

VH Development Task Force | MINUTES

Revision Date 07-22-2016 | Revision 1.0

Relevant Test:	Sequence VG and VH
Note Taker:	Chris Mileti
Meeting Date:	07-20-2016
Lubrizol Attendees:	Mileti, Matasic and Brys
Comments:	Sequence VH Development Task Force conference call to discuss "Sequence VH for July 20 th 2016.ppt" PowerPoint presentation.

SEQUENCE VH UPDATE PRESENTATION:

1. Background:

- a. The PowerPoint file, **Sequence VH for July 20th 2016.pptx**, was distributed via secure link by Andrew Ritchie at 12:54PM on 07-20-2016.

2. Slide #2:

Sequence VH	
	Sequence VH
MY	2013
Short Block	VH
Cylinder head	VH
Intake & Throttle Assembly	VH
Piston	VH (unplated)
Rings	VG
Timing components	VH
ECM	VG
Fuel	DJ0121NX10

- a. The VH engine is predominantly built with Model Year 2013 hardware.
 - i. The two exceptions are the PCM and the piston rings, both of which are from the VG engine.
- b. The current version of the VH engine will not use the external water pump (with VFD).
 - i. Instead, it will use an engine-mounted water pump like the VG.
- c. **Discussion about Naming Conventions:**
 - i. Romano has received pushback from certain organizations regarding the use of the "VH" designation.
 1. They feel that the "VH" name should only be associated with the original 2.0L EcoBoost engine.
 - ii. The general consensus among the Task Force is that there was never any approved Sequence V test associated with the 2.0L engine.
 1. As a result, the "Sequence VH" name is still available for the 2013 4.6L engine.

- iii. The VG-A and VG-B engine designations are officially discontinued.
- d. **Operational Data Reviews:**
 - i. Intertek and Southwest have been continuing their operational data reviews since the original meeting in March 2016.
 - ii. Significant progress has been made in aligning the performance of the two laboratories.

3. Slide #3:

Recent San Antonio VH Data (3 test results)

VH Hardware	AES	BAC	AEV	APV	OSC
SWRI	6.00	6.02	6.83	7.17	70
IAR					
avg	6.90	6.02	6.83	7.17	70.00

VH Hardware	AES	BAC	AEV	APV	OSC
SWRI	7.19	8.38	9.14	8.82	80
IAR 98	7.3	9.08	9.02	7.7	35
avg	7.25	8.73	9.09	8.26	57.50

940 Target	6.61	6.55	6.79	7.2	51
AK Batch 040	6.20	6.72	6.42	6.82	93.4

1009 Target	7.98	9.29	8.99	7.79	6
AK Batch 1000	7.11	9.24	8.87	7.86	48.16

- Fuel Batch DJ0121NX10
- Fuel dilution levels are around 10-12%
- Regular VG varnish ratings with VH pistons
- IAR 940 test is at approximately 120 hours

- a. Southwest and Intertek have completed three tests with the current iteration of the VH engine.
 - i. The data is all uncorrected.
 - ii. The data confirms that there is a reduction in lab-to-lab variation with the AES parameter.
 - iii. There also appears to be adequate discrimination between REO940 and REO1009.
- b. Intertek is currently running a Sequence VH test with REO940, and the results should be available next week.
 - i. The interim data, particularly kinematic viscosity, appears to be tracking along desired levels.
- c. **Fuel Dilution:**
 - i. All of these tests used the latest batch of fuel [DJ0121NX10].
 - ii. The fuel dilution levels for these three tests ranged between 10% and 15%.
 - 1. This is very close to the historical fuel dilution levels for the VG engine.
- d. **Varnish:**
 - i. All of the APV data was generated using the standard VG piston rating procedure that utilizes the full piston skirt.
 - ii. The SWRI APV result with REO1009 is mild of target.
 - iii. Striations in the varnish of the un-plated pistons is concerning.
 - 1. Intertek recently distributed photographs illustrating this unusual varnish pattern.



2. Intertek believes that these striations may actually be beneficial because they increase varnish severity.
- iv. *Request from Ashland:*
 1. Ashland requested that a round-robin be conducted so that the APV ratings with these unusual varnish patterns can be compared between laboratories.
- e. **Sludge:**
 - i. The AES target for REO1009 is around 7.9-merits, so the current Sequence VH AES average of 7.25-merits is acceptable.
 - ii. In fact, the REO1009 results for the "DJ" fuel batch are very close to those for the "AK" fuel batch.
- f. **Oil Screen Clogging (OSC):**
 - i. Afton expressed concern regarding the differences in OSC performance between Intertek and Southwest.
 1. Intertek replied that the primary goal is to generate acceptable sludge results, and that the group will need to find a way to deal with the resulting varnish and OSC issues.
 - ii. Lubrizol, Ford and Infinium stated that the primary concern with the recent OSC results is that this parameter now appears to be uncoupled from AES.
 1. In other words, a reference test can have a passing AES result but a failing OSC result.
 - iii. Romano is receptive to possibly changing oil screen clogging from a "pass/fail" parameter to a "report only" parameter.

4. Slide #4:

VH Path Forward

- San Antonio 'prove-out' testing looks promising for discrimination, repeatability and reproducibility (3 tests).
- 'Prove-out' data is needed before the end of August from the other labs wishing to participate in the PM
 - 2 tests at each lab are required showing discrimination
- Target must now be to start the PM in early September.
 - Sequence V SP call(s) will be needed to authorize the plan
 - August 11th AOAP meeting should review the VH the plan of action
- Strong preference to try to allow the prove-out test results to count towards the PM.

