March 7, 2018

at Southwest Research Institute

Caterpillar Surveillance Panel Conference Minutes

Conference Attendees:
Jim Gutzwiller (Chairman) Elisa Santos, Bob Salgueiro – Infineum
Jim Carroll (Secretary), Jim McCord, Bob Warden, Randy Harmon - SwRI
Bhaskar Prabhakar – Exxon-Mobil
Barb Goodrich - John Deere
Mark Jarrett – Caterpillar
Jim Moritz, Tim Griffin, Garret White, Joshua Ward – Intertek
Sean Moyer - TMC
Mark Cooper, Jo Martinez – Chevron-Oronite
Bob Campbell, Christian Porter - Afton
Derek Grosch – TEI
Pat Joyce, Demetrius Lytle, Andrew Stevens, Bill Larch - Lubrizol

Agenda:
1). COAT
- Review data generated with "new" Aeration measurement system (3 separate tests back to back on the same engine @ Intertek)
- Operational
- Reference Oil 833-1 (new batch)
- Next step is ?

2). C13 Test – Update on Reference Oil tests running the New Liners
3). Test procedure review and updates
- C13 Deposit Test
- COAT
- SCOTE(s) 1K, 1N and 1P, 1R

4). Parts (all test types)
5). Old Business / New Business

Elisa Santos gave a presentation of data from Intertek's three COAT runs with the new aeration systems. (See attached presentation) A=SwRI, B=Lubrizol, G=Intertek.
Pump out oil pressure dropped on the third run by 15 kPa for no known reason.

Tim: The pressure regulator had some stiction and got better as testing completed. All tests had positive Qis at EOT.

Early in the first run Tim found that the box was over insulated and it was running too hot. He had to remove insulation from the door to continue. Data shows high temperatures at first.

Aeration test results for Lab A was13.4%, for Lab B was 12.8% and for Lab G was 12.6% average aeration using the newest Emerson calibration constants.

Raw tube frequencies were also different which is reflected by the differences in constants.

McCord: Should we put all the Micromotion coefficients in our reports?
Tim: I have requested of Emerson to retag the sensors with new constants.
McCord: We should be tracking them.
Sean: I think it would be more of a lab audit type of request.
Gutzwiller: At least add it to the reference test
McCord: They should be listed somewhere because all the aeration results have to be calculated using this information.
Tim: We only need K1, K2, and DTC.
McCord: Did we not talk about submitting a copy of the calibration sheet from emerson to TMC?
Randy: We should get proper paperwork from Emerson with the newest constants.
Sean: The hardware tag should match the calibration records during an audit.
Tim: You can look at the screen on the 5700 transmitter and see the K1,K2, and DTC values.
McCord: Now we have to decide which values to move forward with. And, we need to discuss the calibration and corrections needed during each reference.
Tim: During my calibration it was very close, but I only looked at the analog output.
McCord: We need to discuss if we are aligning to D4052.

Oil pressure difference of the last test was noted by Elisa.
Tim: I don’t think the oil pressure affected aeration. Maybe the pump difference during the last test affected aeration?
Carroll: Requested the 50 to 90c calibration data.
Tim: Can get it tomorrow.
Tim: Looking at the data file on TMC’s website you can see the mode change in column G to see the start of test.
Tim: We now go to test conditions 5 minutes before going on test.

Break

Jose Starling presented the drawings of the new aeration system.

McCord: Can we specify the make of the fittings?

Gutzwiller: Are we putting it in the procedure?
Sean: It deserves to be in the procedure, rather than at the TMC website. We could put the Solidworks file on the TMC website in case it needs to be adjusted later.
Jose: The “STEP” file format is a general format all can use. I can add descriptions as needed to the files.

McCord: Are we going to report ECM data?
Tim: We tried looking for oil pressure and couldn’t find it. Significant figures are low.
Moritz: We are looking for problem modes.

