

Sequence VH Task Force | MINUTES

Revision Date 10-17-2016 | Revision 1.0

Relevant Test:	Sequence VG and VH
Note Taker:	Chris Mileti
Meeting Date:	10-11-2016
Lubrizol Attendees:	N/A
Comments:	Sequence V Surveillance Panel conference call. Andy Ritchie sent out the " SP Sequence VH for update for week of October 10th 2016 " PowerPoint file for review during this meeting.

SEQUENCE VH PROVE-OUT TESTING:

1. Face-to-Face Surveillance Panel Meetings:

- There will be a series of face-to-face Surveillance Panel meetings in San Antonio during the week of November 14th.
- The Sequence III Surveillance Panel will meet for a half-day.
- The Sequence IV and VIII Surveillance Panels will meet.
- The Sequence V Surveillance Panel will meet for a half-day.
- The LSPI and Chain Wear Surveillance Panels need to decide if they will meet.
- The Sequence VI Surveillance Panel will most likely not meet.

2. Review of Presentation for October AOAP Meeting (Ritchie):

- The October AOAP meeting will be held in Detroit later in the week.
- The Task Force will not make a firm request to the AOAP to start the Precision Matrix.
 - The prove-out matrix data will not be ready in time.
- Slide #3:**

VH Summary

- San Antonio 'prove-out' VH test results are promising (6 tests).
 - 940 (3), 1009 (2), 1011(1).
 - 0W-16 Tech 1 oil 1011 replaces the 'high ground' calibration oil 1006-2 AND is well positioned as an oil for the PM
- 3 other labs have made significant progress with their VH installations, shake-downs and prove-out tests but an additional month is needed from them to have sufficient opportunity to meet the terms of the MOA to be included in the precision matrix
 - 2 tests at each lab are required to show discrimination capability
 - If one or more labs are unable to meet this target, the PM will be readjusted for a lower lab count
- All labs have expressed concerns about the Stage 1 oil temperature control and agree that it must be addressed and the changes required incorporated into the VH test procedure.
 - Target is 68 deg.C but actual temperature is often lower than this by 1-2 degrees max. These concerns will grow as the ambient external temperatures drop.
- Revised target to start the PM in late November with this plan of action.
 - 1) Full SP meeting week of November 14th in San Antonio to review VH data.
 - 2) The target for SP to approve VH as ready for Precision Matrix with labs which meet the terms of the MOA
 - 3) SP request to start the PM would then be forwarded to AOAP/PCEOCP groups to start VH matrix
 - There is no scheduled AOAP meeting in November
- Piston varnish weightings need to be finalized and approved at the SP level.
 - A '50%' piston varnish weighting generates lower APV-50% and AEV-50% VH targets versus VG APV and AEV targets.
- There is a strong preference from the labs to allow the prove-out test results to count towards the PM.
 - Engineers and statisticians will review the VH datasets and make their recommendations to the SP.

- i. The engineering group has worked well together to compile their collective insight and make steady progress on the VH test stand installations.
- ii. However, each dependent lab has not yet completed its required two valid prove-out tests.
- iii. *Revised Plan:*
 - 1. The Precision Matrix is now scheduled to start late in November.
 - 2. The prove-out data will be reviewed at face-to-face meetings in San Antonio during the week of November 14th.
 - 3. Any laboratory that has not completed its prove-out test requirements by November 14th will be excluded from the Precision Matrix.

3. Concerns about VH Test Development:

a. *Stage 1 Oil Temperature at Inlet:*

- i. Afton confirmed that the oil temperature control problems are not related to the oil type.
- ii. There is broad agreement among the engineering group that the oil temperature control problems need to be addressed.
 - 1. Each laboratory will implement a solution to address this problem (although the details of this solution may vary slightly).
- iii. This problem originally manifested at Afton and Ashland.
 - 1. However, the San Antonio labs are now seeing similar problems now that their ambient temperatures have dropped into the 50°F range.
 - 2. In some cases, the outlet oil temperature is actually lower than the inlet oil temperature.
 - 3. The model year 2013 engine just does not generate as much heat as the older engine.
- iv. *Afton comment:*
 - 1. One potential solution was to lower the Stage 1 oil temperature set-point.
 - 2. Yet doing so could invalidate existing prove-out data.
- v. Ashland is currently testing a prototype system that heats the process water before it enters the oil heat exchanger.
 - 1. The other labs will mimic this system if it proves to be successful.
- vi. The group agreed that prove-out tests run without a heating system in place will still be valid as long as they have positive oil temperature QI coefficients.
 - 1. Although all of the labs need the heating system in place prior to the Precision Matrix.
- vii. Afton would like the following wording added to the VH procedure to address this issue:
 - 1. "The labs can use any system to increase the oil temperature externally (i.e. through process water conditioning)."
 - 2. "The system cannot directly heat the oil."
- viii. *Intertek Stand #98:*
 - 1. Intertek is going to mimic the Ashland system on this test stand.
 - 2. The heater is being purchased today.
 - 3. They do have some concerns about the fidelity of the temperature control.
 - a. Ashland is confident that the control can be improved with additional tuning.
- ix. *Could a system be installed to heat the oil itself?*
 - 1. TMC noted that two ASTM tests already use a system to heat the oil directly (Sequence VI and Sequence VIII).

