



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

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CALIBRATION

Valid To: May 31, 2023

Certificate Number: 1741.05

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations^{1,2}:

I. Chemical

Parameter/Equipment	Range	CMC ² (±)	Comments
pH Meters ³	4 pH 7 pH 10 pH	0.03 pH units 0.04 pH units 0.07 pH units	Standard pH solutions
Conductivity Meters ³	1 µS/cm 5 µS/cm 10 µS/cm 100 µS/cm 1000 µS/cm	0.56 µS/cm 0.56 µS/cm 0.56 µS/cm 2.2 µS/cm 5.2 µS/cm	Standard conductivity solutions

II. Dimensional

Parameter/Equipment	Range	CMC ^{2,5} (±)	Comments
Cylindrical Measure – Plain Rings	Up to 4 in	(26 + 3.5L) µin	P & W Labmaster™ w/ XX master rings
Pins, Plain Plugs, Discs, Spheres – External Diameter	Up to 4 in	(11 + 5L) µin	P & W Labmaster™ w/ gage blocks

Parameter/Equipment	Range	CMC ^{2, 5} (\pm)	Comments
Calipers ³	Up to 80 in	$(5.7 + 9.4L) \mu\text{in} + 0.6R$	Gage blocks
Micrometers ³ – Outside	Up to 80 in	$(5.7 + 9.4L) \mu\text{in} + 0.6R$	Gage blocks
Linear Indicators ³ – Dial and Test	Up to 4 in	$(5.9 + 9.1L) \mu\text{in} + 0.6R$	Gage blocks
Height Gages ³	Up to 48 in	$(24 + 2L) \mu\text{in} + 0.6R$	Gage blocks, surface plate
Steel Rules ³	Up to 72 in	$(1.5 + 10L) \mu\text{in} + 0.6R$	Gage blocks
Tape Measures ³	Up to 25 ft	$(1.5 + 10L) \mu\text{in} + 0.6R$	Gage blocks
Angle Indicators and Protractors ³	30°, 45°, 60°, 75°, 90°	0.03°	Angle block set
Angle Gages	Up to 90°	0.16°	Vision machine
Hand Tools ³ – Depth Gages, Snap Gages, Thickness Gages	Up to 4 in	$(5.9 + 9.1L) \mu\text{in} + 0.6R$	Gage blocks
Feeler Gages	Up to 1 in	75 μin	Digital micrometer
Optical Comparators ³ – Magnification X – Y Linearity Angle ⁹	10× to 250× Up to 12 in Up to 90°	0.014 in 150 μin 0.1°	Grid plate, glass master and scale Angle block set
Vision Systems ³ – X-Y Linearity Z Axis	Up to 18 in Up to 4 in	$(52 + 2.9L) \mu\text{in}$ 60 μin	Grid plates Gage blocks

Parameter/Equipment	Range	CMC ^{2,5} (\pm)	Comments
Sieves – Average Opening Average Wire Diameter	(0.025 to 30) mm (0.025 to 5) mm	3.9 μ m 3.9 μ m	ASTM E11 vision system
Surface Plates ³ – Repeatability Only/Local Flatness Flatness	0.002 in Up to 60DL (>60 to 120DL)	33 μ m (31 + 0.2DL) μ m (30 + 0.3DL) μ m	Repeat-o-meter Federal level systems
Diameter/Radius/ Fixture Gages – Diameter Radius Length	Up to 12.0 in Up to 12.0 in Up to 12.0 in	(200 + 6L) μ m (200 + 6L) μ m (200 + 6L) μ m	Vision machine
Roughness Specimens – Ra	(2 to 500) μ m	3.4 μ m	Mitutoyo CV-500 surface analyzer

III. Dimensional Testing/Calibration¹

Parameter/Equipment	Range	CMC ^{2,5} (\pm)	Comments
Surface Finish Measure – Ra	(2 to 500) μ m	3.4 μ m	Mitutoyo CV-500 surface analyzer

