A Program of ASTM International

Test Monitoring Center

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http://astmtmc.cmu.edu
412-365-1000

Memorandum: 11-040

Date: October 17, 2011

To: Dave Glaenzer, Chairman, Sequence IIIF Surveillance Panel

From: Richard E. Grundza

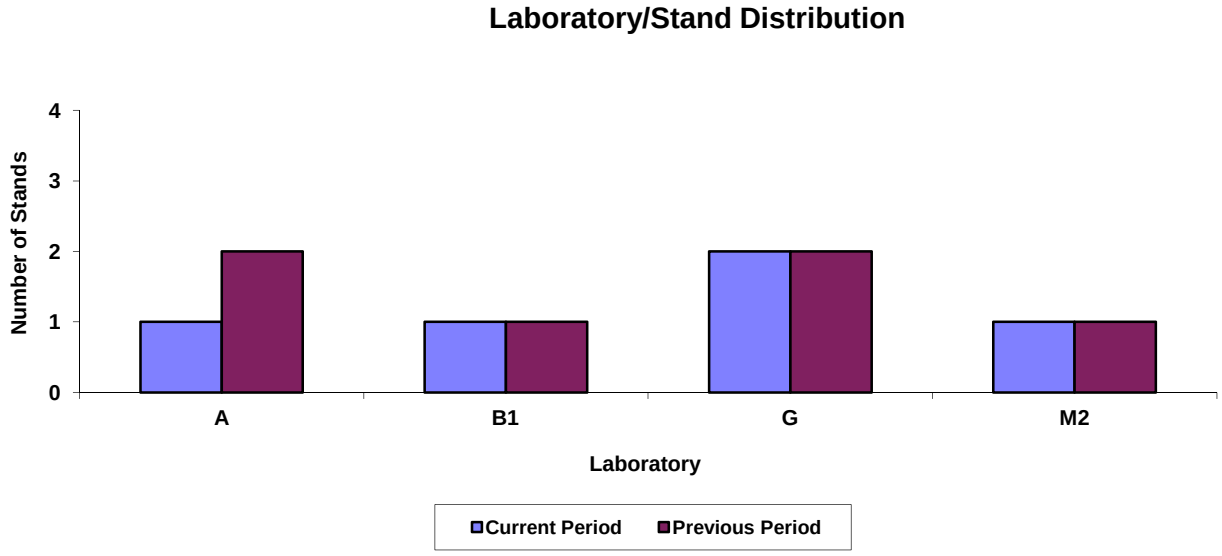
Subject: Sequence IIIF Semiannual Report: April 1, 2011 through September 30, 2011

The following is a summary of Sequence IIIF reference tests that were reported to the Test Monitoring Center during the period April 1, 2011 through September 30, 2011.

Lab/Stand Distribution

	Reporting Data	Calibrated as of September 30, 2011
Number of Laboratories:	4	4
Number of Test Stands:	6	5

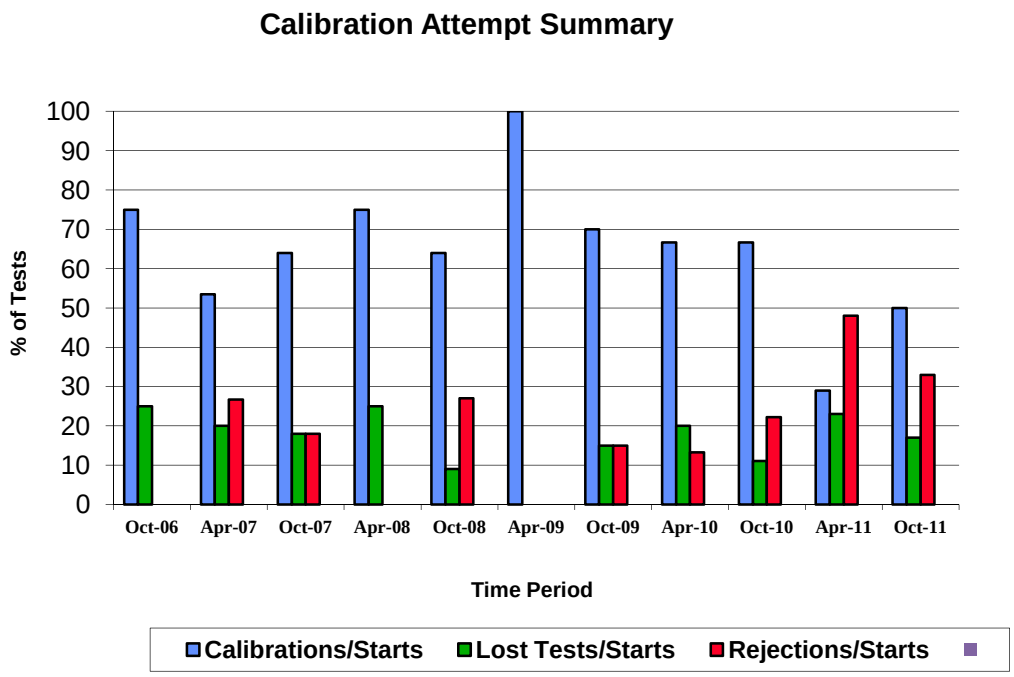
The following chart shows the laboratory/stand distribution:



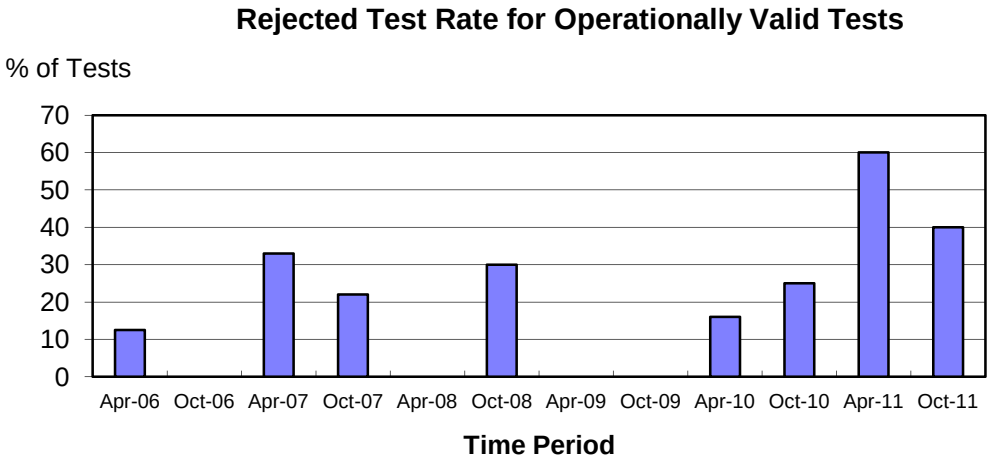
The following summarizes the status of the reference oil tests reported to the TMC:

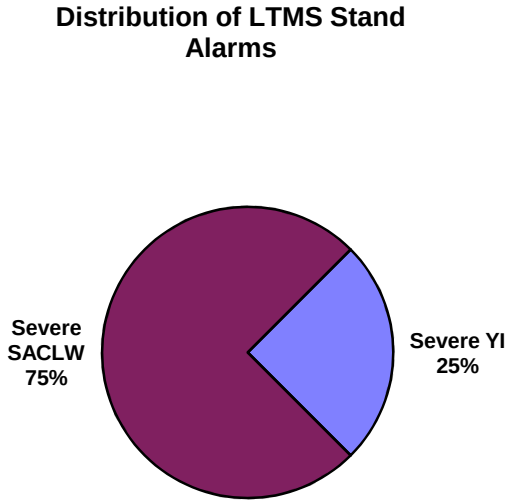
Calibration Start Outcomes	TMC Validity Codes	No. of Tests
Operationally and Statistically Acceptable	AC	6
Operationally Valid, Statistically Unacceptable	OC	4
Aborted	XC	1
Operationally Invalid, by Laboratory	LC	1
Total		12

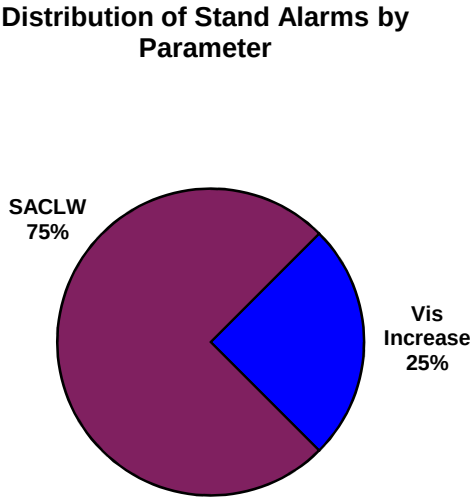
Calibrations per start, lost tests per start and rejection rates are summarized below:



The calibration per start rate has increased with respect to the previous period. The lost test per start and rejected test per start rates have decreased this period. All rates compare well with historical rates.







