



# Test Monitoring Center

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MEMORANDUM: 02-078  
DATE: October 2, 2002  
TO: Gordon Farnsworth, Chairman, Sequence VG Surveillance Panel  
FROM: Richard E. Grundza  
SUBJECT: Sequence VG Reference Test Status from April 1, 2002 through September 30, 2002

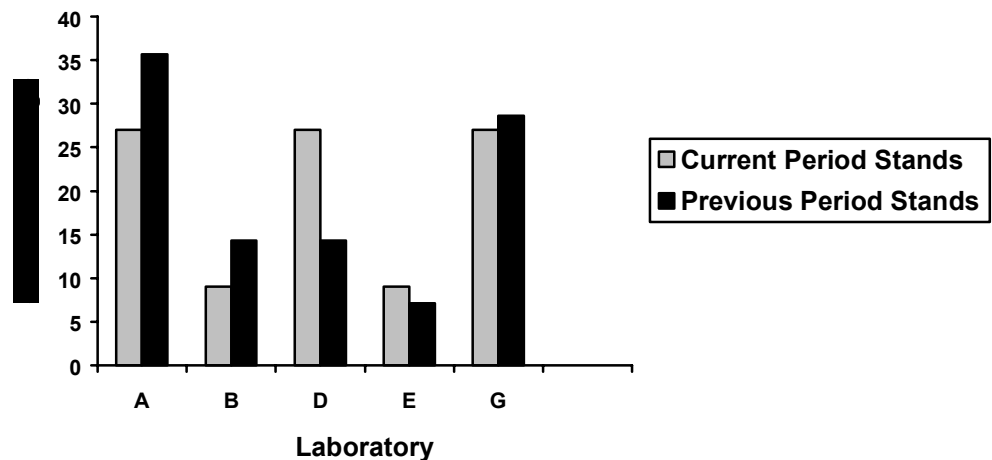
The following is a summary of Sequence VG reference tests that were completed during the period April 1, 2002 through September 30, 2002.

## Lab/Stand Distribution

	Reporting Data	Calibrated as of 9/30/02
Number of Laboratories	5	4
Number of Stands	11	7

The following chart shows the laboratory/stand distribution:

### Laboratory/Stand Distribution

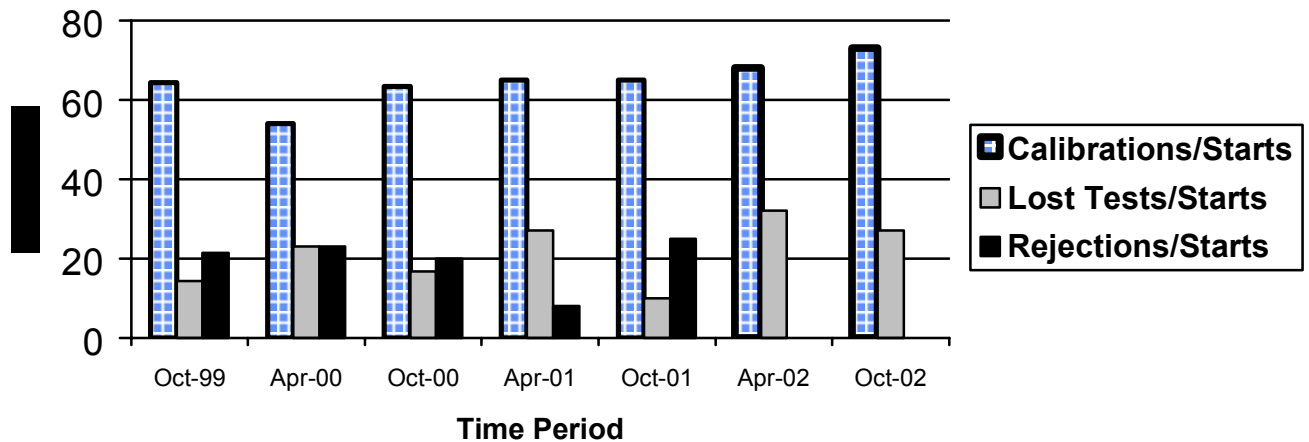


The following summarizes the status of the reference oil tests reported to the TMC:

	TMC Validity Codes	No. of Tests
Operationally and Statistically Acceptable	AC	8
Failed Acceptance Criteria	OC	0
Operationally Invalid, Lab Judgement	LC	3
Hardware Evaluation Test	AN	4
<b>Total</b>		<b>15</b>

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

### Calibration Attempt Summary



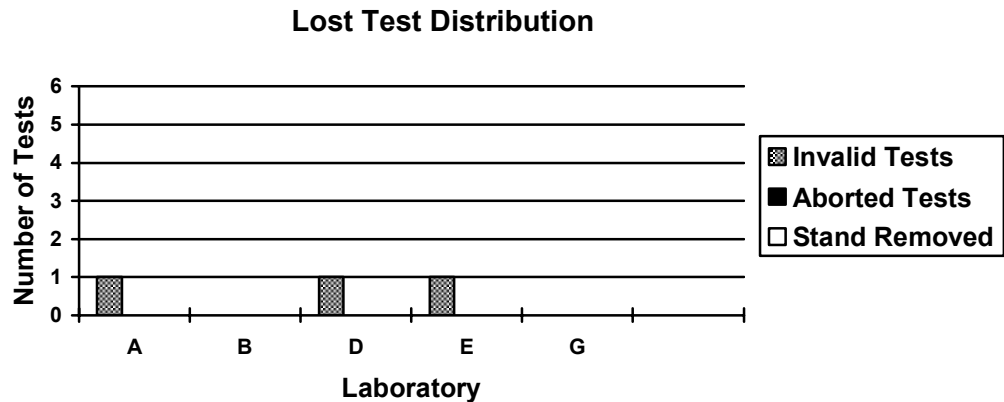
The calibration per start rate is better than the previous period and compares well with the historical rate. The lost test per start has decreased with respect to the previous period and is well within the historical rate. There were no rejected tests this period.

