



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

WESCAN CALIBRATION
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CALIBRATION

Valid To: January 31, 2023

Certificate Number: 1500.02

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations^{1,9}:

I. Chemical

Parameter/Equipment	Range	CMC ^{2,10} (±)	Comments
Electrolytic Conductivity – Measuring Equipment	10 µS/cm 100 µS/cm 1000 µS/cm 10 000 µS/cm	0.30 µS/cm 0.61 µS/cm 5.3 µS/cm 36 µS/cm	Standard solutions

II. Dimensional

Parameter/Equipment	Range	CMC ² (±)	Comments
Angle Blocks	(0 to 30)°	3.1"	Gauge blocks, sine bar, gauging head & amplifier

Parameter/Equipment	Range	CMC ^{2, 4} (±)	Comments
Length Standards	(1 to 40) in	(13 + 4.0L) μin	Gauge blocks, gauging head & amplifier
Crimp Tools	(0.011 to 0.25) in >0.25 in	0.000 23 in 0.000 23 in	Pin gauges, Supermicrometer ^{TM6} , digital caliper
Diameter – External	Up to 10 in (10 to 24) in	(3.8 + 4.3D) μin (13 + 4.0D) μin	Supermicrometer ^{TM6} & gauge blocks Gauge blocks, gauging head & amplifier
Internal	Up to 24 in	(46 + 3.8D) μin	Linear height gage
Flatness – Optical Quality	Up to 3 in	4.1 μin	Optical flat
Surface Plate ³	12 in × 12 in to 12 ft × 12 ft	35 μin	Electronic leveling system
	12 in × 12 in to 12 ft × 12 ft	(26 + 0.056L) μin	Repeat readings
Height Gauges ^{3, 5}	Up to 24 in (24 to 40) in	(1.0 + 3.7L) μin (13 + 3.5L) μin	Gauge blocks
Calipers ^{3, 5}	Up to 40 in	(5.6 + 4.1L) μin	Gauge blocks
Micrometers ^{3, 5} OD ID Depth	Up to 60 in Up to 24 in Up to 12 in	(8.2 + 3.8L) μin (5.5 + 4.0L) μin (2.9 + 3.4L) μin	Gauge blocks
Indicators ^{3, 5}	Up to 3 in	(7.0 + 2.8L) μin	Gauge blocks

Parameter/Equipment	Range	CMC ^{2, 4} (\pm)	Comments
Indicator Calibrators ⁵	Up to 2 in	12 μ in	Gauge blocks
Gauge Head/Amplifier	(0.0001 to 0.2) in	5.4 μ in	Gauge blocks
Step Gauges	Up to 6 in	(7.7 + 0.90L) μ in	Gauge blocks
ID Instruments ^{3, 5} – Bore Gages, ID Micrometers, & Similar ^{3, 12}	Up to 60 in	(5.5 + 4.0L) μ in	Gauge blocks, rings, gauging head/amplifier
Thickness Gauges ⁵	(0.001 to 0.6) in (>0.6 to 1) in	4.7 μ in 11 μ in	Shims & gauge blocks
Rulers, Tapes ⁵	Up to 144 in	(15 + 3.5L) μ in	Gauge blocks
Sine Bars – Parallelism Angle (5 in bar) Angle (10 in bar)	5 in 10 in (0 to 45) $^{\circ}$ (0 to 45) $^{\circ}$	37 μ in 39 μ in 5.5" 3.0"	Gauging head & amplifier Gauge blocks, Supermicrometer ^{TM6} , gauging head & amplifier
Squares	Up to 18 in	11 μ in/in	Master square, gauge blocks
Precision Levels ⁵	Up to 12 in	15 μ in/in	Sine bar, gauge blocks, surface plate
Protractors ⁵	At 0 $^{\circ}$ & 90 $^{\circ}$ (> 0 to < 90) $^{\circ}$	0.000 56 $^{\circ}$ 0.014 $^{\circ}$	Master square Sine bar, gauge blocks, master square

Parameter/Equipment	Range	CMC ² (±)	Comments
Thread Plugs – Major & Pitch Diameter	(0.07 to 10) in	98 μin	Thread wires & Supermicrometer ^{TM6}
Linear Dimension – X-Axis Y-Axis Angle	8 in 4 in (0 to 360)°	0.000 075 in 0.000 075 in 0.017°	Optical comparator

III. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2, 11} (±)	Comments
DC Voltage – Generate ³	(0 to 199.9) μV (0.2 to 1.999) mV (2 to 19.99) mV (20 to 199.99) mV (0.2 to 1.999) V (2 to 19.99) V (20 to 199.99) V (200 to 1100) V	0.0052 % + 0.46 μV 0.000 41 % + 0.000 47 mV 0.000 81 % + 0.000 46 mV 0.000 82 % + 0.000 45 mV 0.000 63 % + 0.000 001 0 V 0.000 62 % + 0.000 003 6 V 0.000 77 % + 0.000 045 V 0.000 89 % + 0.000 45 V	Wavetek 4808
DC Voltage – Measure & Generate ³ Measure Only	(0 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V (100 to 1000) V (1 to 6) kV	8.4 μV/V + 1.4 μV 7.4 μV/V + 3.4 μV 9.7 μV/V + 2.2 μV 9.5 μV/V + 0.29 mV 25 μV/V + 0.50 mV 0.15 % - 1.2 V	Fluke 5520A w/ HP 3458A Fluke 80E-10 w/ HP 3458A opt 002

Parameter/Equipment	Range	CMC ^{2, 11} (\pm)	Comments
DC Current – Measure ³	(0 to 120) nA 100 nA to 1.2 μ A (1 to 12) μ A (10 to 120) μ A 100 μ A to 1.2 mA (1 to 12) mA (10 to 120) mA 100 mA to 1.05 A	0.029 % + 73 pA 25 μ A/A + 68 pA 23 μ A/A + 0.12 nA 23 μ A/A + 0.93 nA 23 μ A/A + 5.9 pA 23 μ A/A + 59 pA 40 μ A/A 0.13 % + 12 μ A	HP 3458A opt 002
	(1 to 3) A (3 to 10) A (10 to 20) A	0.016 % + 48 μ A 0.017 % + 16 μ A 0.025 % - 0.38 mA	Fluke Y5020 & HP 3458A opt 002
DC Current – Generate ³	(0 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 1 A	0.058 % + 100 pA 40 μ A/A + 90 pA 22 μ A/A + 0.14 nA 23 μ A/A + 0.94 nA 23 μ A/A + 6.5 pA 23 μ A/A + 64 pA 40 μ A/A 0.013 % + 12 μ A	Fluke 5520A w/ HP 3458A opt 002
	(1 to 3) A (3 to 10) A (10 to 20) A	0.016 % + 47 μ A 0.017 % + 12 μ A 0.035 % - 1.4 mA	Fluke 5520A w/ Fluke Y5020 & HP 3458A opt 002
	Torroidal Clamps Non-Torroidal Clamps	(20 to 150) A (150 to 1025) A (20 to 150) A (150 to 1025) A	0.23 % + 13 mA 0.25 % + 22 mA 0.45 % + 0.13 A 0.46 % + 0.43 A
DC Current – Generate ³	(0 to 199.9) μ A (0.2 to 1.999) mA (2 to 19.99) mA (20 to 199.99) mA (0.2 to 1.999) A	0.010 % + 0.0018 μ A 0.0054 % + 0.000 018 mA 0.0060 % + 0.000 091 mA 0.0052 % + 0.000 90 mA 0.014 % + 0.000 022 A	Wavetek 4808
Resistance – Generate ³ Fixed Points	10 Ω 100 Ω 1 k Ω 10 k Ω 100 k Ω 1 M Ω 10 M Ω 100 M Ω	0.33 m Ω 1.5 m Ω 14 m Ω 0.14 Ω 1.8 Ω 37 Ω 0.74 k Ω 22 k Ω	Wavetek 4808

Parameter/Equipment	Range	CMC ^{2, 8, 11} (±)	Comments
Resistance – Measure & Generate ³	(1 to 11) mΩ	0.052 %	Leeds & Northrup 4300 w/HP 3458A opt 002
	11 mΩ to 10 Ω (10 to 100) Ω 100 Ω to 1 kΩ (1 to 10) kΩ (10 to 100) kΩ 100 kΩ to 1 MΩ (1 to 10) MΩ (10 to 100) MΩ 100 MΩ to 1 GΩ	13 μΩ/Ω + 0.10 mΩ 13 μΩ/Ω + 0.72 mΩ 11 μΩ/Ω + 1.6 mΩ 10 μΩ/Ω + 19 mΩ 11 μΩ/Ω + 0.12 Ω 15 μΩ/Ω + 5.4 Ω 50 μΩ/Ω + 0.20 kΩ 0.058 % + 1.4 kΩ 0.58 % + 11 kΩ	Fluke 5520A w/HP 3458A

