



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

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CALIBRATION

Valid To: September 30, 2023

Certificate Number: 1741.19

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations^{1, 8}:

I. Chemical

Parameter/Equipment	Range	CMC ² (±)	Comments
pH Meters ³	4 pH 7 pH 10 pH	0.028 pH 0.028 pH 0.036 pH	Standard pH solutions
Conductivity Meters ³	10 µS/cm 100 µS/cm 1000 µS/cm 10 000 µS/cm	0.56 µS/cm 2.2 µS/cm 5.7 µS/cm 41 µS/cm	Standard conductivity solutions
Refractometers ³	(5, 15, 40, 70) % Brix	0.033 % Brix	Sucrose solutions

II. Dimensional

Parameter/Equipment	Range	CMC ^{2, 5} (±)	Comments
Calipers ³	Up to 60 in	(4.6 + 9.8L) µin + 0.6R	Gage blocks
Micrometers ³	Up to 60 in	(4.6 + 9.8L) µin + 0.6R	Gage blocks

Parameter/Equipment	Range ⁵	CMC ^{2, 5, 7} ($\pm$)	Comments
Linear Indicators – Dial and Test ³	Up to 4 in	$(3 + 9.4L) \mu\text{in} + 0.6R$	Gage blocks
Pin Gages – Class ZZ	Up to 1 in	80 μin	Micrometer
Height Gages ³	Up to 20 in (20 to 48) in	$(2.5 + 10L) \mu\text{in} + 0.6R$ $(9.5 + 9.7L) \mu\text{in} + 0.6R$	Gage blocks w/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
Feeler/Thickness Gages ³	Up to 1 in	80 μin	Micrometer
Coating Thickness Gages – Film, Ultrasonic ³	Up to 60 mils	0.1 mils	Coating thickness standards
Optical Comparators ³ – Linear Accuracy Magnification Angle	Up to 12 in 10x to 250x (0 to 90)°	150 μin 0.014 in 0.1°	Glass scale Mag checker Angle block set

Parameter/Equipment	Range ⁵	CMC ^{2, 5} ($\pm$)	Comments
Vision systems ³ – X-Y Linearity Z Axis	Up to 18 in Up to 4 in	61 μ in 60 μ in	Glass scale Gage blocks
Surface Plates Grades AA, A and B ³ – Repeatability Flatness	0.002 in Up to 60 <i>DL</i> in (>60 to 120) <i>DL</i> in	40 μ in (31 + 0.2 <i>DL</i>) μ in (30 + 0.3 <i>DL</i>) μ in	Repeat-o-meter Federal level system
Bench Micrometers, Universal Length Measuring Machines ³ – Linearity Parallelism Force	Up to 20 in Up to 1 in Up to 80 oz	(3.9 + 1.5 <i>L</i>) μ in + 0.6 <i>R</i> 5 μ in 0.32 oz	Gage blocks Reference sphere Futek load cell

III. Dimensional Testing/Calibration⁹

Parameter/Equipment	Range ⁵	CMC ^{2, 5} ($\pm$)	Comments
One Dimensional – Measure ³	Up to 1 in Up to 6 in	80 μ in 0.0026 in	Micrometer Caliper

IV. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2, 6, 7} ($\pm$)	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 (1 to 10) kV (10 to 100) kV	7.8 μ V/V + 0.2 μ V 4.4 μ V/V + 0.3 μ V 4.4 μ V/V + 0.5 μ V 6.8 μ V/V + 30 μ V 7 μ V/V + 0.5 mV 0.03 % + 0.03 V 0.05 % + 0.3 V	Fluke 8588A Vitrek 4700 w/ HVL-100
DC Voltage – Generate ³	(0 to 330) mV 330 mV to 3.3 V (3.3 to 33) V (33 to 330) V (100 to 1020) V	25 μ V/V + 1 μ V 14 μ V/V + 2 μ V 15 μ V/V + 15 μ V 22 μ V/V + 150 μ V 22 μ V/V + 1.5 mV	Fluke 5522A
DC Current – Measure ³	(0 to 10) μ A (10 to 100) μ A (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 (1 to 1000) A	28 μ A/A + 0.4 nA 10 μ A/A + 0.4 nA 10 μ A/A + 4 nA 15 μ A/A + 40 nA 58 μ A/A + 1 μ A 0.014 % + 0.1mA 0.024 % + 0.4 mA 0.056 % + 4.4 mA 0.32 %	Fluke 8588A Empro shunt w/ Fluke 8588A
DC Current – Generate ³	(0 to 330) μ A (0 to 3.3) mA (0 to 33) mA (0 to 330) mA (0 to 1.1) A (1.1 to 3) A (0 to 11) A (11 to 21) A	0.018 % + 0.02 μ A 0.012 % + 0.05 μ A 0.013 % + 0.25 μ A 0.015 % + 2.5 μ A 0.025 % + 40 μ A 0.046 % + 40 μ A 0.06 % + 500 μ A 0.12 % + 750 μ A	Fluke 5522A
DC Clamp-On Meters ³ –			
Toroidal	(Up to 1000) A	0.39 % + 0.5 A	Fluke 5522A w/5500 coil
Non-Toroidal	(Up to 1000) A	0.65 % + 0.5 A	

