

# Deutsche Akkreditierungsstelle GmbH

## Annex to the accreditation certificate D-K-15070-01-06 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 Essen  
Alte Landstraße 3c, 45329 Essen, Germany**

The German original version  
„Anlage zur Akkreditierungsurkunde D-K-15070-01-06 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 power
- DC resistance
- Electrical power
- Capacity
- Time and frequency**
- Time Interval
- Frequency and speed

### Dimensional measurands

#### Length

- Length measuring equipment
- Diameter
- Thread

#### Angle

- Inclinometers

### Thermodynamic measurands

#### Temperature measurands

- Temperature indicators and simulators

### High Frequency and Radiation measurands

#### High-frequency measured quantities

- Oscilloscope measures
- Rise time
- 

Within the measurands/calibration items marked with \*) , the calibration laboratory is permitted to apply the standards/calibration guidelines listed here with different editions 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 its annex reflects the status at the time of the date of issue. The current status of 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>*

**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 up to 22 V		$8 \cdot 10^{-6} U$	
	> 22 V up to 220 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		$50 \cdot 10^{-6} / 8$ 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		$0.2 \cdot 10^{-3} I$	
DC current Sources	> 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		$70 \cdot 10^{-6} I$	
DC current Sources	> 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	$0.5 \cdot 10^{-3} I$	
Direct current strength Current clamps	> 10 A up to 200 A		$1 \cdot 10^{-3} I$	
	1 mA up to 2,2 A		$1 \cdot 10^{-3} I$	
	> 2,2 A up to 20 A		$2 \cdot 10^{-3} I$	
Direct current strength Current clamps	> 20 A up to 1000 A		$3 \cdot 10^{-3} I$	

<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.

Annex to the accreditation certificate D-K-15070-01-06

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 Measuring instruments	0 Ω		50 μΩ	R = measured value
	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 Sources	0 Ω		100 μΩ	
	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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**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	1 Ω up to < 11 Ω		$0.12 \cdot 10^{-3} R$	R = measured value
Measuring instruments	11 Ω up to < 33 Ω		$33 \cdot 10^{-6} R$	
Areas	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		$15 \cdot 10^{-3} R$	
DC resistance	0,001 Ω up to 0,1 Ω	Substitution procedure with normal resistance	$50 \cdot 10^{-6} \cdot R$	
	> 0,1 Ω up to 1 MΩ		$20 \cdot 10^{-6} \cdot R$	
	> 1 MΩ up to 100 MΩ		$30 \cdot 10^{-6} \cdot R$	
AC resistance	0,1 Ω up to 2 Ω	50 Hz to 400 Hz	$10 \cdot 10^{-3} \cdot R$	
AC voltage	1 mV up to 2.2 mV	10 Hz up to 20 Hz	$0.52 \cdot 10^{-3} U$	U = measured value
Measuring instruments and Sources		> 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	$0.33 \cdot 10^{-3} U$	
		Hz up to 1 MHz	$0.45 \cdot 10^{-3} U$	

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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
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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**Permanent laboratory**

