



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

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CALIBRATION

Valid To: May 31, 2019

Certificate Number: 1618.01

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

I. Dimensional

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Micrometers <sup>3</sup>	Up to 1 in (1 to 2) in (2 to 3) in (3 to 4) in (4 to 5) in (5 to 6) in (6 to 7) in (7 to 8) in (8 to 9) in (9 to 10) in (10 to 11) in (11 to 12) in (12 to 20) in	44 μin 53 μin 58 μin 67 μin 97 μin 99 μin 110 μin 110 μin 110 μin 110 μin 180 μin 190 μin 210 μin	Gage blocks
Length <sup>3</sup> –			
Rules	Up to 12 in (12 to 40) in (40 to 60) in	0.0091 in 0.0091 in 0.0091 in	Gage blocks or caliper checker
Tape Measures	Up to 25 ft	0.0091 in every 3 ft	Gage blocks or caliper checker

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Height Gages <sup>3</sup>	Up to 12 in Up to 36 in	240 μin 560 μin	Gage blocks or caliper checker
Calipers <sup>3</sup>	Up to 12 in (12 to 40) in	330 μin 600 μin	Gage blocks or caliper checker
Depth Gages <sup>3</sup>	Up to 1 in Up to 2 in Up to 3 in Up to 4 in Up to 5 in Up to 6 in Up to 7 in Up to 8 in Up to 9 in Up to 10 in Up to 11 in Up to 12 in	61 μin 67 μin 71 μin 86 μin 120 μin 120 μin 120 μin 120 μin 120 μin 120 μin 210 μin 210 μin	Gage blocks
Plug Gages/Pin Gages – Cylindrical OD <sup>3</sup>	Up to 1 in Up to 2 in Up to 3 in Up to 4 in Up to 5 in Up to 6 in Up to 7 in Up to 8 in Up to 10 in	22 μin 34 μin 37 μin 51 μin 57 μin 69 μin 77 μin 79 μin 84 μin	Gage blocks and Supermicrometer™
Dial and Test Indicators <sup>3</sup>	Up to 1 in Up to 2 in Up to 3 in Up to 4 in	60 μin 66 μin 73 μin 80 μin	Gage blocks
Cylindrical OD, Pin Sets <sup>3</sup>	Up to 1 in	60 μin	Laser micrometer

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Cylindrical ID, Ring Gages	Up to 1 in Up to 2 in Up to 3 in Up to 4 in Up to 5 in Up to 6 in (6 to 7) in Up to 8 in Up to 10 in	17 μin 31 μin 45 μin 58 μin 60 μin 65 μin 73 μin 74 μin 80 μin	Gage blocks, internal comparator, and linear amplifier
Squareness <sup>3</sup>	Up to 12 in	84 μin	Surface plate, master square, and linear amplifier
Outside Threads <sup>3</sup> – Major Diameter, Pitch Diameter	Up to 1 in Up to 2 in Up to 3 in Up to 4 in Up to 5 in Up to 6 in	50 μin 57 μin 61 μin 76 μin 78 μin 82 μin	Gage blocks, thread wires, and Supermicrometer <sup>TM</sup>

## II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC <sup>2, 4, 5</sup> (±)	Comments
DC Voltage <sup>3</sup> – Generate	10 V	0.50 μV/V	Fluke 732A
	(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	14 μV/V + 0.4 μV 5.5 μV/V + 0.7 μV 3.8 μV/V + 2.5 μV 3.8 μV/V + 4 μV 5.4 μV/V + 40 μV 7.4 μV/V + 400 μV	Fluke 5720A
	(1 to 30) kV	0.066 % + 7 μV	Hallmark PVD kilovolt divider and Agilent 34401A

Parameter/Equipment	Range	CMC <sup>2, 4, 5</sup> ( $\pm$ )	Comments
DC Voltage <sup>3</sup> – Measure	Up to 200 mV (0.2 to 2.0) V (2.0 to 20) V (20 to 200) V (200 to 1000) V	7.6 $\mu$ V/V + 0.1 $\mu$ V 3.7 $\mu$ V/V + 0.4 $\mu$ V 3.6 $\mu$ V/V + 4 $\mu$ V 5.6 $\mu$ V/V + 40 $\mu$ V 5.5 $\mu$ V/V + 500 $\mu$ V	Fluke 8508A
	10 V	0.50 $\mu$ V/V	Fluke 732A DC voltage reference and Fluke 8508A
DC Voltage <sup>3</sup> – Measure, Compare	(1 to 100) kV	0.033 % + 0.7 V	Hallmark PVD kilovolt divider and Agilent 34401A
DC Current <sup>3, 6</sup> – Generate	(0 to 2) pA (2 to 20) pA (20 to 200) pA 200 pA to 2 nA (2 to 20) nA	2.4 % + 0.02 pA 0.64 % + 0.02 pA 0.27 % + 0.04 pA 0.11 % + 0.13 nA 0.090 % + 1.1 pA	Keithly 263
	(20 to 220) $\mu$ A 220 $\mu$ A to 2.2 mA (2.2 to 22) mA (22 to 220) mA 220 mA to 2.2 A	40 $\mu$ A/A + 6 nA 35 $\mu$ A/A + 7 nA 35 $\mu$ A/A + 40 nA 45 $\mu$ A/A + 0.7 $\mu$ A 80 $\mu$ A/A + 12 $\mu$ A	Fluke 5720A
	(10 to 100) $\mu$ A 100 $\mu$ A to 10 mA 10 mA to 1 A (1 to 10) A (10 to 15) A	0.0035 % + 0.4 nA 0.0035 % + 4 nA 0.0036 % + 0.4 $\mu$ A 0.0036 % + 4 $\mu$ A 0.012 % + 0.1 mA	Standard resistor, Fluke 8508A, and Fluke 5520A
	(15 to 100) A (100 to 300) A	0.042 % + 0.1 mA 0.042 % + 0.1 mA	Standard shunt, Fluke 8508A, Ballantine 1620A, and Fluke 5720A
	(20 to 54.9995) A (55 to 149.9995) A (150 to 549.995) A (550 to 1025) A	1.2 % 0.79 % 0.87 % 0.65 %	Fluke 5500A/Coil and 5520A
	(1 to 200) pA (0.201 to 2) nA (2.01 to 200) nA (0.201 to 20) $\mu$ A	0.34 % 0.062 % 0.049 % 0.0080 %	Fluke 5720A and standard resistors

