



# Test Monitoring Center

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**MEMORANDUM:** 02-091

**DATE:** October 10, 2002

**TO:** Charlie Leverett, Chairman, Sequence VIA/VIB Surveillance Panel

**FROM:** Richard Grundza

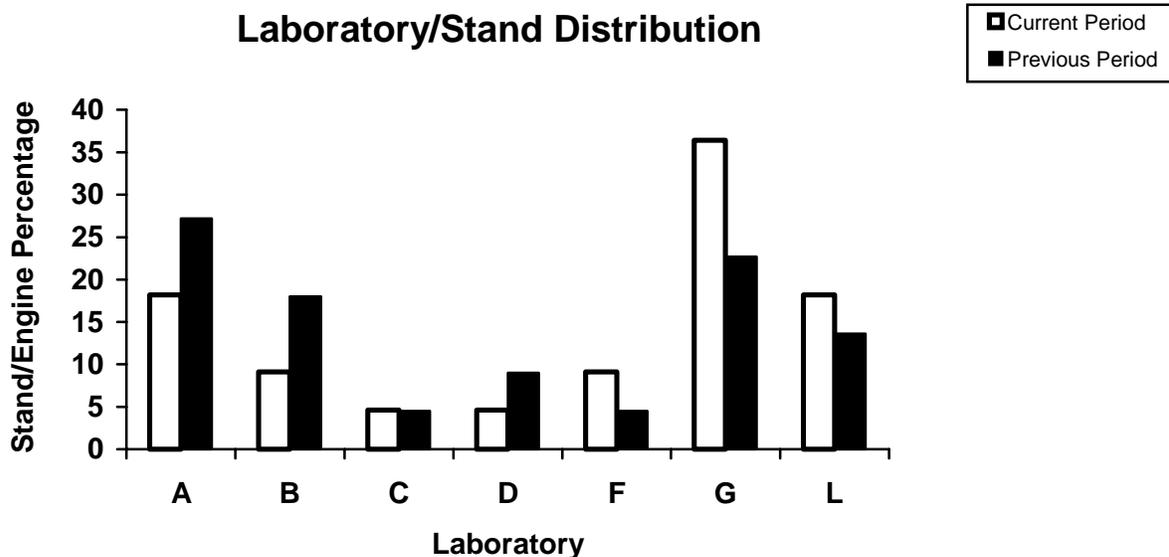
**SUBJECT:** Sequence VIB Test Results from April 1, 2002 through September 30, 2002

The following is a summary of Sequence VIB reference tests that were reported to the Test Monitoring Center during the period April 1, 2002 through September 30, 2002.

### Lab and Stand Summary

	Reported Data During Period	Calibrated as of 09/30/2002
Laboratories	7	4
Stand/Engine Combinations	22	9

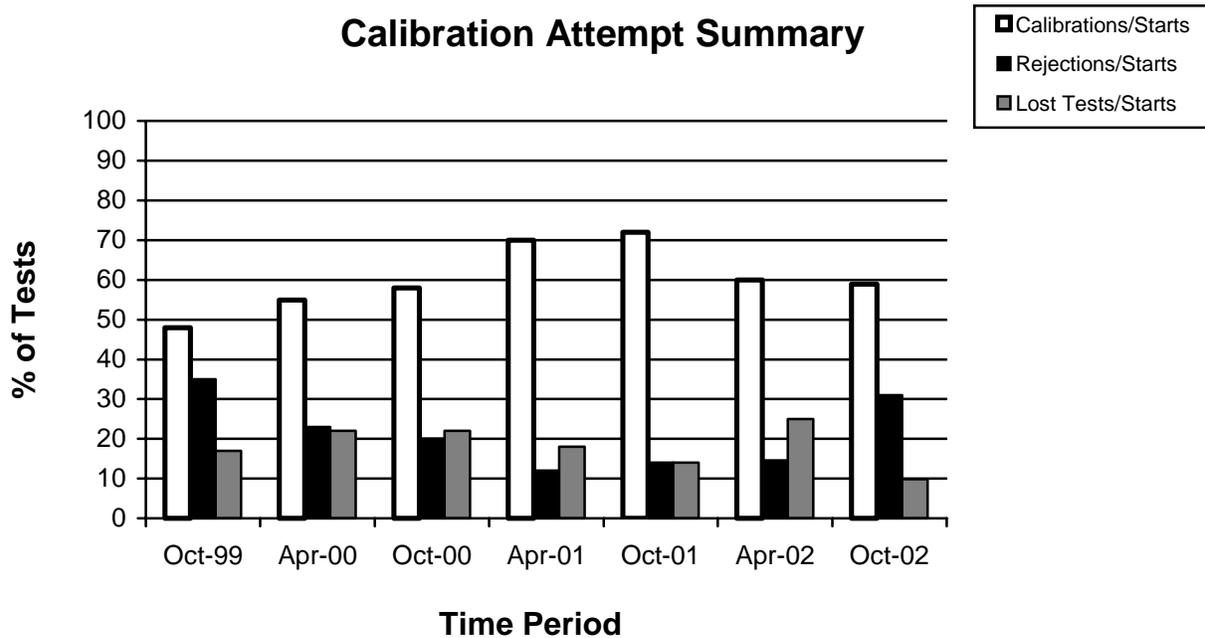
The following chart shows the laboratory stand/engine distribution for data reported during this report period:



