

# Deutsche Akkreditierungsstelle GmbH

## Annex to the accreditation certificate D-K-15070-01-07 according to DIN EN ISO/IEC 17025:2018

**Valid from: 21.07.2021**

Date of issue: 21.07.2021

Certificate holder:

**Testo Industrial Services GmbH, Calibration  
Laboratory Winsen Tönnhäuser Weg 100-106, 21423  
Winsen (Luhe)**

The German original version  
„Anlage zur Akkreditierungsurkunde D-K-15070-01-07 nach DIN EN ISO/IEC 17025:2018“  
is valid.

Calibrations in the areas:

### Electrical measurands

#### Direct current and low frequency measurands

- DC voltage
- AC voltage
- DC current
- AC current strength
- DC resistance
- Electrical power
- Capacitance

#### Time and Frequency

- High Frequency and Radiation Measurands
- Time interval

#### High frequency measurands

- Frequency and Speed
- Oscilloscope measured variables
- Rise time

#### Mechanical measurands

- Print

### Dimensional measurands

#### Length

- Length measuring equipment
- Diameter
- Thread
- Line weight, distances

#### Thermodynamic measurands

##### Temperature measurands

- Temperature Indicators and Simulators

Within the measurands/Calibration items marked with \*), the calibration laboratory is permitted to apply the standards/ calibration guidelines listed here with different issue statuses without requiring prior information and approval by the DAkkS. The calibration laboratory has an up-to-date list of all standards/calibration guidelines in the flexible accreditation area

*The requirements for the management system in DIN EN ISO/IEC 17025 are written in a language relevant for calibration laboratories and are overall in accordance with the principles of DIN EN ISO 9001.*

*The certificate together with the attachment of the certificate shows the stand at the time of the issue date. The current status the scope of accreditation can be found in the database of accredited bodies of the Deutsche Akkreditierungsstelle GmbH (DAkkS).. <https://www.dakks.de/content/datenbank-akkreditierter-stellen>*

Annex to the accreditation certificate D-K-15070-01-07

Permanent laboratory

Calibration and Measurement Capabilities (CMC)

Measurand / calibration item	Measuring range /	Measuring conditions / Procedures	Expanded uncertainty of measurement <sup>1)</sup>	Remarks
DC voltage Measuring instruments	0 V		0.1 $\mu$ V	U - measured value
	0,01 V up to 0,22 V		$7 \cdot 10^{-6} U$ 1 $\mu$ V	
	> 0,22 V up to 2,2 V		$7 \cdot 10^{-6} U$ 1 $\mu$ V	
	> 2,2 V up to 11 V		$9 \cdot 10^{-6} U$	
	> 11 V by 22 V		$8 \cdot 10^{-6} U$	
	> 22 V up to 220 V		$12 \cdot 10^{-6} U$	
	> 220 V up to 1000 V		$12 \cdot 10^{-6} U$	
DC voltage Sources	0 V		0.1 $\mu$ V	
	1 mV up to 100 mV		$8 \cdot 10^{-6} U$ 1 $\mu$ V	
	> 100 mV up to 1 V		$11 \cdot 10^{-6} U$	
	> 1 V up to 10 V		$9 \cdot 10^{-6} U$	
	> 10 V up to 100 V		$13 \cdot 10^{-6} U$	
	> 100 V up to 1000 V		$16 \cdot 10^{-6} U$	
DC current Measuring instruments	0 A		0.2 nA	I - Measured value
	10 $\mu$ A up to 220 $\mu$ A		$50 \cdot 10^{-6} I$ 8 nA	
	> 220 $\mu$ A up to 2.2 mA		$87 \cdot 10^{-6} I$	
	> 2.2 mA up to 22 mA		$87 \cdot 10^{-6} I$	
	> 22 mA up to 220 mA		$89 \cdot 10^{-6} I$	
	> 220 mA up to 2,2 A		$0.2 \cdot 10^{-3} I$	
	> 2,2 A up to 11 A		$0.55 \cdot 10^{-3} I$	
	> 11 A up to 20 A		$1.2 \cdot 10^{-3} I$	
	> 20 A up to 200 A	Voltage drop with Normal resistance	$1.0 \cdot 10^{-3} I$	
DC current Sources	0 A		0.2 nA	
	0.1 $\mu$ A up to 1 $\mu$ A		$0.4 \cdot 10^{-3} I$	
	> 1 $\mu$ A up to 10 $\mu$ A		$0.12 \cdot 10^{-3} I$	
	> 10 $\mu$ A up to 100 $\mu$ A		$0.10 \cdot 10^{-3} I$	
	> 100 $\mu$ A up to 1 mA		$70 \cdot 10^{-6} I$	
	> 1 mA up to 10 mA		$70 \cdot 10^{-6} I$	
	> 10 mA up to 100 mA		$85 \cdot 10^{-6} I$	
	> 100 mA up to 1 A		$0.2 \cdot 10^{-3} I$	
	> 1 A up to 10 A	Voltage drop with Normal resistance	$0.5 \cdot 10^{-3} I$	
> 10 A up to 200 A		$1 \cdot 10^{-3} I$		
DC current Current clamps	1 mA up to 2,2 A		$1 \cdot 10^{-3} I$	
	> 2,2 A up to 20 A		$2 \cdot 10^{-3} I$	
	> 20 A up to 1000 A		$3 \cdot 10^{-3} I$	

