



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017,
ANSI/NCSL Z540-1-1994 & ANSI/NCSL Z540.3-2006

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CALIBRATION

Valid To: March 31, 2025

Certificate Number: 1877.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations^{1, 7}:

I. Chemical

Parameter/Equipment	Range	CMC ^{2, 8} (±)	Comments
pH – Measuring Equipment ^{3, 6}	(4, 7, 10) units	0.011 pH	Buffer solutions
Electrolytic Conductivity – Measuring Equipment ^{3, 6}	≈10 μS/cm ≈100 μS/cm ≈1000 μS/cm ≈10 000 μS/cm	0.62 μS/cm 2.1 μS/cm 4.6 μS/cm 40 μS/cm	Conductivity solutions

II. Dimensional

Parameter/Equipment	Range	CMC ^{2, 8} (±)	Comments
Angle Measuring Equipment ^{6, 9}	Up to 60°	0.0028° + 0.0001°/°	Sine bar, gage blocks, angle blocks

Parameter/Equipment	Range	CMC ² (±)	Comments
Depth Gages ^{3, 9}	Up to 20 in	13 µin + 5.4 µin/in	Gage blocks
Indicators ^{3, 9}	Up to 2 in	17 µin + 2.3 µin/in	Gage blocks
Height Gages ^{3, 9}	Up to 40 in	13 µin + 5.4 µin/in	Gage blocks
Calipers ^{3, 9} –			
Outside	Up to 20 in	12 µin + 5.4 µin/in	Gage blocks
Step/Depth	Up to 20 in	13 µin + 5.4 µin/in	
Micrometers ^{3, 9} –			
Linearity	Up to 20 in	8.7 µin + 5.5 µin/in	Gage blocks
Flatness	50 µin	5.5 µin	Optical flat
Tape Measure & Steel Ruler ^{3, 9}	Up to 39 in 36 in to 100 ft	0.0023 in 0.0023 in + 11 µin/in	Rigid ruler, gage blocks, jeweler's loupe; no tension applied.

III. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2, 4} (±)	Comments
DC Voltage ^{3, 6} – Generate	Up to 220 mV (0.22 to 2.2) V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1100) V	0.49 µV + 5.7 nV/mV 0.8 µV + 3.5 µV/V 2.9 µV + 2.5 µV/V 4.3 µV + 2.5 µV/V 43 µV + 3.5 µV/V 0.42 mV + 4.5 µV/V	Fluke 5720A
DC Voltage ³ – Measure	Up to 200 mV 200 mV to 2 V (2 to 20) V (20 to 200) V (200 to 1000) V	0.11 µV + 5 pV/mV 5.1 µV + 3.6 µV/V 5.3 µV + 3.4 µV/V 0.86 mV + 2.8 µV/V 0.93 mV + 5.1 µV/V	Fluke 8508A

Parameter/Equipment	Range	CMC ^{2, 4, 5} (±)	Comments
DC High Voltage ³ – Measure	(1 to 10) kV (10 to 70) kV	3.2 V + 0.17 V/kV 8.7 V + 0.45 V/kV	Vitretek 4700 HV meter with Vitrek HVL-70 probe.
DC Current ^{3, 6} – Generate	Up to 220 µA (0.22 to 2.2) mA (2.2 to 22) mA (22 to 220) mA (0.22 to 2.2) A (2.2 to 11) A	6 nA + 35 pA/µA 7.1 nA + 30 nA/mA 41 nA + 30 nA/mA 0.73 µA + 50 nA/mA 12 µA + 0.11 mA/A 0.49 mA + 0.34 mA/A	Fluke 5720A w/5725A
Clamp Meters ³	(11 to 20.5) A (10 to 16.5) A (16.5 to 150) A (150 to 1025) A (1000 to 5000) A	9.4 mA + 0.8 mA/A 50 mA + 6.5 mA/A 0.18 A + 3.4 mA/A 0.83 A + 3.3 mA/A 1.2 A + 4.6 mA/A	Fluke 552XA Fluke 5212XA with 5500/coil Fluke 52120 with coil 6KA
DC Current – Generate	(1 to 100) nA 100 nA to 1 µA (1 to 10) µA	0.37 % 0.25 % 0.062 %	5720A, IET standard resistors
DC Current ³ – Measure	Up to 200 µA 200 µA to 2 mA (2 to 20) mA (20 to 200) mA 200 mA to 2 A (2 to 20) A	2.4 nA + 6.4 pA/A 6 nA + 11 nA/A 32 nA + 14 nA/A 0.63 µA + 47 nA/A 14 µA + 0.18 mA/A 0.33 mA + 0.55 mA/A	Fluke 8508A
DC Power ³ – Generate	Up to 1020 V: Up to 3 W (3 to 30) W (30 to 300) W 300 W to 3 kW (3 to 20.9) kW	 0.017 % 0.014 % 0.014 % 0.033 % 0.085 %	Fluke 5520A

