Sequence IVB Sub-Groups | MINUTES

REVISION DATE: 5/25/2018 12:44:00 PM

Relevant Test:	Sequence IVB
Note Taker:	Chris Mileti
Meeting Date:	05-22-2018
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. IVB PRECISION/OPERATIONS SUB-GROUP:

1.1. Opening Comments from Chairman:

1.1.1. *ACEA:*

1.1.1.1. The Sequence IVB test will be adopted into the next ACEA specification.
1.1.1.2. It is not clear whether ACEA will follow the GF-6 specifications.
1.1.1.3. Toyota's intention is to only sell Golden Stands in the United States.
1.1.1.3.1. As a result, European testing will need to be done in U.S. labs.

1.2. Laboratory Update from Intertek:

1.2.1. *NO_X Measurements:*

1.2.1.1. Intertek has completed two tests on IAR165 since NO_X sensors were installed on this stand.
1.2.1.2. *The first test used a reference oil.*
1.2.1.2.1. NO_X Peak = around 4000ppm
1.2.1.2.2. NO_X Average in Stage 1 = 783ppm
1.2.1.2.3. NO_X Average in Stage 2 = 1930ppm
1.2.1.2.4. NO_X Average in Stage 1-2 Transition = 2368ppm
1.2.1.3. *The second test had to be aborted due to a lobe failure.*
1.2.1.3.1. NO_X Peak = around 4000ppm
1.2.1.3.2. NO_X Average in Stage 1 = 705ppm
1.2.1.3.3. NO_X Average in Stage 2 = 1954ppm
1.2.1.3.4. In general, the 2nd test had average NO_X values that were like the 1st test.
1.2.1.4. Intertek will create cycle plots (with ±1 standard deviation limits) once all their data is available.
1.2.1.5. It is too early to tell if anything of consequence can be learned from this data.

1.2.2. *Blowby Sample:*

1.2.2.1. Intertek is still waiting for their Analytical Lab to recommend a procedure for sampling blowby gas and/or liquid.

1.2.3. *Magnetism:*

1.2.3.1. Intertek's Metrology Lab has compiled a large set of data regarding the magnetism of test hardware.
1.2.3.2. Their engineering staff has not yet had time to review this data.

1.2.4. *Silicon:*

1.2.4.1. In the past, Intertek has utilized new OEM rocker arm covers for their engine break-in and aging cycles.

1.2.4.2. They have recently switched to a "used" OEM rocker arm cover for engine break-in and aging.

1.2.4.2.1. This "used" rocker arm cover dropped the silicon level about 25ppm below typical levels.

1.2.5. *Engine History:*

1.2.5.1. Intertek is attempting to understand how engine performance changes over time.

1.2.5.2. They are looking at parameters such as oil consumption, end-of-test iron and cumulative iron.

1.2.5.3. They encourage the other four labs to review their engine history data as well.

1.2.5.4. The Surveillance Panel will eventually have to set an oil consumption validity limit.

1.2.5.4.1. This level will probably be around 1050-1100g per test.

1.2.6. *Procedure:*

1.2.6.1. Intertek is making progress on its procedural action items.

1.2.6.2. Intertek is compiling a list of information that it would like Toyota to provide regarding the 2NR-FE short block.

1.2.6.2.1. This information includes journal clearances, out of round tolerances for journals, bend and twist tolerances for connecting rods, piston diameter limits, etc.

1.3. Laboratory Update from Southwest:

1.3.1. They are working on referencing their other two test stands.

1.4. Laboratory Update from Exxon:

1.4.1. They only have one stand, so it has been difficult for them to run investigative trials while they are trying to complete candidate testing.

1.4.2. They disassembled the engine that was used for the two tests with their high wear oil.

1.4.2.1. They photographed all the critical areas of the engine (i.e. bearings, underside of pistons, cylinder bores, etc.).

1.4.2.2. They will share these photographs with the two sub-groups.

1.4.2.3. This information will help determine which components are contributing to iron generation.

1.4.3. Exxon has decided not to rebuild this 6th run engine with a new cylinder head.

1.4.3.1. It will be decommissioned.

1.5. Sub-Group Meeting Schedule for June:

1.5.1. Buscher has recommended changing the meeting frequency from once a week to once every other week.

1.5.1.1. It is too difficult for the labs to complete their action items within a week.

1.5.2. Buscher will be unavailable for these sub-group meetings during ASTM week in June.

1.5.2.1. Chris Mileti will run the meeting in his absence.

1.6. Precision Matrix Engines on Consignment from OHT:

1.6.1. OHT asked the sub-groups if there is any need to continue to store the Precision Matrix engines.

1.6.1.1. OHT is willing to store these engines for the labs if they are still needed.

1.6.2. OHT originally requested that the labs store these engines in case additional Precision Matrix data was needed.

1.6.2.1. There is no longer any need for additional Precision Matrix data.

1.6.3. Intertek believes that these engines can be released to the labs.

1.6.3.1. OHT confirmed that (if the engines are released to the labs) they will be considered donated material.

1.6.4. *Comments from Lubrizol:*

1.6.4.1. There is still the open issue of how engine hours effects iron severity.

1.6.4.2. *Will there be a need to use these high run engines to generate data on reference oils?*

1.6.4.3. *Could the BOI/VGRA matrix be used to generate data on high run engines?*

1.6.5. *Upcoming Reference Tests:*

1.6.5.1. The BOI/VGRA matrix will be run during the middle to end of the summer.

1.6.5.2. Intertek plans to reference one of their stands using a 7th run engine.

1.6.5.3. Lubrizol plans to reference its stand using a 4th run engine.

1.6.5.4. The Intertek and Lubrizol reference tests can be used to generate data that the statisticians can use for their engine hour effect analysis.