McCord: We have seen 100psi at the IVA gallery. Mark says there is pumping going on. If the actuators are activated you may see a pressure drop.
Carroll: Can we activate them?
Mark: Yes, but only below 1200 rpm.
Moritz: Are folks satisfied with the 3 runs and ready to run reference runs?
Gutzwiller: What does Tim think? I think they performed the same.
Tim: I want to run the last test again.
McCord: I think operationally they were the same. 0.8% apart is not that good. Within a lab 0.3% would be better.
Tim: Temperature drop across the sensor was good. Flows were the same and insulation was the same.
McCord: Based on these aeration results I think we have removed the thought that the lab differences are not due to engine aeration.

Carroll: The fans in the aeration box should be on all the time, and the heaters controlled separately.
Tim: Can’t do it.
Randy: There are jumpers on the fans that allow this.
Tim: OK, but you need a separate power source.
Carroll: Yes
McCord: If we eliminate a variable I recommend it.

McCord: For these three tests, I don’t think we decided what would be a ‘good’ result.
Moritz: We didn’t know.
Elisa: We didn’t know some of the differences went up then down. Before we saw different things went in different ways.
Sean: What was the difference between the first two runs and the third?
Tim: The start was quite different.
Sean: Maybe we should wait to see the results of Tim’s second test.
Tim: By hour 30 it looks good, comparing all three tests.

McCord: We need to discuss the calibration procedures.
Tim: I looked at the analog output during my calibration.

Randy: Apples to apples, use the frequency and calculate density.
McCord: The new coefficients are static. Are we calibrating or not?

Elisa: What is going to change if Tim runs another test?
McCord: Not much.
Elisa: We should run reference oil 833 and 832, discuss operational data, and see if we need to run another reference.
Tim: The DTC value changes aeration significantly. All earlier data would have been affected. I believe everyone's data will move.
McCord: We can move forward with the boxes.
Tim: I think all are valid.
Moritz: That's why we ran last. To use it as a reference.
McCord: We are all probably going to readjust our SAs. It will probably take 3 references to do that.
Elisa: Last year we agreed to run 3 if we had a level 3 alarm after 2 tests.
Sean: With these types of results, everyone will have level 3 alarms
Elisa: We can schedule this now.
Sean: Tim could run 832-1 oil next.
Elisa: I would like to run in stages to compare the same oil's data. Run 833 again.

Gutzwiller: There are only a few runs of original 833 oil left at the labs.
Sean: There is enough for 2.5 tests left at TMC.

McCord to Tim: Any issues with data loss?
Tim: No that was a mix up with hexadecimal settings.

Elisa: Can we agree on the data dictionary so that we can look at the data together.
Moritz: We have a guy to translate one file into a standard format.
Sean: The labs should send their data to me with generic labels on the columns and I will arrange them into a common order.

Lunch

Carroll: We will finish shakedown and be ready to run references mid next week.
Gutzwiller: Run 833 at Lubrizol and SwRI and look at data. Then everyone should run 833-1.
Tim: My current run will be reported as valid. Its appearance is what made me think of re-running.
McCord: Are going to meet again before we start?
Gutzwiller: Jim Carroll and I were just looking at the calibration procedure we note that it does not use the sensor frequency to calculate density.
Tim: I used the analog output of frequency for these last 3 tests.
McCord: But your coefficients will now change your density.

Tim: But the RTD temperature is the same.
McCord: Once our stand is ready we just need to get the procedure set in conference call.
Tim: My damping is set as 2 in my system for the analog data in the transmitter. I run a 6 point average (30 second points for 3 minutes).
McCord: I would like this agreed to completely, so we could do a real time aeration.
Moritz: Is this clear enough for all?
Tim: The only thing I want to discuss is the end of the data set. The last point is not averaged and it shows a spike.
McCord: So we can average back.
Sean: So do what Jim McCord says and use the last 180 seconds to get your average.

McCord: I motion that we use a running average of the Modbus raw tube frequency over the last 180 seconds in the oil density calculation.
Tim seconded the motion.
None opposed.
None waives.
Motion Carried.

Round table discussion ended with a note to have a discussion between labs if, when the calibration is run we are off by more than 1%.

Gutzwiller: SwRI will start next week on 833 reference, Lubrizol within 2 weeks.
McCord: Will we meet before starting.
Gutzwiller: Yes we will have a short lab-to-lab conference call in next week.

