



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017,  
ANSI/NCSL Z540-1-1994 & ANSI/NCSL Z540.3

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CALIBRATION

Valid To: March 31, 2026

Certificate Number: 2357.20

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations<sup>1,7</sup>:

I. Dimensional

Parameter/Equipment	Range	CMC <sup>2,5</sup> ( $\pm$ )	Comments
Calipers <sup>3</sup>	Up to 4 in (>4 to 12) in (>12 to 48) in	(58 + 0.51L) $\mu$ in (54 + 1.9L) $\mu$ in (48 + 2.3L) $\mu$ in	Gage blocks
Micrometers – Inside, Outside, Depth <sup>3</sup> –			
Length	Up to 4 in (>4 to 12) in (>12 to 48) in	(7.7 + 2.1L) $\mu$ in (23 + 2.9L) $\mu$ in (13 + 3.7L) $\mu$ in	Gage blocks
Flatness	Up to 1 in	5.2 $\mu$ in	Optical parallel
Parallelism	Up to 1 in	10 $\mu$ in	

Parameter/Equipment	Range	CMC <sup>2,5</sup> (±)	Comments
Plain Plug & Pin Gages	Up to 1 in	28 µin	Universal measuring machine
Indicators <sup>3</sup>	Up to 6 in (>6 to 12) in (>12 to 48) in	(13 + 1.7L) µin (9.2 + 3.4L) µin (17 + 2.8L) µin	Gage blocks
	Up to 6 in	40 µin	Universal measuring machine
	Up to 6 in	71 µin	Starrett 716

## II. Electrical – DC/Low Frequency

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
AC Current – Generate <sup>3</sup>			
Up to 220 µA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.25 mA/A + 16 nA 0.17 mA/A + 9.3 nA 0.11 mA/A + 7.8 nA 0.32 mA/A + 12 nA 1.0 mA/A + 62 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	0.24 mA/A + 39 nA 0.16 mA/A + 31 nA 0.11 mA/A + 31 nA 0.21 mA/A + 0.10 µA 1.0 mA/A + 0.62 µA	

Parameter/Range	Frequency	CMC <sup>2,4,6</sup> (±)	Comments
AC Current – Generate <sup>3</sup> (cont)			
(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	0.24 mA/A + 0.39 µA 0.16 mA/A + 0.31 µA 0.10 mA/A + 0.31 µA 0.20 mA/A + 0.54 µA 1.0 mA/A + 4.7 µA	Fluke 5730A
(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	0.24 mA/A + 3.9 µA 0.16 mA/A + 3.1 µA 0.11 mA/A + 2.3 µA 0.20 mA/A + 3.1 µA 1.0 mA/A + 9.3 µA	
(0.22 to 2.2) A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.24 mA/A + 31 µA 0.40 mA/A + 78 µA 6.2 mA/A + 0.16 mA	
(2.2 to 11) A	40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.40 mA/A + 0.13 mA 0.76 mA/A + 0.29 mA 2.8 mA/A + 0.58 mA	Fluke 5730A w/ 5725A
(11 to 20.5) A	(45 to 100) Hz (0.1 to 1) kHz (1 to 5) kHz	0.98 mA/A + 3.9 mA 1.2 mA/A + 3.9 mA 23 mA/A + 3.9 mA	Fluke 5522A
Up to 329.99 µA (0.33 to 3.2999) mA (3.3 to 32.999) mA (33 to 329.99) mA (0.33 to 1.099 99) A (1.1 to 2.999 99) A	(10 to 30) kHz (10 to 30) kHz (10 to 30) kHz (10 to 30) kHz (10 to 45) Hz (10 to 45) Hz	12 mA/A + 0.31 µA 7.8 mA/A + 0.47 µA 3.3 mA/A + 3.1 µA 3.1 mA/A + 0.16 mA 1.4 mA/A + 78 µA 1.4 mA/A + 78 µA	
Clamp-On Ammeters			
Toroidal (16.5 to 150) A	(45 to 65) Hz (65 to 440) Hz	0.38 % 0.84 %	Fluke 5520A w/ coil
(150 to 1025) A	(45 to 65) Hz (65 to 440) Hz	0.37 % 0.83 %	
Non-Toroidal (16.5 to 150) A	(45 to 65) Hz (65 to 440) Hz	0.76 % 1.2 %	
(150 to 1025) A	(45 to 65) Hz (65 to 440) Hz	1.2 % 1.6 %	

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments	
<b>AC Current – Measure<sup>3</sup></b>				
Up to 199.99 µA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.79 mA/A + 20 nA 0.51 mA/A + 20 nA 0.66 mA/A + 20 nA 3.3 mA/A + 20 nA	Fluke 8508A	
(0.2 to 1.9999) mA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.61 mA/A + 0.20 µA 0.36 mA/A + 0.20 µA 0.69 mA/A + 0.20 µA 3.5 mA/A + 0.20 µA		
(2 to 19.999) mA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.59 mA/A + 2.0 µA 0.3 mA/A + 2.0 µA 0.65 mA/A + 2.0 µA 5.1 mA/A + 2.0 µA		
(20 to 199.99) mA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz	0.61 mA/A + 20 µA 0.31 mA/A + 20 µA 0.93 mA/A + 20 µA		
(0.2 to 1.9999) A	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz	0.59 mA/A + 0.20 mA 0.68 mA/A + 0.20 mA 2.4 mA/A + 0.20 mA		
(2 to 19.999) A	10 Hz to 2 kHz (2 to 10) kHz	0.81 mA/A + 2.0 mA 2 mA/A + 2.0 mA		
(1 to 20) A	40 Hz to 1 kHz (1 to 5) kHz	0.11 mA/A 0.16 mA/A		Fluke Y5020 w/ HP 3458A opt 002
(20 to 30) A	(45 to 65) Hz	4.0 mA/A		
<b>AC Voltage – Generate<sup>3</sup></b>				
Up 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 (0.5 to 1) MHz	0.38 mV/V + 3.9 µV 0.32 mV/V + 3.9 µV 0.28 mV/V + 3.9 µV 0.33 mV/V + 3.9 µV 0.54 mV/V + 4.7 µV 1.1 mV/V + 9.3 µV 1.5 mV/V + 19 µV 3.1 mV/V + 19 µV	Fluke 5730A	
(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 (0.5 to 1) MHz	0.25 mV/V + 3.9 µV 0.12 mV/V + 3.9 µV 0.10 mV/V + 3.9 µV 0.20 mV/V + 3.9 µV 0.47 mV/V + 4.7 µV 1.0 mV/V + 9.3 µV 1.3 mV/V + 19 µV 2.7 mV/V + 19 µV		