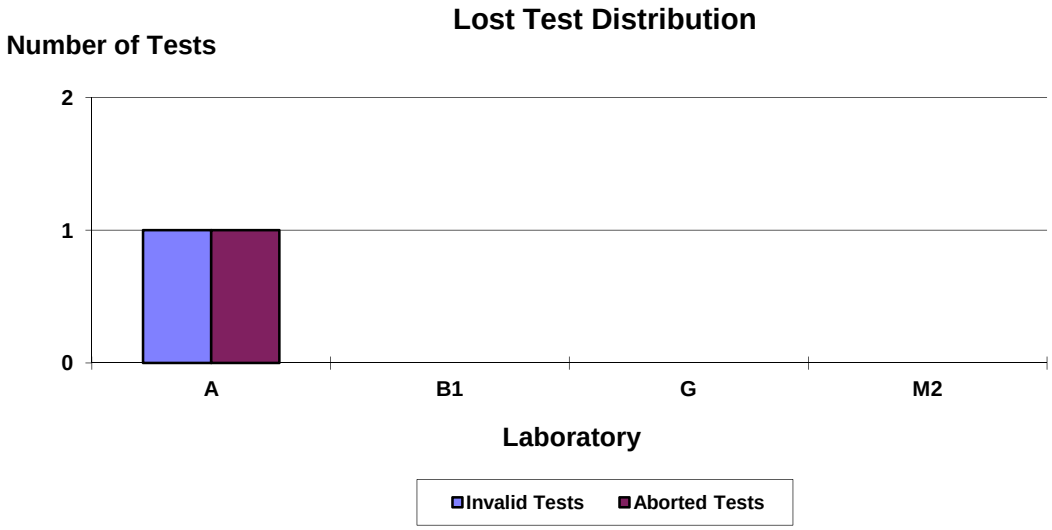
A total of four tests were found to be statistically unacceptable. Three tests failed severe for screened ACLW, while the remaining test failed for severe viscosity increase. All tests this report period were run on reference oil 433-1.

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

Lost Test Summary

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
A	High Iron, Connecting Rod Failure	1
A	Oil Addition Error	1



Information Letters

One information letter was issued this report period. This information letter added a heat exchanger to the engine oil coolant circuit and corrected the concentration of cleaning agent used in the parts cleaning apparatus. A correction to this letter, I.L. 11-1, was issued on September 30, 2011 to address a annex numbering discrepancy in the cover letter of the information letter.

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 values, 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	-0.173	0.036 (df=9)	66% Viscosity Increase[1]
APV	1.197	0.150 (df=9)	0.18 Merits
WPD	-0.115	0.560 (df=9)	-0.06 Merits
PV60[2]	0.695	0.218 (df=9)	46.8% 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	-0.041	1.408	-0.638	0.099
B1	-0.376	0	-1.047	0.281
G	-0.358	1.192	0.610	1.307
M2	0.239	1.567	0.014	1.043

Percent Viscosity Increase (PVIS)

The industry severity control charts were in control for the period. Industry performance was severe for the period, with an average Δ/s value of -0.173 (see Figures 1 & 5), which equates to a shift of 66 % severe in reported units. Precision began the period with a warning alarm, increasing to several action alarms, and is in control as the period ends. Pooled precision estimates have degraded slightly with respect to the previous period (see Figure 9). The summation delta/s chart shows a slight severe trend for the period.

Weighted Piston Deposits (WPD)

Industry control charts for severity and precision were in control this report period. Industry performance was slightly severe for the period, with an average Δ/s value of -0.115 (see Figures 2 & 6), which equates to a shift of -0.06 merits severe in reported units. Precision is similar to the previous period with a standard deviation of 0.560 (see Figure 10). The summation Δ/s chart shows the severity closer to target.

Average Piston Skirt Varnish (APV)

Industry severity has been action alarm the entire period. Industry was mild for the period with an average Δ/s value of 1.197 or 0.18 merits (see Figures 3 & 7). Precision has degraded when compared with the previous period with a pooled standard deviation of 0.15 (see Figure 11). The summation Δ/s chart shows the mild trend which started in April of 2006 continuing through the report period.

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

Two failing results for ACLW/SACLW were reported this period. Both results were obtained with reference oil 433-1, but in different laboratories and stands.

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 severity has been in alarm for almost the entire period. Precision began the period in warning alarm and continued in alarm for most of the period, but was in control at the end of the period.

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

Six results on J cams were reported this period, three results were on H cams and there was one result on an F batch cam.

Reference Oils

Oil	Original Blend, in gallons	TMC Inventory, in gallons	Quantity Used past six months	TMC Inventory, in tests	Laboratory Inventory, in tests	Estimated life
1006-2	5500	3821	93	955	8	~3+ years[1]
433-1	1045	239	52	59	11	~2+ years

[1] Multiple test area reference oil; total TMC inventory shown

With the suspension of reference oil 1006-2, the supply of 433-1 is estimated at a little more than 2 years based on current usage and current industry activity. Any changes in activity and usage will have a significant effect on the life of this oil.

REG/reg

Attachments

c: J. A. Clark, TMC
F. M. Farber, TMC
Sequence IIIF Surveillance Panel
ftp://ftp.astmtmc.cmu.edu/docs/gas/sequenceiii/semiannualreports/IIIF-10-2011.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.

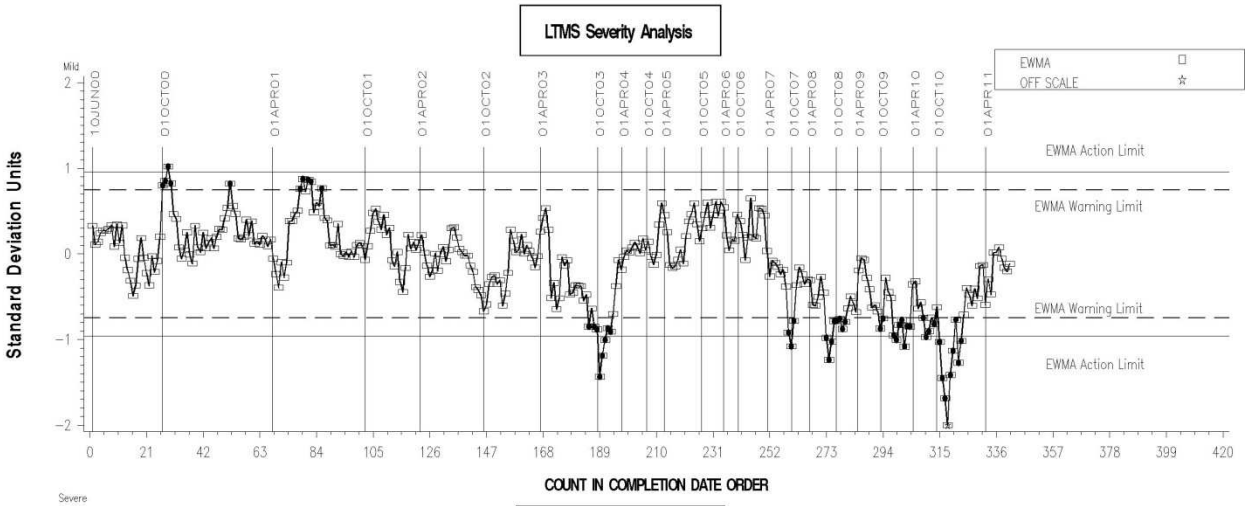
- Figures 9, 10, 11, and 12 are bar charts of pooled standard deviation, by report period, for PVIS, WPD, APV, and PV60.

