



Test Monitoring Center

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MEMORANDUM: 04-077

DATE: October 7, 2004

TO: Charlie Leverett, Chairman, Sequence VIB Surveillance Panel

FROM: Richard Grundza

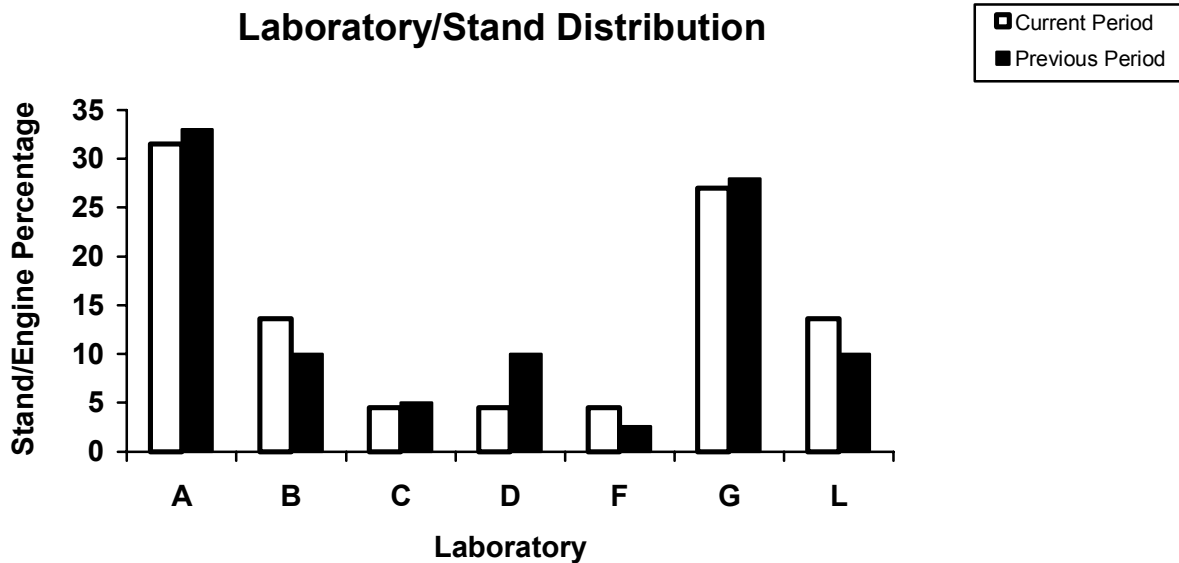
SUBJECT: Sequence VIB Test Results from April 1, 2004 through September 30, 2004

The following is a summary of Sequence VIB reference tests that were reported to the Test Monitoring Center during the period April 1, 2004 through September 30, 2004.

Lab and Stand Summary

	Reported Data During Period	Calibrated as of 09/30/2004
Laboratories	7	7
Stand/Engine Combinations	42	22

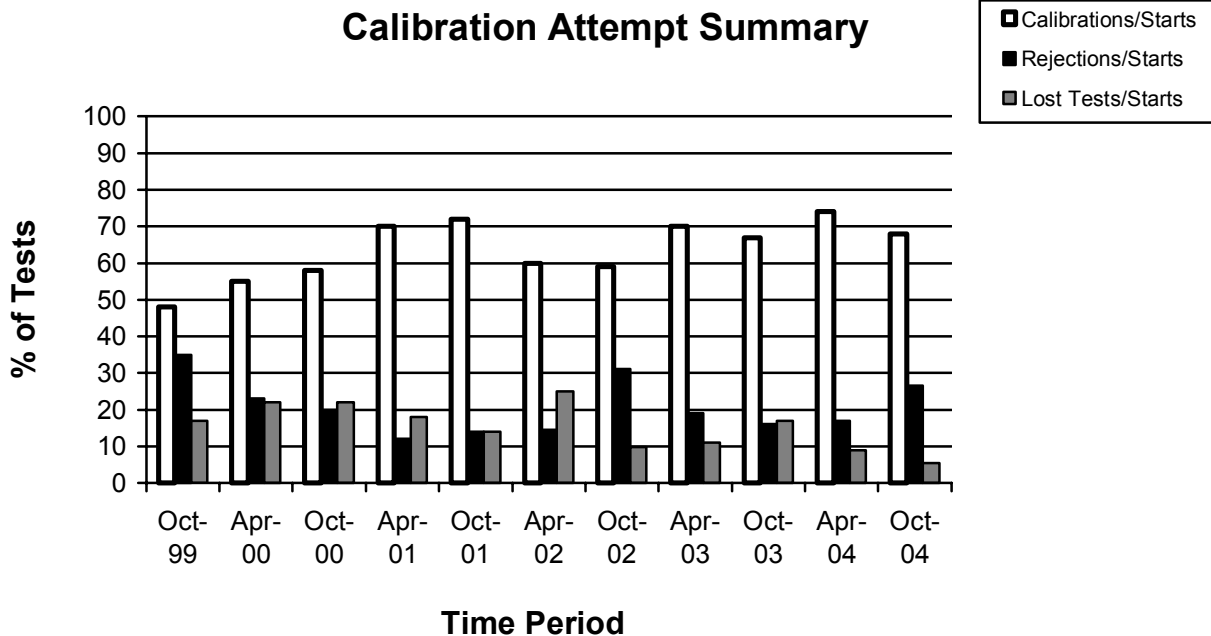
The following chart shows the laboratory stand/engine distribution for data reported during this report period:



The following summarizes the status of the reference oil tests reported to the TMC this report period.

