



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

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CALIBRATION

Valid To: September 30, 2019

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:

I. Dimensional

Parameter/Equipment	Range	CMC <sup>2,5</sup> (±)	Comments
Pin Gage <sup>3</sup> – Class Z & Class ZZ	Up to 1.0 in	80 μin	Micrometer
Calipers <sup>3</sup>	Up to 40 in	(4.5 + 9.9L) μin + 0.6R	Gage blocks
Micrometers <sup>3</sup>	Up to 40 in	(4.5 + 9.9L) μin + 0.6R	Gage blocks
Linear Indicators <sup>3</sup> – Dial & Test	Up to 4 in	(3 + 9.4L) μin + 0.6R	Gage blocks
Height Gages <sup>3</sup>	Up to 48 in	(53 + 8.9L) μin + 0.6R	Gage blocks w/ surface plate
Steel Rules <sup>3</sup>	Up to 72 in	(1.5 + 10L) μin + 0.6R	Gage blocks
Tape Measures <sup>3</sup>	Up to 25 ft	(1.5 + 10L) μin + 0.6R	Gage blocks
Angle Indicators & Protractors <sup>3</sup>	15°, 30°, 45°, 60°, 75°, 90°	0.03°	Angle block set

Parameter/Equipment	Range	CMC <sup>2, 5</sup> (±)	Comments
Optical Comparator <sup>3</sup> – X-Y Linearity Magnification Angle	Up to 6 in 10x to 250x 0° to 90°	150 µin 0.014 in 0.1°	Glass master scales  Angle block set
Feeler/Thickness Gages <sup>3</sup>	Up to 1 in	80 µin	Micrometer
Surface Plates <sup>3</sup> – Grades AA, A & B  Repeatability/Local Flatness  Flatness	0.002 in  Up to 60 in (>60 to 120) in	40 µin  (31 + 0.2DL) µin (30 + 0.3DL) µin	Repeat-o-meter  Federal level systems

## II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC <sup>2, 4, 6</sup> (±)	Comments
DC Voltage <sup>3</sup> – 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 µV/V + 3 µV 61 µV/V + 5 µV 61 µV/V + 50 µV 67 µV/V + 500 µV 69 µV/V + 1.5 mV	Fluke 5500A
DC Voltage <sup>3</sup> – 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

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
DC Current <sup>3</sup> – 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 µA 0.013 % + 0.25 µA 0.013 % + 3.3 µA 0.037 % + 44 µA 0.08 % + 330 µA	Fluke 5500A
DC Current <sup>3</sup> – 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 µA 0.07 % + 0.01 mA 0.19 % + 0.02 mA 0.37 % + 2 mA	Fluke 287

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
AC Voltage <sup>3</sup> – 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	

Parameter/Range	Frequency	CMC <sup>2,4,6</sup> (±)	Comments
AC Voltage <sup>3</sup> – Generate (cont)			
(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	Fluke 5500A
(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	
AC Voltage <sup>3</sup> – Measure (Hipot Testers)			
(5 to 50) V	(45 to 65) Hz 65 Hz to 10 kHz (10 to 20) kHz	0.37 % + 0.025V 0.49 % + 0.025V 0.85 % + 0.04V	Fluke 287
(50 to 500) V	(45 to 65) Hz 65 Hz to 10 kHz	0.37 % + 0.25V 0.49 % + 0.25V	
(500 to 1000) V	(45 to 65) Hz 65 Hz to 10 kHz	0.37 % + 2.5V 0.49 % + 2.5V	
(1 to 6) kV	60 Hz	1.2 %	High voltage probe
AC Current <sup>3</sup> – 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	

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
AC Current <sup>3</sup> – Generate (cont)			
(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	Fluke 5500A
(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	
AC Current <sup>3</sup> – Measure			
(0 to 500) µA	45 Hz to 1 kHz	0.74 % + 0.2 µA	Fluke 287
(0.5 to 5) mA	45 Hz to 1 kHz	0.74 % + 0.5 µA	
(5 to 50) mA	45 Hz to 1 kHz	0.73 % + 0.02 mA	
(50 to 400) mA	45 Hz to 1 kHz	0.73 % + 0.05 mA	
(0.4 to 10) A	45 Hz to 1 kHz	0.97 % + 5 mA	

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
Capacitance <sup>3</sup> – Generate			Fluke 5500A
(0.33 to 11) nF	(50 to 1000) Hz	1 % + 0.01 nF	
(11 to 110) nF	(50 to 1000) Hz	0.32 % + 0.1 nF	
(110 to 330) nF	(50 to 1000) Hz	0.32 % + 0.3 nF	
(0.33 to 1.1) μF	(50 to 1000) Hz	0.32 % + 1 nF	
(1.1 to 3.3) μF	(50 to 1000) Hz	0.43 % + 3 nF	
(3.3 to 11) μF	(50 to 400) Hz	0.44 % + 10 nF	
(11 to 33) μF	(50 to 400) Hz	0.5 % + 30 nF	
(33 to 110) μF	(50 to 200) Hz	0.63 % + 100 nF	
(110 to 330) μF	(50 to 100) Hz	0.86 % + 300 nF	
330 μF to 1.1 mF	(50 to 100) Hz	1.3 % + 300 nF	

