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

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CALIBRATION

Valid to: June 30, 2023 Certificate Number: 5428.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations[1, 10]:

I. Dimensional

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Calipers[3]	Up to 60 in	(71 + 33*L*) µin[9]	Grade 2 gage blocks
Caliper Masters	Up to 12 in	100 µin	Grade 2 gage blocks, electronic indicator, surface plate
CMMs[3] –			
Linear Displacement	Up to 120 in length	(3 + 4*L*) µin	Laser system
Volumetric	Up to 27 in	110 µin	Ball bar
Electronic Indicator	Up to 0.05 in	23 µin[9]	Grade 2 gage blocks
Gage Blocks	Up to 20 in	(2.0 + 1.9*L*) µin	Laser ruler, grade 1 master gage block set
Height Gages[3]	Up to 40 in	(42 + 8.3*L*) µin[9]	Grade 2 gage blocks, surface plate

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Height Masters	Up to 18 in	(9 + 7.4*L*) µin[9]	Electronic indicator, gage blocks, surface plate
Indicators[3]	Up to 5 in	(24 + 29*L*) µin[9]	Grade 2 gage blocks, micrometer head
Ring Gages – Inside Dimension	Up to 11 in	13 µin	Universal measuring machine, master rings
Laser Micrometer[3]	Up to 2 in	14 µin	Master pin gages
Length Standards	Up to 36 in	(34 + 6.2*L*) µin	Universal measuring machine, gage blocks, bench micrometer
Micrometers (OD)[3]	Up to 36 in	(12 + 7.9*L*) µin[9]	Grade 2 gage blocks
Micrometers (ID)[3]	Up to 40 in	(34 + 6.2*L*) µin[9]	Gage blocks, bench micrometer, universal measuring machine
Micrometers – Depth[3]	Up to 12 in	(520 + 1.1*L*) µin	Mike master, gage blocks
Micrometer Heads	Up to 2 in	44 µin[9]	Gage blocks, electronic indicator, optical flat, universal measuring machine
Mike Masters	Up to 6 in	61 µin	Gage blocks, surface plate, electronic indicator
Pin Gages (OD)[3]	Up to 1 in	15 µin	Master pin gage, laser micrometer
Plug Gages (OD)[3]	Up to 20 in	(16 + 1.1*L*) µin	Universal measuring machine, grade 2 gage blocks

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Bore Gages[3]	Up to 12 in	(210 + 19*L*) µin	Gage blocks, gage block accessory, master ring gages
Optical Comparators[3]	Up to 12 in Linearity Magnification	100 µin 53 µin	Glass scales, precision balls
Microscopes[3]	Up to 12 in Linearity Magnification	100 µin 53 µin	Gage blocks, glass scales
VMMs[3]	Up to 12 in Linearity Magnification	110 µin 180 µin	Glass scales, laser
Master Setting Disc	Up to 20 in	(16 + 1.1*L*) µin	Gage blocks, universal measuring machine
Precision Balls	Up to 2 in	22 µin	Universal measuring machine
Snap Gages[3]	Up to 4 in	160 µin	Gage blocks
Surface Plates – Overall Flatness[3] Local Area Flatness[3] (repeat reading)	 Up to 16 ft diagonal Up to 16 ft diagonal	 57 µin 22 µin	Precision levels, repeat-o-meter
Thread Plug Gages – Thread Set Plugs[3]	Up to 10 in	85 µin	Bench micrometer, grade 2 gage blocks, thread measuring wires
Thread Ring Gages	Pitch Diameter: Up to 10 in Minor Diameter: Up to 0.500 in (0.500 to 10.00) in	 100 µin 110 µin 51 µin	Thread set plug masters VMM ULM

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Tapered Thread Plug Gages	Up to 7 in	520 µin Basic 190 µin PD	Thread measuring wires, bench micrometer, O.D. micrometer
Tapered Thread Ring Gages, Crest Check	Up to 7 in	520 µin Basic 520 µin Standoff	Master tapered thread plugs, O.D. micrometer
Rulers	Up to 72 in	(1500 + 1.8*L*) µin	Microscope, gage blocks
Rulers[3]	Up to 72 in	(880 + 8.5*L*) µin	Gage blocks
Tape Measures[3]	Up to 600 in	4800 µin[9]	Gage blocks
Angle Blocks	Up to 45°	64 µin	Gage blocks, sine bar, indicator, surface plate
Angle Leaf	Up to 12 in	(250 + 1.7*L*) µin	VMM
1–2–3 Blocks	Up to 6 in	35 µin	Gage blocks, surface plate, indicator
Radius Gages	Up to 12 in	(250 + 1.7*L*) µin	VMM
V–Blocks	Up to 6 in	110 µin	Pin gages, surface plate, indicator
Parallels and Straight Edges[3]	Up to 48 in	57 µin	Gage blocks, indicator surface plate
Steel Squares	Up to 18 in	(26 + 6.5*L*) µin	Surface plate, indicator, master square
Feeler Gages	Up to 0.5 in	93 µin	Gage blocks, super micrometer