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
AC Voltage – Generate <sup>3</sup>			
(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 (0.5 to 1) MHz	0.36 mV/V + 12 μV 93 μV/V + 6.2 μV 58 μV/V + 6.2 μV 0.12 mV/V + 6.2 μV 0.31 mV/V + 16 μV 0.63 mV/V + 19 μV 1.3 mV/V + 23 μV 2.6 mV/V + 47 μV	Fluke 5730A
(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 (0.5 to 1) MHz	0.49 mV/V + 39 μV 87 μV/V + 16 μV 39 μV/V + 7.8 μV 63 μV/V + 9.3 μV 0.11 mV/V + 31 μV 0.32 mV/V + 78 μV 0.94 mV/V + 0.19 mV 1.6 mV/V + 0.31 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 (0.5 to 1) MHz	0.37 mV/V + 0.39 mV 93 μV/V + 0.16 mV 39 μV/V + 54 μV 63 μV/V + 93 μV 78 μV/V + 0.19 mV 0.23 mV/V + 0.62 mV 0.93 mV/V + 1.9 mV 1.4 mV/V + 3.1 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 (0.5 to 1) MHz	0.43 mV/V + 3.9 mV 90 μV/V + 1.6 mV 54 μV/V + 0.54 mV 80 μV/V + 0.93 mV 0.14 mV/V + 2.3 mV 0.85 mV/V + 16 mV 4.2 mV/V + 39 mV 7.8 mV/V + 78 mV	
(220 to 1100) V	(15 to 50) Hz 50 Hz to 1 kHz	0.28 mV/V + 16 mV 70 μV/V + 3.1 mV	
(220 to 1100) V	40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz	78 μV/V + 3.1 mV 0.13 mV/V + 4.7 mV 0.47 mV/V + 8.5 mV	Fluke 5730A w/ 5725A
(220 to 750) V	(30 to 50) kHz (50 to 100) kHz	0.47 mV/V + 8.5 mV 1.8 mV/V + 35 mV	

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
AC Voltage – Generate <sup>3</sup> (cont)			
Absolute: (0 to 1.1) mV (1.1 to 3) mV (3 to 11) mV (11 to 33) mV (33 to 110) mV (110 to 330) mV (0.33 to 1.1) V (1.1 to 3.5) V	30 Hz to 500 kHz	6.5 mV/V + 1.6 μV 5.5 mV/V + 2.3 μV 5.4 mV/V + 6.2 μV 4.7 mV/V + 12 μV 4.7 mV/V + 31 μV 3.9 mV/V + 78 μV 3.9 mV/V + 0.31 mV 3.1 mV/V + 0.39 mV	Fluke 5730A wideband
Flatness: Up to 1.1 mV	(10 to 30) Hz 30 Hz to 119.99 kHz (0.12 to 2) MHz (2 to 11.9) MHz (12 to 20) MHz (20 to 30) MHz (30 to 50) MHz	2.4 mV/V 0.86 mV/V 1.6 mV/V + 2.3 μV 3.1 mV/V + 2.3 μV 4.7 mV/V + 2.3 μV 12 mV/V + 12 μV 23 mV/V + 12 μV	
(>1.1 to 3) mV	(10 to 30) Hz 30 Hz to 119.99 kHz (0.12 to 2) MHz (2 to 11.9) MHz (12 to 20) MHz (20 to 30) MHz (30 to 50) MHz	2.4 mV/V 0.81 mV/V 0.81 mV/V + 2.3 μV 2.3 mV/V + 2.3 μV 3.9 mV/V + 2.3 μV 12 mV/V + 2.3 μV 23 mV/V + 2.3 μV	
(>3.3 to 11) mV	(10 to 30) Hz 30 Hz to 119.99 kHz (0.12 to 2) MHz (2 to 11.9) MHz (12 to 20) MHz (20 to 30) MHz (30 to 50) MHz	2.3 mV/V 0.80 mV/V 0.80 mV/V + 2.3 μV 1.6 mV/V + 2.3 μV 3.2 mV/V + 2.3 μV 7.8 mV/V + 2.3 μV 16 mV/V + 2.3 μV	
(>11 to 33) mV	(10 to 30) Hz 30 Hz to 119.99 kHz (0.12 to 2) MHz (2 to 11.9) MHz (12 to 20) MHz (20 to 30) MHz (30 to 50) MHz	2.3 mV/V 0.80 mV/V 0.80 mV/V + 2.3 μV 1.6 mV/V + 2.3 μV 3.2 mV/V + 2.3 μV 7.8 mV/V + 2.3 μV 16 mV/V + 2.3 μV	

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
AC Voltage – Generate <sup>3</sup> (cont)			
Flatness: (>33 to 110) mV	(10 to 30) Hz 30 Hz to 119.99 kHz (0.12 to 2) MHz (2 to 11.9) MHz (12 to 20) MHz (20 to 30) MHz (30 to 50) MHz	2.3 mV/V 0.79 mV/V 0.79 mV/V + 2.3 μV 1.6 mV/V + 2.3 μV 3.2 mV/V + 2.3 μV 7.8 mV/V + 2.3 μV 16 mV/V + 2.3 μV	Fluke 5730A
(>110 to 330) mV	(10 to 30) Hz 30 Hz to 119.99 kHz (0.12 to 2) MHz (2 to 11.9) MHz (12 to 20) MHz (20 to 30) MHz (30 to 50) MHz	2.3 mV/V 0.80 mV/V 0.80 mV/V + 2.3 μV 1.6 mV/V + 2.3 μV 3.2 mV/V + 2.3 μV 7.8 mV/V + 2.3 μV 16 mV/V + 2.3 μV	
>330 mV to 1.1 V	(10 to 30) Hz 30 Hz to 119.99 kHz (0.12 to 2) MHz (2 to 11.9) MHz (12 to 20) MHz (20 to 30) MHz (30 to 50) MHz	2.3 mV/V 0.79 mV/V 0.79 mV/V + 2.3 μV 1.6 mV/V + 2.3 μV 3.2 mV/V + 2.3 μV 7.8 mV/V + 2.3 μV 16 mV/V + 2.3 μV	
(1.1 to 3.5) V	(10 to 30) Hz 30 Hz to 119.99 kHz (0.12 to 2) MHz (2 to 11.9) MHz (12 to 20) MHz (20 to 30) MHz (30 to 50) MHz	2.3 mV/V 0.79 mV/V 0.79 mV/V + 2.3 μV 1.6 mV/V + 2.3 μV 3.2 mV/V + 2.3 μV 7.8 mV/V + 2.3 μV 16 mV/V + 2.3 μV	

