

Sequence VH Task Force | MINUTES

Revision Date 08-03-2016 | Revision 1.0

Relevant Test:	Sequence VH
Note Taker:	Chris Mileti
Meeting Date:	08-02-2016
Lubrizol Attendees:	Mileti, Brys and O'Malley
Comments:	This conference call was scheduled to discuss the most recent Sequence VH test results at Southwest.

DISCUSS RECENT EMAILS FROM COLE HUDSON (SOUTHWEST):

1. Background:

- a. The first email was sent by Cole Hudson on 08-01-2016 at 11:58AM EST.
 - i. It contained the results from Southwest's most recent Sequence VH test using REO1006-2.

RO 940

VH Hardware	AES	RAC	AEV	APV	OSC
SWRI	6.8	8.02	8.83	7.17	70
IAR	6.88	8.5	9.09	8.07	98
avg	6.84	8.26	8.96	7.62	84

RO 1009

VH Hardware	AES	RAC	AEV	APV	OSC
SWRI	7.19	8.38	9.16	8.82	80
IAR 98	7.3	9.08	9.02	7.7	35
avg	7.25	8.73	9.09	8.26	57.5

RO 1006-2

VH Hardware	AES	RAC	AEV	APV	OSC
SWRI	8.33	8.83	9.16	9.34	15
avg	8.33	8.83	9.16	9.34	15

940 Target	6.43	8.15	8.79	7.2	51
AK Batch 940	6.29	8.72	8.42	6.82	91.4

1009 Target	7.94	9.29	8.99	7.79	8
AK Batch 1009	7.11	9.24	8.87	7.86	48.16

1006-2 Target	8.65	9.4	9.24	8.52	1.45
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- b. The second email was sent by Cole Hudson on 08-02-2016 at 11:06AM EST.
 - i. It contained a presentation that summarized the findings of a recent operational data review between Intertek and Southwest.

2. Opening Statements from Ritchie:

- a. The recent results at Intertek and Southwest indicate that the Sequence VH test can generate sludge and has adequate sludge discrimination
- b. Obviously, the current varnish severity is mild.
 - i. **Intertek comments:**
 1. All of the APV results in Hudson's email utilized the VG rating technique (i.e. full piston skirt).
 2. The VH rating technique (i.e. top half of piston skirt) will probably need to be implemented.
- c. Oil screen clogging (OSC) is a problem, even for the REO1006-2 "passing" reference oil.
 - i. The recent Southwest test with REO1006-2 had an OSC result that is high but still within the limits for that oil.
 - ii. The OSC parameter should not be "behaving" like this.

- d. The general consensus among the labs is that the Sequence VH test, with the new "DJ" fuel batch, is very severe in terms of sludge.
- e. **New "DJ" Fuel Batch with VG Test:**
 - i. There is not enough reference test data available to implement correction factors for the fuel.
 - ii. **Afton comments:**
 - 1. *When will there be enough data available to implement correction factors?*
 - 2. *Will there ever be enough data available?*
 - 3. This situation is concerning because companies are running VG tests with a very severe fuel and no correction factors.
 - 4. The Industry may need to rely on laboratory severity adjustments until the VG test is declared unavailable.
 - iii. **TMC comments:**
 - 1. There is definitely a justification for Industry correction factors if the necessary data ever becomes available.
 - 2. However, this data may never be available because the reference period of many stands was extended.
 - iv. **Afton follow-up comments:**
 - 1. The Sequence III test uses a continuous severity adjustment.
 - 2. A similar approach could be implemented for the VG test.
 - v. Ritchie agrees that the lack of correction factors with the new "DJ" fuel batch is a problem, while Romano does not think it is an issue.
 - vi. **TMC follow-up comments:**
 - 1. The recent reference tests at Southwest and Intertek with REO940 and REO1009 are either mild or close to the existing targets for sludge.
 - 2. This group previously agreed to discontinue the use of REO1006-2 for VG reference tests.
 - 3. So there may not be a problem with the lack of correction factors after all.

