



Test Monitoring Center

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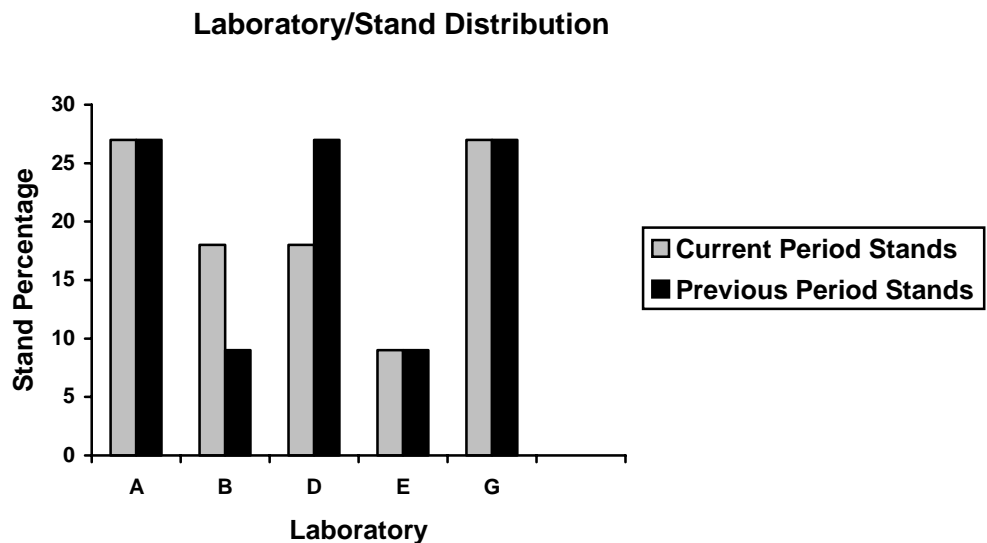
MEMORANDUM: 03-023
DATE: April 9, 2003
TO: Gordon Farnsworth, Chairman, Sequence VG Surveillance Panel
FROM: Richard E. Grundza
SUBJECT: Sequence VG Reference Test Status from October 1, 2002 through March 31, 2003

The following is a summary of Sequence VG reference tests that were completed during the period October 1, 2002 through March 31, 2003.

Lab/Stand Distribution

	Reporting Data	Calibrated as of 3/31/03
Number of Laboratories	5	4
Number of Stands	11	8

The following chart shows the laboratory/stand distribution:

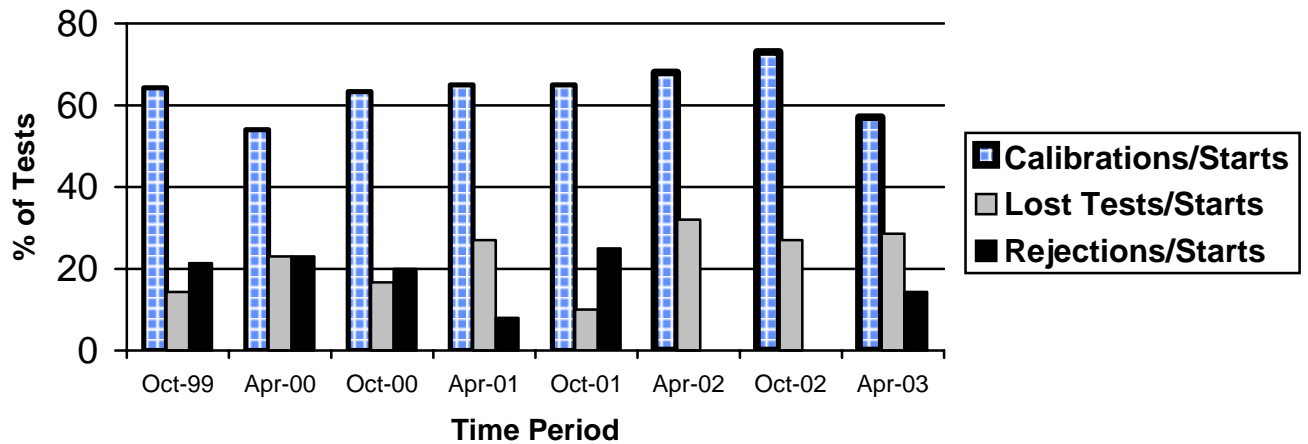


The following summarizes the status of the reference oil tests reported to the TMC:

	TMC Validity Codes	No. of Tests
Operationally and Statistically Acceptable	AC	8
Failed Acceptance Criteria	OC	2
Operationally Invalid, Lab Judgment	LC	3
Aborted Calibration Test	XC	1
Hardware Evaluation Test	AN	10
Aborted Hardware Evaluation Test	XN	1
Total		25

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

Calibration Attempt Summary

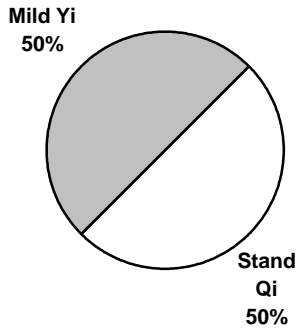


The calibration per start rate has decreased with respect to the previous period and compares well with the historical rate. The lost test per start rate has increased slightly with respect to the previous period and is well within the historical rate. The rejected test per start rate has increased with respect to the previous two periods, when there were no rejected tests.

