



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

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CALIBRATION

Valid To: September 30, 2023

Certificate Number: 1166.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations<sup>1, 8</sup>:

I. Dimensional

Parameter/Equipment	Range	CMC <sup>2, 4</sup> (±)	Comments
Micrometer <sup>3</sup>	Up to 1 in (1 to 12) in (12 to 50) in	57 μin (52 + 2L) μin (360 + 3L) μin	Gage blocks, optical flats, length standards
Caliper <sup>3</sup>	Up to 6 in (6 to 12) in (12 to 50) in	60 μin (45 + 2.5L) μin (32 + 4L) μin	Gage blocks, surface plate, steel balls
Gage Blocks	Up to 4 in  (4 to 20) in	(4.3 + 1.8L) μin  (5.8 + 2.3L) μin	Comparator, gage blocks, optical flat  Mahr ULM
Indicators <sup>3</sup>	Up to 0.07 in (0.07 to 1.0) in (1.0 to 10.0) in	15 μin 28 μin (15 + 4L) μin	Gage blocks, ULM
Cylindrical Gages –  Outside Diameter (O.D.) Inside Diameter (I.D.)	Up to 16 in Up to 16 in	(9 + 4D) μin (9 + 4D) μin	Gage blocks, ULM

Parameter/Equipment	Range	CMC <sup>2, 4, 5, 7</sup> ( $\pm$ )	Comments
Angle – Measuring Equipment <sup>3</sup>	Up to 180°	28" + 0.6R	Gage blocks, sine plate, surface plate, angle blocks
Thread Wires	Up to 0.25 in	9.8 $\mu$ in	ULM, gage blocks, master pin gage set (by comparison)
Thread Plug – Simple Pitch, (4 to 80) TPI  Pitch Diameter Major Diameter	Up to 15 in Up to 15 in	(49 + 2.4D) $\mu$ in (19 + 3.5D) $\mu$ in	Gage blocks, ULM, thread wires
Thread Rings – Simple Pitch  Pitch Diameter Minor Diameter	Up to 15 in Up to 15 in	(45 + 2.5D) $\mu$ in (12 + 3.9D) $\mu$ in	Plain rings, ULM Thread setting plugs (CMC is that of the setting plug used)
Granite Surface Plate <sup>3</sup> –  Flatness  Repeat Reading	12 in to 10 ft  12 in to 10 ft	(10 + 0.63DL) $\mu$ in 21 $\mu$ in	Talyvel 4 electronic levels Repeat-o-meter
Optical Comparators <sup>3</sup> –  Linearity Magnification  Table Angular Alignment	Up to 12 in 10x, 20x, 31.25x, 50x, 62.5x Up to 12 in	58 $\mu$ in + 0.58R 0.14 % 82 $\mu$ in	Master glass scale Magnification checker Dial indicator
Length Standards	Up to 10 in Up to 16 in  Up to 50 in	(13 + 5.4L) $\mu$ in (19 + 5.4L) $\mu$ in  (82 + 7.5L) $\mu$ in	Gage blocks, linear amplifier  Gage blocks, end standards, linear amplifier

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
Height Measurement Gages	Up to 5 in Up to 10 in Up to 20 in Up to 30 in Up to 40 in Up to 50 in	130 μin 140 μin 180 μin 220 μin 280 μin 330 μin	Starrett step gage (reference bar), linear amplifier
Gage Block Comparator <sup>3</sup>			
Repeatability	1 μin resolution	3 μin	Gage blocks
Anvil Pressure	3 oz·ft	0.4 oz·ft	Mechanical force gage
Length Measuring Machines <sup>3</sup> (ULMs & Micrometer Heads)			
Linearity	Up to 4 in	(8 + 0.8L) μin	Gage blocks
Anvil Pressure	3 oz·ft	0.8 oz·ft	Mechanical force gage
Anvil, Base, & Spindle Flatness	Up to 1 in diameter	3.2 μin	Optical flat under helium-discharge (yellow-orange) monochromatic light

## II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC <sup>2,5,6</sup> (±)	Comments
DC Voltage – Generate <sup>3</sup>	(0 to 220) mV (0 to 2.2) V (0 to 11) V (0 to 22) V (0 to 220) V (0 to 1100) V	9 μV/V + 0.4 μV 6 μV/V + 0.7 μV 4 μV/V + 2.5 μV 4 μV/V + 4 μV 6 μV/V + 40 μV 8 μV/V + 400 μV	Fluke 5730A
High Voltage	(1 to 100) kV	0.13 %	Ross VD120Y, Fluke 8508A, HV power supply

