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Committee D02 on PETROLEUM PRODUCTS AND LUBRICANTS

Issued: August 11, 2015

Reply to: Dan Worcester
Southwest Research Institute
6220 Culebra Rd.
San Antonio, TX 78238
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These are the unapproved minutes of the 08.10.2015 Sequence VI Surveillance Panel call.

The meeting was called to order at 8:30 AM Central Time by Chairman Nathan Moles.

Agenda

The Agenda is the included as Attachment 1.

1.0 Roll Call

The Attendance list is Attachment 2.

2.0 Approval of minutes

2.1 Approval of the minutes of the 07.02.2015 meeting.

MOTION: Approve the minutes from the 07.02.2015 conference call.
[Dave Glaenzer, Jason Bowden, second] Approved unanimous.

3.0 Action Item Review

3.1 OHT to report VID & VIE engine usage and expected depletion date of VID engines. (345 additional engines being ordered). – OHT There are 62 of the current engine left. There will be a meeting to discuss the service engine order as there are only 260 remaining in GM inventory. There are also only 210 of the non-adjustable cam gears and no more will be made by the vendor.

3.2 Labs reported VID engine inventory and expected depletion date of VID engines.
-Expected life of engines range from 2016 Q1 to 2018
Lab1: 2 engines
Lab2: 4 engines
Lab3: 4 engines
Lab4: 4 engines This will be an on-going effort.

3.3 SP chair and test sponsor to investigate what is needed to establish VID equivalent limits for VIE. This will be an on-going effort.

4.0 Old Business

4.1 List of items to be reviewed after the Precision Matrix
Do we really need to run three RO tests to establish the new engine for LTMS?
Discussion of reducing the new reference requirement to two oils, then a third oil run after a defined number of candidates.
Discussion of using FEI 2 and FEI Sum for references to match candidate pass/fail criteria.
Discussion of evaluating 80/20 ratio of BL before to after for FEI 1 and 10/90 for FEI 2.
Should the acceptance bands value of 1.96 be rounded up? Due to the rounding on FEI 1 and 2 the actual pass limit is 1.91 and 1.92. This will be an on-going effort.

4.2 Discussion regarding Sequence VIE test ready to proceed with precision matrix.
The Memorandum of Agreement must be signed and the test receive AOAP approval before the Precision Matrix begins.
Lab visits required by TMC are completed.
Labs must have two valid tests run on their stands to participate are completed (waiting for data from one lab).

MOTION: Proceed with the VIE Precision Matrix with the engines and procedure in their current forms for GF-6A development. The GF-6B Task Force will continue to develop a 0W-16 test version.
[Bruce Matthews, Kaustav Sinha, second] Approved: 9 yes, 4 waive, 1 negative.

4.3 There are several of items in the most current draft version of the Seq. VIE test procedure posted on the TMC website that need to be updated. Dave Glaenzer has reconvened the Task Force to review the procedure on July 16th (presentation attached). This presentation was made. See Attachment 3. These procedure changes received unanimous approval.

4.4 Update on progress of 5W-30 Tech1 in VIE testing. –Labs
-FEI1/2 = 1.09/1.05 @ 349 hours Another lab has the oil running.

4.5 Engine hours needs to be addressed in the precision matrix and there is concern in the industry that the current design does not adequately address this. Alternate matrix designs have been requested.
Statisticians will come up with the list of potential designs once all variables (engines, oils, etc.) have been decided. This will be an on-going effort.

4.6 Updated on survey for quantities of VIBL and VIDFO remaining at the laboratories and anticipated life. –Rich Grundza
Survey was sent out 6/12/2015 The BL and FO survey was modified by a request for more FO from one lab. There will be a change in these oils as one of the baseline components is no longer available. BL-5 and FO-5 will be ordered at quantities defined by labs and available next year. Existing BL or FO versions could be moved between labs to support existing testing until the new versions are available. The new BL-5 will be compared to BL-2 when at the labs.

MOTION: Approve procurement of the next BL and FO blends.
[Rich Grundza, Nathan Moles, second] Approved unanimous.

4.7 Update from task force, to investigate alternative Sequence VIE procedures that would improve 0W-16 response in the Sequence VIE test. - Charlie Leverett/Bill Buscher
See Attachment 4 for data on oils 400 and 401 in VIE testing. See Attachment 5 for a comparison of GF-6 A and B. See Attachment 6 for the Toyota fuel economy testing alternatives presentation. See Attachment 7 for an LTMS review. There is data on an 8 stage test version with stages 1a and 3a run at 100 °C oil and 94 °C coolant temperature. A 10 stage was discussed that would include stage 4a and 6a at the same temperatures.

New Business

5.1 Viscosity study in a 2012 Malibu (presentation attached). –Dan Worcester/Kevin Whitney See Attachment 8.

5.2 Intake fixed phaser availability for the upcoming Seq. VIE engine acquisition. – Jason Bowden
There is a limited supply remaining of the intake fixed phasers. The panel will need to decide if intake phasers for an extended period beyond current practice in the future. OHT has obtained the information required for the next engine acquisition and will be scheduling a conference call with our customers after our next Surveillance Panel meeting. See Action Item 3.1.

