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Annex to the Accreditation Certificate D-K-15149-01-00 according to DIN EN ISO/IEC 17025:2018

Valid from: **22.10.2024**

Date of issue: 22.10.2024

Holder of accreditation certificate:

Trigas FI GmbH
Erdinger Str. 2b, 85375 Neufahrn

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:

Fluid quantities

- Liquid flow rate [a)]
- Volume of flowing liquids
- Mass of flowing liquids
- Gas flow rate [a)]
- Volume of flowing gases [a)]
- Mass of flowing gases [a)]

[a)] also on-site calibration

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	Remarks
Liquid flow rate Volume flow rate d*V*/d*t* 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/m³ to 1100 kg/m³ CAL 10247 / 08.01.2024	0.04 %	Measuring instrument with frequency or analogue output or visual display
	10 L/min to 4700 L/min	Volumetric measurement (water flow calibrator) Measured fluid: water with density of 1000 kg/m³ CAL 10247 / 08.01.2024	0.09 %	Measuring instrument with frequency output
			0.12 %	Measuring instrument with analogue output or visual display
Mass flow rate d*m*/d*t* 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 mm²/s to 1600 mm²/s CAL 10247 / 08.01.2024	0.05 %	Measuring instrument with frequency or analogue output or visual display
	10 kg/min to 4700 kg/min	Volumetric measurement (water flow calibrator) Unit conversion via density of 1,0 mm²/s CAL 10247 / 08.01.2024	0.11 %	Measuring instrument with frequency output
			0.13 %	Measuring instrument with analogue output or visual display
Gas flow rate Volume flow rate d*V*/d*t* and volume *V* of flowing gases	Measuring range stated in standard conditions 293,15 K; 1013,25 hPa			Measuring instrument with display of flow rate under actual condition or under standard condition Standard density in according to international accepted normative documents Measuring instrument with frequency or analogue output or visual display
	0,1 mL/min to < 1 L/min	Laminar flow elements Calibration gas: dry air (dew point < -15 °C) CAL 10292 / 26.07.2024	0,59 %	
	1 mL/min to 300 L/min		0.29 %	
	10 L/min to 20000 L/min	critical nozzle Calibration gas: dry air (dew point < -15 °C) CAL 10269 / 08.08.2024	0.27 %	
	1 L/min to 1500 L/min	Bell prover Calibration gas: dry air (dew point < -15 °C) CAL 10248 / 31.07.2024	0.26 %	
	20 mL/min to 4000 mL/min	Seal free piston prover, Calibration gas: dry air (dew point < -15 °C) CAL 10251 / 30.07.2024	0.3 %	

Permanent Laboratory

Calibration and Measurement Capabilities (CMC)

Measured quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
Gas flow rate Volume flow rate dV/dt and volume V of flowing gases	Measuring range stated in standard conditions 293,15 K; 1013,25 hPa			Measuring instrument with display of flow rate under actual condition or under standard condition Standard density in according to international accepted normative documents Measuring instrument with frequency or analogue output or visual display technically pure gases or mixtures with traced composition
	1 L/min to 700 L/min	Bell prover Calibration gases: - nitrogen N_2 - argon Ar - helium He and their mixtures CAL 10248 / 31.07.2024	0.26 %	
	20 mL/min to 4000 mL/min	Seal free piston prover, Calibration gases: - nitrogen N_2 - argon Ar - helium He and their mixtures CAL 10251 / 30.07.2024	0,35 %	
	1 L/min to 300 L/min	Bell prover Calibration gases: - methane CH_4 - carbon dioxide CO_2 - propane C_3H_8 and their mixtures - hydrogen H_2 CAL 10248 / 31.07.2024	0.26 %	
	20 mL/min to 4000 mL/min	Seal free piston prover, Calibration gases: - methane CH_4 - carbon dioxide CO_2 - propane C_3H_8 and theirs mixtures - hydrogen H_2 CAL 10251 / 30.07.2024	0.35 %	
Mass flow rate d*m*/d*t* and mass *m* of flowing gases	0,15 mg/min to < 1,3 g/min	Laminar flow elements Calibration gas: dry air (dew point < -15 °C) CAL 10292 / 26.07.2024	0,59 %	Measuring instrument with frequency or analogue output or visual display
	1.3 mg/min to 380 g/min		0.29 %	
	12 g/min to 1440 kg/h	critical nozzle Calibration gas: dry air (dew point < -15 °C) CAL 10269 / 08.08.2024	0.24 %	
	1290 mg/min to 1939 g/min	Bell prover Calibration gas: dry air (dew point < -15 °C) CAL 10248 / 31.07.2024	0.27 %	
	25.8 mg/min to 5.17 g/min	Seal free piston prover, Calibration gas: dry air (dew point < -15 °C) CAL 10251 / 30.07.2024	0.3 %	

