



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005
& ANSI/NCSL Z540-1-1994

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CALIBRATION

Valid To: November 30, 2018

Certificate Number: 2489.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations¹:

I. Dimensional

Parameter/Equipment	Range	CMC ^{2,3} (±)	Comments
Micrometers – Inside Outside	Up to 12 in Up to 12 in	(300 + 150L + 0.60R) μin (340 + 44L + 0.60R) μin	Comparison to gage blocks
Calipers	Up to 12 in	(340 + 44L + 0.60R) μin	Comparison to gage blocks
Dial Indicators	Up to 2 in	(90 + 14L + 0.60R) μin	Comparison to gage blocks
Depth Gages	Up to 12 in	(430 + 83L + 0.60R) μin	Comparison to gage blocks

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
DC Voltage – Generate	(0 to 220) mV (0.22 to 2.2) V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1100) V	19 $\mu\text{V}/\text{V}$ + 0.50 μV 12 $\mu\text{V}/\text{V}$ + 1.2 μV 4.8 $\mu\text{V}/\text{V}$ + 5.1 μV 9.4 $\mu\text{V}/\text{V}$ + 6.7 μV 14 $\mu\text{V}/\text{V}$ + 48 μV 7.6 $\mu\text{V}/\text{V}$ + 1.2 mV	Fluke 5720A
DC Current – Generate	(0 to 220) μA (0.22 to 2.2) mA (2.2 to 22) mA (22 to 220) mA (0.22 to 2.2) A	46 $\mu\text{A}/\text{A}$ + 8.0 nA 51 $\mu\text{A}/\text{A}$ + 59 nA 50 $\mu\text{A}/\text{A}$ + 0.12 μA 70 $\mu\text{A}/\text{A}$ + 1.4 μA 0.018 % + 23 μA	Fluke 5720A
DC Voltage – Measure	(0 to 200) mV (0.2 to 2) V (2 to 20) V (20 to 200) V (200 to 1000) V	13 $\mu\text{V}/\text{V}$ + 0.20 μV 6.1 $\mu\text{V}/\text{V}$ + 0.50 μV 5.7 $\mu\text{V}/\text{V}$ + 5.0 μV 8.6 $\mu\text{V}/\text{V}$ + 43 μV 7.0 $\mu\text{V}/\text{V}$ + 0.53 mV	Fluke 8508A
DC Current – Measure	(0 to 200) μA (0.2 to 2) mA (2 to 20) mA (20 to 200) mA (0.2 to 2) A (2 to 20) A	23 $\mu\text{A}/\text{A}$ + 1.0 nA 23 $\mu\text{A}/\text{A}$ + 5.0 nA 29 $\mu\text{A}/\text{A}$ + 41 nA 69 $\mu\text{A}/\text{A}$ + 0.90 μA 0.032 % + 17 μA 0.071 % + 0.50 mA	Fluke 8508A
Capacitance – Generate	(0.33 to 0.4999) nF (0.5 to 1.0999) nF (1.1 to 3.2999) nF (3.3 to 10.999) nF (11 to 32.999) nF (33 to 109.99) nF (110 to 329.99) nF (0.33 to 1.0999) μF (1.1 to 3.2999) μF (3.3 to 10.999) μF (11 to 32.999) μF (33 to 109.99) μF (110 to 329.99) μF (0.33 to 1.1) mF	0.57 % + 0.020 nF 1.1 % + 0.020 nF 0.86 % + 0.020 nF 0.69 % + 0.020 nF 0.65 % + 0.20 nF 0.40 % + 0.20 nF 0.40 % + 0.40 nF 0.40 % + 2.0 nF 0.57 % + 4.0 nF 0.52 % + 12 nF 0.60 % + 36 nF 0.75 % + 120 nF 1.1 % + 380 nF 1.4 % + 570 nF	Fluke 5520A

