



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

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CALIBRATION

Valid To: August 31, 2020

Certificate Number: 1892.01

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
Calipers <sup>3</sup> Resolution 0.0005" Resolution 0.001"	Up to 48 in	(280 + 0.7L) μin (580 + 0.7L) μin	Gage blocks, optical flats, Supermicrometer™
Gage Blocks	Up to 4 in (4 to 12) in	(4.7 + 0.7L) μin (4.4 + 5.3L) μin	LabMaster™, standard gage blocks
Height Gage	Up to 40 in	(95 + 1.9L) μin	Gage blocks
Height Master	Up to 36 in	(30 + 6.9L) μin	Gage blocks
Indicators <sup>3</sup>	Up to 4 in	(55 + 7.6L) μin	Gage blocks, Supermicrometer™
Length Standards	Up to 14 in (14 to 40) in	(15 + 4.7L) μin (77 + 5.3L) μin	Gage blocks, electronic height gage, surface plate (standardization)

Parameter/Equipment	Range	CMC <sup>2,4</sup> ( $\pm$ )	Comments
Micrometers <sup>3</sup>	Up to 40 in	(62 + 0.75L) $\mu$ in	Gage blocks
Pin Gauges/Plug Gages	Up to 4 in	(6.5 + 1.4L) $\mu$ in	LabMaster <sup>TM</sup>
Plain Ring Gage	Up to 10 in	(6.6 + 2.7D) $\mu$ in	LabMaster <sup>TM</sup>
Thread Plug Gages – (Pitch and Major Diameter)	Up to 6 in	(78 + 5D) $\mu$ in (30 + 43D) $\mu$ in	Supermicrometer <sup>TM</sup>

## II. Electrical – DC/Low Frequency

Parameter/Range	Frequency	CMC <sup>2,5,6</sup> ( $\pm$ )	Comments
Oscilloscopes <sup>3</sup> –			
Vertical Accuracy Voltage @ 1 kHz	2 mV <sub>(p-p)</sub> (21.9 to 899) mV <sub>(p-p)</sub> 899 mV <sub>(p-p)</sub> to 55 V <sub>(p-p)</sub>	0.30 % + 40 $\mu$ V 0.26 % + 40 $\mu$ V 0.26 % + 40 $\mu$ V	Fluke 5520A- SC1100
Bandwidth Flatness @ 3.4 V <sub>(p-p)</sub>	50 kHz Ref (1 to 100) MHz (100 to 200) MHz (200 to 600) MHz (600 to 1100) MHz	2.1 % 3.6 % 4.1 % 6.2 % 7.2 %	
Timebase	(1 to 2) ns Sine (5 to 100) ns Spike (10 to 20) ms Spike 50 ms Spike 2 s Spike 5 s Spike	58 $\mu$ s 58 $\mu$ s 58 $\mu$ s 58 $\mu$ s 4.1 ms 26 ms	Fluke 5520A- SC1100 time marker

Parameter/Range	Frequency	CMC <sup>2</sup> (±)	Comments
Oscilloscopes <sup>3</sup> – (cont)			
Rise Time 5 mV <sub>(p-p)</sub> to 2.7 V <sub>(p-p)</sub>	1.0000 MHz	58 ps	Fluke 5520A-SC100 edge

Parameter/Equipment	Range	CMC <sup>2,6</sup> (±)	Comments
DC Voltage <sup>3</sup> – Generate	(0 to 220) mV 220 mV to 2.2 V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1100) V	9.5 μV/V + 0.4 μV 5.9 μV/V + 0.7 μV 4.1 μV/V + 2.5 μV 4.1 μV/V + 4 μV 5.9 μV/V + 40 μV 7.6 μV/V + 0.4 mV	Fluke 5720A II
DC Voltage <sup>3</sup> – Measure	(0 to 200) mV 200 mV to 2 V (2 to 20) V (20 to 200) V (200 to 1000) V	7.5 μV/V + 0.1 μV 6.6 μV/V + 0.4 μV 3.5 μV/V + 4 μV 5.3 μV/V + 40 μV 5.2 μV/V + 0.4 mV	Fluke 8508A
DC Current <sup>3</sup> – Generate	(0 to 220) μV 220 μV to 2.2 mA (2.2 to 22) mA (22 to 220) mA 220 mA to 2.2 A (2.2 to 11) A  (11 to 20) A	48 μA/A + 6 nA 42 μA/A + 7 nA 42 μA/A + 40 nA 53 μA/A + 0.7 μA 0.12 mA/A + 12 μA 0.42 mA/A + 0.48 mA  0.82 mA/A + 0.75 mA	Fluke 5720A II      Fluke 5520A
DC Current <sup>3</sup> – Measure	(0 to 200) μA 200 μA to 2 mA (2 to 20) mA (20 to 200) mA 200 mA to 2 A (2 to 20) A	14 μA/A + 0.4 nA 14 μA/A + 4 nA 15 μA/A + 40 nA 43 μA/A + 0.8 μA 0.2 mA/A + 1.6 μA 0.44 mA/A + 200 μA	Fluke 8508A

