DAkkS
Deutsche
Akkreditierungsstelle

Deutsche Akkreditierungsstelle GmbH

Annex to the Accreditation Certificate D-K-15089-01-01 according to DIN EN ISO/IEC 17025:2005

Valid from: 25.07.2019

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Holder of certificate:

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Accredited as calibration laboratory since:	30.07.1993

Calibration in the fields:

Dimensional quantities

Length

- **Gauge blocks**
- **Length measuring instruments**
- **Line scales, distances**
- **Length measuring devices** [a)]
- **Diameter**
- **Form error**
- **Flatness** [a)]
- **Straightness** [a)]
- **Thread**

Coordinate measuring technology

- **Coordinate measuring machines** [c)]

Mechanical quantities

- **Torque** [b)]
- **Pressure**
- **Weighing instruments** [a)]
- **Material testing machines (MTM)**
  - **Hardness (MTM)**

Electrical quantities

DC and low frequency

- **DC voltage**
- **AC voltage**
- **DC current**
- **AC current**
- **DC resistance**

Time and frequency

- **Frequency**

Thermodynamic quantities

Temperature quantities

- **Temperature indicators and simulators**

[a)] also on-site calibration

[b)] also on-site calibration and calibration in the mobile laboratory

[c)] only on-site calibration

Within the measurands/calibration items marked with with *, the calibration laboratory is permitted, without being required to inform and obtain prior approval from DAkkS, to use calibration standards or equivalent calibration procedures listed here with different issue dates.

The calibration laboratory maintains a current list of all calibration standards / equivalent calibration procedures within the flexible scope of accreditation.

Abbreviations used: see last page

[1)] The expanded uncertainties according to EA-4/02 M:2013 are part of CMC and are the best measurement uncertainties within accreditation. They have a coverage probability of approximately 95 % and have a coverage factor of k = 2 unless stated otherwise. Uncertainties without unit are relative uncertainties referring to the measurement value unless stated otherwise.

Permanent Laboratory

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement [1]	Remarks
Length				
Gauge blocks * made of steel according to DIN EN ISO 3650:1999	0.5 mm to 100 mm featuring the nominal values of the standards	DAkkS-DKD-R 4-3 part 3.1:2010 Measurement of the deviation of the central length l_m from the nominal value l_n by comparison measurement Measurement of the deviations f_o and f_u from the central length by 5 points comparison For the smallest measurement uncertainties, the wringability and the wringing characteristics of both measuring surfaces must be checked using an appropriate optical flat	For the central length: $0.05\ \mu m + 0.5 \cdot 10^{-6} \cdot l$ For the deviations f_o and f_u from the central length: 0.05 µm	Measuring surface quality as stated in QMH rsp. in the test specifications l = gauge block length
	> 100 mm to 150 mm featuring the nominal values of the standards		For the central length: $0.05\ \mu m + 0.7 \cdot 10^{-6} \cdot l$ For the deviations f_o and f_u from the central length: 0.07 µm	
Gauge blocks * made of ceramics according to DIN EN ISO 3650:1999	0.5 mm to 100 mm featuring the nominal values of the standards		For the central length: $0.07\ \mu m + 0.6 \cdot 10^{-6} \cdot l$ For the deviations f_o and f_u from the central length: 0.05 µm	
	> 100 mm to 150 mm featuring the nominal values of the standards		For the central length: $0.07\ \mu m + 0.8 \cdot 10^{-6} \cdot l$ For the deviations f_o and f_u from the central length: 0.07 µm	
Gauge blocks * made of steel with special cross section (round or square), also with drilling in the middle	0.5 mm to 100 mm		For the central length: $0.1\ \mu m + 0.5 \cdot 10^{-6} \cdot l$ For the deviations f_o and f_u from the central length: 0.1 µm	At square gauge blocks with drillings the mean size is substituted by ANSI-ASME B89.1.9M measured between hole and front side
Gauge blocks * made of tungsten carbide according to DIN EN ISO 3650:1999	0.5 mm to 100 mm featuring the nominal values of the standards		For the central length: $0.08\ \mu m + 1.2 \cdot 10^{-6} \cdot l$ For the deviations f_o and f_u from the central length: 0.05 µm	
Gauge blocks * made of steel	> 150 mm to 1000 mm in the nominal dimensions, which differ of the standard with a max. of 50 mm	Measurement of the deviation of the central length l_c from the nominal value l_n by comparison measurement	For the central length: $0.2\ \mu m + 0.7 \cdot 10^{-6} \cdot l$	