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	36
Failed Acceptance Criteria	OC	19
Operationally Invalid (Laboratory Judgement)	LC	3
Aborted	XC	3
<b>Total</b>		<b>61</b>

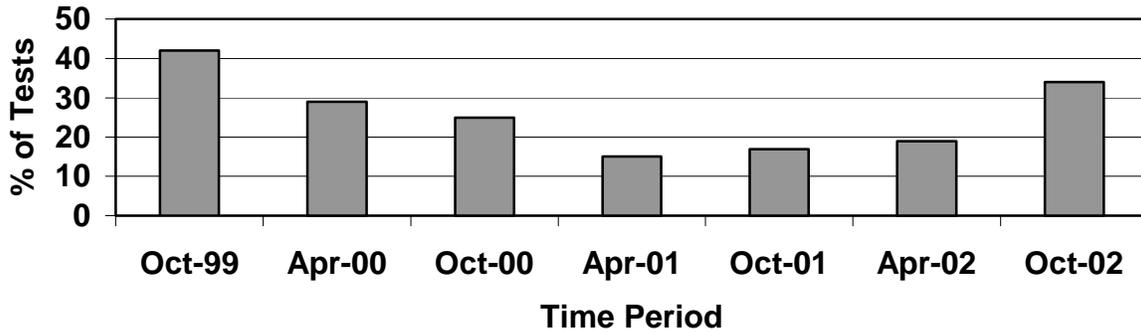
Attempted calibration tests are depicted graphically below by report period:



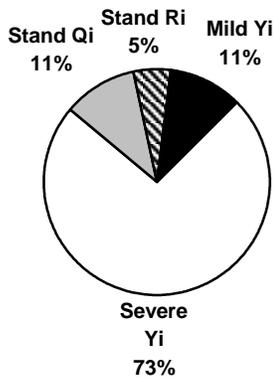
The calibration per start rate is essentially unchanged with respect to the previous period. The rejected per start rate has increased and lost test per start rate has decreased this report period.

The percentage of tests failing the acceptance criteria for operationally valid tests increased this report period. The percentages are depicted graphically below.

