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

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CALIBRATION

Valid To: October 31, 2017 Certificate Number: 2367.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations[1]:

I. Dimensional

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Gage Blocks	Up to 1 in Up to 4 in	(0.54*L* + 5.1) µin (1.5*L* + 4.2) µin	Mahr federal comparator, master gage blocks
Length Standards	(1 to 10) in	9.3*L* µin	Gage blocks, Supermicrometer™
	(10 to 29) in	(5*L* + 30) µin	Gage blocks, gaging head w/amplifier
Diameter –			
External[3]	Up to 10 in	7.4*L* µin	Supermicrometer™ and gage blocks
	Up to 18 in	(3*L* + 80) µin	Electronic gaging amp, gage block set, granite surface plate
Internal	Up to 8 in	(1.5*L* + 100) µin	Comparator and gage blocks

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Flatness[3] – Optical Quality	Up to 0.5 in diameter	5.6 µin	Optical flats
Height Gages[3]	Up to 24 in	14*L* µin	Gage blocks, surface plate
Calipers[3] – Internal Measurement	Up to 24 in	(5*L* + 300) µin 0.0003 in	Gage blocks
Micrometers[3]	Up to 12 in	13*L* µin	Gage blocks
Length Indicators[3] – Dial, Digital Dial Test	 Up to 1 in Up to 0.008 in	 31 µin 59 µin	Gage blocks
Dial Indicator Calibrators[3]	Up to 1 in	42 µin	Gage blocks
Gage Head/Amplifier	(0.0001 to 0.2) in	13 µin	Gage blocks
Squares – Parallelism Squareness	 Up to 12 in	 6.7*L* µin 15*L* µin	 Master square, gauging head w/amplifier
Optical Comparators – X Axis Y Axis Protractor Screen to Table Alignment	 2 in, 4 in, 6 in 1 in, 2 in, 3 in 90°, 180°, 270°, 360° X and Y	 0.00013 in 0.00013 in 0.02° 0.01°	 Magnification checker 0.1875 in sphere

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Thread Plug –			
Lead	Up to 2 in	0.0002 in	Optical comparator
Flank Angle	60°	0.054°	
Pitch Diameter	(0.06 to 0.25) in	77 µin	Thread wires and Supermicrometer™ (UMM)
	(0.25 to 0.5) in	77 µin	
	(0.5 to 0.75) in	76 µin	
	(0.75 to 1) in	77 µin	
V Blocks –			
V Central	Up to (2 ¼ x 2 ¼ x 3) in	55 µin	Plain plug gage, electronic gaging amp granite surface plate, gaging amp, plain plug gage
V Parallel		84 µin	
Precision Levels –			
Concavity	0.0005 in/ft	17*L* µin	Electronic gaging amp, granite surface plate, gage blocks
Left-Right Reading		6*L* µin	
Surface Plates[3] – Flatness	Up to (36 x 48) in	(3*D* + 2.3) µin	Federal leveling system
Supermicrometers	Linearity to 1 in	(0.023*L* + 1.4) µin	Gage blocks
Federal Leveling System	(-990 to 0 to 990) arc seconds	2.4 arc seconds	Gage blocks, sine plate, precision level, surface plate

Parameter/Equipment	Range	CMC[2] (±)	Comments
Gage Block Comparator –			
Measuring Range	(0.1001 to 0.1005) in	3.9 µin	Grade 00 gage blocks
Calibration Constant	1 in	4.6 µin	Grade 00 gage blocks
Lower Contact Pressure	25 g	0.58 g	
Upper Contact Pressure	85 g	1.4 g	
Internal Comparator	A & B Scales (+ and -)	14 µin	Grade 0 gage block set

