

Deutsche Akkreditierungsstelle GmbH

Annex to the Accreditation Certificate D-K-18093-01-00 according to DIN EN ISO/IEC 17025:2018

Valid from: 09.09.2019

Date of issue: 09.09.2019

Holder of certificate:

**Thermo Sensor GmbH
Carl-Zeiss-Straße 1, 59368 Werne**

Calibration in the fields:

Thermodynamic quantities

Temperature quantities

- Resistance thermometers
- Thermocouples
- Directreading thermometers

Abbreviations used: see last page

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.

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Permanent Laboratory

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement ¹⁾	Remarks
Temperature Resistance thermometers; direct reading thermometers with resistance sensor	-38.8344 °C	Triple point of Mercury DKD-R 5-1:2018	15 mK	Calibration at fixed point temperatures
	0.01 °C	Triple point of Water DKD-R 5-1:2018	5 mK	
	29.7646 °C	Melting point of Gallium DKD-R 5-1:2018	15 mK	
	156.5985 °C	Melting point of Indium DKD-R 5-1:2018	15 mK	
	231.928 °C	Solidification point of Tin DKD-R 5-1:2018	15 mK	
	419.527 °C	Solidification point of Zinc DKD-R 5-1:2018	20 mK	
	660.323 °C	Solidification point of Aluminium DKD-R 5-1:2018	25 mK	
	-40 °C to < 50 °C	Liquid bath (ethanol) DKD-R 5-1:2018	60 mK	Comparison with standard resistance thermometer
	50 °C to < 500 °C	Vertical 3 zone furnace DKD-R 5-1:2018	0.15 K	
	500 °C to 660 °C		0.2 K	
Noble metal thermocouples; direct reading thermometers with noble metal thermocouple sensor	156.5985 °C	Melting point of Indium DKD-R 5-3:2018	0.15 K	Calibration at fixed point temperatures
	231.928 °C	Solidification point of Tin DKD-R 5-3:2018	0.15 K	
	419.527 °C	Solidification point of Zinc DKD-R 5-3:2018	0.2 K	
	660.323 °C	Solidification point of Aluminium DKD-R 5-3:2018	0.2 K	
	-40 °C to < 50 °C	Liquid bath (ethanol) DKD-R 5-3:2018	0.35 K	Comparison with standard resistance thermometer
	50 °C to 660 °C	Vertical 3 zone furnace DKD-R 5-3:2018	0.4 K	
	600 °C to < 1100 °C	Vertical 3 zone furnace DKD-R 5-3:2018	1.9 K	Comparison with standard thermocouple
	1100 °C to < 1350 °C	Horizontal tube furnace DKD-R 5-3:2018	3.0 K	
	1350 °C to 1600 °C		4.0 K	

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.

Annex to the accreditation certificate D-K-18093-01-00

Permanent Laboratory

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement ¹⁾	Remarks
Base metal thermocouples; direct reading with base metal thermocouple sensor	156.5985 °C	Melting point of Indium DKD-R 5-3:2018	0.4 K	Calibration at fixed point temperatures
	231.928 °C	Solidification point of Tin DKD-R 5-3:2018	0.5 K	
	419.527 °C	Solidification point of Zinc DKD-R 5-3:2018	0.9 K	
	660.323 °C	Solidification point of Aluminium DKD-R 5-3:2018	1.4 K	
	-40 °C to < 50 °C	Liquid bath (ethanol) DKD-R 5-3:2018	0.4 K	Comparison with standard resistance thermometer
	50 °C to < 100 °C	Vertical 3 zone furnace DKD-R 5-3:2018	0.4 K	
	100 °C to 660 °C		1.4 K	
	600 °C to < 1100 °C	Vertical 3 zone furnace DKD-R 5-3:2018	3.0 K	Comparison with standard thermocouple
	1100 °C to 1350 °C	Horizontal tube furnace DKD-R 5-3:2018	4.0 K	

Abbreviations used:

CMC Calibration and measurement capabilities (Kalibrier- und Messmöglichkeiten)
 DKD-R Calibration Guide of Deutscher Kalibrierdienst (DKD), published by the Physikalisch-Technischen Bundesanstalt

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.