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Resistance – Measure	(0 to 2) Ω (2 to 20) Ω (20 to 200) Ω 200 Ω to 2 kΩ (2 to 20) kΩ (20 to 200) kΩ (0.2 to 2) MΩ (2 to 20) MΩ (20 to 200) MΩ (0.2 to 2) GΩ	37 μΩ 0.21 mΩ 1.7 mΩ 18 mΩ 0.17 Ω 1.7 Ω 21 Ω 430 Ω 23 kΩ 2.1 MΩ	Fluke 8508A
Resistance – Generate	<p>Fixed Points</p> 100 kΩ 190 kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	1.3 Ω 2.5 Ω 24 Ω 48 Ω 0.50 kΩ 1.1 kΩ 12 kΩ	Fluke 5720A
4 Wire	0 Ω 1 Ω 1.9 Ω 10 Ω 19 Ω 100 Ω 190 Ω 1 kΩ 1.9 kΩ 10 kΩ 19 kΩ	74 μΩ 0.11 mΩ 0.21 mΩ 0.27 mΩ 0.51 mΩ 1.2 mΩ 2.3 mΩ 10 mΩ 19 mΩ 0.10 Ω 0.20 Ω	
Temperature – RTD Simulated Generate	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 800) °C	0.050 °C 0.067 °C 0.077 °C 0.089 °C 0.12 °C 0.14 °C 0.17 °C	ESI RS925D (based on platinum RTD 385)

Parameter/Equipment	Range	CMC ² (±)	Comments
Electrical Calibration of Thermocouple Indication Systems –			
Type B	(600 to 800) °C (800 to 1000) °C (1000 to 1550) °C (1550 to 1820) °C	0.52 °C 0.40 °C 0.35 °C 0.39 °C	Fluke 5520A
Type E	(-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C	0.58 °C 0.19 °C 0.17 °C 0.19 °C 0.25 °C	
Type J	(-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1200) °C	0.32 °C 0.19 °C 0.17 °C 0.21 °C 0.27 °C	
Type K	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.39 °C 0.22 °C 0.19 °C 0.31 °C 0.47 °C	
Type N	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1300) °C	0.47 °C 0.26 °C 0.23 °C 0.22 °C 0.32 °C	
Type R	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.66 °C 0.41 °C 0.39 °C 0.47 °C	
Type S	(0 to 250) °C (250 to 1000) °C (1000 to 1400) °C (1400 to 1767) °C	0.55 °C 0.42 °C 0.43 °C 0.54 °C	
Type T	(-250 to 150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.73 °C 0.28 °C 0.19 °C 0.17 °C	

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Voltage – Measure			
(0 to 200) mV	10 Hz to 30 kHz (30 to 100) kHz	0.040 % + 12 μV 0.10 % + 26 μV	Fluke 8508A
(0.2 to 2) V	10 Hz to 30 kHz (30 to 100) kHz 100 kHz to 1 MHz	0.024 % + 20 μV 0.060 % + 0.30 mV 1.8 % + 27 mV	
(20 to 20) V	10 Hz to 30 kHz (30 to 100) kHz 100 kHz to 1 MHz	0.23 % + 270 μV 0.060 % + 3.0 mV 1.9 % + 0.30 V	
(20 to 200) V	10 Hz to 30 kHz (30 to 100) kHz	0.024 % + 5.3 mV 0.060 % + 30 mV	
(200 to 1000) V	10 Hz to 10 kHz (10 to 30) kHz	0.050 % + 27 mV 0.30 % + 27 mV	
AC Voltage – Generate			
(0 to 2.2) mV	10 Hz to 100 kHz 100 kHz to 1 MHz	0.47 % + 6.0 μV 2.6 % + 25 μV	Fluke 5720A
(2.2 to 22) mV	10 Hz to 100 kHz 100 kHz to 1 MHz	0.050 % + 7.0 μV 0.28 % + 24 μV	
(22 to 220) mV	10 Hz to 100 kHz 100 kHz to 1 MHz	0.047 % + 21 μV 0.28 % + 68 μV	
(0.22 to 2.2) V	10 Hz to 100 kHz 100 kHz to 1 MHz	0.029 % + 39 μV 0.20 % + 520 μV	
(2.2 to 22) V	10 Hz to 100 kHz 100 kHz to 1 MHz	0.030 % + 290 μV 0.17 % + 6.4 mV	
(22 to 220) V	10 Hz to 100 kHz	0.018 % + 4.0 mV	
(220 to 1100) V	15 Hz to 1 kHz	0.023 % + 13 mV	

