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Committee D02 on PETROLEUM PRODUCTS AND LUBRICANTS

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Unapproved Minutes of the May 23, 2001 Sequence V Surveillance Panel Meeting held in San Antonio, Texas

1. **Call to Order**

1.1 The meeting was called to order at 8:00am by Chairman Farnsworth. The agenda (attachment 1) was reviewed.

1.2. Secretary for this meeting – The TMC volunteered to provide a permanent secretary for this meeting. The membership was instructed to provide any handouts to the TMC in electronic format.

1.3 Motion & Action Item Recorder – Ben Weber volunteered to be the motion & action item recorder

2. **Membership Changes**

2.1 Dan Worchester replaces Brent Shoffner as the PerkinElmer Automotive Research member. Ron Buck will be the member for Test Engineering, Inc. Barry Jecewski will now be the Ford Motor Company member. An attendance list from this meeting is included as attachment 2.

3. **Approval of Minutes from 5/24/00 meeting** – The minutes were approved unanimously by voice vote with no corrections.

4. **TGC Meeting Report**

4.1 Gordon Farnsworth presented some highlights from the 4/18/01 TGC Meeting (attachment 3). Several items of relevance to the Sequence VG panel were covered:

- Rater Calibration was discussed, including classification of raters, workshop attendance, etc.
- Precision estimates for API Conformance Audit was discussed. The TGC recommendation was that the standard deviation used for calculation of severity adjustments be used for AMAP testing and that these tests only be conducted during periods when the test is in control as defined by the industry and laboratory LTMS control charts.
- The TGC recommended a common statement for all test procedures covering Consensus Ratings. The proposed statement is listed in attachment 3.
- The TGC also approved a recommendation that *all* reference oil data, valid and invalid, be posted on the TMC website in an Excel file. The current CSV files will continue to be posted without changes. This item needs TMB approval before it can be implemented.
- The TGC agreed that a GF-3 Category reference oil should be pursued and introduced in all Sequence tests. Anyone wishing to provide an oil for this use should provide data to the TMC by June 1. The only current candidate for this use is reference oil 1008. Any data provided to the TMC will be coded and circulated to the TGC membership for review. One candidate will be selected.

4.2 Motion (Dwight Bowden/Bill Buscher Jr.) Include the TGC recommended Consensus Rating wording in the Sequence VG procedure. Motion passed unanimously by voice vote.

4.3 Motion (Dwight Bowden/Bill Buscher III) The O&H Panel is empowered to determine which fields in the data dictionary will be considered a priority for these new data files. No review of this action by the Surveillance Panel is necessary. Motion passed unanimously by voice vote.

4.4 TMC Action Items

1. Create a new comma-delimited header file for every comma-delimited data file. These will be given CSV extensions so that they will be readily readable by MS Excel.
2. Pending TMB approval, create a single data file containing *all* Sequence VG reference oil data. File should include *chart* field to identify tests as valid or invalid and use formats similar to the current files and the above action item. Some comments as to the reason the test was invalidated should also be included.

5. **Action Items from 11/16/00 meeting** – The action items from the last meeting were reviewed. A copy is included as attachment 4.

5.1 Motion (Dave Glaenzer/Carl Stephens) Drop the requirement to run Pentane insolubles, Total Base Number, and Viscosity at 100°C analytical tests on the used oil samples from the Sequence VG procedure. The fields will remain in the data dictionary and on the report form set. Motion passed unanimously by voice vote.

6. **TMC Report**

6.1 Rich Grundza presented the TMC Semiannual report on the Sequence VE test, a copy of which is included as attachment 5. There were 7 reference starts at 5 labs on 7 stands. The industry experienced an EWMA severity alarm on RCS. The industry also experienced a EWMA severity alarm on AES. Precision for both RCS and AES have improved since last period. AEV was within limits on severity for the period. Precision estimates for both AEV and APV improved significantly compared to last period. However, given the limited amount of data, this change may not be significant. ACW generated two severity alarms in the severe direction and also experienced a

precision alarm during the period. Both ACW and MCW have poorer precision for the period compared to historical performance. One information letter was issued this period. There are no reference oil supply issues in the Sequence VE test.

6.2 RSI Report – Rick Oliver commented that there was insufficient Sequence VE data for him to generate any usable information so no report would be presented.

6.3 The panel then moved on to discuss Sequence VE fuel supplies, test life, and monitoring and calibration status of the test. The current batch of fuel was made in 1994 and there was concern over the age of that product. The fuel is stored under nitrogen blanket at Phillips but that is not done so at the laboratories. While no independent lab is calibrated at this time, no action was taken to cease monitoring or calibration of the Sequence VE test.

6.4 TMC Report (continued) - Rich Grundza then presented the TMC Semiannual report on the Sequence VG test, a copy of which is included as attachment 6. There were 23 stands at 5 labs. As of 3/31/01 16 of those stands were calibrated. There were 30 reference starts during the period. 63% were acceptable for calibration. There was one LTMS Deviation written during the period. Eight tests were lost this period. Four for Rocker Arm Cover Temperature Control Problems, one for a dyno coil short, one for computer problems, one for excessive dyno water pressure (which damaged the dyno), and one for average blowby being outside the 23-119 hour specification limits. AES was within both the severity and precision limits for the period. RCS experienced three severity alarms as well as a precision alarm for the period. AEV was in control for both severity and precision for the period. APV was also in control for both severity and precision for the period. OSCR is currently in a precision alarm. The new "screen blower" was introduced this period and the labs have differing views on the impact of this device on test severity. One lab claims this device has driven their results mild while another claims it has driven their results severe. There were three Information Letters issued this period. The Sequence VG Test Procedure has been published as Test Method D6593, although it might not yet be available from ASTM Publications. Reference oil inventories were discussed. QI deviations were also discussed. Future TMC semiannual reports will not be mailed; email notification will be sent when it is available.

6.5 RSI Report – Rick Oliver presented the RSI Report for the Sequence VG test. RSI has a new web page: http://www.registration-systems.com Username: acc Password: rsi999 TMC will update the link to the RSI web page on TMC website with new web address. For the past six months, there were 142 operationally valid, interpretable tests, 16 terminated tests, and 5 operationally invalid, completed tests. See the RSI web page for a copy of the report. The Sequence VG test seems to be performing acceptably at this time. A copy of his presentation is included as attachment 7.

7. **Fuels Supply and Reblend Status (VE and VG)**

7.1 Dan Worchester presented the Sequence V Reference Oils and Fuels Report, a copy of which is included as attachment 8. There are approximately a 237 test supply of Phillips "J" fuel. This batch was blended in 1994 and the latest analysis of the fuel in the ChevronPhillips storage tank indicates the fuel *has not* "deteriorated." There was some discussion of the analytical test results on the Phillips "J" fuel and the consensus of the group was that the changes in the analytical results on the fuel were not considered significant.

7.2 Dan then moved on to discussing the Sequence VG test fuel. There are 665,000 gallons of fuel in storage at Haltermann Products and 60,000 gallons at the labs. That translates to approximately a 1,035 Sequence VG tests. Dan recommended a "hand blend" at 6-9 months prior to the projected outage. The current testing rate is approximately 35 tests per month. Based upon this, the "hand blend" would take place around March 2003. The discussion then moved to testing for Benzene in the Sequence VG fuel. This testing is expensive (approximately $200 per sample tested) and the value of these tests was questioned. Robert Rumford noted that there is no source for introduction of Benzene into the fuel once the blend is complete so continued testing for Benzene after the initial

blend is of questionable value. The discussion then moved on to the release of the data gathered on the fuel by the TMC. The TMC has not released this data to industry since it was considered proprietary by the supplier. Rob Rumford presented a copy of the non-proprietary data on the Sequence VG fuel; a copy of this data is listed in attachment 9. He also presented some inventory and usage numbers for this fuel, which are included as attachment 10. According to his data, there is a 29-month supply of fuel remaining in inventory.

7.3 **Motion** (Bob Rumford/Bill Buscher III) Cease performing Benzene analysis on the Sequence VG fuel samples from Haltermann and the test labs. Other checks will still be performed on a monthly basis and submitted to the TMC for analysis. Benzene analysis will only be performed on new blends of fuel. The motion passed unanimously by voice vote.

8. **Sequence VE and VG Test Developer Report**

8.1 Barry Jecewski presented the Test Developer Report, which is included as attachment 11. He discussed new VG hardware development. The Ford Romeo Engine Plant supplied 2,000 MY2000 4.6L Engines. The current plans include 2 tests per block at 0.25mm and 0.50mm oversized cylinder bores to provide consistent bore surface finishes. Labs should plan on standardizing on honing equipment. He then presented some data on the Sequence VG runs made on the development hardware to date. The differences in hardware between the 1995 AER engines and the 2000 Romeo engines were then presented. The engine block has a new part number, the PCV valve is now a low-flow valve, and the camshafts used in the new engine are the same as the 1995 version (dimensionally) but the heat treatment step has been deleted. This has resulted in less-than-desirable durability on the part so further investigation into this situation is planned. He noted that test severity has been maintained at 264 hours with the EV-152 PCV valve change. Test severity at 216 hours has been maintained with the PCV valve change and also an oil charge reduction to 2700 grams. An eight run test hardware validation matrix will be run at Southwest Research and PerkinElmer on reference oils 1006 and 925-3. The matrix is planned for completion by September 2001.

9. **VE & VG O&H Report**

9.1 Dan Worchester presented the O&H Report, a copy of which is included as attachment 12. A meeting was held on 1/18/01 in San Antonio, Texas. Fuel and AFR control trim potentiometers installed in the wiring harness was made as an action item for resolution. This item is used to adjust fuel and mass air flow. Torque specs for the jacketed rocker covers was also discussed. Dwight Bowden commented that 45 in·lb was a possible torque specification as recommended to him from his engineer. This is approximately 1/3 of the value recommended for a fastener threaded into steel.

10. Light Duty Rating Task Force – No activity has taken place and no report was given.

11. Scope & Objectives

11.1 The Scope & Objectives (attachment 13) were reviewed. Objectives 1 and 2 are considered completed. A new objective, introduction of a GF-3 Category reference oil, was added with a November 2001 completion date. Objective 5 was revised to have a November 2001 completion date.

12. Old Business – none.

13. New Business – none.

14. Next Meeting

14.1 The next meeting will be held on 11/14/01 at the Embassy Suites Hotel in San Antonio, Texas. Any meeting prior to this date will be at the call of the chairman.

15. Motions and Action Items

15.1 A listing of motions and action items approved during this meeting is included as attachment 14.

The meeting was adjourned at 10:43am.

Attachment	1
Page	1 of 2
Reference	May 01

Agenda

Sequence VG/VE Surveillance Panel
May 23, 2001
8:00AM – Noon
San Antonio, Texas

1. Secretary for this meeting	
2. Motion and Action recorders	
3. Approval of minutes for May 24, 2000 meeting	
4. Membership changes	
5. Review action Items from last meeting	G. Farnsworth
6. TMC Reference Oil Report (VE and VG)	R. Grundza
7. RSI Candidate Status & Precision Report (VE and VG)	C. R. Oliver
8. Fuels supply and reblend status (VE and VG) - Status of mini batch reblend	Worcester/Rumford
9. VE and VG Test Developer Report - Status of 2000 model hardware	B. Jecewski
10. VE and VG O&H Report	D. Worcester
11. Technical Guidance Committee Highlights	G. Farnsworth
12. Light Duty Rating Task Force	Z. Bishop
13. Scope and Objectives	All

Attachment	1
Page	2 of 2
Reference	May 01

14. Old Business

15. New Business

16. Adjourn

SEQUENCE VE SURVEILANCE PANEL
Member List

Attachment 2
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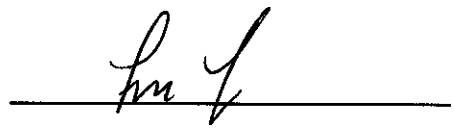

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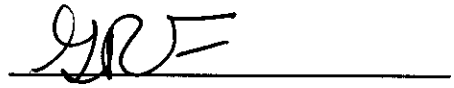

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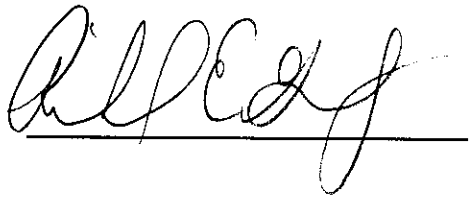

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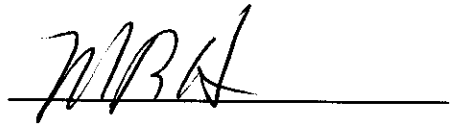

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SEQUENCE VE SURVEILANCE PANEL
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Technical Guidance Committee
April 18, 2001 meeting Highlights

Attachment 3
Page 1 of 1
Reference May 01

Rater Calibration:

A rater calibration procedure was agreed and details of the procedure are available from Zack Bishop.

- Raters classified by skill level (Category I or II)
- Attend at least one rating workshop per year (make-up sessions allowed in rare instances where attendance not possible)
- Maintain records of internal training classification

Precision for API Conformance Audit calculations:

The TGC recommendation is that "The LTMS Severity Adjustment standard deviation for the specific test type be used and that AMAP testing should only be scheduled during periods when the specific test is in control, as defined by the industry and laboratory LTMS precision charts".

Consensus ratings:

There was agreement that all test procedures should have consistent statements regarding consensus ratings. The statement agreed is "If multiple ratings are deemed necessary of a given part or parts, consensus rating may be used according to the following: The raters shall be from the same laboratory in question or an outside rater if required (no category 1 rater available in the lab). No averaging of ratings is permitted. Only one rating value is to be reported and is to be agreed to by the original rater involved. Any consensus rating shall be documented in the comment section of the test report.".

TMC Web Site:

The TGC approved a recommendation that all reference oil test data, valid or invalid, be posted on the TMC web site. The TMC will post this information as an Excel file.

GF-3 Category reference Oil:

The TGC agreed that a GF-3 reference oil should be pursued and introduced in all GF-3 sequence tests. Anyone wishing to provide an oil to the TMC should supply supporting test data to the TMC by June 1. The only current candidate is TMC 1008. The data for all reference candidates received will be blind coded and circulated to the TGC membership for review. One candidate will be selected.

Attachment	4
Page	1 of 2
Reference	May 01

Action Items
From Meeting on November 16, 2000

1.) Reaffirmed that the API SJ limits of the Sequence VG are the same as the SL limits. (Done)

2.) Consensus of the panel: Adopt the recommended reference oil 1007and 1006 LTMS targets and standard deviations as presented by Richard Grundza. Effective for all tests that complete on or after 11/17/00. (Done)

3.) If the ASTM Subcommittee B drops Sequence VG parameter(s) for D4485 GF-3/SL (as redundant), the LTMS control chart actions will be suspended for reference oil tests that complete on or after the D4485 effective date for the VG parameters. (Still pending)

4.) The TMC will calculate the VG statistics for reference oils 1006 and 1007 using a data set without the tests from the "severe stands" (previously identified by the TMC). (Done)

5.) Hand blend the Sequence VG fuel about 9 months prior to the projected Sequence VG fuel batch depletion. (Pending update of current fuel depletion)

6.) Establish the number of Sequence VG tests and the reference oils required to validate the hand blend. (Dan ??)

7.) Follow up with ChevronPhillips regarding the following analytical trends on the "J" fuel in the main storage tank:
Gums
Final Boiling Point
Induction Minutes to Break
(Dan ??)

8.) Strongly suggest a Sequence V Operations and Hardware Sequence V Subpanel Meeting this year to discuss the introduction of the new hardware and associated procedural changes. (Done)

9.) Consider a Builder's Workshop if honing and other build changes are involved in the new part release. (O&H item – Dan)

10.) The TMC should not assign reference oil 925-3 for new stands. (Done)

11.) Consider the elimination of the following analytical measurements from the Sequence VG procedure if no one has studied the data:
Pentane Insolubles
Total Base Number (TBN)
Viscosity at 100C
(Can we take action at this meeting?)

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

Attachment	5
Page	1 of 23
Reference	May 01

Memo: 01-028

Date: April 10, 2001

TO: Gordon Farnsworth, Chairman, Sequence VE Surveillance Panel

FROM: Richard E. Grundza

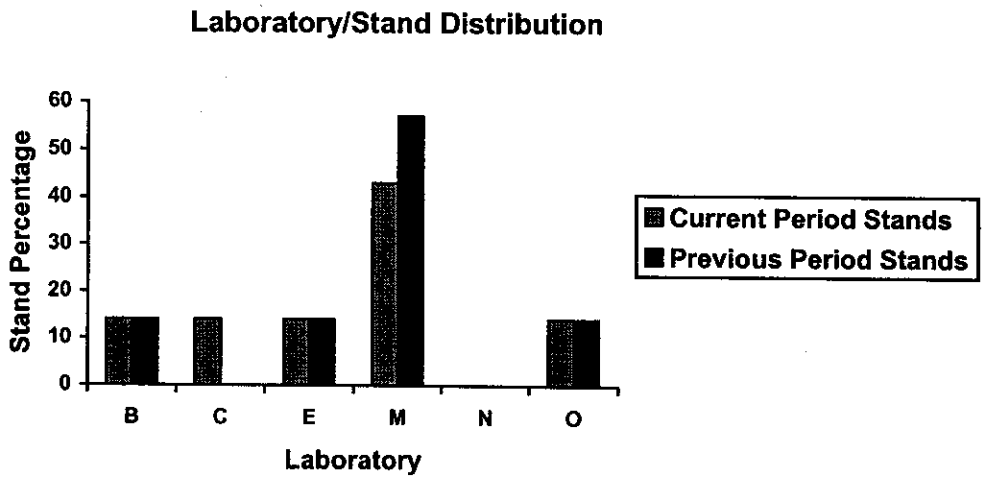
SUBJECT: Sequence VE Reference Test Status from October 1, 2000 through March 31, 2001

The following is a summary of Sequence VE reference tests that were completed during the period October 1, 2000 through March 31, 2001.

Lab/Stand Distribution

	Reporting Data	Calibrated as of 3/31/01
Number of Laboratories	5	3
Number of Stands	7	3

The following chart shows the laboratory/stand distribution:



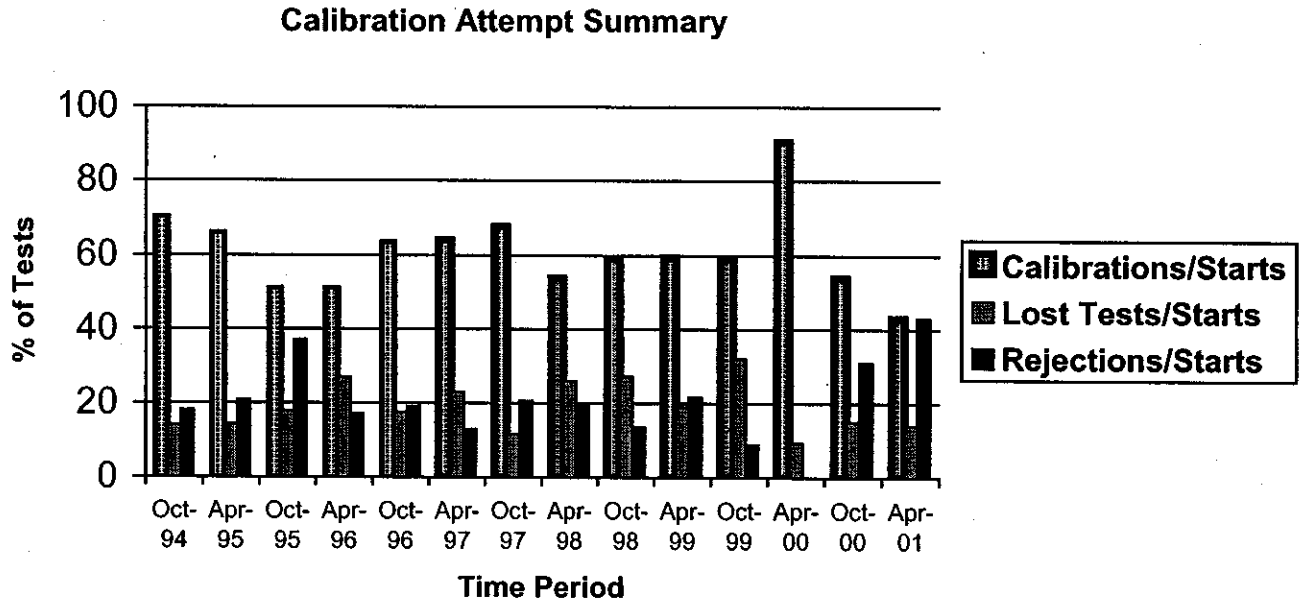
Attachment 5
Page 2 of 23
Reference May 01

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	3
Operationally Valid, Statistically Unacceptable	OC	3
Operationally Valid, Stand Removed from System	MC	1
Total		7

Two of the tests were statistically unacceptable for severe sludge and ACW. The third statistically unacceptable test was due to mild AEV.

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



The calibration per start rate has decreased and is much lower than the historical rate. The lost test per start is comparable to the previous period and historical rates. Rejected test per start rate has increased with respect to the previous report period. The lost test per start rate compares favorably with the historical lost test rate, while the rejected test per start is much higher than the historical rate. Only three of the seven starts this period resulted in successful stand calibration.

