EURAMET TC Mass

2011-2013 TC-M Report to the CCM

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OVERVIEW

- Statistics of the projects
- Key comparisons
- Supplementary comparisons
- Other projects
- EMRP projects

Statistics of projects

Projects

	Comparison	Research	Traceability	Consultation	Total
Proposed	3 (4)	2 (3)	1	-	6 (7)
Agreed	21 (14)	8 (8)	2(3)	-	31 (25)
Completed	48 (45)	37 (34)	7 (6)	15 (15)	107 (100)
Total	**72 (63)**	**47 (45)**	**10 (9)**	**15 (15)**	**144 (132)**

Project breakdown

	Proposed	Agreed	Completed	Total
Density	2 (0)	2 (2)	9 (8)	**13**
Force	0 (2)	6 (7)	7 (5)	**13**
Hardness	-	-	1 (1)	**1**
Mass	2 (0)	7 (7)	41 (39)	**52**
Pressure	2 (5)	13 (6)	42 (40)	**57**
Torque	-	0 (1)	2 (2)	**3**
Viscosity	-	0 (1)	5 (4)	**5**
Gravimetry	-	1 (1)	1 (1)	**2**

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34 Key comparisons

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Comparison ID	Project no.	Title/Range	Subfield	Pilot	Status	Years
EUROMET.M.M-K1	215	Kilogram	Mass	NPL	Approved for equivalence	1992-1999
EUROMET.M.M-K2	445	100 mg to 10 kg	Mass	SP	Approved for equivalence	2001-2003
EUROMET.M.M-K2.1	786	100 mg to 10 kg	Mass	SP	Approved for equivalence	2004-2008
EUROMET.M.M-K2.2	1120	100 mg to 500 g	Mass	BEV	**Approved for equivalence**	2009-2010
EUROMET.M.M-K2.3	1198	20 g, 500 g, 10 kg	Mass	EIM	Approved for equivalence	2011
EUROMET.M.M-K2.4	-	100 mg to 10 kg	Mass	DFM	Proposed	-
EUROMET.M.M-K2.5	1222	10 kg	Mass	BEV	In progress	2012
EUROMET.M.M-K4	510	Kilogram	Mass	NPL	Approved for equivalence	1999-2003
EUROMET.M.M-K4.1	1029	Kilogram	Mass	MIRS	Approved for equivalence	2007-2008
EURAMET.M.M-K4.2	1120	Kilogram	Mass	BEV	**Approved for equivalence**	2009-2010
EUROMET.M.D-K1	339	Solid (3 Si spheres)	Density	METAS	Provisional equivalence	1998-1999
EUROMET.M.D-K1.1	1031	Solid (3 ceramic sph.)	Density	PTB	In progress	2008-2010
EUROMET.M.D-K2	627	Liquid density	Density	PTB	Report in progress, Draft B	2001-2002
EURAMET.M.D-K2	1019	Liquid density	Density	BEV	In progress,Draft A	2007-
EUROMET.M.D-K4.Prev	236	Hydrometers	Density	IMGC	Provisional equivalence	1993-1994
EUROMET.M.D-K4	702	Hydrometers	Density	IMGC	Approved for equivalence	2003-2006
EUROMET.M.P-K1.a	442	0.1 Pa to 1000 Pa	Pressure	BNM-LNE	Approved and published	1999-2002