**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	> 700 mV to 2.2 V	10 Hz up to 20 Hz	$20 \cdot 10^{-6} U$	<i>U</i> = measured value
		> 20 Hz up to 40 Hz	$14 \cdot 10^{-6} U$	
		> 40 Hz up to 20 kHz	$10 \cdot 10^{-6} U$	
		> 20 kHz up to 50 kHz	$10 \cdot 10^{-6} U$	
		> 50 kHz up to 100 kHz	$11 \cdot 10^{-6} U$	
		> 100 kHz up to 300 kHz	$11 \cdot 10^{-6} U$	
> 2.2 V to 7 V	> 2.2 V to 7 V	10 Hz up to 20 Hz	$18 \cdot 10^{-6} U$	
		> 20 Hz up to 40 Hz	$12 \cdot 10^{-6} U$	
		> 40 Hz up to 20 kHz	$11 \cdot 10^{-6} U$	
		> 20 kHz up to 50 kHz	$11 \cdot 10^{-6} U$	
		> 50 kHz up to 100 kHz	$13 \cdot 10^{-6} U$	
		> 100 kHz up to 300 kHz	$13 \cdot 10^{-6} U$	
> 7 V to 22 V	> 7 V to 22 V	10 Hz up to 20 Hz	$17 \cdot 10^{-6} U$	
		> 20 Hz up to 40 Hz	$16 \cdot 10^{-6} U$	
		> 40 Hz up to 20 kHz	$11 \cdot 10^{-6} U$	
		> 20 kHz up to 50 kHz	$11 \cdot 10^{-6} U$	
		> 50 kHz up to 100 kHz	$11 \cdot 10^{-6} U$	
		> 100 kHz up to 300 kHz	$25 \cdot 10^{-6} U$	
> 22 V to 70 V	> 22 V to 70 V	10 Hz up to 20 Hz	$18 \cdot 10^{-6} U$	
		> 20 Hz up to 40 Hz	$16 \cdot 10^{-6} U$	
		> 40 Hz up to 20 kHz	$15 \cdot 10^{-6} U$	
		> 20 kHz up to 50 kHz	$15 \cdot 10^{-6} U$	
		> 50 kHz up to 100 kHz	$25 \cdot 10^{-6} U$	
		> 100 kHz up to 300 kHz	$25 \cdot 10^{-6} U$	
> 70 V to 220 V	> 70 V to 220 V	10 Hz up to 20 Hz	$19 \cdot 10^{-6} U$	
		> 20 Hz up to 40 Hz	$18 \cdot 10^{-6} U$	
		> 40 Hz up to 20 kHz	$17 \cdot 10^{-6} U$	
		> 20 kHz up to 50 kHz	$17 \cdot 10^{-6} U$	
		> 50 kHz up to 100 kHz	$32 \cdot 10^{-6} U$	
		> 100 kHz up to 300 kHz	$32 \cdot 10^{-6} U$	

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Annex to the accreditation certificate D-K-15070-01-06

Permanent laboratory

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	$120 \cdot 10^{-6} I$	$I$ = measured value
		> 40 Hz up to 1 kHz	$160 \cdot 10^{-6} I$	
		> 1 kHz up to 10 kHz	$60 \cdot 10^{-6} I$	
	> 1 mA up to 10 mA	10 Hz up to 40 Hz	$46 \cdot 10^{-6} I$	
	> 40 Hz up to 1 kHz	> 1 kHz up to 10 kHz		
> 10 mA up to 1 A	10 Hz up to 40 Hz	$17 \cdot 10^{-6} I$		
> 40 Hz up to 1 kHz	> 1 kHz up to 10 kHz			
> 1 A up to 10 A	10 Hz up to 40 Hz	$32 \cdot 10^{-6} I$		
> 40 Hz up to 1 kHz	> 1 kHz up to 10 kHz			
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 20 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	$1.4 \cdot 10^{-3} P$	$P$ = set power
		33 mA up to < 11 A 11 A up to 20 A	$2.0 \cdot 10^{-3} P$	
DC power	1 mW up to 300 W		$0.5 \cdot 10^{-3} P$	
	> 300 W up to 20 kW		$1.0 \cdot 10^{-3} P$	
Oscilloscopes Vertical deflection	5 mV up to 5 V	$R_i = 50 \Omega$	$3.5 \cdot 10^{-3} U$ 35 $\mu$ V	Square wave voltage 10 Hz to 10 kHz
	5 mV up to 120 V	$R_i = 1 M\Omega$	$2.4 \cdot 10^{-3} U$ 40 $\mu$ V	
Horizontal deflection	5 ns up to 520 ms > 20 ms up to 5 s		$3 \cdot 10^{-6} T$ 1 ns $30 \cdot 10^{-6} T$ $1.2 \cdot 10^{-4} T^2$	
Rise time	180 ps to 10 ms	25 mV to 1 V $R_i = 50 \Omega$	$40 \cdot 10^{-3}$ tr 7 ps	tr: current rise time

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**Annex to the accreditation certificate D-K-15070-01-06**