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Setting ring gauges * made of steel Diameter	2 mm to 200 mm	DAkkS-DKD-R 4-3 part 4.1:2010	0.4 µm + 2 · 10^{-6} · d	The measurement uncertainty applies to the complete calibration of diameter, roundness, straightness and parallelism. For the calibration of the diameter without form measurement, the best measurement uncertainty increases by 0.2 µm d = measured diameter
Setting plug gauges * made of steel Diameter	1 mm to 200 mm	DAkkS-DKD-R 4-3 part 4.1:2010	0.4 µm + 2 · 10^{-6} · d	
Measuring pins * made of steel Diameter	0.17 mm to 20 mm	DAkkS-DKD-R 4-3 part 4.2:2010	0.4 µm	
Roundness deviation * of abovementioned rings, inside cylinders, plugs or outside cylinders	to 40 µm	DAkkS-DKD-R 4-3 part 4.1:2010	0.2 µm + 1 · 10^{-2} · $RONt$	Diameter: 2 mm to 200 mm
Straigthness deviation * of abovementioned rings, inside cylinders, plugs or outside cylinders	to 10 µm	DAkkS-DKD-R 4-3 part 4.1:2010	0.5 µm	axial length: to 30 mm
Setting dimension *	25 mm to 900 mm	VDI/VDE/DGQ 2618 part 4.4:2009	0.7 µm + 1,5 · 10^{-6} · l	l = measured length
Caliper gauge *	5 mm to 170 mm	DAkkS-DKD-R 4-3 part 4.7:2010	1.5 µm + 10 · 10^{-6} · l	
Reference- and Setting gauge	to 12 mm	Annex F/43:2017-11	3 µm	Feeler gauge, gap gauge of plastic, delrin, teflon, brass or steal
Radius gauge	to 40 mm	Annex F/42:2018-01	3 µm	to 40 mm radii
Angle meter *	0° to 360°	DAkkS-DKD-R 4-3 part 7.2:2010	1' 30''	
Graduator	0° to 180°	Annex F/46:2017-11	12'	
Measuring tape Circumference tape measure	0 m to 50 m	Annex F/47-1:2017-12 Annex F/47-2:2017-12	50 µm + 15 · 10^{-6} · l	l = measured length
Diameter tape measure	0 m to 10 m	Annex F/47-2:2017-12	50 µm + 15 · 10^{-6} · d	d = measured diameter
Rules	0 m to 10 m	Annex F/47-3:2017-12 Annex F/47-4:2017-11	50 µm + 15 · 10^{-6} · l	l = measured length Graduated metal rules, reference- and plotting scale, rules, folding rules
Calipers for external, internal and depth dimensions *	0 mm to 1000 mm	DAkkS-DKD-R 4-3 part 9.1:2010	30 µm + 30 · 10^{-6} · l	l = measured length
Depth calipers *	0 mm to 1000 mm	DAkkS-DKD-R 4-3 part 9.2:2010	30 µm + 30 · 10^{-6} · l	