	TMC Validity Codes	No. of Tests
Operationally and Statistically Acceptable	AC	87
Failed Acceptance Criteria	OC	30
Failed Acceptance Criteria (Not in Charts)	OC	4
Operationally Invalid (Laboratory Judgement)	LC	7
Donated	AG	10
Total		138

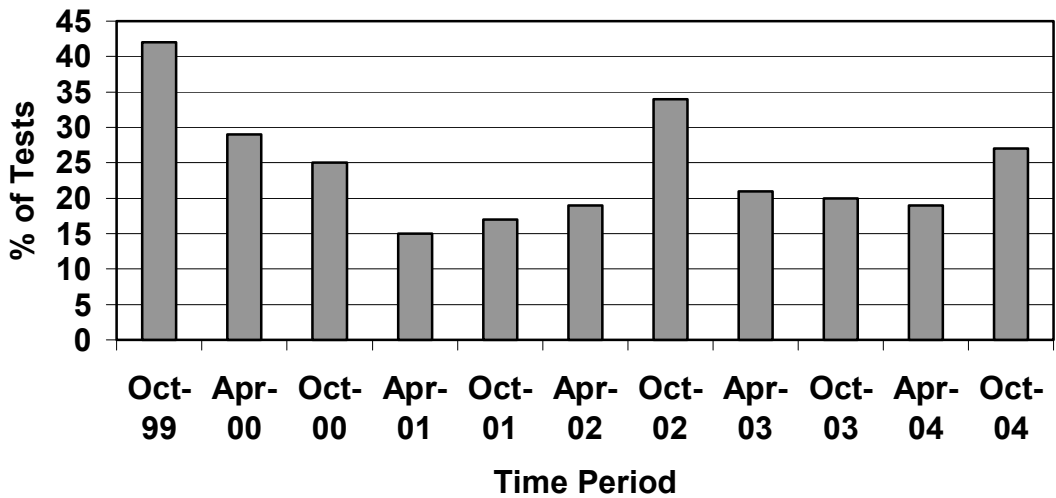
Attempted calibration tests are depicted graphically below by report period:



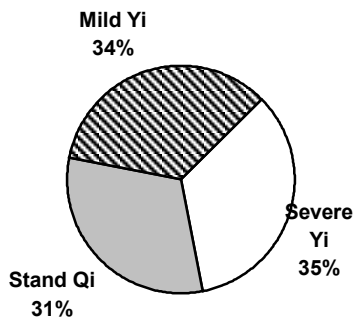
The calibration per start rate has decreased with respect to the previous period and is well within historical rates. The rejected per start rate has increased, while the lost test per start rate has decreased, when compared to the previous report period.

The percentage of tests failing the acceptance criteria for operationally valid tests has increased when compared to the previous period. The percentages are depicted graphically below.

