



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

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CALIBRATION

Valid To: February 29, 2012

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<sup>1</sup>:

I. Dimensional

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
Gage Blocks	Up to 4 in	(2.2 + 1.4L) μin	Mahr federal comparator, master gage blocks
Length Standards	(1 to 10) in	(20 + 11L) μin	Gage blocks, super micrometer
	(10 to 48) in	(20 + 11L) μin	Gage blocks, gaging head w/amplifier
Diameter – External <sup>3</sup>	(0 to 10) in	(20 + 8D) μin	Supermicrometer and gage blocks
	Internal	(0 to 12) in	(40 + 10D) μin

Parameter/Equipment	Range	CMC <sup>2,4</sup> ( $\pm$ )	Comments
Flatness <sup>3</sup> – Optical quality	Up to 3 in diameter	7 $\mu$ in	Optical flats
Height gages <sup>3</sup>	Up to 40 in	(100 + 11L) $\mu$ in	Gage blocks, surface plate
Calipers <sup>3</sup>	Up to 60 in	(300 + 11L) $\mu$ in	Gage blocks
Micrometers <sup>3</sup>	(0 to 60) in	(60 + 8L) $\mu$ in	Gage blocks
Length Indicators <sup>3</sup> (Dial, Test, LVDTs)	(0 to 2) in	70 $\mu$ in	Gage blocks
Dial Indicator Calibrators <sup>3</sup>	(0 to 1) in	60 $\mu$ in	Gage blocks
Gage Head/Amplifier	(0.0001 to 0.2) in	15 $\mu$ in	Gage blocks
Step Gages <sup>3</sup>	(0 to 40) in	(60 + 10L) $\mu$ in	Gage blocks
Bore Gages and Bore Micrometers <sup>3</sup>	(1 to 24) in	(100 + 8L) $\mu$ in	Gage blocks
Squares	(0 to 6) in (6 to 12) in (12 to 24) in	10 $\mu$ in/in 10 $\mu$ in/in 10 $\mu$ in/in	Master square, gauging head w/amplifier
Thickness Gages <sup>3</sup>	(0.001 to 1) in	20 $\mu$ in	Gage blocks
Sine Bars <sup>3</sup>	5 in 10 in	30 $\mu$ in/in 50 $\mu$ in/in	Gage blocks, gaging head/amplifier

Parameter/Equipment	Range	CMC <sup>2, 4</sup> (±)	Comments
Precision Levels	0.0005 in/ft 0.005 in/ft	100 μin/in 100 μin/in	Sine bar, gage blocks
Protractors <sup>3</sup>	(0 to 15)° Vernier (15 to 30)° Vernier (30 to 45)° Vernier (45 to 90)° Vernier (0 to 10)° Digital (15 to 30)° Digital (30 to 45)° Digital (45 to 90)° Digital	0.097 ° 0.092 ° 0.094 ° 0.097 ° 0.058 ° 0.058 ° 0.07 ° 0.07 °	Sine bar, angle block, granite parallel, surface plate  Sine bar, sine step gage, granite angle, granite surface plate
Adjustable Thread Rings <sup>3</sup> – Pitch Diameter	Up to 1 in	(36 + 11D) μin	Thread setting plugs
Thread Plugs <sup>3</sup> – Pitch Diameter	(0.06 to 0.25) in (0.25 to 0.5) in (0.5 to 0.75) in (0.75 to 1) in	0.000076 in 0.000075 in 0.000075 in 0.000075 in	Thread wires and supermicrometers (UMM)
Surface Plates – Flatness <sup>3</sup>	Up to (36 x 48) in	(0.44D + 28) μin	Federal leveling system

## II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC <sup>2, 5</sup> (±)	Comments
DC Voltage <sup>3</sup> – Generate	(0 to 330) mV (0 to 3.3) V (3.3 to 33) V (33 to 330) V (330 to 1000) V	55 μV/V + 1.2 μV 20 μV/V + 2.4 μV 21 μV/V + 24 μV 24 μV/V + 174 μV 29 μV/V + 1800 μV	Fluke 5520A/SC1100
	100 mV Range 1 V Range 10 V Range 100 V Range 1000 V Range	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 5720A