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2, 5, 6] (±)	Comments
DC Voltage[3] – Generate	(0 to 330) mV (0 to 3.3) V (3.3 to 33) V (33 to 330) V (330 to 1000) V (0 to 220) mV (0.22 to 2.2) V (2.2 to 22) V (22 to 220) V 1000 V Range	55 µV/V + 1.2 µV 20 µV/V + 2.4 µV 21 µV/V + 24 µV 24 µV/V + 180 µV 29 µV/V + 1.8 mV 14 µV/V + 0.4 µV 7 µV/V + 0.7 µV 5 µV/V + 2.5 µV 7 µV/V + 40 µV 8 µV/V + 400 µV	Fluke 5520A/SC1100 Fluke 5720A
DC Voltage[3] – Measure	(0 to 100) mV 100.1 mV to 1 V (1.1 to 10) V (10.1 to 100) V (100.1 to 1000) V (1 to 5) kV	26 µV/V + 0.3 µV 12 µV/V + 0.3 µV 9.3 µV/V + 0.5 µV 12 µV/V + 30 µV 15 µV/V + 0.1 mV 3.6 VDC	HP 3458A Fluke 80E-10

Parameter/Equipment	Range	CMC[2, 5, 6, 7] (±)	Comments
DC Current[3] – Generate	330 µA to 3.3 mA (3.3 to 33) mA (33 to 330) mA 330 mA to 1.1 A (1.1 to 3) A (3 to 11) A 220 µA 2 mA 20 mA 200 mA 1 A	0.02 % + 0.024 µA 0.02 % + 0.024 µA 0.02 % + 0.024 µA 0.04 % + 47 µA 0.06 % + 47 µA 0.14 % + 580 µA 84 µA/A + 6 nA 80 µA/A + 7 nA 65 µA/A + 40 nA 73 µA/A + 0.7 nA 0.012 % + 12 µA	Fluke 5520A/SC1100 multifunction calibrator Fluke 5720A
DC Current[3] – Measure	Up to 100 µA 100.1 µA to 1 mA (1.1 to 10) mA (10.1 to 100) mA 100.1 mA to 1 A	0.04 mA/A + 0.8 nA 0.07 mA/A + 5 nA 0.03 mA/A + 50 nA 0.05 mA/A + 0.5 µA 0.14 mA/A + 10 µA	HP 3458A multimeter
DC Power[3] – 33 mV to 1020 V	330 µA to 3.3 mA (3.3 to 33) mA (33 to 330) mA 330 mA to 1.1 A (1.1 to 3) A (3 to 11) A (11 to 20.5) A	0.02 % 0.02 % 0.02 % 0.06 % 0.08 % 0.15 % 0.25 %	Fluke 5520A/SC1100
Resistance[3] – Generate	(0 to 11) Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω 330 Ω to 1.1 kΩ (1.1 to 3.3) kΩ (3.3 to 11) kΩ (11 to 33) kΩ (33 to 110) kΩ (110 to 330) kΩ 330 kΩ to 1.1 MΩ (1.1 to 3.3) MΩ (3.3 to 11) MΩ (11 to 33) MΩ (33 to 110) MΩ	0.02 % + 0.0012 Ω 0.01 % + 0.0017 Ω 0.01 % + 0.0016 Ω 34 µΩ/Ω + 0.0023 Ω 40 µΩ/Ω + 0.0023 Ω 0.01 % + 0.024 Ω 41 µΩ/Ω + 0.024 Ω 0.01 % + 0.24 Ω 41 µΩ/Ω + 0.24 Ω 0.01 % + 2.6 Ω 47 µΩ/Ω + 3 Ω 0.01 % + 37 Ω 0.02 % + 64 Ω 0.05 % + 3 kΩ 0.07 % + 3.6 kΩ	Fluke 5520A/SC1100