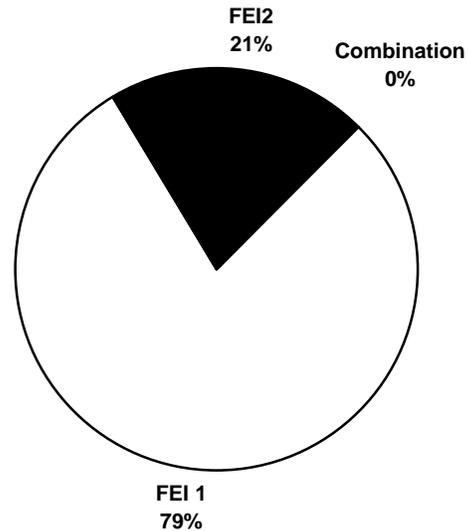
### Rejected Operationally Valid Tests



Distribution of LTMS Stand Alarms

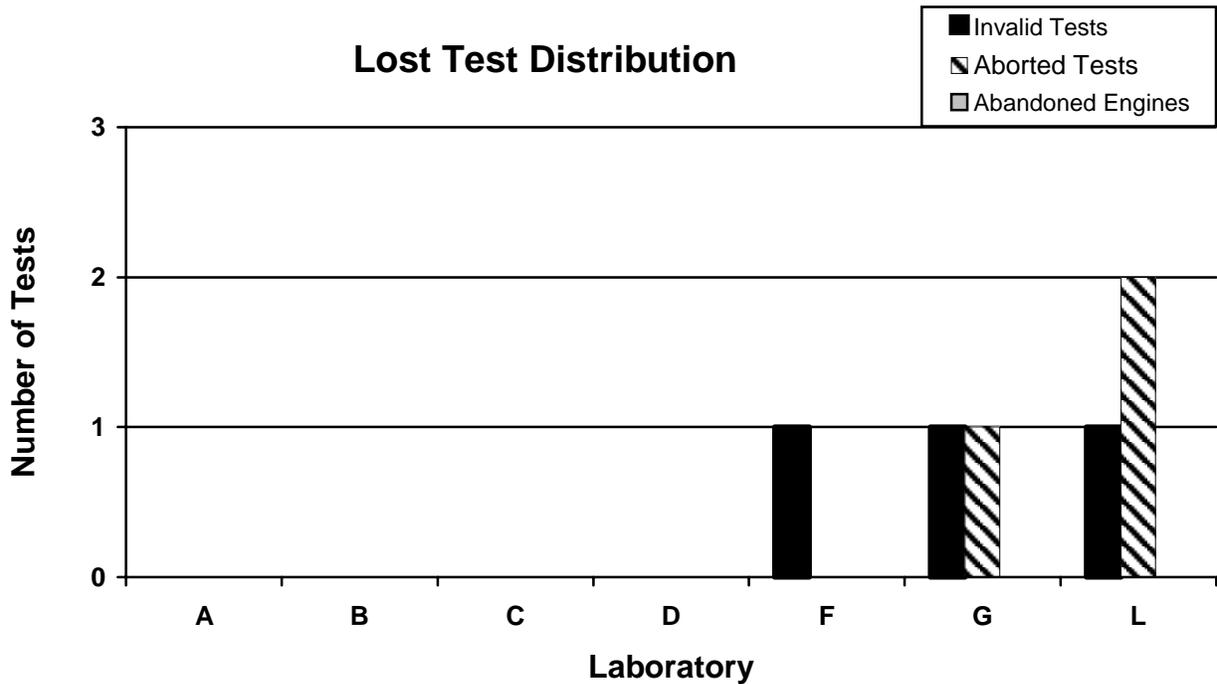


Distribution of Stand Alarms by Parameter

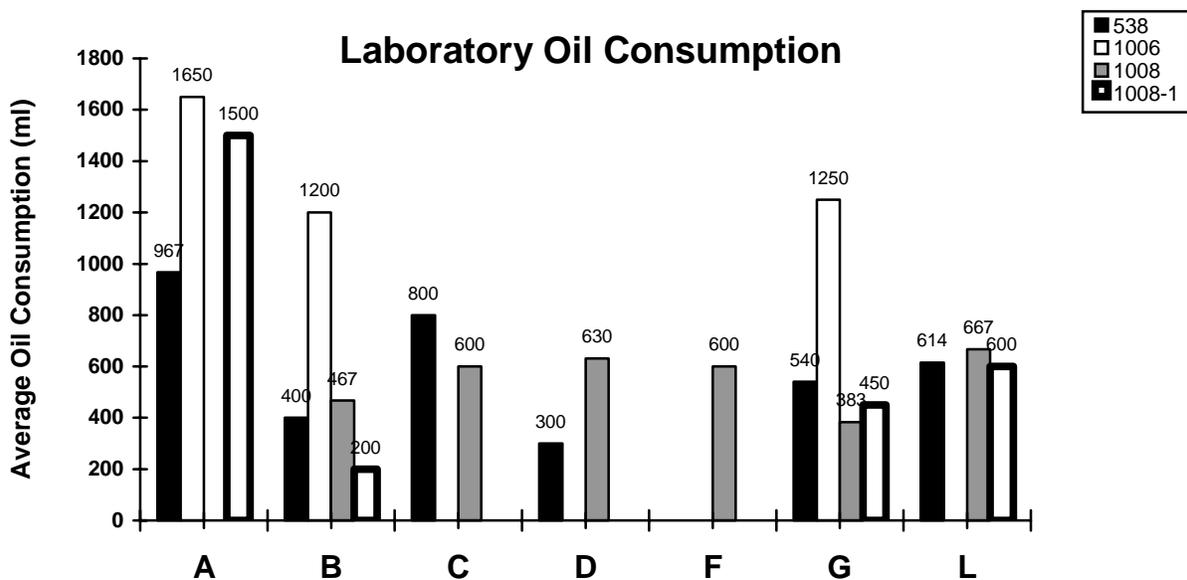


There were fourteen tests rejected for FEI Shewhart (Yi) severe, two tests rejected for FEI Shewhart (Yi) mild, two tests rejected for EWMA precision alarm (Qi), and