Deutsche Akkreditierungsstelle GmbH

Annex to the Accreditation Certificate D-K-15209-01-00 according to ISO/IEC 17025:2005

Period of validity: 16.05.2018 to 15.05.2023 Date of issue: 16.05.2018

Holder of certificate:

Ghana Standards Authority – Metrology Directorate
Shiashie Legon Road, near Gulf House, P. O. Box MB 245, Accra, GHANA

Head:	M. Sc. Paul Michael Date
Deputy:	Mr. Eric Yaw Asamoah
	Ms. Sylvia Aku Agbesinyale
	Mr. Richard Asiedu Ofori
	Mr. Michael Armah
	Mr. Frank Okai
	Mr. Frank Eric Boye Anang

Accredited as calibration laboratory since: 15.05.2008

Calibrations in the fields:

Mechanical quantities

- Mass (mass standards)
- Weighing instruments [a)]
- Pressure [a)]

Chemical analysis, reference materials

- Volume of liquids

Thermodynamic quantities

Temperature quantities

- Direct reading thermometers [a)]
- Liquid-in-glass thermometers
- Thermocouples
- Resistance thermometers
- Climatic chambers (temperature) [b)]

Humidity quantities

- Devices for relative humidity
- Climatic chambers (humidity) [b)]

[a)] Permanent laboratory and on-site calibration

[b)] On-site calibration only

Within the measurands/calibration items marked with [*)], 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.

Abbreviations used: see last page

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 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	
	20 kg		30 mg	
Mass [*)] and Conventional mass [*)]	1 mg to 100 mg	OIML R 111-1:2004	0.016 mg	For free nominal values *m*: measured value
	> 100 mg to 200 mg		0.020 mg	
	> 200 mg to 500 mg		0.025 mg	
	> 500 mg to 1 g		0.03 mg	
	> 1 g to 2 g		0.04 mg	
	> 2 g to 5 g		0.05 mg	
	> 5 g to 10 g		0.06 mg	
	> 10 g to 20 g		0.08 mg	
	> 20 g to 50 g		0.10 mg	
	> 50 g to 100 g		0.16 mg	
	> 100 g to 20 kg		$1.6 \cdot 10^{-6} \cdot m$	

