



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017
& ANSI/NCSL Z540-1-1994 & ANSI/NCSL Z540-3-1994

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CALIBRATION

Valid To: November 30, 2026

Certificate Number: 2348.01

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

I. Acoustical

Parameter/Equipment	Frequency	CMC ² (±)	Comments
Sound Level Meters ³ –			
94 dB	31.5 Hz to 12.5 kHz 16 kHz	0.31 dB 0.32 dB	Bruel & Kjaer 4226
104 dB	31.5 Hz to 12.5 kHz 16 kHz	0.30 dB 0.34 dB	
114 dB	31.5 Hz to 12.5 kHz 16 kHz	0.30 dB 0.57 dB	

II. Chemical

Parameter/Equipment	Range	CMC ^{2, 8} (±)	Comments
pH – Measuring Equipment ³	4.00 pH 7.00 pH 10.00 pH	0.012 pH 0.012 pH 0.012 pH	Buffer solutions

Parameter/Equipment	Range	CMC ^{2, 5, 8} (±)	Comments
Conductivity – Measuring Equipment ³	10 µS/cm 100 µS/cm 1410 µS/cm 10 000 µS/cm	0.65 µS/cm 2.2 µS/cm 6 µS/cm 41 µS/cm	Laboratory standard conductivity solution
Aerosol Particle Counters	(0.3 to 10) µm	2.9 %	TSI electrostatic classifier 3082 TSI condensation particle counter 3772

III. Dimensional

Parameter/Equipment	Range	CMC ^{2, 6} (±)	Comments
Gage Blocks	Up to 4 in (> 4 to 20) in	(2.9 + 0.7L) µin (3.1 + 1.3L) µin	Electronic comparator, master steel gage blocks
Caliper ³	Up to 20 in (> 20 to 40) in	(4.8L + 0.6R) µin (370 + 6L) µin	Gage blocks
Micrometer ³	Up to 12 in (> 12 to 36) in	(4.8L + 0.6R) µin (43 + 8.8L) µin	Gage blocks
Bench Micrometers	Up to 20 in	(12 + 1.3L) µin	Gage blocks
Dial, Digital, & Test Indicator ³	Up to 4 in	(4.8L + 0.6R) µin	Gage blocks
Height Gages ³	Up to 40 in	(4.8L + 0.6R) µin	Gage blocks
Optical Flats	(1 to 8) in	6.2 µin	Standard optical flat

Parameter/Equipment	Range	CMC ^{2,6} (±)	Comments
Measuring Microscopes ³	Up to 12 in	(95 + 3.0L) μin	Glass scale
Cylindrical Gages – Plug & Pin Gages Plain Ring Gages	Up to 1 in (> 1 to 4) in (> 4 to 16) in Up to 1 in (> 1 to 4) in (> 4 to 16) in	(6.8 + 0.7D) μin (5.4 + 2.2D) μin (10 + 1.7D) μin (13 + 0.9D) μin (13 + 1.2D) μin (12 + 2.2D) μin	Universal measuring standard-Supra-500 Universal measuring standard-Supra-500 w/ID probes
Thread Wires	(4 to 20) TPI (> 20 to 80) TPI	17 μin 12 μin	Supermicrometer™ Universal measuring standard-Supra-500
Thread Plug Gage Pitch Diameter Major Diameter	(4 to 20) TPI (> 20 to 80) TPI Up to 16 in	(28 + 1.5D) μin (24 + 0.5D) μin (11 + 1.5D) μin	Supermicrometer™ Universal measuring standard-Supra-500 w/ thread wires Universal measuring standard-Supra-500
Thread Plug Gage – Minor Lead Angle Major Minor Pitch Flank Angle	(4 to 80) TPI Up to 6 in	(95 + 5.4D) μin (31 + 2.6D) μin 0.054° (80 + 4.5L) μin (84 + 3.8L) μin (50 + 5.5L) μin 0° 6' 32"	Quest thread view machine MicroScanner™
Thread Ring Gage – Major Minor Pitch Flank Angle	(80 to 4.5) TPI Up to 6 in	(67 + 0.5D) μin (83 + 4.2L) μin (81 + 4.9L) μin (51 + 7.7L) μin 0° 6' 32' 3"	Universal measuring standard-Supra-500 w/ probe MicroScanner™

Parameter/Equipment	Range	CMC ^{2, 6} (±)	Comments
Surface Plate ³ – Flatness Repeatability	(18 x 18) in to (36 × 72) in	13 μin 28 μin	Autocollimator, repeat-o-meter
Optical Comparator ³ – X Axis Y Axis Angle	Up to 12 in Up to 12 in Up to 360°	(46 + 4L) μin (47 + 3L) μin 2.5 min	Gage blocks, angle blocks
Angle Blocks ³	Up to 45°	2.1 arc sec	Sine plate, gage blocks & electronic indicator
Crimping Tools ³	Up to 1 in diameter	200 μin	Pin gages, optical comparator & pull tester
Precision Levels ³	(2 to 15) in	150 μin	Gage blocks
Protractors/Clinometer ³	Up to 180°	1.3 arc sec + 0.6R	Sine plate w/ angle blocks
Surface Roughness Specimens	Up to 400 μin	0.62 μin	SurfTest w/ reference specimen
Profilometers	Up to 400 μin	0.55 μin	Surface roughness specimen
Rotary Table	(1 to 360)°	4.1 arc sec	Renishaw laser
Steel Rules & Tapes – Steel Rules Measuring Tapes	Up to 72 in Up to 1200 in (in 40 in segments)	0.0027 in (6600 + 16L) μin	Kudale TSCU

IV. Dimensional Testing¹

Parameter/Range	Range	CMC ^{2, 6} (±)	Comments
Length – 1D ⁹	Up to 40 in	5.2 µin/in	Gage blocks, CMM, Supra 500, etc Renishaw laser
	Up to 110 in	(12 + 0.8L) µin	

V. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2, 4} (±)	Comments
DC Voltage – Generate ³	10 V	0.52 µV/V	Fluke 732B
	Up to 220 mV	7.5 µV/V + 0.39 µV	Fluke 5730A
	220 mV to 2.2V	4.6 µV/V + 0.62 µV	
	(2.2 to 11) V	3.1 µV/V + 2.3 µV	
	(11 to 22) V	3.2 µV/V + 3.9 µV	
	(22 to 220) V	4.7 µV/V + 39 µV	
	(220 to 1100) V	6.2 µV/V + 0.39 mV	
DC Voltage – Measure ³	Up to 100 mV	5.7 µV/V + 0.2 µV	FLUKE 8588A
	(0.1 to 1) V	2.8 µV/V + 0.3 µV	
	(1 to 10) V	2.8 µV/V + 0.5 µV	
	(10 to 100) V	4.1 µV/V + 30 µV	
High Voltage	(100 to 1000) V	4.3 µV/V + 0.5 mV	Vitretek 4700/HLV-70
	(1000 to 10 000) V	0.042 % + 0.6R	
	(10 000 to 70 000) V	0.048 % + 0.6R	
DC Current – Generate ³	20 nA to 220 µA	39 µA/A + 5.4 nA	Fluke 5730A,
	220 µA to 2.2 mA	31 µA/A + 6.2 nA	
	(2.2 to 22) mA	32 µA/A + 40 nA	Fluke 5730A, Fluke 5725A
	(22 to 220) mA	46 µA/A + 0.70 µA	
	220 mA to 2.2 A	85 µA/A + 12 A	
	(2.2 to 11) A	0.28 mA/A + 0.37 mA	
	(11 to 20) A	1.1 mA/A + 0.75 mA	Fluke 5522A
	(20 to 700) A	1.5 mA/A + 0.52 A	Keysight 6680A HP 3458A, current shunts
	(20.5 to 120) A	0.8 mA/A + 5.3 mA	Fluke 5730A, 52120A

Parameter/Equipment	Range	CMC ^{2, 4, 5} (\pm)	Comments
DC Current – Clamp Meters	(16.5 to 150) A (150 to 1000) A (1 to 5) kA	0.51 % + 0.15 A 0.52 % + 0.54 A 0.6 % + 1 A	Fluke 5522A w/ Fluke 5500 coils Fluke 5730A/52120A/ 6KA coil
DC Current – Measure ³	(10 to 20) pA (20 to 200) pA (0.2 to 2) nA (2 to 20) nA (20 to 100) nA 100 nA to 1 μ A (1 to 10) μ A (10 to 100) μ A 100 μ A to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1A (1 to 10) A (10 to 30) A (30 to 100) A (100 to 700) A	1.2 % + 3.5 fA 1.2 % + 6 fA 0.27 % + 0.32 pA 0.24 % + 0.6 pA 0.018 % + 60 pA 35 μ A/A + 60 pA 27 μ A/A + 0.14 nA 31 μ A/A + 1 nA 29 μ A/A + 7 nA 30 μ A/A + 70 nA 48 μ A/A + 0.7 μ A 0.014 % + 13 μ A 0.028 % + 0.43 mA 0.07 % + 4.4 mA 0.026 % 0.038 %	Keithley 6517A HP 3458A, option 002 Fluke 8588A HP 3458A, current shunts
Resistance – Generate	(0 to 10.9999) Ω (11 to 32.9999) Ω (33 to 109.9999) Ω (110 to 329.9999) Ω (0.33 to 1.099 999) k Ω (1.1 to 3.299 999) k Ω (3.3 to 10.999 99) k Ω (11 to 32.999 99) k Ω (33 to 109.9999) k Ω (110 to 329.9999) k Ω (0.33 to 1.099 999) M Ω (1.1 to 3.299 999) M Ω (3.3 to 10.999 99) M Ω (11 to 32.999 99) M Ω (33 to 109.9999) M Ω (110 to 330) M Ω (330 to 1100) M Ω	32 $\mu\Omega/\Omega$ + 0.8 m Ω 24 $\mu\Omega/\Omega$ + 1.2 m Ω 22 $\mu\Omega/\Omega$ + 1.1 m Ω 23 $\mu\Omega/\Omega$ + 1.6 m Ω 22 $\mu\Omega/\Omega$ + 1.6 m Ω 22 $\mu\Omega/\Omega$ + 16 m Ω 22 $\mu\Omega/\Omega$ + 16 m Ω 22 $\mu\Omega/\Omega$ + 0.16 Ω 22 $\mu\Omega/\Omega$ + 0.16 Ω 26 $\mu\Omega/\Omega$ + 5.4 Ω 25 $\mu\Omega/\Omega$ + 5.4 Ω 47 $\mu\Omega/\Omega$ + 39 Ω m Ω/Ω + 54 Ω 0.22 m Ω/Ω + 2.1 k Ω 0.39 m Ω/Ω + 2.5 K Ω 2.3 m Ω/Ω + 79 K Ω 12 m Ω/Ω + 0.39 M Ω	Fluke 5522A
Fixed Points	1 Ω 10 k Ω 19 k Ω	10 $\mu\Omega/\Omega$ 5 $\mu\Omega/\Omega$ 5.2 $\mu\Omega/\Omega$	Fluke742A

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Electrical Simulation of Thermocouple ³ – Type J Type K Type T Type N Type E Type B Type S Type R	(-210 to 1200) °C (-200 to 1372) °C (-250 to 400) °C (-200 to 1300) °C (-250 to 1000) °C (600 to 1820) °C (0 to 1767) °C (0 to 1767) °C	0.13 °C 0.13 °C 0.13 °C 0.14 °C 0.14 °C 0.15 °C 0.15 °C 0.15 °C	Fluke 5522A w/ zero reference junction & SPRT
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	0.12 % + 0.1 pF 0.066 % + 2 pF 0.041 % + 10 pF 0.042 % + 0.1 nF 0.044 % + 1 nF 0.062 % + 10 nF 0.063 % + 0.1 μF 0.075 % + 1 μF 0.074 % + 10 μF	Fluke 8588A
Capacitance – Generate ³	(0.22 to 0.4) nF (0.40 to 1.1) nF (1.1 to 3.3) nF (3.3 to 11) nF (11 to 33) nF (33 to 110) nF (0.11 to 0.33) μF (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 (0.11 to 0.33) mF (0.33 to 1.1) mF (1.1 to 3.3) mF (3.3 to 11) mF (11 to 33) mF (33 to 110) mF	0.45 % + 8 pF 0.39 % + 8 pF 0.46 % + 8 pF 0.2 % + 8 pF 0.2 % + 80 pF 0.2 % + 80 pF 0.2 % + 0.24 nF 0.2 % + 0.8 nF 0.2 % + 2.4 nF 0.2 % + 8 nF 0.31 % + 24 nF 0.35 % + 80 nF 0.35 % + 0.24 μF 0.35 % + 0.8 μF 0.35 % + 2.4 μF 0.35 % + 8 μF 0.58 % + 24 μF 0.85 % + 80 μF	Fluke 5522A

