

Deutsche Akkreditierungsstelle GmbH

Annex to the Accreditation Certificate D-K-15149-01-00 according to DIN EN ISO/IEC 17025:2005

Valid from: 2020-02-26

Date of issue: 2020-02-26

Holder of certificate:

Trigas FI GmbH
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Head:	Athanasios Trigas
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Accredited as calibration laboratory since: 2002-07-03

Calibration in the fields:

Fluid quantities

- **Liquid flow rate** ^{a)}
- **Volume of flowing liquids**
- **Mass of flowing liquids**
- **Gas flow rate** ^{a)}
- **Volume of flowing gases**
- **Mass of flowing gases**

^{a)} also on-site calibration

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>

Annex to the accreditation certificate D-K-15149-01-00

Permanent Laboratory

Calibration and Measurement Capabilities (CMC)

Measured quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement ¹⁾	Remarks
Liquid flow rate Volume flow rate dV/dt and volume V of flowing liquids	0.05 mL/min to 2000 L/min	Volumetric measurement (piston prover), Measured fluid: liquids with densities of 700 kg/m ³ to 1100 kg/m ³	0.04 %	Measuring instrument with frequency or analogue output or visual display
	10 L/min to 5000 L/min	Volumetric measurement (water flow calibrator) Measured fluid: water with density of 1000 kg/m ³	0.09 %	Measuring instrument with frequency output
			0.12 %	Measuring instrument with analogue output or visual display
Mass flow rate dm/dt and mass m of flowing liquids	0.04 g/min to 2000 kg/min	Volumetric measurement (piston prover), Unit conversion via density, Viscosities of 0,3 mm ² /s to 1600 mm ² /s	0.05 %	Measuring instrument with frequency or analogue output or visual display
	10 kg/min to 5000 kg/min	Volumetric measurement (water flow calibrator) Unit conversion via density of 1,0 mm ² /s	0.11 %	Measuring instrument with frequency output
			0.13 %	Measuring instrument with analogue output or visual display
Gas flow rate Volume flow rate dV/dt and volume V of flowing gases	Measuring range stated in standard conditions	Calibration object always downstream to flow standards		Measuring instrument with display of flow rate under actual condition or under standard condition Standard density in according to international accepted normative documents
	1 mL/min to 85 L/min	Laminar flow elements Calibration gas: dry air (dew point < -15 °C)	0.34 %	Measuring instrument with frequency or analogue output or visual display
	10 L/min to 20000 L/min	critical nozzle Calibration gas: dry air (dew point < -15 °C)	0.27 %	
	1 L/min to 1500 L/min	Bell prover Calibration gas: dry air (dew point < -15 °C)	0.26 %	
	20 mL/min to 4000 mL/min	Seal free piston prover, Calibration gas: dry air (dew point < -15 °C)	0.3 %	

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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Measured quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement ¹⁾	Remarks
	1 L/min to 700 L/min	Bell prover Calibration gases: - nitrogen N ₂ - argon Ar - helium He - and their mixtures	0.26 %	Measuring instrument with frequency or analogue output or visual display technically pure gases or mixtures with traced composition
Gas flow rate Volume flow rate dV/dt and volume V of flowing gases	Measuring range stated in standard conditions	Calibration object always downstream to flow standards		Measuring instrument with display of flow rate under actual condition or under standard condition Standard density in according to international accepted normative documents
	20 mL/min to 4000 mL/min	Seal free piston prover, Calibration gases: - nitrogen N ₂ - argon Ar - helium He - and their mixtures	0.35 %	Measuring instrument with frequency or analogue output or visual display technically pure gases or mixtures with traced composition
	1 L/min to 300 L/min	Bell prover Calibration gases: - methane CH ₄ - carbon dioxide CO ₂ - propane C ₃ H ₈ - and their mixtures - hydrogen H ₂	0.26 %	
	20 mL/min to 4000 mL/min	Seal free piston prover, Calibration gases: - methane CH ₄ - carbon dioxide CO ₂ - propane C ₃ H ₈ - and their mixtures - hydrogen H ₂	0.35 %	
Mass flow rate dm/dt and mass m of flowing gases	1.3 mg/min to 110 g/min	Calibration object always downstream to flow standards Laminar flow elements Calibration gas: dry air (dew point < -15 °C)	0.36 %	Measuring instrument with frequency or analogue output or visual display
	12 g/min to 1440 kg/h	critical nozzle Calibration gas: dry air (dew point < -15 °C)	0.24 %	
	1290 mg/min to 1939 g/min	Bell prover Calibration gas: dry air (dew point < -15 °C)	0.27 %	
	25.8 mg/min to 5.17 g/min	Seal free piston prover, Calibration gas: dry air (dew point < -15 °C)	0.3 %	