Attachment 5
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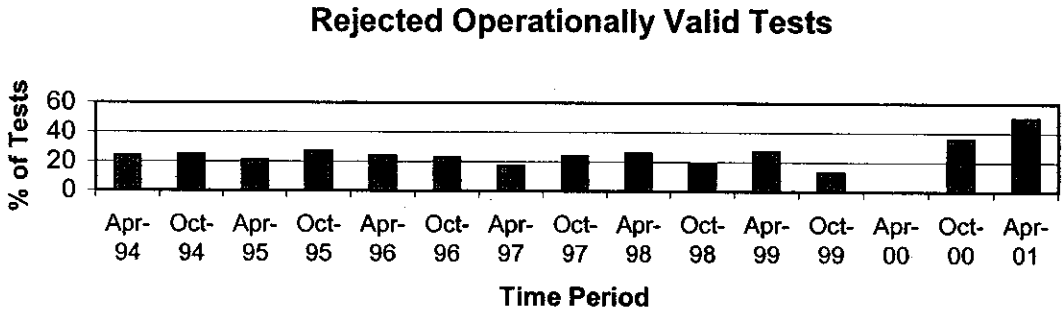
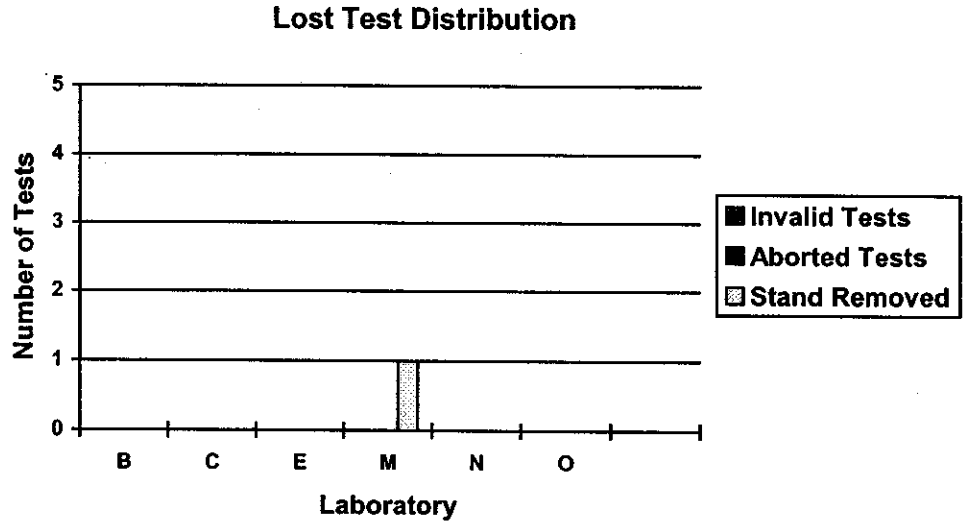
Reference May 01

The following chart shows the percentage of operationally valid tests failing the acceptance criteria:



There were no instances of the application of "Engineering Judgment" in the interpretation of LTMS guidelines during this report period. A total of fourteen LTMS deviations have been granted during the life of the Sequence VE test.

There was one test from which the data was removed from the laboratory control charts, because the stand was abandoned. There were no operationally invalid tests reported during this report period. Aborted and operationally invalid tests by laboratory are summarized with the following chart:



Attachment	5
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Reference	May 01

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. For RCS, AES, ACW and MCW, calculations were performed in transformed units, then converted to reported units. Pooled s and mean delta/s values for RCS, AES, MCW and ACW are shown in transformed units.

Variable	Pooled s All Oils	Mean Delta/s	Confidence Interval	Based on	Delta in Reported Units
RCS	0.447	-0.655	3.97 - 7.42	7.0	-1.35
AES	0.765	-0.818	5.48 – 9.11	9.0	-0.90
APV	0.038	-0.063	6.46 – 6.54	6.5	0.00
AEV	0.126	0.382	4.92 – 5.18	5.0	0.05
ACW	3.038	1.064	131.0 - 317.6	130	84.0
MCW	4.109	0.599	311.2 – 689.7	380	102

The mean Δ/s for this period shows AES (-0.818), RCS (-0.655), MCW (0.599) and ACW (1.064) were severe, AEV (0.382) was mild, and APV (-0.063) was on or near target. Figures 1 through 6 are current industry severity and precision EWMA control charts and plots of summations Δ/s for RCS, AES, APV, AEV, MCW and ACW. Figures 7 through 9 compare the pooled standard deviation of the current period with previous periods.

RCS severity began the period in action alarm. Subsequent tests caused the industry charts to return to the warning level and then clear for three tests, before sounding a warning alarm at the end of the period. The alarm at the beginning period was caused by a severe (-2.653 Δ/s) result from one lab. The alarm goes to a warning level and subsequently clear after results closer to target are reported. A severity warning alarm occurs at the end of the period when a result –2.551 Δ/s from target is reported. This test was from a lab other than the lab reporting the -2.653 Δ/s result at the beginning of the period. RCS precision was in control the entire period. The summation Δ/s plot shows RCS having a severe trend at the beginning of the period, moderating towards the middle of the period.

As with the RCS control chart, AES began this period in severity EWMA action alarm, went to warning alarm, and then cleared for three tests before ending the period in warning alarm. The alarm at the beginning of the period was the result of a test –2.945 Δ/s from target, which followed a similarly severe result run by the same laboratory at the end of the last report period. The alarm clears when additional results, closer to target, are reported. A warning alarm sounds at the end of the period, which was caused by a result –2.916 Δ/s from target. This result was from a lab other than the one reporting severe results at the end of last report period and the beginning of this period. AES precision chart was in control for the period. The summation Δ/s plot shows that with the exception of the last test, severity was on or near target.

The APV severity and precision EWMA charts were in control the entire period. The summation Δ/s shows on or near target results for the period.

AEV severity was in control for the period. AEV precision began the period in control but sounded two precision EWMA warning alarms at the end of the period. The alarm may be lab related, based on a result from one lab which was –1.538 Δ/s from target, which was preceded by a result from a different lab which was 0.801Δ/s and followed by a result from a third lab which was 0.787 Δ/s from target. The lab reporting the severe result has typically been severe on varnish, having a severity adjustment in effect. The summation Δ/s plot shows severity on or near target for most of the period.

The charts for MCW severity and precision were in control the entire period. The summation Δ/s plot shows a severe trend for most of the period.

Industry control charts for ACW severity began the period in action alarm, clearing for four tests and finally sounding a warning alarm at the end of the period. Industry precision has been in warning or action alarm the entire period. Severity and precision problems appear to have been caused by two severe results from two labs. At the beginning of the period, one lab reported a result which was 4.622 Δ/s from target. The following four results were within ± one standard deviation of target. The last test reported was 2.597 Δ/s from target. The summation Δ/s plot shows a severe trend for most of the period.

Pooled precision estimates show AES and RCS precision are directionally improved with respect to the previous period and are not significantly different than historical estimates. Precision for AEV and APV has improved significantly with respect to the previous period and historical estimates. ACW and MCW are directionally poorer when compared to the previous period, but have not degraded significantly with respect to the previous period and 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	227	75	6	3+ years
927	9	3	1	< 1 year
927-1	152	50	10	3+ years
930	281	93	4	3+ years
930-1	265	88	0	3+ years
1006	1573	524	3	2+ years

Note: Oil 1006 is used across multiple test areas, TMC inventory represents total amount of that oil on hand.

Information Letters

Information Letter 01-1 was issued on January 15, 2001. This information letter revised temperature measurement sensor calibration frequency to prior to a calibration attempt.

Information Memos

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

Memo	Date	Subject
00-130	10/4/00	Sequence VE Semi-Annual Report

The following table compares the standard deviation used in the LTMS for severity adjustment calculations, which is a pooled estimate of precision based on oils 930 and 1002, with the current and historical pooled precision of the oils 1002, 1006 and 930.

Parameter	Severity Adjustment Standard Deviation (n = 43)	Historical Pooled Standard Deviation, Oils 930, 1006 and 1002 (n =324)	Current Period Pooled Standard Deviation, Oils 930, 1006 and 1002 (n = 3)
AES	0.594	0.701	0.471
RCS	0.528	0.588	0.076
AEV	0.239	0.264	0.177
APV	0.213	0.253	0.050
ACW	2.318	2.583	0.486
MCW	3.155	3.866	0.235

Summary

Calibration per start rate has decreased with respect to the previous period and historical rates. The rejected test per start has increased with respect to the previous period and historical rates. The lost test per start rate compares favorably with the previous period and historical rates. Precision, when compared to the previous period, is directionally better for AES and RCS and comparable to historical estimates. AEV and APV precision has improved significantly with respect to both the previous period and historical rates. ACW and MCW precision are directionally poorer when compared with the previous period and are not significantly different than historical estimates. AES, ACW, RCS and MCW trended severe this period. AEV was mild and APV was on or near target for severity. The severe results appear to lab related, occurring at the beginning and end of the report period.

Attachments

c: Sequence VE Surveillance Panel
ftp://www.tmc.astm.cmri.cmu.edu/docs/gas/sequencev/semiannualreports/ve-4-2001
J. L. Zalar
F. M. Farber

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

Table 1 summarizes the mean and range of results, by oil, of all operationally valid reference oil tests reported to the TMC, through March 31, 2001, in transformed and reported units, where applicable.

Table 2 summarizes the mean and range of results, by oil, of all operationally valid reference oil tests reported to the TMC from October 1, 2000 through March 31, 2001, in transformed and reported units, where applicable.

Table 3 summarizes the mean and range of individual varnish part results, by oil, of all operationally valid dual plug reference oil tests reported to the TMC through March 31, 2001.

Table 4 summarizes the mean and range of individual sludge part results, by oil, of all operationally valid dual plug reference oil tests reported to the TMC through March 31, 2001.

Table 5 is the Sequence VE Industry Timeline.

Figures 1 through 6 are the Industry control charts for the dual plug head results for AES, RCS, APV, AEV, ACW and MCW.

Figures 7 through 9 compare the pooled standard deviation of the dual plug head results for this ASTM reporting period with previous ASTM reporting periods, for AES and RCS, AEV and APV, and ACW and MCW, respectively.

TABLE 1
SEQUENCE VE DUAL PLUG HEAD
ALL OPERATIONALLY VALID DATA
DATE COMPLETED ENDING MARCH 31, 2001

OIL CODE	TEST PARAMETER	N	MEAN	s	REPORTED RANGE
1002	RCS (-1(LN(9.65-RCS)))	122	-0.505	.516	-1.637 TO 0.734
	RCS (MERITS*)		7.992		4.510 TO 9.170
	AES (-1(LN(9.65-AES)))		0.367	.603	-1.244 TO 1.427
	AES (MERITS*)		8.957		6.180 TO 9.410
	Avg. Pist. Varnish		7.104	.222	6.620 TO 7.570
	Avg. Eng. Varnish		5.590	.272	4.230 TO 6.290
	MCW (Square Root)		14.09	3.22	4.243 TO 19.31
	MCW (micrometres*)		198.5		18.00 TO 373.0
	ACW (Square Root)		9.649	2.42	3.633 TO 15.21
	ACW (micrometres*)		93.09		13.20 TO 231.4
1006	RCS (-1(LN(9.65-RCS)))	54	-0.011	.738	-1.954 TO 1.022
	RCS (MERITS*)		8.639		2.590 TO 9.290
	AES (-1(LN(9.65-AES)))		0.602	.890	-1.792 TO 1.661
	AES (MERITS*)		9.103		3.650 TO 9.460
	Avg. Pist. Varnish		6.949	.271	6.460 TO 7.590
	Avg. Eng. Varnish		5.509	.247	4.940 TO 6.060
	MCW (Square Root)		9.023	4.36	4.359 TO 18.06
	MCW (micrometres*)		81.42		19.00 TO 326.0
	ACW (Square Root)		6.760	3.04	3.033 TO 13.55
	ACW (micrometres*)		45.70		9.200 TO 183.5
925-2	RCS (-1(LN(9.65-RCS)))	9	-1.452	.192	-1.658 TO -1.102
	RCS (MERITS*)		5.380		4.400 TO 6.640
	AES (-1(LN(9.65-AES)))		-0.426	.357	-0.944 TO 0.174
	AES (MERITS*)		8.119		7.080 TO 8.810
	Avg. Pist. Varnish		6.546	.184	6.300 TO 6.900
	Avg. Eng. Varnish		4.477	.227	4.160 TO 4.840
	MCW (Square Root)		6.367	3.37	3.162 TO 12.04
	MCW (micrometres*)		40.54		10.00 TO 145.0
	ACW (Square Root)		4.330	1.39	2.530 TO 6.411
	ACW (micrometres*)		18.75		6.400 TO 41.10
925-3	RCS (-1(LN(9.65-RCS)))	144	-1.215	.334	-2.194 TO -0.182
	RCS (MERITS*)		6.281		0.680 TO 8.450
	AES (-1(LN(9.65-AES)))		-0.443	.528	-1.959 TO 0.916
	AES (MERITS*)		8.093		2.560 TO 9.250
	Avg. Pist. Varnish		6.565	.222	5.730 TO 7.100
	Avg. Eng. Varnish		4.088	.276	3.580 TO 4.950
	MCW (Square Root)		6.531	3.10	2.236 TO 16.85
	MCW (micrometres*)		42.65		5.000 TO 284.0
	ACW (Square Root)		4.830	1.79	2.025 TO 12.28
	ACW (micrometres*)		23.33		4.100 TO 150.9
926-1	RCS (-1(LN(9.65-RCS)))	8	0.476	.469	-0.385 TO 1.050
	RCS (MERITS*)		9.029		8.180 TO 9.300
	AES (-1(LN(9.65-AES)))		1.280	.473	0.301 TO 1.772
	AES (MERITS*)		9.372		8.910 TO 9.480
	Avg. Pist. Varnish		6.963	.154	6.650 TO 7.160
	Avg. Eng. Varnish		5.570	.190	5.230 TO 5.850
	MCW (Square Root)		13.04	4.13	5.745 TO 17.89
	MCW (micrometres*)		169.9		33.00 TO 320.0
	ACW (Square Root)		8.091	2.75	4.648 TO 12.76
	ACW (micrometres*)		65.47		21.60 TO 162.8

TABLE 1
SEQUENCE VE DUAL PLUG HEAD
ALL OPERATIONALLY VALID DATA
DATE COMPLETED ENDING MARCH 31, 2001

OIL CODE	TEST PARAMETER	N	MEAN	s	REPORTED RANGE
927	RCS (-1(LN(9.65-RCS)))	22	-1.583	.489	-2.128 TO -0.049
	RCS (MERITS*)		4.781		1.250 TO 8.600
	AES (-1(LN(9.65-AES)))		-0.907	.744	-1.739 TO 0.916
	AES (MERITS*)		7.174		3.960 TO 9.250
	Avg. Pist. Varnish		6.780	.338	6.150 TO 7.600
	Avg. Eng. Varnish		4.994	.250	4.490 TO 5.510
	MCW (Square Root)		19.02	2.98	8.000 TO 21.73
	MCW (micrometres*)		361.6		64.00 TO 472.0
	ACW (Square Root)		13.55	2.77	5.523 TO 16.75
	ACW (micrometres*)		183.6		30.50 TO 280.4
927-1	RCS (-1(LN(9.65-RCS)))	7	-1.832	.170	-1.981 TO -1.509
	RCS (MERITS*)		3.403		2.400 TO 5.130
	AES (-1(LN(9.65-AES)))		-1.275	.258	-1.537 TO -0.820
	AES (MERITS*)		6.071		5.000 TO 7.380
	Avg. Pist. Varnish		6.991	.214	6.580 TO 7.200
	Avg. Eng. Varnish		5.023	.276	4.500 TO 5.270
	MCW (Square Root)		19.32	1.24	17.92 TO 21.70
	MCW (micrometres*)		373.4		321.0 TO 471.0
	ACW (Square Root)		14.24	.990	13.07 TO 15.83
	ACW (micrometres*)		202.9		170.9 TO 250.7
930	RCS (-1(LN(9.65-RCS)))	151	-0.285	.590	-1.920 TO 1.609
	RCS (MERITS*)		8.320		2.830 TO 9.450
	AES (-1(LN(9.65-AES)))		0.345	.706	-1.656 TO 1.470
	AES (MERITS*)		8.942		4.410 TO 9.420
	Avg. Pist. Varnish		6.993	.268	5.950 TO 7.820
	Avg. Eng. Varnish		4.846	.261	4.130 TO 5.700
	MCW (Square Root)		9.813	4.21	3.464 TO 20.07
	MCW (micrometres*)		96.30		12.00 TO 403.0
	ACW (Square Root)		6.858	2.58	2.470 TO 15.78
	ACW (micrometres*)		47.04		6.100 TO 248.9

* CALCULATED IN TRANSFORMED UNITS AND CONVERTED BACK TO REPORTED UNITS

04/03/01
statsmon.SAS

TABLE 2
SEQUENCE VE DUAL PLUG HEAD
ALL OPERATIONALLY VALID DATA
DATA FROM OCTOBER 1, 2000 THROUGH MARCH 31, 2001

OIL CODE	TEST PARAMETER	N	MEAN	s	REPORTED RANGE
1006	RCS (-1(LN(9.65-RCS)))	2	0.767	.076	0.713 TO 0.821
	RCS (MERITS*)		9.186		9.160 TO 9.210
	AES (-1(LN(9.65-AES)))		1.327	.471	0.994 TO 1.661
	AES (MERITS*)		9.385		9.280 TO 9.460
	Avg. Pist. Varnish		6.885	.049	6.850 TO 6.920
	Avg. Eng. Varnish		5.735	.177	5.610 TO 5.860
	MCW (Square Root)		5.998	.236	5.831 TO 6.164
	MCW (micrometres*)		35.97		34.00 TO 38.00
	ACW (Square Root)		4.656	.486	4.313 TO 5.000
	ACW (micrometres*)		21.68		18.60 TO 25.00
925-3	RCS (-1(LN(9.65-RCS)))	2	-1.750	.628	-2.194 TO -1.306
	RCS (MERITS*)		3.897		0.680 TO 5.960
	AES (-1(LN(9.65-AES)))		-1.270	.973	-1.959 TO -0.582
	AES (MERITS*)		6.088		2.560 TO 7.860
	Avg. Pist. Varnish		6.335	.021	6.320 TO 6.350
	Avg. Eng. Varnish		4.265	.021	4.250 TO 4.280
	MCW (Square Root)		11.39	5.81	7.280 TO 15.49
	MCW (micrometres*)		129.6		53.00 TO 240.0
	ACW (Square Root)		9.044	4.27	6.025 TO 12.06
	ACW (micrometres*)		81.79		36.30 TO 145.5
927-1	RCS (-1(LN(9.65-RCS)))	1	-1.954	.	-1.954 TO -1.954
	RCS (MERITS*)		2.590		2.590 TO 2.590
	AES (-1(LN(9.65-AES)))		-1.418	.	-1.418 TO -1.418
	AES (MERITS*)		5.520		5.520 TO 5.520
	Avg. Pist. Varnish		7.120	.	7.120 TO 7.120
	Avg. Eng. Varnish		4.500	.	4.500 TO 4.500
	MCW (Square Root)		21.70	.	21.70 TO 21.70
	MCW (micrometres*)		471.0		471.0 TO 471.0
	ACW (Square Root)		14.39	.	14.39 TO 14.39
	ACW (micrometres*)		207.0		207.0 TO 207.0
930	RCS (-1(LN(9.65-RCS)))	1	-1.351	.	-1.351 TO -1.351
	RCS (MERITS*)		5.790		5.790 TO 5.790
	AES (-1(LN(9.65-AES)))		-1.044	.	-1.044 TO -1.044
	AES (MERITS*)		6.810		6.810 TO 6.810
	Avg. Pist. Varnish		7.290	.	7.290 TO 7.290
	Avg. Eng. Varnish		4.860	.	4.860 TO 4.860
	MCW (Square Root)		20.07	.	20.07 TO 20.07
	MCW (micrometres*)		403.0		403.0 TO 403.0
	ACW (Square Root)		13.45	.	13.45 TO 13.45
	ACW (micrometres*)		180.8		180.8 TO 180.8

* CALCULATED IN TRANSFORMED UNITS AND CONVERTED BACK TO REPORTED UNITS

04/03/01
statsmon.SAS

TABLE 3

SEQUENCE VE DUAL PLUG
ALL OPERATIONALLY VALID DATA
DATA REPORTED THROUGH MARCH 31, 2001

OIL CODE	VARNISH PART	N	MEAN	s	REPORTED RANGE
1002	AVERAGE PISTON	122	7.104	.222	6.620 TO 7.570
	ROCKER ARM COVER		3.594	.659	2.250 TO 5.540
	CAMSHAFT BAFFLE		7.197	.567	5.170 TO 8.550
	CYLINDER WALL (BRT)		2.916	.661	2.140 TO 8.290
	OIL PAN		7.175	.604	4.020 TO 8.520
1006	AVERAGE PISTON	54	6.949	.271	6.460 TO 7.590
	ROCKER ARM COVER		3.312	.727	1.720 TO 4.650
	CAMSHAFT BAFFLE		7.200	.387	5.890 TO 8.130
	CYLINDER WALL (BRT)		2.906	.311	2.300 TO 3.640
	OIL PAN		7.157	.482	5.380 TO 8.140
925-2	AVERAGE PISTON	9	6.546	.184	6.300 TO 6.900
	ROCKER ARM COVER		3.452	.642	2.280 TO 4.380
	CAMSHAFT BAFFLE		3.679	.810	2.330 TO 4.840
	CYLINDER WALL (BRT)		3.098	.147	2.880 TO 3.290
	OIL PAN		5.613	.295	5.310 TO 6.320
925-3	AVERAGE PISTON	144	6.565	.222	5.730 TO 7.100
	ROCKER ARM COVER		2.457	.577	1.410 TO 4.660
	CAMSHAFT BAFFLE		3.048	.873	1.380 TO 6.150
	CYLINDER WALL (BRT)		3.018	.385	2.240 TO 5.920
	OIL PAN		5.345	.411	4.400 TO 6.360
926-1	AVERAGE PISTON	8	6.963	.154	6.650 TO 7.160
	ROCKER ARM COVER		4.144	.638	3.400 TO 5.080
	CAMSHAFT BAFFLE		7.036	.642	6.120 TO 7.810
	CYLINDER WALL (BRT)		2.713	.270	2.280 TO 3.090
	OIL PAN		6.990	.574	6.280 TO 7.720
927	AVERAGE PISTON	22	6.780	.338	6.150 TO 7.600
	ROCKER ARM COVER		3.409	.792	2.080 TO 5.480
	CAMSHAFT BAFFLE		5.875	.811	3.870 TO 7.270
	CYLINDER WALL (BRT)		2.658	.396	1.940 TO 3.380
	OIL PAN		6.229	.461	5.460 TO 7.100
927-1	AVERAGE PISTON	7	6.991	.214	6.580 TO 7.200
	ROCKER ARM COVER		3.703	.673	2.670 TO 4.780
	CAMSHAFT BAFFLE		5.946	.467	5.350 TO 6.630
	CYLINDER WALL (BRT)		2.503	.415	1.810 TO 2.950
	OIL PAN		5.970	.655	4.830 TO 6.680
930	AVERAGE PISTON	151	6.993	.268	5.950 TO 7.820
	ROCKER ARM COVER		3.158	.707	1.780 TO 5.300
	CAMSHAFT BAFFLE		5.320	.689	3.370 TO 7.390
	CYLINDER WALL (BRT)		2.815	.407	1.920 TO 4.420
	OIL PAN		5.941	.572	4.650 TO 8.160

