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Committee D02 on PETROLEUM PRODUCTS AND LUBRICANTS

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Originally Issued: April 28, 2009

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Unapproved Minutes of the April 22, 2009 Sequence VI Surveillance Panel Meeting held in Plymouth, MI

The meeting was called to order at 2:00 pm by Chairman Charlie Leverett.

Agenda Review

The Agenda was accepted as shown on attachment 1.

Membership Changes

A sign in sheet listing all attendees is included as attachment 2. John Rosenbaum replaces Matthew Ansari as the voting member for Chevron. Ron Romano held Proxy for Tracy King and John Rosenbaum. A hand count of the voting members was conducted and there were a total of 15 voting members present.

Review of Action Items from Last Meeting

Charlie laid out the objectives for this meeting, as listed in the agenda and as follows:
Precision Statement
Reference Oil Targets
LTMS Guidelines
Stage Weighting
Recommendation from the SP to PCEOCP for the inclusion of the VID

Meeting Minute Status

The April 9, 2009 conference call minutes were approved by the surveillance panel.

Review of Action Items

Most of the action items have been completed. The panel will begin working on obtaining the next BL blend shortly. The balance of the engine order is being completed this week and should be at OHT in the next three weeks. Charlie still plans on identifying engine recondition practices for inclusion in the test method. The oil pressure issue will be discussed as part of the Statistical Group presentation. Stage weighting was also reviewed by the Statistical Group and they did not have any suggested changes. Repeat data will also be addressed in the Statistical Group presentation. The Surveillance Panel needs additional discussions on oil pump changes due to the noted correlation in oil pressure and FEI results in the Statistical Groups report.

Analysis of Matrix Data by Statistical Group

Attachment 3 contains the presentation made to the panel by Jo Martinez on behalf of the Statistical Group. The statistical group estimated precision to be 0.18 and 0.19 for FEI1 and FEI2, respectively. They also concluded that if data is adjusted for engine life, the precision estimates become 0.14 and 0.16 for FEI1 and FEI2, respectively. They also found that the test data generated from the matrix meets the ACC Code of Practice. The data does not appear to benefit from a transformation. The group also recommended that the test results, FEI1 and FEI2, be adjusted for engine hours. The adjustments would be $FEI1_{corrected}$=FEI1 – 0.28897*(ln(enhrend) – 7.377) and $FEI2_{corrected}$=FEI2 – 0.28897*(ln(enhrend) – 7.377). Oil pressure was also correlated with test results, but may be a function of engine age and the statistical group did not recommend any corrections for this parameter. They presented it as an observation only. The panel discussed an engine which had an oil pump replaced. This engine was part of the matrix, but had the oil pump replaced prior to the start of the matrix. Several panel members suggested that this may require further review and that a reference oil test may be required after pump replacement on an engine that has been accepted into the LTMS. The panel accepted the statistical group's presentation. A motion was made by Dave Glaenzer, seconded by George Szappanos, to proceed with engine hour correction as per the statistical group's recommendation for correction of test results for engine hours using the correction provided in slide 8 of the Statistical Group presentation. The motion was approved by thirteen affirmative votes, two waives and no negative votes.

LTMS Guidelines

Rich Grundza gave a presentation regarding proposed LTMS guidelines to the panel, which is included as attachment 4. Charlie informed the panel that the intent was not to approve these guidelines at this meeting, but to have them reviewed by the Surveillance Panel and approve them at a later meeting. Rich

also presented the precision statement that will be included in the procedure, as well as the precsion statement from the VIB Test Method (D6837) and the Intermediate precision from the original VIB matrix. This information is included as attachment 5.

Acceptance of the VID Procedure by ASTM

After some discussion, a motion was made by Jim Linden, seconded by Ron Romano, to "Move to accept the Sequence VID as an ASTM test and forward to the Engine Oil Classification Panel as an ASTM procedure in the current format." This brought on discussion about the readiness of the VID procedure. Chris Castanien of Lubrizol gave a presentation regarding stage weighting. A copy of Chris's presentation is included as attachment 6. Lubrizol's conclusions were that the stage weightings chosen to do not reflect the objectives of the GF5 needs statement. Lubrizol's opinion was that most of the weighting addressed stages which are least responsive to lubricants. They also believe that the precision is the same as the VIB and FEI results are lower than the VIB. Lubrizol may provide suggestions for different weighting or additional parameters, to address their concerns about test response. Additional panel members express concerns about the readiness of the test. Concerns were also raised about the LTMS not being implemented yet and that the test is being rushed through. Several members also expressed reservations because of the lack of testing experience. The final vote on the motion to approve the VID test was approved by eleven for, four against and no waives.

TMC Semi Annual Report

There were no questions about the TMC VIB Semi annual report. A copy of the report is available from the TMC Website

Fuel Supplier Report

No fuel supplier report was given, however, a copy is included as attachment 7.

Charlie also informed the panel that he was planning to form a task force to conduct a comprehensive review of the VID procedure. This will be accomplished in the near future. A list of action items from the meeting are included as attachment 8.

Thanks to Toyota for hosting the meeting!

The next meeting will be at the call of the Chair.

The meeting was adjourned at 5:31 pm.

Attachment 1

Sequence VI Surveillance Panel Meeting
April 22-23, 2009
Hosted by Toyota at the Toyota Technical Center
Ann Arbor, MI.

Agenda

1.) Attendance Sheet sign-in, hand count of voting members, Chairman's comments:

The proposal is to recess today's meeting at ~5:00 and reconvene on the 23rd at 9:00, this is open for discussion.

The objectives of these meetings are to walk away on April 23rd with Sequence VID:

Precision Statement
Reference Oil Targets
LTMS Guidelines
Stage Weighting
Recommendation from the SP to PCEOCP for the inclusion of the VID
(Not necessarily in this order)

2.) Approval of the minutes from the 04/09/09 conference call.

3. **Action Item Review**

3.1) The Statistical Group will review BL Shift (BLB vs. BLA) after the Precision Matrix Phase II is completed. Reviewed but no suggestions at this time.

3.2) The Statistical Group will review outlier criteria after the Precision Matrix Phase II is completed. Reviewed, none found.

3.3) The SP is to determine requirements for the next batch of BL by the next Surveillance Panel meeting. Open pending completion of Phase II is currently in Scope & Objectives.

3.4) OHT will notify SP when the new engine supply arrived. (12/16/08). Open - as of 04/07/09 99 engines have been assembled and are in the process of being crated.

3.5) The Surveillance Panel will hold weekly conference calls until all issues relater to oil selection are resolved for Phase II. Completed

3.6) This was an earlier action item which was dropped and now back into place, Labs should start creating a list of acceptable engine reconditioning practices. The SP will review the list and make final recommendations on parts and actions required. (02/18/09) OPEN

3.7) The SP decide to monitor oil pressure and have the Statistical Group review the complete data set (Phase I & II) to see if oil pressure correlates to performance. Reviewed, will discuss in the SG Summary.

3.8) It has been recommended that stage weighting be reviewed as part of the Phase I & II analysis. SG has had a discussion and does not have any suggestions on changes.

3.9) SwRI had presented data on engine 11B after it was reassembled and installed into the stand. They have decided to abandon this engine and will tear it down and report any findings to the SP. (04/02/09)

4.0) Statistical Group is requested to look at all repeat data and only A,D & X data to determine which data set should be used for precision statement. This will be covered in the summary report.

4.) **Presentation of Data Review by Statistical Group**

5.) <u>Old Business</u>

5.1) Next Blend of Baseline oil – at this point we should get a survey started and work into the actual blend to be completed 1st qt 2010.

5.2) Review of the CMA template for the VID.

6.) New Business

6.1) TMC to present VIB semiannual report.

vib-04-2009.pdf

6.2) Draft 6.0 review to fill in anything missing – I plan to form a task force for this review and the final changes will be voted on by the membership.