Parameter/Equipment	Range	CMC <sup>2, 5, 6</sup> ( $\pm$ )	Comments	
DC Voltage – Measure <sup>3</sup>	(0 to 200) mV (0.2 to 2) V (2 to 20) V (20 to 200) V (200 to 1050) V	7.5 $\mu$ V/V + 0.1 $\mu$ V 4.1 $\mu$ V/V + 0.4 $\mu$ V 4.1 $\mu$ V/V + 4 $\mu$ V 6.5 $\mu$ V/V + 40 $\mu$ V 6.4 $\mu$ V/V + 0.5 mV	Fluke 8508A	
	(1 to 100) kV	0.13 %	Ross VD120Y, Fluke 8508A	
DC Current – Generate <sup>3</sup>	(0 to 220) $\mu$ A (0 to 2.2) mA (0 to 22) mA (0 to 220) mA (0 to 2.2) A (0 to 11) A (11 to 20.5) A	46 $\mu$ A/A + 6 nA 41 $\mu$ A/A + 7 nA 41 $\mu$ A/A + 40 nA 52 $\mu$ A/A + 0.7 $\mu$ A 93 $\mu$ A/A + 12 $\mu$ A 0.042 % + 480 $\mu$ A 0.12 % + 750 $\mu$ A	Fluke 5730A/5725	
	(0 to 2) A (2 to 20) A (20 to 120) A	0.01 % + 80 $\mu$ A 0.01 % + 0.8 mA 0.01 % + 4.8 mA	Fluke 5522A 55120A	
	Clamp Meters (Toroidal)	(20 to 5000) A	0.80 % + 1 A	52120A with coils
DC Current – Measure <sup>3</sup>	(2 to 200) $\mu$ A (0.2 to 2) mA (2 to 20) mA (20 to 200) mA (0.2 to 2) A (2 to 20) A	25 $\mu$ A/A + 0.4 nA 17 $\mu$ A/A + 4 nA 15 $\mu$ A/A + 0.04 $\mu$ A 60 $\mu$ A/A + 0.4 $\mu$ A 210 $\mu$ A/A + 16 $\mu$ A 500 $\mu$ A/A + 0.4 mA	Fluke 8508A	
	(2 to 100) A (100 to 300) A	0.06 % 0.12 %	Guildline 9211A	
	(300 to 3000) A	0.3 %	Empro shunt	

Parameter/Range	Frequency	CMC <sup>2, 5, 6</sup> ( $\pm$ )	Comments
Inductance – Generate			
Fixed Points			
10 $\mu$ H	1 kHz	0.011 %	IET (GenRad) 1482 standard inductors
100 $\mu$ H	1 kHz	0.011 %	
1 mH	1 kHz	0.011 %	
10 mH	1 kHz	0.011 %	
100 mH	1 kHz	0.011 %	
1 H	1 kHz	0.011 %	

Parameter/Equipment	Range	CMC <sup>2, 5, 6</sup> ( $\pm$ )	Comments
Resistance – Generate <sup>3</sup>	(0 to 11) $\Omega$ (11 to 33) $\Omega$ (33 to 110) $\Omega$ (110 to 330) $\Omega$ 330 $\Omega$ to 1.1 k $\Omega$ (1.1 to 3.3) k $\Omega$ (3.3 to 11) k $\Omega$ (11 to 33) k $\Omega$ (33 to 110) k $\Omega$ (110 to 330) k $\Omega$ 330 k $\Omega$ to 1.1 M $\Omega$ (1.1 to 3.3) M $\Omega$ (3.3 to 11) M $\Omega$ (11 to 33) M $\Omega$ (33 to 110) M $\Omega$ (110 to 330) M $\Omega$ (330 to 1100) M $\Omega$	50 $\mu\Omega/\Omega$ + 1 m $\Omega$ 36 $\mu\Omega/\Omega$ + 1.5 m $\Omega$ 33 $\mu\Omega/\Omega$ + 1.4 m $\Omega$ 32 $\mu\Omega/\Omega$ + 2 m $\Omega$ 33 $\mu\Omega/\Omega$ + 2 m $\Omega$ 32 $\mu\Omega/\Omega$ + 20 m $\Omega$ 33 $\mu\Omega/\Omega$ + 0.02 $\Omega$ 33 $\mu\Omega/\Omega$ + 0.2 $\Omega$ 33 $\mu\Omega/\Omega$ + 0.2 $\Omega$ 37 $\mu\Omega/\Omega$ + 2 $\Omega$ 37 $\mu\Omega/\Omega$ + 2 $\Omega$ 70 $\mu\Omega/\Omega$ + 30 $\Omega$ 0.015 % + 50 $\Omega$ 0.029 % + 2.5 k $\Omega$ 0.06 % + 3 k $\Omega$ 0.33 % + 100 k $\Omega$ 1.7 % + 500 k $\Omega$	Fluke 5522A
	(10 to 100) M $\Omega$ 100 M $\Omega$ to 1 G $\Omega$ (1 to 10) G $\Omega$ (10 to 100) G $\Omega$	0.12 % 0.23 % 0.6 % 1.2 %	IET HRRS decade
	(100 to 1000) G $\Omega$ (1 to 10) T $\Omega$	2.9 % 4.6 %	Fluke 5320A & HV adapter

