



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005  
& ANSI/NCSL Z540-1-1994

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CALIBRATION

Valid until: September 30, 2019

Certificate Number: 1078.02

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations<sup>1</sup>:

I. Dimensional

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
Bore Gages	Up to 8 in	24 µin + 7.5 µin/in	ULM
Calipers <sup>3</sup>	Up to 4 in (4 to 20) in (20 to 80) in	130 µin + 4.2 µin/in 170 µin + 4.2 µin/in 300 µin + 5.1 µin/in	Gage blocks
CMM <sup>3</sup> –			
Linear	Up to 52 in, in x, y Up to 20 in, in z	(38 + 5.2L) µin (58 + 8.1L) µin	ASME B89.4.1
Probing Analysis	---	2 µm	
Volumetric	Up to 36 in for shortest axis	(82 + 13L) µin	
Bi-Directional	---	(40 + 10L) µin	

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
Cylindrical Rings	Up to 8 in	(15 + 10D) μin	UMM and gage blocks
Cylindrical Plugs	Up to 8 in (8 to 18) in	14 μin + 6.0 μin/in 8.7 μin + 4.2 μin/in	UMM and gage blocks
Gage Amp w/ Probe <sup>3</sup>	----	13 μin	Gage blocks
Gage Blocks	Up to 4 in (4 to 20) in	4.2 μin + 4.7 μin/in 4.6 μin + 4.7 μin/in	Gage block and comparator
Height Gages <sup>3</sup>	Up to 48 in	(0.6R + 30L) μin	Standard reference bar
Indicators <sup>3</sup>	Up to 4 in	(0.6R + 40L) μin	Gage blocks
Indicator Calibrators <sup>3</sup>	----	0.6R + 19 μin	Gage amp w/probe
Length Standards	Up to 8 in (8 to 18) in	14 μin + 6.0 μin/in 8.7 μin + 4.2 μin/in	Universal measuring machine (UMM) and gage blocks
Micrometers –			
Depth <sup>3</sup>	Up to 12 in	40 μin/in + 0.6R	Gage blocks
Inside	Up to 8 in (8 to 18) in	14 μin + 6.0 μin/in 8.7 μin + 4.2 μin/in	UMM and gage blocks
Outside <sup>3</sup>	Up to 4 in (4 to 20) in	58 μin + 4.7 μin/in 140 μin + 4.7 μin/in	Gage blocks
Groove <sup>3</sup>	Up to 4 in	40 μin/in + 0.6R	Gage blocks
NPT Plugs –			
Pitch Diameter Taper	Up to 2 in	(100 + 12D) μin (240 + 13D) μin/in	Thread wires, UMM

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
Tapered Rings <sup>3</sup> –			
Taper	Up to 18 in	400 μin	NPT master plug, UMM
Standoff and Thickness	Up to 18 in	120 μin	NPT master plug and height measuring machine
Functional Diameter	Up to 2 in	(300 + 8D) μin	
Optical Comparators <sup>3</sup> –			
Squareness	(0 to 360)°	2'	Calibration sphere
Linear	Up to 12 in	0.0002 in	Glass scale
Magnification	10x, 20x, 50x, 62.5x, 100x	0.00012 in	Calibration sphere w/overlay
Protractors <sup>3</sup>	(0 to 180)°	0.0076°	Angle blocks
Rules/Linear Scales <sup>3</sup>	Up to 24 in	2200 μin + 11 μin/in	Digiscope master rule
Surface Plate <sup>3</sup> –			
Flatness	24 in × 24 in to 72 in × 144 in	8√D μin	Level meters (D is the diagonal in inches)
Repeatability	6 in × 6 in to 72 in x 144 in	34 μin	Repeat-O-Meter
Tape Measures <sup>3</sup>	Up to 50 ft	(0.08 + 0.003L) in	Master rule
Threaded Plug Gages –			
Simple Pitch Diameter	Up to 14 in	(110 + 9D) μin	UMM, thread wires
Major Diameter	Up to 8 in (8 to 14) in	14 μin + 6.0 μin/in 8.7 μin + 4.2 μin/in	(Best thread wire size)

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
Threaded Rings –  Simple Pitch Diameter Functional Diameter	Up to 14 in Up to 14 in	(140 + 9D) μin (300 + 8D) μin	UMM, set plug