Parameter/Equipment	Range	CMC <sup>2, 4, 5</sup> ( $\pm$ )	Comments
DC Current <sup>3, 6-</sup> Measure	(0 to 200) $\mu$ A (0.2 to 2.0) mA (2.0 to 20) mA (20 to 200) mA 20 mA to 2 A	13 $\mu$ A/A + 0.4 nA 13 $\mu$ A/A + 4 nA 15 $\mu$ A/A + 40 nA 50 $\mu$ A/A + 0.8 $\mu$ A 0.019 % + 16 $\mu$ A	Fluke 8508A
	(10 to 100) $\mu$ A 100 $\mu$ A to 10 mA 10 mA to 1 A (1 to 10) A	0.0032 % IV + 0.4 nA 0.0032 % IV + 4 nA 0.0032 % IV + 0.4 $\mu$ A 0.0032 % IV + 4 $\mu$ A	L&N 4000 series, Biddle Cat. # 601235, and Fluke 8508A
	(10 to 15) A	0.014 % IV + 0.1 mA	L&N 4360 shunt w/ Fluke 8508A
	(15 to 100) A	0.029 % IV + 0.1 mA	L&N 4361 shunt w/ Fluke 8508A
	(100 to 300) A	0.046 % IV + 0.1 mA	L&N 4363 shunt w/ Fluke 8508A
Capacitance <sup>3, 6-</sup> Measure, @ 1 kHz	(10, 100, 1000) pF	0.012 % IV	General radio 1615-A, general radio 1404 series, and ESI SC 1000 standard capacitors
	1 pF to 1 $\mu$ F	0.012 % IV	General radio 1615-A
Capacitance <sup>3, 6-</sup> Generate, @ 1 kHz	(10, 100, 1000) pF	0.0018 % IV	General radio 1404 series and ESI SC 1000 standard capacitors
	1 pF to 1 $\mu$ F	0.053 % IV + 0.7 pF	General radio 1413 decade capacitor

Parameter/Equipment	Range	CMC <sup>2, 4, 5</sup> ( $\pm$ )	Comments
Resistance <sup>3</sup> – Measure	(0.1 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 $\Omega$	20 $\mu\Omega/\Omega$ + 4 $\mu\Omega$ 11 $\mu\Omega/\Omega$ + 14 $\mu\Omega$ 8.4 $\mu\Omega/\Omega$ + 50 $\mu\Omega$ 8.3 $\mu\Omega/\Omega$ + 0.5 m $\Omega$ 8.3 $\mu\Omega/\Omega$ + 5 m $\Omega$ 8.6 $\mu\Omega/\Omega$ + 50 m $\Omega$ 11 $\mu\Omega/\Omega$ + 1 $\Omega$ 24 $\mu\Omega/\Omega$ + 100 $\Omega$ 0.014 % + 10 k $\Omega$	Fluke 8508A
Fixed Points	0.01 $\Omega$ 0.001 $\Omega$ 0.0001 $\Omega$	82 $\mu\Omega/\Omega$ 0.011 % 0.019 %	Fluke 8508A, Guildline 1659, Biddle #601235, and L&N 4334B standard resistors
Shunts	50 $\mu\Omega$ to 0.01 $\Omega$	97 $\mu\Omega/\Omega$	Fluke 8508A, Agilent 34401A, and L&N 4361 standard shunt
Resistance <sup>3</sup> – Generate	(0.1 to 10) $\Omega$ 10 $\Omega$ to 1 k $\Omega$ (1 to 100) k $\Omega$ 100 k $\Omega$ to 10 M $\Omega$ (10 to 100) M $\Omega$	44 $\mu\Omega/\Omega$ 42 $\mu\Omega/\Omega$ 42 $\mu\Omega/\Omega$ 42 $\mu\Omega/\Omega$ 44 $\mu\Omega/\Omega$	Thomas 1 $\Omega$ , ESI SR104 and SR 1010 standard resistors  ESI SR104, ESI SR1010, and ESI SR1050 standard resistors
Fixed Points	0.1 $\Omega$ 0.01 $\Omega$ 0.001 $\Omega$ 0.0001 $\Omega$ 1 $\Omega$	78 $\mu\Omega/\Omega$ 41 $\mu\Omega/\Omega$ 84 $\mu\Omega/\Omega$ 0.033 % 4.7 $\mu\Omega/\Omega$	Biddle Cat. #601235 standard resistor, Guildline type 1659 standard resistor, and L&N 4334B standard resistor
Inductance <sup>3</sup> – Generate, @ 1 kHz	100 $\mu\text{H}$ to 10 H	0.031 % IV	General radio 1482 series standard inductors and DT72A ratio transformer
Inductance <sup>3</sup> – Measure, @ 1 kHz	100 $\mu\text{H}$ to 10 H	0.026 % IV	General radio 1482 standard inductor and ESI DT 72A

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Electrical Simulation Thermocouple Indicators <sup>3</sup> –			
Type B	(600 to 800) °C (800 to 1000) °C (1000 to 1550) °C (1550 to 1820) °C	0.47 °C 0.37 °C 0.34 °C 0.36 °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	0.34 °C 0.30 °C 0.35 °C 0.52 °C 0.86 °C	
Type E	(-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C	0.52 °C 0.22 °C 0.20 °C 0.22 °C 0.26 °C	
Type J	(-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1200) °C	0.31 °C 0.22 °C 0.20 °C 0.23 °C 0.28 °C	
Type K	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.36 °C 0.23 °C 0.22 °C 0.32 °C 0.43 °C	
Type L	(-200 to -100) °C (-100 to 800) °C (800 to 900) °C	0.40 °C 0.30 °C 0.23 °C	
Type N	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1300) °C	0.43 °C 0.27 °C 0.24 °C 0.23 °C 0.31 °C	
Type R	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.59 °C 0.38 °C 0.36 °C 0.43 °C	