Permanent Laboratory

Calibration and Measurement Capabilities (CMC)

Measured quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	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 CAL 10248 / 31.07.2024	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 CAL 10251 / 30.07.2024	0,35%	
	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_3H_8 and their mixtures - hydrogen H_2 CAL 10248 / 31.07.2024	0,26 %	
	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_3H_8 and their mixtures - hydrogen H_2 CAL 10251 / 30.07.2024	0,35 %	

On-site Calibration

Calibration and Measurement Capabilities (CMC)

Measured quantity / Calibration item	Range			Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
Liquid flow rate	0.03 L/min	to	2000 L/min	Volumetric measurement (Transfer standard) Reference turbines, coriolis, gear meter CAL 10247 / 08.01.2024	0.09 %	DN 4 - DN 65
Volume flow rate d*V*/d*t* of flowing liquids	10 L/min	to	4700 L/min		0.12 %	DN 20 - DN 150
Mass flow rate d*m*/d*t* of flowing liquids	0.025 kg/min	to	2000 kg/min	Volumetric measurement (Transfer standard) Reference turbines, coriolis, gear meter Conversion by using density CAL 10247 / 08.01.2024	0.09 %	DN 4 - DN 65
	10 kg/min	to	4700 kg/min		0.12 %	DN 20 - DN 150
Gas flow rate Volume flow rate d*V*/d*t* and volume *V* of flowing gases	Measuring range stated in standard conditions 293,15 K; 1013,25 hPa					Ambient air temperature and medium temperature: 23 °C ± 5 °C Temperature difference between ambient air and medium: < 5 °C Temperature difference between standard input and standard output : < 5 °C
	1 mL/min	to	1200 L/min	Laminar flow elements Calibration gas: dry air (dew point < -15 °C) CAL 10292 / 26.07.2024 CAL 10419 / 07.03.2022	0,37 %	
	10 L/min	to	10000 L/min	critical nozzle Calibration gas: dry air (dew point < -15 °C) CAL 10269 / 08.08.2024 CAL 10419 / 07.03.2022	0,42 %	
	5 mL/min	to	1000 L/min	Alicat Laminar flow elements Calibration gas: dry air (dew point < -15 °C) CAL 10419 / 07.03.2022	0,92 %	
Mass flow rate d*m*/d*t* 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) CAL 10292 / 26.07.2024 CAL 10419 / 07.03.2022	0, 43 %	

On-site Calibration

Calibration and Measurement Capabilities (CMC)

Measured quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
	12.9 g/min to 12900 g/m	critical nozzle Calibration gas: dry air (dew point < -15 °C) CAL 10269 / 08.08.2024 CAL 10419 / 07.03.2022	0,41 %	
	6.46 g/min to 1293 g/min	Alicat Laminar flow elements Calibration gas: dry air (dew point < -15 °C) CAL 10419 / 07.03.2022	0,92 %	
Gas flow rate Volume flow rate dV/dt and volume V of flowing gases	Measuring range stated in standard conditions 293,15 K; 1013,25 hPa			Measuring instrument with frequency or analogue output or visual display technically pure gases or mixtures with traced composition
	20 mL/min to 700 L/min	Laminar flow elements - nitrogen N_2 - argon Ar - helium He CAL 10419 / 07.03.2022	0,43 %	
	20 mL/min to 700 L/min	Alicat Laminar flow elements - nitrogen N_2 - argon Ar - helium He CAL 10419 / 07.03.2022	0,92 %	
	10 L/min to 700 L/min	critical nozzle - nitrogen N_2 - argon Ar - helium He CAL 10419 / 07.03.2022	0,42 %	
	20 mL/min to 300 L/min	Laminar flow elements - methane CH_4 - carbon dioxide CO_2 - propane C_3H_8 - hydrogen H_2 CAL 10419 / 07.03.2022	0,43 %	
	20 mL/min to 300 L/min	Alicat Laminar flow elements - methane CH_4 - carbon dioxide CO_2 - propane C_3H_8 - hydrogen H_2 CAL 10419 / 07.03.2022	0,92 %	
	10 L/min to 300 L/min	critical nozzle - methane CH_4 - carbon dioxide CO_2 - propane C_3H_8 - hydrogen H_2 CAL 10419 / 07.03.2022	0,42 %	