7.) Next Meeting

At the call of the Chairman

8.) Meeting Adjourn

4/23/09

ASTM SEQUENCE VI SURVEILLANCE PANEL

Name	Address	Phone/Fax/Email	Attendance
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4/22/09

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Sequence VID Precision Matrix Analysis

Statistical Group

April 22, 2009

Summary - 1

- The Sequence VID precision is estimated to be 0.18% for FEI1 and 0.19% for FEI2 without accounting for engine hours or 0.14% and 0.16% for FEI1 and FEI2, respectively, with engine hour correction.
  - FEI1 and FEI2 meet ACC Code of Practice Appendix K Template
- No data transformation is needed for FEI1 or FEI2.
- Engine aging effect is significant for FEI1 and FEI2 and is currently best estimated by the natural logarithmic transformation.
- Engine difference within lab is not significant for FEI1 and FEI2 after engine aging correction.
- Engine build difference within lab is not significant for FEI1 and FEI2 after engine aging correction.
- Lab A significantly higher than labs B, D and G while lab F is not significantly different from the other labs.
- Shell data was considered but did not add anything to the matrix analysis because of confounding with engine.

Summary - 2

- Overall Model:
  - Lab, Engine(Lab), Oil (A, B, C, D, X)
  - Lab, Engine(Lab), Oil (A, B, C, D, X), LnEngHr
- Viscosity Grade differences are significant for FEI1 and FEI2.
  - FEI1: 0w20, 5w20 > 5w30, 10w30
  - FEI2: 0w20 > 5w30, 10w30
- HTHS@150C significantly correlates with FEI1 and FEI2 but CCS@-30C weakly correlates with FEI1 and FEI2.
  - HTHS@100C is highly correlated with HTHS@150C
- There is some relationship between FEI results and some measures of oil pressure but there is not additional information from knowing this oil pressure when engine hours are known.
- Draft LTMS to be presented by TMC
  - Option 1: No correction for engine hours
  - Option 2: Correct all reference and candidate results with engine hours (similar to soot correction)

Reference Oil Targets

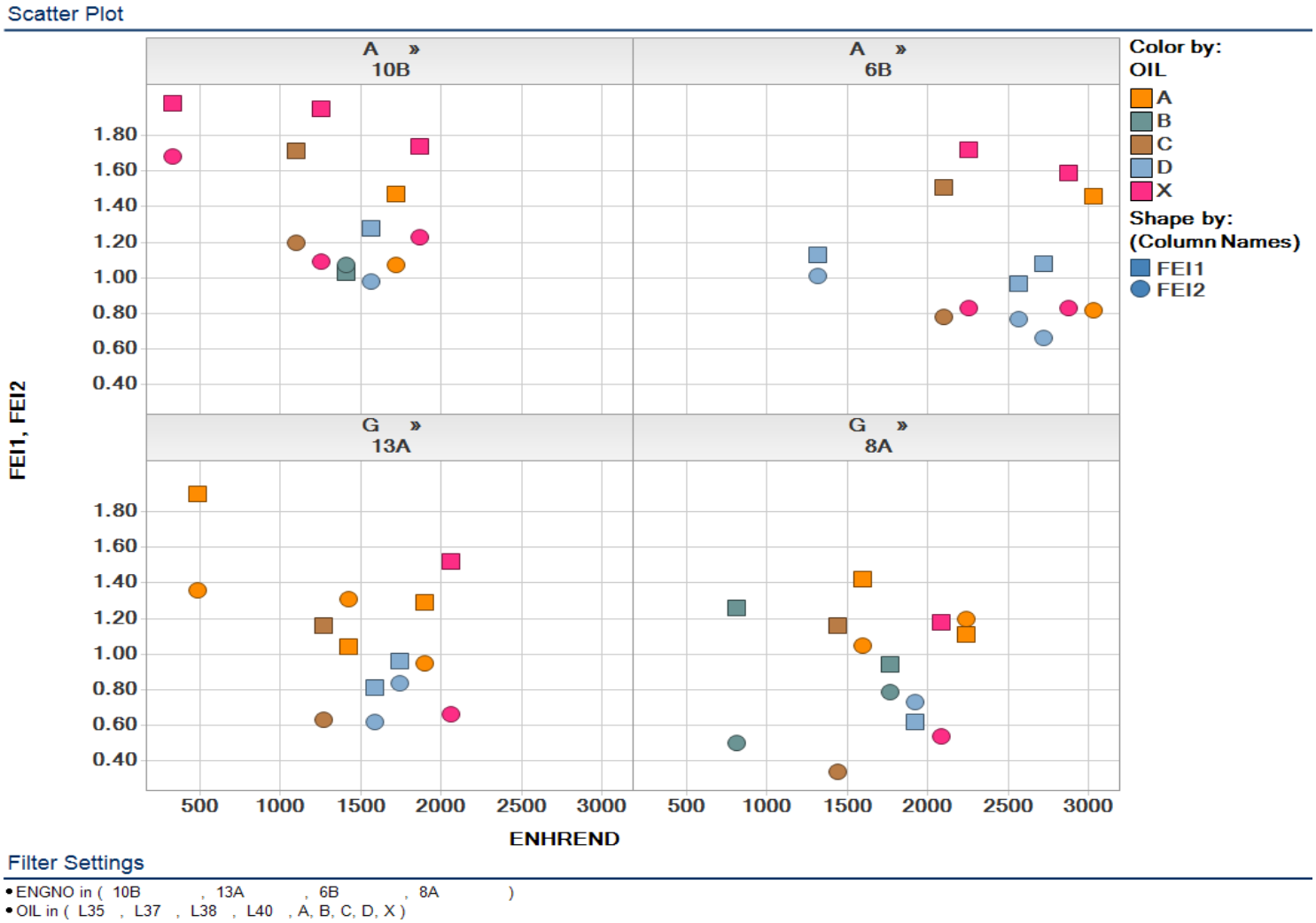
Fuel Economy Improvement at 16 hours
Unit of Measure: % FEI1

Reference Oil	Mean	Standard Deviation
A	1.32	0.18/0.14
D	0.87	0.18/0.14
X	1.49	0.18/0.14

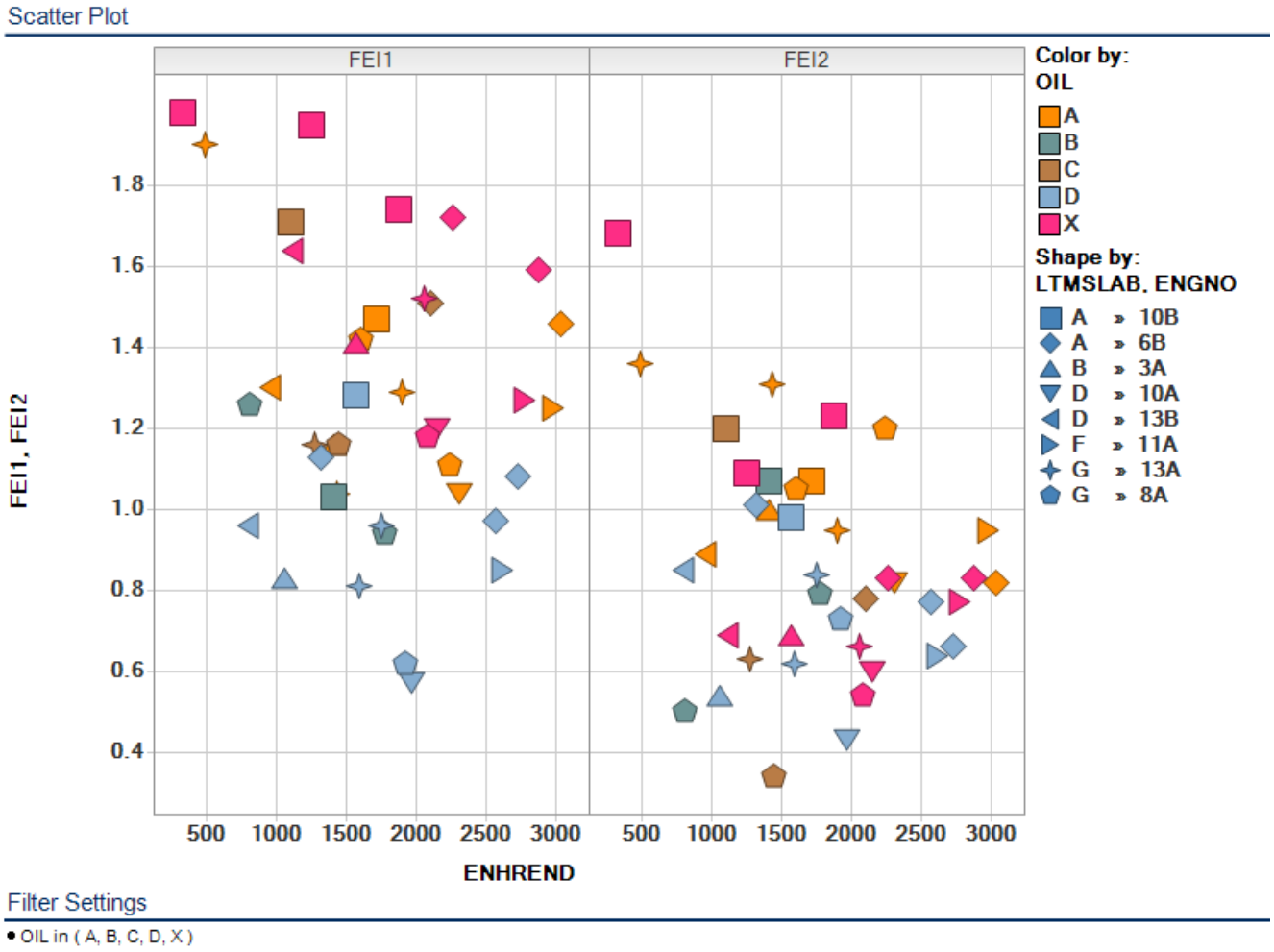
Fuel Economy Improvement at 100 hours
Unit of Measure: % FEI2