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Electrical Simulation Thermocouple Indicators <sup>3</sup> – (cont)			
Type S	(0 to 250) °C (250 to 1000) °C (1000 to 1400) °C (1400 to 1767) °C	0.50 °C 0.39 °C 0.40 °C 0.49 °C	Fluke 5520A
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.65 °C 0.28 °C 0.22 °C 0.20 °C	
Type U	(-200 to 0) °C (0 to 600) °C	0.58 °C 0.31 °C	
Electrical Simulation 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	0.10 °C 0.10 °C 0.14 °C 0.18 °C 0.20 °C 0.24 °C 0.46 °C	Fluke 5520A
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	0.08 °C 0.08 °C 0.08 °C 0.10 °C 0.24 °C 0.26 °C 0.28 °C 0.32 °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 (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.08 °C 0.10 °C 0.10 °C 0.12 °C 0.16 °C 0.16 °C 0.18 °C 0.22 °C	



Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Electrical Simulation RTD Indicators <sup>3</sup> – (cont)			
Pt 385, 1 kΩ	(-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	0.06 °C 0.06 °C 0.08 °C 0.10 °C 0.12 °C 0.14 °C 0.14 °C 0.46 °C	Fluke 5520A
PtNi 385, 120 Ω	(-80 to 0) °C (0 to 100) °C (100 to 260) °C	0.16 °C 0.16 °C 0.28 °C	
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	0.10 °C 0.10 °C 0.14 °C 0.18 °C 0.20 °C 0.24 °C	
Cu 427, 10 Ω	(600 to 630) °C	0.60 °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	0.50 °C 0.08 °C 0.10 °C 0.12 °C 0.14 °C 0.16 °C 0.18 °C 0.20 °C 0.46 °C	

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Electrical Simulation and Measure Thermocouple Indicators <sup>3</sup> –			
Type B	(40 to 100) °C (100 to 260) °C (260 to 500) °C (500 to 700) °C (700 to 1100) °C (1100 to 1500) °C (1500 to 1820) °C	0.14 °C 0.047 °C 0.028 °C 0.024 °C 0.017 °C 0.014 °C 0.016 °C	Fluke 8508A
Type C	(0 to 100) °C (100 to 400) °C (400 to 1000) °C (1000 to 1500) °C (1500 to 1700) °C (1700 to 2000) °C (2000 to 2320) °C	0.011 °C 0.010 °C 0.011 °C 0.016 °C 0.018 °C 0.022 °C 0.031 °C	
Type E	(-270 to -200) °C (-200 to -100) °C (-100 to 100) °C (100 to 700) °C (700 to 1000) °C	0.013 °C 0.0070 °C 0.0060 °C 0.0070 °C 0.0090 °C	
Type J	(-210 to -100) °C (-100 to 500) °C (500 to 900) °C (900 to 1100) °C (1100 to 1200) °C	0.0070 °C 0.0060 °C 0.0070 °C 0.0080 °C 0.010 °C	
Type K	(-270 to -150) °C (-150 to 500) °C (500 to 1100) °C (1100 to 1200) °C (1200 to 1372) °C	0.049 °C 0.0070 °C 0.0080 °C 0.010 °C 0.013 °C	
Type L	(-200 to 0) °C (-0 to 100) °C (100 to 700) °C (700 to 900) °C	0.0070 °C 0.0060 °C 0.0070 °C 0.0080 °C	

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Electrical Simulation and Measure Thermocouple Indicators <sup>3</sup> – (cont)			
Type N	(-270 to -250) °C (-250 to -150) °C (-150 to 0) °C (0 to 900) °C (900 to 1100) °C (1100 to 1300) °C	0.14 °C 0.015 °C 0.0080 °C 0.0070 °C 0.0090 °C 0.011 °C	Fluke 8508A
Type R	(-50 to 0) °C (0 to 100) °C (100 to 900) °C (900 to 1300) °C (1300 to 1768) °C	0.028 °C 0.021 °C 0.015 °C 0.013 °C 0.017 °C	
Type S	(-50 to 0) °C (0 to 100) °C (100 to 1300) °C (1300 to 1768) °C	0.028 °C 0.021 °C 0.015 °C 0.018 °C	
Type T	(-270 to -250) °C (-250 to -200) °C (-200 to -100) °C (-100 to 100) °C (100 to 250) °C (250 to 300) °C (300 to 350) °C (350 to 400) °C	0.070 °C 0.029 °C 0.0080 °C 0.0070 °C 0.0060 °C 0.0070 °C 0.0060 °C 0.0070 °C	
Type U	(-200 to -150) °C (-150 to -50) °C (-50 to 250) °C (250 to 600) °C	0.0090 °C 0.0070 °C 0.0060 °C 0.0070 °C	

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Electrical Simulation and Measure RTD Indicators <sup>3</sup> –			
Pt 385, 100 Ω	(-200 to -40) °C (-40 to 150) °C (150 to 260) °C (260 to 400) °C (400 to 500) °C (500 to 700) °C (700 to 800) °C (800 to 850) °C	0.0060 °C 0.0070 °C 0.0080 °C 0.0090 °C 0.012 °C 0.013 °C 0.014 °C 0.016 °C	Fluke 8508A
Pt 3926, 100 Ω	(-200 to -40) °C (-40 to 150) °C (150 to 260) °C (260 to 400) °C (400 to 600) °C (600 to 660) °C	0.0060 °C 0.0070 °C 0.0080 °C 0.0090 °C 0.012 °C 0.013 °C	
Pt 3916, 100 Ω	(-200 to -40) °C (-40 to 150) °C (150 to 260) °C (260 to 400) °C (400 to 600) °C (600 to 660) °C	0.0060 °C 0.0070 °C 0.0080 °C 0.0090 °C 0.012 °C 0.013 °C	
Pt 385, 200 Ω	(-200 to -20) °C (-20 to 100) °C (100 to 200) °C (200 to 300) °C (300 to 400) °C (400 to 500) °C (500 to 700) °C (700 to 850) °C	0.0060 °C 0.0070 °C 0.0080 °C 0.0090 °C 0.010 °C 0.011 °C 0.012 °C 0.014 °C	
Pt 385, 500 Ω	(-200 to -50) °C (-50 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 500) °C (500 to 700) °C (700 to 850) °C	0.0060 °C 0.0070 °C 0.0080 °C 0.010 °C 0.011 °C 0.012 °C 0.014 °C	