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
AC Voltage – Measure <sup>3</sup>			
(0 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 kHz to 1 MHz (1 to 4) MHz (4 to 8) MHz	0.27 mV/V + 2.3 μV 0.18 mV/V + 0.85 μV 0.25 mV/V + 0.85 μV 0.78 mV/V + 0.85 μV 3.9 mV/V + 0.85 μV 9.3 mV/V + 3.9 μV 54 mV/V + 5.4 μV 0.16 V/V + 6.2 μV	Agilent 3458 OPT 002
(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 300) kHz 300 kHz to 1 MHz (1 to 4) MHz (4 to 8) MHz (8 to 10) MHz	0.13 mV/V + 3.1 μV 71 μV/V + 1.6 μV 0.11 mV/V + 1.6 μV 0.23 mV/V + 1.6 μV 0.62 mV/V + 1.6 μV 2.3 mV/V + 7.8 μV 7.8 mV/V + 7.8 μV 31 mV/V + 54 μV 31 mV/V + 62 μV 0.12 V/V + 78 μV	
(0.1 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 300) kHz 300 kHz to 1 MHz (1 to 4) MHz (4 to 8) MHz (8 to 10) MHz	0.33 mV/V + 31 μV 77 μV/V + 16 μV 0.12 mV/V + 16 μV 0.25 mV/V + 16 μV 0.63 mV/V + 16 μV 3 mV/V + 78 μV 8 mV/V + 78 μV 31 mV/V + 0.54 mV 31 mV/V + 0.62 mV 0.12 V/V + 0.78 mV	
(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 300) kHz 300 kHz to 1 MHz (1 to 4) MHz (4 to 8) MHz (8 to 10) MHz	0.32 mV/V + 0.31 mV 76 μV/V + 0.16 mV 0.12 mV/V + 0.16 mV 0.25 mV/V + 0.16 mV 0.63 mV/V + 0.16 mV 3 mV/V + 0.78 mV 8 mV/V + 0.78 mV 31 mV/V + 5.4 mV 31 mV/V + 6.2 mV 0.12 V/V + 7.8 mV	



Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
AC Voltage – Measure <sup>3</sup> (cont)			
(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 300) kHz 300 kHz to 1 MHz	0.36 mV/V + 3.1 mV 0.16 mV/V + 1.6 mV 0.16 mV/V + 1.6 mV 0.29 mV/V + 1.6 mV 0.93 mV/V + 1.6 mV 3.6 mV/V + 7.8 mV 12 mV/V + 7.8 mV	Agilent 3458 OPT 002
(100 to 700) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.56 mV/V + 31 mV 0.32 mV/V + 16 mV 0.47 mV/V + 16 mV 0.94 mV/V + 16 mV 2.3 mV/V + 16 mV	
(700 to 1000) V	(1 to 10) Hz (10 to 40) Hz 40 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.15 mV/V + 80 mV 0.11 mV/V + 25 mV 0.11 mV/V + 25 mV 0.21 mV/V + 50 mV 0.54 mV/V + 0.25 V	Fluke 8508A
(1 to 10) kV	(15 to 200) Hz (200 to 450) Hz (450 to 600) Hz	0.11 % + 0.12 V 0.43 % + 0.12 V 0.84 % + 0.12 V	Vitrek 4700
(1 to 85) kV	60 Hz	5.9 mV/V	Ross VD120-6.2Y divider w/ HP 34401A

Parameter/Range	Frequency	CMC <sup>2, 4, 5, 6</sup> ( $\pm$ )	Comments
AC Resistance – Measure <sup>3</sup> 10 m $\Omega$ to 100 k $\Omega$	12 Hz to 200 kHz	(0.018 + 0.25 <i>R</i> ) m $\Omega$	GenRad 1689M (CMC valid at 1 kHz only) <sup>10</sup>
AC Resistance – Generate 0.1 $\Omega$ 1 $\Omega$ 10 $\Omega$ 100 $\Omega$ 1 k $\Omega$ 10 k $\Omega$ 100 k $\Omega$	DC to 1 MHz DC to 1 MHz DC to 1 MHz DC to 1 MHz DC to 1 MHz DC to 1 MHz DC to 1 MHz	0.19 % 0.026 % 0.014 % 0.028 % 0.012 % (0.013 + 0.013 <i>f</i> ) % (0.037 + 2.3 <i>f</i> ) %	HP 16074A      <i>f</i> = Frequency in MHz
Inductance – Generate <sup>3</sup> 1 mH 10 mH 100 mH 1 H	100 Hz to 1 kHz 100 Hz to 1 kHz 100 Hz to 1 kHz 100 Hz to 1 kHz	1.6 $\mu$ H 6.5 $\mu$ H 42 $\mu$ H 0.94 mH	GenRad 1482 series
Inductance – Measure <sup>3</sup> 100 $\mu$ H to 10 H	12 Hz to 100 kHz	0.28 mH/H	GenRad 1689M (CMC valid at 1 kHz only) <sup>10</sup>
Capacitance – Generate <sup>3</sup> 0 F 1 pF	1 kHz 100 Hz to 1 kHz 1 kHz to 1 MHz (1 to 2) MHz (2 to 3) MHz (3 to 4) MHz (4 to 5) MHz (5 to 10) MHz (10 to 13) MHz	2.4 pF 0.39 fF 0.40 fF 0.45 fF 0.57 fF 0.73 fF 1.5 fF 2.5 fF 4.1 fF	OPEN HP 16380A