**Permanent laboratory**

**Calibration and Measurement Capabilities (CMC)**

Measurand / calibration item	Measuring range /	Measuring conditions / Procedures	Expanded uncertainty of measurement <sup>1)</sup>	Remarks
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		$2 \cdot 10^{-9} \cdot t$ 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 display-devices for resistance thermometers	-200 °C up to 850 °C		0,03 K	
Temperature display devices 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 metal thermocouples *)	-200 °C up to 1300 °C	DKD-R 5-5: 2018	0,05 K	
Capacity Measuring devices	190 pF up to < 400 pF 400 pF up to < 1.1 nF 1.1 nF up to < 3.3 nF 3.3 nF up to < 11 nF 11 nF up to < 33 nF 33 nF up to < 110 nF 110 nF up to < 330 nF 330 nF up to < 1.1 $\mu$ F 1.1 $\mu$ F up to < 3.3 $\mu$ F 3.3 $\mu$ F up to < 11 $\mu$ F 11 $\mu$ F up to < 33 $\mu$ F 33 $\mu$ F up to < 110 $\mu$ F 110 $\mu$ F up to < 330 $\mu$ F 330 $\mu$ F up to < 1.1 mF 1.1 mF up to < 3.3 mF 3.3 mF up to < 11 mF 11 mF up to < 33 mF 33 mF up to 110 mF	10 Hz up to 10 kHz 10 Hz up to 10 kHz 10 Hz up to 3 kHz 10 Hz up to 1 kHz 10 Hz up to 1 kHz 10 Hz up to 1 kHz 10 Hz up to 1 kHz 10 Hz up to 600 Hz 10 Hz up to 300 Hz 10 Hz up to 150 Hz 10 Hz up to 120 Hz 10 Hz up to 80 Hz DC up to 50 Hz DC up to 20 Hz DC up to 6 Hz DC up to 2 Hz DC up to 0.6 Hz DC up to 0.2 Hz	$4 \cdot 10^{-3} C$ 8 pF $4.5 \cdot 10^{-3} C$ 8 pF $4.0 \cdot 10^{-3} C$ 8 pF $2.5 \cdot 10^{-3} C$ 8 pF $2.5 \cdot 10^{-3} C$ 80 pF $2.5 \cdot 10^{-3} C$ 80 pF $4.5 \cdot 10^{-3} C$ $4.5 \cdot 10^{-3} C$ $4.5 \cdot 10^{-3} C$ $4.5 \cdot 10^{-3} C$ $6.0 \cdot 10^{-3} C$ $6.5 \cdot 10^{-3} C$ $6.0 \cdot 10^{-3} C$ $6.0 \cdot 10^{-3} C$ $6.0 \cdot 10^{-3} C$ $6.0 \cdot 10^{-3} C$ $8.0 \cdot 10^{-3} C$ $11 \cdot 10^{-3} C$	With 5520A / 5522A

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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
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
		Point 3.3.4 (Opt. 3), Point 3.3.5 (Opt. 4)	$0.8 \mu\text{m} \cdot 2 \cdot 10^{-6} \cdot d$	
	Plug gauges: Diameter *)	1 mm up to 200 mm	VDI/VDE/DGQ 2618 Sheet 4.2:2007 Point 3.2.2 (Opt. 1)	
Test Probes: Diameter *)	0.1 mm up to 30 mm	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 multiple-start cylindrical external and internal threads 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
Threaded mandrels: single pitch diameter *)	1.4 mm up to 200 mm Nominal diameter	VDI/VDE/DGQ 2618 Sheet 4.8:2006 Point 3.2.2 (Opt. 1) by Point 3.2.6 (Opt. 5)	$3 \mu\text{m} \cdot 10 \cdot 10^{-6} \cdot d$	Scanning procedure <i>d</i> = is the measured
Outer diameter *)			$2 \mu\text{m}$	Diameter
Core diameter resp. Piercing diameter *)			$5 \mu\text{m}$	
Gradient or pitch			$1.5 \mu\text{m}$	
Thread profile angle $\alpha$			$> 27^\circ$	$(3 \cdot 1 / l)'$ , but not less than $6'$
Threaded rings: single pitch diameter *)	5 mm to 200 mm nominal diameter	VDI/VDE/DGQ 2618 Sheet 4.9:2006 Point 3.2.2 (Opt. 1) by Point 3.2.6 (Opt. 5)	$3 \mu\text{m} \cdot 10 \cdot 10^{-6} \cdot d$	Scanning procedure <i>d</i> = is the measured
Outer diameter *)			$5 \mu\text{m}$	Diameter
Core diameter resp. Piercing diameter *)			$2 \mu\text{m}$	
Gradient or pitch			$1.5 \mu\text{m}$	
Thread profile angle $\alpha$	$> 27^\circ$		$(3 \cdot 1 / l)'$ , but not less than $6'$	<i>l</i> = flank length in mm

<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.

