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REPUBLIC OF SERBIA
Ministry of Economy
Directorate of Measures and Precious Metals

Directorate of Measures and Precious Metals

Installation for the high accuracy flow meter calibration with the weighing method

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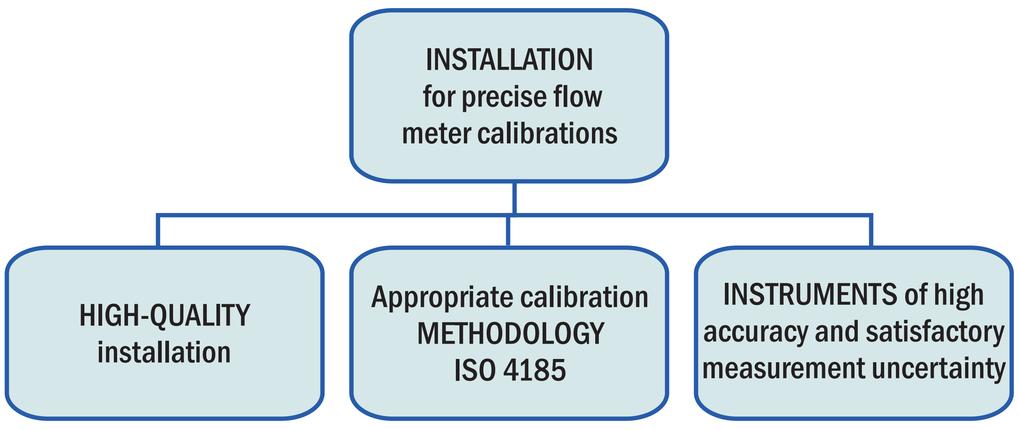
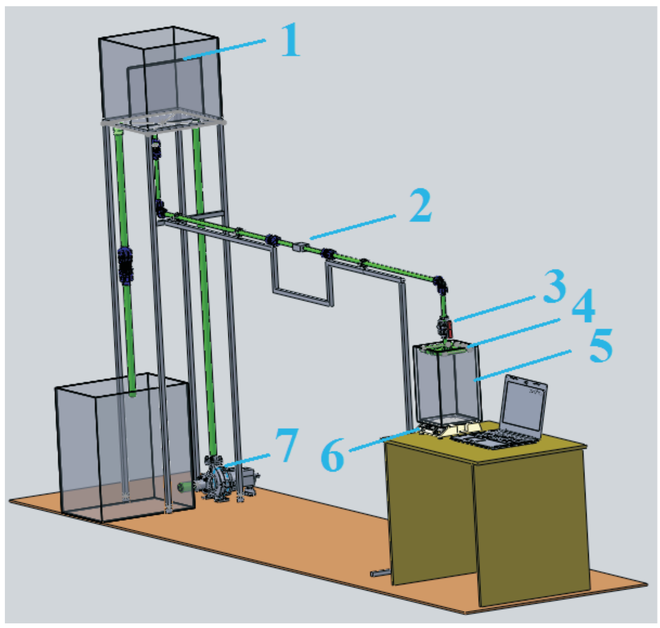
Installation requirements

Designed and assembled installation for flow meters calibration for measurement of liquid flow in closed conduits up to 10 l/min, based on weighing method.
Modified measurement methodology, which mainly follows standard ISO 4185.
The geometry of the whole installation is presented and afterwards used for numerical experiments.



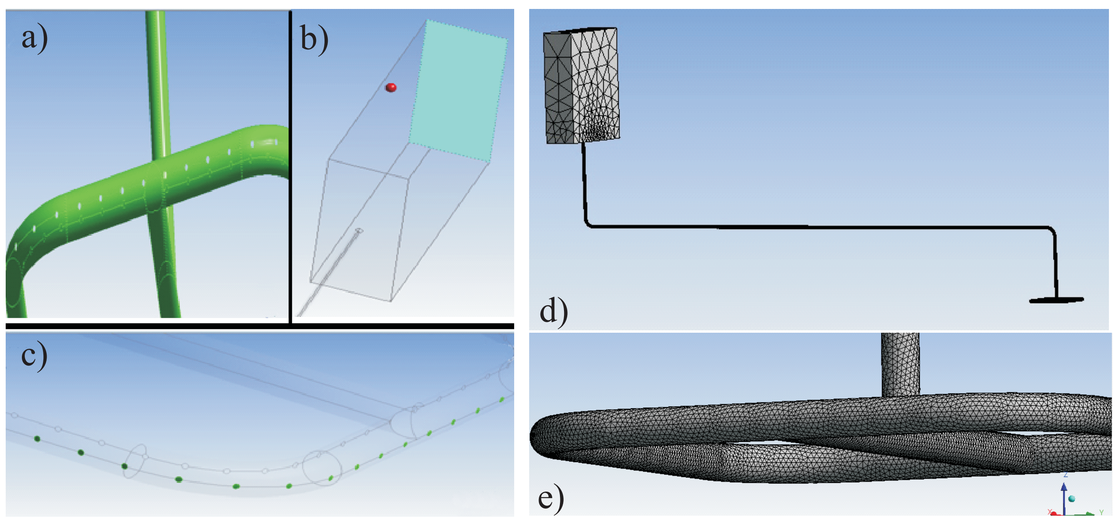


1 - overflow edge,
2 - flowmeter,
3 - valve,
4 - flow distributor,
5 - weighing tank,
6 - weighing machine,
7 - circulating pump.

