

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 Borås, on May 2015, 56 delegates from 26 countries attended the last TC-F meeting. The TC-F community increases and, at the moment, there are 29 contact persons and 60 flow experts involved.

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

2. Projects and comparisons

There is a total of 87 EURAMET projects in the Technical Committee for Flow, where 81% of these projects are comparisons, 17 % are research and 2% consultation. As of the date of this report 61 projects are completed, 5 cancelled and 21 active projects (16 comparisons and 5 research).

In 2015 so far, 5 EURAMET projects were proposed: 1369 - Bi-lateral comparison with TS of Key-Comparison CCM.FF.K2.2011, 1361 - Bilateral comparison of liquid flow facilities from 0.5 to 30 m³/h m³/h, 1353 - Volume comparison on Calibration of micropipettes, 1334 - Bi-Lateral Intercomparison - Volume Calibration (20 litre).

One EURAMET project was completed in 2015: 1291-Comparison between recently developed primary standards (VSL).

A new guide on organization of comparisons is now under discussion within the TCF members.

3. Key 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 relevant 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

And 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 µL

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. One set of CMC from VSL was fast tracked by the JCRB and was published on the BIPM webpage on 20-05-2015.

CMCs from other RMOs were reviewed, namely AFRIMETS.M.2015.

By proposal of EURAMET a Guideline on harmonization of evaluation criteria of CMCs was developed and finalized by the WGFF.

5. Activities of the Sub-Committees

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.

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

The main topics of discussion were the status of the current project in the field of gas flow. The uncertainties reporting in comparisons reports was one of the topics discussed. There was some information on the intentions of the different partners regarding the revision of the ISO9300 and their views on the possibilities this could be an EMPIR project for 2016 call.

- **Liquid Flow subgroup** – Convenor – Petra Milota from BEV

In the liquid flow subgroup meeting, results of EURAMET projects and KCs were discussed. Also a new guide on harmonization of the uncertainty budgets and calibration methods for liquid flow standards was elaborated but needs English translation. Information regarding new facilities in thermal energy was given during the 2015 meeting. A new convener for the liquid subgroup was elected – Marc de Huu from METAS.

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

In the volume and liquid properties subgroup meeting, the results of the running comparisons were presented. A new EURAMET Guide on calibration of micropipettes is now under development. A new regional comparison in the field of micropipettes was also started. A discussion on ISO cooperation in standard development was undertaken within the group and a decision on TC-F Liaison organization type A was approved by the group. Some information was given regarding the photometric method for micropipette calibration and on how to harmonize CMC submissions for volume.

A possibility of a new 20 L project was discussed within the participants.

There was a discussion on project submission by members directly to EURAMET, project 1334 was set as a bad example.

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

The main topics of discussion were the development of guidelines and organization of comparisons. Also some information was given regarding the situation of air speed accreditation laboratories and a new towing tank was presented by CMI. The Guideline for Calibration of Pitot Tubes will be developed in the next year. A guideline for Airspeed laboratories, to be developed in the subgroup and proposed to EA as the basis for a Guide will be developed.

6. EMRP/EMPIR

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

In 2014 the TC-F PRTs were not very successful and therefore some more actions from the TC-F task group will be undertaken in 2015-2016, namely to gather ideas in the TC-F meeting, one year before each call, the Stakeholders contact should be improved by the means of surveys, web platform, accredited laboratories or any other mean, in order to collect information

regarding needs. One TC-F representative (Peter Lucas) should have a more close relation with the EMPIR focus groups.

In October 2014 the EMRP/EMPIR task force organized by Peter Lucas had a new web-meeting and several ideas for PRTs within the 2015 call were proposed.

Participants from the TC-F are involved in several EMRP projects: ENG03 - Metrology for Liquefied Natural Gas, ENG09 – Metrology for Biofuels, ENG06 -Metrology for Improved Power Plant Efficiency and HLT07 - Metrology for drug delivery, ENG54 – Biogas, ENG58 – MultiFlowMet, ENG60 – LNG, ENV60 – IMPRESS and to a lesser extent there is a TC-F members participation in ENV56 - KEY-VOCs, ENG59 – NonNewtonianLiquids, ENV07 – METEOMET (Metrology for Meteorology) and NEW04 (development of uncertainty methods and computations).

7. R&D sheet

A data base was created within the TC-F members to find overlapping R&D efforts and investments within EURAMET TC-F. The shared information will be helpful for future cooperation in the framework of EMPIR or outside it. It will also help to prevent from wasting our limited (national) R&D budgets in duplicating research activities.

8. Guides

Three new guides are now under development:

- Guide on air speed calibration of Pitot tube anemometers (expected to be extended to other types of anemometers in the future)
- Guide on the calibration, operation and handling of micropipettes, several manufacturers of micropipettes are involved.
- Guide on harmonization of the uncertainty budgets and calibration methods for liquid flow standards are almost concluded.

9. Meetings

The annual meeting of the TC-F was held in Boras, Sweden from 05th to 07th of May 2015. The meeting was hosted by the SP, the National Metrology Institute of Sweden.

In the meeting several issues were discussed, mainly:

- Results from comparisons
- Development of calibration guides
- WGFF group and KCs
- CMCs and DUT uncertainties
- EMRP and EMPIR projects, proposals and funding
- New facilities, developments and projects
- The new GUM
- Cooperation with other entities, ISO and OIML

The next TC-F meeting will be in Belgrade, Serbia, from 19th to 21th of April 2016 and be hosted by DMDM.

10. Strategic planning

It was decided to involve NMI and stakeholders in the development of the research topics of TC-F and therefore inquiries are under development.

The EMPIR task force will continue to meet every year during the TC F meeting to help with the development of PRTs.

The CMC revision is now stabilized and every year the NMIs have a chance to submit new CMCs.

A new protocol on EURAMET TC-F comparison organization is now under revision.

A close cooperation with OIML and ISO TC is now under discussion within the TCF group.

11. Outlook for 2015

- New JRP proposals for EMPIR based on the R&D sheet and task force meetings discussions
- Submission of new EURAMET projects
- Development of a result and report template for flow comparisons;
- Development of three/four new guides;
- Responses from stakeholders inquiry on research needs/ideas
- The TCF group will be appointed as Category A liaison organization to ISO TC 48 and cooperate in the development and revision of standards within this TC.
- The TCF has made previous contacts with the OIML TC 8 in order to cooperate in the revision of OIML documents.

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