

CALIBRATION CERTIFICATE # 19893

Calibration date : 2023-07-17

Certificate issued : 2023-07-17

Company name
Company address
City, Province, Canada**Calibration of**
Mass flow meter Brooks SLA5851S S/N : ABCD1**QUALITY PROGRAM CONFORMANCE**

All calibrations are performed in accordance with Polycontrols Laboratory Quality Assurance Manual and conform to ISO/IEC 17025: 2017, ISO 9001 – 2015 and/or other quality requirements defined in customers purchase descriptions. The results are strictly valid for the device under test or calibration. If applicable, the decision rule is described in the certificate.

TRACEABILITY

The traceability for flow standard to the National Institute of Standards and Technology, NIST, is maintained by Fluke Corporation of Phoenix, Arizona and conform to ISO/IEC 17025, ANSI/NCSL Z540-1-1994, ISO-10012-1 and MIL-STD 45662A.

The Calibration Laboratory Assessment Service (CLAS) of the National Research Council of Canada (NRC) has assessed and certified specific calibration capabilities of this laboratory and traceability to the International System of Units (SI) or to standards acceptable to the CLAS program. This certificate of calibration is issued in accordance with the conditions of certification granted by CLAS and the conditions of accreditation granted by the Standards Council of Canada (SCC). Neither CLAS nor SCC guarantee the accuracy of individual calibrations by accredited laboratories.

CALIBRATION OF MEASURING AND TEST EQUIPMENT

For calibration measurement capability, please refer to the Canadian Calibration Network web page at the National Research Council of Canada. This laboratory is accredited by the Standards Council of Canada as part of the Calibration Laboratory Assessment Service (CLAS) program and is listed at nrc.canada.ca.

This document forms part of the Certificate of Accreditation issued by the Standards Council of Canada (SCC). The original version is available in the Directory of Accredited Laboratories on the SCC website at www.scc.ca.

CONDITION SUMMARY OF THE DEVICE UNDER TEST

Initial conditions	In good condition
Work done	Cleaning and calibration
Results	Initial readings out of tolerance Final readings in tolerance
Remarks	Calibration frequency every 12 months

Olivier Duchesne Bamber
Metrologist

Laboratory Manager

Calibration certificate # 19893

Serial Number:	ABCD1	Test stand:	1
Calibration Date:	2023-07-17	Procedure:	POS-CAL-002
Instrument ID:		Decision rule:	Method #3

Standard equipment used for initial calibration

Description	Model	Serial #	Traceability	Due date
Fluke molbloc_30 slpm	3E4-VCR-V-Q	2403	1500339201	2023-09-06
Fluke molbloc_5 slpm	5E3-VCR-V-Q	8049	1500349804	2024-03-01
Fluke molbox1+	Molbox1+	2089	1500349737	2024-02-28
Fluke Calibrator	725	1883200	901048	2024-01-12

Initial specifications of the device under test

Calibration conditions

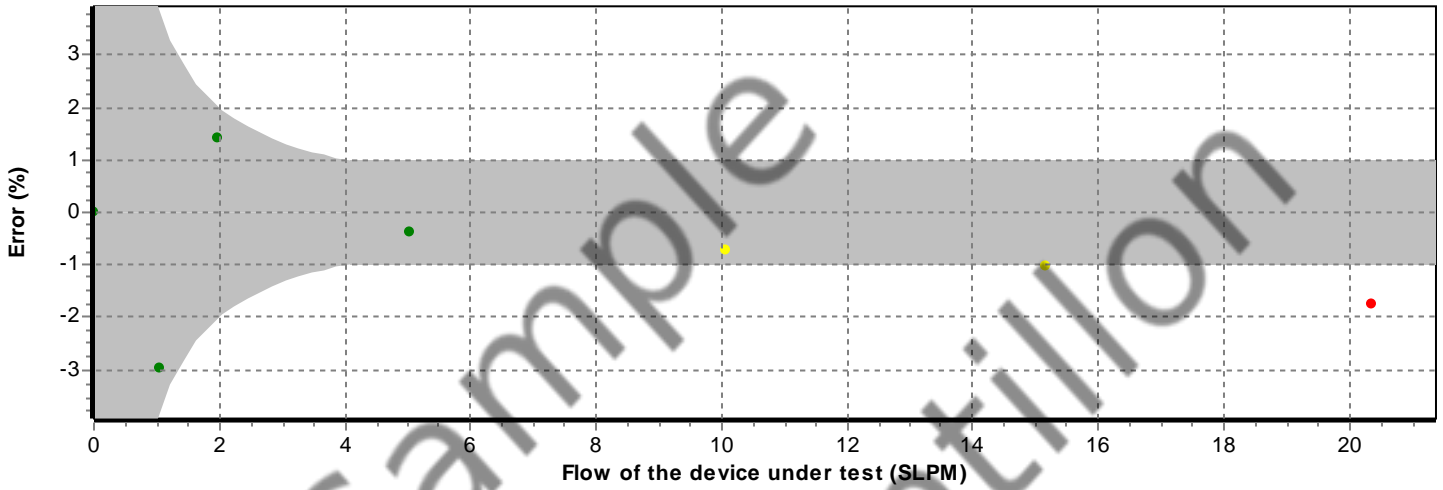
Gas	N2	Gas	N2
Operation temperature	20 °C	Ambient temperature	23.2 °C
Inlet pressure	40 PSIG	Ambient pressure	1003.06 mbar
Outlet pressure	20 PSIG	Gas temperature	22.8 °C
Reference temperature	21.11 °C	Inlet pressure	40 PSIG
Reference pressure	1013.25 mbar	Outlet pressure	20 PSIG
Range	0-20 SLPM	Correction factor	1
Input/Output Signals	4-20 mA	Orientation	Horizontal
Supply	24 VDC	Seals	Viton
Accuracy	±0.2 %F.S. OR ±1 % O.R.	Valve	Viton