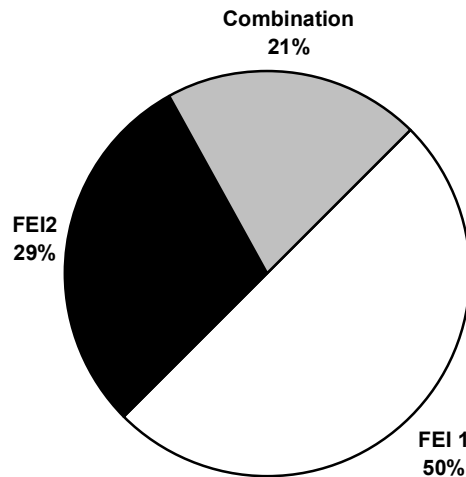
Rejected Operationally Valid Tests



Distribution of LTMS Stand Alarms

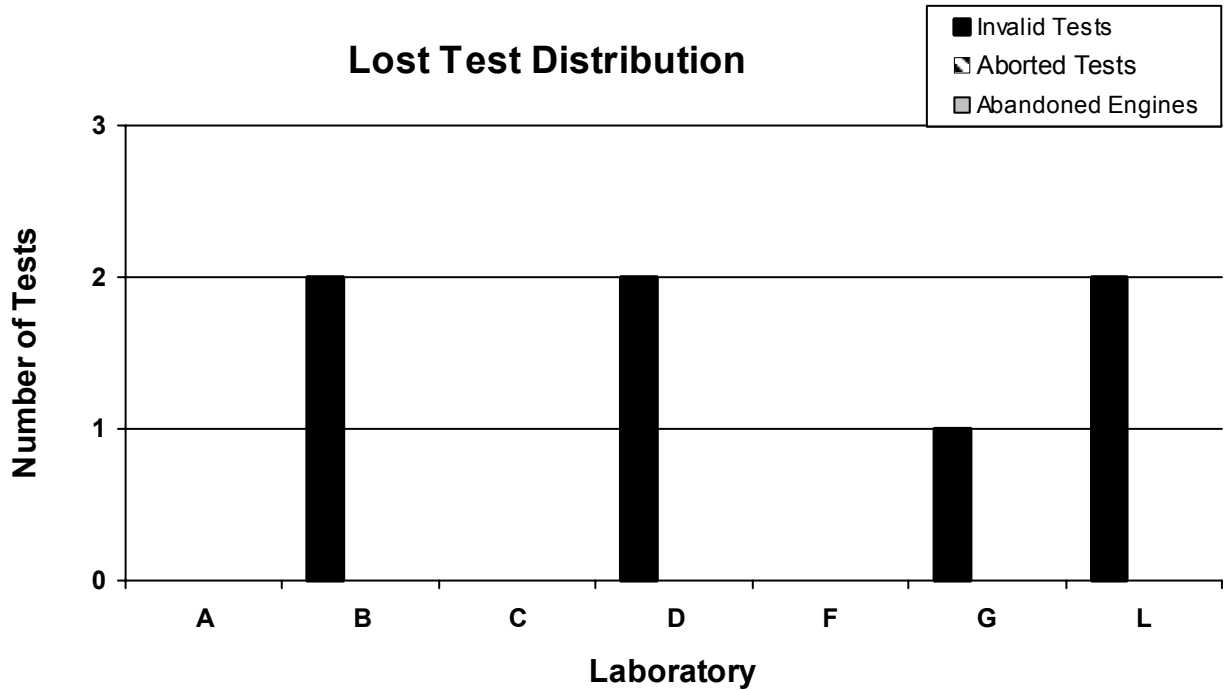


Distribution of Stand Alarms by Parameter

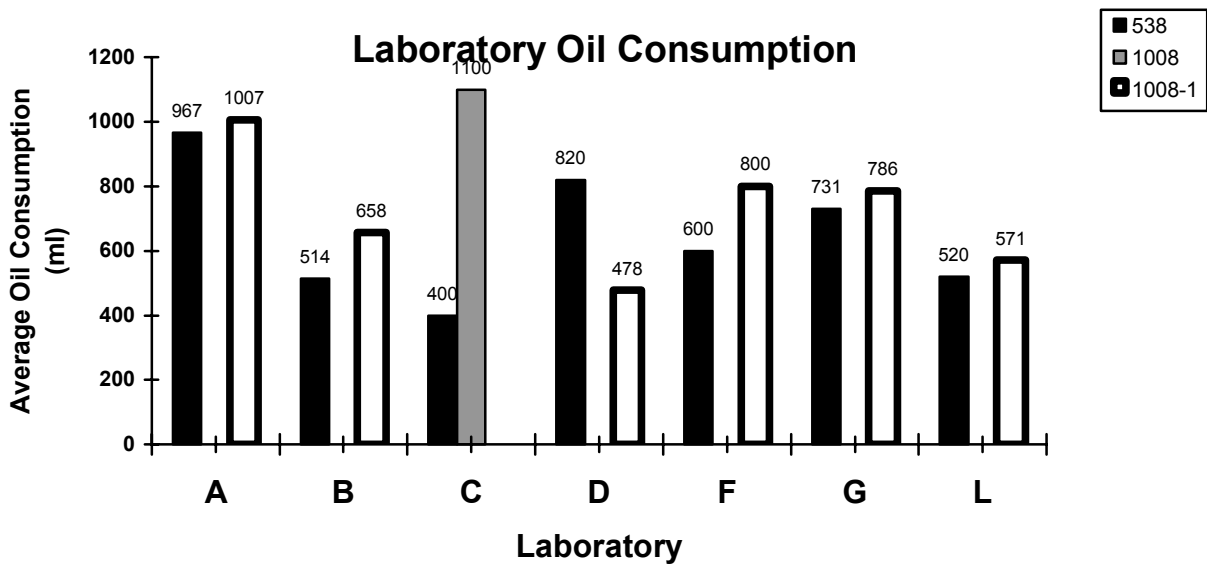


There were twelve tests rejected for FEI Shewhart (Yi) severe, twelve tests rejected for FEI Shewhart (Yi) mild, and ten tests rejected for EWMA precision alarm (Qi). There has not been a LTMS deviation written for Sequence VIB to date.

The laboratory distribution of lost tests is shown below. A detailed list of reasons for tests declared operationally invalid, aborted or lost due to abandoned engines is shown in Table 2 (See Attachment).

