



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

J. A. KING  
124 S. 147<sup>th</sup> East Avenue  
Tulsa, OK 74116  
Connie Foster Phone: 800 327 7727

CALIBRATION

Valid To: April 30, 2021

Certificate Number: 1741.18

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations<sup>1, 11</sup>:

I. Chemical

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
pH Meters <sup>3</sup> – Fixed Points	4 pH 7 pH 10 pH	0.031 pH 0.027 pH 0.032 pH	Standard pH solutions

II. Dimensional

Parameter/Equipment	Range	CMC <sup>2,7</sup> (±)	Comments
Pin Gages <sup>3</sup> – Class ZZ	Up to 1.0 in	140 μin	Bench micrometer
Calipers <sup>3</sup>	Up to 40 in	(4.5 + 9.9L) μin + 0.6R	Gage blocks
Micrometers <sup>3</sup>	Up to 40 in	(4.5 + 9.9L) μin + 0.6R	Gage blocks

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Linear Indicators <sup>3</sup> – Dial & Test	Up to 4 in	$(3 + 9.4L) \mu\text{in} + 0.6R$	Gage blocks
Steel Rules <sup>3</sup>	Up to 72 in	$(1.5 + 10L) \mu\text{in} + 0.6R$	Gage blocks
Height Gages <sup>3</sup>	Up to 48 in	$(53 + 8.9L) \mu\text{in}$	Gage blocks
Length – 1D <sup>3</sup>	Up to 12 in	0.0021 in	Digital caliper
Hand Tools – Depth Gages, Snap Gages, Fixture Gages, Thickness Gages	Up to 4 in	$(6.4 + 3.1L) \mu\text{in}$	Gage blocks
Tape Measures <sup>3</sup>	Up to 25 ft	$(1.5 + 10L) \mu\text{in} + 0.6R$	Gage blocks
Optical Comparator <sup>3</sup> – X-Y Linearity Magnification Angle	Up to 6 in 10x to 250x 0° to 90°	86 $\mu\text{in}$ 0.014 in 0.1°	Glass scale Glass ruler Angle block set
Feeler/Thickness Gages <sup>3</sup>	Up to 1 in	140 $\mu\text{in}$	Bench micrometer
Surface Plates <sup>3</sup> – Grades AA, A, & B Repeatability/Local Flatness Flatness	0.002 in Up to 60 <i>DL</i> in (>60 to 120) <i>DL</i> in	40 $\mu\text{in}$ $(31 + 0.2DL) \mu\text{in}$ $(30 + 0.3DL) \mu\text{in}$	Repeat-o-meter Mahr federal level systems

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Protractor & Angle Indicators <sup>3</sup>	1°, 2°, 3°, 4°, 5°, 10°, 15°, 20°, 25°, 30°	0.03°	Angle block set
	45°, 60°, 75°, 90°	0.03°	

### III. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC <sup>2,4,5,6</sup> (±)	Comments
DC Voltage – Measure <sup>3</sup>	(0 to 200) mV 200 mV to 2 V (2 to 20) V (20 to 200) V (200 to 1000) V	5.8 μV/V + 0.1 μV 4.7 μV/V + 0.4 μV 4.5 μV/V + 4.0 μV 6.2 μV/V + 40 μV 6.2 μV/V + 500 μV	Fluke 8508A
	(1 to 10) kV	0.05 % + 0.3 V	Vitrek 4700
	(10 to 70) kV	0.06 % + 0.2 V	Vitrek 4700 w/ HVL-70
DC Voltage – Generate <sup>3</sup>	(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	11 μV/V + 0.4 μV 6.7 μV/V + 0.7 μV 5 μV/V + 2.5 μV 5.1 μV/V + 4.0 μV 6.7 μV/V + 40 μV 8.5 μV/V + 400 μV	Fluke 5720A
DC Current – Measure <sup>3</sup>	(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	13 μA/A + 0.4 nA 13 μA/A + 4.0 nA 15 μA/A + 40 nA 49 μA/A + 0.8 nA 0.019 % + 16 μA 0.041 % + 0.4 mA	Fluke 8508A
	(1 to 100) A	0.073 %	GL 9230A/300 shunt w/ DMM