Parameter/Equipment	Range	CMC <sup>2, 5, 6</sup> (±)	Comments
Resistance – Generate <sup>3</sup> (cont)  Fixed Points	1 Ω 1.9 Ω 10 Ω 19 Ω 100 Ω 190 Ω 1 kΩ 1.9 kΩ 10 kΩ 19 kΩ 100 kΩ 190 kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	110 μΩ/Ω 110 μΩ/Ω 27 μΩ/Ω 27 μΩ/Ω 12 μΩ/Ω 12 μΩ/Ω 8 μΩ/Ω 8 μΩ/Ω 8 μΩ/Ω 8 μΩ/Ω 10 μΩ/Ω 10 μΩ/Ω 10 μΩ/Ω 15 μΩ/Ω 21 μΩ/Ω 46 μΩ/Ω 54 μΩ/Ω 120 μΩ/Ω	Fluke 5730A
Resistance – Measure <sup>3</sup>	1 mΩ to 2 Ω (2 to 20) Ω (20 to 200) Ω 200 Ω to 2 kΩ (2 to 20) kΩ (20 to 200) kΩ 200 kΩ to 2 MΩ (2 to 20) MΩ (20 to 200) MΩ 200 MΩ to 2 GΩ  (2 to 1000) GΩ (100 to 1000) GΩ	20 μΩ/Ω + 4 μΩ 16 μΩ/Ω + 14 μΩ 10 μΩ/Ω + 50 μΩ 9 μΩ/Ω + 0.05 mΩ 9 μΩ/Ω + 5 mΩ 9 μΩ/Ω + 50 mΩ 11 μΩ/Ω + 1 Ω 23 μΩ/Ω + 100 Ω 140 μΩ/Ω + 10 kΩ 0.18 % + 1 MΩ  1.2 % 1.3 %	Fluke 8508A             Quadtech 1865+

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Electrical Calibration of Thermocouple Indicating Systems <sup>3</sup> –			
Type E	(-250 to -100) °C (-100 to 650) °C (650 to 1000) °C	0.51 °C 0.17 °C 0.22 °C	Fluke 5522A, AMS 2750E
Type J	(-210 to -100) °C (-100 to 760) °C (760 to 1200) °C	0.28 °C 0.18 °C 0.24 °C	
Type K	(-200 to -100) °C (-100 to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.34 °C 0.19 °C 0.27 °C 0.41 °C	
Type N	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1300) °C	0.41 °C 0.23 °C 0.20 °C 0.19 °C 0.28 °C	
Type R	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.58 °C 0.36 °C 0.36 °C 0.41 °C	
Type S	(0 to 250) °C (250 to 1400) °C (1400 to 1767) °C	0.48 °C 0.38 °C 0.47 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.64 °C 0.25 °C 0.17 °C 0.16 °C	

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Electrical Simulation of RTDs <sup>3</sup> –			
Pt 385, 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	0.05 °C 0.05 °C 0.07 °C 0.09 °C 0.10 °C 0.12 °C 0.23 °C	Fluke 5522A
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	0.05 °C 0.05 °C 0.07 °C 0.09 °C 0.10 °C 0.12 °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 (600 to 630) °C	0.25 °C 0.05 °C 0.05 °C 0.06 °C 0.07 °C 0.08 °C 0.09 °C 0.10 °C 0.23 °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	0.04 °C 0.04 °C 0.05 °C 0.05 °C 0.06 °C 0.07 °C 0.07 °C 0.23 °C	



Parameter/Range	Frequency	CMC <sup>2, 5, 6</sup> ( $\pm$ )	Comments
Capacitance – Generate <sup>3</sup>  (0 to 1.111 11) $\mu$ F  (0.19 to 0.4) nF (0.4 to 1.1) nF (1.1 to 3.3) nF (3.3 to 11) nF (11 to 33) nF (33 to 110) nF (110 to 330) nF (0.33 to 1.1) $\mu$ F (1.1 to 3.3) $\mu$ F (3.3 to 11) $\mu$ F (11 to 33) $\mu$ F (33 to 110) $\mu$ F (110 to 330) $\mu$ F (0.33 to 1.1) mF (1.1 to 3.3) mF (3.3 to 11) mF (11 to 33) mF (33 to 110) mF	1 kHz  10 Hz to 10 kHz 10 Hz to 10 kHz 10 Hz to 3 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz (10 to 600) Hz (10 to 300) Hz (10 to 150) Hz (10 to 120) Hz (10 to 80) Hz (0 to 50) Hz (0 to 20) Hz (0 to 6) Hz (0 to 2) Hz (0 to 0.6) Hz (0 to 0.2) Hz	0.08 %  0.6 % + 0.01 nF 0.58 % + 0.01 nF 0.58 % + 0.01 nF 0.29 % + 0.01 nF 0.29 % + 0.1 nF 0.29 % + 0.1 nF 0.29 % + 0.3 nF 0.29 % + 1 nF 0.29 % + 3 nF 0.29 % + 10 nF 0.46 % + 30 nF 0.52 % + 100 nF 0.52 % + 300 nF 0.52 % + 1 $\mu$ F 0.52 % + 3 $\mu$ F 0.52 % + 10 $\mu$ F 0.88 % + 30 $\mu$ F 1.3 % + 100 $\mu$ F	GenRad 1413  Fluke 5522A
Capacitance – Measure  (0 to 1000) pF (1 to 10) nF (10 to 100) nF 100 nF to 1.2 $\mu$ F	1 kHz	6 $\mu$ F/F 16 $\mu$ F/F 35 $\mu$ F/F 71 $\mu$ F/F	Andeen Hagerling 2500A
AC Voltage – Generate <sup>3</sup>  (0.22 to 2.2) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.04 % + 4 $\mu$ V 0.03 % + 4 $\mu$ V 0.03 % + 4 $\mu$ V 0.04 % + 4 $\mu$ V 0.06 % + 5 $\mu$ V 0.13 % + 10 $\mu$ V 0.16 % + 20 $\mu$ V 0.33 % + 20 $\mu$ V	Fluke 5730A

