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CALIBRATION PROCEDURES AND UNCERTAINTY ANALYSIS FOR A THERMAL MASS GAS FLOWMETER OF A NEW GENERATION

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ABSTRACT

This paper deals with the differences between traditional and new technology gas meters, and focuses specifically on the calibration procedure and uncertainty evaluation of CTTMFs (Capillary Type Thermal Mass Flow Meter). In particular, measurements performed on a sample set of commercial CTTMFs for natural gas in domestic/residential (G4) applications allowed to evaluate the modifications to calibration procedures required by the new generation, digital, gas flow meters. Indeed, traditionally natural gas is metered by means of volumetric measurement techniques, while the modern, static gas flow meters (thermal and ultrasonic ones) are based on electronic flow sensors. This implies that the gas volume through the meter is measured by sampling the flow rate at selected time points and integrating the flow rate in time. The measurement time becomes therefore an important parameter, thus requiring a thorough rethinking of the calibration procedure. In order to analyse the effects of the various parameters, a series of ad-hoc calibrations were performed. Specifically, one set of calibrations was performed with constant totalized volume, while the other required a constant measurement time. In order to highlight the novelties that will have to be implemented in ordinary calibration procedures to get the best of the new technologies, the two procedures as performed on a sample set CTTMFs will be compared; the theoretical (generic) evaluation of the associated uncertainty will also be presented. Measurements were carried out at the test facility of INRIM, the Italian National Metrology Institute,