TABLE 4

SEQUENCE VE DUAL PLUG
ALL OPERATIONALLY VALID DATA
DATA REPORTED THROUGH MARCH 31, 2001

OIL CODE	SLUDGE PART	N	MEAN (MERITS*)	s	REPORTED RANGE
1002	ROCKER ARM COVER	122	-.716 (7.954)	.424	4.51 TO 9.17
	CAMSHAFT BAFFLE		0.099 (9.094)	.405	6.19 TO 9.45
	FRONT SEAL HOUSING		0.589 (9.445)	.405	7.90 TO 9.75
	OIL PAN		-.099 (8.896)	.535	5.71 TO 9.50
	VALVE DECK		0.061 (9.059)	.620	3.60 TO 9.59
	UNDERSIDE OF BLOCK		0.242 (9.215)	.452	6.90 TO 9.65
1006	ROCKER ARM COVER	54	-.353 (8.577)	.584	2.59 TO 9.29
	CAMSHAFT BAFFLE		0.084 (9.081)	.640	4.23 TO 9.56
	FRONT SEAL HOUSING		0.554 (9.425)	.685	3.04 TO 9.75
	OIL PAN		-.000 (9.000)	.659	4.50 TO 9.51
	VALVE DECK		-.013 (8.987)	.763	1.30 TO 9.60
	UNDERSIDE OF BLOCK		0.270 (9.236)	.596	5.99 TO 9.67
925-2	ROCKER ARM COVER	9	-1.53 (5.375)	.176	4.40 TO 6.64
	CAMSHAFT BAFFLE		-.781 (7.817)	.637	4.97 TO 9.16
	FRONT SEAL HOUSING		-.313 (8.632)	.490	7.55 TO 9.25
	OIL PAN		-.091 (8.905)	.230	8.26 TO 9.16
	VALVE DECK		0.093 (9.089)	.652	6.77 TO 9.47
	UNDERSIDE OF BLOCK		0.406 (9.334)	.244	8.95 TO 9.53
925-3	ROCKER ARM COVER	144	-1.32 (6.263)	.300	0.68 TO 8.45
	CAMSHAFT BAFFLE		-.912 (7.510)	.598	2.06 TO 9.31
	FRONT SEAL HOUSING		-.454 (8.426)	.619	2.06 TO 9.72
	OIL PAN		-.346 (8.586)	.518	2.80 TO 9.48
	VALVE DECK		-.229 (8.743)	.604	0.39 TO 9.59
	UNDERSIDE OF BLOCK		0.220 (9.198)	.508	4.65 TO 9.65
926-1	ROCKER ARM COVER	8	0.008 (9.008)	.311	8.18 TO 9.30
	CAMSHAFT BAFFLE		0.486 (9.385)	.304	8.76 TO 9.51
	FRONT SEAL HOUSING		0.879 (9.585)	.346	9.30 TO 9.75
	OIL PAN		0.372 (9.311)	.302	8.66 TO 9.50
	VALVE DECK		0.663 (9.485)	.190	9.29 TO 9.60
	UNDERSIDE OF BLOCK		0.515 (9.402)	.114	9.25 TO 9.50
927	ROCKER ARM COVER	22	-1.66 (4.733)	.439	1.25 TO 8.60
	CAMSHAFT BAFFLE		-.875 (7.601)	.692	5.42 TO 9.53
	FRONT SEAL HOUSING		-.783 (7.812)	.892	1.28 TO 9.70
	OIL PAN		-.954 (7.404)	.619	4.58 TO 9.36
	VALVE DECK		-.883 (7.582)	.879	3.00 TO 9.35
	UNDERSIDE OF BLOCK		-.694 (7.999)	.647	4.90 TO 9.43
927-1	ROCKER ARM COVER	7	-1.89 (3.398)	.160	2.40 TO 5.13
	CAMSHAFT BAFFLE		-1.19 (6.714)	.143	6.07 TO 7.40
	FRONT SEAL HOUSING		-1.18 (6.740)	.623	2.64 TO 8.20
	OIL PAN		-1.20 (6.686)	.373	5.38 TO 8.33
	VALVE DECK		-1.40 (5.940)	.291	3.91 TO 7.54
	UNDERSIDE OF BLOCK		-.940 (7.440)	.220	6.77 TO 8.32

TABLE 4

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Attachment Page Reference 13 of 23 May 01

SEQUENCE VE DUAL PLUG
ALL OPERATIONALLY VALID DATA
DATA REPORTED THROUGH MARCH 31, 2000

OIL CODE	SLUDGE PART	N	MEAN	(MERITS*)	s	REPORTED RANGE
930	ROCKER ARM COVER	151	-.547	(8.273)	.465	2.83 TO 9.45
	CAMSHAFT BAFFLE		-.060	(8.938)	.557	4.10 TO 9.53
	FRONT SEAL HOUSING		0.343	(9.290)	.557	5.26 TO 9.70
	OIL PAN		-.164	(8.822)	.592	3.69 TO 9.50
	VALVE DECK		-.023	(8.977)	.643	2.83 TO 9.59
	UNDERSIDE OF BLOCK		0.207	(9.187)	.524	5.81 TO 9.63

Table 5
Sequence VE Industry Timeline

19950201	95-3	Start of Dual Plug VE Testing
19950515		Targets For Oil 925-3 and 930 Updated
19950523	95-5	Sludge Rating Sites Revised on Cylinder Head
19950523	95-5	Oxygen limits in test method were incorrect
19950524	95-4	AEV Correction Factor Approved (Candidates only)
19950601		Targets For Oil 1002 and 930 Updated
19950901		Reground followers introduced.
19960901	95-5	Data dictionary version 19950530 implemented
19951003		Targets for 1002; 925-3 and 930 Updated
19951101	95-6	Increased Aliphatic naphtha concentration to 50%
19951101	95-6	Added requirements to change honing oil & filter 1/15 Hrs
19951101	95-6	Changed cylinder head calibration rig calibration requirements
19951101	95-6	Allowed Torque to Yield bolts to be used twice
19951101	95-6	Corrected errors in footnote 14 and renumbered footnotes
19960101	95-7	Instituted program to monitor test fuel stored at labs
19951003	95-7	Revised pooled s for severity adjustment calculations
19960515	96-2	Implemented industry correction factors for ACW and MCW
19960901	96-1	Standard orifice mount; clean orifice daily; standard correction calculation
19960901	96-1	Revised stage 1 to 2 RAC temperature Ramp
19960901	96-1	Calibration Frequency Changes and requirements
19960901	96-1	Specified Follower Installation Tool
19960901	96-1	Coolant Flush Cart Calibration
19960901	96-1	Pre-lube engine when downtime exceeds 8 hours
19960901	96-1	Require the use of OHTA-007-1 adapter
19960901	96-1	Required use of lifter fill chamber for VE lifters
19960901	96-1	Standardized separator height at 5.5±0.25 in
19960901	96-1	Standardized sample probe distance 2.75±0.25" from exh man flange
19960901	96-1	Required pressurized engine coolant system at 10 psig
19960901	96-1	Specified engine coolant out temperature measurement at 1"
19960901	96-1	Clarified what is a shutdown and reporting requirements
19960901	96-1	Deleted retention requirements for excess oil at oil leveling
19960901	96-1	Corrected errors; footnote 2; table 3; section 9.3.1 and Fig A3.25
19961001	96-2	Forms and Data Dictionary Change, Version 19960726
19961001	96-2	Added requirement to identify sampling technique used for sampling of lab fuel supply
19961119	97-1	Humidity Calibration Requirements Added
19961119	97-1	Clean Blowby Orifice weekly
19970101	97-1	Changed AFR probe location
19970310	97-2	Changed Cam Wear measurements (Avg, Max and individual lobes) to micrometres
19970310	97-2	Forms and data dictionary changes to accompany wear measurement units, Version 19970130
19970429	97-3	Corrected typo errors in 8.3.5, 9.3.2 and 13.2.2.1. Changed Nalcool to Pencool 2000
19970820	97-4	Added requirements to flow test fuel injectors, prior to each test
19970820	97-4	Changed calibration frequency for fuel flow measurement device from every 3rd test to every reference
19971124	97-5	Changed field length for DELACW and DELMCW, Moved notes 29 and 31 into text of procedure
19971118	97-6	Allowed removal of piston staining and deleted Annex A13.
19980611	98-1	Machining of 0.5 mm pistons, Calibration frequency Changes
19980709		Test Target Update, Reference oil 1006 (N=20)
19980611	99-1	Machining of 0.5 mm pistons, Calibration frequency Changes
19990224		Test Target Update, Reference oil 1006 (N=30)
19990615	99-2	Added Procedure for re-using cylinder heads, deleted requirement to identify cams with lobes <50C
19991216	99-3	Revised method to allow use of non-kit parts obtained from Ford Dealers, for other than parts listed in the Origin of Significant Parts Sheet (Form A7.12)
20000916	00-1	Revised definitions to match D02.B Glossary of Terms and Their Definitions
20010115	01-1	Revised calibration frequency for temperature sensors.

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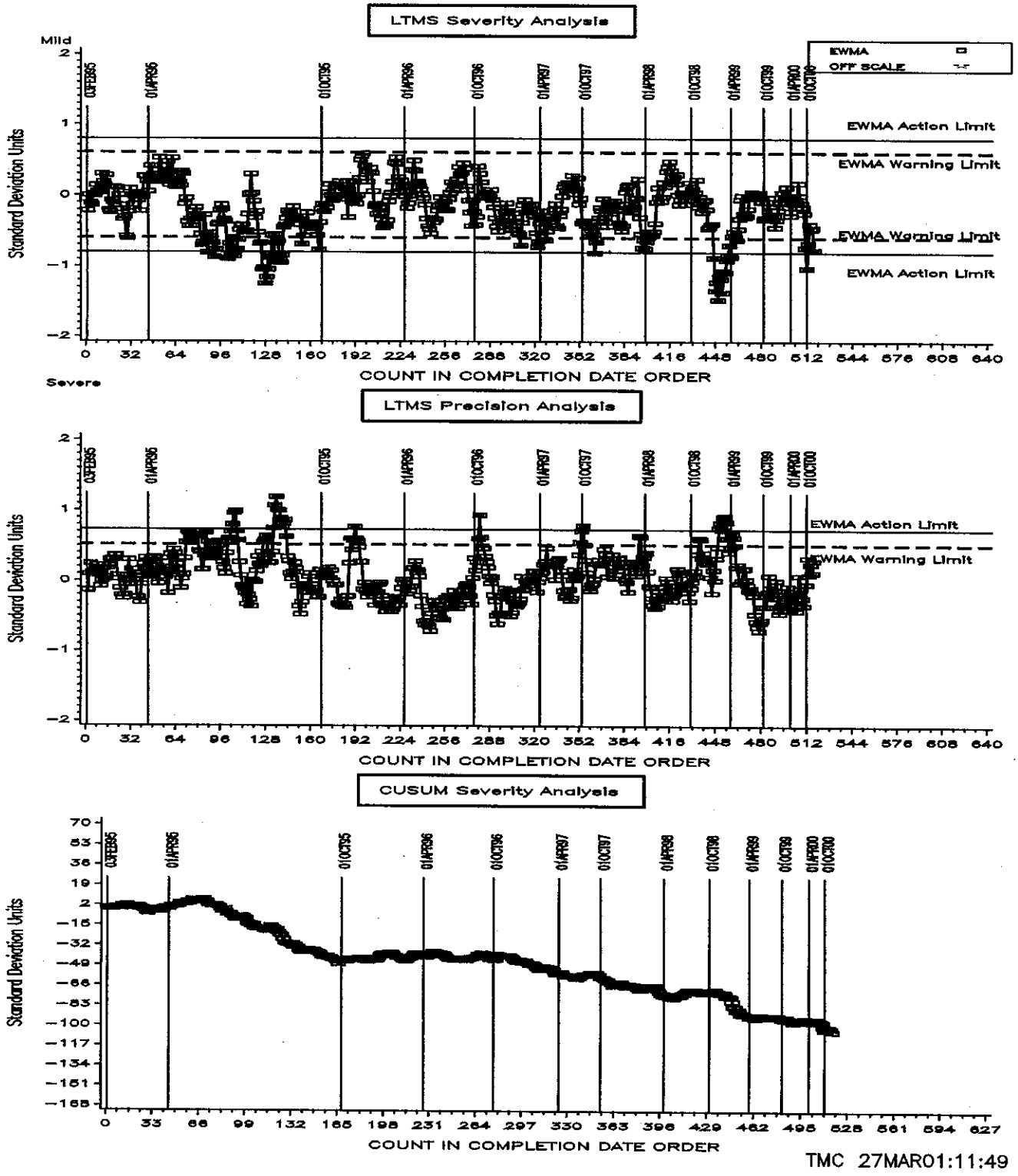
SEQUENCE VE INDUSTRY OPERATIONALLY VALID DATA

Rocker Cover Sludge – Merits

Figure 1



Attachment 5
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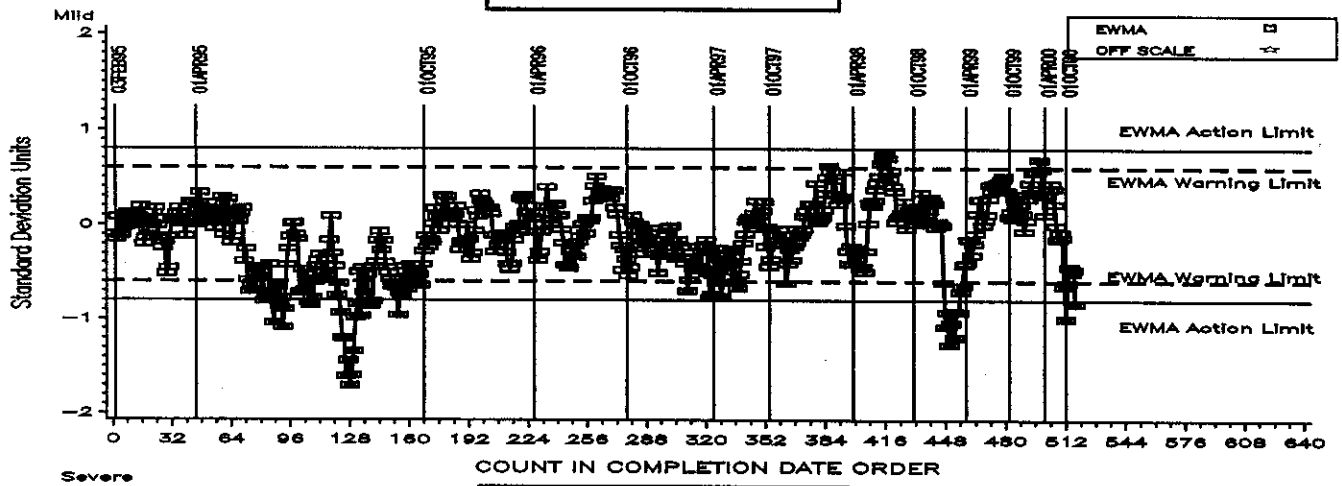
Reference May Figure 2

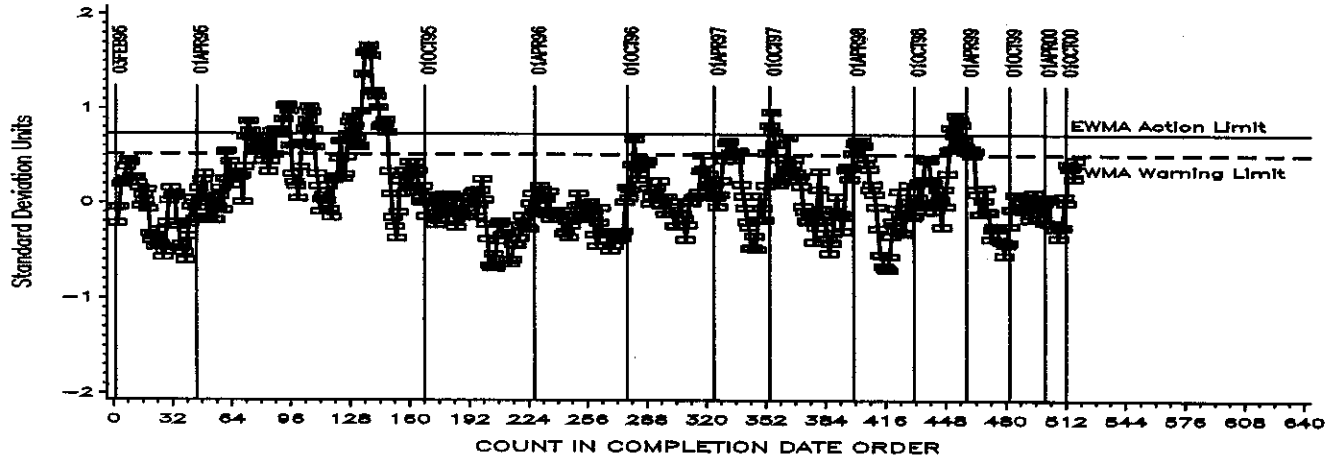
SEQUENCE VE INDUSTRY OPERATIONALLY VALID DATA

Average Engine Sludge — Merits

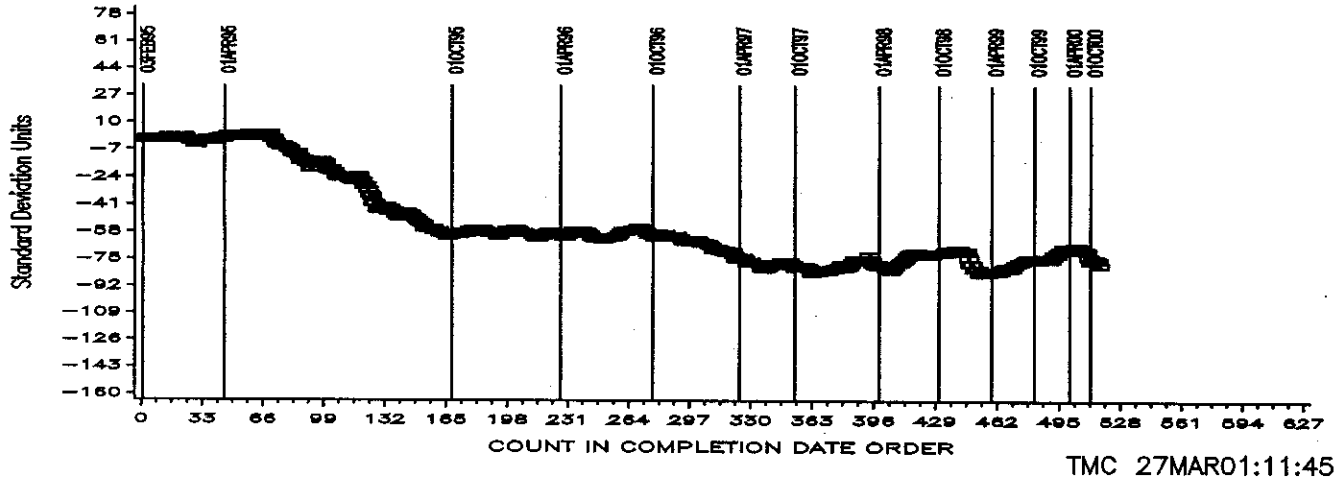
LTMS Severity Analysis



LTMS Precision Analysis



CUSUM Severity Analysis



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SEQUENCE VE INDUSTRY OPERATIONALLY VALID DATA

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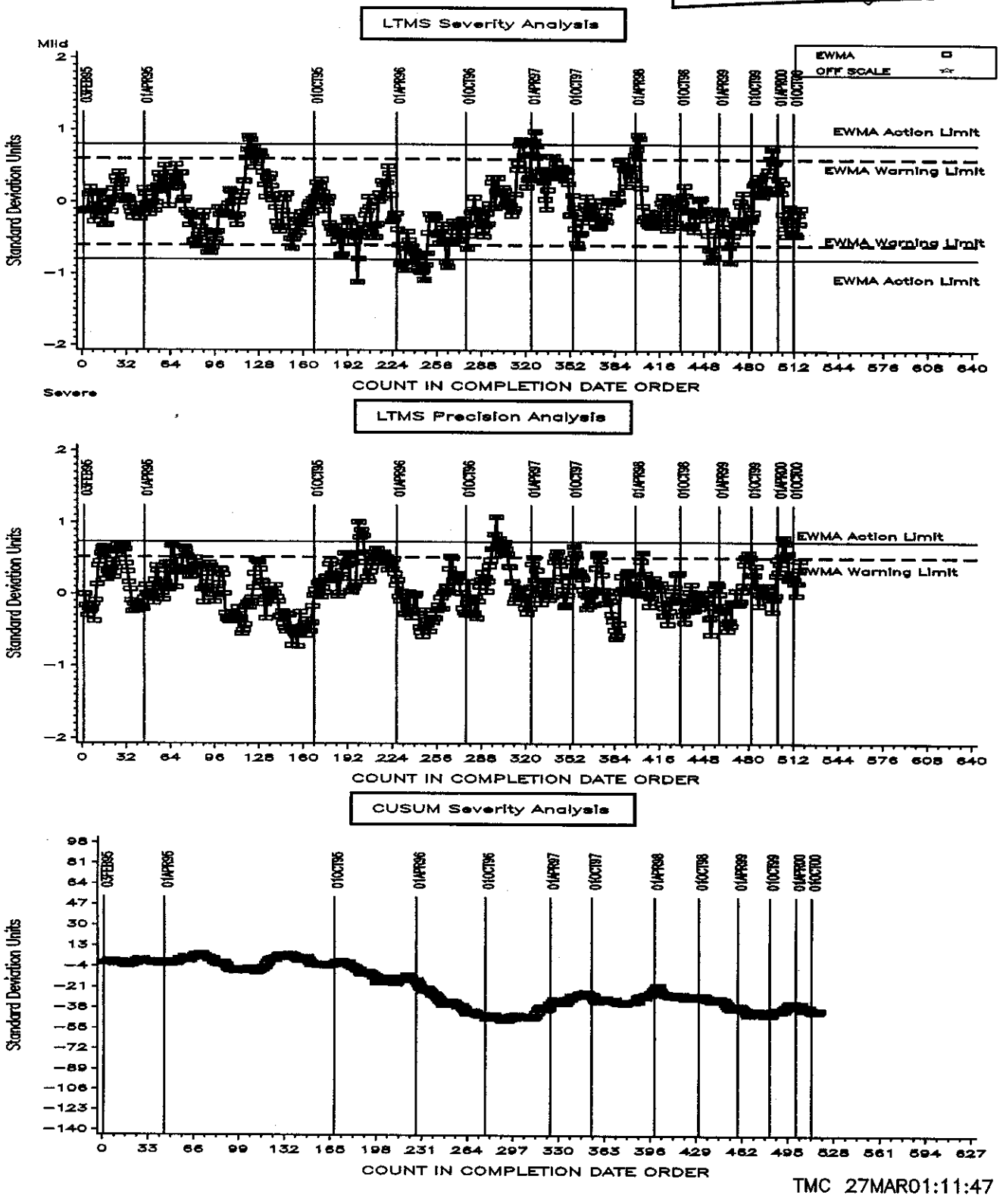
Average Piston Varnish – Merits

