



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017
& ANSI/NCSL Z540-1-1994

CLEVELAND ELECTRIC LABORATORIES.
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CALIBRATION

Valid To: September 30, 2023

Certificate Number: 1658.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations^{1, 5}:

I. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2, 4} (±)	Comments
DC Voltage – Generate	(-300 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V (100 to 1000) V	0.0022 % + 0.3 μV 0.000 95 % + 0.3 μV 0.000 95 % + 0.5 μV 0.0012 % + 30 μV 0.0012 % + 0.1 mV	Keysight 3458A, Fluke 5520A
DC Voltage – Measure	(-300 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V (100 to 1000) V	0.0022 % + 0.3 μV 0.000 95 % + 0.3 μV 0.000 95 % + 0.5 μV 0.0012 % + 30 μV 0.0012 % + 0.1 mV	Keysight 3458A
DC Current – Generate	(0 to 100) μA 100 μA to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A (1 to 10) A (10 to 20) A	0.029 % + 0.8 nA 0.004 % + 5 nA 0.007 % + 50 nA 0.005 % + 0.5 μA 0.013 % + 10 μA 0.58 % + 0.5 mA 0.29 % + 0.75 mA	Keysight 3458A, Fluke 5520A Fluke 5520A

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
DC Current – Measure	(0 to 100) μ A 100 μ A to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A	0.028 % + 0.8 nA 0.004 % + 5 nA 0.007 % + 50 nA 0.005 % + 0.5 μ A 0.013 % + 10 μ A	Keysight 3458A
Resistance – Generate	Up to 10 Ω (10 to 100) Ω 100 Ω to 1 k Ω (1 to 10) k Ω (10 to 100) k Ω 100 k Ω to 1 M Ω (1 to 10) M Ω (11 to 30) M Ω	0.078 % + 50 $\mu\Omega$ 0.0079 % + 500 $\mu\Omega$ 0.0014 % + 500 $\mu\Omega$ 0.0012 % + 5 m Ω 0.0012 % + 50 m Ω 0.0018 % + 2 Ω 0.0058 % + 100 Ω 0.058 % + 300 Ω	Fluke 5520A, Keysight 3458A
Resistance – Measure	Up to 10 Ω (10 to 100) Ω 100 Ω to 1 k Ω (1 to 10) k Ω (10 to 100) k Ω 100 k Ω to 1 M Ω (1 to 10) M Ω (10 to 33) M Ω (33 to 100) M Ω	0.078 % + 50 $\mu\Omega$ 0.0079 % + 500 $\mu\Omega$ 0.0014 % + 500 $\mu\Omega$ 0.0012 % + 5 m Ω 0.0012 % + 50 m Ω 0.0018 % + 2 Ω 0.0058 % + 100 Ω 0.058 % + 1 k Ω 0.058 % + 1 k Ω	Keysight 3458A
Electrical Calibration of Thermocouple Indicating Systems – Measure	Type B (500 to 3300) $^{\circ}$ F Type C (0 to 4200) $^{\circ}$ F Type E (-400 to 1800) $^{\circ}$ F Type J (-340 to 2190) $^{\circ}$ F Type K (-440 to 2500) $^{\circ}$ F Type N (-440 to 2372) $^{\circ}$ F Type R (32 to 3210) $^{\circ}$ F Type S (32 to 3200) $^{\circ}$ F Type T (-450 to 750) $^{\circ}$ F Type Ni/Ni-Mo (32 to 2560) $^{\circ}$ F Type – P II (32 to 2450) $^{\circ}$ F	0.72 $^{\circ}$ F 0.22 $^{\circ}$ F 0.14 $^{\circ}$ F 0.069 $^{\circ}$ F 0.10 $^{\circ}$ F 0.11 $^{\circ}$ F 0.35 $^{\circ}$ F 0.39 $^{\circ}$ F 0.22 $^{\circ}$ F 0.071 $^{\circ}$ F 0.11 $^{\circ}$ F	Keysight 3458A