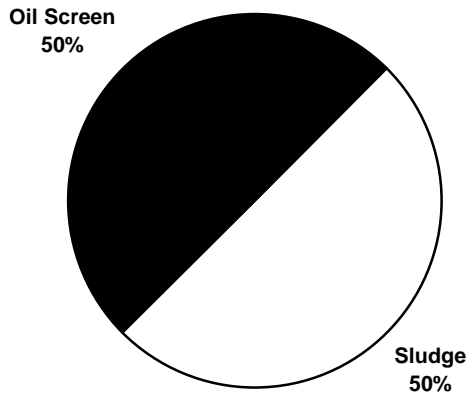
A detailed list of the reasons tests failed the acceptance criteria are shown in the following table:

Reason	Number of Tests
Mild AES and Mild RAC	1
Stand EWMA Precision Alarm, OSCR	1

Distribution of LTMS Stand Alarms



Distribution of Stand Alarms by Parameter



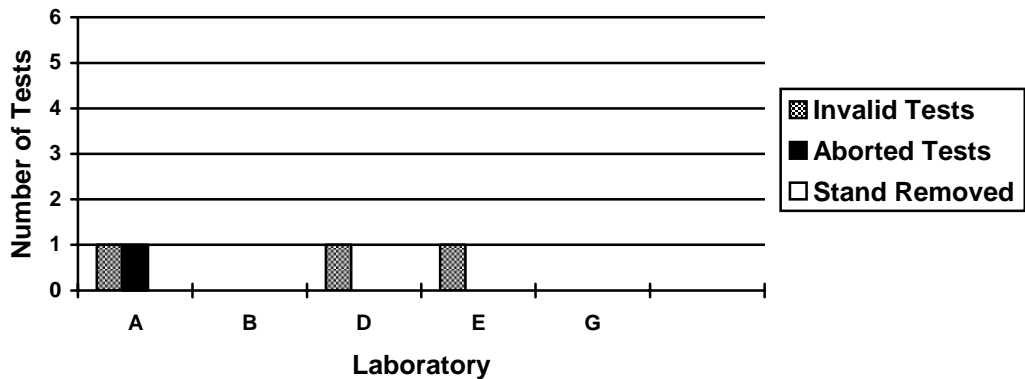
There were no LTMS deviations written during this report period. A total of five LTMS deviations have been written to date. Also, a total of eleven tests were run for hardware evaluation purposes during this report period. One of these hardware evaluation tests was aborted due to a glycol leak. One reference oil test was aborted when an improperly installed thermocouple caused an oil loss.

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

Reason	Number of Tests
Oil added exceeded 400 grams	1
Oil consumption, oil inlet temperature and RAC temperature QI	1
RAC flow calibration error	1

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

Lost Test Distribution



Severity and Precision

Based on the mean delta/s values and pooled standard deviation for the current period, 95% confidence intervals representing severity for the current period are 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	0.204	-0.133	7.83- 8.12	8.0	-0.03
AES	0.302	0.010	7.58 – 8.02	7.8	0.00
APV	0.225	0.315	7.42 – 7.74	7.5	0.08
AEV	0.114	0.109	8.83 – 8.99	8.9	0.01
OSCR	0.747	0.070	13.0- 37.8	20	1.12

The mean Δ/s for this period shows RAC (-0.133) was severe, while AEV (0.109) and APV (0.315) were mild. AES (0.010) and OSCR (0.070) were 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, RAC, AEV, APV and OSCR show severity and precision in control for the period. The summation Δ/s plots show on or near target results for the period for AES, RAC, AEV and OSCR. The industry summation Δ/s plot for APV shows severity trended slightly mild for the period.

Figures 6 and 7 chart the pooled precision estimates for all monitored parameters, by ASTM report period. Figure 6 shows AES and RAC precision degraded slightly with respect to the previous period while OSCR precision has shown an improvement 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 improved with respect to the previous period and precision for both parameters is within historical estimates.

Fuels and Reference Oils

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

Oil	TMC Inventory, in gallons	TMC Inventory, in tests	Laboratory Inventory, in tests	Estimated life
925-3	150	50	9	3+ years
1006	0	0	3	< 1 year
1006-2	5067	1689	3	3+ years
1007	477	159	3	3+ years
1009	985	328	7	3+ years

Note: Oils 1006, 1006-2, 1007 and 1009 are used across multiple test areas, TMC inventory represents total amount of that oil on hand.

Information Letters

Information Letter 02-5 was issued October 25, 2002. This information letter removed remedial statements and made additional editorial changes to Test Method D6593. Information Letter 03-1 was issued February 27, 2003. This letter removed the requirement to include photographs of rated parts in the final test report.

Information Memos

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

<u>Memo</u>	<u>Date</u>	<u>Subject</u>
02-078	10/02/02	Sequence VG Semi-Annual Report
02-86	10/07/02	Proposed Changes to Test Method D6593
02-100	10/23/02	Test Targets, Reference Oil 1009
03-007	01/28/03	Test Targets, Reference Oil 1006-2

TMC Activities

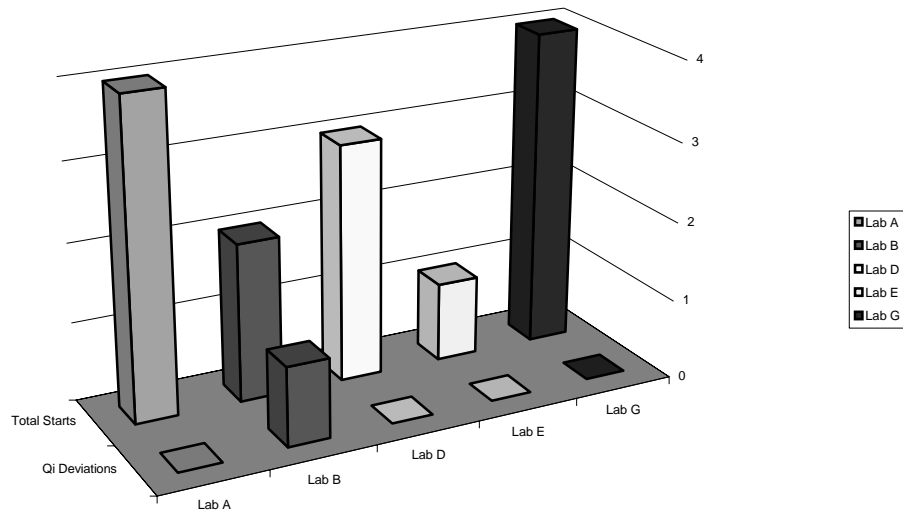
During this report period, the TMC visited three labs. Any discrepancies noted during these visits were identified to the laboratory and corrective action was being taken.