Figure 3



SEQUENCE VE INDUSTRY OPERATIONALLY VALID DATA

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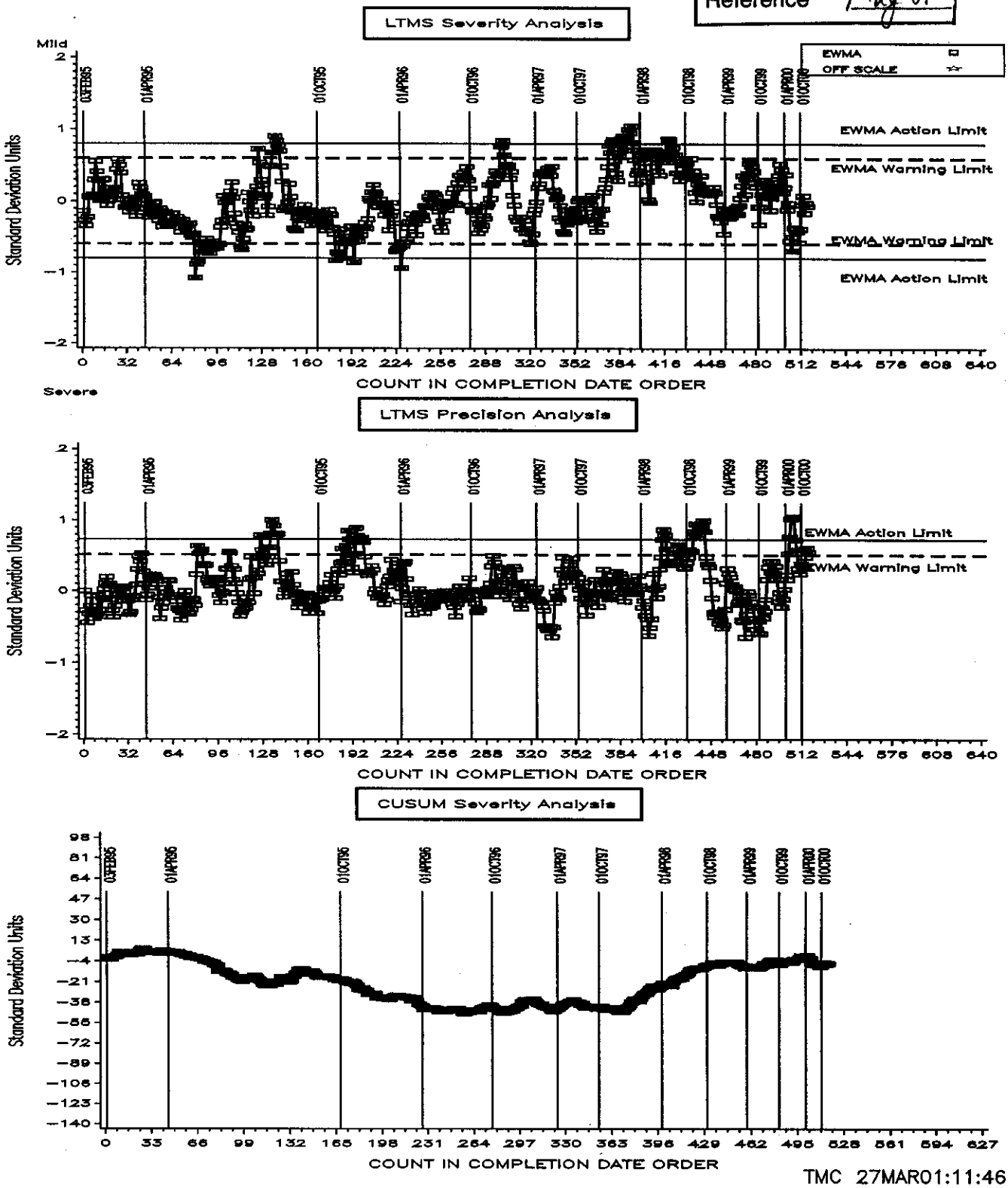
Average Engine Varnish — Merits

Figure 4



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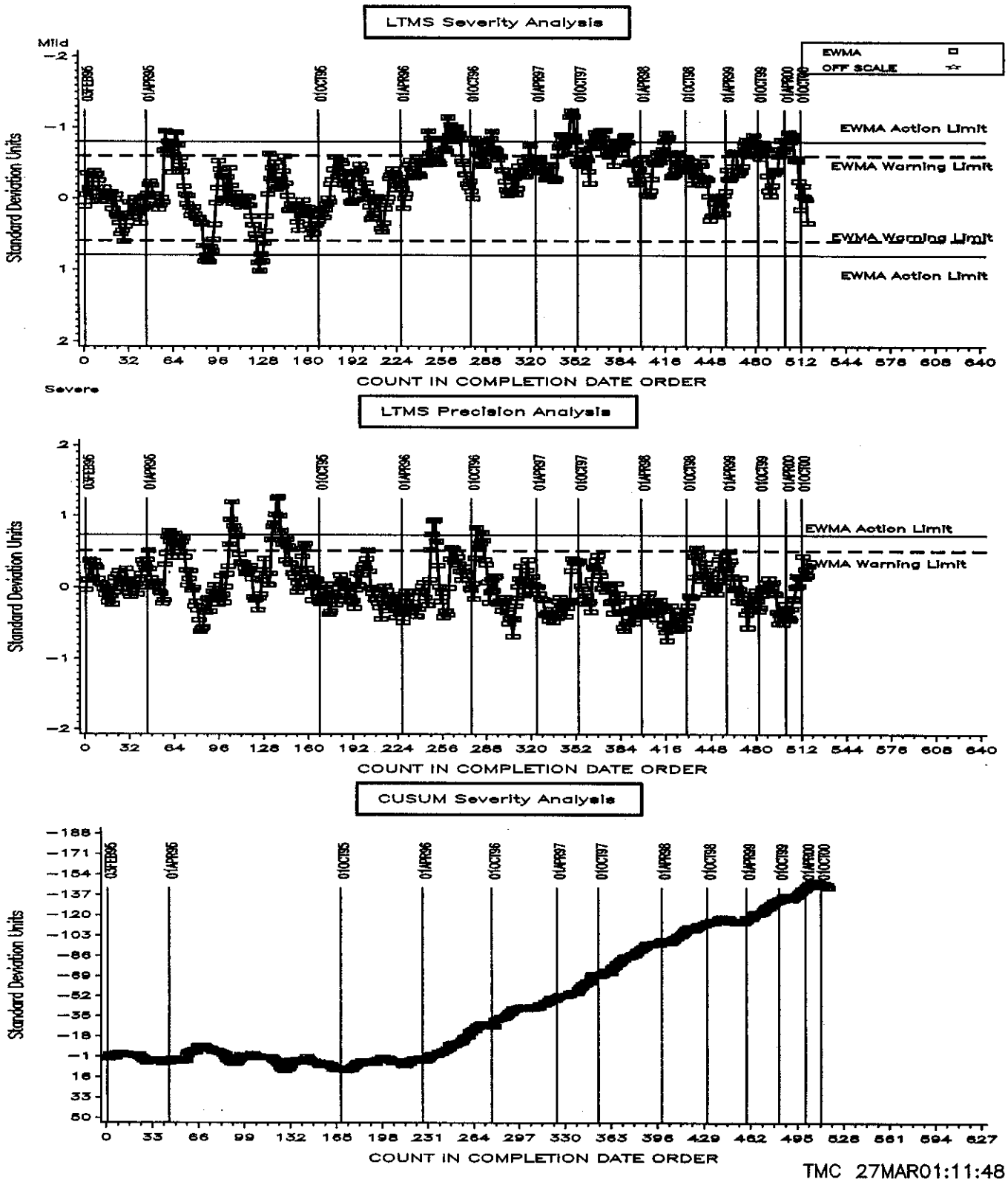
SEQUENCE VE INDUSTRY OPERATIONALLY VALID DATA

Maximum Camshaft Wear (Micrometers)



Attachment 5-
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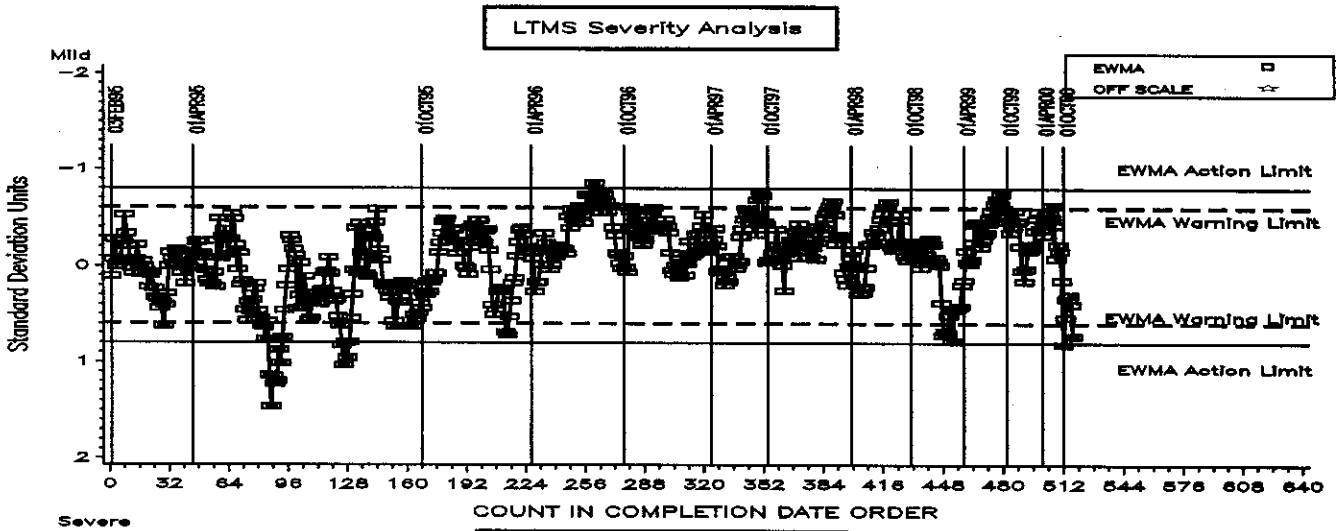
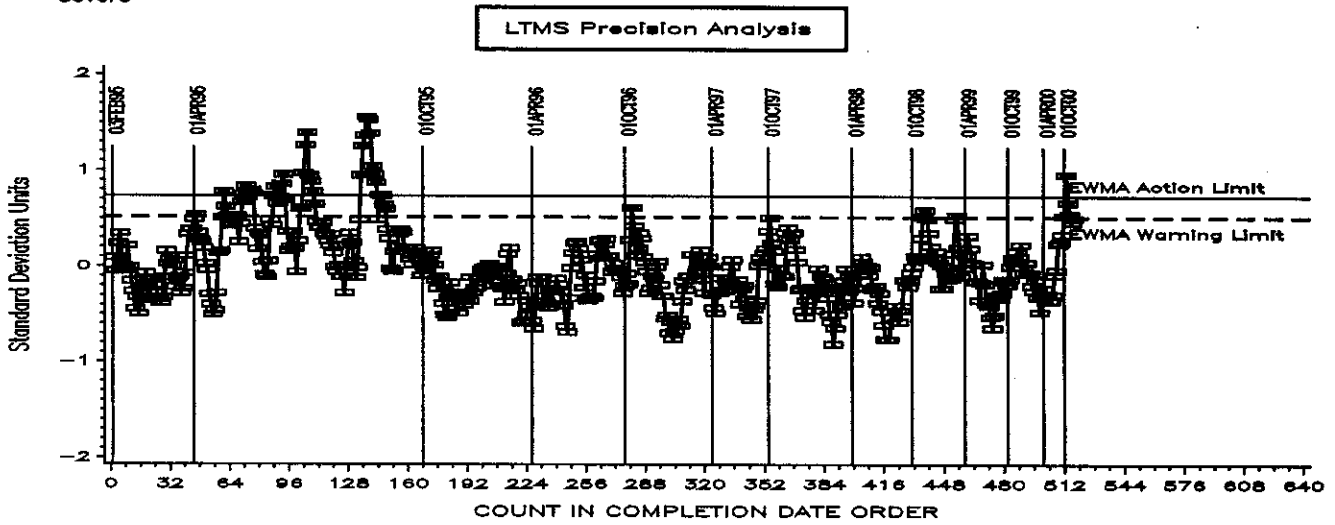
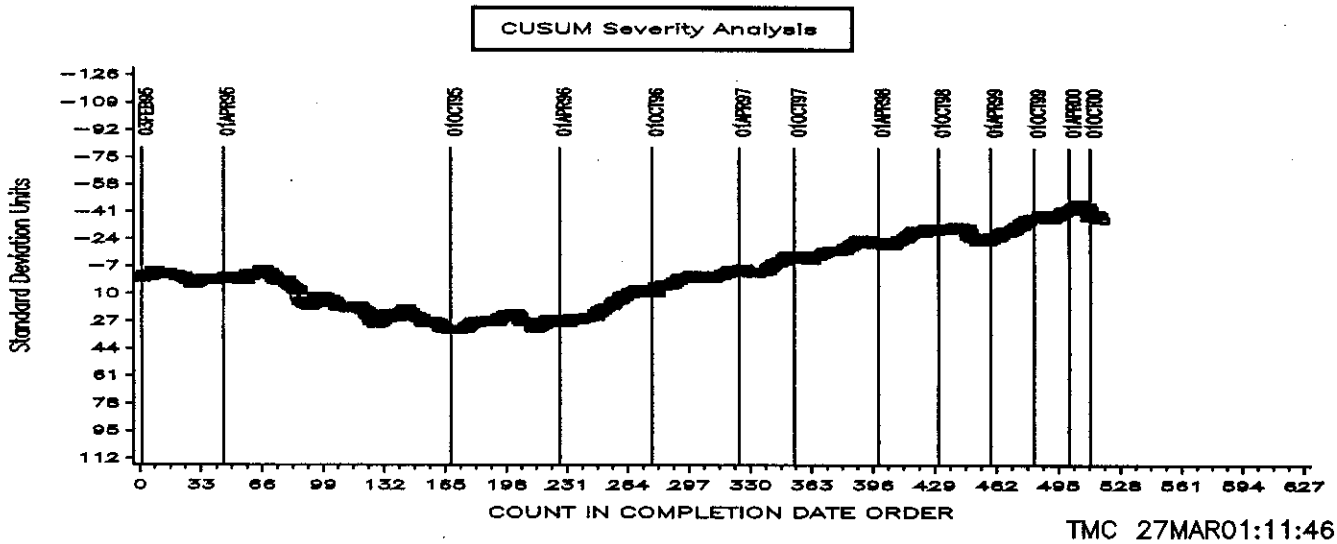
Reference may Figure 6

SEQUENCE VE INDUSTRY OPERATIONALLY VALID DATA

Average Camshaft Wear (Micrometers)







TMC 27MAR01:11:46

Figure 7

Summary of AES and RCS Pooled s Value By ASTM Report Period

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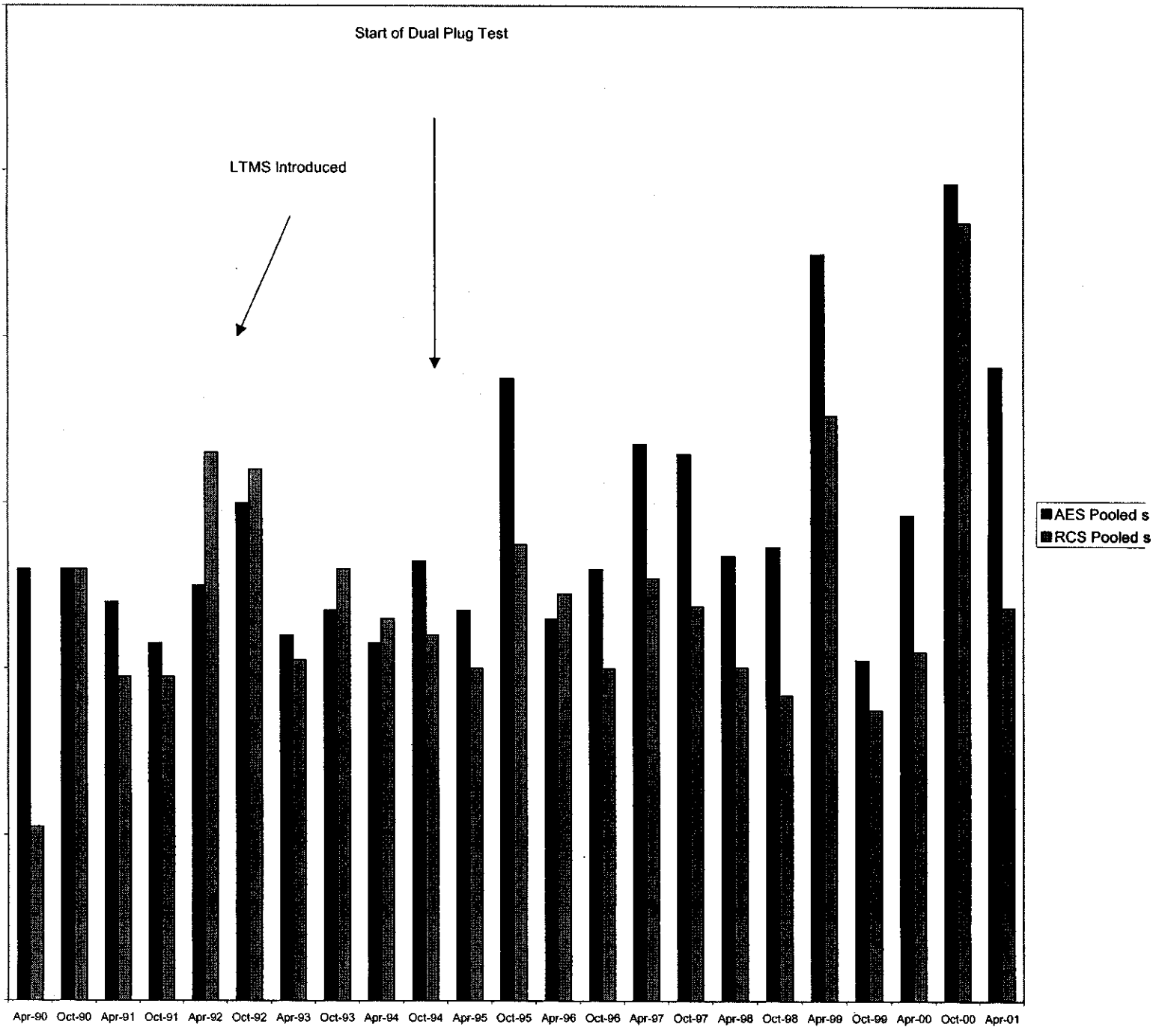

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Summary of AEV and APV Pooled's Values by ASTM Report Period