one test rejected for Shewhart precision alarm (Ri). There has never been an LTMS deviation written for Sequence VIB.

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).

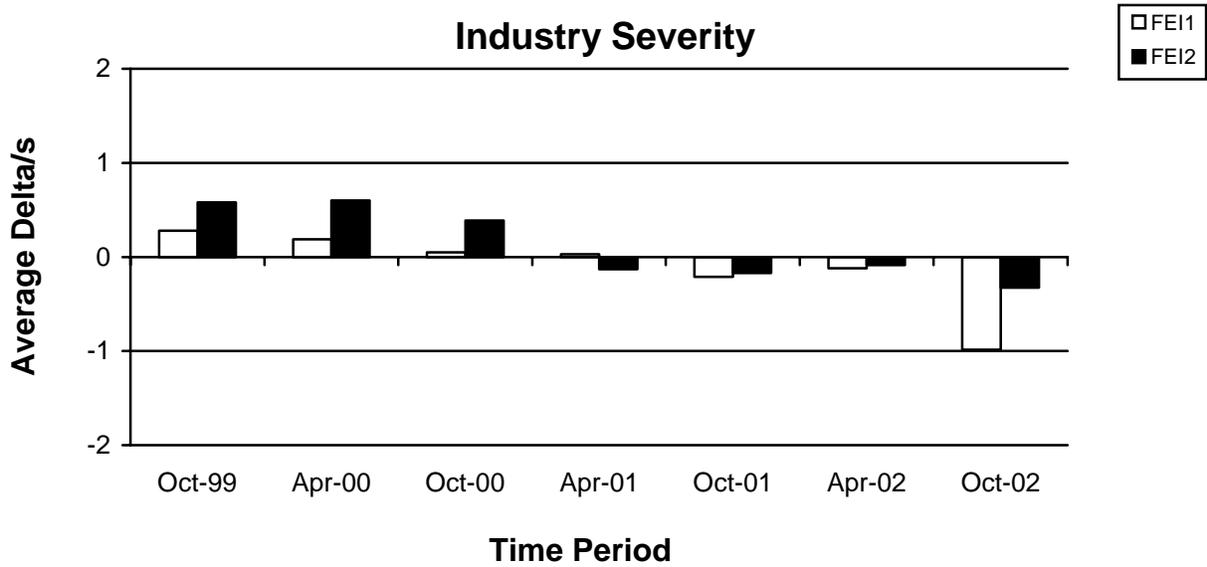


The average oil consumption by oil and laboratory are depicted graphically below. Shown below is a summary of the average oil consumption for all laboratories reporting data this report period.

