



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

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CALIBRATION

Valid To: September 30, 2023

Certificate Number: 1741.10

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations^{1, 8}:

I. Chemical

Parameter/Equipment	Range	CMC ² (±)	Comments
pH Meters ³ – Fixed Points	4 pH 7 pH 10 pH	0.04 pH 0.04 pH 0.07 pH	Standard pH solutions

II. Dimensional

Parameter/Equipment	Range	CMC ^{2, 5} (±)	Comments
Pin Gage ³ – Class Z & Class ZZ	Up to 1.0 in	80 μin	Micrometer
Calipers ³	Up to 40 in	(4.5 + 9.9L) μin + 0.6R	Gage blocks
Micrometers ³	Up to 40 in	(4.5 + 9.9L) μin + 0.6R	Gage blocks
Linear Indicators ³ – Dial & Test	Up to 4 in	(3 + 9.4L) μin + 0.6R	Gage blocks
Height Gages ³	Up to 48 in	(53 + 8.9L) μin + 0.6R	Gage blocks w/ surface plate

Parameter/Equipment	Range	CMC ^{2, 5} (\pm)	Comments
Coating Thickness Gages – (Film, Ultrasonic) ³	Up to 20 mil	0.12 mil	Coating thickness standards
Surface Roughness Meters & Profilometers ³	(10 to 200) μ in	1.6 μ in	Precision roughness standard
Steel Rulers ³	Up to 72 in	(1.5 + 10L) μ in + 0.6R	Gage blocks
Tape Measures ³	Up to 25 ft	(1.5 + 10L) μ in + 0.6R	Gage blocks
Angle Indicators & Protractors ³	15°, 30°, 45°, 60°, 75°, 90°	0.03°	Angle block set
Cylindrical Measure – Plain Rings, Pins, Plain Plugs, Discs, Spheres – External Only Diameter	(0.02 to 8) in	(21 + 1.8L) μ in	Mahr 828 ULM
Thread Plugs – Pitch Diameter Major Diameter	(0.02 to 4) in (0.02 to 4) in	76 μ in (16 + 2.1L) μ in	Mahr 828 ULM
Thread Rings – Simple Pitch Diameter	(0.02 to 4) in	260 μ in	Set plugs
Optical Comparator ³ – X-Y Linearity Magnification Angle	Up to 6 in 10x to 250x 0° to 90°	150 μ in 0.014 in 0.1°	Glass master scales Angle block set
Feeler/Thickness Gages ³	Up to 1 in	80 μ in	Micrometer

Parameter/Equipment	Range	CMC ^{2, 5} (\pm)	Comments
Surface Plates ³ – Grades AA, A & B			
Repeatability/Local Flatness	0.002 in	40 μ m	Repeat-o-meter
Flatness	Up to 60 in (>60 to 120) in	(31 + 0.2DL) μ m (30 + 0.3DL) μ m	Federal level systems

III. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2, 4, 6} (\pm)	Comments
DC Voltage ³ – Generate	(0 to 330) mV 330 mV to 3.3 V (3.3 to 33) V (33 to 330) V (100 to 1020) V	73 μ V/V + 3 μ V 61 μ V/V + 5 μ V 61 μ V/V + 50 μ V 67 μ V/V + 500 μ V 69 μ V/V + 1.5 mV	Fluke 5500A
DC Voltage ³ – Measure (Power Sources, Supplies, Hipot Testers)	(0 to 50) mV (50 to 500) mV 500 mV to 5 V (5 to 50) V (50 to 500) V (500 to 1000) V (1 to 6) kV	0.06 % + 0.02 mV 0.03 % + 0.02 mV 0.03 % + 0.2 mV 0.03 % + 2 mV 0.036 % + 20 mV 0.036 % + 0.2 V 1.2 %	Fluke 287 Fluke 80K-6 & DMM
DC Current ³ – Generate	(0 to 3.3) mA (3.3 to 33) mA (33 to 330) mA 330 mA to 2.2 A (2.2 to 11) A	0.016 % + 0.05 μ A 0.013 % + 0.25 μ A 0.013 % + 3.3 μ A 0.037 % + 44 μ A 0.08 % + 330 μ A	Fluke 5500A
DC Current ³ – Measure (Process Devices, Loop Calibrators)	(0 to 5) mA (5 to 50) mA (50 to 400) mA 400 mA to 10 A	0.1 % + 0.2 μ A 0.07 % + 0.01 mA 0.19 % + 0.02 mA 0.37 % + 2 mA	Fluke 287