Parameter/Equipment	Range	CMC[2] (±)	Comments
Comptor Gage Indicators	Up to 0.04 in	200 µin	Comptor master
Profilometers[3]	Up to 250 µin	6.4 µin	Profilometer standard
Protractors	(0 to 360)°	0.120°	Angle blocks, surface plate, master square
Chamfer Gages[3]	Up to 3 in	99 µin[9]	Chamfer checker gage

II. Dimensional Testing/Calibration[8]

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Dimensional Measurement	Up to 6 in Up to 20 in Up to 18 in Up to 1 in Up to 12 in	(71 + 33*L*) µin[9] 44 µin (9.1 + 7.4*L*) µin (12 + 7.9*L*) µin[9] (250 + 1.7*L*) µin	Caliper Bench micrometer Indicator Micrometer VMM

III. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
DC Voltage – Generate[3]	Up to 330 mV 330 mV to 3.3 V (3.3 to 33) V (33 to 330) V 100 V to 1 kV	1 µV + 16 µV/V 6 µV + 9 µV/V 60 µV + 10 µV/V 0.59 mV + 14 µV/V 5.9 mV + 14 µV/V	Fluke 5520A multi product calibrator

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
DC Voltage – Measure[3]	Up to 100 mV 100 mV to 1 V (1 to 10) V (10 to 100) V 100 V to 1 kV (1 to 6) kV (6 to 20) kV (20 to 35) kV @ (20 to 30) °C (35 to 40) kV	1 µV + 5 µV/V 1 µV + 4 µV/V 2 µV + 4 µV/V 1 µV + 6 µV/V 58 µV + 6 µV/V 0.15 µV + 10 000 µV/V 0.15 µV + 20 000 µV/V 0.15 µV + 10 000 µV/V 0.15 µV + 20 000 µV/V	HP 3458A Opt 002 multimeter Fluke 187 w/ Fluke 80K6 probe Fluke 187 w/ Fluke 80K40 probe
DC Current – Generate[3]	Up 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) A (3 to 11) A (11 to 20) A	20 nA + 0.12 mA/A 0.25 µA + 78 µA/A 0.61 µA + 78 µA/A 6.1 µA + 78 µA/A 66 µA + 0.16 mA/A 66 µA + 0.3 mA/A 0.70 mA + 0.39 mA/A 0.82 mA + 0.78 mA/A	Fluke 5520A multi product calibrator
DC Current – Measure[3]	Up 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 (1 to 1200) A	40 pA + 35 µA/A 40 pA + 25 µA/A 0.1 nA + 25 µA/A 0.8 nA + 25 µA/A 5 nA + 25 µA/A 50 nA + 25 µA/A 0.5 µA + 40 µA/A 10 µA + 0.12 mA/A 10 µA + 100 µA/A	HP 3458A opt 002 multimeter HP 3458A multimeter w/ current shunts Empro B-1200-100
DC Power – Generate[3]	33 mV to 1 kV: 330 µA to 330 mA 330 mA to 11 A (11 to 20.5) A	 5.8 µW + 0.2 nW/W 0.58 mW + 1 nW/W 0.58 mW + 1 nW/W	 Fluke 5520A multi product calibrator

