



TC for Flow (F)
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1. General Aspects

The Technical Committee for Flow (TC-F) is concerned with issues that are relevant to industry, regulation and trade involving the measurement of fluid quantity and fluid speed and related measurements derived from it (e.g. energy). The measurement of fluid quantities focuses on the measures of water, hydrocarbon liquids, air and natural gas but also includes all other fluids and mixtures of fluids.

The first TC-F meeting was held in East Kilbride in 1988 with less than 10 participants. In Belgrade, on April 2016, 48 members from 26 different countries attended the last TC-F meeting. The TC-F community increases and, at the moment, there are 28 contact persons and 89 flow experts involved.

The TC-F members are very active in the development of flow research facilities but also in facilities for type approval and support for legal metrology in the respective countries. Routine work for industrial and laboratory costumers is also a big part of this community.

Furthermore TC-F became a type A liaison organization for ISO/TC 48 for the revision of the ISO 8655 (micropipettes) and a new type A liaison organization with ISO/TC28 is under preparation. A first contact with OIML TC8 – Measurement of quantity of fluids, in order to cooperate on OIML documents revisions, has also been made.

2. Projects

16 projects in terms of comparisons, guides and projects have been proposed the last year. 11 projects have been proposed, one bilateral comparison has been started and four projects have been completed (P1361 LNE-CETIAT - Bilateral comparison of liquid flow facilities from 0,5 to 30 m³/h (2016), P1353 IPQ - Volume comparison on Calibration of micropipettes – Gravimetric and photometric methods (2016), P1296 CMI - Inter-laboratory calibration comparison of a rotary piston gas meter G650, and P1291 VSL - Comparison between recently developed primary standards). These 16 projects are distributed as follows in 4 in gas flow, 5 in liquid flow, 5 in volume, and 2 in fluid speed.

Three new EURAMET guides are now under development:

- Guide on air speed calibration of solid anemometers
- Guide on the calibration, operation and handling of micropipettes, with the cooperation of several manufacturers
- Guide on the harmonization of the uncertainty budgets and calibration methods for liquid flow standards

3. Comparisons

The EURAMET TC-F members are very active at within the BIPM key comparison (KC) level field, where 5 of 6 KCs were organized by EURAMET TC-F members and the European participation was also significant.

A second round of KC is now running. There are 4 ongoing KCs in the subfield of flow at the BIPM/KCDB:

- CCM.FF-K1 – Water flow

- CCM.FF-K2 – Liquid hydrocarbon Flow
- CCM.FF-K3 – Air Speed
- CCM.FF-K5 – High pressure gas flow

Two KCs were concluded in 2013/2015:

- CCM.FF-K4 – Liquid Volume
- CCM.FF-K6 – Low pressure gas flow

There are 8 BIPM/EURAMET supplementary comparisons in the field of fluid flow:

- EUROMET.FF.M.S1 - Comparison of piston and bell provers (2008)
- EURAMET.FF.M.S2 - Comparison of water flow calibration (2013)
- EUROMET.FF.M.S3 - Low pressure gas flow (pressure < 4 105 Pa)(2008)
- EUROMET.FF.M.S4 - Air Speed (2008)
- EUROMET.FF.M.S5 - LDA-based intercomparison of anemometers (2013)
- EURAMET.FF.M.S6 - Comparison of methods and results for the calibration of a 1000 L proving tank
- EURAMET.M.FF.S7 - Comparison of primary standards for liquid micro flow rates (2014-2015)
- EURAMET.M.FF.S8 - Comparison of calibration of 50 ml pycnometer and 500 ml volumetric flasks using the gravimetric method

There are 4 BIPM/EURAMET key comparisons in the field of fluid flow:

- EURAMET.M.FF-K4 – Liquid Volume 100 mL
- EURAMET.M.FF-K4b – Liquid Volume 20 L
- EURAMET.M.FF-K5a – High pressure gas flow
- EURAMET.M.FF-K6 – Low pressure gas flow
- EURAMET.M.FF-K4.2.2011 – Liquid volume 100 μ L

It was decided to upgrade all EURAMET comparisons that were registered not more than 2 years ago to supplementary comparisons.

4. CMCs

A CMC revision group and procedure was created during the 2012 TC-F meeting. This new CMC revision procedure is up and running and is giving good results in terms of efficiency and organization. During the next year all CMC will be revised according to date of submission, range and comparison support. The first revision stage will be done by the CMC revision group.

Two sets of CMCs were posted in the JCRB for RMO revision in 2015, EURAMET.M.43.2015 and EURAMET.M.44.2015. Two CMC are published on the BIPM webpage EURAMET.M.43.2015 on December 9, 2015 and EURAMET.M.44.2015 on September 2, 2015.

One CMC from another RMO was reviewed namely SIM.M.28.2015.