Parameter/Range	Frequency	CMC ^{2, 4, 6} (±)	Comments
AC Voltage ³ – Generate			
(1 to 33) mV	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	0.43 % + 20 μV 0.19 % + 20 μV 0.25 % + 20 μV 0.31 % + 20 μV 0.43 % + 33 μV 1.2 % + 60 μV	Fluke 5500A
(33 to 330) mV	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	0.3 % + 50 μV 0.06 % + 20 μV 0.12 % + 20 μV 0.2 % + 40 μV 0.29 % + 170 μV 0.84 % + 330 μV	
330 mV to 3.3 V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	0.18 % + 250 μV 0.037 % + 60 μV 0.097 % + 60 μV 0.17 % + 300 μV 0.29 % + 1.7 mV 0.6 % + 3.3 mV	
(3.3 to 33) V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.19 % + 2.5 mV 0.05 % + 600 μV 0.1 % + 2.6 mV 0.23 % + 5 mV 0.29 % + 17 mV	
(33 to 330) V	45 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz	0.06 % + 6.6 mV 0.1 % + 15 mV 0.11 % + 33 mV	
(330 to 1000) V	45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.07 % + 80 mV 0.25 % + 100 mV 0.25 % + 500 mV	

Parameter/Range	Frequency	CMC ^{2, 4, 6} (±)	Comments
AC Voltage ³ – Measure (Hipot Testers)			
(5 to 50) V	(45 to 65) Hz 65 Hz to 10 kHz (10 to 20) kHz	0.37 % + 0.025 V 0.49 % + 0.025 V 0.85 % + 0.04 V	Fluke 287
(50 to 500) V	(45 to 65) Hz 65 Hz to 10 kHz	0.37 % + 0.25 V 0.49 % + 0.25 V	
(500 to 1000) V	(45 to 65) Hz 65 Hz to 10 kHz	0.37 % + 2.5 V 0.49 % + 2.5 V	
(1 to 6) kV	60 Hz	1.2 %	High voltage probe
AC Current ³ – Generate			
(29 to 330) µA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.3 % + 0.15 µA 0.15 % + 0.15 µA 0.15 % + 0.25 µA 0.48 % + 0.15 µA 1.5 % + 0.15 µA	Fluke 5500A
(0.33 to 3.3) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.24 % + 0.3 µA 0.12 % + 0.3 µA 0.12 % + 0.3 µA 0.24 % + 0.3 µA 0.72 % + 0.3 µA	
(3.3 to 33) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.24 % + 3 µA 0.12 % + 3 µA 0.11 % + 3 µA 0.24 % + 3 µA 0.72 % + 3 µA	
(33 to 330) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.24 % + 30 µA 0.12 % + 30 µA 0.11 % + 30 µA 0.24 % + 30 µA 0.72 % + 30 µA	
330 mA to 2.2 A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz	0.24 % + 300 µA 0.12 % + 300 µA 0.9 % + 300 µA	
(2.2 to 11) A	(45 to 65) Hz (65 to 500) Hz 500 Hz to 1 kHz	0.08 % + 2 mA 0.12 % + 2 mA 0.4 % + 2 mA	

Parameter/Range	Frequency	CMC ^{2, 4, 6} (±)	Comments
AC Current ³ – Measure (0 to 500) μA (0.5 to 5) mA (5 to 50) mA (50 to 400) mA (0.4 to 10) A	45 Hz to 1 kHz 45 Hz to 1 kHz 45 Hz to 1 kHz 45 Hz to 1 kHz 45 Hz to 1 kHz	0.74 % + 0.2 μA 0.74 % + 0.5 μA 0.73 % + 0.02 mA 0.73 % + 0.05 mA 0.97 % + 5 mA	Fluke 287
Capacitance ³ – Generate (0.33 to 11) nF (11 to 110) nF (110 to 330) nF (0.33 to 1.1) μF (1.1 to 3.3) μF (3.3 to 11) μF (11 to 33) μF (33 to 110) μF (110 to 330) μF 330 μF to 1.1 mF	(50 to 1000) Hz (50 to 1000) Hz (50 to 1000) Hz (50 to 1000) Hz (50 to 1000) Hz (50 to 400) Hz (50 to 400) Hz (50 to 200) Hz (50 to 100) Hz (50 to 100) Hz	1 % + 0.01 nF 0.32 % + 0.1 nF 0.32 % + 0.3 nF 0.32 % + 1 nF 0.43 % + 3 nF 0.44 % + 10 nF 0.5 % + 30 nF 0.63 % + 100 nF 0.86 % + 300 nF 1.3 % + 300 nF	Fluke 5500A