Parameter/Equipment	Range	CMC <sup>2,6</sup> (±)	Comments
Resistance <sup>3</sup> – Generate, Fixed Points	0 Ω 1 Ω 1.9 Ω 10.0 Ω 19.0 Ω 100 Ω 190 Ω 1.0 kΩ 1.9 kΩ 10 kΩ 19 kΩ 100 kΩ 190 kΩ 1.0 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	46 μΩ 0.11 mΩ 0.11 mΩ 1.3 mΩ 0.27 mΩ 1.2 mΩ 1.2 mΩ 9.8 mΩ 9.8 mΩ 0.1 Ω 0.1 Ω 1.3 Ω 1.3 Ω 24 Ω 25 Ω 0.52 kΩ 0.58 kΩ 13 kΩ	Fluke 5720A
Resistance <sup>3</sup> – Measure	(0 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 20) GΩ	17 μΩ/Ω + 4 μΩ 11 μΩ/Ω + 14 Ω 9.8 μΩ/Ω + 50 mΩ 13 μΩ/Ω + 0.5 mΩ 10 μΩ/Ω + 5 mΩ 8.8 μΩ/Ω + 50 mΩ 11 μΩ/Ω + 1 Ω 18 μΩ/Ω + 100 Ω 58 μΩ/Ω + 10 kΩ 1.0 mΩ/Ω + 1 MΩ 0.14 % + 10 MΩ	Fluke 8508A

Parameter/Range	Frequency	CMC <sup>2,6</sup> (±)	Comments
AC Voltage <sup>3</sup> – Generate  (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	1.0 mV/V + 4 μV 0.98 mV/V + 4 μV 0.91 mV/V + 4 μV 0.78 mV/V + 4 μV 0.78 mV/V + 5 μV 1.3 mV/V + 10 μV 1.8 mV/V + 20 μV 3.4 mV/V + 20 μV	Fluke 5720A II

Parameter/Range	Frequency	CMC <sup>2,6</sup> ( $\pm$ )	Comments
AC Voltage <sup>3</sup> – Generate (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	1.4 mV/V + 4 $\mu$ V 0.20 mV/V + 4 $\mu$ V 0.30 mV/V + 46 $\mu$ V 0.30 mV/V + 4 $\mu$ V 0.60 mV/V + 5 $\mu$ V 1.2 mV/V + 10 $\mu$ V 1.6 mV/V + 20 $\mu$ V 3.1 mV/V + 20 $\mu$ V	Fluke 5720A II
(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	0.30 mV/V + 12 $\mu$ V 0.10 mV/V + 7 $\mu$ V 0.081 mV/V + 7 $\mu$ V 0.23 mV/V + 7 $\mu$ V 0.50 mV/V + 17 $\mu$ V 1.0 mV/V + 20 $\mu$ V 1.6 mV/V + 25 $\mu$ V 3.1 mV/V + 45 $\mu$ V	
220 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	0.85 mV/V + 40 $\mu$ V 0.82 mV/V + 15 $\mu$ V 0.82 mV/V + 8 $\mu$ V 0.82 mV/V + 10 $\mu$ V 0.82 mV/V + 30 $\mu$ V 0.92 mV/V + 80 $\mu$ V 1.3 mV/V + 200 $\mu$ V 1.9 mV/V + 300 $\mu$ V	
(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	0.86 mV/V + 400 $\mu$ V 0.82 mV/V + 150 $\mu$ V 0.82 mV/V + 50 $\mu$ V 0.82 mV/V + 100 $\mu$ V 0.82 mV/V + 200 $\mu$ V 0.86 mV/V + 600 $\mu$ V 2.3 mV/V + 2 mV 1.9 mV/V + 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	0.86 mV/V + 4 mV 0.82 mV/V + 1.5 mV 0.82 mV/V + 0.6 mV 0.82 mV/V + 1 mV 0.84 mV/V + 2.5 mV 1.3 mV/V + 16 mV 4.5 mV/V + 40 mV 8.0 mV/V + 80 mV	