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Capacitance[3] – Generate	190 pF 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 3.3 mF (3.3 to 11) mF (11 to 33) mF (33 to 110) mF	10 pF + 0.4 nF/F 10 pF + 0.2 nF/F 80 pF + 0.2 nF/F 0.2 nF + 0.2 nF/F 0.8 nF + 0.2 nF/F 2.3 nF + 0.2 nF/F 7.8 nF + 0.2 nF/F 23 nF + 0.3 nF/F 78 nF + 0.35 nF/F 0.23 µF + 0.35 nF/F 58 nF + 0.35 nF/F 0.58 µF + 0.35 nF/F 0.58 µF + 0.58 nF/F 5.8 µF + 0.85 nF/F	Fluke 5520A multi product calibrator
Resistance[3] – Generate	Up to 11 Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω 330 Ω to 1.1 kΩ (1.1 to 3.3) kΩ (3.3 to 33) kΩ (33 to 110) kΩ (110 to 330) kΩ 330 kΩ to 1.1 MΩ (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	120 µΩ + 31 µΩ/Ω 120 µΩ + 23 µΩ/Ω 120 µΩ + 22 µΩ/Ω 120 µΩ + 22 µΩ/Ω 1200 µΩ + 22 µΩ/Ω 1200 µΩ + 22 µΩ/Ω 12 mΩ + 22 µΩ/Ω 120 mΩ + 22 µΩ/Ω 120 mΩ + 25 µΩ/Ω 1200 mΩ + 25 µΩ/Ω 1200 mΩ + 47 µΩ/Ω 12 Ω + 100 µΩ/Ω 12 Ω + 190 µΩ/Ω 120 Ω + 390 µΩ/Ω 1200 Ω + 2300 µΩ/Ω 12 kΩ + 12 mΩ/Ω	Fluke 5520A multi product calibrator
Resistance[3] – Measure	Up 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	58 µΩ + 10 µΩ/Ω 58 µΩ + 12 µΩ/Ω 0.58 mΩ + 10 µΩ/Ω 5.8 mΩ + 10 µΩ/Ω 57 mΩ + 10 µΩ/Ω 0.58 Ω + 10 µΩ/Ω 5.8 Ω + 50 µΩ/Ω 58 mΩ + 0.5 mΩ/Ω 0.58 Ω + 5 mΩ/Ω	HP 3458A opt 002 multimeter

Parameter/Equipment	Range	CMC[2] (±)	Comments
Electrical Simulation of Thermocouple Indicators[3]			
Type B	(600 to 800) °C (800 to 1000) °C (1000 to 1550) °C (1550 to 1820) °C	0.35 °C 0.28 °C 0.24 °C 0.27 °C	Fluke 5520A-600 multi product calibrator
Type C	(0 to 150) °C (150 to 600) °C (650 to 1000) °C (1000 to 1800) °C (1800 to 2316) °C	0.24 °C 0.21 °C 0.25 °C 0.40 °C 0.66 °C	
Type E	(-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C	0.39 °C 0.13 °C 0.11 °C 0.12 °C 0.16 °C	
Type J	(-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1200) °C	0.21 °C 0.12 °C 0.11 °C 0.13 °C 0.18 °C	
Type K	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.26 °C 0.14 °C 0.12 °C 0.2 °C 0.31 °C	
Type L	(-200 to -100) °C (-100 to 800) °C (800 to 900) °C	0.30 °C 0.21 °C 0.14 °C	
Type N	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1300) °C	0.32 °C 0.18 °C 0.16 °C 0.15 °C 0.22 °C	
\ Type R	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.44 °C 0.27 °C 0.26 °C 0.31 °C	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Electrical Simulation of Thermocouple Indicators[3] (cont)			
Type S	(0 to 250) °C (250 to 1 000) °C (1000 to 1400) °C (1400 to 1767) °C	0.37 °C 0.28 °C 0.29 °C 0.36 °C	Fluke 5520A-600 multi product calibrator
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.49 °C 0.19 °C 0.12 °C 0.11 °C	
Type U	(-200 to 0) °C (0 to 600) °C	0.45 °C 0.22 °C	
Electrical Simulation of RTD Indicators[3] –			
Pt 395, 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 (630 to 800) °C	0.04 °C 0.04 °C 0.06 °C 0.07 °C 0.08 °C 0.09 °C 0.18 °C	Fluke 5520A multi product calibrator
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	0.04 °C 0.04 °C 0.06 °C 0.07 °C 0.08 °C 0.09 °C	
Pt 3916, 100 Ω	(-200 to -190) °C (-180 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 (600 to 630) °C	0.2 °C 0.03 °C 0.04 °C 0.05 °C 0.06 °C 0.06 °C 0.07 °C 0.08 °C 0.18 °C	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Electrical Simulation of RTD Indicators[3] – (cont)			
Pt 385, 200 Ω	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C	0.03 °C 0.03 °C 0.03 °C 0.04 °C	Fluke 5520A multi product calibrator
Pt 385, 500 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 600) °C (600 to 630) °C	0.03 °C 0.04 °C 0.04 °C 0.04 °C 0.06 °C 0.06 °C 0.07 °C 0.09 °C	
Pt 385, 1000 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 600) °C (600 to 630) °C	0.03 °C 0.03 °C 0.03 °C 0.04 °C 0.05 °C 0.06 °C 0.06 °C 0.18 °C	
PtNi 385, 120 Ω	(-80 to 0) °C (0 to 100) °C (100 to 260) °C	0.06 °C 0.06 °C 0.11 °C	
Cu 427, 10 Ω	(-100 to 260) °C	0.23 °C	
AC Voltage – Generate[3]			
(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	7.4 µV + 0.62 mV/V 7.4 µV + 0.12 mV/V 7.4 µV + 0.16 mV/V 7.4 µV + 0.78 mV/V 10 µV + 2.7 mV/V 39 µV + 6.2 mV/V	Fluke 5520A multi product calibrator