Parameter/Equipment	Range	CMC ^{2, 4, 6} (±)	Comments
Resistance ³ – Generate	(0 to 11) Ω (11 to 33) Ω (33 to 330) Ω 330 Ω to 3.3 kΩ (3.3 to 33) kΩ (33 to 110) kΩ (110 to 330) kΩ 330 kΩ to 3.3 MΩ (3.3 to 11) MΩ (11 to 33) MΩ (33 to 110) MΩ (110 to 330) MΩ	0.015 % + 0.008 Ω 0.015 % + 0.015 Ω 0.011 % + 0.015 Ω 0.011 % + 0.06 Ω 0.011 % + 0.6 Ω 0.014 % + 6 Ω 0.015 % + 6 Ω 0.019 % + 55 Ω 0.073 % + 550 Ω 0.12 % + 550 Ω 0.61 % + 5.5 kΩ 0.61 % + 17 kΩ	Fluke 5500A

Parameter/Equipment	Range	CMC ^{2, 4, 6} (\pm)	Comments
Resistance – Measure ³	(0 to 50) Ω (50 to 500) Ω (500 to 5000) Ω (5 to 50) k Ω (50 to 500) k Ω 500 k Ω to 5 M Ω (5 to 30) M Ω (30 to 50) M Ω (50 to 100) M Ω	0.18 % + 0.02 Ω 0.06 % + 0.1 Ω 0.06 % + 0.2 Ω 0.06 % + 2 Ω 0.06 % + 20 Ω 0.19 % + 400 Ω 1.8 % + 4 k Ω 1.8 % + 40 k Ω 3.6 % + 200 k Ω	Fluke 287
Electrical Simulation of Temperature Displays & Readouts ³ –			
Type E	(-250 to -100) °C (-100 to 650) °C (650 to 1000) °C	0.64 °C 0.38 °C 0.34 °C	Fluke 5500A
Type J	(-210 to -100) °C (-100 to 760) °C (760 to 1200) °C	0.4 °C 0.31 °C 0.36 °C	
Type K	(-200 to -100) °C (-100 to 1000) °C (1000 to 1372) °C	0.46 °C 0.39 °C 0.53 °C	
Type R	(0 to 250) °C (250 to 1000) °C (1000 to 1767) °C	0.72 °C 0.48 °C 0.53 °C	
Type S	(0 to 250) °C (250 to 1400) °C (1400 to 1767) °C	0.61 °C 0.5 °C 0.6 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 400) °C	0.79 °C 0.37 °C 0.3 °C	
Electrical Calibration of RTDs ³ –			
Generate	(-200 to 0) °C (0 to 400) °C (400 to 800) °C	0.13 °C 0.25 °C 0.49 °C	Beamex MC2-MF
Measure	(-200 to 0) °C (0 to 400) °C (400 to 800) °C	0.37 °C 0.61 °C 0.97 °C	

IV. Mechanical

Parameter/Equipment	Range	CMC ^{2, 5, 6, 7} (\pm)	Comments
Scales & Balances ³	(1 to 20 000) g (>20 to 5000) kg Up to 1000 lb (1000 to 120 000) lb	0.017 % + 0.6R 0.017 % per 20 000 g + 0.6R 0.017 % + 0.6R 0.017 % per 20 000 lb + 0.6R	Class F weights (applied load)
	(1 to 5) g Up to 10 g Up to 30 g Up to 50 g Up to 100 g Up to 200 g Up to 300 g Up to 500 g Up to 1000 g >1000 g	0.043 mg + 0.6R 0.062 mg + 0.6R 0.092 mg + 0.6R 0.17 mg + 0.6R 0.31 mg + 0.6R 0.63 mg + 0.6R 0.93 mg + 0.6R 1.5 mg + 0.6R 3.1 mg + 0.6R 3.1 mg per 1000 g + 0.6R	ASTM Class 1 weights (applied load)
Force ³ – Measuring Equipment	Up to 1000 lb	0.017 % + 0.6R	ASTM class F weights
	Up to 10 000 lb	0.32 % of Applied Force	Load cells w/ indicator
Torque ³ – Measuring Equipment (Wrenches)	5 in·lbf to 600 ft·lbf	0.65 %	CDI Suretest 5000- ST
Torque Transducers & Analyzers	Up to 250 ft·lbf	0.13 %	Torque arms & weights
Pressure ³ – Measuring Equipment	(0.01 to 300) psig	0.07 % Full Scale	Beamex MC2- IPM20C
	(0 to 3000) psig	0.07 % Full Scale	Druck DPI-3000
	(5 to 10 000) psig	0.07 % Full Scale	Druck DPI-10K
Atmospheric Pressure (Vacuum) ³	(0.01 to 30) in·Hg	0.02 in·Hg	Beamex MC2- IPM2C

