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COAT Micromotion Sensor Density Calibration Procedure

8.3.1.4 Calibration of FDM:

(1) Calibrate the Micro Motion FDM before every reference oil test using the procedure outlined in Annex A16.

**A16. Flow Density Meter Calibration Procedure**

A16.1 *Overview* - The goal of this procedure is to calibrate individual Micro Motion (MM) sensors to match the ASTM D4052 determined density of a standard oil. The standard oil for this procedure will be the currently accepted COAT reference oils as outlined in the LTMS document. This procedure uses linear regression to compare the D4052 densities to those measured with the sensor at similar temperatures. The slope and intercept from the linear regression are incorporated into the data acquisition system and these values are included in the test report.

A16.2 *Calibration Procedure*

A16.2.1 Use a 2013 or newer CMF025M with Emerson temperature compensated calibration and paired transmitter that is shown to be in good working order by Emerson Processing – Micro Motion Division.

A16.2.2 Input all Emerson supplied meter calibration coefficient values into the Transmitter using a Hart Communicator, or other device. These coefficients may not be adjusted unless the sensor is recalibrated by Emerson.

A16.2.3 Set the Micro Motion Density output range from 0 g/mL to 1 g/mL

A16.2.4 Record the values of the initial slope and intercept.

A16.2.5 Initial calibration of each device will require setting the density flow meter data acquisition slope and offset to 1 and 0 respectively. Only first-order corrections are allowed. Slope and offset is applied to calculated density from the tube period.

A16.2.5.1 Per Section 10.2 through 10.2.5 *Aeration Pretest Procedure* run two flushes of reference oil to remove hang-up from previous fluids and use a CAT 1R-1808 fresh filter with the first charge.

A16.2.5.2 On the third and final charge, use a new approved batch controlled oil filter. Run the engine for 5 minutes at idle to flow the newest oil through the aeration measurement circuit (lines, sensor, and pump). After 5 minutes, stop the engine and leave it off until the all the next calibration steps are complete. This will add an extra 5 minutes of warmup time to a reference test.

A16.2.5.3 Obtain D4052 density data from your laboratory at the intervals outlined in the COAT procedure and verify that the linear R2 is greater than 0.9999. These data will be used to set the DAQ’s new slope and intercept.

A16.2.5.4 Set the sensor enclosure temperature controls to target the average of sensor in and sensor out temperature to 50°C ±2°C of target. The enclosure and measured oil temperatures must be stable ±0.50°C for at least 30 minutes. Record MMinTemp, MMoutTemp, MMPeriod, MMRTDTemp at 1Hz for 120 seconds and average it. Note: This target setting and stabilization period can take several hours and the temperature is not stable if rising or falling within the 30 minute stabilization window.

A16.2.5.5 Repeat A16.2.5.4 and target 60, 70, 80, and 90°C.

A16.2.5.6 Using linear regression calculate the DAQ’s New Slope and Offset using the calculated density readings and the D4052 Density values. Report these coefficients on the appropriate report form.

A16.2.5.7 A calibration must occur during the first reference attempt. A new calibration does not need to be done in the event of a re-run of a failed reference test. A change in measured density of 1.0% or more at any of the target temperatures will require change of the DAQ’s slope and intercept. Repair of the flow density meter is required if the density measured is more than 2% different from the D4052 value.

* 1. For example, a reference oil has a D4052 value of .8392 g/mL at 70°C. If the new calibration coefficients produce a shift of more than .0084 g/mL, the coefficients must be changed. If the shift is more than .0168 g/mL at 70°C, the sensor and transmitter must be evaluated by the manufacturer.

A16.2.5.8 Any change to the slope or intercept will immediately terminate the calibration period.