

CCM.F-K2.a, CCM.F-K2.b, CCM.F-K2.a.1, EURAMET.M.F-K2, APMP.M.F-K2.a and APMP.M.F-K2.b

Key comparisons CCM.F-K2.a and CCM.F-K2.b

MEASURAND : Force

NOMINAL VALUES : 50 kN and 100 kN

Dates of measurements : 2004 - 2007

Measurements in key comparisons CCM.F-K2.a and CCM.F-K2.b correspond to the schemes A and B respectively, as explained on page 4 of the Final Report. Two transducers are used in scheme A, and three transducers are used in scheme B:

- in scheme A, the two transducers have a nominal capacity of 100 kN and are used to measure 50 kN and 100 kN forces;
- in scheme B, two transducers have a nominal capacity of 50 kN and are used to measure 50 kN forces, and one transducer has a nominal capacity of 100 kN and is used to measure 50 kN forces.

Detailed results of measurements obtained in both key comparisons are given in Section 9 on page 18 of the Final Report. They are then concatenated (see page 30 of the Final Report) in order to provide one set of measurements for 50 kN forces and one set of measurements for 100 kN forces.

These two sets of results are shown in Figure 26 and Figure 27 on page 31 of the Final Report.

Key comparisons CCM.F-K2.a.1

MEASURAND : Force

NOMINAL VALUES : 50 kN and 100 kN

Dates of measurements : 2010 - 2011

Measurements in key comparisons CCM.F-K2.a.1 were made in scheme A.

Detailed description of the measurement results is given in Sections 8 and 9 of the CCM.F-K2.a.1 Final Report.

Key comparison EUROMET.M.F-K2

MEASURAND : Force

NOMINAL VALUES : 50 kN and 100 kN

Dates of measurements : 2007 - 2009

The same scheme as in CCM.F-K2.a and b is followed for the measurements in key comparison EUROMET.M.F-K2, as explained on page 4 of the EUROMET.M.F-K2 Final Report.

Results obtained by participating laboratories are given in Section 9 (starting on page 14) of the Final Report. The two sets of results (for 50 kN and 100 kN) are shown on Figures 18 and 19 on page 24 of the Final Report.

Key comparison APMP.M.F-K2.a and APMP.M.F-K2.b

MEASURAND : Force

NOMINAL VALUES : 50 kN and 100 kN

Dates of measurements : 2007 - 2014

The same scheme as in CCM.F-K2.a and b is followed for the measurements in key comparisons APMP.M.F-K2.a and APMP.M.F-K2.b. The results are given in Section 6 of the Final Report.

CCM.F-K2.a, CCM.F-K2.b, CCM.F-K2.a.1, EURAMET.M.F-K2, APMP.M.F-K2.a and APMP.M.F-K2.b

Key comparisons CCM.F-K2.a and CCM.F-K2.b

MEASURAND : Force NOMINAL VALUES : 50 kN and 100 kN

For each nominal value of the force, the key comparison reference value, x_R , is calculated as the weighted average of the mean relative deviations from the pilot laboratory obtained by the participating laboratories.
Its standard uncertainty, u_R , is calculated as explained on page 30 of the Final Report.

Force 50 kN: $x_{R\ 50\ \text{kN}} = 0.47 \cdot 10^{-5}$ and $2u_{R\ 50\ \text{kN}} = 0.66 \cdot 10^{-5}$
Force 100 kN: $x_{R\ 100\ \text{kN}} = 0.52 \cdot 10^{-5}$ and $2u_{R\ 100\ \text{kN}} = 0.82 \cdot 10^{-5}$

For each nominal value of the force, the degree of equivalence of each laboratory i with respect to the key comparison reference value is given by a pair of terms, both expressed in 10^{-5} : D_i and U_i , its expanded uncertainty ($k = 2$).
(See the Appendix on page 32 of the Final Report)

Linking key comparison CCM.F-K2.a.1 to CCM.F-K2

Linking is made via the pilot laboratory NPL, who also participated in the CCM.F-K2.a comparison.

Linking key comparison EUROMET.M.F-K2 to CCM.F-K2

For each nominal value of the force, a reference value is computed inside the EURAMET key comparison, as the weighted mean deviation from the pilot value. Based on the assumption that the performance of the common participants in both comparisons, the NPL and the PTB, has remained unchanged, it can be concluded that the EURAMET reference values are $0.6 \cdot 10^{-5}$ and $0.7 \cdot 10^{-5}$ lower than the CCM.F-K2 key comparison reference values, at forces of 50 kN and 100 kN, respectively.