Parameter/Equipment	Range	CMC ² (±)	Comments
Indirect Verification of Rockwell Hardness Testers ³	HRA		Indirect verification per ASTM E18
	Low	0.81 HRA	
	Medium	0.81 HRA	
	High	0.81 HRA	
	HRBW		
	Low	0.82 HRBW	
	Medium	0.81 HRBW	
	High	0.81 HRBW	
	HRC		
	Low	0.85 HRC	
	Medium	0.84 HRC	
	High	0.81 HRC	
	HREW		
	Low	0.82 HREW	
	Medium	0.81 HREW	
	High	0.81 HREW	
	HR15N		
	Low	0.81 HR15N	
	Medium	0.82 HR15N	
	High	0.81 HR15N	
	HR30N		
	Low	0.82 HR30N	
	Medium	0.82 HR30N	
	High	0.82 HR30N	
HR45N			
Low	0.82 HR45N		
Medium	0.81 HR45N		
High	0.82 HR45N		
HR15TW			
Low	0.81 HR15TW		
Medium	0.81 HR15TW		
High	0.82 HR15TW		
HR30TW			
Low	0.81 HR30TW		
Medium	0.82 HR30TW		
High	0.81 HR30TW		

Parameter/Equipment	Range	CMC ² (±)	Comments
Indirect Verification of Rockwell Hardness Testers ³ (cont)	HR45TW Low Medium High	0.81 HR45TW 0.81 HR45TW 0.81 HR45TW	Indirect verification per ASTM E18

V. Thermodynamics

Parameter/Equipment	Range	CMC ^{2,7} (±)	Comments
Relative Humidity ³ – Measure	(10 to 90) % RH	1.2 % RH	Vaisala M170 w/ HMP-76
Temperature ³ – Measure	-196 °C to 420 °C	0.34 °C	Beamex w/ PRT

VI. Time & Frequency

Parameter/Equipment	Range	CMC ² (±)	Comments
Timers & Stopwatches ³	(1 to 3600) s	0.2 s	Stopwatch
Frequency – Generate	0.01 Hz to 2 MHz	31 µHz/Hz + 15mHz	Fluke 5500A

¹ This laboratory offers commercial calibration and field calibration services, where noted.

² Calibration and Measurement Capability Uncertainty (CMC) is the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation when performing more or less routine calibrations of nearly ideal measurement standards or nearly ideal measuring equipment. CMCs represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of $k = 2$. The actual measurement uncertainty of a specific calibration performed by the laboratory may be greater than the CMC due to the behavior of the customer's device and to influences from the circumstances of the specific calibration.

³ Field calibration service is available for this calibration. Please note the actual measurement uncertainties achievable on a customer's site can normally be expected to be larger than the CMC found on the A2LA Scope. Allowance must be made for aspects such as the environment at the place of calibration and for other possible adverse effects such as those caused by transportation of the calibration equipment. The usual allowance for the actual uncertainty introduced by the item being calibrated, (e.g. resolution) must also be considered and this, on its own, could result in the actual measurement uncertainty achievable on a customer's site being larger than the CMC.

⁴ The stated measured values are determined using the indicated instrument (see Comments). This capability is suitable for the calibration of the devices intended to measure or generate the measured value in the ranges indicated. CMCs are expressed as either a specific value that covers the full range or as a fraction/percentage of the reading plus a fixed floor specification.

⁵ In the statement of CMC, L is the numerical value of the nominal length of the device measured in inches, R is the numerical value of the resolution of the device in micro inches, and DL is the length of the diagonal in inches.

⁶ In the statement of CMC, percentages are percentage of reading, unless otherwise indicated.

⁷ The type of instrument or material being calibrated is defined by the parameter. This indicates the laboratory is capable of calibrating instruments that measure or generate the values in the ranges indicated for the listed measurement parameter.

⁸ This scope meets A2LA's *P112 Flexible Scope Policy*.



Accredited Laboratory

A2LA has accredited

CROSS TECHNOLOGIES, INC. dba CROSS (FORMERLY J.A. KING)

Des Moines, IA

for technical competence in the field of

Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets the requirements of R205 – Specific Requirements: Calibration Laboratory Accreditation Program. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).



Presented this 16th day of September 2021.

A blue ink signature of the Vice President of Accreditation Services.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 1741.10
Valid to September 30, 2023

For the calibrations to which this accreditation applies, please refer to the laboratory's Calibration Scope of Accreditation.