1.6.5.4.1. Unfortunately, a lot more than two additional data points will be needed.

1.6.5.5. Southwest plans to reference its stands using new engines.

1.6.6. *High Run Engines:*

1.6.6.1. Intertek agrees that the labs need to start generating reference oil data on high run engines.

1.6.6.2. *Update on Intertek's (4) Precision Matrix Engines:*

1.6.6.2.1. 1st Engine: This engine was disassembled after running (4) tests and (1) test with a high wear oil.

1.6.6.2.2. 2nd Engine: This engine ran (3) Precision Matrix tests, but experienced a lobe failure on the 3rd test.

1.6.6.2.3. 3rd Engine: This engine ran (2) Precision Matrix tests.

1.6.6.2.4. 4th Engine: This engine ran (4) tests and (1) test with the Lubrizol high wear oil (which yielded a mild result).

1.6.7. *Final Decision:*

1.6.7.1. The sub-group decided that OHT could release the Precision Matrix engines to the labs.

1.6.7.2. OHT will follow-up with a formal email authorizing the release of these engines.

1.7. Clutch Alignment Tool:

1.7.1. The new OHT clutch alignment tool is available for sale as of today.

1.7.2. ***Part Number:*** OHTIVB-008-1

1.7.3. Laboratories can request a quote for this part via email.

1.8. Air Filter Box:

1.8.1. The original air filter boxes provided by TEI for the Golden Stand had a fitting on the lid for the pressure transducer.

1.8.2. The new air filter boxes provided by OHT do not have these fittings.

1.8.3. OHT will follow-up on this issue.

1.8.3.1. They may need dimensions from Intertek that specify where the fitting should be located.

1.8.4. Intertek noted that the air pressure fitting is on the filtered-side of the air box.

1.8.4.1. The fitting needs to be secure so that it does not get ingested into the engine.

2. TEST PROCEDURE SUB-GROUP:

2.1. Oxidation and Nitration Measurements:

2.1.1. Afton is concerned that not all the Sequence IVB laboratories are performing these measurements in the same way.
  2.1.1.1. Even though these are not critical parameters, this data may be used to make decisions in the future.
  2.1.1.2. They would like the sub-group to decide on a method and then update the procedure accordingly.
2.1.2. Afton realized that there was an issue with the IVB measurements after a similar problem was identified with the Sequence IIIH test.
  2.1.2.1. Some procedures specify the oxidation and nitration areas, while other procedures specify the peak oxidation and nitration.
2.1.3. Intertek noted that the Sequence IIIG FTIR technique was incorporated into the IVB procedure early in the development of this test.
  2.1.3.1. Changes that were made during the upgrade to the Sequence IIIH may not have been captured in the IVB procedure.

2.2. Selecting Lifter Grades at Start-of-Test:

2.2.1. This action item was assigned to Lubrizol last week.
2.2.2. Lubrizol and Intertek reviewed their respective lifter selection techniques and reached a consensus.

2.2.3. *Procedure for Selecting Intake Lifter Grades:*

2.2.3.1. *Acceptable Clearance Range:* 0.006-0.009 inches
2.2.3.2. *Target Clearance:* 0.007-0.008 inches
2.2.3.3. *Clearances on Low End of Specification:*
  2.2.3.3.1. If the clearance is 0.006-inches, accept the lifter but reduce the lifter grade by one increment for the next test kit.
  2.2.3.3.2. If the clearance is less than or equal to 0.005-inches, remove the lifter and replace it with a lifter grade that is two increments lower.
2.2.3.4. *Clearances on the Top End of the Specification:*
  2.2.3.4.1. Any time the clearance is near the top end of the specification, tap the valve with a rubber mallet to remove any deposits and then remeasure.
  2.2.3.4.2. If the clearance is 0.009-inches, accept the lifter but increase the lifter grade by one increment for the next test kit.
  2.2.3.4.3. If the clearance is greater than or equal to 0.010-inches, remove the lifter and replace it with a lifter grade that is two increments higher.