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Electrical Simulation and Measure RTD Indicators <sup>3</sup> – (cont)			
Pt 385, 1 kΩ	(-200 to -50) °C (-50 to 100) °C (100 to 200) °C (200 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 700) °C (700 to 850) °C	0.0060 °C 0.0070 °C 0.0080 °C 0.010 °C 0.011 °C 0.012 °C 0.014 °C 0.016 °C	Fluke 8508A
PtNi 385, 120 Ω	(-80 to 90) °C (90 to 260) °C	0.0060 °C 0.0070 °C	
Cu 427, 10 Ω	(-190 to -100) °C (-100 to 50) °C (50 to 260) °C	0.0060 °C 0.0070 °C 0.0080 °C	
YSI, 400 Ω	(15 to 50) °C	0.0060 °C	

Parameter/Range	Frequency	CMC <sup>2, 4, 5</sup> (±)	Comments
AC Current – Measure <sup>3, 6</sup>			
Up to 200 μA	10 Hz to 10 kHz	0.036 % + 20 nA	Fluke 8508A
200 μA to 2 mA	10 Hz to 10 kHz	0.031 % + 0.2 μA	
(2 to 20) mA	10 Hz to 10 kHz	0.032 % + 2 μA	
(20 to 200) mA	10 Hz to 10 kHz	0.03 % + 20 μA	
200 mA to 2 A	10 Hz to 2 kHz (2 to 10) kHz	0.073 % + 0.2 mA 0.063 % + 0.2 mA	
(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	0.012 % + 0.2 μA 0.012 % + 0.2 μA 80 μA/A + 0.2 μA 0.010 % + 0.2 μA 0.010 % + 0.2 μA	Fluke A40 shunts, Fluke 5720A, and 8508A
(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	0.012 % + 2 μA 0.012 % + 2 μA 90 μA/A + 2 μA 0.010 % + 2 μA 0.010 % + 2 μA	

Parameter/Range	Frequency	CMC <sup>2, 4, 5</sup> ( $\pm$ )	Comments
AC Current – Measure <sup>3, 6</sup> (cont)			
220 mA to 2.2 A	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.015 % + 20 $\mu$ A 0.015 % + 20 $\mu$ A 0.012 % + 20 $\mu$ A 0.013 % + 20 $\mu$ A 0.013 % + 20 $\mu$ A	Fluke A40 shunts, Fluke 5720A, and 8508A
(2 to 10) A	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.065 % + 0.2 mA 0.064 % + 0.2 mA 0.064 % + 0.2 mA 0.064 % + 0.2 mA 0.064 % + 0.2 mA	
(10 to 20) A	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.069 % + 0.2 mA 0.068 % + 0.2 mA 0.068 % + 0.2 mA 0.068 % + 0.2 mA 0.068 % + 0.2 mA	
(10 to 100) A	60 Hz	0.045 % + 2 mA	L&N 4361 shunt, Fluke 8508A
(100 to 300) A	60 Hz	0.078 % + 2 mA	L&N 4363 shunt, Fluke 8508A

Parameter/Range	Frequency	CMC <sup>2, 4, 5</sup> ( $\pm$ )	Comments
AC Current – Generate <sup>3, 6</sup>			
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	0.025 % + 16 nA 0.016 % + 10 nA 0.012 % + 8 nA 0.028 % + 12 nA 0.11 % + 65 nA	Fluke 5720A, Fluke A40 AC shunts, and 8508A
220 $\mu$ A 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	0.025 % + 40 nA 0.016 % + 35 nA 0.012 % + 35 nA 0.020 % + 110 nA 0.11 % + 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	0.025 % + 400 nA 0.016 % + 350 nA 0.012 % + 350 nA 0.020 % + 500 nA 0.11 % + 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	0.025 % + 4 $\mu$ A 0.016 % + 3.5 $\mu$ A 0.012 % + 2.5 $\mu$ A 0.020 % + 3.5 $\mu$ A 0.11 % + 10 $\mu$ A	
220 mA to 2.2 A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.026 % + 35 $\mu$ A 0.045 % + 80 $\mu$ A 0.70 % + 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	0.014 % + 0.2 $\mu$ A 0.014 % + 0.2 $\mu$ A 0.011 % + 0.2 $\mu$ A 0.013 % + 0.2 $\mu$ A 0.013 % + 0.2 $\mu$ 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	0.014 % + 2 $\mu$ A 0.017 % + 2 $\mu$ A 0.011 % + 2 $\mu$ A 0.013 % + 2 $\mu$ A 0.013 % + 2 $\mu$ A	
(220 to 2.2) A	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.017 % + 20 $\mu$ A 0.016 % + 20 $\mu$ A 0.014 % + 20 $\mu$ A 0.016 % + 20 $\mu$ A 0.016 % + 20 $\mu$ A	