5. Activities of the Subcommittees

The TC-F group is divided in four subgroups, Gas flow, Liquid flow, Volume and Fluid speed. The subgroup meetings are held separately during the TC-F meeting. Each subgroup convener decides the agenda and the subjects to be debated based on participants input. Furthermore the TC-F established three working groups:

- Strategy Working Group with its coordinator Emmelyn Graham from NEL
- CMC Review and comparisons Working Group with its coordinator Elsa Batista from IPQ
- EMPIR Task Force with its coordinator Peter Lucas from VSL

- **Gas Flow subgroup** – Convenor – Bodo Mickan from PTB

The main topics of discussion were the status of the current projects in the field of gas flow and new primary standards. The uncertainties reported in comparisons reports was one of the topics that was discussed. A list of specifications/requirements for the usage of curve fitting in inter comparisons was presented. A further point of interest was the uncertainty statements of air sampler for accredited laboratories.

- **Liquid Flow subgroup** – Convenor – Marc de Huu from METAS

In the liquid flow subgroup meeting, results of EURAMET projects and KCs were discussed. Also the guide on harmonization of the uncertainty budgets and calibration methods for liquid flow standards was discussed and is to be finished within this year. Information regarding new facilities in multiflow applications was given during the 2016 meeting.

- **Volume** – Convenor Miroslava Benkova from CMI

In the volume subgroup meeting, the results of the running comparisons were presented. Guidelines on the determination of uncertainty in gravimetric volume calibration and guidelines on the calibration of standard capacity measures using the volumetric method are now under development.

Within the ISO cooperation in TC 28 SC2 WG4, and ISO TC 30 the TC-F members will check if their country is listed as observer, participant or if they can be included into the working group as an expert. It was decided that the TC-F will be a liaison organization for ISO TC 28.

The project E 1395 comparison of a 20 L standard was discussed within the participants. There will be 20 participants and it will start in May 2016 with an expected duration of about 17 months. The EURAMET guides cg 19 and cg 21 will be revised by the end of the year.

- **Fluid speed** – Convenor – Pier Giorgio Spazzini from INRIM

The main topics of discussion were the organization of comparisons and new developments. A new comparison for low speeds is planned and a EURAMET circulation for dissemination of the KC3 results once the WGFF circulation will be completed is in preparation. For the guide for Pitot Tubes Calibration a work plan was established and is expect to have a draft by the end of 2016.

6. Participation in EMRP/ EMPIR

Since 2012 that PRTs are developed within the TC-F task group, following the EMRP/EMPIR task force web meetings to coordinate the work.

In 2014 and 2015 the TC-F PRTs were not very successful and therefore some more actions from the TC-F task group have been undertaken in 2015-2016, namely to gather ideas in the TC-F meeting, one year before each call and contact with the stakeholders has been improved by means of a survey in order to collect information regarding needs.

In December 2015 the EMRP/EMPIR task force coordinator Peter Lucas organized a web-meeting and collected several ideas for PRTs within the 2016 call.

Participants from the TC-F are involved in several EMRP projects: ENG54 – Biogas, ENG58 – MultiFlowMet, ENG59 – Non Newtonian Liquids, ENG60 – LNG, ENV60, and 15SIP03-Infusionuptake.

Nevertheless reasons for not succeeding in PRTs are still not clear and may be linked to the specific industry related topics familiar to flow.

7. Capacity Building: Activities of the last year and future needs

During the TC-F meeting a series of bilateral discussions („mentoring“) to identify and support needs of emerging members has been established. Within this mentoring program the following mentors volunteered: Nieves Medina, Isabelle Care, Emmelyn Graham, Elsa Batista, Peter Lucas, Bodo Mickan, Marc de Huij, Pier Giorgio Spazzini, and Gerard Bloom. A list of mentors and their interest are available on the webpage.

8. Meetings

The annual meeting of the TC-F was held in Belgrade, Serbia, from 19th to 21st of April. The meeting was hosted by DMDM.

In the meeting several issues were discussed, mainly:

- Results from comparisons
- Development of calibration guides
- WGFF group and KCs
- Low Uncertainties from Accredited Laboratories
- EMRP and EMPIR projects, proposals and funding
- CC WG-Implementation and Operation of the CIPM MRA Recommendations
- Organization of comparisons - new guide development status
- Infrastructure
- Strategic Working Group
- Technical Highlights (new developments, projects, new and unconventional facilities)
- Cooperation with other entities, ISO and OIML

The next TC-F meeting will be in Warsaw, Poland, from 9th to 11th May 2017 and be hosted by GUM.

9. Strategic Planning

The EMPIR task force will continue to meet every year during the TC-F meeting to help with the development of PRTs. The coordinator will get more information about funding possibilities within EMPIR and stays in a closer contact with the tasks forces environment, health and energy. The CMC revision is now stabilized and every year the NMIs have a chance to submit new CMCs. The strategic working group will start to help EURAMET getting a better understanding of the landscape of coordination of TC-F members.

Strengthen the capacity building by the mentoring programme.

Supporting the cooperation with OIML and ISO TC within the TC-F group.

10. Outlook for 2016/2017

- New JRP proposals for EMPIR based on the R&D sheet and task force meetings discussions
- Completion of the guidelines and development of new ones
- Start the discussion about a simple facility database under the restricted area of the TC-F webpage
- The objectives, tasks, responsibilities and members of the newly defined working groups will be described in a document and will be put as information on the TC-F webpage