Parameter/Equipment	Range	CMC[2, 5, 6, 7] (±)	Comments
Resistance[3] – Generate, Fixed Points (Cont.)	1 Ω 1.9 Ω 10 Ω 19 Ω 100 Ω 190 Ω 1 kΩ 1.9 kΩ 10 kΩ 19 kΩ 100 kΩ 190 kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	0.012 % 0.012 % 29 μΩ/Ω 31 μΩ/Ω 13 μΩ/Ω 14 μΩ/Ω 12 μΩ/Ω 10 μΩ/Ω 11 μΩ/Ω 10 μΩ/Ω 13 μΩ/Ω 13 μΩ/Ω 24 μΩ/Ω 25 μΩ/Ω 47 μΩ/Ω 56 μΩ/Ω 0.013 %	Fluke 5720A
Resistance[3] – Measure	Up to 10 Ω (10.1 to 100) Ω 100.1 Ω to 1 kΩ (1.1 to 10) kΩ (10.1 to 100) kΩ 100.1 kΩ to 1 MΩ (1.1 to 10) MΩ (10.1 to 100) MΩ	31 μΩ/Ω + 50 μΩ 22 μΩ/Ω + 0.05 mΩ 14 μΩ /Ω + 0.5 mΩ 14 μΩ /Ω + 5 mΩ 16 μΩ /Ω + 50 mΩ 27 μΩ Ω + 20 Ω 78 μΩ /Ω + 0.1 kΩ 600 μΩ /Ω + 1 kΩ	HP 3458A
AC Power[3] @ (45 to 65) Hz – (33 to 330) mV PF = 1	 (3.3 to 9) mA (9 to 33) mA (33 to 90) mA (90 to 330) mA (330 to 900) mA 900 mA to 1.1 A (1.1 to 3) A (3 to 11) A (11 to 20.5) A	 0.2 % 0.15 % 0.37 % 0.26 % 0.13 % 0.11 % 0.1 % 0.25 % 0.31 %	Fluke 5520A/SC1100

Parameter/Equipment	Range	CMC[2, 5, 7] (±)	Comments
AC Power[3] @ (45 to 65) Hz (Cont.) –			
330 mV to 3.3 V	(3.3 to 9) mA (9 to 33) mA (33 to 90) mA (90 to 330) mA (330 to 900) mA 900 mA to 1.1 A (1.1 to 3) A (3 to 11) A (11 to 20.5) A	0.19 % 0.15 % 0.37 % 0.26 % 0.12 % 0.1 % 0.1 % 0.39 % 0.3 %	Fluke 5520A/SC1100
(3.3 to 33) V	(3.3 to 9) mA (9 to 33) mA (33 to 90) mA (90 to 330) mA (330 to 900) mA 900 mA to 1.1 A (1.1 to 3) A (3 to 11) A (11 to 20.5) A	0.19 % 0.15 % 0.37 % 0.26 % 0.12 % 0.1 % 0.1 % 0.25 % 0.3 %	
(33 to 1020) V	(3.3 to 9) mA (9 to 33) mA (33 to 90) mA (90 to 330) mA (330 to 900) mA 900 mA to 1.1 A (1.1 to 3) A (3 to 11) A (11 to 20.5) A	1.2 % 1.2 % 1.3 % 1.2 % 1.2 % 1.2 % 1.2 % 1.2 % 1.3 %	

Parameter/Range	Frequency	CMC[2, 5] (±)	Comments
Capacitance[3] – Generate			
(0.19 to 0.4) nF	10 Hz to 10 kHz	4.5 % + 0.012 nF	Fluke 5520A/SC1100 multifunction calibrator
(0.4 to 1.1) nF		3.4 % + 0.012 nF	
(1.1 to 3.3) nF	10 Hz to 3 kHz	1.4 % + 0.012 nF	
(3.3 to 11) nF	10 Hz to 1 kHz	0.57 % + 0.012 nF	
(11 to 33) nF		1 % + 0.12 nF	
(33 to 110) nF		0.47 % + 0.12 nF	
(110 to 330) nF		0.54 % + 0.35 nF	
330 nF to 1.1 µF	(10 to 600) Hz	0.47 % + 1.2 nF	
(1.1 to 3.3) µF		0.54 % + 3.5 nF	
(3.3 to 11) µF	(10 to 150) Hz	0.6 % + 12 nF	
(11 to 33) µF	(10 to 120) Hz	0.74 % + 35 nF	
(33 to 110) µF	(10 to 80) Hz	0.87 % + 120 nF	
(110 to 330) µF	Up to 50 Hz	0.82 % + 350 nF	

