TC Chair Annual Report 2021 - 2022

TC for Flow (F)
TC Isabelle Care
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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 measurements 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.
The 32nd annual meeting was held online in September 2021. 78 members from 29 different countries attended this last TC-F meeting. Initially planned in May 2021 in Ljubljana (Slovenia), the 32nd TC-F annual meeting has been postponed in September and finally organized online because of the COVID-19 pandemic.

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 their respective countries. Routine work for industrial and laboratory customers is also a big part of this community.

Furthermore TC-F is a type A liaison for the following organizations:

- ISO/TC 48 for the revision of the ISO 8655 (micropipettes)
- ISO/TC 28 for the revision of ISO 8222
- OIML TC8 – Measurement of quantity of fluids

2. Projects

The table below shows the status of the different projects listed for TC-F in the EURAMET Project database.

The numbers in brackets corresponds to the change since the last report.

	Comparison	Research	Consultation	Total
Agreed	0 (0)	0 (0)	0 (0)	0 (0)
In progress	14 (-1)	2 (+1)	0 (0)	16 (0)
Ongoing	0 (0)	2 (0)	0 (0)	2 (0)
Completed	72 (+3)	10 (0)	7 (+1)	89 (+4)
Concluded	5 (0)	1 (0)	0 (0)	6 (0)
Total	**91 (+2)**	**15 (+1)**	**7 (+1)**	**113 (+4)**

3. Comparisons

The EURAMET TC-F members are very active within the BIPM key comparison (KC) level field.

The status of the different comparisons in which the TC-F is involved is given in the table below (changes since the last annual report are marked in red in the status column). Only comparisons agreed, in progress or approved and completed within the year are listed.

EURAMET n°	Title	Coordinating Institute	Status	KCDB
-	Water flow: 30 m^3/h to 200 m^3/h	PTB	waiting for approval	CCM.FF-K1.2015
-	Hydrocarbon liquid flow and water flow from 10 kg/min to 60 kg/min	VSL	report in progress, Draft B	CCM.FF-K2.2011
-	High pressure gas flow from 65 m^3/h to 1450 m^3/h (0,1 to 8,8 MPa)	PTB	planned	CCM.FF-K5.2021
-	Low pressure gas flow from 2 cm^3/min to 10000 cm^3/min	CMS/ITRI	submitted to the KCDB Office	CCM.FF-K6.2017
1224	Comparison VSL - PTB Volume flow for Natural Gas under High Pressure	PTB	in progress	
1325	Comparison for gas flow range 5 ml/min to 30 l/min	MIKES	completed	EURAMET.M.FF-S10
1397	Comparison of high-pressure gas-flow facilities between NEL, PTB and FORCE	NEL	in progress	

EURAMET n°	Title	Coordinating Institute	Status	KCDB
1450	Comparison of low air speed	CMI	in progress	EURAMET.M.FF-S11
1452	Comparison with 20, 50 and 250 L test measures	VSL	completed	
1473	PTB-VTT MIKES DN100 comparison	MIKES	in progress	EURAMET.M.FF-S13
1476	Air flow low pressure Qmax 400 m3/h	VSL	in progress	EURAMET.M.FF-S12
1479	Inter-comparison of 1000 L proving tank	MIRS	in progress	EURAMET.M.FF-S14
1504	Bilateral inter-comparison in the gas flow range from 0.002 m3/h to 2.5 m3/h with sonic nozzles	CMI	in progress	
1506	Validation of standards for liquid flow rate under dynamic flows	LNE-CETIAT	in progress	
1507	Comparisons of standards for liquid flow rates under static load changes	CMI	in progress	
1508	Pilot study intercomparison of ultra-low liquid flow rates in range below 100 nL/min	NEL	completed	

EURAMET n°	Title	Coordinating Institute	Status	KCDB
1511	Bilateral inter-comparison in the gas flow range from 0.5 m3/h to 75 m3/h with sonic nozzles	CMI	completed	
1515	Comparison of air speed in the range of 1-40 m/s	UME	in progress	
1517	Pilot study on high-pressure natural gas primary calibration facilities	VSL	in progress	
1518	Inter-comparison of gas provers in the gas flow range 0,25 m3/h to 25 m3/h	BEV	in progress	
1526	Supplementary comparison of gravimetric standards for hydrogen refuelling stations	LNE-LADG	in progress	EURAMET.M.FF-S15
1533	Comparison of piston-operated volumetric instruments	DMDM	in progress	EURAMET.M.FF-S16

4. CMCs

The following CMCs have been submitted for JCRB review in 2021 via the KCDB 2.0 web platform. The date of approval is also given in the Table.

