

This report is a slight update of that presented to the 13th CCM on May 13

1. General Aspects

The same considerations made last year still hold. Some of them are copied here for the reader's convenience.

The EURAMET Mass and Related Quantities Technical Committee, TC-M, is characterized, as well as its international counterpart, the CCM, by the number of related quantities and by the diversity of techniques employed in the realization of the corresponding units. Nevertheless, the dominant topic nowadays is for sure the re-definition of the kilogram which, since the 2005 first proposal, has largely conditioned the activity of many NMIs. Actually, several EURAMET NMIs are actively involved in this task, often through co-operative research which is also reflected in EURAMET projects.

A second, although not exclusive of TC-M, circumstance characterizing this period is certainly the EMRP. Either individually or through personal contacts, many Potential Research Topics had been submitted by EURAMET scientists, which implies that a lot of time and energy had been devoted to this task. These efforts were successful, as four JRP's were selected on topics relevant to the TC-M area.

The number of new unfunded proposed projects, both in comparisons and research, is further decreasing.

2. Projects

In the period under review (March 2010 – May 2011) in TC-M area the numbers of proposed, agreed and completed (or cancelled) projects in the various categories are shown in the table below. The numbers of the previous year are shown in brackets (cancelled projects not included).

	Comparison	Research	Traceability	Consultation	Total
Proposed	2 (4)	1 (3)	-	-	3 (7)
Agreed	17 (15)	7 (9)	2 (3)	/ (/)	26 (27)
Completed+ cancelled	46+1 (43)	36+1 (33)	7(6)	15 (15)	104+2 (97)
Total	66 (62)	45 (45)	9 (9)	15 (15)	135 (131)

The projects can be broken down by technical area as follows:

	Proposed	Agreed	Completed/canc.	Total
Density		1 (3)	8 (7)	9
Force	/ (2)	6 (7)	6+1 (5)	13
Hardness			1 (1)	1
Mass		7 (7)	40 (39)	47
Pressure	1 (5)	10 (6)	41 (39)	52
Torque		1 (2)	2+1 (1)	4
Viscosity		/ (1)	5 (4)	5
Gravimetry	1 (/)	1 (1)	1 (1)	3

Three completed projects dealing with general issues were placed under Mass for simplicity.

The process of tracking the status of projects is not always easy. Not all of the project co-ordinators are sufficiently sensitive to the need for keeping the database updated. This is certainly one of the unresolved issues of the TC-M. The suspect is that this issue is common to many TCs.

3. Comparisons

There are 31 registered European key comparison in the area of Mass and Related Quantities, of which 14 are active, 4 have provisional equivalence, 12 have been approved for equivalence. One was a bilateral key comparison between PTB (EURAMET) and CENAM (SIM). Details are given in Table 1.

Comparison ID	Project no.	Title/Range	Subfield	Pilot	Contact	Status	Years
EUROMET.M.M-K1	215	Kilogram	Mass	NPL	Ian Severn	Approved for equivalence	1992-1999
EUROMET.M.M-K2	445	(Sub-)multiples	Mass	SP	Michael Perkin	Approved for equivalence	2001-2003
EUROMET.M.M-K2.1	786	(Sub-)multiples	Mass	SP	Michael Perkin	Approved for equivalence	2004-2008
EUROMET.M.M-K4	510	Kilogram	Mass	NPL	Stuart Davidson	Approved for equivalence	1999-2003
EUROMET.M.M-K4.1	1029	Kilogram	Mass	MIRS	Matej Grum	Approved for equivalence	2007-2008
EURAMET.M.M-K4.2	1120	Kilogram	Mass	BEV	Dietmar Steindl	Report in progress, Draft B	2009-2011
EURAMET.M.M-K2.2	1120	(Sub-)multiples	Mass	BEV	Dietmar Steindl	Report in progress, Draft B	2009-2011
EUROMET.M.D-K1	339	Solid (3 Si spheres)	Density	METAS	Philippe Richard	Provisional equivalence	1998-1999
EUROMET.M.D-K1.1	1031	Solid (3 ceramic sph.)	Density	PTB	Horst Bettin	In progress	2008-2010
EUROMET.M.D-K2	627	Liquid density	Density	PTB	Horst Bettin	Report in progress, Draft B	2001-2002
EURAMET.M.D-K2	1019	Liquid density	Density	BEV	Christian Buchner	In progress, Draft A	2007-
EUROMET.M.D-K4.Prev	236	Hydrometers	Density	IMGC	Salvatore Lorefice	Provisional equivalence	1993-1994
EUROMET.M.D-K4	702	Hydrometers	Density	IMGC	Salvatore Lorefice	Approved for equivalence	2003-2006
EUROMET.M.P-K1.a	442	0.1 Pa to 1000 Pa	Pressure	BNM-LNE	J.C. Legras	Approved for equivalence	1999-2002
EUROMET.M.P-K1.b	442	0.3 mPa to 9 Pa	Pressure	BNM-LNE	J.C. Legras	Approved for equivalence	2000-2002
EUROMET.M.P-K2	305	1 MPa to 4 MPa	Pressure	PTB	Wladimir Sabuga	Approved for equivalence	1994-1995
EUROMET.M.P-K3.a	439	0.05 MPa to 1 MPa	Pressure	LNE/NPL	J.C. Legras	Approved for equivalence	1999-2001
EUROMET.M.P-K3.b	439	0.05 MPa to 1 MPa	Pressure	NPL	Ian Severn	Approved for equivalence	1999-2001
EUROMET.M.P-K4	389	10 MPa to 100 MPa	Pressure	NPL	Ian Severn	Approved for equivalence	1998-1999