Parameter/Range	Frequency	CMC[2, 5] (±)	Comments
AC Voltage[3] – Generate			
(1 to 33) mV	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	0.13 % + 7 µV 0.05 % + 7 µV 0.05 % + 7 µV 0.16 % + 7 µV 0.52 % + 14 µV 1.3 % + 58 µV	Fluke 5520A/SC1100
(33 to 330) mV	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	0.05 % + 9.3 µV 0.03 % + 9.3 µV 0.03 % + 9.3 µV 0.06 % + 9.3 µV 0.14 % + 37 µV 0.33 % + 81 µV	
330 mV to 3.3 V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	0.04 % + 9.3 µV 0.03 % + 9.3 µV 0.03 % + 9.3 µV 0.05 % + 9.3 µV 0.11 % + 37 µV 0.37 % + 81 µV	
(3.3 to 33) V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.04 % + 760 µV 0.02 % + 700 µV 0.04 % + 700 µV 0.05 % + 700 µV 0.13 % + 2.4 mV	
(33 to 330) V	45 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.03 % + 2.4 mV 0.04 % + 7 mV 0.04 % + 7 mV 0.05 % + 7 mV 0.32 % + 59 mV	
(330 to 1020) V	45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.04 % + 12 mV 0.04 % + 12 mV 0.04 % + 12 mV	
2.2 mV Range	40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	1.3 % + 4 µV 3.9 % + 4 µV 1.1 % + 5 µV	Fluke 5720A

Parameter/Range	Frequency	CMC[2, 5] (±)	Comments
AC Voltage[3] – Generate (Cont.)			
22 mV Range	40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz	0.05 % + 4 µV 0.09 % + 4 µV 0.15 % + 5 µV 0.19 % + 10 µV 0.3 % + 20 µV	Fluke 5720A
200 mV Range	(10 to 20) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz	0.042 % + 12 µV 0.018 % + 7 µV 0.032 % + 7 µV 0.1 % + 17 µV 0.13 % + 20 µV 0.2 % + 25 µV	
2.2 V Range	(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	31 µV/V + 40 µV 0.013 % + 15 µV 74 µV/V + 8 µV 0.012 % + 10 µV 0.019 % + 30 µV 0.07 % + 80 µV 0.15 % + 200 µV	
22 V Range	(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	0.034 % + 400 µV 0.013 % + 150 µV 0.007 % + 50 µV 0.012 % + 100 µV 0.017 % + 200 µV 0.05 % + 600 µV 0.15 % + 2 V	
220 V Range	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	0.034 % + 4 mV 0.013 % + 1.5 mV 78 µV/V + 0.6 mV 0.014 % + 1 mV 0.023 % + 2.5 mV	
1100 V Range	(15 to 50) Hz 50 Hz to 1 kHz	0.04 % + 16 mV 95 µV/V + 3.5 mV	

Parameter/Range	Frequency	CMC[2, 6] (±)	Comments
AC Voltage[3] – Measure			
Up to 10 mV	(1 to 40) Hz 40.1 Hz to 1 kHz (1.1 to 20) kHz (20.1 to 50) kHz (50.1 to 100) kHz (100.1 to 300) kHz	0.048 % + 3 µV 0.046 % + 1.1 µV 0.055 % + 1.1 µV 0.59 % + 1.1 µV 0.59 % + 1.1 µV 4.64 % + 2 µV	HP 3458A
(10 to 100) mV	(1 to 40) Hz 40.1 Hz to 1 kHz (1.1 to 20) kHz (20.1 to 50) kHz (50.1 to 100) kHz (100.1 to 300) kHz	0.011 % + 4 µV 0.011 % + 2 µV 0.019 % + 2 µV 0.095 % + 2 µV 0.095 % + 2 µV 0.36 % + 10 µV	
100 mV to 1 V	(1 to 40) Hz 40.1 Hz to 1 kHz (1.1 to 20) kHz (20.1 to 50) kHz (50.1 to 100) kHz (100.1 to 300) kHz (300 to 500) kHz	0.026 % + 40 µV 0.011 % + 20 µV 0.019 % + 20 µV 0.037 % + 20 µV 0.097 % + 20 µV 0.36 % + 0.1 mV 1.2 % + 0.1 mV	
(1 to 10) V	(1 to 40) Hz 40.1 Hz to 1 kHz (1.1 to 20) kHz (20.1 to 50) kHz (50.1 to 100) kHz (100.1 to 300) kHz (300 to 500) kHz	0.011 % + 0.4 mV 0.011 % + 0.2 mV 0.019 % + 0.2 mV 0.037 % + 0.2 mV 0.095 % + 0.2 mV 0.36 % + 1 mV 1.2 % + 1 mV	
(10 to 100) V	(1 to 40) Hz 40.1 Hz to 1 kHz (1.1 to 20) kHz (20.1 to 50) kHz (50.1 to 100) kHz	0.026 % + 4 mV 0.026 % + 2 mV 0.026 % + 2 mV 0.043 % + 2 mV 0.14 % + 2 mV	
(100 to 700) V	1 Hz to 1 kHz	0.05 % + 0.02 V	