The following table lists the reasons for operationally invalid tests this period.

Reason	Number of Tests
Stage II AFR too rich	1
MAP QI	1
Damaged Oberg filter, exhaust backpressure and speed QI	1

There were no LTMS deviations written during this report period. A total of five LTMS deviations have been written to date. Also, a total of four tests were run for hardware evaluation purposes during this report period.

Aborted and operationally invalid tests by laboratory are summarized with the following chart:



Severity and Precision

Based on the mean delta/s values and pooled standard deviation for the current period, a 95% confidence interval representing severity for the current period is given below in reported units.

<u>Variable</u>	<u>Pooled s</u> <u>All Oils</u>	<u>Mean</u> <u>Delta/s</u>	<u>Confidence</u> <u>Interval</u>	<u>Based</u> <u>on</u>	<u>Delta in</u> <u>Reported</u> <u>Units</u>
RAC	0.130	-0.390	7.74- 8.06	8.0	-0.05
AES	0.174	0.010	7.66 – 7.95	7.8	0.00
APV	0.405	0.297	7.72 – 7.98	7.5	0.12
AEV	0.137	0.135	8.83 – 9.03	8.9	0.02
OSCR	0.915	-0.354	6.1- 31.6	20	5.8

The mean  $\Delta/s$  for this period shows RAC (-0.390) was severe and AEV (0.135), APV (0.297) and OSCR (-0.354) were mild. AES (0.010) was on or near target. Figures 1 through 5 are current industry severity and precision EWMA control charts and plots of summations  $\Delta/s$  for AES, RAC, AEV, APV, and OSCR.

Industry control charts for AES show severity and precision in control for the period. The summation  $\Delta$ 's plot shows a slight mild trend during the period.

Industry control charts for RAC show severity and precision in control for the period. The summation  $\Delta$ 's plot shows a slight severe trend for the period.

AEV severity and precision charts were in control for the period. The summation  $\Delta$ 's plots show severity trended slightly mild for the period.

APV severity and precision charts were in control the entire period. The summation  $\Delta$ 's plots show APV on or near target for the period.

With the exception of a warning alarm, OSCR precision was in control the entire period. OSCR severity was in control the entire period. The summation  $\Delta$ 's chart shows on or near target results for most of the period, the exception being a mild trend during the middle of the period. The precision warning alarm appears to be lab related.

Figures 6 and 7 chart the pooled precision estimates for all monitored parameters, by ASTM report period. Figure 6 shows AES and RAC precision improved with respect to the previous period while OSCR precision has shown a slight degradation with respect to the previous period. Precision for all three parameters compares well with historical rates. Figure 7 shows precision for both AEV and APV precision has degraded with respect to the previous period. Precision for AEV is within historical estimates, while APV precision estimates for this period are much higher than the historical estimates.

### Fuels and Reference Oils

Reference oil quantities available at the laboratories and TMC as well as estimated life of these oils, is tabulated below.

Oil	TMC Inventory, in gallons	TMC Inventory, in tests	Laboratory Inventory, in tests	Estimated life
925-3	174	58	9	3+ years
1006	0	0	9	< 1 year
1006-2	5154	1718	2	3+ years
1007	504	168	1	3+ years
1009	1015	338	6	3+ years

Note: Oils 1006, 1007 and 1009 are used across multiple test areas, TMC inventory represents total amount of that oil on hand.

Information Letters

Information Letter 02-4 was issued July 8, 2002. This information letter deleted the requirements to measure bore wear, replaced rating of Rocker Arm Covers for varnish with Cam Baffle ratings, allowed use of an alternate power supply to power the EEC module and lambda sensors and revised the frequency for calibration of the lambda sensor.

Information Memos

The following memos were issued by the TMC during this period.

<u>Memo</u>	<u>Date</u>	<u>Subject</u>
02-017	4/10/02	Sequence VG Semi Annual Report
02-66	8/09/02	Test Targets, Reference Oil 1009
VG-20020606	6/21/02	Report Packet Revision Notice 20020606
VG-20020801	8/2/02	Report Packet Revision Notice 20020801
VG-20020830	9/6/02	Report Packet Revision Notice 20020830