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

Measured quantity / Calibration item	Range	Measurement conditions / procedure	Best measurement capability [1]	Remarks
Weighing instruments Non-automatic electronic weighing instruments *) and Non-automatic self-indicating mechanical weighing instruments *)	up to 2000 g	EURAMET Calibration Guide No. 18 Version 4.0 (11/2015)	$2 \cdot 10^{-6}$	For weight pieces according to OIML R 111-1:2004, Class E_2
	up to 1000 kg		$7 \cdot 10^{-6}$	For weight pieces according to OIML R 111-1:2004, Class F_1
	up to 60 kg		$3 \cdot 10^{-5}$	For weight pieces according to OIML R 111-1:2004, Class F_2
	up to 2000 kg		$1 \cdot 10^{-4}$	For weight pieces according to OIML R 111-1:2004, Class M_1
Volume of liquids Piston pipettes and hand dispensers	1 µL to < 10 µL	Gravimetric method ISO 8655:2009 DKD-R 8-1:2011	2.5 %	
	10 µL to < 100 µL		0.60 %	
	100 µL to 10 mL		0.50 %	
Laboratory glassware	0.1 mL to < 1 mL	Gravimetric method ISO 4787:2010	1.6 %	adjusted as to deliver "Ex"
	1 mL to < 10 mL		0.20 %	
	10 mL to 100 mL		0.08 %	
	1 mL to < 10 mL		1.5 %	adjusted as to contain "In"
	10 mL to < 100 mL		0.18 %	
	100 mL to < 1 L		0.06 %	
	1 L to 10 L		0.05 %	
Standard measuring cans	1 L, 2 L	Gravimetric method GSA-OP-C14-B	0.10 %	
	5 L, 10 L, 20 L		0.06 %	
Pressure Absolute pressure p_{abs} *)	0.8 bar to 1.1 bar	DKD-R 6-1:2014 EURAMET Calibration Guide No. 17 Version 3.0 Principle of measurement: $p_{abs} = p_e + p_{amb}$.	0.08 mbar	Pressure medium: Gas in connection with a gas/ oil volume The uncertainty of the measured atmospheric pressure has to be taken into account.
	> 1.1 bar to 61.0 bar		$8.0 \cdot 10^{-5} \cdot p_{abs} + 0.09$ mbar	
	> 61 bar to 201 bar		25 mbar	
	1 bar to 51 bar		$7.5 \cdot 10^{-5} \cdot p_{abs} + 0.09$ mbar	Pressure medium: Oil. The uncertainty of the measured atmospheric pressure has to be taken into account.
	> 51 bar to 1001 bar		$6.0 \cdot 10^{-5} \cdot p_{abs} + 0.60$ mbar	
	> 1001 bar to 2001 bar		$1.0 \cdot 10^{-4} \cdot p_{abs} + 1.0$ mbar	
Gauge pressure p_e *)	-1bar to 0 bar	DKD-R 6-1:2014 EURAMET Calibration Guide No. 17 Version 3.0 EURAMET Calibration Guide No. 3 Version 1.0	0.75 mbar	Pressure medium: Gas in connection with a gas/ oil volume
	> 0 bar to 0.7 bar		0.08 mbar	
	> 0.7 bar to 1 bar		0.35 mbar	
	> 1 bar to 60 bar		$8.0 \cdot 10^{-5} \cdot p_e + 0.09$ mbar	
	> 60 bar to 200 bar		0.25 mbar	
	0 bar; 1 bar to 50 bar		$7.5 \cdot 10^{-5} \cdot p_e + 0.09$ mbar	Pressure medium: Oil
	> 50 bar to 1000 bar		$6.0 \cdot 10^{-5} \cdot p_e + 0.60$ mbar	
	> 1000 bar to 2000 bar		$1.0 \cdot 10^{-4} \cdot p_e + 1.0$ mbar	

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

Measured quantity / Calibration item	Range	Measurement conditions / procedure	Best measurement capability [1)]	Remarks
Temperature Direct reading thermometers with resistance sensor [*)]	-80 °C to -30 °C	Methanol Bath DAkkS-DKD-R 5-1:2010	40 mK	Comparison with standard resistance thermometers
	> -30 °C to 10 °C	Ethanol Bath DAkkS-DKD-R 5-1:2010	30 mK	
	> 10 °C to 30 °C		25 mK	
	> 30 °C to 70 °C	Water Bath DAkkS-DKD-R 5-1:2010	25 mK	
	> 70 °C to 200 °C	Oil Bath DAkkS-DKD-R 5-1:2010	80 mK	
	> 200 °C to 600 °C	Dry block calibrator DAkkS-DKD-R 5-1:2010	0.25 K	
Direct reading thermometers with thermocouple sensor [*)]	-80 °C to -30 °C	Methanol Bath DAkkS-DKD-R 5-3:2010	0.15 K	Comparison with standard resistance thermometers
	> -30 °C to 10 °C	Ethanol Bath DAkkS-DKD-R 5-3:2010	0.10 K	
	> 10 °C to 30 °C		0.10 K	
	> 30 °C to 70 °C	Water Bath DAkkS-DKD-R 5-3:2010	0.15 K	
	> 70 °C to 200 °C	Oil Bath DAkkS-DKD-R 5-3:2010	0,20 K	
	> 200 °C to 400 °C	Dry block calibrator DAkkS-DKD-R 5-3:2010	0.50 K	
	> 400 °C to 600 °C		0.75 K	
	> 600 °C to 1000 °C	High temperature furnace DAkkS-DKD-R 5-3:2010	1.25 K	Comparison with thermocouples
Resistance thermometers [*)]	-80 °C to -30 °C	Methanol Bath DAkkS-DKD-R 5-1:2010	40 mK	Comparison with standard resistance thermometers
	> -30 °C to 10 °C	Ethanol Bath DAkkS-DKD-R 5-1:2010	30 mK	
	> 10 °C to 30 °C	Ethanol Bath DAkkS-DKD-R 5-1:2010	25 mK	
	> 30 °C to 70 °C	Water Bath DAkkS-DKD-R 5-1:2010	25 mK	
	> 70 °C to 200 °C	Oil Bath DAkkS-DKD-R 5-1:2010	80 mK	
	> 200 °C to 600 °C	Dry block calibrator DAkkS-DKD-R 5-1:2010	0.30 K	
Liquid-in-glass thermometers	> -30 °C to 30 °C	Ethanol Bath PTB testing instruction Volume 2, 2nd edition	50 mK	Comparison with standard resistance thermometers
	> 30 °C to 70 °C	Water Bath PTB testing instruction Volume 2, 2nd edition	60 mK	
	> 70 °C to 200 °C	Oil Bath PTB testing instruction Volume 2, 2nd edition	80 mK	