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
Capacitance – Generate <sup>3</sup> (cont)			
10 pF	100 Hz to 1 kHz	3.5 fF	HP 16380A
	1 kHz to 1 MHz	3.5 fF	
	(1 to 2) MHz	3.8 fF	
	(2 to 3) MHz	3.8 fF	
	(3 to 4) MHz	3.5 fF	
	(4 to 5) MHz	3.5 fF	
	(5 to 10) MHz	4.1 fF	
100 pF	(10 to 13) MHz	4.3 fF	
	100 Hz to 1 kHz	43 fF	
	1 kHz to 1 MHz	35 fF	
	(1 to 2) MHz	36 fF	
	(2 to 3) MHz	37 fF	
	(3 to 4) MHz	38 fF	
	(4 to 5) MHz	39 fF	
1 nF	(5 to 10) MHz	52 fF	
	(10 to 13) MHz	64 fF	
	100 Hz to 1 kHz	0.35 pF	
	1 kHz to 1 MHz	0.35 pF	
	(1 to 2) MHz	0.38 pF	
	(2 to 3) MHz	0.45 pF	
	(3 to 4) MHz	0.56 pF	
10 nF	(4 to 5) MHz	0.72 pF	
	(5 to 10) MHz	2.0 pF	
	(10 to 13) MHz	2.9 pF	
	(100 to 120) Hz	0.62 pF	
100 nF	120 Hz to 1 kHz	0.71 pF	
	(1 to 10) kHz	0.71 pF	
	(10 to 100) kHz	0.73 pF	
	(100 to 120) Hz	7.1 pF	
1 μF	120 Hz to 1 kHz	7.1 pF	
	(1 to 10) kHz	7.1 pF	
	(10 to 100) kHz	9.1 pF	
	(100 to 120) Hz	76 pF	
	120 Hz to 1 kHz	70 pF	
	(1 to 10) kHz	70 pF	
	(10 to 100) kHz	0.58 nF	

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
Capacitance – Generate <sup>3</sup> (cont)			
10 pF	100 Hz to 10 kHz	0.24 fF	GenRad 1404 series
1000 pF	100 Hz to 10 kHz	24 fF	
1 nF	100 Hz to 10 kHz	0.68 pF	GenRad 1409 series
10 nF	100 Hz to 10 kHz	3.4 pF	
100 nF	100 Hz to 10 kHz	33 pF	
1 μF	100 Hz to 10 kHz	0.67 nF	
(0.19 to 1.0999) nF	10 Hz to 10 kHz	4.2 mF/F + 7.8 pF	Fluke 5520A
(1.1 to 3.2999) nF	10 Hz to 3 kHz	4.1 mF/F + 7.8 pF	
(3.3 to 10.9999) nF	10 Hz to 1 kHz	2.4 mF/F + 7.8 pF	
(11 to 109.999) nF	10 Hz to 1 kHz	2.4 mF/F + 78 pF	
(110 to 329.999) nF	10 Hz to 1 kHz	2.3 mF/F + 0.23 nF	
(0.33 to 1.099 99) μF	(10 to 600) Hz	2.4 mF/F + 0.78 nF	
(1.1 to 3.299 99) μF	(10 to 300) Hz	2.3 mF/F + 2.3 nF	
(3.3 to 10.9999) μF	(10 to 150) Hz	2.4 mF/F + 7.8 nF	
(11 to 32.9999) μF	(10 to 120) Hz	3.4 mF/F + 23 nF	
(33 to 109.999) μF	(10 to 80) Hz	3.8 mF/F + 78 nF	
(110 to 329.999) μF	DC to 50 Hz	3.5 mF/F + 0.23 μF	
(0.33 to 1.099 99) mF	DC to 20 Hz	3.5 mF/F + 0.78 μF	
(1.1 to 3.2999) mF	DC to 6 Hz	3.5 mF/F + 2.3 μF	
(3.3 to 10.9999) mF	DC to 2 Hz	3.5 mF/F + 7.8 μF	
(11 to 32.9999) mF	DC to 0.6 Hz	5.8 mF/F + 23 μF	
(33 to 110) mF	DC to 0.2 Hz	8.5 mF/F + 78 μF	
Capacitance – Measure <sup>3</sup>			
0 F	1 kHz	2.4 pF	GenRad 1689M, OPEN
(0.1 to 100) pF	12 Hz to 100 kHz	4.8 mF/F	GenRad 1689M
100 pF to 25 μF	12 Hz to 100 kHz	0.25 mF/F	(CMC valid at 1 kHz only) <sup>10</sup>
(25 to 100) μF	12 Hz to 100 kHz	0.26 mF/F	
100 μF to 1 mF	12 Hz to 100 kHz	2.6 mF/F	
DC Current – Generate <sup>3</sup>			
0 A	0 A	2.2 pA	OPEN
Up to 220 μA	Up to 220 μA	40 μA/A + 5.4 nA	Fluke 5730A
(0.22 to 2.2) mA	(0.22 to 2.2) mA	33 μA/A + 6.2 nA	
(2.2 to 22) mA	(2.2 to 22) mA	33 μA/A + 39 nA	
(22 to 220) mA	(22 to 220) mA	42 μA/A + 0.62 μA	
(0.22 to 2.2) A	(0.22 to 2.2) A	74 μA/A + 12 μA	
(2.2 to 11) A	(2.2 to 11) A	0.28 mA/A + 0.37 mA	Fluke 5730A w/ 5725A
(11 to 20.5) A	(11 to 20.5) A	0.81 mA/A + 0.58 mA	Fluke 5522A
(20 to 149.999) A	(20 to 149.999) A	4.4 mA/A + 0.11 mA	Fluke 5522A w/ 5500A coil
(150 to 1025) A	(150 to 1025) A	4.6 mA/A + 0.39 mA	