TMC Activities

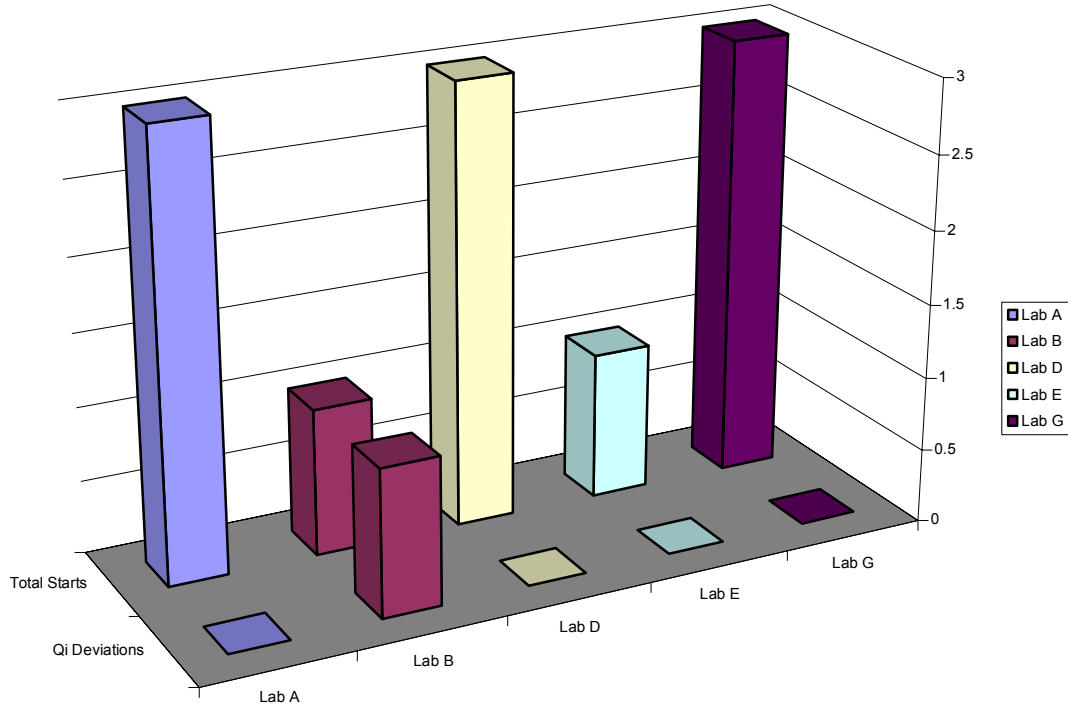
During this report period, the TMC visited four labs. Any discrepancies noted during these visits were identified to the laboratory and corrective action is being taken.

The following table compares the standard deviation used in the LTMS for severity adjustment calculation, which is a pooled estimate of precision based on oils 925-3, 1006, and 1007, with the current pooled precision of the oils 1006, 1007, 1009 and 925-3.

Parameter	Severity Adjustment Standard Deviation (n = 30)	Pooled Standard Deviation, Oils 925-3, 1006, 1007 and 1009 (n =8)
AES	0.51	0.174
RAC	0.24	0.130
AEV	0.10	0.137
APV	0.18	0.405
OSCR	0.828	0.915

QI Deviations

The following charts the number of QI deviations reviewed by the Test Monitoring Center for this report period, by laboratory.



The following tabulates the parameter(s) where QI deviations were written.

Parameter	Number of Tests
Speed	1

The speed deviation was traced to problems with dynamometer, which was corrected early in test.

Summary

Calibrations per start compares well with the previous period and historical rates, while the lost test per start rate has decreased slightly with respect to the previous period. There were no rejected tests this period. AES was on or near target, while APV, AEV and OSCR trended mild and RAC trended severe for the period. Precision for AES, AEV, RAC and OSCR compares well with previous period and historical estimates. APV precision has degraded with respect to the previous period and historical estimates.

REG/reg

Attachments

c: Sequence VG Surveillance Panel

<ftp://ftp.astmtmc.cmu.edu/docs/gas/sequencev/semiannualreports/vg-10-2002.pdf>

J. L. Zalar

F. M. Farber

Listing of Tables and Figures Included as Part of This Report to the Sequence VG Surveillance Panel

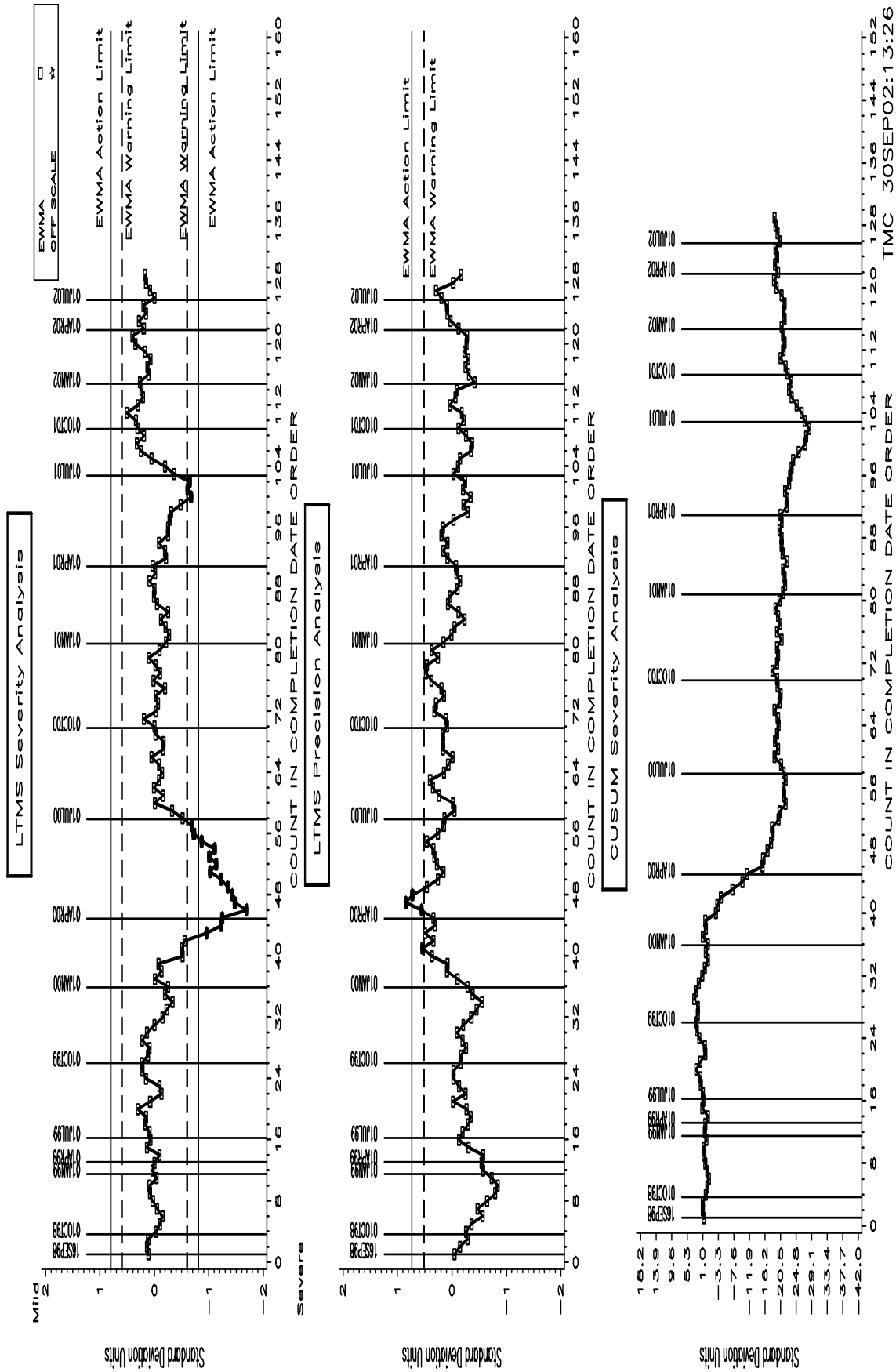
Figures 1 through 5 are the Industry control charts for AES, RAC, AEV, APV and OSCR.