Parameter/Range	Frequency	CMC[2, 5] (±)	Comments
AC Current[3] – Generate			
(29 to 330) µA			
	10 Hz	0.31 % + 0.12 µA	Fluke 5520A/SC110
	20 Hz	0.24 % + 0.12 µA	
	(20 to 45) Hz	0.24 % + 0.12 µA	
	45 Hz to 1 kHz	0.21 % + 0.12 µA	
	(1 to 5) kHz	0.47 % + 0.17 µA	
	(5 to 10) kHz	1.2 % + 0.23 µA	
	(10 to 30) kHz	2.4 % + 0.46 µA	
330 µA to 3.3 mA			
	10 Hz	0.27 % + 0.17 µA	
	20 Hz	0.17 % + 0.17 µA	
	(20 to 45) Hz	0.14 % + 0.17 µA	
	45 Hz to 1 kHz	0.28 % + 0.23 µA	
	(1 to 5) kHz	0.68 % + 21 µA	
	(5 to 10) kHz	1.4 % + 0.69 µA	
	(10 to 30) kHz	1.4 % + 0.69 µA	
(3.3 to 33) mA			
	10 Hz	0.25 % + 2.4 µA	
	20 Hz	0.13 % + 2.4 µA	
	(20 to 45) Hz	0.06 % + 2.4 µA	
	45 Hz to 1 kHz	0.12 % + 2.4 µA	
	(1 to 5) kHz	0.28 % + 3.5 µA	
	(5 to 10) kHz	0.55 % + 4.7 µA	
	(10 to 30) kHz	0.55 % + 4.7 µA	
(33 to 330) mA			
	10 Hz	0.25 % + 24 µA	
	20 Hz	0.13 % + 24 µA	
	(20 to 45) Hz	0.06 % + 24 µA	
	45 Hz to 1 kHz	0.19 % + 58 µA	
	(1 to 5) kHz	0.31 % + 120 µA	
	(5 to 10) kHz	0.62 % + 240 µA	
	(10 to 30) kHz	0.62 % + 240 µA	
330 mA to 1.1 A			
	(10 to 45) Hz	0.25 % + 120 µA	
	45 Hz	0.08 % + 120 µA	
	45 Hz to 1 kHz	0.21 % + 1200 µA	
	(1 to 5) kHz	4 % + 5.8 mA	
	(5 to 10) kHz	4 % + 5.8 mA	
(1.1 to 3) A			
	(10 to 45) Hz	0.25 % + 120 µA	
	45 Hz	0.08 % + 120 µA	
	45 Hz to 1 kHz	0.85 % + 1.2 mA	
	(1 to 5) kHz	3.6 % + 5.8 mA	
	(5 to 10) kHz	3.6 % + 5.8 mA	

Parameter/Range	Frequency	CMC[2, 5] (±)	Comments
AC Current[3] – Generate (Cont.)			
(3 to 11) A	45 Hz (45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.12 % + 2.4 mA 0.17 % + 2.4 mA 4.1 % + 2.4 mA 4.1 % + 2.4 mA	Fluke 5520A/SC1100
(11 to 20.5) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.25 % + 5.8 mA 0.29 % + 5.8 mA 4.1 % + 5.8 mA	
(22 to 220) µA	40 Hz 1 kHz 5 kHz	0.026 % + 8 nA 0.048 % + 12 nA 0.21 % + 65 nA	Fluke 5720A
(0.22 to 2.2) mA	40 Hz 1 kHz 5 kHz	99 µA/A + 35 nA 0.037 % + 110 nA 0.21 % + 650 nA	
(2.3 to 22) mA	40 Hz 1 kHz 5 kHz	0.017 % + 350 nA 0.017 % + 350 nA 0.03 % + 550 nA	
(22.1 to 220) mA	40 Hz 1 kHz 5 kHz	0.017 % + 3.5 nA 0.017 % + 2.5 nA 0.028 % + 3.5 nA	
1 A	40 Hz 1 kHz 5 kHz	0.037 % + 35 µA 0.063 % + 80 µA 0.063 % + 80 µA	
1.5 A	40 Hz 1 kHz 5 kHz	0.034 % + 35 µA 0.059 % + 80 µA 0.059 % + 80 µA	