Parameter/Equipment	Range	CMC ^{2, 6, 7} (±)	Comments
DC Power – Generate ³ 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	0.032 % 0.031 % 0.085 %	Fluke 5522A
Resistance – Measure ³	(0 to 1) Ω (1 to 10) Ω (10 to 100) Ω (0.1 to 1) kΩ (1 to 10) kΩ (10 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ (10 to 100) MΩ (0.1 to 1) GΩ (1 to 10) GΩ	19 μΩ/Ω + 4.0 μΩ 11 μΩ/Ω + 14 μΩ 9.6 μΩ/Ω + 50 μΩ 9.4 μΩ/Ω + 0.5 mΩ 9.4 μΩ/Ω + 5.0 mΩ 9.6 μΩ/Ω + 50 mΩ 11 μΩ/Ω + 1 Ω 24 μΩ/Ω + 100 Ω 0.013 % + 10 kΩ 0.14 % + 1 MΩ 0.14 % + 10 MΩ	Fluke 8588A
Resistance – Generate ³	Up 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	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 5522A
Decade Steps	1 mΩ to 100 Ω	0.026 % + 1 mΩ	IET decade resistor 1433-19-K
Insulation Resistance ³ – Fixed Points	1 MΩ, 10 MΩ 100 MΩ, 1 GΩ, 2 GΩ, 5 GΩ, 10 GΩ, 100 GΩ	1.2 %	Standard resistors

Parameter/Equipment	Range	CMC ^{2, 6, 7} (±)	Comments
Inductance – Generate ³ Fixed Points	100 µH 50 mH 500 mH 2 H	0.32 % 0.14 % 1.2 % 0.14 %	Genrad 1480 series
Capacitance – Generate ³	(3.3 to 11) nF (11 to 110) nF (110 to 330) nF (0.33 to 1.1) µF (1.1 to 3.3) µF (3.3 to 11) µF (11 to 33) µF (33 to 110) µF (110 to 330) µF 330 µF to 1.1 mF (1.1 to 3.3) mF (3.3 to 11) mF (11 to 33) mF (33 to 110) mF	0.34 % + 0.01 nF 0.32 % + 0.1 nF 0.32 % + 0.3 nF 0.32 % + 1 nF 0.32 % + 3 nF 0.32 % + 10 nF 0.5 % + 30 nF 0.57 % + 100 nF 0.57 % + 300 nF 0.58 % + 300 nF 0.56 % + 3 µF 0.56 % + 10 µF 0.9 % + 30 µF 2.2 % + 100 µF	Fluke 5522A
Capacitance – Generate ³ Decade Steps	10 pF to 100 µF	1.3 %	Time electronics 1071
Capacitance – Measure ³ (0.1 to 1) nF (1 to 10) nF (10 to 100) nF (0.1 to 1) µF (1 to 10) µF (10 to 100) µF (0.1 to 1) mF (1 to 10) mF (10 to 100) mF	(50 to 60) Hz (50 to 60) Hz (50 to 60) Hz (50 to 60) Hz (50 to 60) Hz (50 to 60) Hz (50 to 60) Hz (50 to 60) Hz (50 to 60) Hz	0.23 % + 0.1 nF 0.13 % + 0.2 nF 0.1 % + 0.01 nF 0.1 % + 0.1 nF 0.1 % + 0.1 nF 0.11 % + 0.01 µF 0.11 % + 0.1 µF 0.12 % + 1 µF 0.12 % + 0.1 mF	Fluke 8588A