Parameter/Equipment	Range	CMC <sup>2,5,6</sup> (±)	Comments
DC Voltage <sup>3</sup> – Measure	(0 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V (100 to 1000) V	11 μV/V + 0.04 μV 10 μV/V + 0.35 μV 10 μV/V + 0.6 μV 12 μV/V + 35 mV 12 μV/V + 0.12 mV	HP 3458A
	(1 to 10) kV	0.016 % of rdg	Fluke 80E-10
DC Current <sup>3</sup> – 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 (11 to 20.5) A	0.02 % + 0.024 μA 0.02 % + 0.024 μA 0.02 % + 0.024 μA 0.04 % + 47 μA 0.06 % + 47 μA 0.08 % + 580 μA 0.14 % + 900 μA	Fluke 5520A/SC1100 multifunction calibrator
	220 μA 2 mA 20 mA 200 mA 1 A	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 5720A
DC Current <sup>3</sup> – Measure	(0 to 100) nA 100 nA to 1 μA 1 μA to 10 μA 10 μA to 100 μA 100 μA to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A	35 μA/A + 0.05 nA 23 μA/A + 0.05 nA 23 μA/A + 0.12 nA 23 μA/A + 0.9 nA 23 μA/A + 6 nA 23 μA/A + 60 nA 41 μA/A + 0.6 μA 0.013 % + 12 μA	HP 3458A multimeter
	(1 to 20) A	0.015 %	w/Fluke shunt Y5020A

Parameter/Range	Frequency	CMC <sup>2,5</sup> (±)	Comments
DC Power <sup>3</sup> – 33 mV to 1020 V	330 μA to 3.3 mA (3.3 to 33) mA (33 to 330) mA	0.02 % 0.02 % 0.02 %	Fluke 5520A/SC1100

Parameter/Range	Frequency	CMC <sup>2,5</sup> (±)	Comments
DC Power <sup>3</sup> – (cont) 33 mV to 1020 V	330 mA to 1.1 A (1.1 to 3) A (3 to 11) A (11 to 20.5) A	0.06 % 0.08 % 0.15 % 0.25 %	Fluke 5520A/SC1100
AC Power <sup>3</sup> @ (45 to 65) Hz –			
(33 to 330) mV	(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	0.20 % 0.15 % 0.37 % 0.26 % 0.13 % 0.11 % 0.10 % 0.25 % 0.31 %	Fluke 5520A/SC1100
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 % 0.10 % 0.10 % 0.39 % 0.30 %	
(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 % 0.10 % 0.10 % 0.25 % 0.30 %	



Parameter/Range	Frequency	CMC <sup>2, 5, 6</sup> ( $\pm$ )	Comments
Resistance <sup>3</sup> – Generate (cont)	1.9 M $\Omega$ Range 10 M $\Omega$ Range 19 M $\Omega$ Range 100 M $\Omega$ Range	25 $\mu\Omega/\Omega$ 47 $\mu\Omega/\Omega$ 56 $\mu\Omega/\Omega$ 0.013 %	Fluke 5720A
Resistance <sup>3</sup> – Measure	Up to 10 $\Omega$ (10 to 100) $\Omega$ 100 $\Omega$ to 1 k $\Omega$ (1 to 10) k $\Omega$ (10 to 100) k $\Omega$ 100 k $\Omega$ to 1 M $\Omega$ (1 to 10) M $\Omega$ (10 to 100) M $\Omega$ 100 M $\Omega$ to 1 G $\Omega$	18 $\mu\Omega/\Omega$ + 60 $\mu\Omega$ 14 $\mu\Omega/\Omega$ + 0.6 m $\Omega$ 12 $\mu\Omega/\Omega$ + 0.6 m $\Omega$ 12 $\mu\Omega/\Omega$ + 6 m $\Omega$ 12 $\mu\Omega/\Omega$ + 60 m $\Omega$ 18 $\mu\Omega/\Omega$ + 3 $\Omega$ 58 $\mu\Omega/\Omega$ + 120 $\Omega$ 0.058 % + 1.2 k $\Omega$ 0.6 % + 12 k $\Omega$	HP 3458A
Capacitance <sup>3</sup> – Generate			
(0.19 to 0.4) nF (0.4 to 1.1) nF	10 Hz to 10 kHz	4.5 % + 0.012 nF 3.4 % + 0.012 nF	Fluke 5520A/SC1100 multifunction calibrator
(1.1 to 3.3) nF	10 Hz to 3 kHz	1.4 % + 0.012 nF	
(3.3 to 11) nF (11 to 33) nF (33 to 110) nF (110 to 330) nF	10 Hz to 1 kHz	0.57 % + 0.012 nF 1 % + 0.12 nF 0.47 % + 0.12 nF 0.54 % + 0.35 nF	
330 nF to 1.1 $\mu$ F (1.1 to 3.3) $\mu$ F	(10 to 600) Hz	0.47 % + 1.2 nF 0.54 % + 3.5 nF	
(3.3 to 11) $\mu$ F (11 to 33) $\mu$ F (33 to 110) $\mu$ F (110 to 330) $\mu$ F	(10 to 150) Hz (10 to 120) Hz (10 to 80) Hz Up to 50 Hz	0.6 % + 12 nF 0.74 % + 35 nF 0.87 % + 120 nF 0.82 % + 350 nF	