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
AC Voltage – Generate[3] (cont)			
(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	8.5 µV + 0.39 mV/V 8.5 µV + 0.11 mV/V 8.5 µV + 0.13 mV/V 8.5 µV + 0.27 mV/V 26 µV + 0.62 mV/V 55 µV + 1.5 mV/V	Fluke 5520A multi product calibrator
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	3.4 mV + 0.23 mV/V 4.1 mV + 0.12 mV/V 0.18 mV + 0.15 mV/V 0.18 mV + 0.23 mV/V 0.2 mV + 0.55 mV/V 0.5 mV + 1.9 mV/V	
(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	0.77 mV + 0.23 mV/V 0.74 mV + 0.12 mV/V 0.74 mV + 0.19 mV/V 0.74 mV + 0.27 mV/V 1.4 mV + 0.7 mV/V	
(33 to 330) V	45 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	6 mV + 0.15 mV/V 7.4 mV + 0.16 mV/V 7.4 mV + 0.2 mV/V 7.4 mV + 0.23 mV/V 39 mV + 1.6 mV/V	
330 V to 1 kV	45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	58 mV + 0.23 mV/V 58 µV + 0.2 mV/V 59 mV + 0.23 mV/V	
AC Voltage – Measure[3]			
(1 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 250) kHz	10 µV + 32 µV/V 10 µV + 32 µV/V 10 µV + 32 µV/V 10 µV + 32 µV/V 10 µV + 32 µV/V 10 µV + 32 µV/V	HP 3458A Opt 002 multimeter

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
AC Voltage – Measure[3] (cont)			
(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 250) kHz 250 kHz to 1 MHz (1 to 2) MHz	10 µV + 32 µV/V 10 µV + 32 µV/V 10 µV + 32 µV/V 10 µV + 32 µV/V 10 µV + 32 µV/V 10 µV + 32 µV/V 10 µV + 32 µV/V 10 µV + 32 µV/V	HP 3458A opt 002 multimeter
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 250) kHz 250 kHz to 1 MHz (1 to 2) MHz	12 µV + 32 µV/V 12 µV + 32 µV/V 12 µV + 32 µV/V 12 µV + 32 µV/V 12 µV + 32 µV/V 12 µV + 32 µV/V 12 µV + 32 µV/V 12 µV + 32 µV/V	
(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 250) kHz 250 kHz to 1 MHz (1 to 2) MHz	57 µV + 32 µV/V 57 µV + 32 µV/V 57 µV + 32 µV/V 57 µV + 32 µV/V 57 µV + 32 µV/V 57 µV + 32 µV/V 57 µV + 32 µV/V 57 µV + 32 µV/V	
(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 250) kHz 250 kHz to 1 MHz	0.58 mV + 32 µV/V 0.58 mV + 32 µV/V 0.58 mV + 32 µV/V 0.58 mV + 32 µV/V 0.58 mV + 32 µV/V 0.58 mV + 32 µV/V 0.58 mV + 32 µV/V	HP 3458A multimeter w/ Fluke 80K6 probe Fluke 187 w/ Fluke 80K6 probe
100 V to 1 kV	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	11 µV + 32 µV/V 11 µV + 32 µV/V 11 µV + 32 µV/V 11 µV + 32 µV/V 11 µV + 32 µV/V	Fluke 187 w/ Fluke 80K40 probe