Figures 6 and 7 compare pooled precision estimates from this report period with previous periods.

Figure 8 is the Industry Timeline.

VG INDUSTRY OPERATIONALLY VALID DATA  
 AVERAGE ENGINE SLUDGE

Figure 1

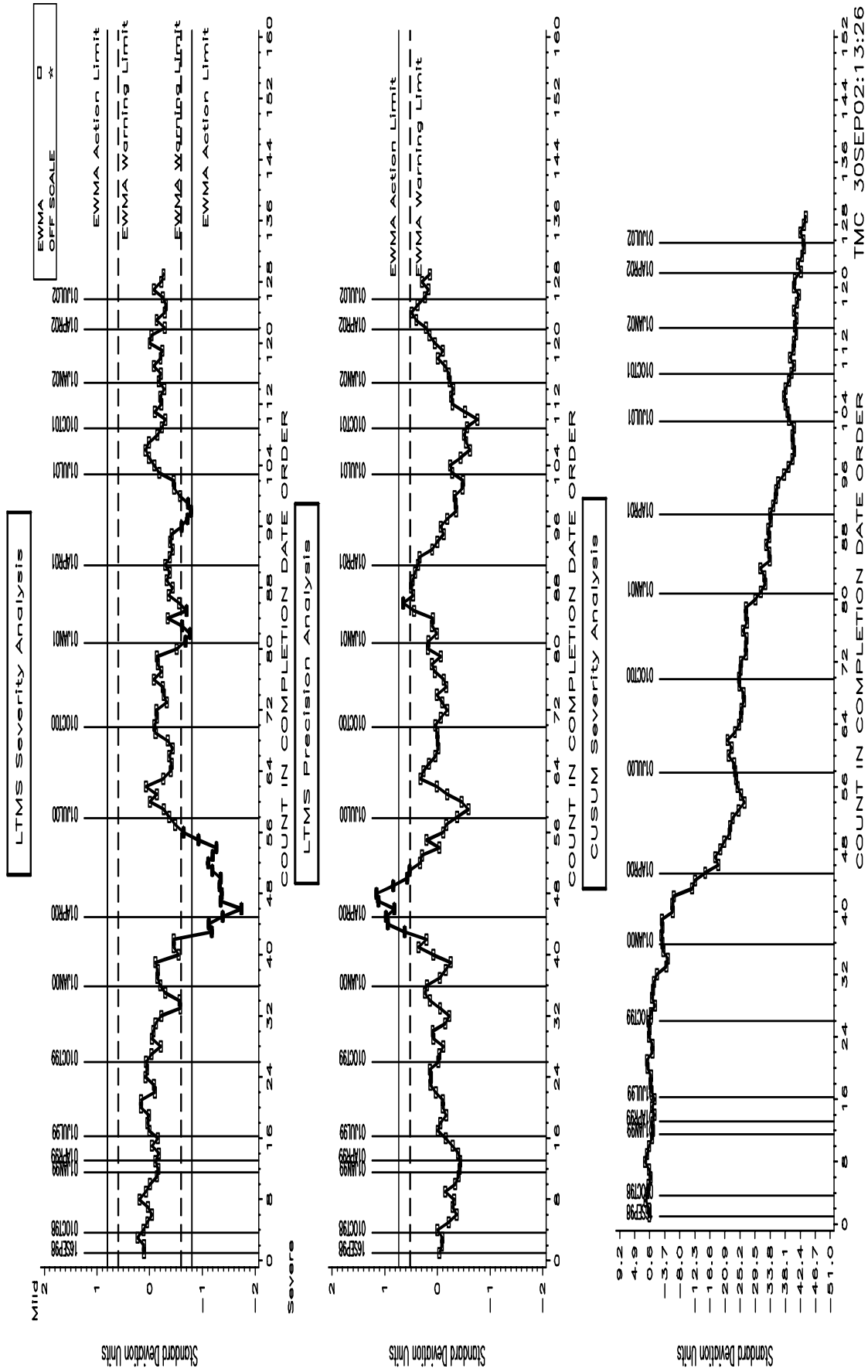




# VG INDUSTRY OPERATIONALLY VALID DATA

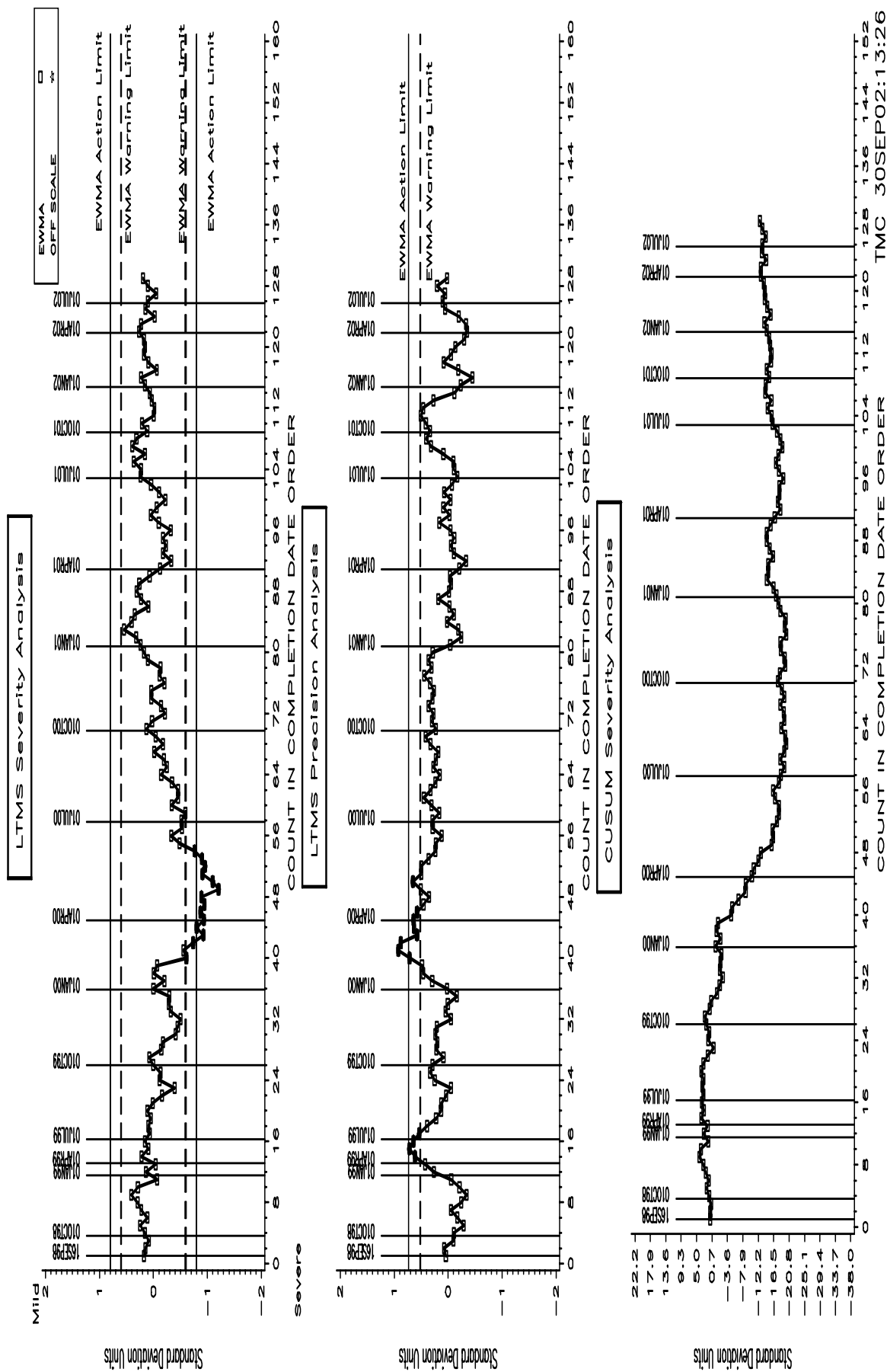
## AVERAGE ROCKER COVER SLUDGE

Figure 2



VG INDUSTRY OPERATIONALLY VALID DATA  