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

Measured quantity / Calibration item	Range	Measurement conditions / procedure	Best measurement capability [1)]	Remarks
Noble metal thermocouples [*)]	-80 °C to -30 °C	Methanol Bath DAkkS-DKD-R 5-3:2010	0.8 K	Comparison with standard resistance thermometers
	> -30 °C to 30 °C	Ethanol Bath DAkkS-DKD-R 5-3:2010	0.6 K	
	> 30 °C to 70 °C	Water Bath DAkkS-DKD-R 5-3:2010	0.6 K	
	> 70 °C to 200 °C	Oil Bath DAkkS-DKD-R 5-3:2010	0.6 K	
	> 200 °C to 600 °C	Dry block calibrator DAkkS-DKD-R 5-3:2010	0.8 K	
	> 600 °C to 1000 °C	High temperature furnace DAkkS-DKD-R 5-3:2010	2.6 K	Comparison with thermocouples
Base metal thermocouples [*)]	-80 °C to -30 °C	Methanol Bath DAkkS-DKD-R 5-3:2010	1.2 K	Comparison with standard resistance thermometers
	> -30 °C to 30 °C	Ethanol Bath DAkkS-DKD-R 5-3:2010	1.0 K	
	> 30 °C to 70 °C	Water Bath DAkkS-DKD-R 5-3:2010	1.0 K	
	> 70 °C to 200 °C	Oil Bath DAkkS-DKD-R 5-3:2010	1.0 K	
	> 200 °C to 600 °C	Dry block calibrator DAkkS-DKD-R 5-3:2010	1.2 K	
	> 600 °C to 1000 °C	High temperature furnace DAkkS-DKD-R 5-3:2010	4 K	Comparison with thermocouples
Relative humidity Hygrometers / Thermohygro-meters (except psychrometers)	10 % to 90 %	Climatic chamber measuring temperature 10° C to 90 °C (dew point not lower than -12 °C) GSA-OP-C53-A	1.6 %	Comparison with standard humidity sensors Measurement uncertainty is an absolute value of the relative humidity
Air temperature sensors / Thermo-hygrometers (no thermocouples)	-40 °C to 10 °C	GSA-OP-C52-A	0.3 K	Comparison with standard resistance thermometers
	> 10 °C to 90 °C		0.2 K	
	> 90 °C to 150 °C		0.3 K	

