SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

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CALIBRATION

Valid To: May 31, 2027 Certificate Number: 1741.08

In recognition of the successful completion of the A2LA evaluation process (including an assessment of the organization's compliance with R205 – A2LA's Calibration Program Requirements), accreditation is granted to this laboratory to perform the following calibrations[1, 10]:

I. Chemical

Parameter/Equipment	Range	CMC[2] (±)	Comments
pH Meters[3]	4 pH 7 pH 10 pH	0.06 pH 0.04 pH 0.07 pH	Standard pH solutions
Conductivity Meters[3] – Fixed Points	10 µS/cm 100 µS/cm 1000 µS/cm	0.63 µS/cm 2.3 µS/cm 6.1 µS/cm	Standard conductivity solutions

II. Dimensional

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Pin Gage[3] – Class ZZ	Up to 2 in	90 µin	Micrometer
Calipers[3]	Up to 120 in	$(5.6 + 10L)$ µin + $0.6R$	Gage blocks

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Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Micrometers[3] – Outside	Up to 1 in (1 to 60) in	13 µin + 0.6*R* (9.8 + 3*L*) µin + 0.6*R*	Gage blocks
Micrometers[3] – Outside with interchangeable rods	(1 to 60) in	(6 + 9.1*L*) µin + 0.6*R*	Gage blocks
Micrometers[3] – Inside	Up to 8 in Up to 10 in (5 to 30) in	(6.1 + 8.9*L*) µin + 0.6*R* (17 + 1.3L) µin (28 + 2.3*L*) µin	Gage blocks Supra 500 ULM Gage blocks & Mu checker
Linear Indicators[3] – Dial & Test	Up to 4 in	(6.3 + 8.5*L*) µin + 0.6*R*	Gage blocks
Height Gages[3]	Up to 48 in	(6.2 + 9.5*L*) µin + 0.6*R* (6.8 + 2.9*L*) µin + 0.6*R*	Gage blocks Gage blocks (cold room)
Steel Rules[3]	Up to 96 in	(3 + 13*L*) µin + 0.6*R*	Gage blocks
Tape Measures[3]	Up to 25 ft	(3 + 13*L*) µin + 0.6*R*	Gage blocks
Angle Indicators & Protractors[3]	15°, 30°, 45°, 60°, 75°, 90°	0.037°	Angle block set
Feeler/Thickness Gages/Shims[3]	Up to 1 in	90 µin	Micrometer
Thickness Films/Shims	Up to 0.2 in	20 µin	Supra 500 ULM
Microscope[3] – Reticle Linearity / Measuring	Up to 1 mm (1 to 10) mm	0.0017 mm + 0.6*R* 0.004 mm + 0.6*R*	Stage micrometer

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Diameter /Radius/Fixture Gages/Weld Gages[3] –			
Diameter	Up to 2.0 in	430 µin	Optical comparator, measuring microscope
Radius	Up to 2.0 in	430 µin	
Length	Up to 12.0 in	430 µin	
	Up to 528 in	0.049 in	Fluke laser distance meter
Circumference	(12 to 36) in	0.0062 in	Pi tape
Optical Comparators[3] –			
X-Y Linearity	Up to 6 in	150 µin	Glass master scales
Magnification	10x to 250x	0.014 in	
Angle	(0 to 90)°	0.06°	Angle block set
Surface Plates[3] – Grades AA, A, & B			
Repeatability	0.002 in	32 µin	Repeat-o-meter
Flatness	Up to 120 *DL* in	(32 + 0.54*DL*) µin	Federal level systems
Surface Roughness[3] –			
Meters	Ra (10 to 200)	1.1 µin	Precision roughness standard
Surface Roughness Specimens / Standards	Ra (10 to 200)	3.2 µin	Profilometer with roughness specimens
Interim Verification of Coordinate Measuring Machines[3] –			
X, Y, Z Linearity	Up to 36 in	(55 + 3*L*) µin	Gage blocks
Volumetric Performance	Up to 10 in	180 µin	Ball bar

