

**July 21, 2017**

**Caterpillar Surveillance Panel Teleconference Minutes**

Teleconference Attendees:

Jim Gutzwiller (Chairman, Gan Hu, Elisa Santos– Infineum  
Jim Carroll (Secretary), Jim McCord, Travis Kostan, Randy Harmon– SwRI  
Mark Jarrett, Hind Abi-Akar – Caterpillar  
Alex Ebner, Kevin O'Malley Andrew Stevens – Lubrizol  
Jim Moritz, Tim Griffin – Intertek  
Sean Moyer - TMC  
Christian Porter, Abaigeal Ritzenthaler - Afton  
Mark Cooper, Jim Rutherford – Chevron-Oronite  
Barb Goodrich - John Deere.  
Greg Shank – Volvo  
Dan Lanctot - TEI

AGENDA

1-COAT stand lab visit

2-COAT data review presentation – Jim Moritz

3-Update/review items from ad-hoc meeting at ASTM

1. Work on harmonizing the test stand setups among the three labs. These include the hardware used in flow meter and density measurement area.
2. Each lab to provide complete model number information for MicroMotion sensor and transmitter. Document software/programming
3. Work on data to correct for the differences in temperature between RTD and the sensor inner tube. Equation is given by Emerson to Jim McCord and the last 11 tests have the RTD temperature data logged.
4. Is the RTD temperature available from earlier tests to recalculate density and aeration values? Need RTD temps and constants.
5. Data sent to TMC
6. Arrange face-to-face meeting with technical support group at Emerson
5. Meeting set for the afternoon of August 15 and morning of August 16 at Emerson in Boulder Colorado
6. Compile list of questions and send to Emerson before the face-to-face meeting
7. Aeration enclosure temperature control setup and strategy
8. Any other items

## **1-COAT stand lab visits**

Lubrizol has a 90 deg fitting prior to its research valve, other labs are straight in.

On outlet of its Micromotion SwRI has a 90 deg elbow, other labs have straight fitting.

Lubrizol has a shut off valve in the line back to the oil pan.

SwRI has a box around the Micromotion.

Pressure transducers are mounted on top of inlet and outlet at Lubrizol and SwRI, but Intertek has a line down to below the flow path of oil.

Inlet tube to the Micromotion is Teflon at SwRI, Lubrizol has steel braided line with inner Teflon tube, and Intertek has stainless steel tubing.

Intertek has 3-way valves in the no flow section between the cross and the transducers.

Mark Jarrett asked that photos of each setup be distributed.

Jim G: Thinks that straight fittings were to be used at all labs.

Sean: Show this to me in the procedure.

Moritz: I have a draft that shows a lot that is not in the procedure.

Sean: Handoff of the procedure from Martin Thompson got lost.

McCord: We can change to straight out, if the panel wants to put it in the procedure.

Moritz I have a feeling the 90 affects the pressure.

McCord: Its possible.

Jim G: The small group should go over this together.

Moritz: We should send around photos done by each lab

Mark: Put it all in one document.

Hind: The outcome would put together any changes.

Action Item: Get the group meeting set up to go over differences between labs.

## **2-COAT data review presentation – Jim Moritz**

I have looked at data in the past that intrigued him.

There may have been some data that is reported but swapped.

RE: Yi plot

Mild shift at lab A in mid 2016.

Mc this was when we got the newly calibrated sensor back from Emerson

Next plot same with reported calibration dates

The first big drop should separate a before and after

McCord: Lubrizol and SwRI had a mild trend except for the big jump at the end. We can see if the RTD temperature changed in mid 2016

Moritz: Just trying to show trends

Tim: Once we added the enclosure to all stands the delta T across the Micromotion got closer.

McCord: As we go through this we will update flat file as necessary

Tim: If just one transducer changes then the other will go in the opposite direction.

McCord: Transducers are calibrated, You are implying that transducers are incorrect

Next plot is the same by date not just by lab.

Moritz We have large differences in Delta P across the Micromotion. They should be tighter and more constant in the lab.

Hind: can this impact aeration?

All said yes.

McCord: Inlet low will get higher aeration

Tim: Do you recall when SwRI switched to absolute pressure transducers.?

McCord: We can look into it.

Sean: We should add Delta P to the data dictionary.

McCord: Any time we are taking a Delta we should try to reduce it.

Tim: The best controller to look at is the pump since all are the same.

Moritz: Showed multiple graphs of controllers vs temperature and pressure.

McCord We perform calibrations before each reference, plus at half reference period on some tests.

McCord We have replaced pumps and valves sometimes.

Tim: Don't you have to run a reference if the pump is replaced?

Hind: Will this be affected by the change in filter?

Moritz: Not really.

McCord If gallery pressure was affected, then maybe.

Moritz: Lab G data stayed tight with the filter change.

Slides were prepared that associated controllers with Yi values.

Moritz: There does seem to be a correlation Yi to pressure. Slide 30

McCord: Need to normalize to RTD temperature to really get a reading on this.

Mark: Seems to be a lot more controller noise somewhere.

Moritz: Could be affected by filtering.

McCord It should be a snapshot.

Moritz went to graphs of data during tests.

McCord: The pressure outlet differences were shown between labs over a single test.

Note that the internal diameter of the Micromotion is 0.2 inch.

Moritz then showed pump output differences

Moritz: Pump The controller was very wide for one test.

Tim: It means the pressure is wrong.

McCord: No. Look at the actual pressure data not the controller.

Moritz then showed Micromotion tube temperature. Slide 40

Morritz has a newer presentation with RTD vs Yi

Slide 41 Engine oil filter inlet pressure showed quite a difference between engines.

Slide 42 Gallery pressure at different engines

Jim G: But Delta P across filters is quite different. There are two possible heat exchanges that could be used.

McCord: It's not just the filter.

Jim G: It' read at oil pump out, and then oil gallery after it has been filtered and cooled.

Moritz: Does everyone have the C13 heat exchanger?

McCord That external exchanger there is for trimming temperature. You could get ~3 degrees.

Moritz: Inlet P is at pump out (SOS location?)

Action item: Discuss delta Ps between labs.

McCord: We should all be using the SS heat exchanger.

Moritz slide 44: Actual aeration plots. Early data has differences. Negative data is unexplained.

McCord: We are comparing to D4052 at 90C and the RTD in the Micromotion is not up to temperature to get the correct density.

Sean: I have been trying to normalize the data. Assuming what we heard from Emerson told us. There is a discrepancy between the RTD and actual oil temperature.

Sean: Emerson assumes the tube is at fluid temperature.

Alex: appropriate calibration could fix this.

Moritz: Doesn't explain why lab B is positive.

Alex: When Emerson calibrates they use RTD temperature.

McC: They have high flow through there meter during calibration.

Sean: Also DV/DT can make a difference.

Question to Sean: Would you see a step up in aeration?

Sean: Yes for the most part it simply shifts the curves up.

McCord In the early days we did not see this, but then we switched to D4052 as the standard. During calibration it does match well.

Hind: We should compile a list of questions for Emerson

~16 people are going to Emerson August 15 and 16

Action item: Have a small group meeting to discuss differences between labs and come up with questions for Emerson. Small group meeting Wednesday August 2 afternoon 1 CDT

Start with questions for Emerson then go on to stand differences.

Jim G: Sean has data to work on RTD normalization. The labs are sending in data on the Micromotion setups at each lab.

Aeration enclosure discussion tabled.

Piston Ring top land discussion tabled.