Parameter/Equipment	Range	CMC ^{2,5} (±)	Comments
Length ⁸ – X Axis Y Axis Z Axis	Up to 25 in (650 mm) Up to 30 in (750 mm) Up to 20 in (500 mm)	(190 + 7.6L) µin	CMM
Volumetric ³	Up to 20 in	(200 + 6.7L) µin	CMM
X-Y Measurements	3 in x 6 in 12 in x 12 in	(280 + 5.8L) µin (200 + 6L) µin	Star Lite 150 vision system sprint- 300

IV. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2,4,6} (±)	Comments
DC Voltage – Measure ³	(0 to 100) mV (0.1 to 1.0) V (1 to 10) V (10 to 100) V (100 to 1000) V (Up to 10) kV (10 to 100) kV	7.8 µV/V + 0.2 µV 4.4 µV/V + 0.3 µV 4.4 µV/V + 0.5 µV 6.8 µV/V + 30 µV 7 µV/V + 0.5 mV 0.05 % + 0.03 V 0.07 % + 0.3 V	Fluke 8588A Vitrek 4700 w/ HVL- 100
DC Voltage – Generate ³	(0 to 220) mV 220 mV to 2.2 V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1100) V	11 µV/V + 0.4 µV 6.7 µV/V + 0.7 µV 5 µV/V + 2.5 µV 5.1 µV/V + 4 µV 6.7 µV/V + 40 µV 8.5 µV/V + 400 µV	Fluke 5730A
DC Current – Measure ³	(0 to 10) µA (10 to 100) µA (0.1 to 1.0) mA (1 to 10) mA (10 to 100) mA (0.1 to 1.0) A (1 to 10) A (1 to 30) A	28 µA/A + 0.4 nA 10 µA/A + 0.4 nA 10 µA/A + 4 nA 15 µA/A + 40 nA 58 µA/A + 1 µA 0.014 % + 0.1mA 0.024 % + 0.4 mA 0.056 % + 4.4 mA	Fluke 8588A

Parameter/Equipment	Range	CMC ^{2, 4, 6} (±)	Comments
DC Current – Measure ³ (cont)	(1 to 20) A	0.017 %	Fluke Y5020 w/ HP 3458A
	(20 to 100) A	0.25 %	Empro shunt w/ HP 3458A
DC Current – Generate ³	(0 to 220) μ A 220 μ A to 2.2 mA (2.2 to 22) mA (22 to 220) mA	50 μ A/A + 6 nA 44 μ A/A + 7 nA 44 μ V/V + 40 nA 55 μ V/V + 0.7 μ A	Fluke 5730A * $\pm (200 I^2)$ μ A/A for $I > 100$ mA
	220 mA to 2.2 A	0.011 % + 12 μ A	$\pm (10 I^2)$ μ A/A for $I > 1$ A
	(2.2 to 11) A	0.011 % + 480 μ A	Fluke 5730A w/Fluke 5725A
	(11 to 21) A	0.12 % + 750 μ A	Fluke 5522A
DC Clamp-On Meters ³ – (Toroidal) (Non-Toroidal)	(20.5 to 1000) A	0.39 % + 0.5 A	Fluke 5522A w/5500 coil
	(20.5 to 1000) A	0.65 % + 0.5 A	
DC Power – Generate ³ 33 mV to 1020V (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 %	Fluke 5522A
		0.03 %	
		0.09 %	
Resistance – Measure ³	(0 to 1) Ω	19 $\mu\Omega/\Omega$ + 4.0 $\mu\Omega$	Fluke 8588A
	(1 to 10) Ω	11 $\mu\Omega/\Omega$ + 14 $\mu\Omega$	
	(10 to 100) Ω	9.6 $\mu\Omega/\Omega$ + 50 $\mu\Omega$	
	(0.1 to 1) k Ω	9.4 $\mu\Omega/\Omega$ + 0.5 m Ω	
	(1 to 10) k Ω	9.4 $\mu\Omega/\Omega$ + 5.0 m Ω	
	(10 to 100) k Ω	9.6 $\mu\Omega/\Omega$ + 50 m Ω	
	(0.1 to 1) M Ω	11 $\mu\Omega/\Omega$ + 1 Ω	
	(1 to 10) M Ω	24 $\mu\Omega/\Omega$ + 100 Ω	
	(10 to 100) M Ω	0.013 % + 10 k Ω	
	(0.1 to 1) G Ω	0.14 % + 1 M Ω	
(1 to 10) G Ω	0.14 % + 10 M Ω		

