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German Accreditation Body

Annex to the Accreditation Certificate D-K-15102-01-00
according to DIN EN ISO/IEC 17025:2005

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Holder of certificate:

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Accredited since: 18.07.2007

Calibrations in the fields:

Mechanical quantities

- Mass (mass standards)
- Weighing instruments
- Pressure

Electrical quantities

DC and low frequency quantities

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

Chemical analysis, reference materials

- Volume of liquids

Thermodynamic quantities

Temperature quantities

- Resistance thermometers
- Thermocouples
- Liquid-in glass thermometers
- Direct reading thermometers
- Mechanical thermometers

Abbreviations used: see last page

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Permanent Laboratory

Measured quantity / Calibration item	Range	Measurement conditions / procedure	Best measurement capability ¹⁾	Remarks
Conventional mass	1 mg, 2 mg, 5 mg	OIML R 111-1:2004	0.006 mg	For weight pieces according to OIML recommendation R 111-1:2004, Class F ₁
	10 mg		0.008 mg	
	20 mg		0.010 mg	
	50 mg		0.012 mg	
	100 mg		0.016 mg	
	200 mg		0.020 mg	
	500 mg		0.025 mg	
	1 g		0.03 mg	
	2 g		0.04 mg	
	5 g		0.05 mg	
	10 g		0.06 mg	
	20 g		0.08 mg	
	50 g		0.10 mg	
	100 g		0.16 mg	
	200 g		0.3 mg	
	500 g		0.8 mg	
	1 kg		1.6 mg	
	2 kg		3.0 mg	
	5 kg		8.0 mg	
10 kg	16 mg			
Conventional mass	1 mg to 100 mg		0.05 mg	For free nominal values
	> 100 mg to 200 mg		0.06 mg	
	> 200 mg to 500 mg		0.08 mg	
	> 500 mg to 1 g		0.10 mg	
	> 1 g to 2 g		0.12 mg	
	> 2 g to 5 g		0.16 mg	
	> 5 g to 10 g		0.20 mg	
	> 10 g to 20 g		0.25 mg	
	> 20 g to 50 g		0.30 mg	
	> 50 g to 100 g		0.5 mg	
	> 100 g to 10 kg		$5 \cdot 10^{-6} \cdot m_c$	m_c : conventional mass
Non automatic weighing instruments with digital indicator	up to 100 g	EURAMET/cg-18/v.03, guidelines on the calibration of non automatic weighing instruments	$2 \cdot 10^{-6}$	for weight pieces according to R 111-1:2004, Class E ₂
	up to 60 kg		$1 \cdot 10^{-5}$	for weight pieces according to R 111-1:2004, Class F ₁

¹⁾ The best measurement capabilities are stated according to EA-4/02. These are expanded uncertainties of measurement with a coverage probability of 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.