Parameter/Range	Frequency	CMC <sup>2,6</sup> (±)	Comments
AC Voltage <sup>3</sup> (cont) – Generate  (220 to 1100) V	(15 to 50) Hz 50 Hz to 1 kHz	0.29 mV/V + 16 μV 67 μV/V + 3.5 μV	Fluke 5720A II
AC Voltage <sup>3</sup> – Measure  Up to 199.99 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	0.40 mV/V + 4 μV 0.26 mV/V + 4 μV 0.26 mV/V + 4 μV 0.36 mV/V + 4 μV 0.68 mV/V + 5 μV 1.4 mV/V + 10 μV 2.2 mV/V + 20 μV 3.4 mV/V + 20 μV	Fluke 8508A
200 mV to 1.9999 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	0.27 mV/V + 12 μV 0.11 mV/V + 7 μV 0.10 mV/V + 7 μV 0.21 mV/V + 7 μV 0.50 mV/V + 17 μV 0.90 mV/V + 20 μV 1.4 mV/V + 25 μV 2.7 mV/V + 45 μV	
(2 to 19.999) 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	0.44 mV/V + 40 μV 0.38 mV/V + 150 μV 0.37 mV/V + 8 μV 0.38 mV/V + 10 μV 0.39 mV/V + 30 μV 0.56 mV/V + 80 μV 1.0 mV/V + 200 μV 1.7 mV/V + 300 μV	
(20 to 199.99) 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	0.88 mV/V + 400 μV 0.76 mV/V + 150 μV 0.75 mV/V + 50 μV 0.76 mV/V + 100 μV 0.77 mV/V + 200 μV 0.93 mV/V + 600 μV 2.1 mV/V + 2 mV 3.1 mV/V + 3.2 mV	

Parameter/Range	Frequency	CMC <sup>2,6</sup> ( $\pm$ )	Comments
AC Voltage <sup>3</sup> – Measure (cont)  (200 to 1050) 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	0.88 mV/V + 400 $\mu$ V 0.76 mV/V + 150 $\mu$ V 0.75 mV/V + 50 $\mu$ V 0.76 mV/V + 100 $\mu$ V 0.77 mV/V + 200 $\mu$ V 0.93 mV/V + 600 $\mu$ V 2.1 mV/V + 600 $\mu$ V 2.7 mV/V + 45 $\mu$ V	Fluke 8508A
AC Current <sup>3</sup> – Generate  Up 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	0.36 mA/A + 16 nA 0.21 mA/A + 10 nA 0.14 mA/A + 8 nA 0.33 mA/A + 12 nA 1.3 mA/A + 65 nA	Fluke 5720A
220 $\mu$ A to 2.2 mA	(10 to 20) Hz (20 to 40) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.36 mA/A + 40 nA 0.20 mA/A + 35 nA 0.14 mA/A + 35 nA 0.23 mA/A + 0.11 $\mu$ A 1.3 mA/A + 0.65 $\mu$ A	
(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	0.35 mA/A + 0.40 $\mu$ A 0.21 mA/A + 0.35 $\mu$ A 0.14 mA/A + 0.35 $\mu$ A 0.23 mA/A + 0.55 $\mu$ A 1.3 mA/A + 5.0 $\mu$ A	
(22 to 220) mA	(10 to 20) Hz (20 to 40) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.37 mA/A + 4.0 $\mu$ A 0.72 mA/A + 3.5 $\mu$ A 0.14 mA/A + 3.5 $\mu$ A 0.23 mA/A + 3.5 $\mu$ A 1.3 mA/A + 10 $\mu$ A	

