

MACK-Volvo Surveillance Panel Meeting Notes

03/10/2021 @ 9:30 AM EST

Attendees

SwRI: Isaac Leer, Robert Warden, Travis Kostan, Jose Starling, Michael Lochte
Oronite: Josephine Martinez, David Lee
Afton: Bob Campbell, Christian Porter, Cory Koglin
Infineum: David Brass (Chairman), Elisa Santos, Jim Gutzwiller
Intertek: Garrett White (Secretary), Pablo Ramirez
Lubrizol: Jim Matasic
CP Chem: Jon VanScoyoc
Haltermann: Prasad Tumati
Exxon Mobil: Paul Rubas, Steve Jetter
TMC: Sean Moyer
TEI: Derek Grosch
Ford: Michael Deegan
Volvo: Patrick Holmes

Agenda

- 1) Mack T-13 Parts Follow-up
- 2) Mack T-11 / T-12 Parts
 - a. Update on oil consumption test- SwRI
 - b. Piston Crown Measurements
 - c. Database of Recent Tests with Parts Measurements
 - d. Statistician Analysis on Parts Measurements
 - e. Top Ring Analysis
 - f. Update on Reference Testing
 - g. Next Steps

Action Items and Key Points

- Volvo to meet again internally to discuss ongoing issues with T-13 cylinder head changes and engine block part number supersessions.
- Volvo to also discuss internally how they can help the surveillance panel with understanding the design of the batch E and F piston crowns and how oil consumption could be affected.
- Test labs need to supply remaining piston ring and piston crown ID's to complete summarized table of recent runs on new batch hardware and previous batch hardware.

- SwRI matrix testing of different combination batch hardware shows there may be a subset of F batch piston crowns that could be causing higher oil consumption rates in the T-12 for phase 1 conditions.
- Intertek will re-run their T-11 reference on W batch liners, X top rings, X second rings, X oil rings and E batch piston crowns.

Summary of Discussion

Mack T-13 Parts Follow-up

No update received from Volvo on the discussions of the cylinder head changes and the engine block part number supersessions.

Volvo to follow up and meet internally regarding the concerns.

Mack T-11 / T-12 Parts

Isaac Leer provided an update on SwRI's revised test plan for different combination batch hardware and their effects on oil consumption in the T-12.

- Stage 4 used hardware from their coordinated reference run which had high oil consumption except for the following components which were from stage 3: All components for cylinder 6 and oil rings for cylinders 2 and 4.
- Stage 4 produced an average phase 1 condition oil consumption rate of 70 g/hr, a substantial increase from stage 3 phase 1 oil consumption rate of 15.2 g/hr.
- Groove width and depth measurements were obtained for both sets of crowns for stage 3 and 4's runs, some slight differences but none that are definitive.
- Next steps will be to replace piston crowns cylinder by cylinder to determine if there is a single crown or group of crowns that are producing the high oil consumption.
- David – Any other labs have ability to measure these crowns?
- Christian – We (Afton) do have a CMM and could measure.
- David – Goal is to screen out a subset of crowns. Is there anyone at Volvo that could help us out with understanding the piston crown design and how oil consumption is impacted?
- Patrick – I can speak with someone internally.
- David – Do the labs still have their used crowns from the references?
- Intertek and Afton confirmed they do still have them.
- Jim Matasic – We have OC rates for phase 1 but none for phase 2 for stages 4 and 5. Was a break in ran after installing new hardware?
- Isaac – During parts replacements we cleaned the crowns of deposits and installed parts. No additional break in was performed after stage 1.
- A clear break in was not performed after replacing parts for stages 2-5 but the hardware for stage 1 completed a break in prior to starting. Stage 3 hardware ran phase 2 conditions for 10 hours therefore both phase 1 and 2 conditions were experienced by the hardware.

- David – What is the timeline to begin the stage 6 run?
- Isaac – Should start today and complete by the end of this week.
- Comparing the measurements of the crowns used in the references to those used in the matrix testing could provide some insight as to what it is about the crowns that is causing the difference in oil consumption.
- David – If the other labs can measure their reference crowns that would help with identifying what could potentially be driving the higher oil consumption.