Parameter/Equipment	Range	CMC ^{2,4,6} (±)	Comments
Resistance – Generate ³ Fixed Points	0 Ω (1, 1.9) Ω (10, 19) Ω (100, 190) Ω (1, 1.9, 10, 19) kΩ (100, 190) kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ (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	50 μΩ 0.012 % 31 μΩ/Ω 13 μΩ/Ω 8.2 μΩ/Ω 11 μΩ/Ω 16 μΩ/Ω 22 μΩ/Ω 50 μΩ/Ω 59 μΩ/Ω 0.013 % 49 μΩ/Ω + 0.001 Ω 51 μΩ/Ω + 0.0015 Ω 34 μΩ/Ω + 0.0014 Ω 34 μΩ/Ω + 0.002 Ω 34 μΩ/Ω + 0.02 Ω 34 μΩ/Ω + 0.2 Ω 39 μΩ/Ω + 2 Ω 73 μΩ/Ω + 30 Ω 0.014 % + 50 Ω 0.03 % + 2.5 kΩ 0.06 % + 3 kΩ 0.36 % + 100 kΩ 1.8 % + 500 kΩ	Fluke 5730A Fluke 5522A
Insulation Resistance ³	1 MΩ, 10 MΩ, 100 MΩ, 1 GΩ, 10 GΩ, 100 GΩ	1.2 %	Local resistor set



Parameter/Range	Frequency	CMC ^{2, 4} (±)	Comments
Capacitance – Generate ³ (220 to 399.9) pF (0.4 to 1.0999) nF (1.1 to 3.2999) nF (3.3 to 10.9999) nF (11 to 109.999) nF (110 to 329.999) nF (0.33 to 1.099 99) μF (1.1 to 3.29999) μF (3.3 to 10.9999) μF (11 to 32.9999) μF (33 to 109.999) μF (110 to 329.999) μF (0.33 to 1.099 99) mF (1.1 to 3.299 99) mF (3.3 to 10.9999) mF (11 to 32.9999) mF (33 to 110) mF	(10 to 10 000) Hz (10 to 10 000) Hz (10 to 3000) Hz (10 to 1000) Hz (10 to 1000) Hz (10 to 1000) Hz (10 to 600) Hz (10 to 300) Hz (10 to 150) Hz (10 to 120) Hz (10 to 80) Hz (0 to 50) Hz (0 to 20) Hz (0 to 6) Hz (0 to 2) Hz (0 to 0.6) Hz (0 to 0.2) Hz	0.88 % + 10 pF 0.6 % + 0.01 nF 0.6 % + 0.01 nF 0.31 % + 0.1 nF 0.31 % + 0.1 nF 0.31 % + 0.3 nF 0.31 % + 1 nF 0.31 % + 3 nF 0.31 % + 10 nF 0.49 % + 30 nF 0.55 % + 100 nF 0.55 % + 300 nF 0.55 % + 1 μF 0.55 % + 3 μF 0.56 % + 10 μF 0.91 % + 30 μF 1.4 % + 100 μF	Fluke 5522A
AC Voltage – Generate ³ (0.22 to 2.2) mV (2.2 to 22) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.19 % + 4 μV 0.12 % + 4 μV 0.086 % + 4 μV 0.15 % + 4 μV 0.21 % + 5 μV 0.37 % + 10 μV 0.53 % + 20 μV 0.69 % + 20 μV 0.031 % + 4 μV 0.014 % + 4 μV 0.013 % + 4 μV 0.03 % + 4 μV 0.066 % + 5 μV 0.14 % + 10 μV 0.18 % + 20 μV 0.35 % + 20 μV	Fluke 5730A



Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Voltage – Generate ³ (cont)			
(22 to 220) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.03 % + 12 μV 0.011 % + 7 μV 0.0073 % + 7 μV 0.015 % + 7 μV 0.038 % + 17 μV 0.08 % + 20 μV 0.17 % + 25 μV 0.34 % + 45 μV	Fluke 5730A
220 mV to 2.2 V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.062 % + 40 μV 0.024 % + 15 μV 53 μV/V + 8 μV 83 μV/V + 10 μV 0.011 % + 30 μV 0.041 % + 80 μV 0.12 % + 200 μV 0.21 % + 300 μV	
(2.2 to 22) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.029 % + 400 μV 0.012 % + 150 μV 55 μV/V + 50 μV 86 μV/V + 100 μV 0.011 % + 200 μV 0.032 % + 600 μV 0.12 % + 2 mV 0.19 % + 3.2 mV	
(22 to 220) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.029 % + 4 mV 0.012 % + 1.5 mV 66 μV/V + 0.6 mV 0.011 % + 1 mV 0.019 % + 2.5 mV 0.11 % + 16 mV 0.53 % + 40 mV 0.97 % + 80 mV	45V Max @ 500 kHz 22V Max @ 1 MHz Refer to Volt-Hertz capability chart
(220 to 1100) V	(15 to 50) Hz 50 Hz to 1 kHz	0.037 % + 16 mV 90 μV/V + 3.5 mV	
(220 to 1100) V	40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz	0.012 % + 4 mV 0.02 % + 6 mV 0.073 % + 11 mV	

Parameter/Range	Frequency	CMC ^{2, 4} (\pm)	Comments
AC Voltage – Generate ³ (cont) (220 to 750) V	 (30 to 50) kHz (50 to 100) kHz	 0.073 % + 11 mV 0.28 % + 45 mV	 Fluke 5730A w/5725A
AC Voltage – Measure ³ (0 to 10) mV	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz (0.3 to 1) MHz	0.034 % + 1.1 μ V 0.041 % + 1.1 μ V 0.042 % + 1.1 μ V 0.031 % + 1.1 μ V 1.1 % + 4 μ V 2.1 % + 4 μ V	Fluke 8588A
(10 to 100) mV	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz (0.3 to 1) MHz	0.01 % + 0.5 μ V 0.014 % + 0.4 μ V 0.024 % + 1 μ V 0.054 % + 5 μ V 0.22 % + 30 μ V 1.2 % + 0.1 mV	
(0.1 to 1) V	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz (0.3 to 1) MHz	0.008 % + 5 μ V 0.013 % + 5 μ V 0.024 % + 10 μ V 0.054 % + 50 μ V 0.22 % + 0.3 mV 1.1 % + 1 mV	
(1 to 10) V	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz (0.3 to 1) MHz	0.008 % + 50 μ V 0.013 % + 50 μ V 0.024 % + 0.1 mV 0.054 % + 0.5 mV 0.22 % + 3 mV 1.1 % + 10 mV	
(10 to 100) V	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz (0.3 to 1) MHz	0.016 % + 0.5mV 0.017 % + 0.5mV 0.027 % + 1 mV 0.061 % + 5 mV 0.38 % + 50 mV 1.2 % + 0.5 V	