NMI	Country	Field	Number of CMCs	Date of Approval
DPM	Albania	Volume	2	2021-02-09
MIKES	Finland	Gas flow	2	2021-02-15
FORCE	Denmark	Gas flow	2	2021-02-20
METAS	Switzerland	Liquid flow	1	2021-03-15
BIM	Bulgaria	Volume	1	2021-12-21

The following CMCs from other RMOs were reviewed in 2021:

NMI	Country	Field	Number of CMCs	Date of Approval
GEOSTM	Georgia	Volume	2	2021-03-10
RECOPE	Costa Rica	Volume	3	2021-04-21
VNIIM	Russia	Gas flow	1	2021-06-14
NIS	Egypt	Volume	3	2021-09-13
KRISS	Korea	Liquid Flow	1	2021-11-10

5. Activities of the Subcommittees

The TC-F group is divided into four subcommittees (Gas flow, Liquid flow, Volume and Fluid speed) and 3 working groups (Strategy Working Group, CMC Review and comparisons Working Group, and Research Programme Task Force).

The subcommittee meetings are held separately during the TC-F annual meeting. Each subcommittee convenor decides on the agenda and the subjects to be debated based on participants' input. However, due to the coronavirus pandemic, the 2021 TC-F meeting has been rescheduled online in September.

The following topics were discussed during the subcommittee meetings:

- Gas Flow subgroup: Toma Valenta (CMI)
  - Status of the on-going projects
  - Presentation of a calibration infrastructure for Hydrogen Flow Measurements.(Germany)
  - Presentation of the participation of VSL in the EMPIR project MetroPEMS (The Netherlands)
  - Survey of the CMCs
- Liquid Flow subgroup: Marc De Huu (METAS)
  - Lecture about the uncertainty components in gravimetric calibrations
  - Status of the on-going projects
  - Presentation of the current development of a large water tests rig at METAS (Switzerland)
  - Election of Florestan Ogheard (LNE-CETIAT, France) as the new convenor
- Volume subgroup : Elsa Batista (IPQ)
  - Lecture about the Calibration of Micropipettes and standardization
  - Status of the on-going projects
  - Active participation of ISO standards' convenors with presentations
  - Organisation of a separate virtual meeting in January 2022 in order to plan the next volume comparisons
- Flow speed subgroup : Jan Gersl (CMI)
  - Status of the on-going projects
  - Presentation of a new facility for the calibration of anemometers at the University of Ljubjana (Slovenia)

The Working Group coordinators and activities are:

- CMC working group: Isabelle Caré (LNE-CETIAT)
  - The review team (12 members with an expertise in the different fields) is in charge of the CMCs review (see §4)

- Strategy working group: Chris Mills (NEL)
  - 7 members
  - Decision to upgrade the strategy roadmap in 2022

- Research Programme working group: Corina Kroner (PTB)

6. Participation in EMRP/ EMPIR

Information on the participation of TC Flow members in on-going EMPIR projects:

Number	Short name	Full name	Coordination	Duration
17IND13	Metrowamet	Metrology for real-world domestic water metering	PTB	2018-2021
18HLT08	MeDDII	Metrology for drug delivery	IPQ	2019-2022
18NRM06	NEWGASMET	Flow metering of renewable gases	LNE	2019-2022
18NET01	Energy Gases	Support for a European Metrology Network for energy gases	VSL	2019-2023
19ENG04	MetroHyVe 2	Metrology for hydrogen vehicles 2	NPL	2020-2023
19ENV09	MetroPEMS	Improved vehicle exhaust quantification by portable emission measurement systems metrology	PTB	2020-2023
20NRM02	MFMET	Establishing metrology standards in microfluidics devices	IPQ	2021-2024
20IND10	Decarb	Metrology for decarbonizing the gas grid	NPL	2021-2024
20IND11	MetHyInfra	Metrology infrastructurefor high-pressure gas and liquid hydrogen flows	PTB	2021-2024
20IND13	SAFEST	Sustainable advanced flow meter calibration for the transport sector	PTB	2021-2024

