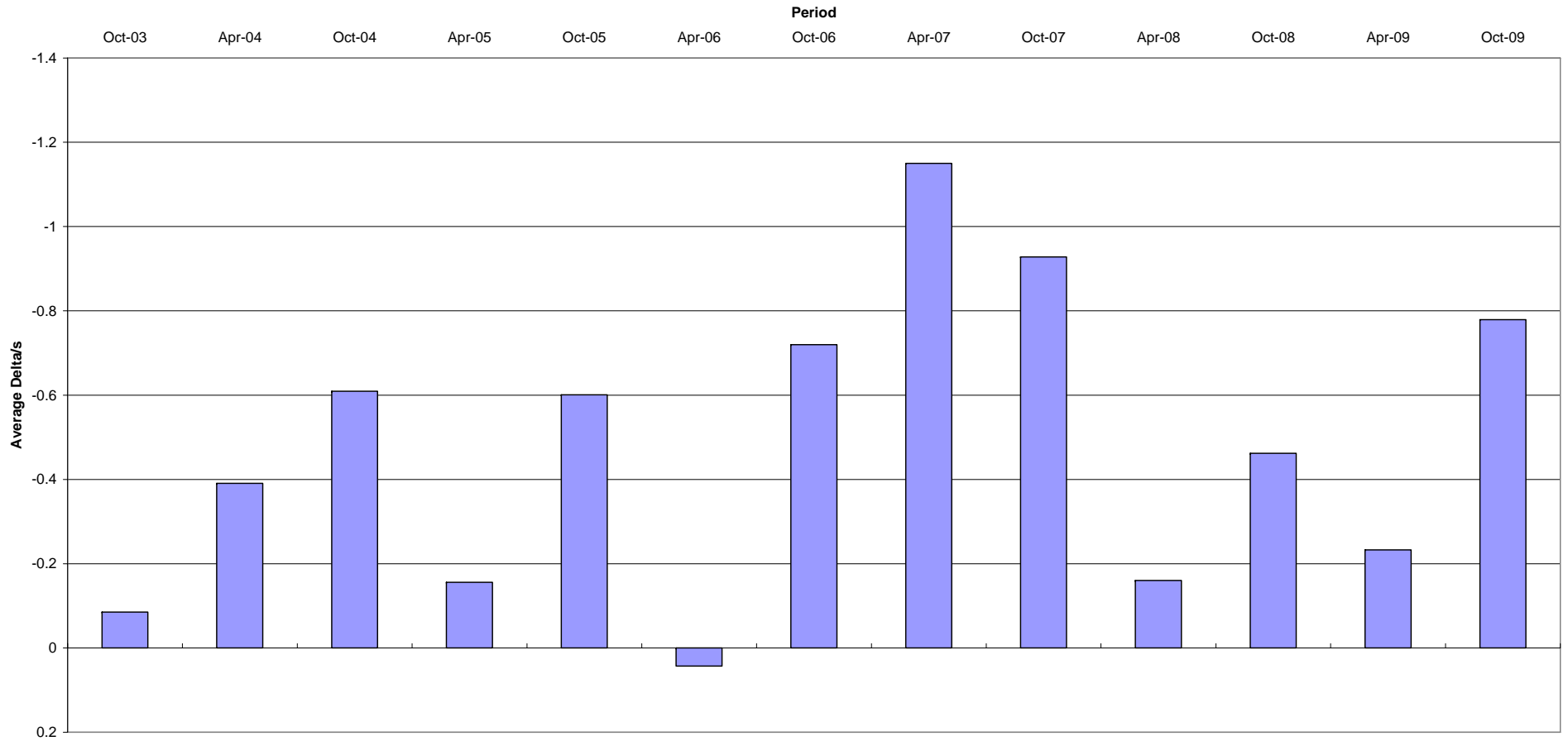


Figure 7 - Percent Viscosity Increase, Pooled Standard Deviation

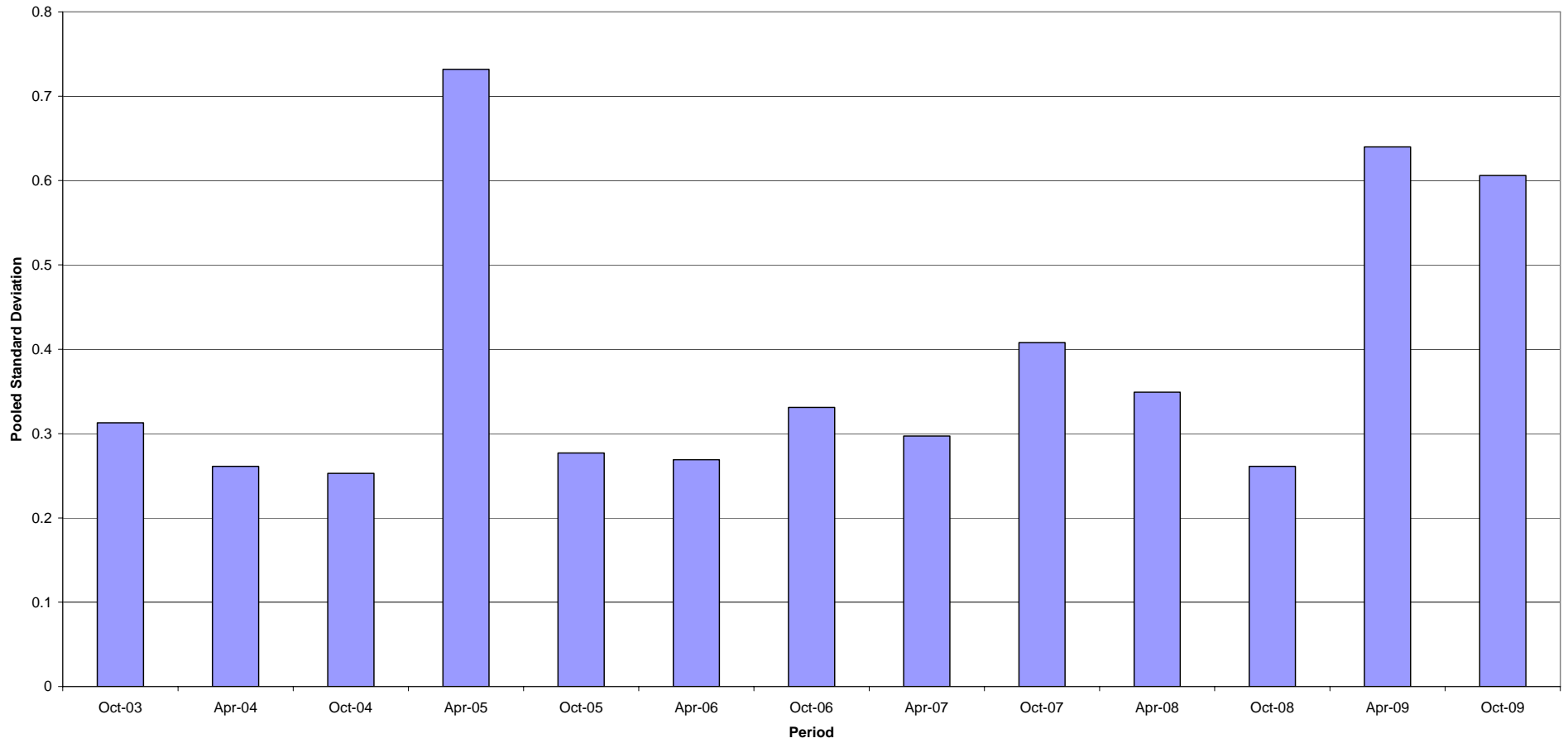


