

Benefits of a global calibration procedure

Dean Standiford, manager, Global Calibration Quality at Emerson Process Management, explains why reference standards and procedures for calibration should be applied on a global basis to ensure flowmeters have the same calibration accuracy wherever in the world they are produced or purchased.

Throughout the world, process manufacturers using flow and density measurement devices should be seeking ISO/IEC 17025 accreditation for the added assurance that the products they purchase and install will meet expectations. Confidence in the technical competency of a calibration laboratory with ISO/IEC 17025 accreditation improves acceptance of goods exported internationally and can avoid expensive retesting when products reach their final destination.

ISO/IEC 17025 is the international standard for calibration. The standard specifies the general requirements for the competence to carry out tests and/or calibrations, including sampling. It covers testing and calibration performed using standard methods, non-standard methods, and laboratory-developed methods.

Device manufacturers will quote a level of accuracy in their technical specifications, but it can be difficult for process manufacturers with production and calibration facilities worldwide, to ensure that the flowmeters purchased will actually meet that specification.

One way to gain assurance is to better understand the procedures that manufacturers adopt for calibration. How do they establish their reference standards and are they traceable to international standards? Perhaps most importantly, how do individual manufacturers ensure these procedures and standards are applied globally across all calibration facilities in an organisation.

Emerson for example, operates multiple flow calibration centres for its Micro Motion Coriolis flowmeters at locations worldwide. As well as providing local support to customers, the centres perform liquid mass flow, density, and volume flow calibrations with mass flow uncertainties as low as 0.017% ($k=2$). Each calibration centre is able to provide traceability of its reference standards back to one, or more, national reference standards.

ISO/IEC 17025 requires calibration laboratories to follow the international standard, JCGM 100:2008 Evaluation of measurement data - Guide to the expression of uncertainty in measurement – commonly referred to as the GUM – when determining their claimed uncertainties, known as calibration and measurement capabilities (CMCs). These CMCs are documented in the calibration laboratories scope of accreditation issued by the accrediting bodies.

Emerson's Micro Motion calibration facility in Boulder, USA, has received ISO/IEC 17025 accreditation from multiple accrediting bodies, most recently: the National Voluntary Laboratory Accreditation Program (NVLAP), confirming Emerson's ability to perform accredited calibration of flowmeters. Similarly, Emerson's European Flow Centre at Ede, the Netherlands, has ISO/IEC 17025 accreditation from the internationally recognised Dutch Accreditation Council RvA. Emerson's Asia Flow Technology Centre at Nanjing, China has accreditation from the Singapore Accreditation Council (SAC-SINGLAS).

Additionally, Emerson's Mobrey facility in the UK maintains a calibration standards laboratory which is ISO/IEC 17025 accredited through the United Kingdom Accreditation Services (UKAS). Among other capabilities, this facility performs density and viscosity calibrations for Micro Motion density and viscosity meters.

To support these

and all production calibration facilities, the global traceability chain has evolved into a three tiered system that links Emerson back to: NIST, USA; VSL, the Netherlands; and NIM, China.

All accrediting bodies utilised by Emerson are members of the International Laboratory Accreditation Cooperation (ILAC), and signatories to the ILAC-MRA, which ensures global acceptance of the laboratory accreditation from one accrediting body to another.

Methods of quality assurance

Emerson's flow calibration centres utilise three methods for Quality Assurance of the flow stands, regardless of calibration method. Gravimetric systems utilise scales which are calibrated annually with weights, while Transfer Standard Method (TSM) systems utilise reference meters which are calibrated annually using Global Reference Meters (GRM's).

GRM's are the travelling measurement standards, which are installed in the 'unit under test' section of the TSM flow stands and are used to verify the calibration of the TSM reference meters. GRMs are calibrated at the Micro Motion facility in the USA, where the TSM process and primary gravimetric systems have been established for many years. The primary gravimetric systems offer mass flow uncertainties of 0.014% ($k=2$).

In addition, all calibration stands have a 'gold meter test' performed at frequent intervals to show the stand is not drifting with time. A 'gold meter' is a Coriolis meter that is used in the same manner as the GRM's, but more frequently.

Traceability back to National Standards is confirmed by ensuring that all calibration stands, whether TSM or Gravimetric, are compared using an inter-laboratory Coriolis meter, (similar to the GRM process). This means that a single size of meter is checked annually at other Micro Motion facilities as well as by National Metrology Institutes.

Emerson's production calibration stands have different flow rate capabilities and may utilise different references, but all follow the same calibration concept. The 'unit under test' is calibrated and adjusted to the reference by determining its flow calibration factor, (this is the factor used to convert meter output into mass flow). Then the calibration stand, with its automated programming, checks the flow performance of the unit by comparing it to that of the reference.

By using Micro Motion Coriolis flowmeters as traveling measurement standards, transfer reference standards, and inter-laboratory comparison meters, Emerson has developed a process for maintaining traceability of its calibration stands globally. The result is that when customers install a flowmeter that has been calibrated at any of its calibration facilities, performance will meet the published specification irrespective of where it was manufactured.

