Bijlage bij accreditatie-certificaat
Annexe au certificat d'accréditation
Annex to the accreditation certificate
Beilage zur Akkreditierungszertifikat

004-CAL

EN ISO/IEC 17025:2005

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Voorzitster van het Accreditatiebureau
La Présidente du Bureau d'Accréditation
Chair of the Accreditation Board
Vorsitzende des Akkreditierungsbüro

De accreditatie werd uitgereikt aan/ L'accréditation est délivrée à/
The accreditation is granted to/ Die akkreditierung wurde erteilt für:

TRESCAL nv
Vosstraat, 200
2600 BERCHEM

Voor activiteiten uitgevoerd door/ Pour des activités exécutés par/
For activities performed by/ Die tätigkeiten werden durchgeführt von:

locatie 1	**BERCHEM**	**Vosstraat, 200** **2600 Berchem**
locatie 2	**WELLIN**	**Rue Jean Meunier, 2** **6920 Halma (Wellin)**

BELAC 6-017 code	ELEKTRICAL (Berchem, In House or In Situ)

1.1.1 Direct voltage

Measure

Measuring range or point	Frequency	CMC (95%)	Remark
± 100 mV	DC	$5{,}0 \times 10^{-6} \times U$	• Transfer standard in "30 day" loop • Fixed points • positive /negative • measuring
± 1 V	DC	$2{,}7 \times 10^{-6} \times U$	
± 10 V	DC	$2{,}1 \times 10^{-6} \times U$	
± 19 V	DC	$2{,}3 \times 10^{-6} \times U$	
± 100 V	DC	$3{,}0 \times 10^{-6} \times U$	
± 1000 V	DC	$3{,}0 \times 10^{-6} \times U$	

Measuring range or point	Frequency	CMC (95%)	Remark
0 mV to 200 mV	DC	$7{,}0 \times 10^{-6} \times U$ or 0,1 µV[1]	• measure • positive / negative
0,2 V to 2 V	DC	$5{,}0 \times 10^{-6} \times U$	
2 V to 20 V	DC	$4{,}5 \times 10^{-6} \times U$	
20 V to 200 V	DC	$5{,}5 \times 10^{-6} \times U$	
200 V to 1000 V	DC	$5{,}5 \times 10^{-6} \times U$	
1 kV to 75 kV	DC	$3{,}0 \times 10^{-4} \times U$	Measure
0,2 V to 11 V	DC	$5{,}0 \times 10^{-6} \times U$	Loop calibration

[1] Whichever is greater

Generate

Generating range or point	Frequency	CMC (95%)	Remark
0 mV to 200 mV	DC	$18 \times 10^{-6} \times U$ or 0,5 µV[1]	• generate • positive / negative
0,2 V to 2 V	DC	$8{,}0 \times 10^{-6} \times U$	
2 V to 20 V	DC	$4{,}5 \times 10^{-6} \times U$	
20 V to 200 V	DC	$7{,}0 \times 10^{-6} \times U$	
200 V to 1100 V	DC	$10 \times 10^{-6} \times U$	
1,1 kV - 40 kV	DC	$3{,}0 \times 10^{-4} \times U$	Generate
0,2 V to 11 V	DC	$8{,}0 \times 10^{-6} \times U$	Loop calibration

[1] Whichever is greater

1.1.2 Direct current

Measure

Measuring range or point	Frequency	CMC (95%)	Remark
±100 µA	DC	$24 \times 10^{-6} \times I$	• Transfer standard in "30 day" loop • Fixed points • positive / negative • Measurement
±1 mA	DC	$16 \times 10^{-6} \times I$	
±10 mA	DC	$16 \times 10^{-6} \times I$	
±100 mA	DC	$19 \times 10^{-6} \times I$	
±1 A	DC	$31 \times 10^{-6} \times I$	
±10 A	DC	$60 \times 10^{-6} \times I$	

Measuring range or point	Frequency	CMC (95%)	Remark
0 µA to 200 µA	DC	$12 \times 10^{-6} \times I$ or 0,5 nA[1]	• measure • in the lowest possible range • positive / negative
0,2 mA to 2 mA	DC	$11 \times 10^{-6} \times I$	
2 mA to 20 mA	DC	$9{,}0 \times 10^{-6} \times I$	
20 mA to 200 mA	DC	$16 \times 10^{-6} \times I$	
0,2 A to 2 A	DC	$90 \times 10^{-6} \times I$	
2 A to 20 A	DC	$90 \times 10^{-6} \times I$	
0,2 mA to 24 mA	DC	$16 \times 10^{-6} \times I$	Loop calibration

[1] Whichever is greater

Calibration of current clamps

Measuring range or point	Frequency	CMC (95%)	Remark
20 A - 1000 A	DC	$5{,}0 \times 10^{-3} \times I$	• with current coils

Generate

Generating range or point	Frequency	CMC (95%)	Remark
0 µA to 20 µA	DC	1,5 nA	• generate • positive / negative
20 µA to 200 µA	DC	$1{,}7 \times 10^{-4} \times I$	
0,2 mA to 200 mA	DC	$0{,}7 \times 10^{-4} \times I$	
0,2 A to 2 A	DC	$1{,}9 \times 10^{-4} \times I$	
2 A to 11 A	DC	$2{,}7 \times 10^{-4} \times I$	
11 A to 20 A	DC	$6{,}0 \times 10^{-4} \times I$	
0,2 mA to 24 mA	DC	$0{,}7 \times 10^{-4} \times I$	Loop calibration

1.1.3 Alternating voltage

Measure

Measuring range or point	Frequency	CMC (95%)	Remark
1 mV	20 Hz to 20 kHz	$3{,}0 \times 10^{-4} \times U$ + 2 µV	• Transfer standard in "30 day" loop • Fixed points • measuring
	30 kHz & 50 kHz	$4{,}0 \times 10^{-4} \times U$ + 2 µV	
	100 kHz	$6{,}5 \times 10^{-4} \times U$ + 2 µV	
10 mV	20 Hz to 20 kHz	$1{,}7 \times 10^{-4} \times U$ + 2 µV	
	30 kHz & 50 kHz	$2{,}5 \times 10^{-4} \times U$ + 2 µV	
	100 kHz	$4{,}5 \times 10^{-4} \times U$ + 2 µV	
100 mV	20 Hz to 20 kHz	$1{,}2 \times 10^{-4} \times U$ + 2 µV	
	30 kHz & 50 kHz	$2{,}0 \times 10^{-4} \times U$ + 2 µV	
	100 kHz	$4{,}0 \times 10^{-4} \times U$ + 2 µV	
1 V	10 Hz to 30 Hz	$4{,}0 \times 10^{-5} \times U$	
	40 Hz to 30 kHz	$3{,}0 \times 10^{-5} \times U$	
	50 kHz	$4{,}0 \times 10^{-5} \times U$	
	100 kHz	$5{,}0 \times 10^{-5} \times U$	
	300 kHz	$12 \times 10^{-5} \times U$	
	500 kHz	$25 \times 10^{-5} \times U$	
	1 MHz	$60 \times 10^{-5} \times U$	
10 V	10 Hz to 30 Hz	$4{,}0 \times 10^{-5} \times U$	• Transfer standard in "30 day" loop • Fixed points • measuring
	40 Hz to 30 kHz	$3{,}0 \times 10^{-5} \times U$	
	50 kHz	$3{,}5 \times 10^{-5} \times U$	
	100 kHz	$4{,}0 \times 10^{-5} \times U$	
	300 kHz	$11 \times 10^{-5} \times U$	
	500 kHz	$22 \times 10^{-5} \times U$	
	1 MHz	$60 \times 10^{-5} \times U$	
19 V	1 kHz	$4{,}0 \times 10^{-5} \times U$	
100 V	10 Hz to 30 Hz	$4{,}5 \times 10^{-5} \times U$	
	40 Hz & 55 Hz	$4{,}0 \times 10^{-5} \times U$	
	300 Hz to 20 kHz	$3{,}0 \times 10^{-5} \times U$	
	30 kHz	$3{,}5 \times 10^{-5} \times U$	
	50 kHz	$4{,}5 \times 10^{-5} \times U$	
	100 kHz	$7{,}4 \times 10^{-5} \times U$	
1000 V	40 Hz to 1 kHz	$4{,}0 \times 10^{-5} \times U$	
	10 kHz	$4{,}5 \times 10^{-5} \times U$	
	20 kHz	$5{,}0 \times 10^{-5} \times U$	
	30 kHz	$7{,}5 \times 10^{-5} \times U$	
700 V	50 kHz	$13 \times 10^{-5} \times U$	
	100 kHz	$35 \times 10^{-5} \times U$	

Measuring range or point	Frequency	CMC (95%)	Remark
0,7 mV to 2,2 mV	10 Hz to 20 Hz	$17 \times 10^{-4} \times U + 1{,}3\ \mu V$	• measure
	20 Hz to 40 Hz	$7{,}4 \times 10^{-4} \times U + 1{,}3\ \mu V$	
	40 Hz to 20 kHz	$4{,}2 \times 10^{-4} \times U + 1{,}3\ \mu V$	
	20 kHz to 50 kHz	$8{,}2 \times 10^{-4} \times U + 2\ \mu V$	
	50 kHz to 100 kHz	$12 \times 10^{-4} \times U + 2{,}5\ \mu V$	
	100 kHz to 300 kHz	$23 \times 10^{-4} \times U + 4\ \mu V$	
	300 kHz to 500 kHz	$26 \times 10^{-4} \times U + 8\ \mu V$	
	500 kHz to 1 MHz	$50 \times 10^{-4} \times U + 8\ \mu V$	
2 mV to 7 mV	10 Hz to 20 Hz	$8{,}5 \times 10^{-4} \times U + 1{,}3\ \mu V$	• measure
	20 Hz to 40 Hz	$3{,}7 \times 10^{-4} \times U + 1{,}3\ \mu V$	
	40 Hz to 20 kHz	$2{,}1 \times 10^{-4} \times U + 1{,}3\ \mu V$	
	20 kHz to 50 kHz	$4{,}1 \times 10^{-4} \times U + 2\ \mu V$	
	50 kHz to 100 kHz	$6{,}1 \times 10^{-4} \times U + 2{,}5\ \mu V$	
	100 kHz to 300 kHz	$12 \times 10^{-4} \times U + 4\ \mu V$	
	300 kHz to 500 kHz	$14 \times 10^{-4} \times U + 8\ \mu V$	
	500 kHz to 1 MHz	$36 \times 10^{-4} \times U + 8\ \mu V$	
7 mV to 22 mV	10 Hz to 20 Hz	$2{,}9 \times 10^{-4} \times U + 1{,}3\ \mu V$	• measure
	20 Hz to 40 Hz	$1{,}9 \times 10^{-4} \times U + 1{,}3\ \mu V$	
	40 Hz to 20 kHz	$1{,}1 \times 10^{-4} \times U + 1{,}3\ \mu V$	
	20 kHz to 50 kHz	$2{,}1 \times 10^{-4} \times U + 2\ \mu V$	
	50 kHz to 100 kHz	$3{,}1 \times 10^{-4} \times U + 2{,}5\ \mu V$	
	100 kHz to 300 kHz	$8{,}2 \times 10^{-4} \times U + 4\ \mu V$	
	300 kHz to 500 kHz	$10 \times 10^{-4} \times U + 8\ \mu V$	
	500 kHz to 1 MHz	$26 \times 10^{-4} \times U + 8\ \mu V$	
22 mV to 70 mV	10 Hz to 20 Hz	$2{,}4 \times 10^{-4} \times U + 1{,}5\ \mu V$	• measure
	20 Hz to 40 Hz	$1{,}3 \times 10^{-4} \times U + 1{,}5\ \mu V$	
	40 Hz to 20 kHz	$0{,}69 \times 10^{-4} \times U + 1{,}5\ \mu V$	
	20 kHz to 50 kHz	$1{,}3 \times 10^{-4} \times U + 2\ \mu V$	
	50 kHz to 100 kHz	$2{,}6 \times 10^{-4} \times U + 2{,}5\ \mu V$	
	100 kHz to 300 kHz	$5{,}3 \times 10^{-4} \times U + 4\ \mu V$	
	300 kHz to 500 kHz	$6{,}8 \times 10^{-4} \times U + 8\ \mu V$	
	500 kHz to 1 MHz	$13 \times 10^{-4} \times U + 8\ \mu V$	
70 mV to 220 mV	10 Hz to 20 Hz	$21 \times 10^{-5} \times U + 1{,}5\ \mu V$	• measure
	20 Hz to 40 Hz	$8{,}7 \times 10^{-5} \times U + 1{,}5\ \mu V$	
	40 Hz to 20 kHz	$4{,}3 \times 10^{-5} \times U + 1{,}5\ \mu V$	
	20 kHz to 50 kHz	$7{,}3 \times 10^{-5} \times U + 2\ \mu V$	
	50 kHz to 100 kHz	$16 \times 10^{-5} \times U + 2{,}5\ \mu V$	
	100 kHz to 300 kHz	$28 \times 10^{-5} \times U + 4\ \mu V$	
	300 kHz to 500 kHz	$40 \times 10^{-5} \times U + 8\ \mu V$	
	500 kHz to 1 MHz	$120 \times 10^{-5} \times U + 8\ \mu V$	
220 mV to 700 mV	10 Hz to 20 Hz	$21 \times 10^{-5} \times U + 1{,}5\ \mu V$	• measure
	20 Hz to 40 Hz	$8{,}7 \times 10^{-5} \times U + 1{,}5\ \mu V$	
	40 Hz to 20 kHz	$3{,}8 \times 10^{-5} \times U + 1{,}5\ \mu V$	
	20 kHz to 50 kHz	$5{,}6 \times 10^{-5} \times U + 2\ \mu V$	
	50 kHz to 100 kHz	$8{,}4 \times 10^{-5} \times U + 2{,}5\ \mu V$	
	100 kHz to 300 kHz	$21 \times 10^{-5} \times U + 4\ \mu V$	
	300 kHz to 500 kHz	$34 \times 10^{-5} \times U + 8\ \mu V$	
	500 kHz to 1 MHz	$120 \times 10^{-5} \times U + 8\ \mu V$	