**Annex to the accreditation certificate D-K-15070-01-06**

**Permanent laboratory**

**Calibration and Measurement Capabilities (CMC)**

Measurand / calibration item	Measuring range /	Measuring conditions / Procedures	Expanded uncertainty of measurement <sup>1)</sup>	Remarks
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
Adjustment dimensions for Outside micrometers	25 mm up to 500 mm	VDI/VDE/DGQ 2618 Sheet 4.4:2009	$1.5 \mu\text{m} \cdot 2 \cdot 10^{-6} \cdot l$	
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 for Exterior, interior 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,	>500 mm 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 micrometers	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	$3 \mu\text{m} \cdot 10 \cdot 10^{-6} \cdot l$	
Micrometer 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	$3 \mu\text{m} \cdot 10 \cdot 10^{-6} \cdot l$	
Inside micrometers with 2-point contact on the object to be calibrated	13 mm up to 300 mm 300 mm 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 micrometers with 3-line contact on the calibration object	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 probe) for outdoor 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

<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.

**Annex to the accreditation certificate D-K-15070-01-06**

**Permanent laboratory**

**Calibration and Measurement Capabilities (CMC)**

Measurand / calibration item	Measuring range /	Measuring conditions / Procedures	Expanded uncertainty of measurement <sup>1)</sup>	Remarks
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 indicators
Fine pointer	0 mm up to 3 mm	VDI/VDE/DGQ 2618 Sheet 11.2:2002	0.6 $\mu\text{m}$	
Lever gauges	0 mm up to 1.6 mm	VDI/VDE/DGQ 2618 Sheet 11.3:2002	1.0 $\mu\text{m}$	
electr. inductive Linear Encoders *)	up to 100 mm	VDI/VDE/DGQ 2618 Sheet 14.1:2010	$0.6 \mu\text{m} \cdot 1 \cdot 10^{-6} \cdot l$	
electr. incremental Linear Encoders *)	up to 100 mm	VDI/VDE/DGQ/DKD 2618 Sheet 11.4:2020	$0.6 \mu\text{m} \cdot 1 \cdot 10^{-6} \cdot l$	
Angle				
Perpendicularity-deviation	up to 30 $\mu\text{m}$	VDI/VDE/DGQ/DKD 2618 Sheet 7.1:2019	$2.5 \mu\text{m} \cdot 1 \cdot 10^{-6} \cdot l_z$	/z = length of the forming or locating element up to 500 mm Leg length
Flatness and Straightness deviation		Point 3.2.2.2 (Opt. 2)	$4 \mu\text{m} \cdot 5 \cdot 10^{-6} \cdot l_z$	
Protractor				
Scale interval 1°	-180° up to 180°	VDI/VDE/DGQ 2618	30'	
Scale interval 5'	0° up to 360°	Sheet 7.2:2008	1'	
Flat rulers				
Parallelism deviation	up to 500 mm	VDI/VDE/DGQ 2618	$4 \mu\text{m} \cdot 5 \cdot 10^{-6} \cdot l$	/ is the measured Length
Flatness deviation		Sheet 5.1:2013	$2.2 \mu\text{m} \cdot 3.5 \cdot 10^{-6} \cdot l$	
Straight edge				
Straightness deviation	up to 500 mm	VDI/VDE/DGQ 2618 Sheet 5.2:2013	$2.2 \mu\text{m} \cdot 3.5 \cdot 10^{-6} \cdot l$	/ is the measured Length
Inclinometers	-2000 $\mu\text{m}/\text{m}$ (-412") up to 2000 $\mu\text{m}/\text{m}$ (412")	4_VB_00244_EN V1	1.7 $\mu\text{m}/\text{m}$ (0,35")	Max. Leg length of the KG: 500 mm

<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.

**Annex to the accreditation certificate D-K-15070-01-06**

**Abbreviations used:**

CMC	Calibration and measurement capabilities DGQ	German Society for
Quality e.V.		
DKD-R	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.