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

Different activities of training and workshops in the field of fluid flow realized in the last years are listed above, as well as future needs already identified:

- 2017
  - Training on Calibration of Volume Equipment
    - Objective: Improvement of the knowledge of the laboratory staff in EURAMET NMIs/DIs on measurement uncertainty in static volume measurement
    - Location: BEV, Vienna, Austria, 2017-11-28 to 2017-11-29
    - Lecturer(s): Elsa Batista (IPQ), Miroslava Benkova (CMI), Zoe Metaxiotou (EIM), Petra Milota (BEV), Wolfgang Schmid (EURAMET), Tanasko Tasić (EURAMET)
- 2018
  - Training on Uncertainty in Volume Measurements
    - Objective: Improvement of the knowledge of the laboratory staff in EURAMET NMIs/DIs on calibration of various type of volume equipment, by the gravimetric and volumetric method
    - Location: IPQ, Caparica, Portugal, 2018-02-20 to 2018-02-23
    - Lecturer(s): Elsa Batista (IPQ)
  - Workshop on preparation of CMC Excel files
    - Objective: Improvement of the knowledge of NMIs/Dis regarding the rules and documents for submitting CMC files, new or revised entries
    - Location: 2018TC-F meeting
    - Lecturer(s): Elsa Batista (IPQ)
  - Workshop Uncertainty Calculation for Gas Meters
    - Objective: establishment of comprehensive working equations and realistic estimation of uncertainties for the input values. A typical technical situation of a volumetric gas flow calibration facility was use as background
    - Location: 2018 TC-F meeting
    - Lecturer(s): Bodo Mickan (PTB)

- 2019
  - Training on Coordination of Comparisons
    - Objective: Improvement of the knowledge of the TC-F members about the coordination of comparisons
    - Location: 2019 TC-F meeting
    - Lecturer(s): Elsa Batista (IPQ)
  - Training on micro and nano flow calibrations
    - Objective: Improvement of the knowledge about micro and nano liquid flow
    - Location: 2019 TC-F meeting
    - Lecturer(s): Hugo Bissig (METAS)
  - Workshop Uncertainty Calculation for Gas Meters: Part II
    - Objective: Procedures to estimate covariances among correlated input values. - Best practice for curve fits to represent calibration results. - Procedure to separate the contributions to Type A uncertainties between MuT and reference standard

- Location: 2019 TC-F meeting
- Lecturer(s): Bodo Mickan (PTB)

- 2021[1]
  - Uncertainty components in gravimetric calibrations in liquid flow
    - Objective: Improvement of the knowledge of the TC-F members
    - Location: 2021 TC-F meeting
    - Lecturer(s): Florestan Ogheard (LNE-CETIAT)
  - Workshop Calibration on Micropipettes and standardization
    - Objective: Improvement of the knowledge of the TC-F members
    - Location: 2021 TC-F meeting
    - Lecturer(s): Zoe Metaxiotou (EIM)
  - EURAMET-COOMET training course on small volume comparisons
    - Objective: Improvement of the knowledge of the laboratory staff in EURAMET and COOMET NMI/DIs on measurement uncertainty evaluation of interlaboratory comparisons in small static volume measurement
    - Location: 2021-10-18&19 online
    - Lecturer(s): Elsa Batista (IPQ), Zoe Metaxiotou (EIM)
  - In house verification of piston pipettes
    - Objective: To provide hospital laboratories with a brief, handy “Rescue Manual ” for performing a quick in house verification of the measuring status of pipettes in order to identify the ones which do not perform safely within specifications in the context of Covid-19 crisis
    - Location: Euramet website
    - Lecturer(s): Elsa Batista (IPQ), Zoe Metaxiotou (EIM)

8. Meetings

Due to the Coronavirus pandemic, the TC-F meeting, initially planned in Ljubljana, Slovenia, during Spring has been rescheduled online 31 August – 01 September 2021.
The Volume Subcommittee’s convenor (Elsa Batista, IPQ) has organized an online meeting in January 2022 to discuss about the projects (in progress and planned) and the need to revise the guides

9. Issues

No particular issue has been reported

10. Strategic Planning

See strategy working group

11. Outlook for 2022/2023

- Review of CMCs
- Foster the cooperation with standardization and regulation groups
- Develop a new strategy plan

[1] 2020 activities have been postponed in 2021 due to the pandemic situation