6 **Next Meeting will be at the Chair notification.**

The meeting adjourned at 10:20 AM.

Sequence VI Surveillance Panel Conference Call Agenda
August 10 @ 9:30-11AM EST

Call-in information is included below:

Call-in Number: 866-528-2256
Conference Code: 3744024

1.0) Roll Call

Do we have any membership changes or additions?

2.0) Approval of minutes

2.1 Approve the minutes from the July 2, 2015 Sequence VI Surveillance Panel.
ftp://ftp.astmtmc.cmu.edu/docs/gas/sequencevi/minutes/VIMinutes20150702%20Conference%20call.pdf

3.0) Action Item Review

3.1 OHT to report VIE engine usage and update on service engine order (345 additional engines being ordered). – OHT

3.2 Update of VID engine inventory and expected depletion date of VID engines.

-Expected life of engines range from 2016 Q1
Lab1: 2 engines
Lab2: 4 engines
Lab3: 4 engines
Lab4: 4 engines

3.3 SP chair and test sponsor to investigate what is needed to establish VID equivalent limits for VIE

4.) Old Business

4.1 List of items to be reviewed after the Precision Matrix

-Do we really need to run three RO tests to establish the new engine for LTMS?

-Discussion of reducing the new reference requirement to two oils, then a third oil run after a defined number of candidates.
-Discussion of using FEI 2 and FEI Sum for references to match candidate pass/fail criteria.
-Discussion of evaluating 80/20 ratio of BL before to after for FEI 1 and 10/90 for FEI 2.
-Should the acceptance bands value of 1.96 be rounded up? Due to the rounding on FEI 1 and 2 the actual pass limit is 1.91 and 1.92.

4.2 Discussion regarding Sequence VIE test ready to proceed with precision matrix.

-The Memorandum of Agreement must be signed and the test receive AOAP approval before the Precision Matrix begins.
-Lab visits required by TMC are completed.
-Labs must have two valid tests run on their stands to participate are completed (waiting for data from one lab).

4.3 There are several of items in the most current draft version of the Seq. VIE test procedure posted on the TMC website that need to be updated. Dave Glaenzer has reconvened the Task Force to review the procedure on July 16th (presentation attached).

4.4 Update on progress of 5W-30 Tech1 in VIE testing. –Labs

-FEI1/2 = 1.09/1.05 @ 349 hours

4.5 Engine hours needs to be addressed in the precision matrix and there is concern in the industry that the current design does not adequately address this. Alternate matrix designs have been requested.

Statisticians will come up with the list of potential designs once all variables (engines, oils, etc.) have been decided.

4.6 Updated on survey for quantities of VIBL and VIDFO remaining at the laboratories and anticipated life. –Rich Grundza

Survey was sent out 6/12/2015

4.7 Update from task force, to investigate alternative Sequence VIE procedures that would improve 0W-16 response in the Sequence VIE test. - Charlie Leverett/Bill Buscher

5.) New Business

5.1 Viscosity study in a 2012 Malibu (presentation attached). –Dan Worester/Kevin Whitney

5.2 Intake fixed phaser availability for the upcoming Seq. VIE engine acquisition. –Jason Bowden

There is a limited supply remaining of the intake fixed phasers. The panel will need to decide if intake phasers for an extended period beyond current practice in the future. OHT has obtained the information required for the next engine acquisition and will be scheduling a conference call with our customers after our next Surveillance Panel meeting.

6.) Next Meeting

Call of the chairman

7.) Meeting Adjourned

ASTM SEQUENCE VI

Name	Address	Phone/Fax/Email	Attendance
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Dan Worcester Voting Member	Southwest Research Institute	Phone: (210) 522-2405 dan.worcester@swri.org	ATTEND

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Hap Thompson	Hapjthom@aol.com	VIE Facilitator	
Brent Calcut			ATTEND

ASTM SEQUENCE VI

Name	Address	Phone/Fax/Email	Attendance

Sequence VIE Procedure Review

Review of 07/14/2014 Draft prior to Precision Matrix testing

David L. Glaenzer, TF Leader

July 22, 2015

Review of 07/14/2014 Draft Procedure

- Section 6.5.1 Coolant pressure should be **100 ± 10 kPa.**
- Section 6.5.3 Second sentence …as shown in Fig A5.1 – **A5.3**.
- Section 6.6.5.3(**5**) This has been deleted. **Remove sentence.**
- Section 6.6.5.9 FIL-2 is renamed to **FIL-1** due to filter removal from circulating system by Surveillance Panel.
- Section 6.6.5.11 Use oil pan **OHT6D-001-2. Oil pan OHT6D-001-2 is oil pan OHT6D-001-1 modified with part number 6E001021 modified oil pan displacement block.** A sight glass…..
- Section 6.10.1.1 **Horiba MEXA 110, MEXA 700, MEXA 730** and ECM AFM1000 analyzers have been found suitable **for** this application (seeX1.25).
- Section 7.1.1 Oil is **VID** BL. **71 L** is required.

