

Deutsche Akkreditierungsstelle GmbH

Annex to the Accreditation Certificate D-K-15172-01-00 according to DIN EN ISO/IEC 17025:2018

Valid from: 03.11.2020

Date of issue: 03.11.2020

Holder of certificate:

Endress+Hauser SE+Co. KG
Hauptstraße 1, 79689 Maulburg

Calibration in the fields:

Mechanical quantities

- Pressure ^{a)}
- Vacuum

Thermodynamical quantities

Temperature quantities

- Resistance thermometers
- Direct reading thermometers

^{a)} also on-site calibration

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.

The management system requirements in DIN EN ISO/IEC 17025 are written in language relevant to operations of calibration laboratories and operate generally 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 Deutsche Akkreditierungsstelle GmbH.
<https://www.dakks.de/en/content/accredited-bodies-dakks>*

Annex to the accreditation certificate D-K-15172-01-00

Permanent Laboratory

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement ¹⁾	Remarks	
Pressure Absolute pressure p_{abs}	0.013 mbar to 0.15 bar	DKD-R 6-1: 2014 EURAMET Calibration Guide 3 Version 1.0	$4 \cdot 10^{-5} \cdot p_{abs} + 0.25 \mu\text{bar}$	Pressure medium: Gas The uncertainty of the measured residual gas pressure has to be taken into account.	
	> 0.15 bar to 0.30 bar		$4.0 \cdot 10^{-5} \cdot p_{abs}$		
	> 0.30 bar to 70 bar		$3.0 \cdot 10^{-5} \cdot p_{abs}$		
	> 70 bar to 101 bar			$3.0 \cdot 10^{-5} \cdot p_{abs}$	Pressure medium: Gas The uncertainty of the barometer has to be taken into account.
	> 101 bar to 201 bar		$4.0 \cdot 10^{-5} \cdot p_{abs}$		
	> 201 bar to 701 bar		$5.0 \cdot 10^{-5} \cdot p_{abs}$		
	> 701 bar to 801 bar		$7.0 \cdot 10^{-5} \cdot p_{abs}$		
Negative and positive gauge pressure p_e	-1.0 bar to -0.3 bar		$4.0 \cdot 10^{-5} \cdot p_e$	Pressure medium: Gas	
	> -0.3 bar to -0.15 bar		$5.0 \cdot 10^{-5} \cdot p_e$		
	> -0.15 bar to 0.1 bar		$4 \cdot 10^{-5} \cdot p_e + 0.25 \mu\text{bar}$		
	> 0.1 bar to 100 bar		$3.0 \cdot 10^{-5} \cdot p_e$		
	> 100 bar to 200 bar		$4.0 \cdot 10^{-5} \cdot p_e$		
	> 200 bar to 700 bar		$5.0 \cdot 10^{-5} \cdot p_e$		
	> 700 bar to 800 bar		$7.0 \cdot 10^{-5} \cdot p_e$		
Differential pressure Δp	$p_{stat} + \Delta p \leq 1.8 \text{ bar}$	DKD-R 6-1: 2014	$4.0 \cdot 10^{-5} \cdot \Delta p + 0.01 \text{ mbar}$	Pressure medium: Gas at line pressure of minimum 10 % of the upper range value of used standard	
	$p_{stat} + \Delta p \leq 7.0 \text{ bar}$		$5.0 \cdot 10^{-5} \cdot \Delta p + 0.04 \text{ mbar}$		
	$p_{stat} + \Delta p \leq 70 \text{ bar}$		$6.0 \cdot 10^{-5} \cdot \Delta p + 0.10 \text{ mbar}$		
Vacuum Calibration of vacuum gauges and other absolute pressure gauges	0.001 mbar to < 0.009 mbar	DKD-R 6-2: 2018 ISO 3567: 2011 ISO 19685:2017 ISO 20146:2019	$0.006 + 4 \cdot 10^{-5} / p$	Pressure medium: Nitrogen Measurement uncertainty given as numerical value equation p : measured pressure in mbar	
	0.009 mbar to 1 mbar		1 %		
	> 1 mbar to 100 mbar		0.4 %	Pressure medium: Nitrogen	

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.

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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 electric thermometer with resistance sensors with display / digital output	- 20 °C to 200 °C	DKD-R 5-1: 2018	0.1 K	Comparison with reference thermometer in bath
	0.00 °C	Ice point DKD-R 5-1: 2018	0.1 K	
Resistance thermometer without display	- 20 °C to 200 °C	DKD-R 5-1: 2018	0.1 K	
	0.00 °C	Ice point DKD-R 5-1: 2018	0.1 K	

On-site Calibration
Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement ¹⁾	Remarks
Pressure Absolute pressure p_{abs}	> 0.013 mbar to 0.15 bar	DKD-R 6-1: 2014 EURAMET Calibration Guide 3 Version 1.0	$4.5 \cdot 10^{-5} \cdot p_{abs} + 0.25 \mu\text{bar}$	Pressure medium: Gas The uncertainty of the measured residual pressure has to be taken into account.
	> 0.15 bar to 0.30 bar		$4.5 \cdot 10^{-5} \cdot p_{abs}$	
	> 0.30 bar to 70 bar		$3.5 \cdot 10^{-5} \cdot p_{abs}$	
	> 70 bar to 101 bar		$3.5 \cdot 10^{-5} \cdot p_{abs}$	Pressure medium: Gas The uncertainty of the barometer has to be taken into account.
	> 101 bar to 501 bar		$1.3 \cdot 10^{-4} \cdot p_{abs}$	
Negative and positive gauge pressure p_e	-1.0 bar to -0.3 bar		$4.5 \cdot 10^{-5} \cdot p_e$	Pressure medium: Gas
	> -0.3 bar to -0.15 bar		$5.5 \cdot 10^{-5} \cdot p_e$	
	-0.15 bar to 0.15 bar		$4.5 \cdot 10^{-5} \cdot p_{abs} + 0.25 \mu\text{bar}$	
	> 0.15 bar to 100 bar		$3.5 \cdot 10^{-5} \cdot p_e$	
	> 100 bar to 500 bar		$1.3 \cdot 10^{-4} \cdot p_e$	

Abbreviations used:

CMC	Calibration and measurement capabilities
DKD-R	Guideline of Deutscher Kalibrierdienst
EURAMET	European Association of National Metrology Institutes
ISO	International Organization for Standardization

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.