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

On-site calibration

Measured quantity / Calibration item	Range	Measurement conditions / procedure	Best measurement capability [1)]	Remarks
Temperature Direct Reading Thermometers with resistance sensor *)	-80 °C to -30 °C	Dry block calibrator DAkkS-DKD-R 5-1:2010	0.25 K	Comparison with standard resistance thermometers
	-30 °C to 40 °C		0.15 K	
	40° C to 600 °C		0.25 K	
Direct Reading Thermometers with thermocouple sensor *)	-80 °C to 150 °C	Dry block calibrator DAkkS-DKD-R 5-3:2010	0,35 K	Comparison with standard resistance thermometers
	> 150 °C to 400 °C		0.50 K	
	> 400 °C to 600 °C		0.75 K	
Climatic chambers with air circulation in empty or defined loaded useful volume *)	-80 °C to -40 °C	DAkkS-DKD-R 5-7:2010 Method A or B	1.3 K	Comparison with resistance thermometers and thermocouples If loaded, type and arrangement of the load are to be precisely stated in the calibration certificate.
	> -40 °C to 10 °C		0.8 K	
	> 10 °C to 50 °C		0.5 K	
	> 50 °C to 150 °C		0.8 K	
	> 150 °C to 400 °C		1.5 K	
Climatic chambers without air circulation in empty or defined loaded useful volume *)	-80 °C to -40 °C	DAkkS-DKD-R 5-7:2010 Method A or B	1.6 K	
	> -40 °C to 10 °C		1.2 K	
	> 10 °C to 50 °C		0.9 K	
	> 50 °C to 150 °C		1.2 K	
	> 150 °C to 350 °C		1.8 K	
Measuring locations in climatic chambers with air circulation, in empty or defined loaded useful volume *)	-80 °C to -40 °C	DAkkS-DKD-R 5-7:2010 Method C	1.3 K	
	> -40 °C to 10 °C		0.6 K	
	> 10 °C to 50 °C		0.4 K	
	> 50 °C to 150 °C		0.6 K	
	> 150 °C to 400 °C		1.4 K	
Measuring locations in climatic chambers without air circulation, in empty or defined loaded useful volume *)	-80 °C to -40 °C	DAkkS-DKD-R 5-7:2010 Method C	1.5 K	
	> -40 °C to 10 °C		1.0 K	
	> 10 °C to 50 °C		0.8 K	
	>50 °C to 150 °C		1.0 K	
	> 150 °C to 350 °C		1.6 K	
Humidity Climatic chambers with air circulation in empty or defined loaded useful volume *)	10 % to 30 %	DAkkS-DKD-R 5-7:2010 Method A or B Temperature range 10 °C to 90 °C	2.1 %	Comparison with capacitive sensor for relative humidity If loaded, type and arrangement of the load are to be precisely stated in the calibration certificate. Uncertainty value is an absolute value
	> 30 % to 60 %		2.3 %	
	> 60 % to 90 %		2.7 %	
Measuring locations in climatic chamber with air circulation, in empty or defined loaded useful volume *)	10 % to 30 %	DAkkS-DKD-R 5-7:2010 Method C Temperature range 10 °C to 90 °C	2.1 %	
	> 30 % to 60 %		2.2 %	
	> 60 % to 90 %		2.5 %	

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

Measured quantity / Calibration item	Range	Measurement conditions / procedure	Best measurement capability [1)]	Remarks
Weighing instruments Non-automatic electronic weighing instruments *) and Non-automatic self-indicating mechanical weighing instruments *)	up to 2000 g	EURAMET Calibration Guide No. 18 Version 4.0 (11/2015)	$2 \cdot 10^{-6}$	For weight pieces according to OIML R 111-1:2004, Class E_2
	up to 1000 kg		$7 \cdot 10^{-6}$	For weight pieces according to OIML R 111-1:2004, Class F_1
	up to 60 kg		$3 \cdot 10^{-5}$	For weight pieces according to OIML R 111-1:2004, Class F_2
	up to 2000 kg		$1 \cdot 10^{-4}$	For weight pieces according to OIML R 111-1:2004, Class M_1
Pressure Gauge pressure p_e *)	-1000 mbar to 0 mbar	DKD-R 6-1:2014, EURAMET Calibration Guide No. 17 Version 3.0 (04/2017)	1.0 mbar	Pressure medium: Gas
	0 mbar to 700 mbar		0.50 mbar	
	> 0.7 bar to 2.0 bar		1.0 mbar	
	> 2 bar to 20 bar		3.0 mbar	
	> 20 bar to 200 bar		50 mbar	
	0 bar to 700 bar		0.40 bar	Pressure medium: Oil

Abbreviations used:

DAkkS-DKD-R	Calibration guide issued by Deutsche Akkreditierungsstelle GmbH
DKD-R	Calibration guide issued by Deutscher Kalibrierdienst
EURAMET	European Association of National Metrology Institutes
GSA-OP	Operation procedure of Ghana Standards Authority
OIML	International Organization of Legal Metrology

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