Parameter/Range	Frequency	CMC <sup>2,5</sup> (±)	Comments
AC Voltage <sup>3</sup> – 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 V 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 % + 2400 μV	
(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 % + 2400 μV 0.04 % + 7000 μV 0.04 % + 7000 μV 0.05 % + 7000 μV 0.32 % + 58 800 μV	
(330 to 1020) V	45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.04 % + 12 000 μV 0.04 % + 12 000 μV 0.04 % + 12 000 μV	
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	

Parameter/Range	Frequency	CMC <sup>2,5</sup> (±)	Comments
AC Voltage <sup>3</sup> – 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 0.30 % + 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 0.10 % + 17 μV 0.13 % + 20 μV 0.20 % + 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 % + 2000 μV	
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 <sup>2,6</sup> (±)	Comments
AC Voltage <sup>3</sup> – Measure			
Up to 10 mV	(1 to 40) Hz 40 Hz to 1kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.035 % + 3.5 μV 0.023 % + 1.3 μV 0.035 % + 1.3 μV 0.12 % + 1.3 μV 0.58 % + 1.3 μV 4.6 % + 2.3 μV	HP 3458A
(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 2) MHz	8 μV/V + 4.6 μV 8 μV/V + 2.3 μV 0.017 % + 2.3 μV 0.035 % + 2.3 μV 0.092 % + 2.3 μV 0.35 % + 12 μV 1.2 % + 12 μV 1.8 % + 12 μV	
100 mV 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 2) MHz	8 μV/V + 46 μV 8 μV/V + 23 μV 0.017 % + 23 μV 0.035 % + 23 μV 0.092 % + 23 mV 0.35 % + 0.12 mV 1.2 % + 0.12 mV 1.8 % + 0.12 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 2) MHz	8 μV/V + 0.46 mV 8 μV/V + 0.23 mV 0.017 % + 0.23 mV 0.035 % + 0.23 mV 0.092 % + 0.23 mV 0.35 % + 1.2 mV 1.2 % + 1.2 mV 1.8 % + 1.2 mV	

