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

WESCAN CALIBRATION
#9-12240 Horseshoe Way
Richmond, B.C., V7A 4X9, Canada
Malcolm Smith Phone: 604 275 0600

CALIBRATION

Valid To: January 31, 2021 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
pH – Measuring Equipment[5]	4 pH 7 pH 10 pH	0.010 pH 0.011 pH 0.018 pH	Standard solutions
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 and amplifier

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Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Length Standards	(1 to 40) in	(13 + 4.0*L*) µin	Gauge blocks, gauging head and amplifier
Crimp Tools	(0.011 to 0.25) in >0.25 in	0.000 23 in 0.000 23 in	Pin gauges, Supermicrometer™[6], digital caliper
Diameter –			
External	Up to 10 in	(3.8 + 4.3*D*) µin	Supermicrometer™[6] and gauge blocks
	(10 to 24) in	(13 + 4.0*D*) µin	Gauge blocks, gauging head and amplifier
Internal	Up to 24 in	(46 + 3.8*D*) 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 + 0.056*L*) µin	Repeat readings
Height Gauges[3, 5]	Up to 24 in (24 to 40) in	(1.0 + 3.7*L*) µin (13 + 3.5*L*) µin	Gauge blocks
Calipers[3, 5]	Up to 40 in	(5.6 + 4.1*L*) µin	Gauge blocks
Micrometers[3, 5] –			
OD ID Depth	Up to 60 in Up to 24 in Up to 12 in	(8.2 + 3.8*L*) µin (5.5 + 4.0*L*) µin (2.9 + 3.4*L*) µin	Gauge blocks
Indicators[3, 5]	Up to 3 in	(7.0 + 2.8*L*) µin	Gauge blocks

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Indicator Calibrators[3, 5]	Up to 2 in	12 µin	Gauge blocks
Gauge Head/Amplifier	(0.0001 to 0.2) in	5.4 µin	Gauge blocks
Step Gauges	Up to 6 in	(7.7 + 0.90*L*) µin	Gauge blocks
ID Instruments[3, 5] – Bore Gages, ID Micrometers, and Similar[3]	Up to 60 in	(5.5 + 4.0*L*) µin	Gauge blocks, rings, gauging head/amplifier
Thickness Gauges[3, 5]	(0.001 to 0.6) in (>0.6 to 1) in	4.7 µin 11 µin	Shims and gauge blocks
Rulers, Tapes[3, 5]	Up to 144 in	(15 + 3.5*L*) µin	Gauge blocks
Sine Bars – Parallelism Angle (5 in bar) Angle (10 in bar)	 5 in 10 in (0 to 45)° (0 to 45)°	 37 µin 39 µin 5.5″ 3.0″	 Gauging head and amplifier Gauge blocks, Supermicrometer™[6], gauging head and amplifier
Squares	Up to 18 in	11 µin/in	Master square, gauge blocks
Precision Levels[5]	Up to 12 in	15 µin/in	Sine bar, gauge blocks, surface plate
Protractors[5]	At 0° and 90º (> 0 to < 90)°	0.00056° 0.014°	Master square Sine bar, gauge blocks, master square
Thread Plugs – Major and Pitch Diameter	(0.07 to 10) in	98 µin	Thread wires and Supermicrometer™[6]

Parameter/Equipment	Range	CMC[2] (±)	Comments
Linear Dimension –			
X-Axis	8 in	0.000 075 in	Optical comparator
Y-Axis	4 in	0.000 075 in	
Angle	(0 to 360)°	0.017°	

III. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2, 8, 11] (±)	Comments
DC Voltage – Generate[3]	(0 to 199.9) µV	0.0052 % + 0.46 µV	Wavetek 4808
	(0.2 to 1.999) mV	0.00041 % + 0.000 47 mV	
	(2 to 19.99) mV	0.00081 % + 0.000 46 mV	
	(20 to 199.99) mV	0.00082 % + 0.000 45 mV	
	(0.2 to 1.999) V	0.00063 % + 0.000 001 0 V	
	(2 to 19.99) V	0.00062 % + 0.000 003 6 V	
	(20 to 199.99) V	0.00077 % + 0.000 045 V	
	(200 to 1100) V	0.00089 % + 0.000 45 V	
DC Voltage – Measure and Generate[3]	(0 to 100) mV	8.4 µV/V + 1.4 µV	Fluke 5520A w/ HP 3458A
	100 mV to 1 V	7.4 µV/V + 3.4 µV	
	(1 to 10) V	9.7 µV/V + 2.2 µV	
	(10 to 100) V	9.5 µV/V + 0.29 mV	
	(100 to 1000) V	25 µV/V + 0.50 mV	
Measure Only	(1 to 6) kV	0.15 % - 1.2 V	Fluke 80E-10 w/ HP 3458A opt 002
DC Current – Measure[3]	(0 to 120) nA	0.029 % + 73 pA	HP 3458A opt 002
	100 nA to 1.2 µA	25 µA/A + 68 pA	
	(1 to 12) µA	23 µA/A + 0.12 nA	
	(10 to 120) µA	23 µA/A + 0.93 nA	
	100 µA to 1.2 mA	23 µA/A + 5.9 pA	
	(1 to 12) mA	23 µA/A + 59 pA	
	(10 to 120) mA	40 µA/A	
	100 mA to 1.05 A	0.13 % + 12 µA	
	(1 to 3) A	0.016 % + 48 µA	
	(3 to 10) A	0.017 % + 16 µA	Fluke Y5020 and HP 3458A opt 002
	(10 to 20) A	0.025 % - 0.38 mA	

Parameter/Equipment	Range	CMC[2, 8, 11] (±)	Comments
DC Current – Generate[3]	(0 to 100) nA 100 nA to 1 µA (1 to 10) µA (10 to 100) µA 100 µA to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A	0.058 % + 100 pA 40 µA/A + 90 pA 22 µA/A + 0.14 nA 23 µA/A + 0.94 nA 23 µA/A + 6.5 pA 23 µA/A + 64 pA 40 µA/A 0.013 % + 12 µA	Fluke 5520A w/ HP 3458A opt 002
Generate Only:	(1 to 3) A (3 to 10) A (10 to 20) A	0.016 % + 47 µA 0.017 % + 12 µA 0.035 % - 1.4 mA	Fluke 5520A w/ Fluke Y5020 and HP 3458A opt 002
Torroidal Clamps	(20 to 150) A (150 to 1025) A	0.23 % + 13 mA 0.25 % + 22 mA	Fluke 5520A w/ Fluke 5500A/coil
Non-Torroidal Clamps	(20 to 150) A (150 to 1025) A	0.45 % + 0.13 A 0.46 % + 0.43 A	
DC Current – Generate	(0 to 199.9) µA (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 µA 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 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ	0.33 mΩ 1.5 mΩ 14 mΩ 0.14 Ω 1.8 Ω 37 Ω 0.74 kΩ 22 kΩ	Wavetek 4808

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

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 and Measure			
(1 to 10) pF	1 kHz	0.012 % + 0.046 pF	Genrad 1689M w/ capacitance source
(10 to 100) pF	1 kHz	0.012 % + 0.046 pF	
(100 to 400) pF	1 kHz	0.012 % + 0.046 pF	
(400 to 1000) pF	1 kHz	0.023 % + 0.000 26 pF	
(1 to 10) nF	1 kHz	0.023 % + 0.000 007 6 nF	
(10 to 100) nF	1 kHz	0.023 % + 0.000 078 nF	
(100 to 1000) nF	1 kHz	0.023 % + 0.000 77 nF	
(1 to 10) µF	1 kHz	0.023 % + 0.000 007 2 µF	
(10 to 100) µF	1 kHz	0.062 % - 0.0038 µF	
(100 to 1000) µF	1 kHz	0.52 % - 0.46 µF	
Inductance – Generate and Measure			
(0.1 to 1) mH	1 kHz	0.012 % + 0.00012 mH	Genrad 1689M w/ inductance source
(1 to 10) mH	1 kHz	0.023 %	
(10 to 100) mH	1 kHz	0.023 %	
(100 to 1000) mH	1 kHz	0.023 %	
(1 to 10) H	1 kHz	0.023 %	