Parameter/Equipment	Range	CMC <sup>2, 4</sup> (±)	Comments
DC Current – Measure <sup>3</sup>	0 A  Up to 20 pA (>20 to 200) pA (>0.2 to 2) nA  (0 to 200) μA (0.2 to 2) mA (2 to 20) mA (20 to 200) mA (0.2 to 2) A (2 to 20) A  (1 to 20) A  (20 to 300) A	2.2 pA  12 mA/A + 3.5 fA 12 mA/A + 5.8 fA 2.3 mA/A + 0.58 pA  13 μA/A + 0.31 nA 13 μA/A + 3.1 nA 15 μA/A + 31 nA 47 μA/A + 0.62 μA 0.18 mA/A + 12 μA 0.43 mA/A + 0.31 mA  50 μA/A  0.57 mA/A	HP 3458A, OPEN  Keithley 6517B  Fluke 8508A  Fluke Y5020A w/ HP 3458A opt 002  L&N 4363 w/ HP 3458A opt 002
DC Resistance – Measure <sup>3</sup>	(0 to 2) Ω (2 to 20) Ω (20 to 200) Ω (0.2 to 2) kΩ (2 to 20) kΩ (2 to 200) kΩ (0.2 to 2) MΩ (2 to 20) MΩ (20 to 200) MΩ (0.2 to 2) GΩ (2 to 20) GΩ	19 μΩ/Ω + 4.0 μΩ 11 μΩ/Ω + 14 μΩ 10 μΩ/Ω + 50 μΩ 8.1 μΩ/Ω + 0.50 mΩ 8.1 μΩ/Ω + 5.0 mΩ 9.6 μΩ/Ω + 50 mΩ 11 μΩ/Ω + 1.0 Ω 35 μΩ/Ω + 10 Ω 98 μΩ/Ω + 1.0 kΩ 0.49 mΩ/Ω + 0.10 MΩ 1.5 mΩ/Ω + 10 MΩ	Fluke 8508A True Ohms Mode  Normal Mode  High Voltage Mode
DC Resistance – Generate <sup>3</sup>	(0 to 10.9999) Ω (11 to 32.9999) Ω (33 to 109.9999) Ω (110 to 329.9999) Ω (330 to 1099.999) Ω (1.1 to 3.299 999) kΩ (3.3 to 10.999 99) kΩ (11 to 32.999 99) kΩ (33 to 109.9999) kΩ (110 to 329.9999) kΩ (330 to 1099.999) kΩ (1.1 to 3.299 999) MΩ (3.3 to 10.999 99) MΩ (11 to 32.999 99) MΩ (33 to 109.9999) MΩ (110 to 329.9999) MΩ (330 to 1099.999) MΩ	38 μΩ/Ω + 0.78 mΩ 28 μΩ/Ω + 1.2 mΩ 24 μΩ/Ω + 1.1 mΩ 24 μΩ/Ω + 1.6 mΩ 23 μΩ/Ω + 1.6 mΩ 24 μΩ/Ω + 16 mΩ 23 μΩ/Ω + 16 mΩ 22 μΩ/Ω + 0.16 Ω 22 μΩ/Ω + 0.16 Ω 25 μΩ/Ω + 1.6 Ω 28 μΩ/Ω + 1.6 Ω 48 μΩ/Ω + 23 Ω 0.11 mΩ/Ω + 39 Ω 0.20 mΩ/Ω + 1.9 kΩ 0.40 mΩ/Ω + 2.3 kΩ 2.4 mΩ/Ω + 78 kΩ 12 mΩ/Ω + 0.39 MΩ	Fluke 5520A



Parameter/Equipment	Range	CMC <sup>2,4,6</sup> (±)	Comments
DC Voltage – Generate <sup>3</sup>	0 V  (0 to 220) mV (0.22 to 2.2) V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1100) V  (1.1 to 10) kV	67 nV  8.9 μV/V + 0.39 μV 4.9 μV/V + 0.62 μV 3.3 μV/V + 2.3 μV 3.3 μV/V + 3.9 μV 4.9 μV/V + 39 μV 6.4 μV/V + 0.39 mV  0.027 % + 40 mV	Copper short  Fluke 5730A      Vitrek 4700
Distortion– Measure Fundamental Frequency <sup>3</sup>			
20 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	(-80 to 0) dB (-70 to 0) dB (-65 to 0) dB	1.2 dB 2.3 dB 2.3 dB	HP 8903B
Electrical Calibration of Thermocouple Indicators <sup>3</sup> –			
Type B	(600 to 800) °C (800 to 1000) °C (1000 to 1550) °C (1550 to 1820) °C	0.34 °C 0.27 °C 0.24 °C 0.26 °C	Fluke 5520A
Type C	(0 to 150) °C (150 to 650) °C (650 to 1000) °C (1000 to 1800) °C (1800 to 2316) °C	0.24 °C 0.21 °C 0.25 °C 0.39 °C 0.65 °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 0.13 °C 0.17 °C	
Type J	(-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1200) °C	0.25 °C 0.13 °C 0.12 °C 0.14 °C 0.18 °C	

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Electrical Calibration of Thermocouple Indicators <sup>3</sup> – (cont)			
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 0.13 °C 0.20 °C 0.31 °C	Fluke 5520A
Type L	(-200 to -100) °C (-100 to 800) °C (800 to 900) °C	0.29 °C 0.20 °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	0.31 °C 0.17 °C 0.15 °C 0.14 °C 0.21 °C	
Type R	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.45 °C 0.28 °C 0.26 °C 0.32 °C	
Type S	(0 to 250) °C (250 to 1000) °C (1000 to 1400) °C (1400 to 1767) °C	0.38 °C 0.28 °C 0.29 °C 0.36 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.50 °C 0.19 °C 0.13 °C 0.11 °C	
Type U	(-200 to 0) °C (0 to 600) °C	0.44 °C 0.21 °C	



Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Electrical Simulation of RTD Indicators <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	0.085 °C 0.12 °C 0.12 °C 0.11 °C 0.097 °C 0.11 °C 0.20 °C	Fluke 5520A
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	0.064 °C 0.076 °C 0.075 °C 0.089 °C 0.095 °C 0.17 °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	0.21 °C 0.060 °C 0.068 °C 0.070 °C 0.077 °C 0.084 °C 0.090 °C 0.13 °C 0.19 °C	
Pt 385, 200 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	0.041 °C 0.043 °C 0.044 °C 0.051 °C 0.098 °C 0.11 °C 0.11 °C 0.13 °C	
Pt 385, 500 Ω	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C	0.036 °C 0.043 °C 0.044 °C 0.051 °C 0.066 °C	

Parameter/Equipment	Range	CMC <sup>2,4,6</sup> (±)	Comments
Electrical Simulation of RTD Indicators <sup>3</sup> – (cont)			
Pt 385, 500 Ω	(300 to 400) °C (400 to 600) °C (600 to 630) °	0.066 °C 0.073 °C 0.088 °C	Fluke 5520A
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	0.029 °C 0.029 °C 0.036 °C 0.042 °C 0.050 °C 0.18 °C 0.057 °C 0.18 °C	
PtNi 385, 120 Ω (Ni120)	(-80 to 0) °C (0 to 100) °C (100 to 260) °C	0.081 °C 0.11 °C 0.11 °C	
Cu 427, 10 Ω	(-100 to 260) °C	0.69 °C	
AC Voltage Flatness – Measure			
(0.5, 1, 3) V Thermal Converter	10 Hz to <30 kHz (30 to <100) kHz (0.1 to <1) MHz (1 to <3) MHz (3 to <8) MHz (8 to <20) MHz (20 to <30) MHz (30 to <50) MHz (50 to <70) MHz (70 to <80) MHz (80 to <100) MHz 100 MHz	0.12 % 0.23 % 0.29 % 0.58 % 0.70 % 0.71 % 0.76 % 1.8 % 2.8 % 3.6 % 3.9 % 4.8 %	By comparison to thermal voltage converters w/ HP 3458A, opt 002