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**Permanent laboratory**

**Calibration and Measurement Capabilities (CMC)**

Measurand / calibration item	Measuring range /	Measuring conditions / Procedures	Expanded uncertainty of measurement <sup>1)</sup>	Remarks
DC resistance	0 Ω		50 μΩ	R = measured value
Measuring instruments	1 Ω		95 · 10 <sup>-6</sup> R	
	1,9 Ω		95 · 10 <sup>-6</sup> R	
	10 Ω		28 · 10 <sup>-6</sup> R	
	19 Ω		27 · 10 <sup>-6</sup> R	
	100 Ω		17 · 10 <sup>-6</sup> R	
	190 Ω		17 · 10 <sup>-6</sup> R	
	1 kΩ		13 · 10 <sup>-6</sup> R	
	1.9 kΩ		13 · 10 <sup>-6</sup> R	
	10 kΩ		12 · 10 <sup>-6</sup> R	
	19 kΩ		12 · 10 <sup>-6</sup> R	
	100 kΩ		14 · 10 <sup>-6</sup> R	
	190 kΩ		14 · 10 <sup>-6</sup> R	
	1 MΩ		20 · 10 <sup>-6</sup> R	
	1.9 MΩ		21 · 10 <sup>-6</sup> R	
	10 MΩ		40 · 10 <sup>-6</sup> R	
	19 MΩ		48 · 10 <sup>-6</sup> R	
	100 MΩ		0.11 · 10 <sup>-3</sup> R	
DC resistance	0 Ω		100 μΩ	
Sources	1 Ω up to 10 Ω		16 · 10 <sup>-6</sup> R 50 μΩ	
	> 10 Ω up to 100 Ω		12 · 10 <sup>-6</sup> R 500 μΩ	
	> 100 Ω up to 1 kΩ		15 · 10 <sup>-6</sup> R	
	> 1 kΩ up to 10 kΩ		15 · 10 <sup>-6</sup> R	
	> 10 kΩ up to 100 kΩ		15 · 10 <sup>-6</sup> R	
	> 100 kΩ up to 1 MΩ		35 · 10 <sup>-6</sup> R	
	> 1 MΩ up to 10 MΩ		0.15 · 10 <sup>-3</sup> R	
> 10 MΩ up to 100 MΩ		0.6 · 10 <sup>-3</sup> R		
	> 100 MΩ up to 1 GΩ		5 · 10 <sup>-3</sup> R	