Reference Oil	Mean	Standard Deviation
A	1.04	0.19/0.16
D	0.71	0.19/0.16
X	0.80	0.19/0.16

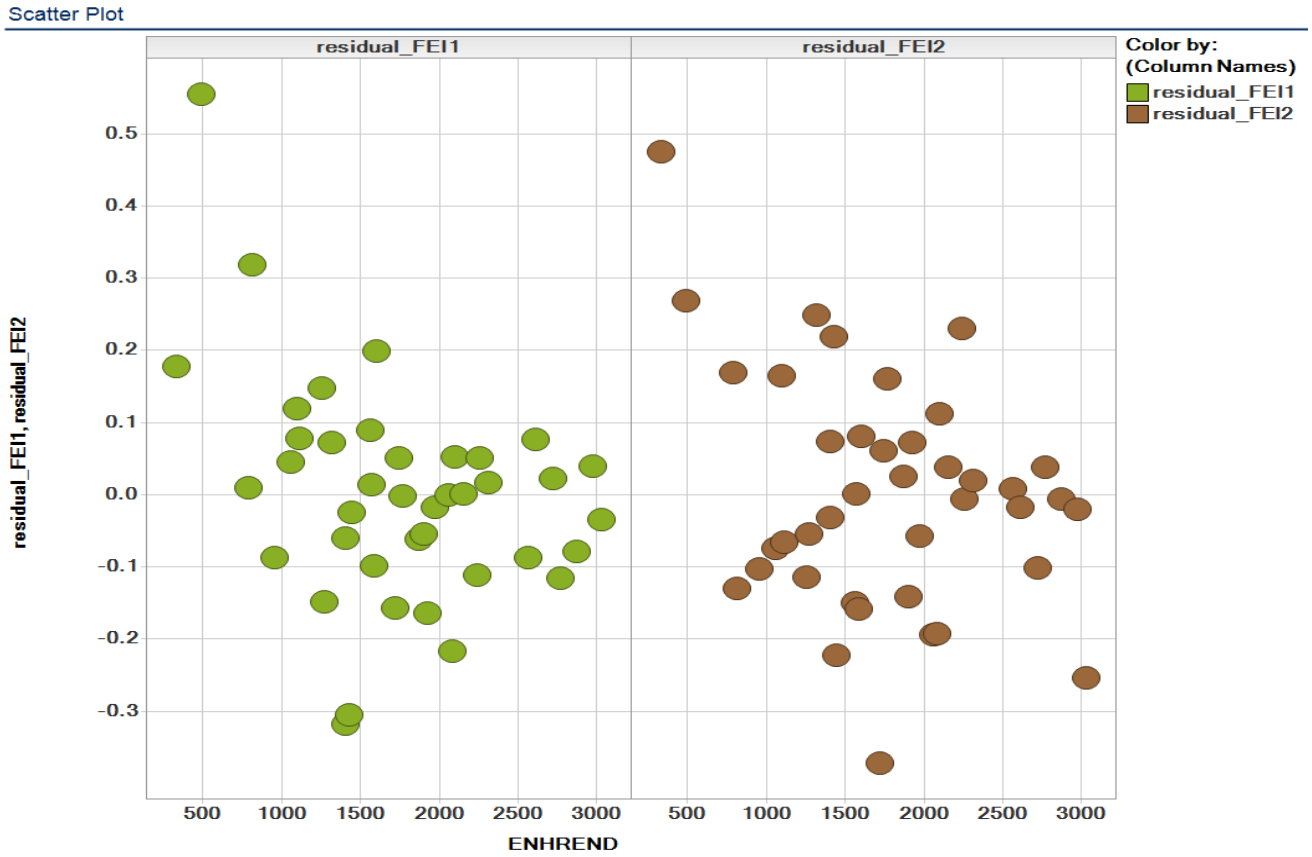
FEI by Engine Hours by Engine



FEI by Engine Hours

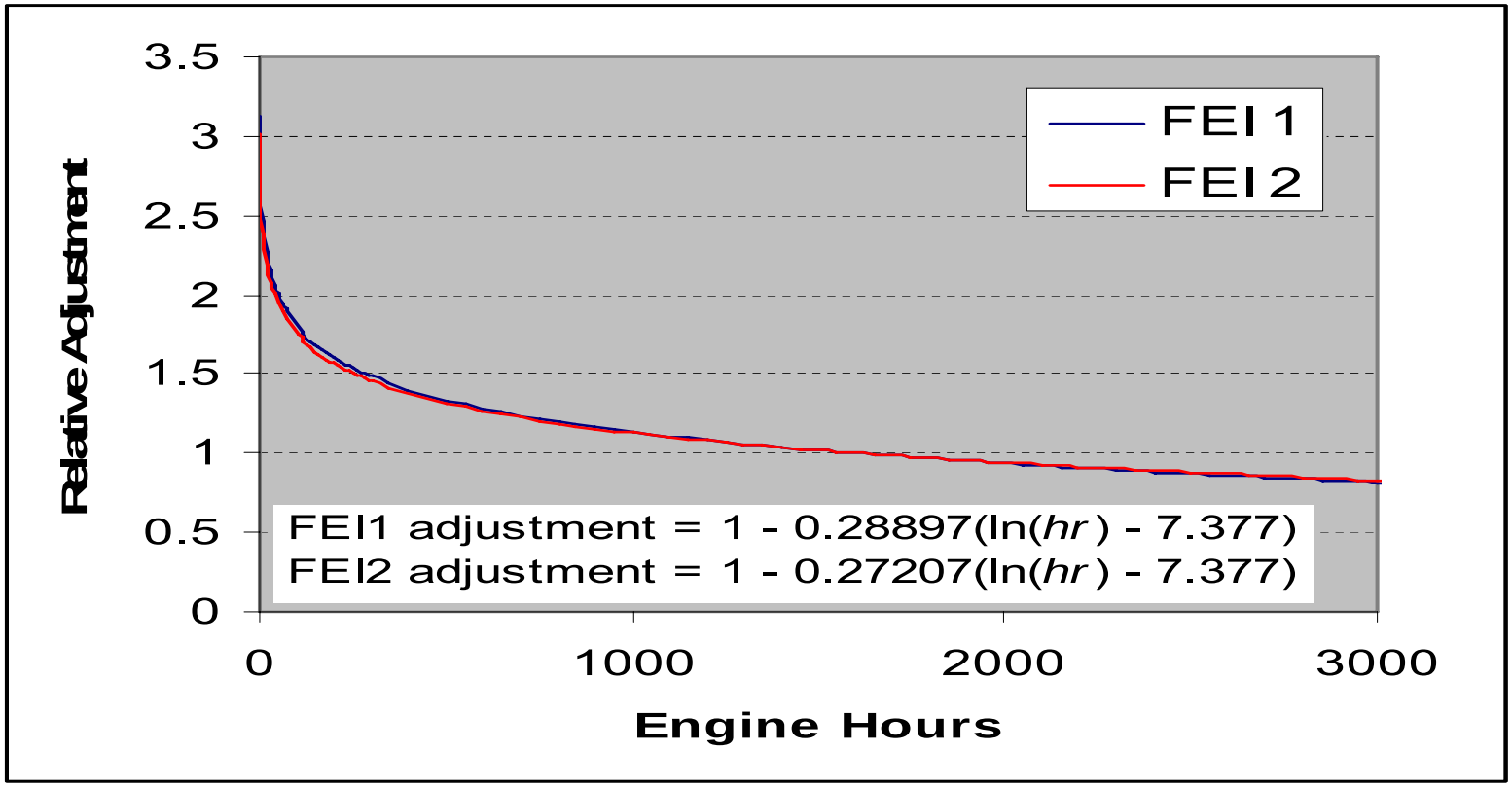


FEI Residuals by Engine Hours



Strong indication of engine hour effect on FEI after correcting for Oil, Lab and Engine within Lab.