Parameter/Equipment	Range	CMC[2, 8, 11] (±)	Comments
Capacitance – Generate, Cardinal Points Only			
	Nominal		
	1 pF	0.14 % of charted value	HP 16380A & GR 1409 series standard capacitors
	10 pF	0.12 % of charted value	
	100 pF	0.12 % of charted value	
	1000 pF	0.12 % of charted value	
	1 nF	0.058 % of charted value	
	10 nF	0.058 % of charted value	
	100 nF	0.058 % of charted value	
	1000 nF	0.058 % of charted value	

Parameter/Equipment	Range	CMC[2, 8, 11] (±)	Comments
DC Power[3] –			
33 mV to 1020 V (@)			
(0.33 to 330) mA	(0.000 011 to 336.6) W	0.022 % + 48 µW	Fluke 5520A
(0.33 to 3) A	(0.011 to 3060) W	0.020 % + 0.18 mW	
(3 to 20.5) A	(0.99 to 20 910) W	0.063 % - 0.24 mW	

Parameter/Range	Frequency	CMC[2, 8, 11] (±)	Comments
AC Power[3]			
(33 to 330) mV @			
(3.3 to 9) mA	(45 to 65) Hz	0.27 % - 0.024 µW	Fluke 5520A
(9 to 33) mA	(45 to 65) Hz	0.11 % + 0.18 µW	
(33 to 90) mA	(45 to 65) Hz	0.13 % + 0.028 µW	
(90 to 330) mA	(45 to 65) Hz	0.091 % + 0.032 µW	
(330 to 900) mA	(45 to 65) Hz	0.12 % - 0.42 µW	
(0.9 to 2.2) A	(45 to 65) Hz	0.10 % + 2.3 µW	
(2.2 to 4.5) A	(45 to 65) Hz	0.12 % - 1.2 µW	
(4.5 to 20.5) A	(45 to 65) Hz	0.10 % + 7.0 µW	
330 mV to 1020 V @			
(3.3 to 9) mA	(45 to 65) Hz	0.11 % + 0.29 µW	
(9 to 33) mA	(45 to 65) Hz	0.10 % - 0.27 mW	
(33 to 90) mA	(45 to 65) Hz	0.11 % - 0.035 µW	
(90 to 330) mA	(45 to 65) Hz	0.073 % - 0.65 mW	
(330 to 900) mA	(45 to 65) Hz	0.11 % - 0.59 mW	
(0.9 to 2.2) A	(45 to 65) Hz	0.084 % - 0.18 mW	
(2.2 to 4.5) A	(45 to 65) Hz	0.11 % + 21 mW	
(4.5 to 20.5) A	(45 to 65) Hz	0.091 % + 1.1 mW	

Parameter/Equipment	Range	CMC[2, 11] (±)	Comments
Electrical Calibration of RTD Indicators and 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, 11] (±)	Comments
Electrical Calibration of Thermocouple Indicators and 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) ºC (-40 to 100) ºC (100 to 150) ºC	0.084 ºC 0.0063 ºC 0.0095 ºC	Decade resistance boxes

Parameter/Range	Frequency	CMC[2, 8, 11] (±)	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 % + 0.00036 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, 8, 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, 8, 11] (±)	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 V 0.018 % + 16 V 0.022 % + 15 V	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 µV 0.027 % + 1.5 µV 0.040 % + 1.5 µV 0.13 % + 1.5 µV 0.67 % + 1.5 µV 0.53 % + 2.7 µV	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 µV 0.0094 % + 3.2 µV 0.019 % + 2.7 µV 0.040 % - 2.7 µV 0.11 % + 2.7 µV 0.40 % + 13 µV 1.3 % + 1.3 µV	
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 µV 0.0094 % + 28 µV 0.019 % + 27 µV 0.040 % + 27 µV 0.11 % + 27 µV 0.40 % + 0.23 mV 1.3 % + 0.13 mV	
(0.7 to 5) kV	60 Hz	0.16 % - 1.2 V	Fluke 80E -10 w/ HP3458A opt 002