Parameter/Range	Frequency	CMC <sup>2,6</sup> (±)	Comments
AC Voltage – Generate <sup>3</sup> (cont)			
(2.2 to 22) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.03 % + 4 μV 0.011 % + 4 μV 0.01 % + 4 μV 0.024 % + 4 μV 0.058 % + 5 μV 0.12 % + 10 μV 0.16 % + 20 μV 0.31 % + 20 μV	Fluke 5730A
(22 to 220) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.028 % + 12 μV 0.01 % + 7 μV 70 μV/V + 7 μV 0.014 % + 7 μV 0.036 % + 17 μV 0.076 % + 20 μV 0.16 % + 25 μV 0.31 % + 45 μV	
(0.22 to 2.2) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.028 % + 40 μV 0.01 % + 15 μV 50 μV/V + 8 μV 80 μV/V + 10 μV 0.01 % + 30 μV 0.04 % + 80 μV 0.12 % + 0.20 mV 0.2 % + 0.30 mV	
(2.2 to 22) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.028 % + 0.40 mV 0.01 % + 0.15 mV 50 μV/V + 50 μV 80 μV/V + 0.10 mV 0.01 % + 0.20 mV 0.029 % + 0.60 mV 0.12 % + 2.0 mV 0.17 % + 3.2 mV	
(22 to 220) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.028 % + 4.0 mV 0.01 % + 1.5 mV 60 μV/V + 0.60 mV 90 μV/V + 1.0 mV 0.017 % + 2.5 mV 0.017 % + 2.5 mV 0.017 % + 2.5 mV 0.017 % + 2.5 mV	Fluke 5730A/5725A

Parameter/Range	Frequency	CMC <sup>2, 5, 6</sup> ( $\pm$ )	Comments
AC Voltage – Generate <sup>3</sup> (cont)			
(220 to 750) V	40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz (30 to 50) kHz (50 to 100) kHz	0.011 % + 4 mV 0.019 % + 6 mV 0.069 % + 11 mV 0.069 % + 11 mV 0.27 % + 45 mV	Fluke 5730A/5725A
(750 to 1100) V	40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz	0.011 % + 4 mV 0.019 % + 6 mV 0.069 % + 11 mV	
AC Voltage Flatness – Generate			
0.3 mV to 3.5 V	(10 to 30) Hz 30 Hz to 119.999 kHz	0.035 % 0.12 %	Fluke 5730A/5
(0.3 to 1.1) mV	120 kHz to 2 MHz (2 to 11.9) MHz (12 to 20) MHz (20 to 30) MHz (30 to 50) MHz	0.23 % + 3 $\mu$ V 0.46 % + 3 $\mu$ V 0.69 % + 3 $\mu$ V 1.7 % + 15 $\mu$ V 3.5 % + 15 $\mu$ V	
(1.1 to 3.3) mV	120 kHz to 2 MHz (2 to 11.9) MHz (12 to 20) MHz (20 to 30) MHz (30 to 50) MHz	0.12 % + 3 $\mu$ V 0.35 % + 3 $\mu$ V 0.58 % + 3 $\mu$ V 1.7 % + 3 $\mu$ V 3.5 % + 3 $\mu$ V	
3.3 mV to 3.5 V	120 kHz to 2 MHz (2 to 11.9) MHz (12 to 20) MHz (20 to 30) MHz (30 to 50) MHz	0.12 % + 3 $\mu$ V 0.23 % + 3 $\mu$ V 0.46 % + 3 $\mu$ V 1.2 % + 3 $\mu$ V 2.3 % + 3 $\mu$ V	
AC Voltage – Measure <sup>3</sup>			
(0 to 2.2) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	2.8 mV/V + 1.3 $\mu$ V 2.2 mV/V + 1.3 $\mu$ V 2.1 mV/V + 1.3 $\mu$ V 2.2 mV/V + 2 $\mu$ V 2.4 mV/V + 2.5 $\mu$ V 3.3 mV/V + 4 $\mu$ V 3.4 mV/V + 8 $\mu$ V 4.5 mV/V + 8 $\mu$ V	Fluke 5790B/5

