MACK-Volvo Surveillance Panel Meeting Notes
05/23/2023 2:00 P.M. EST

Attendees

SwRI: Robert Warden, Isaac Leer
Oronite: Josephine Martinez
Afton: Joseph Hoehn, Amanda Stone, Bob Campbell, Cory Koglin
Infineum: David Brass (Chairman), Elisa Santos, Jacob Goodale, Todd Dvorak
Intertek: Garrett White (Secretary), Khaled Elnagi, Martin Chadwick
Lubrizol: Austin Brininger
CP Chem:
Haltermann:
Exxon Mobil: Steve Jetter
TMC: Sean Moyer
TEI: Derek Grosch
Ford:
Volvo:

Agenda

- Operational Review of Volvo T-13 TMC 823-1 Runs
- Statistical Review of TMC 823-1 Runs
- Mack T-12 Parts
    - Coordinated Referencing of YYYFZQWB
    - Oil Consumption Measurement of Batch F Piston Crowns
- Mack T-8/T-11 Parts
- Volvo T-13 Severity Adjustments
- AOB

Action Items and Key Points

- Motion carried to adopt reference oil 823 targets for reference oil 823-1 and set calibration dates for stands used in the coordinated reference to today if they meet the calibration requirements.
- Motion carried that future references in the T-13 will be run on reference oil 823-1 until n = 10. Once 10 reference tests on 823-1 are completed 823 can be used.
- Motion carried that the next references for T-12 will be done on the new batch of parts at all active labs. Coordinated reference tests should start by July 5, 2023. The batch of parts to be used for these tests will include top ring Y, 2nd ring Y, oil ring Y, piston crown F (randomized

subgroups but will exclude subgroup A), connecting rod bearing Z, main bearing Q, liner W, and piston skirt B.

- Motion carried that until Mack T-12 coordinated references have been completed and parts have been accepted, new batch YYYFZQWB where batch F piston crowns (randomized subgroup excluding subgroup A) are to be used in T-11 kits. This new batch of parts should be referenced by each lab introducing it, followed by a meeting of the SP to confirm performance of the parts. TMC shall adjust the reference periods to have no net gain or loss of reference period time.
- Next surveillance panel meeting (approximately 2 weeks from the date of this meeting) will include further discussion of adopting an ICF or target change for the T-13. Also included in the next meeting will be a discussion of the severity adjustment calculations for the T-13.

Summary of Discussion

Operational Review of Volvo T-13 TMC 823-1 Runs

- All 4 participating labs provided operational data for the test report parameters
- Blowby differences noted amongst labs ranging from 150-250 LPM
- Lab B showed higher compressor discharge pressure compared to other 3 labs
- VGT and EGR position not provided by lab D
    - For 3 other labs EGR positions ranged from 60 to 95%
- Fuel gallery temperatures in all 4 labs ranged from upper 50 °C to 90 °C
- Robert - Lab B's compressor discharge pressure is lower than the intake manifold pressure. Intercooler out pressure makes sense though. Could just be a transducer issue or switched line.
- Lab B oil jet pressure lower than other 3 labs
- Lab B data showed a rise in oil jet temperature in the last 40 hours of the test rising from 129 °C to 132 °C
- Garrett – The oil jet pressure trend for lab B is quite interesting. You can see where shutdowns occurred and have the shear down of the oil but there are instances where the pressure jumps up randomly.
- Bob Campbell – We have seen this happen before but for unknown reasons.
- Austin – We have conducted internal studies and have not seen a correlation between oil jet pressure and test severity.
- Jacob – Was there a loss in oil gallery temperature control near the end of the test? The rise in oil jet temperature is an oddity.
- No issues found in oil gallery temperature control for Lab B during the time frame in which oil jet temperature increased near the end.

Statistical Review of TMC 823-1 Runs

- Todd Dvorak and Elisa Santos put together an analysis of the 823-1 and 823 references
- KV40 and IRPH has been mild since 2015
    - IRPH industry chart shows severity has been mild since the beginning of the T-13 test
    - CUSUM also has been progressively going negative
    - Similarly, for KV40, industry chart shows test has been mild since beginning and currently has exceeded an action limit
- No significant factors found in the model for driving the test mild i.e. hardware batch changes, reference oil, etc.
- Based on the analysis it is recommended that the targets for both parameters are updated to the following:
    - 118.8 for IRPH and 7.447 for sqrt(kv40)
    - Also recommend a follow up analysis after 10 references are completed with the new targets