EURAMET.M.P-K4 2010	1047	0.5 Pa to 15 kPa	Pressure	CMI	Dominik Prazak	In progress	2007
EUROMET.M.P-K5	045	50 MPa to 500 MPa	Pressure	BNM-LNE	J.C. Legras	Provisional equivalence	1993-1995
EUROMET.M.P-K6	110	100 MPa - 1000 MPa	Pressure	BNM-LNE	J.C. Legras	Provisional equivalence	1992-1994
EURAMET.M.P-K7	881	50 MPa to 500 MPa	Pressure	MIKES	Markku Rantanen	Report in progress, Draft B	2005-2007
EURAMET.M.P-K8	1041	25 kPa to 200 kPa	Pressure	METAS	Christian Wuethrich	In progress	2007-
EURAMET.M.P-K13	1091	50 MPa to 500 MPa	Pressure	UME	Ilknur Kocas	In progress	2009-
EUROMET.M.P-K1.c	1179	0.7 MPa to 7 MPa	Pressure	FORCE	Aykurt Altintas	In progress	2011
EUROMET.M.F-K1	535	5 kN to 10 kN	Force	MIKES	Aimo Pusa	Report in progress, Draft B	2002-2004
EUROMET.M.F-K2	518	50 kN to 100 kN	Force	NPL	Andy Knott	Rep. in progress, Draft B	2003-
EUROMET.M.F-K3	505	500 kN to 4 MN	Force	PTB	Rolf Kümme	Proposed	2005-2007
SIM-EUROMET.M.P-BK3		3 mPa to 0.9 Pa	Pressure	PTB/CENAM	Karl Jousten	Approved for equivalence	2001-2002
SIM-EUROMET.M.P-BK4		10 MPa to 100 MPa	Pressure	PTB/CENAM	Wladimir Sabuga	Approved and Published	2002

Table 1: Status of EURAMET Key Comparisons. In red, new entries. In bold, changes in status

There are also 21 supplementary comparisons (two more than last year). Among these comparisons, 13 have been published and 8 are in progress.