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
AC Voltage – Measure[3] (cont)			
(1 to 6) kV	DC to 500 Hz 500 Hz to 1 kHz	15 µV + 10 000 µV/V 15 µV + 20 000 µV/V	Fluke 187 w/ Fluke 80K40 probe
(6 to 40) kV	60 Hz	15 µV + 50 000 µV/V	
AC Current – Generate[3]			
(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	5.2 µA + 2 nA/A 5.2 µA + 1 nA/A 0.1 µA + 1 nA/A 0.9 µA + 2 nA/A 1.1 µA + 4 nA/A 2.1 µA + 12 nA/A	Fluke 5520A multi product calibrator
330 µA to 3.3 mA	(10 to 20) Hz 20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.78 µA + 2 nA/A 0.78 µA + 1 nA/A 1 µA + 2 nA/A 1.6 µA + 4 nA/A 3.1 µA + 8 nA/A	
(3.3 to 33) mA	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	10 µA + 1 nA/A 10 µA + 0.4 nA/A 10 µA + 1 nA/A 16 µA + 1 nA/A 16 µA + 3 nA/A	
(33 to 330) mA	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	17 µA + 1 nA/A 17 µA + 0.4 nA/A 39 µA + 1 nA/A 78 µA + 1 nA/A 0.31 mA + 0.4 nA/A	
330 mA to 3 A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	87 µA + 1 nA/A 87 µA + 0.4 nA/A 0.78 mA + 0.4 nA/A 3.9 mA + 2 nA/A	
(3 to 11) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	16 µA + 0.4 nA/A 16 µA + 1 nA/A 16 µA + 20 nA/A	Fluke 5520A-600 multi product calibrator
(11 to 20.5) A	45 Hz to 1 kHz (1 to 5) kHz	39 µA + 1 nA/A 39 µA + 20 nA/A	Fluke 5520A-600 multi product calibrator W/ S-ACA coil

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
AC Current – Generate[3] (cont)			
(20 to 150) A (150 to 550) A (550 to 1000) A	45 Hz to 1 kHz (45 to 440) Hz (45 to 440) Hz	87 µA + 5000 µA/A 1600 µA + 5000 µA/A 3900 µA + 5000 µA/A	Fluke 5520A-600 multi product calibrator W/ S-ACA coil
AC Current – Measure[3]			
Up to 100 µA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	20 nA + 5 µA/A 20 nA + 5 µA/A 20 nA + 5 µA/A 20 nA + 5 µA/A	HP 3458A opt 002 multimeter
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 (50 to 100) kHz	20 nA + 5 µA/A 20 nA + 5 µA/A 20 nA + 5 µA/A 20 nA + 5 µA/A 20 nA + 5 µA/A 40 nA + 5 µA/A 0.15 µA + 5 µA/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 (50 to 100) kHz	60 nA + 5 µA/A 60 nA + 5 µA/A 60 nA + 5 µA/A 60 nA + 5 µA/A 60 nA + 5 µA/A 70 nA + 5 µA/A 0.16 µA + 5 µA/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 (50 to 100) kHz	0.58 µA + 5 µA/A 0.58 µA + 5 µA/A 0.58 µA + 5 µA/A 0.58 µA + 5 µA/A 0.58 µA + 5 µA/A 0.58 µA + 5 µA/A 0.6 µA + 5 µA/A	HP 3458A multimeter opt 002 w/ current shunt Empro B-1200-100
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	5.8 µA + 5 µA/A 5.8 µA + 5 µA/A 5.8 µA + 5 µA/A 5.8 µA + 5 µA/A 5.8 µA + 5 µA/A 5.8 µA + 5 µA/A	
(1 to 1200) A	1 Hz to 2 MHz	10 µA + 0.11 mA/A	

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
AC Power – Generate[3]	(33 to 330) mV: (3.3 to 330) mA 330 mA to 20.5 A	 5.8 µW + 1 nW/W 0.58 mW + 1 nW/W	 Fluke 5520A multi product calibrator
AC Power – Generate[3]	330 mV to 1 kV: (3.3 to 90) mA (90 to 330) mA (0.33 to 0.9) A 900 mA to 11 A (11 to 20.5) A	 5.8 µW + 1 nW/W 5.8 µW + 20 pW/W 0.58 mW + 1 nW/W 0.58 mW + 1 nW/W 0.58 mW + 0.1 nW/W	 Fluke 5520A multi product calibrator
Oscilloscopes[3] – Square Wave Signal Into 50 Ω at 1 kHz Into 1 MΩ at 1 kHz Leveled Sine Wave Amplitude Leveled Sine Wave Flatness (relative to 50 kHz) Time Marker 50 Ω Source and Period Rise Time	 1 mV to 1.1 kV 1 mV to 1.1 kV 50 kHz reference 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz 5 s to 50 ms 20 ms to 2 ns ≤ 300 ps	 2 mV/V + 30 µV 0.76 mV/V + 30 mV 16 mV/V + 0.23 mV 27 mV/V + 0.23mV 31 mV/V + 0.23 mV 47 mV/V + 0.23 mV 12 mV/V + 78 µV 16 mV/V + 78 µV 31 mV/V + 78 µV 19 µs/s + 54 µs 1.9 µs/s (+ 0 / - 78) ps	 Fluke 5520A SC600 multi product calibrator

