

Sequence VG-A Task Force | MINUTES

Revision Date 05-20-2016 | Revision 1.0

Relevant Test:	Sequence VG and VG-A
Note Taker:	Chris Mileti
Meeting Date:	05-18-2016
Lubrizol Attendees:	CHTM, KVOM and JABS
Comments:	Task Force conference call to discuss GF-6 test development

TEI EXHAUST MANIFOLD:

1. Discussion about the Impact of TEI Exhaust Manifolds on Test Performance:

- a. A motion was made to accept the new TEI exhaust manifold for use with the Sequence VG engine.
 - i. *TEI Part Number: TEI-VGMAN-01*
- b. IAR is running these new TEI manifolds on one of their fuel approval matrix test engines.
 - i. Boese is concerned that the TEI manifold could introduce a new variable into the test results.
 - ii. TMC has not yet ruled on whether this fuel matrix test can be used as a reference test.
- c. Intertek is measuring and controlling exhaust backpressure (per test requirements).
 - i. They are not measuring exhaust temperature.
 - ii. As a result, it is somewhat difficult to make a direct comparison between the OHT and TEI manifolds at this time.
- d. The heat transfer characteristics between the old and new manifolds should be compared [Afton].
 - i. This includes comparing the coolant flow rate, coolant temperature, and exhaust temperature for each.
- e. The Industry is running out of the original manifolds, so new manifolds will need to be introduced shortly.
- f. Differences between the original OHT manifolds and the new TEI manifolds may not be significant.
 - i. Each of the labs will generally use the same set of manifolds for several years.
 - ii. The heat transfer characteristics of these manifolds are definitely changing over time and they age and collect deposits.

2. Motion to Approve TEI Manifolds:

- a. Ritchie [Chairman] requested that TMC issue an electronic ballot to formally approve these manifolds for the current test procedure.
- b. **Grundza [TMC] issued the following email on 05-18-2016 at 2:22PM:**
 - i. *"The Sequence VG Surveillance Panel accepts the water cooled TEI exhaust manifold (PN TEI-VGMAN-01) for use in the VG. The manifold will be a direct*

replacement for the BX-575-1. The new manifolds will be introduced in a reference test before use in candidate testing".

- ii. Intertek made the motion and it was seconded by Afton.

3. Concerns about Communication Breakdown:

- a. OHT expressed concerns that the Surveillance Panel was not properly informed that an alternative to their current VG exhaust manifold was being developed by another vendor.
 - i. OHT requested that the labs inform them when they are performing development work such as this.
- b. **Next-Generation OHT Exhaust Manifold:**
 - i. OHT was in the process of developing a new, more cost-effective exhaust manifold.
 - 1. The new manifolds would be made of stainless steel to make them easier to clean and maintain.
 - 2. This, in turn, would increase their longevity.
 - ii. This new manifold would utilize the same geometry as the marine manifolds originally used on the VG test (i.e. "log" style).
 - 1. They had abandoned their original header-style design over a year ago in response to concerns over fitment.
 - iii. Prototype manifolds were sent to Lubrizol last year for fitment trials.
 - 1. No issues were identified.
- c. The Task Force agreed to make an effort to avoid communication breakdowns like this in the future.

OPERATIONAL DIFFERENCES BETWEEN LABORATORIES:

1. SWRI Trial using Intertek Engine:

- a. SWRI recently completed a test using REO1009 and a VG-A engine built entirely by Intertek.
- b. **Results:**

RO 1009

VGA Hardware	AES	RAC	AEV	APV	OSC
IAR 2	7.20	9.32	9.50	8.90	26
SWRI 1	6.13	8.06	9.48	8.63	98
LZ	6.57	8.95	8.89	8.44	85
IAR 1	7.40	9.20	9.31	8.82	50
SWRI 1	6.54	9.28	8.72	8.36	95
SWRI W/IAR Eng	6.4	9.32	9.23	8.9	95

- i.
- c. The AEV and APV results were very mild, but that was expected with the VG-A engine.
- d. Unfortunately, the AES results were almost identical to the results that they had with their in-house VG-A engine.
 - i. The AES results were also identical to the recent REO1009 VG-A result at Lubrizol.
- e. The OSC results also continue to be extremely severe at two of the three labs.
- f. This trial provided convincing evidence that the recently identified lab-to-lab differences are probably not the result of engine build practices.

2. Lubrizol Update:

- a. In April, Lubrizol changed its coolant flow calibration procedure so that its stand would deliver more realistic coolant flow measurements in Stage 2 and Stage 3.
 - i. This change was made in response to the operational data review that was performed late in March.
- b. Lubrizol also installed the exact same coolant flow control valve that is being used at SWRI and IAR.
- c. Unfortunately, Lubrizol has experienced poor flow control ever since these changes were made.
 - i. Lubrizol is still attempting to resolve these issues.