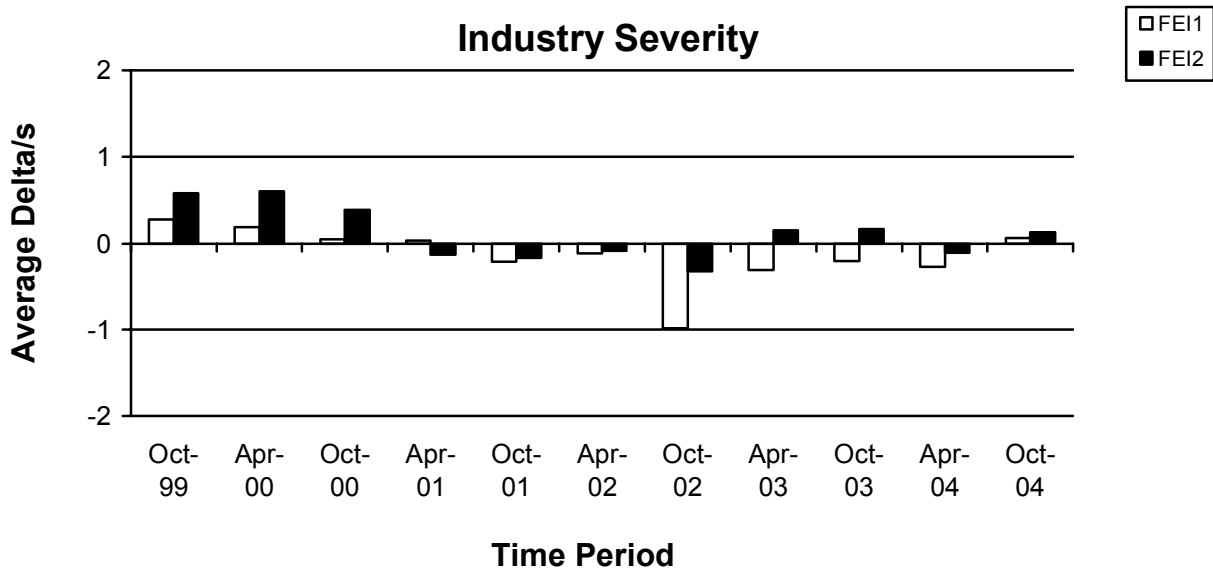


The average oil consumption by oil and laboratory are depicted graphically below. Shown below is a summary of the average oil consumption for all laboratories reporting data this report period.

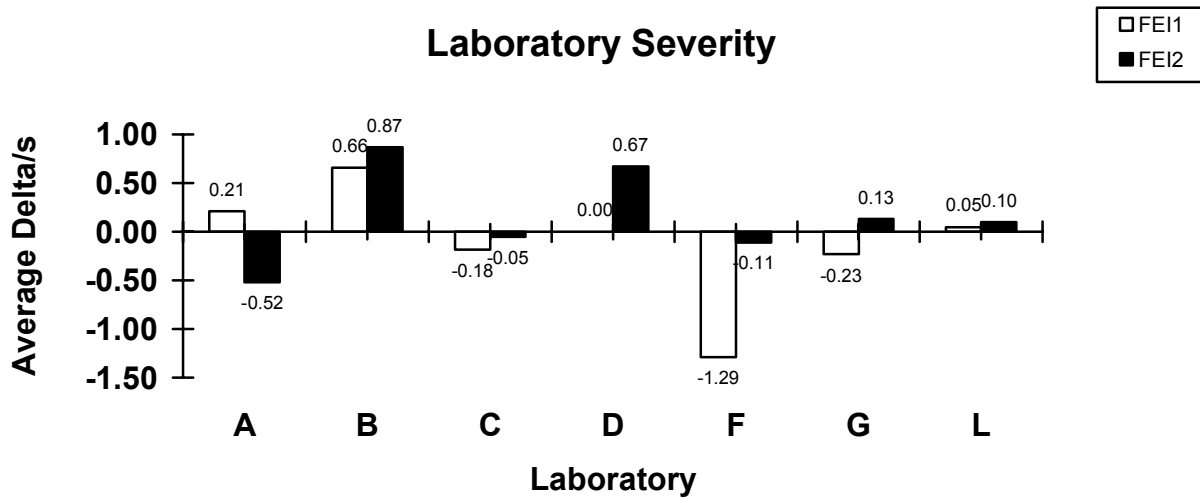


TEST SEVERITY AND PRECISION

The industry mean Δ/s for FEI1 and FEI2, for this report period are 0.06 and 0.13 mild, respectively.

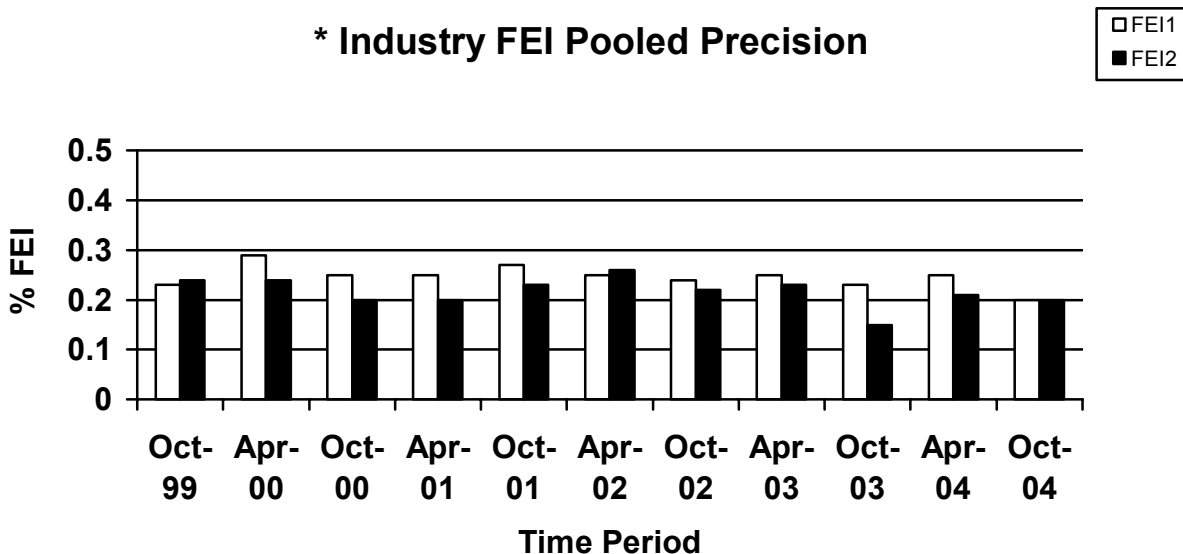


Shown below is a summary of the average FEI Δ/s for all laboratories reporting data this report period.