Parameter/Range	Frequency	CMC <sup>2,6</sup> (±)	Comments
AC Voltage – Measure <sup>3</sup> (cont)			
(2.2 to 7) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	1.2 mV/V + 1.3 μV 0.74 mV/V + 1.3 μV 0.65 mV/V + 1.3 μV 0.76 mV/V + 2 μV 0.92 mV/V + 2.5 μV 1.5 mV/V + 4 μV 1.6 mV/V + 8 μV 2.7 mV/V + 8 μV	Fluke 5790B/5
(7 to 22) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.39 mV/V + 1.3 μV 0.3 mV/V + 1.3 μV 0.24 mV/V + 1.3 μV 0.32 mV/V + 2 μV 0.41 mV/V + 2.5 μV 0.96 mV/V + 4 μV 1.0 mV/V + 8 μV 2.0 mV/V + 8 μV	
(22 to 70) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.28 mV/V + 1.5 μV 0.15 mV/V + 1.5 μV 96 μV/V + 1.5 μV 0.16 mV/V + 2 μV 0.31 mV/V + 2.5 μV 0.59 mV/V + 4 μV 0.78 mV/V + 8 μV 1.3 mV/V + 8 μV	
(70 to 220) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.24 mV/V + 1.5 μV 0.1 mV/V + 1.5 μV 48 μV/V + 1.5 μV 82 μV/V + 2 μV 0.19 mV/V + 2.5 μV 0.29 mV/V + 4 μV 0.44 mV/V + 8 μV 1.2 mV/V + 8 μV	
(220 to 700) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.25 mV/V + 1.5 μV 0.11 mV/V + 1.5 μV 71 μV/V + 1.5 μV 84 μV/V + 2 μV 0.11 mV/V + 2.5 μV 0.22 mV/V + 4 μV 0.35 mV/V + 8 μV 1.1 mV/V + 8 μV	

Parameter/Range	Frequency	CMC <sup>2,6</sup> (±)	Comments
AC Voltage – Measure <sup>3</sup> (cont)			
700 mV to 2.2 V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.23 mV/V 79 µV/V 34 µV/V 57 µV/V 84 µV/V 0.19 mV/V 0.3 mV/V 1 mV/V	Fluke 5790B/5
(2.2 to 22) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.23 mV/V 80 µV/V 34 µV/V 59 µV/V 96 µV/V 0.22 mV/V 0.46 mV/V 1.4 mV/V	
(22 to 70) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.24 mV/V 99 µV/V 71 µV/V 89 µV/V 0.12 mV/V 0.24 mV/V 0.48 mV/V 1.4 mV/V	
(70 to 220) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz	0.23 mV/V 81 µV/V 41 µV/V 82 µV/V 0.11 mV/V 0.24 mV/V 0.58 mV/V	
(220 to 700) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	0.23 mV/V 0.12 mV/V 62 µV/V 0.16 mV/V 0.58 mV/V	
(700 to 1000) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	0.23 mV/V 0.12 mV/V 59 µV/V 0.16 mV/V 0.58 mV/V	

Parameter/Range	Frequency	CMC <sup>2, 5, 6</sup> ( $\pm$ )	Comments
AC Voltage – Measure <sup>3</sup> (cont)  High Voltage (1 to 85) kV	(50 to 60) Hz	1 V	Fluke 8508A with Ross VD120Y
AC Voltage Flatness – Measure <sup>3</sup>  (0 to 2.2) mV	(10 to 30) Hz 30 Hz to 120 kHz 120 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz (30 to 50) MHz	0.2 % 0.1 % 0.1 % + 1 $\mu$ V 0.2 % + 1 $\mu$ V 0.4 % + 1 $\mu$ V 0.8 % + 2 $\mu$ V 1.2 % + 2 $\mu$ V	Fluke 5790B/5
(2.2 to 7) mV	(10 to 30) Hz 30 Hz to 120 kHz 120 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz (30 to 50) MHz	0.1 % 0.07 % 0.09 % + 1 $\mu$ V 0.1 % + 1 $\mu$ V 0.2 % + 1 $\mu$ V 0.4 % + 2 $\mu$ V 0.6 % + 1 $\mu$ V	
(7 to 22) mV	(10 to 30) Hz 30 Hz to 120 kHz 120 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz (30 to 50) MHz	0.1 % 0.06 % 0.08 % 0.1 % 0.2 % 0.4 % 0.7 %	