Parameter/Range	Frequency	CMC ^{2, 4, 6, 7} ($\pm$)	Comments
AC Voltage – Generate ³			
(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	0.1 % + 6 μ V 0.021 % + 6 μ V 0.027 % + 6 μ V 0.12 % + 6 μ V 0.42 % + 12 μ V 0.96 % + 50 μ V	Fluke 5522A
(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	0.036 % + 8 μ V 0.018 % + 8 μ V 0.02 % + 8 μ V 0.042 % + 8 μ V 0.096 % + 32 μ V 0.24 % + 70 μ V	
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	0.04 % + 50 μ V 0.019 % + 60 μ V 0.023 % + 60 μ V 0.036 % + 50 μ V 0.085 % + 130 μ V 0.29 % + 600 μ V	
(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	0.04 % + 650 μ V 0.019 % + 600 μ V 0.029 % + 600 μ V 0.043 % + 600 μ V 0.11 % + 1.6 mV	
(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	0.024 % + 2 mV 0.025 % + 6 mV 0.03 % + 6 mV 0.038 % + 6 mV 0.25 % + 50 mV	
(330 to 1020) V	45 Hz to 10 kHz	0.037 % + 10 mV	

Parameter/Range	Frequency	CMC ^{2, 4, 6, 7} (±)	Comments
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 µV 0.041 % + 1.1 µV 0.042 % + 1.1 µV 0.031 % + 1.1 µV 1.1 % + 4 µV 2.1 % + 4 µV	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 µV 0.014 % + 0.4 µV 0.024 % + 1 µV 0.054 % + 5 µV 0.22 % + 30 µV 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 µV 0.013 % + 5 µV 0.024 % + 10 µV 0.054 % + 50 µV 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 µV 0.013 % + 50 µV 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	
(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	
(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	Vitrek 4700 w/transfer probe

Parameter/Range	Frequency	CMC ^{2, 4, 7} (±)	Comments
AC Clamp-On Meters ³ – Up to 150 A			
Toroidal	(45 to 65) Hz (65 to 440) Hz	0.49 % + 0.025 A 1 % + 0.027 A	Fluke 5522A w/ 5500 coil
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	
Non-Toroidal	(45 to 65) Hz (65 to 440) Hz	0.76 % + 0.9 A 1.3 % + 0.9 A	
AC Current – Generate ³			
Up 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	0.25 % + 0.1 µA 0.18 % + 0.1 µA 0.16 % + 0.1 µA 0.37 % + 0.15 µA 0.97 % + 0.2 µA 1.9 % + 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	0.24 % + 0.15 µA 0.15 % + 0.15 µA 0.13 % + 0.15 µA 0.25 % + 0.2 µA 0.6 % + 0.3 µA 1.2 % + 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	0.22 % + 2 µA 0.11 % + 2 µA 0.05 % + 2 µA 0.1 % + 2 µA 0.25 % + 3 µA 0.49 % + 4 µA	
(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	0.22 % + 20 µA 0.11 % + 20 µA 0.05 % + 20 µA 0.13 % + 50 µA 0.25 % + 100 µA 0.49 % + 200 µA	

Parameter/Range	Frequency	CMC ^{2, 4, 7} ($\pm$)	Comments
AC Current – Generate ³ (cont)			
(0.33 to 1.1) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.22 % + 100 μ A 0.063 % + 100 μ A 0.73 % + 1 mA 3 % + 5 mA	Fluke 5522A
(1.1 to 3.0) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.22 % + 100 μ A 0.08 % + 100 μ A 0.73 % + 1 mA 3 % + 5 mA	
(3.0 to 11) A	45 Hz to 1 kHz (1 to 5) kHz	0.13 % + 2 mA 3.6 % + 2 mA	
(11 to 20.5) A	45 Hz to 1 kHz (1 to 5) kHz	0.19 % + 5 mA 3.6 % + 5 mA	
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	
(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 μ A 0.054 % + 0.5 μ A 0.075 % + 0.5 μ A 0.41 % + 1 μ A	
(10 to 100) mA	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz	0.029 % + 5 μ A 0.053 % + 5 μ A 0.075 % + 5 μ A	