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Cylindrical Measure –			
Plain Rings	Up to 10 in	(32 + 0.9*L*) µin	Supra 500 ULM
Pins, Plain Plugs, Discs, Spheres – External Diameter	Up to 10 in	(17 + 1.3*L*) µin	
Micrometer Standards	Up to 10 in	(17 + 1.3*L*) µin	Supra 500 ULM
	Up to 30 in	(28 + 2.3*L*) µin	Gage blocks & Mu-checker
Thread Plugs –			
Major Diameter	Up to 7 in	27 µin	Supra 500 ULM
Pitch Diameter	(2 to 108) TPI (0.25 to 8) mm	100 µin	Supra 500 ULM w/ thread wire set
Thread Rings – Parallel			
Simple Pitch Diameter Adjustable Rings[11]	Up to 8 in	Set Plug Tolerance	ASME/ANSI B1.2- 1983 & ASME/ANSI B1.3-2007
NPT Tapered Thread Plugs-			
Pitch Diameter	(1 to 108) TPI	90 µin	Supra 500 ULM w/ thread wire set & taper block
Major Diameter	Up to 8 in	49 µin	Supra ULM 500
Crimpers –			
Functional Diameter	(0.011 to 0.250) in	260 µin	Pin gages

III. Dimensional Testing / Calibration

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Length[3,8] –			
X Axis	Up to 138 in	0.0034 in	Faro Arm quantum S
Y Axis	Up to 138 in	0.0034 in	
Z Axis	Up to 138 in	0.0034 in	
Volumetric[3]	Up to 138 in	0.0039 in	
Length –			
1D Measure	Up to 10 in	(17 + 1.3*L*) µin	Supra 500 ULM
	Up to 16 in	(130 + 3.6*L*) µin	Trimos V5 height gauge

IV. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2, 4, 5] (±)	Comments
DC Voltage[3] – Measure	(0 to 100) mV	11 µV/V + 0.3 µV	Agilent 3458A opt 002
	100 mV to 1 V	10 µV/V + 0.3 µV	
	(1 to 10) V	10 µV/V + 0.5 µV	
	(10 to 100) V	11 µV/V + 30 µV	
	(100 to 1000) V	27 µV/V + 100 µV	
	Up to 10 kV	0.05 % + 0.03 V	Vitrek 4700
	(10 to 70) kV	0.07 % + 0.3 V	Vitrek 4700 w/ HVL-70
DC Voltage[3] – Generate	(0 to 330) mV	17 µV/V + 1 µV	Fluke 5522A
	330 mV to 3.3 V	9 µV/V + 2 µV	
	(3.3 to 33) V	10 µV/V + 15 µV	
	(33 to 330) V	15 µV/V + 150 µV	
	(100 to 1020) V	15 µV/V + 1.5 mV	
	Up to 5 kV	0.05 % + 0.03 V	Voltage source w/ Vitrek 4700

Parameter/Equipment	Range	CMC[2, 4, 5] (±)	Comments
DC Power[3] – Generate 33 mV to 1020 V: (0.33 to 329.99) mA (0.33 to 2.9999) A (3 to 20.5) A	 (0.01 to 330) W (0.33 to 3.3) kW (3.3 to 20.5) kW	 0.03 % 0.03 % 0.09 %	 Fluke 5522A
DC Current[3] – Measure	(0 to 100) nA 100 nA to 1 µA (1 to 10) µA (10 to 100) µA 100 µA to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A Up to 50 A	32 µA/A + 0.04 nA 23 µA/A + 0.04 nA 23 µA/A + 0.1 nA 23 µA/A + 0.8 nA 23 µA/A + 5 nA 23 µA/A + 50 nA 37 µA/A + 0.5 µA 0.011 % + 10 µA 0.03 %	Agilent 3458A opt 002 Ohms Lab CS-50 w/ Agilent 3458A
DC Current[3] – Generate	(0 to 330) µA (0 to 3.3) mA (0 to 33) mA (0 to 330) mA (0 to 1.1) A (1.1 to 3) A (3 to 11) A (11 to 21) A Up to 100 A	0.012 % + 0.02 µA 0.008 % + 0.05 µA 0.01 % + 0.25 µA 0.011 % + 2.5 µA 0.016 % + 40 µA 0.028 % + 40 µA 0.04 % + 500 µA 0.08 % + 750 µA 0.07 % + 0.42 A	Fluke 5522A Valhalla 2555A
DC Clamp-On Meters[3]	Up to 150 A (150 to 1000) A	0.51 % + 0.038 A 0.51 % + 0.51 A	Fluke 5522A w/5500 coil
Resistance[3] – Measure	(0 to 10) Ω (10 to 100) Ω 100 Ω to 1kΩ (1 to 10) kΩ (10 to 100) kΩ 100 kΩ to 1 MΩ (1 to 10) MΩ (10 to 100) MΩ 100 MΩ to 1 GΩ	18 µΩ/Ω + 50 µΩ 15 µΩ/Ω + 0.5 mΩ 14 µΩ/Ω + 0.5 mΩ 12 µΩ/Ω + 5 mΩ 12 µΩ/Ω + 50 mΩ 17 µΩ/Ω + 2 Ω 51 µΩ/Ω + 100 Ω 0.051 % + 1 kΩ 0.11 % + 10 kΩ	Agilent 3458A opt 002