Parameter/Range	Frequency	CMC <sup>2, 5, 6</sup> (±)	Comments
AC Voltage Flatness – Measure <sup>3</sup> (cont)			
(22 to 70) mV	(10 to 30) Hz	0.1 %	Fluke 5790B/5
	30 Hz to 2 MHz	0.07 %	
	(2 to 10) MHz	0.1 %	
	(10 to 20) MHz	0.2 %	
	(20 to 30) MHz	0.4 %	
	(30 to 50 MHz)	0.7 %	
(70 to 220) mV	(10 to 30) Hz	0.1 %	Fluke 5790B/5
	30 Hz to 500 kHz	0.05 %	
	500 kHz to 2 MHz	0.06 %	
	(2 to 10) MHz	0.1 %	
	(10 to 20) MHz	0.2 %	
	(20 to 30) MHz	0.4 %	
(220 to 700) mV	(10 to 30) Hz	0.1 %	Fluke 5790B/5
	30 Hz to 500 kHz	0.05 %	
	500 kHz to 2 MHz	0.07 %	
	(2 to 10) MHz	0.1 %	
	(10 to 20) MHz	0.2 %	
	(20 to 30) MHz	0.4 %	
700 mV to 2.2 V	(10 to 30) Hz	0.1 %	Fluke 5790B/5
	30 Hz to 500 kHz	0.04 %	
	500 kHz to 2 MHz	0.06 %	
	(2 to 10) MHz	0.1 %	
	(10 to 20) MHz	0.2 %	
	(20 to 30) MHz	0.4 %	
(2.2 to 7) V	(10 to 30) Hz	0.1 %	Fluke 5790B/5
	30 Hz to 500 kHz	0.05 %	
	500 kHz to 2 MHz	0.07 %	
	(2 to 10) MHz	0.1 %	
	(10 to 20) MHz	0.2 %	
	(20 to 30) MHz	0.4 %	
	(30 to 50) MHz	0.7 %	

Parameter/Range	Frequency	CMC <sup>2, 5, 6</sup> ( $\pm$ )	Comments
AC Current – Generate <sup>3</sup>			
(9 to 220) $\mu$ A	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.029 % + 16 nA 0.018 % + 10 nA 0.012 % + 8 nA 0.032 % + 12 nA 0.12 % + 65 nA	Fluke 5730A
(0.22 to 2.2) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.029 % + 40 nA 0.018 % + 35 nA 0.012 % + 35 nA 0.023 % + 110 nA 0.12 % + 650 nA	
(2.2 to 22) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.029 % + 400 nA 0.018 % + 350 nA 0.012 % + 350 nA 0.023 % + 550 nA 0.13 % + 5 $\mu$ A	
(22 to 220) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.029 % + 4 $\mu$ A 0.018 % + 3.5 $\mu$ A 0.012 % + 2.5 $\mu$ A 0.023 % + 3.5 $\mu$ A 0.13 % + 10 $\mu$ A	
(0.22 to 2.2) A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.028 % + 35 $\mu$ A 0.052 % + 80 $\mu$ A 0.81 % + 0.16 mA	
(2 to 20) A	(10 to 65) Hz (65 to 300) Hz 300 Hz to 1 kHz (1 to 3) kHz (3 to 6) kHz	0.01 % + 0.8 mA 0.027 % + 9.4 mA 0.09 % + 9.4 mA 0.27 % + 31 mA 0.9 % + 62 mA	
(20 to 120) A	(10 to 65) Hz (65 to 300) Hz 300 Hz to 1 kHz (1 to 3) kHz (3 to 6) kHz	0.015 % + 19 mA 0.027 % + 28 mA 0.09 % + 94 mA 0.27 % + 0.23 A 0.9 % + 0.42 A	
Up to 6000 A (Torroidal)	10 Hz to 1 kHz	0.81 %	



Parameter/Range	Frequency	CMC <sup>2, 5, 6</sup> (±)	Comments
AC Current – Measure <sup>3</sup>			
Up to 200 µA	(1 to 10) Hz 10 Hz to 10 kHz	0.058 % + 0.02 µA 0.058 % + 0.02 µA	Fluke 8508A
Up to 2 mA	(1 to 10) Hz 10 Hz to 10 kHz	0.036 % + 0.2 µA 0.035 % + 0.2 µA	
Up to 20 mA	(1 to 10) Hz 10 Hz to 10 kHz	0.036 % + 2 µA 0.035 % + 2 µA	
Up to 200 mA	(1 to 10) Hz 10 Hz to 10 kHz	0.036 % + 20 µA 0.034 % + 20 µA	
Up to 2 A	10 Hz to 2 kHz (2 to 10) kHz	0.072 % + 200 µA 0.085 % + 200 µA	
Up to 20 A	10 Hz to 2 kHz (2 to 10) kHz	0.095 % + 2 mA 0.29 % + 2 mA	
(20 to 30) A	45 Hz to 1 kHz (1 to 5) kHz	0.35 % 5.8 %	Fluke 8508A, Agilent 34330A
(30 to 2500) A	(45 to 500) Hz	4 %	Clamp meter with Iflex