Parameter/Equipment	Range	CMC <sup>2, 4, 5, 6</sup> (±)	Comments
DC Current – Generate <sup>3</sup>	(0 to 220) $\mu$ A 220 $\mu$ A to 2.2 mA (2.2 to 22) mA 22 mA to 220 mA  220 mA to 2.2 A  (1.1 to 3) A (2 to 11) A (11 to 20.5) A  (1 to 100) A	50 $\mu$ A/A + 6.0 nA 44 $\mu$ A/A + 7.0 nA 44 $\mu$ A/A + 40 nA 55 $\mu$ A/A + 0.7 $\mu$ A  0.011 % + 12 $\mu$ A  0.046 % + 40 $\mu$ A 0.06 % + 500 $\mu$ A 0.12 % + 750 $\mu$ A  0.073 %	Fluke 5720A  $\pm (200 I^2)$ $\mu$ A/A for I > 100 mA  $\pm (10 I^2)$ $\mu$ A/A for I > A  Fluke 5522A  GL 9230A/300 shunt w/ DMM and power supply
DC Current – Generate <sup>3</sup>  Clamp-On-Meters  Toroidal Non-Toroidal	Up to 1000 A Up to 1000 A	0.39 % + 0.5 A 0.65 % + 0.5 A	Fluke 5522A w/ 5500 coil
Resistance – Measure <sup>3</sup>	(0 to 2) $\Omega$ (2 to 20) $\Omega$ (20 to 200) $\Omega$ 200 $\Omega$ to 2 k $\Omega$ (2 to 20) k $\Omega$ (20 to 200) k $\Omega$ 200 k $\Omega$ to 2 M $\Omega$ (2 to 20) M $\Omega$ (20 to 200) M $\Omega$ 200 M $\Omega$ to 2 G $\Omega$ (2 to 20) G $\Omega$	18 $\mu\Omega/\Omega$ + 4.0 $\mu\Omega$ 12 $\mu\Omega/\Omega$ + 14 $\mu\Omega$ 10 $\mu\Omega/\Omega$ + 50 $\mu\Omega$ 10 $\mu\Omega/\Omega$ + 0.5 m $\Omega$ 10 $\mu\Omega/\Omega$ + 5.0 m $\Omega$ 10 $\mu\Omega/\Omega$ + 50 m $\Omega$ 11 $\mu\Omega/\Omega$ + 1.0 $\Omega$ 21 $\mu\Omega/\Omega$ + 100 $\Omega$ 0.013 % + 10 k $\Omega$ 0.016 % + 1 M $\Omega$ 0.016 % + 10 M $\Omega$	Fluke 8508A
Resistance – Generate <sup>3</sup>	(0 to 11) $\Omega$ (11 to 33) $\Omega$ (33 to 110) $\Omega$ 110 $\Omega$ to 1.1 k $\Omega$ (1.1 to 11) k $\Omega$ (11 to 110) k $\Omega$ 110 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 $\Omega$	54 $\mu\Omega/\Omega$ + 0.001 $\Omega$ 52 $\mu\Omega/\Omega$ + 0.0015 $\Omega$ 35 $\mu\Omega/\Omega$ + 0.0014 $\Omega$ 35 $\mu\Omega/\Omega$ + 0.002 $\Omega$ 35 $\mu\Omega/\Omega$ + 0.02 $\Omega$ 36 $\mu\Omega/\Omega$ + 0.2 $\Omega$ 40 $\mu\Omega/\Omega$ + 2 $\Omega$ 74 $\mu\Omega/\Omega$ + 30 $\Omega$ 0.016 % + 50 $\Omega$ 0.03 % + 2.5 k $\Omega$ 0.06 % + 3 k $\Omega$ 0.36 % + 100 k $\Omega$ 1.8 % + 500 k $\Omega$	Fluke 5522A