 AVG. ENG. VARN. 3-PART FINAL RESULT APV + BAFFLES

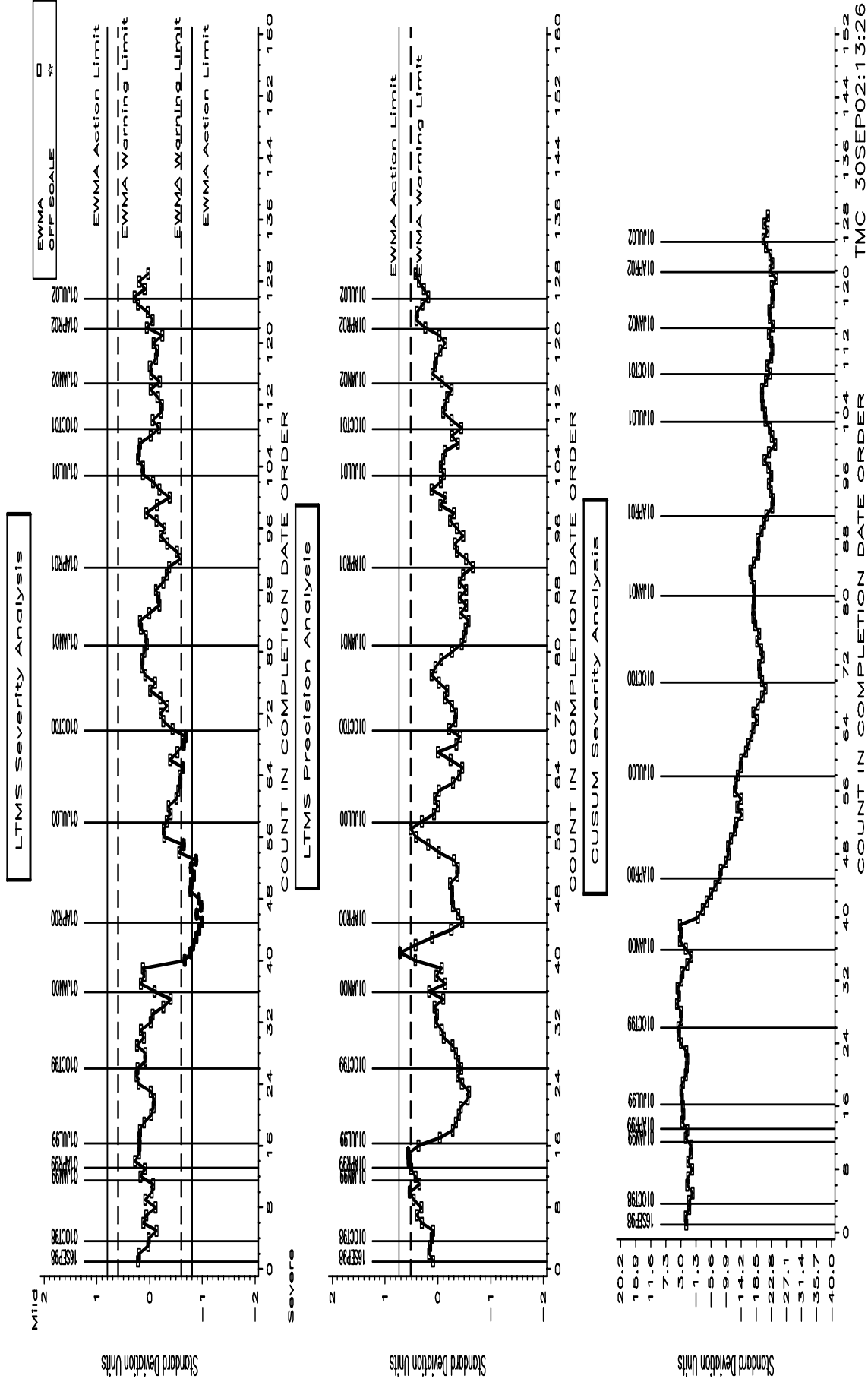
Figure 3



# VG INDUSTRY OPERATIONALLY VALID DATA

## AVG PISTON SKIRT RATING

Figure 4



# VG INDUSTRY OPERATIONALLY VALID DATA

## OIL SCREEN SLUDGE

Figure 5