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Comparison ID	Project no.	Title/Range	Subfield	Pilot	Status	Years
EUROMET.M.P-K1.b	442	0.3 mPa to 9 Pa	Pressure	BNM-LNE	Approved for equivalence	2000-2002
EUROMET.M.P-K1.c	1179	0.7 MPa to 7 MPa	Pressure	FORCE	In progress	2011-2013
EUROMET.M.P-K2	305	1 MPa to 4 MPa	Pressure	PTB	Approved for equivalence	1994-1995
EUROMET.M.P-K3.a	439	0.05 MPa to 1 MPa	Pressure	LNE/NPL	Approved for equivalence	1999-2001
EUROMET.M.P-K3.b	439	0.05 MPa to 1 MPa	Pressure	NPL	**Approved for equivalence**	1999-2001
EUROMET.M.P-K4	389	10 MPa to 100 MPa	Pressure	NPL	Approved for equivalence	1998-1999
EURAMET.M.P-K4 2010	1047	0.5 Pa to 15 kPa	Pressure	CMI	In progress	2007
EUROMET.M.P-K5	045	50 MPa to 500 MPa	Pressure	BNM-LNE	Provisional equivalence	1993-1995
EUROMET.M.P-K6	110	100 MPa - 1000 MPa	Pressure	BNM-LNE	Provisional equivalence	1992-1994
EURAMET.M.P-K7	881	50 MPa to 500 MPa	Pressure	MIKES	Report in progress, Draft B	2005-2007
EURAMET.M.P-K8	1041	25 kPa to 200 kPa	Pressure	METAS	In progress	2007-
EURAMET.M.P-K13	1091	50 MPa to 500 MPa	Pressure	UME	In progress	2009-
EUROMET.M.F-K1	535	5 kN to 10 kN	Force	MIKES	Report in progress, Draft B	2002-2004
EUROMET.M.F-K2	518	50 kN to 100 kN	Force	NPL	Rep. in progress, Draft B	2003-
EUROMET.M.F-K3	505	500 kN to 4 MN	Force	PTB	In progress	2005-2007
EURAMET.M.G-K1	1186	Free fall acceleration	Gravimetry	METAS	**Approved for equivalence**	2011
SIM-EUROMET.M.P-BK3		3 mPa to 0.9 Pa	Pressure	PTB/CENAM	Approved for equivalence	2001-2002
SIM-EUROMET.M.P-BK4		10 MPa to 100 MPa	Pressure	PTB/CENAM	Approved for equivalence	2002

23 Supplementary comparisons

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Comparison ID	Project no.	Title/Range	Subfield	Pilot	Status	Years
EUROMET.M.V-S1	273	(0.989-4600) mm^2/s	Viscosity	PTB	Published	1992-1993
EUROMET.M.V-S2	303	(0.4- 67743 mm^2/s	Viscosity	PTB	Published	1993-1996
EUROMET.M.V-S3	415	(190- 774000 mm^2/s	Viscosity	PTB	Published	1997-2000
EUROMET.M.V-S4	415	(0.33-144000) mm^2/s	Viscosity	PTB	Published	1997
EUROMET.M.M-S1	461	500 kg	Mass	CMI	Report in progress, Draft B	2001-2005
EURAMET.M.M-S2	1054	0.1 mg to 100 g	Mass	NPL	**Approved and Published**	2008-
EURAMET.M.M-S3	-	100 mg to 50 kg	Mass	UME	In progress	2011-2012
EURAMET.M.M-S4	1232	2 mg to 50 kg	Mass	INRIM	Proposed	2012
EURAMET.M.M-S5	-	100 mg to 1 kg	Mass	NSAI	Planned	2012-2013
EURAMET.M.D-S1	1240	Liquid density	Density	BEV	In progress	2012-2013
EUROMET.M.P-S1	788	0.05 MPa to 1 MPa	Pressure	METAS	Approved and Published	2004-2006
EUROMET.M.P-S2	922	30 Pa to 7 kPa	Pressure	PTB	Approved and Published	2006-2007
EUROMET.M.P-S3	884	80 kPa to 110 kPa	Pressure	LNE	Approved and Published	2006-2008
EUROMET.M.P-S4	861	40 kPa to 1.75 MPa	Pressure	UME	Approved and Published	2005-2006
EURAMET.M.P-S5	931	50 MPa to 500 MPa	Pressure	PTB	Report in progress, Draft B	2007-2008
EURAMET.M.P-S6	-	1.5 kPa to 300 kPa	Pressure	PTB	Approved and Published	2007-2008
EURAMET.M.P-S7	1040	0.1 mPa to 1 Pa	Pressure	METAS	In progress	2007-
EURAMET.M.P-S8	1131	-100 kPa to +100 kPa	Pressure	MIKES	Approved and Published	2009-2010
EURAMET.M.P-S9	1170	-950 hPa to 0 hPa	Pressure	LNE	In progress	2011
EURAMET.M.P-S10	-	0.005 Pa to 100 Pa	Pressure	CEM	**Approved and Published**	2010-2011
EURAMET.M.P-S11	-	0 MPa to 50 MPa	Pressure	UME	**Approved and Published**	2011
EURAMET.M.T-S1	1055	1 N.m to 1000 N.m	Torque	PTB	Approved and Published	2008-2010
EURAMET.M.T-S2	1141	100 N m	Torque	PTB	Rep. in progress, Draft A	2008-
EURAMET.M.T-S3	-	10 N.m to 1 kN.m	Torque	CEM	**Approved and Published**	2010
EURAMET.M.G-S1	1093	Free fall acceleration	Gravimetry	METAS	Approved and Published	2008-2009
EURAMET.M.F-S1	-	5 kN to 5 MN	Force	NPL	Approved and Published	2005-2006