Figure 8 - Weighted Piston Deposits, Pooled Standard Deviation

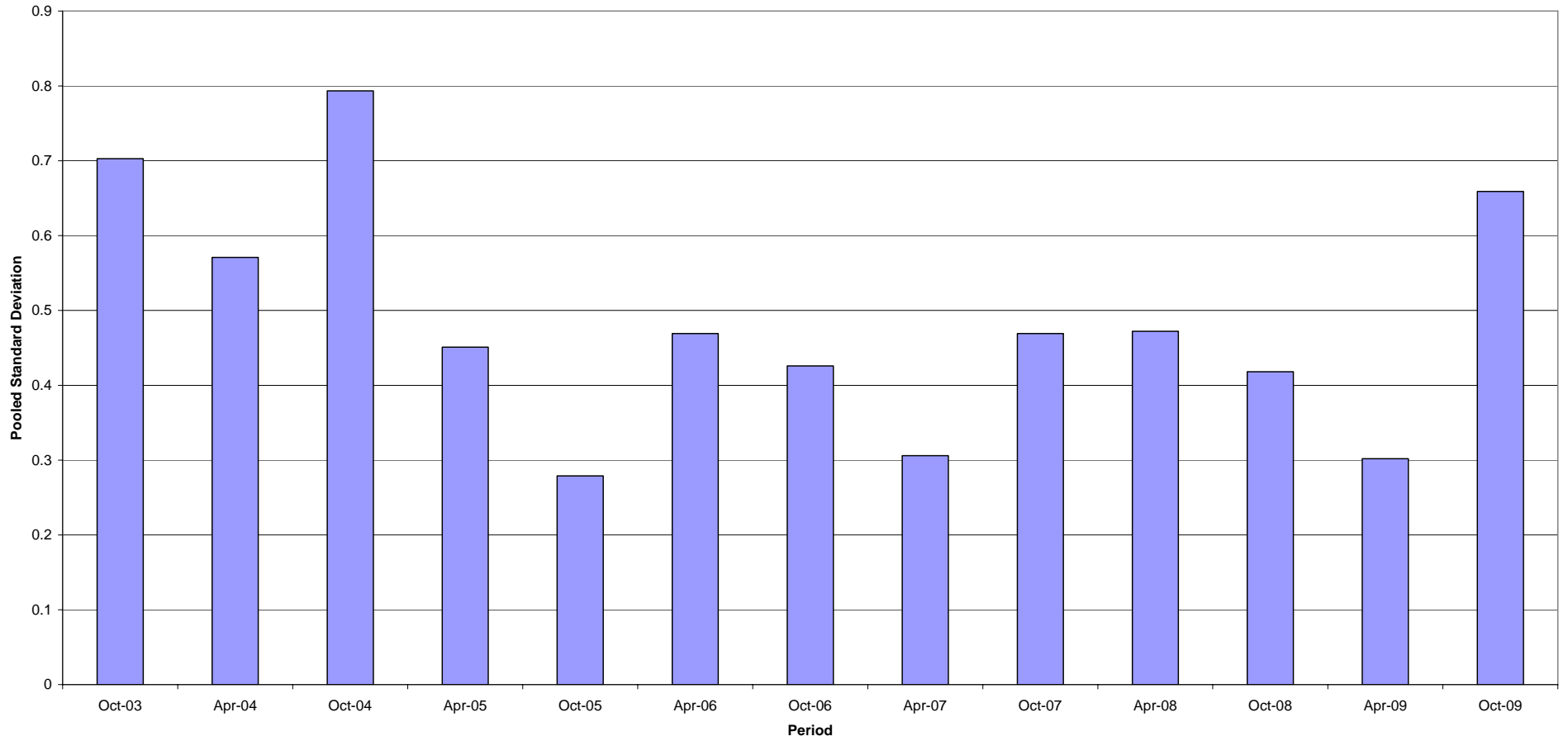


Figure 9 - Average Camshaft plus