Parameter/Range	Frequency	CMC[2, 6] (±)	Comments
AC Current[3] – Measure			
Up to 100 µA	(10 to 20) Hz (20.1 to 45) Hz (45.1 to 100) Hz 100.1 Hz to 1 kHz	0.5 % + 0.03 µA 0.21 % + 0.03 µA 0.11 % + 0.03 µA 0.11 % + 0.03 µA	HP 3458A
100 µA to 1 mA	(10 to 20) Hz (20.1 to 45) Hz (45.1 to 100) Hz 100.1 Hz to 5 kHz (5.1 to 20) kHz	0.49 % + 0.2 µA 0.2 % + 0.2 µA 0.09 % + 0.2 µA 0.06 % + 0.2 µA 0.07 % + 0.2 µA	
(1 to 10) mA	(10 to 20) Hz (20.1 to 45) Hz (45.1 to 100) Hz 100.1 Hz to 5 kHz (5.1 to 20) kHz	0.49 % + 2 µA 0.2 % + 2 µA 0.09 % + 2 µA 0.06 % + 2 µA 0.09 % + 2 µA	
(10 to 100) mA	(10 to 20) Hz (20.1 to 45) Hz (45.1 to 100) Hz 100.1 Hz to 5 kHz	0.49 % + 20 µA 0.2 % + 20 µA 0.09 % + 20 µA 0.06 % + 20 µA	
100 mA to 1 A	(10 to 20) Hz (20.1 to 45) Hz (45.1 to 100) Hz 100.1 Hz to 5 kHz	0.49 % + 0.2 mA 0.21 % + 0.2 mA 0.12 % + 0.2 mA 0.14 % + 0.2 mA	
(1 to 20) A	(1 to 40) Hz 40.1 Hz to 1 kHz	3.0 % + 2 mA 4.1 % + 2 mA	w/Fluke Y5020 shunt