Comparison ID	Project no.	Title/Range	Subfield	Pilot	Contact	Status	Years
EUROMET.M.V-S1	273	(0.989-4600) mm ² /s	Viscosity	PTB	Henning Wolf	Published	1992-1993
EUROMET.M.V-S2	303	(0.4- 67743 mm ² /s	Viscosity	PTB	Henning Wolf	Published	1993-1996
EUROMET.M.V-S3	415	(190- 774000 mm ² /s	Viscosity	PTB	Henning Wolf	Published	1997-2000
EUROMET.M.V-S4	415	(0.33-144000) mm ² /s	Viscosity	PTB	Henning Wolf	Published	1997
EUROMET.M.M-S1	461	500 kg	Mass	CMI	Ivan Kriz	Report in progress, Draft B	2001-2005
EURAMET.M.M-S2	1054	0.1 mg to 100 g	Mass	NPL	Stuart Davidson	In progress	2008-
EUROMET.M.P-S1	788	0.05 MPa to 1 MPa	Pressure	METAS	Christian Wuethrich	Approved and Published	2004-2006
EUROMET.M.P-S2	922	30 Pa to 7 kPa	Pressure	PTB	Karl Jousten	Approved and Published	2006-2007
EUROMET.M.P-S3	884	80 kPa to 110 kPa	Pressure	LNE	Pierre Otal	Approved and Published	2006-2008
EUROMET.M.P-S4	861	40 kPa to 1.75 MPa	Pressure	UME	Ilknur Kokas	Approved and Published	2005-2006
EURAMET.M.P-S5	931	50 MPa to 500 MPa	Pressure	PTB	Wladimir Sabuga	Report in progress, Draft B	2007-2008
EURAMET.M.P-S7	1040	0.1 mPa to 1 Pa	Pressure	METAS	Christian Wuethrich	In progress	2007-
EURAMET.M.P-S8	1131	-100 kPa to +100 kPa	Pressure	MIKES	Sari Saxholm	Approved and Published	2009-2010
EURAMET.M.P-S9	1170	-950 hPa to 0 hPa	Pressure	LNE	Isabelle Morgado	In progress	2011
EURAMET.M.P-S10		0.005 Pa to 100 Pa	Pressure	CEM	Nieves Medina	In progress	2010
EURAMET.M.T-S1	1055	1 N.m to 1000 N.m	Torque	PTB	Dirk Roeske	Approved and Published	2008-2010
EURAMET.M.T-S2	1141	100 N m	Torque	PTB	Dirk Roeske	Rep. in progress, Draft A	2008-
EURAMET.M.T-S3		10 N.m to 1 kN.m	Torque	CEM	Nieves Medina	Protocol complete	2010
EURAMET.M.G-S1	1093	g	Gravimetry	METAS	Henri Baumann	Approved and Published	2008-2009
EURAMET.M.P-S6		1.5 kPa to 300 kPa	Pressure	PTB	Wladimir Sabuga	Approved and Published	2007-2008
EURAMET.M.F-S1		5 kN to 5 MN	Force	NPL	Andy Knott	Approved and Published	2005-2006

Table 2: Status of EURAMET Supplementary Comparisons. In red, new entries. In bold, changes in status

4. Other EURAMET Projects

Many projects had been for many years at the status of agreed/started, if not of proposed, with no progress report at all. Many project coordinators are not sensitive to these issues, so that the project database is not informative about the current situation.

The situation of (nominally) active EURAMET projects in the TC-M area, as per the EURAMET project Database is given in Table 3 below.

Ref.	Title	Institute	Status	Year	Collaboration
285	Calibration of precision force measuring devices and transfer standards of the capacities up to 16,5 MN.	PTB	agreed/started	1993	traceability
286	Traceability in force measurement at national laboratory level in range up to 2 MN	PTB	agreed/started	1993	traceability
351	Workshop on 'Secondary and Reference Mass Standard'	LNE	agreed/started	1995	research
402	Mass measurement (Guide to the mass determination).	SMU	agreed/started	1997	research
518	An intercomparison of force standards at 50 kN and 100 kN	NPL	agreed/started	2003	comparison
803	FPG-type digital piston manometer – exchange of experiences	MIKES	agreed/started	2004	research
838	Bilateral Comparison of Force Standard Machines	UME	agreed/started	2005	comparison
890	Dynamic Force Measurement	PTB	agreed/started	2006	research
911	Study of standard leaks performance for different gas, in the transition regime	INRIM	agreed/started	2006	research
1030	Second regional (European) Comparison of Absolute Gravimeters (ECAG-2007)	INRIM	agreed/started	2008	comparison
1097	Bilateral comparison on Force measurement at: 0 kN, 5 kN, 10 kN	BIM-NCM	agreed/started	2008	comparison
1110	Determination of magnetic properties of mass standards	PTB	agreed/started	2009	research
1115	R-134a leak comparison in atmospheric pressure	LNE	agreed/started	2010	comparison
1121	Transferring of knowledge in the field of gas pressure balance calibration	EIM	proposed	2009	research

Table 3: EURAMET active TC-M projects.

5. CMCs

Over the last year, 11 CMCs from other RMOs were reviewed. Some of them are still under review by other RMOs. A very recent submission in mass by SIM is currently under review.

As concerns EURAMET submissions, the following is an update since March 2010.