Parameter/Range	Frequency	CMC ^{2, 4} (±)	Comments
AC Voltage – Measure ³ (cont)			
(100 to 1000) V	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz	0.012 % + 25 mV 0.012 % + 25 mV 0.025 % + 25 mV 0.06 % + 0.1 V	Fluke 8588A
(1 to 10) kV (10 to 70) kV	(50 to 60) Hz (50 to 60) Hz	0.15 % + 0.1 V 0.15 % + 0.6 V	Vitretek 4700 w/ HVL-100
AC Current – Generate ³			
(0 to 220) µA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.031 % + 16 nA 0.02 % + 10 nA 0.014 % + 8 nA 0.029 % + 12 nA 0.14 % + 65 nA	Fluke 5730A
220 µA to 2.2 mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.031 % + 40 nA 0.02 % + 35 nA 0.013 % + 35 nA 0.025 % + 110 nA 0.14 % + 650 nA	
(2.2 to 22) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.033 % + 400 nA 0.02 % + 350 nA 0.013 % + 350 nA 0.025 % + 550 nA 0.14 % + 5 µA	
(22 to 220) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.033 % + 4 µA 0.02 % + 3.5 µA 0.013 % + 2.5 µA 0.025 % + 3.5 µA 0.14 % + 10 µA	
220 mA to 2.2 A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.03 % + 35 µA 0.055 % + 80 µA 0.85 % + 160 µA	

Parameter/Range	Frequency	CMC ^{2, 4} (\pm)	Comments
AC Current – Generate ³ (cont)			
(2.2 to 11) A	40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.056 % + 170 μ A 0.12 % + 380 μ A 0.44 % + 750 μ A	Fluke 5730A
(11 to 20.5) A	45 Hz to 1 kHz	0.19 % + 5 mA	Fluke 5522A
AC Clamp-On Meters ^{3–}			
(10 to 150) A			Fluke 5522A
Toroidal	(45 to 65) Hz (65 to 440) Hz	0.49 % + 0.025 A 1 % + 0.027 A	
Non-Toroidal	(45 to 65) Hz (65 to 440) Hz	0.76 % + 0.25 A 1.3 % + 0.25 A	
(150 to 1025) A			
Toroidal	(45 to 65) Hz (65 to 440) Hz	0.49 % + 0.09 A 1 % + 0.1 A	Fluke 5520A w/ 5500 coil
Non-Toroidal	(45 to 65) Hz (65 to 440) Hz	0.76 % + 0.9 A 1.3 % + 0.9 A	
AC Current – Measure ³			
(0 to 10) μ A	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz	0.21 % + 2.5 nA 0.21 % + 2.5 nA 0.21 % + 2.5 nA	Fluke 8588A
(10 to 100) μ A	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz	0.029 % + 5 nA 0.054 % + 5 nA 0.075 % + 5 nA 0.41 % + 10 nA	
(0.1 to 1) mA	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz	0.029 % + 50 nA 0.054 % + 50 nA 0.075 % + 50 nA 0.41 % + 0.1 μ A	

Parameter/Range	Frequency	CMC ^{2, 4, 6} (±)	Comments
AC Current – Measure ³ (cont)			
(1 to 10) mA	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz	0.029 % + 0.5 μA 0.054 % + 0.5 μA 0.075 % + 0.5 μA 0.41 % + 1 μA	Fluke 8588A
(10 to 100) mA	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz	0.029 % + 5 μA 0.053 % + 5 μA 0.075 % + 5 μA	
(0.1 to 1) A	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz	0.031 % + 0.1 mA 0.056 % + 0.1 mA 0.08 % + 0.1 mA	
(1 to 10) A	10 Hz to 2 kHz (2 to 10) kHz	0.085 % + 0.5 mA 0.085 % + 0.5 mA	
(10 to 30) A	10 Hz to 2 kHz (2 to 10) kHz	0.085 % + 12 mA 0.13 % + 12 mA	
(1 to 20) A	Up to 1 kHz	0.022 %	Fluke Y5020 w/ HP 3458A
(20 to 100) A	Up to 60 Hz	0.27 %	Empro shunt w/ HP 3458A