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	0.302
RAC	0.24	0.204
AEV	0.10	0.114
APV	0.18	0.225
OSCR	0.828	0.747

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.

Reason	Number of Tests
RAC Coolant Flow QI	1

The RAC coolant flow deviation was traced to a drain valve which was inadvertently opened at 200 hours. The open valve was discovered and closed at 211 hours.

Summary

The calibrations per start rate has decreased with respect to the previous period, but compares well with historical rates. The lost test per start rate has increased slightly with respect to the previous period. The rejected tests per start rate has shown an increase over the past two periods, when there were no rejected tests. AES and OSCR were on or near target, while APV and AEV trended mild and RAC trended severe for the period. Precision for all parameters compares well with previous period and historical estimates.

REG/reg

Attachments

c: Sequence VG Surveillance Panel

J. L. Zalar

F. M. Farber

<ftp://ftp.astmtmc.cmu.edu/docs/gas/sequencev/semiannualreports/vg-04-2003.pdf>

Distribution: Email

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

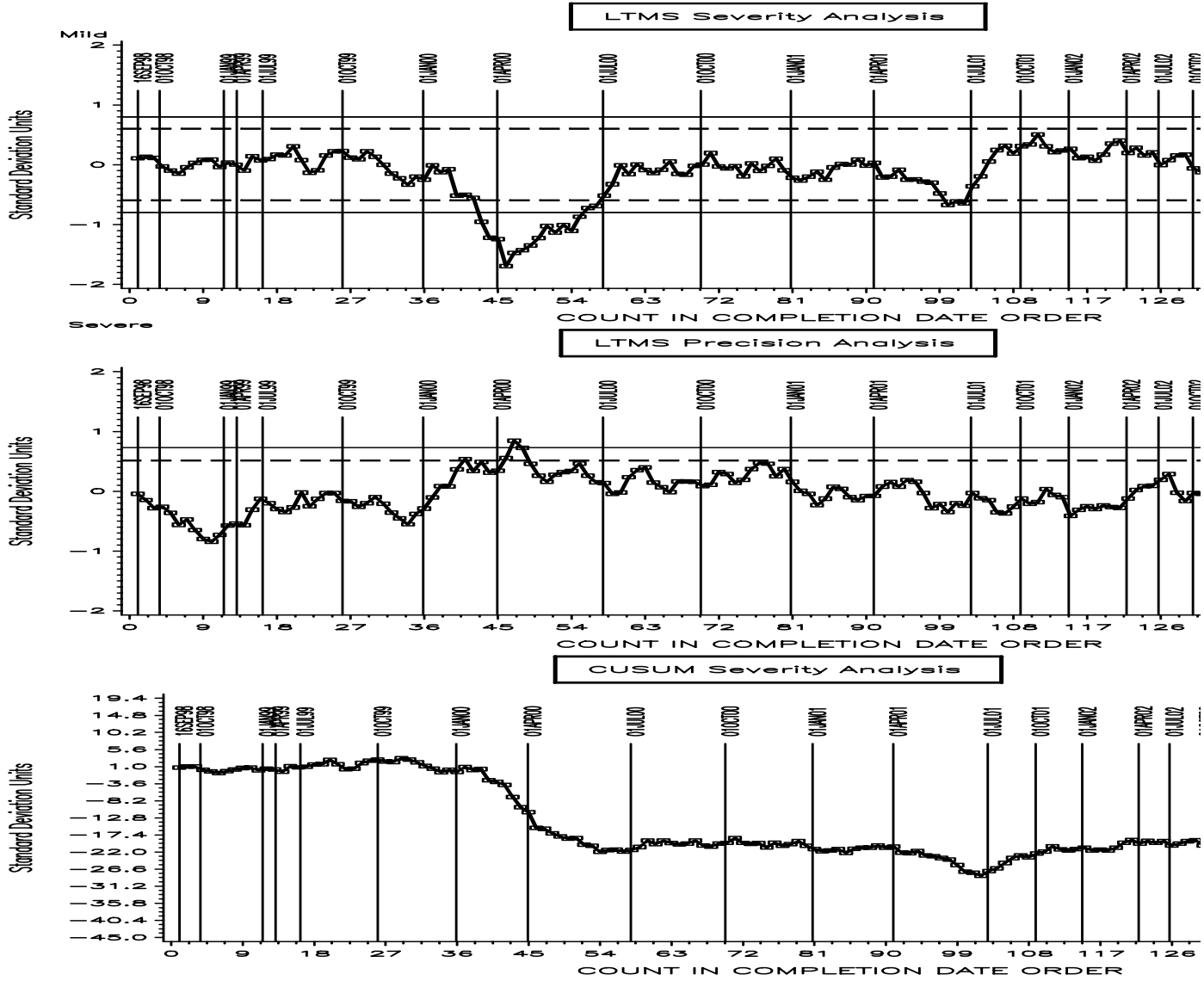
Figures 1 through 5 are the Industry control charts for AES, RAC, AEV, APV and OSCR.