Parameter/Range	Frequency	CMC <sup>2, 4, 5</sup> (±)	Comments
AC Current – Generate <sup>3, 6</sup> (cont)			
(2 to 10) A	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.065 % + 0.2 mA 0.064 % + 0.2 mA 0.064 % + 0.2 mA 0.064 % + 0.2 mA 0.064 % + 0.2 mA	Fluke A40 AC shunts, 5720A, 5220A, and 8508A
(10 to 100) A	45 Hz to 1 kHz	0.60 %	Fluke 5720A and Ballentine AC current calibrator
(20 to 34.999) A	(45 to 65) Hz (66 to 400) Hz	1.8 % 2.3 %	
(35 to 49.999) A	(45 to 65) Hz (66 to 400) Hz	1.3 % 1.7 %	
(50 to 54.9995) A	(45 to 65) Hz (66 to 400) Hz	1.1 % 1.5 %	
(55 to 99.995) A	(45 to 65) Hz (66 to 400) Hz	1 % 1.5 %	
(100 to 144.995) A	(45 to 65) Hz (66 to 400) Hz	0.85 % 1.3 %	Fluke 5520A w/ 5500A/Coil
(145 to 149.9995) A	(45 to 65) Hz (66 to 400) Hz	0.77 % 1.2 %	
(150 to 299.995) A	(45 to 65) Hz (66 to 400) Hz	1.2% 1.6%	
(300 to 549.995) A	(45 to 65) Hz (66 to 400) Hz	0.9 % 1.3 %	
(550 to 749.995) A	(45 to 65) Hz (66 to 400) Hz	0.79 % 1.2 %	
(750 to 1025) A	(45 to 65) Hz	0.74 %	
(750 to 850) A	(66 to 400) Hz	1.2 %	
(851 to 1025) A	(66 to 300) Hz	1.1 %	



Parameter/Range	Frequency	CMC <sup>2, 4, 5</sup> (±)	Comments
AC Voltage – Measure, Fixed Points <sup>3</sup>	10 mV	10 Hz	Fluke 792A and 5720A
		20 Hz	
		40 Hz	
		100 Hz	
		1 kHz	
		10 kHz	
		20 kHz	
		50 kHz	
		100 kHz	
		300 kHz	
		500 kHz	
		800 kHz	
		1 MHz	
	20 mV	10 Hz	0.022 %
		20 Hz	0.011 %
		40 Hz	0.011 %
		100 Hz	0.011 %
		1 kHz	79 μV/V
		10 kHz	0.017 %
		20 kHz	73 μV/V
		50 kHz	88 μV/V
		100 kHz	0.024 %
		300 kHz	0.027 %
		500 kHz	0.042 %
		800 kHz	0.048 %
		1 MHz	0.041 %
	60 mV	10 Hz	0.018 %
		20 Hz	0.021 %
		40 Hz	64 μV/V
		100 Hz	56 μV/V
		1 kHz	47 μV/V
		10 kHz	55 μV/V
		20 kHz	0.016 %
50 kHz		41 μV/V	
100 kHz		47 μV/V	
300 kHz		0.021 %	
500 kHz		0.20 %	
800 kHz		0.29 %	
1 MHz		0.33 %	

Parameter/Range	Frequency	CMC <sup>2, 4, 5</sup> (±)	Comments	
AC Voltage – Measure, Fixed Points <sup>3</sup> (cont)	100 mV	10 Hz	0.38 %	Fluke 792A and 5720A
		20 Hz	41 μV/V	
		40 Hz	44 μV/V	
		100 Hz	34 μV/V	
		1 kHz	29 μV/V	
		10 kHz	23 μV/V	
		20 kHz	27 μV/V	
		50 kHz	25 μV/V	
		100 kHz	44 μV/V	
		300 kHz	86 μV/V	
		500 kHz	0.016 %	
		800 kHz	0.019 %	
		1 MHz	0.023 %	
	200 mV	10 Hz	0.011 %	
		20 Hz	39 μV/V	
		40 Hz	28 μV/V	
		100 Hz	20 μV/V	
		1 kHz	23 μV/V	
		10 kHz	19 μV/V	
		20 kHz	21 μV/V	
		50 kHz	25 μV/V	
		100 kHz	36 μV/V	
		300 kHz	76 μV/V	
		500 kHz	0.014 %	
		800 kHz	0.019 %	
		1 MHz	0.019 %	
	600 mV	10 Hz	62 μV/V	
		20 Hz	62 μV/V	
		40 Hz	78 μV/V	
		100 Hz	0.011 %	
		1 kHz	26 μV/V	
		10 kHz	20 μV/V	
		20 kHz	15 μV/V	
50 kHz		19 μV/V		
100 kHz		22 μV/V		
300 kHz		21 μV/V		
500 kHz		18 μV/V		
800 kHz		14 μV/V		
1 MHz		30 μV/V		

Parameter/Range	Frequency	CMC <sup>2, 4, 5</sup> (±)	Comments	
AC Voltage – Measure, Fixed Points <sup>3</sup> (cont)	1 V	10 Hz	0.013 %	Fluke 792A and 5720A
		20 Hz	27 μV/V	
		40 Hz	19 μV/V	
		100 Hz	14 μV/V	
		1 kHz	18 μV/V	
		10 kHz	9.0 μV/V	
		20 kHz	9.0 μV/V	
		50 kHz	14 μV/V	
		100 kHz	26 μV/V	
		300 kHz	69 μV/V	
		500 kHz	86 μV/V	
		800 kHz	86 μV/V	
		1 MHz	86 μV/V	
	2 V	10 Hz	66 μV/V	
		20 Hz	27 μV/V	
		40 Hz	25 μV/V	
		100 Hz	19 μV/V	
		1 kHz	14 μV/V	
		10 kHz	10 μV/V	
		20 kHz	10 μV/V	
		50 kHz	13 μV/V	
		100 kHz	19 μV/V	
		300 kHz	48 μV/V	
		500 kHz	49 μV/V	
		800 kHz	51 μV/V	
		1 MHz	63 μV/V	
	6 V	10 Hz	63 μV/V	
		20 Hz	55 μV/V	
		40 Hz	18 μV/V	
		100 Hz	18 μV/V	
		1 kHz	12 μV/V	
		10 kHz	9 μV/V	
		20 kHz	9 μV/V	
		50 kHz	12 μV/V	
		100 kHz	14 μV/V	
		300 kHz	38 μV/V	
500 kHz		34 μV/V		
800 kHz		40 μV/V		
1 MHz		89 μV/V		