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Height gauge *	0 mm to 1000 mm	DAkkS-DKD-R 4-3 part 9.3:2010	20 µm + 10 · 10^{-6} · l	with contact help
Micrometers *	0 mm to 100 mm	DAkkS-DKD-R 4-3 part 10.1:2010	3 µm + 10 · 10^{-6} · l	100 mm = final value of the measuring range
Indicating caliper micrometers *	0 mm to 100 mm	DAkkS-DKD-R 4-3 part 10.3:2010	2 µm + 10 · 10^{-6} · l	l = measured length
Indicating caliper gap gauge	0 mm to 100 mm	Annex F/39:2017-12	2 µm + 10 · 10^{-6} · l	
Depth micrometers *	0 mm to 300 mm	VDI/VDE/DGQ 2618 part 10.5:2010	3 µm + 10 · 10^{-6} · l	with interchangeable contact points
Internal micrometers with two-point contact *	25 mm to 950 mm	DAkkS-DKD-R 4-3 part 10.7:2010	3.5 µm + 5 · 10^{-6} · d	d = measured diameter
Internal micrometers with jaws	5 mm to 100 mm	Annex F/37:2017-11	5 µm + 5 · 10^{-6} · d	
Internal micrometers with three-point contact *	3 mm to 200 mm	DAkkS-DKD-R 4-3 part 10.8:2010	3 µm + 5 · 10^{-6} · d	
Dial gauges with scales * Scale interval > 1 µm	to 100 mm	DAkkS-DKD-R 4-3 part 11.1:2010	3 µm + 10 · 10^{-6} · l	l = measured length
Dial gauges with scales * Scale interval 1 µm	to 5 mm		1.5 µm	error of measurement y_i
			2 µm	deviation span f_e, f_{ges}, f_u, f_t and f_w
Dial gauges with scales * Scale interval > 1 µm	to 100 mm	VDI/VDE/DGQ 2618 part 11.1:2014	3 µm + 10 · 10^{-6} · l	l = measured length
Dial gauges with scales * Scale interval 1 µm	to 5 mm		1.5 µm	error of measurement y_i
			2 µm	deviation span MPE_t, MPE_e, MPE_{ges}, $MPE_{1/1}$, $MPE_{1/2}$, $MPE_{1/10}$, MPE_u
Dial gauges with digital display Numerical interval 0.1 µm	to 25 mm	Annex F/04-2 V5:2014	0.6 µm + 10 · 10^{-6} · l	error of measurement y_i
			0.8 µm + 10 · 10^{-6} · l	deviation span f_e, f_t and f_w
Dial gauges with digital display Numerical interval 1 µm	to 100 mm		1 µm + 10 · 10^{-6} · l	error of measurement y_i
			1.5 µm + 10 · 10^{-6} · l	deviation span f_e, f_t and f_w
Dial indicators * Scale interval > 0.5 µm	to 3 mm	DAkkS-DKD-R 4-3 part 11.2:2010	0.6 µm	
Lever gauges *	to 1.6 mm	DAkkS-DKD-R 4-3 part 11.3:2010	1 µm	
Lever gauges for external measurements *	0 mm to 70 mm	DAkkS-DKD-R 4-3 part 12.1:2010	7 µm + 10 · 10^{-6} · l	up to a probe length of 200 mm

