

March 14, 2018

COAT Engineering Group Conference Minutes

Conference Attendees:

Jim Gutzwiller (Chairman) Elisa Santos – Infineum
Jim Carroll (Secretary), Jim McCord, Randy Harmon - SwRI
Hind Abi-Akar, Mark Jarrett – Caterpillar
Tim Griffin – Intertek
Sean Moyer - TMC
Alex Ebner, Demetrius Lytle - Lubrizol

Agenda:

Review how Intertek verified MicroMotion density vs chem lab D4052. Do labs verify again with the Aeration system installed at each lab?

Is any of the data Filtered and if so what data - when and how much filtering/averaging:

- Internal MM processor
- Test stand data acquisition system
- Post test

When to transition from Warm-up to On-Test conditions. System prove-out tests were run:

- Warm-up - stage 1 - 35 minutes at 150kPaA Average MM Oil Sample pressure
- Warm-up - stage 2 - 5 minutes at 84kPaA Average MM Oil Sample pressure
- Goes to On-Test conditions (On-Test clock starts) and no data is discarded at the beginning of the test.

Everyone needs to go back through old meeting minutes from 2018 and 2017 so the group can be ready to review things that have been discussed and many implied that would/should be done when the new aeration systems will be installed and used for reference and candidate oil testing.

Review how Intertek ran the prove-out tests on the new aeration systems.

Gutzwiller: We are using the frequency from the Micromotion (MM) to calculate density using D1, D2, K1, K2, DTC coefficients and using Emerson's equation.

Tim and McCord: We received new K1, K2, and DTCs from Emerson which were calculated based off of the bath temperatures used during their calibrations and we will get new calibration sheets and tags for the meters.

Gutzwiller: The equation for density was made public some years back so we can publish it in the procedure according to Tim Patten.

Tim: The change in coefficients makes a 0.6% aeration difference.

McCord: The TAU has to put in as microseconds.

Tim: DTC has to be divided by 10000.

Randy: The DTC unit is % per 100C so it is divided by 10000. The K factor is the period in microseconds so it needs to be multiplied by a million (10^6).

Gutzwiller to Tim: You ran the 50-90C calibration density procedure.

Alex: So, why are we doing the calibration procedure?

Mark: This is a double check.

Alex: Shouldn't we be adjusting this procedure to use the tube frequency?

Sean: Yes we agreed last week to do this.

Mr. Gutzwiller put the existing procedure on Skype for discussion.

Gutzwiller: We need to update this procedure before we start any testing.

Alex: At the start it states to set output to 0-1 density range.

Tim: You still need to do this for analog out. But you need this for the screen on the transmitter. Just go ahead and continue as is.

Alex You don't need this anymore. It's not necessary in the procedure.

Gutzwiller: So strike thru A16.2.3

McCord: I thought the limits for flow was 0-2 l/min.

Tim: I did all the tests with scaling of 0-4 l/min.

Randy: I do not think it makes a difference for this procedure. If we use the RS485 (digital output readings) then it won't make a difference since it's only when the output is saturated that we would have a problem with an analog output.

McCord: Thanks for the explanation.

A number of updates were made to the pre-reference calibration procedure.

McCord: It is not clear what we need to show TMC if we send back the out of tolerance meter and get a re-calibrated meter back.

Sean: We should be more worried about a shift of 1% every time you run the calibration, so that you have shifted 10% in 10 calibrations.

Tim: I don't expect to see more than a 1% difference.

McCord Do we correct back to D4052 on the initial calibration, or do we correct only if we are over 1%? I can go either way.

Carroll: We should correct back to D4052 to get all the labs closer.

Alex I agree with that.

Gutzwiller. Do we document and keep track of these calibration coefficients?

Alex It's a really good idea

Sean: We should add it.

Gutzwiller That's OK.

Alex: The RTD does affect the flow rate

Randy: I'm not sure that true. It's measuring the time it takes the tubes to move.

Alex: it gets the mass that way, but then uses its internal calculated density to get volumetric flow rate.

Tim: More than likely the labs are going to use an analog output for flow.

McCord: Luckily flow does not affect aeration as much.

Sean: From the minutes from the meeting at Boulder the errors are really small. Running at 90C would have been best.

Gutzwiller: Should we include send back the transmitter with the meter?

Randy: Yes.

Sean: To be clear, we are going to add the calibration slope and intercept to the data dictionary.

Alex: We should explicitly say that the coefficients from Emerson for the meter are not to be changed, only the slope and offset calculated from this procedure can be changed.

Sean: Do we want to add the meter coefficients to the test report?

Tim: There is a long number from Emerson that includes all the coefficients.

Sean: It's not any more work leave it as separate numbers. We can probably scrub the report forms too. We could add to the procedure a picture of the tag on the meter.

Gutzwiller: We have all agreed to plug the Oil filter bypass, In September we agreed to go for 35 minutes at 150 kPa oil pressure and then go to 84 kPa for the last 5 minutes.

Sean: Information letter 17-2 was issued to that effect.

September 21st meeting minutes mentions C13 engine had wide/narrow oil cooler and should have been COAT engine.

