

Deutsche Akkreditierungsstelle

Annex to the Partial Accreditation Certificate D-K-12107-01-01 according to DIN EN ISO/IEC 17025:2018

Valid from: 27.09.2023

Date of issue: 21.11.2023

This annex is a part of the accreditation certificate D-K-12107-01-00.

Holder of partial accreditation certificate:

**IPH Institut "Prüffeld für elektrische Hochleistungstechnik" GmbH
Landsberger Allee 378 A, 12681 Berlin**

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 they conform to the general principles of DIN EN ISO 9001.

Calibration in the fields:

Electrical quantities

DC and low frequency quantities

- DC voltage ^{a)}
- AC voltage ^{a)}
- DC current
- AC current ^{a)}
- DC resistance ^{a)}
- High voltage quantities ^{a)}
- High voltage impulse quantities ^{a)}
- DC transformer ^{a)}
- AC transformer ^{a)}

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>.

Abbreviations used: see last page

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This document is a translation. The definitive version is the original German annex to the accreditation certificate.

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^{a)} also on-site calibrations

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

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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
Current ratio and phase displacement	1 A to 40 kA (primary) 1 A or 5 A (secondary)	Frequencies: 16.7 Hz; 50 Hz; 60 Hz	0.03 %; 1'	Measurement uncertainty of ratio in %; Measurement uncertainty of phase displacement in ' °
Voltage ratio and phase displacement	0.1 kV to 72 kV (primary) [0,1 kV; $\frac{0.1 \text{ kV}}{\sqrt{3}}$; 0,11 kV; $\frac{0.11 \text{ kV}}{\sqrt{3}}$; 0,2 kV] (secondary)	Frequencies: 16.7 Hz; 50 Hz; 60 Hz	0.03 %; 1'	
DC voltage / Sensors, quadrupoles and measuring instruments	1 mV to 330 mV > 330 mV to 3.3 V > 3.3 V to 33 V > 33 V to 330 V > 330 V to 1020 V		0.005 % + 3 µV 0.003 % + 20 µV 0.003 % + 200 µV 0.003 % + 2 mV 0.003 % + 20 mV	
DC voltage / Sensors and measuring systems	1 kV to 30 kV > 30 kV to 200 kV > 200 kV to 400 kV	IEC 60060-2:2010	0.3 % 0.7 % 0.8 %	
AC voltage / Sensors, quadrupoles and measuring instruments	1 mV to 10 mV	1 Hz to 40 Hz 41 Hz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz	0.08 % + 2.5 µV 0.03 % + 1.5 µV 0.1 % + 2 µV 0.5 % + 10 µV 4 % + 30 µV	
	10.1 mV to 100 mV	1 Hz to 40 Hz 41 Hz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 1 MHz 1 MHz to 25 MHz	0.02 % + 5 µV 0.02 % + 3 µV 0.04 % + 4 µV 0.1 % + 5 µV 1.5 % 4.5 % + 0.5 mV	
	> 100 mV to 1 V	1 Hz to 40 Hz 41 Hz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 1 MHz 1 MHz to 25 MHz	0.02 % + 50 µV 0.02 % + 40 µV 0.04 % + 40 µV 0.1 % + 50 µV 1.5 % 4.5 % + 0.5 mV	
	> 1 V to 10 V	1 Hz to 40 Hz 41 Hz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 1 MHz 1 MHz to 25 MHz	0.02 % + 0.5 mV 0.02 % + 0.4 mV 0.04 % + 0.4 mV 0.1 % + 0.5 mV 1.5 % 4.5 %	
AC voltage / Sensors, quadrupoles and measuring instruments	10 V to 100 V	1 Hz to 40 Hz 41 Hz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz	0.05 % + 5 mV 0.03 % + 5 mV 0.05 % + 5 mV 0.2 % + 5 mV 0.7 % + 10 mV 2.5 %	