Parameter/Equipment	Range	CMC ^{2, 4} ($\pm$)	Comments
DC Resistance ^{3, 6} – Generate	(0 to 10.9999) Ω (11 to 32.9999) Ω (33 to 109.9999) Ω (110 to 329.9999) Ω (330 to 1099.999) 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 (330 to 1099.999) k 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 329.9999) M Ω (330 to 1100) M Ω	1.2 m Ω + 24 $\mu\Omega/\Omega$ 1.5 m Ω + 24 $\mu\Omega/\Omega$ 1.9 m Ω + 22 $\mu\Omega/\Omega$ 4.1 m Ω + 22 $\mu\Omega/\Omega$ 9.1 m Ω + 22 $\mu\Omega/\Omega$ 41 m Ω + 22 $\mu\Omega/\Omega$ 92 m Ω + 22 $\mu\Omega/\Omega$ 0.41 Ω + 22 $\mu\Omega/\Omega$ 0.9 Ω + 22 $\mu\Omega/\Omega$ 8.4 Ω + 26 $\mu\Omega/\Omega$ 14 Ω + 26 $\mu\Omega/\Omega$ 93 Ω + 48 $\mu\Omega/\Omega$ 0.4 k Ω + 0.1 m Ω/Ω 4.4 k Ω + 0.2 m Ω/Ω 16 k Ω + 0.4 m Ω/Ω 0.35 M Ω + 2.4 m Ω/Ω 4.4 M Ω + 12 m Ω/Ω	Fluke 552XA
Calibration of High Voltage Megohm Meters	1 Ω 1.8 Ω 3.7 Ω 5.9 Ω 10 Ω 18 Ω 37 Ω 59 Ω 100 Ω 180 Ω 370 Ω 590 Ω 1 k Ω 1.8 k Ω 3.7 k Ω 5.9 k Ω 18.24 G Ω (10 to 99.99) k Ω (100 to 999.9) k Ω (1 to 9.99) M Ω (10 to 99.99) M Ω (100 to 999.9) M Ω (1 to 10.05) G Ω	11 m Ω 15 m Ω 22 m Ω 30 m Ω 46 m Ω 78 m Ω 0.16 Ω 0.29 Ω 0.46 Ω 0.78 Ω 1.6 Ω 2.1 Ω 3.1 Ω 4.1 Ω 5.4 Ω 6.2 Ω 0.6 G Ω 22 Ω + 2.1 m Ω/Ω 0.22 k Ω + 2.1 m Ω/Ω 3.2 k Ω + 3.1 m Ω/Ω 52 k Ω + 5.2 m Ω/Ω 0.52 M Ω + 5.2 m Ω/Ω 10 M Ω + 10 m Ω/Ω	Fluke 5080A/MEG

Parameter/Equipment	Range	CMC ^{2, 4, 5} ($\pm$)	Comments
DC Resistance ^{3, 6} – Generate (cont)			
Fixed Points	0 Ω 1 Ω 1.9 Ω 10 Ω 19 Ω 100 Ω 190 Ω 1 k Ω 1.9 k Ω 10 k Ω 19 k Ω 100 k Ω 190 k Ω 1 M Ω 1.9 M Ω 10 M Ω 19 M Ω 100 M Ω	50 $\mu\Omega$ 95 $\mu\Omega$ 0.18 m Ω 0.26 m Ω 0.48 m Ω 1.1 m Ω 2 m Ω 9 m Ω 17 m Ω 90 m Ω 0.17 Ω 1.1 Ω 2.1 Ω 18 Ω 36 Ω 0.37 k Ω 0.89 k Ω 10 k Ω	Fluke 5720A
DC Resistance ³ – Generate, Fixed Points, High Voltage			
Up to 20 V	1 k Ω 10 k Ω 100 k Ω 1 M Ω	0.0013 % 0.0013 % 0.0013 % 0.0022 %	IET VRS-100-10- 1K-BP
Up to 100 V	10 M Ω	0.004 %	
Up to 1000 V	100 M Ω 1 G Ω 10 G Ω 100 G Ω 1 T Ω	0.012 % 0.062 % 0.24 % 0.36 % 0.51 %	
Up to 5000 V	10 M Ω 100 M Ω 1 G Ω 10 G Ω 100 G Ω 1 T Ω	0.54 % 0.5 % 0.5 % 0.5 % 0.51 % 0.51 %	

Parameter/Equipment	Range	CMC ^{2, 4, 5} ($\pm$)	Comments
DC Resistance ³ – Generate, Fixed Points to Calibrate Thermometer Digital Readouts	25 Ω 75 Ω 100 Ω 200 Ω 400 Ω	23 $\mu\Omega$ 70 $\mu\Omega$ 96 $\mu\Omega$ 0.19 m Ω 0.37 m Ω	IET SRL standard resistors
Resistance ³ – Measure	Up to 2 Ω (2 to 20) Ω (20 to 200) Ω 200 Ω to 2 k Ω (2 to 20) k Ω (20 to 200) k Ω 200 k Ω to 2 M Ω (2 to 20) M Ω (20 to 200) M Ω 200 M Ω to 2 G Ω (2 to 20) G Ω	4.7 $\mu\Omega$ + 17 $\mu\Omega/\Omega$ 48 $\mu\Omega$ + 7.9 $\mu\Omega/\Omega$ 0.13 m Ω + 7.4 $\mu\Omega/\Omega$ 0.47 m Ω + 7.8 $\mu\Omega/\Omega$ 14 m Ω + 7.8 $\mu\Omega/\Omega$ 4.7 m Ω + 7.8 $\mu\Omega/\Omega$ 0.93 Ω + 10 $\mu\Omega/\Omega$ 93 Ω + 21 $\mu\Omega/\Omega$ 9.3 k Ω + 0.12 m Ω/Ω 0.93 M Ω + 1.4 m Ω/Ω 9.3 M Ω + 1.4 m Ω/Ω	Fluke 8508A
Resistance ³ – Measure	333 $\mu\Omega$ 1 m Ω 10 m Ω 100 m Ω 1 Ω 10 Ω 100 Ω 1 k Ω 10 K Ω	0.0063 % 0.0066 % 0.0023 % 0.0031 % 0.0016 % 0.0016 % 0.0016 % 0.0016 % 0.0016 %	Current transfer using standard shunt, Agilent 3458A