Parameter/Equipment	Range	CMC[2, 4, 5] (±)	Comments
Insulation Resistance	10 mΩ 100 mΩ to 5 Ω (5 to 200) Ω 200 Ω to 1 MΩ (1 to 10) MΩ 10 MΩ to 1 GΩ (1 to 10) GΩ 100 GΩ 350 MΩ to 99.99 GΩ (100 to 999.9) GΩ (1 to 10) TΩ	1.2 % 0.37 % + 10 mΩ 0.25 % + 10 mΩ 0.25 % 0.37 % 0.6 % 1.2 % 3.6 % 1.8 % 3 % 4.2 %	Fluke 5322A Fluke 5322A w/ resistance multiplier adapter
Resistance[3] – Generate	(0 to 11) Ω (11 to 33) Ω (33 to 110) Ω 110 Ω to 1.1 kΩ (1.1 to 11) kΩ (11 to 110) kΩ 110 kΩ to 1.1 MΩ (1.1 to 3.3) MΩ (3.3 to 11) MΩ (11 to 33) MΩ (33 to 110) MΩ (110 to 330) MΩ (330 to 1100) MΩ	32 µΩ/Ω + 0.001 Ω 36 µΩ/Ω + 0.0015 Ω 22 µΩ/Ω + 0.0014 Ω 22 µΩ/Ω + 0.002 Ω 22 µΩ/Ω + 0.02 Ω 22 µΩ/Ω + 0.2 Ω 25 µΩ/Ω + 2 Ω 47 µΩ/Ω + 30 Ω 0.01 % + 50 Ω 0.02 % + 2.5 kΩ 0.039 % + 3 kΩ 0.24 % + 100 kΩ 1.2 % + 500 kΩ	Fluke 5522A
Fixed Values	1 mΩ 10 mΩ 100 mΩ	0.12 % 0.03 % 0.1 %	Standard resistors