Parameter/Range	Frequency	CMC <sup>2,6</sup> (±)	Comments
AC Current <sup>3</sup> – Generate (cont)  220 mA to 2.2 A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.30 mA/A + 35 µA 0.53 mA/A + 80 µA 8.1 mA/A + 0.16 mA	Fluke 5720A
AC Current <sup>3</sup> – Measure  (0 to 200) µA  200 µA to 2 mA  (2 to 20) mA  (20 to 200) mA  200 mA to 2 A  (2 to 20) A	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz  (1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz  (1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz  10 Hz to 10 kHz  10 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz  10 Hz to 2 kHz (2 to 10) kHz	1.0 mA/A + 20 nA 0.55 mA/A + 20 nA 0.075 mA/A + 20 nA  0.62 mA/A + 0.20 µA 0.33 mA/A + 0.20 µA 0.75 mA/A + 0.20 µA  0.89 mA/A + 2.0 µA 0.32 mA/A + 2.0 µA 0.75 mA/A + 2.0 µA  0.29 mA/A + 20 µA  0.69 mA/A + 0.20 mA 0.82 mA/A + 0.20 mA 3.5 mA/A + 0.20 mA  0.93 mA/A + 2.0 mA 2.9 mA/A + 2.0 mA	Fluke 8508A

Parameter/Equipment	Range	CMC <sup>2,5,6</sup> (±)	Comments
AC High Voltage – Measure	(1 to 20) kV (20 to 70) kV	1.0 % 1.0 %	Northstar VD100 w/Fluke 8846A DMM
DC High Voltage – Measure	(1 to 20) kV (20 to 70) kV	0.15 % 0.15 %	Northstar VD100 w/Fluke 8846A DMM





Parameter/Range	Frequency	CMC <sup>2,5,6</sup> (±)	Comments
AC Flatness – Measure			
(220 to 700) mV	(10 to 30) Hz (30 to 120) Hz (0.12 to 1.2) kHz (1.2 to 120) kHz (120 to 500) kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 10) MHz (10 to 20) MHz	0.1 % 0.03 % 0.03 % 0.04 % 0.04 % 0.06 % 0.06 % 0.14 % 0.27 %	Fluke 5790A
700 mV to 2.2 V	(10 to 30) Hz (30 to 120) Hz (0.12 to 1.2) kHz (1.2 to 120) kHz (120 to 500) kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 10) MHz (10 to 20) MHz	0.1 % 0.04 % 0.04 % 0.03 % 0.03 % 0.06 % 0.07 % 0.1 % 0.2 %	
(2.2 to 7) V	(10 to 30) Hz (30 to 120) Hz (0.12 to 1.2) kHz (1.2 to 120) kHz (120 to 500) kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 10) MHz (10 to 20) MHz	0.1 % 0.04 % 0.04 % 0.04 % 0.04 % 0.05 % 0.06 % 0.1 % 0.2 %	

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Electrical Calibration of Thermocouple Indicators <sup>3</sup> – Generate & Measure			
Type B	600 °C to 800 °C 800 °C to 1000 °C 1000 °C to 1550 °C 1550 °C to 1820 °C	0.44 °C 0.34 °C 0.30 °C 0.33 °C	Fluke 5520A

