Sequence VIII Bearing Task Force Conference Call Notes

Date: December 21, 2015

Members Present:

Zack Bishop, Clayton Knight, Dan Lanctot/TEI

Andy Ritchie, Gordon Farnsworth/Infineum

Cliff Salvesen/ExxonMobil

Adrian Alfonso, Bill Buscher/Intertek

Jerry Brys/Lubrizol

Jason and Matt Bowden/OHT

Tim Caudill, Dave Caproni/Valvoline

Paul Ovares/Federal Mogul

Tony Hendrix, Patrick Lang/SwRI

- We reviewed the SEM analysis done by SwRI. SwRI confirmed that the 08-15 bearing batch SEM analysis that was presented (see attachment 1) represents results from three individual bearings halves. It is unknown whether or not the three data points on each of the 01-09 and 09-10 bearings are from the same or three individual bearings (this data was pulled from an archive so they were not analyzed at the same time as the 08-15). The SEM data suggests that the copper/lead ratio on the 08-15 bearings is in the range that we observed for the 01-09 and 09-10 batches. However, the tin is lower on the 08-10 batch compared to the two earlier batches.
- The difference in Tin percentages was discussed. Federal Mogul doesn't expect the differences in Tin to affect the performance of the bearing. Tin is more likely to affect the overall strength of the material (loading/fatigue).
- Paul from Federal Mogul stated that they confirm the bearing material concentration post-production by ICP analysis of the bearing matrix material (removed the material matrix from a sample bearing during production).
- Paul stated that he would expect to see the lead content to be in the 21 to 27% range. The SwRI SEM analysis shows the lead to be higher than Paul would expect. This is likely due to the fact that the SEM results and the ICP methods quantify differently.
- Pat Lang asked if the blend of the copper/lead could be adjusted if it was decided to order a new batch of bearings. Paul stated that it would be very difficult to do. The pre-production bearing powder mix on the latest batch (08-15) of bearings measured in the middle of the specification. As a result, it would be risky to adjust this ratio, i.e., which way would we go and how much.

Intertek is doing some in-house testing. See below:

- Use RO 1006-2 retains
- Use 08-15 bearings
- Clean and weight bearings as always
- Install bearing and complete 4 hours BI, remove bearings, determine BWL, re-install and continue test to 40 hours. Also collect oil sample after BI and complete ICP
- Determine BWL at 40 hours and collect EOT oil sample and complete ICP
- Look at <u>used</u> bearings (09-10) and compare to used 08-15s.

SwRI is planning to perform some additional visual inspections of the bearings to see if any differences can be observed. Perhaps there is a difference in bearing appearance that can be correlated to the variation in results that SwRI observed on oil 704. If a difference can be observed in the bearing surface SwRI will consider running a test to confirm the affect.

In summary the group agreed that at this point we have not identified anything wrong with the bearings to warrant a decision to make a new batch. As a result we will continue to investigate the problem but we are leaning towards figuring out a way to make the 08-15 bearings work. Since labs can't calibrate due to the severity, an industry correction factor will have to be determined. To determine a correction factor, it is likely additional reference data will be needed.

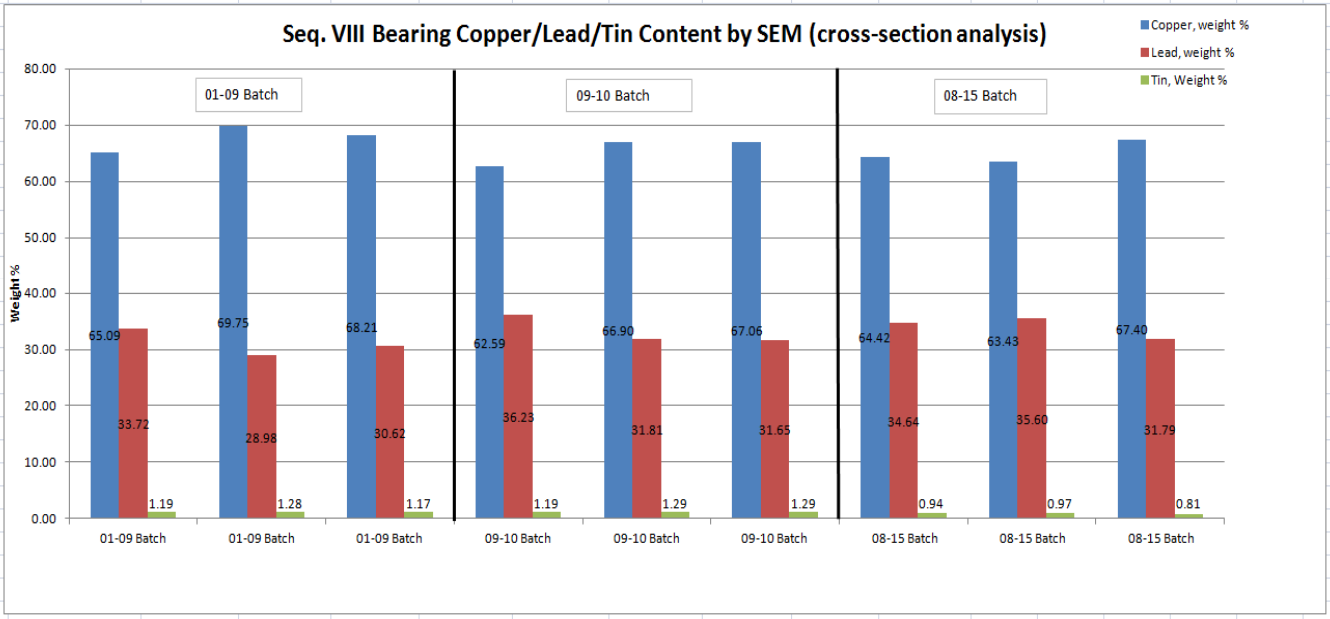
<u>Action Items</u>:

1. Get industry statisticians to review current reference data on the 08-15 bearing batch to see what can be done to develop a correction factor.

2. Next call to be scheduled for January 8th. Time and call-in information to be distributed the week of January 4th.

Attachment 1: SwRI SEM Summary

SEM Sample ID	1276	1277	1278	1272	1273	1274	2231	2232	2233
Bearing Batch	**01-09 Batch**	**01-09 Batch**	**01-09 Batch**	**09-10 Batch**	**09-10 Batch**	**09-10 Batch**	**08-15 Batch**	**08-15 Batch**	**08-15 Batch**
Copper, weight %	65.09	69.75	68.21	62.59	66.90	67.06	64.42	63.43	67.40
Lead, weight %	33.72	28.98	30.62	36.23	31.81	31.65	34.64	35.60	31.79
Tin, Weight %	1.19	1.28	1.17	1.19	1.29	1.29	0.94	0.97	0.81



SwRI, 12-17-15