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Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement [1]	Remarks
Lever gauges for internal measurements *	2.5 mm to 80 mm	DAkkS-DKD-R 4-3 part 13.1:2010	7 µm + 10 · 10^{-6} · l	l = measured length
Thickness gauges *	0 mm to 30 mm	DAkkS-DKD-R 4-3 part 12.1:2010	7 µm + 10 · 10^{-6} · l	l = measured length up to a measuring depth of 200 mm
Bore gauges with two-point contact *	1 mm to 3 mm	VDI/VDE/DGQ 2618 part 13.2:2005 (image 1)	0.8 µm	range of application: with gauge slider d = 1.75 mm to d = 25 mm
		VDI/VDE/DGQ 2618 part 13.2:2005 (image 2)	0.8 µm	range of application: to d = 300 mm
			1.2 µm	range of application: d > 300 mm to d = 600 mm
		VDI/VDE/DGQ 2618 part 13.2:2005 (image 3)	0.8 µm	range of application: plug gauge to d = 100 mm
Height gauges *	0 mm to 1000 mm	VDI/VDE/DGQ 2618 part 16.1:2009	1.5 µm + 3 · 10^{-6} · L	L = measured length
Deviation from straightness and Perpendicularity	to 30 µm	to 800 mm lead length	2.5 µm + 1 · 10^{-6} · l_z	l_z = lead length
90° Squares Perpendicularity	to 30 µm	Annex F/12 V3:2010 to 750 mm leg length	2 µm + 2 · 10^{-6} · l_z	l_z = length of form respectively position embodiment
Deviation from straightness and parallelism	to 30 µm	to 750 mm length	1 µm + 2 · 10^{-6} · l_z	
Flatness deviation	to 30 µm	to 750 mm edge length	1 µm + 2 · 10^{-6} · l_z	
Deviation from flatness Horizontal flatness standard, e.g. surface plates as per DIN 876:1984	to 50 µm	Annex F/13 V2:2010 to 2 m edge length electronic inclination measuring	1 µm + 1 · 10^{-6} · l	l = longest edge length of the measuring standard For calibration in the DAkkS calibration laboratory, the uncertainty increases starting by an edge length l > 1 m by a factor of 1.2
Deviation from straightness Horizontal flatness standard, e.g. surface plates as per DIN 876:1984	to 50 µm	Annex F/13 V2:2010 to 5 m edge length electronic inclination measuring	1 µm + 1 · 10^{-6} · l	

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Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement [1]	Remarks
Thread gauges * (single-start and multi-start cylindrical and conical external and internal threads with straight flanks, symmetrical and asymmetrical profile)				
External thread	3 mm to 90 mm			
Simple pitch diameter	Nominal diameter	Scanning method	2.5 µm	
Outside diameter		DAkkS-DKD-R 4-3 part 4.8:2010, Option 1 to option 4	2 µm	
Core diameter or recess diameter		(Specifying the thread angle α)	5 µm	
Lead or pitch	0.5 mm to 8 mm		1 µm	
Thread angle α	≥ 27°		(1.2 + 3 mm / l_F)', but not lower at 6'	l_F = side length
Internal thread	3 mm to 100 mm			
Simple pitch diameter	Nominal diameter	Scanning method	2.5 µm	
Outside diameter or recess diameter		DAkkS-DKD-R 4-3 part 4.9:2010, Option 1 to option 4	5 µm	
Core diameter		(Specifying the thread angle α)	2 µm	
Lead or pitch	0.5 mm to 8 mm		1 µm	
Thread angle α	≥ 27°		(1.2 + 3 mm / l_F)', but not lower at 6'	
Thread plug gauge * Simple pitch diameter	1.4 mm to 150 mm	DAkkS-DKD-R 4-3 part 4.8:2010, Option 1 (Three wire procedure)	2.5 µm + 7.5 · 10^{-6} · d	d = measured diameter P_h = lead P_h ≥ 0.3 mm to ≤ 6 mm
Torque * Hand torque assembly tools	1 N·m to 1000 N·m	DIN EN ISO 6789-2:2017	0.5 %	only operated torque tools
Torque wrench calibration devices	4 N·m to 1000 N·m	DAkkS-DKD-R 3-8:2010	0.2 %	
Pressure * gauge pressure p_e	1 bar 700 bar ≥ 700 bar to 800 bar	DIN EN 837:1997 DKD-R 6-1:2014	0.2 bar 0.5 bar	Pressure medium: oil
gauge pressure p_e	1 bar to 30 bar		0.01 bar	Pressure medium: gas