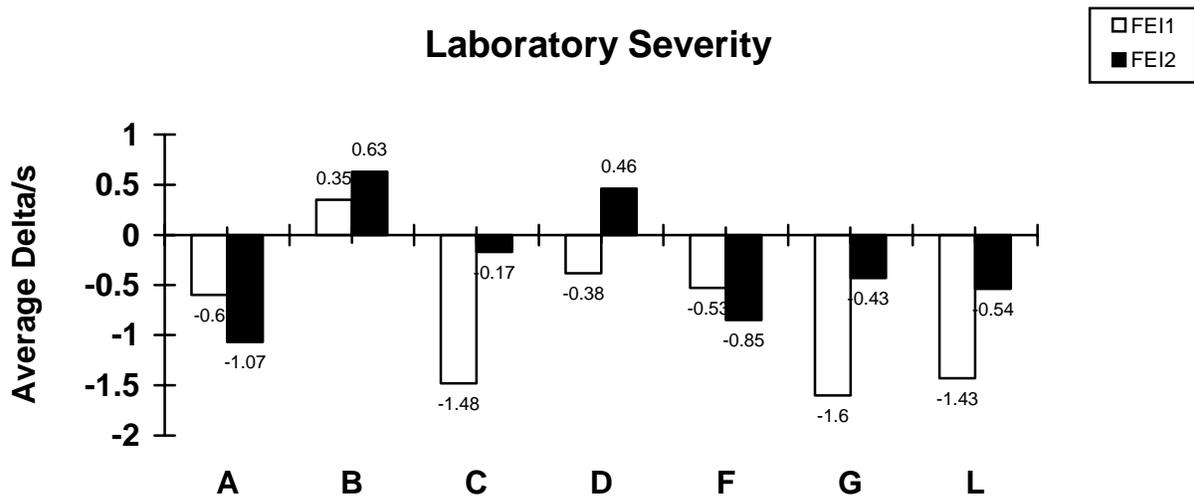


TEST SEVERITY AND PRECISION

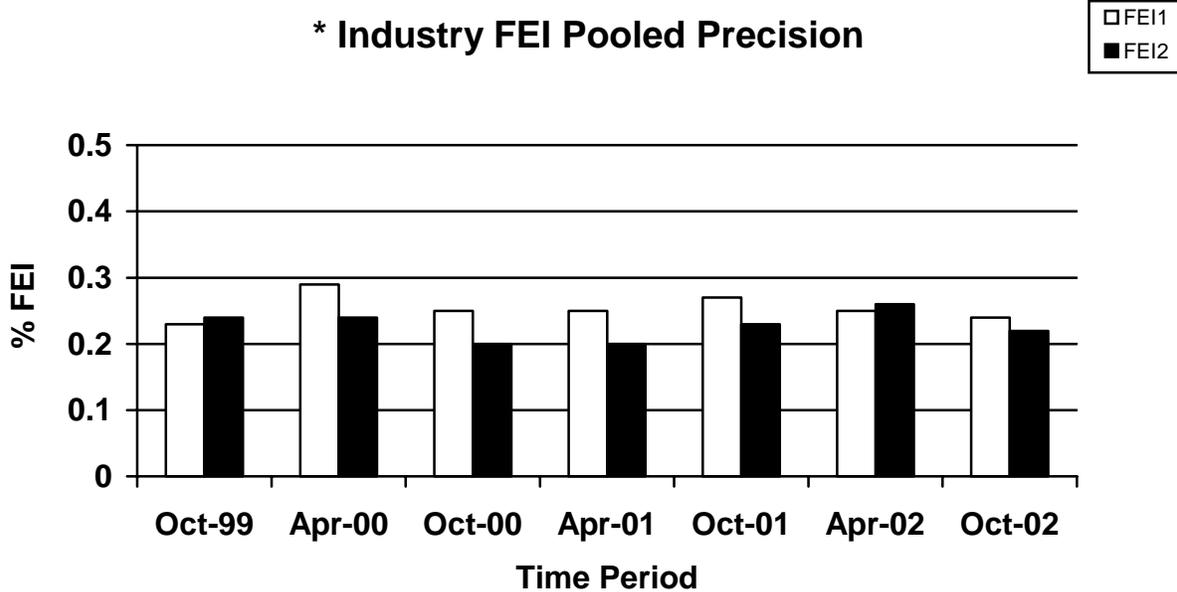
The industry mean  $\Delta/s$  for FEI1 and FEI2, for this report period are -0.99 severe and -0.32 severe, respectively. FEI1 and FEI2 severity are severe of target for this report period.



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



The industry precision estimates for FEI1 and FEI2 for this report period are 0.24 and 0.22 (pooled s), respectively. Precision for both FEI1 and FEI2 has shown little change this report period.



