

April 18, 2016

## Caterpillar Surveillance Panel Conference Minutes

### Attendees:

Hind Abi-Akar – CAT - Host  
Jim Gutzwiller -  
Greg Miranda – Lubrizol  
Jeff Clark, Sean Moyer – TMC  
Caroline Laufer – Infineum  
Tim Rutherford  
Kevin O'Malley  
Elisa Santos  
Bob Salgueiro – Infineum  
Mark Jarrett – CAT  
Jim McCord - SwRI  
Jim Carroll – SwRI - Secretary  
Andrew Stevens, Bill Larch – Lubrizol  
Mey Dewey  
Mark Cooper – Chevron/Oronite  
Jim Moritz –  
Mark Jarrett – CAT  
Mike Alessi  
Bob Campbell  
Tim Griffin – Intertek  
Robert Stockwell

### **Agenda Items**

- The C13 procedure is unclear on how to handle the oil consumption regression if there is a shutdown. The procedure says to not include 4 hours of values after a shutdown, but nothing about using weighted segments like other procedures.

Need to clean up the procedure wording to describe the time-weighted method. Need to send an Information Letter once description is updated, use the 1P or T12 descriptive paragraphs. Mey volunteered to do the write-up and send it to the panel, along with an e-mail ballot for approval.

- There is disagreement of report precision of results between the report, merit calculation and limits table. The procedure (Table A8.2) says report deposits to 0.1 rating units and the report has 0.01 rating unit, but the merit table has whole number values for limits. Oil consumption is similar with 0.1 in the Table A8.2 and the report, but whole numbers in the merit table for limits.

Jim Rutherford thought that we should round as you go along, so that users can re-create results. Users cannot recreate the value if precision truncates values. Data dictionary has field lengths that define precision.

D4485 has a defined precision which is whole number. Option is to use its precision for the report and calculate merits.

Section A8 says report to 0.1 g OC. Option is to round to extra decimal for calculating merits, but use the less precise number for pass/fail.

Q? Does 53.2 pass or fail if the limit is 53? SwRI is set up to fail if 53 is surpassed at all.

A8 section may need to be updated. Tables A8.2 and A14 need to be addressed.

Section 13.1 shows how to calculate results.

Deposits results are in whole numbers, OC is to 1 decimal place.

Jeff? Noted that everyone should stop carrying unseen precision in all calculations. i.e. Round OC per segment to one decimal, and use it in all subsequent calculations.

All labs should use ASTM rounding, as called out in the procedure.

Needs a vote, information letter, and form change (Beta test).

Conclusion: Cannot be resolved today. How does it affect CF, SA, pass/fail, and acceptance range calculations. Could lose resolution for all results.

Hind. Should we have a single meeting to resolve this, and clarify the intent?

Panel resolved to table this concern until the in-person meeting in a couple of weeks (May).

"We'll have someone put together options." Unassigned quote.

- The title for Table A8.1 is not correct.

Get rid of note regarding mass loss. Change to "Significant Digits for Operational Parameters"

- How do we handle reporting oil consumption when there was a leak or confirmed turbo effect on OC? Can we adjust the OC data somehow to remove the influence of the leak or bad turbos?

It is handled now by a note in test report, we could show pre- and post-leak rate change.

How do we bound this? C13 has emergency add provision.

Jim McCord - Historically we have not made adjustments for a leak, or any other reason for high oil consumption such as loss through turbo and subsequent replacement of turbo.

We usually put a comment in if there is a definite change. Many oil leaks are not as discreet time-wise, so how do you do it?

Mey – If there is a dramatic OC change after hot shutdown, with a repair or other change made due to the shutdown, then we could calculate the OC slope change and set a limit, to assess if the change is allowed, or not.

Action item: Bring examples of when, and when not, to allow it. How do we account for it? Define how to handle it.

- 1N/1K humidity calibration instrument. The current procedure specifies a chilled mirror. I believe with the new technology we should be able to use something else with similar or better accuracy. It would be nice if we could extend the 24 hr. period as well.