## II. Electrical – DC/Low Frequency

Parameter/Range	Frequency	CMC <sup>2,5</sup> (±)	Comments
AC Current – Generate <sup>3</sup>  (29 to 330) μA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.16 % + 0.1 μA 0.12 % + 0.1 μA 0.1 % + 0.1 μA 0.24 % + 0.15 μA 0.62 % + 0.2 μA 1.3 % + 0.4 μA	Fluke 5520A
330 μA to 3.3 mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.16 % + 0.15 μA 0.1 % + 0.15 μA 0.08 % + 0.15 μA 0.16 % + 0.2 μA 0.38 % + 0.3 μA 0.8 % + 0.6 μA	
(3.3 to 33) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.14 % + 2 μA 0.07 % + 2 μA 0.031 % + 2 μA 0.062 % + 2 μA 0.16 % + 3 μA 0.31 % + 4 μA	
(33 to 330) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.14 % + 20 μA 0.07 % + 20 μA 0.032 % + 20 μA 0.08 % + 50 μA 0.16 % + 0.12 mA 0.31 % + 0.2 mA	
330 mA to 1.1 A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.14 % + 0.1 mA 0.039 % + 0.1 mA 0.46 % + 1 mA 2.0 % + 5 mA	

Parameter/Range	Frequency	CMC <sup>2,5</sup> (±)	Comments
AC Current – Generate <sup>3</sup> (cont)			
(1.1 to 3) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.14 % + 0.1 mA 0.047 % + 0.1 mA 0.46 % + 1 mA 1.9 % + 5 mA	Fluke 5520A
(3 to 11) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.048 % + 5 mA 0.081 % + 2 mA 2.4 % + 2 mA	
(11 to 20.5) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.095 % + 5 mA 0.12 % + 5 mA 2.4 % + 5 mA	
(20 to 150) A 150 A to 1 kA	50 Hz to 1 kHz 50 Hz to 1 kHz	0.26 % 0.51 %	Fluke 5520 w/5500A coil
AC Current – Measure <sup>3</sup>			
Up to 100 µA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.46 % + 0.03 µA 0.18 % + 0.03 µA 0.073 % + 0.03 µA 0.073 % + 0.03 µA	HP 3458A
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 (50 to 100) kHz	0.46 % + 0.2 µA 0.18 % + 0.2 µA 0.072 % + 0.2 µA 0.043 % + 0.2 µA 0.072 % + 0.2 µA 0.46 % + 0.4 µA 0.64 % + 1.5 µA	
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 (50 to 100) kHz	0.46 % + 2 µA 0.18 % + 2 µA 0.072 % + 2 µA 0.043 % + 2 µA 0.072 % + 2 µA 0.46 % + 4 µA 0.64 % + 15 µA	

Parameter/Range	Frequency	CMC <sup>2,5,6</sup> (±)	Comments
AC Current – Measure <sup>3</sup> (cont)			
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 (50 to 100) kHz	0.46 % + 20 µA 0.18 % + 20 µA 0.072 % + 20 µA 0.043 % + 20 µA 0.072 % + 20 µA 0.46 % + 40 µA 0.64 % + 0.25 mA	HP 3458A
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 (20 to 50) kHz	0.46 % + 0.2 mA 0.19 % + 0.2 mA 0.1 % + 0.2 mA 0.13 % + 0.2 mA 0.35 % + 0.2 mA 1.2 % + 0.4 mA	
(1 to 3) A	10 Hz to 5 kHz (5 to 10) kHz	0.18 % + 2 mA 0.41 % + 22 mA	Fluke 8845A
(3 to 10) A	10 Hz to 5 kHz (5 to 10) kHz	0.18 % + 6 mA 0.41 % + 70 mA	
AC High Voltage – Measure <sup>3</sup>			
(1 to 2) kV <sub>peak</sub>	(20 to 100) Hz (100 to 400) Hz	0.1 % + 0.12 % rng 0.46 % + 0.12 % rng	Vitretek 4620B
(2 to 20) kV <sub>peak</sub>	(2 to 100) Hz	0.23 % + 0.12 % rng	
AC Power <sup>3</sup> –			
PF = 1			
(3.3 to 9) mA (9 to 33) mA (33 to 90) mA (90 to 330) mA 330 mA to 0.9 A (0.9 to 2.2) A (2.2 to 4.5) A (4.5 to 20.5) A	(10 to 65) Hz 33 mV to 1020 V	0.15 % 0.13 % 0.15 % 0.13 % 0.19 % 0.18 % 0.29 % 0.18 %	Fluke 5520A