IV. Electrical – RF/Microwave

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
RF Power – Measure			
(20 to 30) dBm	30 MHz to 2 GHz (2 to 4.2) GHz (4.2 to 18) GHz (18 to 26.5) GHz	0.33 dB 0.34 dB 0.51 dB 0.43 dB	N5531X Measuring receiver (includes N9030B, N9091EMOE, N1913A, N5532B)
(0 to 20) dBm	30 MHz to 2 GHz (2 to 4.2) GHz (4.2 to 18) GHz (18 to 26.5) GHz	0.26 dB 0.28 dB 0.47 dB 0.38 dB	
(-5 to 0) dBm	30 MHz to 2 GHz (2 to 4.2) GHz (4.2 to 18) GHz (18 to 26.5) GHz	0.26 dB 0.28 dB 0.47 dB 0.38 dB	
(-10 to -5) dBm	30 MHz to 2 GHz (2 to 4.2) GHz (4.2 to 18) GHz (18 to 26.5) GHz	0.27 dB 0.29 dB 0.48 dB 0.39 dB	
(-136 to 20) dBm	100 Hz to 26.5 GHz	0.67 dB	
RF Power – Generate			96270A Leveled microwave output
(-100 to +24) dB (-100 to +20) dB (-100 to +18) dB	1 mH to 4 GHz (1.4 to 20) GHz (20 to 26.5) GHz	0.70 dB 1.3 dB 1.7 dB	

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Level Sine Wave – Generate			
(-130 to -94) dBm	(10 to 128) MHz 128 MHz to 3 GHz	0.87 dB 1.7 dB	96270A with 96040A-50
(-94 to -84) dBm	100 kHz to 10 MHz (10 to 128) MHz (128 to 300) MHz 300 MHz to 3 GHz	0.67 dB 0.47 dB 0.67 dB 1.2 dB	
(-84 to -74) dBm	100 kHz to 10 MHz (10 to 128) MHz (128 to 300) MHz 300 MHz to 1.4 GHz (1.4 to 4) GHz	0.67 dB 0.27 dB 0.47 dB 0.67 dB 1.2 dB	
(-74 to -48) dBm	100 kHz to 100 MHz (10 to 300) MHz 300 MHz to 1.4 GHz (1.4 to 4) GHz	0.37 dB 0.27 dB 0.57 dB 0.67 dB	
(-48 to -17) dBm	10 Hz to 100 kHz 100 kHz to 128 MHz (128 to 300) MHz 300 MHz to 1.4 GHz (1.4 to 3) GHz (3 to 4) GHz	0.20 dB 0.22 dB 0.24 dB 0.37 dB 0.47 dB 0.67 dB	
(-17 to +14) dBm	10 Hz to 100 kHz 100 kHz to 128 MHz (128 to 300) MHz 300 MHz to 1.4 GHz (1.4 to 4) GHz	0.20 dB 0.22 dB 0.24 dB 0.37 dB 0.47 dB	
(+14 to +20) dBm	10 Hz to 100 kHz 100 kHz to 128 MHz (128 to 300) MHz 300 MHz to 1.4 GHz	0.20 dB 0.22 dB 0.24 dB 0.37 dB	
(+20 to +24) dBm	10 Hz to 100 kHz 100 kHz to 128 MHz	0.20 dB 0.22 dB	
Level Sine Wave – Microwave Output			
(-100 to +24) dBm	10 Hz to 4 GHz (4 to 26.5) GHZ	0.5 dB 1.0 dB	96270A Phase Noise Reference Source

