May 17th, 2021

Caterpillar Engineering Group Teleconference Minutes

Conference Attendees:

Infineum - Jim Gutzwiller (Chairman), Elisa Santos, David Brass
Caterpillar - Hind Abi-Akar, Mark Jarrett
Intertek - Josh Ward (Secretary), Timothy Griffin
TMC - Sean Moyer
SwRI – Bob Warden
Lubrizol – Alex Ebner
Afton – Bob Campbell, Christian Porter
Chevron – Jo Martinez

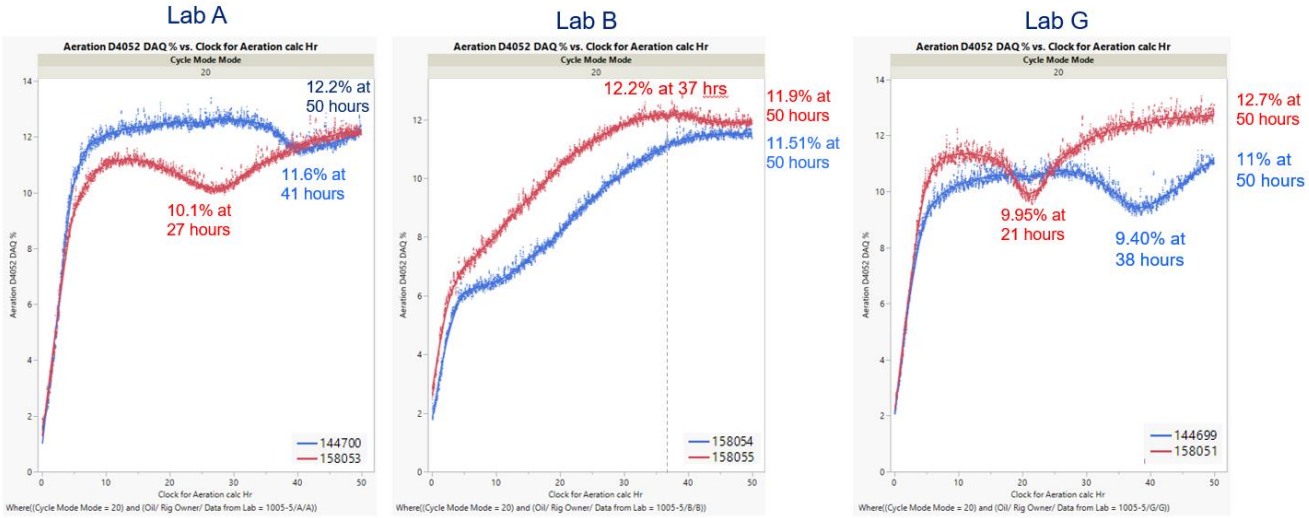
Agenda Items:

- Review results and operational data from 1005-5 COAT tests for comparison with EOAT

Discussion:

1005-5 Oil Test Results:

- Aeration trends from six tests on 1005-5 oil show drops in aeration and unusual aeration trends.