Parameter/Range	Frequency	CMC <sup>2,6</sup> (±)	Comments
AC Power <sup>3</sup> – (cont)			
(3.3 to 9) mA	(65 to 500) Hz	0.10 %	Fluke 5520A
(9 to 33) mA	33 mV to 1020 V	0.07 %	
(33 to 90) mA		0.10 %	
(90 to 330) mA		0.12 %	
330 mA to 0.9 A		0.09 %	
(0.9 to 2.2) A		0.08 %	
(2.2 to 4.5) A		0.18 %	
(4.5 to 20.5) A		0.18 %	
(3.3 to 9) mA	500 Hz to 1 kHz	0.10 %	
(9 to 33) mA	33 mV to 1020 V	0.07 %	
(33 to 90) mA		0.10 %	
(90 to 330) mA		0.12 %	
330 mA to 0.9 A		0.09 %	
(0.9 to 2.2) A		0.08 %	
(2.2 to 4.5) A		0.18 %	
(4.5 to 20.5) A		0.18 %	
(3.3 to 9) mA	(1 to 5) kHz	0.14 %	
(9 to 33) mA	33 mV to 1020 V	0.12 %	
(33 to 90) mA		0.21 %	
(90 to 330) mA		0.15 %	
330 mA to 0.9 A		0.69 %	
(0.9 to 2.2) A		0.56 %	
(2.2 to 4.5) A		2.5 %	
(4.5 to 20.5) A		2.5 %	
(3.3 to 9) mA	(5 to 10) kHz	0.38 %	
(9 to 33) mA	33 mV to 1020 V	0.35 %	
(33 to 90) mA		0.52 %	
(90 to 330) mA		0.38 %	
330 mA to 0.9 A		3.1 %	
(0.9 to 2.2) A		2.4 %	
(3.3 to 9) mA	(10 to 30) kHz	1.3 %	
(9 to 33) mA	33 mV to 1020 V	1.2 %	
(33 to 90) mA		1.4 %	
(90 to 330) mA		1.3 %	



Parameter/Range	Frequency	CMC <sup>2,5</sup> (±)	Comments
AC Voltage – Generate <sup>3</sup>			
(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	0.063 % + 6 μV 0.017 % + 6 μV 0.02 % + 6 μV 0.08 % + 6 μV 0.27 % + 12 μV 0.62 % + 50 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	0.023 % + 8 μV 0.012 % + 8 μV 0.013 % + 8 μV 0.028 % + 8 μV 0.062 % + 32 μV 0.16 % + 70 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	0.023 % + 50 μV 0.012 % + 60 μV 0.016 % + 60 μV 0.024 % + 50 μV 0.055 % + 0.13 mV 0.19 % + 0.6 mV	
(3.3 to 33) V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.023 % + 0.65 mV 0.012 % + 0.6 mV 0.019 % + 0.6 mV 0.028 % + 0.6 mV 0.072 % + 1.6 mV	
(33 to 330) V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.015 % + 2 mV 0.016 % + 6 mV 0.02 % + 6 mV 0.026 % + 6 mV 0.16 % + 50 mV	
(330 to 1020) V	45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.024 % + 10 mV 0.02 % + 10 mV 0.024 % + 10 mV	