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

Figure 8 is the Industry Timeline.

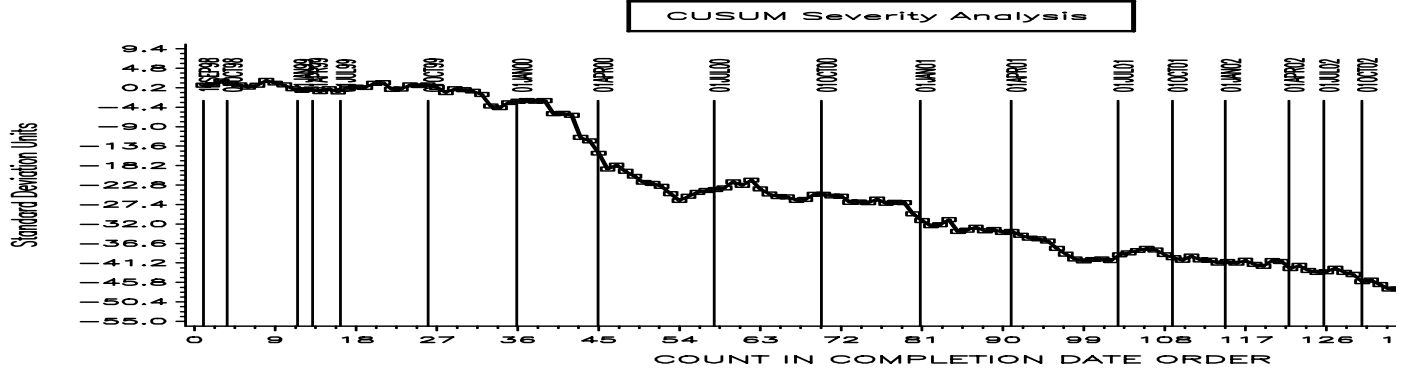
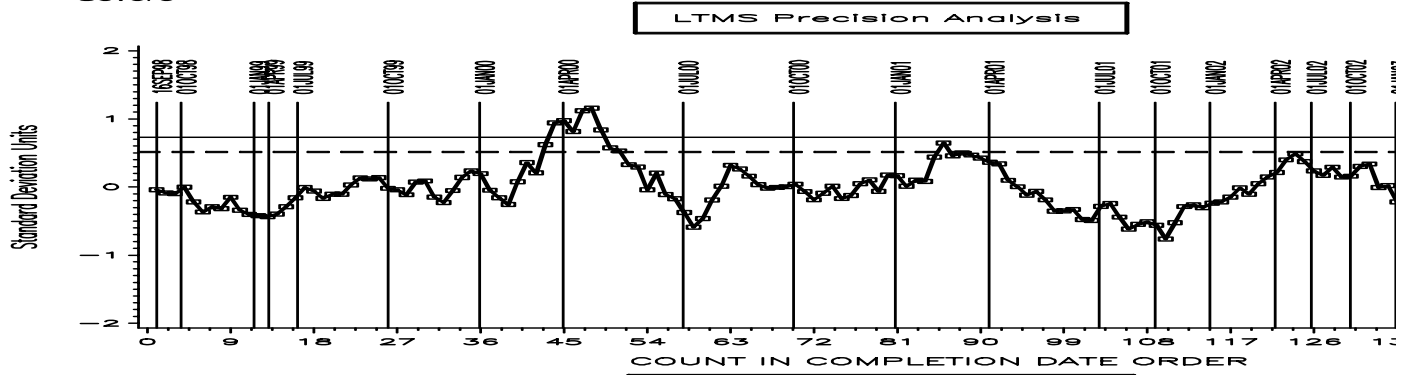
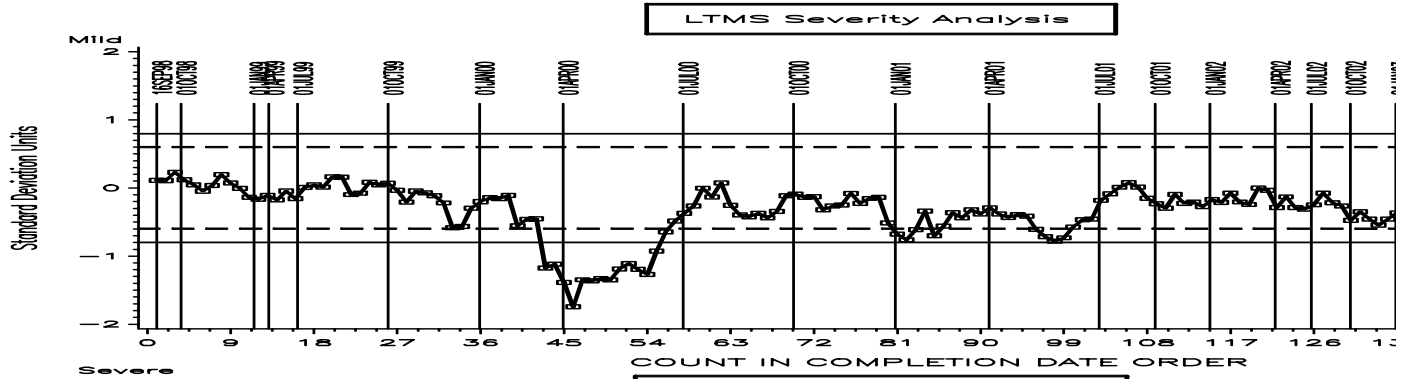
VG INDUSTRY OPERATIONALLY VALID DATA