Parameter/Equipment	Range	CMC ² (±)	Comments
Electrical Calibration of Thermocouple Indicators ³ –			
Type B	(600 to 800) °C (800 to 1550) °C 1550 to 1820) °C	0.35 °C 0.28 °C 0.23 °C	Fluke 7526A
Type C	(0 to 1000) °C (1000 to 1800) °C (1800 to 2000) °C (2000 to 2316) °C	0.16 °C 0.23 °C 0.27 °C 0.36 °C	
Type E	(-250 to -200) °C (-200 to -100) °C (-100 to 0) °C (0 to 600) °C (600 to 1000) °C	0.25 °C 0.12 °C 0.091 °C 0.082 °C 0.1 °C	
Type J	(-210 to -100) °C (-100 to 800) °C (800 to 1200) °C	0.14 °C 0.091 °C 0.11 °C	
Type K	(-250 to -200) °C (-200 to -100) °C (-100 to 500) °C (500 to 800) °C (800 to 1372) °C	0.46 °C 0.16 °C 0.1 °C 0.1 °C 0.13 °C	
Type L	(-200 to -100) °C (-100 to 900) °C	0.1 °C 0.091 °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	0.73 °C 0.23 °C 0.12 °C 0.11 °C 0.1 °C 0.13 °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	0.55 °C 0.45 °C 0.39 °C 0.28 °C 0.22 °C 0.21 °C 0.2 °C 0.24 °C	

Parameter/Equipment	Range	CMC ² (±)	Comments
Electrical Calibration of Thermocouple Indicators – (cont)			
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 (1000 to 1600) °C (1600 to 1767) °C	0.51 °C 0.43 °C 0.38 °C 0.29 °C 0.23 °C 0.22 °C 0.22 °C 0.27 °C	Fluke 7526A
Type T	(-250 to -200) °C (-200 to -100) °C (-100 to 0) °C (0 to 200) °C (200 to 400) °C	0.35 °C 0.16 °C 0.14 °C 0.12 °C 0.12 °C	
Type U	(-200 to 0) °C (0 to 200) °C (200 to 600) °C	0.23 °C 0.1 °C 0.1 °C	
Electrical Calibration of RTDs ³ Indicating Systems –			
Pt 385, 100 Ω	(-200 to 80) °C (-80 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 800) °C	0.018 °C 0.023 °C 0.026 °C 0.029 °C 0.035 °C 0.042 °C	Fluke 7526A
Pt 3926, 100 Ω	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C	0.016 °C 0.018 °C 0.020 °C 0.024 °C 0.028 °C 0.035 °C	

Parameter/Equipment	Range	CMC ² (±)	Comments
Electrical Calibration of RTDs ³ Indicating Systems – (cont)			
Pt 3916, 100 Ω	(-200 to -190) °C (-190 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.015 °C 0.016 °C 0.019 °C 0.019 °C 0.025 °C 0.028 °C 0.033 °C 0.037 °C	Fluke 7526A
Pt 385, 200 Ω	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 630) °C	0.054 °C 0.057 °C 0.061 °C 0.061 °C 0.070 °C 0.072 °C 0.089 °C	
Pt 385, 500 Ω	(-200 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C	0.028 °C 0.029 °C 0.036 °C 0.040 °C 0.047 °C	
Pt 385, 1000 Ω	(-200 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C	0.019 °C 0.020 °C 0.027 °C 0.028 °C 0.035 °C	
Ni 120, 120 Ω	(-80 to 260) °C	0.010 °C	
Cu 427, 10 Ω	(-100 to 260) °C	0.12 °C	

Parameter/Range	Frequency	CMC ^{2, 4} ($\pm$)	Comments
AC Voltage ^{3, 6} – Generate			
Up 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 500 kHz to 1 MHz	4 μ V + 0.33 μ V/mV 4 μ V + 85 nV/mV 4 μ V + 75 nV/mV 4 μ V + 0.18 μ V/mV 5 μ V + 0.46 μ V/mV 10 μ V + 0.9 μ V/mV 20 μ V + 1.2 μ V/mV 20 μ V + 2.5 μ V/mV	Fluke 5720A
(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	4.5 μ V + 0.22 μ V/mV 4.2 μ V + 85 nV/mV 4.2 μ V + 75 nV/mV 4.4 μ V + 0.18 μ V/mV 6.1 μ V + 0.46 μ V/mV 12 μ V + 0.9 μ V/mV 23 μ V + 1.2 μ V/mV 26 μ V + 2.5 μ V/mV	
(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	17 μ V + 0.22 μ V/mV 9 μ V + 85 nV/mV 8.7 μ V + 75 nV/mV 11 μ V + 0.18 μ V/mV 16 μ V + 0.46 μ V/mV 31 μ V + 0.9 μ V/mV 48 μ V + 1.2 μ V/mV 78 μ V + 2.5 μ V/mV	
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	90 μ V + 0.22 mV/V 34 μ V + 79 μ V/V 18 μ V + 39 μ V/V 26 μ V + 70 μ V/V 54 μ V + 0.11 mV/V 0.16 mV + 0.34 mV/V 0.56 mV + 0.83 mV/V 0.64 mV + 1.5 mV/V	
(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	0.89 mV + 0.22 mV/V 0.34 mV + 80 μ V/V 0.15 mV + 40 μ V/V 0.26 mV + 70 μ V/V 0.41 mV + 0.1 mV/V 1.2 mV + 0.26 mV/V 4 mV + 0.9 mV/V 6.1 mV + 1.3 mV/V	

Parameter/Range	Frequency	CMC ^{2, 4} (±)	Comments
AC Voltage ^{3, 6} – Generate (cont)			Fluke 5720A
(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	8.9 mV + 0.22 mV/V 3.4 mV + 80 µV/V 1.7 mV + 47 µV/V 3.5 mV + 72 µV/V 5.9 mV + 0.13 mV/V 34 mV + 0.8 mV/V 0.13 V + 4.2 mV/V 0.24 V + 7 mV/V	* 220 V range subject to 2.2E7 V- Hz limitation
(220 to 750) V	(30 to 50) kHz (50 to 100) kHz	93 mV + 0.36 mV/V 0.34 V + 1.3 mV/V	w/ 5725A
(220 to 1100) V	40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz	22 mV + 80 µV/V 34 mV + 0.13 mV/V 93 mV + 0.36 mV/V	
AC Voltage ³ – Measure			Fluke 8508A
Up to 200 mV	(1 to 10) Hz (10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz	13 µV + 0.16 µV/V 4 µV + 0.12 µV/V 4.1 µV + 0.1 µV/V 2.1 µV + 0.1 µV/V 4.1 µV + 0.13 µV/V 7.9 µV + 0.31 µV/V 19 µV + 0.66 µV/V	
200 mV to 2 V	(1 to 10) Hz (10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz	0.15 mV + 0.15 mV/V 30 µV + 0.11 mV/V 28 µV + 88 µV/V 26 µV + 74 µV/V 31 µV + 0.11 mV/V 0.27 mV + 0.13 mV/V 0.24 mV + 0.51 mV/V 2.1 mV + 2.3 mV/V	
(2 to 20) V	(1 to 10) Hz (10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz	0.24 mV + .016 mV/V 0.11 mV + 0.12 mV/V 0.29 mV + 78 µV/V 40 µV + 74 µV/V 72 µV + 0.11 mV/V 0.1 mV + 0.21 mV/V 0.25 mV + 0.51 mV/V 2.1 mV + 2.3 mV/V	