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
Capacitance[3] – Generate			
(220.0 to 399.9) pF	(10 to 10 000) Hz	0.39 % + 10 pF	Fluke 5522A
(0.4 to 1.0999) nF	(10 to 10 000) Hz	0.39 % + 0.01 nF	
(1.1 to 3.2999) nF	(10 to 3000) Hz	0.39 % + 0.01 nF	
(3.3 to 10.9999) nF	(10 to 1000) Hz	0.2 % + 0.1 nF	
(11 to 109.999) nF	(10 to 1000) Hz	0.2 % + 0.1 nF	
(110 to 329.999) nF	(10 to 1000) Hz	0.2 % + 0.3 nF	
(0.33 to 1.099 99) µF	(10 to 600) Hz	0.2 % + 1 nF	
(1.1 to 3.299 99) µF	(10 to 300) Hz	0.2 % + 3 nF	
(3.3 to 10.9999) µF	(10 to 150) Hz	0.2 % + 10 nF	
(11 to 32.9999) µF	(10 to 120) Hz	0.32 % + 30 nF	
(33 to 109.999) µF	(10 to 80) Hz	0.36 % + 100 nF	
(110 to 329.999) µF	Up to 50 Hz	0.36 % + 300 nF	
(.33 to 1.099 99) mF	Up to 20 Hz	0.36 % + 1 µF	
(1.1 to 3.299 99) mF	Up to 6 Hz	0.37 % + 3 µF	
(3.3 to 10.9999) mF	Up to 2 Hz	0.37 % + 10 µF	
(11 to 32.9999) mF	Up to 0.6 Hz	0.6 % + 30 µF	
(33 to 110) mF	Up to 0.2 Hz	0.87 % + 100 µF	
AC Voltage[3] – Generate			
(1 to 33) mV	(10 to 45) Hz	0.063 % + 6 µV	Fluke 5522A
	45 Hz to 10 kHz	0.014 % + 6 µV	
	(10 to 20) kHz	0.017 % + 6 µV	
	(20 to 50) kHz	0.078 % + 6 µV	
	(50 to 100) kHz	0.28 % + 12 µV	
	(100 to 500) kHz	0.63 % + 50 µV	
(33 to 330) mV	(10 to 45) Hz	0.024 % + 8 µV	
	45 Hz to 10 kHz	0.012 % + 8 µV	
	(10 to 20) kHz	0.013 % + 8 µV	
	(20 to 50) kHz	0.028 % + 8 µV	
	(50 to 100) kHz	0.063 % + 32 µV	
	(100 to 500) kHz	0.16 % + 70 µV	
330 mV to 3.3 V	(10 to 45) Hz	0.024 % + 50 µV	
	45 Hz to 10 kHz	0.012 % + 60 µV	
	(10 to 20) kHz	0.015 % + 60 µV	
	(20 to 50) kHz	0.024 % + 50 µV	
	(50 to 100) kHz	0.055 % + 130 µV	
	(100 to 500) kHz	0.19 % + 600 µV	
(3.3 to 33) V	(10 to 45) Hz	0.024 % + 650 µV	
	45 Hz to 10 kHz	0.012 % + 600 µV	
	(10 to 20) kHz	0.019 % + 600 µV	
	(20 to 50) kHz	0.028 % + 600 µV	
	(50 to 100) kHz	0.07 % + 1.6 mV	

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
AC Voltage[3] – Generate (cont)			
(33 to 330) V	45 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.015 % + 2 mV 0.016 % + 6 mV 0.02 % + 6 mV 0.024 % + 6 mV 0.16 % + 50 mV	Fluke 5522A
(330 to 1020) V	45 Hz to 10 kHz	0.024 % + 10 mV	
AC Voltage[3] – Measure			
Up to 10 mV	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.031 % + 0.03 % of rng 0.021 % + 0.011 % of rng 0.031 % + 0.011 % of rng 0.11 % + 0.011 % of rng 0.51 % + 0.011 % of rng 4.1 % + 0.02 % of rng	Agilent 3458A opt 002
10 mV to 10 V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.008 % + 0.004 % of rng 0.008 % + 0.002 % of rng 0.015 % + 0.002 % of rng 0.031 % + 0.002 % of rng 0.081 % + 0.002 % of rng 0.31 % + 0.01 % of rng	Agilent 3458A
(10 to 100) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.021 % + 0.004 % of rng 0.021 % + 0.002 % of rng 0.021 % + 0.002 % of rng 0.036 % + 0.002 % of rng 0.13 % + 0.002 % of rng 0.41 % + 0.01 % of rng	
(100 to 600) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.041 % + 0.004 % of rng 0.041 % + 0.002 % of rng 0.061 % + 0.002 % of rng 0.13 % + 0.002 % of rng 0.31 % + 0.002 % of rng	
Up to 10 kV[3]	60 Hz	0.15 % + 0.1 V	Vitrek 4700
(10 to 50) kV[3]	60 Hz	0.15 % + 0.6 V	Vitrek 4700 w/ HVL-70