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Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement [1]	Remarks
Weighing instruments *				
Nonautomatic weighing instruments	to ≤ 50 kg	EURAMET Calibration Guide No. 18 version 4.0 (11/2015)	$1{,}2 \cdot 10^{-5}$	with weights OIML R 111-1:2004 according to the class F1
Material testing machines (MTM)				Direct measurement with reference standards for travel and power. Optical calibration of the geometrical measurements with optical and tactile coordinate measuring machines
Hardness (MTM) * Hardness Testers according to hardness scales Shore A, AO and D	0 Shore to 100 Shore	DIN ISO 7619-1:2012 DIN ISO 18898:2014	1 Shore	
Measuring range	to 2.5 mm		6 µm	
Diameter, radii, lengths	to 27 mm		3.5 µm	
Area	to 600 mm²		5 µm²	
Angle	28° to 37°		0.1°	
Elastic force	0 N to 44.5 N		0.5 % of final value	
Shore A, AO and D Measuring path standard	0.5 mm to 2.5 mm	Annex F/34 V1:2014	0.8 µm	
Temperature quantities *				
Temperature indicators for thermocouples	-200 °C to 1300 °C	DAkkS-DKD-R 5-5:2010	0.5 K	Simulation of the thermo-electric on multifunction generator (input in temperature units (° C)) Electric consideration of the reference junction
Temperature indicators for resistance thermo-meters with sensor PT100	-100 °C to 800 °C		0.2 K	Simulation of the resistance value on multifunction calibrator (input in temperature units (° C))
DC and low frequency quantities				
DC voltage Measuring instruments	0 mV to 200 mV		$2.8\ \mu V + 16 \cdot 10^{-6} \cdot U$	U = measuring value
	> 0.2 V to 2 V		$2.8\ \mu V + 10 \cdot 10^{-6} \cdot U$	
	> 2 V to 20 V		$28\ \mu V + 10 \cdot 10^{-6} \cdot U$	
	> 20 V to 200 V		$0.28\ mV + 15 \cdot 10^{-6} \cdot U$	
	> 200 V to 1000 V		$2.8\ mV + 15 \cdot 10^{-6} \cdot U$	
Sources	0 V to 0.1 V		$0.77\ \mu V + 2.6 \cdot 10^{-6} \cdot U$	
	> 0.1 V to 1 V		$0.88\ \mu V + 4.8 \cdot 10^{-6} \cdot U$	
	> 1 V to 10 V		$6.6\ \mu V + 5.4 \cdot 10^{-6} \cdot U$	
	> 10 V to 100 V		$98\ \mu V + 7.2 \cdot 10^{-6} \cdot U$	
	> 100 V to 1000 V		$1.4\ mV + 7.3 \cdot 10^{-6} \cdot U$	