Other projects

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14 active projects (no comparisons)

Ref.	Title	Institute	Year	Collaboration
1215	Primary mercury columns using floats - exchange of experiences	CEM	2011	research
1214	Density measurement of viscous oils	VSL	2011	research
1210	Best practice for the dissemination of the kilogram	VSL	2011	traceability
1205	Review of EURAMET cg 18: Guidelines on the Calibration of Non-Automatic Weighing Instruments	CEM	2011	research
1125	Evaluation of cross-float measurements with pressure balances	LNE	2010	research
1121	Transferring of knowledge in the field of gas pressure balance calibration	EIM	2009	research
1110	Determination of magnetic properties of mass standards	PTB	2009	research
911	Study of standard leaks performance for different gas, in the transition regime	INRIM	2006	research
890	Dynamic Force Measurement	PTB	2006	research
803	FPG-type digital piston manometer – exchange of experiences	MIKES	2004	research
402	Mass mesurement (Guide to the mass determination)	SMU	1997	research
351	Workshop on 'Secondary and Reference Mass Standards"	LNE	1995	research
286	Traceability in force measurement at national laboratory level in range up to 2 MN	PTB	1993	traceability
285	Calibration of precision force measuring devices and transfer standards of the capacities up to 16,5 MN.	PTB	1993	traceability

EURAMET project 1205: Review of EURAMET Calibration Guide 18 “Guidelines on the Calibration of Non-Automatic Weighing Instruments”

SCOPE: It has being adopted also by other RMOs and broadly used by accreditation bodies as mandatory

17 NMIs participating

First review with a direct collaboration of manufacturers

EMRP projects

(out of the statistics)

EMRP 2010

Number	Short Name	Full Name
IND 03	HIGHpress	High Pressure Metrology for Industrial Applications
IND 09	Dynamic	Traceable Dynamic Measurement of Mechanical Quantities
IND 12	Vacuum	Vacuum metrology for production environments

High Pressure Metrology for Industrial Applications

SCOPE: Pressures up to 1.5 GPa are used in high-pressure technologies in general engineering, automotive, petrochemical, pharmaceutical and food industries.

GOAL: Traceability up to 1.6 GPa with a relative expanded uncertainty as low as 0.05 %.

PARTNERS: PTB, CMI, EJPD, LNE, SMU, TUC.

Workshop on High Pressure Metrology for Industry (14th June 2012)

Traceable Dynamic Measurement of Mechanical Quantities

SCOPE: Many applications of the measurement of force, torque and pressure are dynamic (strong variation over time). Transducers are calibrated by static procedures but mechanical sensors exhibit distinctive dynamic behaviour.

GOAL: Traceability for force, torque and pressure for measurements under dynamic conditions.

PARTNERS: PTB, CEM, CMI, INRIM, LNE, MIKES, NPL, SP, UME.

Workshop on Analysis of Dynamic Measurements (15th-16th October 2012)

Vacuum metrology for production environments

SCOPE: Traditional measurements are based on the pressures of pure gases in stable conditions. In industry it is the opposite: gas mixtures and pressures changing with time.

GOAL: This research will lead to a facility for dynamic pressures and establish traceability for partial pressures, outgassing rates and leak rate measurement in industry.