AVERAGE ENGINE SLUDGE

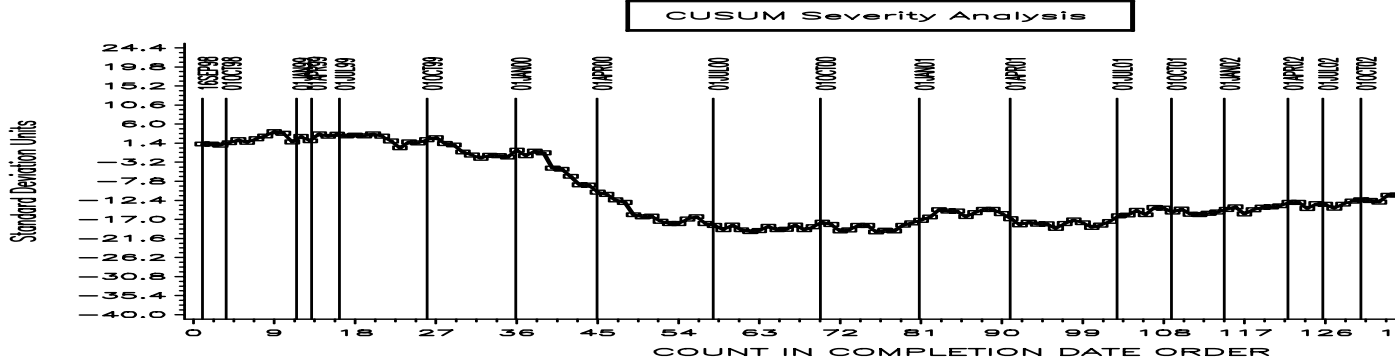
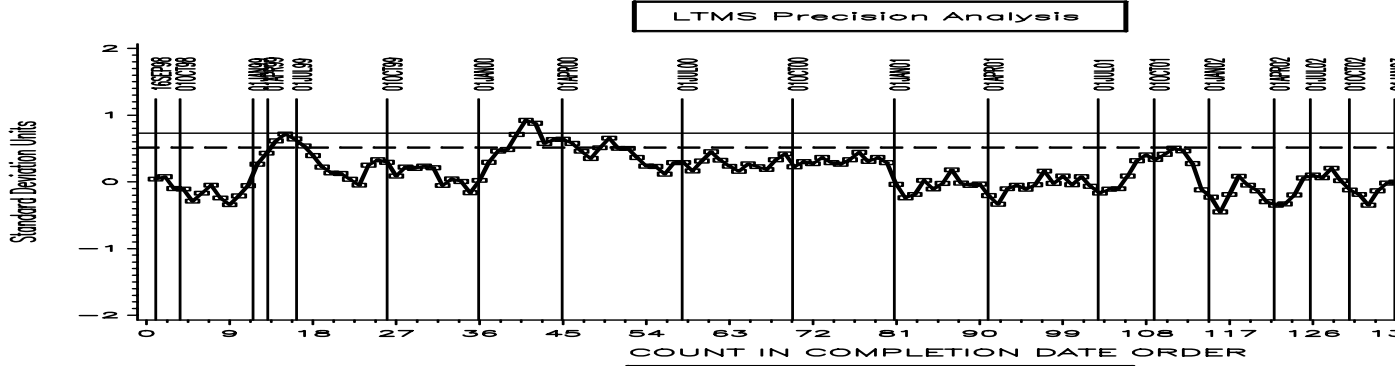
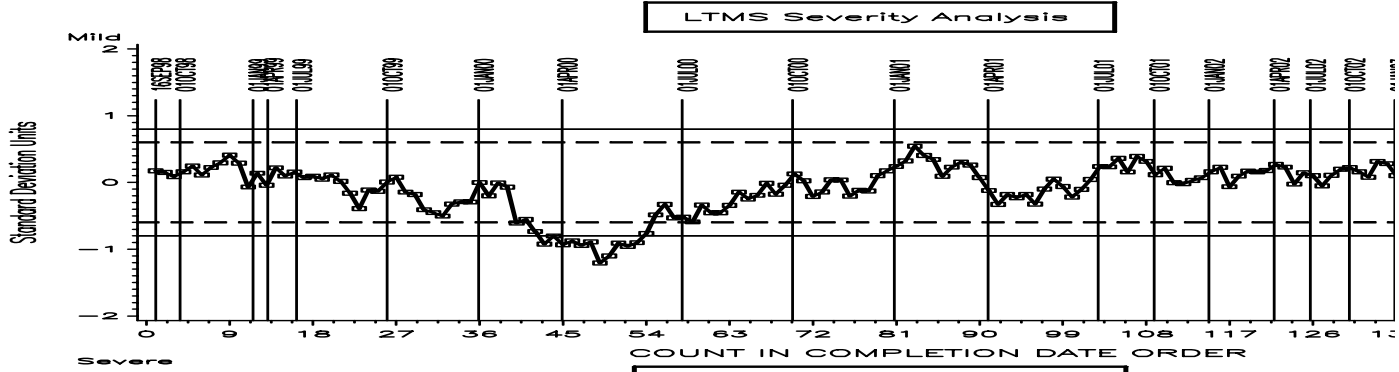


