

Understanding the Sage Metering Calibration Verification

Any thermal mass flow meter is factory calibrated to relate the operating power to mass flow. Calibration requires a NIST traceable flow calibration fixture. It is virtually impossible for the user to calibrate a thermal mass flow meter in the field thus requiring return of the flow meter to the manufacturer for periodic re-calibration if needed. This can be an expensive and time consuming procedure frequently requiring the user to purchase a second flow meter; in addition the re-calibration costs can become expensive.

Many users are used to calibrating or checking calibration of the various instrumentation in their facility. This is desired to meet the Company's internal operational procedures or meet appropriate regulatory requirements; this is especially common when the flow meter is used for measuring and reporting emissions to regulatory authorities or reporting Green House Gas emissions (See Sage white paper on Greenhouse Gas Emissions Monitoring Using Thermal Mass Flow Meters)

Various manufacturers of thermal mass flow meters have recognized the difficulty in field calibrating a thermal flow meter and have developed methods for verifying the calibration in the field. Ideally any procedure will check both the sensor and transmitter and the test can be performed without removing the sensor from the pipe. These different methods include:

- 1) Removing the sensor from the pipe into a special compartment and isolate it from the flow path. Using an external source of bottled gas, flow a known amount of a reference gas past the sensor. Repeat multiple times and compare data against data obtained during initial calibration.
Advantages – checks both sensor and electronics against known reference
Disadvantage – expensive hardware, unable to add hardware at later date, cumbersome, requires additional initial factory calibration data on the process gas and the reference gas.

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- 2) Take unit out of service and keep in the pipe. Isolate the flow signal from the sensor and simulate external signal. Vary signal (power) to the sensor elements; transmitter then evaluates electrical output giving a pass/fail message.
Advantage – no extra hardware required, can be done in-situ
Disadvantage – only test electrical signal and electronics. Does not check sensor operation or if sensor clean. Many field difficulties with thermal mass flow meters is due to build up or sensor issues which this test does not check.
- 3) Remove unit from pipe. Isolate the sensor and connect transmitter to a computer. The computer sends the flow meter a known signal and then confirms that transmitter output matches expected value. Requires computer and purchase of special software
Advantages – none
Disadvantage – only test the electronics verifying that output matches calibration curve. Does not check sensor operation or sensor drift.
- 4) Remove sensor from pipe. Test operation under no flow and simulated high flow condition using a water bath. Results must compare to data obtained during original calibration.
Advantage – checks both sensor and electronics at known values
Disadvantage – must remove flow meter from pipe
- 5) Withdraw sensor and isolate it from flow. Compare zero flow signal from the flow meter with original calibration data.
Advantage. No special equipment required. In-situ test can be performed while process is in operation. Checks both sensor and electronics. Verifies that operating zero flow data point matches calibration curve. Due to resolution of signal and stable zero flow data point, any offset at no flow would occur throughout curve. If the zero flow data point matches original calibration data, the user can be assured that the performance has not shifted.
Disadvantage: None

Only one test fits the desired requirements of an in-situ test, checks performance of entire flow meter (sensor and transmitter) and does not require any additional hardware. To further simplify the test, the zero flow signal is shown on the nameplate thereby eliminating the need to look up original calibration documents.

This test method is developed by the innovative and creative minds at Sage Metering. Look to Sage Metering for advanced developments and new technology for thermal mass flow measurement.