Parameter/Range	Frequency	CMC ^{2, 4, 5} (±)	Comments
Capacitance Generate ³ (cont)			
Fixed Point:			
1 pF	1 kHz to 1 MHz	0.037 %	Fluke 5522A
	2 MHz	0.027 %	
	3 MHz	0.044 %	
	4 MHz	0.065 %	
	5 MHz	0.089 %	
	10 MHz	0.25 %	
	13 MHz	0.37 %	
10 pF	1 kHz to 1 MHz	0.011 %	Agilent 316380A
	2 MHz/3 MHz	0.011 %	
	4 MHz/5 MHz	0.012 %	
	10 MHz	0.016 %	
	13 MHz	0.019 %	
100 pF	1 kHz to 1 MHz	0.011 %	
	2 MHz/3 MHz	0.012 %	
	4 MHz	0.014 %	
	5 MHz	0.017 %	
	10 MHz	0.035 %	
	13 MHz	0.050 %	
1000 pF	1 kHz to 1 MHz	0.012 %	
	2 MHz	0.015 %	
	3 MHz	0.030 %	
	4 MHz	0.046 %	
	5 MHz	0.063 %	
	10 MHz	0.19 %	
	13 MHz	0.28 %	
10 nF	(100/120) Hz	0.014 %	
	(1/10/100) kHz	0.014 %	
100 nF	(100/120) Hz/1 kHz	0.014 %	Agilent 16380C
	(1/10/100) kHz	0.014 %	
	(100/120) Hz	0.014 %	
	(1/10) kHz	0.014 %	
	100 kHz	0.015 %	
1000 nF	(100/120) Hz/1 kHz	0.014 %	
	10 kHz	0.021 %	
	100 kHz	0.70 %	

Parameter/Range	Frequency	CMC ^{2, 4} (±)	Comments
AC Voltage – Generate ³			
300 μV to 2.2 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 (0.5 to 1.0) MHz	0.25 mV/V + 4.0 μV 90 μV/V + 4.0 μV 90 μV/V + 4.0 μV 0.20 mV/V + 4.0 μV 0.50 mV/V + 5.0 μV 1.0 mV/V + 10 μV 1.4 mV/V + 20 μV 2.7 mV/V + 20 μV	Fluke 5730A, Fluke 5725A
(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 (0.5 to 1.0) MHz	0.24 mV/V + 4.0 μV 90 μV/V + 4.0 μV 80 μV/V + 4.0 μV 0.20 mV/V + 4.0 μV 0.47 mV/V + 4.0 μV 1.0 mV/V + 10 μV 1.4 mV/V + 20 μV 1.4 mV/V + 20 μV	
(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 (0.5 to 1.0) MHz	0.24 mV/V + 12 μV 90 μV/V + 6.2 μV 54 μV/V + 6.2 μV 0.12 mV/V + 6.2 μV 0.31 mV/V + 16 μV 0.62 mV/V + 20 μV 1.4 mV/V + 24 μV 2.7 mV/V + 47 μV	
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 (0.5 to 1.0) MHz	0.24 mV/V + 40 μV 85 μV/V + 16 μV 37 μV/V + 8 μV 62 μV/V + 10 μV 77 μV/V + 31 μV 0.31 mV/V + 80 μV 0.93 mV/V + 0.2 μV 1.6 mV/V + 0.31 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 (0.5 to 1.0) MHz	0.24 mV/V + 0.4 mV 85 μV/V + 0.16 mV 38 μV/V + 54 μV 62 μV/V + 93 μV 77 μV/V + 0.2 mV 0.24 mV/V + 0.62 mV 0.93 mV/V + 2 mV 1.4 mV/V + 3.1 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	0.24 mV/V + 4 mV 0.85 mV/V + 1.5 mV 51 μV/V + 0.5 mV 80 μV/V + 1 mV 0.15 mV/V + 2.4 mV	

Parameter/Range	Frequency	CMC ^{2, 4, 6} (±)	Comments
AC Voltage – Generate ³ (cont)			Fluke 5520A
(220 to 750) V	40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	72 μ V/V + 3.1 mV 0.13 mV/V + 4.7 mV 0.47 mV/V + 8.5 mV 0.2 % + 35 mV	
(750 to 1100) V	40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz	70 μ V/V + 3.1 mV 0.13mV/V + 4.7 mV 0.47mV/V + 8.5 mV	
High Voltage: (1000 to 10 000) V (10 000 to 50 000) V	60 Hz 60 Hz	0.18 % + 0.6R 0.14 % + 0.6R	
AC Voltage – Measure ³			
Up to 10 mV	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz (300 to 1000) kHz	0.026 % + 1.1 μ V 0.034 % + 1.1 μ V 0.035 % + 1.1 μ V 0.03 % + 0.8 μ V 1 % + 4 μ V 2.1 % + 3.8 μ V	
(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 (300 to 1000) kHz	0.007 % + 0.5 μ V 0.012 % + 0.5 μ V 0.024 % + 1 μ V 0.055 % + 5 μ V 0.23 % + 31 μ V 1.2 % + 0.1 mV	
100 mV to 1 V	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz (300 to 1000) kHz	0.0073 % + 5 μ V 0.012 % + 5 μ V 0.022 % + 0.01 mV 0.053 % + 0.05 mV 0.21 % + 0.3 mV 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 (300 to 1000) kHz	0.0066 % + 0.05 mV 0.012 % + 0.05 mV 0.022 % + 0.1 mV 0.052 % + 0.5 mV 0.21 % + 3.1 mV 1.1 % + 10 mV	