Lifter Wear, Pooled Standard Deviation

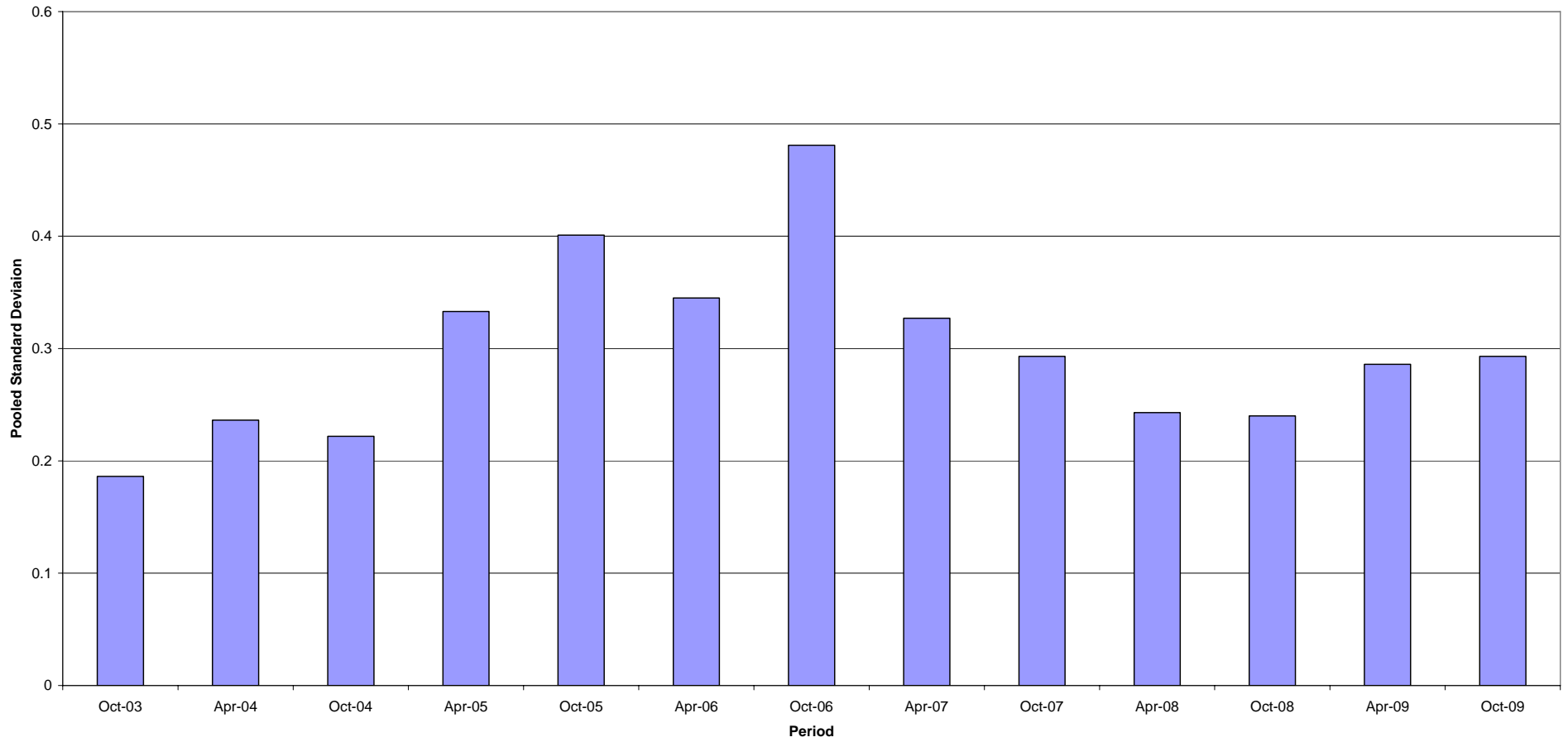


Figure 10

SEQUENCE III GA INDUSTRY OPERATIONALLY VALID DATA