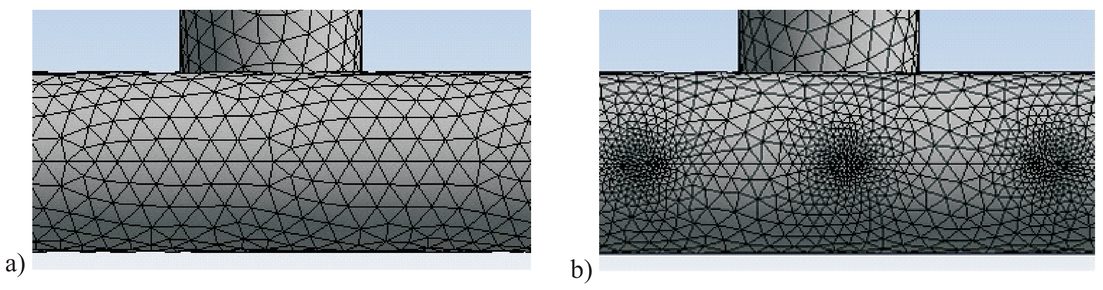
CAD 3D model of the installation for flow meters calibration

Numerical analysis of the flow in the installation

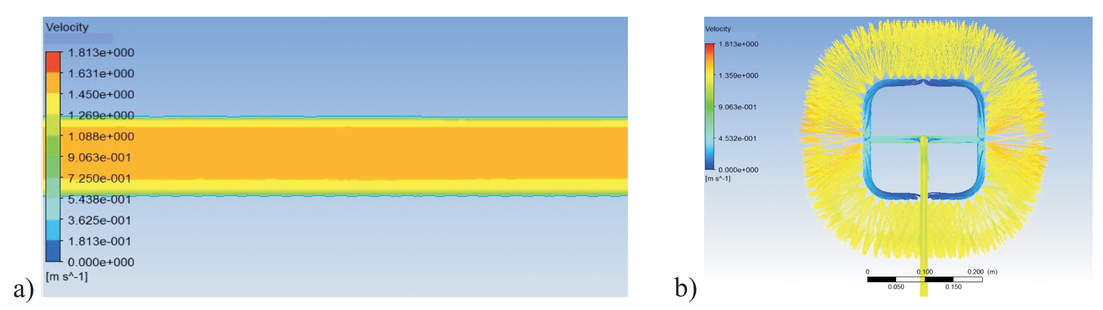
Two numerical meshes were tested. First approach had a half a million cells and the second mesh was consisted of approximately 1.6 million cells. Both meshes were unstructured.
Numerical results were used for installation test before manufacturing and assembling.



Geometry: a) wall b) inlet c) outlet and mesh: d) complete and e) flow distributor.



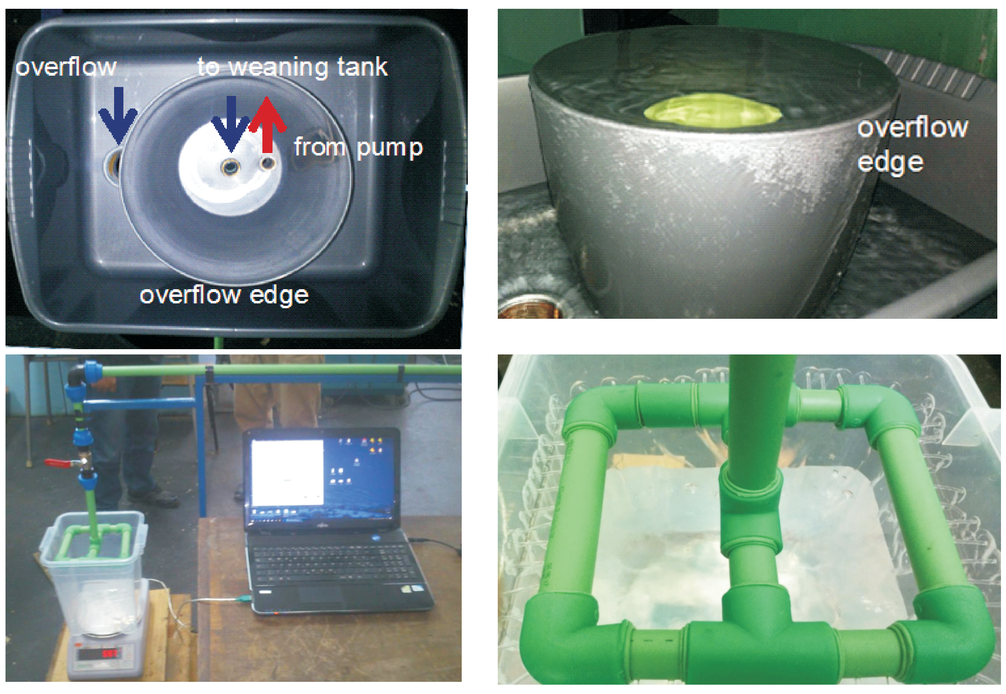
Meshes of flow distributor – outlet region: a) coarse and b) fine grids.