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
AC Current[3] – Measure			
(0 to 100) µA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz 100 Hz to 5 kHz	0.4 % + 0.03 % rng 0.15 % + 0.03 % rng 0.06 % + 0.03 % rng 0.06 % + 0.03 % rng	Agilent 3458A opt 002
(0.1 to 100) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.4 % + 0.02 % rng 0.15 % + 0.02 % rng 0.06 % + 0.02 % rng 0.03 % + 0.02 % rng 0.06 % + 0.02 % rng 0.4 % + 0.04 % rng 0.55 % + 0.15 % rng	
(0.1 to 1) A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz	0.4 % + 0.02 % rng 0.16 % + 0.02 % rng 0.08 % + 0.02 % rng 0.1 % + 0.02 % rng 0.3 % + 0.02 % rng 1 % + 0.04 % rng	Agilent 3458A opt 002
(1 to 50) A	DC to 60 Hz	0.03 %	Ohms Lab CS-50 w/ Agilent 3458A
AC Current[3] – Generate			
(0 to 0.33) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.16 % + 0.1 µA 0.12 % + 0.1 µA 0.097 % + 0.1 µA 0.24 % + 0.15 µA 0.63 % + 0.2 µA 1.3 % + 0.4 µA	Fluke 5522A
(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 (10 to 30) kHz	0.16 % + 0.15 µA 0.097 % + 0.15 µA 0.078 % + 0.15 µA 0.16 % + 0.2 µA 0.39 % + 0.3 µA 0.78 % + 0.6 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 (10 to 30) kHz	0.14 % + 2 µA 0.07 % + 2 µA 0.032 % + 2 µA 0.063 % + 2 µA 0.16 % + 3 µA 0.32 % + 4 µA	

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
AC Current[3] – Generate (cont)			
(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 (10 to 30) kHz	0.14 % + 20 µA 0.07 % + 20 µA 0.032 % + 20 µA 0.078 % + 50 µA 0.16 % + 100 µA 0.32 % + 200 µA	Fluke 5522A
(0.33 to 1.1) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.14 % + 100 µA 0.039 % + 100 µA 0.47 % + 1 mA 2 % + 5 mA	
AC Current[3] – Generate			
(1.1 to 3) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.14 % + 100 µA 0.047 % + 100 µA 0.47 % + 1 mA 2 % + 5 mA	Fluke 5522A
(3 to 11) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.047 + 2mA 0.078 % + 2 mA 2.4 % + 2 mA	
(11 to 20.5) A	(45 to 100) Hz 45 Hz to 1 kHz (1 to 5) kHz	0.094 % + 5mA 0.12 % + 5 mA 2.4 % + 5 mA	Valhalla 2555A
Up to 100 A	Up to 100 Hz (100 to 400) Hz	0.14 % + 0.35 A 0.24 % + 0.47 A	
AC Clamp-On Meters[3] –			
Up to 150 A: Toroidal	(45 to 65) Hz (65 to 440) Hz	0.29 % + 0.026 A 0.8 % + 0.28 A	Fluke 5520A w/ 5500 coil
Non-Toroidal	(45 to 65) Hz (65 to 440) Hz	0.57 % + 0.25 A 1 % + 0.25 A	
(150 to 1025) A: Toroidal	(45 to 65) Hz (65 to 440) Hz	0.3 % + 0.27 A 0.8 % + 0.27 A	
Non-Toroidal	(45 to 65) Hz (65 to 440) Hz	0.57 % + 0.94 A 1 % + 0.94 A	