Parameter/Equipment	Range	CMC <sup>2, 4, 6</sup> ( $\pm$ )	Comments
Oscilloscopes <sup>3</sup> – Amplitude DC Signal			
50 $\Omega$ Load	0 V to $\pm$ 6.6 V	1.9 mV/V + 31 $\mu$ V	Fluke 5522A
1 M $\Omega$ Load	0 V to $\pm$ 130 V	0.39 mV/V + 31 $\mu$ V	
Amplitude Square Wave 10 Hz to 10 kHz			
50 $\Omega$ Load	1 mV to $\pm$ 6.0 V <sub>p-p</sub> 10 Hz to 10 kHz	2.1 mV/V + 31 $\mu$ V	Fluke 5522A
1 M $\Omega$ Load	1 mV to $\pm$ 200 V <sub>p-p</sub> 10 Hz to 10 kHz	0.78 mV/V + 31 $\mu$ V	
Bandwidth / Level Sine Flatness <sup>3</sup>	50 kHz to 100 MHz	2.9 %	Power meter & sensor with signal generator
	(100 to 300) MHz	3.1 %	
	(300 to 600) MHz	4.1 %	
	(600 to 1100) MHz	4.7 %	
	(1.1 to 3) GHz	3.9 %	
Time Marker	1 ns to 20 ms 50 ms to 5 s Non-cardinal point	2.5 $\mu$ s/s (19 + 38t) $\mu$ s/s 39 $\mu$ s/s	Fluke 5522A t = time in seconds
Rise Time – Generate	1 kHz to 2 MHz, (200 to 300) ps	19 ps	
	(2 to 10) MHz, (200 to 350) ps	19 ps	
Resistance	(40 to 60) $\Omega$ (0.6 to 1.5) M $\Omega$	0.79 m $\Omega$ / $\Omega$ 0.79 m $\Omega$ / $\Omega$	
DC Power – Generate <sup>3</sup> , PF = 1	0.01 mW to 337 W (0.01 to 3060) W (3060 to 20 910) W	0.018 % 0.017 % 0.057 %	Fluke 5520A

Parameter/Equipment	Range	CMC <sup>2,4,6</sup> (±)	Comments
AC Power – Generate <sup>3</sup> PF = (0 to 1) <sup>11</sup>			
(10 to 45) Hz	(33 to 329.99) mV		Fluke 5522A
(0.1089 to 2.9696) mW	(3.3 to 8.999) mA	0.15 %	
(0.297 to 10.8893) mW	(9 to 32.999) mA	0.15 %	
(1.089 to 29.6958) mW	(33 to 89.99) mA	0.040 %	
(2.97 to 108.8934) mW	(90 to 329.99) mA	0.040 %	
(10.89 to 296.958) mW	(330 to 899.9) mA	0.049 %	
(29.7 to 725.945) mW	(0.9 to 2.1999) A	0.052 %	
(72.6 to 1484.922) mW	(2.2 to 4.4999) A	0.064 %	
148.5 mW to 6.7648 W	(4.5 to 20.5) A	0.11 %	
	330 mV to 1020 V		
1.089 mW to 9.179 W	(3.3 to 8.999) mA	0.15 %	
2.97 mW to 33.659 W	(9 to 32.999) mA	0.15 %	
10.89 mW to 91.7898 W	(33 to 89.99) mA	0.044 %	
(0.0297 to 336.5898) W	(90 to 329.99) mA	0.044 %	
(0.1089 to 917.898) W	(330 to 899.9) mA	0.053 %	
(0.297 to 2243.898) W	(0.9 to 2.1999) A	0.056 %	
(0.726 to 4589.898) W	(2.2 to 4.4999) A	0.067 %	
1.485 W to 20.91 kW	(4.5 to 20.5) A	0.12 %	
(45 to 65) Hz	(33 to 329.999) mV		
(0.109 to 3.0) mW	(3.3 to 8.999) mA	0.23 %	
(0.297 to 10.89) mW	(9 to 32.999) mA	0.14 %	
(1.09 to 29.7) mW	(33 to 89.99) mA	0.11 %	
(3.0 to 108.9) mW	(90 to 329.99) mA	0.13 %	
(10.9 to 297) mW	(330 to 899.9) mA	0.10 %	
(29.7 to 726) mW	(0.9 to 2.1999) A	0.10 %	
72.6 mW to 1.5 W	(2.2 to 4.4999) A	0.11 %	
148.5 mW to 6.8 W	(4.5 to 20.5) A	0.10 %	
	330 mV to 1020 V		
1.09 mW to 9.2 W	(3.3 to 8.999) mA	0.34 %	
2.97 mW to 33.6 W	(9 to 32.999) mA	0.062 %	
10.9 mW to 91.8 W	(33 to 89.99) mA	0.094 %	
29.7 mW to 336.6 W	(90 to 329.99) mA	0.062 %	
108.9 mW to 918 W	(330 to 899.9) mA	0.086 %	
297 mW to 2244 W	(0.9 to 2.1999) A	0.071 %	
72.6 mW to 4590 W	(2.2 to 4.4999) A	0.098 %	
(1.49 to 20 910) W	(4.5 to 20.5) A	0.077 %	