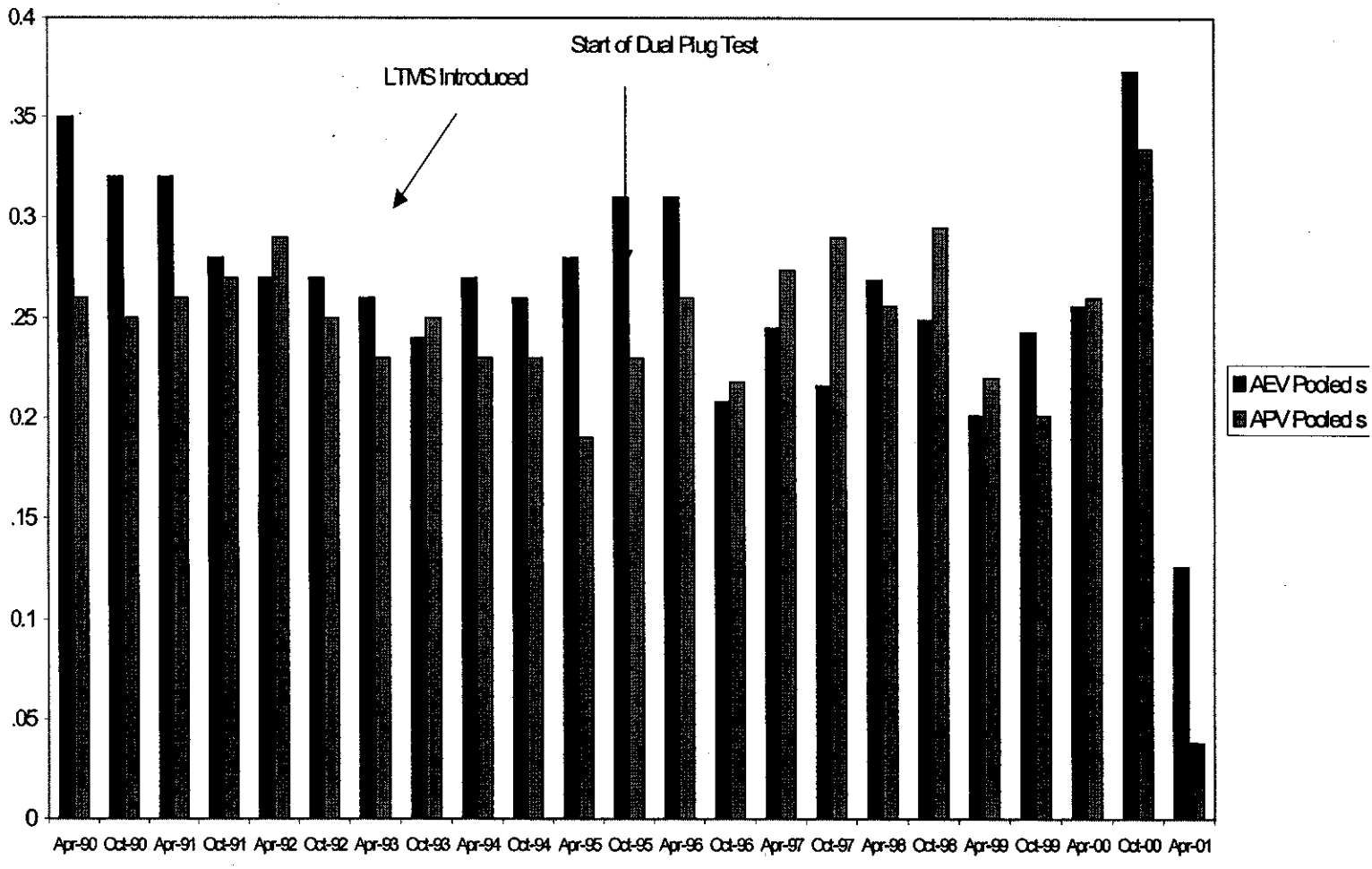

Figure 9

Summary of ACW and MCW Pooled s Values by ASTM Report Period

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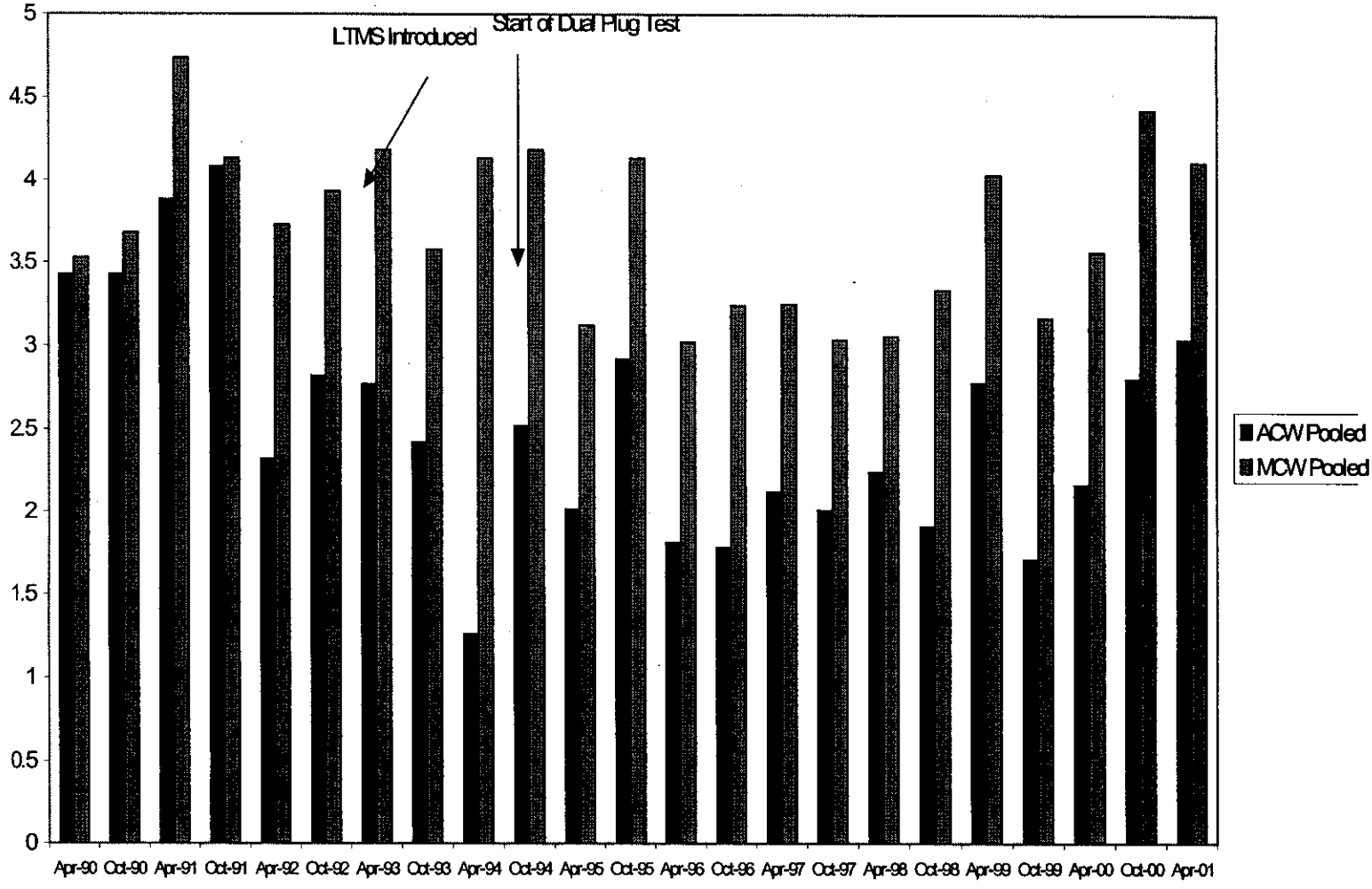

Test Monitoring Center
6555 Penn Avenue
Pittsburgh, PA 15206-4489
(412) 365-1000

Attachment 6
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Reference May 01

MEMORANDUM: 01-032

DATE: April 10, 2001

TO: Gordon Farnsworth, Chairman, Sequence VG Surveillance Panel

FROM: Richard E. Grundza

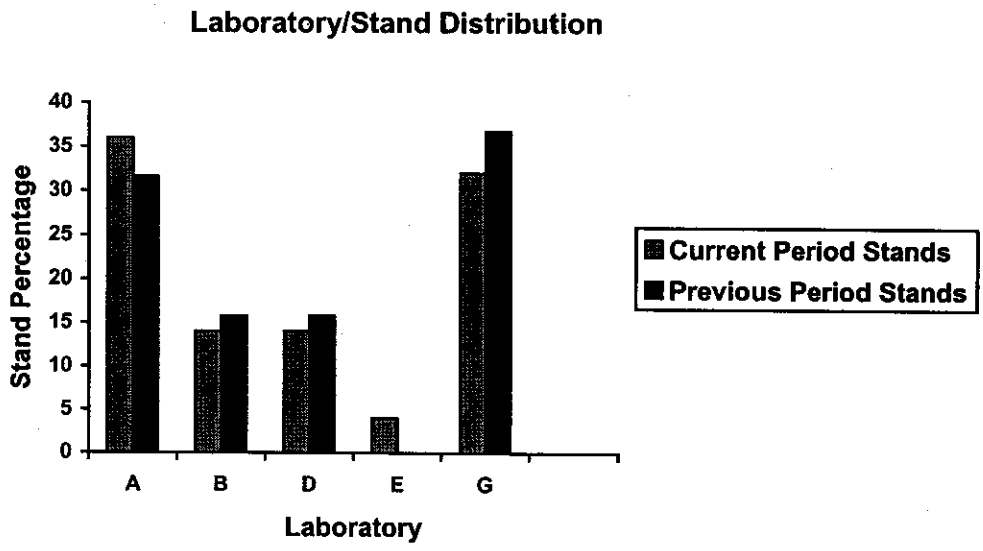
SUBJECT: Sequence VG Reference Test Status from October 1, 2000 through March 31, 2001

The following is a summary of Sequence VG reference tests that were completed during the period October 1, 2000 through March 31, 2001.

Lab/Stand Distribution

	Reporting Data	Calibrated as of 3/31/01
Number of Laboratories	5	5
Number of Stands	23	16

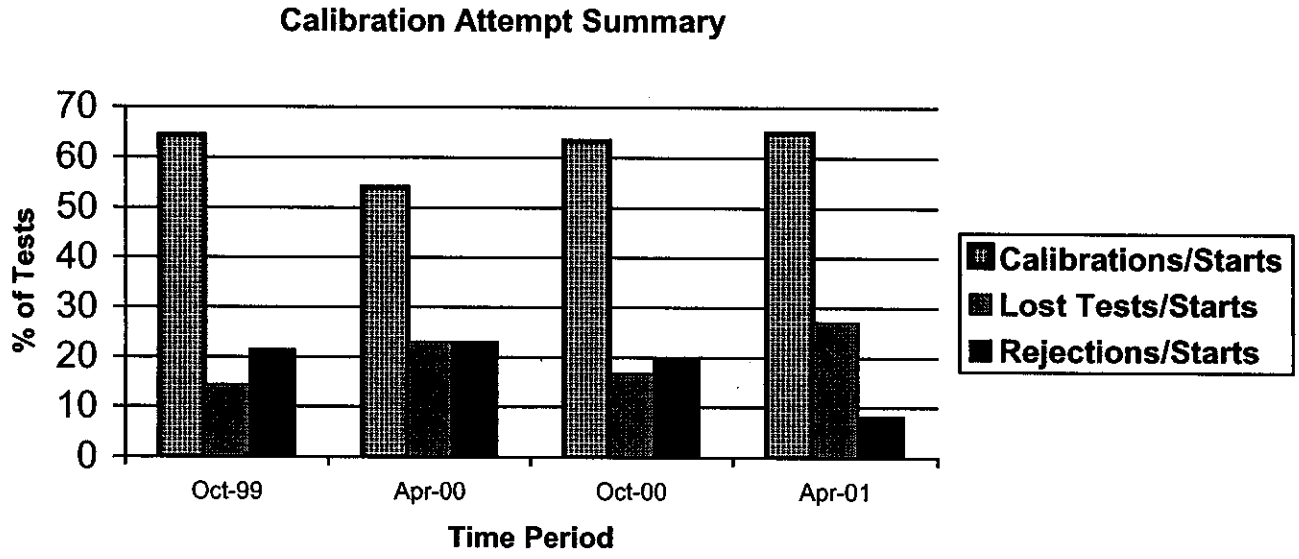
The following chart shows the laboratory/stand distribution:



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	19
Failed Acceptance Criteria	OC	2
Operationally Invalid, Lab Judgement	LC	8
Data Removed from Stand Chart	MC	1
Total		30

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



The calibration per start rate is comparable to both the previous period and also compares well with the historical rate. The lost test per start has increased and rejected test per start rate has decreased with respect to the previous period. The lost test rate is somewhat higher than the historical rate and rejected test per start rate appears to be somewhat lower than the historical rate.

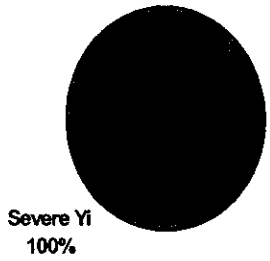
A detailed list of reasons tests failed the acceptance criteria is shown in the following table.

Reason	Number of Tests
Severe RACS	2

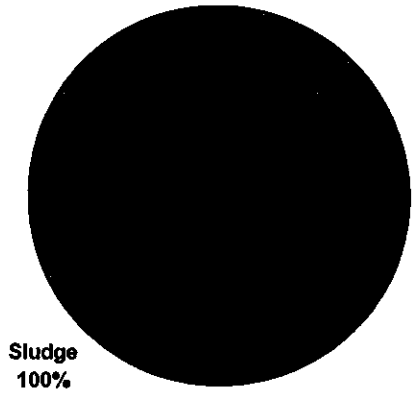
Failing RACS results were noted in two labs with different reference oils.

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



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

Reason	Number of Tests
Rocker Arm Cover Temperature Control Problems	4
Dyno Coil Shorted out	1
Computer Problems	1
Average Blowby Outside 23 –119 Hour Specifications, Low	1
Excessive Dyno Water Pressure, Damage to Dyno	1

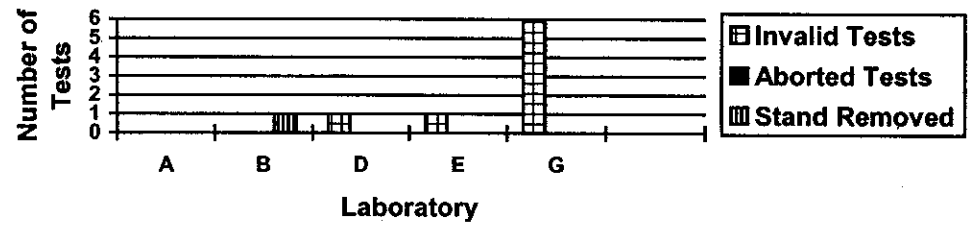
The following table lists the reasons for Data Removed From Stand Chart test.

Reason	Number of Tests
Reworked RAC Cover Flow System.	1

One test was coded as stand data removed from system (MC). This result failed severe on an existing stand. Subsequent investigations into the failing result disclosed problems with the rocker cover system. The laboratory corrected the rocker cover cooling system problems, successfully completed a shakedown run and the first of two reference oil tests required to bring the stand back into the system.

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

Lost Test Distribution



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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.

Variable	Pooled s All Oils	Mean Delta/s	Confidence Interval	Based on	Delta in Reported Units
RAC	0.346	-0.428	7.69 – 8.10	8.0	-0.15
AES	0.530	-0.056	7.53 – 8.01	7.8	-0.03
APV	0.110	0.019	7.45 – 7.55	7.5	0.00
AEV	0.160	0.194	8.86 – 9.00	8.9	0.03
OSCR	0.741	-0.080	13.9 - 28.2	20	-1.2

The mean Δ/s for this period shows AEV (0.194) was mild, RACS (-0.428) was severe and AES (-0.056), APV (0.019) and OSCR (-0.080) were all on or near target. Figures 1 through 5 are current industry severity and precision EWMA control charts and plots of summations Δ/s for AES, RAC, AEV, APV, and OSCR.

Industry control charts for AES severity and precision were in control for the period. The summation Δ/s plot shows a small (~ five test) severe trend during the middle of the period, with a level trend on either side of this short trend.

RAC severity began the period in control, but sounded a series of three warning alarms, which cleared for one test, followed by another one test warning alarm. After the second warning alarm clears, the chart remains in control for the remainder of the period. The severity alarm sounds when a severe result from one lab is reported. This result (-2.639 Δ/s) was on reference oil 925-3, whose targets were set with only four test results. A subsequent reference test in the same stand with reference oil 925-3 was much closer (-1.611Δ/s) to target. The severity EWMA alarm clears for one test, when a one test warning alarm sounds, caused by a test from a different lab with a different reference oil, which was –2.75 Δ/s from target. Subsequent tests clear the alarm and EWMA severity remains in control for the remainder of the period. With the exception of one warning alarm, caused by the –2.75 Δ/s result, EWMA precision was in control for the period. The summation Δ/s chart shows a severe trend beginning about midway through the period.

AEV severity and precision charts were in control for the period. The summation Δ/s plots show a mild trend about ten tests into the period, which continues for approximately six tests, before returning near target for the remainder of the period.

APV severity and precision charts were in control the entire period. The summation Δ/s plots show APV on or near target for the period.

Oil screen clogging severity and precision charts were in control for the period. The summation Δ/s charts reflects an on or near target trend the first half of the period, and trending mild the remainder of the period.

Figures 6 and 7 chart the pooled precision estimates for all monitored parameters, by ASTM report period. Figure 6 shows precision for RAC is about the same as the previous period and OSCR has shown some improvement with respect to the previous period and both have shown significant improvement when compared to historical rates. AES precision is directionally poorer than the previous period, but still compares well with historical rates. Figure 7 also shows significant degradation for both APV and AEV when compared to the previous period. APV has also seen a significant degradation when compared to historical estimates, while AEV has degraded with respect to the previous period, but compares well with historical rates.

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	227	78	5	3+ years
1006	1130	376	6	~1 year
1007	618	206	8	~18 months

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

Information Letters

Information Letter 00-3 was issued on November 1, 2000. This information letter revised Section clarified how to transform oil screen clogging results given in Section13.4.1 and made report forms and data dictionary changes, as documented in version 20000831. Information Letter 01-1 was issued on January 16, 2001. This information letter updated the method for determining water in the fuel, deleted Section 7.1.1 which refers to Hardware Control Guidelines in Section D0.2.B0, 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% O_2 calibration gas, modified fuel injector flow requirements and updated Appendix X2. Information Letter 01-2 was issued March 20, 2001. 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.

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Information Memos

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

Memo	Date	Subject
00-134	10/6/00	Sequence VG Semi Annual Report
00-175	11/20/00	Reference Oil Target Update, Reference Oils 1006 and 1007
00-178	11/29/00	Reference Oil Target Update, Reference Oil 925-3
01-1	1/3/01	Report Forms and Data Dictionary, Version 20001214
01-5	1/5/01	Proposed Changes to Precision Statement in Test Method D6593
01-6	1/12/01	Fuels and Reference Oil Report, Months of November and December 2000
01-7	1/16/01	Corrections to Report Forms and Data Dictionary, Version 20001214
01-15	2/7/01	Fuels and Reference Oil Report, Month of January 2001
01-18	3/8/01	Fuels and Reference Oil Report, Month of February 2001

TMC Activities

During this report period, the TMC visited one lab with no significant discrepancies noted.

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 and 925-3.

Parameter	Severity Adjustment Standard Deviation (n = 30)	Pooled Standard Deviation, Oils 925-3, 1006 and 1007 (n =21)
AES	0.51	0.530
RCS	0.24	0.350
AEV	0.10	0.171
APV	0.18	0.204
OSCR	0.828	0.741

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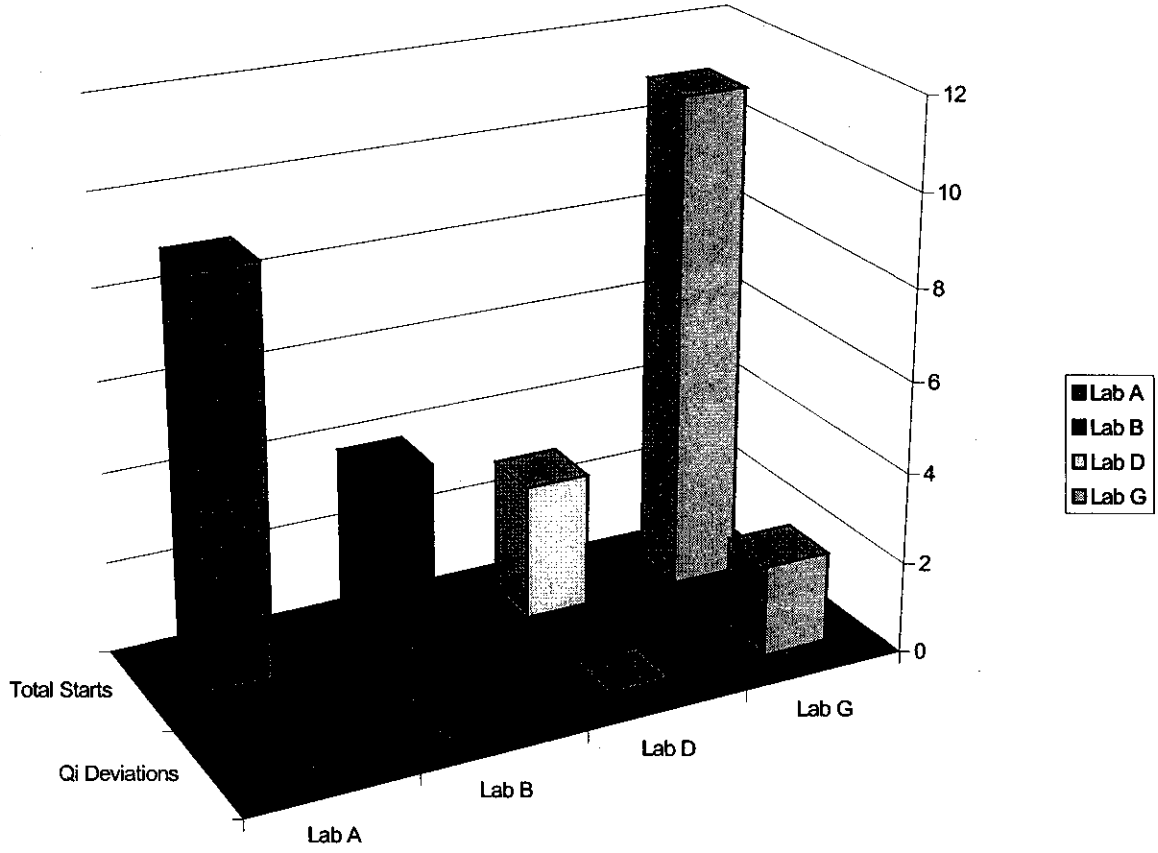
QI Deviations

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
Power and Engine Coolant Flow	1
Power	1
Manifold Absolute Pressure	1
Rocker Cover Inlet Temperature	1

Both the power and power in conjunction with engine coolant flow deviations were evaluated for different stands in the same lab. The power deviations were traced to a failure to properly adjust the throttle cable, which would not allow the throttle to fully close during stage 3. The Engine coolant flow deviation was caused by a closed bypass valve in the system, which was not identified until the stand was shutdown by a low coolant flow alarm. The manifold absolute pressure deviation was caused by a sticking throttle body. The rocker cover coolant temperature deviation was caused by a heater failure. In all cases,corrective action was taken to resolve the cause of the QI deviation.

Attachment	6
Page	8 of 17
Reference	May 01

Summary

Calibrations per start compares well with the previous period and historical rates, while the rejected tests per start rate has decreased and the lost test per start rate has increased with respect to the previous period. AES, OSCR and APV are on or near target, RAC was severe and AEV was mild for the period. Precision for AES is comparable with previous period and historical estimates. RAC precision has shown improvement with respect to the previous period and compares well with historical rates. AEV and APV precision have degraded significantly with respect to the previous period. AEV precision is comparable to historical rates, while APV precision has degraded significantly with respect to historical estimates. OSCR precision compares well with respect to the previous period and has shown improvement with respect to historical rates.

REG/reg

Attachments

c: Sequence VG Surveillance Panel
ftp://www.tmc.astm.cmri.cmu.edu/docs/gas/sequencev/semiannualreports/vg-4-2001
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.

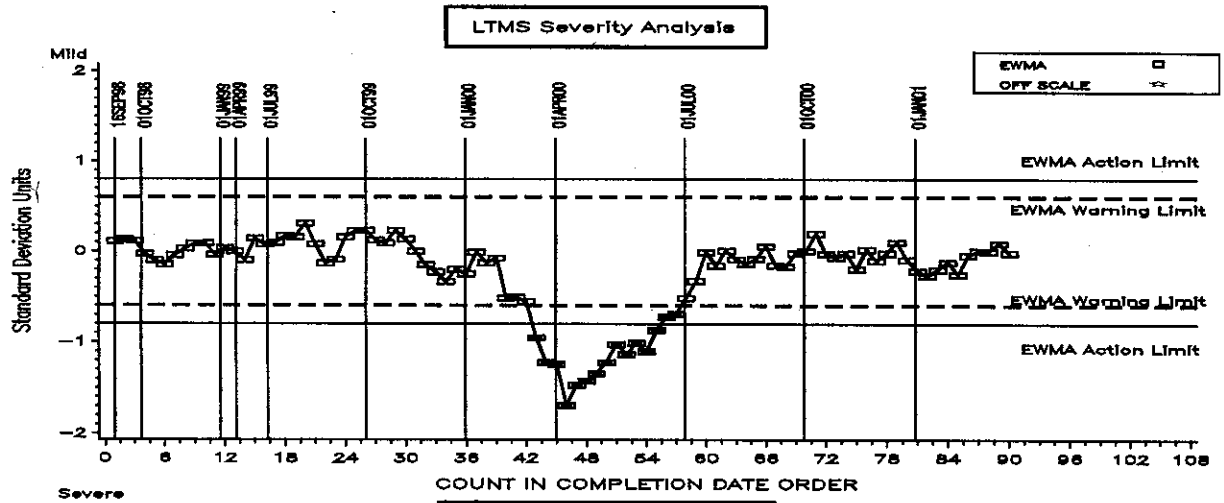
Figures 6 and 7 compare pooled precision estimates from this report period with previous periods.