Gutzwiller: We spoke of using CAT ET on the engine for diagnostic purposes. And the access the electronic address for the pressure sensor in the valve cover.

McCord: We can't get it. Best you can do is put a pressure sensor up there.

Gutzwiller SwRI you saw high pressures.

McCord: Yes

Mark: It should be very noisy. Could be used as a diagnostic.

McCord: Should we report it as a non-controlled item?

Gutzwiller: Intertek only had a few channels left for DAQ. We spoke of taking other data like oil heat exchanger outlet pressure. That's more important.

Carroll: We are setup for this. SwRI put pressure transducers on the IVA gallery, and inlet to the oil filter (outlet of the oil heat exchanger) on the COAT engine.

At start of test:

Oil pump out pressure = 542.4 kPaG

Filter in pressure = 457.6 kPaG

Oil gallery pressure = 397.9 kPaG

IVA pressure was > 687 kPaG

After running overnight:

Oil pump out pressure = 500 kPaG

Filter in pressure = = 421 kPaG

Oil gallery pressure = 366 kPaG

IVA pressure was = 666 kPaG

Demetrius: Lubrizol has done this.

Gutzwiller: Tim you know what you have to do.

Tim: The hose lengths are going to be different. You could tap into the newly plugged side of the filter housing.

Gutzwiller: That's after the filter.

Gutzwiller: There are a number of parameters that can be recorded from the CAN data.

McCord: Yes we can.

Gutzwiller: Can we get the engineers together to decide what data to take.

Carroll: We are taking a dozen different parameters.

Tim: Send me the list

Carroll: I will send the list to Lubrizol and Intertek.

Gutzwiller: This is just to see if all the engines are running the same, no need to slow things down.

Gutzwiller: There was a question about the VVT in the rocker box. If it should be replaced.

Mark: The check valve? The feedback is don't do that. It is a blow off valve to protect things.

Gutzwiller: Should we put a life on it? Replace it at specific intervals?

Mark: Has SwRI had to replace them?

McCord: We had to replace 2-3 on 5 engines over 10 years.

Gutzwiller: If it does go bad would it set a trouble code?

McCord: If we are monitoring the rocker box pressure then we would see it. It will trip an IVA unit code. But you may not notice it if you are not running at high power.

Gutzwiller: If the regulator goes bad it dumps oil onto the valve deck and changes the oil flow through the engine.

Tim: Now that I'm getting rid of some of my analog channels I may have more input channels.

McCord: I know the pressure drops if the valve fails but I don't know by how much.

Tim: Can we move the pressure tap to the back of the IVA gallery?

Carroll: Yes, we'll move ours too.

Gutzwiller: We'll have readings from the CAT ET or CAN.

McCord: I showed what SwRI was monitoring now from the CAT CAN feed on screen.

Gutzwiller: If there are differences in any of these at different labs would that mean the engines are running differently?

Mark: Not really.

Gutzwiller: In past experience we have had differences and the manufacturers have found that the ECU flash has been slightly different.

Gutzwiller: Other discussion?

McCord: 180 minute moving average of frequency.

McCord: We are calculating on the fly an average.

Demetrius: We could do that.

Tim: I am not sure if we can do that. We record it at 1.5 second for our flight data recorder.

McCord: Ours looks at the data at 1000 Hz. Updates formulas at 100 Hz.

Tim: Can't we do it the way we do it now? It would be a lot of trouble for us to change.

McCord: You read 1 Hz data?

Tim: No I just get a snap shot. So I ran a 6 point running average. Jim C is right there is noise in the sensor so there is damping in the transmitter.

Sean: Is there a way to get 1 second data just for that channel?

Carroll: Yes but 50 hours of 1 second data is a huge file.

McCord to Tim: Can't you write formulas into you DAQ?

Tim: Yes but I don't know if we can do this averaging easily.

Gutzwiller: Tim has been running with snapshots averaged over 3 minutes. Unless Tim finds he can do something different we should take the raw data.

Gutzwiller: About the averaging, start on the 6th data point and moving forward to the last point.

McCord: First data point is single, second is average of 2, etc.

McCord: When do we expect to get started?

Gutzwiller: Ask the labs.

McCord: When do we get assigned the reference oil?

Gutzwiller: Are you ready? We decided to run 833 and stop and move on from there.

McCord and Carroll: We are ready.

Gutzwiller: Lubrizol?

Demetrius: We are starting our shakedown tomorrow or Friday. Full shakedown mid-week March 26.

Tim: I can recalculate my calibration set offset.

Gutzwiller: First run 833, stop, discuss, then run 832.

Hind: Will there be a list of items necessary before starting?

Tim: Jim Carroll you need to take a raw data point not an average.

Elisa We need the data reported from Lubrizol and SwRI like the data reported from Intertek.

Gutzwiller: Currently the data on the TMC website is incorrect. Because the Emerson coefficients were changed.

McCord: Are waiting until the 26th to order the oil?

Gutzwiller: You can do the verification/calibration ahead of time if you order now. Intertek is not running now.

Hind: Is there a timeline?

Gutzwiller: First week of April the data would be compiled and compare labs to each other. Then issue the next set of reference oils.

Gutzwiller: We need to let the rest of the panel know when we start the reference tests.