

## 20<sup>th</sup> anniversary of the harmonized cubic metre

In this annual review of 2019 EuReGa likes to dwell on the 20<sup>th</sup> anniversary of the harmonized cubic metre. Further we will look back on the successful intercomparison of the primary standards for high-pressure gas flow measurement of Germany, Denmark and The Netherlands. The EuReGa MoU Annexes are all complete now, which is an important step in EuReGa’s quality management. Of course, new Intercomparisons are being planned. The next one is in 2020. Also, EuReGa is taking steps to expand the harmonised range up to 30000 m<sup>3</sup>/h.

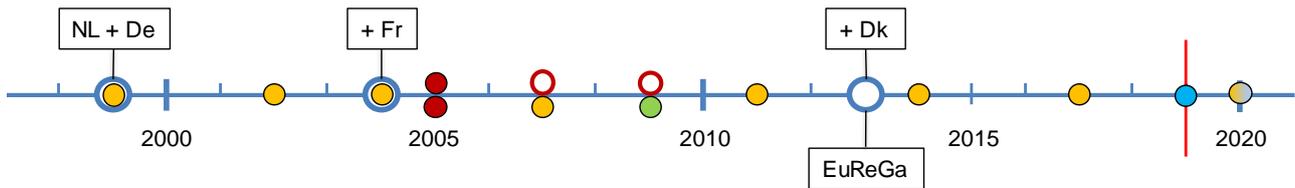


Figure 1: Updated timeline of intercomparisons using turbine gasmeters intended for high-pressure natural gas. The yellow dots indicate harmonization intercomparisons, the yellow-grey dots planned intercomparisons, the red dots key comparisons, the red rings subsequent bilateral comparisons, the green dot a EURAMET bilateral comparison, and the blue dot the primary standards’ intercomparison. The white flags mark the dates at which the labs participated in the harmonization consortium. In 2013 the cooperation was renewed under the EuReGa label.

### 20 years of harmonized m<sup>3</sup>

In 1999 VSL and PTB agreed in Dordrecht for the first time on the harmonized reference value for high-pressure natural gas. Since then more intercomparisons were performed and more partners entered EuReGa. A concise historical overview is given in the introduction of [1]. Figure 1 gives an updated timeline. The benefits of the past two decades are a reduction of measurement uncertainties and smaller differences between the participating laboratories.



Figure 2: Group picture in 1999 on the occasion of the agreement between PTB and VSL on the first harmonized cubic metre.

### Intercomparison of primary standards

In addition to the existing intercomparisons [1], the EuReGa experts’ team organizes an intercomparison to demonstrate the equivalence of the primary piston prover standards of the Netherlands, Germany and Denmark. With minor modifications to the pipework, it appears to be possible to make a direct intercomparison of the piston provers using the available DN100 packages.



Figure 3: One of the 4" packages used for the piston prover intercomparison.

The initially reported results [2] were reprocessed and published on the Flomeko in Lisbon [3] and at the North Sea Flow Measurement Workshop in Tønsberg [4]. The results show consistency between the results of the harmonization intercomparison in 2017-2018 and the piston prover intercomparison of 2019. The piston prover results show smaller differences between the laboratories than when working standards are used. 95% of the normalized differences are less than unity, which supports the CMC claims of the laboratories. The transfer packages were also calibrated at PTB using atmospheric air. When the PTB turbine meter model is applied, these results connect

well in the Reynolds domain with the curves obtained with natural gas.

### EuReGa MoU Annexes complete

The cooperation between the National Metrology Institutes (NMIs) and Designated Institutes (DIs) on high-pressure gas flow measurement is formalized in 2013 by signing a Memorandum of Understanding (MoU). The signatories to this document, listed in Annex 1 to the MoU, are VSL, PTB, LNE and FORCE Technology. Annex 3 lists the procedure and method of data processing. Based on the experiences during the 2017-2018 intercomparison this document has been updated. And this year Annex 2: Evaluation of candidates for membership, has been finalized and agreed. Parties interested to be part of EuReGa can contact the EuReGa coordinator [5]. The most important requirement is that the candidate NMI or DI has a high-pressure traceability chain that is independent of the other participants.

This means that the Memorandum of Understanding on collaboration to facilitate a European Reference for gas metering (EUREGA) is complete now, which is an important step in the professionalization of EuReGa.

Although EuReGa documents are for internal use only, the contents of Annex 3 have been published in the open literature [1].

### Extending the intercomparison range

Currently, the range of harmonized flowrates is limited between 40 m<sup>3</sup>/h and 6500 m<sup>3</sup>/h. It is EuReGa's ambition to extend this range to approximately 30000 m<sup>3</sup>/h. Force and Euroloop already have facilities operating in this range and they will be accompanied by Pigsar which is extending its facilities with the construction of a new closed loop. To this end EuReGa aims to acquire a 24" ultrasonic flowmeter. The specifications were drafted, and three

manufacturers sent in quotations. In the beginning 2020 a formal decision on the meter acquisition is expected.

### Intercomparison in 2020

During the last meeting of the Team of experts the planning for the 2020 intercomparison was agreed. It was also agreed to register the intercomparison with BIPM as supplementary comparison (SC). The SC protocol is currently being written. It needs to be agreed on before the intercomparison starts. In addition, the traceability chains of the participating countries need to be recalibrated before the intercomparison measurements are performed.

### Conclusion

EuReGa looks back at a successful year and has a lot of plans for the years to come.

### References

- [1] Jos van der Grinten, Henri Foulon, Arnthor Gunnarsson, Bodo Mickan (2018): [Reducing measurement uncertainties of high-pressure gas flow calibrations by using reference values based on multiple independent traceability chains](#), *Technisches Messen*, Vol. 85(12), pp 754-763
- [2] EuReGa Communique No. 3 (2019): Intercomparison of primary high-pressure flow standards, EURAMET website: <https://tinyurl.com/y39lx5ud>
- [3] Arnthor Gunnarsson, Jos van der Grinten, Mijndert van der Beek, Bodo Mickan (2019): Primary Piston Prover Intercomparison Between PTB, VSL and FORCE Technology, [Proceedings of the 18<sup>th</sup> International Flow Measurement Conference](#), FLOMEKO, 26-28 June 2019, Lisbon, Portugal.
- [4] Jos G.M. van der Grinten, Arnthor Gunnarsson, Mijndert van der Beek and Bodo Mickan (2019): [An intercomparison between primary high-pressure gas flow standards with sub-permille uncertainties](#), 35<sup>th</sup> International North Sea Flow Measurement Workshop, Tønsberg, Norway, 22 - 24 October 2019.
- [5] EuReGa coordinator, see EuReGa-1 project page: <https://tinyurl.com/yb3t2twy>