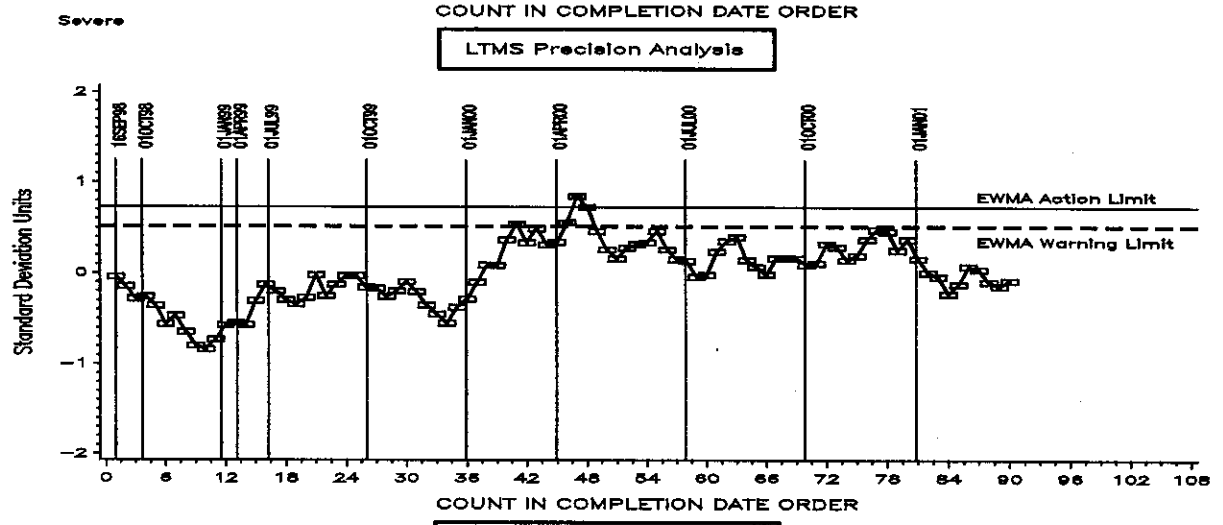
Figure 8 is the Industry Timeline.

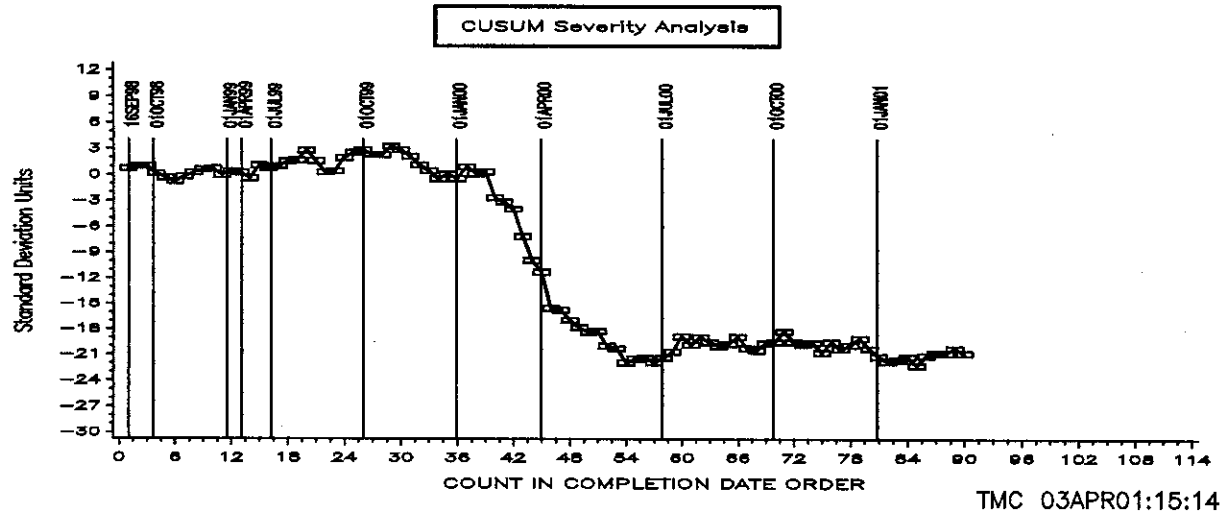
Attachment 6
Page 10 of 17
Reference May 01
Figure 1

SEQUENCE VG INDUSTRY OPERATIONALLY VALIDATA

AVERAGE ENGINE SLUDGE





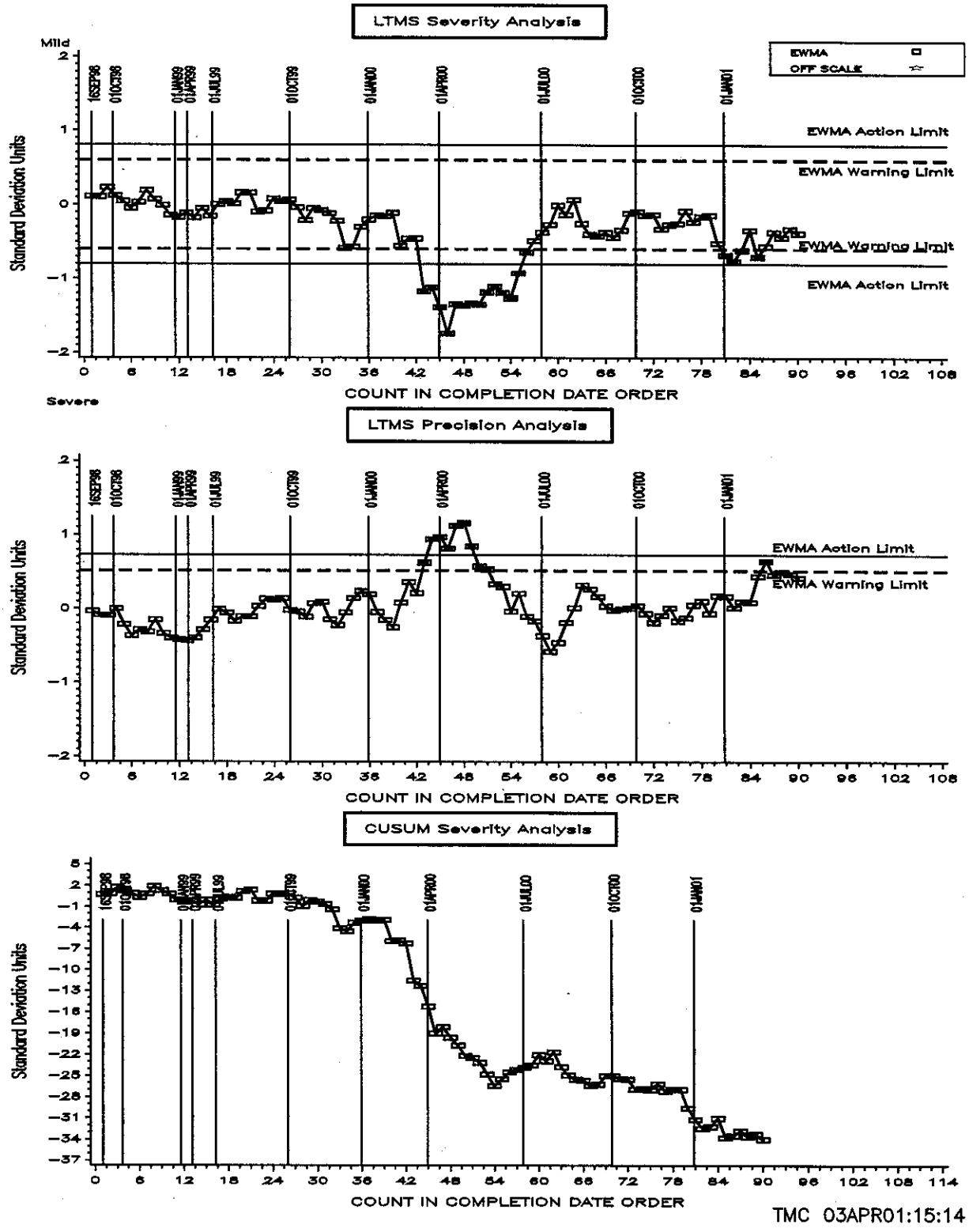


TMC 03APR01:15:14

SEQUENCE VG INDUSTRY OPERATIONALLY VALID DATA

AVERAGE ROCKER COVER SLUDGE

Figure 2



Attachment 6
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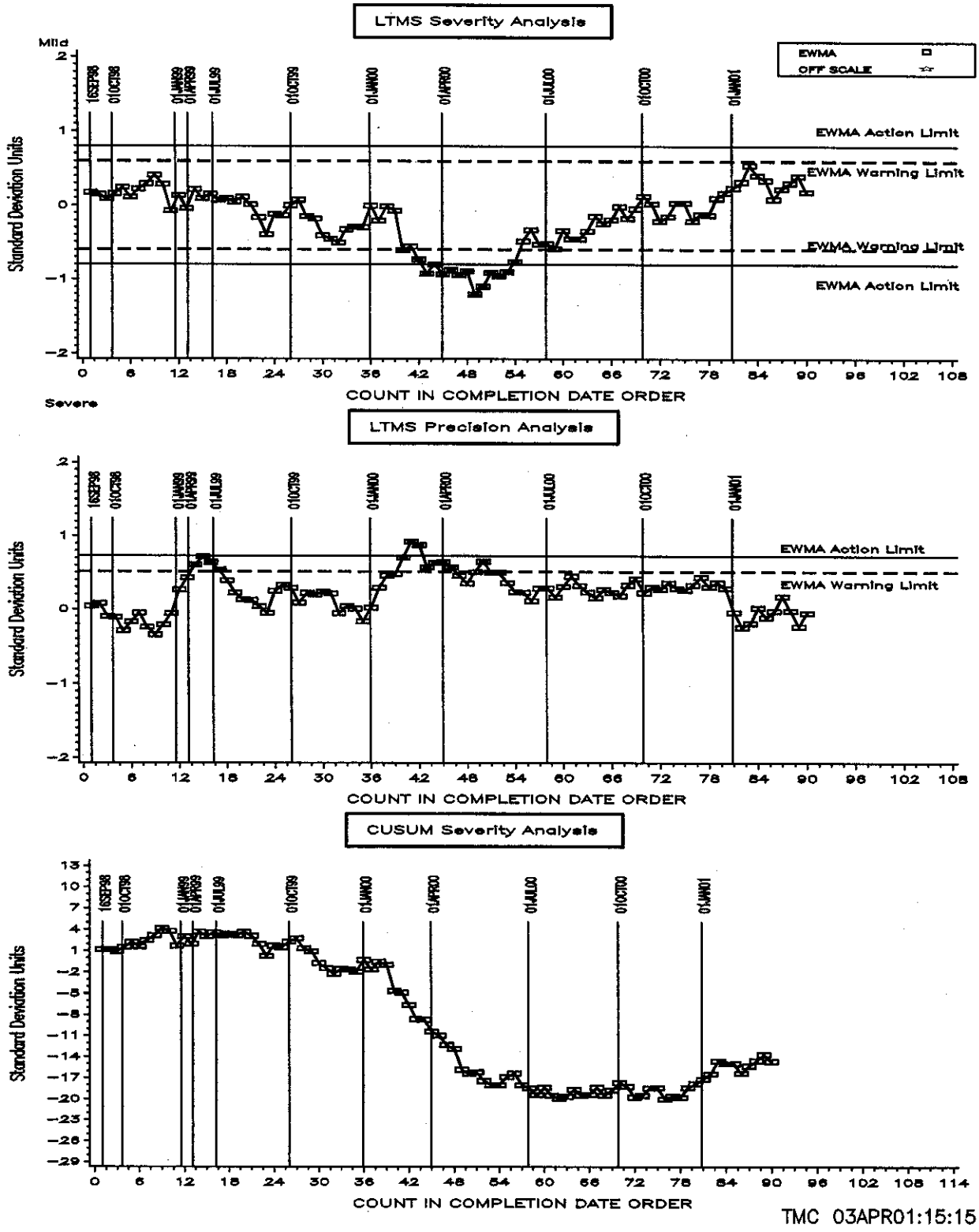
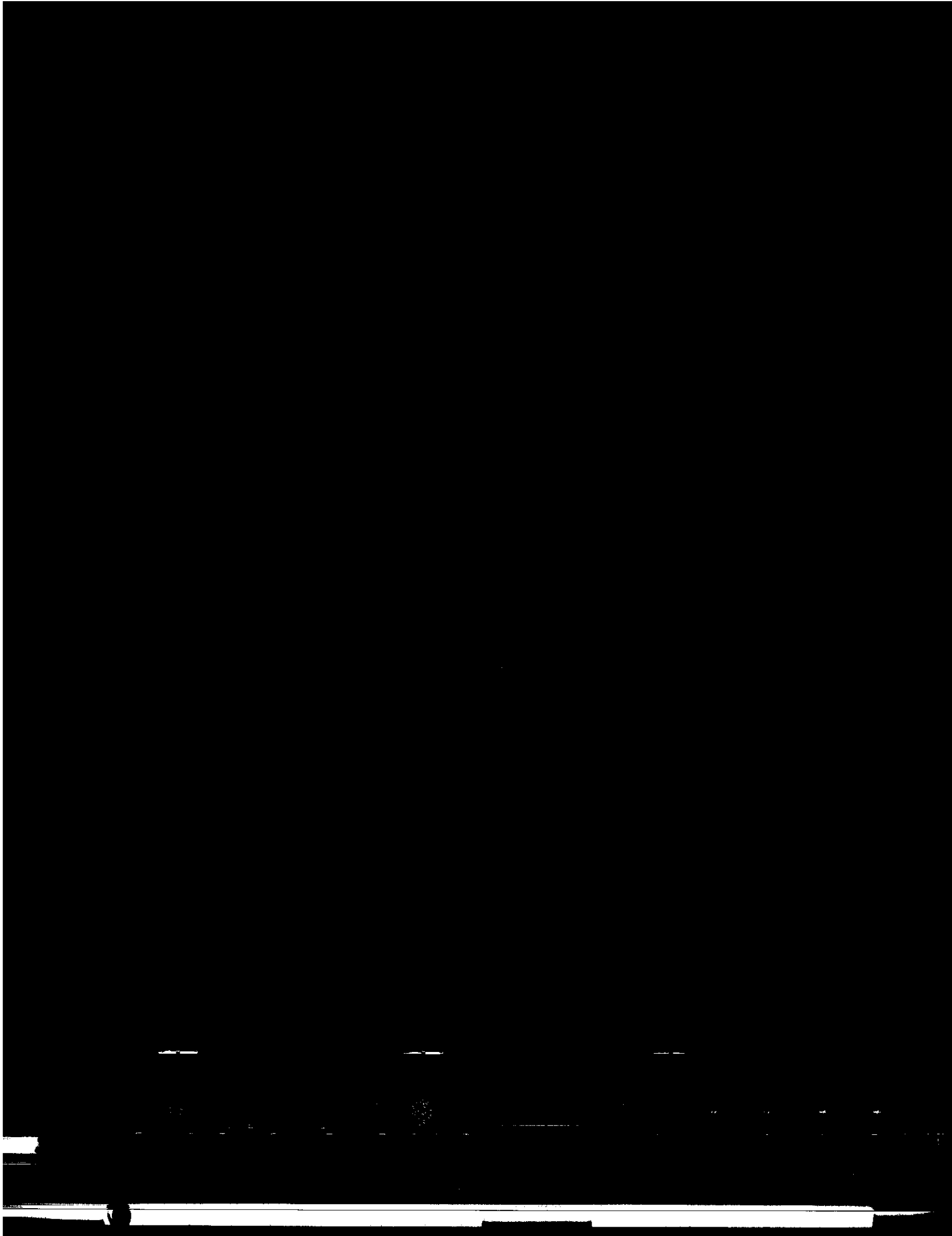
Reference May 01
Figure 3

SEQUENCE VG INDUSTRY OPERATIONALLY VALID DATA

AVERAGE ENGINE VARNISH 3–PART FINAL RESULT





Attachment 6
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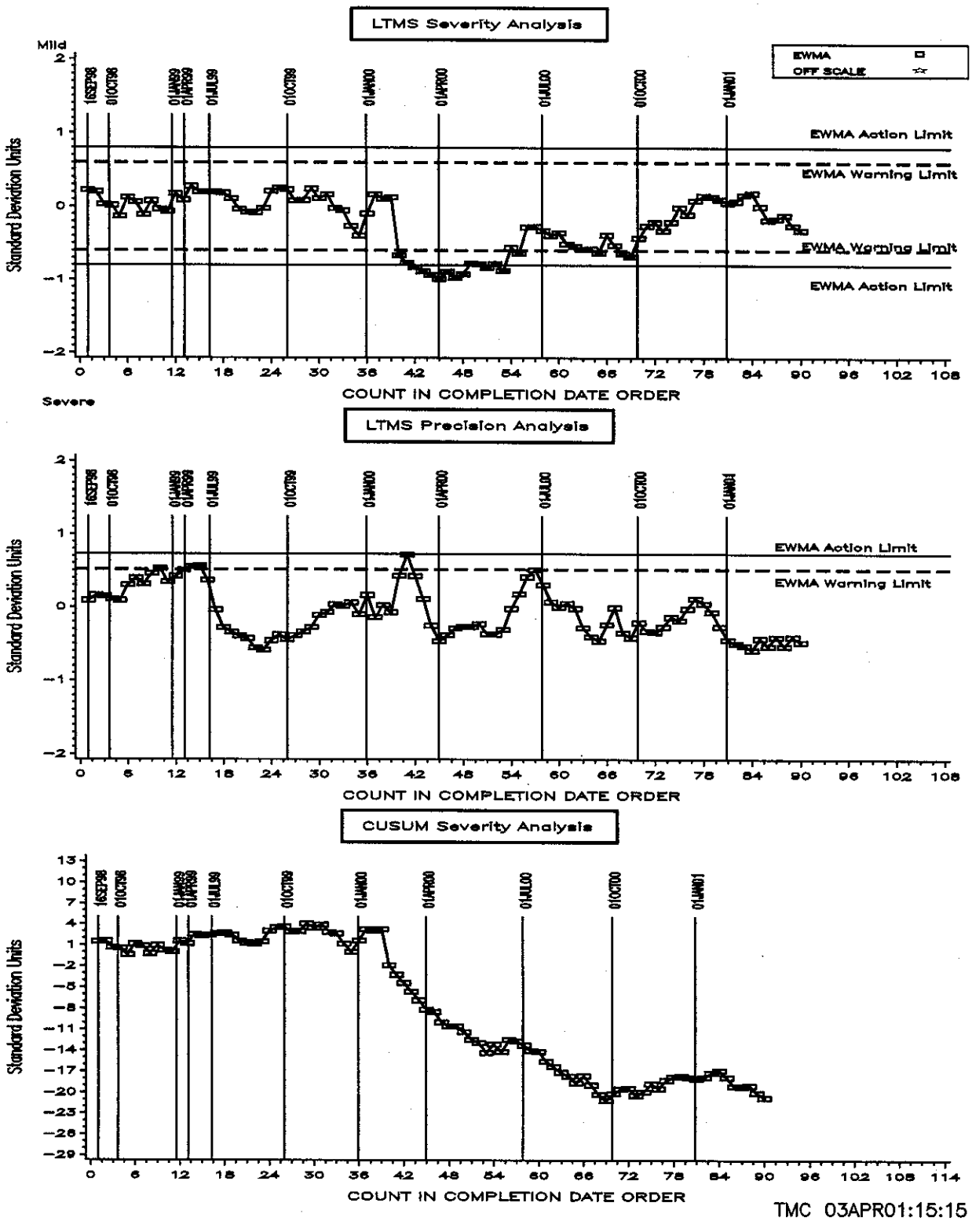
Reference Figure 4 May 01

SEQUENCE VG INDUSTRY OPERATIONALLY VALID DATA

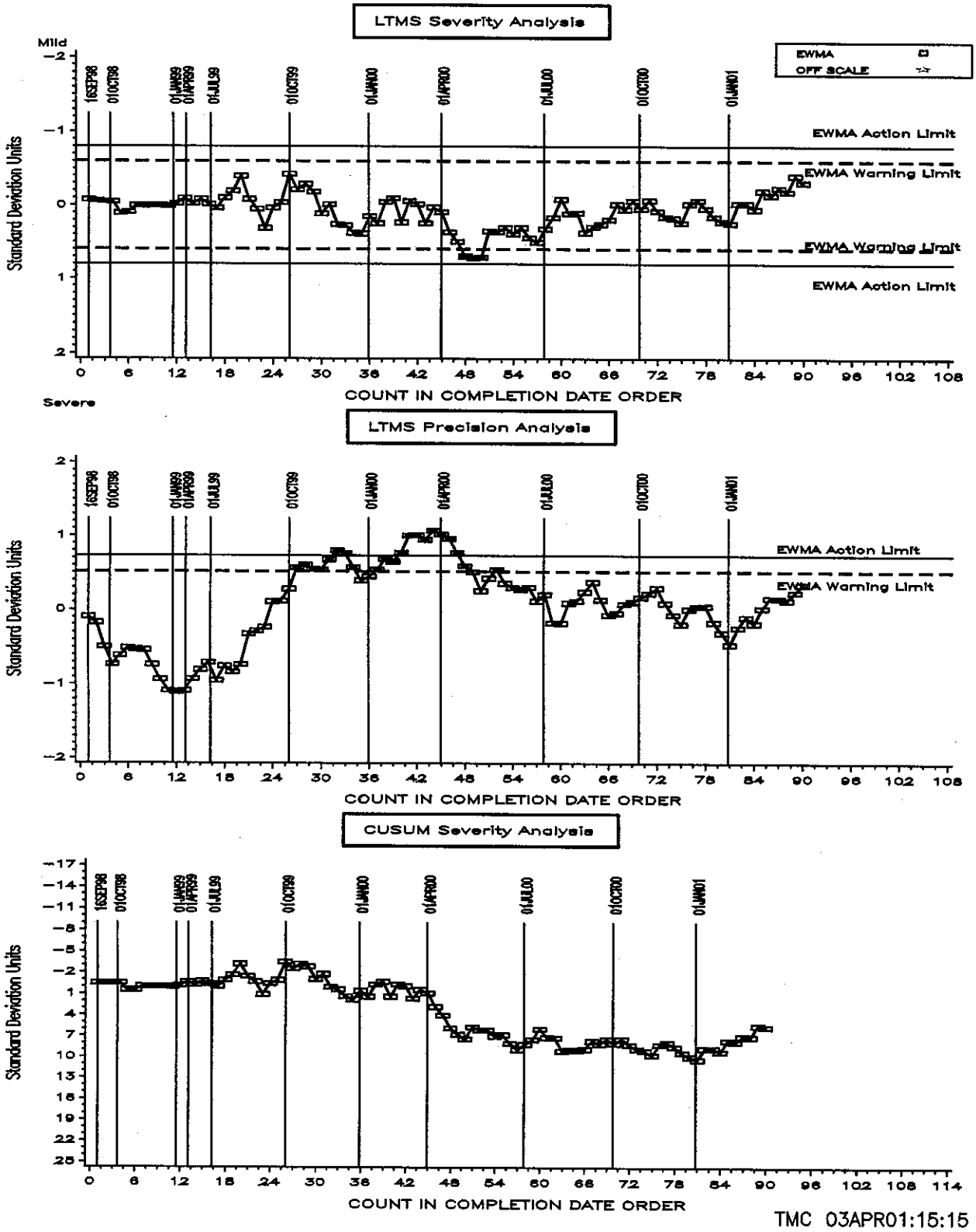
AVG PISTON SKIRT RATING (MERITS)