Parameter/Range	Frequency	CMC ^{2, 8, 11} (±)	Comments
Capacitance – Generate ³			
(0.19 to 0.4) nF	10 Hz to 10 kHz	0.51 % + 8.7 pF	Fluke 5520A
(0.4 to 1.1) nF	10 Hz to 10 kHz	0.34 % + 8.9 pF	
(1.1 to 3.3) nF	10 Hz to 3 kHz	0.38 % + 9.0 pF	
(3.3 to 11) nF	10 Hz to 1 kHz	0.20 % + 8.9 pF	
(11 to 33) nF	10 Hz to 1 kHz	0.20 % + 80 pF	
(33 to 110) nF	10 Hz to 1 kHz	0.20 % + 82 pF	
(110 to 330) nF	10 Hz to 1 kHz	0.20 % + 0.24 nF	
330 nF to 1.1 μF	(10 to 300) Hz	0.20 % + 0.82 nF	
(1.1 to 3.3) μF	(10 to 300) Hz	0.20 % + 2.5 nF	
(3.3 to 11) μF	(10 to 150) Hz	0.20 % + 82 pF	
(11 to 33) μF	(10 to 120) Hz	0.32 % + 24 nF	
(33 to 110) μF	(10 to 80) Hz	0.37 % + 78 nF	
(110 to 330) μF	(0 to 50) Hz	0.37 % + 0.24 μF	
330 μF to 1.1 mF	(0 to 20) Hz	0.35 % + 0.92 μF	
(1.1 to 3.3) mF	(0 to 6) Hz	0.36 % + 2.4 μF	
(3.3 to 11) mF	(0 to 2) Hz	0.36 % + 8.1 μF	
(11 to 33) mF	(0 to 0.6) Hz	0.22 % + 69 μF	
(33 to 110) mF	(0 to 0.2) Hz	0.88 % + 80 μF	

Parameter/Range	Frequency	CMC ^{2, 8, 11} (±)	Comments
Capacitance – Generate & Measure (1 to 10) pF (10 to 100) pF (100 to 400) pF (400 to 1000) pF (1 to 10) nF (10 to 100) nF (100 to 1000) nF (1 to 10) μF (10 to 100) μF (100 to 1000) μF	1 kHz 1 kHz 1 kHz 1 kHz 1 kHz 1 kHz 1 kHz 1 kHz 1 kHz 1 kHz	0.012 % + 0.046 pF 0.012 % + 0.046 pF 0.012 % + 0.046 pF 0.023 % + 0.000 26 pF 0.023 % + 0.000 0076 nF 0.023 % + 0.000 078 nF 0.023 % + 0.000 77 nF 0.023 % + 0.000 007 2 μF 0.062 % - 0.0038 μF 0.52 % - 0.46 μF	Genrad 1689M w/ capacitance source
Inductance – Generate & Measure (0.1 to 1) mH (1 to 10) mH (10 to 100) mH (100 to 1000) mH (1 to 10) H	1 kHz 1 kHz 1 kHz 1 kHz 1 kHz	0.012 % + 0.000 12 mH 0.023 % 0.023 % 0.023 % 0.023 %	Genrad 1689M w/ inductance source

Parameter/Equipment	Range	CMC ^{2, 11} (±)	Comments
Capacitance – Generate, Cardinal Points Only	Nominal 1 pF 10 pF 100 pF 1000 pF 1 nF 10 nF 100 nF 1000 nF	0.14 % of charted value 0.12 % of charted value 0.12 % of charted value 0.12 % of charted value 0.058 % of charted value 0.058 % of charted value 0.058 % of charted value 0.058 % of charted value	HP 16380A & GR 1409 series standard capacitors

Parameter/Equipment	Range	CMC ^{2, 11} (±)	Comments
DC Power ³ – 33 mV to 1020 V (@) (0.33 to 330) mA (0.33 to 3) A (3 to 20.5) A	(0.000 011 to 336.6) W (0.011 to 3060) W (0.99 to 20 910) W	0.022 % + 48 μW 0.020 % + 0.18 mW 0.063 % - 0.24 mW	Fluke 5520A

Parameter/Range	Frequency	CMC ^{2, 11} (±)	Comments
AC Power ³ (33 to 330) mV @ (3.3 to 9) mA (9 to 33) mA (33 to 90) mA (90 to 330) mA (330 to 900) mA (0.9 to 2.2) A (2.2 to 4.5) A (4.5 to 20.5) A 330 mV to 1020 V @ (3.3 to 9) mA (9 to 33) mA (33 to 90) mA (90 to 330) mA (330 to 900) mA (0.9 to 2.2) A (2.2 to 4.5) A (4.5 to 20.5) A	(45 to 65) Hz (45 to 65) Hz (45 to 65) Hz (45 to 65) Hz (45 to 65) Hz (45 to 65) Hz (45 to 65) Hz (45 to 65) Hz (45 to 65) Hz (45 to 65) Hz (45 to 65) Hz (45 to 65) Hz (45 to 65) Hz (45 to 65) Hz (45 to 65) Hz (45 to 65) Hz (45 to 65) Hz	0.27 % - 0.024 μW 0.11 % + 0.18 μW 0.13 % + 0.028 μW 0.091 % + 0.032 μW 0.12 % - 0.42 μW 0.10 % + 2.3 μW 0.12 % - 1.2 μW 0.10 % + 7.0 μW 0.11 % + 0.29 μW 0.10 % - 0.27 mW 0.11 % - 0.035 μW 0.073 % - 0.65 mW 0.11 % - 0.59 mW 0.084 % - 0.18 mW 0.11 % + 21 mW 0.091 % + 1.1 mW	Fluke 5520A