Parameter/Equipment	Range	CMC[2, 5, 7] (±)	Comments
Oscilloscope Calibration[3] –			
Squarewave Signal			
50 Ω at 1 kHz	100 mV 1 V 2 V 5 V	0.37 % + 40 µV 0.65 % + 40 µV 0.54 % + 40 µV 0.44 % + 40 µV	Fluke 5520A/SC1100
1 MΩ at 1 kHz	25 mV 200 mV 2.2 V 10 V	0.48 % + 40 µV 0.087 % + 40 µV 0.29 % + 40 µV 0.14 % + 40 µV	
Time Marker (50 Ω Source and Period)	200 ns 1 µs 50 µs 200 µs 1 ms 10 ms	0.0003 % 0.0003 % 0.0003 % 0.0003 % 0.0003 % 0.0003 %	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Electrical Calibration of RTD Indicators and Indicating Systems[3] –			
Pt 395, 3926, 100 Ω	(-200 to 0) ºC (0.1 to 100) ºC (100.1 to 300) ºC (300.1 to 400) ºC (400.1 to 630) ºC	0.035 °C 0.019 °C 0.048 °C 0.047 °C 0.056 °C	Fluke 5520A/SC1100
Pt 395 Only	(630 to 800) ºC	0.056 °C	
Pt 3916, 100 Ω	(-200 to -190) ºC (-189.9 to -80) ºC (-79.9 to 100) ºC (100.1 to 260) ºC (260.1 to 300) ºC (300.1 to 400) ºC (400.1 to 600) ºC (600.1 to 630) ºC	0.098 °C 0.042 °C 0.019 °C 0.043 °C 0.029 °C 0.047 °C 0.059 °C 0.047 °C	
Pt 385, 200 Ω	(-200 to 100) ºC (100.1 to 260) ºC (260.1 to 300) ºC (300.1 to 400) ºC (400.1 to 600) ºC (600.1 to 630) ºC	0.042 °C 0.037 °C 0.048 °C 0.068 °C 0.056 °C 0.059 °C	
Pt 385, 500 Ω	(-200 to -80) ºC (-79.9 to 260) ºC (260.1 to 400) ºC (400.1 to 600) ºC (600.1 to 630) ºC	0.019 °C 0.043 °C 0.047 °C 0.052 °C 0.047 °C	
Pt 385, 1000 Ω	(-200 to 0) ºC (0.1 to 100) ºC (100.1 to 260) ºC (260.1 to 300) ºC (300.1 to 600) ºC (600.1 to 630) ºC	0.035 °C 0.019 °C 0.029 °C 0.049 °C 0.047 °C 0.052 °C	
PtNi 385, 120 Ω	(-80 to 100) ºC (100.1 to 260) ºC	0.043 °C 0.029 °C	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Electrical Calibration of Thermocouple Indicators and Indicating Systems[3] –			
Type E	(-250 to -100) ºC (-99.9 to -25) ºC (-24.9 to 350) ºC (350.1 to 650) ºC (650.1 to 1000) ºC	0.076 °C 0.073 °C 0.14 °C 0.14 °C 0.14 °C	Fluke 5520A/SC1100
Type J	(-210 to -100) ºC (-99.9 to -30) ºC (-29.9 to 150) ºC (150.1 to 760) ºC (760.1 to 1200) ºC	0.081 °C 0.089 °C 0.088 °C 0.17 °C 0.17 °C	
Type K	(-200 to -100) ºC (-99.9 to -25) ºC (-24.9 to 120) ºC (120.1 to 1000) ºC (1000.1 to 1372) ºC	0.11 °C 0.092 °C 0.11 °C 0.21 °C 0.21 °C	
Type R	(0 to 250) ºC (250.1 to 400) ºC (400.1 to 1000) ºC (1000.1 to 1767) ºC	0.77 °C 0.77 °C 1.6 °C 1.6 °C	
Type S	(0 to 250) ºC (250.1 to 1000) ºC (1000.1 to 1400) ºC (1400.1 to 1767) ºC	0.75 °C 1.6 °C 1.6 °C 1.6 °C	
Type T	(-250 to -150) ºC (-149.9 to 0) ºC (0.1 to 120) ºC (120.1 to 400) ºC	0.12 °C 0.093 °C 0.11 °C 0.22 °C	

III. Mechanical

Parameter/Equipment	Range	CMC[2, 4, 7] (±)	Comments
Dynamometers	Up to 2000 lb (2001 to 4000) lb (4001 to 6000) lb (6001 to 8000) lb (8001 to 10 000) lb	(-0.001 *AF* + 9.5) lb (-0.0014 *AF* + 16) lb (-0.0018 *AF* + 23) lb (-0.0021 *AF* + 31) lb (-0.0025 *AF* + 39) lb	TSD1220 & TSD1200 load cell & readout
Force – Measuring Equipment	(0 to 40) lbf (40.1 to 200) lbf	0.31 % 0.04 % + 0.093 lbf	Dead weight
Scales and Balances[3]	(1 to 10) g (10 to 500) g 210 g to 45 kg (45.1 to 226) kg	0.037 g 0.016 % + 0.16 g 0.008 % + 0.005 kg 0.002 % + 0.16 kg	OIML Class E2 weights NIST Class F weights
Mass – Measure	(1 to 500) mg (1 to 5) g (6 to 210) g	0.041 mg 0.057 mg (4.4*M* + 3.3) mg	ASTM Class 1 weights, balance
Torque[3] – Measuring Equipment	Up to 100 ft·lbf Up to 600 ft·lbf 50 in·lbf (50.1 to 150) in·lbf (150.1 to 250) in·lbf (250.1 to 500) in·lbf Up to 30 ft·lbf (30.1 to 150) ft·lbf (150.1 to 250) ft·lbf Up to 150 ft·lbf (150.1 to 360) ft·lbf (360.1 to 600) ft·lbf	0.35 ft·lbf 3.7 ft·lbf 0.52 in·lbf 1.2 in·lbf 1.6 in·lbf 4.1 in·lbf 0.45 ft·lbf 1.1 ft·lbf 1.6 ft·lbf 1.9 ft·lbf 3.2 ft·lbf 6.6 ft·lbf	AKO torque calibrator transducer C AKO torque calibrator transducer A AWS torque calibrator transducer B AWS torque calibrator transducer C AWS torque calibrator transducer D