VG INDUSTRY OPERATIONALLY VALID DATA

AVERAGE ROCKER COVER SLUDGE

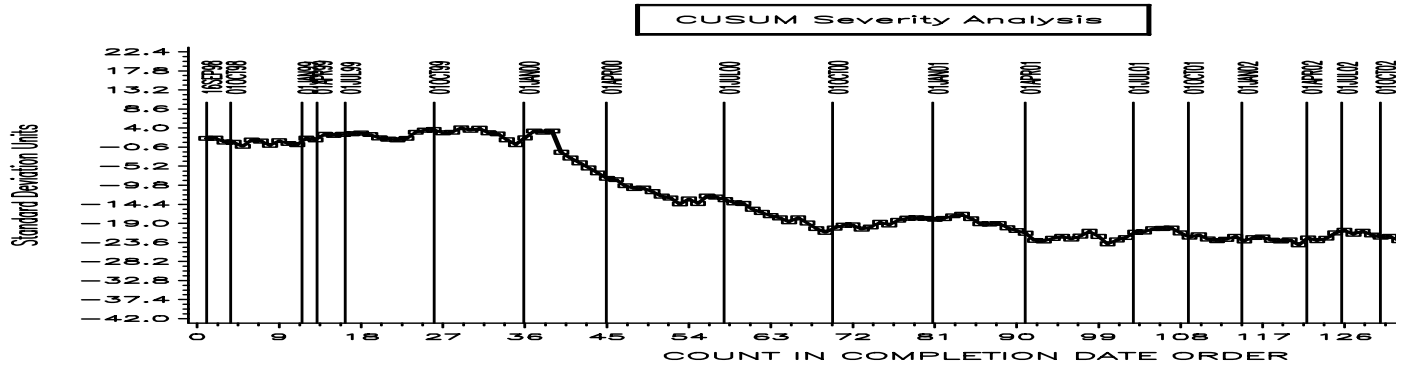
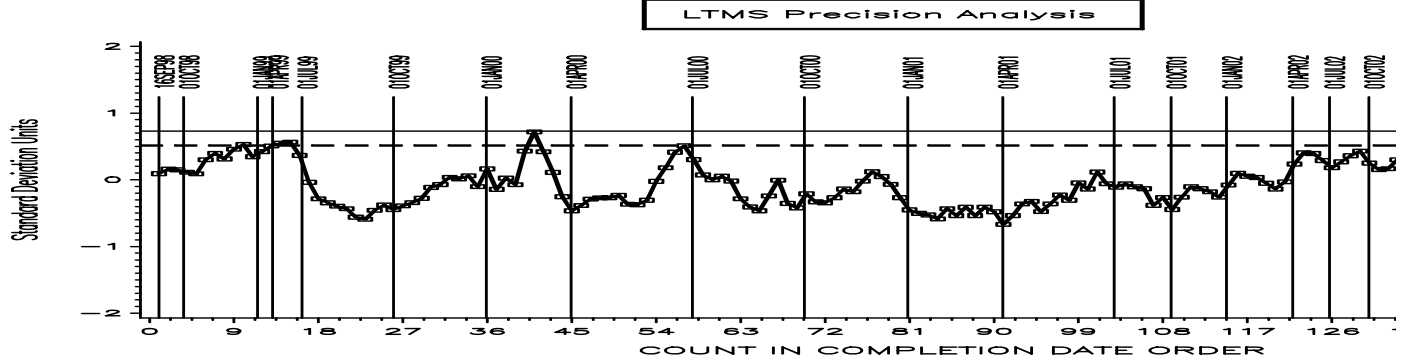
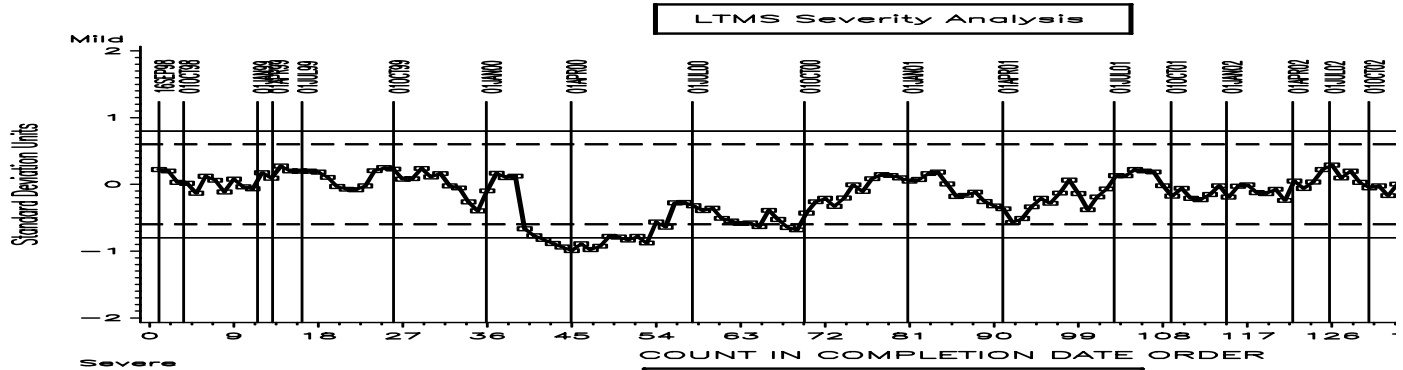