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Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement [1]	Remarks
DC current Measuring instruments	0 µA to 200 µA > 0.2 mA to 2 mA > 2 mA to 20 mA > 20 mA to 200 mA > 0,2 A to 2 A > 2 A to 20 A		16 nA + 0.1 · 10^{-3} · I 57 nA + 50 · 10^{-6} · I 0.6 µA + 45 · 10^{-6} · I 2.4 µA + 0.12 · 10^{-3} · I 0.26 mA + 87 · 10^{-6} · I 0.55 mA + 0.34 · 10^{-3} · I	I = measuring value
DC current sources	10 µA to 100 µA > 0.1 mA to 1.0 mA > 1.0 mA to 10 mA > 10 mA to 100 mA > 0.1 A to 1.0 A > 1 A to 10 A > 10 A to 30 A		0.46 nA + 9.5 · 10^{-6} · I 4.9 nA + 9.3 · 10^{-6} · I 0.05 µA + 11 · 10^{-6} · I 0.71 µA + 35 · 10^{-6} · I 15 µA + 0.17 · 10^{-3} · I 0.4 mA + 0.42 · 10^{-3} · I 5 mA + 0.58 · 10^{-3} · I	I = measuring value
DC current clamps	0.2 A to < 10 A 10 A to 100 A > 100 A to 1000 A		10 mA + 2 · 10^{-3} · I 0.1 A + 2 · 10^{-3} · I 0.8 A + 2.5 · 10^{-3} · I	I = measuring value with current coil with 2, 10 and 50 windings
AC voltage Measuring instruments	0.02 V to 0.2 V	45 Hz to 999 Hz 1 kHz to 19.999 kHz	24 µV + 0.2 · 10^{-3} · U 36 µV + 0.25 · 10^{-3} · U	U = measuring value
	> 0.2 V to 2 V	45 Hz to 999 Hz 1 kHz to 19.999 kHz	0.15 mV + 0.21 · 10^{-3} · U 0.2 mV + 0.3 · 10^{-3} · U	
	> 2 V to 20 V	45 Hz to 999 Hz 1 kHz to 19.999 kHz	1.1 mV + 0.22 · 10^{-3} · U 1.8 mV + 0.3 · 10^{-3} · U	
	> 20 V to 200 V	45 Hz to 999 Hz 1 kHz to 10 kHz	14 mV + 0.2 · 10^{-3} · U 18 mV + 0.3 · 10^{-3} · U	
	> 200 V to 1000 V	45 Hz to 999 Hz 1 kHz to 10 kHz	0.07 V + 0.26 · 10^{-3} · U 0.13 V + 0.35 · 10^{-3} · U	
AC voltage Sources	10 mV to 100 mV	40 Hz to 200 Hz > 200 Hz to 2 kHz > 2 kHz to 20 kHz	11 µV + 0.33 · 10^{-3} · U 11 µV + 0.27 · 10^{-3} · U 13 µV + 0.34 · 10^{-3} · U	
	> 0.1 V to 1.0 V	40 Hz to 200 Hz > 200 Hz to 2 kHz > 2 kHz to 20 kHz	0.07 mV + 0.23 · 10^{-3} · U 0.06 mV + 0.22 · 10^{-3} · U 0.07 mV + 0.94 · 10^{-3} · U	
	> 1.0 V to 10 V	40 Hz to 200 Hz > 200 Hz to 2 kHz > 2 kHz to 20 kHz	0.7 mV + 0.24 · 10^{-3} · U 0.7 mV + 0.23 · 10^{-3} · U 0.73 mV + 0.93 · 10^{-3} · U	
	> 10 V to 100 V	40 Hz to 200 Hz > 200 Hz to 2 kHz > 2 kHz to 20 kHz	10 mV + 0.3 · 10^{-3} · U 7.6 mV + 0.28 · 10^{-3} · U 8 mV + 0.88 · 10^{-3} · U	
	> 100 V to 1000 V	40 Hz to 200 Hz > 200 Hz to 2 kHz > 2 kHz to 20 kHz	83 mV + 0.48 · 10^{-3} · U 52 mV + 0.69 · 10^{-3} · U 58 mV + 1.4 · 10^{-3} · U	