0,7 V to 2,2 V	10 Hz to 20 Hz	$20 \times 10^{-5} \times U$	• measure
	20 Hz to 40 Hz	$6{,}9 \times 10^{-5} \times U$	
	40 Hz to 20 kHz	$2{,}9 \times 10^{-5} \times U$	
	20 kHz to 50 kHz	$5{,}2 \times 10^{-5} \times U$	
	50 kHz to 100 kHz	$7{,}6 \times 10^{-5} \times U$	
	100 kHz to 300 kHz	$20 \times 10^{-5} \times U$	
	300 kHz to 500 kHz	$31 \times 10^{-5} \times U$	
	500 kHz to 1 MHz	$120 \times 10^{-5} \times U$	
2,2 V to 7 V	10 Hz to 20 Hz	$20 \times 10^{-5} \times U$	• measure
	20 Hz to 40 Hz	$7{,}0 \times 10^{-5} \times U$	
	40 Hz to 20 kHz	$2{,}9 \times 10^{-5} \times U$	
	20 kHz to 50 kHz	$5{,}3 \times 10^{-5} \times U$	
	50 kHz to 100 kHz	$8{,}8 \times 10^{-5} \times U$	
	100 kHz to 300 kHz	$22 \times 10^{-5} \times U$	
	300 kHz to 500 kHz	$47 \times 10^{-5} \times U$	
	500 kHz to 1 MHz	$150 \times 10^{-5} \times U$	
7 V to 22 V	10 Hz to 20 Hz	$20 \times 10^{-5} \times U$	• measure
	20 Hz to 40 Hz	$7{,}0 \times 10^{-5} \times U$	
	40 Hz to 20 kHz	$3{,}1 \times 10^{-5} \times U$	
	20 kHz to 50 kHz	$5{,}3 \times 10^{-5} \times U$	
	50 kHz to 100 kHz	$8{,}5 \times 10^{-5} \times U$	
	100 kHz to 300 kHz	$22 \times 10^{-5} \times U$	
	300 kHz to 500 kHz	$47 \times 10^{-5} \times U$	
	500 kHz to 1 MHz	$150 \times 10^{-5} \times U$	
22 V to 70 V	10 Hz to 20 Hz	$20 \times 10^{-5} \times U$	• measure
	20 Hz to 40 Hz	$7{,}2 \times 10^{-5} \times U$	
	40 Hz to 20 kHz	$3{,}9 \times 10^{-5} \times U$	
	20 kHz to 50 kHz	$6{,}3 \times 10^{-5} \times U$	
	50 kHz to 100 kHz	$11 \times 10^{-5} \times U$	
	100 kHz to 300 kHz	$22 \times 10^{-5} \times U$	
	300 kHz to 500 kHz	$51 \times 10^{-5} \times U$	
	500 kHz to 1 MHz	$150 \times 10^{-5} \times U$	
70 V to 220 V	10 Hz to 20 Hz	$20 \times 10^{-5} \times U$	• measure
	20 Hz to 40 Hz	$7{,}2 \times 10^{-5} \times U$	
	40 Hz to 20 kHz	$3{,}8 \times 10^{-5} \times U$	
	20 kHz to 50 kHz	$7{,}7 \times 10^{-5} \times U$	
	50 kHz to 100 kHz	$11 \times 10^{-5} \times U$	
	100 kHz to 300 kHz	$26 \times 10^{-5} \times U$	
	300 kHz to 500 kHz	$70 \times 10^{-5} \times U$	
220 V to 700 V	10 Hz to 20 Hz	$20 \times 10^{-5} \times U$	• measure
	20 Hz to 40 Hz	$11 \times 10^{-5} \times U$	
	40 Hz to 20 kHz	$4{,}7 \times 10^{-5} \times U$	
	20 kHz to 50 kHz	$15 \times 10^{-5} \times U$	
	50 kHz to 100 kHz	$85 \times 10^{-5} \times U$	
700 V to 1000 V	10 Hz to 20 Hz	$20 \times 10^{-5} \times U$	• measure
	20 Hz to 40 Hz	$11 \times 10^{-5} \times U$	
	40 Hz to 20 kHz	$4{,}4 \times 10^{-5} \times U$	
	20 kHz to 50 kHz	$15 \times 10^{-5} \times U$	
	50 kHz to 100 kHz	$85 \times 10^{-5} \times U$	
1 kV to 53 kV	50 Hz	$3{,}0 \times 10^{-3} \times U$	• measure

Generate

Generating range or point	Frequency	CMC (95%)	Remark
2 mV to 20 mV	1 kHz to10 kHz	$7{,}0 \times 10^{-4} \times U$	• generate
	10 kHz to100 kHz	$11 \times 10^{-4} \times U$	
20 mV to 200 mV	10 Hz to 300 Hz	$2{,}1 \times 10^{-4} \times U$	• generate
	300 Hz to 10 kHz	$1{,}8 \times 10^{-4} \times U$	
	10 kHz to 30 kHz	$2{,}8 \times 10^{-4} \times U$	
	30 kHz to 100 kHz	$6{,}1 \times 10^{-4} \times U$	
0,2 V to 2 V	10 Hz to 300 Hz	$1{,}6 \times 10^{-4} \times U$	• generate
	300 Hz to 1 kHz	$1{,}1 \times 10^{-4} \times U$	
	1 kHz to30 kHz	$0{,}7 \times 10^{-4} \times U$	
	30 kHz to 100 kHz	$1{,}6 \times 10^{-4} \times U$	
	100 kHz to 300 kHz	$6{,}0 \times 10^{-4} \times U$	
	300 kHz to 1 MHz	$30 \times 10^{-4} \times U$	
2 V to 20 V	10 Hz to 300 Hz	$1{,}6 \times 10^{-4} \times U$	• generate
	300 Hz to 1 kHz	$1{,}0 \times 10^{-4} \times U$	
	1 kHz to10 kHz	$0{,}8 \times 10^{-4} \times U$	
	10 kHz to 30 kHz	$0{,}7 \times 10^{-4} \times U$	
	30 kHz to 100 kHz	$1{,}7 \times 10^{-4} \times U$	
	100 kHz to 300 kHz	$6{,}0 \times 10^{-4} \times U$	
	300 kHz to 1 MHz	$30 \times 10^{-4} \times U$	
20 V to 200 V	10 Hz to 300 Hz	$1{,}6 \times 10^{-4} \times U$	• generate
	300 Hz to 1 kHz	$1{,}2 \times 10^{-4} \times U$	
	1 kHz to10 kHz	$1{,}0 \times 10^{-4} \times U$	
	10 kHz to 30 kHz	$1{,}1 \times 10^{-4} \times U$	
	30 kHz to 100 kHz	$2{,}1 \times 10^{-4} \times U$	
200 V to 1000 V	40 Hz to 300 Hz	$2{,}3 \times 10^{-4} \times U$	• generate
	300 Hz to 1 kHz	$2{,}3 \times 10^{-4} \times U$	
	1 kHz to10 kHz	$1{,}7 \times 10^{-4} \times U$	
	10 kHz to 30 kHz	$2{,}2 \times 10^{-4} \times U$	
200 V to 750 V	30 kHz to 100 kHz	$15 \times 10^{-4} \times U$	• generate
1 kV to 45 kV	50 Hz	$3{,}0 \times 10^{-3} \times U$	• generate

1.1.4 Alternating current

Measure

Measuring range or point	Frequency	CMC (95%)	Remark
100 µA	10 Hz to 30 Hz	$1{,}4 \times 10^{-4} \times I$	• Transfer standard in "30 day" loop • Fixed points • Measurement
	40 Hz to 1 kHz	$1{,}1 \times 10^{-4} \times I$	
	5 kHz	$1{,}7 \times 10^{-4} \times I$	
1 mA	10 Hz to 30 Hz	$1{,}3 \times 10^{-4} \times I$	
	40 Hz to 1 kHz	$1{,}0 \times 10^{-4} \times I$	
	5 kHz	$1{,}5 \times 10^{-4} \times I$	
10 mA	10 Hz to 30 Hz	$1{,}3 \times 10^{-4} \times I$	
	40 Hz to 1 kHz	$1{,}0 \times 10^{-4} \times I$	
	5 kHz	$1{,}5 \times 10^{-4} \times I$	
100 mA	10 Hz to 30 Hz	$1{,}3 \times 10^{-4} \times I$	
	40 Hz to 1 kHz	$1{,}0 \times 10^{-4} \times I$	
	5 kHz	$1{,}5 \times 10^{-4} \times I$	
1 A	10 Hz to 30 Hz	$1{,}8 \times 10^{-4} \times I$	
	40 Hz to 1 kHz	$1{,}2 \times 10^{-4} \times I$	
	5 kHz	$2{,}3 \times 10^{-4} \times I$	
10 A	40 Hz	$3{,}0 \times 10^{-4} \times I$	
	50 Hz to 1 kHz	$2{,}9 \times 10^{-4} \times I$	
	5 kHz	$4{,}0 \times 10^{-4} \times I$	
	10 kHz	$7{,}0 \times 10^{-4} \times I$	