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Attenuation – Measure			
10 Hz to 128 MHz	(0 to 55) dB (55 to 64) dB (64 to 74) dB (74 to 100) dB (100 to 116) dB	0.08 dB 0.09 dB 0.11 dB 0.13 dB 0.21 dB	96270A with N9030A and NRP-Z55.03
Amplitude Modulation – Measure			
(Carrier: 2 Hz to 26.5 GHz)	Depth: (5 to 99) %	2.0 %	N9030B PXA Signal Analyzer
(Carrier: 10 MHz to 26.5 GHz; Rate: 38 Hz to 243 kHz)	Depth: (5 to 99) %	2.0 %	
Amplitude Modulation – Generate			
(Carrier: 50 kHz to 4 GHz; Rate: 1 Hz to 100 kHz)	Depth: (5 to 10) % Depth: (10 to 99) %	3.3 % 3.9 %	96270A with 96040A-50
Frequency Modulation – Measure			
(Carrier: 2 Hz to 26.5 GHz; Rate: 1 Hz to 12.5 MHz)	Deviation: Up to 10 MHz	300 mHz/Hz + 1.4 Hz	N5531X Measuring Receiver
(Carrier: 10 MHz to 26.5 GHz; Rate: 10 Hz to 1 MHz)	Deviation: Up to 10 MHz	300 mHz/Hz + 1.4 Hz	
Frequency Modulation – Generate			
(Carrier: 9 MHz to 31.25 MHz; Rate: 1 Hz to 50 kHz)	Deviation: 10 Hz to 300 kHz	130 mHz/Hz	96270A with 96040A-50

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Frequency Modulation – Generate (cont) (Carrier: 31.25 MHz to 125 MHz; Rate: 50 kHz to 300 kHz)	Deviation: 10 Hz to 300 kHz	310 mHz/Hz	96270A with 96040A-50
Frequency Modulation – Generate (cont) (Carrier: 31.25 MHz to 125 MHz; Rate: 1 Hz to 50 kHz)	Deviation: 10 Hz to 750 kHz	130 mHz/Hz	96270A with 96040A-50
(Carrier: 31.25 MHz to 125 MHz; Rate: 50 kHz to 300 kHz)	Deviation: 10 Hz to 750 kHz	310 mHz/Hz	
(Carrier: 125 MHz to 4 GHz; Rate: 1 Hz to 50 kHz)	Deviation: 10 Hz to 4.8 MHz	130 mHz/Hz	
(Carrier: 125 MHz to 4 GHz; Rate: 50 kHz to 300 kHz)	Deviation: 10 Hz to 4.8 MHz	310 mHz/Hz	
Phase Modulation – Measure (Carrier: 2 Hz to 26.5 GHz; Rate: 50 Hz to 100 kHz)	Deviation: (0.01 to 25000) rad	7.9E-03 rad/rad	N5531X Measuring Receiver
(Carrier: 10 MHz to 26.5 GHz; Rate: 100 kHz to 1 MHz)	Deviation: (0.01 to 25000) rad	7.9E-03 rad/rad	

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Phase Modulation – Generate			96270A Phase noise reference source
(Carrier: 9 MHz to 4 GHz; Rate: 1 Hz to 50 kHz)	Deviation: Up to 1000 rad	3.0E-03 rad/rad	
(Carrier: 9 MHz to 4 GHz; Rate: 1 Hz to 50 kHz)	Deviation: Up to 1000 rad	3.0E-03 rad/rad	

V. Mechanical

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Force Gage[3] (Tension and Compression)	Up to 10 lb (10 to 110) lb (110 to 500) lb	0.05 lb 0.15 lb 0.46 lb	Test weights
Laboratory Balance[3]	Up to 6000 g	(0.01 + 0.000 000 14*W*) mg	Weight kit
Industrial Scales[3]	Up to 500 lb	0.012 lb[9]	Weight kit
Pipettes[3]	(0.5 to 100) µL (100 to 10 000) µL	(0.0064 + 0.025 *vol*) µL (1.4 + 0.0002 *vol*) µL	Laboratory balances
Pressure Gages[3]	(10 to 10 000) psig (-15 to 0.001) psig (0.001 to 300) psig (300 to 10 000) psig	0.035 % 0.042 % 0.042 % 0.035 %	Dead weight tester Pressure monitor

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Rockwell Hardness Testers[3]	HRC: High Medium Low HRBW: High Medium Low HR15N: High Medium Low HR30N: High Medium Low HR45N: High Medium Low HR15T: High Medium Low HR30T: High Medium Low	 1.3 HRC 1.2 HRC 1.2 HRC 1.5 HRBW 1.6 HRBW 2.3 HRBW 1.2 HR15N 1.2 HR15N 1 HR15N 1.2 HR30N 1.3 HR30N 1.5 HR30N 1.4 HR45N 1.7 HR45N 1.7 HR45N 1.1 HR15T 1.1 HR15T 1.3 HR15T 1.1 HR30T 1.1 HR30T 1.4 HR30T	Test blocks
Brinell Hardness Testers[3]	(100 to 240) HBW (240 to 600) HBW Above 600 HBW	1 HBW 1.9 HBW 5.1 HBW	Test blocks
Vickers Hardness Testers[3]	(170 to 700) HV	15 HV	Test blocks
Knoop Hardness Testers[3]	(170 to 200) HK (200 to 400) HK (400 to 700) HK	1 HK 2.4 HK 5.5 HK	Test blocks