The degrees of equivalence found inside the EURAMET key comparison (offsets and expanded uncertainties) are adjusted accordingly, as explained on page 28 of the EUROMET.M.F-K2 Final Report, to be transferred to key comparison CCM.F-K2.

Linking key comparison APMP.M.F-K2.a and APMP.M.F-K2.b to CCM.F-K.a and CCM.F-K2.b

Linking of results for 50 kN is made via KRISS, NIM and NMIJ/AIST who also participated in the CCM.F-K2.a and CCM.F-K2.b comparisons.

Linking of results for 100 kN is made via KRISS and NIM who also participated in the CCM.F-K2.a and CCM.F-K2.b comparisons.

CCM.F-K2.a, CCM.F-K2.b, CCM.F-K2.a.1, EURAMET.M.F-K2, APMP.M.F-K2.a and APMP.M.F-K2.b

MEASURAND : Force
 NOMINAL VALUE : 50 kN

Degrees of equivalence relative to the CCM.F-K2 key comparison reference value

Lab <i>i</i>	D_i	U_i
	/ (10 ⁻⁵)	
NPL	-0.5	1.6
NMISA	1.1	60.0
LNE	-0.7	1.8
NMIJ	-1.7	2.0
KRISS	0.8	2.4
NIM	0.8	2.4
UME	-4.5	2.5
PTB	-1.1	2.6
SMD	7.9	5.2
SP	4.0	5.4
NIST	2.4	2.0
INRIM	3.6	2.7
CENAM	-2.8	4.3
MIKES	0.0	5.2
INTI	-1.5	10.2
CEM	-6.1	2.7

Lab <i>i</i>	D_i	U_i
	/ (10 ⁻⁵)	
NPL	-0.5	2.4
VSL	-10.3	10.3
METAS	-1.0	3.3
MKEH	4.4	20.2
PTB	-1.0	3.0
CMI	0.4	20.2
IPQ	-0.2	3.4
INM(RO)	-0.8	5.6
EIM	0.6	3.1
FORCE	-3.6	10.4
INMETRO	-0.9	3.3
GUM	1.9	10.3

Lab <i>i</i>	D_i	U_i
	/ (10 ⁻⁵)	
KRISS	1.1	3.2
NMIM	-2.6	4.2
NIS	-16.6	3.1
NPLI	0.3	3.0
NMC, A*STAR	-4.7	6.4
SCL	-1.6	4.8
VMI	-25.4	50.1
ITRI	-3.7	30.5
NIMT	-1.5	3.7
RCM-LIPI	0.4	10.4
KEBS	22.1	50.5
NIM	-1.1	4.3
NMIJ	0.7	3.7

Red: CCM.F-K2
 Orange: CCM.F-K2.a.1
 Blue: EURAMET.M.F-K2
 Green: APMP.M.F-K2.a and APMP.M.F-K2.b

CCM.F-K2.a, CCM.F-K2.b, CCM.F-K2.a.1, EURAMET.M.F-K2, APMP.M.F-K2.a and APMP.M.F-K2.b

MEASURAND : Force
 NOMINAL VALUE : 100 kN

Degrees of equivalence relative to the CCM.F-K2 key comparison reference value

Lab *i* ↓

	D_i	U_i
	/ (10^{-5})	
NPL	-0.5	1.7
KRISS	1.4	2.7
NIM	0.2	2.3
UME	-4.0	2.6
PTB	-1.4	2.6
SMD	3.6	5.2
SP	4.7	5.5
NIST	2.1	2.1
INRIM	3.2	2.7
CENAM	1.1	3.1
MIKES	-0.2	5.2
INTI	-1.9	10.2
CEM	-4.7	2.8