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments	
AC Voltage – Measure, Fixed Points <sup>3</sup> (cont)	10 V	10 Hz	87 µV/V	Fluke 792A and 5720A
		20 Hz	31 µV/V	
		40 Hz	24 µV/V	
		100 Hz	19 µV/V	
		1 kHz	12 µV/V	
		10 kHz	9.0 µV/V	
		20 kHz	9.0 µV/V	
		50 kHz	11 µV/V	
		100 kHz	14 µV/V	
		300 kHz	36 µV/V	
		500 kHz	40 µV/V	
		800 kHz	61 µV/V	
		1 MHz	86 µV/V	
	20 V	10 Hz	69 µV/V	
		20 Hz	28 µV/V	
		40 Hz	24 µV/V	
		100 Hz	20 µV/V	
		1 kHz	14 µV/V	
		10 kHz	10 µV/V	
		20 kHz	10 µV/V	
		50 kHz	13 µV/V	
		100 kHz	17 µV/V	
		300 kHz	39 µV/V	
		500 kHz	42 µV/V	
		800 kHz	1.0 µV/V	
		1 MHz	86 µV/V	
	60 V	10 Hz	70 µV/V	
		20 Hz	31 µV/V	
		40 Hz	26 µV/V	
		100 Hz	20 µV/V	
		1 kHz	14 µV/V	
		10 kHz	11 µV/V	
		20 kHz	11 µV/V	
		50 kHz	13 µV/V	
		100 kHz	15 µV/V	
		300 kHz	55 µV/V	

Parameter/Range	Frequency	CMC <sup>2, 4, 5</sup> ( $\pm$ )	Comments
AC Voltage – Measure, Fixed Points <sup>3</sup> (cont)			
100 V	10 Hz	93 $\mu$ V/V	Fluke 792A and 5720A
	20 Hz	33 $\mu$ V/V	
	40 Hz	25 $\mu$ V/V	
	100 Hz	14 $\mu$ V/V	
	1 kHz	13 $\mu$ V/V	
	10 kHz	11 $\mu$ V/V	
	20 kHz	12 $\mu$ V/V	
	50 kHz	22 $\mu$ V/V	
	100 kHz	32 $\mu$ V/V	
200 V	10 Hz	72 $\mu$ V/V	Fluke 792A, 5720A, and 5205A
	20 Hz	28 $\mu$ V/V	
	40 Hz	25 $\mu$ V/V	
	100 Hz	14 $\mu$ V/V	
	1 kHz	14 $\mu$ V/V	
	10 kHz	11 $\mu$ V/V	
	20 kHz	13 $\mu$ V/V	
	50 kHz	27 $\mu$ V/V	
	100 kHz	48 $\mu$ V/V	
600 V	20 Hz	48 $\mu$ V/V	High voltage divider and Agilent 34401A
	40 Hz	30 $\mu$ V/V	
	100 Hz	22 $\mu$ V/V	
	1 kHz	18 $\mu$ V/V	
	10 kHz	15 $\mu$ V/V	
	20 kHz	16 $\mu$ V/V	
	50 kHz	34 $\mu$ V/V	
	100 kHz	64 $\mu$ V/V	
	1000 V	20 Hz	
40 Hz		31 $\mu$ V/V	
100 Hz		23 $\mu$ V/V	
1 kHz		22 $\mu$ V/V	
10 kHz		19 $\mu$ V/V	
20 kHz		22 $\mu$ V/V	
50 kHz		42 $\mu$ V/V	
100 kHz		67 $\mu$ V/V	
(1 to 30) kV		60 Hz	0.50 % IV + 3 V

Parameter/Range	Frequency	CMC <sup>2, 4, 5</sup> (±)	Comments	
AC Voltage – Generate, Fixed Points <sup>3</sup>	10 mV	10 Hz	0.037 %	Fluke 792A and 5720A
		20 Hz	0.016 %	
		40 Hz	0.018 %	
		100 Hz	0.018 %	
		1 kHz	0.015 %	
		10 kHz	0.020 %	
		20 kHz	0.013 %	
		50 kHz	0.024 %	
		100 kHz	0.056 %	
		300 kHz	0.17 %	
		500 kHz	0.55 %	
		800 kHz	0.86 %	
		1 MHz	0.86 %	
	20 mV	10 Hz	0.050 %	
		20 Hz	0.046 %	
		40 Hz	0.031 %	
		100 Hz	0.030 %	
		1 kHz	0.030 %	
		10 kHz	0.033 %	
		20 kHz	0.029 %	
		50 kHz	0.041 %	
		100 kHz	0.079 %	
		300 kHz	0.16 %	
		500 kHz	0.25 %	
		800 kHz	0.38 %	
		1 MHz	0.38 %	
	60 mV	10 Hz	0.049 %	
		20 Hz	0.045 %	
		40 Hz	0.022 %	
		100 Hz	0.021 %	
		1 kHz	0.021 %	
		10 kHz	0.025 %	
		20 kHz	0.021 %	
50 kHz		0.032 %		
100 kHz		0.078 %		
300 kHz		0.19 %		
500 kHz		0.19 %		
800 kHz		0.35 %		
1 MHz		0.35 %		

Parameter/Range	Frequency	CMC <sup>2, 4, 5</sup> (±)	Comments	
AC Voltage – Generate, Fixed Points <sup>3</sup> (cont)	100 mV	10 Hz	0.041 %	Fluke 792A and 5720A
		20 Hz	0.037 %	
		40 Hz	0.017 %	
		100 Hz	0.016 %	
		1 kHz	0.016 %	
		10 kHz	0.016 %	
		20 kHz	0.016 %	
		50 kHz	0.028 %	
		100 kHz	0.064 %	
		300 kHz	0.11 %	
		500 kHz	0.17 %	
		800 kHz	0.32 %	
		1 MHz	0.32 %	
	200 mV	10 Hz	0.032 %	
		20 Hz	0.031 %	
		40 Hz	0.013 %	
		100 Hz	0.012 %	
		1 kHz	0.012 %	
		10 kHz	0.012 %	
		20 kHz	0.012 %	
		50 kHz	0.024 %	
		100 kHz	0.055 %	
		300 kHz	0.11 %	
		500 kHz	0.16 %	
		800 kHz	0.30 %	
		1 MHz	0.30 %	
	600 mV	10 Hz	0.033 %	
		20 Hz	0.031 %	
		40 Hz	0.012 %	
		100 Hz	0.010 %	
		1 kHz	0.010 %	
		10 kHz	0.010 %	
		20 kHz	0.010 %	
		50 kHz	0.022 %	
		100 kHz	0.051 %	
		300 kHz	0.11 %	
500 kHz		0.18 %		
800 kHz		0.32 %		
1 MHz		0.32 %		