- 2017 is when fuel flow control, humidity control and coolant filter usage were introduced. The T-13 formerly controlled engine load rather than fuel rate.
- Chart showing results from matrix testing in 2017 of the new control parameters and forward shows a clear change in severity to the mild side after introduction.
- Asterisks denote the 823-1 data points. Results are within the historical range of the 823 runs after 2017.
- Bob C – IRPH seems to react differently to liner batch changes. KV40 does not seem to behave the same with the liner changes.
- High proportion of data is mild/below the target value.
- Should a CF be applied? No, rational is the results have been mild since the beginning.
- Recommend use of model 6 to establish ref oil target (refer to presentation slides for details of model 6)
- Bob C – Which liner batch was used in the initial matrix testing?
- Unknown - Liner batch A was used for setting the targets.
- Bob C – Suggesting that liner A produced on target results but liner B, C and D could have caused the shift in the mild direction.
- Todd – The means for each liner/bearing combo show that liner A/B had a lower mean than A/PNB3. Subsequent liner batches B,C,D / PNB3 bearing data sets have averages closer to the proposed target.
- Final Summary: Recommendation is to update targets from 127.4 to 118.8 for IRPH and 8.610 to 7.447 for sqrt(KV40 %) increase. Also recommend performing a follow up review after 10 tests to see if there are any other factors.
- Bob W – Concerned with updating targets for an oil we don't have any more.
- TMC – There are currently 2 drums of 823. TMC has one and a lab has the other drum.
- Josephine – Cautious about changing the target. Rather than changing targets how about an ICF?
- Todd – In most cases you would consider a CF, but if you look at the charts since the beginning of the test it has been mild so a target change is more appropriate.
- Martin – 15 years ago it was determined to avoid changing targets only when a new reference oil shows a shift. The effective pass limit on candidates is impacted by the shift in the SA's from a target change.
- Bob C – Labs have stands held in limbo. Don't think we have enough information to adopt new targets or an ICF today.

Bob Campbell motions to adopt reference oil 823 targets for reference oil 823-1 and set calibration dates for stands used in the coordinated reference to today if they meet the calibration requirements.

Austin Brininger – Seconded motion

Afton - Yes

Lubrizol - Yes

Infineum - Yes

Oronite - Yes

TMC - Yes

TEI - Yes

Intertek - Yes

SwRI - Yes

Exxon Mobil – Yes

CP Chem – No answer

Haltermann – No answer

Ford – No answer

Volvo – No answer

Vote count: Yes (9), No (0), Waive (0), No Answer (4)

Motion carried

Volvo T-13 Reference Status

- David – Should we require labs to conduct upcoming reference runs on 823-1 going forward?
- Sean – 1 lab does have a barrel of 823.

David Brass motions that future references in the T-13 will be run on reference oil 823-1 until n = 10. Once 10 reference tests on 823-1 are completed 823 can be used.

Bob Campbell – Seconded motion

Afton - Yes

Lubrizol - Yes

Infineum - Yes

Oronite - Yes

TMC - Yes

TEI - Yes

Intertek - Yes

SwRI - Yes

Exxon Mobil - Yes

CP Chem – No answer

Haltermann – No answer

Ford – No answer

Volvo – No answer

Vote count: Yes (9), No (0), Waive (0), No answer (4)

Motion carried

MACK T-12

- Limiting part for T-12 kits is batch X 2nd ring
- Piston crown will be the next limiting part in the new kits
- 2 of 3 labs are coming off reference towards end of June 2023
- July timeframe will be when references start
- Subgroup of crown has not been determined but will exclude subgroup A
- Experiment carried out on batch F subgroup A crowns with YYY ring set resulted in a phase 1 average oil consumption of 45.9 g/hr
- An experiment combining subgroup A and other subgroup crowns in a single engine build showed that if 3 or more subgroup A crowns are used in an engine build the oil consumption exceeds 25.0 g/hr.
- Bob C – My concern is this is a ring and liner wear test. What impact do subgroup A piston crowns have on the liner and ring wear? Do we have any wear data from a full length run on subgroup A crowns?
- David – Yes, there were a few full length runs completed on the subgroup A crowns.

David Brass motions that the next references for T-12 will be done on the new batch of parts at all active labs. Coordinated Reference Tests should start by July 5, 2023. The batch of parts to be used for these tests will include top ring Y, 2nd ring Y, oil ring Y, piston crown F (randomized subgroups but will exclude subgroup A), connecting rod bearing Z, main bearing Q, liner W, and piston skirt B.

Robert Warden – Seconded motion

Afton: Yes

Lubrizol: Yes

Infineum: Yes

Oronite: Yes

TMC: Waive

TEI: Yes

Intertek: Yes

SwRI: Yes

Exxon: Yes

CP Chem – No answer

Haltermann – No answer

Ford – No answer

Volvo – No answer

Vote count: Yes (8), No (0), Waive (1), No answer (4)

Motion carried

T-11 Hardware

- T-11 moved forward with Y ring set and Batch F subgroup E crowns.
- Lab G completed a T-11 reference test on YYYFZQWB (Batch F subgroup E piston crowns) which resulted in an average oil consumption of 26.0 g/hr. Parts were approved by email ballot.

David Brass motions that until Mack T-12 coordinated references have been completed and parts accepted, new batch YYYFZQWB where batch F piston crowns (randomized subgroup excluding subgroup A) are used in the T-11 kits. This new batch of parts should be referenced by each lab introducing it, followed by a meeting of the SP to confirm performance of the parts. TMC shall adjust the reference periods to have no net gain or loss of reference period time.

Joseph Hoehn - Seconded motion

Afton: Yes

Lubrizol: Yes

Infineum: Yes

Oronite: Yes

TMC: Yes

TEI: Yes

Intertek: Yes

SwRI: Yes

Exxon: Yes

CP Chem – No answer

Haltermann – No answer

Ford – No answer

Volvo – No answer

Vote count: Yes (9), No (0), Waive (0), No answer (4)

Motion carried

T-8 Hardware

- Batch W 2nd rings are no longer available.
- T-8 kits will now include YYY ring set going forward.

T-13 Severity Adjustments

- Discussion to take place in the next meeting along with discussion of target change and/or ICF.

Next Meeting Date/Time

Meeting poll to be sent out by David Brass

Meeting adjourned at 4:14 PM EST.