Parameter/Equipment	Range	CMC <sup>2,4,6</sup> (±)	Comments
AC Power – Generate <sup>3</sup> PF = (0 to 1) <sup>11</sup> (cont)			
65 Hz to 1 kHz	(33 to 329.99) mV		Fluke 5522A
(0.109 to 3.0) mW	(3.3 to 8.999) mA	0.040 %	
(0.297 to 10.89) mW	(9 to 32.999) mA	0.040 %	
(1.09 to 29.7) mW	(33 to 89.99) mA	0.042 %	
(3.0 to 108.9) mW	(90 to 329.99) mA	0.039 %	
(10.9 to 297) mW	(330 to 899.9) mA	0.54 %	
(29.7 to 726) mW	(0.9 to 2.1999) A	0.053 %	
72.6 mW to 1.5 W	(2.2 to 4.4999) A	0.094 %	
148.5 mW to 6.8 W	(4.5 to 20.5) A	0.14 %	
	330 mV to 1020 V		
1.089 mW to 9.179 W	(3.3 to 8.999) mA	0.043 %	
2.97 mW to 33.659 W	(9 to 32.999) mA	0.043 %	
10.89 mW to 91.7898 W	(33 to 89.99) mA	0.045 %	
(0.0297 to 336.5898) W	(90 to 329.99) mA	0.042 %	
(0.0189 to 917.898) W	(330 to 899.9) mA	0.54 %	
(0.297 to 2243.898) W	(0.9 to 2.1999) A	0.055 %	
(0.726 to 4589.898) W	(2.2 to 4.4999) A	0.095 %	
1.485 W to 20.91 kW	(4.5 to 20.5) A	0.14 %	
(1 to 5) kHz	(33 to 329.99) mW		
(0.1089 to 2.9696) mW	(3.3 to 8.999) mA	0.13 %	
(0.297 to 10.8893) mW	(9 to 32.999) mA	0.13 %	
(1.089 to 29.6958) mW	(33 to 89.99) mA	0.15 %	
(2.97 to 108.8934) mW	(90 to 329.99) mA	0.15 %	
(10.89 to 296.958) mW	(330 to 899.9) mA	0.55 %	
(29.7 to 725.945) mW	(0.9 to 2.1999) A	0.50 %	
(72.6 to 1484.922) mW	(2.2 to 4.4999) A	0.15 %	
148.5 mW to 6.7648 W	(4.5 to 20.5) A	0.18 %	
	330 mV to 1020 V		
1.089 mW to 9.179 W	(3.3 to 8.999) mA	0.14 %	
2.97 mW to 33.659 W	(9 to 32.999) mA	0.14 %	
10.89 mW to 91.7898 W	(33 to 89.99) mA	0.15 %	
(0.0297 to 336.5898) W	(90 to 329.99) mA	0.15 %	
(0.1089 to 917.898) W	(330 to 899.9) mA	0.55 %	
(0.297 to 2243.898) W	(0.9 to 2.1999) A	0.51 %	
(0.726 to 4589.898) W	(2.2 to 4.4999) A	0.15 %	
1.485 W to 20.91 kW	(4.5 to 20.5) A	0.18 %	

Parameter/Equipment	Range	CMC <sup>2,4,6</sup> (±)	Comments
AC Power – Generate <sup>3</sup> PF = (0 to 1) <sup>11</sup> (cont)			
(5 to 10) kHz (0.1089 to 2.9696) mW (0.297 to 10.8893) mW (1.089 to 29.6958) mW (2.97 to 108.8934) mW (10.89 to 296.958) mW (29.7 to 725.945) mW (72.6 to 989.9667) mW	(33 to 329.99) mV (3.3 to 8.999) mA (9 to 32.999) mA (33 to 89.99) mA (90 to 329.99) mA (330 to 899.9) mA (0.9 to 2.1999) A (2.2 to 2.999 99) A	0.47 % 0.47 % 0.48 % 0.47 % 0.69 % 0.66 % 0.66 %	Fluke 5522A
1.089 mW to 9.179 W 2.97 mW to 33.659 W 10.89 mW to 91.7898 W 29.7 mW to 336.5898 W (0.1089 to 917.898) W (0.297 to 2243.898) W (0.726 to 3059.9898) W	330 mV to 1020 V (3.3 to 8.999) mA (9 to 32.999) mA (33 to 89.99) mA (90 to 329.99) mA (330 to 899.9) mA (0.9 to 2.1999) A (2.2 to 2.999 99) A	0.46 % 0.47 % 0.47 % 0.48 % 0.47 % 0.69 % 0.66 %	
(10 to 30) kHz (0.1089 to 2.9696) mW (0.297 to 10.8893) mW (1.089 to 29.6958) mW (2.97 to 108.8934) mW	(33 to 329.99) mV (3.3 to 8.999) mA (9 to 32.999) mA (33 to 89.99) mA (90 to 329.99) mA	1.8 % 1.8 % 1.8 % 1.8 %	
1.089 mW to 9.179 W 2.97 mW to 33.659 W 10.89 mW to 91.7898 W 29.7 mW to 336.5898 W	330 mV to 1020 V (3.3 to 8.999) mA (9 to 32.999) mA (33 to 89.99) mA (90 to 329.99) mA	1.8 % 1.8 % 1.8 % 1.8 %	
Power Supplies <sup>3</sup> –			
Ripple / Noise RMS - CV Ripple / Noise RMS - CC	Up to 1000 V Up to 50 A	59 μV/V 62 μA/A	Tektronix MDO3014 w/ load
Transient Response Time Voltage	Up to 5 ms Up to 1 V	12 mS/S 8.3 mV/V	Tektronix MDO3014 w/ load

III. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC <sup>2, 4, 6</sup> (±)	Comments
RF Power – Measure <sup>3</sup>  (-30 to +30) dBm (-70 to -30) dBm  (-10 to +20) dBm (-20 to -10) dBm	3 Hz to 100 kHz   100 kHz to 4.2 GHz	0.060 dB 0.091 dB  0.081 dB 0.080 dB	HP 33250A / 3458A  Power meter w/ power sensor: 8482A
RF Power – Generate <sup>3</sup>  (-56 to 27) dBm	DC to 5 MHz (>5 to 20) MHz	0.19 dB 0.35 dB	Tektronix AFG2021

IV. Mechanical

Parameter/Equipment	Range	CMC <sup>2, 6, 8</sup> (±)	Comments
Pressure <sup>3</sup> –  Hydraulic	(2 to 500) psig (200 to 10 000) psig	(0.040 + 0.000 076 <i>P</i> ) psi (0.0040 + 0.000 072 <i>P</i> ) psi	Pressurements W2200-3
	(3 to 500) psig (-14.5 to 0) psig (15 to 150) in·H <sub>2</sub> O	(0.0062 + 0.000 068 <i>P</i> ) psi (0.000 59 + 0.000 049 <i>P</i> ) psi 0.019 %	Pressurements T-3500/3 Pressurements T9000
Pneumatic	(-13.2 to 35) psia (-5 to 300) psia (0 to 3000) psia	0.010 % + 0.0041 psi 0.010 % + 0.026 psi 0.010 % + 0.24 psi	Fluke PM600 modules
	(0 to 1) in·H <sub>2</sub> O (1 to 10) in·H <sub>2</sub> O	(0.000 44 + 0.0024 <i>P</i> ) in·H <sub>2</sub> O (0.0053 + 0.000 85 <i>P</i> ) in·H <sub>2</sub> O	Ashcroft AQS-1 modules <i>P</i> is applied pressure