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

INDUSTRY CONTROL CHARTS

**FEI1**

FEI1 severity began the period with a warning alarm, quickly going to action level for 27 tests before sounding a warning alarm and finally returning to in control status for the remainder of the period. The alarms appear to have been caused by a large amount of tests on new engines. Of the 55 operationally valid results reported this period, 41 were on new engines. FEI1 precision sounded a warning alarm at the beginning of the period, which cleared for 4 tests, when another one test warning alarm sounds. Precision remained in control for 9 more tests before sounding a warning alarm, followed by 7 action alarms and then followed by 4 warning alarms. Precision came back in control for 2 tests, sounded a 2 test warning alarm, came back in control for 3 tests before sounding a series of a warning, action and warning alarm. Precision alarms cleared for 2 tests, then sounded an additional warning alarm before coming back in control for the remainder of the period. Again the intermixing of a large number of new engine tests which tended to be more severe than existing engines appears to have caused the precision and severity issues this period. During the period, there were 6 results greater than -2.5 standard deviations from target, all of which were run on a new stand/engine combination.

**FEI2**

There were 6 severity warning alarms this report period as illustrated in Figure 2. Precision was in control for the entire period. Much like FEI1, severity trends observed during the period are a result of the relatively large number of tests report on new engines, which tend 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	1006-2	1007	1008	1008-1
A	0	0	0	0	7	3	1
B	1	0	0	0	2	0	1
C	0	0	4	0	2	3	0
D	0	0	6	0	5	6	0
F	0	0	4	0	3	3	0
G	2	0	1	0	3	4	0
L	4	0	0	0	5	3	1
TMC	492	198	0	*	**	***	****

\* 5,154 Gallons (Multiple test area usage)

\*\* 504 Gallons (Multiple test area usage)

\*\*\* 44 Gallons (Multiple test area usage)

\*\*\*\* 2551 Gallons (Multiple test area usage)

Reblends of reference oils 1006 (1006-2) and 1008 (1008-1) have been obtained. The VIB panel elected not to introduce reference oil 1006-2 into the LTMS. A total of 7 tests have been reported on reference oil 1008-1 to date.

**LAB VISITS**

Five lab visits were conducted during this report period.

**INFORMATION LETTERS**

No information letters were issued this report period. TMC memorandum 02-059 was issued on July 11, 2002. This memo updated the targets for reference oil 538.

SUMMARY

Severity for FEI1 and FEI2 were severe for this report period.

FEI1 and FEI2 precision has shown little change when compared to the last report period.

The percentage of calibrations per starts has decreased slightly 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 VIA/VIB Surveillance Panel  
Sequence VIA/VIB Test Engineers  
<ftp://ftp.astmtmc.cmu.edu/docs/gas/sequencevi/semiannualreports/vib-10-2002.pdf>

Sequence VIB Semiannual Report  
List of Attachments

- Table 1 is a historic statistical summary for reference oils through September 30, 2002.
- 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 10/01/02

OIL CODE 1006				
N	TEST PARAMETER	MEAN	s	REPORTED RANGE
223	FEI1	1.41	0.29	0.61 - 2.50
223	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
224	FEI1	1.82	0.24	1.19 - 2.47
224	FEI2	1.23	0.21	0.58 - 1.74
OIL CODE 1008-1				
N	TEST PARAMETER	MEAN	s	REPORTED RANGE
6	FEI1	1.93	0.25	1.55 - 2.36
6	FEI2	1.34	0.25	0.96 - 1.68
OIL CODE 538				
N	TEST PARAMETER	MEAN	s	REPORTED RANGE
23	FEI1	1.64	0.27	0.89 - 2.11
23	FEI2	1.46	0.15	1.21 - 1.78
568	TOTAL			

