MACK-Volvo Surveillance Panel Meeting Notes 09/26/2024

Attendees

SwRI: Robert Warden, Isaac Leer, Jose Starling
Oronite: Josephine Martinez
Afton: Amanda Stone, Bob Campbell
Infineum: David Brass (Chairman), Todd Dvorak, Jacob Goodale, Andrew Smith
Intertek: Garrett White (Secretary), Khaled Elnagi
Lubrizol: Alex Ebner
CP Chem:
Haltermann:
Exxon Mobil: Mike Shea, Steve Jetter
TMC: Sean Moyer
TEI: Derek Grosch
Ford:
Volvo:
John Deere: Ashu Gupta

Agenda

1. Volvo T-13 Reference Oil 823-1 Target Values
2. Volvo T-13 Oil Consumption Testing and Parts Recommendations
3. Volvo T-13 Reference Oil Testing
4. Volvo T-13 Test Metrology Measurements
5. Volvo T-13 Bearings
6. Mack T-12 Reference Testing with Chevron Delo 50/50 Coolant
7. AOB

Action Items and Key Points

- The statisticians group recommended changes to the IRPH target, from 109.3 to 110.5 abs/cm and KV40 from 8.139 to 8.50 with a change in ICF from 0.857 to 1.07 for KV40 for the T-13 test. No changes were instituted and the conversation was tabled until the next meeting to allow for procurement of more data points.
- SwRI carried out 96-hour T-13 experiment tests with various groups of pistons and rings, including rings sourced directly from Mahle through an online retailer. Data from the experiment showed potential influence of the Mahle-direct rings on oil consumption. Labs will have 1 week from the date of the meeting to decide on whether to exchange the rings in their existing kits with these new Mahle-direct rings with TEI.

- **Motion carried** to make connecting rod bearing weight loss, main bearing weight loss, ring weight loss, ring gap increase and liner wear step non-mandatory in the T-13 candidate reports effective on the date of this meeting, however, these measurements are still mandatory for reference test reports.
- Labs A and G completed T-12 references using Chevron Delo 50/50 Pre-mix for the engine coolant. Lab A calibrated their stand, however, lab G's stand did not due to mild results on delta lead (Pb) from 0 to 300 hours and delta lead from 250 to 300 hours (Pb2). Lab G would begin a second reference test on the date of this meeting.

Summary of Discussion

Volvo T-13 Reference Oil 823-1 Target Values

- Stats group reviewed recent T-13 references on oil 823-1 for potential target and ICF changes after 12 tests have been completed on this oil.
- Josephine Martinez presented slides summarizing the statistician group's analysis.
- No significant linear correlation between average oil consumption from 48-192 hours (OC) and peak height oxidation at 360 hours (IRPH) and percent viscosity increase from 300 to 360 hours (KV40).
- The statisticians' analysis recommends changes to the IRPH target, from 109.3 to 110.5 abs/cm and KV40 from 8.139 to 8.50 with a change in ICF from 0.857 to 1.07 for KV40. Standard deviations would be unchanged at 11.1 and 0.929 for IRPH and KV40, respectively. Current 823-1 targets are based on 5 data points (completed reference tests in the industry).
- The same models used for this analysis were used for the initial target calculations for 823-1.
- One data point was removed from the analysis of the linear correlation between OC to IRPH and KV40. T
- he one test came from Lab D which had an average oil consumption rate of about 39 g/hr.
- No ICF recommended for IRPH.
- David B – What is the influence of the 1 data point that is significantly higher than the other data set in KV40?
- Robert W – Is there a way to evaluate stand excessive influence in the industry data?
- Todd D – We do not have an outlier screening system on this test, but we will take it as an action item to see if there is any significance to that data point.
- David B – Is there anyone who wishes to move forward with the changes?
- Garrett W – I say we maintain the current targets and reevaluate after more data points are gathered.
- Bob C – It would also be good to bring the changes, if any, for both IRPH and KV40 in at the same time.
- No changes made to IRPH or KV40 targets and ICFs.