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Measurand / calibration item	Measuring range /	Measuring conditions / Procedures	Expanded uncertainty of measurement <sup>1)</sup>	Remarks
DC resistance ranges Measuring instruments and sources	1 Ω up to < 11 Ω		$0.12 \cdot 10^{-3} R$	R = measured value
	11 Ω up to < 33 Ω		$33 \cdot 10^{-6} R$	
	33 Ω up to < 110 Ω		$29 \cdot 10^{-6} R$	
	110 Ω up to < 330 Ω		$28 \cdot 10^{-6} R$	
	330 Ω up to < 1.1 kΩ		$28 \cdot 10^{-6} R$	
	1.1 kΩ up to < 3.3 kΩ		$28 \cdot 10^{-6} R$	
	3.3 kΩ up to < 11 kΩ		$28 \cdot 10^{-6} R$	
	11 kΩ up to < 33 kΩ		$28 \cdot 10^{-6} R$	
	33 kΩ up to < 110 kΩ		$28 \cdot 10^{-6} R$	
	110 kΩ up to < 330 kΩ		$32 \cdot 10^{-6} R$	
	330 kΩ up to < 1.1 MΩ		$33 \cdot 10^{-6} R$	
	1.1 MΩ up to < 3.3 MΩ		$62 \cdot 10^{-6} R$	
	3.3 MΩ up to < 11 MΩ		$0.13 \cdot 10^{-3} R$	
	11 MΩ up to < 33 MΩ		$0.25 \cdot 10^{-3} R$	
	33 MΩ up to < 110 MΩ		$0.5 \cdot 10^{-3} R$	
	110 MΩ up to < 330 MΩ		$3 \cdot 10^{-3} R$	
	330 MΩ up to < 1.1 GΩ		$15 \cdot 10^{-3} R$	
	0,001 Ω up to 0,1 Ω	Substitution procedure with normal resistance	$50 \cdot 10^{-6} R$	
	> 0,1 Ω up to 1 MΩ		$20 \cdot 10^{-6} R$	
	> 1 MΩ up to 100 MΩ		$30 \cdot 10^{-6} R$	
AC resistance	0,1 Ω up to 2 Ω	50 Hz up to 400 Hz	$10 \cdot 10^{-3} \cdot R$	
AC voltage Measuring instruments and Sources	1 mV up to 2.2 mV	10 Hz up to 20 Hz	$0.52 \cdot 10^{-3} U$	U = measured value
		> 20 Hz up to 40 Hz	$0.52 \cdot 10^{-3} U$	
		> 40 Hz up to 20 kHz	$0.40 \cdot 10^{-3} U$	
		> 20 kHz up to 50 kHz	$0.40 \cdot 10^{-3} U$	
		> 50 kHz up to 100 kHz	$0.41 \cdot 10^{-3} U$	
		> 100 kHz up to 300 kHz	$0.46 \cdot 10^{-3} U$	
		> 300 kHz up to 500 kHz	$0.55 \cdot 10^{-3} U$	
	> 500 kHz up to 1 MHz	$0.60 \cdot 10^{-3} U$		
	> 2.2 mV up to 7 mV	10 Hz up to 20 Hz	$0.22 \cdot 10^{-3} U$	
		> 20 Hz up to 40 Hz	$0.22 \cdot 10^{-3} U$	
		> 40 Hz up to 20 kHz	$0.16 \cdot 10^{-3} U$	
		> 20 kHz up to 50 kHz	$0.16 \cdot 10^{-3} U$	
		> 50 kHz up to 100 kHz	$0.20 \cdot 10^{-3} U$	
		> 100 kHz up to 300 kHz	$0.22 \cdot 10^{-3} U$	
> 300 kHz up to 500 kHz		$0.33 \cdot 10^{-3} U$		
> 500 kHz up to 1 MHz	$0.45 \cdot 10^{-3} U$			