Parameter/Range	Frequency	CMC <sup>2,5</sup> (±)	Comments
AC Voltage – Measure <sup>3</sup>			
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	0.039 % + 3 μV 0.03 % + 1.1 μV 0.039 % + 1.1 μV 0.12 % + 1.1 μV 0.58 % + 1.1 μV 4.6 % + 2 μV	HP 3458A
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 (1 to 2) MHz	0.014 % + 4 μV 0.012 % + 2 μV 0.018 % + 2 μV 0.031 % + 2 μV 0.092 % + 2 μV 0.34 % + 10 μV 1.2 % + 10 μV 1.8 % + 10 μV	
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 (1 to 2) MHz	0.014 % + 40 μV 0.012 % + 20 μV 0.018 % + 20 μV 0.031 % + 20 μV 0.092 % + 20 μV 0.34 % + 0.1 mV 1.2 % + 0.1 mV 1.8 % + 0.1 mV	
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 (1 to 2) MHz	0.014 % + 0.4 mV 0.012 % + 0.2 mV 0.018 % + 0.2 mV 0.031 % + 0.2 mV 0.092 % + 0.2 mV 0.34 % + 1 mV 1.2 % + 1 mV 1.8 % + 1 mV	
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 300 kHz to 1 MHz	0.025 % + 4 mV 0.025 % + 2 mV 0.025 % + 2 mV 0.04 % + 2 mV 0.14 % + 2 mV 0.46 % + 10 mV 1.7 % + 10 mV	
1000 V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.047 % + 40 mV 0.047 % + 20 mV 0.07 % + 20 mV 0.14 % + 20 mV 0.34 % + 20 mV	

Parameter/Equipment	Range	CMC <sup>2,5</sup> (±)	Comments
Capacitance – Generate <sup>3</sup>	(0.19 to 3.3) nF (3.3 to 11) nF (11 to 110) nF (110 to 330) nF 330 nF to 1.1 μF (1.1 to 3.3) μF (3.3 to 11) μF (11 to 33) μF (33 to 110) μF (110 to 330) μF 330 μF to 1.1 mF (1.1 to 3.3) mF (3.3 to 11) mF (11 to 33) mF	0.5 % + 0.01 nF 0.25 % + 0.01 nF 0.25 % + 0.1 nF 0.25 % + 0.3 nF 0.25 % + 1 nF 0.25 % + 3 nF 0.25 % + 10 nF 0.4 % + 30 nF 0.45 % + 100 nF 0.45 % + 300 nF 0.45 % + 1 μF 0.45 % + 3 μF 0.45 % + 10 μF 0.75 % + 30 μF	Fluke 5520A
DC Current – Generate <sup>3</sup>	(0 to 330) μA 330 μA to 3.3 mA (3.3 to 33) mA (33 to 330) mA 330 mA to 1.1 A (1.1 to 3.0) A (3 to 11) A (11 to 20.5) A	0.012 % + 0.02 μA 79 μA/A + 0.05 μA 79 μA/A + 0.25 μA 79 μA/A + 2.5 μA 0.016 % + 40 μA 0.03 % + 40 μA 0.04 % + 500 μA 0.078 % + 750 μA	Fluke 5520A
DC Current – Measure <sup>3</sup>	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 (1 to 2) A (2 to 10) A	52 mA/A + 0.04 nA 25 mA/A + 0.04 nA 25 mA/A + 0.1 nA 26 mA/A + 0.8 nA 27 mA/A + 5 nA 26 mA/A + 50 nA 42 mA/A + 0.5 mA 0.013 % + 10 mA 0.15 % 0.19 %	HP 3458A  Fluke 8845A
DC High Voltage – Measure <sup>3</sup>	(1 to 2) kV (2 to 20) kV	0.05 % + 0.023 % rng 0.46 % + 0.12 % rng	Vitrek 4620B