Volvo T-13 Oil Consumption Testing and Parts Recommendations

- SwRI sourced T-13 piston ring sets directly from Mahle through an online distributor (jegs.com).
- Packaging indicated the rings were from the Brazil manufacturing plant with the same part number as those used currently in the test.
- Volvo has 2 manufacturing lines for the MP8/D13 rings, one in Portugal and another in Brazil.
- Rings directly from Mahle lack the Volvo QC process markings.
- ID numbering similar to what has been seen in recent ring sets.
- 96 hour runs on the same oil of viscosity grade 5W-30 were performed with the following hardware and resultant average oil consumption
    - Run 1: Liner batch A, Top rings Volvo/TEI (500k series), Pistons pre-0619. 24.5 g/hr.
    - Run 2: Liner batch D, Top rings Volvo/TEI (900/934k), Pistons 0522. 39.5 g/hr.
    - Run 3: Liner batch D, Top rings Volvo/TEI (939/959/967k), Pistons 0822/0922. 41.0 g/hr.
    - Run 4: Liner batch D, Top rings Mahle (1189k), Pistons 0423. 25.6 g/hr.

    - Run 5: Liner batch D, Top rings Mahle (1189k), Pistons 0423. 23.2 g/hr.
- Appears to be a separation of OC performance from around 40 g/hr. to the mid 20 g/hr. range due to the change to the Mahle-direct top rings along with changes in the pistons.
- David B – July 22 to May 23 date code pistons are the only ones currently available. Quickest change would be to replace the rings.
- The following measurements were taken of the top rings along with noticeable differences:
    - Ring tension: None
    - Ring gap: Slightly higher than previous ring groups
    - Face width, average of 3 locations: Slightly higher than previous ring groups
    - Peak height, average of 3 locations: Slightly lower than previous ring groups
    - Peak height location from top, average of 3 locations: None
- The following measurements were taken of the 2nd rings
    - Ring tension: None
    - Ring gap: Slightly higher than previous ring groups
    - Face width, average of 3 locations: None
    - Witness line width, average of 3 locations: None
    - Base slope angle, average of 3 locations: None
- The following measurements were taken of the oil rings
    - Ring tension: None
    - Ring gap: None
    - Gap between rails, average of 3 locations: None
    - Width, average of 3 locations: Slightly lower on average than previous ring groups
    - Top rail width, average of 3 locations: Slightly lower on average than previous ring groups
    - Bottom rail width, average of 3 locations Slightly lower on average than previous ring groups
    - Rail height differential, average of 3 locations: More variability compared to previous ring groups.
- Bob C – Do we know what the spec is from MACK?
  Isaac L – We do not know.
- David B – We did bring this up to Volvo and they did not believe the differences found in these parameters should have much of an effect on oil consumption.
- Material analysis showed similar metal composition between Mahle-direct and Volvo rings.
- TEI can now purchase parts directly from Mahle for the T13 kits.
- At this time most rings being placed into the T-13 kits are coming from Portugal.
    - Most of the US dealers are receiving rings from Portugal.
- It appears that both plants are making rings to the same engineering prints, but outcome is slightly different. However, these differences are still within Volvo's acceptance range.
- 88 sets of rings obtained from Mahle
    - These sets are similar to the rings ran in the testing that produced the data from SwRI's experiment.
- Liner batch E has been ordered by TEI.
- The Brazil rings are to be used in testing going forward as parts-not-batched (PNB) until a batch can be established.

- There are 88 ring sets from Brazil (14 kits) at TEI.
- 60 ring sets were ordered by SwRI 10 kits, 2 kits have been used
- Goal is to reference in batched parts (rings, pistons and liners) starting with batch E.
- Intertek does not plan to re-reference a stand until early 2025.
- SwRI has one stand currently running reference, there are no plans to begin a reference in the other non-calibrated stand.
- Recommendation would be that TEI purchases a batch of rings and pistons direct from Mahle for the T13.
- Garrett W – Are other labs still seeing elevated OC in the 35-40 g/hr range?
- Bob C – We are still seeing some tests with elevated oil consumption.
- Labs have the discretion to exchange the rings currently on hand to the Mahle rings.
- Labs to have 1 week to decide if they wish to exchange rings in existing kits for Mahle rings.