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Oscilloscopes ³ – (cont)			Fluke 5522A w/ SC1100
Level Sine Wave:			
Frequency	(0 to 1100) MHz	3.3 µHz/Hz	
Amplitude	50 kHz Reference 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (300 to 1100) MHz	2.4 % + 300 µV 4.2 % + 300 µV 4.8 % + 300 µV 7.2 % + 300 µV 8.4 % + 300 µV	
Flatness (Bandwidth)	0 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (300 to 1100) MHz	1.8 % + 100 µV 2.4 % + 100 µV 4.8 % + 100 µV 6 % + 100 µV	
Time Markers:			
Into a 50 Ω load	5 s to 50 ms 20 ms to 2 ns	(30 + 1000t) 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 –			Fluke 5522A
Type B	(600 to 800) °C (800 to 1820) °C	0.53 °C 0.43 °C	
Type E	(-250 to -100) °C (-100 to 650) °C (650 to 1000) °C	0.56 °C 0.20 °C 0.26 °C	
Type J	(-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1200) °C	0.33 °C 0.20 °C 0.17 °C 0.21 °C 0.28 °C	
Type K	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.40 °C 0.22 °C 0.20 °C 0.32 °C 0.48 °C	

Parameter/Equipment	Range	CMC ² (±)	Comments
Electrical Simulation of Thermocouples ³ – (cont)			Fluke 5522A
Type N	(-210 to -100) °C (-100 to 410) °C (410 to 1300) °C	0.50 °C 0.30 °C 0.36 °C	
Type R	(0 to 250) °C (250 to 1000) °C (1000 to 1767) °C	0.70 °C 0.42 °C 0.50 °C	
Type S	(0 to 250) °C (250 to 1400) °C (1400 to 1767) °C	0.58 °C 0.46 °C 0.57 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 400) °C	0.76 °C 0.30 °C 0.21 °C	
Electrical Simulation of RTDs ³			Fluke 5522A
Pt 385, 100 Ω	(-200 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 800) °C	0.08 °C 0.10 °C 0.11 °C 0.13 °C 0.15 °C 0.28 °C	
	(-200 to 100) °C (100 to 800) °C	0.07 °C 0.17 °C	Fluke 754
RTD – Measure ³			
Pt 385, 100 Ω	(-200 to 100) °C (100 to 800) °C	0.11 °C 0.26 °C	Fluke 754

V. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC ^{2, 6, 11} (±)	Comments
RF Power – Measure (-20 to 30) dBm 1 μW to 100 nW	100 kHz to 4.2 GHz	1.5 %	HP437B/8482A

VI. Mechanical

Parameter/Equipment	Range	CMC ^{2, 6} (±)	Comments
Torque Wrenches ³	40 in·oz to 600 ft·lbf	0.65 %	CDI suretest 5000-ST
Torque Testers	Up to 1000 ft·lbf	0.08 %	Class F weights w/ torque arms
Rotary Torque Tools ³ – Pneumatic, DC, Pulse	(0.02 to 2) N·m (0.2 to 20) N·m (0.75 to 75) N·m (18 to 180) N·m	1.3 % full scale	Crane-torque star w/ rotary transducers
Force ³ Measuring Equipment – Tension and Compression (Field Only)	Up to 5000 lbf Up to 10 000 lbf	0.05 % + 0.6R 0.35 %	Standard weights Load cells w/ indicator
Compression Only (Field Only)	(12 000 to 200 000) lbf	0.31 %	Load cells w/ indicator