Parameter/Range	Frequency	CMC <sup>2, 4, 5</sup> (±)	Comments	
AC Voltage – Generate, Fixed Points <sup>3</sup> (cont)	1 V	10 Hz	0.031 %	Fluke 792A and 5720A
		20 Hz	0.029 %	
		40 Hz	0.011 %	
		100 Hz	89 µV/V	
		1 kHz	90 µV/V	
		10 kHz	89 µV/V	
		20 kHz	89 µV/V	
		50 kHz	0.021 %	
		100 kHz	0.050 %	
		300 kHz	0.099 %	
		500 kHz	0.16 %	
		800 kHz	0.30 %	
		1 MHz	0.30 %	
	2 V	10 Hz	0.027 %	
		20 Hz	0.027 %	
		40 Hz	0.011 %	
		100 Hz	86 µV/V	
		1 kHz	85 µV/V	
		10 kHz	85 µV/V	
		20 kHz	85 µV/V	
		50 kHz	0.021 %	
		100 kHz	0.048 %	
		300 kHz	0.095 %	
		500 kHz	0.15 %	
		800 kHz	0.29 %	
		1 MHz	0.29 %	
	6 V	10 Hz	0.032 %	
		20 Hz	0.032 %	
		40 Hz	0.012 %	
		100 Hz	56 µV/V	
		1 kHz	55 µV/V	
		10 kHz	54 µV/V	
		20 kHz	54 µV/V	
50 kHz		92 µV/V		
100 kHz		0.014 %		
300 kHz		0.038 %		
500 kHz		0.014 %		
800 kHz		0.21 %		
1 MHz		0.21 %		



Parameter/Range	Frequency	CMC <sup>2, 4, 5</sup> (±)	Comments	
AC Voltage – Generate, Fixed Points <sup>3</sup> (cont)	10 V	10 Hz	0.030 %	Fluke 792A and 5720A
		20 Hz	0.029 %	
		40 Hz	0.011 %	
		100 Hz	53 µV/V	
		1 kHz	51 µV/V	
		10 kHz	51 µV/V	
		20 kHz	51 µV/V	
		50 kHz	86 µV/V	
		100 kHz	0.013 %	
		300 kHz	0.034 %	
		500 kHz	0.12 %	
		800 kHz	0.19 %	
		1 MHz	0.19 %	
	20 V	10 Hz	0.027 %	
		20 Hz	0.027 %	
		40 Hz	0.010 %	
		100 Hz	52 µV/V	
		1 kHz	49 µV/V	
		10 kHz	49 µV/V	
		20 kHz	49 µV/V	
		50 kHz	81 µV/V	
		100 kHz	0.012 %	
		300 kHz	0.031 %	
		500 kHz	0.11 %	
		800 kHz	0.17 %	
		1 MHz	0.17 %	
	60 V	10 Hz	0.032 %	
		20 Hz	0.031 %	
		40 Hz	0.012 %	
		100 Hz	65 µV/V	
		1 kHz	64 µV/V	
		10 kHz	63 µV/V	
		20 kHz	63 µV/V	
		50 kHz	98 µV/V	
		100 kHz	0.02 %	
		300 kHz	0.12 %	

Parameter/Range	Frequency	CMC <sup>2, 4, 5</sup> (±)	Comments
AC Voltage – Generate, Fixed Points <sup>3</sup> (cont)			
100 V	10 Hz	0.030 %	Fluke 792A and 5720A
	20 Hz	0.029 %	
	40 Hz	0.011 %	
	100 Hz	60 µV/V	
	1 kHz	60 µV/V	
	10 kHz	59 µV/V	
	20 kHz	59 µV/V	
	50 kHz	93 µV/V	
	100 kHz	0.018 %	
200 V	10 Hz	0.027 %	Fluke 792A, 5720A, and 5205A
	20 Hz	0.027 %	
	40 Hz	0.011 %	
	100 Hz	57 µV/V	
	1 kHz	57 µV/V	
	10 kHz	56 µV/V	
	20 kHz	57 µV/V	
	50 kHz	89 µV/V	
	100 kHz	0.017 %	
600 V	20 Hz	0.033 %	Fluke 792A, 5720A, and 5205A
	40 Hz	0.033 %	
	100 Hz	79 µV/V	
	1 kHz	78 µV/V	
	10 kHz	0.044 %	
	20 kHz	0.044 %	
	50 kHz	0.089 %	
	100 kHz	0.12 %	
	1000 V	20 Hz	
40 Hz		0.032 %	
100 Hz		77 µV/V	
1 kHz		77 µV/V	
10 kHz		0.043 %	
20 kHz		0.043 %	
50 kHz		0.086 %	
100 kHz		0.12 %	
(1 to 6) kV		60 Hz	0.26 %

III. Electrical – RF/Microwave

Parameter/Equipment	Frequency	CMC <sup>2,5</sup> (±)	Comments
RF Power <sup>3</sup> – 1 mW	(1 to 1000) MHz	0.74 %	Agilent 478A-H75 and 34401A
RF Power Meter Display Accuracy, DC Substitution Method	3 μW to 100 mW	2.9 mW/W + 360 μW/W	Hewlett Packard 11683A range calibrator

IV. Mechanical

Parameter/Equipment	Range	CMC <sup>2,5</sup> (±)	Comments
Pressure – Measuring Equipment <sup>3</sup>			
Vacuum	(-15 to 0) psi	0.049 %	PTE-1, pressure calibrator
Pressure	(0 to 60) psi	0.047 %	PTE-1, pressure calibrator
	(0 to 500) psi	0.058 %	
Pressure	(0 to 1000) psi	0.16 %	Deadweight tester
	(1000 to 10 000) psi	0.16 %	
Pressure	(0 to 1) inH <sub>2</sub> O	0.077 %	PTE-1, pressure calibrator
	(0 to 5) inH <sub>2</sub> O	0.088 %	
	(0 to 50) inH <sub>2</sub> O	0.072 %	
Torque – Measuring Equipment <sup>3</sup>	(0 to 1000) ft·lbf	0.80 %	CDI torque calibrator