Parameter/Equipment	Range	CMC <sup>2, 5, 6</sup> ( $\pm$ )	Comments
DC Power <sup>3</sup> – 33 mV to 1020 V	330 $\mu$ A to 1.1 A (1.1 to 3) A (3 to 11) A (11 to 20.5) A	0.068 % 0.070 % 0.095 % 0.12 %	Fluke 5520A
DC Voltage – Generate <sup>3</sup>	(0 to 330) $\mu$ V 330 $\mu$ V to 3.3 V (3.3 to 33) V (33 to 330) V (330 to 1000) V	16 $\mu$ V + 1 $\mu$ V 9.1 $\mu$ V/V + 2 $\mu$ V 11 $\mu$ V/V + 20 $\mu$ V 15 $\mu$ V/V + 150 $\mu$ V 15 $\mu$ V/V + 1500 $\mu$ V	Fluke 5520A
DC Voltage – Measure <sup>3</sup>	Up to 100 mV 100 mV to 1 V (1 to 10) V (10 to 100) V (100 to 1000) V	9.6 $\mu$ V/V + 0.23 $\mu$ V 6.1 $\mu$ V/V + 0.25 $\mu$ V 5.6 $\mu$ V/V + 1 $\mu$ V 7.4 $\mu$ V/V + 25 $\mu$ V 7.6 $\mu$ V/V + 100 $\mu$ V	HP 3458A
Electrical Simulation of RTDs <sup>3</sup> –			
Pt 385, 100 $\Omega$	(-200 to 0) $^{\circ}$ C (0 to 100) $^{\circ}$ C (100 to 300) $^{\circ}$ C (300 to 400) $^{\circ}$ C (400 to 630) $^{\circ}$ C (630 to 800) $^{\circ}$ C	0.05 $^{\circ}$ C 0.07 $^{\circ}$ C 0.09 $^{\circ}$ C 0.1 $^{\circ}$ C 0.12 $^{\circ}$ C 0.23 $^{\circ}$ C	Fluke 5520A
Pt 3926, 100 $\Omega$	(-200 to 0) $^{\circ}$ C (0 to 100) $^{\circ}$ C (100 to 300) $^{\circ}$ C (300 to 400) $^{\circ}$ C (400 to 630) $^{\circ}$ C	0.05 $^{\circ}$ C 0.07 $^{\circ}$ C 0.09 $^{\circ}$ C 0.1 $^{\circ}$ C 0.12 $^{\circ}$ C	
PtNi 385, 120 $\Omega$	(-80 to 100) $^{\circ}$ C (100 to 260) $^{\circ}$ C	0.08 $^{\circ}$ C 0.14 $^{\circ}$ C	

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Electrical Simulation of RTDs <sup>3</sup> – (cont)			
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	0.04 °C 0.05 °C 0.12 °C 0.13 °C 0.14 °C 0.16 °C	Fluke 5520A
Pt 385, 500 Ω	(-200 to -80) °C (-80 to 100) °C (100 to 260) °C (260 to 400) °C (400 to 600) °C (600 to 630) °C	0.04 °C 0.05 °C 0.06 °C 0.08 °C 0.09 °C 0.11 °C	
Pt 385, 1000 Ω	(-200 to 0) °C (100 to 260) °C (260 to 300) °C (300 to 600) °C (600 to 630) °C	0.03 °C 0.04 °C 0.05 °C 0.06 °C 0.07 °C	
Pt 3916, 100 Ω	(-200 to -190) °C (-190 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 600) °C	0.23 °C 0.25 °C 0.04 °C 0.05 °C 0.06 °C 0.07 °C 0.08 °C 0.09 °C	
Electrical Simulation of Thermocouple <sup>3</sup> –			
Type E	(-250 to -100) °C (-100 to 650) °C (650 to 1000) °C	0.5 °C 0.16 °C 0.21 °C	Fluke 5520A
Type J	(-210 to -100) °C (-100 to 760) °C (760 to 1200) °C	0.28 °C 0.17 °C 0.23 °C	

Parameter/Equipment	Range	CMC <sup>2,5</sup> (±)	Comments
Electrical Simulation of Thermocouple <sup>3</sup> – (cont)			
Type K	(-200 to -100) °C (-100 to 120) °C (120 to 1000) C (1000 to 1372) °C	0.34 °C 0.18 °C 0.26 °C 0.4 °C	Fluke 5520A
Type S	(0 to 250) °C (250 to 1400) °C (1400 to 1767) °C	0.47 °C 0.37 °C 0.46 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 400) °C	0.63 °C 0.24 °C 0.15 °C	
Oscilloscope Calibration <sup>3</sup> –			
Squarewave Signal 50 Ω at 1 kHz Source	± 1 mV to 6.6 V <sub>p-p</sub>	0.28 % + 40 μV	Fluke 5520A/SC1100
Squarewave Signal 1 MΩ at 1 kHz Source	± 1 mV to 130 V <sub>p-p</sub>	0.12 % + 40 μV	
Leveled Sine Wave Amplitude – Range: 5 mV to 5.5 V <sub>p-p</sub>	50 kHz reference 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz	2 % + 300 μV 3.5 % + 300 μV 4 % + 300 μV 6 % + 300 μV	Fluke 5520A/SC1100, <i>t</i> is in seconds
Range: 4 mV to 3.5 V <sub>p-p</sub>	(600 to 1100) MHz	7 % + 300 μV	
Leveled Sine Wave Flatness (Relative to 50 kHz)	50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (600 to 1100) MHz	1.5 % + 100 μV 2 % + 100 μV 4 % + 100 μV 5 % + 100 μV	
Time Marker into 50 Ω Generate and Measure	5 s to 50 ms 20 ms to 1 ns	(26 + <i>t</i> · 1000) parts in 10 <sup>6</sup> 2.6 parts in 10 <sup>6</sup>	
Rise Time	≤ 300 ps	+0 /-100 ps	