Parameter/Range	Frequency	CMC <sup>2,5,6</sup> ( $\pm$ )	Comments
AC Voltage <sup>3</sup> – Measure			
(10 to 100) V	(1 to 40) Hz 40 Hz to 1kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.024 % + 4.6 mV 0.024 % + 2.3 mV 0.024 % + 2.3 mV 0.04 % + 2.3 mV 0.14 % + 2.3 mV 0.46 % + 12 mV 1.8 % + 12 mV	HP 3458A
(100 to 1000) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.046 % + 46 mV 0.046 % + 23 mV 0.069 % + 23 mV 0.14 % + 23 mV 0.35 % + 23 mV	
(1 to 6) kV	(0 to 60) Hz	1.2 % of rdg	Fluke 80K-6 w/4.5 digit multimeter
AC Current <sup>3</sup> – Generate			
(29 to 330) $\mu$ A	10 Hz 20 Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.31 % + 0.12 $\mu$ A 0.24 % + 0.12 $\mu$ A 0.24 % + 0.12 $\mu$ A 0.21 % + 0.12 $\mu$ A 0.47 % + 0.17 $\mu$ A 1.2 % + 0.23 $\mu$ A 2.4 % + 0.46 $\mu$ A	Fluke 5520A/SC110
330 $\mu$ A to 3.3 mA	10 Hz 20 Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.27 % + 0.17 $\mu$ A 0.17 % + 0.17 $\mu$ A 0.14 % + 0.17 $\mu$ A 0.28 % + 0.23 $\mu$ A 0.68 % + 21 $\mu$ A 1.4 % + 0.69 $\mu$ A 1.4 % + 0.69 $\mu$ A	

Parameter/Range	Frequency	CMC <sup>2, 6</sup> (±)	Comments
AC Current <sup>3</sup> – Generate (cont)			Fluke 5520A/SC1100
(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 % + 5800 µA	
	(5 to 10) kHz	4 % + 5800 µA	
(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 % + 1200 µA	
	(1 to 5) kHz	3.6 % + 5800 µA	
	(5 to 10) kHz	3.6 % + 5800 µA	
(3 to 11) A	45 Hz	0.12 % + 2400 µA	
	(45 to 100) Hz	0.17 % + 2400 µA	
	100 kHz to 1 kHz	4.1 % + 2400 µA	
	(1 to 5) kHz	4.1 % + 2400 µA	
(11 to 20.5) A	(45 to 100) Hz	0.25 % + 5800 µA	
	100 Hz to 1 kHz	0.29 % + 5800 µA	
	(1 to 5) kHz	4.1 % + 5800 µA	

Parameter/Range	Frequency	CMC <sup>2, 5, 6</sup> (±)	Comments
AC Current <sup>3</sup> (cont.) – Generate			
100 µA Range	40 Hz 1 kHz 5 kHz	0.026 % + 8 nA 0.048 % + 12 nA 0.21 % + 65 nA	Fluke 5720A
1 mA Range	40 Hz 1 kHz 5 kHz	99 µA/A + 35 nA 0.037 % + 110 nA 0.21 % + 650 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	0.34 % + 35 µA 0.059 % + 80 µA 0.059 % + 80 µA	
AC Current <sup>3</sup> – Measure			
Up to 100 µA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 1 kHz	0.46 % + 0.035 µA 0.17 % + 0.035 µA 0.07 % + 0.035 µA 0.07 % + 0.035 µA	HP 3458A
100 µA to 1 mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.46 % + 0.23 µA 0.17 % + 0.23 µA 0.07 % + 0.23 µA 0.035 % + 0.23 µA 0.07 % + 0.23 µA 0.46 % + 0.46 µA 0.64 % + 1.7 µA	
(1 to 10) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.46 % + 2.3 µA 0.17 % + 2.3 µA 0.07 % + 2.3 µA 0.035 % + 2.3 µA 0.07 % + 2.3 µA 0.46 % + 4.6 µA 0.64 % + 17 µA	

Parameter/Range	Frequency	CMC <sup>2,5,6</sup> ( $\pm$ )	Comments
AC Current <sup>3</sup> (cont.) – Measure			
(10 to 100) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.46 % + 23 $\mu$ A 0.17 % + 23 $\mu$ A 0.07 % + 23 $\mu$ A 0.035 % + 23 $\mu$ A 0.07 % + 23 $\mu$ A 0.46 % + 46 $\mu$ A 0.64 % + 0.17 mA	HP 3458A
100 mA to 1 A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz	0.46 % + 0.23 mA 0.19 % + 0.23 mA 0.09 % + 0.23 mA 0.12 % + 0.23 mA 0.35 % + 0.23 mA 1.2 % + 0.46 mA	w/Fluke Y5020 shunt
(1 to 20) A	(1 to 40) Hz 40 Hz to 1 kHz	0.05 % 0.05 %	
Oscilloscope Calibration <sup>3</sup> – Squarewave Signal			
(50 $\Omega$ at 1 kHz)	100 mV 1 V 2 V 5 V	0.03 % + 9.3 $\mu$ V 0.03 % + 70 $\mu$ V 0.02 % + 70 $\mu$ V 0.02 % + 700 $\mu$ V	Fluke 5520A/SC1100
(1 M $\Omega$ at 1 kHz)	25 mV 200 mV 2.2 V 11 V	0.04 % + 7 $\mu$ V 0.03 % + 9.3 $\mu$ V 0.04 % + 70 $\mu$ V 0.03 % + 700 $\mu$ V	
Time Marker (50 $\Omega$ Source and Period)	200 ns 1 $\mu$ s 50 $\mu$ s 200 $\mu$ s 1 ms 10 ms	0.0003 % 0.0003 % 0.0003 % 0.0003 % 0.0003 % 0.0003 %	