Parameter/Equipment	Range	CMC <sup>2, 5</sup> (±)	Comments
Scales and Balances <sup>3</sup>	(1, 2, 5, 10, 20, 50) mg (100, 200, 500) mg	0.012 mg 0.012 mg	ASTM Class 1 weights
	(1, 2, 5) g 10 g 20 g 30 g 50 g 100 g 200 g 300 g 500 g 1000 g  1.5 kg 2.0 kg 3.0 kg 7.221 kg	0.037 mg 0.056 mg 0.082 mg 0.13 mg 0.15 mg 0.29 mg 0.56 mg 0.83 mg 1.4 mg 2.8 mg  3.3 mg 6.2 mg 8.4 mg 13 mg	
Force <sup>3</sup> —			
Scales and Balance	1 lb 2 lb 5 lb 10 lb 20 lb 50 lb 250 lb  (0 to 500) lb (500 to 3000) lb	0.0055 oz 0.013 oz 0.012 oz 0.018 oz 0.041 oz 0.84 oz 0.24 oz  0.44 oz 2.6 oz	ASTM Class 6 weights  ASTM Class 6 weights transfer method
Load Cells	Up to 500 lb Up to 5 klb Up to 50 klb	0.15 % FS 0.15 % FS 0.16 % FS	Interface load cells

#### V. Thermodynamics

Parameter/Equipment	Range	CMC <sup>2, 5</sup> (±)	Comments
Relative Humidity – Measure <sup>3</sup>	(10 to 90) % RH (91 to 100) % RH	1.5 % RH 3 % RH	Vaisala HMI 41 w/HMP 46

Parameter/Equipment	Range	CMC <sup>2, 5</sup> ( $\pm$ )	Comments
Temperature – Measuring Equipment and Measure <sup>3</sup>	(-80 to -30) °C	0.24 °C	Hart 1560 w/2560 black stack thermometer, Hart 5626 PRT and bath
	(-30 to 100) °C	0.025 °C	Hart 1560 w/ 2560 black stack thermometer, Hart 5626 PRT, and Lauda RE106 fluid bath
	(50 to 550) °C	0.059 °C	Hart 1560 w/2560 black stack thermometer, Hart 5626 PRT, and Jofra 600S dry well
Infrared Temperature Source	@ 0 °C	0.58 °C	Hart 1560 w/ 2560 black stack thermometer, Hart 5626 PRT, and Lauda RE106 fluid bath
	@ 35 °C	0.42 °C	Fluke 4181
	@ 100 °C	0.55 °C	
	@ 200 °C	0.9 °C	
	@ 350 °C	1.3 °C	
@ 500 °C	1.9 °C		

## VI. Time & Frequency

Parameter/Equipment	Frequency	CMC <sup>2</sup> ( $\pm$ )	Comments
Frequency – Measuring Equipment <sup>3</sup>	10 MHz	2 pHz/Hz	Spectracom SecureSync® OCXO (GPS-disciplined) frequency standard (coverage over 24 hours when GPS locked)
	10 MHz	0.5 nHz/Hz	Spectracom SecureSync® OCXO (with loss of GPS- discipline) frequency standard (without GPS after 2 weeks of GPS Lock)

Parameter/Equipment	Frequency	CMC <sup>2</sup> (±)	Comments
Frequency – Measuring Equipment <sup>3</sup> (cont)	0.1 Hz to 80 MHz	58 nHz/Hz	Calibration accuracy of the Agilent 33250A tied to the Spectracom SecureSync® OCXO (GPS-Disciplined) frequency standard (coverage over 24 hours when GPS locked)
	0.1 Hz to 80 MHz	58 nHz/Hz	Calibration accuracy of the Agilent 33250A tied to the Spectracom SecureSync® OCXO (with loss of GPS-discipline) frequency standard (without GPS after 2 weeks of GPS lock)
	10 MHz to 18 GHz	8.3 nHz/Hz	Calibration accuracy of the Hewlett Packard 8340B Spectracom SecureSync® OCXO (GPS-disciplined) frequency standard (coverage over 24 hours when GPS locked)
	10 MHz to 18 GHz	8.4 nHz/Hz	Calibration accuracy of the Hewlett Packard 8340B tied to the Spectracom SecureSync® OCXO (with loss of GPS-discipline) frequency standard (without GPS after 2 weeks of GPS lock)
Frequency – Measure <sup>3</sup>	0.1 Hz to 18 GHz	1.8 nHz/Hz	Spectracom SecureSync® OCXO (GPS-disciplined) frequency standard (coverage over 24 hours when GPS locked), Agilent 53131A Opt 10, Opt 124, and Agilent 5340B Opt 001, Opt 011
	0.1 Hz to 18 GHz	18 nHz/Hz	Spectracom SecureSync® OCXO (with loss of GPS-discipline) frequency standard (without GPS after 2 weeks of GPS Lock), Agilent 53131A Opt 10, Opt 124, and Agilent 5340B Opt 001, Opt 011

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<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. CMC 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> The stated measure 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 of the reading/percent plus a range specification.

<sup>5</sup> In the statement of CMC, percentages are to be read as percent of reading; otherwise, % RH represents percent relative humidity, % FS represents percent of full scale, and % IV represents percent of indicated value.

<sup>6</sup> The contributions from the “best existing device” are not included in the CMC claim.



## Accredited Laboratory

A2LA has accredited

**J. H. METROLOGY CO., INC.**

*Rolling Meadows, IL*

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/NCCL 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 8 January 2009).



Presented this 16<sup>th</sup> day of May 2017.

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

Vice President, Accreditation Services  
For the Accreditation Council  
Certificate Number 1618.01  
Valid to May 31, 2019  
Revised April 23, 2019

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