

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 Warsaw, on April 2017, 48 members from 26 different countries attended the last TC-F meeting.

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.

A TC F type A liaison organization for ISO/TC 48 for the revision of the ISO 8655 within WG4 (micropipettes) has been implemented. A new liaison with ISO TC 28 was created in 2016.

2. Projects

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
- Therefore the editors of guide on the harmonization of the uncertainty budgets and calibration methods for liquid flow standards are not available anymore and the content of the final version is to extensive the former guide will be finish and provided under the restricted area as technical report inclusive the corresponding excel sheet. A new round by means of a web meeting will be organized to create a task force to define the structure of the future calibration guideline, based on sections of this document.

3. Comparisons

- **Proposed comparisons**
 - 1415 Bi-lateral comparison of standards for low-pressure gas flow
 - 1397 Comparison of high-pressure gas-flow facilities between NEL, PTB and FORCE
 - 1396 Bi-lateral inter-comparison in the gas flow range from 1 m³/h to 250 m³/h
- **Agreed/started comparisons**
 - 1395 Volume comparison at 20 L - EURAMET Regional Key Comparison of CCM.FF-K4.1.2011 - EURAMET.M.FF-K4.1.2016
 - 1325 Comparison for gas flow range 5 ml/min to 30 l/min

- **Completed comparisons**
 - 1399 Bi-lateral comparison of 500 ml flask
 - 1322 Volume comparison at 100 microliter - Calibration of micropipettes - EURAMET.M.FF-K4.2.2014
 - 1297 Comparison of a 50 mL pycnometer and a 500 mL flask
 - 1225 Intercomparison of very low air speed standard facilities (0.05-1m/s)
- **Draft A report**
 - 1333 Comparison of standards for low-pressure gas flow 1 000 m³/L to 10 000 m³/L

There is one EURAMET supplementary comparisons in the field of fluid flow:

- EURAMET.M.FF-S8 – Calibration of a 50 pycnometer and a 500 ml flask– Draft B sent for approval

EURAMET.M.FF-K4.2.2014 – Micropipettes report was sent to Metrologia for publication

- **In progress/planned**
 - CCM.FF-K1.2015 – Water flow
 - CCM.FF-K2.2011 – Hydrocarbon flow
 - CCM.FF-K3.2011.1 - Air speed from 0,5 m/s to 40 m/s Transferdevice(s)
 - CCM.FF-K5.2016 Volume/mass of flowing gas (air / nitrogen / naturalgas); Volume flow rate: from 65 m³/h to 1450 m³/h; Mass flow rate: from 78 kg/h to 1x10⁵ kg/h
 - EURAMET.M.FF-K5a – High pressure gas flow (protocol completed)
 - EURAMET.M.FF-K4.1.2016 – 20 L measure (measurements undergoing)

4. CMCs

A CMC revision group and procedure was created during the 2012 TC-F meeting. This CMC revision procedure is up and running and is giving good results in terms of efficiency and organization, a second version was developed during 2016. During next year all CMC will be revised according to date of submission, range and comparison support. The first revision stage will be done by each NMI in order to simplify entries and perform changes that does not need the revision process.

One set within of CMCs were posted in the JCRB for RMO revision in 2016, EURAMET.M.47.2016: Austria, France, Portugal, Turkey and Germany and published in November 2016.

New CMCs revision process started in December 2016 with the submission from 13 Countries.

During 2016 one CMC batch from other RMOs was revised, mainly SIM.M.33.2016, INACAL, Peru and LATU Uruguay but not yet published.

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 convenor 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 part of the meeting was spent on the progress of EURAMET projects, specifically E1325, E1396 and E1397. The E1396 includes investigations on the oil film thickness at bell provers and preliminary results were presented. Within the E1397, the usage of venture tubes as transfer standard for high pressure gas was discussed in detail with respect to dependencies on flow numbers which are not yet clarified.

In the second part of the sub group meeting, the success of capacity building at DMDM was presented. It was the aim to have basic capability to provide traceability for verification and performing type approval of domestic gas meters.

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

A major part of the meeting was devoted to how to deal with the outcome of the EURAMET project E1267 on the harmonization of the uncertainty budgets and calibration methods for liquid flow standards. The work of Rainer Engel has been acknowledged but deemed not well suited to be used as a guideline. It has therefore been decided to close the project and publish the report and its accompanying Excel sheet as a technical report on the restricted TC F webpage area. A task force has been created to define the structure of the future calibration guideline, based on sections of the current technical report.