TABLE 1A

SEQUENCE VIB  
 OPERATIONALLY VALID DATA SET  
 DATA FROM 04/01/02 THRU 09/30/02

OIL CODE 1006				
N	TEST PARAMETER	MEAN	s	REPORTED RANGE
13	FEI1	1.32	0.18	1.00 - 1.63
13	FEI2	0.41	0.27	0.04 - 0.89
OIL CODE 1008				
N	TEST PARAMETER	MEAN	s	REPORTED RANGE
16	FEI1	1.67	0.28	1.25 - 2.22
16	FEI2	1.26	0.22	0.89 - 1.70
OIL CODE 1008-1				
N	TEST PARAMETER	MEAN	s	REPORTED RANGE
6	FEI1	1.91	0.26	1.55 - 2.36
6	FEI2	1.30	0.24	0.96 - 1.80
OIL CODE 538				
N	TEST PARAMETER	MEAN	s	REPORTED RANGE
20	FEI1	1.62	0.26	0.89 - 1.93
20	FEI2	1.46	0.15	1.21 - 1.78
55 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
F	Engine Coolant Flow and Oil Gallery Temperature Out of Spec	1	16.7%
G	Broken Valve Spring	1	33.3%
	Engine Coolant Flow out of Spec	1	
L	Load out of Spec	2	50%
	Abandon Engine	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 of Use 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

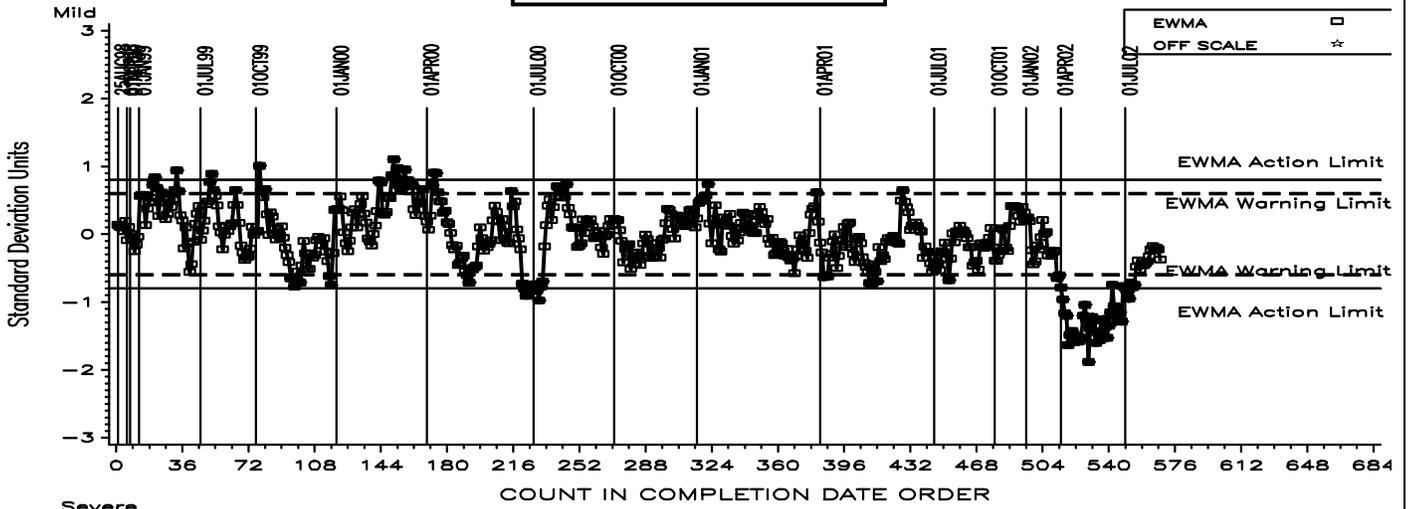
Date	Item Changed	Information Letter
20000801	A Task Force Was Appointed by the VIB Surveillance Panel to Address Lab To Lab Differences with Oil Consumption and FEI Severity. Information Letter 00-4 was a result of the Lab Visit Discrepancies.	
20000915	Increase Oil Charge to 6.0 Liters	00-4
20000915	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)	