MRV VISCOSITY RESULT

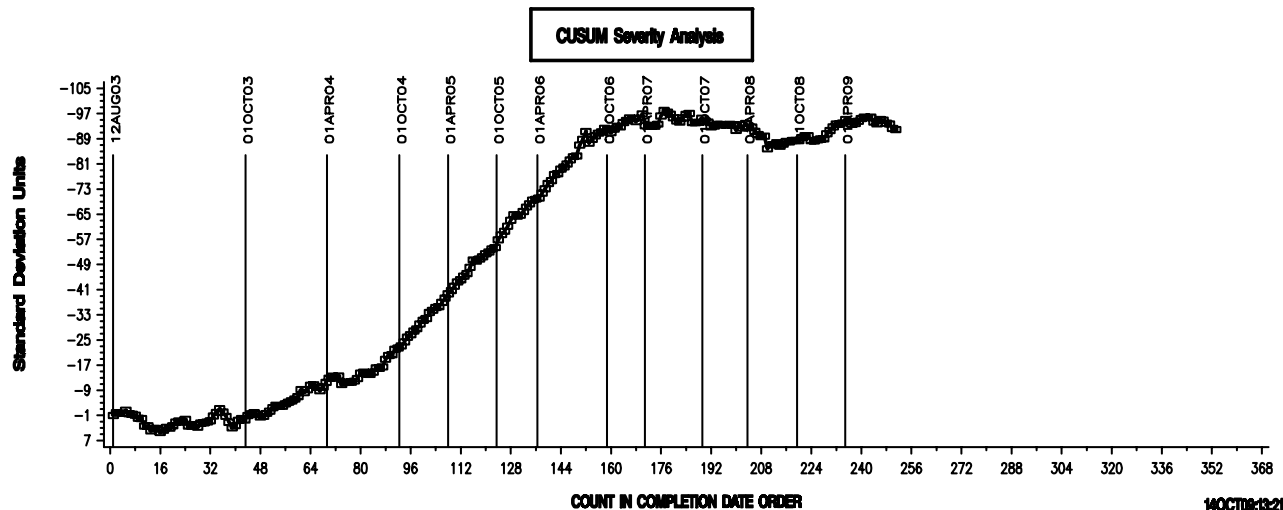
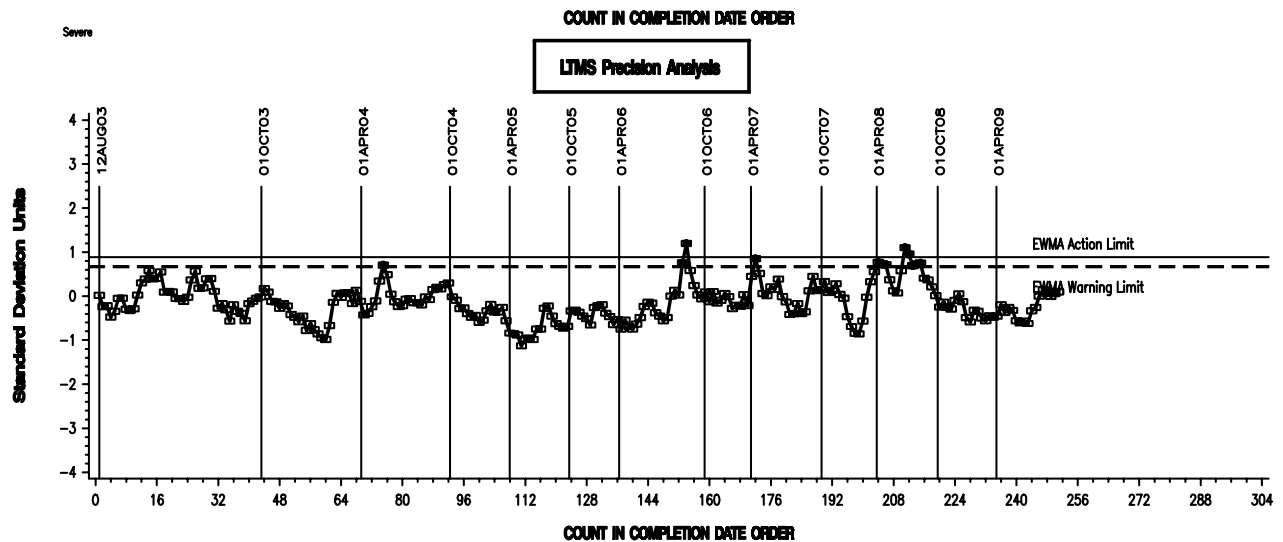
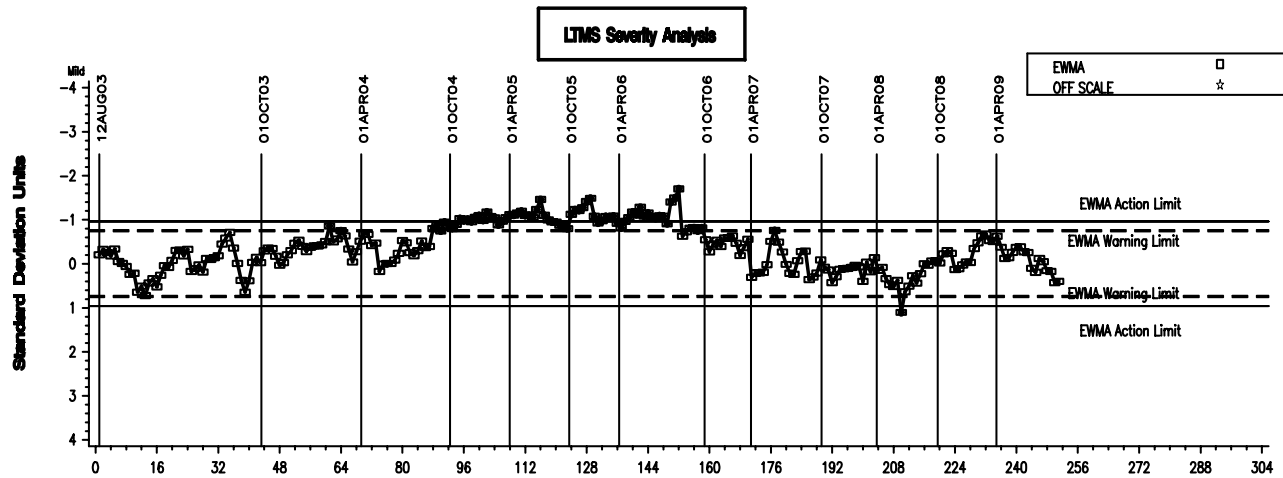