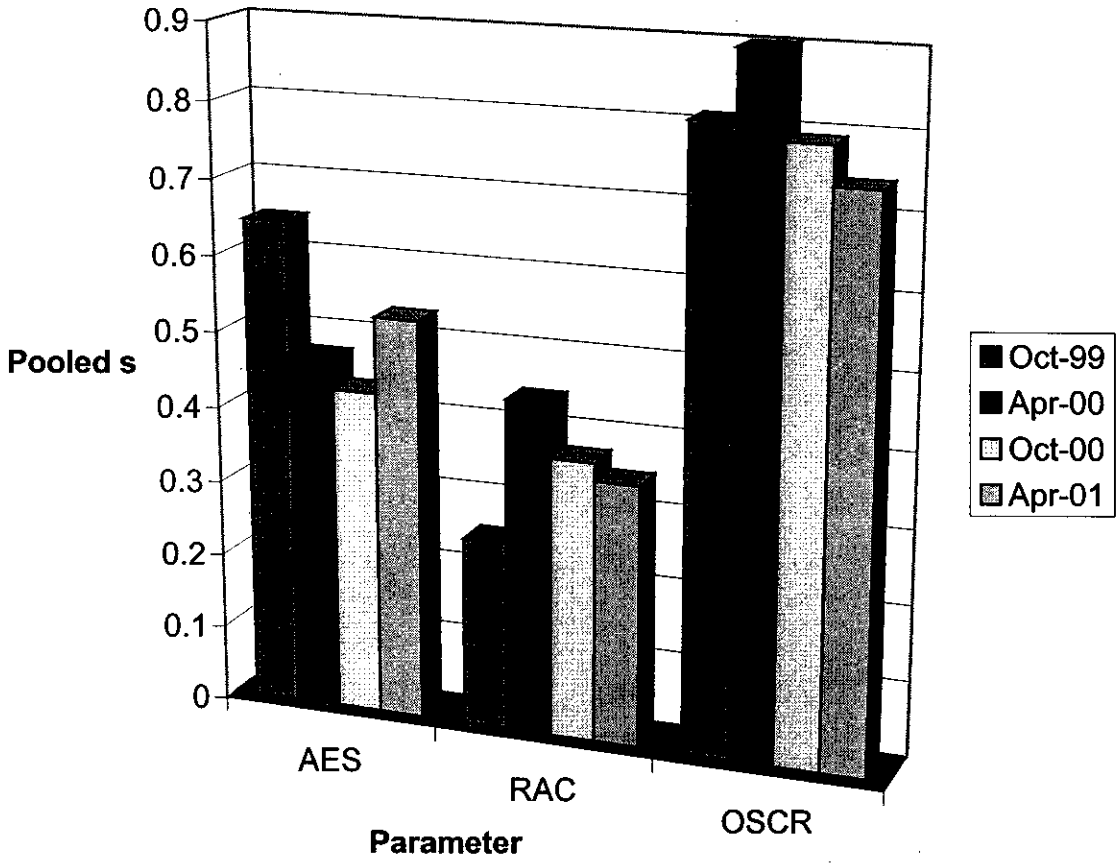
Attachment 6
Page 14 of 17
Reference Figure 5 May 01

SEQUENCE VG INDUSTRY OPERATIONALLY VALID DATA

OIL SCREEN SLUDGE



Comparison of Pooled Precision Estimates By ASTM Report Period



Pooled s in Original Units, with the Exception of OSCR, Which is transformed using ln(OSCR + 1)

Attachment	6
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Reference	May 01

Figure 7

Comparison of Pooled Precision Estimates By ASTM Report Period

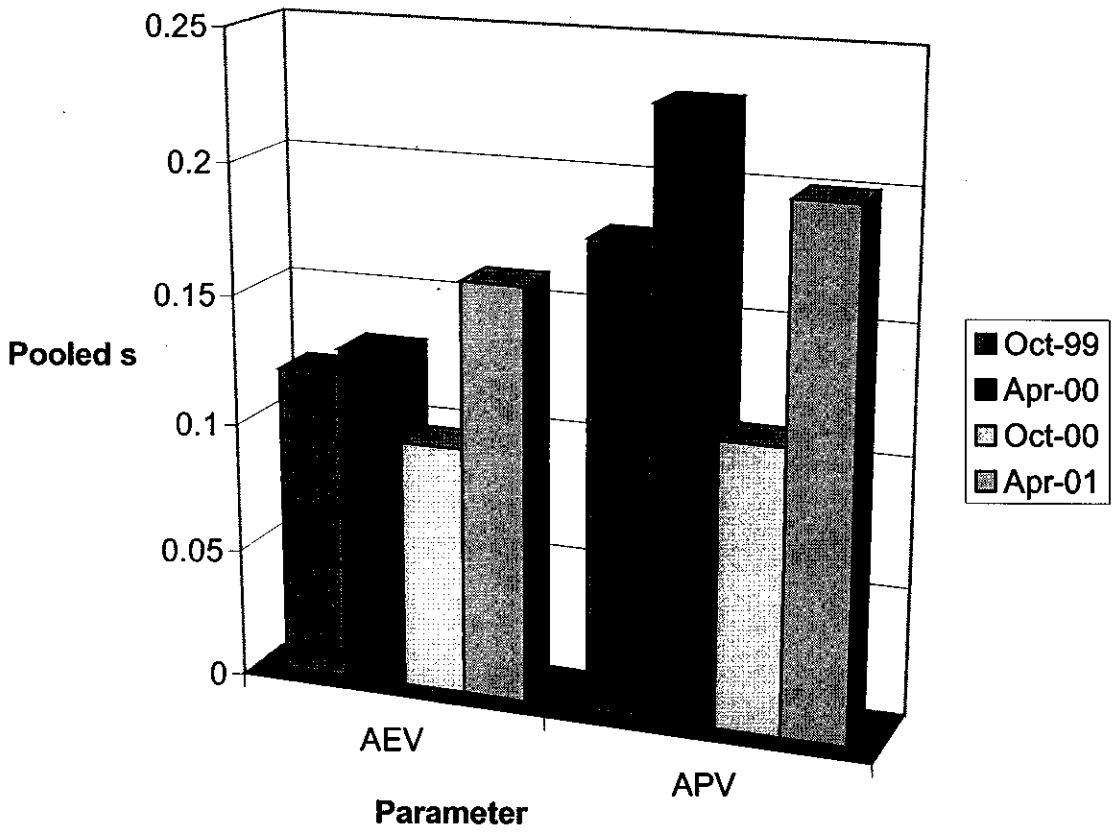


Figure 8
Sequence VG Industry Timeline

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 Surveillance Panel meeting.
19991025	99-3	Revised Exhaust Backpressure limits for stages I and II to 102 and 106 kPa, repectively
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 Changed bore wear measurements from all cylinders to cylinders 1 and 8.
20000802	00-2	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 changes, version 20000831
20010115	01-1	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.

Attachment	7
Page	1 of 2
Reference	May 01

Seq. VG Semi-Annual Report
Six-Month Period Ending March 2001

SEQUENCE VG STATUS OF REPORTED TESTS

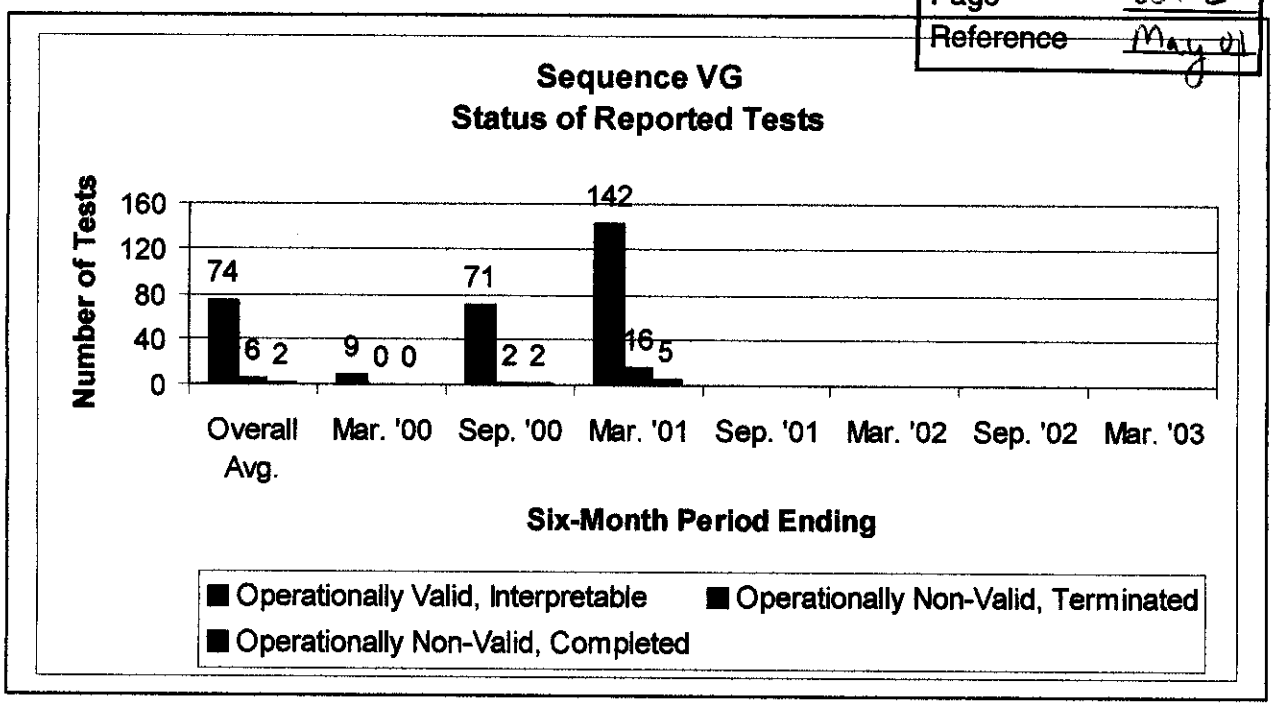
STATUS	N	PERCENT
Operationally Non-Valid, Terminated	16	9.8
Operationally Non-Valid, Completed	5	3.1
Operationally Valid, Interpretable	142	87.1
Total Reported Tests	163	100.0

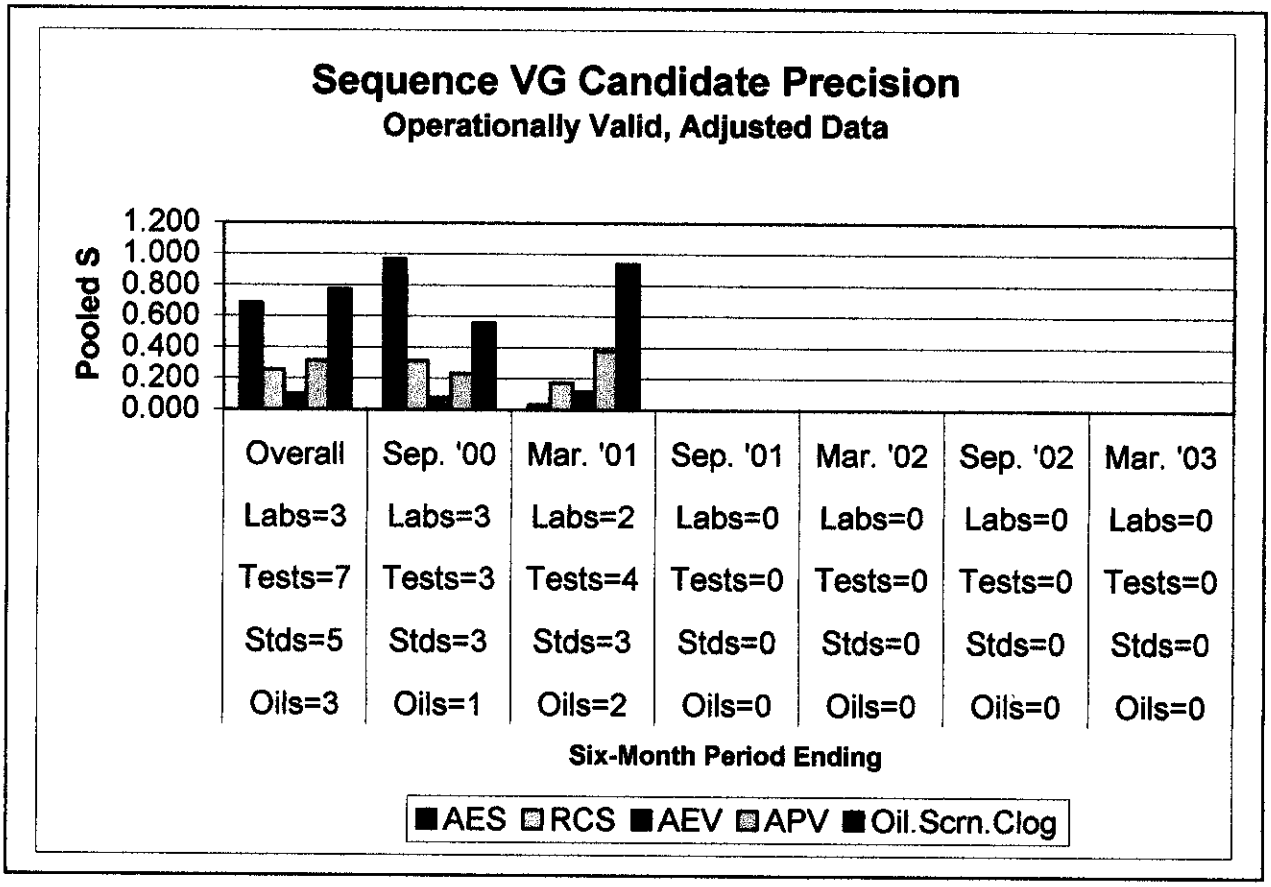
CAUSES FOR LOST TESTS	N
Blowby	4
Oil Consumption	2
Control Problems	2
Engine Mechanical Problems	3
Support Equipment Problems	1
Sponsor Request	9

SEQUENCE VG PRECISION

COMPONENTS OF REPLICATE DATA BASE	N
Number of Tests	4
Number of Oils	2
Number of Labs	2
Number of Stands	3
Number of Severity Adjusted Average Engine Sludge Tests	1
Number of Severity Adjusted Rocker Cover Sludge Tests	1
Number of Severity Adjusted Average Engine Varnish Tests	3
Number of Severity Adjusted Average Piston Varnish Tests	1
Number of Severity Adjusted Oil Screen Sludge Tests	1

VARIABLE	Pooled s	R
Average Engine Sludge, Non-Adjusted	0.210	0.558
Average Engine Sludge, Adjusted	0.035	0.099
Rocker Cover Sludge, Non-Adjusted	0.035	0.099
Rocker Cover Sludge, Adjusted	0.175	0.490
Average Engine Varnish, Non-Adjusted	0.151	0.423
Average Engine Varnish, Adjusted	0.117	0.327
Average Piston Varnish, Non-Adjusted	0.336	0.940
Average Piston Varnish. Adjusted	0.378	1.059
Oil Screen Sludge, Non-Adjusted	1.243	3.481
Oil Screen Sludge, Adjusted	0.938	2.627


Sequence VG
Status of Reported Tests
Number of Tests
160
120
80
40
0
74
6 2
9
0 0
71
2 2
142
16
5
Overall Avg.
Mar. '00
Sep. '00
Mar. '01
Sep. '01
Mar. '02
Sep. '02
Mar. '03
Six-Month Period Ending
Operationally Valid, Interpretable
Operationally Non-Valid, Terminated
Operationally Non-Valid, Completed


Sequence VG Candidate Precision
Operationally Valid, Adjusted Data
Pooled S
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Overall
Labs=3
Tests=7
Stds=5
Oils=3
Sep. '00
Labs=3
Tests=3
Stds=3
Oils=1
Mar. '01
Labs=2
Tests=4
Stds=3
Oils=2
Sep. '01
Labs=0
Tests=0
Stds=0
Oils=0
Mar. '02
Labs=0
Tests=0
Stds=0
Oils=0
Sep. '02
Labs=0
Tests=0
Stds=0
Oils=0
Mar. '03
Labs=0
Tests=0
Stds=0
Oils=0
Six-Month Period Ending
AES
RCS
AEV
APV
Oil.Scrn.Clog

Sequence V Reference Oils and Fuels Report

Dan Worcester 05.23.2001

- **Phillips "J" Fuel**

  - Quantity in storage at ChevronPhillips 148K gallons
    Fuel at the laboratories 30K gallons
    Total "J" fuel 178K gallons
    Assume 7% used for other tests (13K) gallons
    "J" fuel for VE testing 165K gallons

    Approx. # of VE tests remaining 237 tests

  - **Batch 43 "J" Fuel Aging**
    The batch was blended in 1994
    The latest analysis of the fuel in the ChevronPhillips storage tank indicates that it *has not* "deteriorated".

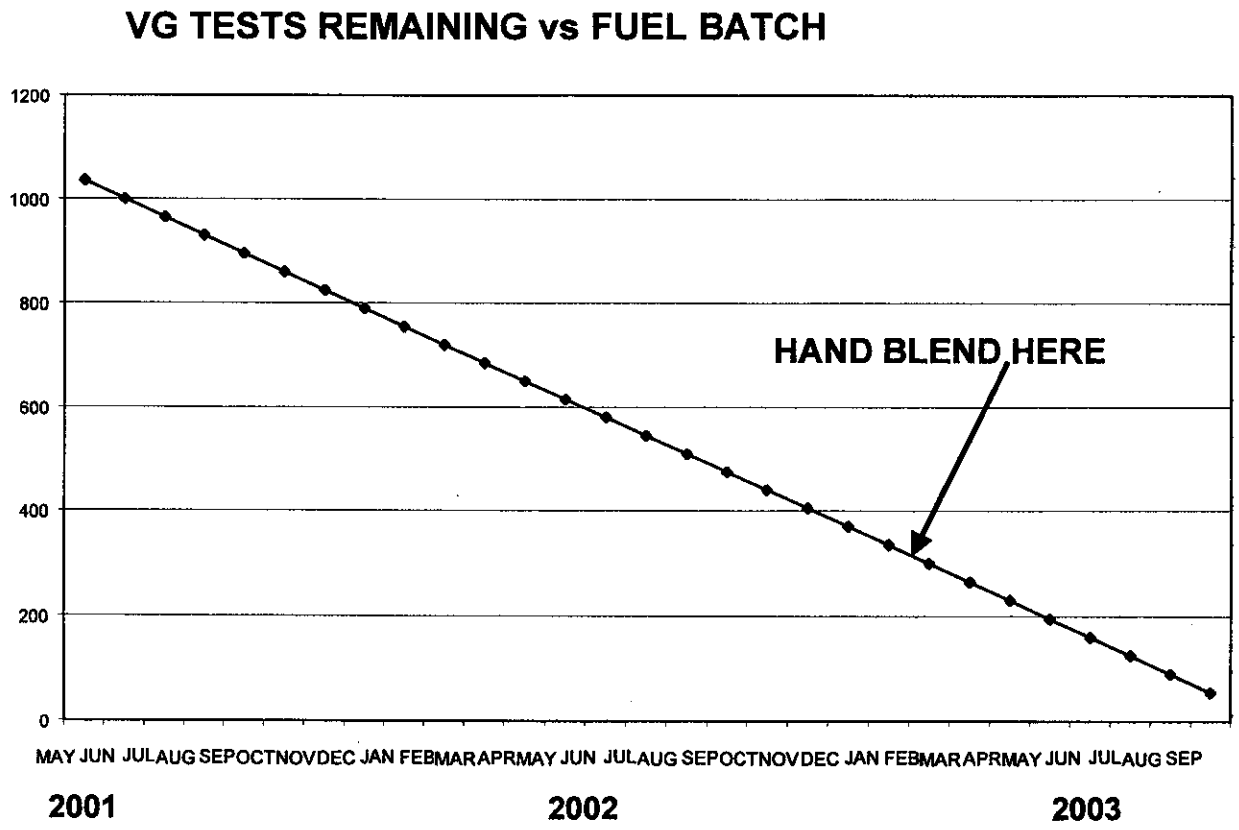
	Analysis Date	
Parameter	**02/22/1995**	**04.25.2001**
API Gravity	54.2	52
Initial Boiling Point (F)	100	100
10%	130	138
50%	217	228
90%	329	335
Final Boiling Point (F)	427	450
Reid Vapor Pressure (psi)	8.0	6.9
Existant Gums (mg/100ml)	1.2	2.1
Gums after induction (mg/100ml)	10.2	pending
Induction minutes to Break	2280	pending

VG Fuel

- The detailed analyticals from the storage tank are being sent to the TMC.

Quantity in storage at Haltermann	665K gallons
Fuel at the laboratories	60K gallons
Total "VG" fuel	725K gallons
Approx. # of VG tests (700 gal/test)	**1035 tests**

- Recommend "hand blend" 6-9 months prior to projected outage.
- Current testing rate is 35 per month – calibration and candidate.