Parameter/Equipment	Range	CMC ^{2, 5, 6} (\pm)	Comments
Scale and Balances ³	(1 to 500) mg	0.006 mg + 0.6R	ASTM Class 0 weights (applied load)
	500 mg to 5 g	0.02 mg + 0.6R	
	(5 to 10) g	0.03 mg + 0.6R	
	(10 to 20) g	0.045 mg + 0.6R	
	(20 to 50) g	0.073 mg + 0.6R	
	(50 to 100) g	0.16 mg + 0.6R	
	(100 to 200) g	0.3 mg + 0.6R	
	(> 200 to 600) g	0.3 mg per 200 g + 0.6R	ASTM Class 1 weights (applied load)
	(1 to 5) g	0.043 mg + 0.6R	
	Up to 10 g	0.062 mg + 0.6R	
	Up to 30 g	0.096 mg + 0.6R	
	Up to 50 g	0.17 mg + 0.6R	
	Up to 100 g	0.31 mg + 0.6R	
Up to 200 g	0.63 mg + 0.6R		
Up to 300 g	0.92 mg + 0.6R	Class F weights (applied load)	
Up to 500 g	1.5 mg + 0.6R		
Up to 1000 g	3.1 mg + 0.6R		
(> 1 to 15) kg	3.1 mg per 1000 g + 0.6R		
(1 to 20 000) g	0.017 % + 0.6R		Class F weights (applied load)
(> 20 to 5000) kg	0.017 % per 20 000 g + 0.6R		
Up to 1000 lbs	0.017 % + 0.6R	Class F weights (applied load)	
(1000 to 120 000) lbs	0.017 % per 20 000 lb + 0.6R		

Parameter/Equipment	Range	CMC ^{2,6} (±)	Comments		
Pressure ³ – Measuring Equipment and Measure	Pneumatic	(0 to 28) in H ₂ O	0.033 % of full scale	Merriam M200LS Merriam ZM200LS	
		(0 to 200) in H ₂ O	0.03 % of full scale		
		(0.01 to 30) psig	0.07 % of full scale		Fluke 754 / 700PD5 series modules
		(0.01 to 100) psig	0.07 % of full scale		Fluke 754 / 750PD6 series modules
	Hydraulic	(0.1 to 300) psig	0.07 % of full scale	Fluke 718 300G	
		(0.1 to 300) psig	0.07 % of full scale	Fluke 718 300G	
		(0.1 to 1000) psig	0.07 % of full scale	Fluke 754 w/750P08 series modules	
		(1 to 10 000) psig	0.12 % of full scale	Fluke 754 w/ 700 series modules	
	(5 to 10 000) psig	0.13 %	Ametek DM-T-100		
Absolute and Barometric Pressure Measuring Equipment ³	(0 to 60) in·Hg	0.08 in·Hg	Druck DPI705		
Atmospheric Pressure Measuring Equipment (Vacuum ³)	(0 to 28.5) in·Hg	0.07 % of full scale	Fluke 754 w/ 700PD6		
Mass Measure – Field Check Weight Comparison ³					
Load Fixtures, Hangers, Package and Check Weights	Up to 70 lbs	0.07 %	Scale w/Class F weights		

Parameter/Equipment	Range	CMC ^{2, 6} (±)	Comments
Indirect Verification of Rockwell Hardness Testers ³	HRC: Low Medium High HRB W: Low Medium High	0.56 HRC 0.56 HRC 0.55 HRC 0.54 HRBW 0.42 HRBW 0.42 HRBW	Indirect verification per ASTM E18
Speed/RPM/Rate Simulation	(6 to 200 000) rpm	0.003 %	Agilent 33220A frequency synthesizer
Durometer Calibration – (Type A, B, C, D, DO, O, OO) Indenter Extension and Shape – Diameter Radius Angle Extension Indenter Display Spring Calibration – Force	 Up to 0.105 in Up to 0.125 in (25 to 40) ° Up to 0.105 in (0 to 100) duro units Up to 45 N	 200 μin 200 μin 0.16° 70 μin 0.7 durometer units 0.032 N	ASTM D2240 Vision system Gage blocks Gage blocks Precision bench scale
Speed ³ – Measure Optic/Non-Contact: RPM Totalizer/Rate Meters Contact: RPM Totalizer/Rate Meters	 (6 to 200 000) rpm (2 to 3300) fpm (6 to 20 000) rpm (2 to 3300) fpm	 0.018 % 0.018 % 0.22 % 0.22 %	 Monarch PLT200 Monarch PLT200