Parameter/Range	Frequency	CMC ^{2, 4, 7} (±)	Comments
AC Current – Measure ³ (cont)			
(0.1 to 1) A	1 Hz to 2 kHz	0.031 % + 0.1 mA	Fluke 8588A
	(2 to 10) kHz	0.056 % + 0.1 mA	
(1 to 10) A	(10 to 30) kHz	0.08 % + 0.1 mA	
(10 to 30) A	10 Hz to 2 kHz	0.085 % + 0.5 mA	Fluke 8588A
	(2 to 10) kHz	0.085 % + 0.5 mA	
	10 Hz to 2 kHz	0.085 % + 12 mA	Fluke 8588A
	(2 to 10) kHz	0.13 % + 12 mA	
AC Power – Generate ³			
(45 to 65) Hz; PF=1			Fluke 5522A
(33 to 330) mV Range			
(3.3 to 8.99) mA	110 µW to 3 mW	0.17 %	
(9 to 32.99) mA	(3 to 11) mW	0.12 %	
(33 to 89.99) mA	(1.1 to 30) mW	0.17 %	
(90 to 329.99) mA	(3 to 110) mW	0.12 %	
(0.33 to 0.8999) A	(11 to 300) mW	0.16 %	
(0.9 to 2.1999) A	(30 to 730) mW	0.14 %	
(2.2 to 4.4999) A	73 mW to 1.5 W	0.16 %	
(4.5 to 20.5) A	150 mW to 6.8 W	0.14 %	
(45 to 65) Hz; PF=1			
330 mV to 1020 V Range			
(3.3 to 8.99) mA	1.1 mW to 9 W	0.15 %	
(9 to 32.99) mA	3 mW to 33 W	0.1 %	
(33 to 89.99) mA	11 mW to 90 W	0.15 %	
(90 to 329.99) mA	30 mW to 330 W	0.1 %	
(0.33 to 0.8999) A	110 mW to 900 W	0.14 %	
(0.9 to 2.1999) A	300 mW to 2200 W	0.11 %	
(2.2 to 4.4999) A	730 mW to 4500 W	0.15 %	
(4.5 to 20.5) A	(1.5 to 20.9) kW	0.12 %	

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Thermocouple Simulation ³ –			
Type B	(600 to 800) °C (800 to 1550) °C (1550 to 1820) °C	0.44 °C 0.36 °C 0.3 °C	Fluke 7526A
Type C	(0 to 1000) °C (1000 to 1800) °C (1800 to 2000) °C (2000 to 2316) °C	0.23 °C 0.31 °C 0.34 °C 0.44 °C	
Type E	(-250 to -200) °C (-200 to -100) °C (-100 to 0) °C (0 to 600) °C (600 to 1000) °C	0.32 °C 0.18 °C 0.15 °C 0.14 °C 0.16 °C	
Type J	(-210 to -100) °C (-100 to 800) °C (800 to 1200) °C	0.2 °C 0.15 °C 0.16 °C	
Type K	(-250 to -200) °C (-200 to -100) °C (-100 to 500) °C (500 to 800) °C (800 to 1372) °C	0.56 °C 0.22 °C 0.16 °C 0.16 °C 0.19 °C	
Type N	(-250 to 200) °C (-200 to -100) °C (-100 to 0) °C (0 to 100) °C (100 to 800) °C (800 to 1300) °C	0.89 °C 0.31 °C 0.19 °C 0.17 °C 0.18 °C 0.19 °C	
Type R	(-50 to -25) °C (-25 to 0) °C (0 to 100) °C (100 to 400) °C (400 to 600) °C (600 to 1000) °C (1000 to 1600) °C (1600 to 1767) °C	0.67 °C 0.55 °C 0.48 °C 0.36 °C 0.29 °C 0.28 °C 0.26 °C 0.31 °C	
Type S	(-50 to -25) °C (-25 to 0) °C (0 to 100) °C (100 to 400) °C (400 to 600) °C (600 to 1000) °C	0.63 °C 0.54 °C 0.48 °C 0.37 °C 0.31 °C 0.29 °C	

Parameter/Equipment	Range	CMC ^{2, 7} (±)	Comments
Thermocouple Simulation ³ – (cont)			
Type S	(1000 to 1600) °C (1600 to 1767) °C	0.3 °C 0.34 °C	Fluke 7526A
Type T	(-250 to -200) °C (-200 to 0) °C (0 to 200) °C (200 to 400) °C	0.44 °C 0.23 °C 0.17 °C 0.17 °C	
Electrical Simulation of RTDs ³ –			
Pt 385, 100 Ω	(-200 to 800) °C	0.07 °C	
Pt 3926, 100 Ω	(-200 to 630) °C	0.07 °C	Fluke 7526A
Pt 3916, 100 Ω	(-200 to 630) °C	0.07 °C	
Pt 385, 200 Ω	(-200 to 400) °C (400 to 630) °C	0.48 °C 0.61 °C	
Pt 385, 500 Ω	(-200 to 630) °C	0.21 °C	
Pt 385, 1000 Ω	(-200 to 630) °C	0.12 °C	
Ni 120, 120 Ω	(-80 to 260) °C	0.05 °C	
Cu 427, 10 Ω	(-100 to 260) °C	0.46 °C	
YSI 400	(15 to 50) °C	0.04 °C	
RTD – Measure ³			
Pt 385, 100 Ω	(-200 to 800) °C	0.06 °C	Fluke 7526A
Pt 3926, 100 Ω	(-200 to 630) °C	0.06 °C	
Pt 3916, 100 Ω	(-200 to 630) °C	0.06 °C	
Pt 385, 200 Ω	(-200 to 400) °C (400 to 630) °C	0.1 °C 0.12 °C	