Measuring range or point	Frequency	CMC (95%)	Remark
5 µA to 200 µA	10 Hz to 5 kHz	$1{,}6 \times 10^{-4} \times I$	• measure
	5 kHz to 10 kHz	$5{,}0 \times 10^{-4} \times I$	
0,2 mA to 2 mA	10 Hz to 5 kHz	$0{,}6 \times 10^{-4} \times I$	
	5 kHz to 10 kHz	$1{,}3 \times 10^{-4} \times I$	
2 mA to 20 mA	10 Hz to 5 kHz	$1{,}0 \times 10^{-4} \times I$	
	5 kHz to 10 kHz	$5{,}0 \times 10^{-4} \times I$	
20 mA to 200 mA	10 Hz to 1 kHz	$1{,}0 \times 10^{-4} \times I$	
	1 kHz to 10 kHz	$26 \times 10^{-4} \times I$	
0,2 A to 2 A	10 Hz to 1 kHz	$1{,}0 \times 10^{-4} \times I$	
	1 kHz to 10 kHz	$4{,}0 \times 10^{-4} \times I$	
2 A to 20 A	10 Hz to 1 kHz	$1{,}0 \times 10^{-4} \times I$	
	1 kHz to 5 kHz	$3{,}0 \times 10^{-4} \times I$	
	5 kHz to 10 kHz	$10 \times 10^{-4} \times I$	

Calibration of current clamps

Measuring range or point	Frequency	CMC (95%)	Remark
20 A to 1000 A	45 Hz to 440 Hz	$5{,}0 \times 10^{-3} \times I$	• with current coils

Generate

Generating range or point	Frequency	CMC (95%)	Remark
20 µA to 200 µA	10 Hz to 1 kHz	$4{,}0 \times 10^{-4} \times I$	• generate • in the lowest range possible
	1 kHz to 5 kHz	$6{,}0 \times 10^{-4} \times I$	
0,2 mA to 2 mA	10 Hz to 1 kHz	$3{,}2 \times 10^{-4} \times I$	
	1 kHz to 5 kHz	$4{,}0 \times 10^{-4} \times I$	
2 mA to 20 mA	10 Hz to 1 kHz	$3{,}1 \times 10^{-4} \times I$	
	1 kHz to 5 kHz	$4{,}1 \times 10^{-4} \times I$	
20 mA to 200 mA	10 Hz to 1 kHz	$3{,}1 \times 10^{-4} \times I$	
	1 kHz to 5 kHz	$4{,}0 \times 10^{-4} \times I$	
0,2 A to 2 A	10 Hz to 1 kHz	$6{,}0 \times 10^{-4} \times I$	
	1 kHz to 5 kHz	$7{,}1 \times 10^{-4} \times I$	
2 A to 10 A	10 Hz to 1 kHz	$6{,}1 \times 10^{-4} \times I$	
	1 kHz to 5 kHz	$12 \times 10^{-4} \times I$	
	5 kHz to 10 kHz	$34 \times 10^{-4} \times I$	
10 A to 20 A	45 Hz to 100 Hz	$17 \times 10^{-4} \times I$	
	100 Hz to 1 kHz	$20 \times 10^{-4} \times I$	

1.1.5 Power and Energy

Measuring range or point	Frequency	CMC (95%)	Remark
Mono phase , direct without measuring clamps			
33 mV to 1000 V / 0,33 mA to 330 mA	DC	$3{,}0 \times 10^{-4} \times P$	11 µW to 330 W generate
33 mV to 1000 V / 0,33 A to 3,3 A	DC	$5{,}0 \times 10^{-4} \times P$	3,3 kW generate
33 mV to 1000 V / 3,3 A to 10,5 A	DC	$6{,}0 \times 10^{-4} \times P$	10,5 kW generate
33 mV to 1000 V / 10,5 A to 20,5 A	DC	$11 \times 10^{-4} \times P$	20,5 kW generate
33 mV to 1000 V / 0,1 mA to 20,5A	45 Hz to 1 kHz	$15 \times 10^{-4} \times P$	3,3 µW to 20,5 kW / kVA(r) generate cosphi/sinphi > 0,5
33 mV to 1000 V / 0,1 mA to 20,5A	45 Hz to 1 kHz	$40 \times 10^{-4} \times P$	3,3 µW to 20,5 kW / kVA(r) generate cosphi/sinphi > 0,25
Mono phase , direct with measuring clamps			
33 mV to 1000 V / 20 A to 500 A	DC	$1{,}0 \times 10^{-4} \times P$	0,66 W to 500 kW / kVA(r) generate
33 mV to 1000 V / 20 A to 500 A	45 Hz to 100 Hz	$1{,}1 \times 10^{-3} \times P$	0,66 W to 500 kW / kVA(r) generate cosphi/sinphi > 0,25
33 mV to 1000 V / 20 A to 500 A	100 Hz to 440 Hz	$16 \times 10^{-3} \times P$	0,66 W to 500 kW / kVA(r) generate cosphi/sinphi > 0,25
3-phase, direct without measuring clamps			
1 V to 300 V / 0,3 A to 100 A	50 Hz & 60 Hz	$2{,}0 \times 10^{-3} \times P$	0,3 W to 30 kW / kVA(r) generate cosphi/sinphi > 0,5
1 V to 300 V / 0,3 A to 100 A	50 Hz & 60 Hz	$4{,}0 \times 10^{-3} \times P$	0,3 W to 30 kW / kVA(r) generate cosphi/sinphi > 0,25
1 V to 1000 V / 0,3 A to 100 A	10 Hz to 1 kHz	$2{,}0 \times 10^{-3} \times P$	0,3 W to 100 kW / kVA(r) measure cosphi/sinphi > 0,5
1 V to 1000 V / 0,3 A to 100 A	10 Hz to 1 kHz	$4{,}0 \times 10^{-3} \times P$	0,3 W to 100 kW / kVA(r) measure cosphi/sinphi > 0,25
3-phase, direct with measuring clamps			
1 V to 300 V / 20 A to 500 A	50 Hz & 60 Hz	$11 \times 10^{-3} \times P$	20 W to 150 kW / kVA(r) generate cosphi/sinphi > 0,25
1 V to 1000 V / 20 A to 100 A	15 Hz to 440 Hz	$16 \times 10^{-3} \times P$	20 W to 100 kW / kVA(r) measure cosphi/sinphi > 0,25

Phase / phase angle			
Cosphi/sinphi -1 to 1	10 Hz to 1 kHz	0,000 40	measure / generate
Phase angle -180 to 180 °	10 Hz to 1 kHz	0,02°	measure / generate
P indicates active,reactive as well as apparent power.			

RF Power

Range amplitude	Frequency	CMC (95%)	Remark
-67 dBm to -19 dBm	20 kHz to 100 MHz	0,056 dB	• measure
	100 MHZ to 4 GHz	0,047 dB	
	4 GHz to 6 GHz	0,048 dB	
-19 dBm to 1 dBm	20 kHz to 100 MHz	0,066 dB	• measure
	100 MHZ to 4 GHz	0,058 dB	
	4 GHz to 6 GHz	0,063 dB	
1 dBm to 23 dBm	20 kHz to 100 MHz	0,083 dB	• measure
	100 MHZ to 4 GHz	0,072 dB	
	4 GHz to 6 GHz	0,082 dB	
24 dBm to 20 dBm	10 Hz to 20 kHz	0,050 dB	• generate
	20 kHz to 100 kHz	0,050 dB	
	100 kHz to 10 MHz	0,050 dB	
	10 MHz to 125 MHz	0,050 dB	
20 dBm to 14 dBm	10 Hz to 20 kHz	0,050 dB	• generate
	20 kHz to 100 kHz	0,050 dB	
	100 kHz to 10 MHz	0,050 dB	
	10 MHz to 125 MHz	0,050 dB	
	125 MHz to 300 MHz	0,10 dB	
	300 MHz to 1,4 GHz	0,25 dB	
14 dBm to -17 dBm	10 Hz to 20 kHz	0,050 dB	• generate
	20 kHz to 100 kHz	0,050 dB	
	100 kHz to 10 MHz	0,050 dB	
	10 MHz to 125 MHz	0,050 dB	
	125 MHz to 300 MHz	0,10 dB	
	300 MHz to 1,4 GHz	0,25 dB	
	1,4 GHz to 3 GHz	0,30 dB	
	3 GHz to 4 GHz	0,50 dB	
-17 dBm to -48 dBm	10 Hz to 20 kHz	0,050 dB	• generate
	20 kHz to 100 kHz	0,050 dB	
	100 kHz to 10 MHz	0,050 dB	
	10 MHz to 125 MHz	0,050 dB	
	125 MHz to 300 MHz	0,10 dB	
	300 MHz to 1,4 GHz	0,50 dB	
	1,4 GHz to 3 GHz	0,50 dB	
	3 GHz to 4 GHz	0,50 dB	
-48 dBm to -74 dBm	100 kHz to 10 MHz	0,20 dB	• generate
	10 MHz to 125 MHz	0,20 dB	
	125 MHz to 300 MHz	0,20 dB	
	300 MHz to 1,4 GHz	0,50 dB	
	1,4 GHz to 3 GHz	0,50 dB	
	3 GHz to 4 GHz	0,50 dB	
-74 dBm to -84 dBm	100 kHz to 10 MHz	0,50 dB	• generate
	10 MHz to 125 MHz	0,50 dB	
	125 MHz to 300 MHz	0,50 dB	
	300 MHz to 1,4 GHz	1,0 dB	
	1,4 GHz to 3 GHz	1,0 dB	
	3 GHz to 4 GHz	1,0 dB	

-84 dBm to -94 dBm	100 kHz to 10 MHz	0,50 dB	• generate
	10 MHz to 125 MHz	0,50 dB	
	125 MHz to 300 MHz	0,50 dB	
	300 MHz to 1,4 GHz	1,0 dB	
	1,4 GHz to 3 GHz	1,0 dB	
-94 dBm to -124 dBm	100 kHz to 10 MHz	1,5 dB	• generate
	10 MHz to 125 MHz	1,5 dB	
	125 MHz to 300 MHz	1,5 dB	
	300 MHz to 1,4 GHz	1,5 dB	
	1,4 GHz to 3 GHz	1,5 dB	

1.1.6 Impedance (DC/LF)

Measure

Measuring range or point	Frequency	CMC (95%)	Remark
1 Ω	DC	$11 \times 10^{-6} \times R$	• Transfer standard in "30 day" loop • Fixed points • Measuring • 4-wire resistance measurement • Negligible dissipated power
10 Ω	DC	$9{,}5 \times 10^{-6} \times R$	
100 Ω	DC	$6{,}5 \times 10^{-6} \times R$	
1 kΩ	DC	$4{,}5 \times 10^{-6} \times R$	
10 kΩ	DC	$4{,}5 \times 10^{-6} \times R$	
100 kΩ	DC	$7{,}5 \times 10^{-6} \times R$	
1 MΩ	DC	$14 \times 10^{-6} \times R$	
10 MΩ	DC	$25 \times 10^{-6} \times R$	
100 MΩ	DC	$200 \times 10^{-6} \times R$	