Parameter/Equipment	Range	CMC ² (±)	Comments
Electrical Calibration of RTD Indicators & Indicating Systems ³ –			
Pt 385, 3926, 100 Ω	(-200 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C	0.050 °C 0.060 °C 0.080 °C 0.090 °C 0.11 °C	Fluke 5520A
Pt 385 Only	(630 to 800) °C	0.21 °C	
Pt 3916, 100 Ω	(-200 to -190) °C (-190 to -80) °C (-80 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.23 °C 0.040 °C 0.050 °C 0.060 °C 0.070 °C 0.080 °C 0.090 °C 0.21 °C	
Pt 385, 200 Ω	(-200 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.040 °C 0.050 °C 0.11 °C 0.12 °C 0.13 °C 0.14 °C	
Pt 385, 500 Ω	(-200 to -80) °C (-80 to 260) °C (260 to 400) °C (400 to 600) °C (600 to 630) °C	0.040 °C 0.050 °C 0.070 °C 0.08 °C 0.10 °C	
Pt 385, 1000 Ω	(-200 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 600) °C (600 to 630) °C	0.030 °C 0.040 °C 0.050 °C 0.060 °C 0.21 °C	
PtNi 385, 120 Ω	(-80 to 100) °C (100 to 260) °C	0.070 °C 0.13 °C	
Cu 427, 10 Ω	(-100 to 260) °C	0.27 °C	

Parameter/Equipment	Range	CMC ² (±)	Comments
Electrical Calibration of Thermocouple Indicators & Indicating Systems ³ –			
Type E	(-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C	0.42 °C 0.14 °C 0.13 °C 0.16 °C 0.18 °C	Fluke 5520A
Type J	(-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1200) °C	0.42 °C 0.18 °C 0.17 °C 0.15 °C 0.19 °C	
Type K	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.28 °C 0.19 °C 0.16 °C 0.22 °C 0.33 °C	
Type N	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1300) °C	0.34 °C 0.21 °C 0.20 °C 0.19 °C 0.23 °C	
Type S	(0 to 250) °C (250 to 1000) °C (1000 to 1400) °C (140 to 1767) °C	0.51 °C 0.31 °C 0.32 °C 0.38 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.51 °C 0.20 °C 0.14 °C 0.13 °C	
Thermistors	(-80 to -40) °C (-40 to 100) °C (100 to 150) °C	0.084 °C 0.0063 °C 0.0095 °C	Decade resistance boxes

Parameter/Range	Frequency	CMC ^{2, 11} (\pm)	Comments
AC Voltage – Generate ³			
(0.09 to 1.999) mV	(10 to 31) Hz (32 to 330) Hz 300 Hz to 10 kHz (10 to 33) kHz (30 to 100) kHz (100 to 330) kHz 300 kHz to 1 MHz	0.014 % + 0.0055 mV 0.016 % + 0.0054 mV 0.016 % + 0.0054 mV 0.033 % + 0.0054 mV 0.052 % + 0.0055 mV 0.12 % + 0.022 mV 0.25 % + 0.025 mV	Wavetek 4808
(0.9 to 19.99) mV	(10 to 31) Hz (32 to 330) Hz 300 Hz to 10 kHz (10 to 33) kHz (30 to 100) kHz (100 to 330) kHz 300 kHz to 1 MHz	0.020 % + 0.0052 mV 0.017 % + 0.0052 mV 0.017 % + 0.0052 mV 0.027 % + 0.0052 mV 0.050 % + 0.0052 mV 0.12 % + 0.021 mV 0.24 % + 0.025 mV	
(9 to 199.999) mV	(10 to 31) Hz (32 to 330) Hz 300 Hz to 10 kHz (10 to 33) kHz (30 to 100) kHz (100 to 330) kHz 300 kHz to 1 MHz	0.017 % + 0.0090 mV 0.013 % + 0.0087 mV 0.012 % + 0.0083 mV 0.023 % + 0.0083 mV 0.046 % + 0.0084 mV 0.12 % + 0.036 mV 0.24 % + 0.13 mV	
(0.09 to 1.999) V	(10 to 31) Hz (32 to 330) Hz 300 Hz to 33 kHz (30 to 100) kHz (100 to 330) kHz 300 kHz to 1 MHz	0.012 % + 0.000 033 V 0.0076 % + 0.000 019 V 0.0076 % + 0.000 009 4 V 0.014 % + 0.000 019 V 0.040 % + 0.000 009 0 V 0.23 % + 0.000 36 V	
(0.9 to 19.99) V	(10 to 31) Hz (32 to 330) Hz 300 Hz to 33 kHz (30 to 100) kHz (100 to 330) kHz 300 kHz to 1 MHz	0.013 % + 0.000 28 V 0.0077 % + 0.000 18 V 0.0077 % + 0.000 091 V 0.014 % + 0.000 19 V 0.038 % + 0.0045 V 0.22 % + 0.0045 V	