Parameter/Range	Frequency	CMC[2, 8, 11] (±)	Comments
AC Voltage – Generate and 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	
(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	Fluke 5520A

Parameter/Range	Frequency	CMC[2, 8, 11] (±)	Comments
AC Current – Measure[3]			
(0 to 100) µA	(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 µA 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 µA 0.17 % + 0.23 µA 0.070 % + 0.23 µA 0.035 % + 0.23 µA 0.068 % + 0.25 µA 0.46 % + 0.46 µA	
(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 µA 0.17 % + 2.3 µA 0.070 % + 2.3 µA 0.035 % + 2.3 µA 0.070 % + 2.3 µA 0.46 % + 4.6 µA	
(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 µA 0.17 % + 23 µA 0.070 % + 23 µA 0.035 % + 23 µA 0.070 % + 23 µA 0.46 % + 46 µA	
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	

Parameter/Range	Frequency	CMC[2, 8, 11] (±)	Comments
AC Current – Measure[3] (cont)			
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, 8, 11] (±)	Comments
Oscilloscopes[3] –			
DC and 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	1.7 % + 0.24 mV	
	Relative to 50 kHz Reference		
	50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (600 to 1100) MHz	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 (2.6 to 12) GHz (12 to 26.5) GHz	0.26 dB 0.28 dB 0.32 dB	HP 8902A, HP 11722A, HP 11792A
(10 to 20) dBm	100 kHz to 2.6 GHz (2.6 to 12) GHz (12 to 26.5) GHz	0.23 dB 0.25 dB 0.30 dB	
(0 to 10) dBm	100 kHz to 2.6 GHz (2.6 to 12) GHz (12 to 26.5) GHz	0.21 dB 0.23 dB 0.28 dB	
(-10 to 0) dBm	100 kHz to 2.6 GHz (2.6 to 12) GHz (12 to 26.5) GHz	0.34 dB 0.24 dB 0.30 dB	
(-20 to -10) dBm	100 kHz to 2.6 GHz (2.6 to 12) GHz (12 to 26.5) GHz	0.27 dB 0.29 dB 0.34 dB	
High RF Power – Measure			
(0.3 to 100) W	(25 to 440) MHz	6.1 %	Bird 4421A w/ 4022A

Parameter/Range	Frequency	CMC[2, 8, 11] (±)	Comments
Amplitude Modulation –			
Carrier: 150 kHz to 10 MHz Depth: Up to 99 %	(20 to 50) Hz (0.05 to 100) kHz	3.0 % 2.0 %	HP 8902A
Carrier: (0.1 to 1.3) GHz Depth: Up to 99 %	(20 to 50) Hz (0.05 to 100) kHz	1.1 % 3.0 %	
Frequency Modulation –			
Carrier: (0.25 to 10) MHz Dev: Up to 40 kHz	(0.02 to 10) kHz	2.3 % + 12 Hz	HP 8902A
Carrier: (0.01 to 1.3) GHz Dev: Up to 400 kHz	(0.05 to 100) kHz (100 to 200) kHz	1.2 % + 0.12 kHz 5.8 % + 0.12 kHz	
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 and Measuring Equipment[3, 5]	(0 to 500) lbf	0.038 %	Dead weight
Mass	1 mg to 1 g	0.0080 mg	Troemner weights and comparators
	(>1 to 10) g	(0.0021 - 0.00018X) %	X in g
	(>10 to 210) g	0.000 090 %	
	(>210 to 6.1) kg	(0.000 66 - 0.000 083Y) %	Y in kg