Review of 07/14/2014 Draft Procedure (continued)

- Section 7.1.2 Oil is **VID** FO.
- Section 7.2 Use only Haltermann (see X1.33) **Sequence VI-E W/DCA fuel. Product Code: HF2003.** Specification for **Sequence VI-E W/DCA** fuel is contained …..
- Section 9.4.12.3 Paxton Model **numbers 8F002-004 or 8F002-007 have** been found to be ..…
- Section 10.1.1.1 **Remove XXXXXXXXXXXXX.**
- Section 11.6.2.2(10) It is suggested that the acceptable percent delta between BLB1 and BLB2, as well as between BLB2 and BLB3 may need adjustment for the VIE engine. **Suggest Stats Group review following Precision Matrix.**
- Section 11.6.3 Add sentences. **Data obtained for all stages, including flushing will be one minute snapshot logging. Section 11.6.5 which specifies logging during BSFC routine remains unchanged.**

Review of 07/14/2014 Draft Procedure (continued)

- Section 11.6.3.1 …..aged **for 16 and 125 h run** at …..
- Section 11.6.16 change 1400 mL to **1800 mL.**
- Table 3 Fuel to Flow Meter temperature **26 ± 2.**
  Remove line (delta from the max stage average reading shall be ≤ 4).
- Table 4 Fuel to Flow Meter temperature **26 ± 2.**
  Remove line (delta from the max stage average reading shall be ≤ 4).
- **Table 8 Need Precision Statistics following Precision Matrix. Stats Group review following Precision Matrix.**
- Figure A5.20 **Need updated figure to show sight glass to 1800 mL low.**

Review of 07/14/2014 Draft Procedure (continued)

- Annex Table A7.2 Replace OHT6D-001-1 Pan, Seq. VID / VIE (with Gems Sensor and Displacement block) with **OHT6D-001-2 Pan, Seq. VID / VIE (with Gems Sensor and Displacement block). Add 6E001021 Block, displacement, 600 mL with grooves, Seq. VID / VIE.**
- Annex A15 Need updated engine hour adjustment factor(s) following Precision Matrix review. **Stats Group review following Precision Matrix.** Need updated BLB2 & BLA weighting for Cand1 and Cand2 results if deemed necessary following Precision Matrix review. **Stats Group review following Precision Matrix.**
- Appendix X1.25 The recommended AFR analyzers are **Horiba MEXA 110, MEXA 700, MEXA 730** or ECM AFM1000 which may be ordered from:

Review Sequence VIE Test Report

- Form 8 Footnote A needs to be changes (or eliminated) to reflect data acquisition frequency as required by procedure.
- Form 9 Footnote A needs to be changes (or eliminated) to reflect data acquisition frequency as required by procedure.
- Forms 10 – 15 Fuel to Flow Meter Temperature 26 ± 2. Remove #4 specifying a delta temperature (#3 is a hard spec.).

Thanks to my Select Blue Ribbon Review Group

David L. Glaenzer	Afton Chemical Corporation
Adrian Alfonso	Intertek Automotive Research
Charlie Leverett	Intertek Automotive Research
Cole Hudson	Southwest Research Institute
Clifford Salvesen	ExxonMobil
Hap Thompson	ASTM Facilitator
Jim Linden	Consultant
Layden Mantle	Ashland Petroleum Additives
Mark Mosher	ExxonMobil
Pat Lang	Southwest Research Institute
Terry Hoffman	Afton Chemical
Jerry Brys in absentia	The Lubrizol Corporation

- TF Chairman left him off the mailing list.

Low Visc Oil Performance; VID vs. VIE at IAR

Intertek
Valued Quality. Delivered.

Background:

- Run VIE tests on oil 400 and 401 in support of GF6B TF
- Complete analysis and Compare the results to VID results from the Toyota Matrix

VID vs. VIE. Oil 400 and 401

Intertek
Valued Quality. Delivered.

Summary

Oil	EOT Hr.	FEI1	Hr. Corr	SA	FEI1 Corr	FEI2	HR. Corr	SA	FEI2 Corr	FEI Sum
401 D1	2531	1.56	0.13	-0.14	1.55	1.42	0.12	-0.17	1.37	2.92
401 D2	2688	1.18	0.15	-0.14	1.19	1.27	0.14	-0.17	1.24	2.43
400 D1	1273	1.57	-0.07	-0.09	1.41	1.61	-0.06	0.00	1.55	2.96
400 D2	2846	1.57	0.17	-0.14	1.60	1.56	0.16	-0.17	1.55	3.15
401 E1	549	2.21	-0.31	NA	1.90	2.15	-0.29	NA	1.86	3.76
400 E1	1209	1.60	-0.08	NA	1.52	1.17	-0.08	NA	1.09	2.61

* 400 D1 was run on the first calibration period, therefore the SA are different

VID Test: Oil 401 Run 1

Intertek
Valued Quality. Delivered.