Measuring range or point	Frequency	CMC (95%)	Remark
0 Ω to 2 Ω	DC	$18 \times 10^{-6} \times R$ or 20 μΩ[1]	• measure • 4-wire resistance measurement • negligible dissipated power
2 Ω to 20 Ω	DC	$3{,}1 \times 10^{-6} \times R$	
20 Ω to 200 Ω	DC	$5{,}5 \times 10^{-6} \times R$	
0,2 kΩ to 2 kΩ	DC	$2{,}6 \times 10^{-6} \times R$	
2 kΩ to 20 kΩ	DC	$5{,}0 \times 10^{-6} \times R$	
20 kΩ to 200 kΩ	DC	$6{,}3 \times 10^{-6} \times R$	
0,2 MΩ to 2 MΩ	DC	$6{,}0 \times 10^{-6} \times R$	
2 MΩ to 20 MΩ	DC	$11 \times 10^{-6} \times R$	
20 MΩ to 200 MΩ	DC	$60 \times 10^{-6} \times R$	
200 MΩ to 2 GΩ	DC	$1{,}2 \times 10^{-3} \times R$	

[1] Whichever is greater

Generate

Generating range or point	Frequency	CMC (95%)	Remark
0 Ω	DC	100 µΩ	• generate • fixed points • 4-wire resistance • Negligible dissipated power in the lowest range possible
10 Ω	DC	$39 \times 10^{-6} \times R$	
100 Ω	DC	$13 \times 10^{-6} \times R$	
1 kΩ	DC	$16 \times 10^{-6} \times R$	
10 kΩ	DC	$14 \times 10^{-6} \times R$	
100 kΩ	DC	$14 \times 10^{-6} \times R$	
1 MΩ	DC	$36 \times 10^{-6} \times R$	
10 MΩ	DC	$65 \times 10^{-6} \times R$	
100 MΩ	DC	$340 \times 10^{-6} \times R$	
10 Ω	DC	$0{,}6 \times 10^{-6} \times R$	• generate • standard resistors • also combinations of these resistors[1] • 4-wire resistance
25 Ω	DC	$0{,}6 \times 10^{-6} \times R$	
100 Ω	DC	$0{,}6 \times 10^{-6} \times R$	
378 Ω	DC	$2{,}0 \times 10^{-6} \times R$	
10 Ω	75 Hz	$3{,}0 \times 10^{-6} \times R$	• generate • standard resistors • also combinations of these resistors[1] • 4- wire resistance
25 Ω	75 Hz	$1{,}5 \times 10^{-6} \times R$	
100 Ω	75 Hz	$1{,}5 \times 10^{-6} \times R$	
378 Ω	75 Hz	$3{,}0 \times 10^{-6} \times R$	

[1] The uncertainty varies as the combinations and the dissipated power are different.

Calibration of resistor / insulation meters

Measuring range or point	Frequency	CMC (95%)	Remark
50 V to 250 V	10 kΩ to 40 MΩ	$1{,}0 \times 10^{-4} \times R$	
	40 MΩ to 200 MΩ	$5{,}0 \times 10^{-4} \times R$	
250 V to 1000 V	100 kΩ to 200 MΩ	$1{,}0 \times 10^{-4} \times R$	
	200 MΩ to 1000 MΩ	$3{,}0 \times 10^{-4} \times R$	
1 kV to 10 kV	1 MΩ to 10 GΩ	$60 \times 10^{-4} \times R$	

Capacity

Measuring range or point	Frequency	CMC (95%)	Remark
10 pF to 100 pF	1 kHz	$15 \times 10^{-4} \times C$	Measure / generate
100 pF to 1000 nF	1 kHz	$10 \times 10^{-4} \times C$	Measure / generate
1000 nF	100 Hz	$4{,}0 \times 10^{-4} \times C$	Measure / generate
10 pF, 100 pF, 1 nF, 10 nF	1 kHz	$1{,}0 \times 10^{-4} \times C$	Generate
100 nF, 1 µF	1 kHz	$1{,}5 \times 10^{-4} \times C$	
10 µF	1 kHz	$3{,}0 \times 10^{-4} \times C$	
100 µF	1 kHz	$5{,}0 \times 10^{-4} \times C$	
1 µF	100 Hz	$2{,}0 \times 10^{-4} \times C$	
10 µF	100 Hz	$3{,}0 \times 10^{-4} \times C$	
100 µF	100 Hz	$5{,}0 \times 10^{-4} \times C$	

Inductance

Measuring range or point	Frequency	CMC (95%)	Remark
100 µH to 1 H	1 kHz	$10 \times 10^{-4} \times L$	Measure / generate
1 H to 10 H	1 kHz	$20 \times 10^{-4} \times L$	Measure / generate
100 µH, 1 mH, 10 mH, 100 mH, 1H	1 kHz	$5{,}0 \times 10^{-4} \times L$	generate
10 H	100 Hz, 1 kHz	$7{,}0 \times 10^{-4} \times L$	

Oscilloscopes (on screen) – input impedance 50 Ω and 1 MΩ

Measuring range or point	Frequency	CMC (95%)	Remark
± 1 mV to 200 V	DC	$2{,}5 \times 10^{-4} \times U$ + 25 µV	50 Ω to 5,56 V
1 mVpp to 21 mVpp	10 Hz to 10 kHz	$25 \times 10^{-4} \times U$ + 10 µV	Square wave
21 mVpp to 556 mVpp	10 Hz to 10 kHz	$10 \times 10^{-4} \times U$ + 10 µV	Square wave
556 mVpp to 210 Vpp	10 Hz to 10 kHz	$5{,}0 \times 10^{-4} \times U$ + 10 µV	Square wave 50 Ω to 5,56 V
4,44 mVpp to 5,56 Vpp	100 mHz to 100 MHz	$1{,}5 \times 10^{-2} \times U$	Sine wave
4,44 mVpp to 5,56 Vpp	100 MHz to 550 MHz	$3{,}0 \times 10^{-2} \times U$	Sine wave
4,44 mVpp to 3,35 Vpp	550 MHz to 1 GHz	$4{,}0 \times 10^{-2} \times U$	Sine wave
4,44 mVpp to 3,54 Vpp	1 GHz to 4 GHz	$6{,}0 \times 10^{-2} \times U$	Sine wave
500 ps	-	40 ps	Rise/ falltime (max. 3 V)
250 ps to 10 ks	-	$5{,}0 \times 10^{-9} \times t$	Time base
40 Ω to 90 Ω	1 kHz	$1{,}0 \times 10^{-3} \times Z$	Input impedance
0,8 MΩ to 1,2 MΩ			
10 Ω to 150 Ω	1 kHz	$5{,}0 \times 10^{-3} \times Z$	Input impedance
50 kΩ to 12 MΩ			
	0,1 Hz to 100 MHz	0,15 dB	Attenuation at bandwidth
	100 MHz to 550 MHz	0,30 dB	Attenuation at bandwidth
	550 MHz to 1 GHz	0,40 dB	Attenuation at bandwidth
	1 GHz to 4 GHz	0,50 dB	Attenuation at bandwidth

Bridge calibration

Measuring range or point	Frequency	CMC (95%)	Remark
-2,5 mV / V to 2,5 mV / V	225 Hz	50 × 10-6 mV / V	5 V supply / 350 Ω bridges

BELAC 6-017 code	ELEKTRICAL (Wellin, In House or In Situ)

1.1.1 Direct voltage

Measure

Measuring range or point	Frequency	CMC (95%)	Remark
0 mV to 200 mV	DC	$8{,}0 \times 10^{-6} \times U$ or 0,12 µV[1]	• measure • positive / negative
0,2 V to 2 V	DC	$10 \times 10^{-6} \times U$	
2 V to 20 V	DC	$7{,}0 \times 10^{-6} \times U$	
20 V to 200 V	DC	$5{,}0 \times 10^{-6} \times U$	
200 V to 1000 V	DC	$5{,}0 \times 10^{-6} \times U$	
[1] Whichever is greater			

Generate

Generating range or point	Frequency	CMC (95%)	Remark
0 V	DC	0,5 µV	• generate • positive / negative
0 mV to 220 mV	DC	$13 \times 10^{-6} \times U$ or 1,0 µV[1]	
220 V to 2,2 V	DC	$4{,}0 \times 10^{-6} \times U$	
2,2 V to 22 V	DC	$4{,}0 \times 10^{-6} \times U$	
22 V to 220 V	DC	$7{,}0 \times 10^{-6} \times U$	
220 V to 1100 V	DC	$7{,}0 \times 10^{-6} \times U$	
[1] Whichever is greater			

1.1.2 Direct current

Measure

Measuring range or point	Frequency	CMC (95%)	Remark
0 µA to 200 µA	DC	$20 \times 10^{-6} \times I$ or 0,5 nA[1]	• measure • in the lowest possible range • positive / negative
0,2 mA to 2,0 mA	DC	$10 \times 10^{-6} \times I$	
2,0 mA to 20 mA	DC	$10 \times 10^{-6} \times I$	
20 mA to 200 mA	DC	$10 \times 10^{-6} \times I$	
0,2 A to 2 A	DC	$60 \times 10^{-6} \times I$	
2 A to 20 A	DC	$200 \times 10^{-6} \times I$	
20 A to 100 A	DC	$1{,}5 \times 10^{-4} \times I$ or 2,0 mA[1]	
[1] Whichever is greater			

Calibration of current clamps

Measuring range or point	Frequency	CMC (95%)	Remark
20 A to 500 A	DC	$10 \times 10^{-3} \times I$	• with current coils

Generate

Generating range or point	Frequency	CMC (95%)	Remark
0 µA to 220 mA	DC	$40 \times 10^{-6} \times I$ or 1,0 nA[1]	• generate • positive / negative
220 mA to 2,2 A	DC	$1{,}0 \times 10^{-4} \times I$	
2,2 A to 11 A	DC	$2{,}0 \times 10^{-4} \times I$	
11 A to 100 A	DC	$10 \times 10^{-4} \times I$	
[1] Whichever is greater			