Parameter/Range	Frequency	CMC ^{2, 11} (±)	Comments
AC Voltage – Generate ³ (cont)			
(9 to 199.999) V	(10 to 31) Hz (32 to 330) Hz 300 Hz to 10 kHz (10 to 33) kHz (30 to 100) kHz	0.018 % + 0.000 92 V 0.011 % + 0.0018 V 0.0077 % + 0.000 92 V 0.0087 % + 0.0018 V 0.028 % + 0.0027 V	Wavetek 4808
(9 to 100.000) V	(100 to 330) kHz	0.098 % + 0.042 V	
(90 to 1100) V (to 500 V only)	(10 to 31) Hz	0.014 % + 0.050 V	
(90 to 1100) V	(32 to 330) Hz 300 Hz to 3.3 kHz (3 to 10) kHz (10 to 33) kHz (30 to 100) kHz	0.016 % + 0.044 V 0.013 % + 0.038 V 0.013 % + 0.039 V 0.015 % + 0.061 V 0.093 % + 0.20 V	
(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	0.072 % + 5.5 μV 0.014 % + 5.5 μV 0.018 % + 5.5 μV 0.090 % + 5.5 μV 0.31 % + 11 μV 0.72 % + 45 μV	Fluke 5520A
(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	0.027 % + 7.2 μV 0.012 % + 7.2 μV 0.014 % + 7.2 μV 0.032 % + 7.2 μV 0.072 % + 29 μV 0.18 % + 63 μV	
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	0.027 % + 45 μV 0.011 % + 23 μV 0.017 % + 45 μV 0.027 % + 45 μV 0.063 % + 0.11 mV 0.22 % + 0.54 mV	

Parameter/Range	Frequency	CMC ^{2, 11} (\pm)	Comments
AC Voltage – Generate ³ (cont) (750 to 1020) V	 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	 0.022 % + 15 mV 0.018 % + 16 mV 0.022 % + 15 mV	 Fluke 5520A
AC Voltage – Measure ³ (0 to 10) mV	 (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	 0.048 % + 4.0 μ V 0.027 % + 1.5 μ V 0.040 % + 1.5 μ V 0.13 % + 1.5 μ V 0.67 % + 1.5 μ V 0.53 % + 2.7 μ V	 HP 3458A opt 002
(10 to 100) mV	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.027 % + 5.8 μ V 0.0094 % + 3.2 μ V 0.019 % + 2.7 μ V 0.040 % - 2.7 μ V 0.11 % + 2.7 μ V 0.40 % + 13 μ V 1.3 % + 1.3 μ V	
100 mV to 1 V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.027 % + 56 μ V 0.0094 % + 28 μ V 0.019 % + 27 μ V 0.040 % + 27 μ V 0.11 % + 27 μ V 0.40 % + 0.23 mV 1.3 % + 0.13 mV	
(0.7 to 5) kV	60 Hz	0.15 % - 0.45 V	Fluke 80E -10 w/ HP3458A opt 002