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Measurand / calibration item	Measuring range /	Measuring conditions / Procedures	Expanded uncertainty of measurement <sup>1)</sup>	Remarks
AC voltage measuring instruments and sources	> 7 mV up to 22 mV	10 Hz up to 20 Hz > 20 Hz up to 40 Hz > 40 Hz up to 20 kHz > 20 kHz up to 50 kHz > 50 kHz up to 100 kHz > 100 kHz up to 300 kHz > 300 kHz up to 500 kHz > 500 kHz up to 1 MHz	$80 \cdot 10^{-6} U$ $80 \cdot 10^{-6} U$ $65 \cdot 10^{-6} U$ $75 \cdot 10^{-6} U$ $75 \cdot 10^{-6} U$ $95 \cdot 10^{-6} U$ $0.19 \cdot 10^{-3} U$ $0.21 \cdot 10^{-3} U$	<i>U</i> = measured value
	> 22 mV up to 70 mV	10 Hz up to 20 Hz > 20 Hz up to 40 Hz > 40 Hz up to 20 kHz > 20 kHz up to 50 kHz > 50 kHz up to 100 kHz > 100 kHz up to 300 kHz > 300 kHz up to 500 kHz > 500 kHz up to 1 MHz	$70 \cdot 10^{-6} U$ $58 \cdot 10^{-6} U$ $35 \cdot 10^{-6} U$ $35 \cdot 10^{-6} U$ $45 \cdot 10^{-6} U$ $55 \cdot 10^{-6} U$ $0.11 \cdot 10^{-3} U$ $0.13 \cdot 10^{-3} U$	
	> 70 mV up to 220 mV	10 Hz up to 20 Hz > 20 Hz up to 40 Hz > 40 Hz up to 20 kHz > 20 kHz up to 50 kHz > 50 kHz up to 100 kHz > 100 kHz up to 300 kHz > 300 kHz up to 500 kHz > 500 kHz up to 1 MHz	$39 \cdot 10^{-6} U$ $35 \cdot 10^{-6} U$ $25 \cdot 10^{-6} U$ $25 \cdot 10^{-6} U$ $28 \cdot 10^{-6} U$ $42 \cdot 10^{-6} U$ $85 \cdot 10^{-6} U$ $0.1 \cdot 10^{-3} U$	
	> 220 mV up to 700 mV	10 Hz up to 20 Hz > 20 Hz up to 40 Hz > 40 Hz up to 20 kHz > 20 kHz up to 50 kHz > 50 kHz up to 100 kHz > 100 kHz up to 300 kHz > 300 kHz up to 500 kHz > 500 kHz up to 1 MHz	$25 \cdot 10^{-6} U$ $22 \cdot 10^{-6} U$ $12 \cdot 10^{-6} U$ $12 \cdot 10^{-6} U$ $13 \cdot 10^{-6} U$ $14 \cdot 10^{-6} U$ $27 \cdot 10^{-6} U$ $40 \cdot 10^{-6} U$	

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Measurand / calibration item	Measuring range /	Measuring conditions / Procedures	Expanded uncertainty of measurement <sup>1)</sup>	Remarks
AC voltage measuring instruments and sources	> 700 mV up to 2.2 V	10 Hz up to 20 Hz > 20 Hz up to 40 Hz > 40 Hz up to 20 kHz > 20 kHz up to 50 kHz > 50 kHz up to 100 kHz > 100 kHz up to 300 kHz > 300 kHz up to 500 kHz > 500 kHz up to 1 MHz	$20 \cdot 10^{-6} U$ $14 \cdot 10^{-6} U$ $10 \cdot 10^{-6} U$ $10 \cdot 10^{-6} U$ $11 \cdot 10^{-6} U$ $11 \cdot 10^{-6} U$ $22 \cdot 10^{-6} U$ $68 \cdot 10^{-6} U$	<i>U</i> = measured value
	> 2.2 V up to 7 V	10 Hz up to 20 Hz > 20 Hz up to 40 Hz > 40 Hz up to 20 kHz > 20 kHz up to 50 kHz > 50 kHz up to 100 kHz > 100 kHz up to 300 kHz > 300 kHz up to 500 kHz > 500 kHz up to 1 MHz	$18 \cdot 10^{-6} U$ $12 \cdot 10^{-6} U$ $11 \cdot 10^{-6} U$ $11 \cdot 10^{-6} U$ $13 \cdot 10^{-6} U$ $13 \cdot 10^{-6} U$ $30 \cdot 10^{-6} U$ $95 \cdot 10^{-6} U$	
	> 7 V up to 22 V	10 Hz up to 20 Hz > 20 Hz up to 40 Hz > 40 Hz up to 20 kHz > 20 kHz up to 50 kHz > 50 kHz up to 100 kHz > 100 kHz up to 300 kHz > 300 kHz up to 500 kHz > 500 kHz up to 1 MHz	$17 \cdot 10^{-6} U$ $16 \cdot 10^{-6} U$ $11 \cdot 10^{-6} U$ $11 \cdot 10^{-6} U$ $11 \cdot 10^{-6} U$ $25 \cdot 10^{-6} U$ $30 \cdot 10^{-6} U$ $0.11 \cdot 10^{-3} U$	
	> 22 V up to 70 V	10 Hz up to 20 Hz > 20 Hz up to 40 Hz > 40 Hz up to 20 kHz > 20 kHz up to 50 kHz > 50 kHz up to 100 kHz > 100 kHz up to 300 kHz > 300 kHz up to 500 kHz > 500 kHz up to 1 MHz	$18 \cdot 10^{-6} U$ $16 \cdot 10^{-6} U$ $15 \cdot 10^{-6} U$ $15 \cdot 10^{-6} U$ $25 \cdot 10^{-6} U$ $25 \cdot 10^{-6} U$ $40 \cdot 10^{-6} U$ $0.13 \cdot 10^{-3} U$	
	> 70 V up to 220 V	10 Hz up to 20 Hz > 20 Hz up to 40 Hz > 40 Hz up to 20 kHz > 20 kHz up to 50 kHz > 50 kHz up to 100 kHz	$19 \cdot 10^{-6} U$ $18 \cdot 10^{-6} U$ $17 \cdot 10^{-6} U$ $17 \cdot 10^{-6} U$ $32 \cdot 10^{-6} U$	