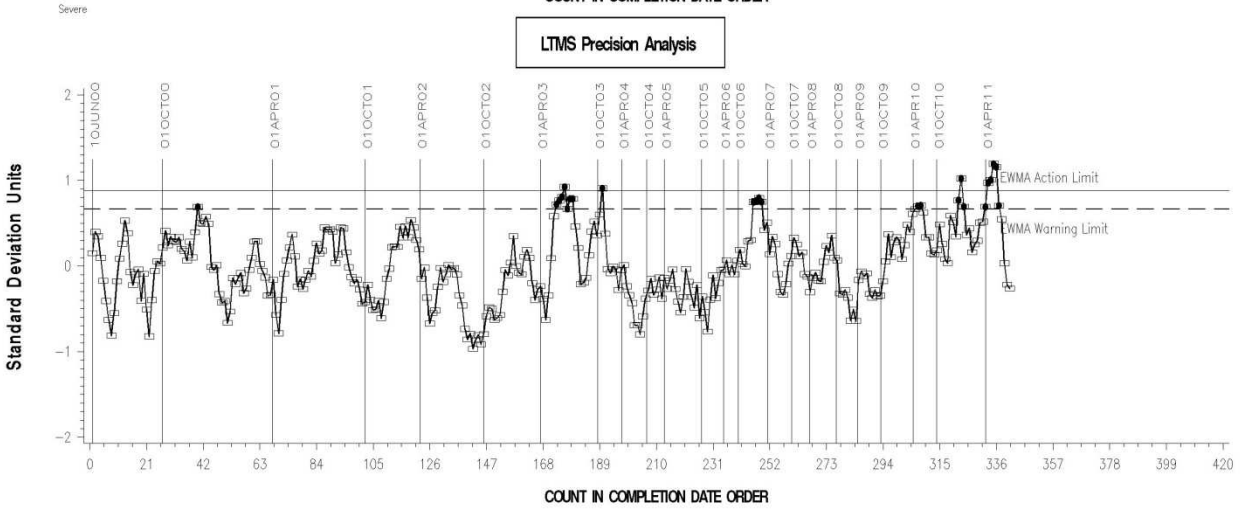
- Figure 13 is the Sequence IIIF Timeline.

Figure 1

SEQUENCE IIIF INDUSTRY OPERATIONALLY VALID DATA

% VISCOSITY INCREASE





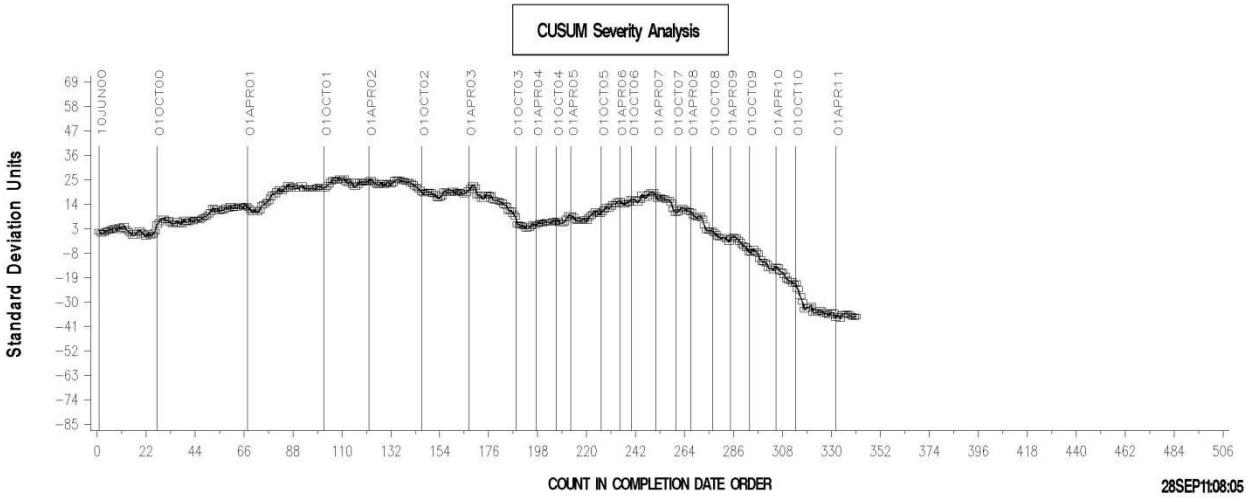


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Figure 2

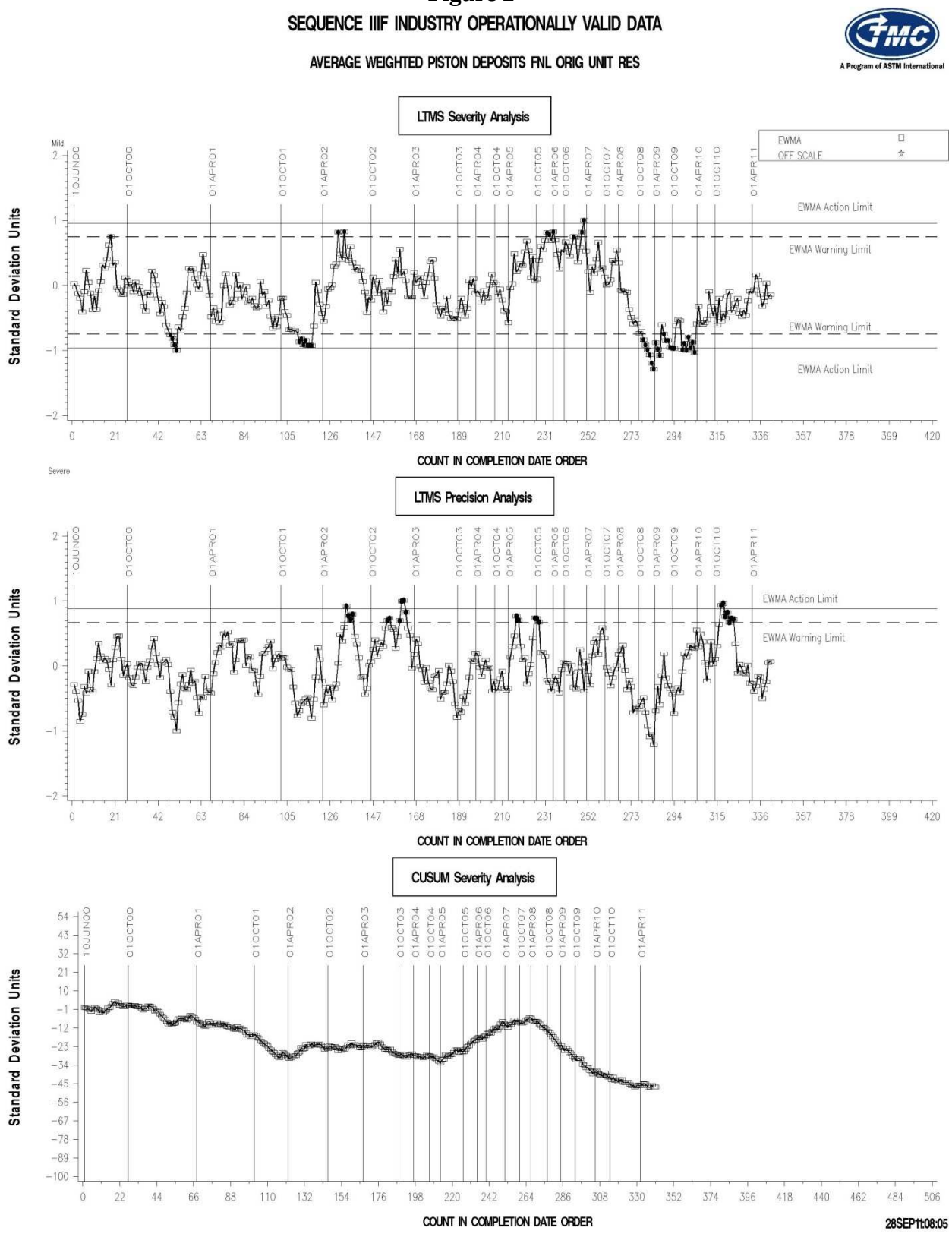
SEQUENCE IIIF INDUSTRY OPERATIONALLY VALID DATA
AVERAGE WEIGHTED PISTON DEPOSITS FNL ORIG UNIT RES
A Program of ASTM International
LTMS Severity Analysis
Mild
Severe
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
LTMS Precision Analysis
EWMA Action Limit
EWMA Warning Limit
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
CUSUM Severity Analysis
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
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Figure 3