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Voltage – Measure ³ (cont)			
(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 (300 to 1000) kHz	0.007 % + 0.5 mV 0.0091 % + 0.5 mV 0.022 % + 1 mV 0.052 % + 5 mV 0.35 % + 47 mV 1.1 % + 0.5 V	Vitrek 4700/HLV-70
(100 to 1000) V	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz	0.0094 % + 25 mV 0.0093 % + 25 mV 0.023 % + 25 mV 0.054 % + 0.1 V	Fluke 8588A
2.2 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 (0.5 to 1.0) MHz	1.4 mV/V + 1 μV 0.58 mV/V + 1 μV 0.33 mV/V + 1 μV 0.62 mV/V + 1.6 μV 0.93 mV/V + 2 μV 1.8 mV/V + 3.1 μV 1.9 mV/V + 6.2 μV 2.7 mV/V + 6.2 μV	
(2.2 to 7) 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 (0.5 to 1.0) MHz	0.66 mV/V + 1 μV 0.29 mV/V + 1 μV 0.17 mV/V + 1 μV 0.32 mV/V + 1.5 μV 0.48 mV/V + 2 μV 0.93 mV/V + 3.1 μV 1 mV/V + 6.2 μV 1.8 mV/V + 6.2 μV	
(7 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 (0.5 to 1.0) MHz	0.24 mV/V + 1 μV 0.15 mV/V + 1 μV 85 μV/V + 1 μV 0.17 mV/V + 1.6 μV 0.25 mV/V + 2 μV 0.63 mV/V + 3.1 μV 0.7 mV/V + 6.2 μV 1.4 mV/V + 6.2 μV	
(22 to 70) 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 (0.5 to 1.0) MHz	0.19 mV/V + 1.2 μV 93 μV/V + 1.2 μV 51 μV/V + 1.2 μV mV/V + 1.5 μV mV/V + 2 μV mV/V + 3.1 μV 0.52 mV/V + 6.2 μV 0.86 mV/V + 6.2 μV	

Parameter/Range	Frequency	CMC ^{2, 4} (±)	Comments
AC Voltage – Measure ³ (cont)			
(70 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 (0.5 to 1.0) MHz	0.18 mV/V + 1.2 μV 66 μV/V + 1.2 μV 30 μV/V + 1.2 μV 54 μV/V + 1.6 μV 0.13 mV/V + 2 μV 0.2 mV/V + 3.1 μV 0.3 mV/V + 6.2 μV 0.78 mV/V + 6.2 μV	Fluke 5790B
(220 to 700) 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 (0.5 to 1.0) MHz	0.17 mV/V + 1.2 μV 60 μV/V + 1.2 μV 26 μV/V + 1.2 μV 40 μV/V + 1.5 μV 62 μV/V + 2 μV 0.14 mV/V + 3.1 μV 0.24 mV/V + 6.2 μV 0.75 mV/V + 6.2 μV	
700 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 (0.5 to 1.0) MHz	0.16 mV/V 52 μV/V 20 μV/V 36 μV/V 55 μV/V 0.13 mV/V 0.2 mV/V 0.7 mV/V	
(2.2 to 7) 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 (0.5 to 1.0) MHz	0.16 mV/V 52 μV/V 19 μV/V 38 μV/V 64 μV/V 0.15 mV/V 0.32 mV/V 0.94 mV/V	
(7 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 (0.5 to 1.0) MHz	0.16 mV/V 52 μV/V 21 μV/V 37 μV/V 64 μV/V 0.15 mV/V 0.31 mV/V 0.95 mV/V	

Parameter/Range	Frequency	CMC ^{2, 4, 5} (±)	Comments
AC Voltage – Measure ³ (cont)			
(22 to 70) 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 (0.5 to 1.0) MHz	0.16 mV/V 54 µV/V 26 µV/V 44 µV/V 74 µV/V 0.16 mV/V 1.4 mV/V 1.4 mV/V	Fluke 5790B
(70 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	0.16 mV/V 55 µV/V 25 µV/V 55 µV/V 80 µV/V 1.4 mV/V 1.4 mV/V	
(220 to 700) V	(15 to 50) Hz 50 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	1.6 mV/V 80 µV/V 32 µV/V 0.11 mV/V 0.4 mV/V	
(700 to 1000) V	(15 to 50) Hz 50 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	1.4 mV/V 80 µV/V 30 µV/V 1.4 mV/V 1.4 mV/V	
AC Voltage Flatness ³			
2.2 mV	30 Hz 120 kHz 2 MHz 10 MHz 20 MHz 30 MHz 50 MHz	0.08 % 0.04 % 0.06 % + 0.8 µV 0.14 % + 0.8 µV 0.24 % + 0.8 µV 0.54 % + 1.6 µV 0.8 % + 1.6 µV	
(2.2 to 7) mV	30 Hz 120 kHz 2 MHz 10 MHz 20 MHz 30 MHz 50 MHz	0.08 % 0.04 % 0.06 % + 0.8 µV 0.08 % + 0.8 µV 0.14 % + 0.8 µV 0.3 % + 0.8 µV 0.4 % + 0.8 µV	

Parameter/Range	Frequency	CMC ^{2, 4, 5} (±)	Comments
AC Voltage Flatness ³ (cont)			
(7 to 22) mV	30 Hz	0.08 %	Fluke 5790B
	120 kHz	0.04 %	
	2 MHz	0.054 %	
	10 MHz	0.08 %	
	20 MHz	0.14 %	
	30 MHz	0.29 %	
	50 MHz	0.47 %	
(22 to 70) mV	30 Hz	0.08 %	
	2 MHz	0.04 %	
	10 MHz	0.08 %	
	20 MHz	0.12 %	
	30 MHz	0.27 %	
	50 MHz	0.47 %	
(70 to 220) mV	30 Hz	0.08 %	
	500kHz	0.04 %	
	2 MHz	0.04 %	
	10 MHz	0.08 %	
	20 MHz	0.12 %	
	30 MHz	0.27 %	
	50 MHz	0.47 %	
(220 to 700) mV	30 Hz	0.08 %	
	500kHz	0.03 %	
	2 MHz	0.04 %	
	10 MHz	0.08 %	
	20 MHz	0.12 %	
	30 MHz	0.27 %	
	50 MHz	0.47 %	
700 mV to 2.2 V	30 Hz	0.08 %	
	500kHz	0.03 %	
	2 MHz	0.04 %	
	10 MHz	0.08 %	
	20 MHz	0.12 %	
	30 MHz	0.27 %	
	50 MHz	0.47 %	
(2.2 to 7) V	30 Hz	0.08 %	
	500kHz	0.03 %	
	2 MHz	0.04 %	
	10 MHz	0.08 %	
	20 MHz	0.12 %	
	30 MHz	0.27 %	
	50 MHz	0.47 %	