VID Testing

- Test 1:

Oil	EOT Hr.	FEI1	Hr. Corr	SA	FEI1 Corr	FEI2	HR. Corr	SA	FEI2 Corr	FEI Sum
401	2531	1.56	0.13	-0.14	1.55	1.42	0.12	-0.17	1.37	2.92

Stage Contribution to Final FEI						
	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Weighted FEI1 vs. (0.8 BLB2 + 0.2 BLA)	0.71%	0.16%	0.52%	0.08%	0.02%	0.08%
Weighted FEI2 vs. (0.1 BLB2 + 0.9 BLA)	0.67%	0.17%	0.49%	0.05%	0.02%	0.01%

VID Test: Oil 401 Run 2

Intertek
Valued Quality. Delivered.

VID Testing

- Test 2:

Oil	EOT Hr.	FEI1	Hr. Corr	SA	FEI1 Corr	FEI2	HR. Corr	SA	FEI2 Corr	FEI Sum
401	2688	1.18	0.15	-0.14	1.19	1.27	0.14	-0.17	1.24	2.43

Stage Contribution to Final FEI						
	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Weighted FEI1 vs. (0.8 BLB2 + 0.2 BLA)	0.58%	0.15%	0.39%	0.01%	0.02%	0.03%
Weighted FEI2 vs. (0.1 BLB2 + 0.9 BLA)	0.58%	0.17%	0.42%	0.08%	0.02%	0.00%

VID Test: Oil 400 Run 1

Intertek
Valued Quality. Delivered.

VID Testing

- Test 1:

Oil	EOT Hr.	FEI1	Hr. Corr	SA	FEI1 Corr	FEI2	HR. Corr	SA	FEI2 Corr	FEI Sum
400	1273	1.57	-0.07	-0.09	1.41	1.61	-0.06	0.00	1.55	2.96

Stage Contribution to Final FEI						
	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Weighted FEI1 vs. (0.8 BLB2 + 0.2 BLA)	0.80%	0.15%	0.48%	0.07%	0.02%	0.05%
Weighted FEI2 vs. (0.1 BLB2 + 0.9 BLA)	0.80%	0.16%	0.54%	0.08%	0.02%	0.02%

VID Test: Oil 400 Run 2

Intertek
Valued Quality. Delivered.

VID Testing

- Test 2:

Oil	EOT Hr.	FEI1	Hr. Corr	SA	FEI1 Corr	FEI2	HR. Corr	SA	FEI2 Corr	FEI Sum
400	2846	1.57	0.17	-0.14	1.60	1.56	0.16	-0.17	1.55	3.15

Stage Contribution to Final FEI						
	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Weighted FEI1 vs. (0.8 BLB2 + 0.2 BLA)	0.72%	0.16%	0.55%	0.06%	0.03%	0.05%
Weighted FEI2 vs. (0.1 BLB2 + 0.9 BLA)	0.73%	0.20%	0.58%	0.02%	0.02%	0.00%

VIE Test: Oil 401

VIE Testing, Using VID Engine Hour Correction

- Test 1:

Oil	EOT Hr.	FEI1	Hr. Corr	SA	FEI1 Corr	FEI2	HR. Corr	SA	FEI2 Corr	FEI Sum
401	549	2.21	-0.31	NA	1.90	2.15	-0.29	NA	1.86	3.76

Stage Contribution to Final FEI						
	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Weighted FEI1 vs. (0.8 BLB2 + 0.2 BLA)	1.09%	0.15%	0.66%	0.14%	0.02%	0.15%
Weighted FEI2 vs. (0.1 BLB2 + 0.9 BLA)	1.11%	0.15%	0.60%	0.14%	0.02%	0.13%

VIE Test: Oil 400

VIE Testing, Using VID Engine Hour Correction

- Test 1:

Oil	EOT Hr.	FEI1	Hr. Corr	SA	FEI1 Corr	FEI2	HR. Corr	SA	FEI2 Corr	FEI Sum
400	1209	1.60	-0.08	NA	1.52	1.17	-0.08	NA	1.09	2.61

Stage Contribution to Final FEI						
	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Weighted FEI1 vs. (0.8 BLB2 + 0.2 BLA)	0.96%	0.18%	0.38%	0.07%	0.03%	-0.02%
Weighted FEI2 vs. (0.1 BLB2 + 0.9 BLA)	0.89%	0.17%	0.22%	-0.03%	0.03%	-0.11%