Parameter/Equipment	Range	CMC <sup>2,5</sup> (±)	Comments
Electrical Calibration of RTD Indicators and Indicating Systems <sup>3</sup> –			
Pt 395, 3926, 100 Ω	(-200 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C	0.10 °C 0.12 °C 0.14 °C 0.15 °C 0.17 °C	Fluke 5520A/SC1100
Pt 395 only	(630 to 800) °C	0.28 °C	
Pt 3916, 100 Ω	(-200 to -190) °C (-190 to -80) °C (-80 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.30 °C 0.09 °C 0.10 °C 0.11 °C 0.12 °C 0.13 °C 0.14 °C 0.28 °C	
Pt 385, 200 Ω	(-200 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.09 °C 0.10 °C 0.17 °C 0.18 °C 0.19 °C 0.21 °C	
Pt 385, 500 Ω	(-200 to -80) °C (-80 to 260) °C (100 to 260) °C (260 to 400) °C (400 to 600) °C (600 to 630) °C	0.09 °C 0.10 °C 0.11 °C 0.13 °C 0.14 °C 0.16 °C	
Pt 385, 1000 Ω	(-200 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 600) °C (600 to 630) °C	0.08 °C 0.09 °C 0.10 °C 0.11 °C 0.12 °C 0.28 °C	
PtNi 385, 120 Ω	(-80 to 100) °C (100 to 260) °C	0.13 °C 0.19 °C	
Cu 4276, 10 Ω	(-100 to 260) °C	0.35 °C	

Parameter/Equipment	Range	CMC <sup>2,5</sup> (±)	Comments
Electrical Calibration of Thermocouple Indicators and Indicating Systems <sup>3</sup> –			
Type B	(600 to 800) °C (800 to 1000) °C (1000 to 1550) °C (1550 to 1820) °C	0.49 °C 0.39 °C 0.35 °C 0.38 °C	Fluke 5520A/SC1100
Type C	(0 to 150) °C (150 to 650) °C (650 to 1000) °C (1000 to 1800) °C (1800 to 2316) °C	0.35 °C 0.31 °C 0.36 °C 0.55 °C 0.89 °C	
Type E	(-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C	0.55 °C 0.21 °C 0.19 °C 0.21 °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	0.32 °C 0.21 °C 0.19 °C 0.22 °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	0.38 °C 0.23 °C 0.21 °C 0.31 °C 0.45 °C	
Type L	(-200 to -100) °C (-100 to 800) °C (800 to 900) °C	0.42 °C 0.31 °C 0.22 °C	
Type N	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1300) °C	0.45 °C 0.27 °C 0.24 °C 0.23 °C 0.32 °C	

Parameter/Equipment	Range	CMC <sup>2,5</sup> (±)	Comments
Electrical Calibration of Thermocouple Indicators and Indicating Systems <sup>3</sup> (cont.) –			
Type R	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.62 °C 0.40 °C 0.38 °C 0.48 °C	Fluke 5520A/SC1100
Type S	(0 to 250) °C (250 to 1000) °C (1000 to 1400) °C (1400 to 1767) °C	0.52 °C 0.41 °C 0.42 °C 0.51 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.68 °C 0.29 °C 0.21 °C 0.19 °C	
Type U	(-200 to 0) °C (0 to 600) °C	0.61 °C 0.32 °C	