Parameter/Range	Frequency	CMC ^{2, 4} (±)	Comments	
AC Current – Generate ³				
(29 to 330) µA	(10 to 30) kHz	1.3 % + 0.31 µA	Fluke 5522A	
(0.33 to 3.3) mA	(10 to 30) kHz	0.77 % + 0.47 µA		
(3.3 to 33) mA	(10 to 30) kHz	0.31 % + 3.1 µA		
(33 to 330) mA	(10 to 30) kHz	0.31 % + 0.16 mA		
(0.33 to 1.1) A	(10 to 45) Hz	0.14 % + 77 µA		
(1.1 to 3) A	(10 to 45) Hz	0.14 % + 77 µA		
(3 to 20.5) A	(45 to 100) Hz	0.093 % + 5 mA		
	100 Hz to 1kHz (1 to 5) kHz	0.12 % + 5 mA 2.4 % + 5 mA		
Up to 220 µA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.024 % + 16 nA 0.016 % + 10 nA 0.01 % + 8 nA 0.028 % + 12 nA 0.1 % + 62 nA	Fluke5730A/5725A	
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	0.024 % + 39 nA 0.016 % + 31 nA 0.01 % + 31 nA 0.019 % + 0.1 µA 0.1 % + 0.62 µA		
(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	0.024 % + 0.39 µA 0.016 % + 0.31 µA 0.01 % + 0.31 µA 0.019 % + 0.54 µA 0.1 % + 4.7 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	0.024 % + 3.8 µA 0.016 % + 3.1 µA 0.01 % + 2.4 µA 0.019 % + 3.1 µA 0.1 % + 9.3 µA		
220 mA to 2.2 A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.024 % + 31 µA 0.039 % + 77 µA 0.62 % + 0.16 mA		
(2.2 to 11) A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.036 % + 0.14 mA 0.078 % + 0.3 mA 0.28 % + 0.6 mA		
Up to 120 A	(10 to 65) Hz (65 to 300) Hz (0.3 to 1) kHz	0.026 % + 29 mA 0.024 % + 46 mA 0.077 % + 0.13 mA		Fluke 5730A /52120A

Parameter/Range	Frequency	CMC ^{2, 4} (±)	Comments
Clamp On Meters			
(16.5 to 150) A	(45 to 65) Hz (65 to 400) Hz	0.31 % + 0.03 A 0.86 % + 0.032 A	Fluke 5522A w/5500 coil
(150 to 1025) A	(45 to 5) Hz (65 to 400) Hz	0.34 % + 0.19 A 1.2 % + 0.35 A	
(1000 to 6000) A	(10 to 1000) Hz	0.58 % + 1 A	Fluke 5730A/ 52120A/6KA coil
AC Current – Measure			
Up to 20 µA	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz	0.2 % + 2.5 nA 0.20 % + 2.5 nA 0.23 % + 2.5 nA	Fluke 8588A
(20 to 200) µA	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz	0.026 % + 5 nA 0.051 % + 5 nA 0.072 % + 5 nA 0.45 % + 10 nA	
200 µA to 2 mA	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz	0.026 % + 50 nA 0.051 % + 50 nA 0.072 % + 50 nA 0.45 % + 0.1 µA	
(2 to 20) mA	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz	0.026 % + 0.5 µA 0.051 % + 0.5 µA 0.072 % + 0.5 µA 0.46 % + 1 µA	
(20 to 200) mA	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz	0.026 % + 5 µA 0.05 % + 5 µA 0.07 % + 5 µA	
200 mA to 2 A	1 Hz to 2 kHz 2 to 10) kHz (10 to 30) kHz	0.026 % + 0.1 mA 0.051 % + 0.1 mA 0.084 % + 0.1 mA	
(2 to 20) A	10 Hz to 2 kHz (2 to 10) kHz	0.08 % + 0.5 mA 0.08 % + 0.5 mA	
(20 to 30) A	10 Hz to 2 kHz (2 to 5) kHz	0.08 % + 12 mA 0.12 % + 12 mA	

Parameter/Range	Frequency	CMC ^{2, 4, 5} (±)	Comments
AC Current – Measure (cont)			
Up to 1 mA	(10 to 20) Hz	0.017 %	Fluke 5790B/A40B
	(20 to 40) Hz	0.0075 %	
	40 Hz to 1 kHz	0.006 %	
	(1 to 10) kHz	0.0078 %	
	(10 to 30) kHz	0.0083 %	
	(30 to 50) kHz	0.016 %	
	(50 to 100) kHz	0.017 %	
(1 to 10) mA	(10 to 20) Hz	0.016 %	
	(20 to 40) Hz	0.0058 %	
	40 Hz to 20 kHz	0.0033 %	
	(20 to 50) kHz	0.0044 %	
	(50 to 100) kHz	0.0069 %	
(10 to 200) mA	(10 to 20) Hz	0.016 %	
	(20 to 40) Hz	0.0058 %	
	40 Hz to 20 kHz	0.0033 %	
	(20 to 50) kHz	0.0044 %	
	(50 to 100) kHz	0.006 %	
(0.2 to 2) A	(10 to 20) Hz	0.016 %	
	(20 to 40) Hz	0.0058 %	
	40 Hz to 1 kHz	0.0035 %	
	(1 to 10) kHz	0.0038 %	
	(10 to 30) kHz	0.0085 %	
	(30 to 50) kHz	0.0068 %	
	(50 to 100) kHz	0.008 %	
(2 to 20) A	(10 to 20) Hz	0.017 %	
	(20 to 40) Hz	0.0068 %	
	40 Hz to 1 kHz	0.0048 %	
	(1 to 10) kHz	0.0057 %	
	(10 to 20) kHz	0.0079 %	
	(20 to 30) kHz	0.0085 %	
	(30 to 100) kHz	0.013 %	
(20 to 100) A	(10 to 20) Hz	0.018 %	
	(20 to 40) Hz	0.0085 %	
	40 Hz to 1 kHz	0.0069 %	
	(1 to 10) kHz	0.0095 %	
	(10 to 20) kHz	0.011 %	
	(20 to 30) kHz	0.011 %	
	(30 to 50) kHz	0.018 %	
(50 to 100) kHz	0.019 %		