On-site Calibration

Calibration and Measurement Capabilities (CMC)

Measured quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
Mass flow rate d*m*/d*t* and mass *m* of flowing gases	Measuring range stated in standard conditions 293,15 K; 1013,25 hPa			
	25 mg/min to 875 g/min 35 mg/min to 1249 g/min 3,57 mg/min to 125 g/min	Laminar flow elements - nitrogen N_2 - argon Ar - helium He CAL 10419 / 07.03.2022	0,43 %	
	25 mg/min to 875 g/min 35 mg/min to 1249 g/min 3,57 mg/min to 125 g/min	Alicat Laminar flow elements - nitrogen N_2 - argon Ar - helium He CAL 10419 / 07.03.2022	0,92 %	

On-site Calibration

Calibration and Measurement Capabilities (CMC)

Measured quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
Gas flow rate Mass flow rate d*m*/d*t* and mass *m* of flowing gases	12,5 g/min to 875 g/min 17,84 g/min to 1249 g/min 1,78 g/min to 125 g/min	critical nozzle - nitrogen N_2 - argon Ar - helium He CAL 10419 / 07.03.2022	0,41 %	
	14,3 mg/min to 215 g/min 39,5 mg/min to 593 g/min 40 mg/min to 603 g/min 1,8 mg/min to 27 g/min	Laminar flow elements - methane CH_4 - carbon dioxide CO_2 - propane C_3H_8 - hydrogen H_2 CAL 10419 / 07.03.2022	0,43 %	
	14,3 mg/min to 215 g/min 39,5 mg/min to 593 g/min 40 mg/min to 603 g/min 1,8 mg/min to 27 g/min	Alicat Laminar flow elements - methane CH_4 - carbon dioxide CO_2 - propane C_3H_8 - hydrogen H_2 CAL 10419 / 07.03.2022	0,92 %	
	7,17 g/min to 215 g/min 19,7 g/min to 593 g/min 20,1 g/min to 603 g/min 0,9 g/min to 27 g/min	critical nozzle - methane CH_4 - carbon dioxide CO_2 - propane C_3H_8 - hydrogen H_2 CAL 10419 / 07.03.2022	0,41 %	

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Measured quantity / Calibration item	Range	Measurement conditions / procedure	Expanded uncertainty of measurement	Remarks
Mass flow rate d*m*/d*t* and mass *m* of flowing gases	10 kg/h to 250 kg/h	Master method with tempering calibration medium: gases, especially H_2, He, N_2, natural gas with an operating pressure > 20 bar CAL_ML001 27.04.2022	0,54 %	H2-filling stations and filling and dispensing systems up to 1070 bar
	60 kg/h to 1500 kg/h	Master method with tempering calibration medium: gases, especially H_2, He, N_2, natural gas with an operating pressure > 20 bar CAL_ML002 04.03.2022	1,2 %	
Mass flow rate d*m*/d*t* and mass *m* of flowing gases	80 kg/h to 2000 kg/h	Master method with tempering calibration medium: gases, especially H_2, He, N_2, natural gas with an operating pressure > 20 bar CAL_ML002 04.03.2022	1,2 %	H2-mobile and stationary dispensing systems up to 350 bar

Abbreviations used:

CAL	In house procedure of Trigas FI GmbH
CMC	Calibration and measurement capabilities
DN	Nominal diamete