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**Calibration and Measurement Capabilities (CMC)**

Measurand / calibration item	Measuring range /	Measuring conditions / Procedures	Expanded uncertainty of measurement <sup>1)</sup>	Remarks
AC voltage measuring instruments and sources	> 220 V up to 1000 V	10 Hz up to 20 Hz	$25 \cdot 10^{-6} U$	$U$ = measured value
		> 20 Hz up to 40 Hz	$27 \cdot 10^{-6} U$	
		> 40 Hz up to 20 kHz	$45 \cdot 10^{-6} U$	
		> 20 kHz up to 50 kHz	$45 \cdot 10^{-6} U$	
		> 50 kHz up to 100 kHz	$65 \cdot 10^{-6} U$	
AC power sources and Measuring instruments	100 $\mu$ A up to 1 mA	10 Hz up to 40 Hz > 40 Hz up to 1 kHz; > 1 kHz up to 10 kHz;	$120 \cdot 10^{-6} I$ $160 \cdot 10^{-6} I$ $60 \cdot 10^{-6} I$	$I$ = measured value
	> 1 mA up to 10 mA	10 Hz up to 40 Hz > 40 Hz up to 1 kHz; > 1 kHz up to 10 kHz;	$46 \cdot 10^{-6} I$	
AC power sources and Measuring instruments	> 10 mA up to 1 A	10 Hz up to 40 Hz > 40 Hz up to 1 kHz; > 1 kHz up to 10 kHz;	$17 \cdot 10^{-6} I$	
	> 1 A up to 10 A	10 Hz up to 40 Hz > 40 Hz up to 1 kHz; > 1 kHz up to 10 kHz;	$32 \cdot 10^{-6} I$	
	> 10 A up to 20 A	10 Hz up to 40 Hz > 40 Hz up to 1 kHz; > 1 kHz up to 10 kHz;	$39 \cdot 10^{-6} I$	
Alternating current Current clamps	1 mA up to 2.2 A	40 Hz up to 5 kHz	$2 \cdot 10^{-3} I$	
	> 2.2 A up to A	40 Hz up to 5 kHz	$3 \cdot 10^{-3} I$	
	> 20 A up to 800 A	40 Hz up to 65 Hz	$4 \cdot 10^{-3} I$	
AC active power Measuring devices	109 $\mu$ W up to <11 kW 363 mW up to 20 kW	33 mV up to 1000 V 45 Hz up to 65 Hz PF = 1 33 mA up to < 11 A 11 A up to 20 A	$1.4 \cdot 10^{-3} P$ $2.0 \cdot 10^{-3} P$	$P$ = set power
DC power	1 mW up to 300 W		$0.5 \cdot 10^{-3} P$	
	> 300 W up to 20 kW		$1.0 \cdot 10^{-3} P$	

