

Sequence IVB Sub-Groups | MINUTES

REVISION DATE: 7/23/2018 3:36:00 PM

Relevant Test:	Sequence IVB
Note Taker:	Chris Mileti
Meeting Date:	07-10-2018
Comments:	This was a back-to-back conference call with the two Sequence IVB Sub-Groups: IVB Procedure Review Sub-Group and IVB Precision/Operations Sub-Group .

1. PRESENTATION TO AOAP:

1.1. Opening Comments from B. Buscher:

- 1.1.1. Section 4 of the Sequence IVB engine build procedure is out for review.
 - 1.1.1.1. This section deals with rebuilding an engine after a camshaft lobe failure.
- 1.1.2. The presentations that Buscher reviewed at the AOAP and PCEOCP groups are almost identical.
 - 1.1.2.1. There were some updates made to the AOAP presentation after feedback that he received at PCEOCP.
 - 1.1.2.2. The AOAP presentation discusses the 3rd Sequence IVB Sub-Group (Metrology).
- 1.1.3. **Lubrizol Update on 1st Metrology Sub-Group Meeting:**
 - 1.1.3.1. The main purpose of the 1st meeting was to decide on a format for the sub-group and review the metrology action items from the main Surveillance Panel.
 - 1.1.3.1.1. Meeting minutes have been posted to the TMC website.
 - 1.1.3.2. The 2nd sub-group meeting will focus exclusively on the action item to conduct a (5) lab Keyence round-robin.
 - 1.1.3.2.1. Kevin O'Malley will attend the call so that he can answer statistical questions from the initial (3) round-robins.
 - 1.1.3.2.2. The 2nd meeting will be held in three weeks instead of the normal two weeks because some metrology technicians will be at the ASTM Gear Rater Workshop.

1.2. Overview of Presentation to AOAP:

- 1.2.1. **This presentation reviewed the following key topics:**
 - 1.2.1.1. Overview of new LTMS system
 - 1.2.1.2. Minutes from May 24th Surveillance Panel meeting
 - 1.2.1.3. Recent e-Ballot activity
 - 1.2.1.4. Review of the progress made by the three Sequence IVB sub-groups

1.3. Slide #2:

- Fully developing the FEWMEOT parameter, including:
 - FEWMEOT measurement procedure
 - Evaluate FEWMEOT for all precision matrix 2 tests
 - Implement FEWMEOT into LTMS
- Finalizing the definition and all procedures associated with camshaft lobe failures, including:
 - Camshaft lobe failure definition
 - Test interpretability and/or test validity criteria for camshaft lobe failure
 - Engine health checklist
 - Engine reconditioning after a lobe failure procedure
 - Stand maintenance after a lobe failure procedure
- Finalizing test interpretability and/or test validity criteria for oil consumption

1.3.1.1. Buscher will summarize the action items that need to be completed over the summer.

1.3.1.2. The ACC wants the critical action items finalized before they will allow registration to start for IVB tests.

1.3.2. The critical action items include:

1.3.2.1. Finalize and implement a procedure for the FEWMEOT pass/fail parameter.

1.3.2.2. Specifically define what a camshaft lobe failure is.

1.3.2.3. Establish validity and interpretability criteria for tests that experience a camshaft lobe failure.

1.3.2.4. Establish an engine “health” checklist that can be used by laboratories to confirm that an engine is suitable for continued testing.

1.3.2.4.1. Lubrizol is responsible for this action item.

1.3.2.5. Establish procedures for reconditioning an engine and test stand after a camshaft lobe failure.

1.3.3. ACC survey on camshaft lobe failures (TMC):

1.3.3.1. The ACC has requested that the TMC conduct a survey to establish the frequency of camshaft lobe failures throughout the Industry.

1.3.3.2. The TMC expects to issue their findings today.

1.3.3.3. It is surprising that one lab did not experience any lobe failures, and another lab experienced a significant number of lobe failures.

1.3.3.4. The dataset is not very large (~100 tests), and the ACC did not ask for a lot of accompanying data.

1.3.3.5. The TMC does not know what the ACC plans to do with this data.

1.3.3.6. Infineum asked if the results of the survey can be distributed to the full Surveillance Panel.

1.3.3.6.1. The TMC is willing to do this.

1.3.3.7. Intertek will send the TMC a revised data set that includes some of their recently completed candidate tests.

1.3.4. Oil Consumption (Buscher):

1.3.4.1. The oil consumption validity criteria concerned more people at the AOAP than he expected.

- 1.3.4.1.1. Their concern is that the oil consumption limit will be too tight.
- 1.3.4.2. A recommendation for an oil consumption validity threshold will be determined during the upcoming statistical analysis of the Industry's engine life data.
- 1.3.4.3. The main goal of this limit will be to avoid aeration or foaming (due to a low oil level in the sump).