3. Update on Dependent Lab Readiness for VH Prove-Out Testing:

- a. **Lubrizol:**
 - i. Lubrizol is shaking down its VH test stand now using a VG utility engine.
 - ii. The goal is to be able to start a VH prove-out test by the end of next week.
- b. **Afton:**
 - i. Afton is currently dealing with coolant flow issues.
 - ii. They plan to have their shakedown completed next week, and may start their VH prove-out test shortly afterwards.
- c. **Ashland:**
 - i. Ashland started shaking down its VH test stand using a VG utility engine.
 - ii. They hope to start a VH prove-out test around the same time as the other two labs.
- d. **Ritchie comments:**
 - i. All three dependent labs should try to start their VH prove-out tests by Monday, August 15th.
- e. The three dependent labs were instructed to start their VH prove-out testing with REO940.

4. Concern About Oil Screen Clogging:

- a. Lubrizol is concerned that oil screen clogging has become "uncoupled" from average engine sludge with the new "DJ" fuel batch.

- b. **Romano comments:**
 - i. Romano agrees that OSC is too variable.
 - ii. He is willing to drop OSC as a “pass/fail” parameter [yet keep it as a “report only” parameter].
- c. **TMC comments:**
 - i. The OSC issue should be discussed after the completion of the Precision Matrix.
 - ii. One option could be to keep OSC as a severity adjusted parameter that is not necessarily used to determine stand calibration.

5. Concern About Average Piston Varnish:

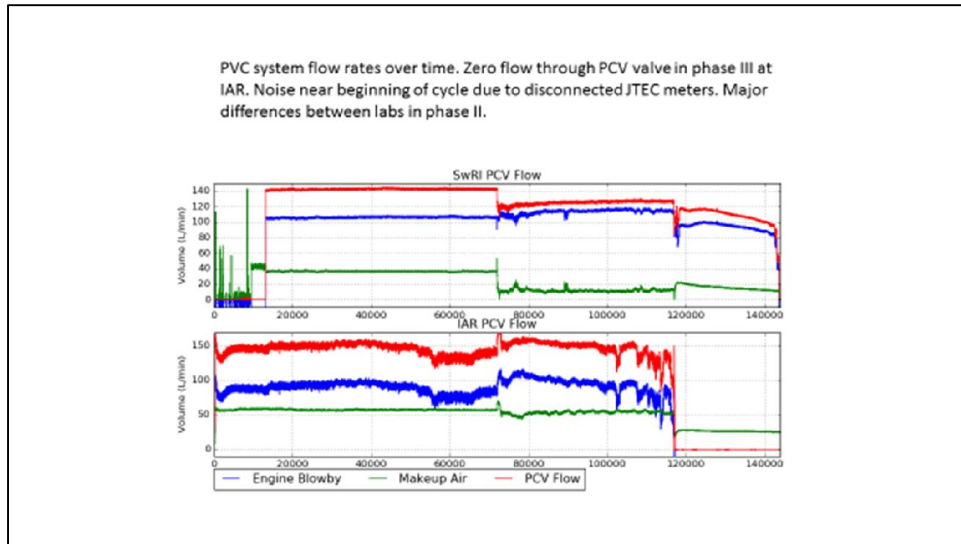
- a. **Romano comments:**
 - i. Romano is concerned that average piston varnish (APV) is too mild with REO1006-2.
 - ii. However, this is no reason to stop test development.
 - iii. All of the labs should be storing their [end of test] pistons, so they can rate this hardware again using the VH rating technique (i.e. top half of piston skirt).
- b. **Intertek comments:**
 - i. Intertek has already collected the “half skirt” piston ratings, and will publish them shortly.
 - ii. Intertek had an APV result of 7.7-merits with their recent REO1009 Sequence VH test.
 - 1. There was varnish on the entire piston skirt.
 - 2. The polishing pattern of the piston created striations in the varnish.
 - 3. Southwest, on the other hand, did not see varnish on the entire skirt of their REO1009 Sequence VH test.
 - iii. The varnish coverage trends were switched for the REO940 oil.
 - 1. Intertek did not see varnish on the entire piston skirt while Southwest did.
- c. **Southwest comments:**
 - i. Southwest agreed with Intertek that there appears to be two different types of varnish patterns with the VH pistons.
 - ii. They have seen these two types of varnish patterns with all three reference oils.
 - iii. Southwest has already performed “half skirt” ratings on some of their pistons.