Parameter/Equipment	Range	CMC ^{2, 7} ($\pm$)	Comments
RTD – Measure ³ (cont)			
Pt 385, 500 Ω	(-200 to 630) °C	0.07 °C	Fluke 7526A
Pt 385, 1000 Ω	(-200 to 630) °C	0.06 °C	
Ni 120, 120 Ω	(-80 to 260) °C	0.04 °C	
Cu 427, 10 Ω	(-100 to 260) °C	0.14 °C	
YSI 400	(15 to 50) °C	0.02 °C	
Oscilloscopes ³ –			
Square Wave Signal:			Fluke 5522A w/ SC1100
50 Ω Load @ 1 kHz	1 mV to 6.6 V _{pk - pk}	0.32 % + 40 μ V	
1 M Ω Load @ 1 kHz	1 mV to 130 V _{pk - pk}	0.16 % + 40 μ V	
DC Volt Amplitude:			
50 Ω Load	(0 to 6.6) V	0.3 % + 40 μ V	
1 M Ω Load	(0 to 130) V	0.07 % + 40 μ V	
Level Sine Wave:			
Frequency	(0 to 1100) MHz	3.3 μ Hz/Hz	
Level Sine Wave:			
Amplitude	50 kHz Reference 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (300 to 1100) MHz	2.4 % + 300 μ V 4.4 % + 300 μ V 4.9 % + 300 μ V 7.2 % + 300 μ V 8.4 % + 300 μ V	
Flatness (Bandwidth)	0 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (300 to 1100) MHz	2.1 % + 100 μ V 2.6 % + 100 μ V 4.9 % + 100 μ V 6.1 % + 100 μ V	

Parameter/Equipment	Range	CMC ² (±)	Comments
Oscilloscopes ³ – (cont)			
Time Markers:			
Into a 50 Ω load	5 s to 50 ms 20 ms to 2 ns	(30 + 1000 <i>t</i>) μs/s 3.5 μs/s	<i>t</i> = time in seconds
Rise Time:			
1 kHz to 2 MHz (2 to 10) MHz	≤ 300 ps ≤ 350 ps	130 ps 130 ps	Fluke 5522A w/ SC1100

V. Fluid Quantities

Parameter/Equipment	Range	CMC ² (±)	Comments
Fume Hoods – Air Velocity Only ³	(20 to 200) ft/min	4.5 %	Anemometer RCC-561
Flow Meters ³ – Totalizers	Up to 50 gallons	0.7 %	Gravimetric method
Viscosity Meters ³	Up to 16 000 cP 25 000 cP 32 000 cP	1.5 cP 90 cP 150 cP	Standard viscosity solution w/ bath

VI. Mechanical

Parameter/Equipment	Range	CMC ^{2, 5, 6, 7} ($\pm$)	Comments
Force – Measuring Equipment ³	Up to 1000 lbf Up to 5 lbf Up to 100 lbf Up to 250 lbf Up to 500 lbf Up to 1000 lbf Up to 2500 lbf Up to 5000 lbf Up to 10 000 lbf Up to 20 000 lbf Up to 50 000 lbf	0.03 % + 0.6R 0.02 lbf 0.12 lbf 0.24 lbf 0.46 lbf 1.3 lbf 2.2 lbf 4.2 lbf 7.3 lbf 18 lbf 45 lbf	Class F weights Load cells w/ indicator
Scales and Balances ³	(1 to 20 000) g Up to 1000 lb (1 to 500) mg Up 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 Above 1000 g	0.017 % + 0.6R 0.017 % + 0.6R 0.013 mg + 0.6R 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	Class F weights (applied load) Class 1 weights
Torque – Measuring Equipment ³ Wrenches and Screwdrivers	5 in·lbf to 600 ft·lbf	0.65 %	CDI Suretest 5000-ST