1.4. Slide #12:

Summary of Activity Since 5/10/18 **TOYOTA**

- **Highlights cont'd:**
 - Created a Sequence IVB Metrology sub-group to focus on opened metrology action items and reviewing metrology procedures
 - Will be a third sub-group, including primarily metrology technicians
 - First meeting scheduled for today, 6/27/18
 - The initial focus for the Sequence IVB Metrology sub-group will be on the following:
 - Developing a DOE/Round Robin to compare the Keyence units at all five laboratories
 - Providing input to the engineering sub-groups regarding what metrology data should be included in the IVB test report
 - Finalizing a procedure to use the Keyence G2 software to screen lifters for profile
 - Determine whether Keyence instruments should be monitored in LTMS

1.4.1. A slide was added to the AOAP presentation that reviews the formation of a third IVB sub-group.

1.4.1.1. This sub-group is focusing exclusively on the Surveillance Panel's metrology action items.

1.4.2. The details in the slide summarize the agenda issued by Lubrizol for the 1st IVB Metrology Sub-Group meeting.

1.5. Slide #13:

Summary of Activity Since 5/10/18

TOYOTA

- The BOI/VGRA task force recommends replacing 1 or 2 “all Ca” technologies with 1 or 2 “Mg/Ca” technologies for the Sequence IVB’s BOI/VGRA matrix
 - Currently, all three precision matrix oils have high Ca levels and are not LSPI-compliant
 - High Mg / low Ca oils potentially perform poorer than high Ca / low Mg oils in the Sequence IVB
 - Propose replacing technology 436 with an LSPI compliant technology oil
 - Have an offer to replace technology 300 or 1011 with an LSPI compliant technology oil
 - Jo Martinez evaluated alternate matrix designs replacing 436 with one LSPI compliant technology and replacing either 300 or 1011 with a second LSPI compliant technology
 - Replacing 300 proves to be detrimental
 - Replacing 436 and 1011 proves to be acceptable
 - Recommend replacing 436 with Tech 1 and 1011 with Tech 2

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- 1.5.1. This slide contains details about the upcoming BOI/VGRA matrix.
- 1.5.2. The decision has been made to replace REO436 with an LSPI-compliant oil.
- 1.5.3. REO1011 will likely be replaced with an LSPI-compliant oil as well.
- 1.5.4. The decision was made to not remove REO300 as a BOI/VGRA matrix oil.
- 1.5.5. The Statistics Group is comfortable with these changes.
- 1.5.6. The TMC does not believe that they have inventory of all the BOI/VGRA reference oils yet.

1.6. Slide #14:

Next Surveillance Panel Meeting

TOYOTA

- Sequence IV surveillance panel will meet face-to-face in July or August, prior to the start of the BOI/VGRA matrix
- Topics for discussion at the next Sequence IV surveillance panel meeting include:
 - Updates from sub-groups
 - Motions on sub-group recommendations
 - ACC registration and retro-registration (if needed)
 - Starting the BOI/VGRA matrix

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- 1.6.1. The Surveillance Panel will need to convene a face-to-face meeting sometime in July or August.
 - 1.6.1.1. The consensus from the participants of the conference call was that the week of August 12th would be ideal.
- 1.6.2. Toyota's Japanese offices will be closed during the week of August 12th.
 - 1.6.2.1. However, Hirano-san is willing to call-in if the Surveillance Panel meeting is held during this week.
- 1.6.3. **Comments from Afton:**
 - 1.6.3.1. The Statistics Group still needs to review the iron and engine life data.
 - 1.6.3.1.1. They will need adequate time to do this.
 - 1.6.3.1.2. Many of the statisticians are currently busy doing BOI/VGRA work for other Surveillance Panels.
 - 1.6.3.2. The ACC is looking for most of the action items to be completed by the end of August.
 - 1.6.3.2.1. The ACC may want to extend the Tech Demo period if these action items are not completed during that time.
- 1.6.4. **Comments from Lubrizol:**
 - 1.6.4.1. Afton brings up a valid point – this sub-group needs to get the iron/engine life data file to the Statistics Group as soon as possible.
 - 1.6.4.2. The sub-group also needs to solicit feedback from the statisticians about an ideal format for this data.
- 1.6.5. **Comments from both Afton and Lubrizol:**
 - 1.6.5.1. The Surveillance Panel needs to be confident that an engine-based LTMS system is not needed.
 - 1.6.5.2. A statistical analysis of the iron/engine life data will provide important insight into this issue.