Figure 11 - Mini Rotary Viscometer result, Average Delta/s

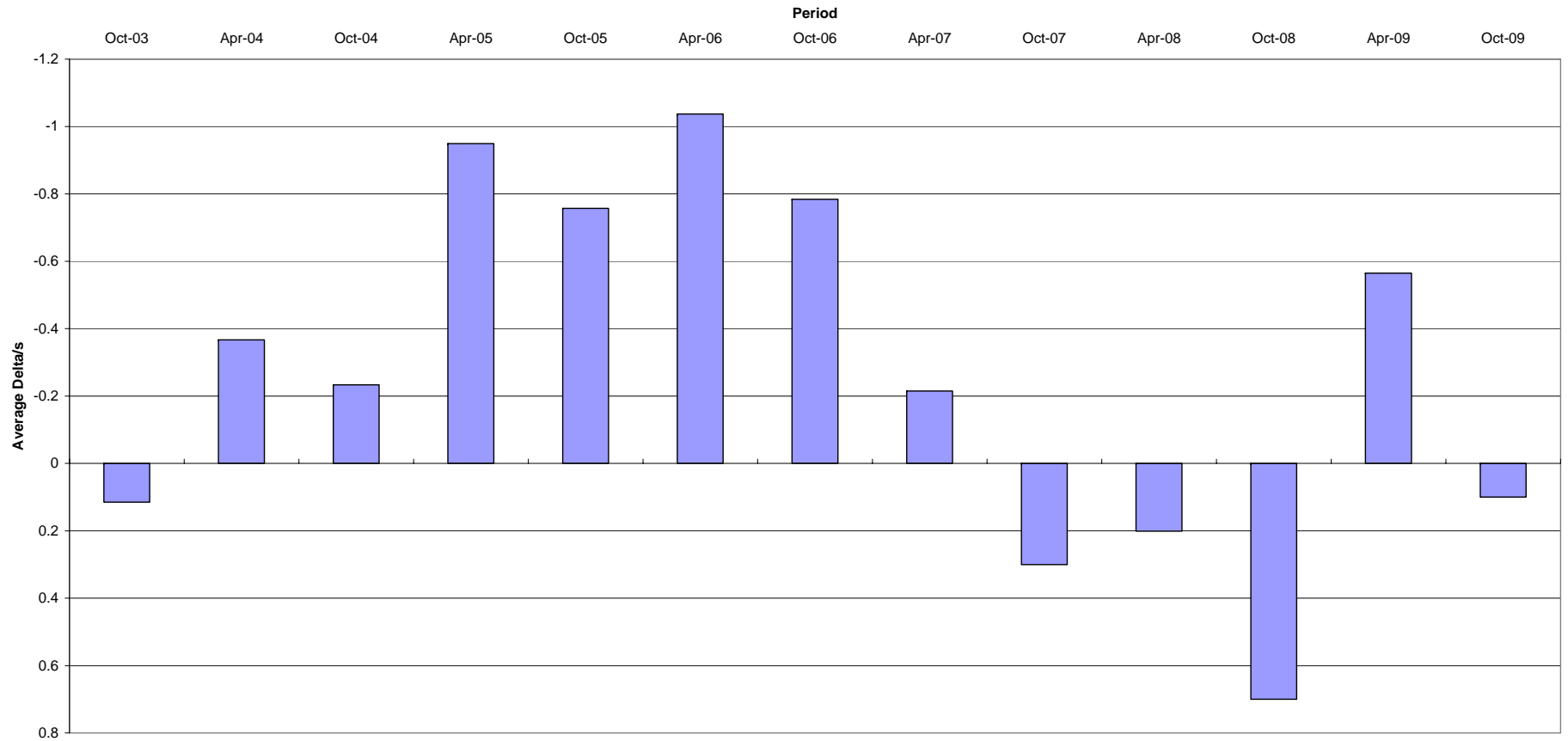


Figure 12 -Mini Rotary Viscometer result, Pooled Standard Deviation

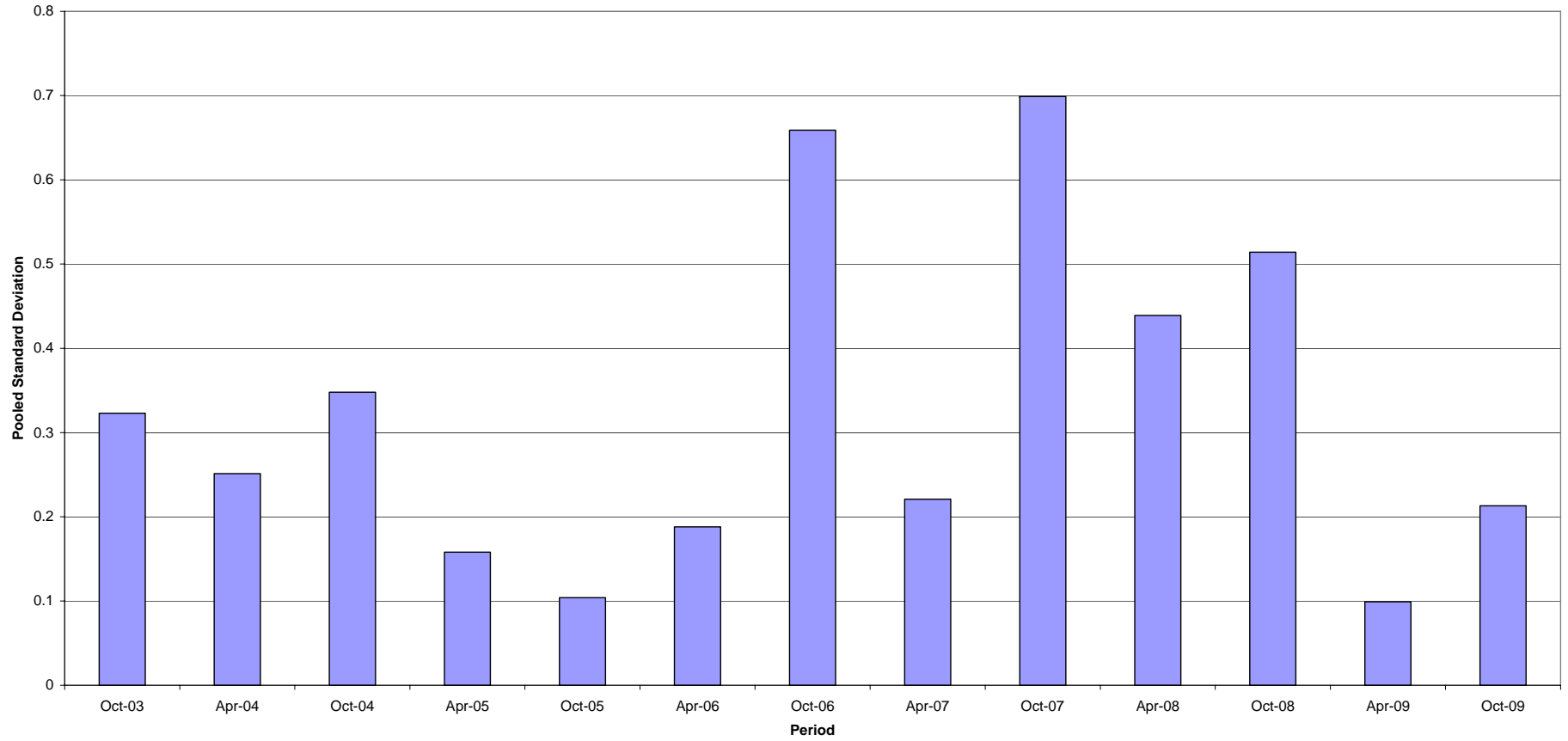


Figure 13
SEQUENCE IIIGB INDUSTRY OPERATIONALLY VALID DATA
PHOS RETENTION

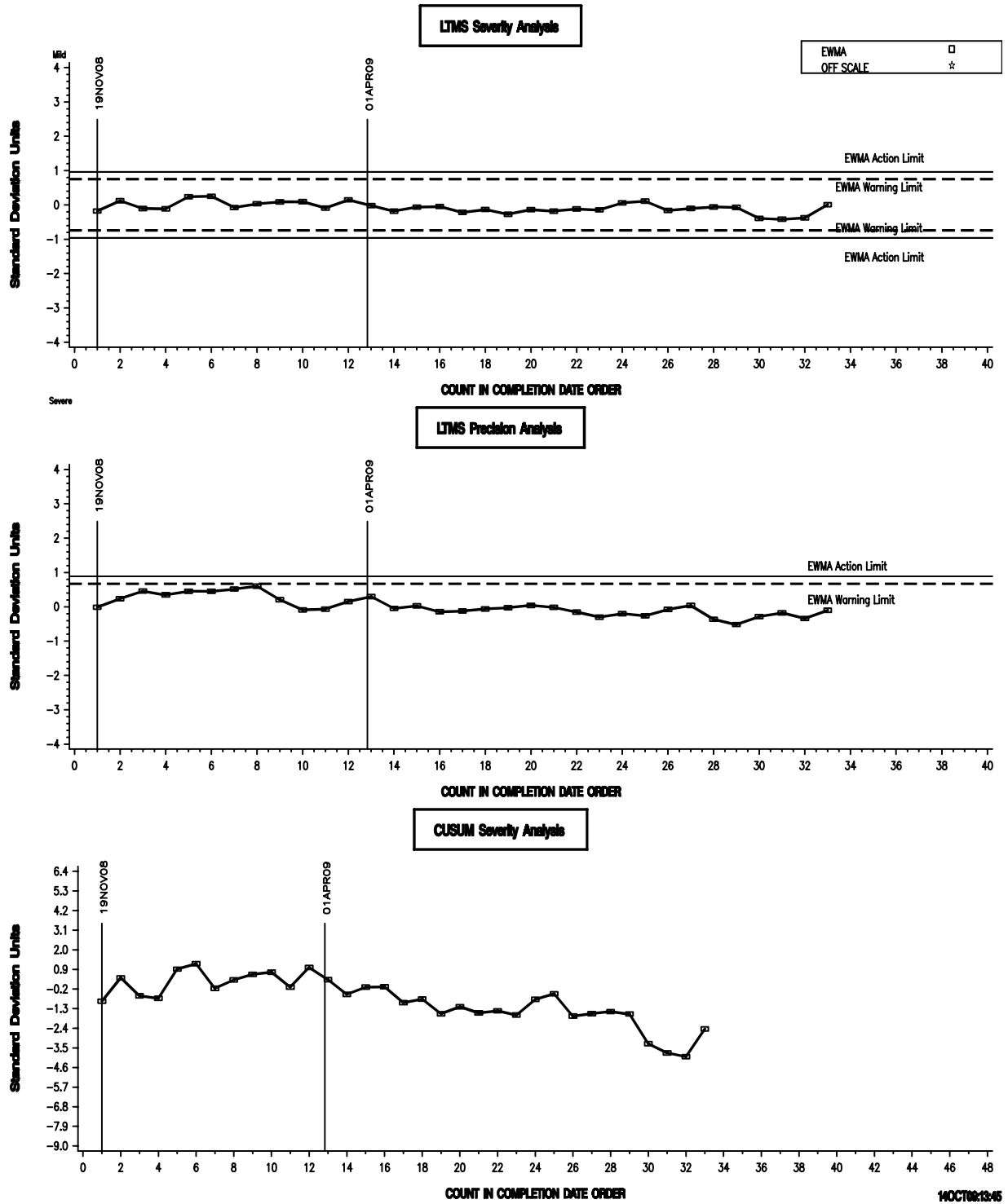


Figure 15 -Phosphorus Retention result, Pooled Standard Deviation

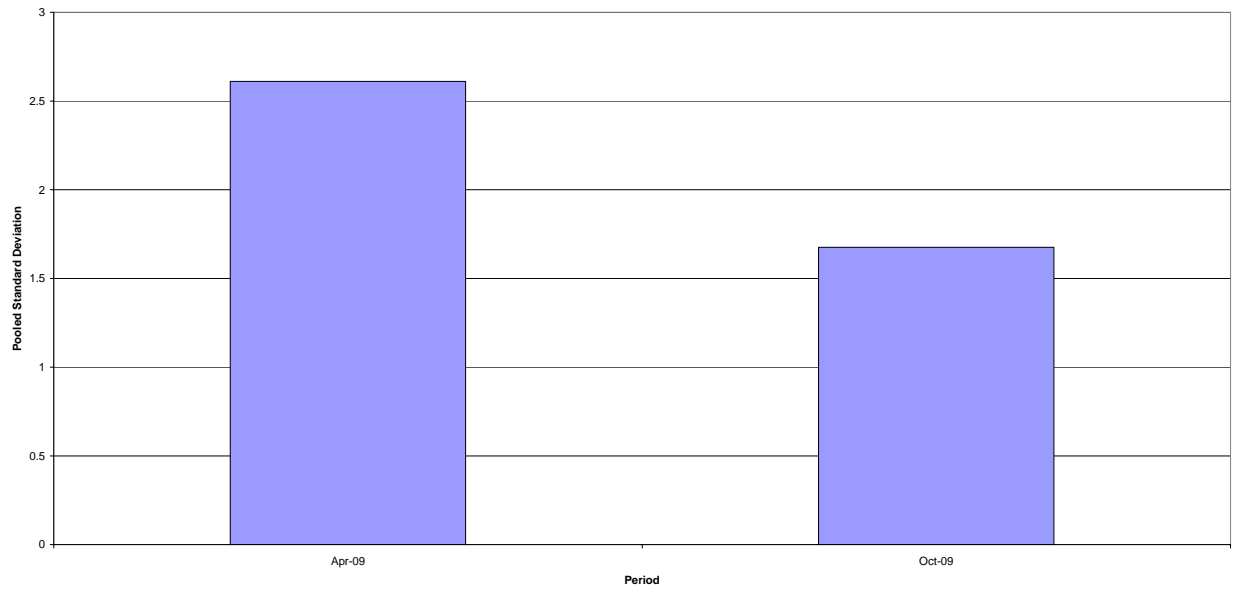


Figure 14 -Phosphorus Retention result, Average Delta/s

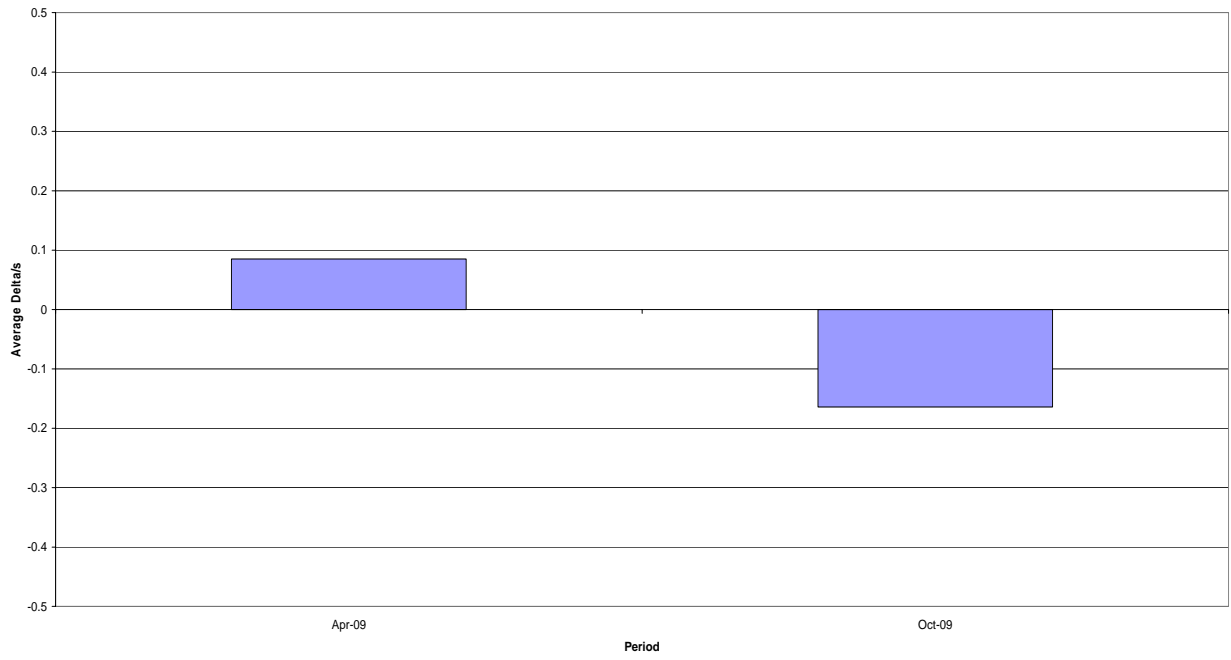


Figure 16 – Sequence IIIG/AB Timeline

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
8/8/2005	First occurrence of BC-5 rings	
