From:	Starling, Jose Y.
To:	Sean A. Moyer
Cc:	Robert Slocum (robert.slocum@lubrizol.com); Starling, Jose Y.
Subject:	DD13 SP Meeting Minutes for September 18, 2023
Date:	Tuesday, October 10, 2023 10:55:21 AM
Attachments:	image001.png image002.png

Hi Sean, can we please have the below DD13 SP Meeting minutes of 9/18/23 posted on the TMC site. Thanks.

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Daimler SP Meeting Minutes - 9/18/23

Attendees;
Infineum – David Brass, Jim Gutzwiller, Elisa Santos (Y)
DD – Suzanne Neal (Y)
SwRI – Bob Warden (Y)
IAR – Josh Ward (Y)
TMC – Sean Moyer (Y)
Lubrizol – Robert Slocum (Y)
TEI – Dan Lanctot, Derek Grosch (Waive)
Oronite – Jo Martinez (Y)
Afton – Bob Campbell, Amanda Stone (Y)

Presentation on DD13 Proposal for Liner Screening Limits – David Brass
This was a follow up analysis to the previous presentation around additional screening limits for DD13 liners. TEI was able to provide specific location measurements for the various surface parameters, not just averages for the part. As a recap, this is being examined due to the increase in oils scuffing prior to 31 hours with the introduction of Batch C liners. This aligned with the change in liner supplier. Infineum conducted a study looking at both the TMC reference oil as well as internal candidate data. Resolving this increase in early scuffing is critical heading into BOI/VGRA matrix testing for PC12. Based on modelling the contact location it was determined that the liner roughness played the largest role in the fluid film thickness.

Updated analysis focused on Rk Rvk, and Rpk measurements, rather than just the Ra value. This includes data measured at the thrust, anti-thrust, front, and rear locations. Based on this analysis the recommendation table below was shown;

Proposed liner roughness values

Property	Current Limit	Previous Proposal	Proposed New Limits
R_a (um)		**≥ 0.28**	
R_k (um)	0.2 – 0.8	0.2 – **1.0**	**0.49 – 1.00**
R_{pk} (um)	≤ 0.27	≤ 0.27	≤ 0.27 **(Single measurement < 0.35)**
R_{vk} (um)	0.7 – 2.0	0.7 – 2.0	0.7 – 2.0 **(Single measurement ≥ 0.7)**
Expected Additional Rejection Rate		22%	25%

For the parameters with a “single measurement” component, the other value shown is for the average of the 4 locations measured on the liner.
Revised analysis was performed on the early scuffing reference runs to try and explain why liners with an allowable Ra range still scuffed. There was an extensive color key for this analysis, see attached presentation.

The proposed new screening method would have removed a number of scuffed liners based on a variety of parameters. The fact that difference parameters seemed to align with the scuffing in certain instances highlights the need for a multi-variable screening process.
Josh Ward asked if the data had also been looked at for passing references.
David noted that they did, and for the most part passing references had a higher percentage of parts that would not have been screened out. There were still some, but less than the early scuffing tests.

Candidate data was shown for 3 formulations that ran multiple tests. The Ra value seemed to predict performance when the average was less than 0.28, and the additional parameters being proposed aligned well with performance.
There was a substantial drop in Rk for Batch C, although still within the specification. The original DDC honed liners were close to 0.79 Rk on average, and likely would have been largely rejected based on the 0.2-0.8 range for Batch C.

Batch D liners were slightly rougher than Batch C, but still below the average Rk from the DDC Honed liners. Based upon all of the data shown, David was proposing the following be adopted, along with an indication of the number of parts that would have been rejected from the reference tests. This assume the liners from the reference tests are representative of the overall population.

Proposed liner roughness values

Property	Current Limit	Proposed New Limits	Screened Out
R_k (um)	0.2 – 0.8	**0.49 – 1.00**	**33 / 176 Parts (19%)** **3 / 9 (≤ 30 hr tests removed)**
R_{pk} (um)	≤ 0.27	≤ 0.27 **(Single measurement < 0.35)**	**17 / 176 Parts (10%)** **2 / 9 (≤ 30 hr tests removed)**
R_{vk} (um)	0.7 – 2.0	0.7 – 2.0 **(Single measurement ≥ 0.7)**	**16 / 176 Parts (9%)** **4 / 9 (≤ 30 hr tests removed)**
All Above Limits Combined			**44 / 176 Parts (25%)** **7 / 9 (≤ 30 hr tests removed)**

David brought up the data for reference runs that made it to 31 hours+. There seemed to be a number of tests that made it just past the transition with no liners having been screened, while there were a few that made it to 31 hours and would have had every liner screened out. It appears that this isn't going to push runs that would make it to 31 hours today out to 100+ hours.

The above proposal was made by David Brass, seconded by Robert Slocum. Motion passes unanimously, voting status indicated in the attendance above. Each lab will need to coordinate with TEI to replace impacted liners in kits. It would be recommended to make replacements for parts that are in engines as well. The data dictionary and report forms may need to increase. Sean Moyer noted that we have other tests with hardware specs that don't go into the form, and wondered if we need to make a dictionary modification. David countered that having the data going into the system would make analysis later more effective.

Derek offered to send an updated database to TMC once a month with all of the parameters. This avoids making changes to the forms and dictionary for now. It will start with everything that was compiled for this effort, and have existing kits moving forward.

Meeting closed out an hour early.

-Bob Warden
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