Parameter/Equipment	Range	CMC ^{2, 4, 5} (\pm)	Comments
Oscilloscopes ³ –			
Amplitude DC Signal: Into 50 Ω Load Into 1 M Ω Load	(-6.6 to 6.6) V (-130 to 130) V	0.25 % + 40 μ V 0.050 % + 40 μ V	Fluke 5522A/SC1100
Rise Time	< 300 ps	+0 ps/-100 ps	
Leveled Sine Wave Flatness, Relative to 50 kHz, 5 mV(p-p) to 5.5 V(p-p)	50 Hz to 100 MHz (100 to 300) MHz (300 to 600) MHz 600 MHz to 1.1 GHz	1.5 % + 100 μ V 2.0 % + 100 μ V 4.0 % + 100 μ V 5.0 % + 100 μ V	
Time Marker Into 50 Ω Load	(5 to 50) ms 20 ms to 2 ns	(25 + 1000t) parts in 10 ⁶ 2.5 parts in 10 ⁶	t is time in seconds
Bandwidth	(0.1 to 300) MHz (300 to 550) MHz 550 MHz to 1.1 GHz 1.1 GHz to 3.2 GHz	2 % 2.7 % 3.3 % 4.1 %	FLUKE 9500B/9530
Time Marker	9.0091 ns to 83 μ s	0.22 μ s/s	
Voltage:			
DC Into 1 M Ω	83 μ s to 55 s	2.4 μ s/s	
DC Into 50 Ω	83 μ s to 55 s	2.4 μ s/s	
Squarewave Into 1 M Ω	\pm 1 mV to 200 V \pm 1 mV to 5 V	0.024 % + 20 μ V 0.024 % + 20 μ V	
Squarewave Into 50 Ω	40 μ V + 200 Vp-p 40 μ V + 5 Vp-p	0.08 % + 8 μ V 0.08 % + 8 μ V	
Risetime	10 Hz to 2 MHz	22 ps	
Tachometers ³	(6 to 99 999) RPM	0.004 %	Frequency standard w/LED
Phase – Measure (0 to 360) ^o	5 Hz to 2 kHz (2 to 5) kHz (5 to 10) kHz (10 to 50) kHz	0.03 ^o 0.04 ^o 0.05 ^o 0.06 ^o	Clark Hess 6000A

VI. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC ^{2,4,5} (±)	Comments
Power Sensor – Calibration Factors (-30 to 20) dBm (-30 to 20) dBm	0.1 MHz to 4.2 GHz 50 MHz to 26.5 GHz	2.8 % <i>CF</i> 3.5 % <i>CF</i>	Agilent power sensors 8482A & 8485A <i>CF</i> is calibration factor
Amplitude Modulation ³ – Carrier: (0.15 to 10) MHz Depth: Up to 99 % Carrier: 10 MHz to 1.3 GHz Depth: Up to 99 %	(20 to 50) Hz 50 Hz to 10 kHz (20 to 50) Hz 50 Hz to 50 kHz (50 to 100) kHz	3.8 % 2.7 % 3.8 % 1.6 % 3.8 %	HP 8902A measuring receiver w/ 11722A power sensor
Frequency Modulation ³ – Carrier: 250 kHz to 10 MHz Dev: Up to 40 kHz Carrier: 10 MHz to 1.3 GHz Dev: Up to 400 kHz	20 Hz to 10 kHz (20 to 50) Hz 50 Hz to 100 kHz (100 to 200) kHz	2.9 % 5.9 % 1.3 % 5.9 %	HP 8902A measuring receiver w/ 11722A power sensor
Phase Modulation ³ – Carrier: 150 kHz to 10 MHz Carrier: 10 MHz to 1.3 GHz	200 Hz to 10 kHz 200 Hz to 20 kHz	4.8 % 3.7 %	HP 8902A measuring receiver w/ 11722A power sensor
Absolute Power – Measure ³ (0 to -10) dBm (-10 to -20) dBm (-20 to -30) dBm (-30 to -40) dBm (-40 to -50) dBm (-50 to -60) dBm (-60 to -70) dBm (-70 to -80) dBm (-80 to -90) dBm (-90 to -100) dBm (-100 to -110) dBm (-110 to -120) dBm	10 MHz to 26.5 GHz	0.08 dB 0.10 dB 0.12 dB 0.13 dB 0.15 dB 0.17 dB 0.20 dB 0.23 dB 0.28 dB 0.33 dB 0.39 dB 0.43 dB	HP 8902A measuring receiver w/ 11722A & 11792A power sensors

VII. Fluid Quantities

Parameter/Equipment	Range ⁷	CMC ^{2, 8} (±)	Comments
Flow – Gas ³	(0.5 to 5) sccm	1.2 %	DH instruments flow meter calibrator Molbox1 Alicat MCR2500SLM
	(5 to 50) sccm	1.2 %	
	(0.05 to 0.5) lpm	0.28 %	
	(0.5 to 5) lpm	0.26 %	
	(3 to 30) lpm	0.42 %	
	(30 to 100) lpm	0.65 %	
Flow – Liquid ³	(100 to 2500) lpm	1.2 %	Flow technology turbine meter Compuflow test stand
	(0.02 to 3) gpm	0.11 %	
	(0.5 to 60.0) gpm	0.09 %	
	(1.5 to 160) gpm	0.09 %	
	(0.1 to 10) gpm	0.067 %	
	(10 to 400) gpm	0.079 %	