REVIEW OF SWRI PRESENTATION FROM 08-02-2016:

1. JTEC Instrumentation:

- a. Intertek and Southwest installed JTEC flow meters on their test stands to analyze blowby flow.
 - i. Each lab installed a JTEC on the outlet of the PCV valve.
 - ii. They also installed a JTEC on the fresh-air make-up line.
- b. The goal of the JTEC study was to identify differences in blowby flow that could be responsible for differences in overall test severity.
 - i. These severity differences were more apparent with the VG and VG-A hardware than with the current VH hardware.

2. Slide #1:



- a. Intertek measured almost no blowby flow through their PCV valve during Stage 3 conditions.
 - i. Their PCV valve is either closed or clogged with deposits.
- b. Intertek and Southwest measured the flow through several PCV valves at both labs, and each lab selected valves that had similar flow characteristics.
- c. **Lubrizol Comment #1:**
 - i. *Did Intertek check the Tygon hoses from their PCV system for internal delamination?*
 1. Intertek did not check the hoses for delamination.
 2. However, these hoses were not used long enough to become damaged from the blowby gases.
 3. These measurements were taken on the 5th cycle.
- d. **Fuel Condensation in the Fresh-Air Make-Up Line:**
 - i. Intertek regularly finds condensed moisture and fuel in their fresh-air make-up line, while Southwest does not see this condensation in their lab.
 1. Lubrizol confirmed that it sometime sees moisture in its fresh-air make-up line as well.
 2. Afton confirmed that it does not normally see moisture in its fresh-air make-up line.
- e. **Lubrizol Comment #2:**
 - i. This moisture in the fresh-air make-up line occurs when a vacuum forms in the air cleaner box during the Stage 1 → 2 transition.
 1. The air cleaner box vacuum can divert blowby flow away from the PCV valve.
 - ii. This vacuum occurs when the PID tuning of the intake air valve is relatively slow and cannot keep pace with the engine's demand for air.
 1. This vacuum can last for 5-10 seconds.
 - iii. *Southwest follow-up comment:*
 1. Southwest did, in fact, notice differences in the air cleaner box pressure between Intertek and Southwest.
 2. Southwest actually develops a small spike in their air cleaner box pressure during the Stage 1 → 2 transition.
 3. Intertek, on the other hand, develops a small vacuum in their air cleaner box during the Stage 1 → 2 transition.
 4. Intertek also uses a much longer fresh-air make-up line than Southwest.
 - a. It is possible that the length is effecting condensation in the line.

- iv. *Ashland follow-up comment:*
 - 1. The Sequence VH procedure should be modified to specify that the intake air pressure should never drop below zero.
- f. Southwest is very concerned about the difference in Stage 3 blowby flow rate between the two San Antonio labs.
 - i. Intertek wants to check their JTEC flow meter to confirm that it is functioning correctly.
 - ii. Southwest also speculated that their PCV valve may be sticking.
 - iii. *Lubrizol comment #3:*
 - 1. Certain hose clamps can distort the plastic shell of the PCV and cause the internal valve to stick.
 - 2. Lubrizol recommends using zip ties to connect the Tygon hose to the PCV valve and not metal hose clamps.

3. Update on Intertek Sequence VH REO1011 Prove-Out Test:

- a. This test is currently at the 150HR milestone and is scheduled to end in three days.
- b. Intertek hopes to have results available early in the week of August 8th.
- c. The oil analysis data that is currently available indicates that the kinematic viscosity curve has not yet “broken” (and remains relatively flat).