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Measured quantity / Calibration item	Range	Measurement conditions / procedure	Best measurement capability ¹⁾	Remarks
Temperature Resistance thermometers	-80 °C to 30 °C	Alcohol bath	20 mK	Comparison with standard resistance thermometer
	> 30 °C to 80 °C	Water bath	30 mK	
	> 80 °C to 200 °C	Oil bath	0.10 K	
	> 200 °C to 660 °C	Fluidized bath	0.30 K	
Thermocouples, noble metal	0 °C to 200 °C	Liquid bath	0.5 K	Comparison with resistance thermometer
	> 200 °C to 600 °C	Fluidized bath	0.7 K	
	> 600 °C to 900 °C	Furnace	1.1 K	Comparison with thermocouple
	> 900 °C to 1200 °C		1.5 K	
Thermocouples, base metal	0 °C to 200 °C	Furnace	1.0 K	Comparison with thermocouple
	> 200 °C to 600 °C		1.0 K	
	> 600 °C to 900 °C		1.5 K	
	> 900 °C to 1200 °C		2.0 K	
Liquid in glass thermometers	-80 °C to 30 °C	Alcohol bath	25 mK	Comparison with standard resistance thermometer
	> 30 °C to 80 °C	Water bath	30 mK	
	> 80 °C to 200 °C	Oil bath	0.10 K	
	> 200 °C to 360 °C	Fluidized bath	0.30 K	
Direct reading electrical thermometers	-80 °C to 30 °C	Alcohol bath	20 mK	Comparison with standard resistance thermometer
	> 30 °C to 80 °C	Water bath	30 mK	
	> 80 °C to 200 °C	Oil bath	0.10 K	
	> 200 °C to 660 °C	Fluidized bath	0.30 K	
Mechanical (dial) thermometers	-80 °C to 80 °C	Alcohol or water bath	30 mK	Comparison with standard resistance thermometer
	> 80 °C to 200 °C	Oil bath	0.10 K	
	> 200 °C to 400 °C	Fluidized bath	0.30 K	
Pressure Absolute pressure p_{abs}	0.14 bar to 1.7 bar	DKD-R 6-1:2014	$2.7 \cdot 10^{-5} \cdot p_{obs} + 18 \mu\text{bar}$	Pressure medium: Gas The uncertainty of the residual pressure has to be added
	> 1.7 bar to 7.0 bar	EURAMET /cg-17/v.02 DIN EN 837:1997	$2.8 \cdot 10^{-5} \cdot p_{obs} + 22 \mu\text{bar}$	
	> 7.0 bar to 70 bar	EURAMET /cg-3/v.01	$3.2 \cdot 10^{-5} \cdot p_{obs} + 0.10 \text{ mbar}$	
Gauge pressure p_e	0 bar; 0.014 bar to 1.7 bar	DKD-R 6-1:2014	$2.7 \cdot 10^{-5} \cdot p_e + 18 \mu\text{bar}$	Pressure medium: Gas
	> 1.7 bar to 7.0 bar	EURAMET /cg-17/v.02 DIN EN 837:1997	$2.8 \cdot 10^{-5} \cdot p_e + 22 \mu\text{bar}$	
	> 7.0 bar to 70 bar	EURAMET /cg-3/v.01	$3.2 \cdot 10^{-5} \cdot p_e + 0,10 \mu\text{bar}$	
	> 70 bar to 140 bar		25 mbar	
	0 bar 0.5 bar to 60 bar	DKD-R 6-1:2014	$7.0 \cdot 10^{-5} \cdot p_e + 0.15 \text{ mbar}$	Pressure medium: Oil
	> 60 bar to 1200 bar	EURAMET /cg-17/v.02 DIN EN 837:1997 EURAMET /cg-3/v.01	$1.4 \cdot 10^{-4} \cdot p_e + 5.8 \text{ mbar}$	

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Measured quantity / Calibration item	Range	Measurement conditions / procedure	Best measurement capability ¹⁾	Remarks
Volume of liquids Volumetric burettes	1 mℓ	ISO 4787:2010-06	2.8 μℓ	
	2 mℓ		2.9 μℓ	
	5 mℓ		4.3 μℓ	
	10 mℓ		8.1 μℓ	
	25 mℓ		22 μℓ	
	50 mℓ		38 μℓ	
	100 mℓ		70 μℓ	
Volumetric pipettes	0.5 mℓ	ISO 4787:2010-06	1.5 μℓ	
	1 mℓ		4.4 μℓ	
	2 mℓ		5.6 μℓ	
	5 mℓ		7.4 μℓ	
	10 mℓ		8.7 μℓ	
	20 mℓ		12 μℓ	
	25 mℓ		16 μℓ	
	50 mℓ		17 μℓ	
	100 mℓ		39 μℓ	
Volumetric flask	1 mℓ, 2 mℓ, 5 mℓ, 10 mℓ		11 μℓ	
	20 mℓ, 25 mℓ		19 μℓ	
	50 mℓ		30 μℓ	
	100 mℓ		41 μℓ	
	200 mℓ, 250 mℓ		59 μℓ	
	500 mℓ		85 μℓ	
	1000 mℓ		0.13 mℓ	
	2000 mℓ		0.22 mℓ	
	5000 mℓ		0.39 mℓ	
Measuring cylinders	5 mℓ		35 μℓ	
	10 mℓ		61 μℓ	
	25 mℓ		93 μℓ	
	50 mℓ		0.13 mℓ	
	100 mℓ		0.20 mℓ	
	250 mℓ		0.36 mℓ	
	500 mℓ		0.58 mℓ	
	1000 mℓ		0.93 mℓ	
	2000 mℓ		1.5 mℓ	
Provers	5 ℓ		4.2 mℓ	
	10 ℓ		6.8 mℓ	
	20 ℓ		7.7 mℓ	