Ln Engine Hour Correction

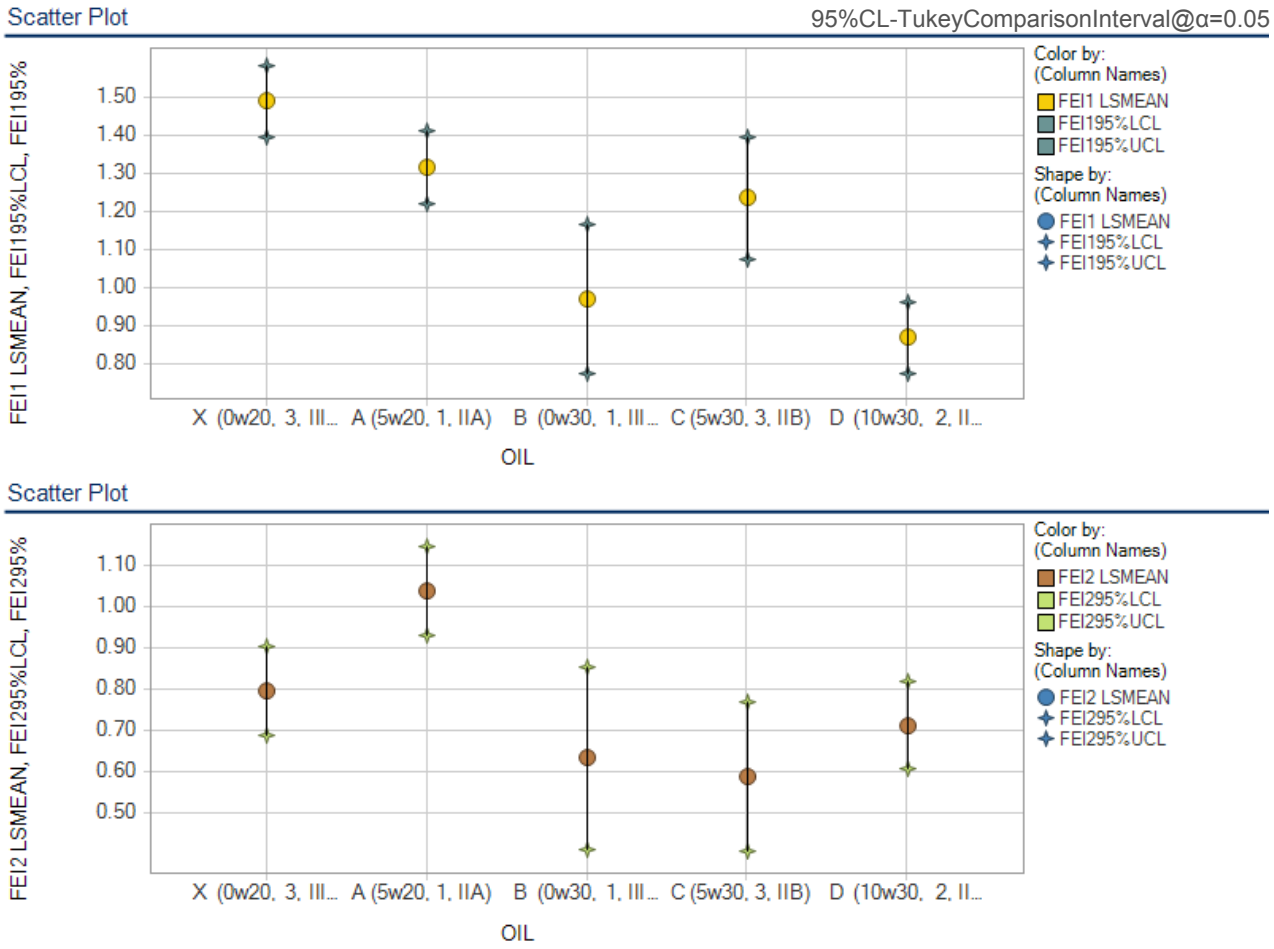


How to apply correction:

FEI1corrected = FEI1original + 0.28897[ln(hour) – 7.377]

FEI2corrected = FEI2original + 0.27207[ln(hour) – 7.377]

FEI LSMean by Oil



OIL	FEI1 LSMEAN	FEI2 LSMEAN
A	1.32	1.04
B	0.97	0.63
C	1.24	0.59
D	0.87	0.71
X	1.49	0.80
OIL Difference	**P-value**	**P-value**
A-B	0.0172	0.0133
A-C	0.8792	0.0008
A-D	<.0001	0.0007
A-X	0.0706	0.0173
B-C	0.1651	0.9963
B-D	0.8579	0.9612
B-X	0.0002	0.6228
C-D	0.0018	0.7044
C-X	0.0468	0.2286
D-X	<.0001	0.7457