Parameter/Range	Frequency	CMC <sup>2, 5, 6</sup> (±)	Comments
Oscilloscopes –			
Voltage Amplitude – DC – 1 MΩ DC – 50 Ω	1 mV to 200 V 1 mV to 5 V	0.03 % + 25 μV 0.03 % + 25 μV	Fluke 9500B with active heads
Square Wave – 50 Ω	(0.04 to 1) mV 1 mV to 5 V	1.2 % + 10 μV 0.23 % + 10 μV	
Rise Time	150 ps @ 5 mV to 3 V 70 ps @ 25 mV to 2 V	29 ps 23 ps	
Timing	Narrow Triangle 900.91 ms to 55 s	3 μs/s	
Leveled Sine Wave Amplitude	5 mV to 5 V	1.8 %	
Bandwidth (Flatness)	0.1 Hz to 300 MHz (300 to 550) MHz 550 MHz to 3.0 GHz (3.0 to 6.0) GHz	2.4 % 3 % 4.5 % 5.5 %	
Pulse Width	(1 to 100) ns	5.8 % + 200 ps	

### III. Mechanical

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Direct Verification of Type A & D Durometers –			
Indenter Extension & Shape –			ASTM D2240
Extension	0.098 in	100 μin	Gage blocks
Spring & Display Calibration –			
Type – A	Up to 100 Duropoints	0.59 Duropoints	Durocalibrator
Type – D	Up to 100 Duropoints	0.53 Duropoints	
Diameter	(0.05 to 0.111) in	0.0003 in	Optical comparator

Parameter/Equipment	Range	CMC <sup>2, 4, 7</sup> ( $\pm$ )	Comments
Direct Verification of Type A & D Durometers – (cont)			
Angle	(30 to 35)°	0.05°	Optical comparator
Force Verification of Testing Machines <sup>3</sup> –			
Force Measuring Equipment – Tension & Compression	Up to 250 lbf Up to 1000 lbf Up to 25 000 lbf Up to 100 000 lbf	0.15 % of reading 0.12 % of reading 0.13 % of reading 0.14 % of reading	Interface 9840 readout with load cell standards
	(0 to 2000) lbf (10 to 10 000) lbf (10 to 100 000) lbf	0.02 % of reading 0.01 % of reading 0.04 % of reading	Morehouse universal calibrating machine
Force Gages	(0 to 1000) lbf	0.017 % of reading	ASTM Class 6 weights
	(0 to 1000) lbf	0.11 % of reading	Universal test machine
Pressure <sup>3</sup> –			
Absolute	(0 to 1) inH <sub>2</sub> O (0 to 10) inH <sub>2</sub> O	0.003 inH <sub>2</sub> O + 0.6R 0.009 inH <sub>2</sub> O + 0.6R	Additel ADT761
	(11 to 17) psia	0.02 % + 0.6R	Mensor DPG2320
	(0 to 150) psia	0.1 % + 0.6R	Additel ADT681
	(3 to 850) inH <sub>2</sub> O	0.014 % + 0.6R	Ruska T9000-850
	(10 to 1600) psi	0.014 % + 0.6R	DH Budenburg
	(Up to 15 000) psi	0.016 % + 0.6R	Fluke E-DWT
	(Up to 30 000) psi	16 psi	Additel ADT949, ADT681
Vacuum <sup>3</sup>	(-15 to 0) psi	0.006 psi 0.014 inHg 0.310 mmHg	Additel ADT681

Parameter/Equipment	Range	CMC <sup>2, 5, 7</sup> (±)	Comments
Torque – Measuring Devices	Up to 2000 ft-lbf	0.06 %	Torque arm, torque wheel, ASTM6 weights
Torque Wrenches <sup>3</sup>	Up to 2000 ft-lbf	1 % of reading	CDI multitest system
Torque Arms, Cables, & Wheels			
Length	2.5 in 40 in	140 μin 290 μin	Height gage, reference bar, optical comparator, gage blocks, micrometer
Cable Diameter	0.035 in 0.2 in	63 μin 81 μin	
Scales <sup>3</sup>	Up to 10 lbs Up to 50 lbs Up to 100 lbs Up to 200 lbs Up to 500 lbs Up to 1000 lbs	0.0003 lbs. 0.0005 lbs. 0.0008 lbs. 0.0014 lbs. 0.0041 lbs. 0.0075 lbs.	ASTM Class 6 weights
Balances <sup>3</sup>	Up to 20 g Up to 100 g Up to 200 g Up to 500 g Up to 1000 g Up to 3000 g Up to 5000 g Up to 10 000 g  Up to 20 000 g	0.27 mg 0.13 mg 0.3 mg 0.61 mg 1.4 mg 2.7 mg 3.4 mg 15 mg  16 mg	ASTM Class 1 weights         ASTM Class 1 & 2 weights
Indirect Verification of Rockwell Hardness Testers <sup>3</sup>	HRBW: (40 to 59) HRBW (60 to 79) HRBW (80 to 100) HRBW	0.7 HRBW 0.6 HRBW 0.6 HRBW	Indirect verification per ASTM E18