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Measurand / calibration item	Measuring range /	Measuring conditions / Procedures	Expanded uncertainty of measurement <sup>1)</sup>	Remarks
Oscilloscopes				
Vertical deflection	5 mV up to 5 V 5 mV up to 120 V	$R_i = 50 \Omega$ $R_i = 1 M\Omega$	$3.5 \cdot 10^{-3} U$ 35 $\mu$ V $2.4 \cdot 10^{-3} U$ 40 $\mu$ V	Square wave voltage 10 Hz up to 10 kHz
Horizontal deflection				
Rise time	5 ns up to 520 ms > 20 ms up to 5 s		$3 \cdot 10^{-6} T$ 1 ns $30 \cdot 10^{-6} T$ 1.2 $\cdot 10^{-4} T^2$	
	180 ps up to 10 ms	25 mV up to 1 V $R_i = 50 \Omega$	$40 \cdot 10^{-3} \cdot tr$ 7 ps	tr: current rise time
Frequency	1 MHz up to 1 GHz		$2 \cdot 10^{-9} \cdot f_{UTf}$	$f$ = current measured value $UTf$ = Trigger uncertainty
Time interval	1 $\mu$ s up to 1000 s		$2 \cdot 10^{-9} \cdot t$ 2 ns	$t$ = current measured value
Temperature simulators for resistance thermometer *)	-200 °C up to 850 °C	DKD-R 5-5:2018	0,016 K	Characteristic according to DIN EN 60751:2009
Temperature indicators and -simulators for resistance thermometers *)	-200 °C up to 850 °C		0,03 K	
Temperature indicators and simulators for precious metal thermocouples *)	-200 °C up to 1750 °C	DKD-R 5-5: 2018	0,1 K	Characteristic according to DIN EN 60584-1:2014
Temperature indicators and simulators for Non-Precious Metals thermocouples *)	-200 °C up to 1300 °C	DKD-R 5-5: 2018	0,05 K	Characteristic according to DIN EN 60584-1:2014

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Capacity Measuring devices	190 pF up to < 400 pF	10 Hz up to 10 kHz	$4 \cdot 10^{-3} C$ 8 pF	With 5520A / 5522A
	400 pF up to < 1.1 nF	10 Hz up to 10 kHz	$4.5 \cdot 10^{-3} C$ 8 pF	
	1.1 nF up to < 3.3 nF	10 Hz up to 3 kHz	$4.0 \cdot 10^{-3} C$ 8 pF	
	3.3 nF up to < 11 nF	10 Hz up to 1 kHz	$2.5 \cdot 10^{-3} C$ 8 pF	
	11 nF up to < 33 nF	10 Hz up to 1 kHz	$2.5 \cdot 10^{-3} C$ 80 pF	
	33 nF up to < 110 nF	10 Hz up to 1 kHz	$2.5 \cdot 10^{-3} C$ 80 pF	
	110 nF up to < 330 nF	10 Hz up to 1 kHz	$4.5 \cdot 10^{-3} C$	
	330 nF up to < 1.1 μF	10 Hz up to 600 Hz	$4.5 \cdot 10^{-3} C$	
	1.1 μF up to < 3.3 μF	10 Hz up to 300 Hz	$4.5 \cdot 10^{-3} C$	
	3.3 μF up to < 11 μF	10 Hz up to 150 Hz	$4.5 \cdot 10^{-3} C$	
	11 μF up to < 33 μF	10 Hz up to 120 Hz	$6.0 \cdot 10^{-3} C$	
	33 μF up to < 110 μF	10 Hz up to 80 Hz	$6.5 \cdot 10^{-3} C$	
	110 μF up to < 330 μF	DC up to 50 Hz	$6.0 \cdot 10^{-3} C$	
	330 μF up to < 1.1 mF	DC up to 20 Hz	$6.0 \cdot 10^{-3} C$	
	1.1 mF up to < 3.3 mF	DC up to 6 Hz	$6.0 \cdot 10^{-3} C$	
	3.3 mF up to < 11 mF	DC up to 2 Hz	$6.0 \cdot 10^{-3} C$	
11 mF up to < 33 mF	DC up to 0.6 Hz	$8.0 \cdot 10^{-3} C$		
33 mF up to 110 mF	DC up to 0.2 Hz	$11 \cdot 10^{-3} C$		
Absolute pressure $p_{ABS}$	0.03 bar up to 11 bar	DKD-R 6-1 2014	0.2 mbar $1 \cdot 10^{-4} \cdot p_{ABS}$	Print Medium: Gas
	> 11 bar up to 251 bar	Calibration method $p_{ABS} = p_E \cdot p_{AMB}$	$2 \cdot 10^{-4} \cdot p_{ABS}$	The measurement uncertainty of the barometer is to take into account
Negative and positive	> -1 bar up to 10 bar	DKD-R 6-1 2014	0.2 mbar $1 \cdot 10^{-4} \cdot p_E$	
Overpressure $p_E$	> 10 bar up to 250 bar		$2 \cdot 10^{-4} \cdot p_E$	

