Development of a calibration system for water meters close to real world conditions

D. Schumann[1], G. Wendt[2], J. Tränckner[3]

[1]PTB – The National Metrology Institute of Germany, Daniel.Schumann@ptb.de, Braunschweig, Germany
[2]PTB – The National Metrology Institute of Germany, Gudrun.Wendt@ptb.de, Braunschweig, Germany
[3]The University of Rostock, Jens.Traenckner@uni-rostock.de, Rostock, Germany
E-mail (corresponding author): Daniel.Schumann@ptb.de

A growing awareness of environment as well as consumption leads to rising and novel requirements on flow metering technology, e. g. higher flowrate ranges, smaller measurement uncertainties and calibration procedures more orientated to the actual requirements of further use. This means a changeover from ideal stationary calibration conditions to realistic measurements and a demand for meters which operate precisely under the real working conditions.
As an example, realistic conditions, especially the patterns of real water demand, differ fundamentally from the existing test procedures of water meters (prescribed for instance in the existing documents in legal metrology like OIML R49) at well defined, reproducible reference flows. In real world, a daily profile of water consumption is characterized by short water tappings, overlays of different tapping events, varying flank increases, leakage and stagnation. The main purpose of the investigations described is to develop both - highly realistic calibration procedures for water meters based on real water consumption profiles as well as the physical opportunities to generate it. Based on the analysis of water consumption measurements at more than 300 German households and of several international consumption profiles, realistic flowrates and flowrate sequences can be identified. To simulate such highly variable flowrates, a device-related test setup using cavitation nozzles has been developed. With the test rig it is possible to generate reproducible dynamic flowrates also under laboratory conditions. The corresponding behaviour of different water meters at the simulated consumption profile is recorded electronically and traceable to a gravimetric standard. First results show remarkable differences in the behaviour of the water meters in dependence on the different realistic profiles used. In addition, laser Doppler anemometry (LDA) has been used to determine the real time behaviour of the flow during the different calibration sequences. It could be shown that there occur short-term surges in the water column when the flowrates rapidly change.