David shared the spreadsheet of summarized data for the new hardware runs and some runs from previous batch hardware and their respective OC rates.

- Some of the ID numbers provided are serial numbers which are provided by Federal Mogul.
- David – Knowing the Federal Mogul SN's could help with grouping components by manufacturing date.
- David – Has any analysis by the statisticians been performed on the spreadsheet?
- Elisa – We will need to meet internally and meet with the other lab statisticians to dig deeper.
- Josephine Martinez – There are still pieces of the data set missing and it would help to have them.
- **Test labs will need to supply the missing ID's for the crowns and rings to complete the data set.**

David shared a presentation from 2016 comparing the W batch top rings to the previous batches:

- Barrel rise similar across all batches.
- Major difference was the elemental composition, Mo and Ni levels in the W batch were higher than prior batches.
- W batch Ni-Mo domains were larger than previous batches.
- Cross sectional view shows U rings were very porous and had a thinner top layer, W rings have a smoother surface.
- Thicknesses of rings were comparable to each other.
- Pores in W batch were smaller, surface was also smoother when compared to previous batches.
- Pore density of U rings were uniform, W ring had minimal surface pores.
- W rings were voted in for use in the T-11 but not for the T-12 due to low liner wear.

David shared TEI data for top and 2nd rings for batches W and X.

Top rings:

- Face width, height and width of cross sections were measured.
 - Face width is the measurement from the top to bottom of the barrel on the side that contacts the liner.

- Total width is the overall thickness of the ring at its highest and lowest point, top to bottom.
- Height is the top to bottom measurement of the ring measured at 0.1" from the outer edge (barrel side) of the ring.
- Face widths slightly higher for batch W.
- Total width for W batch slightly higher than X batch.
- There was a noticeable amount of W rings that would be considered outliers that did not fall within the general population for total width.
- X batch heights slightly lower than W batch.
- W rings overall seem larger than X batch rings.

2nd ring measurements

- Two measurements taken, face width and width.
 - Face width measured as top to bottom on the side contacting the liner.
 - Width measured as front to back of the surface contacting the top of the groove.
- W batch 2nd rings had 2 subsets, face widths in W for first 400 rings were lower than the remaining 600.
- X rings face width comparable to last 600 rings of the W batch.
- Width of X batch rings similar to the last 850 W batch rings. Appears to be a subset in the first 150 W rings where the width is higher than the remainder of the batch.

David – Any update from Intertek on their T-11 reference start date?

Pablo – We should begin the reference the week of March 22nd and be completed around April 1st-2nd.

Next steps:

- SwRI will continue their oil consumption runs and replace piston crowns one cylinder at a time to determine if there is a crown or group of crowns driving oil consumption.
- T-11 reference at Intertek to be re-ran and will start on the week of March 22nd.
- ID's needed for piston rings and piston crowns for completed runs (just about every lab is missing data in the table).
- Any additional measurements that the labs can do on the crowns would be helpful.

Bob – Would it be worth moving back to the E crowns?

Derek – There are 158 E crowns remaining.

Jim Matasic – Using the remaining E crowns in the T-11 makes more sense since it is flush and run. Would be able to obtain more use out of a set.

Perhaps the E crowns should be used in the T-11 reference at Intertek?

Pablo – We can do random selection of the W liner and use E crowns for the next run.

W liner, X top ring, X 2nd ring, X oil ring, and E crown combination has not been tested, that may be a better route with the T-11 reference.

Intertek to run their T-11 reference re-run with the following combination: Liner = W , Top Ring = X , 2nd Ring = X, Oil Ring = X , Piston Crown = E.

David - Letter should be going out within the next week or two stating the T-12 is unavailable.

Meeting adjourned @ 11:48 a.m. EST.

Next Meeting Date/Time

April 6th from 10:30 a.m. to 12:00 p.m. EST.