4. Upcoming AOAP Meeting on August 11th:

- a. Intertek is willing to bring a 2nd Sequence VH stand online to increase the speed of test development.
- b. Intertek inquired whether the development labs can continue to advance through the Precision Matrix even though not all of the MOA requirements have been met.
 - i. *TMC response:*
 - 1. The labs will need to make sure that they have “all of their ducks in a row” if they continue to advance through the matrix.
 - 2. Otherwise, this Task Force can open itself up to criticism by the AOAP panel.
 - 3. Basically, the Task Force needs to be able to make the case that the Sequence VH stands are essentially Sequence VG stands.
- c. Ritchie confirmed that there is a general agreement among the VH Task Force participants that prove-out test results can be applied to the Precision Matrix.
- d. Ritchie will summarize the official position of the VH Task Force in a single slide that will be presented to the AOAP.
 - i. Ritchie will also ask for approval to start the Precision Matrix on September 8th.
- e. ***Statistician Comments about Precision Matrix Run Order:***
 - i. The run order of the Sequence VH Precision Matrix is important, even though a new engine is used for each test.
 - 1. The run order is used to evaluate time effects and lab effects.
 - 2. The run order is established to estimate multiple variables at one time.
 - ii. Retroactively applying prove-out tests to the Precision Matrix obviously changes the original run order.
 - iii. The typical process is not to retroactively apply prove-out tests to the Precision Matrix.
 - 1. At least one other Task Force (the Sequence IVB Task Force) is going to attempt to do the same thing, but they have not yet received approval from the AOAP either.

5. Sequence VG vs. Sequence VH Hardware Differences:

- a. Southwest previously distributed a presentation that explains how the VG wiring harness needs to be modified to fit the VH engine.
- b. Southwest also reiterated that the correct throttle body elbow needs to be used to prevent a vacuum leak.
- c. Southwest will distribute photographs and a part number list that specifies the correct throttle body hardware for the VH engine.
- d. **Intertek's Throttle Body Concerns:**
 - i. The EEC-IV ECM does use the throttle position sensor (TPS).
 - ii. *Are the TPS sensors different on the various throttle bodies?*
 - iii. The Task Force needs to confirm that the voltage signal from the various TPS sensors are the same.
 - iv. The presentation issued by Southwest shows the newer throttle body.
 - 1. Even though this throttle body is no longer in production, a small number are still available through dealerships.
- e. **Romano's Comments:**
 - i. Romano said that all of the labs should be using the same throttle body on their VH engines.
 - ii. It was agreed during a previous conference call that each lab would purchase model year 2011-2013 throttle bodies from Cunningham.
 - iii. *Lubrizol response:*
 - 1. Lubrizol purchased throttle bodies and elbows from Cunningham over a year ago.
 - 2. It will distribute its P.O. information from this purchase to the other labs.

6. Motion to Approve Electronic Coolant Flow Meters for the VG and VH Procedures:

- a. The VH Task Force agreed to approve the use of electronic flow meters for the VG and VH test procedures back in June 2016.
 - i. Unfortunately, Mileti was on a Sequence IVB Task Force conference call at the time so this conversation was never documented.
- b. Lubrizol [Brys] drafted a motion and distributed it via email on 06-06-2016.
- c. The full Sequence V Surveillance Panel needs to vote on this motion.
- d. Lubrizol will redistribute this motion to the Sequence VH Task Force for approval so that it can be properly documented by the TMC.
 - i. Once the Task Force approves this motion, Ritchie will distribute it to the full Sequence V Surveillance Panel via a formal electronic ballot.
- e. The motion will allow for the use of either the Barco or an electronic flow meter for both the VG and VH test procedures.
 - i. Neither Intertek nor Southwest have converted any of their VG or VH stands to an electronic flow meter.
 - ii. Lubrizol is ready to reference its Sequence VG stand with a Tiger Mag in place of the Barco.
 - 1. Lubrizol's Sequence VH test stand has also been converted to the Tiger Mag sensor as well.
- f. **Potential Issue Regarding the Retroactive Approval of Electronic Coolant Flow Meter for Precision Matrix Tests:**
 - i. The Sequence VH prove-out matrix will include a mixture of tests that used the Barco and tests that used an electronic flow meter.
 - ii. *TMC comments:*
 - 1. There is currently no approved VH procedure.
 - 2. So the initial VH procedure can be written to allow for either the Barco or electronic flow meter.

3. The final VH procedure can then be modified after the Precision Matrix to only allow the electronic coolant flow meter.

7. TMC Database:

- a. The database currently uses a wide range of test names (i.e. VG-A, VG-B, VH, 2.0L and 4.6L).
- b. Ritchie requested that the files in the database be segregated and renamed.
- c. Ford and TMC will review the files that are currently in the database and decide how they will be organized.