1.1.3 Alternating voltage

Measure

Measuring range or point	Frequency	CMC (95%)	Remark
0,7 mV to 2,2 mV	10 Hz to 20 Hz	$17 \times 10^{-4} \times U$ + 1,3 µV	• measure
	20 Hz to 40 Hz	$7{,}4 \times 10^{-4} \times U$ + 1,3 µV	
	40 Hz to 20 kHz	$4{,}2 \times 10^{-4} \times U$ + 1,3 µV	
	20 kHz to 50 kHz	$8{,}2 \times 10^{-4} \times U$ + 2 µV	
	50 kHz to 100 kHz	$12 \times 10^{-4} \times U$ + 2,5 µV	
	100 kHz to 300 kHz	$23 \times 10^{-4} \times U$ + 4 µV	
	300 kHz to 500 kHz	$26 \times 10^{-4} \times U$ + 8 µV	
	500 kHz to 1 MHz	$50 \times 10^{-4} \times U$ + 8 µV	
2 mV to 7 mV	10 Hz to 20 Hz	$8{,}5 \times 10^{-4} \times U$ + 1,3 µV	• measure
	20 Hz to 40 Hz	$3{,}7 \times 10^{-4} \times U$ + 1,3 µV	
	40 Hz to 20 kHz	$2{,}1 \times 10^{-4} \times U$ + 1,3 µV	
	20 kHz to 50 kHz	$4{,}1 \times 10^{-4} \times U$ + 2 µV	
	50 kHz to 100 kHz	$6{,}1 \times 10^{-4} \times U$ + 2,5 µV	
	100 kHz to 300 kHz	$12 \times 10^{-4} \times U$ + 4 µV	
	300 kHz to 500 kHz	$14 \times 10^{-4} \times U$ + 8 µV	
	500 kHz to 1 MHz	$36 \times 10^{-4} \times U$ + 8 µV	
7 mV to 22 mV	10 Hz to 20 Hz	$2{,}9 \times 10^{-4} \times U$ + 1,3 µV	• measure
	20 Hz to 40 Hz	$1{,}9 \times 10^{-4} \times U$ + 1,3 µV	
	40 Hz to 20 kHz	$1{,}1 \times 10^{-4} \times U$ + 1,3 µV	
	20 kHz to 50 kHz	$2{,}1 \times 10^{-4} \times U$ + 2 µV	
	50 kHz to 100 kHz	$3{,}1 \times 10^{-4} \times U$ + 2,5 µV	
	100 kHz to 300 kHz	$8{,}2 \times 10^{-4} \times U$ + 4 µV	
	300 kHz to 500 kHz	$10 \times 10^{-4} \times U$ + 8 µV	
	500 kHz to 1 MHz	$26 \times 10^{-4} \times U$ + 8 µV	
22 mV to 70 mV	10 Hz to 20 Hz	$2{,}4 \times 10^{-4} \times U$ + 1,5 µV	• measure
	20 Hz to 40 Hz	$1{,}3 \times 10^{-4} \times U$ + 1,5 µV	
	40 Hz to 20 kHz	$0{,}69 \times 10^{-4} \times U$ + 1,5 µV	
	20 kHz to 50 kHz	$1{,}3 \times 10^{-4} \times U$ + 2 µV	
	50 kHz to 100 kHz	$2{,}6 \times 10^{-4} \times U$ + 2,5 µV	
	100 kHz to 300 kHz	$5{,}3 \times 10^{-4} \times U$ + 4 µV	
	300 kHz to 500 kHz	$6{,}8 \times 10^{-4} \times U$ + 8 µV	
	500 kHz to 1 MHz	$13 \times 10^{-4} \times U$ + 8 µV	
70 mV to 220 mV	10 Hz to 20 Hz	$21 \times 10^{-5} \times U$ + 1,5 µV	• measure
	20 Hz to 40 Hz	$8{,}7 \times 10^{-5} \times U$ + 1,5 µV	
	40 Hz to 20 kHz	$4{,}3 \times 10^{-5} \times U$ + 1,5 µV	
	20 kHz to 50 kHz	$7{,}3 \times 10^{-5} \times U$ + 2 µV	
	50 kHz to 100 kHz	$16 \times 10^{-5} \times U$ + 2,5 µV	
	100 kHz to 300 kHz	$28 \times 10^{-5} \times U$ + 4 µV	
	300 kHz to 500 kHz	$40 \times 10^{-5} \times U$ + 8 µV	
	500 kHz to 1 MHz	$120 \times 10^{-5} \times U$ + 8 µV	
220 mV to 700 mV	10 Hz to 20 Hz	$21 \times 10^{-5} \times U$ + 1,5 µV	• measure
	20 Hz to 40 Hz	$8{,}7 \times 10^{-5} \times U$ + 1,5 µV	
	40 Hz to 20 kHz	$3{,}8 \times 10^{-5} \times U$ + 1,5 µV	
	20 kHz to 50 kHz	$5{,}6 \times 10^{-5} \times U$ + 2 µV	
	50 kHz to 100 kHz	$8{,}4 \times 10^{-5} \times U$ + 2,5 µV	
	100 kHz to 300 kHz	$21 \times 10^{-5} \times U$ + 4 µV	
	300 kHz to 500 kHz	$34 \times 10^{-5} \times U$ + 8 µV	
	500 kHz to 1 MHz	$120 \times 10^{-5} \times U$ + 8 µV	

0,7 V to 2,2 V	10 Hz to 20 Hz	$20 \times 10^{-5} \times U$	• measure
	20 Hz to 40 Hz	$6{,}9 \times 10^{-5} \times U$	
	40 Hz to 20 kHz	$2{,}9 \times 10^{-5} \times U$	
	20 kHz to 50 kHz	$5{,}2 \times 10^{-5} \times U$	
	50 kHz to 100 kHz	$7{,}6 \times 10^{-5} \times U$	
	100 kHz to 300 kHz	$20 \times 10^{-5} \times U$	
	300 kHz to 500 kHz	$31 \times 10^{-5} \times U$	
	500 kHz to 1 MHz	$120 \times 10^{-5} \times U$	
2,2 V to 7 V	10 Hz to 20 Hz	$20 \times 10^{-5} \times U$	• measure
	20 Hz to 40 Hz	$7{,}0 \times 10^{-5} \times U$	
	40 Hz to 20 kHz	$2{,}9 \times 10^{-5} \times U$	
	20 kHz to 50 kHz	$5{,}3 \times 10^{-5} \times U$	
	50 kHz to 100 kHz	$8{,}8 \times 10^{-5} \times U$	
	100 kHz to 300 kHz	$22 \times 10^{-5} \times U$	
	300 kHz to 500 kHz	$47 \times 10^{-5} \times U$	
	500 kHz to 1 MHz	$150 \times 10^{-5} \times U$	
7 V to 22 V	10 Hz to 20 Hz	$20 \times 10^{-5} \times U$	• measure
	20 Hz to 40 Hz	$7{,}0 \times 10^{-5} \times U$	
	40 Hz to 20 kHz	$3{,}1 \times 10^{-5} \times U$	
	20 kHz to 50 kHz	$5{,}3 \times 10^{-5} \times U$	
	50 kHz to 100 kHz	$8{,}5 \times 10^{-5} \times U$	
	100 kHz to 300 kHz	$22 \times 10^{-5} \times U$	
	300 kHz to 500 kHz	$47 \times 10^{-5} \times U$	
	500 kHz to 1 MHz	$150 \times 10^{-5} \times U$	
22 V to 70 V	10 Hz to 20 Hz	$20 \times 10^{-5} \times U$	• measure
	20 Hz to 40 Hz	$7{,}2 \times 10^{-5} \times U$	
	40 Hz to 20 kHz	$3{,}9 \times 10^{-5} \times U$	
	20 kHz to 50 kHz	$6{,}3 \times 10^{-5} \times U$	
	50 kHz to 100 kHz	$11 \times 10^{-5} \times U$	
	100 kHz to 300 kHz	$22 \times 10^{-5} \times U$	
	300 kHz to 500 kHz	$51 \times 10^{-5} \times U$	
	500 kHz to 1 MHz	$150 \times 10^{-5} \times U$	
70 V to 220 V	10 Hz to 20 Hz	$20 \times 10^{-5} \times U$	• measure
	20 Hz to 40 Hz	$7{,}2 \times 10^{-5} \times U$	
	40 Hz to 20 kHz	3,8 × 10-5 × U	
	20 kHz to 50 kHz	$7{,}7 \times 10^{-5} \times U$	
	50 kHz to 100 kHz	$11 \times 10^{-5} \times U$	
	100 kHz to 300 kHz	$26 \times 10^{-5} \times U$	
	300 kHz to 500 kHz	$70 \times 10^{-5} \times U$	
220 to 700 V	10 Hz to 20 Hz	$20 \times 10^{-5} \times U$	• measure
	20 Hz to 40 Hz	$11 \times 10^{-5} \times U$	
	40 Hz to 20 kHz	$4{,}7 \times 10^{-5} \times U$	
	20 kHz to 50 kHz	$15 \times 10^{-5} \times U$	
	50 kHz to 100 kHz	$85 \times 10^{-5} \times U$	
700 V to 1000 V	10 Hz to 20 Hz	$20 \times 10^{-5} \times U$	• measure
	20 Hz to 40 Hz	$11 \times 10^{-5} \times U$	
	40 Hz to 20 kHz	$4{,}4 \times 10^{-5} \times U$	
	20 kHz to 50 kHz	$15 \times 10^{-5} \times U$	
	50 kHz to 100 kHz	$85 \times 10^{-5} \times U$	

Generate

Generating range or point	Frequency	CMC (95%)	Remark
2,2 mV to 22 mV	20 Hz to 20 kHz	$4{,}0 \times 10^{-4} \times U$	• generate
	20 kHz to 100 kHz	$11 \times 10^{-4} \times U$	
22 mV to 220 mV	20 Hz to 20 kHz	$0{,}5 \times 10^{-4} \times U$	• generate
	20 kHz to 100 kHz	$23 \times 10^{-4} \times U$	
0,22 V to 2,2 V	20 Hz to 20 kHz	$0{,}5 \times 10^{-4} \times U$	• generate
	20 kHz to 100 kHz	$20 \times 10^{-4} \times U$	
2,2 V to 22 V	40 Hz to 20 kHz	$0{,}5 \times 10^{-4} \times U$	• generate
	20 kHz to 100 kHz	$1{,}0 \times 10^{-4} \times U$	
22 V to 220 V	40 Hz to 20 kHz	$0{,}6 \times 10^{-4} \times U$	• generate
	20 kHz to 100 kHz	$6{,}0 \times 10^{-4} \times U$	
220 V to 1000 V	50 Hz to 20 kHz	$0{,}6 \times 10^{-4} \times U$	• generate

1.1.4 Alternating currect

Measure

Measuring range or point	Frequency	CMC (95%)	Remark
10 µA to 200 µA	55 Hz to 5 kHz	$2{,}0 \times 10^{-4} \times I$	• measure
0,2 mA to 2 mA	55 Hz to 5 kHz	$1{,}0 \times 10^{-4} \times I$	
2 mA to 20 mA	55 Hz to 5 kHz	$2{,}0 \times 10^{-4} \times I$	
20 mA to 200 mA	55 Hz to 5 kHz	$1{,}0 \times 10^{-4} \times I$	
0,2 A to 2 A	55 Hz to 1 kHz	$3{,}0 \times 10^{-4} \times I$	
	1 kHz to 5 kHz	$8{,}0 \times 10^{-4} \times I$	
2 A to 20 A	55 Hz to 1 kHz	$40 \times 10^{-4} \times I$	

Calibration of current clamps

Measuring range or point	Frequency	CMC (95%)	Remark
20 A to 500 A	45 Hz to 100 Hz	$10 \times 10^{-3} \times I$	• with current coils
20 A to 500 A	100 Hz to 440 Hz	$15 \times 10^{-3} \times I$	• with current coils

Generate

Generating range or point	Frequency	CMC (95%)	Remark
10 µA to 2,2 A	40 Hz to 1 kHz	$2{,}0 \times 10^{-4} \times I$	• generate
2,2 A to 10 A	20 Hz to 1 kHz	$6{,}0 \times 10^{-4} \times I$	

1.1.6 Impedance (DC/LF)

Measure

Measuring range or point	Frequency	CMC (95%)	Remark
0 Ω to 2 Ω	DC	$30 \times 10^{-6} \times R$ or 70 µΩ[1]	• measure • 4-wire resistance measurement • negligible dissipated power
2 Ω to 20 Ω	DC	$10 \times 10^{-6} \times R$	
20 Ω to 200 Ω	DC	$11 \times 10^{-6} \times R$	
0,2 kΩ to 200 kΩ	DC	$10 \times 10^{-6} \times R$	
0,2 MΩ to 2 MΩ	DC	$40 \times 10^{-6} \times R$	
2 MΩ to 20 MΩ	DC	$80 \times 10^{-6} \times R$	
20 MΩ to 200 MΩ	DC	$40 \times 10^{-6} \times R$	
200 MΩ to 2 GΩ	DC	$1{,}0 \times 10^{-3} \times R$	