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AC current	20 µA to	200 µA	45 Hz to	1 kHz	$0.23\ \mu A + 1.1 \cdot 10^{-3} \cdot I$	I = measuring value
Measuring instruments	> 0.2 mA to	2 mA	45 Hz to	1 kHz	$0.23\ \mu A + 1.1 \cdot 10^{-3} \cdot I$	
	> 2 mA to	20 mA	45 Hz to	1 kHz	$2.3\ \mu A + 1.1 \cdot 10^{-3} \cdot I$	
	> 20 mA to	200 mA	45 Hz to	1 kHz	$23\ \mu A + 1.1 \cdot 10^{-3} \cdot I$	
	> 0.2 A to	2 A	45 Hz to	1 kHz	$0.23\ mA + 1.1 \cdot 10^{-3} \cdot I$	
	> 2 A to	20 A	45 Hz to	100 Hz	$2.3\ mA + 1.1 \cdot 10^{-3} \cdot I$	
AC current clumps	0.2 A to	< 10 A		50 Hz	$10\ mA + 2 \cdot 10^{-3} \cdot I$	I = measuring value with current coil with 2, 10 and 50 windings
	10 A to	100 A		50 Hz	$0.1\ A + 2 \cdot 10^{-3} \cdot I$	
	> 100 A to	500 A		50 Hz	$0.4\ A + 2.5 \cdot 10^{-3} \cdot I$	
	> 500 A to	1000 A		50 Hz	$0.8\ A + 2.5 \cdot 10^{-3} \cdot I$	
AC current sources	0.1 mA to	1.0 mA	40 Hz to	1 kHz	$0.17\ \mu A + 0.35 \cdot 10^{-3} \cdot I$	I = measuring value
	> 1.0 mA to	10 mA	40 Hz to	1 kHz	$1.4\ \mu A + 0.37 \cdot 10^{-3} \cdot I$	
	> 10 mA to	100 mA	40 Hz to	1 kHz	$14\ \mu A + 0.37 \cdot 10^{-3} \cdot I$	
	> 0.1 A to	1.0 A	40 Hz to	1 kHz	$0.17\ mA + 0.49 \cdot 10^{-3} \cdot I$	
	> 1.0 A to	10 A	40 Hz to	1 kHz	$4.6\ mA + 0.85 \cdot 10^{-3} \cdot I$	
	> 10 A to	30 A	40 Hz to	1 kHz	$14\ mA + 0.87 \cdot 10^{-3} \cdot I$	
DC resistance		0 Ω			5.8 mΩ	Fixed resistors
Measuring instruments		0.1 Ω			5.8 mΩ	
4-wire connection		1 Ω			6 mΩ	
		10 Ω			7 mΩ	
		100 Ω			12 mΩ	
		1 kΩ			93 mΩ	
		10 kΩ			0.93 Ω	
		100 kΩ			9.3 Ω	
DC resistances	0 Ω to	1 Ω			$0.23\ m\Omega + 2 \cdot 10^{-6} \cdot R$	R = measuring value
4-wire connection	> 1 Ω to	10 Ω			$0.23\ m\Omega + 4 \cdot 10^{-6} \cdot R$	
	> 10 Ω to	100 Ω			$0.27\ m\Omega + 9 \cdot 10^{-6} \cdot R$	
	> 100 Ω to	1 kΩ			$1.6\ m\Omega + 8.3 \cdot 10^{-6} \cdot R$	
	> 1 kΩ to	10 kΩ			$15\ m\Omega + 10 \cdot 10^{-6} \cdot R$	
	> 10 kΩ to	100 kΩ			$0.28\ \Omega + 9.7 \cdot 10^{-6} \cdot R$	
DC resistance		1 MΩ			0.16 kΩ	Fixed resistors
Measuring instruments		10 MΩ			4.6 kΩ	
2-wire connection		100 MΩ			0.6 MΩ	
		1000 MΩ			14 MΩ	
DC resistances	> 100 kΩ to	1 MΩ			$5.8\ \Omega + 10 \cdot 10^{-6} \cdot R$	R = measuring value
2-wire connection	> 1 MΩ to	10 MΩ			$0.1\ k\Omega + 17 \cdot 10^{-6} \cdot R$	
Time and frequency						
Frequency		10 Hz			$23 \cdot 10^{-6} \cdot F$	F = measuring value
Measuring instruments		100 Hz				
		1 kHz				
		10 kHz				
		20 kHz				
		50 kHz				
		100 kHz				
		1 MHz				
		10 MHz				

[1] The expanded uncertainties according to EA-4/02 M:2013 are part of CMC and are the best measurement uncertainties within accreditation. They have a coverage probability of approximately 95 % and have a coverage factor of k = 2 unless stated otherwise. Uncertainties without unit are relative uncertainties referring to the measurement value unless stated otherwise.