# VIB INDUSTRY OPERATIONALLY VALID DATA

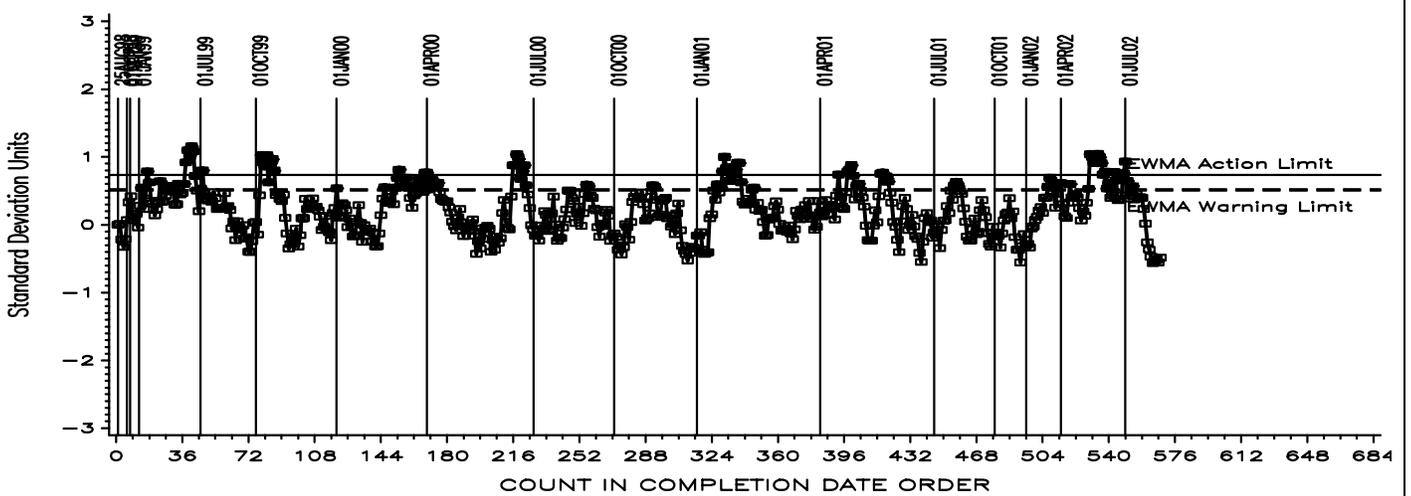
Figure 1

## FEI FINAL RESULT PHASE I (%)

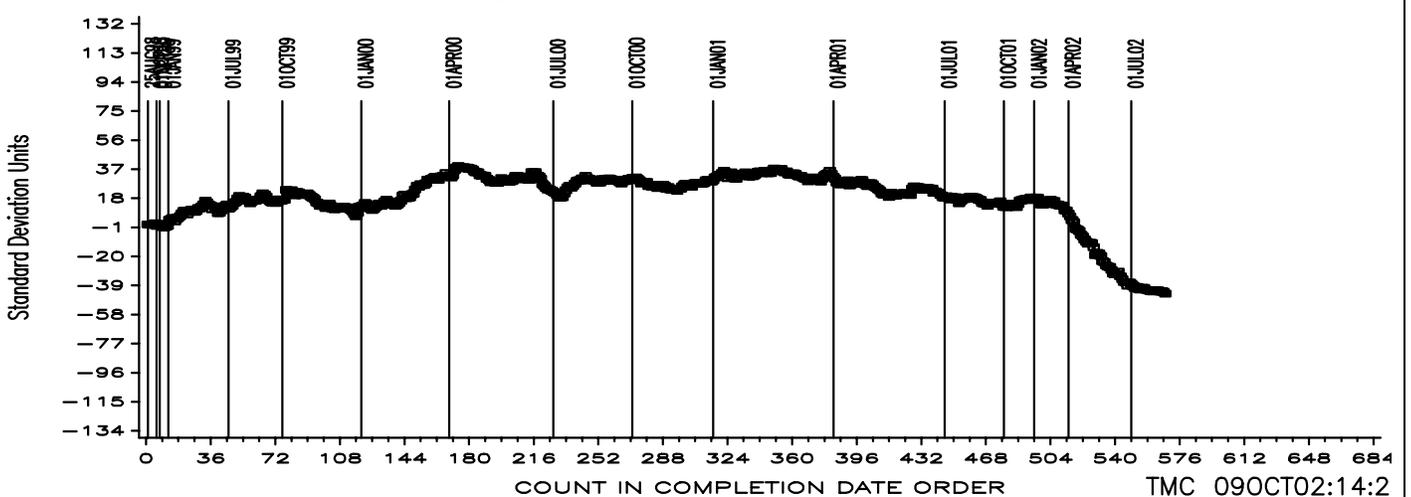
### LTMS Severity Analysis



### LTMS Precision Analysis



### CUSUM Severity Analysis



# VIB INDUSTRY OPERATIONALLY VALID DATA

FEI FINAL RESULT PHASE II (%)

Figure 2