[1] Whichever is greater

Generate

Generating range or point	Frequency	CMC (95%)	Remark
0 Ω	DC	1 mΩ	• generate • fixed points • 2-wire resistance
1 Ω	DC	$100 \times 10^{-6} \times R$ + 8 mΩ	
1,9 Ω	DC	$100 \times 10^{-6} \times R$ + 8 mΩ	
10 Ω	DC	$30 \times 10^{-6} \times R$ + 8 mΩ	
19 Ω	DC	$30 \times 10^{-6} \times R$ + 8 mΩ	
100 Ω	DC	$20 \times 10^{-6} \times R$ + 8 mΩ	
190 Ω	DC	$20 \times 10^{-6} \times R$ + 8 mΩ	
1,0 kΩ	DC	$15 \times 10^{-6} \times R$ + 20 mΩ	
1,9 kΩ	DC	$15 \times 10^{-6} \times R$ + 20 mΩ	
10 kΩ	DC	$15 \times 10^{-6} \times R$ + 100 mΩ	
19 kΩ	DC	$15 \times 10^{-6} \times R$ + 100 mΩ	
100 kΩ	DC	$20 \times 10^{-6} \times R$ + 100 mΩ	
190 kΩ	DC	$20 \times 10^{-6} \times R$ + 100 mΩ	
1 MΩ	DC	$25 \times 10^{-6} \times R$	
1,9 MΩ	DC	$30 \times 10^{-6} \times R$	
10 MΩ	DC	$50 \times 10^{-6} \times R$	
19 MΩ	DC	$60 \times 10^{-6} \times R$	
100 MΩ	DC	$140 \times 10^{-6} \times R$	
0 Ω	DC	100 µΩ	• generate • fixed points • 4- wire resistance
1 Ω, 1,9 Ω, 10 Ω, 19 Ω, 100 Ω, 190 Ω	DC	$30 \times 10^{-6} \times R$	
1 kΩ, 1,9 kΩ, 10 kΩ, 19 kΩ, 100 kΩ, 190 kΩ	DC	$10 \times 10^{-6} \times R$	
1 MΩ, 1,9 MΩ	DC	$18 \times 10^{-6} \times R$	
1,9 MΩ	DC	$40 \times 10^{-6} \times R$	
10 MΩ	DC	$60 \times 10^{-6} \times R$	
19 MΩ	DC	$250 \times 10^{-6} \times R$	

Calibration of resistor / insulation meters

Measuring range or point	Frequency	CMC (95%)	Remark
50 V to 250 V	10 kΩ to 40 MΩ	$1{,}0 \times 10^{-4} \times R$	
	40 MΩ to 200 MΩ	$5{,}0 \times 10^{-4} \times R$	
250 V to 1000 V	100 kΩ to 200 MΩ	$1{,}0 \times 10^{-4} \times R$	
	200 MΩ to 1000 MΩ	$3{,}0 \times 10^{-4} \times R$	

BELAC 6-017 code	TIME AND FREQUENCY (Berchem, In House or In Situ)

1.4.2 Relative time

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Tachometers, stroboscopes (optical)	1,2 rpm to 100 000 rpm	$3{,}0 \times 10^{-7} \times n$	
Mechanical tachometers	10 rpm to 17 000 rpm	$0{,}050 \text{ rpm} + 10 \times 10^{-5} \times n$	
n: number of rotations in rpm			

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Frequencymeters, frequencygenerators, counters	1 Hz	$5{,}0 \times 10^{-11} \times f$	• generate • fixed points • CMC calculated at 600 s measuring time
	1 MHz	$5{,}0 \times 10^{-11} \times f$	
	5 MHz	$5{,}0 \times 10^{-11} \times f$	
	10 MHz	$5{,}0 \times 10^{-11} \times f$	
	0,002 Hz to 3 GHz	$6{,}0 \times 10^{-11} \times f$	• meassure • CMC calculated at 600 s measuring time
	0,002 Hz to 4 GHz	$5{,}0 \times 10^{-9} \times f$	• generate • CMC calculated at 600 s measuring time

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Electronic chronometers	n.a.	0,10 s / 24 h	direct measurement
Mechanic chronometers	n.a.	5,0 s / 24 h	direct measurement
Elektronic & mechanic chronometers	Standard 0 h to 72 h	0,50 s / 24 h with a minimum van 0,30 s	By comparison with a standard chronometer via a digital-optical recorder
Signal-triggered chronometers	Standard 0 h to 72 h	0,15 s / 24 h with a minimum van 0,060 s	By comparison with a standard chronometer via a digital-optical recorder

BELAC 6-017 code	TIME AND FREQUENCY (Wellin, In House or In Situ)

1.4.2 Relative time

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Tachometers, stroboscopes (optical)	6 rpm to 100 000 rpm	$3{,}0 \times 10^{-7} \times n$	
n : number of rotations in rpm			

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Frequencymeters, frequencygenerators, counters	10 MHz	$4 \times 10^{-10} \times f$	Value generated by a Rb Quarz (reference frequency)
	1 MHz to 10 MHz	$5 \times 10^{-10} \times f$	Measurement by means of an electronic counter synchronized to the reference frequency
	0,1 Hz to 10 MHz	$5 \times 10^{-10} \times f$ + 0,5 mHz	
	10 MHz to 1000 MHz	$5 \times 10^{-10} \times f$ + 0,5 mHz	
	1 GHz to 45 GHz	$5 \times 10^{-10} \times f$ + 1,5 Hz	

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Electronic chronometers	n.a.	0,10 s / 24 h	direct measurement
Mechanic chronometers	n.a.	5,0 s / 24 h	direct measurement

BELAC 6-017 code	DIMENSIONAL (Berchem)

1.5.2 Length gauges

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Central length steel	0,5 mm to 100 mm 0,02 inch to 4 inch	0,060 µm + 0,90 × 10^{-6} × *l*	fixed sizes
Central length tungsten carbide		0,060 µm + 0,70 × 10^{-6} × *l*	
Central length ceramic		0,060 µm + 0,80 × 10^{-6} × *l*	
		0,060 µm + 1,2 × 10^{-6} × *l*	reference steel
Central length steel, tungsten carbide, ceramic	0,05 mm to 500 mm 0,005 inch to 20 inch	0,10 µm + 2,0 × 10^{-6} × *l*	all sizes
Lengthvariation steel, tungsten carbide, ceramic	0,5 mm to 100 mm 0,02 inch to 4 inch	0,050 µm	
Step gauge	to 1200 mm	0,80 µm + 3,0 × 10^{-6} × *l*	

1.5.5 Clinometers

See 1.5.13

1.5.6 Line scales, distances

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Ruler (all models)	to 200 mm	1,5 µm + 3,0 × 10^{-6} × *l*	e.g. spring rule
	to 400 mm	2,0 µm + 3,0 × 10^{-6} × *l*	
	to 3000 mm	12 µm + 3,0 × 10^{-6} × *l*	
	to 100 m	6,0 µm + 5,0 × 10^{-6} × *l*	
Feeler gauges	to 5 mm	0,50 µm + 2,0 × 10^{-6} × *l*	
Setting standard for external micrometers	to 300 mm	0,50 µm + 2,0 × 10^{-6} × *l*	
	300 to 500 mm	0,90 µm + 0,60 × 10^{-6} × *l*	
	500 to 3000 mm	3,0 µm + 3,0 × 10^{-6} × *l*	
Other distance of 2 parallel planes	to 300 mm	0,50 µm + 2,0 × 10^{-6} × *l*	
	300 to 500 mm	0,90 µm + 0,60 × 10^{-6} × *l*	
	500 to 3000 mm	3,0 µm + 3,0 × 10^{-6} × *l*	

1.5.7 Length measuring instruments

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Hand held tools for external measurements	0 mm to 200 mm	0,45 µm + 0,50 × R + 25 × 10^{-6} × *l*	(1) e.g. vernier, micrometer, …
	200 mm to 3000 mm	4,0 µm + 0,50 × R + 5,0 × 10^{-6} × *l*	
Hand held tools for internal measurements			(1) e.g. internal micrometers
2-point	0 mm to 200 mm	0,70 µm + 0,50 × R + 25 × 10^{-6} × *l*	
	200 mm to 400 mm	5,0 µm + 0,50 × R + 4,0 × 10^{-6} × *l*	
2- and 3-point	0 mm to 250 mm	1,5 µm + 0,50 × R + 25 × 10^{-6} × *l*	
Hand held tools for height and depth measurements	0 mm to 500 mm	0,70 µm + 0,50 × R + 25 × 10^{-6} × *l*	(1)
Linear displacement sensor	to 200 mm	0,050 µm + 2,5 × 10^{-6} × *l* + 0,80 × R	to 50 mm (1)
Height gauge	to 1500 mm	0,80 µm + 0,70 × R + 2,5 × 10^{-6} × *l*	(1)
Film thickness gauge	to 2 mm	1,0 µm + 2,0 × 10^{-3} × *l*	(1)
Laser distance meter	to 25 m	0,50 mm + 40 × 10^{-6} × *l* + 0,60 × R	

1.5.8 Diameter

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Setting rings and ring gauges	Ø 1 mm to Ø 250 mm	0,50 µm + 2,0 × 10^{-6} × *l*	
Cylindrical setting pins	to 200 mm	0,50 µm + 1,5 × 10^{-6} × *l*	
Plain plug gauges	to 200 mm	0,50 µm + 1,5 × 10^{-6} × *l*	
Thread wires	to 20 mm	0,50 µm + 1,5 × 10^{-6} × *l*	
Radius gauge	to Ø 200 mm	3,0 µm + 5,0 × 10^{-6} × *l*	
Other internal diameters	Ø 1 mm to Ø 250 mm	0,50 µm + 2,0 × 10^{-6} × *l*	
Other external diameters	Ø 0,05 mm to Ø 300 mm	0,50 µm + 1,5 × 10^{-6} × *l*	
	Ø 300 mm to Ø 500 mm	0,90 µm + 0,60 × 10^{-6} × *l*	

1.5.9 Form error

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Knife edge straight edge	to 300 mm	0,30 µm	
Straight edge	to 6000 mm	0,50 µm + 0,50 × 10^{-6} × *l*	(1)
Surface plate	to 6 000 mm x 10 000 mm	0,30 µm + 1,6 × 10^{-6} × *l*	(1) *l* = longest side of the surface plate
Roundness tester	to 300 µm	0,050 µm + 0,50 × R	(1)
Roundness standard	to Ø 300 mm	0,050 µm + 0,020 × A	A = measured roundness
Flick standard (roundness standard)	to 1 mm	0,25 µm	

1.5.10 Roughness

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Surface texture measuring instruments	Ra: 0,05 µm to 5 µm	0,040 × A + 0,50 × R (minimum 0,030 µm)	(1) A = Ra-value of reference
	Rz: 0,1 µm to 10 µm	0,060 × A + 0,50 × R (minimum 0,050 µm)	(1) A = Rz-value of reference
	Rmax: 0,1 µm to 10 µm	0,060 × A + 0,50 × R (minimum 0,050 µm)	(1) A = Rmax-value of reference
Roughness standards	Ra: to 10 µm	0,025 µm + 0,060 × A	A = measured Ra-value
	Rz: to 15 µm	0,030 µm + 0,090 × A	A = measured Rz-value
	Rmax: to 15 µm	0,030 µm + 0,090 × A	A = measured Rmax-value

