Sequence X Alternate Fuel Supplier Requirements Task Force

Teleconference Minutes

02/28/2022 – 9:00-10:30 CST

1) Attendance
   - Prasad Tumati
   - Charlie Leverett
   - Rich Grundza
   - Izabela Gabrel
   - Travis Kostan
   - Patrick Lang
   - Christine Eickstead
   - Todd Dvorak
   - Christian Mueller
   - Timothy Hadaway
   - Michael Deegan
   - Al Lopez
   - Jason Soto

2) Agenda:
   - Scope:

     Form a task force to develop a procedure that will provide protocols a new fuel supplier must follow to be considered a supplier for the Sequence X test.

   - Objective:
     (1) Determine testing requirements for potential alternate fuel supplier. How many tests, stands, labs…
     (2) Input from statistics group.
     (3) Develop a procedure containing requirements.
     (4) Submit task force recommendations to Sequence X surveillance panel.

3) Minutes:

Patt Lang: The first step is to decide if the technical group wants the introduction of a new fuel. The panel does not have to form a task force if they don't want a new fuel supplier. The group agreed to proceed with the meeting.

Charlie Leverett: The Sequence X chair to send out an E-ballot for the fuel supplier vote. Are we allowing multiple fuel suppliers?

Jason Soto: Brought up that the Sequence X is in the middle of a mild severity shift. How will this affect the introduction of a new fuel?

Patt Lang: The severity issue must be resolved first but we can set a procedure in place to assume the test is in control.

Al Lopez: The Sequence X should have a resolution for severity in April.

Travis Kostan: Presented the Sequence IX Alternate Fuel Supplier Requirements Initial Discussion to use as a guideline.

Al Lopez: Will the fuel suppliers be required to run scoping tests to prove the performance of their fuel before starting the matrix? Will there be quantity requirements for the pilot batch? What is the new batch approval process? Will there be a fuel correction?

Travis Kostan: The scoping responsibility falls on the supplier, the task force only sets guidelines. The pilot batch needs to be enough to complete the matrix. Requirements can be set once approved. Do all labs need to be on the same fuel? Stats group to meet after questions are met.

- How many engines?
- How many stands?
- How many labs?
- How many reference oils?
- Engine age requirements?
- All alternate fuels tests or should both fuels be run in an alternating fashion like Sequence VI?

Need to pick stands that are on target. The Sequence IIIH procedure (D8111-21a Annex 13) can be referenced for stand selection criteria.

4) Next Meeting: TBD

5) Appendix:

Sequence IX Alternate Fuel Supplier Requirements Initial Discussion

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Agenda

- Discuss willingness to develop alternate fuel procedures
- Discuss procedure development objective
- Review other procedures with completed or near completed procedures
- Starter questions for discussion
- Next steps

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Determine willingness to develop alternate fuel procedures

It is TGC guidelines that if a Surveillance Panel is approached by an alternate fuel supplier, that each Surveillance Panel consider the appropriateness of having another test fuel for the specific test type. This can be multiple fuels approved for use simultaneously, this can be multiple approved suppliers but only one supplier provides fuel to the industry at a time, or something in between. However, the Surveillance Panel can also say that having another fuel is not appropriate under any circumstances and stop there.

Before we invest many hours of industry time to develop alternate fuel procedures for this test, does the Sequence IX Surveillance Panel wish to go down this path?

Objective

The objective is to establish an alternate fuel procedure which is black and white in terms of pass/fail requirements for a new fuel.

- Has been termed "free pass requirements" in other test types, since meeting the requirements will automatically make the fuel an "eligible" fuel for use in the particular test type without any additional requirements from the Surveillance Panel.
- On the other hand, failing to meet the requirements does not automatically mean the fuel can not be used, but that the fuel will require additional Surveillance Panel scrutiny and perhaps additional testing before approval is given.
- The distinction between the two points above is important to keep in mind when developing these procedures.