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Length Cylindrical setting standards, ring gauges: Diameter	1 mm up to 200 mm	VDI/VDE/DGQ 2618 Sheet 4.1:2006	$0.8 \mu\text{m} \cdot 2 \cdot 10^{-6} \cdot d$	<i>d</i> = is the measured Diameter
	Plug gauges: Diameter	Point 3.3.4 (Opt. 3), Point 3.3.5 (Opt. 4)	$0.8 \mu\text{m} \cdot 2 \cdot 10^{-6} \cdot d$	
	Test Probes: Diameter	VDI/VDE/DGQ 2618 Sheet 4.2:2007 Point 3.2.2 (Opt. 1)	$0.8 \mu\text{m} \cdot 2 \cdot 10^{-6} \cdot d$	
Thread gauges (single and multi-start cylindrical external and internal thread with straight flanks, symmetrical profile) Threaded mandrels: simple Flank diameter	1.4 mm up to 200 mm nominal pitch: 0.3 mm up to 6 mm	VDI/VDE/DGQ 2618 Sheet 4.8:2006 Point 3.2.2 (Opt. 1)	$3 \mu\text{m} \cdot 10 \cdot 10^{-6} \cdot d$	Three-wire method <i>d</i> = is the measured diameter
Threaded rings: simpler Flank diameter	3 mm up to 200 mm nominal pitch: 0.5 mm up to 6 mm	VDI/VDE/DGQ 2618 Sheet 4.9:2006 Point 3.2.2 (Opt. 1)	$3 \mu\text{m} \cdot 10 \cdot 10^{-6} \cdot d$	Two-ball method <i>d</i> = is the measured Diameter
Length of plane-parallel, spherical or cylindrical Measuring surfaces	0,01 mm up to 500 mm	VDI/VDE/DGQ 2618 Sheet 19.1:2014	$1.5 \mu\text{m} \cdot 2 \cdot 10^{-6} \cdot l$	<i>l</i> is the measured Length
Diameter	0,01 mm up to 200 mm	VDI/VDE/DGQ 2618 Sheet 4.1:2006 Point 3.3.4 (Opt. 3), Point 3.3.5 (Opt. 4)	$1.5 \mu\text{m} \cdot 2 \cdot 10^{-6} \cdot d$	<i>d</i> is the measured Diameter
Feeler gauges	0.03 mm up to 2.00 mm	DIN 2275:2014	$1.5 \mu\text{m} \cdot 2 \cdot 10^{-6} \cdot l$	<i>l</i> is the measured length
Setting dimensions for Outside micrometers	25 mm up to 500 mm	VDI/VDE/DGQ 2618 Sheet 4.4:2009	$1.5 \mu\text{m} \cdot 2 \cdot 10^{-6} \cdot l$	

<sup>1)</sup> The CMCs contain the extended measurement uncertainties according to EA-4/02 M:2013. Within the framework of accreditation, these are the smallest measurement uncertainties that can be specified with a coverage probability of about 95 % and, unless otherwise specified, have the coverage factor  $k = 2$ . Uncertainties of measurement without indication of units are relative values related to the measured value, unless otherwise stated.