Parameter/Equipment	Range	CMC ^{2, 6} (±)	Comments
Totalize Meters ³ – (Length Counters and Totalizers)			
Distance Measure	Up to 2000 yards	0.7 %	Monarch PLT200 w/ encoder wheel

VII. Fluid Quantities

Parameter/Equipment	Range	CMC ^{2, 6} (±)	Comments
Gas Flow Measuring Equipment– Air and N2			
Laminar Flow	(0.01 to 50) slpm (50 to 100) slpm	0.5 % 0.65 %	Fluke Molbox 1 + TM w/Molbloc Elements
Sonic Flow	(28 to 120) slpm	0.8 %	
Piston Operated Volumetric Apparatus ³ – Pipettes and Burettes	(1 to 10) µL (10 to 100) µL (100 to 1000) µL (1000 to 10 000) µL	0.11 µL 0.17 µL 0.63 µL 12 µL	Gravimetric method
Volumetric Measuring Devices –			
(Cylinders, Burettes, Pipettes, Syringes, Flasks, Beakers, Vessels)	Up to 80 mL (>80 to 200) mL (>200 to 5000) mL	0.036 mL 0.17 mL 2.2 mL	Gravimetric method

VIII. Thermodynamics

Parameter/Equipment	Range	CMC ^{2, 10, 11} (±)	Comments
Temperature – Measure	(0 to 100) °C	0.04 °C	Fluke 1524 w/ thermistor probe
	(-200 to 300) °C	0.06 °C	Fluke 1524 w/ PRT probe
	(-200 to 420) °C	0.08 °C	Fluke 1524 w/ PRT probe
Temperature – Measuring Instruments ³	(-30 to 125) °C	0.087 °C	Fluke 7103 w/ reference probe
	(35 to 350) °C	0.65 °C	Fluke 9140
Infrared Temperature Indicators ³ (Optical Pyrometers)	35°C (35 to 100) °C (100 to 200) °C (200 to 350) °C (350 to 500) °C	0.84 °C 0.95 °C 1.2 °C 1.7 °C 2.3 °C	Fluke 4181 Emissivity = 0.95 (8 to 14) μm
Relative Humidity-Measure ³	(10 to 90) % RH	1.5 % RH	Vaisala MI-70 w/ HMP76B probe
Relative Humidity – Measuring Equipment ³	(15 to 90) % RH	1.5 % RH	Vaisala MI-70 w/ HMP76B probe w/ Controlled Environment

VIII. Time and Frequency

Parameter/Equipment	Range	CMC ^{2, 11} (\pm)	Comments
Frequency – Measuring Equipment ³	0.01Hz to 2 MHz	5.6 μ Hz/Hz + 5 μ Hz	Fluke 5522A
Frequency – Measure	(0 to 200) MHz	2.5 μ Hz/Hz	HP/Agilent 5335A
Timers & Stopwatches ³	(1 to 3600) s	0.050s	HP 5335A

¹ This laboratory offers commercial calibration and dimensional testing services, and field calibration and field dimensional testing 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 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.

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’s are expressed as either a specific value that covers the full range or as a percent or fraction 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 its respective units; DL is the diagonal length of the device in inches.

⁶ In the statement of CMC, percentages are to be read as percent of reading unless otherwise noted.

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 This test is not equivalent to that of a calibration

¹⁰ Applicable to Optical Comparators ONLY.

¹¹ 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.

¹² This scope meets A2LA's *P112 Flexible Scope Policy*.



Accredited Laboratory

A2LA has accredited

CROSS TECHNOLOGIES, INC DBA CROSS (FORMERLY J.A. KING)
RALEIGH, NC

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 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 11th day of November 2020.

A blue ink signature of the Vice President of Accreditation Services, written over a horizontal line.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 1741.05
Valid to May 31, 2023
Revised May 11, 2021

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