<u>Next discussion item</u>

Regarding TGC task force solutions we are to be made aware of the status of the process. The surveillance panel chairs are going to be asked if all of the fuel specifications (specs) are agreed upon for PC9 and PC10.
There are slightly different specs in different test types. They want to standardize the specs once. Many procedures never got updated.
Also, since there is only one supplier, maybe another supplier could come on board to get prices down.
There is also the idea of getting a contract to make one batch for all the fuel supplied to all the users.
There will also be a database on the TMC website for all fuel suppliers to upload their Certificates of Analysis (COAs).
Some people had made comments that to control prices maybe two suppliers could bid for long-term contracts.

C13 deposit test

Gutzwiller: The new liners are out. One lab is running with them.
Afton's test had a 26.7 delta this morning. Side-by-side the liners did not look different. The oil broke in the last 100 to 150 hours.
Intertek's test is at 375 hours and just past the flat spot.
SwRI just started its test.
Lubrizol is about to start their test

Sean: Reading thru the minutes from Feb 2 no decision was made on what to do next.
Andrew: I don't want to hold anyone up.
Moritz: If results fall in, then the lab falls in.
Christian: We don't have deposit results yet.
Bob: Are we coalescing around agreement?
McCord: If everyone moves in different directions there may be a problem
Moritz: If all the data gives us a correction factor for the new hardware we can correct.
Sean: Then you are taking a risk to continue.
Bob: Is it the same manufacturer?
Mark: No, not even the same country or steel.
Bob: If we wait a month we can back calculate CF for references.
Sean: You can't go back with candidates too.
Bob: I think you can from a technical standpoint.
Sean: Technically, but running fast and loose is not a good idea.
Andrew: If we start a candidate what happens to it?
Sean: Their status remains good. But you can lose calibration if you do this.
Mark: Should we schedule a meeting?
Gutzwiller: Thursday next week.
McCord: I was going to have Travis check if our top grooves offsets per cylinder were done correctly 15 years ago.

CAT parts

Mark: Lots of parts for C13, 1K, and 1N with some challenges for 1R. Received the prints for the governor base (5724) that we have 2 on inventory. It will be reviewed and sent out.

Test Procedure Updates

Bob: Did we every update the oil consumption procedure?
Sean: It is in Info letter 16-1
McCord: The 1P and 1R humidity calculations specify measuring humidity measurement locations that differ. Let's make it the same. It's left over from the 1Q procedure with EGR.
Moritz: Have you received comments on the procedure updates needed?
McCord: Nice to have a ballot box to send notes.

Sean: We will need a complete meeting just for the COAT procedure update.

McCord: I make a motion to move the location of the humidity probe in the 1R procedure in Annex A4 to the location specified in the 1P procedure in Annex A8.
Bob seconded.
More discussion? None
Any opposed? None
Any waives? None
Motion passed.

Bob: There needs to be a way to address how to decide whether non-critical data losses are handled. Whether it is samples missed or lost or other problems.
Gutzwiller: Need to add in the updated filter base modification diagram with the newly blocked off filter pressure bypass blocked off.
Sean: I can add it to the procedure.
Consensus was that a press fit or threaded plug is OK, but not a welded plug (due to possibility of warping).
McCord: It would be good to use the same filter holder for both the COAT and C13 tests.

McCord: I make a motion that the C13 use the same modified filter base as the COAT procedure beginning with the next C13 test.
Bob: I second it.
Salgueiro: Why change something after 10 years?
Bob: I see it as an improvement.
Salgueiro: Standardized testing should not change, and could have unintended consequences.
Bob: Good point but leaving it as is could allow for oil to leak by and change how the oil should be flowing.
More discussion? None
Any opposed? None
Any waives? None
Motion passed

C13 Figure A4-19 needs to be updated showing the oil cooler.
C13 Figure A4-17 is incorrect.

Sean will update C13 procedure Table A3.1 with the correct stem seals numbers and valve guides numbers.

Moritz: When do you want to review and re-write the COAT procedure?

Gutzwiller: SwRI and Lubrizol will do the density verification. We should have some discussion after that. So we can do it in steps. Lab engineers need to review the procedures as outlined.

Meeting of lab engineers for COAT: Wednesday, March 14, 8:30-2:30

C13 test results meeting: Friday, March 16, 9-10+