Parameter/Equipment	Range	CMC[2, 7] (±)	Comments
Pressure/Vacuum[3] – Measuring Equipment	(2 to 10) inwc (Inches Water Column)	0.014 inwc	Mensor CPC 8000
	(0 to 30) psi (0 to 14 488) psi vacuum	0.06 psi 0.05 psi vacuum	Fluke 717 30G calibrator
	(10 to 100) psi (100.1 to 500) psi (500.1 to 1000) psi (1000.1 to 1500) psi (1000.1 to 3000) psi (3000.1 to 5000) psi (5000.1 to 10 000) psi	0.14 psi 0.39 psi 0.62 psi 0.58 psi 2.3 psi 3.9 psi 7.8 psi	Fluke 700 P06 Fluke 700 P07 Fluke 700 P08 Fluke 700 P09 Fluke 700 P29 Fluke 700 P30 Fluke 700 P31
	Ambient to 14 488 psi vacuum	0.032 psi vacuum	Fluke 700 PA4
	(0 to 250) psi (250.1 to 500) psi (500.1 to 750) psi (750.1 to 1500) psi (1500.1 to 2500) psi (2500.1 to 5000) psi (5000.1 to 10 000) psi	0.032 % 0.016 % 0.013 % 0.008 % 0.007 % 0.013 % 0.009 %	Deadweight tester
	(10 to 100) psi (100.1 to 700) psi (700.1 to 1500) psi (1500.1 to 3000) psi (3000.1 to 6015) psi	0.11 psi 0.13 psi (0.0001*P* + 0.1) psi (0.0002*P* + 0.018) psi (0.0002*P* + 0.003) psi	Mensor CPC 8000 pressure calibrator *P* = measured pressure

IV. Thermodynamics

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Temperature[3] – Measure	(-20 to 80) ºC	0.15 °C	Guildline 9540A digital thermometer
	(20 to 70) ºC	0.0036*T* + 0.19 ºC	Vaisala HMI41/ HMP46

Parameter/Equipment	Range	CMC[2] (±)	Comments
Temperature[3] – Measuring Equipment	Ice Point -5 ºC to 60 ºC 60 ºC to 100 ºC	0.01 °C 0.042 °C 0.47 °C	SPRT, monitoring ice bath SPRT, monitoring Hart Scientific 7102 micro-bath
Relative Humidity[3] – Measuring Equipment	33.1 % RH 75.5 % RH	0.57 % RH 1.0 % RH	Vaisala HMI41/ HMP46 with RH reference salts
Relative Humidity[3] – Measure	Up to 90 % RH	1.4 % RH	Vaisala HMI41/ HMP46

[1] This laboratory offers commercial calibration service and field calibration service.

[2] 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.

[3] 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 aspfects 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.

[4] In the statement of CMC, L is the length of the unit under test in inches, D is the diagonal length of the unit under test in inches, M is the mass of the unit under test in grams, and T is the temperature in ºC.

[5] The measurands stated are generated with the Fluke 5520A and 5720A series of instruments. This capability is suitable for the calibration of the devices intended to measure the stated measurand in the ranges indicated. CMCs are expressed as either a specific value that covers the full range or as a fraction of the reading plus a fixed floor specification.

[6] The measurands stated are measured with the HP 3458A. This capability is suitable for the calibration of the devices intended to generate the measurand in the ranges indicated. CMCs are expressed as either a specific value that covers the full range or as a combination of the fraction of the reading/output plus a range specification.

[7] In the statement of CMC, the value is defined as the percentage of reading unless otherwise noted.

Accredited Laboratory

A2LA has accredited

GLOBAL CALIBRATION SERVICES LLC

Seattle, WA

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 any additional program requirements in the field of calibration. 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 24th day of March, 2016.

Senior Director of Quality and Communications
For the Accreditation Council
Certificate Number 2367.01
Valid to October 31, 2017

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