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AC voltage / Sensors, quadrupoles and measuring instruments (continued)	> 100 V to 1000 V	1 Hz to 40 Hz 41 Hz to 10 kHz 10 kHz to 30 kHz	0.07 % + 50 mV 0.03 % + 5 mV 0.1 % + 50 mV	
	1 kV to 72 kV	IEC 60060-2:2010 16.7 Hz; 50 Hz; 60 Hz	0.3 %	
	1 kV to 200 kV	IEC 60060-2:2010 IEC 60060-3:2006 30 Hz to 300 Hz	0.7 %	
	1 kV to 150 kV	IEC 60060-2:2010 IEC 60060-3:2006 15 Hz bis 30 Hz	0.9 %	
	200 kV to 400 kV	IEC 60060-2:2010 IEC 60060-3:2006 50 Hz	1.2 %	
Lightning impulse voltage (LI)/ measuring instruments, time parameters	9 V to 1600 V	IEC 61083-1:2001	0.6 %	
T_1	0.8 μ s to 1.6 μ s		2.2 %	
T_2	60 μ s		2.2 %	
Lightning impulse voltage (LI)/ Peak value / sensors and measuring systems time parameters	± 500 V to ± 50 kV ± 50 kV to ± 800 kV	IEC 60060-2:2010	0.8 % 0.9 %	
T_1	0.8 μ s to 1.6 μ s		2.5 %	
T_2	40 μ s to 60 μ s		1.7 %	
Lightning impulse voltage (LIC)/ Peak value / measuring instruments time parameter T_c	± 40 V to ± 770 V 0,5 μ s	IEC 61083-1:2001	1,4 % 3,0 %	
Lightning impulse voltage (LIC)/ Peak value / sensors and measuring systems time parameter T_c	± 200 kV 3 μ s bis 6 μ s		0,9 % 3,8 %	
Switching impulse voltage (SI)/ measuring instruments time parameters	9 V to 1600 V	IEC 61083-1:2001	0.6 %	
T_p	20 μ s to 50 μ s		2.2 %	
T_2	2500 μ s to 4000 μ s		1.0 %	

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Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement ¹	Remarks
Switching impulse voltage (SI) Peak value / sensors and measuring system	±80 kV to ±700 kV	IEC 60060-2:2010	0.8 %	
time parameter				
T_p T_2	200 µs to 300 µs 1000 µs to 4000 µs		3 % 3 %	
Impulse charge / calibrators and partial discharge measuring devices	1 pC to 10 nC	IEC 60270:2000 AMD1:2015	$0.02 \cdot q + 0.2 \text{ pC}$	$q = \text{Measured value}$
Rise time and Impulse width / Partial discharge calibrators, amplifier and sensors	1 ns to 1 ms		5 %	Rise time: the time required for a pulse to rise from 10 % to 90 % of its steady value
Puls duration / Partial discharge calibrators	10 ns to 1 s		2 %	Pulse duration: time between the 10% values of the amplitude of the rising edge and the falling edge of the charge pulse
DC current / sensors and measuring instruments	30 µA to 330 µA > 330 µA to 4 mA > 4 mA to 40 mA > 40 mA to 400 mA > 400 mA to 4 A > 4 A to 40 A > 40 A to 100 A		0.02 % + 0.02 µA 0.02 % + 0.8 µA 0.02 % + 10 µA 0.02 % + 80 µA 0.02 % + 0.8 mA 0.02 % + 8 mA 0.02 % + 60 mA	
Current clamps	> 100 A to 2000 A		1.0 %	
Scale factor DC / DC converter, shunt	1 µV/A to 100 mV/A	10 A < I < 1000 A; IEC 62475:2010	0.05 %	Determination of scale factor
	1 µV/A to 100 mV/A	1000 A < I < 5000 A; IEC 62475:2010	0.1 %	
Short time DC current DC converter, shunt	100 A to 1000 A	IEC 62475:2010	0.1 %	Determination of scale factor and linearity
	1 kA to 140 kA		1.0 %	