Parameter/Range	Frequency	CMC ^{2, 11} (±)	Comments
AC Voltage – Generate & Measure ³			
(1 to 10) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.0096 % + 0.55 mV 0.0095 % + 0.27 mV 0.019 % + 0.27 mV 0.040 % + 0.27 mV 0.11 % + 0.27 mV 0.40 % + 1.3 mV 1.3 % + 1.3 mV	Fluke 5520A w/ HP 3458A opt 002
(10 to 100) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.027 % + 5.4 mV 0.027 % + 2.7 mV 0.027 % + 2.7 mV 0.047 % + 2.7 mV 0.16 % + 2.7 mV 0.53 % + 13 mV	
(100 to 750) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.053 % + 56 mV 0.054 % + 26 mV 0.080 % + 27 mV 0.16 % + 27 mV 0.40 % + 27 mV	
AC Current – Generate ³			
(20 to 199.9) µA	10 Hz to 1 kHz (1 to 5) kHz	0.017 % + 0.0090 µA 0.035 % + 0.13 µA	Wavetek 4808
(0.2 to 1.999) mA	10 Hz to 1 kHz (1 to 5) kHz	0.013 % + 0.000 091 mA 0.026 % + 0.000 13 mA	
(2 to 19.99) mA	10 Hz to 1 kHz (1 to 5) kHz	0.012 % + 0.000 90 mA 0.026 % + 0.000 90 mA	
(20 to 199.99) mA	10 Hz to 1 kHz (1 to 5) kHz	0.012 % + 0.0090 mA 0.026 % + 0.0092 mA	
(0.2 to 1.999) A	10 Hz to 1 kHz (1 to 5) kHz	0.014 % + 0.000 12 A 0.020 % + 0.000 23 A	
(3 to 11) A	(45 to 100) Hz (100 to 1000) Hz (1 to 5) kHz	0.056 % + 1.8 mA 0.091 % + 1.8 mA 2.7 % + 1.8 mA	Fluke 5520A
(11 to 20) A	(45 to 100) Hz (100 to 1000) Hz (1 to 5) kHz	0.11 % + 4.4 mA 0.14 % + 4.4 mA 2.7 % + 4.5 mA	

Parameter/Range	Frequency	CMC ^{2, 11} (\pm)	Comments
AC Current – Generate ³ (cont)			
Toroidal Clamps & Clamp Meters			
(20 to 150) A (150 to 1025) A	(45 to 65) Hz	0.26 % + 22 mA 0.30 % + 38 mA	Fluke 5520A w/ Fluke 5500A/coil
(20 to 150) A (150 to 1025) A	(65 to 440) Hz	0.71 % + 24 mA 0.75 % + 70 mA	
Non-Toroidal Clamps & Clamp Meters			
(20 to 150) A (150 to 1025) A	(45 to 65) Hz	0.51 % + 0.22 A 0.52 % + 0.78 A	
(20 to 150) A (150 to 1025) A	(65 to 440) Hz	0.90 % + 0.22 A 0.92 % + 0.79 A	
AC Current – Measure ³			
(0 to 100) μ A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.46 % + 23 nA 0.17 % + 23 nA 0.070 % + 23 nA 0.070 % + 23 nA	HP 3458A opt 002
100 μ A to 1 mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz	0.17 % + 23 μ A 0.17 % + 0.23 μ A 0.070 % + 0.23 μ A 0.035 % + 0.23 μ A 0.068 % + 0.25 μ A 0.46 % + 0.46 μ A	
(1 to 10) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz	0.46 % + 2.3 μ A 0.17 % + 2.3 μ A 0.070 % + 2.3 μ A 0.035 % + 2.3 μ A 0.070 % + 2.3 μ A 0.46 % + 4.6 μ A	
(10 to 100) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz	0.46 % + 23 μ A 0.17 % + 23 μ A 0.070 % + 23 μ A 0.035 % + 23 μ A 0.070 % + 23 μ A 0.46 % + 46 μ A	

Parameter/Range	Frequency	CMC ^{2, 11} (±)	Comments
AC Current – Measure ³ (cont)			
100 mA to 1 A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz	0.46 % + 0.23 mA 0.46 % + 0.23 mA 0.093 % + 0.23 mA 0.12 % + 0.23 mA 0.35 % + 0.23 mA	HP 3458A opt 002
Measure Only (1 to 20) A	45 Hz to 1 kHz (1 to 5) kHz	0.031 % + 65 µA 0.046 % + 0.21 mA	HP 3458A opt 002 w/Fluke Y5020 shunt
Distortion (THD)	20 Hz to 20 kHz (20 to 100) kHz	14 % of Indicated THD 30 % of Indicated THD	HP 8903A

Parameter/Equipment	Range	CMC ^{2, 11} (±)	Comments
Oscilloscopes ³⁻			
DC & Square Wave 5 mV to 6.5 V	Up to 50 Ω	0.2 % + 32 µV	Fluke 5520A/SC600
DC Only 5 mV to 130 V	Up to 1 MΩ	0.040 % + 32 µV	
Square Wave 5 mV to 130 V	Up to 1 MΩ	0.090 % + 32 µV	
Leveled Sine Wave	50 kHz Reference Relative to 50 kHz Reference 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (600 to 1100) MHz	1.7 % + 0.24 mV 1.3 % + 80 µV 1.7 % + 80 µV 3.3 % + 80 µV 5.8 % + 0.12 mV	
Time Marker	5 s to 50 ms 20 ms to 2 ns	0.20 % - 0.36 ms 2.3 µs/s	Fluke 5522A/SC1100