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Calibration and Measurement Capabilities (CMC)

Measured quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement ¹⁾	Remarks
Gas flow rate Mass flow rate dm/dt and mass m of flowing gases	1250 mg/min to 875 g/min 1784 mg/min to 1249 g/min 178 mg/min to 125 g/min	Bell prover Calibration gases: - nitrogen N ₂ - argon Ar - helium He - and their mixtures	0.27 %	Measuring instrument with frequency or analogue output or visual display technically pure gases or mixtures with traced composition
	25 mg/min to 5.0 g/min 35 mg/min to 7.14 g/min 3.57 mg/min to 714 mg/min	Seal free piston prover, Calibration gases: - nitrogen N ₂ - argon Ar - helium He - and their mixtures	0.35%	
Gas flow rate Mass flow rate dm/dt and mass m of flowing gases	717 mg/min to 215 g/min 1970 mg/min to 593 g/min 2010 mg/min to 603 g/min 90 mg/min to 27 g/min	Bell prover Calibration gases: - methane CH ₄ - carbon dioxide CO ₂ - propane C ₃ H ₈ - and their mixtures - hydrogen H ₂	0.26 %	Measuring instrument with frequency or analogue output or visual display technically pure gases or mixtures with traced composition
	14.3 mg/min to 2.870 g/min 39.5 mg/min to 7.907 g/min 40 mg/min to 8.042 g/min 1.8 mg/min to 360 mg/min	seal free piston prover Calibration gases: - methane CH ₄ - carbon dioxide CO ₂ - propane C ₃ H ₈ - and their mixtures - hydrogen H ₂	0.35 %	

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On-site Calibration

Calibration and Measurement Capabilities (CMC)

Measured quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement ¹⁾	Remarks
Liquid flow rate Volume flow rate dV/dt of flowing liquids	0.03 L/min to 2000 L/min	Volumetric measurement (Transfer standard) Reference turbines, coriolis, gear meter	0.09 %	DN 4 - DN 65
	10 L/min to 5000 L/min	Volumetric measurement (Transfer standard) Reference turbines, coriolis, gear meter	0.12 %	DN 20 - DN 150
Mass flow rate dm/dt of flowing liquids	0.025 kg/min to 2000 kg/min	Volumetric measurement (Transfer standard) Reference turbines, coriolis, gear meter Conversion by using density	0.09 %	DN 4 - DN 65
	10 kg/min to 5000 kg/min	Volumetric measurement (Transfer standard) Reference turbines, coriolis, gear meter Conversion by using density	0.12 %	DN 20 - DN 150
Liquid flow rate Volume flow rate dV/dt and volume V of flowing gases	1 mL/min to 1200 L/min	Laminar flow elements Calibration gas: dry air (dew point < -15 °C)	1.05 %	Ambient air temperature and medium temperature: 23 °C ± 5 °C
	10 L/min to 10000 L/min	critical nozzle Calibration gas: dry air (dew point < -15 °C)	1.06 %	Temperature difference between ambient air and medium: < 5 °C
	5 mL/min to 1000 L/min	Alicat Laminar flow elements Calibration gas: dry air (dew point < -15 °C)	1.29 %	Temperature difference between standard input and standard output : < 5 °C
Mass flow rate dm/dt and mass m of flowing gases	1.29 mg/min to 1551 g/min	Laminar flow elements Calibration gas: dry air (dew point < -15 °C)	1.05 %	Stability criteria: PRC 10419 Rev D: 17.09.2019
	12.9 g/min to 12900 g/min	critical nozzle Calibration gas: dry air (dew point < -15 °C)	1.06 %	
	6.46 g/min to 1293 g/min	Alicat Laminar flow elements Calibration gas: dry air (dew point < -15 °C)	1.29 %	

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Abbreviations used:

CMC	Calibration and measurement capabilities (Kalibrier- und Messmöglichkeiten)
DN	Nominal diameter

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