2. Afton's main concern with adding an additional system to heat the oil is that it could substantially change the external oil volume of the test stand.
- x. Ford requested that Ashland distribute a schematic of its system so that it can be included in the final Sequence VH procedure.
- b. **Average Piston Varnish Ratings:**
 - i. The initial prove-out data indicated that the 50% APV ratings, along with a modified AEV rating that uses these 50% APV ratings in its calculation, provide better oil discrimination.
 - ii. The group needs to formally decide how the APV ratings will be handled in the Precision Matrix.
- c. **Applying Valid Prove-Out Tests to Precision Matrix:**
 - i. The San Antonio labs would like to apply their completed prove-out tests to the upcoming Precision Matrix.

4. Laboratory Updates:

- a. **Lubrizol:**
 - i. Lubrizol expects to have two valid prove-out tests completed by the middle of November.
 - ii. Lubrizol has not yet encountered any oil temperature control problems with the Sequence VH engine.
 1. However, there is a lot of concern that this problem will manifest itself during the upcoming winter months.
 - iii. The external heating system will not be in place for these two prove-out tests, but it will be in place prior to the start of the Precision Matrix.
- b. **Southwest:**
 - i. They expect to begin trials with a replica of the Ashland heating system this week.

5. 50% APV Ratings:

- a. **50% APV Ratings from Lubrizol's 1st (Invalidated) REO940 Prove-Out Test:**
 - i. Lubrizol's full APV ratings were almost exactly on target, but its 50% APV ratings were extremely severe.
 - ii. It has shipped this piston set to Intertek to initiate a Sequence VH rating "round robin".
- b. The Raters need to finalize a procedure for the VH pistons (i.e. dealing with varnish striations) before the start of the Precision Matrix.
- c. The engineering group agreed that each lab will provide both full APV ratings and 50% APV ratings for each prove-out and Precision Matrix test.
 - i. A final decision on piston rating will not be made until after the Precision Matrix data is analyzed in its entirety.
- d. **Rater Workshop Last Week:**
 - i. Sequence VH piston rating issues were discussed.
 - ii. *Intertek comments:*
 1. The current varnish intensity scale will still be used for the VH pistons, even with hardware that has the striations.
 2. There was agreement on the general rating methodology.
 3. The VH test may require a slightly different piston template because the VH piston skirts are longer than those of the VG pistons.
- e. **Afton comments:**
 - i. Afton has a set of pistons (which were milder than the Lubrizol pistons) that they will add to the APV "round robin".

- ii. This will allow for both “mild” and “severe” hardware to be included.
- f. **Reporting APV Data to the TMC:**
 - i. The group agreed to submit the full APV ratings in the test report.
 - ii. The 50% APV ratings, along with the “AEV50” rating (AEV calculated using the 50% APV rating), will be listed in the test comments.

6. Review of MOA Preparedness:

- a. **Statistician Comments:**
 - i. One of the reference oils needs to be replicated at each lab (preferably in the same stand).
 - ii. Even though it is not explicitly stated in the MOA, the intent [of the prove-out testing] is to establish repeatability, reproducibility and discrimination.
- b. It is not necessary to have data available for REO1011 because only REO940 and REO1009 are being used to establish discrimination.
- c. Laboratory inspections are complete.
- d. The report forms are complete and each lab has demonstrated successful data transmission to the TMC.
- e. The appropriate reference oils are available at each lab.
- f. Validity criteria will be established prior to the Precision Matrix.

HALTERMANN UPDATE:

1. Current VH Fuel Inventory:

- a. They have 300,000-gallon in the tank.
 - i. Approximately 250,000-gallons of this fuel can be easily accessed.
- b. They expect a surge in fuel orders once the Precision Matrix starts.
- c. The engineering team estimates that the Industry is approximately 1.5-years away from needing another batch of Sequence V fuel.

2. Sequence VH Capacity:

- a. Intertek and Southwest will each have (5) Sequence VH stands.
- b. Lubrizol will have (2) Sequence VH stands.
- c. Afton and Ashland will each have (1) Sequence VH stand.

DISCUSSION AMONG ENGINEERING TEAM ONLY:

1. Ashland’s Oil Temperature Heating System:

- a. They are using a compact 4000W tube heater.
 - i. However, they feel that a 3000W heater would probably also work.
 - ii. Stands that only have a 120V supply will be limited to heaters of 2500W or less.
- b. Southwest and Lubrizol plan to use the 240V/5000W heaters that are currently used for the IVA test stands.
- c. A high temperature limiting switch has been installed to disable the relay if the temperature becomes too hot.
- d. Southwest noted that the heater should be installed as close to the heat exchanger as possible to improve the controller’s response time.
- e. Interestingly, the valve position on this new system is in about the same position for all three stages.

Action Items	Person responsible	Completion Date

Follow-up Notes/Updates:	Initials	Date Added