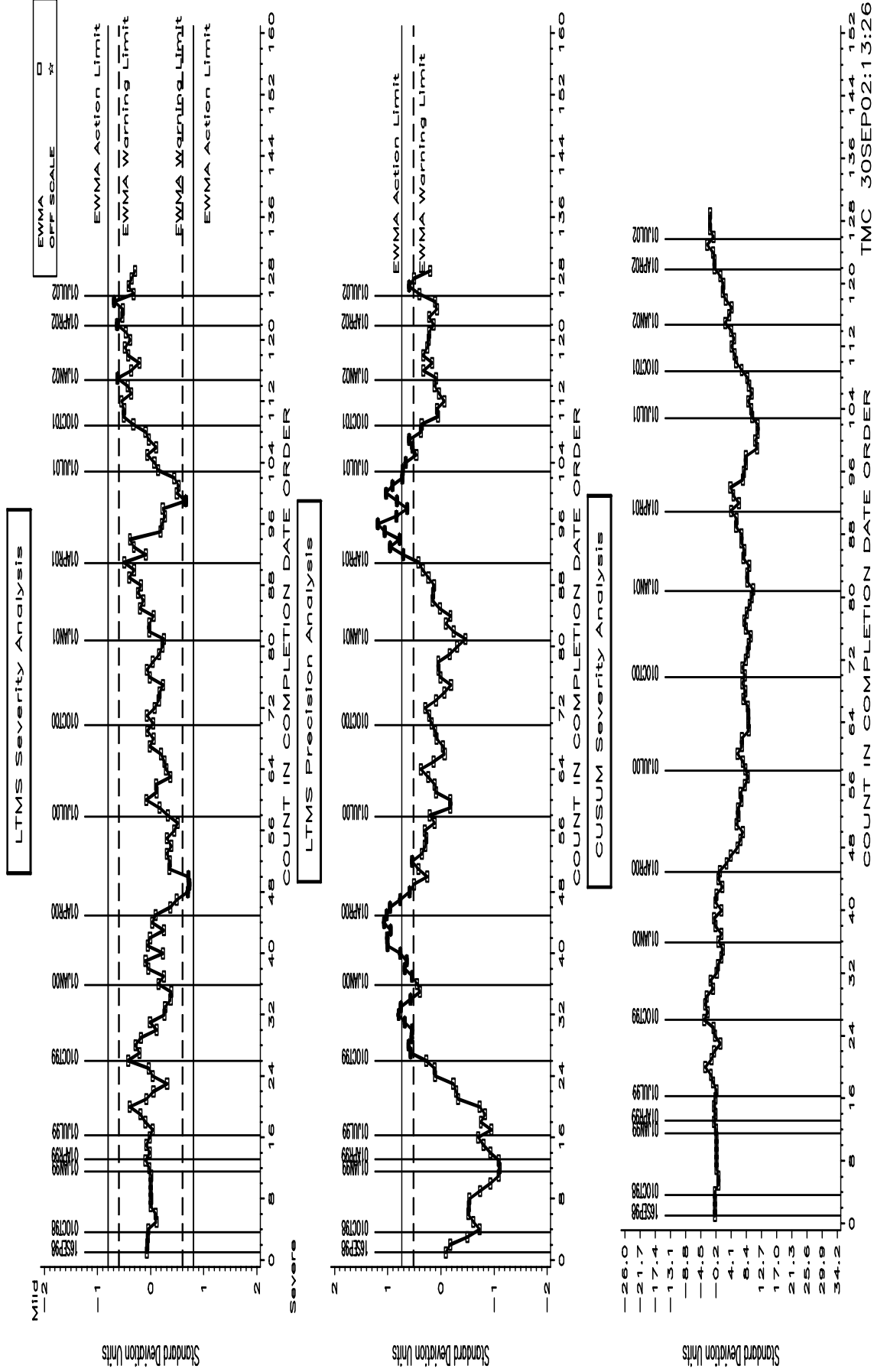


Figure 6

### Comparison of Pooled Precision Estimates By ASTM Report Period

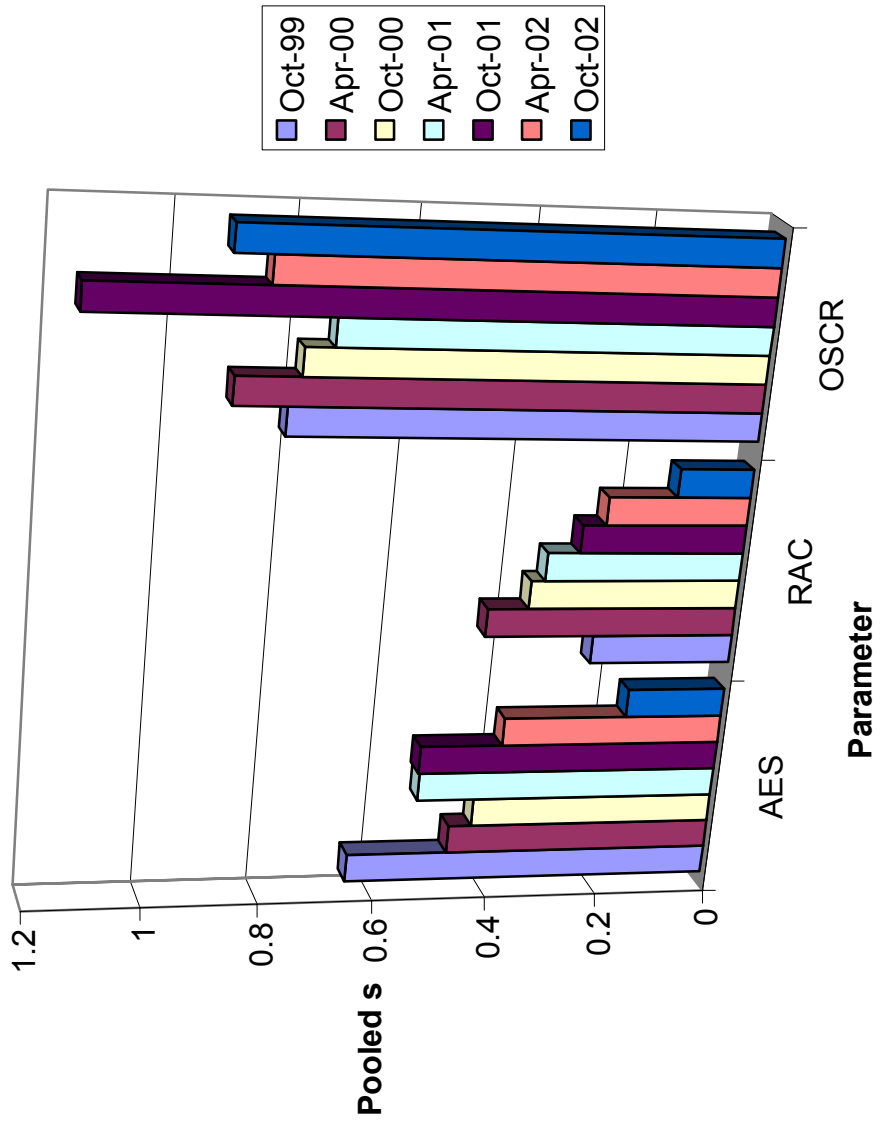
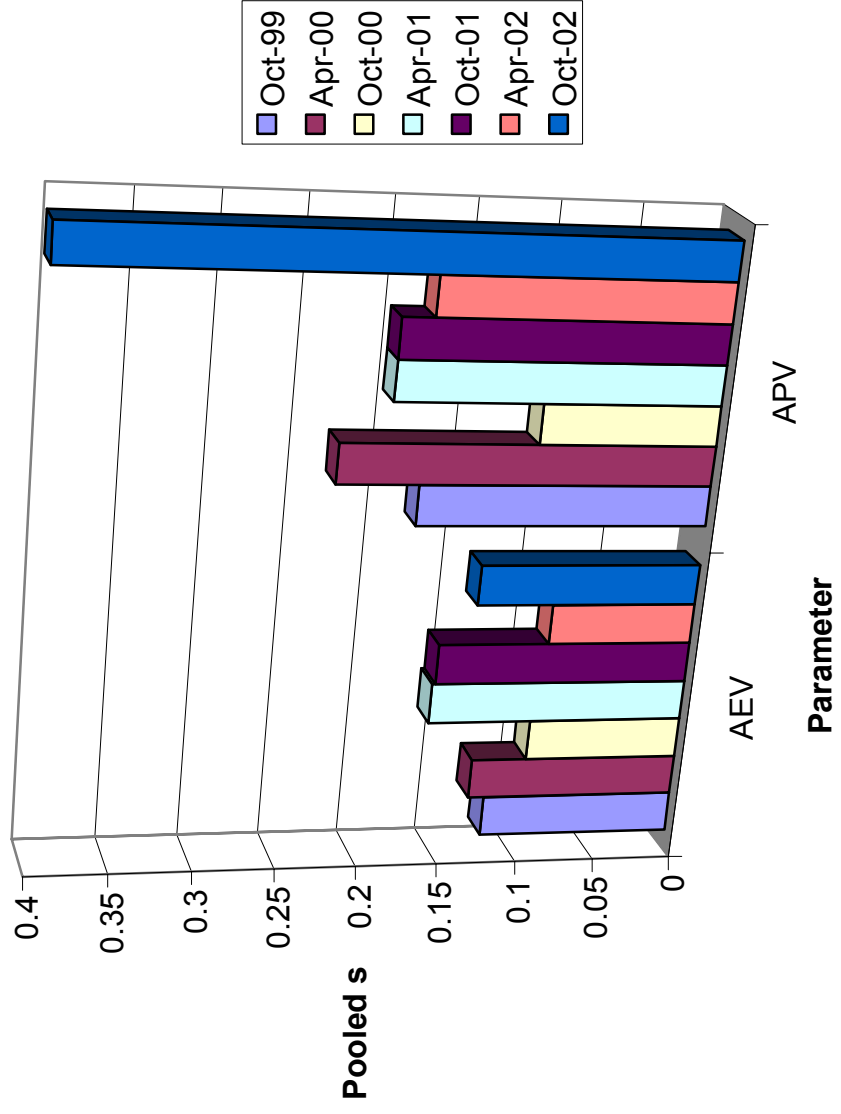


