Recalibration of a volumetric test facility for flow rates between 0.6 m³/h and 120 m³/h

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The department of Liquid Flow at PTB operates a test facility for the calibration of flow meters in the range between 0.6 m³/h and 120 m³/h. The test fluid is white spirit. The test facility belongs of four separate volume tanks with capacities of 5000, 1000, 200 and 100 litres, respectively. For the final filling stage of the tanks the liquid level can be detected by manual meniscus reading. Additionally, at the 1000 litre tank the liquid level is measured gradually by using a magnetostriction displacement sensor. For traceable gravimetric calibrations of flow meters a balance system with a maximum weight of 500 kg is also installed.

The aim of this study was to evaluate the proven uncertainty of the facility (0.05 %, k = 2) by a recalibration of the volumetric standard tanks. In a comparison between a gravimetric and a volumetric method, the best practise procedure was determined and discussed.

The practised calibration procedures are based on the EURAMET guidelines “cg-19” [1] and “cg-21” [2] in order to calibrate the tanks by a gravimetric method and, respectively, by a volumetric method. For the volumetric calibration the filling method was applied by using a 100 litre traceable pipette. For the gravimetric method a special installed high resolution balance system (max. weight 100 kg, resolution 1 g) was used.

Results show a high comparability between the both calibration methods as well as for the repeated measurements of each method. We found, that the highest source of measurement error is the manual meniscus reading in combination with resolution of the manual level scale. Our presentation will show the final results, including an overview about the developed uncertainty budgets for the gravimetric and the volumetric method. The comparison of both methods will be presented to exemplify the advantages and disadvantages of the methods on this practical example of calibration a volumetric test facility.

References:

[1] EURAMET 2012: Guidelines on the determination of uncertainty in gravimetric volume calibration. Version 2.1(03/2012)

[2] EURAMET 2013: Guidelines on the Calibration of Standard Capacity Measures using the Volumetric Method. Version 1.0(04/2013)