Permanent Laboratory

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement [1)]	Remarks
Revolution speed Revolution counter optical	240 min^{-1} bis 60000 min^{-1}		0.1 min^{-1} + 18 · 10^{-6} · n	direct optical excitation n = measuring value

On-site Calibration

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement [1)]	Remarks
Length				
Deviation from flatness Horizontal flatness standard, e.g.surface plates as per DIN 876:1984	to 50 µm	Annex F/13 V2:2010 to 2 m edge length electronic inclination measuring	1 µm + 1 · 10^{-6} · l	l = longest edge length of the measuring standard
Deviation from straightness Horizontal flatness standard, e.g.surface plates as per DIN 876:1984	to 50 µm	Annex F/13 V2:2010 to 5 m edge length electronic inclination measuring	1 µm + 1 · 10^{-6} · l	
Height gauges *	0 mm to 600 mm	VDI/VDE/DGQ 2618 part 16.1:2009	2.5 µm + 5 · 10^{-6} · L	L = measured length

[1)] The expanded uncertainties according to EA-4/02 M:2013 are part of CMC and are the best measurement uncertainties within accreditation. They have a coverage probability of approximately 95 % and have a coverage factor of k = 2 unless stated otherwise. Uncertainties without unit are relative uncertainties referring to the measurement value unless stated otherwise.

On-site Calibration

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement [1]	Remarks
Coordinate measuring technology *				
Measuring projectors Measuring microscopes	Devices featuring a measuring surface with a face diagonal ≤ 530 mm	Calibration of metro-logical characteristics according to DAkkS-DKD-R 4-3 part 18.1:2010, and the folloing standards and gudelines DIN EN ISO 10360 VDI/VDE 2617		
		Determination of probing error *PS-1D(OT)* with a graduated scale made of glass according to VDI/VDE 2617 part 6.1:2007	0.4 µm	Measuring projectors and measuring Microscopes with visual probing with crosshairs or electronic edge detection
		The error of indication for size measurement *E-1D(OT)* and *E-2D(OT)* is determined with a graduated scale made of glass according to VDI/VDE 2617 part 6.1:2007	0.5 µm + 0.5 · 10^{-6} · L	L = measured length
Weighing instruments *				
Nonautomatic weighing instruments	to ≤ 50 kg	EURAMET Calibration Guide No. 18 version 4.0 (11/2015)	1 · 10^{-5}	with weights OIML R 111-1:2004 according to the class F1
Torque *				
Hand torque assembly tools	1 N·m to 1000 N·m	DIN EN ISO 6789-2:2017	0.5 %	only operated torque tools

Mobile Laboratory

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement [1]	Remarks
Torque *				
Hand torque assembly tools	1 N·m to 1000 N·m	DIN EN ISO 6789-2:2017	0.5 %	only operated torque tools

[1] The expanded uncertainties according to EA-4/02 M:2013 are part of CMC and are the best measurement uncertainties within accreditation. They have a coverage probability of approximately 95 % and have a coverage factor of k = 2 unless stated otherwise. Uncertainties without unit are relative uncertainties referring to the measurement value unless stated otherwise.

Abbreviations used:

CMC	Calibration and measurement capabilities (Kalibrier- und Messmöglichkeiten)
DIN	Deutsches Institut für Normung e.V.
DAkkS-DKD-R	Guideline: Deutsche Akkreditierungsstelle GmbH
DKD-R	Guideline: Deutscher Kalibrierdienst (DKD), issued by Physikalisch-Technische Bundesanstalt
EURAMET	European Association of National Metrology Institutes
VDI/VDE 2617	Guideline: Accuracy of coordinate measuring machines
VDI/VDE/DGQ 2618	Guideline: Inspection of measuring and test equipment
VDE	Verband der Elektrotechnik, Elektronik und Informationstechnik
VDI	Verein Deutscher Ingenieure

[1] The expanded uncertainties according to EA-4/02 M:2013 are part of CMC and are the best measurement uncertainties within accreditation. They have a coverage probability of approximately 95 % and have a coverage factor of k = 2 unless stated otherwise. Uncertainties without unit are relative uncertainties referring to the measurement value unless stated otherwise.