Parameter/Equipment	Range	CMC[2, 4, 5] (±)	Comments
AC Power[3] – Generate			
(45 to 65) Hz; PF=1			
(33 to 330) mV Range:			
(3.3 to 8.99) mA	110 µW to 3 mW	0.11 %	Fluke 5522A
(9 to 32.99) mA	(3 to 11) mW	0.08 %	
(33 to 89.99) mA	(1.1 to 30) mW	0.11 %	
(90 to 329.99) mA	(3 to 110) mW	0.08 %	
(0.33 to 0.8999) A	(11 to 300) mW	0.11 %	
(0.9 to 2.1999) A	(30 to 730) mW	0.09 %	
(2.2 to 4.4999) A	73 mW to 1.5 W	0.11 %	
(4.5 to 20.5) A	150 mW to 6.8 W	0.11 %	
330 mV to 1020 V Range:			
(3.3 to 8.99) mA	1.1 mW to 9 W	0.1 %	
(9 to 32.99) mA	3 mW to 33 W	0.07 %	
(33 to 89.99) mA	11 mW to 90 W	0.1 %	
(90 to 329.99) mA	30 mW to 330 W	0.07 %	
(0.33 to 0.8999) A	110 mW to 900 W	0.09 %	
(0.9 to 2.1999) A	300 mW to 2200 W	0.08 %	
(2.2 to 4.4999) A	730 mW to 4500 W	0.1 %	
(4.5 to 20.5) A	(1.5 to 20.9) kW	0.1 %	
Oscilloscopes[3] –			Fluke 5522A w/ SC1100
Square Wave Signal:			
50 Ω Load @ 1 kHz	1 mV to 6.6 $V_{pk - pk}$	0.31 % + 40 µV	
1 MΩ Load @ 1 kHz	1 mV to 130 $V_{pk - pk}$	0.14 % + 40 µV	
DC Volt Amplitude:			
50 Ω Load	(0 to 6.6) V	0.3 % + 40 µV	
1 MΩ Load	(0 to 130) V	0.06 % + 40 µV	
Level Sine Wave:			
Frequency	(0 to 1100) MHz	3.3 µHz/Hz	
Amplitude	50 kHz Reference	2.4 % + 300 µV	
	50 kHz to 100 MHz	4.2 % + 300 µV	
	(100 to 300) MHz	4.8 % + 300 µV	
	(300 to 600) MHz	7.2 % + 300 µV	
	(600 to 1100) MHz	8.4 % + 300 µV	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Oscilloscopes[3] – (cont)			Fluke 5522A w/ SC1100
Flatness (Bandwidth)	0 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (600 to 1100) MHz	1.8 % + 100 µV 2.4 % + 100 µV 4.8 % + 100 µV 6 % + 100 µV	*t* is time in seconds
Time Markers:			
Into a 50 Ω Load	5 s to 50 ms 20 ms to 1 ns	(30 + 1000*t*) µs/s 3.5 µs/s	
Rise Time:			
1 kHz to 2 MHz (2 to 10) MHz	≤ 300 ps ≤ 350 ps	130 ps 130 ps	
Electrical Simulation of Thermocouples[3] –			
Type B	(600 to 800) °C (800 to 1820) °C	0.35 °C 0.29 °C	Fluke 5522A
Type E	(-250 to -100) °C (-100 to 650) °C (650 to 1000) °C	0.40 °C 0.14 °C 0.18 °C	
Type J	(-210 to -100) °C (-100 to 760) °C (760 to 1200) °C	0.22 °C 0.15 °C 0.19 °C	
Type K	(-200 to -100) °C (-100 to 1000) °C (1000 to 1372) °C	0.27 °C 0.21 °C 0.32 °C	
Type R	(0 to 250) °C (250 to 1000) °C (1000 to 1767) °C	0.46 °C 0.30 °C 0.34 °C	
Type S	(0 to 250) °C (250 to 1400) °C (1400 to 1767) °C	0.39 °C 0.32 °C 0.38 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 400) °C	0.50 °C 0.20 °C 0.14 °C	

Parameter/Range	Frequency	CMC[2] (±)	Comments
Electrical Simulation of Thermocouples[3] –			
Type J	(-200 to 1200) °C	0.07 °C	Fluke 5522A w/ ice point reference
Type K	(-200 to 1372) °C	0.07 °C	
Type T	(-250 to 400) °C	0.07 °C	
Electrical Simulation of RTDs[3]			
Pt 385, 100 Ω	(-200 to 0) °C (0 to 400) °C (400 to 630) °C (630 to 800) °C	0.08 °C 0.12 °C 0.14 °C 0.24 °C	Fluke 5522A

V. Fluid Quantities

Parameter/Equipment	Range	CMC[2, 5, 9] (±)	Comments
Viscosity Meters[3]	Up To 16 300 cP	0.9 %	Standard viscosity solution w/ bath
Viscosity Dip Cups[3] (Kinematic Viscosity, Efflux Time)	Up to 1000 mm²/s	2.2 cSt	Certified viscosity oil
Volumetric Air Flow – Measure & Measuring Equipment[3] (Air Samples)	(20 to 200) lpm	1.4 %	Reference flowmeter

VI. Mechanical

Parameter/Equipment	Range	CMC[2, 5, 6] (±)	Comments
Torque Testers /Analyzers, Transducers[3]	Up to 1000 lbf·ft	0.18 %	Class F weights & arm