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Current – Measure			
(0 to 200) µA	10 Hz to 10 kHz	0.042 % + 48 nA	Fluke 8508A
(0.2 to 2) mA	10 Hz to 10 kHz	0.052 % + 210 nA	
(2 to 20) mA	10 Hz to 10 kHz	0.045 % + 3.1 µA	
(20 to 200) mA	10 Hz to 10 kHz	0.043 % + 27 µA	
(0.2 to 2) A	10 Hz to 10 kHz	1.7 mA/A + 240 µA	
(2 to 20) A	10 Hz to 10 kHz	4.4 mA/A + 3.0 mA	
AC Current – Generate			
(9 to 220) µA	10 Hz to 5 kHz (5 to 10) kHz	0.070 % + 24 nA 0.16 % + 0.10 µA	Comparison to a multifunction calibrator Fluke 5720A
(0.22 to 2.2) mA	10 Hz to 5 kHz (5 to 10) kHz	0.024 % + 200 nA 0.14 % + 1.0 µA	
(2.2 to 22) mA	10 Hz to 5 kHz (5 to 10) kHz	0.022 % + 1.7 µA 0.13 % + 8.6 µA	
(22 to 220) mA	10 Hz to 5 kHz (5 to 10) kHz	0.022 % + 15 µA 0.13 % + 45 µA	
(0.22 to 2.2) A	20 Hz to 5 kHz (5 to 10) kHz	0.048 % + 250 µA 0.83 % + 460 µA	

III. Fluid Quantities

Parameter/Equipment	Range	CMC ² (±)	Comments
Flow – Air	(1 to 20) sccm (20 to 50) sccm (50 to 100) sccm (100 to 150) sccm (150 to 200) sccm (0.2 to 0.5) slm (0.5 to 1) slm (1 to 1.5) slm (1.5 to 2) slm (2 to 5) slm (5 to 10) slm (10 to 15) slm (15 to 20) slm (20 to 25) slm (25 to 30) slm (30 to 35) slm (35 to 40) slm (40 to 50) slm (50 to 60) slm (60 to 70) slm (70 to 80) slm (80 to 90) slm (90 to 100) slm (100 to 125) slm (125 to 150) slm (150 to 175) slm (175 to 200) slm (200 to 225) slm (225 to 250) slm (250 to 300) slm (300 to 400) slm (400 to 500) slm (500 to 600) slm (600 to 700) slm (700 to 800) slm (800 to 900) slm (900 to 1000) slm	0.050 sccm 0.12 sccm 0.23 sccm 0.35 sccm 0.46 sccm 0.0020 slm 0.0030 slm 0.0040 slm 0.0050 slm 0.060 slm 0.11 slm 0.16 slm 0.22 slm 0.070 slm 0.090 slm 0.10 slm 0.12 slm 0.12 slm 0.14 slm 0.16 slm 0.18 slm 0.21 slm 0.23 slm 0.30 slm 0.36 slm 0.42 slm 0.48 slm 0.54 slm 0.59 slm 0.71 slm 0.95 slm 1.2 slm 1.5 slm 1.7 slm 1.9 slm 2.2 slm 2.4 slm	DH Molbloc system

IV. Mechanical

Parameter/Equipment	Range	CMC ² (±)	Comments
Vacuum – Measure & Measuring Equipment	Up to 1000 µm Hg	1.0 % of reading	MKS 660B/627B direct reading vacuum gage
	(1 to 10) mm Hg	0.50 % of reading	MKS 660B/626A direct reading vacuum gage
Scales and Balances – Fixed Values (0 to 20) kg*	(1 to 500) mg 1 g 2 g 5 g 10 g 20 g 50 g 100 g 200 g 500 g 1 kg 2 kg 5 kg	0.14 mg 0.16 mg 0.19 mg 0.24 mg 0.29 mg 0.38 mg 0.63 mg 1.1 mg 2.1 mg 7.8 mg 15 mg 23 mg 53 mg	Class 3 weights *fixed values uncertainties are per weight
(0 to 2500) lb*	0.5 lb 1 lb 2 lb 5 lb 10 lb 20 lb 50 lb	0.00011 lb 0.00016 lb 0.00021 lb 0.00052 lb 0.0011 lb 0.0022 lb 0.0053 lb	Class F weights *fixed values uncertainties are per weight
Pressure – Measure & Measuring Equipment Pneumatic	(2.5 to 9.5) psig (9.5 to 1023) psig	80 parts in 10 ⁶ psig 45 parts in 10 ⁶ psig	2465 piston gauge