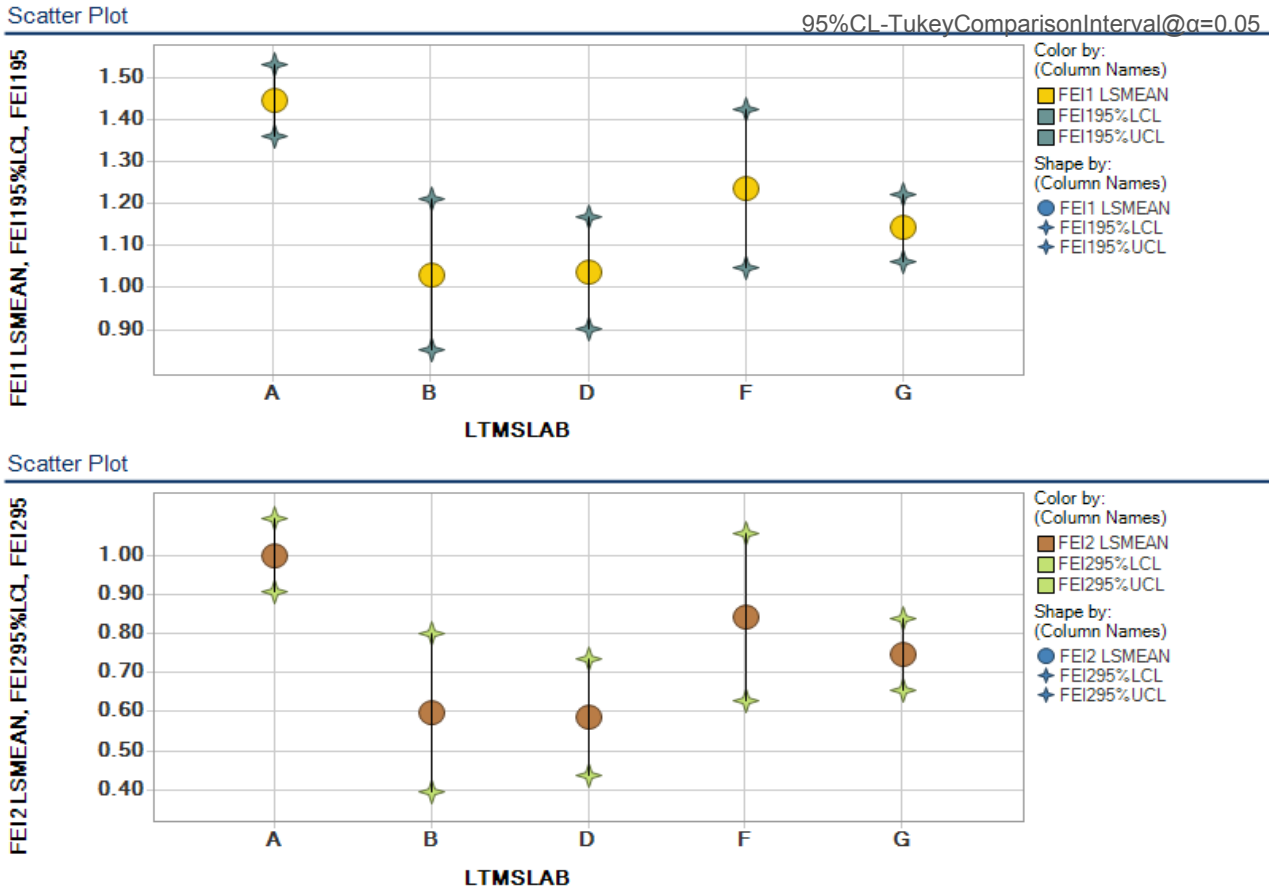
FEI1: A, X > B, D

X > C > D

FEI2: A > B, C, D, X

Based on repeated oils data.

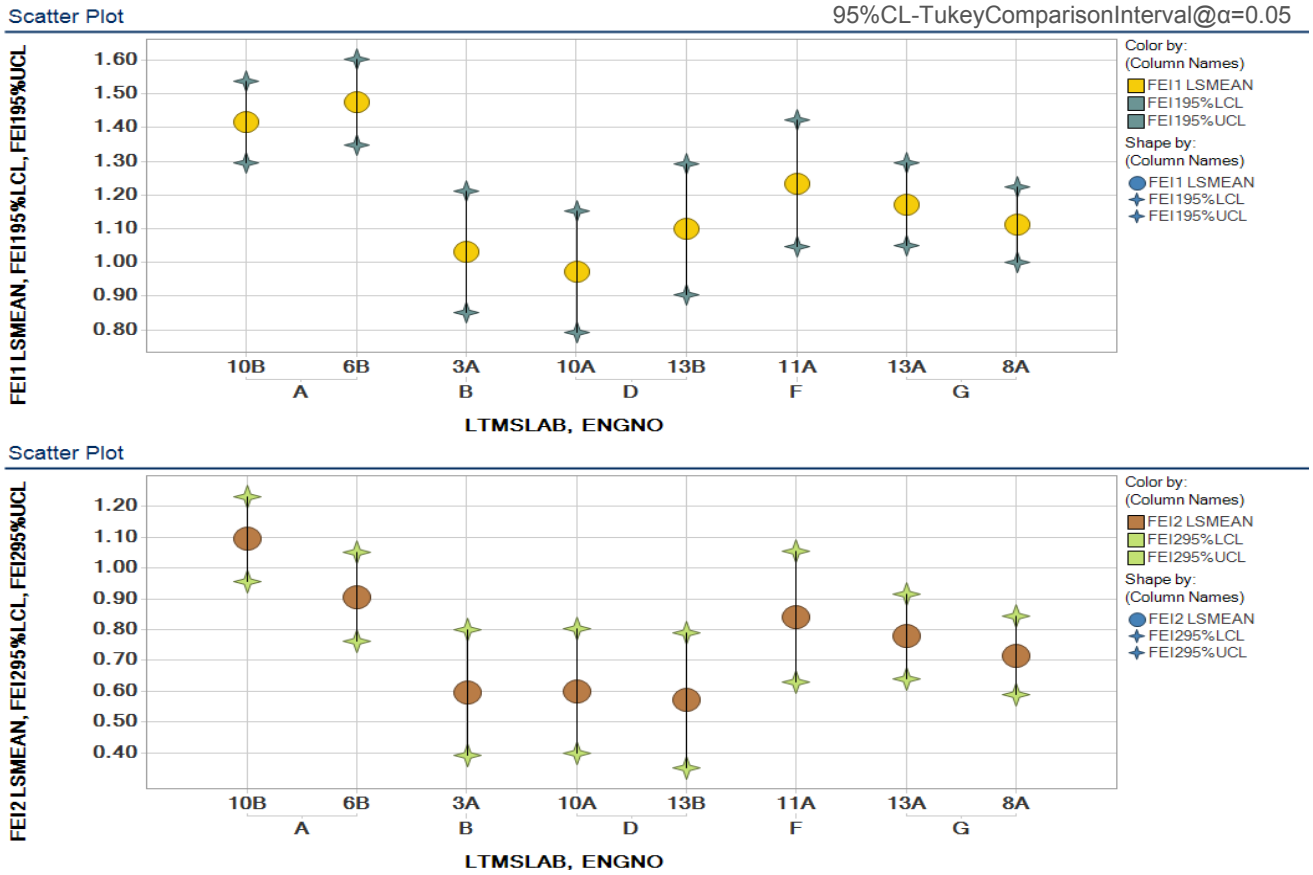
FEI LSMean by Lab



Lab A is significantly higher than labs B, D and G while lab F is not significantly different than the other labs.

Based on repeated oils data.

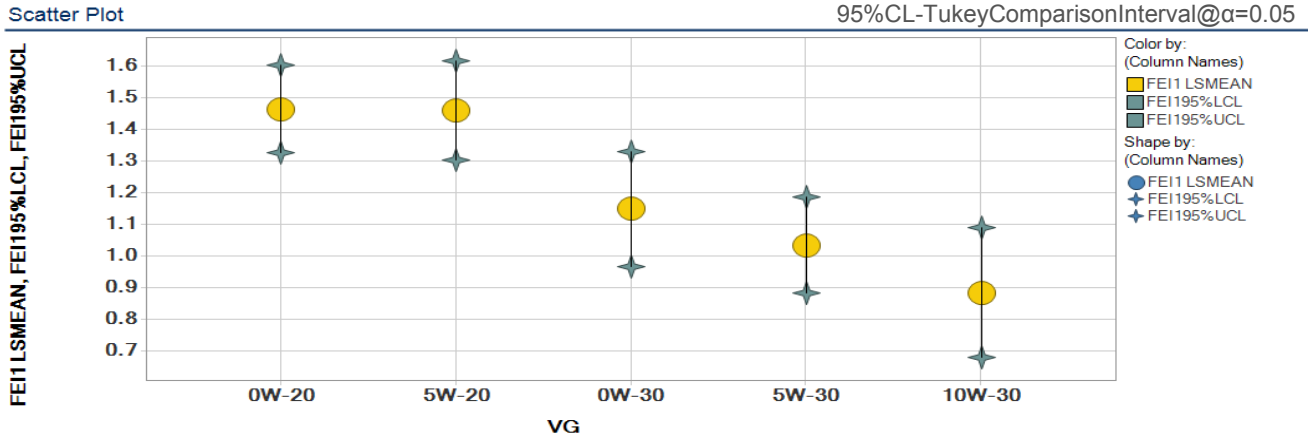
FEI LSMean by Engine within Lab



Engine differences within lab are not significant after engine aging correction.