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Torque Transducers Torque Watches	Up to 10 ozf·in (10 to 50) ozf·in (50 to 10) lbf·in (10 to 50) lbf·in (50 to 100) lbf·in (100 to 250) lbf·in (250 to 600) lbf·in	0.023 ozf·in 0.05 ozf·in 0.005 lbf·in 0.013 lbf·in 0.053 lbf·in 0.08 lbf·in 0.16 lbf·in	Dead weights, torque arms and wheels
Torque Wrenches[3]	Up to 26 ozf·in (26 to 50) lbf·in (50 to 500) lbf·in 500 lbf·in to 150 lbf·ft (150 to 250) lbf·ft (250 to 600) lbf·ft (600 to 1000) lbf·ft	0.23 ozf·in 0.23 lbf·in 0.94 lbf·in 0.38 lbf·ft 0.40 lbf·ft 3.5 lbf·ft 3.6 lbf·ft	Torque transducer system

VI. Thermodynamics

Parameter/Equipment	Range	CMC[2, 7] (±)	Comments
Temperature – Measure	(-180 to 0) ºC (0 to 100) ºC (100 to 200) ºC (200 to 400) ºC (400 to 600) ºC	0.011 ºC 0.015 ºC 0.019 ºC 0.023 ºC 0.031 ºC	Fluke 1524 thermometer
Humidity[3] – Measure	(0 to 90) % RH (90 to 100) % RH	1.4 % RH 2.2 % RH	Vaisala HMI41, HMP46 humidity indicator and probe

VII. Time & Frequency

Parameter/Equipment	Range	CMC[2, 7] (±)	Comments
Frequency – Generate[3]	DC to 600 MHz 600 MHz to 40 GHz	5 µHz/Hz 1 µHz/Hz	Fluke 5520A multi product calibrator w/ Fluke PM6681R Agilent E8257D signal generator w/ Fluke PM6681R
Frequency – Measure[3]	0.11 Hz to 1.3 GHz 10 Hz to 46 GHz DC to 12.4 GHz	$2.0 \cdot 10^{-10}$ Hz $1.5 \cdot 10^{-11}$ Hz $4 \cdot 10^{-8}$ Hz	Fluke PM6681R Agilent 53152A Agilent 53131A frequency counters
Frequency – Dissemination	10 MHz	$2.3 \cdot 10^{-10}$ Hz	Fluke PM6681R
Timers and Stopwatches[3]	1 s to 24 h	0.03 s	Timometer 4500

[1] This laboratory offers commercial dimensional testing, calibration and field calibration service.

[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. CMC's 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 found on the A2LA Scope. Allowance must be made for aspects such as the environment at the place of calibration and for other possible adverse effects such as those caused by transportation of the calibration equipment. The usual allowance for the actual uncertainty introduced by the item being calibrated, (e.g. resolution) must also be considered and this, on its own, could result in the actual measurement uncertainty achievable on a customer's site being larger than the CMC.

[4] The stated measured values are determined using the indicated instrument (see Comments). This capability is suitable for the calibration of the devices intended to measure or generate the measured value in the ranges indicated. 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.

[5] In the statement of CMC, *L* is the numerical value of the nominal length of the device measured in inches. *W* is the applied weight in milligrams. In the statement of CMC, the value is defined as the percentage of reading, unless otherwise noted. In the statement of CMC, *vol* is defined as the volume of the reading.

[6] In the statement of CMC, percentages are percentage of reading, unless otherwise indicated.

[7] 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.

[8] This laboratory meets *R205 – Specific Requirements: Calibration Laboratory Accreditation Program* for the types of dimensional tests listed above and is considered equivalent to that of a calibration.

[9] In the statement of CMC the resolution of the instrument is not taken into account. Addition of 0.6 times the resolution will be added to the uncertainty for the individual unit under test.

[10] This scope meets A2LA's *P112 Flexible Scope Policy*.

Accredited Laboratory

A2LA has accredited

PRECISION REPAIR AND CALIBRATION

Blaine, MN

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 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 1st day of November 2021.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 5428.01
Valid to June 30, 2023
Revised April 26, 2023

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