Not discussed

- System-Calibrate the primary humidity measuring system during the first 24 h of each stand calibration test with a chilled mirror dew point hygrometer having an accuracy of  $\pm 0.55$  °C at 24 °C dew point and moisture content in dry air of 6.06 g / kg. Perform additional stand calibrations when ambient temperature and ambient humidity conditions differ from the last semi-annual ambient test condition to ensure that the stand humidity remains within test requirements

Not discussed

- C13 TEST Missing an Oil Sample = Looking into the procedure, there is some interpretation involved in determining that a missed sample actually renders the test "invalid." Also, from an engineering perspective it's my opinion that one missed sample will not negatively affect the outcome of the test and I believe others may share this opinion. My recommendation would be that we add a line in the procedure to handle missed samples with an engineering review to determine test validity.

This happened on a 1N also. Suggestion: If you miss a sample collection, take one at your earliest convenience. If a sample is lost what do you do?

Conclusion: This issue is not just associated with oil samples. It cannot be resolved at this panel's level.

- COAT = Micromotion calibration by manufacturer may not cover the temperature range we use in the test.

Greg Miranda showed the Lubrizol experiments with Micromotion internal temperature readings. Lubrizol found a significant effect of MM internal temperature calibration (offset from actual oil temperature was  $\sim 4$  degC.) Caused a 1.4-1.7% difference. When temperature reading was corrected two different tests with two different MMs got much closer results. Modulus of elasticity of SS rod is affected by temperature. It is not calibrated by MM, and not adjusted by MM.

Conclusions: Internal temperature reading affects both density and volumetric flow.

Older MM are affected, new MM are not affected.

New units respond faster.

Older units were used for the precision Matrix.

Goal: Reduce test-to-test variability.

Proposal: Confirm Lubrizol observations.

Recreate the earlier Lubrizol tests at both labs on the last candidate oil before reference. Perform large temperature swings, and pressure swings.

Later we may do full tests with and without temperature adjustment with similar oils at two outside labs.

Comment: All earlier data is suspect.

Response: Does not change oil ranking within a lab.

Comment: Making the adjustment to temperature, or switching to a new unit, can be compensated for by severity adjustments over a few references.

Would like to get data before the May meeting.

If calibration changes are needed then a correction factor (SA?) can be used, rather than changing targets.

Comment: 3-4 tests need to be done on oils to come up with a matrix.

Suggestion: Rather than run the Lubrizol oil, run a reference right after the experiment.

Comment: Candidate quality is the most important aspect of the discussion. Candidate companies need to be made aware of this concern.

Question: Should we all buy the latest model MM?

Hind: Do we have a motion for the next step?

See the attached next step proposal.

“All the labs will run the experiment described on the next candidate oil after the fifty hour candidate oil test. Calibration period will end at the end of the test. Then a stand calibration will be required. No net gain or loss for the calibration period.”

The panel will adjust next reference period(s) such that no net gain or loss from the early termination of this reference period.

Comment: There is a system in place to account for a shift occurring due to changes made after the experiment.

Hind made the motion to perform the next step. Jim McCord seconded it.

Mark? called a vote for any opposed. None opposed. TMC waived. Motion carried.

We will try to have a meeting next week to discuss any test results.

Jim Gutzwiller will setup the face-to-face meeting for 1:30pm May 4.

- Engine Hardware

CAT is producing new C13 liners: There is a materials change to control graphite, will use centrifugal casting, work will be done on a new machine line, and will have a new part number. Internal validation is ongoing. See attached CAT presentation material.

Reason for the change to the test is to keep C13 in line with production.

Current liners will be available through 2016, and new liners will be available Q2/Q3 2016.

Specs will not change, but surface will be examined more accurately, rather than by eye.

Proposal: Use liners in upcoming scheduled reference tests.

Can we align reference tests to provide multiple data points?

Action Item:

Laboratories are to estimate due dates for the next references to coordinate delivery and availability of liners by CAT. Bring this information to May's face-to-face meeting.