Parameter/Equipment	Range	CMC <sup>4,5,6</sup> (±)	Comments
Resistance – Generate <sup>3</sup>  Fixed Points	0 Ω (1, 1.9) Ω (10, 19) Ω (100, 190) Ω (1, 1.9, 10, 19) kΩ (100, 190) kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	50 μΩ 0.012 % 31 μΩ/Ω 13 μΩ/Ω 8.2 μΩ/Ω 11 μΩ/Ω 16 μΩ/Ω 22 μΩ/Ω 50 μΩ/Ω 59 μΩ/Ω 0.013 %	Fluke 5720A
Insulation Resistance <sup>3</sup>  Fixed Points	10 Ω, 100 Ω, 1 kΩ, 10 kΩ, 100 kΩ, 1 MΩ, 10 MΩ, 100 MΩ, 1 GΩ, 10 GΩ, 100 GΩ	1.2 %	Standard resistor set 100 Ω to 1 MΩ
Capacitance – Generate <sup>3</sup>  (220 to 399.9) pF (0.4 to 1.0999) nF (1.1 to 3.2999) nF (3.3 to 10.9999) nF (11 to 109.999) nF (110 to 329.999) nF (0.33 to 1.099 99) μF (1.1 to 3.299 99) μF (3.3 to 10.9999) μF (11 to 32.9999) μF (33 to 109.999) μF (110 to 329.999) μF (0.33 to 1.099 99) mF (1.1 to 3.299 99) mF (3.3 to 10.9999) mF (11 to 32.9999) mF (33 to 110) mF	(10 to 10 000) Hz (10 to 10 000) Hz (10 to 3000) Hz (10 to 1000) Hz (10 to 1000) Hz (10 to 1000) Hz (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	0.88 % + 10 pF 0.6 % + 0.01 nF 0.6 % + 0.01 nF 0.31 % + 0.1 nF 0.31 % + 0.1 nF 0.31 % + 0.3 nF 0.31 % + 1 nF 0.31 % + 3 nF 0.31 % + 10 nF 0.49 % + 30 nF 0.55 % + 100 nF 0.55 % + 300 nF 0.55 % + 1 μF 0.55 % + 3 μF 0.56 % + 10 μF 0.91 % + 30 μF 1.4 % + 100 μF	Fluke 5522 w/ scope option

Parameter/Range	Frequency	CMC <sup>2, 4, 5, 6</sup> (±)	Comments
AC Voltage – Measure <sup>3</sup>			
Up to 200 mV	(1 to 10) Hz (10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz	0.017 % + 14 μV 0.014 % + 4 μV 0.012 % + 4 μV 0.011 % + 2 μV 0.014 % + 4 μV 0.034 % + 8 μV 0.077 % + 20 μV	Fluke 8508A
200 mV to 2 V	(1 to 10) Hz (10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.015 % + 0.12 mV 0.012 % + 0.02 mV 0.01 % + 0.02 mV 0.008 % + 0.02 mV 0.012 % + 0.02 mV 0.023 % + 0.04 mV 0.058 % + 0.2 mV 0.31 % + 2 mV 1 % + 20 mV	
(2 to 20) V	(1 to 10) Hz (10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.015 % + 1.2 mV 0.012 % + 0.2 mV 0.01 % + 0.2 mV 0.008 % + 0.2 mV 0.012 % + 0.2 mV 0.023 % + 0.4 mV 0.058 % + 2 mV 0.31 % + 20 mV 1 % + 0.2 V	
(20 to 200) V	(1 to 10) Hz (10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.015 % + 12 mV 0.012 % + 2 mV 0.01 % + 2 mV 0.008 % + 2 mV 0.012 % + 2 mV 0.023 % + 4 mV 0.058 % + 20 mV 0.31 % + 0.2 V 1 % + 2 V	
(200 to 1000) V	(1 to 10) Hz (10 to 40) Hz 40 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.015 % + 70 mV 0.013 % + 20 mV 0.012 % + 20 mV 0.023 % + 40 mV 0.058 % + 0.2 V	

Parameter/Range	Frequency	CMC <sup>2, 4, 5, 6</sup> (±)	Comments
AC Voltage – Measure <sup>3</sup> (cont)			
(1 to 10) kV	60 Hz	0.013 % + 0.01 V	Vitrek 4670, Vitrek 4670 w/ HVL-70
(10 to 70) kV	60 Hz	0.013 % + 0.4 V	
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	0.19 % + 4 μV 0.12 % + 4 μV 0.086 % + 4 μV 0.15 % + 4 μV 0.21 % + 5 μV 0.37 % + 10 μV 0.53 % + 20 μV 0.69 % + 20 μV	Fluke 5720
(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	0.031 % + 4 μV 0.014 % + 4 μV 0.013 % + 4 μV 0.03 % + 4 μV 0.066 % + 5 μV 0.14 % + 10 μV 0.18 % + 20 μV 0.35 % + 20 μV	
(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	0.03 % + 12 μV 0.011 % + 7 μV 0.01 % + 7 μV 0.025 % + 7 μV 0.056 % + 17 μV 0.11 % + 20 μV 0.17 % + 25 μV 0.34 % + 45 μV	
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	0.62 % + 40 μV 0.024 % + 15 μV 56 μV/V + 8 μV 93 μV/V + 10 μV 0.014 % + 30 μV 0.051 % + 80 μV 0.012 % + 200 μV 0.021 % + 300 μV	