Parameter/Range	Frequency	CMC ^{2, 4} ($\pm$)	Comments
AC Voltage ³ – Measure (cont) (20 to 200) V (200 to 1050) V	(1 to 10) Hz (10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz (1 to 10) Hz (10 to 40) Hz 40 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	11 mV + 0.16 mV/V 2.0 mV + 0.12 mV/V 2.0 mV + 90 μ V/V 1.9 mV + 76 μ V/V 2 mV + 0.11 mV/V 4.1 mV + 0.21 mV/V 19 mV + 0.51 mV/V 0.19 V + 2.3 mV/V 67 mV + 0.15 mV/V 26 mV + 0.11 mV/V 3300 mV + 0.11 mV/V 49 mV + 0.2 mV/V 0.21 V + 0.54 mV/V	Fluke 8508A
AC High Voltage ^{3, 6} – Measure	(1 to 10) kVrms 60 Hz (10 to 50) kVrms 60 Hz	9.6 V + 0.8 V/kV 14 V + 1.2 V/kV	Vitrek 4700 HV meter with Vitrek HVL-70 probe
AC Current ^{3, 6} – Generate Up to 220 μ A 220 μ A 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 (10 to 30) kHz (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	63 nA + 0.13 nA/ μ A 12 nA + 0.14 nA/ μ A 9 nA + 0.11 nA/ μ A 15 nA + 0.25 nA/ μ A 75 nA + 0.9 nA/ μ A 0.69 μ A + 13 nA/ μ A 93 nA + 0.23 μ A/mA 67 nA + 0.14 μ A/mA 60 nA + 0.11 μ A/mA 0.15 μ A + 0.18 μ A/mA 0.85 μ A + 0.9 μ A/mA 3.4 μ A + 8 μ A/mA	Fluke 5720A Fluke 552XA Fluke 5720A Fluke 552XA

Parameter/Range	Frequency	CMC ^{2, 4} ($\pm$)	Comments
AC Current ^{3, 6} – Generate (cont)			
(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 (10 to 30) kHz	0.92 μ A + 0.23 μ A/mA 0.69 μ A + 0.14 μ A/mA 0.6 μ A + 0.11 μ A/mA 0.95 μ A + 0.18 μ A/mA 7 μ A + 0.9 μ A/mA 14 μ A + 3.2 μ A/A	Fluke 5720A Fluke 552XA
(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 (10 to 30) kHz	9.3 μ A + 0.23 μ A/mA 6.8 μ A + 0.14 μ A/mA 5 μ A + 0.11 μ A/mA 7.5 μ A + 0.18 μ A/mA 30 μ A + 0.9 μ A/mA 0.27 mA + 3.2 μ A/mA	Fluke 5720A Fluke 552XA
220 mA to 2.2 A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	89 μ A + 0.24 mA/A 0.17 mA + 0.39 mA/A 1.5 mA + 6 mA/A	Fluke 5720A
(2.2 to 11) A	40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	1.1 mA + 0.4 mA/A 2.3 mA + 0.85 mA/A 8 mA + 3.3 mA/A	5720A w/5725A
(11 to 20.5) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	15 mA + 0.96 mA/A 17 mA + 1.2 mA/A 0.27 A + 24 mA/A	552XA
AC Current Clamps –			
Toroidal: (10 to 16.5) A (16.5 to 150) A (150 to 1025) A	(45 to 65) Hz	26 mA + 2.1 mA/A 50 mA + 1.9 mA/A 0.34 A + 1.9 mA/A	Fluke 552XA with 5500A/coil
(10 to 16.5) A (16.5 to 150) A (150 to 1025) A	(65 to 440) Hz	60 mA + 6 mA/A 0.11 A + 5.3 mA/A 0.86 A + 5.3 mA/A	

Parameter/Range	Frequency	CMC ^{2, 4} ($\pm$)	Comments
AC Current Clamps – (cont.)			
Non-Toroidal: (10 to 16.5) A (16.5 to 150) A (150 to 1025) A	(45 to 65) Hz	60 mA + 3.8 mA/A 0.23 A + 3.7 mA/A 1.2 A + 3.7 mA/A	Fluke 552XA with 5500A/coil
(10 to 16.5) A (16.5 to 150) A (150 to 1025) A	(65 to 440) Hz	90 mA + 7.2 mA/A 0.28 A + 6.7 mA/A 1.6 A + 6.7 mA/A	
(120 to 6000) A	10 Hz to 1 kHz	1 A + 4.7 mA/A	52120A with coil 6KA
AC Current ³ – Measure			
Up to 200 μ A	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.23 μ A + 0.13 nA/A 19 nA + 48 pA/A 19 nA + 62 pA/A 19 nA + 3.1 nA/A	Fluke 8508A
200 μ A to 2 mA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.42 μ A + 0.25 μ A/A 0.56 μ A + 0.19 μ A/A 0.25 μ A + 0.62 μ A/A 0.5 μ A + 3.1 μ A/A	
(2 to 20) mA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	48 μ A + 32 nA/A 1.9 μ A + 0.29 μ A/A 1.9 μ A + 0.62 μ A/A 2.2 μ A + 3.1 μ A/A	
(20 to 200) mA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz	24 μ A + 0.29 μ A/A 19 μ A + 0.28 μ A/A 19 μ A + 0.57 μ A/A	
200 mA to 2 A	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz	0.4 mA + 0.5 mA/A 0.26 mA + 0.67 mA/A 0.42 mA + 2.5 mA/A	
(2 to 20) A	10 Hz to 2 kHz (2 to 10) kHz	1.9 mA + 0.72 mA/A 2.1 mA + 1.9 mA/A	