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Measured quantity / Calibration item	Range	Measurement conditions / procedure	Best measurement capability ¹⁾	Remarks
DC Voltage Zener standards	10 V	Direct comparison with Zener standard	70 µV	
Sources, fixed values	0.1 V		7.0 µV	
	1 V		30 µV	
	10 V		0.13 mV	
	100 V		1.3 mV	
	1000 V		20 mV	
Measuring instruments	10 mV to 11 V		$8.0 \cdot 10^{-6} \cdot U + 6.0 \mu\text{V}$	U: measured value
	> 11 V to 22 V		$9.0 \cdot 10^{-6} \cdot U + 4.0 \mu\text{V}$	
	> 22 V to 275 V		$10 \cdot 10^{-6} \cdot U + 90 \mu\text{V}$	
	> 275 V to 1 kV		$16 \cdot 10^{-6} \cdot U + 0.17 \text{ mV}$	
DC Current Sources, fixed values	0.1 A		$0.65 \cdot 10^{-3} \cdot I$	I: measured value
	2 A		$0.60 \cdot 10^{-3} \cdot I$	
	4 A, 6 A, 8 A, 10 A, 12 A, 14 A, 16 A, 18 A, 20 A		$0.50 \cdot 10^{-3} \cdot I$	
Measuring instruments	3.3 mA to 33 mA		$7.0 \cdot 10^{-6} \cdot I + 40 \mu\text{A}$	I: measured value
	> 33 mA to 330 mA		$60 \cdot 10^{-6} \cdot I + 40 \mu\text{A}$	
	> 330 mA to 1 A		$0.23 \cdot 10^{-3} \cdot I + 60 \mu\text{A}$	
	> 1 A to 3 A		$0.45 \cdot 10^{-3} \cdot I + 50 \mu\text{A}$	
	> 3 A to 11 A		$0.58 \cdot 10^{-3} \cdot I + 0.58 \text{ mA}$	
	> 11 A to 20 A		$1.1 \cdot 10^{-3} \cdot I + 0.90 \text{ mA}$	
DC Resistance Resistors, fixed values	1 mΩ		$2.1 \cdot 10^{-3} \cdot R$	R: measured value
	10 mΩ		$0.30 \cdot 10^{-3} \cdot R$	
	100 mΩ		$0.11 \cdot 10^{-3} \cdot R$	
	1 Ω		$30 \cdot 10^{-6} \cdot R$	
	10 Ω		$30 \cdot 10^{-6} \cdot R$	
	100 Ω		$0.11 \cdot 10^{-3} \cdot R$	
	1 kΩ		$70 \cdot 10^{-6} \cdot R$	
	10 kΩ		$40 \cdot 10^{-6} \cdot R$	
	100 kΩ		$0.11 \cdot 10^{-3} \cdot R$	
	1 MΩ		$1.0 \cdot 10^{-3} \cdot R$	