A status report on comparison E1379 has been presented, as well as a comparison proposal with 2 inductive flow meters in series. NEL is still looking for potential partners for a comparison in high temperature and high pressure ranges.

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

The subgroup convenor Miroslava Benkova provided an overview of the meeting and activities in the past year. Essentially all countries are involved in one new running comparison project, which assumes the CMCs review and approval process. The status of on-going and new projects was presented in this meeting. Uncertainties evaluation was discussed during the meeting, the speakers pointed out the problems in uncertainty evaluation in laboratories. Also the differences in the uncertainty evaluation in accredited laboratories were discussed. It was decided that the next session will focus on training in uncertainties or other practical problems arising from the completed comparisons.

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

The main topics of discussion were the results of comparisons and new developments. Furthermore aspects of the calibration of LDA systems have been presented. Completion of the Guideline for Calibration of Pitot Tubes will be performed within the year and a guideline for Airspeed laboratories, to be developed in the subgroup and proposed to EA as the basis for a Guide will be started.

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.

After a short reminder on the motivation and goal of this Working Group, a summary of the submitted JRPs involving Flow in 2016 has been presented. From 18 submitted PRTs, 7 went through as SRTs and eventually 6 JRPs got funded, a very honourable result. The highlight for this period is the collaboration with the Flow Measurement Institute (FMI) in the UK and the organization of an Industry Workshop for the 2017 EMPIR call on Industry in January 2017 in Coventry. Over 60 delegates were present (1/3 NMI, 1/3 academia and 1/3 industry). Over 23 topics have been addressed that led to 11 potential PRTs. This event has been considered a success by all parties.

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

The Mentoring Program within TC F has been implemented during the TC F meeting in 2016. The purpose is to encourage other members of TC-F to become more fully engaged in committee discussions and activities. The mentoring involved initial bilateral meetings between the mentor and representatives of different NMIs/DIs. This effectively broke down barriers to dialogue and engagement. It highlighted areas where they would like to build capabilities and what they want to achieve. Regrettably our mentor Nieves Medina Martín is not taking part of the TC F meetings any more therefore two new mentors could be found, Zoe Metaxiotou and Tomas Valenta.

The first World Café within TC F was intended to facilitate discussion, in small groups and then linking ideas within the plenary to access the collective knowledge. Three questions have been raised and were discussed by the participants. The main questions therefore were about recommendations for improvement of coordination, main barriers to coordination and the needs for training. The following ideas have been discussed and approved during the last session of the annual meeting:

- Preparing a form with picture of participants, his/her field of interests, competences etc.
- Preparing a list of questions and answers about FAQ preparation
- Networking about LinkedIn-profile, webinars, share point, YouTube training...
- Workshop possibilities
- Onsite workshop every year before / during our annual TC F meeting at the hosting NMI
- Next year labtour will be replaced by an uncertainty workshop held by Bodo Mickan
- In future: Labtour will be replaced by practical workshop

Before end of meeting 2018 a slot for EMPIR normative and SIP with invitation to standardization body will be scheduled.

8. Meetings

The annual meeting of the TC-F was held in Warsaw, Poland, from 4th to 6th of April 2017. The meeting was hosted by GUM.

In the meeting several issues were discussed, mainly:

- Results from comparisons
- Development of calibration guides
- WGFF group and KCs
- EMPIR projects, proposals and funding
- Strategic Working Group and updated road map
- Technical Highlights (new developments, projects, new and unconventional facilities)
- Cooperation with other entities, ISO and OIML

The next TC-F meeting will be in Funchal, Portugal, date open.

9. Strategic Planning

The EMPIR task force will arrange further workshops to stay in closer contact with the flow community and get more information about their needs. The information about PRTs will be shared with other TCs because in most of the calls TC F is just a work package. Before End of meeting 2018 a slot for EMPIR normative and SIP with invitation to standardization body will be scheduled. The CMC revision is now stabilized and every year the NMIs have a chance to submit new CMCs. A main goal is to simplify and possible merge of CMC entries.

The strategic working group will review the TC-F road map and help EURAMET getting a better understanding of the landscape of coordination of TC-F members.

Further strengthening the capacity building by the mentoring programme and world cafes. Supporting the cooperation with OIML and ISO TC within the TC-F group.

10. Outlook for 2017/2018

- 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
- New structure of the annual meeting
- Better integration of web base communication tools
- Supporting emerging countries regarding cooperation with standardization bodies and industry partners