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
Resistance <sup>3</sup> – Generate			Fluke 5500A
	(0 to 11) Ω	0.015 % + 0.008 Ω	
	(11 to 33) Ω	0.015 % + 0.015 Ω	
	(33 to 330) Ω	0.011 % + 0.015 Ω	
	330 Ω to 3.3 kΩ	0.011 % + 0.06 Ω	
	(3.3 to 33) kΩ	0.011 % + 0.6 Ω	
	(33 to 110) kΩ	0.014 % + 6 Ω	
	(110 to 330) kΩ	0.015 % + 6 Ω	
	330 kΩ to 3.3 MΩ	0.019 % + 55 Ω	
	(3.3 to 11) MΩ	0.073% + 550 Ω	
	(11 to 33) MΩ	0.12 % + 550 Ω	
	(33 to 110) MΩ	0.61 % + 5.5 kΩ	
	(110 to 330) MΩ	0.61 % + 17 kΩ	
Resistance – Measure <sup>3</sup>			Fluke 287
	(0 to 50) Ω	0.18 % + 0.02 Ω	
	(50 to 500) Ω	0.06 % + 0.1 Ω	
	(500 to 5000) Ω	0.06 % + 0.2 Ω	
	(5 to 50) kΩ	0.06 % + 2 Ω	
	(50 to 500) kΩ	0.06 % + 20 Ω	
	500 kΩ to 5 MΩ	0.19 % + 400 Ω	
	(5 to 30) MΩ	1.8 % + 4 kΩ	
	(30 to 50) MΩ	1.8 % + 40 kΩ	
	(50 to 100) MΩ	3.6 % + 200 kΩ	

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Electrical Simulation of Temperature Displays & Readouts <sup>3</sup> –			
Type J	-210 °C to -100 °C -100 °C to 760 °C 760 °C to 1200 °C	0.4 °C 0.31 °C 0.36 °C	Fluke 5500A
Type K	-200 °C to -100 °C -100 °C to 1000 °C 1000 °C to 1372 °C	0.46 °C 0.39 °C 0.53 °C	
Type R	0 °C to 250 °C 250 °C to 1000 °C 1000 °C to 1767 °C	0.72 °C 0.48 °C 0.53 °C	
Type S	0 °C to 250 °C 250 °C to 1400 °C 1400 °C to 1767 °C	0.61 °C 0.5 °C 0.6 °C	
Type T	-250 °C to -150 °C -150 °C to 0 °C 0 °C to 400 °C	0.79 °C 0.37 °C 0.3 °C	
Electrical Calibration of RTDs <sup>3</sup>			
Generate	-200 °C to 0 °C 0 °C to 400 °C 400 °C to 800 °C	0.13 °C 0.25 °C 0.49 °C	Beamex MC2-MF
Measure	-200 °C to 0 °C 0 °C to 400 °C 400 °C to 800 °C	0.37 °C 0.61 °C 0.97 °C	

### III. Mechanical

Parameter/Equipment	Range	CMC <sup>2, 5, 6</sup> (±)	Comments
Scales & Balances <sup>3</sup>	(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 <sup>3</sup>	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 <sup>3</sup> – Measuring Equipment (Wrenches)	5 in·lbf to 600 ft·lbf	0.65 %	CDI Suretest 5000- ST
Pressure <sup>3</sup>	(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 10000) psig	0.07 % Full Scale	Druck DPI-10K
Atmospheric Pressure (Vacuum) <sup>3</sup>	(0.01 to 30) in Hg	0.02 in Hg	Beamex MC2- IPM2C



#### IV. Thermodynamics

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Relative Humidity <sup>3</sup>	(10 to 90) % RH	1.2 % RH	Vaisala M170 w/ HMP- 76
RTD <sup>3</sup> – Generate	-200 °C to 0 °C 0 °C to 400 °C 400 °C to 800 °C	0.13 °C 0.25 °C 0.49 °C	Beamex MC2-MF
RTD <sup>3</sup> – Measure	-200 °C to 0 °C 0 °C to 400 °C 400 °C to 800 °C	0.37 °C 0.61 °C 0.97 °C	Beamex MC2-MF
Temperature <sup>3</sup> – Measure	-196 °C to 420 °C	0.34 °C	Beamex w/ PRT

#### V. Time and Frequency

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Timers & Stopwatches <sup>3</sup>	(1 to 3600) s	0.2 s	Stopwatch

<sup>1</sup> This laboratory offers commercial calibration and field calibration services, where noted.

<sup>2</sup> 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. 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.

<sup>3</sup> Field calibration service is available for this calibration and this laboratory meets A2LA R104 – *General Requirements: Accreditation of Field Testing and Field Calibration Laboratories* for these calibrations. 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.

- <sup>4</sup> 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.
- <sup>5</sup> 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.
- <sup>6</sup> In the statement of CMC, percentages are percentage of reading, unless otherwise indicated.



## Accredited Laboratory

A2LA has accredited

**J.A. KING & COMPANY, LLC**

*Des Moines, IA*

for technical competence in the field of

**Calibration**

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets 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 5<sup>th</sup> day of October 2017.

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

President and CEO  
For the Accreditation Council  
Certificate Number 1741.10  
Valid to September 30, 2019

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