Action Items	Person responsible	Completion Date

Follow-up Notes/Updates:	Initials	Date Added																																																																																																
<p>Lubrizon issued the following motion for review by the VH Development Task Force (reference Chris Mileti email from 08-02-2016 at 3:11PM EST):</p> <p>Motion:</p> <p><i>The volumetric engine coolant flow rate can be measured using any venturi or electronic flow meter that has an accuracy of $\leq 0.5\%$. This change is effective 06-06-2016.</i></p> <p>This motion will be applied to both the VG and VH procedures. This motion was distributed by Andy Ritchie to the Sequence V Surveillance Panel on 08-04-2016 4:17AM EST.</p>	CHTM	08-08-2016																																																																																																
<p>Southwest issued additional information on the VH throttle body hardware (reference Cole Hudson email from 08-02-2016 at 3:56PM EST). This information was summarized in the "TB Pictures.pptx" file.</p>	CHTM	08-08-2016																																																																																																
<p>Intertek distributed the 50% APV ratings for its recent VH prove-out tests (reference Al Lopez email from 08-02-2016 at 5:28PM EST):</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="6">RO 940</th> <th colspan="6">RO 1009</th> </tr> <tr> <th>VH Hardware</th> <th>AES</th> <th>RAC</th> <th>AEV</th> <th>APV</th> <th>APV 50%</th> <th>OSC</th> <th>VH Hardware</th> <th>AES</th> <th>RAC</th> <th>AEV</th> <th>APV</th> <th>APV 50%</th> <th>OSC</th> </tr> </thead> <tbody> <tr> <td>SWRI</td> <td>6.80</td> <td>8.02</td> <td>8.83</td> <td>7.17</td> <td></td> <td>70</td> <td>SWRI</td> <td>7.19</td> <td>8.38</td> <td>9.16</td> <td>8.82</td> <td></td> <td>80</td> </tr> <tr> <td>IAR 98</td> <td>6.88</td> <td>8.5</td> <td>9.09</td> <td>8.07</td> <td>7.36</td> <td>98</td> <td>IAR 98</td> <td>7.3</td> <td>9.08</td> <td>9.02</td> <td>7.7</td> <td>7.62</td> <td>35</td> </tr> <tr> <td>avg</td> <td>6.84</td> <td>8.26</td> <td>8.96</td> <td>7.62</td> <td>7.36</td> <td>84.00</td> <td>avg</td> <td>7.25</td> <td>8.73</td> <td>9.09</td> <td>8.26</td> <td>7.62</td> <td>57.50</td> </tr> <tr> <td>940 Target</td> <td>6.43</td> <td>8.15</td> <td>8.79</td> <td>7.2</td> <td></td> <td>51</td> <td>1009 Target</td> <td>7.94</td> <td>9.29</td> <td>8.99</td> <td>7.79</td> <td></td> <td>8</td> </tr> <tr> <td>AK Batch 940</td> <td>6.29</td> <td>8.72</td> <td>8.42</td> <td>6.82</td> <td></td> <td>91.4</td> <td>AK Batch 1009</td> <td>7.11</td> <td>9.24</td> <td>8.87</td> <td>7.86</td> <td></td> <td>48.16</td> </tr> </tbody> </table>	RO 940						RO 1009						VH Hardware	AES	RAC	AEV	APV	APV 50%	OSC	VH Hardware	AES	RAC	AEV	APV	APV 50%	OSC	SWRI	6.80	8.02	8.83	7.17		70	SWRI	7.19	8.38	9.16	8.82		80	IAR 98	6.88	8.5	9.09	8.07	7.36	98	IAR 98	7.3	9.08	9.02	7.7	7.62	35	avg	6.84	8.26	8.96	7.62	7.36	84.00	avg	7.25	8.73	9.09	8.26	7.62	57.50	940 Target	6.43	8.15	8.79	7.2		51	1009 Target	7.94	9.29	8.99	7.79		8	AK Batch 940	6.29	8.72	8.42	6.82		91.4	AK Batch 1009	7.11	9.24	8.87	7.86		48.16	CHTM	08-08-2016
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Follow-up Notes/Updates:	Initials	Date Added
Intertek reported its REO1011 Sequence VH prove-out test results to the TMC. The test key is 119152. (Reference Rich Grundza email from 08-06-2016 at 9:07AM EST.)	CHTM	08-08-2016