Parameter/Equipment	Range	CMC[2, 5, 6] (±)	Comments
Torque Wrenches[3]	Up to 600 lbf·ft	0.8 %	CDI Suretest 5000-ST
Rotary Torque Tools (Pneumatic, DC, Pulse) [3]	(0.02 to 2) N·m (0.5 to 5) N·m (1 to 10) N·m (2 to 20) N·m (2.5 to 25) N·m (7.5 to 75) N·m (18 to 180) N·m	0.017 N·m 0.043 N·m 0.085 N·m 0.17 N·m 0.22 N·m 0.64 N·m 1.6 N·m	Crane – torque star w/ rotary transducers
Scales & Balances[3]	500 mg to 1g (1 to 5) g (5 to 10) g (10 to 500) g (1 to 20 000) g (> 20 to 5000) kg Up to 1000 lb (1000 to 120 000) lb (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	0.18 % + 0.6*R* 0.11 % + 0.6*R* 0.04 % + 0.6*R* 0.025 % + 0.6*R* 0.017 % + 0.6*R* 0.017 % per 20 kg + 0.6*R* 0.017 % + 0.6*R* 0.017 % per 1000 lb + 0.6*R* 0.041 mg + 0.6*R* 0.06 mg + 0.6*R* 0.089 mg + 0.6*R* 0.14 mg + 0.6*R* 0.3 mg + 0.6*R* 0.6 mg + 0.6*R* 0.9 mg + 0.6*R* 1.4 mg + 0.6*R* 3 mg + 0.6*R* 3 mg per 1000 g + 0.6*R*	Class F weights (applied load) Class 1 weights (applied load)
Force – Measuring Equipment[3]	Up to 5000 lbf Up to 10 000 lbf (2500 to 25 000) lbf	0.04 % + 0.6*R* 0.14 % 0.3 %	Class F weights Load cells w/ indicator
Force – Crimp Pull Force	Up to 200 lbf	0.79 lbf	Force gauge w/stand

Parameter/Equipment	Range	CMC[2, 5, 9] (±)	Comments
Pressure[3] – Measure & Measuring Equipment	Up to 1 inH_2O	0.002 inH_2O	Additel ADT161
	Up to 5 inH_2O	0.007 inH_2O	Additel ADT161
	Up to 10 inH_2O	0.014 H_2O	Additel ADT161
	Up to 50 H_2O	0.073 H_2O	Additel ADT161
	Up to 300 inH_2O	0.26 inH_2O	Additel ADT161
	(Up to 100) psia	0.063 psia	Fluke 700GA6
	Up to 100 psig Up to 1000 psig Up to 10 000 psig	0.08 psig 0.7 psig 7 psig	Fluke 754 w/ 700 series modules
	(30 to 300) psig (300 to 3000) psig	0.09 psig 0.9 psig	Additel ADT-681 Additel ADT-681
Barometric Pressure[3]	(60 to 110) kPa	0.076 kPa	Additel ADT226
Vacuum[3]	(0.01 to 28.5) in·Hg	0.17 inHg	Fluke 754 w/ 700PD6
Speed[3] –			
Optic/Non-Contact: RPM	(5 to 200 000) rpm	0.018 %	Monarch PT200
Contact: RPM Totalizer/Rate Meters	(0.5 to 20 000) rpm (1 to 6561.7) rpm	0.22 % 0.22 %	Monarch PT200
Speed/RPM/Rate Simulation	(6 to 200 000) rpm	0.003 %	Agilent 33220A

Parameter/Equipment	Range	CMC[2] (±)	Comments
Indirect Verification of Rockwell Hardness Testers[3]	HRA: (20 to 65) (70 to 78) (80 to 84) HRBW: (40 to 59) (60 to 79) (80 to 100) HRC: (20 to 30) (35 to 55) (60 to 65) HR15N: (70 to 77) (78 to 88) (90 to 92) HR30N: (42 to 50) (55 to 73) (77 to 82) HR45N: (20 to 31) (37 to 61) (66 to 72) 15T: Low Medium High 30T: Low Medium High	 0.82 HRA 0.82 HRA 0.82 HRA 0.82 HRBW 0.82 HRBW 0.82 HRBW 0.85 HRC 0.85 HRC 0.81 HRC 0.85 HR15N 0.85 HR15N 0.85 HR15N 0.82 HR30N 0.82 HR30N 0.82 HR30N 0.82 HR45N 0.82 HR45N 0.82 HR45N 0.83 HR15T 0.83 HR15T 0.83 HR15T 0.82 HR30T 0.82 HR30T 0.82 HR30T	Indirect verification per ASTM E18
Indirect Verification of Microindention Hardness Testers[3] (Vickers) 500g Force	 (100 to 240) HV (240 to 600) HV	 11 HV 11 HV	 ASTM E92