2. LABORATORY UPDATES:

2.1. Intertek Update:

- 2.1.1. **Section 4 of the Engine Assembly Manual:**
 - 2.1.1.1. Section 4 provides instructions for rebuilding an engine after a camshaft lobe failure.
 - 2.1.1.2. Intertek recently used this draft procedure to rebuild two engines that experienced lobe failures.
 - 2.1.1.3. This gave their engine builders time to review the document.
 - 2.1.1.4. The draft document is ready to be reviewed by the sub-group, but it is not yet in the official ASTM format.
 - 2.1.1.4.1. Southwest offered to help convert this document into the ASTM format.
 - 2.1.1.5. Intertek would like Exxon and Afton to use this draft procedure to rebuild the engines at each lab that recently experienced a lobe failure.
 - 2.1.1.6. Intertek will now focus its attention on drafting a procedure for test stand maintenance after a camshaft lobe failure.
- 2.1.2. Intertek will soon start analyzing the E.O.T. oil samples from the 2nd Precision Matrix.
- 2.1.3. **NO_x Analysis:**
 - 2.1.3.1. Intertek is analyzing NO_x levels in one of their IVB test stands.
 - 2.1.3.2. The data looks relatively repeatable within a stand.
 - 2.1.3.3. They will eventually share this data with the sub-group.
- 2.1.4. **Definition of Lobe Failure:**

- 2.1.4.1. Intertek plans to use Lubrizol's earlier suggestion as the formal definition of a camshaft lobe failure.
- 2.1.4.2. Any lobe wear of more than 20µm will be considered a failure.
- 2.1.5. Intertek will compile the iron and engine life data from all five labs so that it can be given to the Statistics Group for review.

2.2. Lubrizol Update:

2.2.1. Procedure for Using Keyence to Screen Lifter Profiles:

- 2.2.1.1. Lubrizol is leading the Metrology sub-group.
- 2.2.1.2. Lubrizol has drafted a proposed procedure for using the Keyence to quickly screen lifters for profile acceptance.
 - 2.2.1.2.1. This draft procedure will be distributed to the Metrology Sub-Group within the next 1-2 days.
- 2.2.1.3. This proposed procedure does not require any changes to the Keyence template.
- 2.2.1.4. Areas of blue shading in the height map indicate areas of concavity in the profile.
- 2.2.1.5. *Toyota's Comments:*
 - 2.2.1.5.1. They are in favor of Lubrizol's suggestion to use color mapping to screen lifter profiles.
 - 2.2.1.5.2. Their original goal for the Keyence was to use it to quickly screen hardware.

3. REVIEW OF ACTION ITEM LIST:

3.1. OHT Timing Chain Wedge:

- 3.1.1. This action item has been placed on hold.
- 3.1.2. OHT is no longer being asked to offer a timing chain wedge for the IVB test.
- 3.1.3. Instead, a drawing will be added to the IVB procedure for a "generic" timing chain wedge.

3.2. Sequence IVB Test Report Format:

- 3.2.1. Intertek will follow-up with the TMC on this action item.
- 3.2.2. The TMC would like the Surveillance Panel to approve the final IVB test report format before it is implemented.
- 3.2.3. Several members of the Surveillance Panel have asked for a field in the report that indicates whether the current test follows a test that experienced a lobe failure.

3.3. TMC Proposal to Apply a Calcium (or Other Detergent) Adjustment to Iron:

- 3.3.1. Intertek has made some minor mark-ups to the TMC proposal.

3.4. Decide Whether to Include Tech Demo Tests in Iron Analysis:

- 3.4.1. This was an older action item.
- 3.4.2. Lubrizol noted that the Surveillance Panel is already doing this.
 - 3.4.2.1. The Tech Demo period started in July 2018.
 - 3.4.2.2. The five laboratories have supplied engine life data for all the tests that they have run since the 2nd Precision Matrix (including tests from July).
- 3.4.3. This will be removed from the action item list.