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Electrical Calibration of Thermocouple Indicating Systems – Generate Type B Type C Type E Type J Type K Type N Type R Type S Type T Type Ni/Ni-Mo Type - P II	(500 to 3300) °F (0 to 4200) °F (-400 to 1800) °F (-340 to 2190) °F (-440 to 2500) °F (-440 to 2372) °F (32 to 3210) °F (32 to 3200) °F (-450 to 750) °F (32 to 2560) °F (32 to 2450) °F	0.72 °F 0.22 °F 0.14 °F 0.069 °F 0.10 °F 0.11 °F 0.35 °F 0.39 °F 0.22 °F 0.08 °F 0.11 °F	Fluke 5520A, Keysight 3458A
Electrical Calibration of RTDs – Measure Pt 385, 100 Ω Pt 385, 1000 Ω	(32 to 1200) °F (32 to 1100) °F	0.15 °F 0.066 °F	Keysight 3458A
Electrical Calibration of RTDs – Generate Pt 385, 100 Ω Pt 385, 1000 Ω	(32 to 1200) °F (32 to 1100) °F	0.15 °F 0.066 °F	Keysight 3458A, Fluke5520A

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Current – Measure (0 to 100) μA 100 μA to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A	50 Hz 50 Hz 50 Hz 50 Hz 50 Hz	0.029 % + 30 nA 0.003 % + 200 nA 0.015 % + 2 μA 0.007 % + 20 μA 0.093 % + 200 μA	Keysight 3458A

Parameter/Range	Frequency	CMC ^{2, 4} (±)	Comments
AC Current – Generate (30 to 100) µA 100 µA to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A (1 to 3) A (3 to 20) A	50 Hz 50 Hz 50 Hz 50 Hz 50 Hz 50 Hz 50 Hz	0.029 % + 30 nA 0.003 % + 200 nA 0.015 % + 2 µA 0.007 % + 20 µA 0.093 % + 200 µA 0.14 % + 0.2 mA 0.14 % + 2 mA	Keysight 3458A Fluke 5520A Fluke 5520A
AC Voltage – Measure Up to 100 mV 100 mV to 1 V (1 to 10) V (10 to 100) V (100 to 700) V	50 Hz 50 Hz 50 Hz 50 Hz 50 Hz	0.07 % + 10 µV 0.07 % + 100 µV 0.07 % + 1 mV 0.07 % + 10 mV 0.09 % + 140 mV	Keysight 3458A
AC Voltage – Generate Up to 100 mV 100 mV to 1 V (1 to 10) V (10 to 100) V (100 to 700) V	50 Hz 50 Hz 50 Hz 50 Hz 50 Hz	0.07 % + 10 µV 0.07 % + 100 µV 0.07 % + 1 mV 0.07 % + 10 mV 0.09 % + 140 mV	Fluke 5520A, Keysight 3458A