Figure 7

### Comparison of Pooled Precision Estimates By ASTM Report Period



**Figure 8**  
**Sequence VG Industry Timeline**

19980901		Matrix testing begins
19990211		Sequence VG Test approved, matrix stands charted and calibrated where applicable
19990503	99-1	Information Letter 99-1 issued, adding ring weight loss, bore wear and pin wear measurements; as well as other procedural changes
19990615	99-2	Numerous procedure updates as identified in Information Letter 99-2
19990830		In conjunction with approval of VG fuel batch 996416, new test targets were published for oils 1006 and 1007
19990830		Batch 996416 was approved for qualified testing at 8/13/99
19991025	99-3	Surveillance Panel meeting.
19991025	99-3	Revised Exhaust Backpressure limits for stages I and II to 102 and 106 kPa, respectively
19991025	99-3	Deleted rating of Underside of Block sludge and revised report forms and data dictionary accordingly
19991025	99-3	Added Section 11 to document stand referencing requirements
19991025	99-3	Added Section 16 and Annex A14, which give precision and bias statements
19991025	99-3	Updated listing of kit parts given in Sections 7.2 and 7.3 and Annex A5
19991025	99-3	Revised the type of oil filter and screen size, Sections 7.4.9 and 8.3.2.2 and A3.8 changed to reflect this
19991115		Update reference oil targets for oils 1006 and 1007 (n=10), also revised severity adjustment standard deviation
20000215	00-1	Revised Exhaust Backpressure Limits for stages I and II to 104 and 107 kPa, respectively
20000215	00-1	Deleted varnish ratings for cam baffles, oil pan, timing chain cover and rear seal housing.
20000215	00-1	Revised Form 8 to not allow value to be entered for oil added at cycle 54 and deleted form 7.
20000802	00-2	Added Oil Ring Clogging Rating, changed follower pin wear measurement from all 8 cylinders to cylinder 8 only
20000802	00-2	Changed bore wear measurements from all cylinders to cylinders 1 and 8. Changed from ring weight loss to ring gap increase on cylinders 1 & 8.
20000802	00-2	Transformation for oil screen clogging. Deleted photos for cam baffles, timing chain cover rear seal housing varnish.
20000802	00-2	Report forms and Data dictionary changes, version 20000713
20001101	00-3	Revised Section 13.4.1. Report forms and Data dictionary

20010115	01-1	changes, version 20000831 Changed analysis method for water in fuel, deleted Section 7.1.1, enhanced the measurement techniques for bore wear, oil screen clogging, pin wear and top ring gap increase, changed RAC inlet temperature ramp for stage III to I, removed ring chamfer measurements, changed calibration frequency for temperature and pressure measurement sensors. Changed dipstick calibration procedure, dropped stage I blowby measurements, dropped 0.5% O2 calibration gas, modified fuel injector flow requirements and updated Appendix X2.
20010320	01-2	This information letter was issued against Test Method D6593 to incorporate information letters not included in the initial issue of the method and to correct the precision statement in the method.
20010320	01-3	This information letter dropped the requirement to measure benzene in the fuel, defined a process for concensus rating and no longer requires analysis of used oil for TBN, vis @ 100 °C and pentane insolubles.
20011114	02-1	This information letter dropped the requirement to measure NOx, monitor Power Qi, addressed rating changes recommended by the Light Duty Rating Task Force and allow adjustments to blowby flow rates during the first 48 hours of the test.
20020301	02-2	This information letter replaced CO, CO2 and O2 measurements with Lambda measurement.
20020408	02-3	Revised references to CRC manuals 12 and 14 with CRC manual 20.
20020515	02-4	This information letter allowed use of power supply for EEC and Lambda sensor power, replaced Rocker Arm cover varnish with cam baffle varnish, revised lambda sensor calibration frequency and dropped requirement to measure bore wear.