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Electrical Calibration of Thermocouple Indicators <sup>3</sup> (cont) – Generate & Measure			
Type C	0 °C to 150 °C 150 °C to 650 °C 650 °C to 1000 °C 1000 °C to 1800 °C 1800 °C to 2316 °C	0.30 °C 0.26 °C 0.31 °C 0.50 °C 0.84 °C	Fluke 5520A
Type E	-250 °C to -100 °C -100 °C to -25 °C -25 °C to 350 °C 350 °C to 650 °C 650 °C to 1000 °C	0.50 °C 0.16 °C 0.14 °C 0.16 °C 0.21 °C	
Type J	-210 °C to -100 °C -100 °C to -30 °C -30 °C to 150 °C 150 °C to 760 °C 760 °C to 1200 °C	0.27 °C 0.16 °C 0.14 °C 0.17 °C 0.23 °C	
Type K	-200 °C to -100 °C -100 °C to -25 °C -25 °C to 120 °C 120 °C to 1000 °C 1000 °C to 1372 °C	0.33 °C 0.18 °C 0.16 °C 0.26 °C 0.40 °C	
Type L	-200 °C to -100 °C -100 °C to 800 °C 800 °C to 900 °C	0.37 °C 0.26 °C 0.17 °C	
Type N	-200 °C to -100 °C -100 °C to -25 °C -25 °C to 120 °C 120 °C to 410 °C 410 °C to 1300 °C	0.40 °C 0.22 °C 0.19 °C 0.18 °C 0.27 °C	
Type R	0 °C to 250 °C 250 °C to 400 °C 400 °C to 1000 °C 1000 °C to 1767 °C	0.57 °C 0.35 °C 0.33 °C 0.40 °C	

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Electrical Calibration of Thermocouple Indicators <sup>3</sup> (cont) – Generate & Measure			
Type S	0 °C to 250 °C 250 °C to 1000° C 1000 °C to 1400 °C 1400 °C to 1767° C	0.47 °C 0.36 °C 0.37 °C 0.46 °C	Fluke 5520A
Type T	-250 °C to -150 °C -150 °C to 0 °C 0 °C to 120 °C 120 °C to 400 °C	0.63 °C 0.24 °C 0.16 °C 0.14 °C	
Type U	-200 °C to 0 °C 0 °C to 600 °C	0.56 °C 0.27 °C	
Electrical Calibration of RTD Indicators <sup>3</sup> – Generate & Measure			
Pt 385,100 Ω	-200 °C to 0 °C 0 °C to 100 °C 100 °C to 300 °C 300 °C to 400 °C 400 °C to 630 °C 630 °C to 800 °C	0.05 °C 0.07 °C 0.09 °C 0.10 °C 0.12 °C 0.23 °C	Fluke 5520A
Pt 3926, 100 Ω	-200 °C to 0 °C 0 °C to 100 °C 100 °C to 300 °C 300 °C to 400 °C 400 °C to 630 °C	0.05 °C 0.07 °C 0.09 °C 0.10 °C 0.12 °C	
Pt 3916, 100 Ω	-200 °C to -190 °C -190 °C to -80 °C -80 °C to 0 °C 0 °C to 100 °C 100 °C to 260 °C 260 °C to 300 °C 300 °C to 400 °C 400 °C to 600 °C 600 °C to 630 °C	0.25 °C 0.04 °C 0.05 °C 0.06 °C 0.07 °C 0.08 °C 0.09 °C 0.10 °C 0.23 °C	

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Electrical Calibration of RTD Indicators <sup>3</sup> (cont) – Generate & Measure			
Pt 385, 200 Ω	-200 °C to -80 °C -80 °C to 0 °C 0 °C to 100 °C 100 °C to 260 °C 260 °C to 300 °C 300 °C to 400 °C 400 °C to 600 °C 600 °C to 630 °C	0.04 °C 0.04 °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 °C to -80 °C -80 °C to 100 °C 100 °C to 260 °C 260 °C to 400 °C 400 °C to 600 °C 600 °C 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 °C to 0 °C 0 °C to 100 °C 100 °C to 260 °C 260 °C to 300 °C 300 °C to 600 °C 600 °C to 630 °C	0.03 °C 0.04 °C 0.05 °C 0.06 °C 0.07 °C 0.23 °C	
PtNi 385, 120 Ω	80 °C to 100 °C 100 °C to 260 °C	0.1 °C 0.1 °C	
Cu 427, 10 Ω	-100 °C to 260 °C	0.87 °C	
YSI 400	15 °C to 50 °C	0.09 °C	

Parameter/Range	Frequency	CMC <sup>2</sup> (±)	Comments
Distortion – Measure			
(-75 to 0) dB Dist	10 Hz to 500 kHz	0.74 dB	HP 334A
(-99.99 to 0) dB Dist	9 kHz to 30 MHz	2.1 dB	HP 8595E