Parameter/Equipment	Range	CMC <sup>2, 6, 8</sup> (±)	Comments
Scales & Balances <sup>3</sup>	(1 to 50) mg	17 µg	Class S weights
	(50 to 100) mg	12 µg	
	(100 to 500) mg	29 µg	
	(0.5 to 2) g	44 µg	
	(2 to 3) g	83 µg	
	(3 to 5) g	56 µg	
	(5 to 10) g	60 µg	
	(10 to 50) g	0.15 mg	
	(50 to 100) g	0.30 mg	
	(100 to 200) g	0.67 mg	
	(200 to 300) g	0.95 mg	
	(300 to 500) g	1.6 mg	
	(0.5 to 1) kg	3.0 mg	
	(1 to 2) kg	6.3 mg	
	(2 to 3) kg	9.3 mg	
	(3 to 3.5) kg	14 mg	Class F weights
Up to 1 lb	0.000 089 lb		
(1 to 10) lb	0.000 89 lb		
(10 to 25) lb	0.0013 lb		
(25 to 100) lb	0.054 lb		
(100 to 250) lb	0.059 lb		
(250 to 500) lb	0.071 lb		
Tachometers –			
Optical	(55 to 200 000) RPM	0.0023 RPM	HP 3325 w/ LED
Mechanical	(55 to 750) RPM (>750 to 40 000) RPM	(0.080 + 0.000 91R) RPM (0.56 + 0.000 15R) RPM	GEC H8224-837837 monitored w/5335A & GPS; R is for the measured RPM
Torque Measure – Torque Wrenches & Tools <sup>3</sup>	(5 to 50) lbf·in (40 to 400) lbf·in (100 to 1000) lbf·in (25 to 250) lbf·ft (60 to 600) lbf·ft (5 to 50) ozf·in (15 to 200) ozf·in	0.30 % 0.30 % 0.46 % 0.43 % 0.65 % 0.61 % 0.31 %	CDI Display w/ 2000-400-02  CDI 2000-12-02 CDI 2000-04-02 CDI 2000-05-02



V. Thermodynamics

Parameter/Equipment	Range	CMC <sup>2,8</sup> (±)	Comments
Relative Humidity – Measure <sup>3</sup>	(20 to 90) % RH (90 to 95) % RH	1.3 % RH 2.4 % RH	Vaisala HMI-41 RH meter w/ HMP 46 probe
Temperature – Measuring Equipment <sup>3</sup>	(-30 to -5) °C (-5 to 100) °C (100 to 200) °C (200 to 660) °C  (0 to 100) °C	0.087 °C 0.077 °C 0.074 °C 0.27 °C  0.067 °C	RTD Hart 5628 w/readout: Hart 9011 Hart 7102 Hart 6102 Hart 9011  Thermistor 5665 w/readout, thermal bath
Temperature – Measure <sup>3</sup>	(-200 to 200) °C (200 to 420) °C (420 to 660) °C  (0 to 100) °C	0.060 °C 0.076 °C 0.12 °C  0.067 °C	RTD Hart 5628 w/readout   Thermistor 5665 w/readout
Infrared Temperature – Measuring Equipment <sup>3,9</sup>	(10 to 100) °C (100 to 120) °C  35 °C (>35 to 100) °C (100 to 200) °C (200 to 350) °C (350 to 500) °C	0.56 °C 0.65 °C  0.45 °C 0.57 °C 0.86 °C 1.4 °C 1.9 °C	Fluke 4180 $\epsilon = (0.9 \text{ to } 1)$ , $\lambda = (8 \text{ to } 14) \mu\text{m}$  Fluke 4181 $\epsilon = (0.9 \text{ to } 1)$ , $\lambda = (8 \text{ to } 14) \mu\text{m}$

VI. Time & Frequency

Parameter/Equipment	Range	CMC <sup>2,8</sup> (±)	Comments
Frequency – Measuring Equipment <sup>3</sup>	(0.001 to 1000) Hz 1000 Hz to 20 MHz  10 MHz to 3 GHz	0.17 mHz/Hz 0.18 nHz/Hz  0.17 nHz/Hz	GPS disciplined oscillator, Tektronix AFG2021  GPS disciplined oscillator, Keysight E4438C
Stopwatches & Timers <sup>3</sup>	(0 to 19.99) s/day	0.040 s/day	Timometer 4500

Parameter/Equipment	Range	CMC <sup>2,8</sup> (±)	Comments
Frequency – Measure <sup>3</sup>	0.001 Hz to 1 kHz (1 to 1000) kHz (1 to 225) MHz 225 MHz to 3 GHz	54 µHz/Hz 0.34 nHz/Hz 0.21 nHz/Hz 0.21 nHz/Hz	Agilent 5313XA OPT 3 w/ GPS

<sup>1</sup> This laboratory offers commercial 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. 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.

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

<sup>5</sup> In the statement of CMC,  $L$  is the numerical value of the nominal length of the device measured in inches;  $R$  is the resolution of the unit under test.

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

<sup>7</sup> This scope meets A2LA's *P112 Flexible Scope Policy*.

<sup>8</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>9</sup> Measurements made on calibrated blackbody source with an emissivity of 0.95 within the (8 to 14) µm spectral band.

<sup>10</sup> Measurement uncertainty at intermediate values is calculated using the Manufacturers Limits of Error Calculator

<sup>11</sup> Measurement uncertainty at PF other than 1 is calculated using the Manufacturers Guide in the Service Manual stating "Overall uncertainty for power output in Watts (or VARs) is based on the root sum square (rss) of the individual uncertainties in percent for the selected voltage, current, and power factor parameters.



# Accredited Laboratory

A2LA has accredited

**TEKTRONIX, INC.**

Charlotte, NC

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 the requirements of ANSI/NCSLI Z540.3-2006 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 31<sup>st</sup> day of January 2024.

A blue ink signature of Trace McInturff, written in a cursive style.

Mr. Trace McInturff, Vice President, Accreditation Services  
For the Accreditation Council  
Certificate Number 2357.20  
Valid to March 31, 2026

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