PARTNERS: PTB, CEM, CMI, IMT, INRIM, LNE, UME, DANFOSS, INFICON, LAZZERO, VACOM.

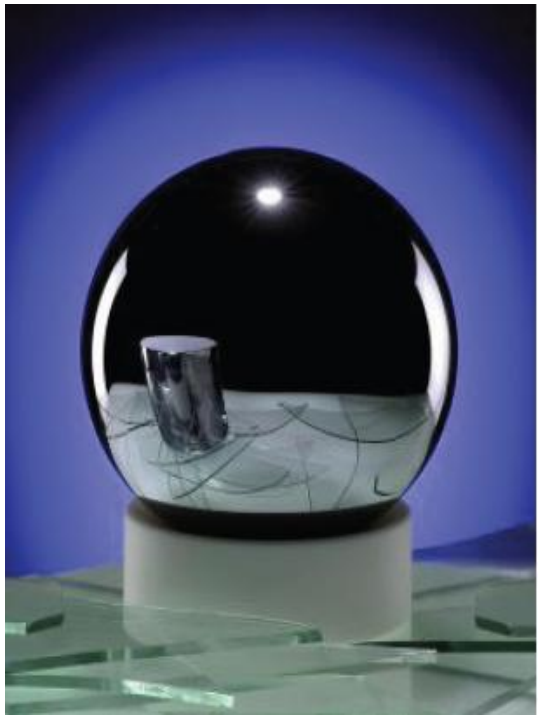
Workshop on measurement characteristics and use of quadrupole mass spectrometers for vacuum applications (12^{th}-13^{th} April 2012)

EMRP 2011

Number	Short Name	Full Name
SIB03	KNOW	Realisation of the awaited definition of the kilogram - resolving the discrepancies
SIB05	NewKILO	Developing a practical means of disseminating the new kilogram

Realisation of the awaited definition of the kilogram - resolving the discrepancies

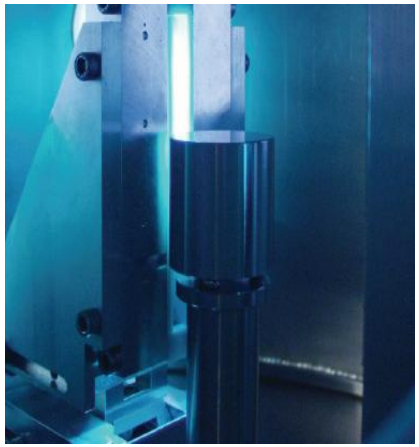
SCOPE: A significant international effort is under way to establish a new definition of the kilogram based on the Planck constant *h*. These experiments have been completed (watt-balance and Si-sphere Avogadro), but the results show discrepancies.



GOAL: Resolving the existing discrepancies with relative standard uncertainties not larger than 5×10^{-8}

PARTNERS: PTB, INRIM, NPL, CNAM, NIST, NCR, EJPD.

Developing a practical means of disseminating the new kilogram



SCOPE: Practical experiments for the new definition of the kilogram cannot be performed as frequently as desired.
In the new definition the kilogram will have an uncertainty, the traceability chain has to be improved to avoid affecting uncertainties provided to the user.

GOAL: Ensuring the continuity of the practical realisation of the mass unit between existing and new realisations of the kilogram.
Dissemination at the level of the NMIs must be achievable with relative uncertainty $< 2 \times 10^{-8}$.

PARTNERS: NPL, CMI, DFM, EJPD, LNE, PTB, MIKES, CNAM, MHEST, UME, INRIM, NCR

EMRP 2012

Number	Short Name	Full Name
SIB63	Force Metrology	Force traceability within the meganewton range

Force traceability within the meganewton range

SCOPE: This project addresses the increasing demand for traceabilityin the MN force range in European industry, in civil engineering, materials testing, wind power systems, off-shore industry, aviation industry and aerospace.

GOAL: Extending primary force standards up to 50 MN, developing new transducer principles, investigating the effects of influencing quantities and providing new procedures.

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PARTNERS: PTB, BAM, NPL, CEM, CMI, EJPD, LNE, MG, MIKES,TUBITAK, INRIM,

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Thank you very much for your attention