

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 30th annual meeting was held in Bern (Switzerland) in April 2019. 55 members from 30 different countries attended this last TC-F meeting. Initially planned at the end of March 2020 in Ljubljana (Slovenia), the 31st TC-F annual meeting has been postponed in November because of the lockdown caused by 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 latest information, since the last report.

	Comparison	Research	Consultation	Total
Agreed	4 (4)	0 (0)	0 (0)	4 (4)
In progress	7 (2)	1 (0)	0 (0)	8 (2)
Ongoing	0 (0)	2 (0)	0 (0)	2 (0)
Completed	70 (2)	10 (0)	6 (1)	86 (3)
Concluded	5 (1)	1 (0)	0 (0)	6 (1)
Total	86 (9)	14 (0)	6 (1)	106 (10)

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):

EURAMET n°	Title	Coordinating Institute	Status	KCDB
-	Water flow: 30 m ³ /h to 200 m ³ /h	PTB	Report in progress, Draft B	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
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	Draft B report waiting for final approval by WGFF	EURAMET.M.FF-S10
1395	Volume comparison at 20 L - EURAMET Regional Key Comparison of CCM.FF-K4.1.2011	INRIM	Approved for equivalence	EURAMET.M.FF-K4.1.2016
1397	Comparison of high-pressure gas-flow facilities between NEL, PTB and FORCE	NEL	in progress	
1450	Comparison of low air speed	CMI	in progress	EURAMET.M.FF-S11
1452	Comparison with 20, 50 and 250 L test measures	VSL	in progress	
1473	PTB-VTT MIKES DN100 comparison	MIKES	in progress	EURAMET.M.FF-S13
1476	Air flow low pressure Qmax 400 m ³ /h	VSL	in progress	EURAMET.M.FF-S12

EURAMET n°	Title	Coordinating Institute	Status	KCDB
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 m ³ /h to 2.5 m ³ /h with sonic nozzles	CMI	agreed	
1506	Validation of standards for liquid flow rate under dynamic flows	LNE-CETIAT	agreed	
1507	Comparisons of standards for liquid flow rates under static load changes	CMI	agreed	
1508	Pilot study intercomparison of ultra-low liquid flow rates in range below 100 nL/min	NEL	agreed	

4. CMCs

The new CMC revision process 2018/2019 started in December 2018 (EURAMET.M.65.2019) with the submission from 26 countries. After the intra RMO and the inter RMO reviews, the publication has been delayed until the beginning of 2020 due to the new KCDB launch.

At the end of 2019, before the new KCDB launch, a new intra RMO review process has been initiated for 12 countries. After the completion of this process and the launch of the KCDB 2.0, the writers have been invited to submit their new and/or modified CMCs on the KCDB web portal for the 2nd phase of the review process (inter RMO review). For 6 of them, the modified CMCs concerned only a change in service category. The CMCs were then automatically updated in the new KCDB database. For the 6 other countries, the CMCs have been submitted for JCRB review. They concern:

NMI	Country	Field	Number of CMCs
IMBiH	Bosnia and Herzegovina	Volume	2
GUM	Poland	Gas flow	1
VTT MIKES	Finland	Gas flow	2
DPM	Albania	Volume	2
BIM	Bulgaria	Volume	1
FORCE	Denmark	Gas flow	2
LNE-LADG	France	Gas flow	3

Four sets from other RMO were reviewed in 2019: SIM.M.44.2019 (NIST/USA), APMP.M.50.2019 (A*STAR/SINGAPORE, NIMT/THAILAND), COOMET.M.35.2019 (VNIIR/RUSSIA) and COOMET.M.36.2019 (BELGIM/BELARUS).

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 EMPIR 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 2020 TC-F meeting has been rescheduled in November.

The subcommittees' convenors are:

- Gas Flow subgroup: Toma Valenta (CMI)
- Liquid Flow subgroup: Marc De Huu (METAS)
- Volume subgroup : Elsa Batista (IPQ)
- Flow speed subgroup : Jan Gersl (CMI)

The Working Group coordinators and activities are:

- CMC working group: Petra Milota (BEV)
 - 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 on behalf of Emmelyn Graham (NEL)
 - 7 members
 - After the 2019 TC-F meeting, Emmelyn Graham informed us she will no longer be involved in the TC-F activities with immediate effect. Until an official vote during the next TC-F meeting, her colleague, Chris Mills, agreed to do the role. However, the update of the roadmap is delayed
- EMPIR working group: Corina Kroner (PTB)
 - 8 members
 - Organisation of TC-F Stakeholders' workshop for EMPIR Call 2020 end of October 2019 in Berlin. Possible 5 PRTs as output

6. Participation in EMRP/ EMPIR

Information of the participation of on-going projects:

Number	Short name	Full name	Coordination	Duration
16ENG01	MetroHyVe	Metrology for hydrogen vehicles	NPL	2017-2020
16ENG07	MultiFlowMet II	Multiphase flow reference metrology	NEL	2017-2020
16ENG09	LNG III	Metrological support for LNG and LBG as transport fuel	VSL	2017-2020
16ENV08	IMPRESS 2	Metrology for air pollutant emissions	NPL	2017-2020
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

7. Capacity Building: Activities of the last years 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)
- 2020
 - Uncertainty components in gravimetric calibrations in liquid flow
 - Objective: Improvement of the knowledge of the TC-F members
 - Location: 2019 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: 2019 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: Initially planned in March 2020 GEOSTM, Tbilisi, Georgia.
POSTPONED
- 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, tbd
 - Lecturer(s): Elsa Batista (IPQ), Zoe Metaxiotou (EIM)

8. Meetings

Due to the Coronavirus pandemic, the next TC-F meeting, initially planned in Ljubljana, Slovenia, 31st March - 02nd April 2020, has been rescheduled 3rd – 5th November 2020.

10. Strategic Planning

See strategy working group.

11. Outlook for 2020/2021

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