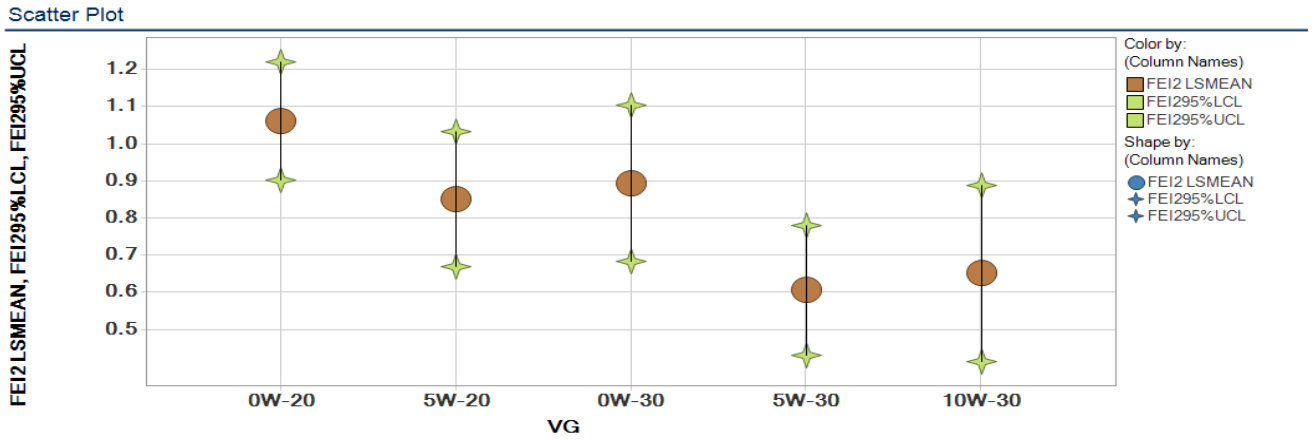
Based on repeated oils data.

FEI LSMean by Viscosity Grade



FEI1:

0W20, 5w20 > 5w30, 10w30



FEI2:

0W20 > 5w30, 10w30

Viscosity Grade differences are significant for FEI1 and FEI2.

Based on all matrix data.

The following are the specific Sequence VID calibration test requirements.

A. Reference Oils and Critical Parameters

The parameters are FEI1 and FEI2. The reference oils required for test stand and test laboratory calibration are reference oils accepted by the ASTM VID Surveillance Panel. The means and standard deviations for the current reference oils for each parameter are presented below.

FEI1
Unit of Measure: Percent
Critical Parameter

Reference Oil	Mean	Standard Deviation
GF5A	1.32	0.14
GF5D	0.87	0.14
GF5X	1.49	0.14

FEI2
Unit of Measure: Percent
Critical Parameter

Reference Oil	Mean	Standard Deviation
GF5A	1.04	0.16
GF5D	0.71	0.16
GF5X	0.80	0.16

B. Acceptance Criteria

1. New Test Engine(s)

a. A minimum of three (3) operationally valid calibration tests, with no Shewhart severity alarms (all parameters), are required to calibrate each test engine.

b. For every two (2) operationally invalid tests during the attempt to calibrate a new engine, an additional operationally valid calibration test will be added to the stand/engine calibration requirement. If the subsequent three calibration attempts are acceptable, then the stand/engine combination need not run a fourth calibration attempt.

2. Existing Test Engine(s)

a. A test engine shall begin a reference oil test no later than 80 days following the completion of the engine's previous reference oil test or:

2nd calibration: after no more than 4 test starts in the engine
3rd calibration: after no more than 6 test starts in the engine
Subsequent calibration: after no more than 10 test starts in the engine

whichever comes first (these intervals may be reduced depending on the status of the engine control charts).

b. If there are two (2) or more operationally invalid tests during the attempt to calibrate an existing engine, then two (2) operationally valid calibration tests, with no Shewhart severity alarms (all parameters), are required to calibrate the engine.

3. Reference Oil Assignment:

New Engines: GF5A, GF5D, GF5X

Existing Engines:

GF5A: 40%
GF5D: 20%
GF5X: 40%

4. Control Charts

In Section 1, the construction of the control charts that contribute to the Lubricant Test Monitoring System is outlined. The constants used for the construction of the control charts for the VID, and the response necessary in the case of control chart limit alarms, are depicted below. *Note that laboratory control charts are only updated following an acceptable stand calibration test.*

		EWMA				Shewhart Chart	
		LAMBDA		K		K	
Chart Level	Limit Type	Precision	Severity	Precision	Severity	Precision	Severity
Engine	Reduced K	--	--	--	--	--	--
	Special K	--	--	--	--	--	Stand K + 1
	Warning	--	--	--	--	1.645	--
	Action	0.1	0.3	1.645	0.00	2.325	1.96
Lab	Warning	--	--	--	--	1.645	--
	Action	0.1	0.2	1.645	1.96	2.325	--
Industry	Warning	0.1	0.2	1.645	1.96	--	--
	Action	0.1	0.2	2.33	2.575	--	--

The following are the steps that must be taken in the case of exceeding control chart limits. The steps are listed in order of priority, although charts should be studied simultaneously to determine the cause(s) of a problem. In the case of multiple alarms, contact the TMC for guidance. The laboratory always has the option of removing any stand from the system.

- o

o Exceed EWMA Precision Engine Action Alarm

- Special K no longer apply for the parameter.
- Immediately conduct an additional calibration test in the offending engine.
- Reduce the reference interval for the next scheduled reference test in the engine by fifty percent (50%).

o Exceed Shewhart Precision Engine Action Alarm

- Special K no longer apply for the parameter.
- Reduce the reference interval for the next scheduled reference test in the stand by fifty percent (50%).
-

o Exceed Shewhart Precision Engine Warning Alarm

- Special K no longer apply for the parameter.
- Reduce the reference interval for the next scheduled reference test in the stand by twenty-five percent (25%). (round down)

o Exceed Shewhart Severity Engine Action Alarm

- First check the status of the Precision alarms. Under certain circumstances Special K, and/or Severity Adjustments MAY NOT be utilized.
- Immediately conduct an additional calibration test in the offending engine. However, if a severity adjustment existed in the engine prior to the reference test, and the alarm is in the direction of the severity adjustment, then an additional calibration test need not be run as long as the test result is within the Special K control chart limit.
- If there are two (2) or more operationally invalid tests during the attempt to calibrate an existing engine, then two (2) operationally valid calibration tests, with no Shewhart severity alarms (all parameters), are required to calibrate the engine.

o Exceed EWMA Severity Engine Action Alarm

- First check the status of the Precision alarms. Under certain circumstances, Special K, and/or Severity Adjustments MAY NOT be utilized.
- Calculate test engine Severity Adjustment (SA) for each parameter that exceeds the action limit. Use the current laboratory EWMA (Zi) as follows:

  FEI1: SA = -Zi*0.14
  FEI2: SA = -Zi*0.16

- Confirm calculation with the TMC.

5. Removal of Test Stands from the System

The laboratory must notify the TMC and the ACC Monitoring Agency when removing a stand/engine from the system. No reference oil data shall be removed from the control charts from test stand/engine(s) that have been used for registered candidate oil testing. Reintroduction of a stand/engine into the system requires completion of new stand/engine acceptance requirements. In all instances of stand/engine removal, stand/engine renumbering can occur only if the stand/engine undergoes a significant rebuild, as agreed upon by the laboratory and the TMC.

TABLE 8 Sequence VIB Reference Oil Precision Statistics [A]

Variable	Intermediate Precision		Reproducibility	
	$s_{i.p.}$ [B]	i.p.	S_R [B]	R
Fuel Economy Improvement, %				
at 16 h	0.22	0.616	0.24	0.672
at 96 h	0.21	0.588	0.25	0.700

[A] These statistics are based on results obtained on Test Monitoring Reference Oils 1006, 1007, and 1008.
[B] s = standard deviation.4

TABLE 8 Sequence VID Reference Oil Precision Statistics [A]

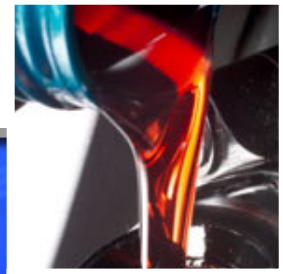
Variable	Intermediate Precision		Reproducibility	
	$s_{i.p.}$ [B]	i.p.	S_R [B]	R
Fuel Economy Improvement, %				
at 16 h	0.14	0.392	0.22	0.616
at 100 h	0.16	0.448	0.23	0.644

[A] These statistics are based on results obtained on Test Monitoring Reference Oils GF5A, GF5X, GF5B, GF5C and 1008.
[B] s = standard deviation.