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DC resistance Measuring instruments	0 Ω to 11 Ω > 11 Ω to 33 Ω > 33 Ω to 110 Ω > 110 Ω to 330 Ω > 330 Ω to 1100 Ω > 1100 Ω to 3300 Ω > 3.3 k Ω to 11 k Ω > 11 k Ω to 33 k Ω > 33 k Ω to 110 k Ω > 110 k Ω to 330 k Ω > 330 k Ω to 1100 k Ω > 1100 k Ω to 3300 k Ω > 3.3 M Ω to 11 M Ω > 11 M Ω to 33 M Ω > 33 M Ω to 110 M Ω > 110 M Ω to 330 M Ω > 330 M Ω to 1100 M Ω		0.005 % + 1.1 m Ω 0.003 % + 1.7 m Ω 0.003 % + 2 m Ω 0.003 % + 3 m Ω 0.003 % + 4 m Ω 0.003 % + 30 m Ω 0.003 % + 40 m Ω 0.003 % + 300 m Ω 0.003 % + 400 m Ω 0.0035 % + 2.5 Ω 0.0035 % + 4 Ω 0.0065 % + 40 Ω 0.015 % + 100 Ω 0.03 % + 3 k Ω 0.055 % + 6 k Ω 0.35 % + 200 k Ω 1.5 % + 2000 k Ω	
DC resistance / Measuring instruments	5 $\mu\Omega$ 15 $\mu\Omega$ 100 $\mu\Omega$ 1 m Ω 10 m Ω 40 m Ω 100 m Ω 600 m Ω 1 Ω 10 Ω 100 Ω 1 k Ω 10 k Ω 100 k Ω	200 A to 1000 A 200 A to 1000 A 30 A 200 A 10 A 3 A 1 A 1 A 0.3 A 0.1 A 0.03 A 0.01 A 0.003 A 0.001 A	0.1 % 0.1 % 0.05 % 0.05 % 0.05 % 0.05 % 0.05 % 0.05 % 0.05 % 0.05 % 0.05 % 0.05 % 0.05 %	
DC resistance	0.2 Ω to 2 Ω > 2 Ω to 20 Ω > 20 Ω to 200 Ω > 200 Ω to 2 k Ω > 2 k Ω to 20 k Ω > 20 k Ω to 200 k Ω > 200 k Ω to 2 M Ω > 2 M Ω to 20 M Ω > 20 M Ω to 200 M Ω 200 M Ω to 2 G Ω		0.0016 % + 0.01 m Ω 0.001 % + 0.02 m Ω 0.0008 % + 0.1 m Ω 0.0008 % + 1 m Ω 0.0008 % + 0.06 Ω 0.0008 % + 0.8 Ω 0.0009 % + 0.02 k Ω 0.0017 % + 0.1 k Ω 0.007 % + 15 k Ω 0.5 % + 1.5 M Ω	
DC resistance / shunt	10 $\mu\Omega$ to 200 $\mu\Omega$ > 200 $\mu\Omega$ to 2 m Ω > 2 m Ω to 20 m Ω > 20 m Ω to 2 Ω > 2 Ω to 100 Ω 1 $\mu\Omega$ to 10 $\mu\Omega$ > 10 $\mu\Omega$ to 1 m Ω > 1 m Ω to 100 m Ω	10 A 1 A, 10 A 100 mA, 1 A, 10 A 1 A, 100 mA, 10 mA 10 mA, 1 mA, 100 μ A 200 A < I < 1000 A 50 A < I < 1000 A 10 A < I < 200 A	0.05 %	Determination of Resistance Voltage range for resistance: 1 mV to 9 V

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AC current / sensors and measuring instruments				
	29 μ A to 330 μ A	10 Hz to 45 Hz 45 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz 10 kHz to 30 kHz	0.15 % + 0.15 μ A 0.1 % + 0.15 μ A 0.25 % + 0.2 μ A 0.6 % + 0.4 μ A 1.5 % + 0.5 μ A	
	> 330 μ A to 4 mA	10 Hz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz	0.05 % + 2 μ A 0.12 % + 2.5 μ A 0.15 % + 5 μ A 0.4 % + 7 μ A	
	> 4 mA to 40 mA	10 Hz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz	0.05 % + 20 μ A 0.12 % + 25 μ A 0.15 % + 50 μ A 0.4 % + 70 μ A	
	> 40 mA to 400 mA	10 Hz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz	0.05 % + 200 μ A 0.12 % + 250 μ A 0.15 % + 500 μ A 0.4 % + 700 μ A	
	> 400 mA to 4 A	10 Hz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz	0.05 % + 2 mA 0.12 % + 2.5 mA 0.15 % + 5 mA 0.4 % + 7 mA	
	> 4 A to 40 A	10 Hz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz	0.05 % + 20 mA 0.12 % + 25 mA 0.15 % + 50 mA 0.4 % + 70 mA	
	> 40 A to 100 A	10 Hz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz	0.05 % + 80 mA 0.12 % + 120 mA 0.15 % + 200 mA 0.4 % + 300 mA	
AC current/ Clamp meter	> 100 A to 2000 A	16.7 Hz; 50 Hz; 60 Hz	1.0 %	
Current AC / shunt; Rogowski-measuring systems; current transformer	5 A to 40 kA	IEC 62475:2010	0.1 %	Measurement RMS; 50/60 Hz; continuous current
	100 A to 140 kA		1.0 %	Measurement RMS; 50 Hz; short time current
	250 A to 350 kA		1.0 %	Measurement peak; 50 Hz; short time current
impulse current / Shunt, Rogowski-measuring systems; current transformer	20 A to 8 kA	IEC 62475:2010	1.0 %	Measurement peak; 8/20 μ s impulse current
Impulse current; time parameters	6 μ s to 24 μ s	IEC 62475:2010	3.0 %	Measurement front time and time to half value

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On-site Calibration

Calibration and Measurement Capabilities (CMC)

Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement ¹	Remarks
Current ratio and phase displacement	<u>1 A to 40 kA (primary)</u> 1 A or 5 A (secondary)	Measuring frequencies: 16.7 Hz; 50 Hz; 60 Hz	(0.05 % ; 1.5')	Measurement uncertainty of ratio in %; Measurement uncertainty of phase displacement in ' °
Voltage ratio and phase displacement	<u>0.1 kV to 72 kV (primary)</u> [0,1 kV; $\frac{0,1 \text{ kV}}{\sqrt{3}}$; 0,11 kV; $\frac{0,11 \text{ kV}}{\sqrt{3}}$; 0,2 kV] (secondary)			
DC voltage / Sensors and measuring systems	1 kV to 30 kV > 30 kV to 200 kV > 200 kV to 400 kV	IEC 60060-2:2010	0.3 % 0.7 % 0.8 %	
AC voltage / sensors and measuring systems	1 kV to 72 kV	IEC 60060-2:2010 16.7 Hz; 50 Hz; 60 Hz	0.3 %	
	1 kV to 200 kV	IEC 60060-2:2010 IEC 60060-3:2006 30 Hz to 300 Hz	0.7 %	
	1 kV to 150 kV	IEC 60060-2:2010 IEC 60060-3:2006 15 Hz bis 30 Hz	0,9 %	
	200 kV to 400 kV	IEC 60060-2:2010 IEC 60060-3:2006 50 Hz	1,2 %	
Lightning impulse voltage (LI)/ measuring instruments, time parameters	9 V to 1600 V	IEC 61083:2001	0.6 %	
T_1	0.8 μs to 1.6 μs		2.2 %	
T_2	60 μs		2.2 %	
Lightning impulse voltage (LI) Peak value / sensors and measuring systems	500 V to 150 kV 150 kV to 500 kV	IEC 60060-2:2010	0.8 % 1 %	
T_1	0.8 μs to 1.6 μs		5 %	
T_2	40 μs to 60 μs		3 %	
Lightning impulse voltage (LIC)/ Peak value / measuring instruments	$\pm 40 \text{ V}$ to $\pm 770 \text{ V}$	IEC 61083-1:2001	1,4 %	
time parameter T_c	0,5 μs		3,0 %	
Lightning impulse voltage (LIC)/ Peak value / sensors and measuring systems	$\pm 200 \text{ V}$	IEC 60060-2:2010	0,9 %	
time parameter T_c	3 μs to 6 μs		3,8 %	

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On-site Calibration

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Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement ¹	Remarks
Switching impulse voltage (SI)* / measuring instruments time parameters	9 V to 1600 V	IEC 60060-2:2010	0.6%	
T_p	20 μ s to 250 μ s		2.2%	
T_2	2500 μ s to 4000 μ s		1.0%	
Switching impulse voltage (SI)*				
Peak value / sensors and measuring system	± 80 V to ± 700 V	IEC 60060-2:2010	0.8 %	
time parameter				
T_p	200 μ s to 300 μ s		3 %	
T_2	1000 μ s to 4000 μ s		3 %	
Impulse charge / calibrators and partial discharge measuring devices	1 pC to 10 nC	IEC 60270:2000 AMD1:2015	0.02 q + 0.2 pC	q = Measured value
Rise time and Impulse width / Partial discharge calibrators, amplifier and sensors	1 ns to 1 ms		5 %	Rise time: the time required for a pulse to rise from 10 % to 90 % of its steady value
Pulse duration / Partial discharge calibrators	10 ns to 1 s		2 %	Pulse duration: time between the 10% values of the amplitude of the rising edge and the falling edge of the charge pulse
Current AC / Shunt, Rogowski-measuring systems; current transformer	5 A to 40 kA	IEC 62475:2010	0.3 %	Measurement RMS; 50 Hz/60 Hz; Continuous current
	100 A to 140 kA		1.0 %	Measurement RMS; 50 Hz; short time current
	250 A to 350 kA		1.0 %	Measurement peak; 50 Hz; short time current
impulse current / Shunt, Rogowski-measuring systems; current transformer	20 A to 8 kA	IEC 62475:2010	1.0 %	
Impulse current; time parameters	6 μ s to 24 μ s		3.0 %	

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Measurement quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement ¹	Remarks
DC resistance / shunt	10 $\mu\Omega$ to 200 $\mu\Omega$	10 A	0.05 %	Determination of resistance Voltage range for resistance: 1 mV to 9 V
	> 200 $\mu\Omega$ to 2 m Ω	1 A, 10 A		
	> 2 m Ω to 20 m Ω	100 mA, 1 A, 10 A		
	> 20 m Ω to 2 Ω	1 A, 100 mA, 10 mA		
	> 2 Ω to 100 Ω	10 mA, 1 mA, 100 μ A		
	1 $\mu\Omega$ to 10 $\mu\Omega$	200 A < I < 1000 A		
	> 10 $\mu\Omega$ to 1 m Ω	50 A < I < 1000 A		
	> 1 m Ω to 100 m Ω	10 A < I < 200 A		
DC scaling factor DC transformer, shunt	1 μ VA to 100 mVA	10 A < I < 1000 A; IEC 62475:2010	0.05 %	
	1 μ VA to 100 mVA	> 1000 A < I < 5000 A; IEC 62475:2010	0.1 %	

Abbreviations used:

DIN Deutsches Institut für Normung e.V. – German institute for standardization
IEC International Electrotechnical Commission

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