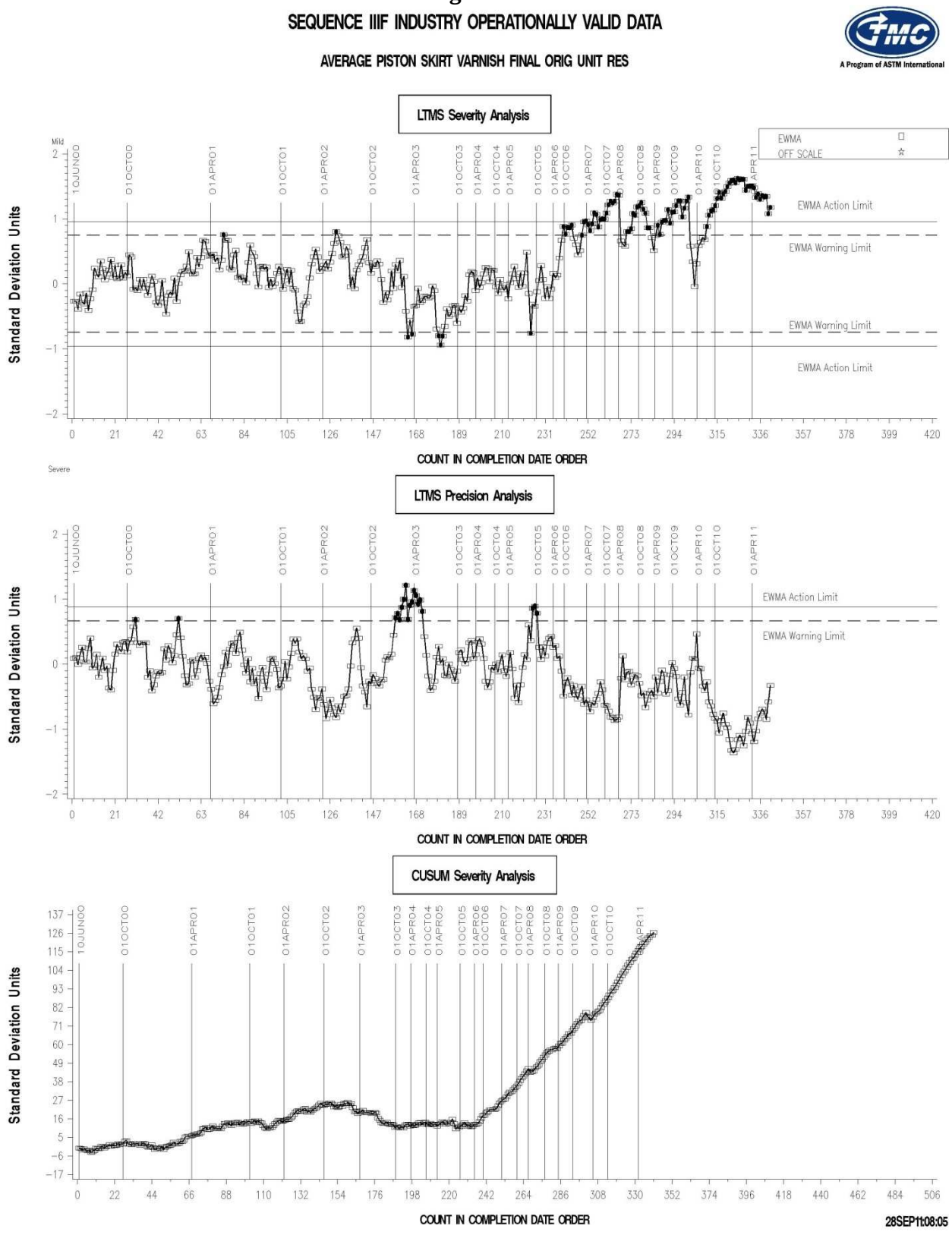
SEQUENCE IIIF INDUSTRY OPERATIONALLY VALID DATA
AVERAGE PISTON SKIRT VARNISH FINAL ORIG UNIT RES
A Program of ASTM International
LTMS Severity Analysis
Mild
Severe
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
LTMS Precision Analysis
EWMA Action Limit
EWMA Warning Limit
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
CUSUM Severity Analysis
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
28SEP11:08:05

Figure 4

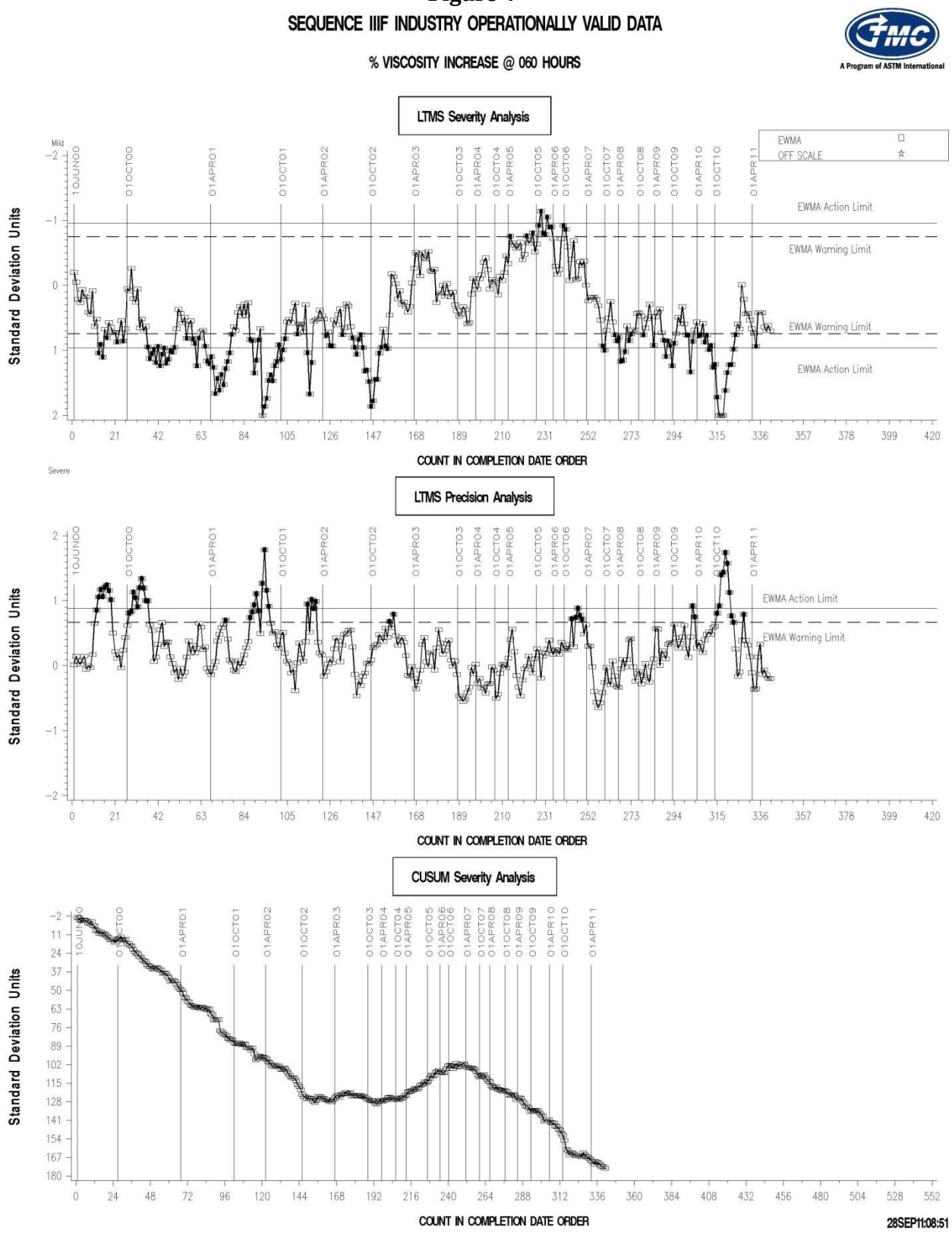
SEQUENCE IIIF INDUSTRY OPERATIONALLY VALID DATA
% VISCOSITY INCREASE @ 060 HOURS
A Program of ASTM International
LTMS Severity Analysis
Mild
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
Severe
LTMS Precision Analysis
EWMA Action Limit
EWMA Warning Limit
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
CUSUM Severity Analysis
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
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Figure 5-Percent Viscosity Increase Delta/s