Sequence VI GF-6A + GF-6B Options

Aug 6, 2015 Issued by B. Buscher, IAR
Aug 7, 2015 Updated by S. Hirano, Toyota

Options	Test	Engine	Stand Configuration	Reference Oils	LTMS Targets of REOs	LTMS Control Charts and Calculations	Engine Hours Correction	Oil Evaluation	Ability to Immediately Proceed with GF-6A VIE Precision Matrix
1	One 8-Stage test procedure.	Same.	Same.	Same.	1 set of targets differently calculated by vis grade. Or, 2 separate sets of targets between GF-6A and GF-6B (*1)	1 set of charts and cals, or, 2 separate sets between GF-6A and GF-6B (*1)	Same or Different between GF-6A and GF-6B (*1)	Different, stage 1 and 3 for GF-6A and stage 1A and 3A for GF-6B.	No
2	Two different 6-Stage test procedures.	Same. Any of two procedures can be run on the same engine within the same calibration period.	Same.	Same.	Each REO has 1 target. Test procedure chosen by vis grade. (*2)	1 set shared between 2 procedures. (*2)	Same or Different between GF-6A and GF-6B.	Different, current VIE stages for GF-6A and alternate VIE stages for GF-6B.	Yes
3	Two different 6-Stage test procedures.	Same engine type used by both tests, but different physical engine used by each test.	Same.	Different.		Different.	Different.	Different, current VIE stages for GF-6A and alternate VIE stages for GF-6B.	Yes

*1 : Each REO can have 2 different results, standard VIE results calculated by Stage 1, 2, 3, 4, 5, and 6, low temp VIE results calculated by Stage 1A, 2, 3A, 4, 5, and 6. In that case, option 1 can have two separate sets of LTMS calculation and engine hour correction equations.

Examples : Case 1 : 1 Set of Charts and Calcs

	Calculation
TMC542 (0W-20)	Stg-1,2,3,4,5,6
TM1010 (5W-20)	Stg-1,2,3,4,5,6
TMC1011 (Tech1 0W-16	Stg-1A,2,3A,4,5,6
	One common LTMS

Case 2 : 2 Sets of Charts and Calcs

	Calculation	
TMC542	Stg-1,2,3,4,5,6	Stg-1A,2,3A,4,5,6
TM1010	Stg-1,2,3,4,5,6	Stg-1A,2,3A,4,5,6
TMC1011	Stg-1,2,3,4,5,6	Stg-1A,2,3A,4,5,6
	LTMS for GF-6A	LTMS for GF-6B

*2 : EWMA calculates parameters based on standard deviation. All parameters are transformed into relative basis. Assuming the severity variation as relative bassis can occur in the same manner no matter which test procedure is run, 3 REOs can constitute the one common set of EWMA charts and calculations.

Examples : Case 1 : 1 Set of Charts and Calcs

	Test Procedure
TMC542 (0W-20)	Standard VIE
TM1010 (5W-20)	Standard VIE
TMC1011 (Tech1 0W-16	Low Temp VIE
	One common LTMS

Southwest Research INSTITUTE®

SwRI Internal Research Project R8502

Lubricant Impact on Fuel Economy - Correlation between Measured Engine Component Friction and Vehicle Fuel Economy

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Project Objectives

- Utilize SwRI established test methods to investigate lubricant effects on engine component friction and vehicle fuel economy
  - Lubricant properties of interest:
    - Viscosity grades
- Develop correlations between friction measurement and vehicle fuel economy testing
  - Based on statistical analysis
  - Utilizing physics based models (GT-Suite Software)

Brief Overview of Vehicle Testing

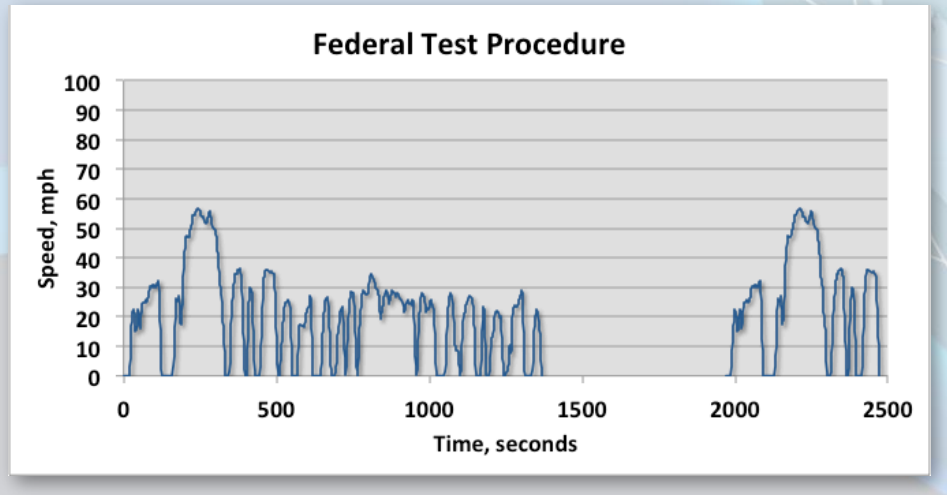
- Investigate lubricant effects on engine component friction and vehicle fuel economy
- 2012 Chevrolet Malibu with 3.6L V6
- Crankcase lubricants were blended to study the impact of viscosity