Previous Alternate Fuel Supplier Requirements - Finished or In-progress

- PCMO
  - Sequence VI
  - Sequence IIIH
  - Sequence VH
- HD
  - T8, T11, T12, and T13
  - ISB
  - COAT
  - DD13

Sequence VI Alternate Fuel Requirement Highlights

- Must meet fuel C of A requirements
- Minimum of 8 tests, with 4 tests per engine and a minimum of 2 engines
  - All tests conducted on a single test stand using only reference oil 1010-1.
  - Engine 1 – Break-in with current fuel, then "Current, Alternate, Current, Alternate."
  - Engine 2 – Break-in with alternate fuel, then "Alternate, Current, Alternate, Current."
  - Check pass/fail criteria. May continue to engine 3 if not a pass or petition surveillance panel for further review.
- Passing criteria (Applies to both FEI1 and FEI2)
  - Average standardized results between current and alternate fuel to be within 0.75 sigma.
  - Variability check – No part of a 95% confidence interval on the mean difference between fuels shall exceed +/- 2.5 sigma.
- Each lab may individually choose which of the approved fuels they wish to use. All candidate testing must be conducted on the same fuel used to calibrate the engine.

Sequence IIIH Alternate Fuel Requirement Highlights

- Must meet fuel C of A requirements
- 9 total tests
  - All tests on alternative fuel only
  - 3 tests stands coming from a minimum of 2 labs. Chosen test stands must have 3 successful calibrations in the past 18 months.
  - Each stand runs all 3 reference oils
  - Check pass/fail criteria.
- Passing Criteria (Applies to PVIS, WPD, and PHOS)
  - Acceptance based on Ei values, which is Yi – Zi , where Zi is the stand Zi and represents where the stand was performing with the current fuel.
    - Average of the 9 Ei values for each parameter must be less than 0.62 in absolute value.
  - Variability check – No part of a 95% confidence interval on the mean difference between fuels shall exceed +/- 1.5 sigma.
  - At most one outlier test, defined as abs(Ei) > 2.066, is allowed to be removed and rerun.
- Each lab may individually choose which of the approved fuels they wish to use. All candidate testing must be conducted on the same fuel used to calibrate the stand.
- When a lab switches fuel, a C of A is required for the blended sample with no more than 10% of the volume being from the current fuel batch.

HD Alt. Fuel Procedures Highlights

- Less tests because diesel fuel is felt to be a lower risk change.
  - Current procedures all require one calibration test w/ current fuel + two tests w/ alternate fuel
- Most test types judging pass/fail based on Ei values like the IIIH.
- Added operational parameter criteria for alternate fuel tests
  - Example from T-11
    - Average front and rear exhaust temperature shall be within +/- 5 deg. C of the calibration test
    - Average power shall be within +/- 10 kW of the calibration test
    - Average injection timing shall be within +/- 1.5 degrees of the calibration test

Initial Questions for Sequence IX Alt. Fuel Procedure

1. How many engines?
2. How many stands?
3. How many labs?
4. How many reference oils?
5. Engineage requirements?
6. All alternate fuel tests or should both fuels be run in an alternating fashion like the Sequence VI?

For each of these questions above, consider that each additional variable will make it harder to see differences in the fuel for the same fixed number of tests. Balance this risk with the potential risk that fuel differences may only appear in a certain lab, with a particular reference oil, etc.

Next Steps

1. Determine if the Sequence IX SP wishes to adopt an alternate fuel procedure at all.
2. Answer initial questions on slide 9.
3. Based on answers to initial questions, statisticians work to produce power calculations based on number of tests and present this to fuel task force.
   - Power calculations will inform the task force of the minimum fuel differences we expect to be able to detect, if differences exist. This will be done for multiple test matrix designs.
4. Task force votes on test matrix.
5. Add any addition testing requirements if desired.
6. Develop implementation guidelines for a new fuel.
7. Present final document to Surveillance Panel for vote.