Parameter/Equipment	Range	CMC ^{2, 5, 6, 7} ($\pm$)	Comments
Rotary Torque Tools ³ Pneumatic, DC, Pulse	(0.02 to 2) N·m (0.5 to 5) N·m (1 to 10) N·m (02 to 20) N·m (0.75 to 75) N·m (18 to 180) N·m (50 to 500) N·m	1.3 % FS 1.3 % FS 1.3 % FS 1.3 % FS 1.3 % FS 1.3 % FS 1.3 % FS	Rotary transducers w/ display
Torque Testers ³	Up to 250 ft·lbf	0.13 %	Class F weights & arms
Atmospheric Pressure Vacuum ³ – Measuring Equipment	(0.01 to 28.5) inHg	0.015 inHg	Heise ST-2H w/HQS series modules
Barometric Pressure – Measuring Equipment ³	(0 to 17) psia	0.015 psia	Fluke 6270 w/ PM600 A700K and A7M modules
Pressure – Measuring Equipment ³ Differential Pneumatic Absolute	(-0.5 to 0.5) in·H ₂ O (-60 to 60) in·H ₂ O (-12 to 100) psi (100 to 1000) psi Up to 100 psig + atmospheric (100 to 250) psig + atmospheric	0.002 in·H ₂ O Greater of 0.016 % rdg or 0.0036 % Span Greater of 0.016 % rdg or 0.0036 % Span 0.015 psi 0.04 psi	Heise ST-2H w/ HQS series modules Fluke 6270 w/PM600 series modules Fluke 6270 w/ PM600 A700K and A7M modules

Parameter/Equipment	Range	CMC ^{2, 6, 7} (±)	Comments
Pressure – Measuring Equipment ³ (cont)			
Absolute	(250 to 500) psig + atmospheric	0.06 psi	Fluke 6270 w/ PM600 A700K and A7M Modules
	(500 to 750) psig + atmospheric	0.09 psi	
	(750 to 1000) psig + atmospheric	0.12 psi	
	Up to 1000 psig	0.26 psi	Fluke 2700G-BG7M
	(0 to 5000) psig	1.3 psi	Fluke 2700G-G35M
Hydraulic	(5 to 15 000) psig	9.4 psi	Additel ADT681-05-GP15K-PSI-N
Indirect Verification of Rockwell Hardness Testers ³	HRC: Low Medium High HRBW: Low Medium High HRA: Low Medium High HREW Low Medium High HR15N Low Medium High	0.77 HRC 0.77 HRC 0.76 HRC 0.9 HRBW 0.87 HRBW 0.81 HRBW 0.79 HRA 0.77 HRA 0.76 HRA 0.76 HREW 0.77 HREW 0.76 HREW 0.81 HR15N 0.81 HR15N 0.81 HR15N	Indirect verification per ASTM E18

Parameter/Equipment	Range	CMC ^{2, 6} ($\pm$)	Comments
Indirect Verification of Rockwell Hardness Testers ³ (cont)	HR30N Low Medium High HR45N Low Medium High HR15TW Low Medium High HR30TW Low Medium High HR45TW Low Medium High	0.82 HR30N 0.82 HR30N 0.82 HR30N 0.82 HR45N 0.81 HR45N 0.82 HR45N 0.81 HR15TW 0.81 HR15TW 0.82 HR15TW 0.82 HR30TW 0.81 HR30TW 0.81 HR30TW 0.81 HR45TW 0.81 HR45TW 0.81 HR45TW	Indirect verification per ASTM E18
Indirect Verification of Vickers Hardness Testers ³ Vickers < 1 kgf	HV: Low Mid High	2.9 HV 11 HV 11 HV	ASTM E384 w/ ASTM E92
Indirect Verification of Brinell Hardness Testers ³ – HBW 10mm/3000kg	HBW: Low Medium High	4.5 HBW 4.5 HBW 2.6 HBW	ASTM E10

Parameter/Equipment	Range	CMC ^{2, 6, 7} (±)	Comments
Speed – Measure ³ Optic/Non-Contact: RPM Totalizer/Rate Meters Contact: RPM Totalizer/Rate Meters	(5 to 200 000) rpm (2 to 3300) fpm (0.5 to 12 000) rpm (2 to 3300) fpm	0.017 % 0.017 % 0.22 % 0.22 %	Monarch PLT200
Speed/RPM/Rate Simulation ³	(6 to 200 000) rpm	0.003 %	Agilent 33120A
Totalize Meters ³ – Distance Measure Mechanical Counter/Totalizers	Up to 200 ft Up to 999 999 counts	0.64 % (0.02 % + 0.6R)	Monarch PLT200 w/ 10 cm wheel
Tensile Testers ³ – Speed / Rate Displacement	Up 50 in/min Up to 20 in	0.025 % 0.000 25 in	Timer and caliper Gage blocks w/ indicator
Mass – Field Check Weight Comparison ³ Load Fixtures, Hangers, Package and Check Weights	Up to 50 lbs	0.024 %	Scale w/ weights