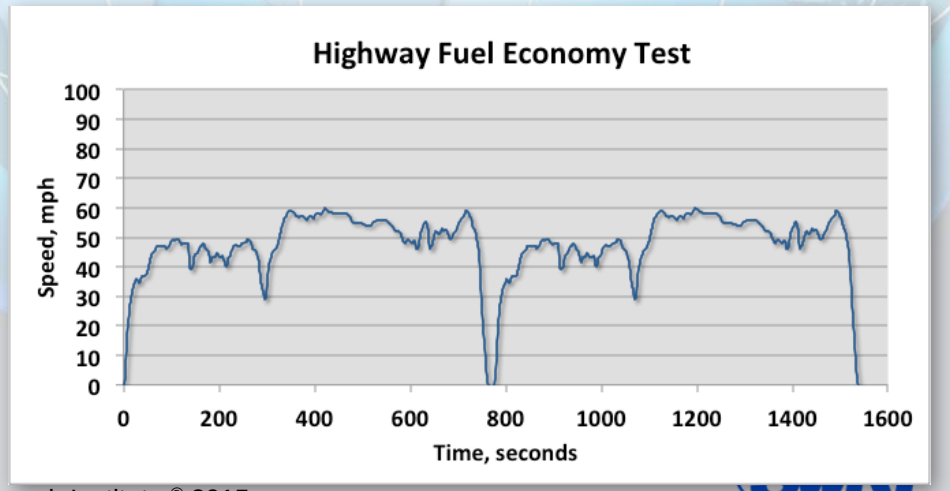
Subset of Oil Matrix: Only Viscosity Effects

Test Oil	Description	HTHS	FM?	SAE Grade
2	High Viscosity	3.7	No	10W-40
4	Mid Viscosity	3.0	No	5W-30
3	Low Viscosity	2.3	No	0W-16

Vehicle Fuel Economy Testing

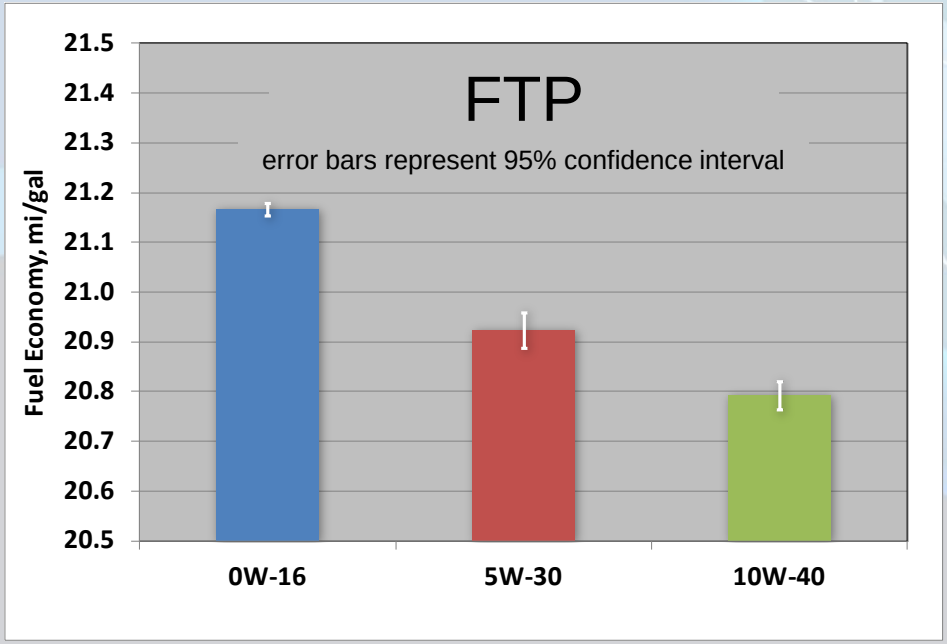
- Cold-start FTP-75 and hot-running HwFET are used to determine fuel economy results for CAFE compliance
- Lubricants are being tested over triplicate test cycles following an extensive oil change sequence