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Measured quantity / Calibration item	Range	Measurement conditions / procedure	Best measurement capability ¹⁾	Remarks
DC Resistance Measuring instruments	0.10 Ω to 11 Ω		$47 \cdot 10^{-6} \cdot R + 1.2 \text{ m}\Omega$	R: measured value
	> 11 Ω to 33 Ω		$50 \cdot 10^{-6} \cdot R + 20 \text{ m}\Omega$	
	> 33 Ω to 110 Ω		$70 \cdot 10^{-6} \cdot R + 20 \text{ m}\Omega$	
	> 110 Ω to 330 Ω		$0.18 \cdot 10^{-3} \cdot R + 15 \text{ m}\Omega$	
	> 330 Ω to 1.1 kΩ		$0.30 \cdot 10^{-3} \cdot R + 6 \text{ m}\Omega$	
	> 1.1 kΩ to 3.3 kΩ		$80 \cdot 10^{-6} \cdot R + 0.20 \Omega$	
	> 3.3 kΩ to 11 kΩ		$0.10 \cdot 10^{-3} \cdot R + 0.10 \Omega$	
	> 11 kΩ to 33 kΩ		$0.10 \cdot 10^{-3} \cdot R + 0.80 \Omega$	
	> 33 kΩ to 110 kΩ		$0.10 \cdot 10^{-3} \cdot R + 0.60 \Omega$	
	> 110 kΩ to 330 kΩ		$0.90 \cdot 10^{-3} \cdot R + 1.5 \Omega$	
	> 330 kΩ to 1.1 MΩ		$40 \cdot 10^{-6} \cdot R + 12 \Omega$	
	> 1.1 MΩ to 3.3 MΩ		$70 \cdot 10^{-6} \cdot R + 0.17 \text{ k}\Omega$	
	> 3.3 MΩ to 11 MΩ		$0.20 \cdot 10^{-3} \cdot R + 0.24 \text{ k}\Omega$	
	> 11 MΩ to 33 MΩ		$0.37 \cdot 10^{-3} \cdot R + 2.6 \text{ k}\Omega$	
	> 33 MΩ to 110 MΩ		$0.93 \cdot 10^{-3} \cdot R + 2.3 \text{ k}\Omega$	
> 110 MΩ to 330 MΩ	$3.5 \cdot 10^{-3} \cdot R + 0.12 \text{ M}\Omega$			
> 330 MΩ to 1.1 GΩ	$18 \cdot 10^{-3} \cdot R + 0.58 \text{ M}\Omega$			
AC Voltage Measuring instruments	10 mV to 33 mV	40 Hz to 10 kHz	$4.0 \cdot 10^{-6} \cdot U + 0.50 \text{ mV}$	U: measured value
	> 33 mV to 0.33 V		$16 \cdot 10^{-6} \cdot U + 0.50 \text{ mV}$	
	> 0.33 V to 3.3 V	45 Hz to 10 kHz	$0.12 \cdot 10^{-3} \cdot U + 0.50 \text{ mV}$	
	> 3.3 V to 33 V		$0.20 \cdot 10^{-3} \cdot U + 1.2 \text{ mV}$	
	> 33 V to 330 V		$0.24 \cdot 10^{-3} \cdot U + 8.0 \text{ mV}$	
	> 330 V to 1000 V		$0.33 \cdot 10^{-3} \cdot U + 70 \text{ mV}$	
AC Current Measuring instruments	3.3 mA to 33 mA	45 Hz to 1 kHz	$20 \cdot 10^{-6} \cdot I + 0.24 \text{ mA}$	I: measured value
	> 33 mA to 330 mA		$0.25 \cdot 10^{-3} \cdot I + 0.16 \text{ mA}$	
	> 330 mA to 1 A		$0.60 \cdot 10^{-3} \cdot I + 0.12 \text{ mA}$	
	> 1 A to 3 A		$0.70 \cdot 10^{-3} \cdot I + 0.12 \text{ mA}$	
	> 3 A to 11 A		$0.70 \cdot 10^{-3} \cdot I + 3.0 \text{ mA}$	
	> 11 A to 20 A		$1.5 \cdot 10^{-3} \cdot I + 6.0 \text{ mA}$	

Abbreviations used:

DKD-R 6-1 Guideline on „Calibration of Pressure Gauges“

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