Parameter/Range	Frequency	CMC <sup>2,5,6</sup> (±)	Comments
<b>Capacitance – Generate</b>			
190 pF to 1.1 nF	10 Hz to 10 kHz	1.8 %	Fluke 5520A
(1.1 to 3.3) nF	10 Hz to 3 kHz	0.87 %	
(3.3 to 11) nF	10 Hz to 1 kHz	0.36 %	
(11 to 33) nF	10 Hz to 1 kHz	0.59 %	
(33 to 110) nF	10 Hz to 1 kHz	0.34 %	
(110 to 330) nF	10 Hz to 1 kHz	0.36 %	
(0.33 to 1.1) μF	(10 to 600) Hz	0.34 %	
(1.1 to 3.3) μF	(10 to 300) Hz	0.35 %	
(3.3 to 11) μF	(10 to 150) Hz	0.35 %	
(11 to 33) μF	(10 to 120) Hz	0.51 %	
(33 to 110) μF	(10 to 80) Hz	0.55 %	
(110 to 330) μF	DC to 50 Hz	0.56 %	
(0.33 to 1.1) mF	DC to 20 Hz	0.55 %	
(1.1 to 3.3) mF	DC to 6 Hz	0.55 %	
(3.3 to 11) mF	DC to 2 Hz	0.54 %	
(11 to 33) mF	DC to 0.6 Hz	0.85 %	
(33 to 110) mF	DC to 0.2 Hz	1.2 %	
<b>Fixed Points</b>			
1 pF	1 kHz	0.16 %	HP 16380A and HP 16380C standard capacitor sets
10 pF	1 kHz	0.16 %	
100 pF	1 kHz	0.16 %	
1000 pF	1 kHz	0.16 %	
0.01 μF	1 kHz	0.1 %	
0.10 μF	1 kHz	0.1 %	
1.0 μF	1 kHz	0.1 %	
<b>Capacitance – Measure</b>			
1000 pF	120 Hz to 100 kHz	0.1 %	Agilent E4980A
0.1 μF	120 Hz to 100 kHz	0.08 %	
10 μF	120 Hz to 100 kHz	0.17 %	
<b>Inductance – Generate</b>			
100 mH	100 Hz to 1 kHz	0.1 %	GenRad 1482-L

III. Mechanical

Parameter/Equipment	Range	CMC <sup>2, 4, 5, 7</sup> (±)	Comments
Scales & Balances <sup>3</sup>	0.0 mg to 42 g (43 to 160) g 160 g to 30 kg  (0 to 1000) lb	0.082 mg 0.12 mg 58 mg  0.01 % + 0.6R	Class 00, Class 0 and Class 1 weights  Class F weights
Mass – Measure	0.1 mg to 210 g  210 g to 5 kg (5 to 30) kg	0.09 mg  24 mg 0.24 g	Analytical balances  Top loading balances
Torque – Measure	0.5 in·ozf to 2000 ft·lbf	0.3 %	Torque transducers
Torque <sup>3</sup> – Measure	5in-lbf to 600 ft-lbf	0.35 %	Torque transducers
Torque Transducers	(0.5 to 400) in·ozf (4 to 150) in·lbf (150 to 400) in·lbf (10 to 2000) ft·lbf	0.05 % 0.05 % 0.06 % 0.05 %	Torque arms Class F weights
Force Measurement <sup>3</sup>	(5 to 500 000) lbf	0.29 %	Load cells, proving rings, Class F, Class 1 weights
Force – Measure and Measuring Equipment			
Compression	(65 to 6500) lbf (6500 to 50 000) lbf	0.98 lbf 7.3 lbf	Proving rings
Tension	(65 to 6500) lbf (500 to 50 000) lbf	0.98 lbf 7.3 lbf	