The industry precision estimates for FEI1 and FEI2 for this report period are 0.20 and 0.20 (pooled s), respectively. Precision for both FEI1 and FEI2 have improved when compared to the previous period and compared well with historical estimates.

*** Industry FEI Pooled Precision**



*Precision estimates are calculated by pooling oil and stand/engine combination.

INDUSTRY CONTROL CHARTS

FEI1

Figure 1 shows FEI1 severity began the period in control. Fourteen tests into the period, FEI1 severity sounded a warning and two action alarms, which cleared for one test before sounding a sequence of a warning alarm, an action alarm and another warning alarm. The charts remain in control for fifteen tests before sounding two warning alarms. The charts are in control for the next twenty eight tests when a pair of warning alarms sound. The industry control charts remained in control for the rest of the period. The alarms appeared to have been caused by results from new engines. FEI1 precision also began the period in control. Thirty tests into the period, a warning alarm occurred, which cleared for a test before an additional three warning alarms sounded. After clearing for four tests, another series of three warning alarms sounded and afterwards the charts cleared for seven tests, then sounded an additional two warning alarms. After remaining clear for twenty-one tests, a warning alarm sounded followed by the chart being in control for fifteen tests. A series of two warning alarms, which cleared for one test, followed by three action and three warning alarms occurred. The charts return in control until the last five tests in the period, where a series of three warning and two action alarms sounded. Precision alarms appeared to be the result of a number of severe tests from new/stand engines, intermixed with on target to mild results from existing stands.

FEI2

Figure 2 shows severity began the period in control. After seventeen tests, a warning alarm occurred, after which the charts remained in control for three more tests, when a warning, an action and a warning alarm sounded. The charts are in control for a total of forty-seven tests when an action and two warning alarms sound. With the exception of one warning alarm near the end of the period, the charts remained in control for the remainder of the report period. Precision was in control for the first thirty tests, when a warning alarm was noted. The charts cleared for a test, then a series of four warning alarms

occurred. After clearing for a test, a series of five warning and three action alarms occurred, with the charts back in control for the remainder of the period. Much like FEI1, severity trends and precision alarms observed during the period are a result of a relatively large number of tests reported on new engines, which tended to be more severe.

REFERENCE OILS

The following table quantifies reference oils by the number of tests remaining at the TMC and each laboratory. Sequence VIB reference oils are shipped in quantities of 5 gallons per test.

LAB	538	539	1006	1007	1008	1008-1
A	6	1	0	7	0	7
B	1	1	0	2	0	1
C	0	1	0	2	0	1
D	3	0	0	0	0	2
F	1	1	0	3	0	0
G	3	2	0	3	0	5
L	4	1	0	5	0	3
TMC	108	182	0	*	**	***

* 474 Gallons (Multiple test area usage)

** 29 Gallons (Multiple test area usage)

*** 1665 Gallons (Multiple test area usage)

The panel recently agreed not to use reference oil 539 for calibration tests at this time. A total of ten donated tests were run to evaluate two potential reference oils. At the September 15, 2004 Surveillance panel meeting, the panel agreed not to use these two oils.

LAB VISITS

Five lab visits were conducted during this report period. Any discrepancies noted during these visits have been identified to the laboratory and the appropriate corrective actions taken have been documented.

INFORMATION LETTERS

Information Letters 04-2 and 04-3 were issued this report period. Information Letter 04-2, issued August 2, 2004, added another spark plug type to the procedure, allowed the replacement of the rear crankshaft seal and made some editorial changes to the precision statement. Information Letter 04-3, issued October 1, 2004 revised the referencing requirements to address engine hours and revised the calibration frequencies for a number of stand instrumentation channels.

SUMMARY

Severity for FEI1 was mild this report period.

Severity for FEI2 trended mild for this report period.

FEI1 and FEI2 precision has improved when compared to the last report period.

The percentage of calibrations per starts has decreased this report period.

The percentage of lost tests per starts has decreased this report period.

The percentage of statistically rejected tests per starts has increased this report period.

The percentage of operationally valid tests rejected statistically has increased this report period.

REG/reg

Attachments

c: Sequence VIB Surveillance Panel

Sequence VIB Test Engineers

<ftp://ftp.astmtmc.cmu.edu/docs/gas/sequencevi/semiannualreports/vib-10-2004.pdf>

Sequence VIB Semiannual Report
List of Attachments

- Table 1 is a historic statistical summary for reference oils through September 30, 2004.
- Table 1A is a statistical summary for reference oils for the current report period.
- Table 2 is a summary of lost tests due to operationally invalid, aborted, abandoned engines or lost due to BC shift exceeding the test limits.
- Table 3 is the Sequence VIB Timeline.
- Figure 1 graphically present the Industry control charts for FEI1.
- Figure 2 graphically present the Industry control charts for FEI2.