PRODUCT INFORMATION

Haltermann PRODUCTS

T (281) 457-2768 F (281) 457-1469

PRODUCT: SVGM2

PRODUCT CODE: HF295

Batch No.:	9906416	9906416	9906416	9906416
TMC No.:	n/a	n/a	n/a	n/a
TMO No.:	n/a	n/a	n/a	n/a
Tank No.:	74	74	74	74
Analysis Date:	4/3/01	3/1/01	2/5/01	1/8/01

TEST	METHOD	UNITS	RESULTS	RESULTS	RESULTS	RESULTS
Distillation - IBP	ASTM D86	°F	89	85	85	88
5%		°F	114	112	110	111
10%		°F	128	126	125	126
20%		°F	151	150	150	149
30%		°F	181	180	179	181
40%		°F	211	213	213	214
50%		°F	230	230	231	220
60%		°F	242	242	241	241
70%		°F	257	257	257	258
80%		°F	290	292	290	291
90%		°F	342	342	342	341
95%		°F	356	358	359	359
Distillation - EP		°F	392	399	398	393
Recovery		vol %	97.0	97.8	97.9	98.0
Residue		vol %	1.0	1.0	1.0	1.0
Loss		vol %	2.0	1.2	1.2	1.0
Gravity	ASTM D4052	°API	57.3	57.2	57.2	57.3
Specific Gravity	ASTM D4052	-	0.7490	0.7499	0.7499	0.7499
Reid Vapor Pressure	ASTM D323	psi	9.0	9.0	8.9	9.0
Reid Vapor Pressure	ASTM D5191	psi	8.9	9.0	9.0	9.0
Sulfur	ASTM D4294	wt %	<0.015	<0.01	<0.01	<0.01
Lead	ASTM D3237	g/gal	<0.01	<0.01	<0.01	<0.01
Existent gum, washed	ASTM D381	mg/100mls	<1	<1	<1	<1

Haltermann
PRODUCTS

Attachment	10
Page	1 of 1
Reference	May 01

SEQUENCE VG FUEL REPORT

23-May-01

SALEABLE GALLONS AT HATLTERMANN PRODUCTS	665,000
GALLONS SHIPPED SIX MONTH PERIOD 10/1/2000-3/30/01	137,176
AVERAGE USAGE PER MONTH	22,863
NUMBER OF TESTS SUPPORTED BY PRESENT INVENTORY	950
NUMBER OF MONTHS OF INVENTORY ON HAND	29

1201 South Sheldon Road P.O. Box 429 Channelview, TX 77530-0429
T 281-457-2768 F 281-457-1469 CS 800-969-2542
Registered in England No. 000000 A trading division of Ascot Chemicals Limited
An Ascot Speciality Chemicals Company

Sequence VG Test Report

ASTM Sequence VG Surveillance Panel Meeting

San Antonio, Texas

May 23, 2001

Barry Jeceewski

Ford Motor Company

Fuels and Lubricants Engineering

New VG Engine Hardware Development

- Ford Romeo Engine Plant supplied 2,000 2000 Model Year 4.6L 2V engines.

- Current plans include 2 tests/block at 0.25 and 0.50 mm oversized cylinder bores to provide consistent bore surface finishes. All labs should plan on standardizing their cylinder boring and honing equipment.

- Several tests conducted with new engines indicate sludge and varnish deposits are comparable to AER built engines with minor hardware and procedure changes.

- Solicitation to distribute all 2,000 new engines and kits will be made 3nd quarter 2001 to assure engines are available a few months before testing is expected to start late 2001/early 2002.

- Assuming use of new engines starts 1/1/2002, 2 tests/block and 650 VG tests/year should meet VG test needs for about 5 years.

Attachment 11
Page 2 of 7
Reference May 01

Barry Jecewski
Ford Motor Company
Fuels and Lubricants Eng

Estimated VG Engine Availability and Test Plans
TMC Survey Taken October 2000

Lab	Test Stands	Engines * Available	Expected 2000 CY Tests	Expected 2001 CY Tests	Engines 1/1/2002
A	9	225	60	250	-25
B	3	98	24	85	+13
C	1	19	0	15	+4
D	3	70	65	95	-25
G	9	310	85	180	+130
Total	25	722	234	625	+97

Attachment 11
Page Reference 3 of 7
May 01

* Assumes total of 703 engines ordered from AER are included and none used for 2000 CY Tests.

* AER engines to be used prior to 2000 MY Romeo Built Engines.

Barry Jecewski
Ford Motor Company
Fuels and Lubricants Eng

Summary/Next Steps

-Test severity has been maintained at 264 Hours with EV-152 PCV change.

-Test severity has been maintained at 216 Hours with PCV change and oil charge reduction (2700grams).

-An 8 engine test hardware validation matrix will be run at SWRI and Perkin-Elmer

-

Sequence VG Tests with Production Engines from Romeo Engine Plant

	GF-3 Spec	AER Builds	29-7-80 (test #1)	29-8-81 (test #2)	29-9-82 (test #3)	29-10-83 (test #4)
Test Completion Date			2/13/2000	3/27/2000	4/9/2000	4/23/2000
Purpose			1st "F5" heads	1st "F8" heads	Compare to Test #2 "F8" hds	Repeat Test #2
Oil Code		1006	1006	1006	1006	1006
Cylinder Head			F5	F8	F5	F8
Bore Size		+0.5 mm	Production	Production	Production	Production
Comments			Standard bore pistons graphite manually removed	Standard bore pistons no graphite applied	Standard bore pistons Fed. Mogule no graphite applied tin plate	Standard bore pistons Fed. Mogule no graphite applied tin plate
AES	7.8 min	8.43 (7.05-9.65)	8.80	9.42	9.22	9.45
RCS	8.0 min	9.34 (8.87-9.81)	9.31	9.53	9.59	9.55
AEV	8.9 min	9.27 (9.05-9.49)	8.81	8.67	8.98	9.01
PSV	8.0 min	8.49 (8.20-8.92)	6.30	6.44	7.26	7.35
Hot Stuck Rings	None		None	None	None	None
Cold Stuck Rings	R & R		None	None	None	None
Oil Screen Clogging, %	20% max	2.99(-3.6-12.6)	15	1	0	5
Follower Pin Wear, max	R & R		8.3	11.0	9.6	9.3
Follower Pin Wear, avg	R & R		7.1	9.4	9.3	8.8
Cyl Bore Wear, max	R & R		17.0	26.0	6.0	6.0
Cyl Bore Wear, avg	R & R		6.8	2.0	0.5	0.1
Ring Weight Loss, max	R & R		92.5	78.1	90.7	85.6
Ring Weight Loss, avg	R & R		44.7	47.7	57.0	53.2
Average, Nox			3499	3188.0	3475.0	3473.0
Oil Consumption,grams			1823.0	1956.0	2018.0	1759.0
Fuel Dilution, Avg			8.4	6.8	6.7	6.8

Attachment 11
Page Reference 5 of 12
(Mike Riley)

Mike Riley/Barry Jecewski
Ford Motor Co
Fuel and Lubes Eng
5/31/2001

Sequence VG Tests with Production Engines from Romeo Engine Plant

29-11-84 (test #5)	29-12-85 (test #6)	29-13-86 (test #7)	29-14-87 (test #8)	29-15-88 (test #9)	(test #10) Void	7-8-21 (test #11)
6/30/2000	8/21/2000	9/10/2000	10/17/2000	12/14/2000	12/22/00 *	1/17/2001
	MAP 75 kpa	PCV = 2.5 cfm	PCV = 2.5 cfm	EV-152 PCV 2.5 cfm	EV-152 PCV 2.5 cfm	EV-152 PCV 2.5 cfm
	others 69 kpa	others 5 cfm	MAP 73 kpa	MAP 75 kpa	MAP 75 kpa	MAP 69 kpa
1006	1006	1006	1006	1006	1006	1006
	F5 & F8					
0.5mm oversize	0.5mm oversize	0.5mm oversize	0.5mm oversize	0.25mm oversize	0.50mm oversize	0.25mm oversize
Standard bore pistons Fed. Mogule no graphite applied tin plate	Standard bore pistons Fed. Mogule no graphite applied tin plate	Standard bore pistons Fed. Mogule no graphite applied tin plate	Standard bore pistons Fed. Mogule no graphite applied tin plate	Standard bore pistons Fed. Mogule no graphite applied tin plate	Test stopped @7:00 hrs coolant leak	Note: Test time =264 Hrs (on test 1-11-01)
9.24	8.41	8.64	9.10	9.34	n/a	8.79
9.44	9.2	8.56	9.39	9.48	n/a	9.43
9.40	9.24	9.43	9.37	9.39	n/a	9.47
8.43	8.41	8.65	8.45	8.56	n/a	8.63
None	None	None	None	None	n/a	None
None	None	None	None	None	n/a	None
0	1	5	0	0	n/a	4
11.9	10.6	4.8	7.9	8.1	n/a	
11.40	10.00	5			n/a	
11.0	9.0	11.0	11.0	14.0	n/a	
5.3	2.3	1.3	4.8	2.7	n/a	
95.4						
47.2						
3225.0	3257.0	3223.0	3375.0	3456.0		3273.0
1728.0	1646.0	1441.0	1974.0	1621.0		2052.0
6.8	6.0	6.3	7.9	8.2	n/a	

Attachment 11
Page Reference 6 of 7
May 01

Mike Riley/Barry Jecewski
Ford Motor Co
Fuel and Lubes Eng
5/31/2001

Sequence VG Tests with Production Engines from Romeo Engine Plant

29-17-90 (test #12)		29-18-91 (test #13)	AER Builds	29-19-91 (test #14)	29-19-91 (test #15)
1/25/2001		2/12/2001		5/8/2001	5/18/2001
EV-152 PCV 2.5 cfm		EV-152 PCV 2.5 cfm		EV-152 PCV 2.5 cfm	EV-152 PCV 2.5 cfm
MAP 69 kpa		MAP 69 kpa		MAP 69 kpa	MAP 69 kpa
1006	925-3	925-3	1006	1006	1006
0.50mm oversize	Target Acceptance Band	0.50mm oversize	+0.5 mm	0.25mm oversize	0.25mm oversize
Test #10 engine rebuilt (on test 1-14-01) Test time =264 Hrs		Test time =264 Hrs		Test time 144 Hrs Reduced oil fill (2300g)	Test time 216 Hrs Reduced oil fill (2700g)
8.49	6.440 4.946-7.934 merits	6.42	8.43 (7.05-9.65)	7.72	
9.12	7.600 6.9522-8.248 merits	7.00	9.34 (8.87-9.81)	9.05	
9.41	8.520 7.998-9.042 merits	8.16	9.27 (9.05-9.49)	9.42	
8.61	7.390 6.652-8.128 merits	7.53	8.49 (8.20-8.92)	8.08	
None		None		None	
None		None		None	
2		0	2.99 (-3.6-12.6)	0	
8.7		6.5		8.3	
8.50		6		6.0	
2.0		12.0		19.0	
-0.3		2.0		0.2	
3508.0		3374.0			
2234.0		2248.0		542.0	
6.6		7.5			

Attachment 11
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Reference May 01

Mike Riley/Barry Jecewski
Ford Motor Co
Fuel and Lubes Eng
5/31/2001

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Sequence V Operations & Hardware Report to the Sequence V Surveillance Panel; 05.23.2001

1. A meeting was held 01.18.2001 at Southwest Research Institute.

2. 2000 model new Romeo engines are being tested at SwRI.

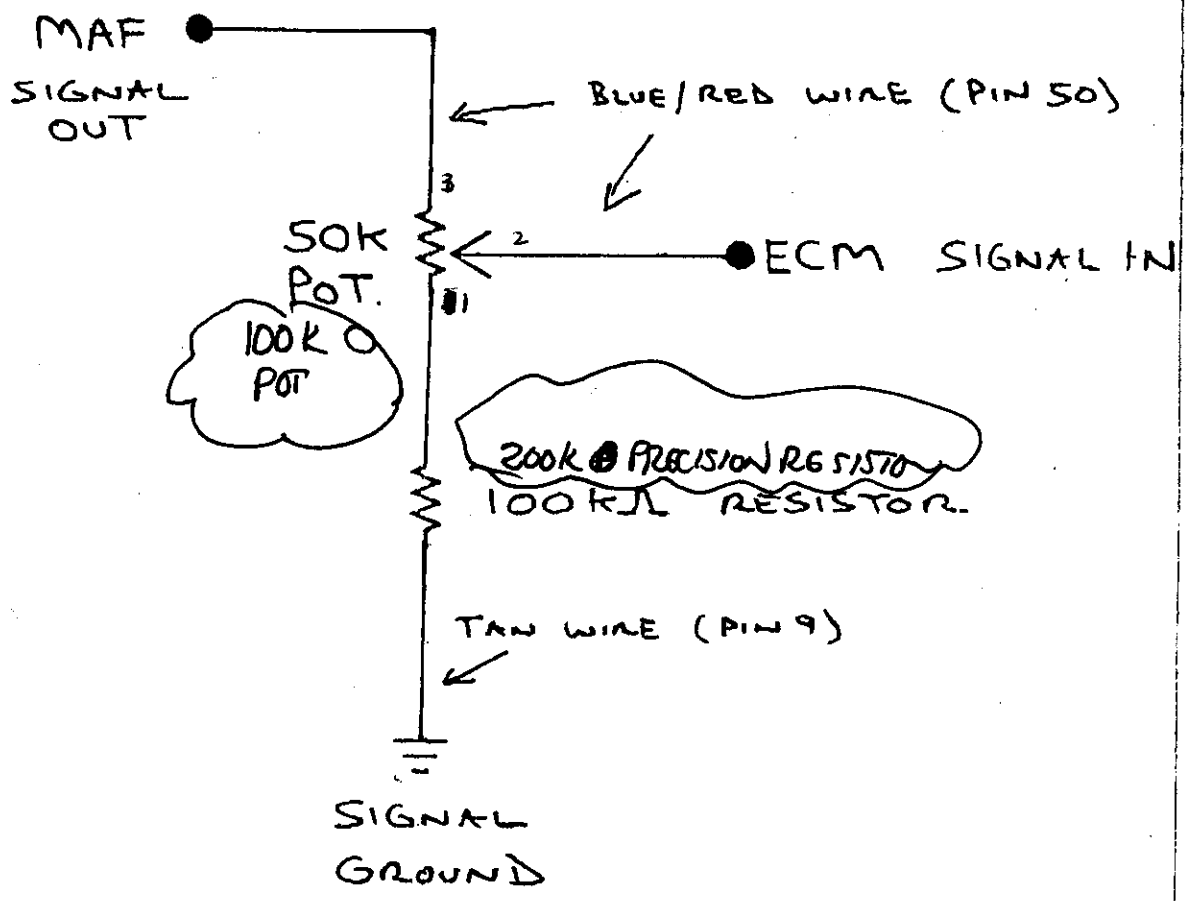
3. Fuel and AFR control trim potentiometers installed in wiring harness was made an action item for resolution.

4. Dwight Bowden will review torque specifications for the jacketed rocker cover.

Dan Worcester
Chairman

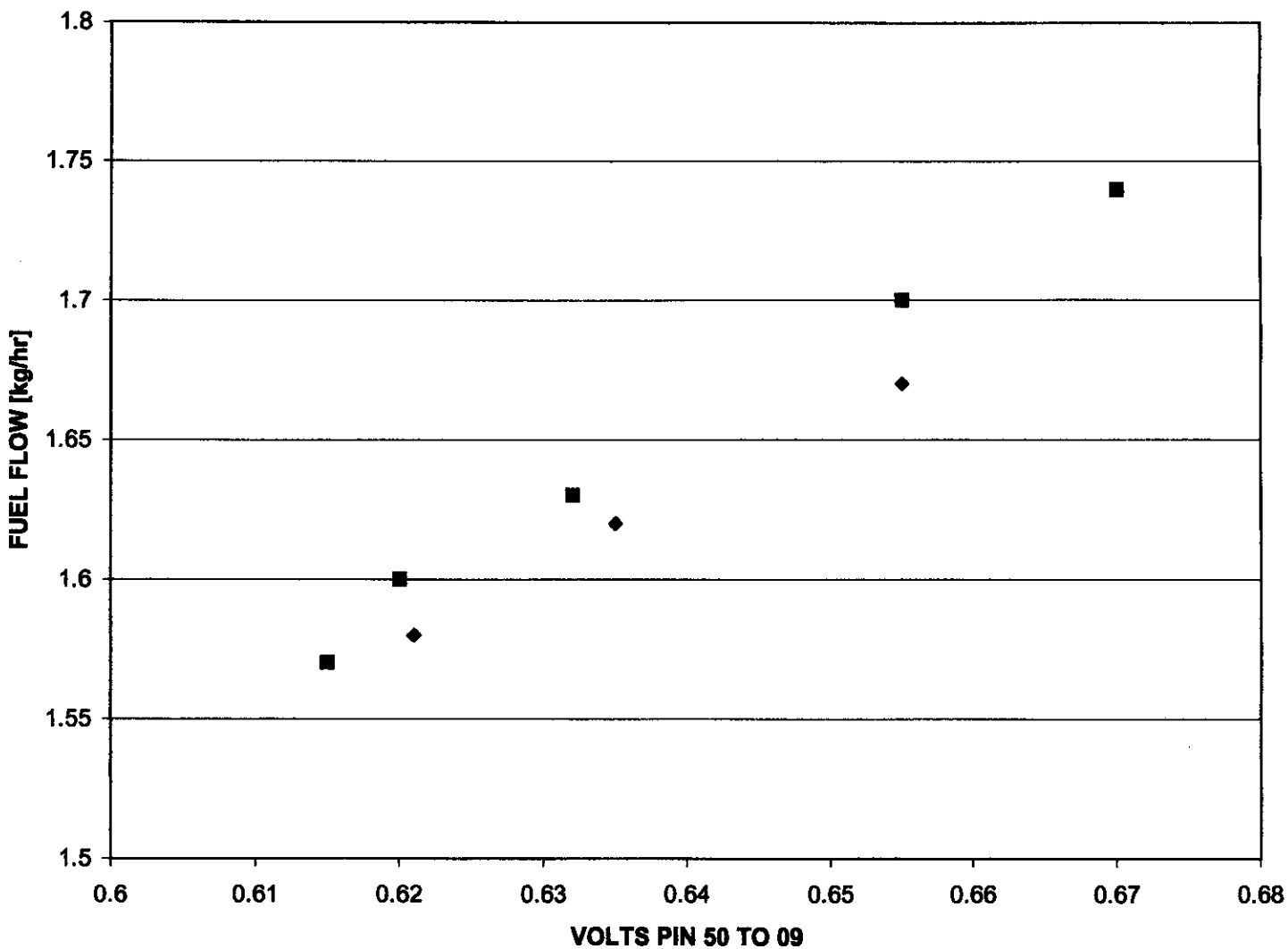
Attachment 12
Page 2 of 4
Reference May 01

SEQUENCE VG
MAF SENSOR POT



BR
SwRI
03.27.01

NEW vs USED MAF SENSOR DATA WITH 50K POT and 100K RESISTOR



Attachment 12
Page Reference 3 of 4
MW 01

Ford Sequence VG Test Development Program

MY 2000 4.6L V8 Ford Romeo Production Engine

Prove-out Matrix Design

Test Number	Test Laboratory	Oil Code	Block Size
1	Southwest Research Institute	925-3	0.25MM
2	Southwest Research Institute	925-3	0.50MM
3	Southwest Research Institute	1006	0.25MM
4	Southwest Research Institute	1006	0.50MM
5	PerkinElmer	925-3	0.25MM
6	PerkinElmer	925-3	0.50MM
7	PerkinElmer	1006	0.25MM
8	PerkinElmer	1006	0.50MM

Random Order = 4 ,1 ,5 ,8 ,2 ,7 ,6 ,3

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Reference May 01

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ASTM SEQUENCE VE SURVEILLANCE PANEL

SCOPE:

The Sequence V Surveillance Panel is responsible for the surveillance and continued improvement of the Sequence VE test documented in ASTM Standard D5302-92 and VG ASTM Standard D6593 as updated by the Information Letter System. Data on test precision and laboratory versus field correlation will be solicited and evaluated at least every six months. Improvements in rating technique, test operation, test monitoring and test validation will be accomplished through continual communication with the Test Sponsor, ASTM Test Monitoring Center, ASTM BO.01, Passenger Car Engine Oil Classification Panel, ASTM Light Duty Rating Task Force, ASTM Committee B0.01, CMA Monitoring Agency and CRC Motor Rating Methods Group. Actions to improve the process will be recommended when deemed appropriate based on input from the preceding. Development and correlation of updated test procedures with previous test procedures will be reviewed by the panel. This process will provide the best possible test procedure for evaluating automotive lubricant performance with respect to the lubricant's ability to prevent engine sludge, engine varnish, cam lobe wear, oil screen plugging, oil ring clogging and ring sticking.

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Reference	May 01

Sequence V Objectives

Objective	Target Date
~~1. Update VG/VE correlation for PCEOCP~~	~~May 2000 (Done)~~
~~2. Review need for VG rate and report items~~	~~Nov. 2000 (Done)~~
3. Establish VG fuel reblend confirmation trial timing	Jan. 2002
4. Approval testing of next VG fuel reblend	May 2002
5. New engine batch equivalency testing complete	Nov. ~~March~~ 2001
6. Introduce GF-3 reference Oil	Nov. 2001

Updated May 23, 2001
San Antonio, Texas

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Reference	May 01

May 23, 2001 Sequence V Surveillance Panel Meeting
San Antonio, Texas
Motions and Actions Items as Recorded at the Meeting

1. The previous meeting minutes posted on the TMC website were unanimously approved.
2. [Motion by Dwight Bowden/Bill Buscher, Jr.] Add the verbage from the TGC recommendation concerning consensus ratings to the Sequence VG Test Method. Passed unanimously.
3. [Motion by Dwight Bowden/Bill Buscher, III] Have the O&H panel mark the report forms as to what data they want listed on the TMC Website and in what priority. The O&H will have final authority to implement their actions. Passed unanimously.
4. [Motion by Dwight Bowden/Bill Buscher, III] Have the TMC to create a new comma delimited header file for every comma delimited data file. Passed unanimously.
5. [Action Item] Add the GF-3 category reference oil desire to the Sequence V Scope and Objectives
6. [Action Item] The following action items from the November 16, 2000 meeting are still open/pending: 3, 5, 6, 7, 9
7. [Motion made by Dave Glaenzer and seconded by Carl Stephens] eliminate Pentane Insolubles, TBN and Viscosity at 100C analytical measurements from the Sequence VG Test Method. They can still be performed if requested. It was decided to leave these fields in the report forms to accommodate the special requests.
8. [Motion made by Rich Grunza and seconded by Dave Glaenzer] The TMC reports for the VE and VG were unanimously accepted as presented.
9. [Motion made by Rick Oliver and seconded by Bill Buscher, III] The RSI VG report (there was no VE report due to lack of testing) was unanimously accepted as presented.
10. [Motion made by Bob Rumford and seconded by Bill Buscher, III] Stop performing Benzene analysis on the VG fuel samples from Halterman and the test labs. All other quality checks will still be performed on a monthly basis and submitted to the TMC for analysis. Passed unanimously.
11. [Motion made by Dan Worcester and seconded by Bill Buscher, III] Accept the O&H report as presented.
12. [Action Item] Update the date of March 2001 for the completion of new engine hardware development/matrix testing to November 2001.