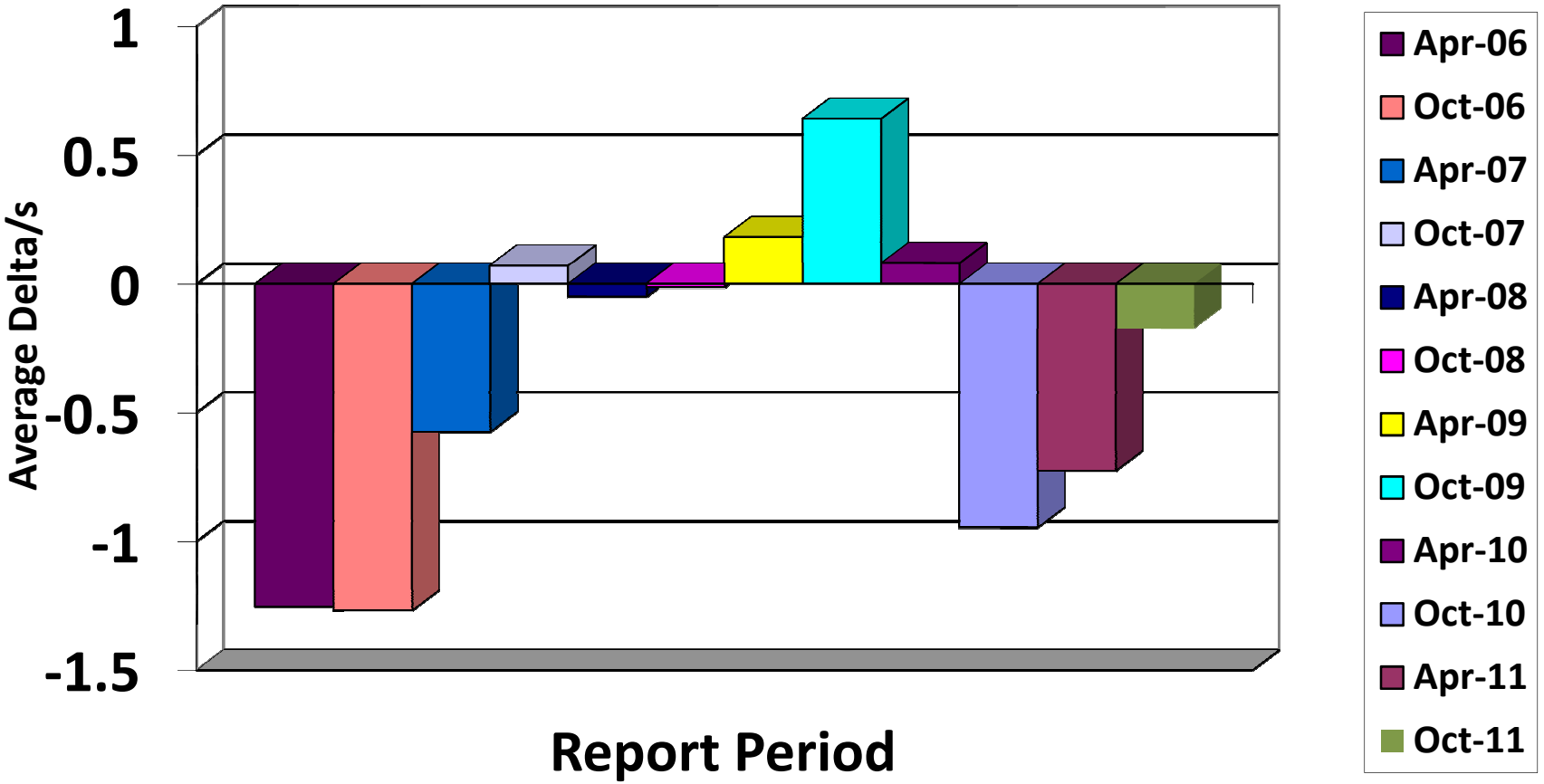

Figure 6-Weighted Piston Deposit Delta/s

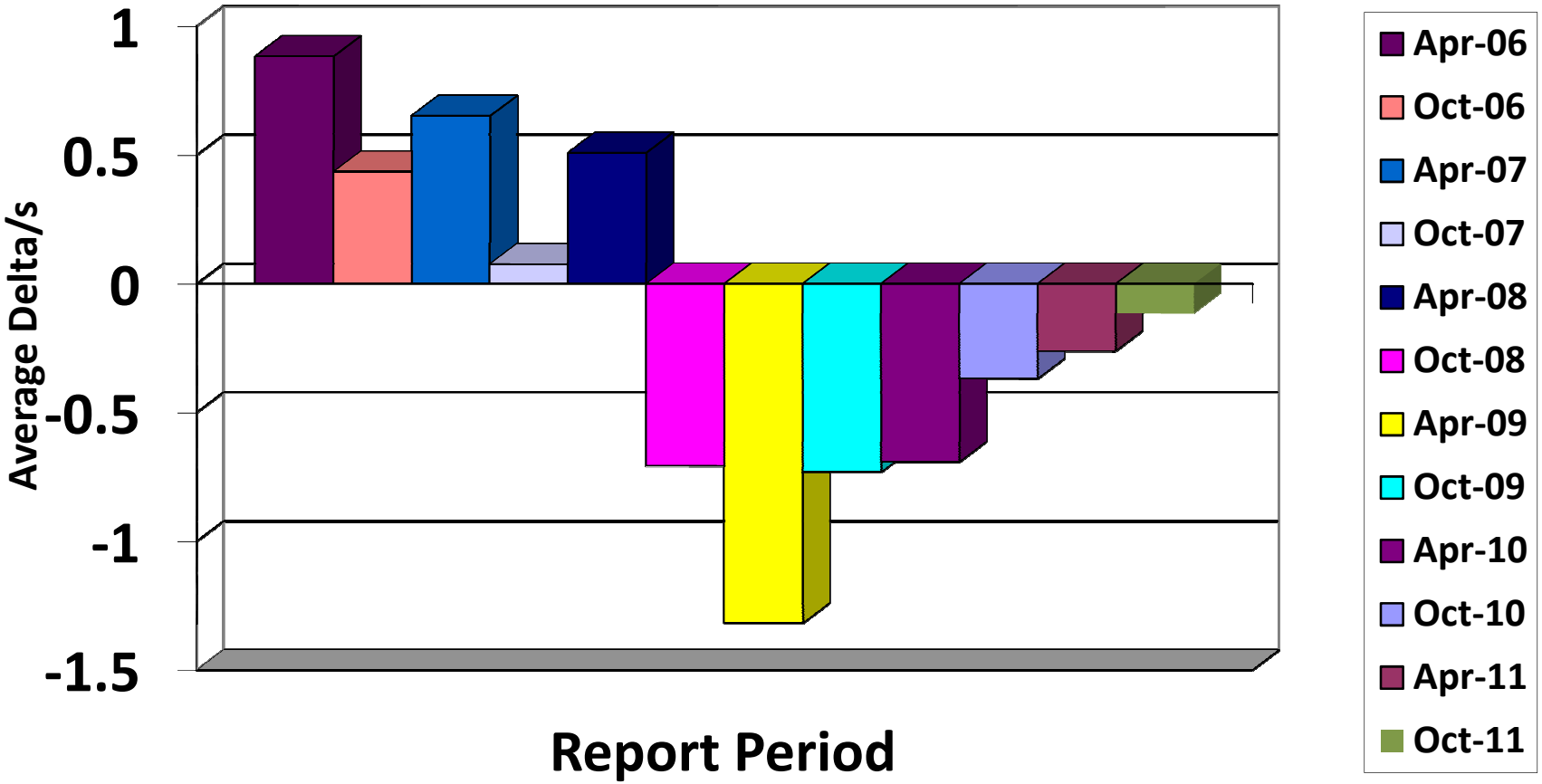

Figure 7-Average Piston Varnish Delta/s

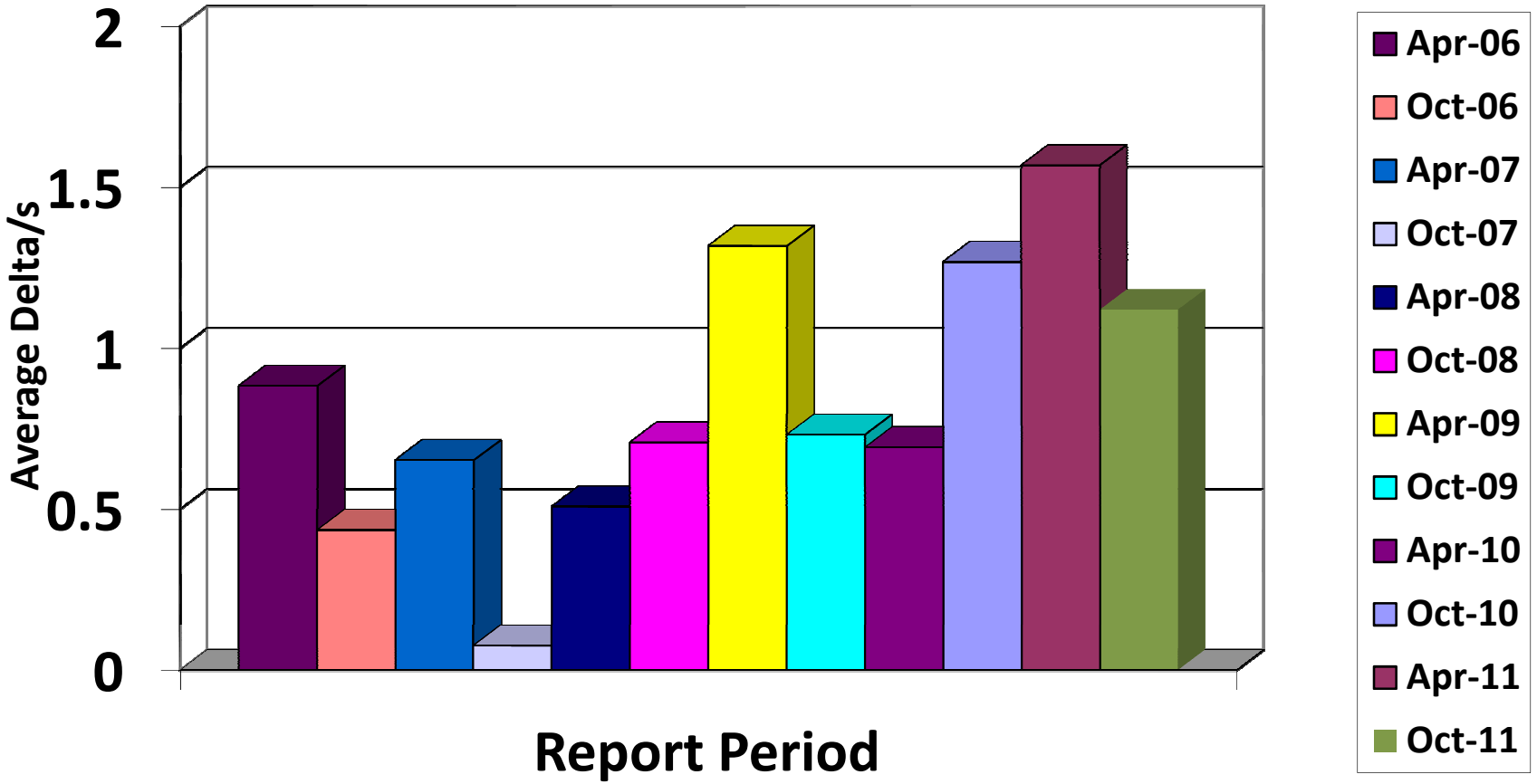

Figure 8-Percent Viscosity Increase @ 60 Hours Delta/s

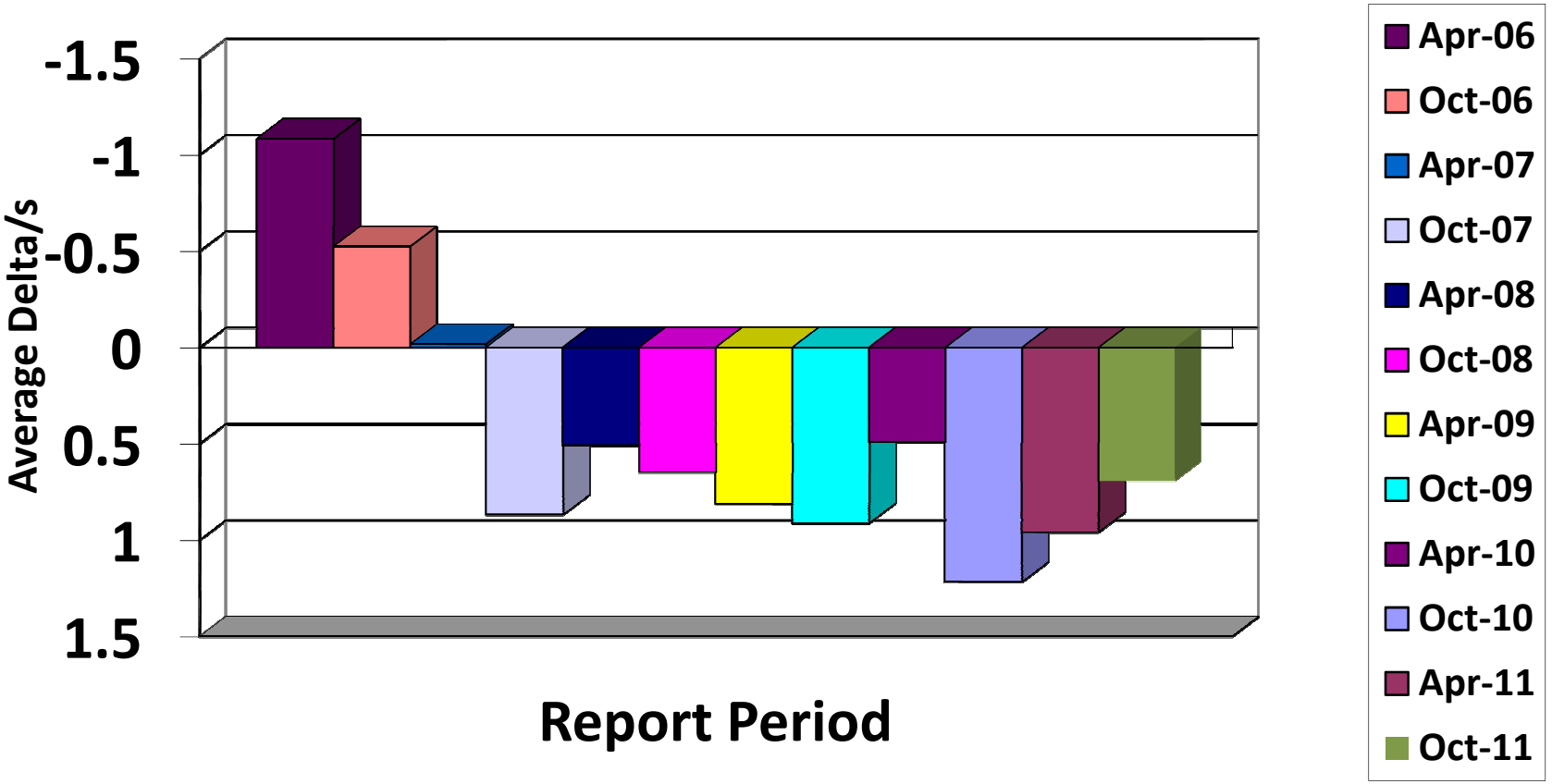

Figure 9-Percent Viscosity Pooled Standard Deviation

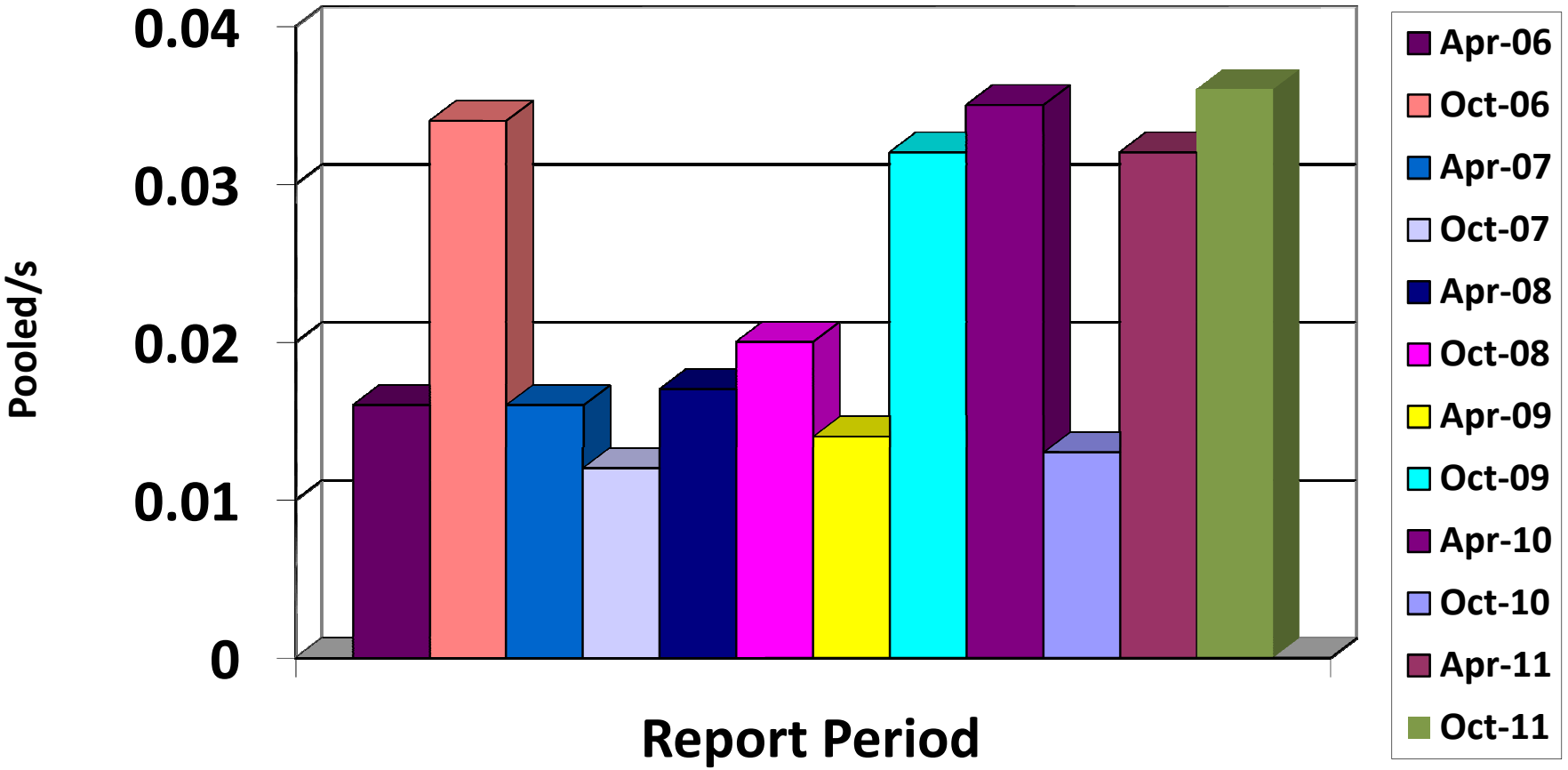

Figure 10-Weighted Piston Deposit Pooled Standard Deviation

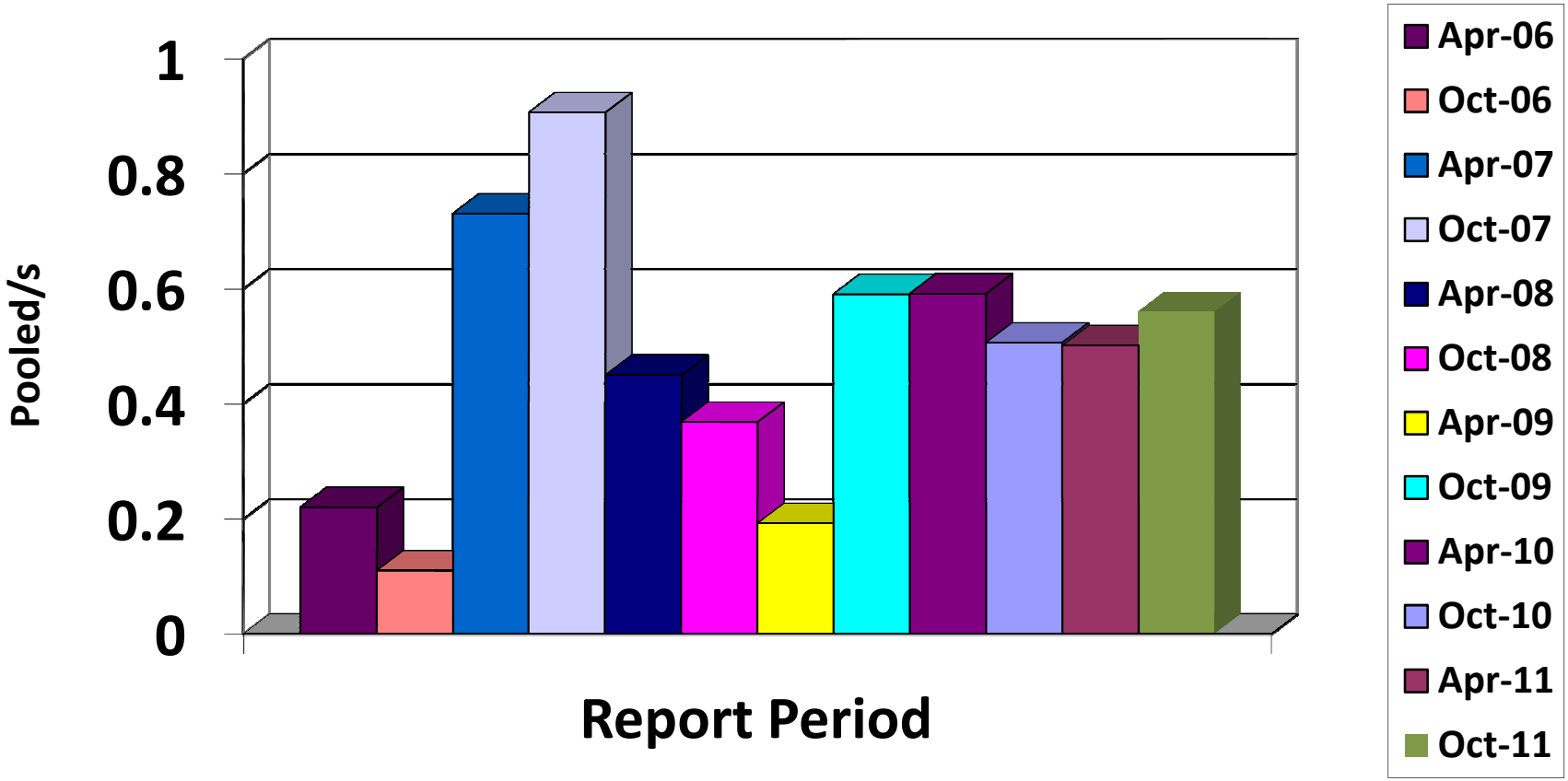

Figure 11-Average Piston Varnish Pooled Standard Deviation

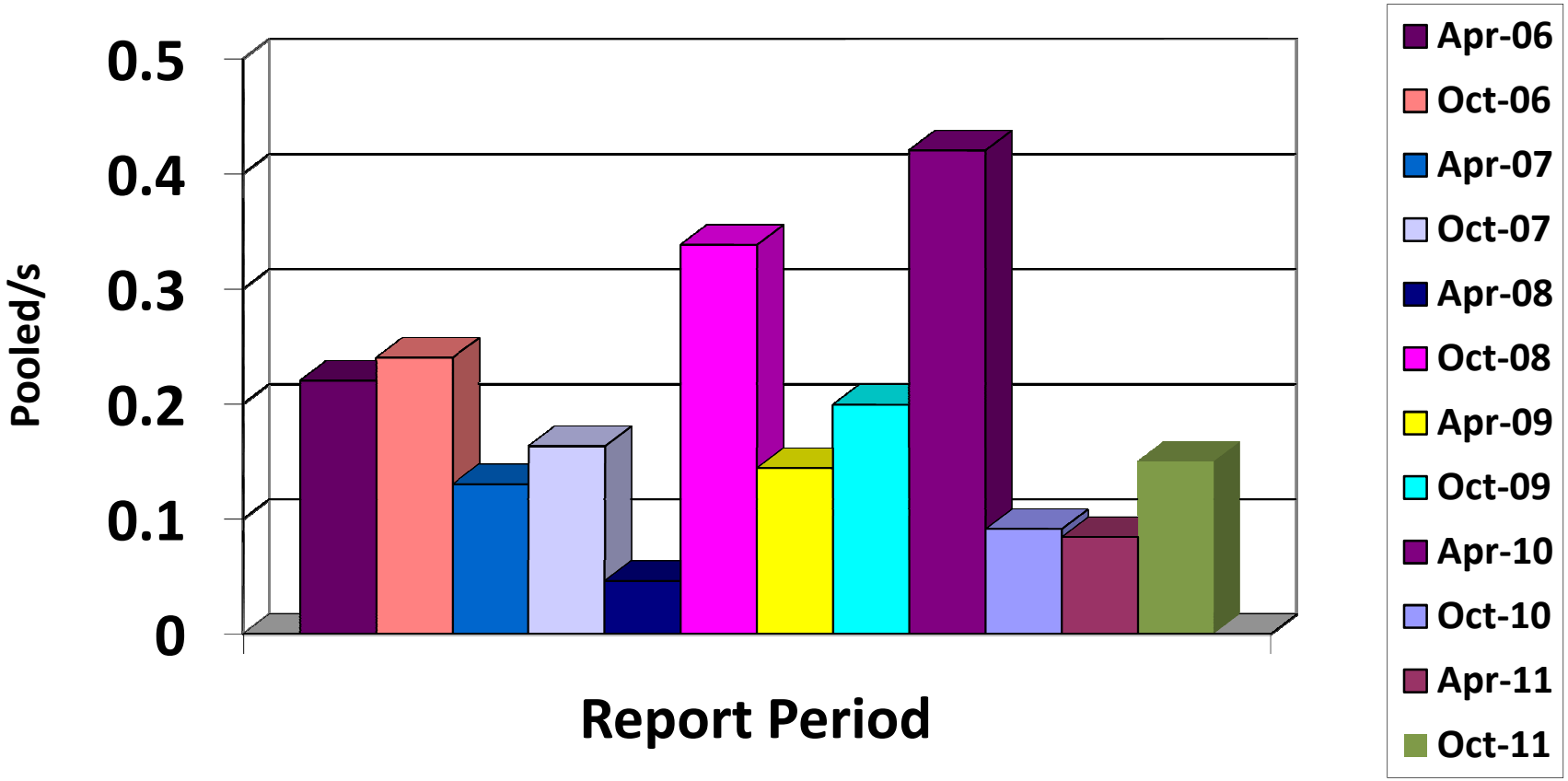

Figure 12-Percent Viscosity Increase @ 60 Hours
Pooled Standard Deviation

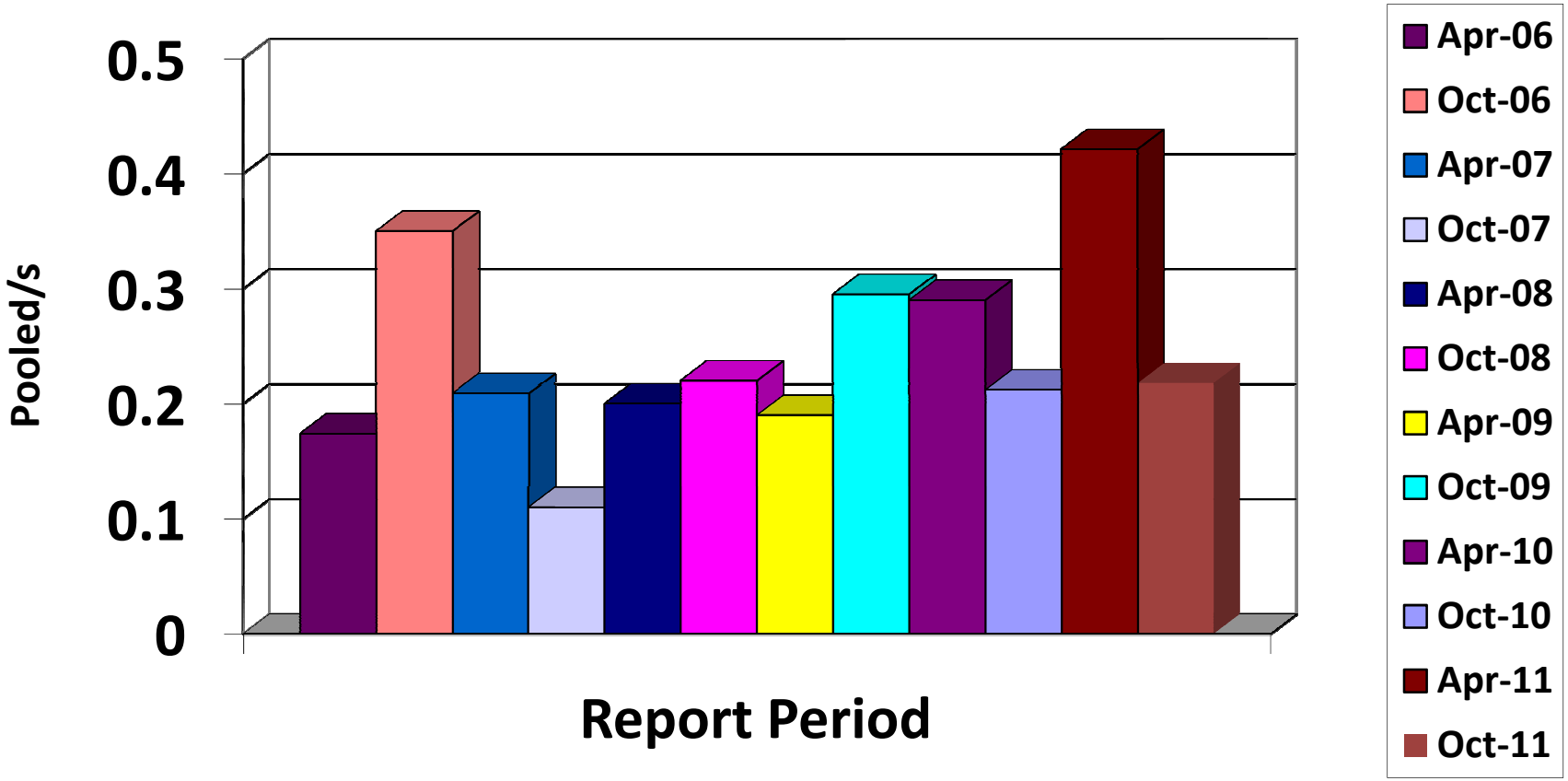

Figure 13 – Sequence IIIF Timeline

Date	Topic	Information Letter
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 do	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
12/15/2003	New Honing Procedure approved and added to Assembly Manual	