1.5.11 Thread quantities

Thread external			
Measured quantity, instrument or gauge	**Range**	**CMC (95%)**	**Remarks**
Pitch	to 10 mm	2 µm	
Profile angle	to 180°	(0,50 + 12/*l*) bgmin	*l* = leg length in mm
Simple pitch diameter	Ø 1 mm to Ø 300 mm	α = 30°: (6,0 µm to 9,7 µm)	Acc. to Euramet/CG-10, method 1a or 1b
		α = 60°: (3,2 µm to 5,9 µm)	
		α = 90°: (2,6 µm to 5,5 µm)	
Thread internal			
Measured quantity, instrument or gauge	**Range**	**CMC (95%)**	**Remarks**
Pitch	to 10 mm	2 µm	
Profile angle	to 180°	(0,50 + 12/*l*) bgmin	*l* = leg length in mm
Simple pitch diameter	Ø 4 mm to Ø 300 mm	α = 30°: (9,0 µm to 14,0 µm)	Acc. to Euramet/CG-10, method 1a or 1b
		α = 60°: (3,6 µm to 7,0 µm)	
		α = 90°: (3,1 µm to 6,2 µm)	

1.5.12 Coordinate measuring machines

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Deviation of nominal displacement	to 20 m		e.g. 1D/2D/3D Measuring machine with:
		0,15 µm + 0,70 × R + 1,0 × 10^{-6} × *l*	Zerodur scales; (1)
		0,15 µm + 0,70 × R + 1,3 × 10^{-6} × *l*	Glass scales; (1)
		0,15 µm + 0,70 × R + 1,6 × 10^{-6} × *l*	Steel scales; (1)
	to 400 mm	0,30 µm + 2,3 × 10^{-6} × *l*	using reference glass scale; (1)
Deviations transverse to the translation directions	to 0,5 mm	0,30 µm + 3,0 × 10^{-6} × *l* + 5,0 × 10^{-3} × A	A = measured deviation Measuring length to 3000 mm; (1)
Rotational deviations around the translation direction	to 400 as	0,50 as + 3,5 × 10^{-3} × A	A = measured angle; horizontal translation only; (1)

Other rotational deviations	to 7200 as	0,50 as + 1,6 × 10^{-3} × A	A = measured angle; measured length to 4500 mm; (1)
as = arcsecond			

1.5.3 Angle gauges

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Angle gauge block	to 180°	0,000 28° + 10 × 10^{-6} × A	A = measured angle
		1,0" + 10 × 10^{-6} × A	
Cylindrical square	to Ø 300 mm to height 300 mm	0,30 µm + 2,0 × 10^{-6} × *l*	Squareness
Square	to 300 mm leg length	0,30 µm + 2,0 × 10^{-6} × *l*	Squareness
Angle plate	90°	0,50 as	
Polygon	to 360 °	0,50 as	
Pentagonprism	90 °	0,50 as	
as = arcsecond			

1.5.13 Angle (measuring instruments)

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Spirit level	to 12,5 mm/m	0,50 µm/m + 1,0 × 10^{-3} × A + 0,7 × R	A = set angle
	to 2600 as	0,10 as + 1,0 × 10^{-3} × A + 0,70 × R	
Autocollimator	to 12,5 mm/m	0,50 µm/m + 1,0 × 10^{-3} × A + 0,70 × R	A = set angle
	to 2600 as	0,10 as + 1,0 × 10^{-3} × A + 0,70 × R	
Angle meters	0° - 360°	0,50 amin	e.g. protractor; (1)
Angle sensor	0° - 360°	2,0 as	e.g. protractor; (1)
Clinometers	0° - 360°	2,0 as	
Theodolites	180°	3,0 as	Rotation around vertical axis
	180°	1,5 as	Defining horizontal plane
	180°	1,8 as	Deviation of crosshairs to rotations
as = arcsecond amin = arcminute			

1.5.15 Product measurement

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Form			
Surface profile	to 10 mm × 100 mm	1,0 µm + 0,010 × A	A = measured profile height
Roughness value	Ra: to 10 µm	0,025 µm + 0,060 × A	A = measured Ra-value
	Rz: to 15 µm	0,030 µm + 0,090 × A	A = measured Rz-value
	Rmax: to 15 µm	0,030 µm + 0,090 × A	A = measured Rmax-value
Straightness	to 10 mm × 100 mm	1,0 µm + 0,010 × A	A = measured profile height
	to 300 mm	0,30 µm	
	to 6000 mm	0,50 µm + 0,50 × 10^{-6} × L	(1)
Roundness			
Roundness external	to Ø 300 mm	0,050 µm + 0,020 × A	A = measured roundness
Roundness internal	Ø 0,7 mm to Ø 300 mm	0,050 µm + 0,020 × A	A = measured roundness
Cilindricity			
Cilindricity external	to Ø 300 mm to height 300 mm	0,40 µm + 0,040 × A	A = measured cilindricity
Cilindricity internal	Ø 0,7 mm to Ø 300 mm to height 300 mm	0,40 µm + 0,040 × A	A = measured cilindricity
Coaxiality and concentricity	Ø 0,7 mm to Ø300 mm to height 300 mm	0,10 µm + 0,040 × A	A = measured coaxiality / concentricity
Planes or sides			
Flatness	to Ø 55 mm	0,050 µm	
	to Ø 150 mm	0,060 µm	
	to Ø 290 mm	0,15 µm	
	to 6 000 mm × 10 000 mm	0,50 µm + 1,5 × 10^{-6} × *l*	*l* = longest side of surface plate; (1)
Angle between sides or planes	to 180°	(0,50 + 12/*l*) amin	*l* = leg length in mm; leg length to 200 mm
		3,0 as	optical surfaces
Squareness	to 1200 x 550 mm	2,1 µm + 4,0 × 10^{-6} × *l*	*l* = leg length ratio leg length : reference length = 1 : 1
Parallelism	to 1200 mm	1,0 µm + 2,0 × 10^{-6} × *l*	*l* = leg length
Diameter			
External	Ø 0,05 mm to Ø 300 mm	0,50 µm + 1,5 × 10^{-6} × *l*	
	Ø 300 mm to Ø 500 mm	0,90 µm + 0,60 × 10^{-6} × *l*	
	Ø 500 mm to Ø 3000 mm	0,40 µm + 2,0 × 10^{-6} × *l*	
Internal	Ø 1 mm to Ø 250 mm	0,50 µm + 2,0 × 10^{-6} × *l*	
Distance of 2 parallel surfaces			
External	to 200 mm	0,50 µm + 2,0 × 10^{-6} × *l*	
	to 3000 mm	0,40 µm + 4,0 × 10^{-6} × *l*	
Internal	to 1200 mm	1,2 µm + 4,0 × 10^{-6} × *l*	

Thread external			
Pitch	to 10 mm	2,0 µm	
Profile angle	to 180°	(0,50 + 12 / l) bgmin	l = leg length in mm
Simple pitch diameter	Ø 1 mm to Ø 300 mm	α = 30°: (6,0 µm to 9,7 µm)	Acc. to Euramet/CG-10, method 1a or 1b
		α = 60°: (3,2 µm to 5,9 µm)	
		α = 90°: (2,6 µm to 5,5 µm)	
Thread internal			
Pitch	to 10 mm	2,0 µm	
Profile angle	to 180°	(0,50 + 12 / l) bgmin	l = leg length in mm
Simple pitch diameter	Ø 4 mm to Ø 300 mm	α = 30°: (9,0 µm to 14,0 µm)	Acc. to Euramet/CG-10, method 1a or 1b
		α = 60°: (3,6 µm to 7,0 µm)	
		α = 90°: (3,1 µm to 6,2 µm)	
(1): also on site, the CMC can be bigger on site			
R: resolution of the instrument ; l : measured length			

BELAC 6-017 code	FORCE AND TORQUE (Berchem)

1.6 Force

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Push pull force measuring devices in tension and compression	0,80 N to 5 000 N	$1{,}0 \times 10^{-4} \times F$	dead weights, f.i. ISO376 and ISO7500-1[3]
	2 kN to 200 kN	$8{,}0 \times 10^{-4} \times F$	Generation and measurement by comparison with standard load cells, f.i. ISO376 and ISO7500-1[3]
	200 kN to 500 kN	$10 \times 10^{-4} \times F$	Generation and measurement by comparison with standard load cells, f.i. ISO376 and ISO7500-1[3]
	500 kN to 1,0 MN	$10 \times 10^{-4} \times F$	Measurement only by comparison with standard load cells, f.i. ISO376 and ISO7500-1[3]
Gram force gauges	0,050 N to 500 N	$0{,}010 \times F$	

1.6 Torque

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Torque tools	0,1 Nm to 2700 Nm	$8{,}0 \times 10^{-3} \times M$	Accuracy acc. to ISO 6789[3]
Torque measuring devices	0,1 Nm to 1 Nm	$1 \times 10^{-3} \times M$	With torque arms and weights
	1 Nm to 200 Nm	$1{,}0 \times 10^{-3} \times M$	
	200 Nm to 4000 Nm	$0{,}5 \times 10^{-3} \times M$	

[3] in situ calibration also

BELAC 6-017 code	MASS (Berchem)

1.7.1 Mass standards

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Weights and masses	1 mg	0,001 0 mg	For example mass pieces up to grade E1 according to OIML R111-1
	2 mg	0,001 0 mg	
	5 mg	0,001 0 mg	
	10 mg	0,001 0 mg	
	20 mg	0,001 0 mg	
	50 mg	0,001 2 mg	
	100 mg	0,001 6 mg	
	200 mg	0,002 0 mg	
	500 mg	0,002 5 mg	
	1 g	0,003 0 mg	
	2 g	0,004 0 mg	
	5 g	0,005 0 mg	
	10 g	0,007 0 mg	
	20 g	0,008 0 mg	
	50 g	0,010 mg	
	100 g	0,017 mg	
	200 g	0,033 mg	
	500 g	0,080 mg	
	1 kg	0,16 mg	
	2 kg	0,33 mg	
	5 kg	0,80 mg	
	10 kg	1,7 mg	
	20 kg	10 mg	For example mass pieces up to grade E2 according to OIML R111-1
	50 kg	600 mg	For example mass pieces up to grade M1 according to OIML R111-1
	100 kg	1 000 mg	
	150 kg	1 600 mg	

1.7.2 Weighing instruments

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Non automatic weiging machines	1 mg to 645 kg 0,5 t to 10 t 20 t by substitution	$20 \times 10^{-6} \times m$	Available weights: grade E2: 1 mg to 5 kg grade F1: 1 g to 20 kg grade M1: 1 g to 500 kg

BELAC 6-017 code	PRESSURE AND VACUUM (Berchem)