VII. Optical Quantities

Parameter/Equipment	Range	CMC ² (±)	Comments
Light Booths ³ – Illuminance Color Temperature (CCT)	Up to 10 000 Lux (1700 to 6500) K	2.8 % 51 K	Illuminance spectrophotometer

VIII. Thermodynamics

Parameter/Equipment	Range	CMC ^{2, 7} (±)	Comments
Relative Humidity – Measure ³	(10 to 90) % RH	1.0 % RH	Rotronic HC2A-SH
Plate Temperature – Infrared Measuring Equipment ³	35 °C (35 to 100) °C (100 to 200) °C (200 to 350) °C (350 to 500) °C	0.84 °C 1 °C 1.2 °C 1.7 °C 2.3 °C	Fluke 4181
Temperature – Measure ³	(-200 to 200) °C (200 to 420) °C (420 to 660) °C (660 to 1100) °C (1100 to 1200) °C	0.046 °C 0.063 °C 0.1 °C 1.8 °C 2.5 °C	Fluke 1524 w/ 5609 PRT Probe Fluke 1524 w/ Isotech 935- 14-91
Temperature – Measuring Equipment ³	(-30 to 125) °C (150 to 660) °C (660 to 1200) °C	0.087 °C 3.1 °C 4.8 °C	Fluke 7103 micro bath w/ reference probe Hart 9150 furnace w/5609 PRT probe Hart 9150 furnace w/reference probe

Parameter/Equipment	Range	CMC ^{2, 7} (±)	Comments
Ovens, Furnaces, Refrigerators, Freezers, Incubators, Environmental Chambers, Baths and Dry Blocks ^{3, 7} – (System Accuracy Tests and Uniformity Surveys)			
Temperature	(-200 to 200) °C	0.046 °C	Fluke 1524 w/ 5609 PRT Probe
	(200 to 420) °C	0.063 °C	
	(420 to 660) °C	0.2 °C	
	(660 to 950) °C	2.5 °C	Fluke 1524 w/ Isotech 935-14-91
	(950 to 1100) °C	3.0 °C	
	(1100 to 1200) °C	3.8 °C	Rotronic HC2A-SH
Humidity	(10 to 90) % RH	1.0 % RH	

IX. Rubber and Plastics Industry Specific Equipment

Parameter/Equipment	Range	CMC ^{2, 6} (±)	Comments
Extrusion Plastometers ³ –			ASTM D1238
Cylinder Bore (Section 5.2)	(8 to 10) mm	0.0015 mm	Bore micrometer
Die Orifice (Section 5.3)	(0.992 to 2.1) mm	0.000 83 mm	Go/no-go pin gages
Piston Land (Foot) Diameter (Section 5.4)	Up to 30 mm	0.0015 mm	Micrometer
Piston Rod Diameter (Section 5.4)	Up to 30 mm	0.0015 mm	
Piston Land Foot Length (Section 5.4)	Up to 30 mm	0.0015 mm	
Die (Orifice) Length (Section 5.3)	Up to 30 mm	0.0015 mm	

Parameter/Equipment	Range	CMC ^{2, 6} (±)	Comments
Extrusion Plastometers ³ – (cont)			
Piston & Load Weight (Section 5.4)	Up to 5000 g	0.13 %	Bench scale w/weights ASTM D1238:
Temperature (Section 5.5)	(0 to 400) °C	0.08 °C	Digital thermometer
Timing Devices (Section 5.6)	(0 to 3600) s	0.2 s	Stopwatch

X. Time and Frequency

Parameter/Equipment	Range	CMC ^{2, 6, 7} (±)	Comments
Timers & Stopwatches ³	(1 to 3600) s	0.2 s	Stopwatch
Frequency – Measuring Equipment ³	0.01 Hz to 2 MHz Up to 15 MHz	5.6 µHz/Hz + 5 µHz 0.003 %	Fluke 5522A HP 33120A
Frequency – Measure ³	Up to 3 GHz	0.33 µHz/Hz	Agilent 53181A

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CALIBRATION

I. Chemical

Parameter/Equipment	Range	CMC ² (±)	Comments
pH Meters	4 pH 7 pH 10 pH	0.03 pH 0.029 pH 0.036 pH	Standard pH solutions

