

Deutsche Akkreditierungsstelle GmbH

Annex to the Accreditation Certificate D-K-15081-02-00 according to DIN EN ISO/IEC 17025:2005

Valid from: 2019-02-21

Date of issue: 2019-02-21

Holder of certificate:

ABB Automation Products GmbH
Wallstadter Straße 59, 68526 Ladenburg

with the calibration laboratory

Schillerstraße 72, 32425 Minden

Head:	Dipl.-Ing. Andreas Meyer
Deputy head:	Dipl.-Ing. Andreas Meyer Michael Antoni

Accredited as calibration laboratory since: 2009-02-04

Calibration in the fields:

Mechanical quantities

- **Pressure**

Thermodynamic quantities

Temperature quantities

- **Resistance thermometers**
- **Thermocouples**
- **Direct reading thermometers**
- **Temperature transmitters, data logger**

Abbreviations used: see last page

*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 Deutsche Akkreditierungsstelle GmbH.
<https://www.dakks.de/en/content/accredited-bodies-dakks>*

Permanent Laboratory

Calibration and Measurement Capabilities (CMC)

Measured quantity / Calibration item	Range	Measurement conditions / procedure	expanded uncertainty of measurement ¹⁾	Remarks
Pressure Absolute pressure p_{abs}	0 bar to 1 bar	DIN EN 837:1997 DKD R 6-1:2014	$14 \mu\text{bar} + 1.9 \cdot 10^{-5} \cdot p_{abs}$	Pressure medium: Gas The uncertainty of the measured residual pressure has to be taken into account.
	> 1 bar to 5 bar		$26 \mu\text{bar} + 2.0 \cdot 10^{-5} \cdot p_{abs}$	
	> 5 bar to 20 bar		$0.11 \text{ mbar} + 1.8 \cdot 10^{-5} \cdot p_{abs}$	
Absolute pressure p_{abs}	> 20 bar to 101 bar		$0.7 \text{ mbar} + 2.2 \cdot 10^{-5} \cdot p_{abs}$	Pressure medium: Gas The uncertainty of the barometer has to be taken into account. Measuring principle: $p_{abs} = p_e + p_{amb}$
	> 101 bar to 401 bar		$9.0 \cdot 10^{-5} \cdot p_{abs}$	
Absolute pressure p_{abs}	1 bar; 41 bar to 1001 bar		$1.1 \cdot 10^{-4} \cdot p_{abs}$; but not lower than 10 mbar	Pressure medium: Oil The uncertainty of the barometer has to be taken into account. Measuring principle: $p_{abs} = p_e + p_{amb}$
	> 1001 bar to 2501 bar		$2.1 \cdot 10^{-4} \cdot p_{abs}$	
Positive gauge pressure p_e	0 mbar; 0.2 mbar to 50 mbar		$1.1 \mu\text{bar} + 1 \cdot 10^{-4} \cdot p_e$	Pressure medium: Gas
	> 50 mbar to 1 bar		$5 \mu\text{bar} + 1.8 \cdot 10^{-5} \cdot p_e$	
	> 1 bar to 5 bar		$17 \mu\text{bar} + 1.9 \cdot 10^{-5} \cdot p_e$	
	> 5 bar to 20 bar		$75 \mu\text{bar} + 1.7 \cdot 10^{-5} \cdot p_e$	
	> 20 bar to 100 bar		$0.7 \text{ mbar} + 2.2 \cdot 10^{-5} \cdot p_e$	
	> 100 bar to 400 bar		$9.0 \cdot 10^{-5} \cdot p_e$	
Gauge pressure p_e	0 bar; 40 bar to 1000 bar		$1.1 \cdot 10^{-4} \cdot p_e$; but not lower than 10 mbar	Pressure medium: Oil
	> 1000 bar to 2500 bar		$2.1 \cdot 10^{-4} \cdot p_e$	
Differential pressure Δp_e	0 mbar to 160 mbar		$1.1 \mu\text{bar} + 1 \cdot 10^{-4} \cdot \Delta p_e$	Pressure medium: Gas line pressure $p_{stat} = 10 \text{ mbar}$
	0 bar to 4.0 bar		$1 \cdot 10^{-4} \text{ bar} + 1 \cdot 10^{-4} \cdot \Delta p_e + 4.0 \cdot 10^{-6} \cdot p_{stat}$	

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 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)

Measured quantity / Calibration item	Range	Measurement conditions / procedure	expanded uncertainty of measurement ¹⁾	Remarks
Temperature Resistance thermometers (with or without direct indication)	0 °C	DAkKS-DKD-R 5-1:2010 Ice point	10 mK	Mixture of ice and water in Dewar (electrical conductivity ≤ 20 µS/m)
	0.01 °C	DAkKS-DKD-R 5-1:2010 triple point of water	5 mK	Calibration at fixed point temperatures
	-196 °C	DAkKS-DKD-R 5-1:2010 boiling point of liquid nitrogen	0.10 K	Comparison with standard resistance thermometers
	-35 °C to 350 °C	DAkKS-DKD-R 5-1:2010	20 mK	Comparison with standard resistance thermometers in thermostatic liquid baths
	> 350 °C to 500 °C		50 mK	
	> 500 °C to 850 °C		1.0 K	Comparison with thermocouple type S in tube furnace
Noble metal thermocouples in wire style ($d_{max} = 1 \text{ mm}$)	1553.4 °C	DAkKS-DKD-R 5-3:2010 Melting point of Palladium in atmospheric air	2.5 K	Melting off method
Noble metal thermocouples (with or without direct indication)	-35 °C to 500 °C	DAkKS-DKD-R 5-3:2010	0.5 K	Comparison with standard resistance thermometers in thermostatic baths
	500 °C to 1000 °C	DAkKS-DKD-R 5-3:2010	1.0 K	Comparison with thermocouple type S in tube furnace
	> 1000 °C to 1200 °C	Sodium heat pipe for the range from 550 °C to 1000 °C	1.5 K	
Base metal thermocouples (with or without direct indication)	-35 °C to < 0 °C	DAkKS-DKD-R 5-3:2010	1.0 K	Comparison with standard resistance thermometers in thermostatic baths
	0 °C to 200 °C		0.2 K	
	> 200 °C to 400 °C		0.4 K	
	> 400 °C to 500 °C		1.0 K	
	500 °C to 1000 °C	DAkKS-DKD-R 5-3:2010	2.0 K	Comparison with thermocouple type S in tube furnace
> 1000 °C to 1200 °C	Sodium heat pipe for the range from 550 °C to 1000 °C	3.0 K		

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Calibration and Measurement Capabilities (CMC)

Measured quantity / Calibration item	Range	Measurement conditions / procedure	expanded uncertainty of measurement ¹⁾	Remarks
Temperature Transmitters with resistance thermometer	-35 °C to 850 °C	DAkks-DKD-R 5-1:2010 see resistance thermometers	$U_{PRT} + 0.10 \text{ K}$	U_{PRT}, U_{TE} is the expanded measurement uncertainty from the calibration of the sole resistance thermometer resp. the sole thermocouples
Transmitters with thermocouple	-35 °C to 1200 °C	DAkks-DKD-R 5-1:2010 see thermocouples	$U_{TE} + 0.10 \text{ K}$	

Abbreviations used:

- CMC Calibration and measurement capabilities (Kalibrier- und Messmöglichkeiten)
- DAkks-DKD-R Richtlinie der Deutschen Akkreditierungsstelle GmbH
- DKD-R Richtlinie des Deutschen Kalibrierdienstes (DKD), herausgegeben von der 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 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.