Parameter/Range	Frequency	CMC <sup>2, 4, 5, 6</sup> (±)	Comments
AC Voltage – Generate <sup>3</sup> (cont)			
(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	0.029 % + 400 μV 0.12 % + 150 μV 58 μV/V + 50 μV 95 μV/V + 100 μV 0.013 % + 200 μV 0.035 % + 600 μV 0.12 % + 2 mV 0.19 % + 3.2 mV	Fluke 5720
(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	0.029 % + 4 mV 0.012 % + 1.5 mV 66 μV/V + 0.6 mV 0.011 % + 1 mV 0.019 % + 2.5 mV	
(220 to 1100) V	(15 to 50) Hz 50 Hz to 1 kHz	0.037 % + 16 mV 58 μV/V + 3.5 mV	
AC Current – Measure <sup>3</sup>			
(0 to 200) μA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.051 % + 0.02 μA 0.051 % + 0.02 μA 0.072 % + 0.02 μA 0.41 % + 0.02 μA	Fluke 8508A
(0.2 to 2) mA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.032 % + 0.2 μA 0.031 % + 0.2 μA 0.072 % + 0.2 μA 0.41 % + 0.2 μA	
(2 to 20) mA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.032 % + 2 μA 0.031 % + 2 μA 0.072 % + 2 μA 0.41 % + 2 μA	
(20 to 200) mA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz	0.032 % + 0.02 mA 0.031 % + 0.02 mA 0.063 % + 0.02 mA	
(0.2 to 2) A	10 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz	0.063 % + 0.2 mA 0.074 % + 0.2 mA 0.31 % + 0.2 mA	
(2 to 20) A	10 Hz to 2 kHz (2 to 10) kHz	0.083 % + 2 mA 0.26 % + 2 mA	



Parameter/Range	Frequency	CMC <sup>2, 4, 5, 6</sup> (±)	Comments
AC Current – Generate <sup>3</sup>			
(10 to 220) µA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.031 % + 16 nA 0.020 % + 10 nA 0.014 % + 8 nA 0.029 % + 12 nA 0.14 % + 65 nA	Fluke 5720A
(33 to 330) µA	(10 to 30) kHz	2 % + 0.4 µA	Fluke 5522A
220 µA 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	0.031 % + 40 nA 0.020 % + 35 nA 0.013 % + 35 nA 0.025 % + 110 nA 0.14 % + 650 nA	Fluke 5720A
(0.33 to 3.3) mA	(10 to 30) kHz	1.2 % + 0.6 µA	Fluke 5522A
(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	0.033 % + 400 nA 0.020 % + 350 nA 0.013 % + 350 nA 0.025 % + 550 nA 0.14 % + 5 µA	Fluke 5720A
(3.3 to 33) mA	(10 to 30) kHz	0.5 % + 4 µA	Fluke 5522A
(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	0.033 % + 4 µA 0.020 % + 3.5 µA 0.013 % + 2.5 µA 0.025 % + 3.5 µA 0.14 % + 10 µA	Fluke 5720A
(33 to 330) mA	(10 to 30) kHz	0.5 % + 200 µA	Fluke 5522A
220 mA to 2.2 A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.03 % + 35 µA 0.055 % + 80 µA 0.85 % + 160 µA	Fluke 5720A
(2.2 to 11) A	40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.056 % + 170 µA 0.12 % + 380 µA 0.44 % + 750 µA	
(11 to 20.5) A	45 Hz to 1 kHz	0.19 % + 5 mA	Fluke 5522A

