Deutsche Akkreditierungsstelle

Annex to the Accreditation Certificate D-K-12115-01-00 according to DIN EN ISO/IEC 17025:2018

Valid from: **13.09.2023**

Date of issue: 13.09.2023

Holder of accreditation certificate:

ABB AG
Calibration laboratory for pressure, flow and temperature
Schillerstraße 72, 32425 Minden

The calibration laboratory meets the requirements of DIN EN ISO/IEC 17025:2018 to carry out the conformity assessment activities listed in this annex. The calibration laboratory meets additional legal and normative requirements, if applicable, including those in relevant sectoral schemes, provided that these are explicitly confirmed below.

The management system requirements of DIN EN ISO/IEC 17025 are written in the language relevant to the operations of calibration laboratories and confirm generally with the principles of DIN EN ISO 9001.

Calibration in the fields:

Mechanical quantities
- **Pressure**
- **Fluid Quantities**
  - **Gas flow rate**

Thermodynamic quantities
- **Temperature quantities**
  - **Resistance thermometers**
  - **Thermocouples**
  - **Direct reading thermometers**
  - **Temperature transmitters, data loggers**

This certificate annex is only valid together with the written accreditation certificate and reflects the status as indicated by the date of issue. The current status of any given scope of accreditation can be found in the directory of accredited bodies maintained by Deutsche Akkreditierungsstelle GmbH at https://www.dakks.de.

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	DKD R 6-1:2014	14 µbar + 2.1 · 10^{-5} · p_{abs}	Pressure medium: Gas The uncertainty of the measured residual pressure has to be taken into account.
	> 1 bar	to	5 bar		60 µbar + 2.3 · 10^{-5} · p_{abs}	
	> 5 bar	to	20 bar		0.14 mbar + 2.2 · 10^{-5} · p_{abs}	
Absolute pressure p_{abs}	> 20 bar	to	101 bar		0.9 mbar + 2.2 · 10^{-5} · 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		9.0·10^{-5} · p_{abs}	
Absolute pressure p_{abs}	1 bar; 41 bar	to	1001 bar		1.1 · 10^{-4} · p_{abs}; but not lower than 25 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 · 10^{-4} · p_{abs}	
Positive gauge pressure p_e	0 mbar; 0.2 mbar	to	50 mbar		1.1 µbar + 1,6 · 10^{-4} · p_e	Pressure medium: Gas
	> 50 mbar	to	1 bar		9 µbar + 2.5 · 10^{-5}· p_e	
	> 1 bar	to	5 bar		17 µbar + 1.9 · 10^{-5}· p_e	
	> 5 bar	to	20 bar		75 µbar + 1.7 · 10^{-5}· p_e	
	> 20 bar	to	100 bar		0.9 mbar + 2.2 · 10^{-5}· p_e	
	> 100 bar	to	400 bar		9.0 ·10^{-5} · p_e	
Gauge pressure p_e	0 bar; 40 bar	to	1000 bar		1.1 · 10^{-4} · p_e ; but not lower than 25 mbar	Pressure medium: Oil
	> 1000 bar	to	2500 bar		2.1 · 10^{-4} · p_e	
Differential pressure Δp_e	0 mbar	to	160 mbar		1.1 µbar + 1,6 · 10^{-4} · Δp_e	Pressure medium: Gas line pressure p_{stat} = 10 mbar
	0 bar	to	4.0 bar		1·10^{-4} bar + 1 · 10^{-4} · Δp_e + 4.0 · 10^{-6} · p_{stat}	Pressure medium: Gas Maximum line pressure p_{stat} = 400 bar The uncertainty of the oil based pressure balance has to be taken into account.

Permanent Laboratory

Calibration and Measurement Capabilities (CMC)

Measured quantity / Calibration item	Range	Measurement conditions / procedure	expanded uncertainty of measurement	Remarks
Temperature Resistance thermometers (with or without direct indication)	0 °C	DKD-R 5-1:2018 Ice point	10 mK	Mixture of ice and water in Dewar (electrical conductivity ≤ 20 µS/cm)
	0.01 °C	DKD-R 5-1:2018 triple point of water	5 mK	Calibration at fixed point temperatures
	-196 °C	DKD-R 5-1:2018 boiling point of liquid nitrogen	0.10 K	Comparison with standard resistance thermometers
	-35 °C to 350 °C	DKD-R 5-1:2018	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 thermo-couple type S in tube furnace
Noble metal thermocouples in wire style (d_{max} = 1 mm)	1553.4 °C	DKD-R 5-3:2018 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	DKD-R 5-3:2018	0.5 K	Comparison with standard resistance thermometers in thermostatic baths
	500 °C to 1000 °C	DKD-R 5-3:2018 Sodium heat pipe for the range from 550 °C to 1000 °C	1.0 K	Comparison with thermo-couple type S in tube furnace
	> 1000 °C to 1200 °C		1.5 K	
Base metal thermocouples (with or without direct indication)	-35 °C to < 0 °C 0 °C to 200 °C > 200 °C to 400 °C > 400 °C to 500 °C	DKD-R 5-3:2018	1.0 K 0.2 K 0.4 K 1.0 K	Comparison with standard resistance thermometers in thermostatic baths
	500 °C to 1000 °C	DKD-R 5-3:2018 Sodium heat pipe for the range from 550 °C to 1000 °C	2.0 K	Comparison with thermo-couple type S in tube furnace
	> 1000 °C to 1200 °C		3.0 K	
Transmitters with resistance thermometer	-35 °C to 850 °C	DKD-R 5-1:2018 see resistance thermometers	U_{PRT} + 0.10 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	DKD-R 5-1:2018 see thermocouples	U_{TE} + 0.10 K	

Permanent Laboratory

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
Gas flow rate Volume flow rate d*V*/d*t* of flowing gases	0.8 m^3/h to 100 m^3/h	critical Venturi nozzle IOM-AA-0136 Version 02: 2023-05-15	0.4 %	Measured fluid: atmospheric air calibration of positive displacement and flow gas meters, flow meters (e.g. laminar or thermal flow meter) and pressure differential devices (e.g. nozzles or orifices)
	> 100 m^3/h to 7300 m^3/h		0.3 %	
Mass flow rate d*m*/d*t* of flowing gases	1 kg/h to 120 kg/h		0.4 %	
	> 120 kg/h to 8800 kg/h		0.3 %	

1) Unless otherwise specified, the unit of the variable corresponds to the unit of the measuring range.

Abbreviations used:

CMC	Calibration and measurement capabilities
DKD-R	Guideline of Deutscher Kalibrierdienst (DKD)
DIN	Deutsches Institut für Normung e.V. (German Institut for Standardization)
IOM-AA	In house procedure of ABB AG