**EMPIR Call 2016 – Energy, Environment, Normative and Research Potential**

Selected Research Topic number: **SRT-n15**
Version: 1.0

# Title: Extension of ISO wet-gas flow measurement standards


## Abstract

Wet-gas flow measurement is essential to enable the natural gas produced (which small quantities of water and oil - typically < 5 %) to be measured accurately. Most field measurements rely on Venturi tubes, deployed according to ISO/TR 11583:2012 and/or ISO/TR 12748:2015, however, these standards rely on data that cover only a limited range of conditions. Errors resulting from the extrapolation of data to industrial conditions can sometimes exceed 10 % and this is serious cause for concern given Europe‘s annual gas production (40 bn €). Consequently there is a need for traceable data and models relating to 3-component (oil-water-gas) and vertical wet gas flow, together with clearer recommendations on upstream straight-lengths.



## Keywords

Wet gas, allocation, fiscal allocation, Venturi, orifice plate, differential pressure, natural gas, flow metering


## Background to the Metrological Challenges

Flow measurement is crucial to the European economy as not only does it underpin the valuation of most traded fluids but it is vital for process, quality and environmental measurement and control. ISO/TC 30 identified a shortage of data and understanding to account for 3-component (oil/water/gas) wet-gas flow and specific, industrially relevant installation effects. Wet-gas flow measurement is extremely important to industry (such as sub-sea engineering) to enable the gas produced (flowing with small quantities of water and oil) to be measured accurately. Wet-gas metering is also required for monitoring production and changes within reservoirs, as well as process control of the downstream fluids at the lowest possible cost per unit of gas produced. To bring smaller gas fields into service (including shale gas) is necessary to measure the gas flowrate without having to provide additional costly separators, thereby improving European energy security. Accurate wet-gas measurement is also required to ensure fair allocation of gas production in shared pipeline systems at minimal financial exposure. Finally, it may be required for equitable fiscal allocation for taxation purposes.

Given the importance of wet-gas flow measurement, it is vital that the standards that govern it are accurate and trusted. However these standards have limitations as they rely on limited existing data and understanding. Existing recommendations are incorporated in two key ISO publications: TR 11583:2012 and TR 12748:2015. ISO/TR 11583:2012 and ISO/TR 12748:2015 only cover 2-component flow. ISO/TR 11583 only covers 2-component flow through horizontal Venturi tubes rather than 3-component flow. Moreover, some Venturi tubes used for wet-gas flow measurement have been installed vertically (for example to save space), and more would be installed vertically if accurate and reliable equations were available however very little public-domain data are available for vertical Venturi tubes. ISO/TR 12748:2015 makes reference to a Venturi orientation effect, but this is largely illustrative as the comparison between horizontal and vertical orientation is made for only one Venturi diameter ratio over a very limited range of other parameters. Further research is required to understand whether one orientation is better than the other. Moreover, there may be errors in measurements in the field due to inadequate upstream lengths, but at present there is no data on wet-gas installation effects with regard to minimum upstream straight-length requirements. The minimum straight lengths determined for single-phase flow are sometimes used, but may be inappropriate. There is also a need for greater harmonisation between the outputs of ISO TC 30 (Measurement of fluid flow in closed conduits) and ISO TC 193 (Natural Gas), which will be greatly assisted by addressing some of the data gaps identified here.


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## Objectives

Proposers should address the objectives stated below, which are based on the PRT submissions. Proposers may identify amendments to the objectives or choose to address a subset of them in order to maximise the overall impact, or address budgetary or scientific / technical constraints, but the reasons for this should be clearly stated in the protocol.

The JRP shall focus on metrology research necessary to support standardisation in 3-component and vertical wet-gas flow.

The specific objectives are

1. To provide base-line data, methods and models, for the measurement of 3-component (oil/water/gas) wet-gas flow using Venturi tubes positioned in both horizontal and vertical orientation across a range of experimentally achievable conditions deemed most important by end users and ISO/TC 30/SC 2 and ISO/TC 193/SC 3.
2. To establish and understand the influence of upstream straight-length on over-readings for the measurement of 3-component (oil/water/gas) wet-gas flow using Venturi tubes positioned in horizontal and vertical orientation and to recommend the minimum upstream straight-lengths necessary for a given uncertainty of measurement.
3. To contribute to future revisions of ISO/TR 11583:2012 and/or ISO/TR 12748:2015 by providing data, methods, understanding and recommendations to both ISO committees (ISO/TC 30/SC 2 and ISO/TC 193/SC 3). In addition, to ensure that the outputs of the project are aligned with the needs of ISO/TC 30 and in a form that can be incorporated into the standards at the earliest opportunity.

The proposed research shall be justified by clear reference to the measurement needs within strategic documents published by the relevant Standards Developing Organisation or by a letter signed by the convenor of the respective TC/WG. EURAMET encourages proposals that include representatives from industry, regulators and standardisation bodies actively participating in the projects.

Proposers should establish the current state of the art, and explain how their proposed research goes beyond this and EMRP JRP ENG58 MultiFlowMet.

EURAMET expects the average EU Contribution for the selected JRPs in this TP to be 0.6 M€, and has defined an upper limit of 0.8 M€ for this project.

EURAMET also expects the EU Contribution to the external funded partners to not exceed 30 % of the total EU Contribution to the project.

Any industrial partners that will receive significant benefit from the results of the proposed project are expected to be unfunded partners.

## Potential Impact

Proposals must demonstrate adequate and appropriate participation/links to the “end user” community, describing how the project partners will engage with relevant communities during the project to facilitate knowledge transfer and accelerate the uptake of project outputs. Evidence of support from the “end user” community (e.g. letters of support) is also encouraged.

You should detail how your JRP results are going to:

- Address the SRT objectives and deliver solutions to the documented needs,
- Feed into the development of urgent documentary standards through appropriate standards bodies, in particular ISO/TC 30,
- Transfer knowledge to the oil and gas sector.

You should detail other impacts of your proposed JRP as specified in the document “Guide 4: Writing Joint Research Projects (JRPs)”

You should also detail how your approach to realising the objectives will further the aim of EMPIR to develop a coherent approach at the European level in the field of metrology and include the best available contributions from across the metrology community. Specifically the opportunities for:

- improvement of the efficiency of use of available resources to better meet metrological needs and to assure the traceability of national standards

- the metrology capacity of EURAMET Member States whose metrology programmes are at an early stage of development to be increased
- organisations other than NMIs and DIs to be involved in the work

## Time-scale

The project should be of up to 3 years duration.

## Additional information

CEN/CENELEC identified this topic as one of their priorities. Details are available at http://msu.euramet.org/current_calls/pre_norm_2016/documents/SRT_related_CEN_priorities/cen_priority_17_2015.doc