Initial readings

Device under test		Flow reference	Calculated Error	Acceptable Error	Uncertainty k = 2	TUR
mA	SLPM	SLPM	SLPM	SLPM	SLPM	
4.002	0.002	0.0000				
4.804	1.005	1.0359	-0.031	0.040	0.0022	>4
5.605	2.006	1.9782	0.028	0.040	0.0041	>4
8.001	5.001	5.0214	-0.020	0.050	0.0152	3.30
11.998	9.997	10.0700	-0.073	0.101	0.0304	3.32
16.000	15.000	15.1548	-0.155	0.152	0.0456	3.32
20.002	20.002	20.3567	-0.355	0.204	0.0613	3.32

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Initial results


See the appendix for the guideline of decision rule

Calibration certificate # 19893

Serial Number:	ABCD1	Test stand:	1
Calibration Date:	2023-07-17	Procedure:	POS-CAL-002
Instrument ID:		Decision rule:	Method #3

Standard equipment used for final calibration

Description	Model	Serial #	Traceability	Due date
Fluke molbloc_30 slpm	3E4-VCR-V-Q	2403	1500339201	2023-09-06
Fluke molbloc_5 slpm	5E3-VCR-V-Q	8049	1500349804	2024-03-01
Fluke molbox1+	Molbox1+	2089	1500349737	2024-02-28
Fluke Calibrator	725	1883200	901048	2024-01-12

Final specifications of the device under test

Calibration conditions

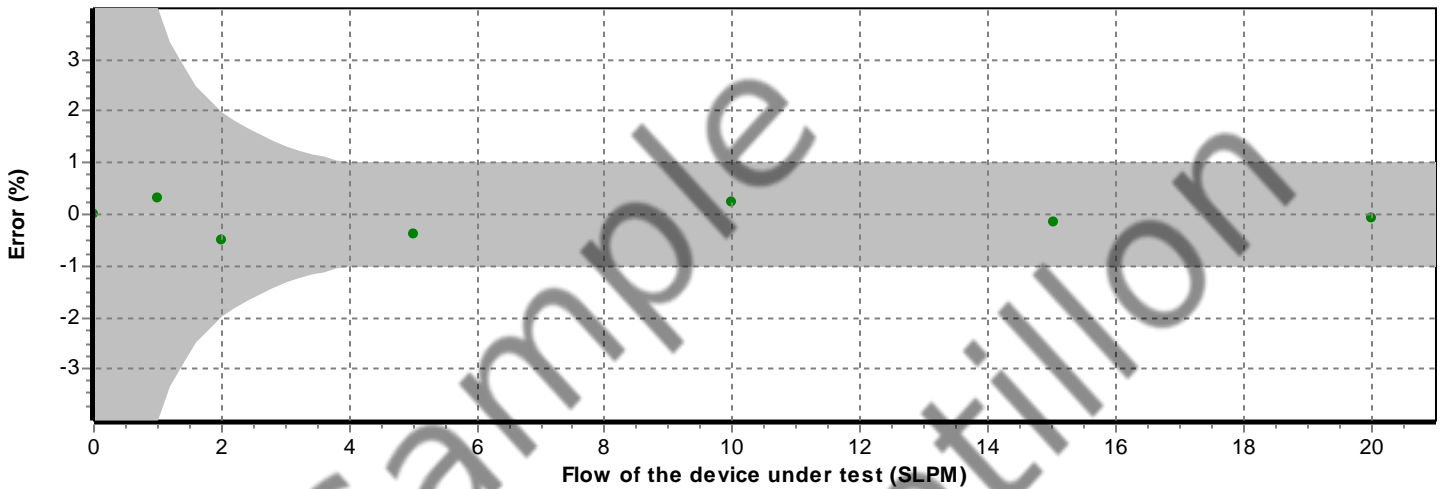
Gas	N2	Gas	N2
Operation temperature	20 °C	Ambient temperature	22.9 °C
Inlet pressure	40 PSIG	Ambient pressure	985.16 mbar
Outlet pressure	20 PSIG	Gas temperature	22.4 °C
Reference temperature	21.11 °C	Inlet pressure	40 PSIG
Reference pressure	1013.25 mbar	Outlet pressure	20 PSIG
Range	0-20 SLPM	Correction factor	1
Input/Output Signals	4-20 mA	Orientation	Horizontal
Supply	24 VDC	Seals	Viton
Accuracy	±0.2 %F.S. OR ±1 % O.R.	Valve	Viton