- a. The three other laboratories that are planning to participate in the Precision Matrix (Afton, Ashland and Lubrizol) each need to run (2) prove-out tests to establish oil discrimination.
 - i. Ideally, these (6) tests can be completed by Labor Day so that the Precision Matrix can be started sometime in September.
- b. **Afton Update on Readiness:**
 - i. They plan to start shaking down their VH stand next week.
 - ii. They will then be ready to start their first prove-out test.
- c. **Lubrizol Update on Readiness:**
 - i. Lubrizol is calibrating its new Tiger Mag flow meter now and plans to run a shakedown next week.
- d. **Ashland Update on Readiness:**
 - i. They will be ready to run before the 2nd week of September.
 - ii. They have enough of the "AK" fuel remaining in their tank to run one more test.

1. They will need to transfer this fuel to another tank before they can receive the "DJ" fuel batch.

e. **Surveillance Panel Conference Call or Meeting:**

- i. The full Sequence V Surveillance Panel will need to approve this plan.
 1. The Surveillance Panel also needs to discuss whether or not prove-out tests can be applied to the Precision Matrix.
 2. Toyota has set a precedent for doing this with the IVB test.
- ii. The plan will also need to be presented to the AOAP Panel on August 11th.
- iii. Ford, Intertek and Southwest will need to complete an initial draft of the VH procedure before the Precision Matrix can begin.

5. **Slide #5:**

VH Precision Matrix Details							
Run Order	Afton	Ashland	LZ	IAR Stand 1	IAR Stand 2	SWRI 1	SWRI 2
1	1011	1011	1009	940	940	1009	1011
2	1009	1011	940	940	1011	1009	1009
3	1009	940	1011	1009	1009	1011	940
4	940	1009	1011	1011	1009	940	940

➤ 28 tests total – minimum 2 months of testing plus data evaluation time.

➤ Oil 1011 Scoping test (Tech 1 0W-16) to establish 0W-16 capability.

➤ 1006-2 RO not included in PM – inventory is low on this oil.

- a. This general Precision Matrix design has been around for about 18-months.
 - i. It includes (5) labs and (28) tests.
- b. The tests that are highlighted in red have either been completed or are currently running.
- c. REO1011 is the Tech 1 oil in the 0W-16 viscosity.
 - i. It was chosen in order to confirm that the VH test has the capability to run low viscosity oils.

REFERENCE OILS:

1. REO1006-2 "Good" VG Reference Oil:

- a. REO1006-2 is the only reference oil with extensive data that shows it produces "good" results with the VG test.
 - i. It is not currently included in the VH Precision Matrix design.
- b. The general consensus within the VH Development Task Force is that REO1006-2 data should be generated with the VH engine before the Precision Matrix is started.
 - i. Southwest has an REO1006-2 test in progress, and results are expected next week.

2. REO1011:

- a. There is currently no data for this reference oil with the VH engine.
- b. Lubrizol expressed concerns that REO1011 has been included in the Precision Matrix even though there is no data showing that it can replace REO1006-2 as a "good" VH reference oil.

- i. Ritchie suggested that Afton, Ashland and Lubrizol run REO940 and REO1011 as their two upcoming prove-out tests.
 - ii. REO940 would be run first to prove that each lab can generate sludge, and then REO1011 would be run next to confirm discrimination.
- c. Intertek reinforced that there are two goals of a Precision Matrix:
 - i. *Goal #1* – Establish test precision
 - ii. *Goal #2* – Baseline reference oils
 - iii. If REO1011 does not fulfill its purpose as a “good” reference oil, then the group will need to determine if REO1010 is a more appropriate candidate.
- d. Ritchie stated that REO1010 is probably more similar to REO1009 (“borderline” VG reference oil) than it is to REO1006-2 (“good” VG reference oil).
 - i. REO1010 is a GF-5 category reference oil.
 - ii. REO1010 will not be very useful if it is, in fact, similar to REO1009.
- e. The consensus among the VH Development Task Force is that at least one lab needs to run REO1011 fairly quickly.
 - i. Lubrizol is willing to run REO1011, but feels that the data will be more insightful if it originated from a lab that has been running the new VH test (i.e. Intertek or Southwest).
 - ii. Intertek agreed to donate an REO1011 prove-out test after their REO940 test completes.
 - 1. Intertek reiterated that this oil needs to perform as well as, or better than, REO1006-2 in order to remain in the Precision Matrix.

GENERAL DISCUSSION:

1. Federal Mogul Pistons:

- a. Romano sent out an email several days ago regarding the VH pistons.
- b. Federal Mogul is offering one last opportunity to purchase these pistons before they discard the tooling hardware.
- c. Ashland appears to be the only laboratory that may be interested in a follow-up piston purchase, although Southwest needs to review their inventory.
- d. Romano said that he needs to know by Friday (07-22-2016) if any laboratories want to place additional orders.

2. Final Discussion of Differences Between VG and VH Tests:

- a. Unlike the Sequence VG test, the Sequence VH test uses coolant flow set points in Stage 2 and Stage 3.
- b. The VG wiring harness needs to be modified so that it can extend over the taller intake manifold of the VH engine.
 - i. The solid plastic bracket underneath the harness needs to be removed.
 - ii. Pig tails need to be added to some of the connectors.
- c. Ron Francis makes a new VH-specific wiring harness that does not require modification.

Action Items	Person responsible	Completion Date

Follow-up Notes/Updates:	Initials	Date Added
<p>Additional information on VH engine hardware provided by AI Lopez (Intertek) on 07-22-2016:</p> <ol style="list-style-type: none"> 1. VG pick-up tube 2. VH cylinder head gaskets 3. VH harmonic balancer 4. VG front cover 5. VG pulleys and tensioner 6. No coolant restrictor plates used 7. Both chain tensioners (LS and RS) need to utilize spacer plates 	CHTM	07-22-2016