5/30/2003	New Oil Filter	03-1
6/30/2003	New 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
10/29/2003	Revised Fuel Pressure Specification	03-3
10/29/2003	Automatic Parts Washing Machine Maintenance Requirement	03-3
10/29/2003	Main Bearing Bore Mandrel Procedure made optional	03-3
10/29/2003	Piston Ring Cleaning Requirements	03-3
10/29/2003	Additional Allowable RTV Sealing Compounds	03-3
10/29/2003	Main Bearing Cap Bolt Replacement Specification	03-3
10/29/2003	Revised Camshaft Measurement Procedure	03-3
10/29/2003	Revised Camshaft Lubrication & Installation Procedure	03-3
10/29/2003	Revised Oil Consumption Reporting Procedure	03-3
10/29/2003	Fluid Conditioning Module Equipment Specifications	03-3
10/29/2003	Revised Camshaft Measurement Equipment Specifications	03-3
10/29/2003	Rating Workshop Attendance Requirement	03-3
4/13/2004	Revised Intake Manifold Gasket	04-1
4/13/2004	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	MRV Reporting	04-2
5/12/2004	Amount of Test Oil used for Camshaft & Lifter Lubrication	04-2
11/4/2004	Torque Specs for Powered Metal Rods	04-3
11/4/2004	Editorial Changes to Precision Statements	04-3
11/4/2004	New Front and Rear Main Seals	04-3
11/4/2004	New Exhaust Valves	04-3
11/4/2004	New Oil Pan Gasket	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
8/10/2005	Corrections to Table A7.1	05-2
12/16/2006	Revised Rating Workshop Attendance Requirements	05-3
12/16/2006	Acceptance of Torque Wrench ETW-E180	05-3
4/4/2006	Added requirements for fuel monitoring and revised aromatic content in fuel specification	06-1
8/18/2006	Procedural enhancements from unified engine build	06-2
8/18/2006	Revised Table A4 to clarify methods and measurement units	06-2
10/3/2006	Change to PMNS connecting rods	06-3
11/7/2006	Change in rater calibration requirements	06-4
3/19/2007	Added IIIFVIS test procedure	07-1
4/1/2007	Revised Cylinder head torqueing procedure in engine assembly manual	
6/5/2007	Changed designation of IIIFVIS procedure to IIIFVS	07-2
6/5/2007	Changed values in Table A4 to metric	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
9/1/2009	Deleted requirement to send hard copy final report to TMC	09-1
10/1/2009	BC7 Valve springs to be scrapped	
12/14/2009	Allowed use of Teflon tape and 1/16” Thermocouples	09-2
12/14/2009	Corrected reference to annex in Section 10.8.10.1	09-2
12/14/2009	Revised U & L limits for condenser coolant outlet temp QI calculations	09-2
5/21/2010	Added additional criteria for oil filter change	10-1
5/21/2010	AFR real time measurements for AFR verification	10-1
6/24/2010	Enhancements for pre and post test camshaft and lifter handling	10-2
7/19/2010	NOx measurements no longer required	10-3
8/3/2010	Revised calibration periods for multiple stand labs	10-4
3/15/2011	1st Occurrence of J cams	
8/10/11	Added heat exchanger to engine oil cooling circuit	11-1
8/10/11	Corrected error in NAT-50/PDN-50 concentration	11-1