Final readings

Device under test		Flow reference	Calculated Error	Acceptable Error	Uncertainty k = 2	TUR
mA	SLPM	SLPM	SLPM	SLPM	SLPM	
4.000	0.000	0.0000				
4.800	1.000	0.9974	0.003	0.040	0.0021	>4
5.600	2.000	2.0101	-0.010	0.040	0.0042	>4
7.999	4.999	5.0178	-0.019	0.050	0.0152	3.30
12.002	10.003	9.9776	0.025	0.100	0.0301	3.32
16.000	15.000	15.0249	-0.025	0.150	0.0452	3.32
20.001	20.001	20.0146	-0.014	0.200	0.0602	3.32

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Final results


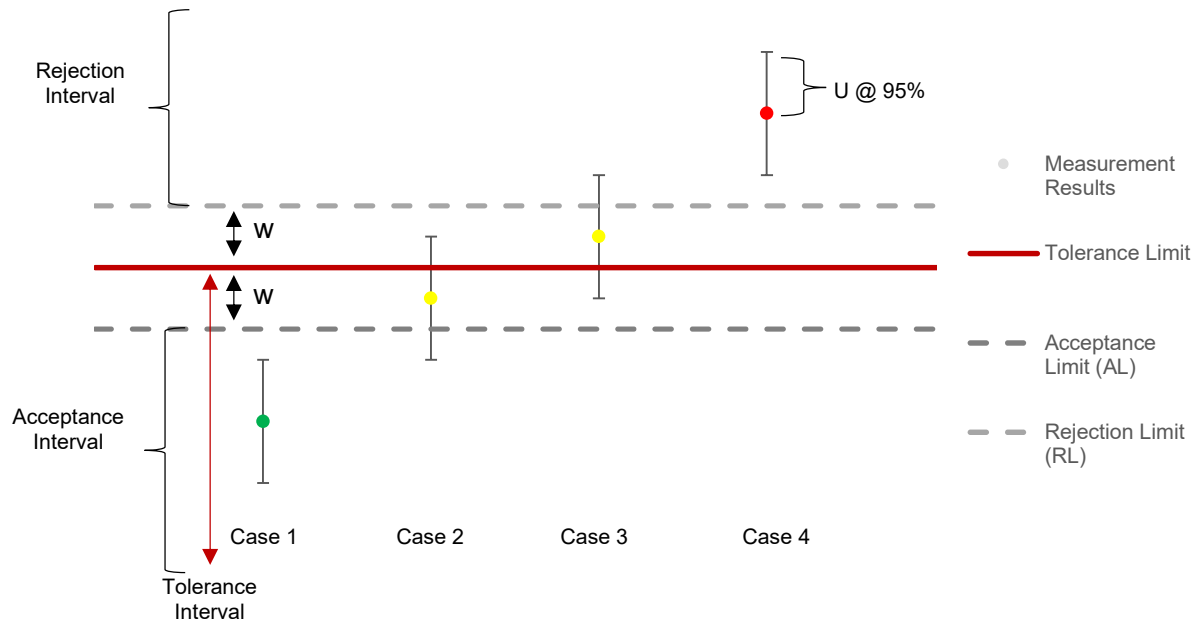
See the appendix for the guideline of decision rule

Appendix for the decision rule

Method #3 Non-binary Statement with Guard Band, uncertainty directly taken into account

This decision rule uses a guard band to define the acceptance and rejection interval. The acceptance limit is defined by the following mathematical formula $AL = TL - w$ and the rejection limit $RL = TL + w$, where $w = rU$. The multiple r that is multiplied by the expanded measurement uncertainty U can be defined following ILAC G8: 2019 table 1 section 5.2. The expanded measurement uncertainty U has a 95% coverage probability ($k = 2$). Non-binary statement with guard band exists when the result is limited to four choices: pass, conditional pass, conditional fail, and fail.

Statements of conformity are reported as:



Graphical representation of a Non-Binary Statement with a Guard Band

Case 1 – Below acceptance limit AL

Status: In tolerance

- The result is inside the acceptance interval. However, assuming a normal distribution, the risk that the result is outside the tolerance limit could be up to 2.5%. Uncertainty is directly taken into account. *Green*.

Case 2 – Below tolerance limit TL, greater than acceptance limit AL

Status: In tolerance-Conditional

- The result is outside the acceptance interval but below tolerance limit. However, the observed value is inside the guard band $w = TL - AL$ and the status is conditional on the customer's risk assessment. Uncertainty is directly taken into account. *Yellow*.

Case 3 – Greater than tolerance limit, below rejection limit RL

Status: Out of tolerance-Conditional

- The result is greater than tolerance limit but outside the rejection interval. However, the observed value is inside the guard band $w = RL - TL$ and the status is conditional on the customer's risk assessment. Uncertainty is directly taken into account. *Yellow*.

Case 4 – Greater than rejection limit RL

Status: Out of tolerance

- The result is inside the rejection interval. Uncertainty is directly taken into account. *Red*.