Parameter/Equipment	Range	CMC ² (±)	Comments
Pressure – Measure & Measuring Equipment (cont)			
Hydraulic Only	(1000 to 22 000) psig	45 parts in 10 ⁶ psig	DHI PG7302
Torque – Measuring Equipment			
Counter Clockwise & Clockwise	(1.25 to 4) in·lbf (4 to 8) in·lbf (8 to 12) in·lbf (12 to 16) in·lbf (16 to 20) in·lbf (20 to 40) in·lbf (40 to 60) in·lbf (60 to 80) in·lbf (80 to 100) in·lbf (100 to 120) in·lbf (10 to 20) ft·lbf (20 to 40) ft·lbf (40 to 60) ft·lbf (60 to 80) ft·lbf (80 to 100) ft·lbf (100 to 120) ft·lbf (120 to 180) ft·lbf (180 to 240) ft·lbf (240 to 300) ft·lbf (300 to 400) ft·lbf (400 to 600) ft·lbf (600 to 800) ft·lbf (800 to 1000) ft·lbf (1000 to 1600) ft·lbf (1600 to 2400) ft·lbf (2400 to 3200) ft·lbf (3200 to 4000) ft·lbf (4000 to 5200) ft·lbf (5200 to 6500) ft·lbf	0.10 in·lbf 0.10 in·lbf 0.13 in·lbf 0.14 in·lbf 0.16 in·lbf 0.21 in·lbf 0.49 in·lbf 0.65 in·lbf 0.81 in·lbf 0.97 in·lbf 0.16 ft·lbf 0.32 ft·lbf 0.49 ft·lbf 0.65 ft·lbf 0.81 ft·lbf 0.97 ft·lbf 1.5 ft·lbf 2.0 ft·lbf 2.5 ft·lbf 3.3 ft·lbf 4.9 ft·lbf 6.5 ft·lbf 8.1 ft·lbf 13 ft·lbf 20 ft·lbf 26 ft·lbf 33 ft·lbf 42 ft·lbf 53 ft·lbf	Torque arms & class F weights

Parameter/Equipment	Range	CMC ² (±)	Comments
Torque – Measuring Equipment (cont) Clockwise Only	(6500 to 8000) ft·lbf (8000 to 12 000) ft·lbf (12 000 to 16 000) ft·lbf (16 000 to 20 000) ft·lbf	95 ft·lbf 150 ft·lbf 190 ft·lbf 240 ft·lbf	Torque arms & class F weights
Torque Wrenches & Hand Tools	(1.25 to 120) in·lbf (10 to 300) ft·lbf (300 to 1000) ft·lbf (1000 to 4000) ft·lbf	2.8 in·lbf 2.8 ft·lbf 8.2 ft·lbf 78 ft·lbf	AKO torque transducers & test stand

V. Thermodynamics

Parameter/Equipment	Range	CMC ² (±)	Comments
Temperature – Measure	(-20 to 0) °C (0 to 300) °C (300 to 500) °C (500 to 550) °C	0.030 °C 0.040 °C 0.040 °C 0.040 °C	Circulating bath/SPRT

VI. Time & Frequency

Parameter/Equipment	Range	CMC ² (±)	Comments
Frequency – Measuring Equipment	1 Hz to 80 MHz 10 MHz	4.4 mHz 6.8 pHz/Hz	Fluke 910R/ synthesizer
Frequency – Measure	1 Hz to 100 kHz 100 kHz to 1 MHz (1 to 100) MHz (100 to 225) MHz	14 μHz 150 μHz 6.8 mHz 17 mHz	Fluke 910R /counter

¹ This laboratory offers commercial calibration service.

² Calibration and Measurement Capability (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. Calibration and Measurement Capabilities 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 In the statement of CMC, L is the numerical value of the nominal length of the device measured in inches and R is the value of the resolution of the device in microinches.

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. CMC 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.



Accredited Laboratory

A2LA has accredited

FIRSTENERGY BETA LABORATORY

Mayfield Village, OH

for technical competence in the field of

Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994 and 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 8 January 2009).



Presented this 7th day of February 2017.

A handwritten signature in black ink, written over a horizontal line.

President and CEO
For the Accreditation Council
Certificate Number 2489.01
Valid to November 30, 2018

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