### III. Mechanical

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Force – Measuring Equipment	(10 to 400) lb (1000 to 20 000) lb	0.04 % of rdg 0.025 % of rdg	Dead weight Load Cells
Scales and Balances <sup>3</sup>	1 mg to 10 g (10 to 210) g	0.05 mg 0.0005 % of rdg	OIML class E2 weights
	210 g to 135 kg	0.05 % of rdg	NIST class F weights

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Mass – Measure	1 mg to 10 g (10 to 210) g	0.05 mg 0.0005 % of rdg	OIML Class E2 weights, balance
Torque Measuring Equipment <sup>3</sup>	(90 to 350) in·lb  (25 to 1100) ft·lb  (10 to 100) in·lb  (10 to 100) ft·lb  (100 to 1000) ft·lb  (250 to 2000) ft·lb	0.7 % of rdg  0.7 % of rdg  0.4 % of rdg  0.4 % of rdg  0.8 % of rdg  0.8 % of rdg	Norbar torque calibrator  Norbar torque calibrator  AKO torque calibrator transducer D AKO torque calibrator transducer C AKO torque calibrator transducer A AKO torque calibrator transducer B
Pressure/Vacuum Measuring Equipment <sup>3</sup>	(0 to 30) psi (0 to 14 488) psi vacuum  (10 to 100) psi (Over 100 to 500) psi (Over 500 to 1000) psi (Over 1000 to 1500) psi (Over 1000 to 3000) psi (Over 3000 to 5000) psi (Over 5000 to 10 000) psi  Ambient to 14 488 psi vacuum	0.06 psi 0.05 psi vacuum  0.096 psi 0.39 psi 0.77 psi 0.58 psi 2.3 psi 3.9 psi 7.8 psi  0.032 psi vacuum	Fluke 717 30G calibrator  Fluke 700 P06 Fluke 700 P07 Fluke 700 P08 Fluke 700 P09 Fluke 700 P29 Fluke 700 P30 Fluke 700 P31  Fluke 700 PA4
Pressure Generating Equipment – Hydraulic	(0 to 15 000) psi	0.075 % of rdg	Deadweight tester

IV. Thermodynamics

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Temperature <sup>3</sup> – Measure	-20 °C to 60 °C	0.07 °C	Guildline 9540A digital thermometer
Temperature – Measuring Equipment <sup>3</sup>	Ice Point -5 °C to 60 °C 60 °C to 125 °C	0.01 °C 0.07 °C 0.46 °C	SPRT, Ice bath SPRT, Hart Scientific 7102 micro-bath
Relative Humidity <sup>3</sup> – Measure and Measuring Equipment	(0 to 90) % RH (90 to 100) % RH	0.75 % RH 1.3 % RH	ASTM salts – as per ASTM E 104-85 (re-approved 1991)

V. Time and Frequency

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Frequency – Measure	0.01 Hz to 18 GHz	2.5 parts in 10 <sup>9</sup>	Rubidium Standard w/ HP 53131/EIP575
Frequency – Measuring Equipment	10 MHz to 26.5 GHz	2.5 parts in 10 <sup>9</sup>	HP 8340B w/ Rubidium frequency standard

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

<sup>2</sup> Calibration and Measurement Capability (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. Calibration and Measurement Capabilities 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>  $L$  is the length of the Unit Under Test in inches,  $D$  is the diagonal length of the Unit Under Test in inches.
- <sup>5</sup> The measurands stated are generated with the Fluke 5520A series of instruments. This capability is suitable for the calibration of the devices intended to measure the stated measurand in the ranges indicated. CMC's are expressed as either a specific value that covers the full range or as a fraction of the reading plus a fixed floor specification.
- <sup>6</sup> 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. CMC's 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.



The American Association for Laboratory Accreditation

World Class Accreditation

# 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 and 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 18<sup>th</sup> day of June 2010.



  
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President & CEO

For the Accreditation Council  
Certificate Number 2367.01  
Valid to February 29, 2012  
Revised December 27, 2011

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