VIII. Optical Quantities

Parameter/Equipment	Range ⁷	CMC ^{2, 8} (±)	Comments
Illuminance – Light Meters	(5 to 200) fc	2.8 %	Hoffman light source w/ PCS 600 light meter
	(200 to 2000) fc	3.1 %	
Optical Wavelength – Measure	(700 to 1650) nm	0.000 48 %	Keysight 86120A
Optical Absolute Power – Measure	-20 dBm @ 850 nm	0.091 dBm	Agilent 81624A
	-20 dBm @ 1550 nm	0.090 dBm	

Parameter/Equipment	Range	CMC ^{2, 8} (±)	Comments
Optical Power Linearity – Measure			
850 nm	0 dBm -10 dBm -20 dBm -30 dBm -40 dBm -50 dBm	0.022 dBm 0.024 dBm 0.023 dBm 0.024 dBm 0.024 dBm 0.029 dBm	Agilent 81624A
1310 nm	0 dBm -10 dBm -20 dBm -30 dBm -40 dBm -50 dBm	0.023 dBm 0.024 dBm 0.025 dBm 0.025 dBm 0.027 dBm 0.030 dBm	
1550 nm	0 dBm -10 dBm -20 dBm -30 dBm -40 dBm -50 dBm	0.022 dBm 0.025 dBm 0.023 dBm 0.024 dBm 0.024 dBm 0.030 dBm	

IX. Mechanical

Parameter/Equipment	Range	CMC ² (±)	Comments
Pressure Gauges & Transducer / Vacuum ³			
Pneumatic	(0 to 17) psia Up to 600 psig Up to 3000 psig Up to 6000 psig Up to 10 000 psig	0.002 % + 0.001 psia 0.010 % + 0.001 psig 0.010 % + 0.01 psig 0.011 % + 0.1 psig 0.021 % + 0.1 psig	Mensor CPC 8000 DH Instruments pressure calibrator, PPCH-G
Hydraulic	(5 to 40 000) psig (725 to 72 500) psi	0.030 % 0.030 %	Ruska Model 2450-701 DH-Budenberg 5306

Parameter/Equipment	Range	CMC ² (±)	Comments
Torque Analyzers ³	(1 to 10) ozf·in (10 to 100) ozf·in (4 to 50) lbf·in (30 to 400) lbf·in (80 to 1000) lbf·in (20 to 250) lbf·ft (200 to 2000) lbf·ft	0.16 % 0.12 % 0.065 % 0.025 % 0.026 % 0.017 % 0.086 %	Torque arms w/ Class F weights
Torque Tools ³	(1 to 10) ozf·in (10 to 100) ozf·in (4 to 50) lbf·in (30 to 400) lbf·in (80 to 1000) lbf·in (20 to 250) lbf·ft (200 to 2000) lbf·ft	0.11 % 0.01 % 0.19 % 0.51 % 0.34 % 0.34 % 0.36 %	Mountz MTX10Z AWS: QC10-100 CDI torque, force & tension calibration system, Model: 200-400-02
Air Velocity Instruments	(25 to 350) fpm (350 to 1000) fpm (1000 to 9000) fpm	2.6 % 2.4 % 1.3 %	Omega WT4401-D petit tube
Fume Hood			
Anemometer	(25 to 500) fpm	4.9 %	Testo anemometer
Air Volume Flow	(200 to 400) cfm	9 cfm	Testo flow hood systems
Force Gages & Transducers ³	Up to 1 lbf (1 to 100) lbf (1 to 1000) lbf (350 to 1000) lbf (1000 to 30 000) lbf (30 000 to 100 000) lbf	0.064 % 0.049 % 0.037 % 0.12 % 0.026 % + 1.5 lbf 0.028 %	Dead weights Morehouse force machine w/ load cell
Durometer Calibrator –			
A Scale	(56.08 to 820.87) g	2.6 g	25 lbf load cell
D Scale	(0 to 4.53) kg	0.012 kg	

Parameter/Equipment	Range	CMC ^{2, 8} (±)	Comments
Pipettes	≤ 1 µL ≤ 10 µL ≤ 100 µL ≤ 1000 µL ≤ 5 mL ≤ 10 mL	0.007 µL 0.008 µL 0.017 µL 0.040 µL 0.045 µL 0.66 µL	Sartorius CC111, Sartorius WZA 225-CW mass comparator
Volumetric – Measure	(0 to 5) L	0.094 mL/L	Sartorius mass comparator
Durometers – Type A, B, O Type C, D, DO Indentor Geometry: Length Diameter Angle Radius	(0 to 100) DUROS (0 to 100) DUROS Up to 0.2 in Up to 1 in (0 to 90)° Up to 1 in	0.52 DUROS 0.46 DUROS 0.58 m·in 0.41 m·in 0.049° 0.18 m·in	REX-1 durometer calibrator Optical comparator
Indirect Verification of Rockwell Hardness Testers ³	HRA: Low Mid High HRBW: Low Mid High HRC: Low Mid High HR15N: Low Mid High	0.31 HRA 0.22 HRA 0.19 HRA 0.60 HRBW 0.50 HRBW 0.68 HRBW 0.56 HRC 0.46 HRC 0.40 HRC 0.54 HR15N 0.47 HR15N 0.61 HR15N	ASTM E18

Parameter/Equipment	Range	CMC ² (±)	Comments
Indirect Verification of Rockwell Hardness Testers ³ (cont)	HR15TW: Low Mid High HR30N: Low Mid High HR30TW: Low Mid High HR45N: Low Mid High HR45TW: Low Mid High	0.29 HR15TW 0.29 HR15TW 0.47 HR15TW 0.35 HR30N 0.52 HR30N 0.57 HR30N 0.40 HR30TW 0.38 HR30TW 0.34 HR30TW 0.56 HR45N 0.35 HR45N 0.29 HR45N 0.89 HR45TW 0.62 HR45TW 0.61 HR45TW	ASTM E18
Direct Verification of Rockwell Hardness Testers			
Verification of Test Force	(15 to 150) kgf	0.08 % + 0.01 kgf	Load cell
Verification of Depth Measuring Device	(0 to 260) µm	0.17 µm	Digital indicator system
Accelerometers –			
Vibration: Sensitivity/Frequency Response	(0.5 to 10) Hz (5 to 10 000) Hz (10 000 to 15 000) Hz	1.7 % 1.9 % 2.2 %	Modal shop 9155w/ PCB accelerometers
Shock: Linearity	Up to 10 000 g	2.3 %	
Dynamic Pressure: Linearity	Up to 15 000 psi	3.1 %	