Velocity distributions: a) through the measuring section and b) outlet from the flow distributor.

Experimental installation

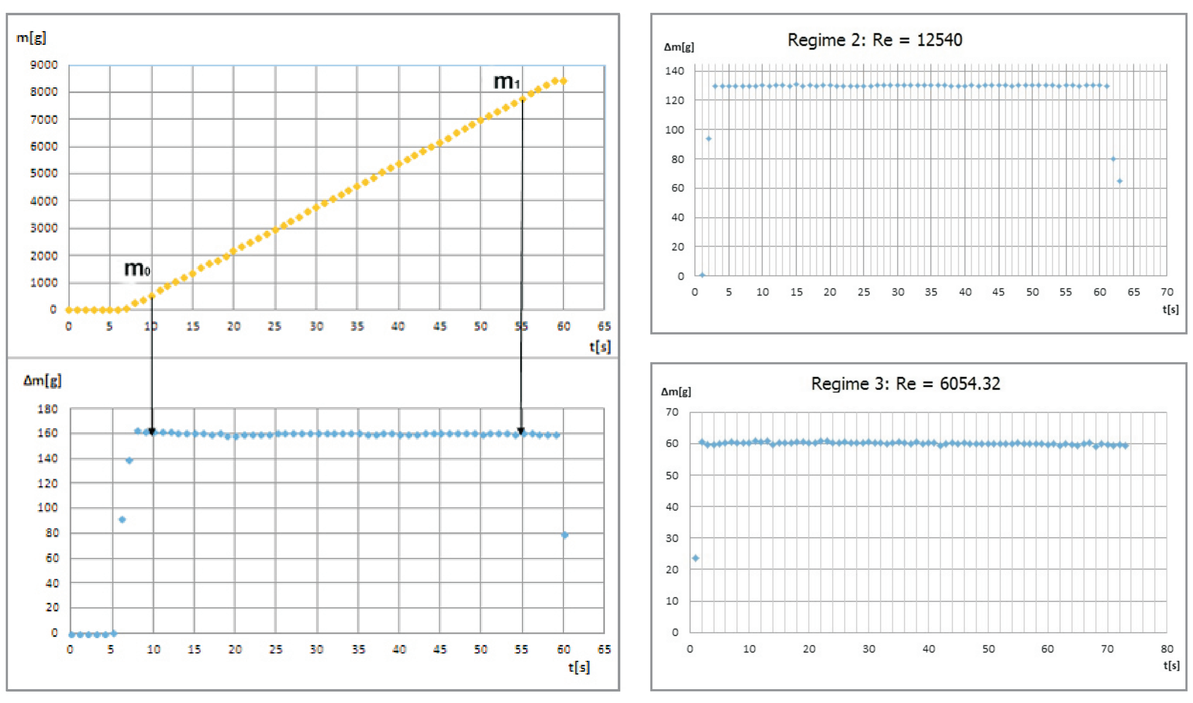
The test rig was manufactured after the numerical results evaluation.



The experimental test rig

Experimental results

Obtained experimental results and measurement uncertainty for three operating regimes were analysed and reported.



Regime I: Re = 15473.26

Systematic error: $e_s = \pm 100\sqrt{\left[\frac{(e_s)_b}{m}\right]^2 + \left[\frac{(e_s)_t}{t}\right]^2 + \left[\frac{(e_s)_d}{\rho}\right]^2}\ \% < 0.03\%$

It was proved, experimentally and numerically, that uniform, i.e. developed turbulent flow, was achieved in the straight measurement section. Developed and presented installation is adequate and should be accredited by the Accreditation body of Serbia. In addition, this is one of three developed installations at the laboratory of the Hydraulic Machinery and Energy Systems Department for volume flow rates up to 50 l/s and 200 l/s. So, this Laboratory should be recognized as the designated institute by the Directorate of Measures and Precious Metals, Ministry of Economy, Republic of Serbia.

Acknowledgment

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