Parameter/Equipment	Range	CMC <sup>2,5,7</sup> (±)	Comments
Pressure – Measure and Measuring Equipment			
Pneumatic	(-2.2 to 2.2) psig (0 to 15) psig	0.00012 psi 0.0004 psi	Fluke PPC3 pressure calibrator
Absolute	(-14.7 to 60) psig Up to 200 psig Up to 500 psig Up to 1 000 psig	0.0090 psi 0.024 psi 0.060 psi 0.13 psi	Mensor CPC 6000
Hydraulic	(0 to 34) inHg (50 to 10 000) psi	0.012 inHg 0.012 %	Mensor CPC 6000 Deadweight tester
Pressure –Field <sup>3</sup> , Measure and Measuring Equipment			
Hydraulic	(5 to 10 000) psig	0.12 %	Deadweight tester
Pneumatic	Up to 1 psig Up to 5 psig Up to 30 psig Up to 100 psig Up to 300 psig Up to 1000 psig Up to 5000 psig	0.0012 psi 0.04 psi 0.018 psi 0.12 psi 0.17 psi 0.59 psi 4.7 psi	Fluke modules

#### IV. Thermodynamics

Parameter/Equipment	Range	CMC <sup>2,5,7</sup> (±)	Comments
Thermometers <sup>3</sup>	-20 °C to 100 °C 100 °C to 400 °C 400 °C to 650 °C	0.05 °C 0.08 °C 0.6 °C	Liquid bath Dry block/PRT
Infrared Thermometers – Measuring Equipment	(-15 to 120) °C (100 to 200) °C (200 to 350) °C (350 to 500) °C	0.7 °C 0.73 °C 1.0 °C 1.7 °C	Fluke 4180/4181
Ovens <sup>3</sup>	0 °C to 650 °C	1.4 °C	Fluke 525B thermocouples

Parameter/Equipment	Range	CMC <sup>2, 5, 7</sup> (±)	Comments
Temp/Humidity Indicators –			
Relative Humidity	(10 to 80) % RH	1.2 %	Environmental chamber/ Vaisala HM 141
Temperature	(-20 to 20) °C	0.37 °C	
	(20 to 30) °C (30 to 70) °C	0.32 °C 0.37 °C	
Temperature – Measure	(-75 to < 0) °C 0 °C (> 0 to 200) °C (> 200 to 400) °C (400 to 650) °C	0.084 °C 0.019 °C 0.040 °C 0.053 °C 0.067 °C	Fluke 1502A with 5628 PRT
Relative Humidity – Measure <sup>3</sup>	(13 to 73) % RH @ 25°C  (10 to 95) % RH	0.75 % RH  1.2 % RH	Optica dew point monitor/sensor  Vaisala HM 141
Nuclear Density Gauges, Fixed Points – Density <sup>3</sup>	110.84 lb/ft <sup>3</sup> 139.02 lb/ft <sup>3</sup> 168.88 lb/ft <sup>3</sup>	1.4 lb/ft <sup>3</sup> 1.4 lb/ft <sup>3</sup> 1.4 lb/ft <sup>3</sup>	Density block
Nuclear Density Gauges, Fixed Points – Moisture <sup>3</sup>	Up to 35 lb/ft <sup>3</sup>	2.3 lb/ft <sup>3</sup>	Moisture blocks

#### V. Time & Frequency

Parameter/Equipment	Range	CMC <sup>2, 7</sup> (±)	Comments
Frequency – Measure	(0 to 200) MHz 10 MHz to 26.5 GHz	3.6 parts in 10 <sup>6</sup> Hz/Hz 2.1 parts in 10 <sup>6</sup> Hz/Hz	Agilent 53151A Agilent 53132A
Frequency – Measuring Equipment	10 µHz to 10 MHz	2 parts in 10 <sup>7</sup> Hz/Hz	Agilent 33120A, 4410A GPS

<sup>1</sup> This laboratory offers commercial calibration service and field calibration service.



- <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 numerical values of the nominal length of the device measured in inches,  $R$  is the numerical value of the resolution of the device in microinches, and  $D$  is the diameter of the device in inches
- <sup>5</sup> In the statement of CMC, a % denotes a percent of reading unless otherwise noted.
- <sup>6</sup> The measurands stated are generated using the indicated instrument (see Comments). This capability is suitable for the calibration of the devices intended to measure the measurand in the ranges indicated. CMC's are expressed as either a specific value that covers the full range or as a fraction/percentage 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

### **NATIONAL CALIBRATION INC.**

*Phoenix, AZ*

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 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 18<sup>th</sup> day of October 2018.

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

President and CEO  
For the Accreditation Council  
Certificate Number 1892.01  
Valid to August 31, 2020

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