1.8.1 Gas pressure

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Gauges, digital indicators, plotters, calibrators, liquid column, transmitters, transducers and pressure balances for relative and absolute[1] pressures	0 Pa to 4800 Pa	$1 \times 10^{-4} \times p$ minimum 0,03 Pa	By comparison with a low pressure standard
	-100 kPa to -1,5 kPa	$80 \times 10^{-6} \times p$	By comparison with a gas pressure balance
	1,5 kPa to 5,0 kPa	$80 \times 10^{-6} \times p$	
	5,0 kPa to 350 kPa	$20 \times 10^{-6} \times p$	
	5,0 kPa to 1,9 MPa	$26 \times 10^{-6} \times p$	
	1,9 MPa to 7,6 MPa	$30 \times 10^{-6} \times p$	
	7,6 MPa to 12 MPa	$70 \times 10^{-6} \times p$	
Barometers	5,0 kPa to 350 kPa abs	$20 \times 10^{-6} \times p$	By comparison with a gas pressure balance
Piston/cilinder combination (effective area)[2]	5,0 kPa to 350 kPa	$20 \times 10^{-6} \times p$	By comparison with a gas pressure balance
	350 kPa to 1,9 MPa	$25 \times 10^{-6} \times p$	
	1,9 MPa to 7,6 MPa	$30 \times 10^{-6} \times p$	
	7,6 MPa to 12 MPa	$70 \times 10^{-6} \times p$	

1 For absolute pressures the uncertainty of the atmospheric pressure is added to the uncertainty (except when working with an absolute pressure balance)
2 The masses can be calibrated in our mass laboratory

1.8.2 Liquid pressure

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Gauges, digital indicators, plotters, calibrators, liquid column, transmitters, transducers and pressure balances for relative and absolute[1] pressures	0,30 MPa to 2,5 MPa	$65 \times 10^{-6} \times p$	By comparison with a liquid pressure balance
	2,5 MPa to 100 MPa	$30 \times 10^{-6} \times p$	
	100 MPa to 120 MPa	$70 \times 10^{-6} \times p$	
	120 MPa to 400 MPa	$250 \times 10^{-6} \times p$	
Piston/cilinder combination (effective area)[2]	0,30 MPa to 2,5 MPa	$65 \times 10^{-6} \times p$	By comparison with a liquid pressure balance
	2,5 MPa to 100 MPa	$30 \times 10^{-6} \times p$	
	100 MPa to 120 MPa	$70 \times 10^{-6} \times p$	

1 For absolute pressures the uncertainty of the atmospheric pressure is added to the uncertainty (except when working with an absolute pressure balance)
2 The masses can be calibrated in our mass laboratory

1.8.3 Vacuum quantities

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Absolute pressure	1 Pa to 5 kPa	$2 \times 10^{-2} \times p$	By comparison with capacitive pressure indicators
	1 mPa to 1 Pa	$2{,}5 \times 10^{-2} \times p + 5$ mPa	

In Situ

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Relative pressures	20 kPa to 60 MPa	$1 \times 10^{-3} \times p$	By comparison with digital pressure indicators
Absolute pressures	20 kPa to 60 MPa abs.	$1 \times 10^{-3} \times p$	

BELAC 6-017 code	DENSITY AND VISCOSITY (Berchem)

1.12 Density and viscosity (volume)

Measure quantity, instrument or gauge	Range	CMC (95%)	Remarks
Volume measuring devices, pipettes	10 µl to 50 µl	0,40 µl	Gravimetric method
	50 µl to 100 µl	0,50 µl	
	100 µl to 500 µl	0,60 µl	
	500 µl to 1 ml	1,0 µl	
	1 ml to 10 ml	10 µl	
	10 ml to 25 ml	20 µl	
	25 ml to 50 ml	50 µl	
Volume measuring devices, glass cups, recipients, …	50 ml to 100 ml	1,0 ml	Gravimetric method
	100 ml to 200 ml	1,5 ml	
	200 ml to 300 ml	2,0 ml	
	300 ml to 500 ml	2,5 ml	
	500 ml to 1000 ml	3,0 ml	
	1 l to 5 l	3,5 ml	

BELAC 6-017 code	FLOW OF GAS/LIQUIDS (Berchem)

1.13.3 Velocity of gases

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Windspeed	0,1 m/s to 35 m/s	0,60 % + 0,020 m/s	By comparison with an LDV in a windtunnel

BELAC 6-017 code	TEMPERATURE (Berchem)

1.16.2 Standard Pt resistance thermometers

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Resistance thermometers	-196 °C	0,025 °C	By comparison with reference standards in liquid nitrogen at atmospheric pressure
	-100 °C to -40 °C	0,050 °C	By comparison with reference standards
	-40 °C to 0 °C	0,025 °C	
	0 °C to 280 °C	0,015 °C	
	250 °C to 660 °C	0,040 °C	

1.16.3 Thermocouples

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Thermocouples B, R & S	0 °C to 280 °C	0,40 °C	By comparison with reference standards
	280 °C to 660 °C	0,70 °C	
	660 °C to 1100 °C	1,7 °C	
	1100 °C to 1300 °C	2,3 °C	
Thermocouples	-196 °C	0,20 °C	By comparison with reference standards in liquid nitrogen at atmospheric pressure
	-100 °C to 280 °C	0,20 °C	By comparison with reference standards
	280 °C to 660 °C	0,50 °C	
	660 °C to 1100 °C	1,7 °C	
	1100 °C to 1300 °C	2,3 °C	

1.16.4 Self indicating thermometers

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Temperature indicators with resistance probe	-196 °C	0,025 °C	By comparison with reference standards in liquid nitrogen at atmospheric pressure
	-100 °C to -40 °C	0,050 °C	By comparison with reference standards
	-40 °C to 0 °C	0,025 °C	
	0 °C to 280 °C	0,015 °C	
	250 °C to 660 °C	0,040 °C	
Temperature indicators with thermocouple probes B, R & S	0 °C to 280 °C	0,40 °C	By comparison with reference standards
	280 °C to 660 °C	0,70 °C	
	660 °C to 1100 °C	1,7 °C	
	1100 °C to 1300 °C	2,3 °C	
Temperature indicators with thermocouple probes	-196 °C	0,20 °C	By comparison with reference standards in liquid nitrogen at atmospheric pressure
	-100 °C to 280 °C	0,20 °C	By comparison with reference standards
	280 °C to 660 °C	0,50 °C	
	660 °C to 1100 °C	1,7 °C	
	1100 °C to 1300 °C	2,3 °C	
Analogue thermometers	-100 °C to 0 °C	0,60 °C	By comparison with reference standards
	0 °C to 280 °C	0,20 °C	

Liquid in glass thermometers with a resolution of	-100 °C to 0 °C		By comparison with reference standards (totally or partially submerged) Partially submerged thermometers have a bigger CMC than mentioned
5 °C		2,0 °C	
2 °C		0,80 °C	
1 °C		0,40 °C	
0,5 °C		0,20 °C	
0,2 °C		0,090 °C	
0,1 °C		0,060 °C	
0,05 °C		0,060 °C	
Liquid in glass thermometers with a resolution of	0 °C to 275 °C		By comparison with reference standards (totally or partially submerged) Partially submerged thermometers have a bigger CMC than mentioned
5 °C		2,0 °C	
2 °C		0,80 °C	
1 °C		0,40 °C	
0,5 °C		0,20 °C	
0,2 °C		0,070 °C	
0,1 °C		0,050 °C	
0,05 °C		0,025 °C	
Surface temperature probes	ambient to 300 °C	0,50 % × t + 0,50 °C	By comparison with reference standards

1.16.5 Radiation thermometry

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Infrared thermometry	-17 °C to 100 °C	0,50 °C	By comparison with reference standards
	100 °C to 200 °C	0,60 °C	
	200 °C to 400 °C	1,7 °C	
	400 °C to 600 °C	0,60%	
	600 °C to 800 °C	0,70%	

1.16.9 Contact thermometry fixed points for realizing ITS-90

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Platinum resistance thermometers which meet the specifications of the ITS-90 or close to these specifications			Fixed points
	-38,8344 °C	0,004 °C	triple point of mercury
	0,01 °C	0,004 °C	triple point of water
	29,7646 °C	0,004 °C	melting point of gallium
	156,5985 °C	0,005 °C	freeze point of indium
	231,928 °C	0,005 °C	freeze point of tin
	419,527 °C	0,006 °C	freeze point of zinc
	660,323 °C	0,015 °C	freeze point of aluminum
Temperature indicators with resistance probe			Fixed points
	-38,8344 °C	0,004 °C	triple point of mercury
	0,01 °C	0,004 °C	triple point of water
	29,7646 °C	0,004 °C	melting point of gallium
	156,5985 °C	0,005 °C	freeze point of indium
	231,928 °C	0,005 °C	freeze point of tin
	419,527 °C	0,006 °C	freeze point of zinc
	660,323 °C	0,015 °C	freeze point of aluminum

1.16.11 Temperature controlled chambers

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Charcterisation of ovens and climatic chambers	-100 °C to -38,5 °C	1,6 °C	Using thermocouple type K
	-38,5 °C to 230 °C	0,080 °C	Using Pt100 probes
	230 °C to 600 °C	1,5 °C	Using thermocouple type R & S

1.16.12 Other temperature enclosures

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Blok calibrators	-100 °C to 650 °C	0,040 °C + 0,000 05 × |*t*|	Full evaluation following DOC EM/CG/13 "Guidelines on the Calibration of Temperature Block Calibrators" Or calibration with known evaluation information

1.16.14 Cold junction compensation

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Cold junction compensation B, R & S	0 °C	0,06 °C	
Cold junction compensation	0 °C	0,025 °C	

1.16.15 In Situ calibration

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Temperature probe with or without readout	-100 °C to -20 °C	0,11 °C	By comparison in Block calibrators with external reference standards
	-20 °C to 50 °C	0,09 °C	
	50 °C to 250 °C	0,16 °C	
	250 °C to 650 °C	0,22 °C	

BELAC 6-017 code	HUMIDITY (Berchem)

1.17.1 Hygrometers

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
RH meters with sensor type: resistive, capacitive, electrolytic, impedance, …	10 % RH to 95 % RH @ ambient temperature	0,50 % RH	by comparison with two pressure humitiy generator
	10 % RH to 95 % RH @ 10 to 35 °C	1,0 % RH to 0,50 % RH	
	10 % RH to 95 % RH @ -10 to 10 °C	2,5 % RH to 0,50 % RH	
	10 % RH to 95 % RH @ 35 to 70 °C	1,5 % RH to 0,50 % RH	
Ambient thermometer / humidity meters with sensor type: resistive, capacitive, electrolytic, impedance, …	30 % RH to 85 % RH -20 °C to 140 °C	4,0 % RH 0,10 °C	by comparison with standard sensor in a climate chamber

1.17.2 Other instruments for humidity

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Dew point meters	-70 °C to 0 °C	0,10 °C	Temperature frost- or dewpoint
	0 °C to 10 °C	0,12 °C	

1.17.3 Generators for Humidity

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Humidity generator	10 % RH to 90 % RH	0,10 % RH to 0,90 % RH	by comparison with dew pointmeter

1.17.4 Humidity of temperature controlled chambers

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Charcterisation of climatic chambers	10 % RH to 90 % RH	1,5 % RH	Only between -20 °C to 100 °C

BELAC 6-017 code	REFERENCE MATERIALS - HARDNESS (Berchem)

1.19.3 Hardness

Measured quantity, instrument or gauge	Range	CMC (95%)	Remarks
Hardness tester	0 Shore A to 100 Shore A	0,50 Shore A	
	0 Shore D to 100 Shore D	0,50 Shore D	
Reference for hardness tester	Shore A	2,0 mN	
	Shore D	6,0 mN	