Parameter/Equipment	Range	CMC[2, 8, 10] (±)	Comments
Scales and Balances[3, 5]	1 mg to 1 g (1 to 10) g 10 g to 11 kg (11 to 200) kg	0.0050 mg (0.00048 – 0.000 038X) % 0.000060 % 0.012 %	Troemner weights X in g Class F weights
Volume[3]	(0.5 to 2) µL (2 to 20) µL (20 to 200) µL (200 to 1000) µL (1000 to 25 000) µL	0.040 µL 0.052 µL (0.037 + 0.0033·*V*) µL (0.26 + 0.0020·*V*) µL (2.1 + 0.0011·*V*) µL	Balances *V* is the volume in µL
Torque – Measure and Measuring Equipment[3] Measuring Equipment Only[5]	2 in·lbf to 2000 ft·lbf (1 to 200) in·lbf	0.25 % 0.13 %	AKO torque system Torque arm and weights
Pressure/Vacuum – Measure and Measuring Equipment[3, 5]	(-5 to 5) in H20 (-12 to 30) psia (30 to 3000) psi (3000 to 15 000) psig	0.006 in H_2O 0.0030 psi 0.010 % 0.12 %	Digital pressure gage Fluke 6270A Digital pressure gauges

Parameter/Equipment	Range	CMC[2, 8] (±)	Comments
Durometer Calibration – (Type A, B, C, D, DO, O, OO)[3, 5]			ASTM D2240
Indentor Extension and Shape –			Optical comparator
Diameter	Up to 0.105 in	0.000 26 in	
Radius	Up to 0.125 in	0.000 26 in	
Angle	25° to 40°	0.068°	
Extension	Up to 0.105 in	0.000 26 in	
Indentor Display[5]	(0 to 100) durometer units	0.009 durometer units	Gage blocks
Spring Calibration – Force	Up to 10.2 lbf	(0.000 60 + 0.000 40 rdg) durometer units	Weights

VI. Thermodynamics

Parameter/Equipment	Range	CMC[2, 10] (±)	Comments
Temperature – Measure[3]	(-200 to -20) °C	0.033 °C	Fluke 5609, Hart 1529
Temperature – Measure and Measuring Equipment[3]	-196 °C	0.029 °C	Liquid N_2, Fluke 5609, Hart 1529
	(-70 to -20) °C	0.033 °C	Fluke 5609, Hart 1529 with solid CO_2 and isopropyl alcohol
	(-20 to 150) °C (150 to 200) °C (200 to 425) °C (425 to 600) ºC	0.033 °C 0.044 °C 0.053 °C 0.089 °C	w/ Fluke 7320 w/ Fluke 6102 w/ Fluke 9172 w/ Hart 9127
	Ice Point (generate only)	0.0027 °C	ASTM E563 ice point

Parameter/Equipment	Range	CMC[2, 10] (±)	Comments
Thermocouples –	(-200 to 1000) °C	0.057 °C	HP3458, Ice Bath, Fluke 5609/1529
Infrared Temperature – Measure and Measuring Equipment[3]	(35 to 500) ºC	(0.30 + 0.0040 rdg) ºC	Fluke 4181
Relative Humidity – Measure and Measuring Equipment[3, 5]	(10 to 95) % RH	0.5 % RH	Thunder Scientific 1200

VII. Time & Frequency

Parameter/Equipment	Range	CMC[2, 4, 7, 10] (±)	Comments
Frequency – Measure[5]	1 mHz to 26.5 GHz	3.5 parts in 10^{12} + 0.6*R* 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} + 0.6*R* Hz	HP Z3801A GPS HP Z3801A GPS locked with signal generator
Frequency – Measure and 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, HP68377B

[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 this calibration and this laboratory meets A2LA *R104 – General Requirements: Accreditation of Field Testing and Field Calibration Laboratories* for these calibrations. Please note the actual measurement uncertainties achievable on a customer's site can normally be expected to be larger than the CMC found on the A2LA Scope. Allowance must be made for aspects such as the environment at the place of calibration and for other possible adverse effects such as those caused by transportation of the calibration equipment. The usual allowance for the actual uncertainty introduced by the item being calibrated, (e.g. resolution) must also be considered and this, on its own, could result in the actual measurement uncertainty achievable on a customer's site being larger than the CMC.

[4] 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] *R* 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.

Accredited Laboratory

A2LA has accredited

WESCAN CALIBRATION

Richmond, British Columbia, CANADA

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/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 10th day of July 2019.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 1500.02
Valid to January 31, 2021

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