II. Thermodynamics

Parameter/Equipment	Range	CMC ² (±)	Comments
Test and Calibration of Thermocouples ³ –			
(32 to 2000) °F			
Type B	(500 to 2000) °F	0.86 °F	ASTM E220, Keysight 3458A, Type “S” platinum standard TC, Keithley 3706 scanner
Type C	(32 to 2000) °F	0.62 °F	
Type E	(32 to 1800) °F	0.59 °F	
Type J	(32 to 2000) °F	0.59 °F	
Type K	(32 to 2000) °F	0.63 °F	
Type N	(32 to 2000) °F	0.70 °F	
Type R	(32 to 2000) °F	0.67 °F	
Type S	(32 to 2000) °F	0.70 °F	
Type T	(32 to 750) °F	0.63 °F	
Type Ni/Ni-Mo	(32 to 2000) °F	0.55 °F	
Type – P II	(32 to 2000) °F	0.57 °F	
>2000 °F			
Type B	(2000 to 2800) °F	3.4 °F	ASTM E220, Keysight 3458A, Type “S” platinum standard TC, Keithley 3706 scanner
Type C	(2000 to 2800) °F	3.1 °F	
Type J	(2000 to 2190) °F	3.1 °F	
Type K	(2000 to 2500) °F	3.1 °F	
Type N	(2000 to 2372) °F	3.2 °F	
Type R	(2000 to 2800) °F	3.2 °F	
Type S	(2000 to 2800) °F	3.2 °F	
Type Ni/Ni-Mo	(2000 to 2560) °F	3.1 °F	
Type – P II	(2000 to 2450) °F	3.1 °F	
(-320 to 800) °F			
Type E	(-320 to 800) °F	0.12 °F	ASTM E220, Kaye IRTD-500, Keysight 3458A
Type J	(-320 to 800) °F	0.15 °F	
Type K	(-320 to 800) °F	0.22 °F	
Type N	(-320 to 800) °F	0.32 °F	
Type T	(-320 to 750) °F	0.22 °F	
(-320 to 800) °F			
Type E	(-320 to 750) °F	0.52 °F	ASTM E 220, Kaye IRTD-500, AK20a
Type J	(-320 to 750) °F	0.5 °F	
Type K	(-320 to 750) °F	0.56 °F	
Type N	(-320 to 750) °F	0.49 °F	
Type T	(-320 to 750) °F	0.47 °F	

Parameter/Equipment	Range	CMC ² (±)	Comments
Test and Calibration of Thermocouples ³ – (cont) (32 to 1760) °F Type B Type E Type J Type K Type N Type R Type S Type T Type B Type E Type J Type K Type N Type R Type S Type T	 (500 to 1760) °F (32 to 1760) °F (32 to 1760) °F (32 to 1760) °F (32 to 1760) °F (32 to 1760) °F (32 to 1760) °F (32 to 750) °F (500 to 1760) °F (32 to 1760) °F (32 to 1760) °F (32 to 1760) °F (32 to 1760) °F (32 to 1760) °F (32 to 1760) °F (32 to 750) °F	 0.64 °F 0.15 °F 0.16 °F 0.22 °F 0.32 °F 0.31 °F 0.35 °F 0.22 °F 2.2 °F 0.53 °F 0.51 °F 0.56 °F 0.5 °F 1.3 °F 1.3 °F 0.47 °F	 ASTM E 220, Hart Scientific PRT 5624 w/ 1502A readout, Keysight 3458A ASTM E 220, Hart Scientific PRT 5624 w/ 1502A readout, AK20a
Test and Calibration of RTDs ³ – Pt385, 100 Ω Pt385, 1000 Ω Pt385, 100 Ω Pt385, 1000 Ω	 (-320 to 750) °F (-320 to 750) °F (32 to 1200) °F (32 to 1100) °F	 0.074 °F 0.073 °F 0.14 °F 0.14 °F	 Kaye IRTD-500, Keysight 3458A Hart Scientific PRT 5624 w/ 1502A readout, Keysight 3458A

¹ This laboratory offers commercial calibration service.

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 The measurands stated are determined by the test of thermocouples or RTDs from the beginning and the end of a coil or spool of bulk thermocouple or RTD material, tested at selected temperatures appropriate to the range of measurements against a primary standard type "S" thermocouples or PRT primary standard; or by calibration of individual artifacts involving measurements at specific temperatures against a type "S" primary standard thermocouple or a PRT standard in accordance with ASTM-E220-02 and customer requirements.

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 of the reading plus a fixed floor specification.

⁵ This scope meets A2LA's *P112 Flexible Scope Policy*.



Accredited Laboratory

A2LA has accredited

CLEVELAND ELECTRIC LABORATORIES

Twinsburg, OH

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 ANSI/NCCL 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 April 2017).



Presented this 24th 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 1658.01
Valid to September 30, 2023

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