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**Permanent laboratory**

**Calibration and Measurement Capabilities (CMC)**

Measurand / calibration item	Measuring range /	Measuring conditions / Procedures	Expanded uncertainty of measurement <sup>1)</sup>	Remarks
Throat gauges	3 mm up to 200 mm	VDI/VDE/DGQ 2618 Sheet 4.7:2005 Point 3.3.2 (Opt. 2)	$0.8 \mu\text{m} \cdot 2 \cdot 10^{-6} \cdot d$	<i>d</i> is the measured Diameter
Caliper gauge for outside, inside and Depth measurements	0 mm up to 500 mm	VDI/VDE/DGQ 2618 Sheet 9.1:2006	$30 \mu\text{m} \cdot 30 \cdot 10^{-6} \cdot l$	<i>l</i> is the measured length
Depth calipers,	>500mm up to 1000 mm	VDI/VDE/DGQ 2618 Sheet 9.2:2006	$50 \mu\text{m} \cdot 30 \cdot 10^{-6} \cdot l$	
Height caliper		VDI/VDE/DGQ 2618 Sheet 9.3:2006		
Outside micrometres	0 mm up to 500 mm	VDI/VDE/DGQ 2618 Sheet 10.1:2001	$3 \mu\text{m} \cdot 10 \cdot 10^{-6} \cdot l$	
Fine pointer measuring screws	0 mm up to 200 mm	VDI/VDE/DGQ 2618 Sheet 10.3:2002	$3 \mu\text{m} \cdot 10 \cdot 10^{-6} \cdot l$	
Micrometre head screws	0 mm up to 50 mm	VDI/VDE/DGQ 2618 Sheet 10.4:2008	$3 \mu\text{m} \cdot 10 \cdot 10^{-6} \cdot l$	
Depth gauges	0 mm up to 300 mm	VDI/VDE/DGQ 2618 Sheet 10.5:2010	$3 \mu\text{m} \cdot 10 \cdot 10^{-6} \cdot l$	
Internal micrometres with 2-point contact on the object to be calibrated	13 mm up to 300 mm >300mm up to 500 mm	VDI/VDE/DGQ 2618 Sheet 10.7:2010	$3 \mu\text{m} \cdot 10 \cdot 10^{-6} \cdot l$ $5 \mu\text{m} \cdot 10 \cdot 10^{-6} \cdot l$	
Inside micrometres with 3-line contact on the object to be calibrated	3 mm up to 100 mm	VDI/VDE/DGQ 2618 Sheet 10.8:2002	$3 \mu\text{m} \cdot 10 \cdot 10^{-6} \cdot d$	<i>d</i> is the measured diameter
Lever gauges (quick feelers) for External measurements	up to 200 mm	VDI/VDE/DGQ 2618 Sheet 12.1:2005	$7 \mu\text{m} \cdot 10 \cdot 10^{-6} \cdot l$	<i>l</i> is the measured length
Lever gauges (quick probe) for internal measurements	2 mm up to 200 mm	VDI/VDE/DGQ 2618 Sheet 13.1:2005	$7 \mu\text{m} \cdot 10 \cdot 10^{-6} \cdot l$	
Dial gauges	0 mm up to 100 mm	VDI/VDE/DGQ/DKD 2618 Sheet 11.1:2021	$3 \mu\text{m} \cdot 10 \cdot 10^{-6} \cdot l$	mechanical dial indicators
		VDI/VDE/DGQ/DKD 2618 Sheet 11.4:2020	$3 \mu\text{m} \cdot 10 \cdot 10^{-6} \cdot l$	electronic digital dial gauges
Fine pointer	0 mm up to 3 mm	VDI/VDE/DGQ 2618 Sheet 11.2:2002	0.6 $\mu\text{m}$	<i>l</i> is the measured length
Lever gauges	0 mm up to 1.6 mm	VDI/VDE/DGQ 2618 Sheet 11.3:2002	1.0 $\mu\text{m}$	
Tape measures and scales				
Tape measures	0 m up to 100 m	4_VB_00237_EN V1	$50 \mu\text{m} \cdot 20 \cdot 10^{-6} \cdot l$	<i>l</i> is the measured length
Standards	0 m up to 3 m			

<sup>1)</sup> The CMCs contain the extended measurement uncertainties according to EA-4/02 M:2013. Within the framework of accreditation, these are the smallest measurement uncertainties that can be specified with a coverage probability of about 95 % and, unless otherwise specified, have the coverage factor  $k = 2$ . Uncertainties of measurement without indication of units are relative values related to the measured value, unless otherwise stated.

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**Abbreviations used:**

CMC Standardization e.V.	Calibration and measurement capabilities DIN German Institute for
DGQ	German Society for Quality e.V.
DKD	Guideline of the German Calibration Service (DKD), published by the Physikalisch-Technische Bundesanstalt (PTB)
VB	Self-developed calibration method of the laboratory
VDE	Association for Electrical, Electronic & Information Technologies e.V.
VDI	Verein of German Engineers e.V.
VDI/VDE/DGQ 2618	VDI guideline series for test equipment monitoring

<sup>1)</sup> The CMCs contain the extended measurement uncertainties according to EA-4/02 M:2013. Within the framework of accreditation, these are the smallest measurement uncertainties that can be specified with a coverage probability of about 95 % and, unless otherwise specified, have the coverage factor  $k = 2$ . Uncertainties of measurement without indication of units are relative values related to the measured value, unless otherwise stated.