Lab *i* ↓

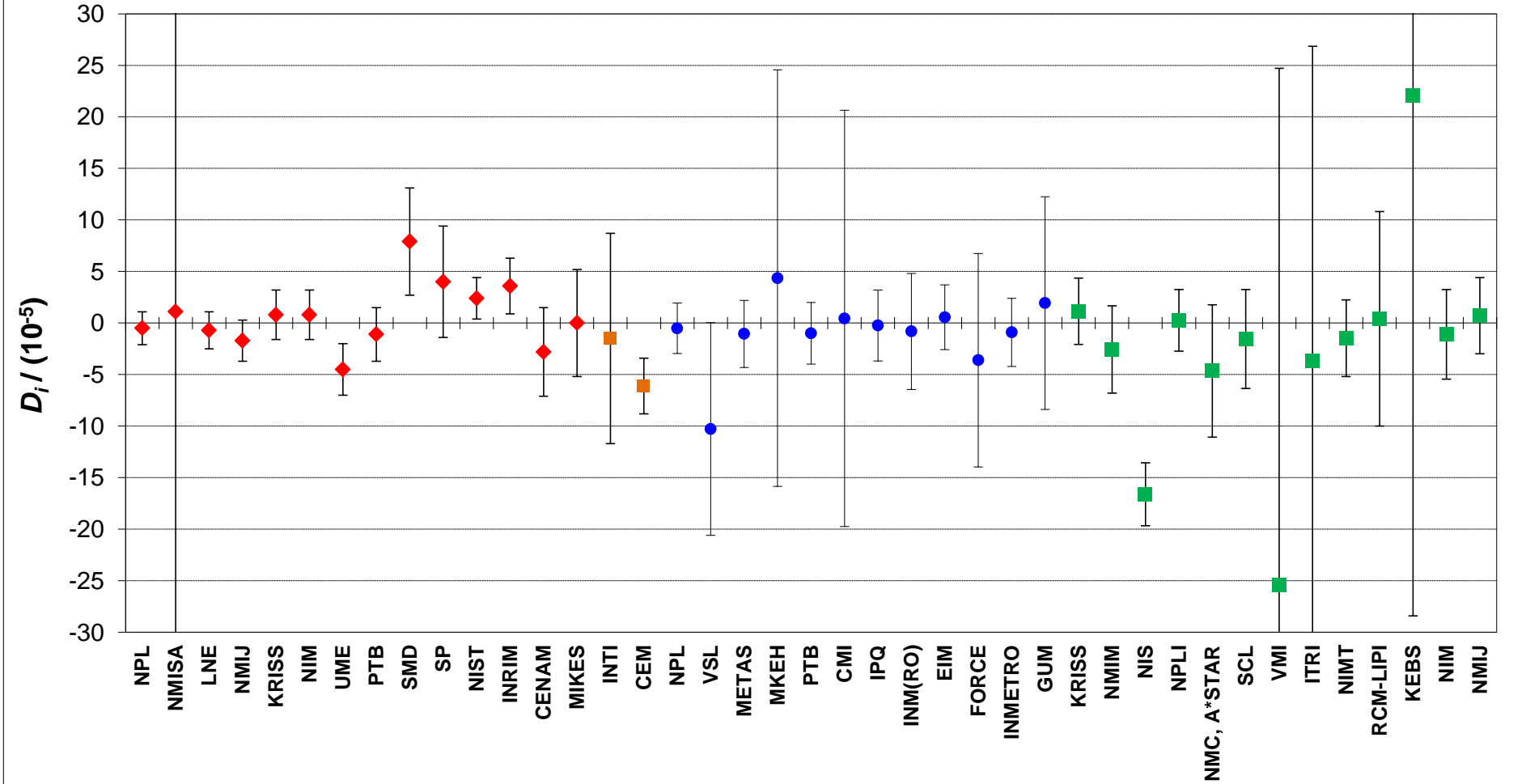
	D_i	U_i
	/ (10^{-5})	
NPL	-0.7	2.4
VSL	-9.4	10.3
METAS	-0.7	3.2
MKEH	2.5	20.2
PTB	-1.0	2.9
CMI	1.1	20.2
IPQ	-0.7	3.3
INM(RO)	-1.1	5.6
EIM	0.1	3.1
FORCE	1.2	10.4
INMETRO	-0.9	3.3

Lab *i* ↓

	D_i	U_i
	/ (10^{-5})	
KRISS	1.2	3.8
NPLI	-1.4	4.0
NMC, A*STAR	-13.3	20.9
SCL	-24.2	20.9
VMI	-31.9	49.9
ITRI	-2.5	30.2
NIMT	-1.1	4.1
RCM-LIPI	-3.0	10.5
KEBS	18.7	50.1
NIM	-0.8	4.2
NMIJ	0.6	4.1

Red: CCM.F-K2
 Orange: CCM.F-K2.a.1
 Blue: EUROMET.M.F-K2
 Green: APMP.M.F-K2.a and APMP.M.F-K2.b