Parameter/Equipment	Range	CMC ^{2, 4, 5} (±)	Comments
AC Power ³ – Generate (45 to 65) Hz, PF=1	Up to 1020 V Up to 33 W (33 to 330) W 330 W to 1.1 kW (1.1 to 3) kW (3 to 11) kW (11 to 20.9) kW	0.1 % 0.062 % 0.072 % 0.075 % 0.087 % 0.14 %	Fluke 5520A
Duty Cycle ³ – Generate	(1 to 9.99) % (10 to 49.99) % 50 % (50.01 to 90) % (90.01 to 99)	0.32 % 0.02 % 0.013 % 0.02 % 0.31 %	Fluke 5522A

Parameter/Range	Frequency	CMC ^{2, 4} (±)	Comments
Capacitance ³ – Generate (0.19 to 0.3999) nF (0.4 to 1.0999) nF (1.1 to 3.2999) nF (3.3 to 10.9999) nF (11 to 32.9999) nF (33 to 109.999) nF (110 to 329.999) nF (0.33 to 1.0999) μF (1.1 to 3.299 99) 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 1.09 999) mF (1.1 to 3.2999) mF (3.3 to 10.9999) mF (11 to 32.9999) mF (33 to 110) mF	10 Hz to 10 kHz 10 Hz to 10 kHz 10 Hz to 3 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz (10 to 600) Hz (10 to 300) Hz (10 to 150) Hz (10 to 120) Hz (10 to 80) Hz (10 to 50) Hz (10 to 20) Hz (0 to 6) Hz (0 to 2) Hz (0 to 0.6) Hz (0 to 0.2) Hz	8.8 pF + 4 pF/nF 9.7 pF + 4 pF/nF 13 pF + 4 pF/nF 15 pF + 2 pF/nF 0.1 nF + 2 pF/nF 0.15 nF + 2 pF/nF 0.46 nF + 2 pF/nF 1.5 nF + 2 nF/μF 4.6 nF + 2 nF/μF 15 nF + 2 nF/μF 59 nF + 3.2 nF/μF 0.2 μF + 3.6 nF/μF 0.64 μF + 3.6 nF/μF 2 μF + 3.6 μF/mF 7 μF + 3.5 μF/mF 38 μF + 2.6 μF/mF 90 μF + 6 μF/mF 0.37 mF + 8.8 μF/mF	Fluke 5520A

Parameter/Range	Frequency	CMC ^{2, 4, 5} (±)	Comments
Capacitance – Measure			Fluke PM6304
1 pF	50 Hz to 1 kHz (1 to 100) kHz	12 % 1.2 %	
10 pF	(50 to 300) Hz 300 Hz to 10 kHz (10 to 20) kHz (20 to 100) kHz	12 % 1.2 % 0.13 % 0.47 %	
100 pF	(50 to 100) Hz 100 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz	12 % 1.2 % 0.13 % 0.47 %	
1 nF	(50 to 300) Hz 300 Hz to 20 kHz (20 to 100) kHz	1.2 % 0.13 % 0.47 %	
10 nF	50 Hz to 20 kHz (20 to 100) kHz	0.13 % 0.47 %	
100 nF	50 Hz to 20 kHz (20 to 100) kHz	0.13 % 0.47 %	
1 µF	50 Hz to 20 kHz (20 to 100) kHz	0.13 % 0.47 %	
10 µF	50 Hz to 20 kHz (20 to 100) kHz	0.13 % 1.2 %	
100 µF	50 Hz to 10 kHz (10 to 20) kHz (20 to 100) kHz	0.13 % 1.2 % 12 %	
AC Flatness ³ – Measure	10 Hz 100 Hz to 100 kHz 500 kHz 1 MHz (3 to 8) MHz 10 MHz 15 MHz 20 MHz 26 MHz 30 MHz	0.2 % 0.069 % 0.11 % 0.11 % 0.21 % 0.21 % 0.21 % 0.23 % 0.36 % 0.55 %	EL1100 3V TVC

Parameter/Range	Frequency	CMC ^{2, 4, 5} (±)	Comments
Inductance – Generate & Measure ^{3, 4}			
100 µH	100 Hz to 2 kHz 5 kHz 10 kHz 20 kHz 100 kHz	1.2 % 0.13 % 0.14 % 0.19 % 0.47 %	General Radio 1491-G & Fluke PM6304
1 mH	(100 to 200) Hz 500 Hz to 20 kHz 100 kHz	1.2 % 0.12 % 0.46 %	
10 mH	100 Hz 200 Hz to 20 kHz	1.2 % 0.12 %	
100 mH	100 Hz to 10 kHz 20 kHz	0.14 % 0.4 %	
1 H	100 Hz to 5 kHz	0.12 %	
10 H	100 Hz to 1 kHz 2 kHz	0.12 % 0.22 %	
Phase – Generate ³			
Up to 360°	(10 to 65) Hz (65 to 500) Hz 500 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.1° 0.26° 0.51° 2.6° 5.1° 10°	Fluke 552XA