Parameter/Equipment	Range	CMC ^{2, 6, 8} (\pm)	Comments
Balances ³	Up to 310 g Up to 4100 g Up to 15 kg	0.3 mg + 0.6R 48 mg + 0.6R 0.52 g + 0.6R	Class 1 master weights
Scales ³	Up to 100 lb Up to 1000 lb Up to 7200 lb	7.7 g + 0.6R 0.12 kg + 0.6R 0.051 % + 0.6R	Class 4 master weights Standard weights
Mass – Measure	30 kg 25 kg 20 kg 10 kg 5 kg 3 kg 2 kg 1 kg 500g 300 g 200 g 100 g 50 g 30 g 20 g 10 g 5 g 3 g 2 g 1 g 500 mg 300 mg 200 mg 100 mg 50 mg 30 mg 20 mg 10 mg 5 mg 3 mg 2 mg 1 mg	15 mg 13 mg 10g 5.5 mg 2.5 mg 4.9 mg 2.3 mg 1.6 mg 0.57 mg 0.36 mg 0.19 mg 0.19 mg 73 μ g 64 μ g 9.3 μ g 6.1 μ g 4.6 μ g 4.2 μ g 4.6 μ g 4.6 μ g 3.3 μ g 3.2 μ g 2.9 μ g 2.9 μ g 2.5 μ g 3.0 μ g 2.5 μ g 2.5 μ g 2.5 μ g 2.9 μ g 2.5 μ g 2.5 μ g	Single substitution
Mass – Measure (Avoirdupois)	1 lb 5 lb 10 lb 25 lb 50 lb 500 lb 1000 lb	5.3 μ lb (2.4 mg) 5.3 μ lb (2.4 mg) 2.1 μ lb (9.5 mg) 11 μ lb (4.8 mg) 33 μ lb (15 mg) 0.026 lb (12 g) 0.068 lb (31 g)	Single substitution Load cell

X. Thermodynamics

Parameter/Equipment	Range	CMC ^{2, 6, 8} (\pm)	Comments	
Temperature – Measure & Measuring Equipment	(-196 to -80) °C (-80 to 100) °C (100 to 660) °C	0.034 °C 0.021 °C 0.039 °C	Fluke 1560 w/SPRT, TempSens cal-sys -196/-80 & Fluke 7380	
	(400 to 1600) °C	0.27 % + 0.6R	Type R TC w/ Tempsens cal-sys 1700	
Infrared / Pyrometers ³	(50 to 500) °C	1.4 °C + 0.6R	Fluke 9132 $\epsilon = 0.95$ $\lambda = (8 \text{ to } 14) \mu\text{m}$	
	(150 to 1200) °C	0.48 % + 0.6R	IsoTech Pegasus R970 $\epsilon = 0.995$ $\lambda = (9 \text{ to } 14) \mu\text{m}$	
	(-30 to 150) °C	0.8 °C	Fluke 9133	
Humidity – Measuring Equipment, (10 to 30) °C	(5 to 15) % RH (5 to 25) % RH (25 to 35) % RH (35 to 50) % RH (50 to 65) % RH (65 to 80) % RH (80 to 95) % RH	0.40 % 0.49 % 0.52 % 0.59 % 0.62 % 0.66 % 0.83 %	Rotronic HC2-SH & GEO 2000	
Temperature – Measuring Equipment, Fixed Point	Triple Point of Water	8.3 mK	Pond Engineering TPW	
	Liquid Nitrogen	7.5 mK		
Humidity – Measure ³	(-50 to 90) °C	Frost Point Dew Point	1.1 °C 0.14 °C	Chilled mirror
	(10 to 30) °C	(5 to 15) % RH (5 to 25) % RH (25 to 35) % RH	0.20 % 0.36 % 0.40 %	Rotronic HC2-SH
	(10 to 30) °C	(35 to 50) % RH (50 to 65) % RH (65 to 80) % RH (80 to 95) % RH	0.47 % 0.51 % 0.56 % 0.77 %	Rotronic HC2-SH

Parameter/Equipment	Range	CMC ² (±)	Comments
Dew Point	(100 to -65) °C	0.35 °C	Edge tech 1500
Environmental Chambers, Ovens, Furnaces, Freezers, Temperature Baths & Dry Wells	(-80 to 1000) °C	2.0 °C	Type K TCs & Vaisala RH probe

XI. Time & Frequency

Parameter/Equipment	Range	CMC ^{2, 8} (±)	Comments
Frequency – Measuring Equipment	10 MHz Reference Signal	2.0 parts in 10 ¹⁰ Hz	Datum 9390-6000 w/ GPS
Frequency – Measure	1 MHz to 40 GHz	9.3 parts in 10 ⁹ Hz 1.4 part in 10 ⁷ Hz	10 MHz signal from Datum 9390-6000 w/GPS to: 53131 counter 53152A counter
Stopwatches	Up to 24 hrs	0.048 s/day	Timometer 4500

¹ This laboratory offers commercial calibration service and field calibration service, 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 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. CMCs 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, percentages are to be read as percent of reading, unless noted otherwise.

⁶ 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 under test in microinches, D is the numerical value of the nominal diameter of the device measured in inches.

⁷ This scope meets A2LA's *P112 Flexible Scope Policy*.

⁸ 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.

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

MICRO QUALITY CALIBRATION, LLC

Chatsworth, CA

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 30th day of January 2025.

A blue ink signature of Mr. Trace McInturff, written over a horizontal line.

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 2348.01
Valid to November 30, 2026

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