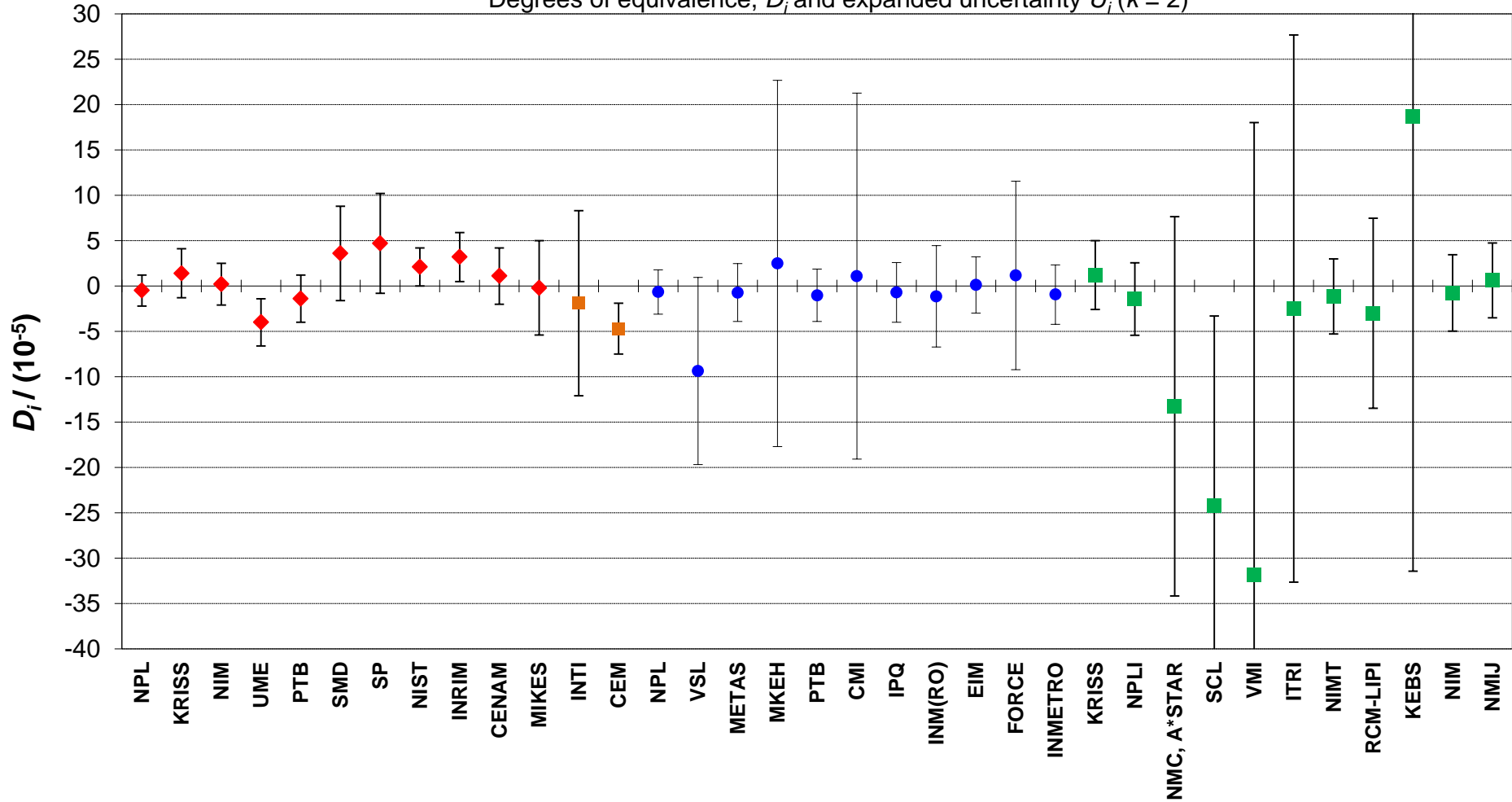
CCM.F-K2, CCM.F-K2.a.1, EUROMET.M.F-K2, APMP.M.F-K2.a and APMP.M.F-K2.b : force 50 kN
 Degrees of equivalence, D_i and expanded uncertainty U_i ($k = 2$)



Red diamonds: CCM.F-K2
 Orange squares: CCM.F-K2.1.a
 Blue circles: EUROMET.M.F-K2
 Green squares: APMP.M.F-K2.a and b

$U_{NMISA} = 60.0 \text{ E-05}$

CCM.F-K2, CCM.F-K2.a.1, EUROMET.M.F-K2, APMP.M.F-K2.a and APMP.M.F-K2.b: force 100 kN
 Degrees of equivalence, D_i and expanded uncertainty U_i ($k = 2$)



Red diamonds: participants in CCM.F-K2
 Orange squares: participants in CCM.F-K2.a.1
 Blue circles: participants in EUROMET.M.F-K2
 Green squares: APMP.M.F-K2.a and b