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Indirect Verification of Rockwell Hardness Testers <sup>3</sup> – (cont)	<p>HRC: (20 to 30) HRC (35 to 55) HRC (60 to 65) HRC</p> <p>HR15N: (70 to 77) HR15N (78 to 88) HR15N (90 to 92) HR15N</p> <p>HR15TW: (74 to 80) HR15TW (81 to 86) HR15TW (87 to 93) HR15TW</p> <p>HRA: (20 to 65) HRA (70 to 78) HRA (80 to 84) HRA</p> <p>HRRW: 114 HRRW</p> <p>HRE: (70 to 79) HRE (84 to 90) HRE (93 to 100) HRE</p> <p>HRMW: 93 HRMW 112 HRMW</p>	<p>0.5 HRC 0.5 HRC 0.5 HRC</p> <p>0.5 HR15N 0.5 HR15N 0.5 HR15N</p> <p>0.5 HR15TW 0.6 HR15TW 0.5 HR15TW</p> <p>0.5 HRA 0.6 HRA 0.5 HRA</p> <p>0.6 HRRW</p> <p>0.6 HRE 0.5 HRE 0.7 HRE</p> <p>0.7 HRMW 0.6 HRMW</p>	Indirect verification per ASTM E18
Indirect Verification of Brinell Hardness Testers <sup>3</sup>  HBW 10/3000	<p>HBW: &lt;196 HBW (196 to 650) HRMW</p>	<p>2.1 HBW 2.7 HBW</p>	Indirect verification per ASTM E10
Indirect Verification of Vickers Hardness Testers <sup>3</sup>	<p>HV: &gt;600 HV</p>	<p>12 HV</p>	Indirect verification per ASTM E384 with ASTM E92

Parameter/Equipment	Range	CMC <sup>2,5</sup> ( $\pm$ )	Comments
Viscometers <sup>3</sup> – Fixed Points	C20 C60 C100 RT100 RT1000 RT5000 RT12 500 RT30 000 RT100 000	0.46 % 0.46 % 0.46 % 0.46 % 0.5 % 0.55 % 0.6 % 0.6 % 0.6 %	Standard viscosity fluids

#### IV. Thermodynamics

Parameter/Equipment	Range	CMC <sup>2,5,7</sup> ( $\pm$ )	Comments
Relative Humidity –  Generate	(10 to 95) %	0.6 % RH	Thunder Scientific 2500
Measure <sup>3</sup> (+15 to 25) °C	Up to 90 % (>90 to 100) %	1.5 % RH 2.1 %	Vaisala M170/HMP76
Temperature Measuring Devices <sup>3</sup> –	(-200 to 500) °C (501 to 670) °C	0.03 °C 0.04 °C	Fluke 1523, 5618B Fluke 1523, 5609
Temperature Generate Devices <sup>3</sup> –	(-45 to 150) °C (-25 to 150) °C (50 to 660) °C	0.04 °C 0.07 °C 0.08 °C	Fluke 7341, 1523, 5609 Fluke 9142, 1523, 5609 Fluke 9144, 1523, 5609
Surface Temperature – Measuring Devices <sup>3</sup>	(35 to 400) °C	0.37 °C	Fluke 1523, 3125-400, 5609
Infrared Non-Contact <sup>3</sup>	(-35 to 500) °C	0.45 °C	Fluke 4180/4181black body

## V. Time & Frequency

Parameter/Equipment	Range	CMC <sup>2, 7</sup> ( $\pm$ )	Comments
Frequency – Measuring Equipment			
GPS	10 MHz	$2.1 \times 10^{-8}$ Hz/Hz	Datum 9300
Tachometers <sup>3</sup>	(0.1 to 100 000) RPM	0.035 RPM	Agilent 33250A & LED
Timers/Stopwatches <sup>3</sup>	1 s to 24 hr	37 ms	GPS receiver, totalize method

<sup>1</sup> This laboratory offers commercial 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. 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 the CMC,  $R$  is the resolution of the device under test,  $L$  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, and  $DL$  is the dimensional length measured in inches.

<sup>5</sup> In the statement of CMC, percentages are to be read as percent of reading unless otherwise noted.

<sup>6</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. 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.

<sup>7</sup> 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.

<sup>8</sup> This scope meets A2LA's *P112 Flexible Scope Policy*.



# Accredited Laboratory

A2LA has accredited

## PROBATA CORPORATION

Edmond, OK

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/NC SL 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 8<sup>th</sup> day of October 2021.

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

Vice President, Accreditation Services  
For the Accreditation Council  
Certificate Number 1166.01  
Valid to September 30, 2023

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