3. Opinions Regarding Possible Forward Action Plans:

a. **Southwest:**

- i. SWRI will meet with IAR to try and identify any further operational differences.
- ii. SWRI will also review their recent VG-B work with IAR.

b. **Romano [Ford]:**

i. *There are two options:*

1. OPTION #1 - Continue the investigation into the cause of the stand-to-stand differences.
 - a. This may require another round of stand inspections.
 - b. Even though the recent VG-B results from SWRI are encouraging, they do not address the issue of lab variability.
2. OPTION #2 – Accept both the VG-A test and the established lab-to-lab variation.
 - a. The Surveillance Panel will also need to accept the fact that there would not be ideal discrimination between REO1009 and REO940.

c. **Afton:**

- i. Afton expressed concern that the labs are delivering very different levels of OSC severity.
 1. All three fuel matrix labs (SWRI, IAR and Lubrizol) are all using new water pumps with each engine build.
- ii. Afton requested that each lab (IAR and SWRI) confirm the location and depth of their oil inlet and outlet thermocouples.
 1. Intertek uses a jig to establish their thermocouple depths.

d. **Intertek:**

- i. IAR and SWRI need to compare crankcase pressure and intake air pressure during the transitions.

SOUTHWEST SEQUENCE VG-B TRIALS:

1. SWRI Update:

- a. SWRI conducted these internal VG-B trials in response to their severe results with the VG-A engine.
- b. **VG-B Engine Specifications:**
 - i. Sequence VH engine block, cylinder heads, and intake manifold (with throttle body).
 - ii. Sequence VG piston rings, EEC-IV computer module and test stand.
 - iii. *Coolant flow is controlled to the following set points:*
 1. Stage 1 = 48 L/min

- 2. Stage 2 = 118 L/min
- 3. Stage 3 = 28 L/min
- iv. The Ron Francis wiring harness must be used because it has leads that are long enough to clear the VH's plastic intake manifold.
- v. *Typical fuel dilution: 12%-13%*
- vi. *Intertek comment:*
 - 1. The original VH engine was generating fuel dilution levels around 20%-22%.
 - 2. The fuel was literally washing the sludge from the engine hardware.
 - 3. SWRI noted that the fuel dilution problem was fixed late in the test's development by modifying the engine's timing.

2. Task Force Consensus:

- a. The Task Force agreed that the ultimate goal is to implement a test that is similar to the VG-B work done at SWRI.
- b. **Specifications:**
 - i. VH engine block and cylinder heads.
 - ii. VG piston rings, ECM and test stand.
 - iii. Coolant flow control during all three stages.
 - iv. New Haltermann fuel batch.
- c. **Haltermann's Comments:**
 - i. Haltermann intentionally made the latest fuel batch more severe at the request of the Surveillance Panel.
 - ii. However, they did not do anything to the fuel to intentionally change its fuel dilution properties.
 - 1. They do not know why the fuel dilution with this latest batch is lower.
- d. Intertek is willing to build a VG-B engine and run a test with the new Haltermann fuel.
 - i. They will not be able to start this test for at least another week.
 - ii. This will give the two San Antonio labs more time to investigate potential operational differences.

RELEASING NEW FUEL BATCH FOR SEQUENCE VG TEST:

1. Hardware Redistribution:

- a. Afton is in the process of delivering (20) sets of VG pistons to Intertek and (40) sets of VG pistons to Southwest.
 - i. Afton still has an inventory of piston rings remaining.
- b. Afton also provided two new engine blocks to each of the San Antonio labs.
- c. Ashland will inventory their remaining VG hardware and make it available to the Industry if needed.
- d. This hardware redistribution should allow each of the San Antonio labs to run an additional (40) VG tests.

2. Recent Haltermann Fuel Delivery:

- a. Haltermann recently delivered 1800-gallons of fuel to Afton and Ashland.
 - i. Lubrizol did not have the storage available to receive the shipment at this time.
- b. This fuel is to be used by these labs to run two Sequence VG-A prove-out tests.
 - i. These prove-out tests are needed to satisfy the MOA requirements that will allow the labs to participate in the upcoming Precision Matrix.

3. Forward Action Plan:

- a. IAR and SWRI will complete their 2nd operational review, and IAR will run a VG-B test.
 - i. The results of each will be communicated via email to the Sequence V Surveillance Panel members.
- b. The next conference call will be held after these results are available (around May 31st at 2PM EST).

Action Items	Person responsible	Completion Date

Follow-up Notes/Updates:	Initials	Date Added