SENSIA
Rockwell Automation + SLB

+ CASE STUDY

Advanced master meter proving systems for verification of fiscal and custody transfer assets across Kenya

In-situ verification by high performance liquid Ultrasonic meter technology

Challenges

+ Regulatory Compliance: Required to comply with Local Weights and Measures Kenya and applicable international standards.
+ Master Meter Precision: Minimize uncertainty and avoid any measurement bias.
+ System Pressure loss Optimization: Balance overall system pressure loss and ensure sufficient back pressure to prevent any potential for cavitation across a diverse range of installations and fluids.
+ Verification & Stability: Designed for long term stability minimising the requirement for prescriptive reverification.

Key highlights

+ The Caldon LEFM 280Ci resides at the heart of the mobile master meter proving system delivering a robust solution.
+ High accuracy solution for in-situ verification of the Meter Under Test (MUT).
+ Capable of verifying multiple installations throughout Kenya the solution ensuring that the MUT is not only traceable to local and international standards but that the duty meters are also performing within agreed contractual obligations.
+ The LEFM 280Ci has a global track record spanning over two decades in being deployed across a wide range of applications and process conditions for high accuracy master metering.

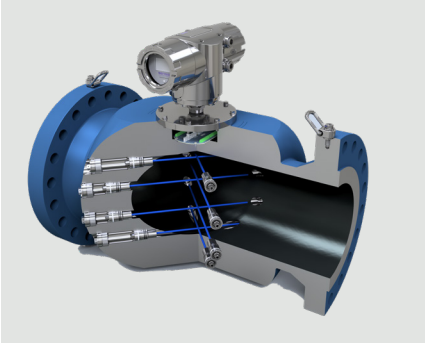
The deployment of Caldon's LEFM 280Ci Eight-Path Liquid Ultrasonic Flowmeter in a mobile master meter proving system addresses a customer's fiscal and custody transfer verification challenges in Kenya. Collaborating with our local partner, Royal Automation of Kenya, the solution ensures compliance with stringent local and international standards whilst reducing uncertainty and improving operational efficiency. Our LEFM 280Ci full bore meter is equipped with our patented coating, which features anti-adhesive and anti-corrosion properties, offering a combination of reduced system pressure loss and long-term measurement stability. The result is a reliable, portable system enabling in-situ verification of meters across a diverse range of sites, minimizing financial exposure whilst meeting contractual agreements and ensuring traceability of critical assets.

Product Name

+ Caldon LEFM 280Ci Eight-Path Liquid Ultrasonic Flow Meter
+ 12-inch Mobile Master Meter Run
+ 8-inch Mobile Master Meter Run
+ Two 6-inch Master Meter Run
+ Proving Flow Computer with Touchscreen HMI

Result

The solution offers significant operational advantages whilst enabling the verification of a wide range of duty meters in-situ across multiple sites. The superior installation performance of the LEFM 280Ci, combined with the BFC, delivers a high-performance, low-uncertainty master meter proving system with minimal system pressure loss. Its robust design and long-term stability ensure traceability of the duty meters, while also reducing the frequency of required master meter calibrations.



Solutions

To address the application requirements the Caldon LEFM 280Ci was selected for this project, offering:

1. Lowest Uncertainty and Superior Installation Performance:
   Our LEFM 280Ci is a true eight-path configuration using crossed paths in each of four chordal planes to effectively cancel the effect of non-axial velocities and accurately integrate the axial velocity profile. The meter is OIML R117 Class 0.3 certified with a minimum requirement of 5D upstream without the need for flow conditioning, however, to remove any varying hydraulic influences owing to the orientation of the flexible hoses the LEFM 280Ci has been used in conjunction with our Brownian Flow Conditioner (BFC).
2. Reduced System Pressure loss:
   Conventional thick plate conditioners typically employ annual circular passages to achieve the required graded resistance to achieve a desired flow profile, however for these plates the pressure loss co-efficient is in the range of 2-5. The high performance BFC was specifically developed based on segmented annual passages producing a conditioner that will retard swirl and have a desired radial distribution of resistance, in combination with a specified overall pressure loss of K = 0.55. The BFC ensures that the overall system pressure loss is optimized for operational efficiency.
3. Long Term Stability:
   Caldon provided 8 years of stability data for the LEFM 280Ci. These calibration results were presented to demonstrate meter stability over a period. These results demonstrated that the meter factor remains within +/- 0.07% over a long period of time, approaching eight years. Relative to the meter's specified linearity and accounting for the uncertainty of the reference calibration system (+/- 0.04 %), these results demonstrated that there is no inherent need for periodic recalibration over this time scale.
4. Longevity:
   The largest impact on the long-term performance of an ultrasonic meter is corrosion and contamination or deposition that result in changes in cross-sectional area, path lengths or path angles. In this instance, a carbon steel meter was specified by the operator, and as these meters would be exposed to a range of different fluids, depressurized and exposed to a range of atmospheric conditions. It was prudent to ensure that the master meter was of a robust design. For carbon steel meters, as an option, Caldon apply a field-proven and patented internal coating to the meter I.D and transducer faces, which significantly reduces or eliminates the risk of corrosion and contamination. The coating has anti corrosion properties, high thermal stability, chemical inertness in aggressive environments, and superior adhesion resistance. This solution has been tested in a wide range of conditions and has been employed by CALDON for more than 10 years including challenging applications, such as crude oils with high paraffin content.

The solution included 12-inch and 8-inch mobile master meter systems, along with two 6-inch master meter runs, covering a range of flow meter sizes across multiple sites.