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
Phase – Measure Up to 360°			
(10 to 32) mV 32 mV to 100 V (100 to 320) V	10 Hz to 5 kHz	0.23° 0.059° 0.12°	Krohn-Hite 6620A
(10 to 32) mV 32 mV to 100 V	(5 to 10) kHz	0.23° 0.059°	
(10 to 100) mV 100 mV to 100 V	(10 to 40) kHz	0.41° 0.061°	
(10 to 100) mV 100 mV to 100 V	(40 to 50) kHz	0.41° 0.071°	
(10 to 100) mV 100 mV to 100 V	(50 to 100) kHz	0.41° 0.41°	
Distortion – Measure ^{3,6}	20 Hz to 20 kHz (20 to 100) kHz	1.2 dB 2.3 dB	Agilent 8903A
	100 kHz to 2.9 GHz (2.9 to 6.5) GHz (6.5 to 13.2) GHz (13.2 to 50) GHz	2.4 dB 3.1 dB 3.6 dB 4.8 dB	Keysight 8568EC

Parameter/Range	Frequency	CMC ^{2, 4, 5} ($\pm$)	Comments
Oscilloscopes ³ –			
Amplitude – DC Signal:			
50 Ω Load	(-6.6 to 6.6) V	33 μ V + 2 mV/V	Fluke 5520A with SC1100
1 M Ω Load	(-130 to 130) V	33 μ V + 0.39 mV/V	
Amplitude – Squarewave:			
50 Ω Load	1 mV to 6.6 Vp-p	91 μ V + 4.3 mV/V	
1 M Ω Load	1 mV to 130 Vp-p 10 Hz to 1 kHz	0.2 mV + 0.8 mV/V	
	1 mV to 130 Vp-p (1 to 100) kHz	0.24 mV + 2 mV/V	
Edge into 50 Ω	$\leq$ 300 ps (up to 2 MHz) $\leq$ 350 ps (above 2 MHz)	82 ps 82 ps	
Bandwidth	50 kHz ref 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (600 to 1100) MHz	0.33 mV + 1.7 mV/V 0.4 mV + 31 mV/V 0.43 mV + 36 mV/V 0.53 mV + 57 mV/V 0.58 mV + 67 mV/V	
Time Markers	5 s to 50 ms 20 ms to 1 ns	0.0021 % + (T/1000) % 0.000 36 %	T = time in seconds
Pulse Generator, Positive Into 50 Ω			
Rise/Fall Time	10, 25, 100 & 250 mV 1 V, 2.5 V	1.2 ns	
Pulse Width	(4 to 500) ns 50 Hz to 6.6 MHz	1.7 ns + 39 ps/ns	
Pulse Period	20 ms to 200 ns	0.000 21 %	

IV. Electrical – RF/Microwave

Parameter/Equipment	Range	CMC ^{2, 4, 5} ($\pm$)	Comments
Power Meter ³			Agilent 432A, 478A-H55, Agilent 3458A
Power Reference @ 1 mW	50 MHz	0.45 %	
Power Accuracy	3 μ W to 100 mW	0.29 %	Range calibrator

Parameter/Range	Frequency	CMC ^{2, 4} ($\pm$)	Comments
Relative Power ³ – Measure			
(0 to -10) dB	2.5 MHz to 1.3 GHz	0.047 dB	8902A
(-10 to -20) dB		0.06 dB	
(-20 to -30) dB		0.074 dB	
(-30 to -40) dB		0.087 dB	
(-40 to -50) dB		0.1 dB	
(-50 to -60) dB		0.1 dB	
(-60 to -70) dB		0.11 dB	
(-70 to -80) dB		0.12 dB	
(-80 to -90) dB		0.13 dB	
(-90 to -100) dB		0.15 dB	
(-100 to -110) dB		0.15 dB	
(-110 to -120) dB		0.28 dB	
(-120 to -127) dB		0.29 dB	
(0 to -10) dB	(1.3 to 26.5) GHz	0.066 dB	
(-10 to -20) dB		0.06 dB	
(-20 to -30) dB		0.074 dB	
(-30 to -40) dB		0.087 dB	
(-40 to -50) dB		0.1 dB	
(-50 to -60) dB		0.1 dB	
(-60 to -70) dB		0.11 dB	
(-70 to -80) dB		0.12 dB	
(-80 to -90) dB		0.13 dB	
(-90 to -100) dB		0.15 dB	
(-100 to -110) dB		0.15 dB	
(-110 to -120) dB		0.28 dB	
(-120 to -127) dB		0.29 dB	

Parameter/Range	Frequency	CMC ^{2, 4, 5} (±)	Comments
Absolute Power ³ – Measure			
(0 to +20) dBm	9 kHz to 16 GHz (16 to 18) GHz	2.6 % 2.8 %	Agilent E4418B: Agilent E9304A
(-10 to 0) dBm	9 kHz to 16 GHz (16 to 18) GHz	3.1 % 3.3 %	
(-60 to -10) dBm	9 kHz to 2 GHz (2 to 16) GHz (16 to 18) GHz	3.6 % 3.7 % 3.8 %	
(+10 to +20) dBm	100 kHz to 4.2 GHz (4.2 to 18) GHz (18 to 26.5) GHz	3.6 % 3.7 % 4.7 %	Agilent 8482A Agilent 8481A Agilent 8485A
(-30 to +10) dBm	100 kHz to 4.2 GHz (4.2 to 18) GHz (18 to 26.5) GHz	1.1 % 1.3 % 3.2 %	Agilent 8482A Agilent 8481A Agilent 8485A
Amplitude Modulation ³ – Measure			
Rate: 50 Hz to 10 kHz Depths: (5 to 99) %	150 kHz to 10 MHz	0.14 % depth + 0.024 % depth/% depth	8902A
Rate: 20 Hz to 10 kHz Depths: to 99 %	150 kHz to 10 MHz	0.11 % depth + 0.023 % depth/% depth	
Rate: 50 Hz to 50 kHz Depths: (5 to 99) %	(0.01 to 1.3) GHz	0.15 % depth + 0.01 % depth/% depth	
Rate: 20 Hz to 100 kHz Depths: to 99 %	(0.01 to 1.3) GHz	0.11 % depth + 0.023 % depth/% depth	
Rate: 50 Hz to 50 kHz Depths: (5 to 99) %	(1.3 to 26.5) GHz	0.33 % depth + 0.008 % depth/% depth	
Rate: 20 Hz to 100 kHz Depths: to 99 %	(1.3 to 26.5) GHz	0.31 % depth + 0.021 % depth/% depth	