Sequence VIB Final Matrix Report

Variable	Intermediate Precision		Reproducibility	
	$s_{i.p.}$ [B]	i.p.	S_R [B]	R
Fuel Economy Improvement, %				
at 16 h	0.18	0.504		
at 96 h	0.17	0.476		

VID Suitability







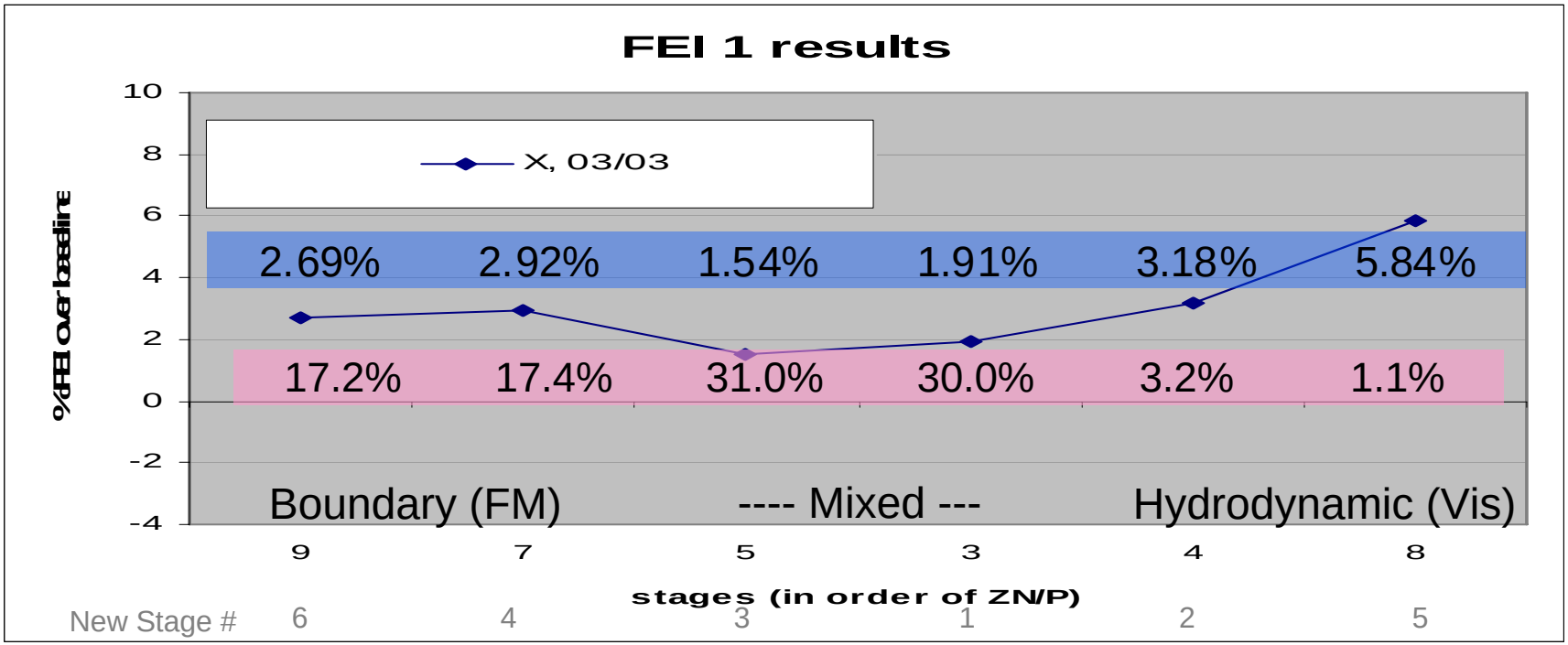


Seq VI SP meeting 4/22/09

Topics for Today's Presentation

- In depth review of the FEI Impact of individual stages as a result of stage weightings & power factors
- Review the objectives of the VID Consortium & GF-5 Needs Statement
- Next steps?

Consortium Weighting Factors Seem to Damp Down Oil Performance



FEI1 Average of %	3.01%
FEI1 Weighting %s	2.19%
Proposed "FTP" FEI1	1.95%

8/10ths

Another 1/4%

FEI IMPACTS by stage are significantly different from most user's expectations.
High performance in Boundary and Hydrodynamic stages is muted in FEI calculations

Technical Reviewed by TMC

FEI% Impact of Wt. Factors Selected

Consortium Selected Weighting Factors

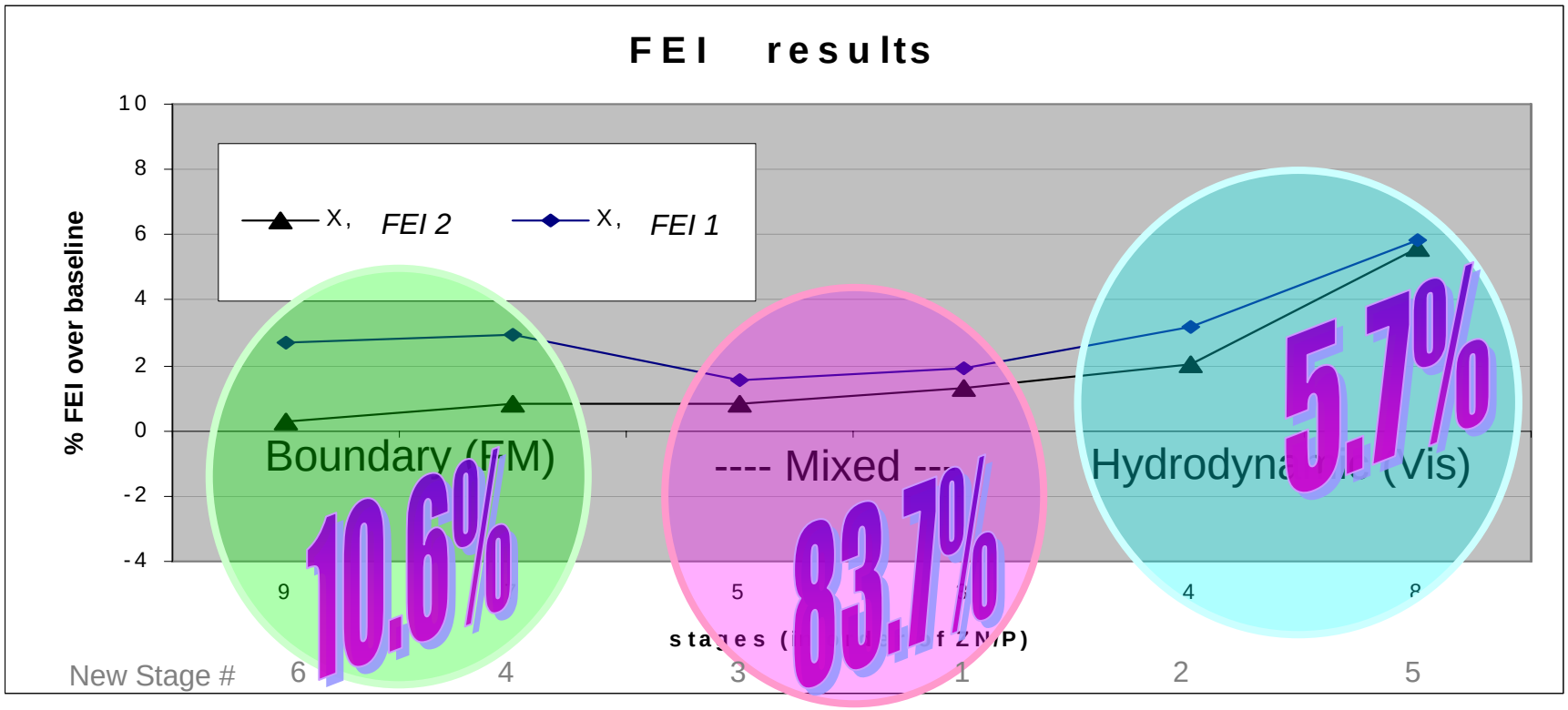
New Stage	1	2	3	4	5	6
Old Stage	3	4	5	7	8	9
Wt. Factor	30.0%	3.2%	31.0%	17.4%	1.1%	17.2%
Nominal Power	21.99	21.99	16.49	1.46	1.46	2.91
FEI Impact	47.17%	5.28%	36.53%	4.85%	0.37%	5.80%

The stage fuel consumption rates are multiplied by both the Consortium Weighting Factors and the Stage Nominal Power. This further enhances the impact of stages 3 & 5 such that they dominate the FEI calculation

Hydrodynamic - Viscometrics (8 & 4)	5.7%
Boundary - FM (9 & 7)	10.6%
Mixed - Limited oil impact (3 & 5)	83.7%

Skip detail

Friction Effects are Detectible
But Weighting and Power Factors Deaden the Response



The two mixed stages, accounting for 84% of the FEI weighting, show the least change giving decent variability but limiting response

Sequence VID Consortium – Scope and Objectives

Scope

Develop an engine dynamometer-based fuel economy test for ILSAC GF-5 that will replace the ILSAC GF-4 Sequence VIB fuel economy test. The new test should represent both viscometric and friction modifier oil effects on the fuel economy of current and future North American and Japanese engines.