VG INDUSTRY OPERATIONALLY VALID DATA
 AVG. ENG. VARN. 3-PART FINAL RESULT APV + BAFFLES



VG INDUSTRY OPERATIONALLY VALID DATA

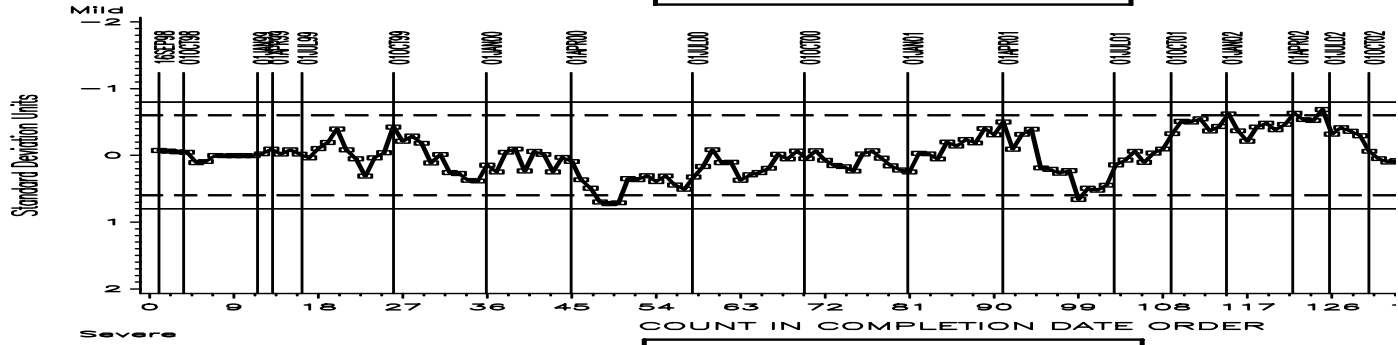
AVG PISTON SKIRT RATING



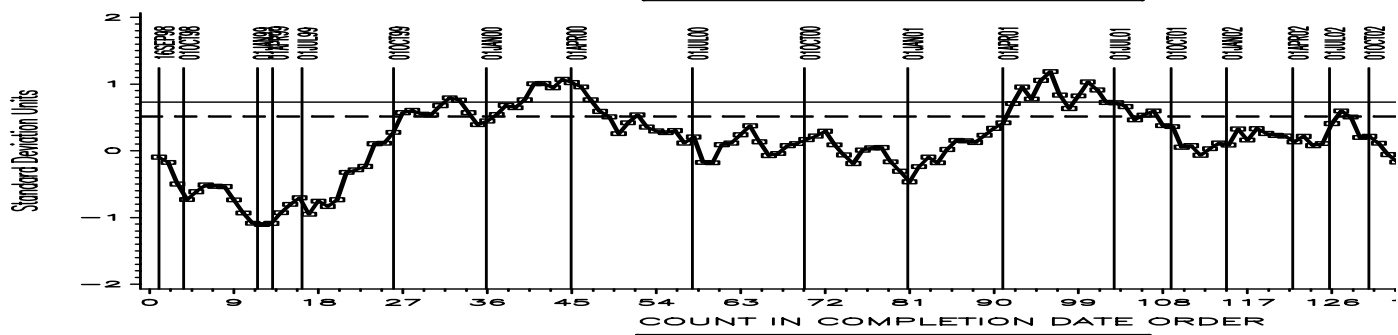
VG INDUSTRY OPERATIONALLY VALID DATA

OIL SCREEN SLUDGE

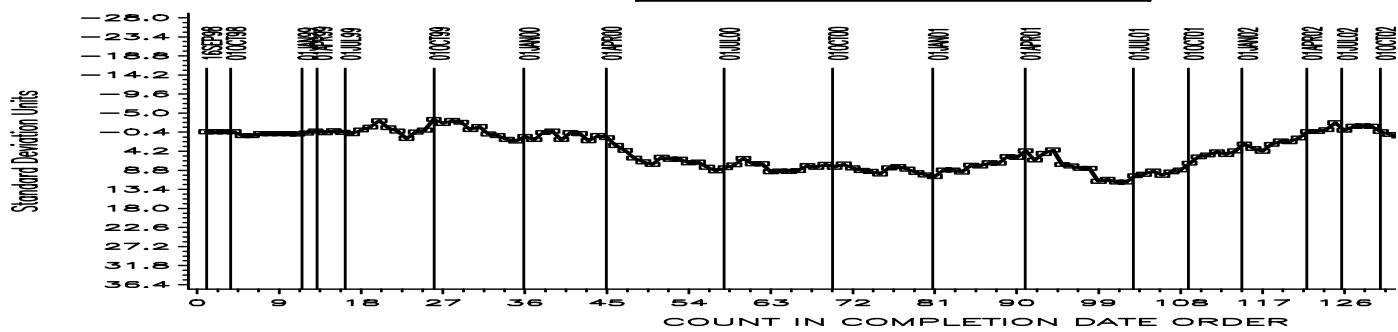
LTMS Severity Analysis



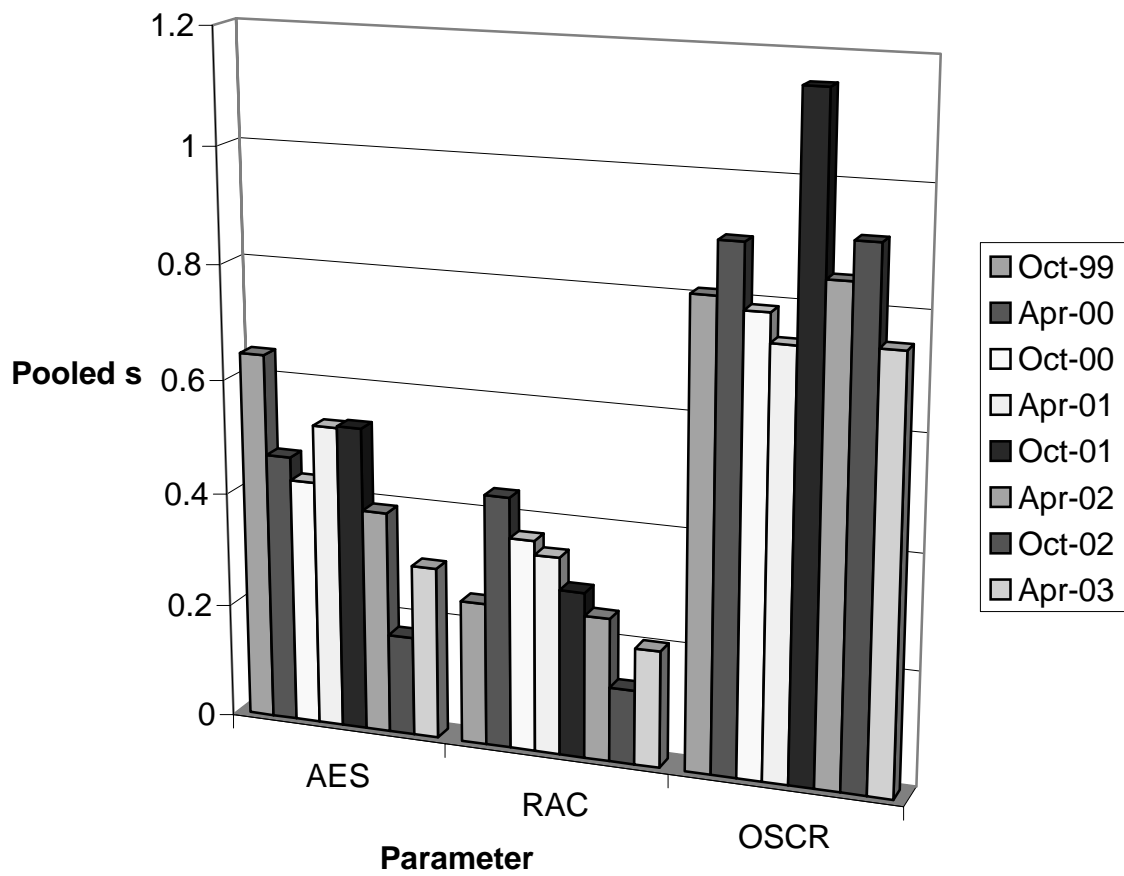
LTMS Precision Analysis



CUSUM Severity Analysis



Comparison of Pooled Precision Estimates By ASTM Report Period



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

Figure 7

Comparison of Pooled Precision Estimates By ASTM Report Period

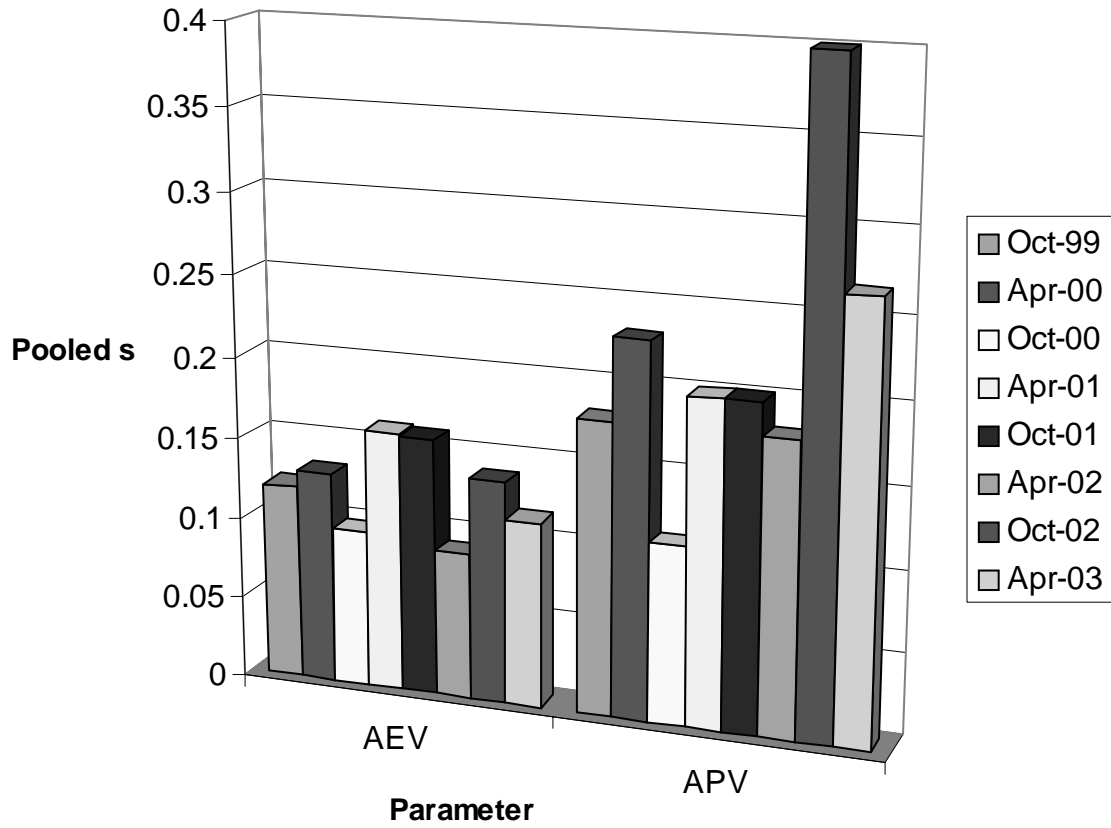


Figure 8 Sequence VG Industry Timeline

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, 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 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.
20010320	01-3	This information letter dropped the requirement to measure benzene in the fuel, defined a process for consensus 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.
20020809		Test Targets, Reference oil 1009, n = 3.
20021023		Test Targets, Reference oil 1009, n = 5.
20021025	02-5	Removed remedial statements from test method and addressed other editorial changes.
20030128		Test Targets, Reference oil 1006-2, n = 10.
20030227	03-1	Removed requirement to include photographs of rated parts in final test report.