TABLE 1

SEQUENCE VIB
 OPERATIONALLY VALID DATA SET
 DATA PRIOR TO 10/01/04

OIL CODE 1006				
N	TEST PARAMETER	MEAN	s	REPORTED RANGE
236	FEI1	1.40	0.29	0.61 - 2.50
236	FEI2	0.52	0.27	-.36 - 1.23
OIL CODE 1007				
N	TEST PARAMETER	MEAN	s	REPORTED RANGE
92	FEI1	0.75	0.30	0.24 - 2.11
92	FEI2	0.45	0.27	-.55 - 1.25
OIL CODE 1008				
N	TEST PARAMETER	MEAN	s	REPORTED RANGE
245	FEI1	1.82	0.24	1.18 - 2.47
245	FEI2	1.24	0.21	0.58 - 1.74
OIL CODE 1008-1				
N	TEST PARAMETER	MEAN	s	REPORTED RANGE
147	FEI1	1.89	0.25	1.24 - 2.55
147	FEI2	1.27	0.22	0.52 - 1.95
OIL CODE 538				
N	TEST PARAMETER	MEAN	s	REPORTED RANGE
171	FEI1	1.87	0.31	0.86 - 2.67
171	FEI2	1.58	0.23	0.93 - 2.32
891	TOTAL			

TABLE 1A

SEQUENCE VIB
 OPERATIONALLY VALID DATA SET
 DATA FROM 04/01/04 THRU 09/30/04

OIL CODE 1008				
N	TEST PARAMETER	MEAN	s	REPORTED RANGE
1	FEI1	1.73	N/A	1.73 - 1.73
1	FEI2	1.21	N/A	1.21 - 1.21
OIL CODE 1008-1				
N	TEST PARAMETER	MEAN	s	REPORTED RANGE
59	FEI1	1.93	0.25	1.43 - 2.55
59	FEI2	1.29	0.24	0.52 - 1.95
OIL CODE 538				
N	TEST PARAMETER	MEAN	s	REPORTED RANGE
57	FEI1	1.96	0.31	1.07 - 2.67
57	FEI2	1.62	0.26	1.18 - 2.32
117 TOTAL				

Table 2

Lost Tests Summary

Tests declared operationally invalid, aborted or lost due to abandoned engines are summarized below by laboratory, reason, number of lost tests, and percent of lost tests:

LAB	REASON	Tests Lost	% of Tests Lost
B	Computer problems	1	28.6%
	Tensioner failure	1	
G	Excessive downtime	1	14.3%
D	Worn chain guides	1	28.6%
	Load cell calibration problems	1	
L	Load out of specification	1	28.6%
	80 hour aging exceeded 80 hours	1	

Sequence VIB Timeline

Date	Item Changed	Information Letter
19990809	Reference oil 1006 targets updated	
19990809	Reference oil 1007 targets updated	
19990809	Reference oil 1008 targets updated	
19990924	Calibration requirements	99-1
19990924	Alternative Cooling system	99-1
19990924	Fuel injection flow procedure	99-1
19990924	Requirement for use of maintenance log	99-1
19990924	Coolant flow measurement device calibration revision	99-1
19990924	Preparation procedure for oil charge	99-1
19990924	Recording compression pressures	99-1
19990924	Ignition timing checks	99-1
19990924	Valve stem seal replacements	99-1
19990924	Alternative Racor oil filter (LFS-62) use approved	99-1
19990924	Engine serial number added to report	99-1
19991015	Invalid test BC shift limits of -0.5 to 0.8% added	99-2
19991015	Tests terminated due to an FEI result are not permitted	99-2
19991015	Section 11.5.17.3 deleted – Manual data logging no longer required	99-2
19991015	Exhaust back pressure calibration prior to calibration test added	99-2
19991015	Instrumentation calibration requirements	99-2
19991015	Use of Eaton 37KW (50hp) dry gap dynamometer approved	99-2
19991015	New flush oil (BCFHD) and flush oil procedure	99-2
19991015	Micro motion model CMF010 mass flow meter approved	99-2
19991015	Kinematic viscosity measurements on new reference oils permitted	99-2
19991015	Report form editorial change for LABVALID made	99-2
19990924	Valve stem seal revised part number	99-3
20000207	Oil sight glass calibration	00-1
20000207	Revised Figure A2.22 – Oil Level Marker Ruler	00-1
20000207	Revised flush effectiveness procedure	00-1
20000207	Coolant flush procedure	00-1
20000207	Oil consumption validity interpretation	00-1
20000207	Load cell temperature specification	00-1
20000410	Valve Spring Replacement	00-2
20000524	Eliminate Baseline Shift Criteria	00-3
20000601	Maximum Allowable Oil Consumption Test Limit	00-3
20000601	Oil Sample Location Defined	00-3
20000601	Revised Blow-by and Crankcase Ventilation System	00-3
20000807	Fuel Injector Calibration Flow Rate Specification Added	00-3
20000807	Dynamometer Replacement During a test is not permitted	00-3
20000807	Engine Break-in Stand Requirements	00-3
20000807	Removal of Ford Wiring Harness Diagram	00-3
20000807	Addition of Alternative Injector Wiring Harness Part Numbers	00-3
20000807	Addition of Alternative HEGO Sensor Part Numbers	00-3
20000807	Addition of Alternative Throttle Body Adapter Part Number	00-3
20000807	Visteon EEC Control Module	00-3
20000901	Barometric Pressure added to report packet as record only	00-3