Parameter/Equipment	Range	CMC <sup>2,5</sup> (±)	Comments
Resistance – Generate <sup>3</sup>	(0 to 11) Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω (330 to 1100) Ω (1.1 to 3.3) kΩ (3.3 to 11) kΩ (11 to 33) kΩ (33 to 110) kΩ (110 to 330) kΩ (330 to 1100) kΩ (1.1 to 3.3) MΩ (3.3 to 11) MΩ (11 to 33) MΩ (33 to 110) MΩ (110 to 330) MΩ (330 to 1100) MΩ	34 μΩ/Ω + 0.001 Ω 30 μΩ/Ω + 0.015 Ω 25 μΩ/Ω + 0.015 Ω 27 μΩ/Ω + 0.02 Ω 24 μΩ/Ω + 0.02 Ω 25 μΩ/Ω + 0.2 Ω 24 μΩ/Ω + 0.1 Ω 24 μΩ/Ω + 1 Ω 24 μΩ/Ω + 1 Ω 31 μΩ/Ω + 10 Ω 28 μΩ/Ω + 10 Ω 47 μΩ/Ω + 0.15 kΩ 0.011 % + 0.25 kΩ 0.02 % + 2.5 kΩ 0.039 % + 3 kΩ 0.24 % + 0.1 MΩ 1.2 % + 0.5 MΩ	Fluke 5520A
Resistance – Generate	(1 to 999) MΩ (1 to 9.9) GΩ (10 to 100) GΩ	0.13 % + 550 kΩ 0.50 % + 130 kΩ 1.0 % + 7.5 MΩ	Decade resistors
Resistance – Measure <sup>3</sup>	(0 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	19 μΩ/Ω + 50 μΩ 14 μΩ/Ω + 0.05 mΩ 12 μΩ/Ω + 0.5 mΩ 12 μΩ/Ω + 5 mΩ 12 μΩ/Ω + 50 mΩ 17 μΩ/Ω + 2 Ω 59 μΩ/Ω + 100 Ω 0.058 % + 1 kΩ 0.58 % + 10 kΩ	HP 3458A

III. Mechanical

Parameter/Equipment	Range	CMC <sup>2,4,6</sup> (±)	Comments
Force Gages <sup>3</sup>	(0 to 250) lbf	0.12 % + 0.6R	Deadweights
Indirect Verification of Rockwell Hardness and Rockwell Superficial Hardness Testers <sup>3</sup>	HRA: Low Mid High  HRBW: Low Mid High  HRC: Low Mid High  HREW: Low Mid High  HR15N: Low Mid High  HR30N: Low Mid High	0.29 HRA 0.56 HRA 0.24 HRA  0.94 HRBW 0.69 HRBW 0.62 HRBW  0.78 HRC 0.92 HRC 0.39 HRC  0.92 HREW 1.1 HREW 0.89 HREW  0.76 HR15N 0.75 HR15N 1.0 HR15N  0.55 HR30N 0.48 HR30N 0.46 HR30N	ASTM E18