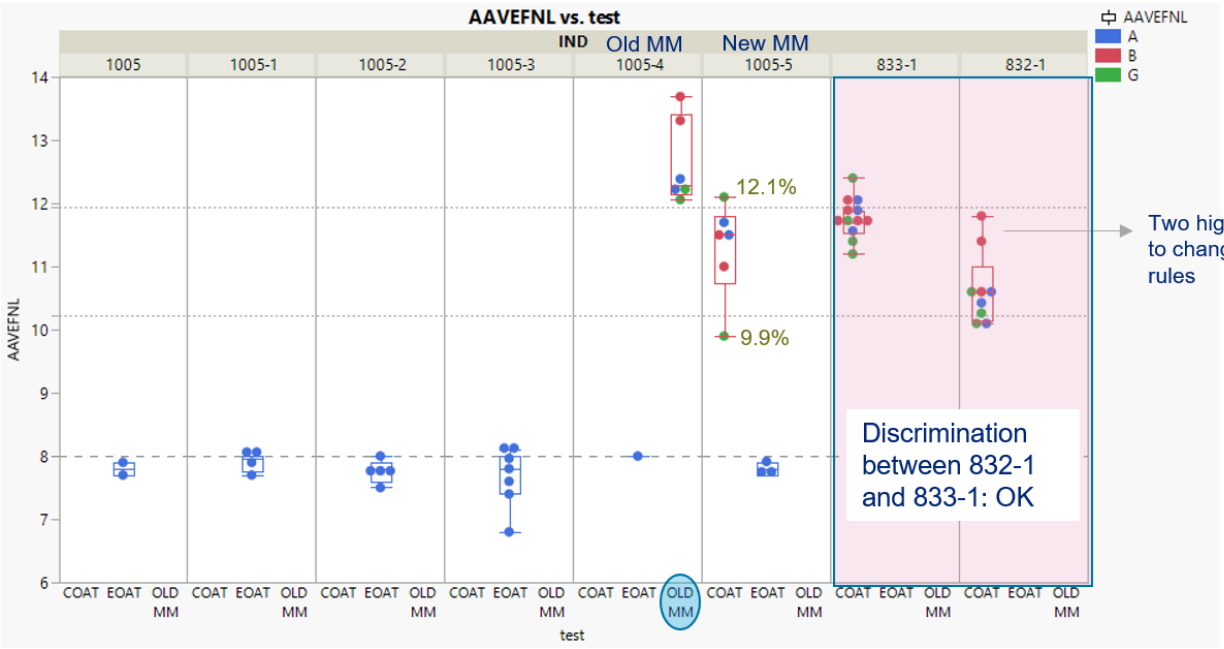
- Labs A and G ran one test each on oil drums that were filled and shipped by the TMC in April 2019 (144### oil codes/test keys).
- Labs A and G ran one test each and Lab B ran two tests on oil drums that were filled. and shipped by the TMC in August 2020 (158### oil codes/test keys)
- Before all tests, oils were stirred before pouring by the labs following the new oil stirring procedure.
- No major operational or procedural issues were noted during the six tests on 1005-5 oil.
- Acceptable reference tests were completed by the labs either just before or just after the 1005-5 matrix tests were completed.
- 1005-5 matrix tests at all labs were ran back-to-back.

1005-5 Test Results Discussion:

- It was noted that oil drums had changed between the 144### and 158### oil shipments. TMC confirmed that the change only affected the drum color and did not change the barrel liner coating material.
- Operational data showed increases in oil gallery pressures coinciding with the drops in measured aeration. Discussion on this topic indicated that the measured aeration drops were not a measurement issue. Other operational data parameters confirmed this.
- Possible changes between oil blends 1005-4 and 1005-5 were discussed. See excerpt below from the T8 panel meeting where the blend changes were previously discussed:

> TMC1005-5 was confirmed to have been blended using the exact same recipe as TMC1005-4. All the same additive components are used. The same base stock cuts were purchased from the same manufacturer.
> However, since several years separate when these two batches were blended, the base stocks batches used do differ in their saturates level. The primary base stock in TMC1005-4 had an ASTM D2007 saturates of 77% while in TMC1005-5 it was 82%. Since the Mack T-8E test does respond positively to saturates level, and the difference between the saturates level (5%) is slightly greater than the reproducibility of the D2007 method (4%), it is possible that the latest batch of TMC1005-5 may result in slightly milder results than the previous TMC1005-4 batch. Stacking this effect on top of the impact of slightly milder fuel severity factor, and this may explain the current mild trend in the Mack T-8E reference results.

- 1005-5 tests ran in the EOAT produced repeatable results with previous tests on 1005-4 oil blend. See data below:



- There is not yet a good argument to run more COAT tests on 1005-5 oil due to the low supply of oil and the large number of tests that use 1005-5 as a reference oil.

- Oil age affect on test results was discussed concerning the time oil was stored in drums at the labs. Further review of chemistry analysis from the six tests would be beneficial in determining affect of oil age and effectiveness of stirring procedure.
- The possibility of running 833-1 or 832-1 reference oils in the EOAT was discussed. Running new technology oils in older tests is generally not an accepted means of determining backwards compatibility but it could be discussed further with API if the panel deems it would be beneficial.
- Main operational data parameters were reviewed but a more detailed review of the data will be necessary.

Actions:

- Complete more detailed review of operational data for the six 1005-5 COAT tests

Next CAT Engineering Group Call Scheduled for 05/20/21 9:00AM to 10:00AM CST