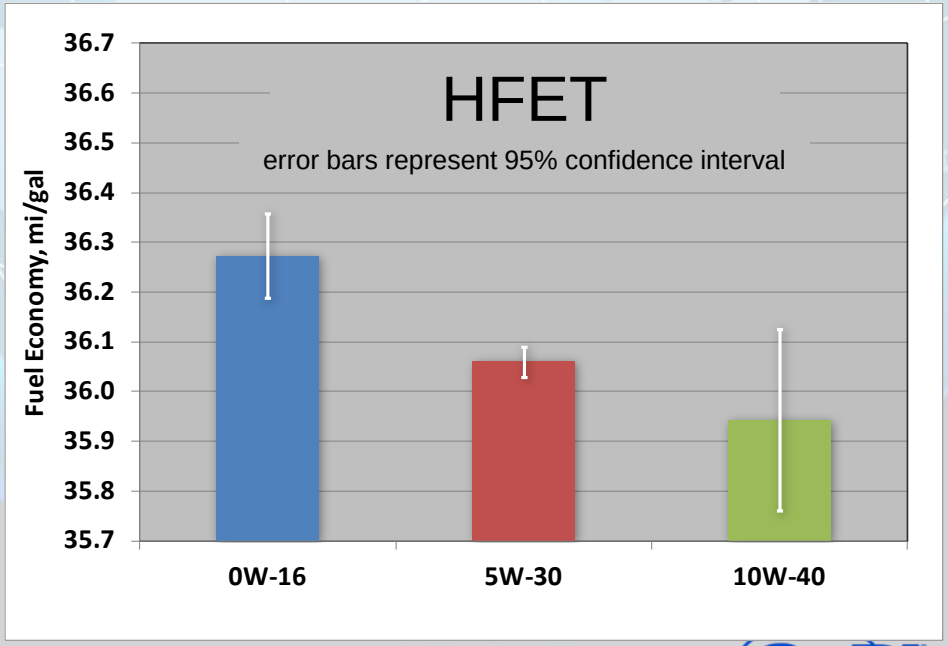




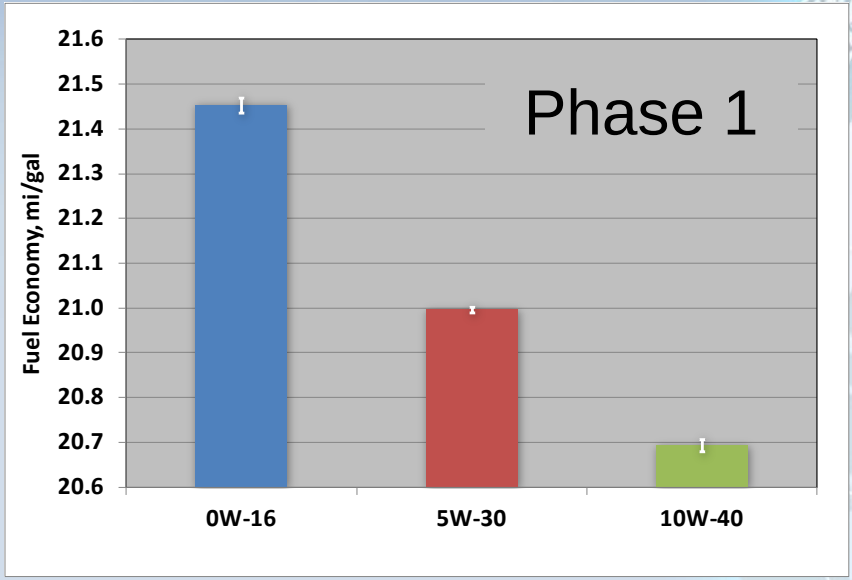
Vehicle Fuel Economy Testing: Preliminary Results

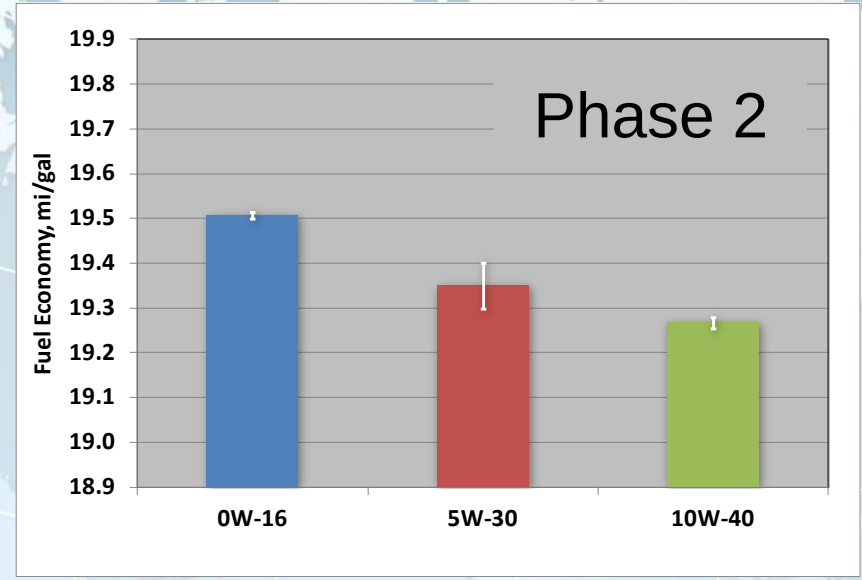
- Viscosity effects are clearly discernible on both test cycles
- 0W-16 has significant FE improvements over 5W-30
  - FTP: 1.2%
  - HFET: 0.6%