Parameter/Range	Frequency	CMC <sup>2,4,5,6</sup> ( $\pm$ )	Comments
AC Clamp-On-Meters <sup>3</sup> –  (10 to 150) A  (Toroidal)  (Non-Toroidal)  (150 to 1025) A  (Toroidal)  (Non-Toroidal)	  (45 to 65) Hz (65 to 440) Hz  (45 to 65) Hz (65 to 440) Hz  (45 to 65) Hz (65 to 440) Hz  (45 to 65) Hz (65 to 440) Hz	  0.49 % + 0.025 A 1 % + 0.027 A  0.76 % + 0.25 A 1.3 % + 0.25 A  0.49 % + 0.09 A 1 % + 0.1 A  0.76 % + 0.9 A 1.3 % + 0.9 A	  Fluke 5522A w/ 5500 coil  Fluke 5522A w/ 5500 coil  Fluke 5522A w/ 5500 coil  Fluke 5522A w/ 5500 coil
Oscilloscopes <sup>3</sup> –  Square Wave Amplitude:  50 $\Omega$ at 1 kHz  1 M $\Omega$ at 1 kHz  DC Voltage Amplitude:  50 $\Omega$ Load  1 M $\Omega$ Load  Level Sine Wave:  Frequency  Amplitude	  1.0 mV to 6.6 V <sub>pk-pk</sub>  1.0 mV to 130 V <sub>pk-pk</sub>  (0 to $\pm$ 6.6) V  (0 to $\pm$ 130) V  Up to 1100 MHz  50 kHz Reference 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (600 to 1100) MHz	  0.32 % + 40 $\mu$ V  0.16 % + 40 $\mu$ V  0.30 % + 40 $\mu$ V  0.07 % + 40 $\mu$ V  3.3 $\mu$ Hz/Hz  2.4 % + 300 $\mu$ V 4.4 % + 300 $\mu$ V 4.9 % + 300 $\mu$ V 7.3 % + 300 $\mu$ V 8.4 % + 300 $\mu$ V	  Fluke 5522A SC1100

Parameter/Equipment	Range	CMC <sup>2,6,9</sup> (±)	Comments
Oscilloscopes <sup>3</sup> – (cont)			
Flatness (Bandwidth)	50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (600 to 1100) MHz	2.1 % + 100 μV 2.6 % + 100 μV 4.9 % + 100 μV 6 % + 100 μV	Fluke 5522A SC1100
Time Markers:			
Into a 50 Ω load	5 s to 50 ms 20 ms to 2 ns	(30 + 1000t) μs/s 3.5 μs/s	
Rise Time:			
1 kHz to 2 MHz (2 to 10) MHz	≤ 300 ps ≤ 350 ps	130 ps 130 ps	
Thermocouple Simulation <sup>3</sup> –			
Type E	(-250 to -100) °C (-100 to 650) °C (650 to 1000) °C	0.56 °C 0.20 °C 0.26 °C	Fluke 5522A
Type J	(-210 to -100) °C (-100 to 760) °C (760 to 1200) °C	0.33 °C 0.22 °C 0.29 °C	
Type K	(-200 to -100) °C (-100 to 1000) °C (1000 to 1372) °C	0.40 °C 0.32 °C 0.49 °C	
Type R	(0 to 250) °C (250 to 1000) °C (1000 to 1767) °C	0.70 °C 0.42 °C 0.50 °C	
Type S	(0 to 250) °C (250 to 1400) °C (1400 to 1767) °C	0.58 °C 0.46 °C 0.57 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 400) °C	0.77 °C 0.31 °C 0.22 °C	

Parameter/Equipment	Range	CMC <sup>2,6</sup> (±)	Comments
Electrical Calibration of RTD Indicators & Indicating Systems <sup>3</sup> –  Pt 385, 100 Ω	(-200 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 800) °C	0.07 °C 0.092 °C 0.11 °C 0.13 °C 0.15 °C 0.28 °C	Fluke 5522A

#### IV. Mechanical

Parameter/Equipment	Range	CMC <sup>2,8,10</sup> (±)	Comments
Scales & Balances <sup>3</sup>	(1 to 5) g Up to 10 g Up to 30 g Up to 50 g Up to 100 g Up to 200 g Up to 300 g Up to 500 g Up to 1000 g  1 g to 20 kg (20 to 900) kg  Up to 1000 lb (1000 to 16 000) lb	0.041 mg + 0.6R 0.06 mg + 0.6R 0.09 mg + 0.6R 0.14 mg + 0.6R 0.3 mg + 0.6R 0.6 mg + 0.6R 0.9 mg + 0.6R 1.5 mg + 0.6R 3 mg + 0.6R  0.017 % + 0.6R 0.017 % per 20 kg + 0.6R  0.017 % + 0.6R 0.017 % per 1000 lb + 0.6R	ASTM Class 1 weights (applied load)          Class F weights
Torque – Measuring Equipment (Wrenches) <sup>3</sup>	5 in·lbf to 600 ft·lbf	0.65 %	CDI Suretest 5000-ST