Parameter/Equipment	Range	CMC[2] (±)	Comments
Indirect Verification of Brinell Hardness Testers at Test Condition[3] –			
HBW 2.5/187.5	79.2 HBW 145 HBW	4.0 HBW 4.0 HBW	Indirect verification ASTM E10
HBW 10/500	75.6 HBW 130 HBW	4.0 HBW 1.6 HBW	
HBW 5/750	118 HBW 148 HBW 180 HBW 289 HBW 420 HBW	4.0 HBW 4.0 HBW 4.0 HBW 1.6 HBW 4.5 HBW	
HBW 10/1000	182 HBW 299 HBW	4.4 HBW 4.4 HBW	
HBW 10/3000	418 HBW	3.2 HBW	

VII. Optical Quantities

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Gloss Meters[3] 20°, 60°, 85°	Up to 100 GU	0.67 GU	Gloss standards
Light Booths[3] – Illuminance Color Temperature (CCT), Incandescent	Up to 50 000 Lux (2300 to 6500) K	2.7 % 60 K	Illuminance spectrophotometer

VIII. Thermodynamics

Parameter/Equipment	Range	CMC[2, 9] (±)	Comments
Infrared Thermometry[3] – Measuring Equipment	(35 to 100) °C (100 to 200) °C (200 to 350) °C (350 to 500) °C	1 °C 1.2 °C 1.7 °C 2.3 °C	Fluke 4181
Temperature[3] – Measure	(-200 to 0) °C (0 to 232) °C (232 to 420) °C (420 to 660) °C	0.024 °C 0.027 °C 0.035 °C 0.052 °C	Additel Secondary PRT
Temperature[3] – Measuring Equipment	(-15 to 350) °C (25 to 85) °C (0 to 150) °C	0.14 °C 0.04 °C 0.14	Fluke 9009 w/ reference probe Water bath w/ reference probe Oil bath w/ reference probe
Relative Humidity[3] – Measuring Equipment	(20 to 80) % RH	1.5 % RH	Vaisala MI70 w/ HMP-76 w/ controlled environment
Relative Humidity[3] – Measure	(10 to 90) % RH	1.5 % RH	Vaisala MI70 w/ HMP-76

VIII. Time & Frequency

Parameter/Equipment	Range	CMC[2, 9] (±)	Comments
Frequency[3] – Measuring Equipment	Up to 1100 MHz	3.3 µHz/Hz + 0.0001 Hz	Fluke 5522A/1GHz
Frequency[3] – Measure	Up to 350 MHz	1.7 µHz/Hz	Agilent 53220A

Parameter/Equipment	Range	CMC[2, 9] (±)	Comments
Timers & Stopwatches[3]	(1 to 3600) s	0.017 s	Agilent 53220A

[1] This laboratory offers commercial calibration, dimensional testing 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, a percent (%) refers to a percent of reading unless otherwise noted.

[6] In the statement of CMC, L is the numerical value of the nominal length of the device measured in inches. In the Calibration and Measurement Capability, R is the numerical value of the resolution of the device, and DL is the length of the diagonal in inches.

[7] In the statement of CMC, t represents the time in seconds.

[8] This laboratory meets R205 – *Specific Requirements: Calibration Laboratory Accreditation Program* for the types of dimensional tests listed above and is considered equivalent to that of a calibration.

[9] 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.

[10] This scope meets A2LA's *P112 Flexible Scope Policy.*

[11] Adjustable thread rings are set to applicable specifications using calibrated master set plug gages.

Accredited Laboratory

A2LA has accredited

CROSS TECHNOLOGIES, INC

Fairview, TN

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 18th day of June 2025.

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 1741.08
Valid to May 31, 2027

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