Parameter/Range	Frequency	CMC ^{2, 4} (±)	Comments
Frequency Modulation ³ – Measure			
Rate: 20 Hz to 10 kHz Dev.: ≤ 40 kHz Peak	250 kHz to 10 MHz	3.5 Hz + 16 Hz/kHz	8902A
Rate: 50 Hz to 100 kHz Dev.: ≤ 400 kHz Peak	(0.01 to 1.3) GHz	3.5 Hz + 7.8 Hz/kHz	
Rate: 20 Hz to 200 kHz Dev.: ≤ 400 kHz Peak	(0.01 to 1.3) GHz	6.8 Hz + 39 Hz/kHz	
Rate: 50 Hz to 100 kHz Dev.: ≤ 400 kHz Peak	(1.3 to 26.5) GHz	6.8 Hz + 7.8 Hz/kHz	
Rate: 20 Hz to 200 kHz Dev.: ≤ 400 kHz Peak	(1.3 to 26.5) GHz	6.8 Hz + 39 Hz/kHz	
Phase Modulation ³ – Measure			
Rate: 200 Hz to 10 kHz (0 to 100) rad	150 kHz to 10MHz	36 mrad + 37 mrad/rad	8902A
Rate: 200 Hz to 20 kHz (0 to 100) rad	(0.01 to 1.3) GHz	36 mrad + 37 mrad/rad	
Rate: 200 Hz to 20 kHz (0 to 100) rad	(1.3 to 26.5) GHz	36 mrad + 37 mrad/rad	

V. Mechanical

Parameter/Equipment	Range	CMC ^{2, 5, 8} (±)	Comments
Accelerometers ⁶ –			
Amplitude Response (mV/g Sensitivity) @ Test Levels From (1 to 10) g	(10 to 99) Hz 100 Hz (101 to 920) Hz 921 Hz to 5 kHz (5.001 to 10) kHz	1.4 % 1.1 % 1.2 % 1.6 % 2 %	VR9500 with 3120B reference sensor

Parameter/Equipment	Range	CMC ^{2, 5, 8} (□)	Comments
Mass ⁶ – Measure			
Class 2 or Higher	(1 to 500) mg 1 g 2 g 3 g 5 g 10 g 20 g 30 g 50 g 100 g 200 g (300 to 500) g	12 µg 20 µg 14 µg 15 µg 17 µg 26 µg 33 µg 41 µg 61 µg 65 µg 0.17 mg 1.1 mg	Mass comparator, Class 1, Class 6, Class F weights (ABBA method)
Class F or Higher	(1 to 2) kg (3 to 5) kg (10 to 32) kg	12 mg 11 mg 100 mg	
Mass – Direct Weigh	Up to 50 g (50 to 100) g (100 to 205) g Up to 620 g Up to 6 kg Up to 32 kg	31 µg 34 µg 41 µg 2.7 mg 29 mg 0.81 g	Electronic balances
Balances ^{3, 6}			
0.0001 g Resolution	Up to 500 mg > 500 mg to 5 g > 5 g to 15 kg	0.82 x <i>R</i> 0.91 x <i>R</i> 1.2 x <i>R</i>	Class 1, Class 6 weights
0.001 g Resolution	Up to 50 g (>50 to 100) g (>100 to 300) g > 300 g to 15 kg	0.83 x <i>R</i> 0.87 x <i>R</i> 1.0 x <i>R</i> 1.2 x <i>R</i>	
0.01 g Resolution	Up to 500 g	0.83 x <i>R</i>	
0.1 g and 1 g Resolution	Up to 15 kg	1.4 x <i>R</i>	
Scales ^{3, 6}	Up to 2000 lb	0.82 x <i>R</i>	Class 6 weights

Parameter/Equipment	Range	CMC ^{2, 5, 8} (±)	Comments
Force Measuring Equipment ^{3, 6} – Tension & Compression	Up to 500 lb	0.0023 %	Class F weights
Cable Tensiometers ⁶	Up to 250 lbf (250 to 600) lbf	0.45 % 0.42 %	CDI torque calibration system, tension cables
Pressure – Precision Measuring Equipment ⁶ Pneumatic ³	(-14 to < 0) psia (0.2 to 25) psia (25 to 1000) psia (0.2 to 25) psig (25 to 1000) psig (0.6 to 50) psig (1.3 to 55) psia (1.5 to 250) psig (3.6 to 275) psia (6 to 1000) psig (14.5 to 1100) psia (8 to 17) psia (-15 to 15) psig (-15 to 50) psig (> 50 to 150) psig (-15 to 100) psig (> 100 to 300) psig (-15 to 330) psig (> 300 to 1000) psig (4 to 854) in·H ₂ O	0.0017 % 0.0049 % 0.0057 % 0.0014 % 0.0031 % 0.0012 % 0.0012 % 0.0014 % 0.0014 % 0.002 % 0.002 % 0.01 % 0.003 psi 0.0044 psi 0.008 % 0.0083 psi 0.008 % 0.027 psi 0.008 % 0.0087 %	Ruska 2465 gas piston gauge Fluke PG7601 with AMH-38 Mensor CPC6050 w/ sensor range: (8 to 17) psia module (-15 to +15) psig module (-15 to 150) psig module (-15 to 300) psig module (-15 to 1000) psig module Ametek PK-854WC-SS