Parameter/Equipment	Range	CMC <sup>2, 6</sup> (±)	Comments
Indirect Verification of Rockwell Hardness and Rockwell Superficial Hardness Testers <sup>3</sup> (cont)	HR45N: Low Mid High  HR15TW: Low Mid High  HR30TW: Low Mid High  HR45TW: Low Mid High	0.68 HR45N 0.72 HR45N 0.66 HR45N  0.79 HR15TW 0.52 HR15TW 0.61 HR15TW  0.70 HR30TW 0.61 HR30TW 0.42 HR30TW  0.98 HR45TW 0.78 HR45TW 0.81 HR45TW	ASTM E18
Mass	(0 to 300) g (301 to 500) g (501 to 1000) g (1001 to 4989) g (4990 to 9177) g (9178 to 11 191) g	0.0058 g 0.0071 g 0.0082 g 0.012 g 0.015 g 0.021 g	By comparison
Pressure Gages/Transducers <sup>3</sup>	Up to 10 inH <sub>2</sub> O (>10 to 200) inH <sub>2</sub> O >200 inH <sub>2</sub> O to 60 psia (>60 to 100) psia (>100 to 1000) psia (>985 to 5000) psig (>5000 to 10 000) psig (>10 000 to 30 000) psig	0.026 inH <sub>2</sub> O 0.12 inH <sub>2</sub> O 0.17 % 0.027 psia 0.19 % 5 psig 10 psig 24 psig	Heise HQS pressure calibrator  Heise 901A pressure calibrator



Parameter/Equipment	Range	CMC <sup>2,4</sup> ( $\pm$ )	Comments
Scales <sup>3</sup>	(50 to 100) lb (100 to 750) lb	0.04 lb + 0.6R 0.09 lb + 0.6R	Class F weights
Scales/Balances <sup>3</sup>	(1 to 162) mg 162 mg to 400 g (1 to 50) lb	0.26 mg 2.6 mg 0.0028 lb	Class S1 weights
Scales <sup>3</sup> – Proportional Testing	(750 to 1500) lb (1500 to 3000) lb (3000 to 4500) lb (4500 to 6000) lb	0.41 lb + 0.6R 0.81 lb + 0.6R 1.3 lb + 0.6R 1.7 lb + 0.6R	Class F weights
Tachometers <sup>3</sup> – Photo	Up to 100 000 rpm	0.8R	Function generator
Torque Testers	(0.1 to 1000) ft·lbf	0.1 % + 0.6R	Class F weights
Torque Wrenches <sup>3</sup>	(0 to 1000) ft·lbf (0 to 1200) in·lbf	0.62 % + 0.12 ft·lbf 0.7 % + 1.1 in·lbf	Torque calibrator

#### IV. Thermodynamics

Parameter/Equipment	Range	CMC <sup>2</sup> ( $\pm$ )	Comments
Temperature – Temperature Measuring Devices	@ 100 °C (-30 to 139) °C 140 to 660 °C	0.076 °C 0.081 °C 0.25 °C	Drywell and SPRT

## V. Time & Frequency

Parameter/Equipment	Range	CMC <sup>2</sup> ( $\pm$ )	Comments
Frequency	0.1 Hz to 3 GHz	180 pHz/Hz + 12 pHz	GPS, frequency counter
	10 MHz	1 part in 10 <sup>9</sup> Hz/Hz	Agilent Z3801A GPS receiver
Frequency <sup>3</sup>	0.1 Hz to 3 GHz	0.22 $\mu$ Hz/Hz + 1.4 $\mu$ Hz	Frequency counter
Stop Watches and Timers	$\geq$ 10 ms	28 ms + 0.18 ms/s	Functional generator and frequency counter

<sup>1</sup> This laboratory offers commercial calibration service and field calibration service (where noted).

<sup>2</sup> 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.

<sup>3</sup> 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.

<sup>4</sup> In the statement of CMC,  $L$  is the linear displacement in inches;  $R$  is the resolution of the unit under test;  $D$  is the linear displacement in inches.

<sup>5</sup> The stated measured values are determined using the indicated instrument (see Comments). This capability is suitable for the calibration of the devices intended to measure or generate the measured value in the ranges indicated. CMC's are expressed as either a specific value that covers the full range or as a percent or fraction of the reading plus a fixed floor specification.

<sup>6</sup> In the statement of CMC, percentages are to be read as percent of reading, unless noted otherwise.



## *Accredited Laboratory*

A2LA has accredited

### **PRECISION METROLOGY, INC. - SOUTH**

*Dade City, FL*

for technical competence in the field of

### **Calibration**

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets ANSI/NCSL 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 8 January 2009*).



Presented this 16<sup>th</sup> day of January 2018.

A handwritten signature in black ink, written over a horizontal line.

President and CEO  
For the Accreditation Council  
Certificate Number 1078.02  
Valid to September 30, 2019

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