3.5. Define an “Engine”:

- 3.5.1. The statisticians requested a formal definition of an “engine”.
- 3.5.2. This definition will guide their analysis of the iron and engine life data.
- 3.5.3. The sub-group decided during the last conference call that an “engine” means the short block.
 - 3.5.3.1. Toyota is comfortable with this definition.

3.6. All Five Labs to Supply Iron and Engine Life Data:

- 3.6.1. All five labs are to compile iron and engine life data for all the tests that they have run since the 2nd Precision Matrix.
- 3.6.2. Exxon will have their data to Intertek this week.
- 3.6.3. Afton will have their data to Intertek within the next day.

3.7. Determine If REO1011 Can Be Blended Again:

- 3.7.1. TMC confirmed that REO1011 can be blended again if needed.
- 3.7.2. The TMC currently has a 2-year supply of REO1011 (~200-gallons).
 - 3.7.2.1. They will not pursue another blend until their inventory drops to a 1-year supply.

3.8. Introduce the REO300-1 Batch of Reference Oil:

- 3.8.1. The TMC is out of REO300.
- 3.8.2. All available inventory of REO300 is being held at the laboratories.
- 3.8.3. The Surveillance Panel needs to implement a plan for introducing REO300-1 sooner rather than later.

4. PROCEDURE REVIEW:

4.1. Section 4 – Procedure to Rebuild Engines After Lobe Failures (Intertek):

- 4.1.1. Intertek and Southwest are rebuilding engines after lobe failures.
- 4.1.2. Lubrizol is currently decommissioning lobe failure engines instead of rebuilding them.
- 4.1.3. Intertek recently made some enhancements to the cleaning procedure for lobe failure engines.
- 4.1.4. **Bearings:**
 - 4.1.4.1. Page 9 contains example photographs of distressed bearings.
 - 4.1.4.2. Intertek has a supply of bearings that they can make available to the other laboratories as needed.
 - 4.1.4.3. OHT will eventually take over the role of supplying bearings to the labs.
- 4.1.5. Intertek recently had to decommission a 7th run engine that experienced a camshaft lobe failure.
 - 4.1.5.1. The crankshaft showed signs of distress.
- 4.1.6. **Reusing Cylinder Heads:**
 - 4.1.6.1. In certain situations, a lab may decide to reuse a cylinder head on another engine block.
 - 4.1.6.2. Intertek recommends cleaning the fully assembled cylinder head in an ultrasonic cleaner.
 - 4.1.6.3. In fact, fully assembled pistons can be cleaned in the ultrasonic cleaner as well.
- 4.1.7. **Rebuild Kit:**
 - 4.1.7.1. *Should a rebuild kit be offered for the Sequence IVB test?*
 - 4.1.7.2. It may be difficult to offer a standard rebuild kit because different engines require different bearing grades.

- 4.1.7.3. Section 4 instructs the lab to inspect all bearings and replace them as needed.
 - 4.1.7.3.1. *Should Section 4 be updated to require that all bearings be replaced no matter how they look?*
- 4.1.8. The bolt specifications in Section 4 are based on data recently provided by Toyota.
- 4.1.9. **Comments from Afton:**
 - 4.1.9.1. Some camshaft lobe failures are more severe than others (i.e. wear of 20µm versus wear down to the base circle).
 - 4.1.9.2. *Will the Section 4 rebuild be sufficient in both instances?*
 - 4.1.9.3. Reply from Intertek:
 - 4.1.9.3.1. The severity of the lobe failure does influence bearing distress and the amount of debris on the valve deck and in the oil pan.
 - 4.1.9.3.2. The engine will need to be disassembled and cleaned even if the lobe is merely scuffed.
- 4.1.10. **Follow-Up Comments from Afton:**
 - 4.1.10.1. *What if the engine was used during a test that generated abnormally high iron?*
 - 4.1.10.2. Exxon agreed that this is an issue that should be discussed.
 - 4.1.10.2.1. It is their experience that high iron levels occur in conjunction with "out-of-control" oil consumption.
 - 4.1.10.3. Lubrizol, Exxon and Afton all agree that they would not want their oils to be used in an engine that just completed a high iron test.
- 4.1.11. The Surveillance Panel will also need to establish criteria regarding whether the lab or the test sponsor is financially responsible for a test that experienced a lobe failure.

Action Items	Person responsible	Completion Date

Follow-up Notes/Updates	Initials	Date Added

Attendees	Organization	Contact Information