Sequence VIB Timeline

Date	Item Changed	Information Letter
20000801	A Task Force Was Appointed by the VIB Surveillance Panel to Address Lab To Lab Differences with Oil Consumption and FEI Severity. Information Letter 00-4 was a result of the Lab Visit Discrepancies.	
20000915	Increase Oil Charge to 6.0 Liters	00-4
20000915	Revise Oil Level/Sight Glass Calibration Procedure	00-4
20000915	Oil Pan Oil Level Requirement	00-4
20001116	Reduced Calibration Frequency	01-1
20001117	Validity Interpretation During BSFC Measurement Cycle	01-1
20001117	Reporting Stage Restarts or Any Test Time Deviations	01-1
20001117	Alternate HEGO Sensor Part Number	01-1
20001117	Revisions to New Engine Cyclic Break-in	01-1
20010301	Revisions to Test Length Calculation and Reporting Format	01-1
20010301	Additional Oil Analysis Requirements	01-1
20010822	Allowed Timing Chain Tensioner with Subsequent Reference Oil Test	01-2
20010822	Defined Maximum Total Test Length as 150 h	01-2
20010822	Defined Off Test Time and Allows No More Than 2 h of Off Time During Phase I and II Aging	01-2
20010822	Added Reference to Ford 543 Engine Assembly Manual	01-2
20010822	Refined Oil Analysis Procedure for HTHS, CCS Viscosity, Friction Coefficient by HFRR, Fuel Dilution and Infrared for Oxidation & Nitration	01-2
20010822	Correction of Company Suppliers in X1.3 and X1.19	01-2
20011005	Pressurization of Engine Coolant System to 69±13.8 kPa	01-3
20011005	Deleted Requirement to Measure Blowby	01-3
20011005	Revised Load Cell Temperature Delta for 3°C to 6°C in 6.4.2.3	01-3
20011005	Corrected Fuel Supplier Name and Address in Section 7.2 and Footnote 15	01-3
20011129	Added Provisions for VIBSJ Test	01-4
20011207	Revised AFR limits from 14.25:1 - 15.25:1 to 14.00:1 – 15.00:1	01-5
20020405	Allowed Replacement of Timing Chain as Part of Tensioner Assembly	02-1
20020405	Revised Procedure to Require Viscosity Measurements for Both Reference and Non Reference Oils	02-1
20020712	Reference oil 538 targets updated (n=20)	
20021016	Reference oil 538 targets updated (n=30)	
20021114	Reference oil 1008-1 initial targets generated (n=10)	
20030327	Updated Test Method D6837 to incorporate info letter 02-1 and remove remedial statements	03-1
20030521	Reference oil 1008-1 initial targets generated (n=20)	
20030618	Dropped requirements to monitor HTHS, CCS, FC by HFRR and INI and INO	03-2
20030703	Reference oil 1008-1 initial targets generated (n=30)	
20040101	Added reference to fuel spec, replaced Aliphatic Naphtha with Type II Class C solvent	03-3
20040130	Added addition micromotion transducers to test method, revised calibration requirements for oil heat exchanger thermocouple and made editorial changes relating to precision statements.	04-1
20040802	Added MotorCraft AGSF32FM to test method	04-2