11/29/2005	Revision to requirements for attendance to rater workshops	05-2
11/29/2005	Allows the use of torque wrench ETW-E180	05-2
3/29/2006	First occurrence of BC-6 rings	
04/04/2006	Added requirement to monitor fuel at lab and revised aromatic content in fuel specification	06-1
08/18/2006	Procedure changes as a result of UEB and revised Table A4 to clarify units and test methods	06-2
10/03/06	Change in connecting rod (PMNS) and updated part numbers	06-3

10/008/06	First occurrence of powdered metal non-slotted connecting rods (PMNS)	
11/06/06	Changes in rater calibration requirements	06-4
3/19/07	Added IIIGVIS procedure to test method	07-1
4/01/07	Start of new cylinder head torquing procedures	
6/05/07	Revised designation of IIIGVIS to IIIGVS	07-2
6/05/07	Changed values in Table A4 to metric	07-2
6/05/07	Revised ring gap delta values and revised stand instrumentation calibration requirements	07-2
12/13/2007	Added substitute Rocker Cover Bushing to Test Method	07-3
12/13/2007	Change name of Rater Calibration workshop	07-3
12/13/2007	Added provisions to allow test stand to be calibrated as IIIF and IIIG	07-3
12/13/2007	Revised instrumentation calibration requirements	07-3
5/20/2008	Clarified definition of downtime during oil leveling and sampling	08-1
6/08/2008	1 st occurrence of BC-7 rings	
11/06/2008	Added IIIGB test procedure to test method	08-2
11/24/2008	Added Snap on torque wrench to test method	08-3
11/24/2008	Updated source of Perfect seal number 4 gasket sealer	08-3
11/24/2008	Addressed several editorial changes	08-3
3/09/2009	Added section addressing oil filter and cooler replacement	09-1
3/09/2009	Corrected conversion error in dry bulb temperature	09-1
5/28/2009	Added requirement to repeat fuel analysis when values are found out of spec	09-2
5/28/2009	Added requirement to report the results of all tests run to completion, regardless of validity	09-2
5/28/2009	Allowed use of new oil pan gasket	09-2
7/28/2009	Added industry correction factor for Phosphorus retention	09-3
8/13/2009	Dropped requirement to send hard copy test report to the TMC	09-4