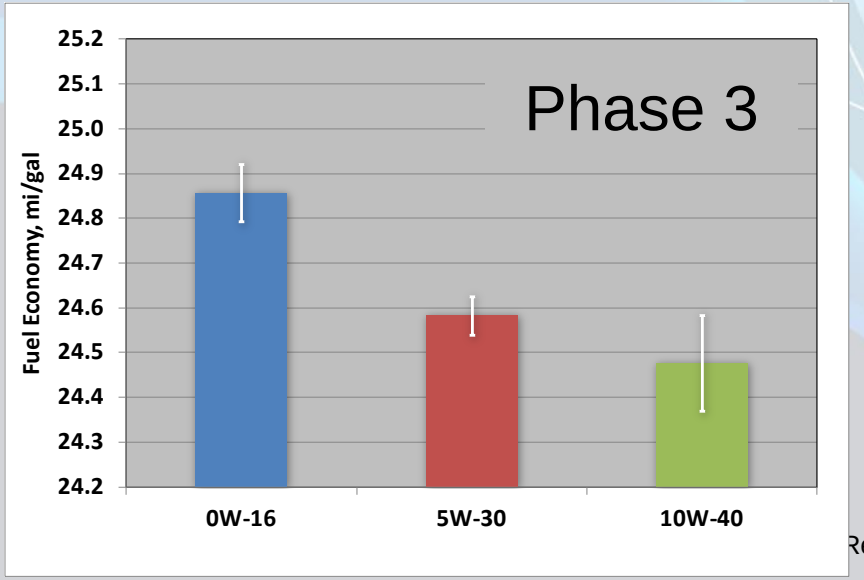




Vehicle Fuel Economy Testing: Preliminary Results



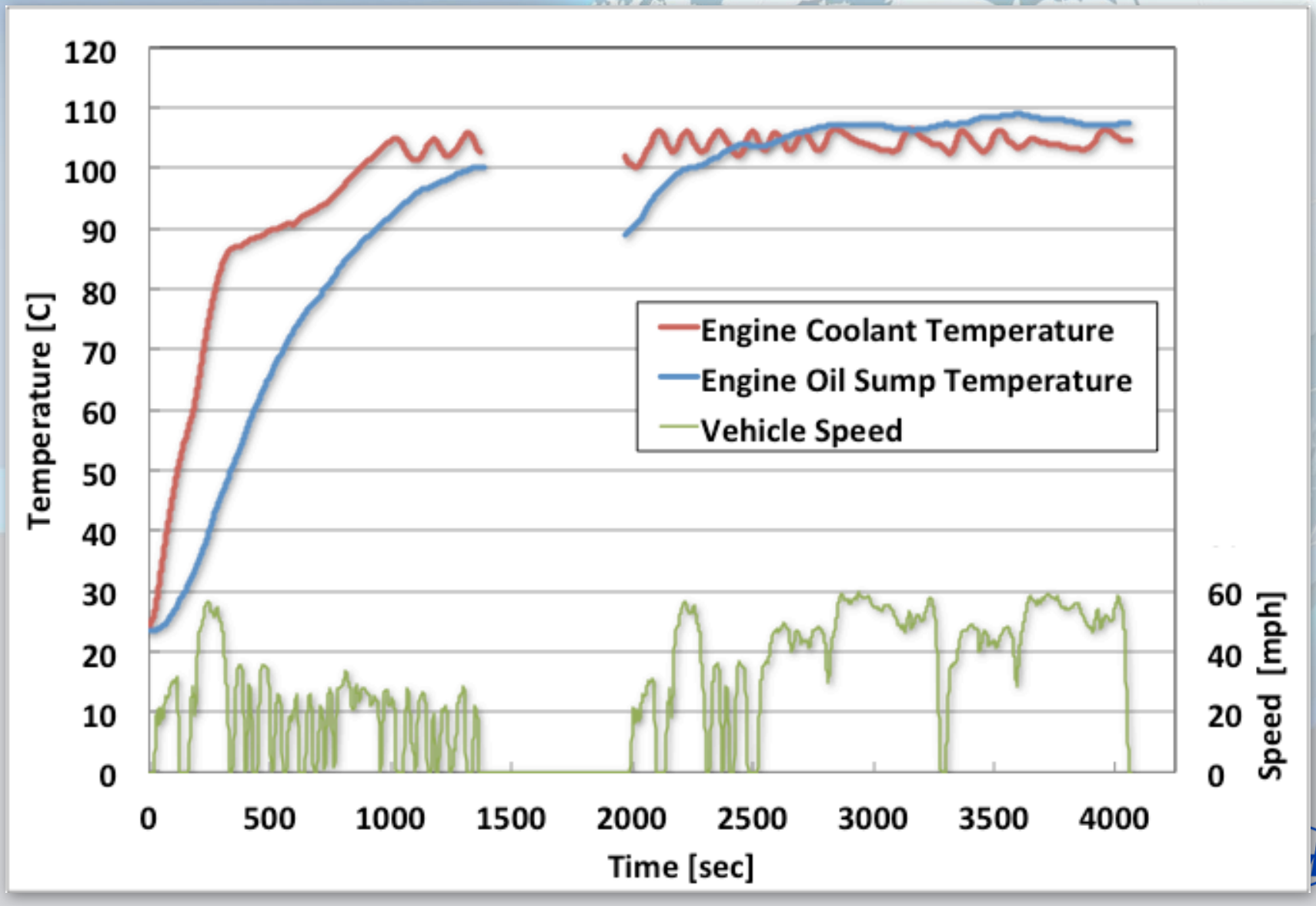




error bars on all graphs represent 95% confidence interval

- **Viscosity effect most apparent during the cold-start phase of the FTP**
- **0W-16 shows significant FE improvements over 5W-30**
  - **Phase 1: 2.2%**
  - **Phase 2: 0.8%**
  - **Phase 3: 1.1%**

Oil and Coolant Temperatures



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