IV. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC ^{2, 8, 11} (±)	Comments
Relative Power – Attenuation			
(0 to -10) dBm	2.5 MHz to 26.5 GHz	0.026 dB	HP 8902A w/ 11793A
(-10 to -20) dBm	2.5 MHz to 26.5 GHz	0.038 dB	
(-20 to -30) dBm	2.5 MHz to 26.5 GHz	0.046 dB	
(-30 to -40) dBm	2.5 MHz to 26.5 GHz	0.063 dB	
(-40 to -50) dBm	2.5 MHz to 26.5 GHz	0.082 dB	
(-50 to -60) dBm	2.5 MHz to 26.5 GHz	0.084 dB	
(-60 to -70) dBm	2.5 MHz to 26.5 GHz	0.10 dB	
(-70 to -80) dBm	2.5 MHz to 26.5 GHz	0.12 dB	
(-80 to -90) dBm	2.5 MHz to 26.5 GHz	0.13 dB	
(-90 to -100) dBm	2.5 MHz to 26.5 GHz	0.14 dB	
(-100 to -110) dBm	(2.5 to 1300) MHz	0.15 dB	
(-110 to -120) dBm	(2.5 to 1300) MHz	0.17 dB	
Absolute Power –			
(20 to 30) dBm	100 kHz to 2.6 GHz	0.26 dB	HP 8902A, HP 11722A, HP 11792A
	(2.6 to 12) GHz	0.28 dB	
	(12 to 26.5) GHz	0.32 dB	
(10 to 20) dBm	100 kHz to 2.6 GHz	0.23 dB	
	(2.6 to 12) GHz	0.25 dB	
	(12 to 26.5) GHz	0.30 dB	
(0 to 10) dBm	100 kHz to 2.6 GHz	0.21 dB	
	(2.6 to 12) GHz	0.23 dB	
	(12 to 26.5) GHz	0.28 dB	
(-10 to 0) dBm	100 kHz to 2.6 GHz	0.34 dB	
	(2.6 to 12) GHz	0.24 dB	
	(12 to 26.5) GHz	0.30 dB	
(-20 to -10) dBm	100 kHz to 2.6 GHz	0.27 dB	
	(2.6 to 12) GHz	0.29 dB	
	(12 to 26.5) GHz	0.34 dB	
High RF Power – Measure			
(0.3 to 100) W	(25 to 440) MHz	3.3 %	Bird 4421A w/ 4022A

Parameter/Range	Frequency	CMC ^{2, 8} (±)	Comments
Amplitude Modulation – Carrier: 150 kHz to 10 MHz Depth: Up to 99 % Carrier: (0.1 to 1.3) GHz Depth: Up to 99 %	(20 to 50) Hz (0.05 to 100) kHz (20 to 50) Hz (0.05 to 100) kHz	3.0 % 2.0 % 1.1 % 3.0 %	HP 8902A
Frequency Modulation – Carrier: (0.25 to 10) MHz Dev: Up to 40 kHz Carrier: (0.01 to 1.3) GHz Dev: Up to 400 kHz	(0.02 to 10) kHz (0.05 to 100) kHz (100 to 200) kHz	2.3 % + 12 Hz 1.2 % + 0.12 kHz 5.8 % + 0.12 kHz	HP 8902A
Phase Modulation – Carrier (0.15 to 10) MHz Carrier (0.01 to 1.3) GHz	(0.2 to 10) kHz (0.2 to 20) kHz	4.8 % + 0.012 rad 3.7 % + 0.12 rad	HP 8902A

V. Mechanical

Parameter/Equipment	Range	CMC ^{2, 8, 10} (±)	Comments
Force – Measure & Measuring Equipment ^{3, 5}	Up to 500 lbf	0.038 %	Dead weight
Mass ³	1 mg to 1 g (>1 to 10) g (>10 to 210) g (>210 to 6.1) kg	0.0080 mg (0.0021 - 0.000 18X) % 0.000 090 % (0.000 66 - 0.000 083Y) %	Troemner weights & comparators X in g Y in kg