Approved EURAMET CMC revisions or new submissions

EURAMET.M.11.2009 (NIS, Egypt, new CMCs for mass)
 EURAMET.M.17.2010 (ZMDM, Serbia, new CMCs for mass)
 EURAMET.M.18.2010 (EIM, Greece, revision of mass CMCs)
 EURAMET.M.19.2010 (VSL, The Netherlands, extension of the temperature range for viscosity)
 EURAMET.M.20.2010 (IPQ, Portugal, a slight extension of the range in pressure)

A submission from Ireland concerning pressure is awaiting transmission to the JCRB until some supporting comparison has been successfully carried out.

Also a submission from France concerning an improvement of uncertainties was presented weeks ago (EURAMET.M.22.2011), and a further from Bosnia and Herzegovina (first submission in mass) is under internal review.

There is an issue on torque. PTB is ready to raise the upper limit for this quantity to a value that no other Country can attain at present, and this might represent a problem when the corresponding CMC will be submitted.

Peer reviews in various subfields were carried out at UME, CEM, IPQ and INRIM. Salvatore Loreface (INRIM) carried out a peer review of the volume and viscosity fields at CENAM, Mexico, in January 2010.

As concerns inter-RMO CMC review, some discrepancy in the vision concerning CMC declaration and review, respectively, were made evident in the past years. Examples are the magnetic properties of mass standards for the former issue and capability of measuring input quantities (such as volume for mass) for the latter. It is suspected that these are only two among many similar cases. Harmonization of these presently different viewpoints is necessary.

6. Sub-Committees

Mass, Force, Pressure and Density sub-committees meet annually just before the TC-M Contact Persons meeting. Summary reports of the last meetings were given in last year's report to the TCC meeting.

Ulf Jacobsson, IRMM, the mass Sub-Committee Convenor, resigned recently due to a change in his duties at IRMM. Many thanks to him for the excellent collaboration in these years. Stuart Davidson accepted to provisionally take on Ulf's role. Many thanks also to Stuart.

7. Participation in iMERA and EMRP

As concerns the EMRP call 2010, membership of TC-M had presented several Potential Research Topics (PRTs) under the topic area "Metrology for industry": As a result of the selection process, the following are those JRP's falling totally (the first three) or largely (the fourth) under the field of interest of the TC-M.

- Traceable Dynamic Measurement of Mechanical Quantities
- High Pressure Metrology for Industrial Applications
- Vacuum metrology for production environments
- Dynamic mechanical properties and long-term deformation behaviour of viscous materials.

In the framework of the 2011 calls, several PRTs were discussed during the March meeting. Two concern the kilogram re-definition and *mise en pratique*, under the topic "SI broader scope", a further one is under the same topic, and one is under "New technologies".

8. Meetings

The 2011 Mass and related quantities TC Contact Persons meeting was held in San Anton, Malta on 4th March and, as usual, was preceded by technical meetings for the various subfields to review progress in projects in mass, force, pressure, density. A preliminary joint session was devoted to EMRP.

9. Issues

EURAMET Calibration Guidance Document

As it is well known, all EA Calibration Guidance Documents had been transferred across to EURAMET. Among those relevant to TC-M,

- The EURAMET Calibration Guide 03 “Calibration of Pressure Balances” had been extensively modified and a new, final draft had been presented at the 2010 TC-M meeting. The document was eventually adopted during the last March TC-M meeting and subsequently published.
- The EURAMET Calibration Guide 04 “Uncertainty of Calibration Results in Force Measurements” is now adopted and published.
- The EURAMET Calibration Guide 18 “Guidelines on the Calibration of Non-Automatic Weighing Instruments” had been revised and version 02 had been produced. Subsequently, several misprints were corrected, notation was better aligned with ISO 80000 series and some references were actualized. The present version 02.1 is now published. Concerns were expressed by some influential users that the document, which is being adopted also by other RMOs as mandatory, is too complicated and needs some further adjustment. The issue was discussed during the last TC-M meeting and it was decided to start a project to revise the document.

10. TC-M Chair

Walter Bich will not chair the TC for a second term. Nieves Medina (CEM, Spain), will succeed to him on the chair. Best wishes to Nieves.

11. Outlook for 2011/2012

Next year activity will be largely dominated by work on the kilogram redefinition, especially concerning its *mise en pratique*, and by EMRP-related work.

Walter Bich, INRiM,
TC-M Chairman
2011-06-01