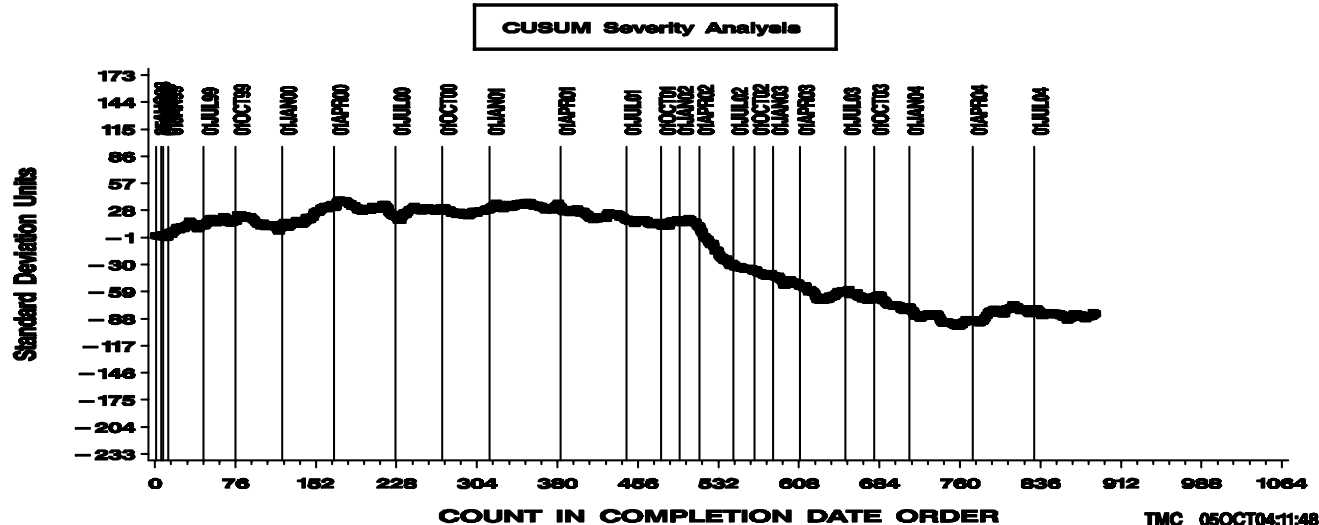
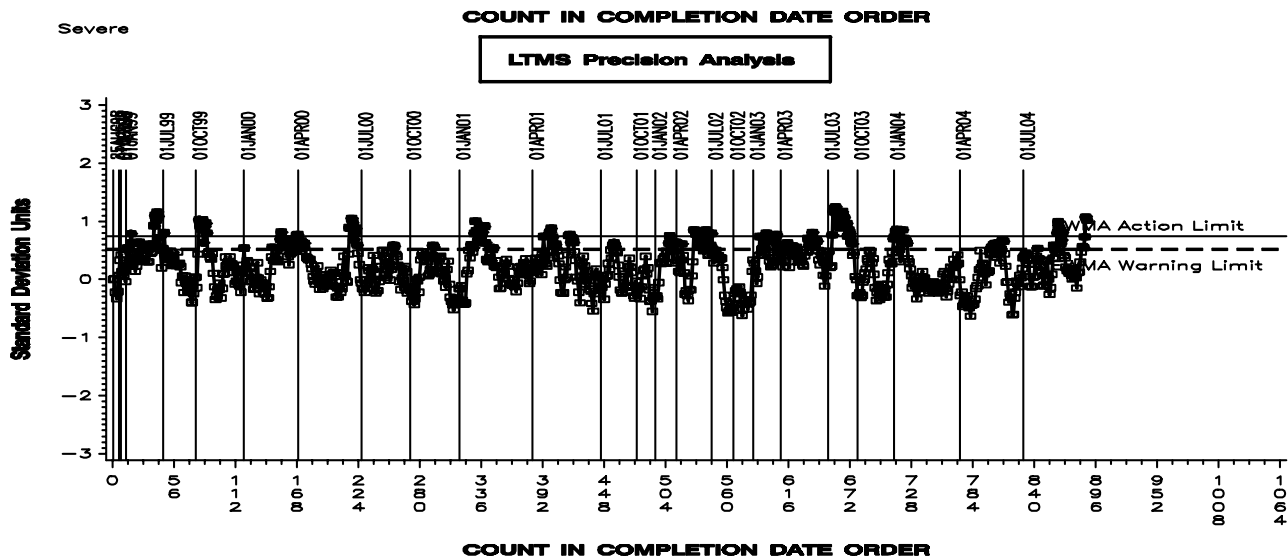
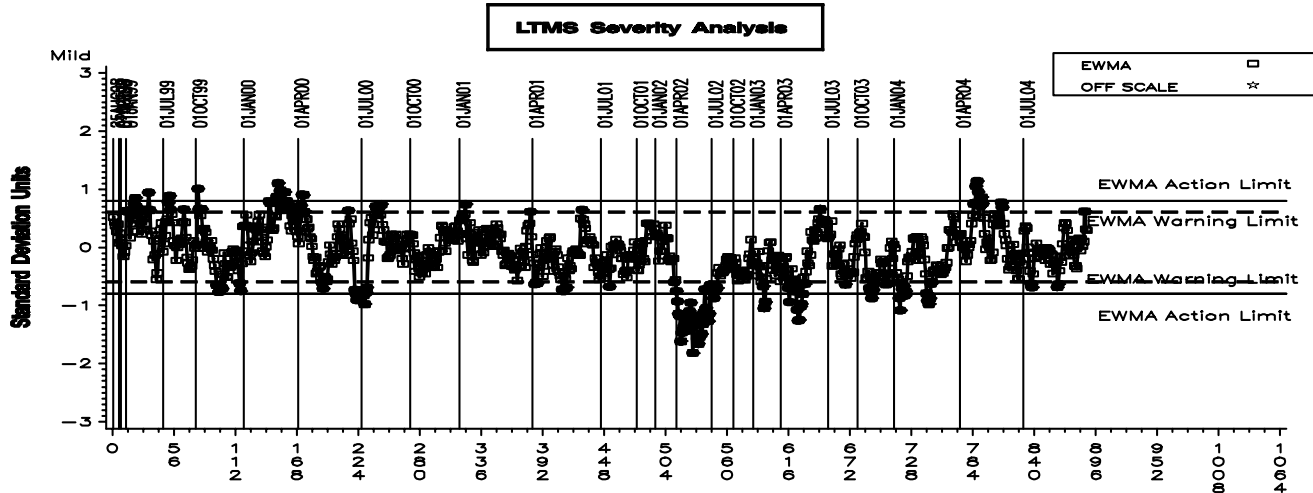
Sequence VIB Timeline

Date	Item Changed	Information Letter
20040802	Added rear crankshaft seal to parts allowed to be replaced on engine	04-2
20040802	Made editorial changes to precision statement	04-2
20040921	Changed Z_0 calculation to be the average of first shewhart acceptable through and including second acceptable reference test to initialize stand charts. Also excluded any unacceptable shewhart results, prior to the first acceptable result on a new stand/engine from control charts.	
20041001	Revised stand/engine calibration requirements to include engine test hours	04-3
20041001	Change calibration frequency for fuel flow, speed, AFR and EBP to prior to a reference sequence.	04-3
20041001	Decreased calibration frequency for coolant flow, thermocouple & temperature measurement systems and other instrumentation to every six months	04-3

SEQUENCE VIB INDUSTRY OPERATIONALLY VALID DATA

Figure 1

FEI FINAL RESULT PHASE I (%)



SEQUENCE VIB INDUSTRY OPERATIONALLY VALID DATA Figure 2

FEI FINAL RESULT PHASE II (%)