Parameter/Equipment	Range	CMC ^{2, 8, 10} (±)	Comments
Scales & Balances ^{3, 5}	1 mg to 1 g	0.0050 mg	Troemner weights
	(1 to 10) g	(0.000 48 – 0.000 038X) %	X in g
	10 g to 11 kg	0.000 060 %	
	(11 to 200) kg	0.012 %	Class F weights
Torque – Measure & Measuring Equipment ³	(0.2 to 1.6) ft·lbf	0.57 %	Norbar 20 lb.in transducer
	(0.5 to 2000) ft·lbf	0.27 %	AKO torque system
Measuring Equipment Only ⁵	(1 to 200) in·lbf	0.13 %	Torque arm & weights
Pressure/Vacuum – Measure & Measuring Equipment ^{3, 5}	(-2 to 2) in H ₂ O	0.000 76 in H ₂ O	Dwyer 1430 Microtector Hook gauge
	(-5 to 5) in H ₂ O	0.006 in H ₂ O	Digital pressure gage
	(0 to 8.5) psia (8.5 to 17) psia	0.0011 psia 0.0019 psia	Mensor CPG2500
	(-12 to 30) psia (30 to 3000) psi	0.0030 psi 0.010 %	Fluke 6270A
	(0 to -14.2) psig (0 to 6) psig (> 6 to 15 000) psig	0.038 psig 0.0061 psig 0.11 %	Digital pressure gauges

Parameter/Equipment	Range	CMC ² (±)	Comments
Volume ³	(0.5 to 2) μL	0.040 μL	Balances <i>V</i> is the volume in μL
	(2 to 20) μL	0.052 μL	
	(20 to 200) μL	(0.037 + 0.0033 · <i>V</i>) μL	
	(200 to 1000) μL	(0.26 + 0.0020 · <i>V</i>) μL	
	(1000 to 25 000) μL	(2.1 + 0.0011 · <i>V</i>) μL	

VI. Thermodynamics

Parameter/Equipment	Range	CMC ^{2, 10} (±)	Comments
Temperature – Measure ³	(-196 to -20) °C	0.033 °C	Fluke 5609, Hart 1529
Thermocouples –	(-196 to 1000) °C	0.057 °C	HP3458, Ice Bath, Fluke 5609/1529
Temperature – Measure & Measuring Equipment ³	-196 °C (Generate Only)	0.029 °C	Liquid N ₂ , Fluke 5609, Hart 1529
	-78 °C (Generate Only)	0.033 °C	Fluke 5609, Hart 1529 with solid CO ₂ & isopropyl alcohol
	(-20 to 150) °C	0.033 °C	w/ Fluke 7320
	(150 to 200) °C	0.044 °C	w/ Fluke 6102
	(200 to 425) °C	0.053 °C	w/ Fluke 9172
	(425 to 600) °C	0.089 °C	w/ Hart 9127
	Ice Point (Generate only)	0.0027 °C	ASTM E563 ice point
Infrared Temperature – Measure & Measuring Equipment ³	(35 to 500) °C	(0.30 + 0.0040 rdg) °C	Fluke 4181

Parameter/Equipment	Range	CMC ^{2, 10} (\pm)	Comments
Relative Humidity – Measure & Measuring Equipment ^{3, 5}	(10 to 95) % RH	0.5 % RH	Thunder Scientific 1200

VII. Time & Frequency

Parameter/Equipment	Range	CMC ^{2, 7, 10} (\pm)	Comments
Frequency – Measure ⁵	1 mHz to 26.5 GHz	3.5 parts in $10^{12} + 0.6RE$ Hz	HP Z3801A GPS locked with frequency counter
Frequency – Measuring Equipment ⁵	10 MHz Reference 1 mHz to 26.5 GHz	3.5 parts in 10^{12} Hz 3.5 parts in $10^{12} + 0.6RE$ Hz	HP Z3801A GPS HP Z3801A GPS locked with signal generator
Frequency – Measure & Measuring Equipment ³	(0.01 to 10) Hz (10 to 100) Hz 100 Hz to 26.5 GHz	1.1 part in 10^3 Hz 4.1 part in 10^6 Hz 1.1 part in 10^7 Hz	HP 5345A HP5350A, Anritsu 68377B

¹ This laboratory offers commercial calibration service and field and mobile 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 and mobile calibration service is available for this calibration except pipettes as a mobile laboratory activity. Please note the actual measurement uncertainties achievable on a customer's site can normally be expected to be larger than the Calibration and Measurement Capability Uncertainty (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 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 In the statement of CMC, L is the numerical value of the nominal length of the device measured in inches. D is the numerical value of the nominal diameter of the device measured in inches except where noted. R is the resolution of the unit under test.
- ⁵ The contributions from the “best existing device” are not included in the CMC claim.
- ⁶ "Supermicrometer" is a registered trade mark with a last listed owner of Pratt & Whitney Measurement Systems, Inc., Connecticut U.S.A.
- ⁷ RE is the resolution of the signal generator or counter.
- ⁸ Unless otherwise indicated all units listed in % means % of reading.
- ⁹ This scope meets A2LA's *P112 Flexible Scope Policy*.
- ¹⁰ 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.
- ¹¹ 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.



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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 7th day of May 2021.

A blue ink signature of the Vice President of Accreditation Services.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 1500.02
Valid to January 31, 2023

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