Objectives

- The test should be responsive to both viscometric and friction modifier effects in oils.
- Ideally, the test should show improved test precision over the current Sequence VIB fuel economy test. This will be quantified by showing that the new test has a lower standard deviation of fuel economy improvement.
- Develop a VID engine test based on the operating conditions mapped proportionally to the FTP-75 and Highway Fuel Economy tests, and which generally agrees with the FTP fuel economy data generated by the consortium. Other data may be considered, as appropriate. The test should emulate aging observed during mileage accumulation at 6500 miles from the FTP program, discriminate between Oil Z and the other matrix oils based on viscosity effects and determine FM effects.

VID Consortium Report
PCEOCP Meeting
June 17, 2008

8

Final ILSAC/Oil Needs Statement
Adopted January 23, 2008

The International Lubricant Standardization and Approval Committee (ILSAC) GF-5 provides a minimum performance level of an engine oil for spark-ignited internal combustion engines. This performance standard must provide improvements relative to ILSAC GF-4 in the following three categories:

- Fuel economy and fuel economy retention
- Engine oil robustness
- Protection of emission control systems

The final standard will have to result in a balance among these three equally important needs. More specifically, ILSAC GF-5 must incorporate:

- Increased fuel economy throughout the oil change interval. Automotive manufacturers are facing increasingly stringent regulatory requirements. Fuel consumption remains a critical issue for automotive and oil industry customers.

In Lubrizol's opinion, the proposed measures of "fuel economy and fuel economy retention" do not meet the Needs Statement.

VID Development & Status

- VID Consortium had three objectives
  - Improved Precision over the VIB
    - *Initial results suggest similar precision to the VIB*
    - *Magnitude of FEI improvements in VID are less than VIB*
  - Correlate to the US FTP test
    - *Weighting factors were recommended based upon FTP analysis*
    - *These weighting factors put almost 85% of the FEI Impact on the stages with the least response to lubricants*
  - Respond to Friction Modifiers & Viscosity effects
    - *While viscosity effects can be seen, FM effects are lost in FEI2 although their impacts are clearly visible in the stage data*

Bottom Line

- The Consortium Weighting factors put 84% of the FEI response on two mixed lubrication stages
  - This was a surprise to many
- A meaningful fuel economy test is key for GF-5.
- Lubrizol believes there may be alternate ways of processing the data to meet all of the GF-5 Needs Statement Objectives.

Attachment 7

PRODUCT INFORMATION

Haltermann PRODUCTS

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

EEE-Lube Cert Gasoline
Seq. III & VI
HF0003

Batch No.:	XC2021LT10	XB0221LT10	WL0121LT10	XA3021LT10
TMO No.:	MTS	MTS	MTS	MTS
Tank No.:	110	T110	110	110
Date:	4/1/2009	3/2/2009	2/19/2009	1/30/2009

TEST	METHOD	UNITS	HALTERMANN Specs			RESULTS	RESULTS	RESULTS	RESULTS
			MIN	TARGET	MAX				
Distillation - IBP	ASTM D86	°C	23.9		35.0	30.4	30.1	30.8	30.2
5%		°C				42.4	44.3	45.0	44.0
10%		°C	48.9		57.2	50.3	52.2	53.1	52.0
20%		°C				62.7	64.7	65.8	64.7
30%		°C				76.5	78.2	79.1	78.0
40%		°C				94.1	93.6	93.6	93.0
50%		°C	93.3		110.0	106.2	104.7	104.3	104.0
60%		°C				112.9	111.2	110.8	110.3
70%		°C				119.8	117.6	117.4	116.8
80%		°C				132.4	128.6	128.0	127.4
90%		°C	151.7		162.8	159.6	157.1	156.3	156.1
95%		°C				167.0	166.3	165.7	166.2
Distillation - EP		°C			212.8	196.7	189.0	185.5	187.4
Recovery		vol %		Report		97.0	97.3	97.4	97.4
Residue		vol %		Report		1.0	1.1	1.1	1.1
Loss		vol %		Report		2.0	1.6	1.5	1.5
Gravity @ 60°F/60°F	ASTM D4052	°API	58.7		61.2	59.37	59.5	59.05	59.10
Density @ 15° C	ASTM D4052	kg/l	0.734		0.744	0.741	0.741	0.742	0.742
Reid Vapor Pressure	ASTM D5191	kPa	60.6		63.4	61.9	63.4	62.4	62.9
Carbon	ASTM D3343	wt fraction		Report		0.8642	0.8645	0.8647	0.8650
Carbon	ASTM E191	wt fraction		Report		0.8649	0.8614	0.8620	0.8621
Hydrogen	ASTM E191	wt fraction		Report		0.1326	0.1362	0.1361	0.1353
Hydrogen/Carbon ratio	ASTM E191	mole/mole		Report		1.826	1.884	1.881	1.870
Oxygen	ASTM D4815	wt %			0.05	<0.01	<0.01	<0.01	<0.01
Sulfur	ASTM D5453	mg/kg	3		15	3	3	4	5
Lead	ASTM D2622	wt%			2.6	<1.0	<1.0	<1.0	<2.6
Phosphorous	ASTM D3237	mg/l			1.3	<0.10	<0.10	<0.10	<0.02
Composition, aromatics	ASTM D1319	vol %	26.0		32.5	27.1	27.5	27.6	27.6
Composition, olefins	ASTM D1319	vol %			10.0	0.6	0.6	0.6	0.7
Composition, saturates	ASTM D1319	vol %		Report		72.3	72.0	71.8	71.7
Particulate matter	ASTM D5452	mg/l			1	0.8	0.5	0.6	0.6
Oxidation Stability	ASTM D525	minutes	1000			>1000	>1000	>1000	>1000
Copper Corrosion	ASTM D130				1	1a	1a	1a	1a
Gum content, washed	ASTM D381	mg/100mls			5.0	0.5	<0.5	<0.5	<0.5
Fuel Economy Numerator/C Density	ASTM E191		2401		2441	2428	2419	2423	2423
C Factor	ASTM E191			Report		1.0033	0.9982	0.9993	0.9990
Research Octane Number	ASTM D2699		96.0			97.4	97.9	98.0	97.7
Motor Octane Number	ASTM D2700			Report		89.1	89.4	89.5	89.2
Sensitivity			7.5			8.3	8.5	8.5	8.6
Net Heating Value, btu/lb	ASTM D3338	btu/lb		Report		18502	18494	18488	18488
Net Heating Value, btu/lb	ASTM D240	btu/lb		Report		18404	18442	18446	18450
Color	VISUAL	1.75 ptb		Red		Red	Red	Red	Red

EEE Lube Cert (HF-0003) Fuel Sales Summary
Test Use: Seq. III & VI
Haltermann Products
Update:2-3-09
JEC

Dates	2003	2004	2005	2006	2007	2008		Q1-2008	Q2-2008	Q3-2008	Q4-2008
Volume, Gal	875,048	1,055,540	479,888	596,656	813,460	577,362		93,312	104,645	194,799	184,606

Action Item Update April 22, 2009
Sequence VI Surveillance Panel Meeting
held in Plymouth, MI

Action Items

1.) The Surveillance Panel needs additional discussions on oil pump changes due to the noted correlation in oil pressure and FEI results in the Statistical Groups report.

2.) Finalize LTMS by

3.) Review of ACC Template

4.) The SP is to determine requirements for the next batch of BL by the next Surveillance Panel meeting.

5.) Labs should start creating a list of acceptable engine reconditioning practices.

6.) SwRI had presented data on engine 11B after it was reassembled and installed into the stand. They have decided to abandon this engine and will tear it down and report any findings to the SP. (04/02/09)