2.2.4. *Procedure for Selecting Exhaust Lifter Grades:*

2.2.4.1. *Acceptable Clearance Range:* 0.011-0.014 inches
2.2.4.2. *Target Clearance:* 0.012-0.013 inches
2.2.4.3. *Clearances on Low End of Specification:*
  2.2.4.3.1. If the clearance is 0.011-inches, accept the lifter but reduce the lifter grade by one increment for the next test kit.
  2.2.4.3.2. If the clearance is less than or equal to 0.010-inches, remove the lifter and replace it with a lifter grade that is two increments lower.
2.2.4.4. *Clearances on the Top End of the Specification:*
  2.2.4.4.1. Any time the clearance is near the top end of the specification, tap the valve with a rubber mallet to remove any deposits and then remeasure.
  2.2.4.4.2. If the clearance is as 0.014-inches, accept the lifter but increase the lifter grade by one increment for the next test kit.
  2.2.4.4.3. If the clearance is greater than or equal to 0.015-inches, remove the lifter and replace it with a lifter grade that is two increments higher.

2.2.5. *Comments from Exxon:*

2.2.5.1. They do not let their valve clearances get close to the edges of the specification.

2.2.5.2. They select their lifter grades to achieve the target clearances.

2.2.6. *Comments from Intertek:*

2.2.6.1. They have found no correlation between lifter clearances and lifter wear.

2.3. Fuel Batch Approval:

2.3.1. Southwest is working on a proposal for approving new fuel batches.

2.3.1.1. They are referencing the Sequence VH procedure for this approval process.

2.3.2. Labs are required to analyze their VH fuel monthly.

2.3.2.1. This sub-group agreed that a quarterly analysis is more appropriate for the Sequence IVB test.

2.3.3. Southwest will remove any reference to a fuel release matrix before the VH wording is incorporated into the IVB procedure.

2.4. Develop Cumulative Iron Curves for Engines:

2.4.1. Lubrizol stressed that the two sub-groups need to first focus on the action items that relate to iron.

2.4.1.1. A lot of work needs to be done on this parameter if it is going to be successfully reintroduced after the Tech Demo period.

2.4.2. *Comments from TMC:*

2.4.2.1. One of their action items from the last week's meeting was to develop a procedure for applying a calcium retention adjustment to iron.

2.4.2.2. They are working on a draft for this procedure now.

2.4.2.3. They foresee the biggest hurdle being the fact that some oils do not use calcium.

2.4.3. The sub-group agreed that the next action item to pursue should be the one regarding cumulative iron curves for engines.

2.4.3.1. This data should be collected for all engines that have been run since the procedure stabilized.

2.4.3.2. Intertek will provide a template that can be used to collect this data.

2.4.4. *Authorization:*

2.4.4.1. Obviously, some of this data will come from candidate tests.

2.4.4.2. Each lab will need to get approval from their test sponsors to share this data with the Surveillance Panel.

2.4.4.3. Hopefully, each lab can gain this approval by the beginning of next week.

2.4.4.4. Exxon noted that some parameters, like viscosity grade, may be more sensitive than others.

2.4.5. *Data to be Collected:*

2.4.5.1. Engine hours

2.4.5.2. Number of runs on engine

2.4.5.3. Cumulative iron

2.4.5.4. Oil consumption

2.4.5.5. Viscosity grade

2.4.5.6. Identify when a cylinder head swap occurred

2.4.5.7. Identify when a camshaft lobe failure occurred

2.4.6. Intertek noted that break-in data can be collected from engines before the Precision Matrix because the break-in/aging procedure has not changed in some time.

2.5. Camshaft Lobe Failures:

2.5.1. Exxon recently experienced a lobe failure with an oil that was not their high wear oil.

2.5.2. They flushed the engine after the lobe failure and repeated the test.

2.5.2.1. Their flush procedure was successful because there were no issues during the repeat test.

2.5.3. Lubrizol is not confident that lobe failures are the result of chemistry.

2.5.4. Intertek countered by saying that it had two consecutive lobe failures with the same candidate oil.

2.5.5. *"Crop Circles":*

2.5.5.1. Southwest previously did work to analyze the small, circular wear patterns (i.e. "crop circles") sometimes seen around the nose of camshaft lobes.

2.5.5.2. It is not unusual to see more than one "crop circle" on a lobe.

2.5.5.3. Southwest eventually determined that these "crop circles" are micro-cracks.

2.5.5.4. Intertek has seen 4-micron deep chips (a.k.a. "chads") in the surface of the lobe that occur near "crop circles".

2.6. Compression and Leak-Down Checks:

2.6.1. Afton asked why the procedure calls for compression and leak-down checks at the start and end of each test.

2.6.1.1. *What is being done with this data?*

2.6.2. Intertek noted that there are no specific condemnation limits for each measurement.

2.6.2.1. Instead, these measurements are a good indicator of excessive deposits on the valves.

2.6.2.2. Tapping on the valve stem will usually dislodge these deposits.

2.6.2.3. Valve deposits were a bigger problem early in test development.

2.6.3. Afton would like this group to eliminate either the S.O.T. or E.O.T. measurements.

2.6.3.1. Doing both measurements is redundant.

Action Items	Person responsible	Completion Date

Follow-up Notes/Updates	Initials	Date Added

Attendees	Organization	Contact Information