II. Dimensional

Parameter/Equipment	Range	CMC ^{2, 5} (±)	Comments
Pin Gage – Class ZZ	Up to 1 in	80 μin	Micrometer
Calipers	Up to 24 in	$(4.6 + 9.8L) \mu\text{in} + 0.6R$	Gage blocks
Micrometers	Up to 24 in	$(4.6 + 9.8L) \mu\text{in} + 0.6R$	Gage blocks
Linear Indicators – Dial and Test	Up to 4 in	$(3 + 9.4L) \mu\text{in} + 0.6R$	Gage blocks
Height Gauges	Up to 24 in	$(53 + 8.9L) \mu\text{in} + 0.6R$	Gage blocks w/surface plate
Steel Rules	Up to 72 in	$(1.5 + 10L) \mu\text{in} + 0.6R$	Gage blocks
Tape Measures	Up to 25 ft	$(66 + 8.8L) \mu\text{in} + 0.6R$	Gage blocks
Feeler/Thickness Gages	Up to 1 in	80 μin	Micrometer

Parameter/Equipment	Range	CMC ^{2, 5} (±)	Comments
Ring Gages / Cylinder Rings	(6 to 100) mm	0.0047 mm	Tri mic set
Tri – Mics	(6 to 100) mm (100 to 200) mm	0.0023 mm 0.0034 mm	Mitutoyo ring gauges
Angle Indicators and Protractors	30°, 45°, 60°, 75°, 90°	0.03°	Angle block set
Coating Thickness Gages – Film, Ultrasonic	Up to 60 mils	0.1 mils	Coating thickness standards
Measuring Microscope	Up to 2 in	0.000 17 in	Stage micrometer

III. Dimensional Testing/Calibration⁹

Parameter/Equipment	Range	CMC ^{2, 6} (±)	Comments
Length – X - Axis Y - Axis Z - Axis Volumetric	Up to 47 in Up to 79 in Up to 39 in Up to 79 in	$(290 + 5.4L) \mu\text{in}$ $(290 + 6.8L) \mu\text{in}$ $(290 + 4.8L) \mu\text{in}$ $(850 + 3.9L) \mu\text{in}$	Brown & Sharpe Xcel CMM
Weld/Braze Evaluation – 1D Length	Up to 2 in Up to 6 in	0.02 in or 0.51 mm 0.0026 in	Microscope w/stage micrometer Caliper
Paint Thickness	Up to 20 mils	1.2 mils	Coating thickness gage

IV. Fluid Quantities

Parameter/Equipment	Range	CMC ^{2, 6, 7} ($\pm$)	Comments
Flow Meters Totalizers	Up to 50 gallons	0.7 %	Gravimetric method

V. Mechanical

Parameter/Equipment	Range	CMC ^{2, 5, 6, 7} ($\pm$)	Comments
Force – Measuring Equipment	Up to 1000 lbf	0.03 % + 0.6R	Class F weights
Scales and Balances	Up to 1000 lbs	0.017 % + 0.6R	Class F weights (applied load)
Torque – Measuring Equipment Wrenches and Screwdrivers	 5 in·lbf to 600 ft·lbf	 0.65 %	 CDI Suretest 5000-ST
Rotary Torque Tools Pneumatic, DC, Pulse	 (2 to 20) Nm (18 to 180) Nm (50 to 500) Nm (140 to 1400) Nm (300 to 3000) Nm	 2.4 % 1.1 % 1.5 % 1.8 % 1.8 %	 Atlas Copco torque analyzer
Atmospheric Pressure & Vacuum – Measuring Equipment	Up to 27 in·Hg	0.09 in·Hg	Druck DPI610
Pressure – Measuring Equipment Pneumatic	 Up to 300 psig	 0.18 psi	 Druck DPI104

Parameter/Equipment	Range	CMC ^{2, 5, 6, 7} ($\pm$)	Comments
Leak Testers – Fixed Points	250 sccm	6.7 %	Cincinnati test systems leak standards
	50 sccm	6.7 %	

VI. Mechanical Testing

Test	Test Method(s)
Hardness – Vickers, 500 gf	Leco LV 800T
Paint Adhesion, X Cut	ASTM D3359 Reference Tape

¹ This laboratory offers commercial calibration and field calibration services, where noted.

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 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. 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 The statement of the 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 the statement of the Range or the CMC, DL is the diagonal length of the device in inches.

⁶ In the statement of CMC, percentages are percentage of reading, unless otherwise indicated.

⁷ 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.

⁸ This scope meets A2LA's *P112 Flexible Scope Policy*.

⁹ 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.



Accredited Laboratory

A2LA has accredited

CROSS TECHNOLOGIES, INC dba CROSS (FORMERLY J.A. KING)

Louisville, KY

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 15th day of October 2021.

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

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 1741.19
Valid to September 30, 2023

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