Parameter/Equipment	Range	CMC ^{2, 5, 8} ($\pm$)	Comments
Pressure – Precision Measuring Equipment ^{3, 6}			
Pneumatic	(0 to 16) inH ₂ O Up to ± 1 inH ₂ O (0 to 0.5) inH ₂ O	0.011 inH ₂ O 0.0014 inH ₂ O 0.00041 inH ₂ O	AQS-1 modules w/digital display
	(-8 to 8) inH ₂ O	0.000 045 inH ₂ O + 0.0012 inH ₂ O/inH ₂ O	Furnace Control PPC500
	(-80 to 80) inH ₂ O	0.000 41 inH ₂ O + 0.0012 inH ₂ O/inH ₂ O	
	$\pm$ (0 to 25) inH ₂ O	0.0014 inH ₂ O + 0.000 047 inH ₂ O/inH ₂ O	Fluke 7250LP
	(-100 to -25) inH ₂ O (25 to 100) inH ₂ O	0.011 %	
	(-15 to 30) psi	0.028 psi	Fluke 700PD7
	(0.1 to 10) in-H ₂ O	0.034 in-H ₂ O	Fluke 700P01
	(14.5 to 3625) psig (29 to 3640) psia	0.0016 psi + 0.004 % 0.0029 psi + 0.004 %	DHI PG7202 with: PC7200-500 piston
	(20 to 10 000) psia (34.5 to 10 015) psia	0.0049 psi + 0.012 % 0.0069 psi + 0.012 %	PC7200-100 piston
Hydraulic	(58 to 14 500) psig (72.5 to 14 518) psia	0.012 psi + 0.012 % 0.012 psi + 0.012 %	PC7200-2 piston
	(1 to 1000) psi	0.0092 %	Ametek HK-1000
	(10 to 15 000) psi	0.016 %	Ametek WG-15Q-1L
Torque Tools ^{3, 6}	15 ozf·in to 2000 lbf·ft	0.31 %	CDI torque calibration system
Torque Transducers ^{3, 6}	5 ozf·in to 10 lbf·in 10 lbf·in to 250 lbf·ft (250 to 2000) lbf·ft	0.039 % 0.036 % 0.034 %	Torque arms, Class 6 weights

IV. Photometry

Parameter/Equipment	Range	CMC ^{2, 5, 8} (±)	Comments
Illuminance – Measuring Equipment	(5 to 5200) Lux	1.6 %	Meter-to-meter comparison using Konica Minolta CL200A, lamp
Luminance – Measuring Equipment	(0.5 to 1700) fL	1.8 %	Hoffman Engineering LS-65-8C

V. Thermodynamic

Parameter/Equipment	Range	CMC ^{2, 8} (±)	Comments
Temperature –Measuring Equipment ³	-196 °C (-80 to -40) °C (-40 to -5) °C (-5 to 110) °C (110 to 150) °C (150 to 661) °C	0.0092 °C 0.014 °C 0.012 °C 0.0087 °C 0.015 °C 0.043 °C + 0.000 83 x T _{change from 150 °C}	AM1762 PRT, Additel 286, calibration bath/LN2 comparator
Temperature – Measure ³	(-200 to 661) °C	0.0083 °C + 0.000 018 x Δ T _{change from - 200°C}	Additel 286 reference thermometer, AM1762 PRT, ADT80-RS-25 resistor
Infrared Temperature Measuring Equipment ^{3, 6}	(-15 to < -12) °C (-12 to < -8) °C (-8 to -4) °C (-4 to 0) °C (0 to 120) °C (35 to 500) °C	0.51 °C 0.5 °C 0.49 °C 0.48 °C 0.6 °C + 0.0017 x Δ T _{change from 0 °C} 0.54 °C + 0.0042 x Δ T _{change from 35 °C}	Fluke 4180 Fluke 4181

Parameter/Equipment	Range	CMC ^{2, 8} ($\pm$)	Comments
Humidity Measuring Equipment	(10 to 95) % RH	0.66 % RH	Thunder Scientific 1200
Humidity – Measure ³	(10 to 90) % RH (90 to 100) % RH	1.3 % RH 2.1 % RH	Vaisala HMP77 probe

VI. Thermodynamic Testing/Calibration

Parameter/Equipment	Range	CMC ² ($\pm$)	Comments
Climatic – Freezers, Refrigerators, Incubators, Ovens, Furnaces ³ Temperature Uniformity Survey (TUS)	(-196 to 1200) °C	1.3 °C + 0.0034 x $\Delta T_{\text{Change from -196 °C}}$	AMS 2750E/F/G w/ 1586A Super-DAQ, 1586 DAQ-STAQ Multiplexer, thermocouples

VII. Time & Frequency

Parameter/Equipment	Range	CMC ^{2, 8} ($\pm$)	Comments
Frequency – Measuring Equipment ³	0.01 Hz to 20 MHz 20 MHz to 26.5 GHz	0.58 μ Hz 0.58 Hz	Agilent 33220A & 8640A, GPS receiver
Frequency – Measure ³	0.1 Hz to 12.4 GHz	73 nHz + 12 pHz/Hz	HP 53132A, GPS receiver
Stopwatches & Timers ³	$\pm$ (0 to 19.99) sec/day	37 ms/day	Timometer
Tachometers ³	(1 to 100 000) rpm	0.000 35 rpm + 0.000 038 rpm/rpm	Fluke 5520A

- ¹ This laboratory offers commercial calibration services and field calibration services.
- 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 uncertainty 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 uncertainty.
- 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 percentage or fraction of the reading plus a fixed floor specification.
- ⁵ In the statement of CMC, R is the resolution of the unit under test; all percentages are percent of reading unless otherwise indicated.
- ⁶ Uncertainty components that can be reasonably attributed to the Unit Under Test have not been utilized in the calculation of the CMC value for this measurement parameter.
- 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 The contributions from the resolution of the device under calibration are not included in the CMC claim.



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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/NCSL Z540-1-1994 and the requirements of ANSI/NCSL Z540.3-2006 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 13th day of June 2023.

A blue ink signature of Mr. Trace McInturff.

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 1877.01
Valid to March 31, 2025

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