Parameter/Equipment	Range	CMC <sup>2, 10</sup> (±)	Comments
Pressure <sup>3</sup> – Measuring Equipment	(-14.5 to 30) psi	0.07 % FS	Fluke 744 w/ 700 series pressure modules
	(10 to 100) psi	0.07 % FS	
	(50 to 500) psi	0.07 % FS	Druck PM620-16G
	(100 to 1000) psi	0.04 % FS	
	(1000 to 10 000) psi	0.1 % FS	
(3000 to 30 000) psi	0.13 % FS	Additel 681	
Indirect Verification of Rockwell Hardness Testers <sup>3</sup>	HRA		Indirect verification per ASTM E18
	Low	0.75 HRA	
	Medium	0.73 HRA	
	High	0.8 HRA	
	HRBW		
	Low	0.4 HRBW	
	Medium	0.45 HRBW	
	High	0.38 HRBW	
	HRC		
	Low	0.43 HRC	
	Medium	0.43 HRC	
	High	0.38 HRC	
	HREW		
	Low	0.77 HREW	
	Medium	0.77 HREW	
	High	0.77 HREW	
	HR15N		
	Low	0.42 HR15N	
	Medium	0.42 HR15N	
	High	0.42 HR15N	
	HR30N		
	Low	0.58 HR30N	
	Medium	0.5 HR30N	
	High	0.6 HR30N	
HR45N			
Low	0.48 HR45N		
Medium	0.48 HR45N		
High	0.49 HR45N		

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Indirect Verification of Rockwell Hardness Testers <sup>3</sup> (cont)	HR15TW		Indirect verification per ASTM E18
	Low	0.4 HR15TW	
	Medium	0.4 HR15TW	
	High	0.42 HR15TW	
	HR30TW		
	Low	0.41 HR30TW	
	Medium	0.42 HR30TW	
	High	0.42 HR30TW	
	HR45TW		
Low	0.93 HR45TW		
Medium	0.5 HR45TW		
High	0.6 HR45TW		

#### V. Thermodynamics

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Temperature – Measure <sup>3</sup>	(-197 to 420) °C	0.065 °C	Fluke 1523 w/5615 PRT
Plate Temperature – Infrared Devices <sup>3</sup>	Up to 100 °C	1 °C	Fluke 4181
	Up to 200 °C	1.2 °C	
	Up to 350 °C	1.7 °C	
	Up to 500 °C	2.3 °C	
Temperature – Measuring Equipment <sup>3</sup>	(-10 to 122) °C	0.40 °C	Fluke 9102S
	(35 to 350) °C	0.80 °C	Fluke 9140

## VI. Time & Frequency

Parameter/Equipment	Range	CMC <sup>2,10</sup> ( $\pm$ )	Comments
Timers & Stopwatches <sup>3</sup>	(1 to 3600) s	0.05 s	HP 53132A
Frequency – Measuring Equipment <sup>3</sup>	0.01 Hz to 2 MHz	5.6 $\mu$ Hz/Hz + 5 $\mu$ Hz	Fluke 5522A
	Up to 1100 MHz	3.3 $\mu$ Hz/Hz	Fluke 5522A w/ SC 1100 MHz scope option

<sup>1</sup> This laboratory offers commercial calibration and field calibration services, 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> Based on using the standard at the temperature the Fluke 5720A, Fluke 5520A was calibrated ( $t_{cal} \pm 5$  °C) and assuming the instrument is zeroed at least every seven days or when the ambient temperature changes more than 5 °C. For resistance, a zero calibration is performed at least every 12 hours within  $\pm 1$  °C of use.

<sup>5</sup> Based on using the standard at the temperature the 8508A was calibrated ( $t_{cal} \pm 5$  °C).

<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 fraction/percentage of the reading plus a fixed floor specification.

<sup>7</sup> The statement of Calibration and Measurement Capability,  $L$  is the numerical value of the nominal length of the device measured in inches. In the Calibration and Measurement Capability,  $R$  is the numerical value of the resolution of the device.  $DL$  is the length of the diagonal in inches.

<sup>8</sup> Unless otherwise noted, percentage refers to percent of reading.

<sup>9</sup> In the statement of CMC,  $t$  represents the time in seconds.

<sup>10</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>11</sup> This scope meets A2LA's *P112 Flexible Scope Policy*.





## Accredited Laboratory

A2LA has accredited

**J.A. KING**

*Tulsa, 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 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 1<sup>st</sup> day of April 2019.

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

Vice President, Accreditation Services  
For the Accreditation Council  
Certificate Number 1741.18  
Valid to April 30, 2021

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