Volvo T-13 Reference Oil Matrix Testing

- David B – Does the panel think we are ready to begin the new reference oil matrix test? Initially there were concerns regarding average oil consumption which hindered the start.
- Garrett W – It would be good to see full length test data on the new rings before beginning the matrix.
- Afton voiced concerns regarding the new reference oil matrix running in a non-calibrated stand, claiming that this is not how things were conducted in the past. Concern was also raised about receiving calibration status after completing the matrix tests.
- Andrew S – The Cummins panel has done this before to bring in new hardware batches and new reference oils.
- Sean M – We shouldn't determine how to proceed with this based on how other panels have handled similar situations.
- No agreement was reached on how to handle calibration status of the stands upon completion of the matrix nor was an agreement reached on whether a calibrated or non-calibrated stand could run the matrix tests.
- David B – We need to make sure the new rings oil consumption performance is confirmed before we run the matrix based on candidate data.
- The discussion was tabled and will be revisited once oil consumption is confirmed with the new piston rings.

Volvo T-13 Test Measurements

- A request was made by a panel member to allow for the following parts measurements to be non-mandatory in the T-13 test:
    - Connecting rod bearing weight loss, main bearing weight loss, ring weight losses (top, 2nd and oil), ring gap increases (top, 2nd and oil) and liner wear step.
- Currently, only liner surface roughness and piston ratings are non-mandatory.
- Garrett W – It would be good to maintain these measurements for the references; candidates can be non-mandatory.

Isaac Leer motions to make connecting rod bearing weight loss, main bearing weight loss, ring weight loss, ring gap increase and liner wear step non-mandatory in the T-13 candidate reports effective today, however, these measurements are still mandatory for reference test reports.

Bob Campbell – Seconded motion

SwRI - Yes

Oronite - Yes

Afton - Yes

Infineum - Yes

Intertek - Yes

Lubrizol - Yes

CP Chem - No vote

Haltermann - No vote

Exxon Mobil - Yes

TMC - Yes

TEI - Waive

Ford - No vote

Volvo - No vote

John Deere – Yes

Vote count: Yes (9), Waive (1), No Vote (4)

Motion carried

<u>Volvo T-13 Rod Bearings</u>

- Red coated upper connecting rod bearings are the latest ones being used in T-13 testing.
- A new upper rod bearing has been introduced with a dark colored coating
- Labs were made aware in case there are any concerns related to bearings or influence of test results from these new parts.

Mack T-12 Reference Testing with Chevron Delo 50/50 Coolant (T-13 test coolant)

- Lab A completed an acceptable reference on 9/11/24.
- Lab G completed an out of calibration reference on 9/9/24.
- David B – When does lab G plan to begin the next reference attempt?
- Garrett W – Intertek plans to start it today (9/26/2024).
- A review of the reported data from both labs A and G was conducted during the meeting.
- Cylinder liner wear (CLW) on target for A and mild for lab G, but within acceptable range.
- Average stage 2 oil consumption (OC) for lab A elevated but on target for lab G.
- Lead (Pb) mild for lab A but within acceptable range, lab G very mild and outside acceptable Yi range.
    - Same for lead 2 (Pb2) as Pb for both lab A and G.
- Top ring weight loss (TRWL), lab A slightly severe and lab G slightly severe, both within acceptable Yi range.
- Both lab A and G had low fuel rate in stage 1, low in stage 2 only for lab A.
- Stage 2 intake CO2 low for both lab A and G.
- Lab A load in stage 2 on lower end, lab G within normal historic range
- Average oil sump temperature for both labs on the lower side of historic.
- No comments or questions were noted.
- Discussion tabled until the next reference at lab G is completed, and data is reported.

Next Meeting Date/Time

Next meeting date/time to be determined

Meeting adjourned on 9/26/2024 @ 12:12 PM EST