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

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CALIBRATION

Valid To: October 31, 2021 Certificate Number: 1489.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations[1, 7]:

I. Dimensional

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Angle Blocks	Up to 90°	0.02°	Optical comparator
Calipers[3]	Up to 24 in (< 24 to 60) in	(300 + 10*L*) µin (1400 + 1.2*L*) µin	Gage blocks
Cylindrical Plugs/Pins	Up to 1 in Up to 1 in	(13 + 8*D*) µin 46 µin	P&W Labmaster™, gage block masters Mitutoyo laser micrometer, gage block masters
Cylindrical Ring Gages	(0.25 to 12) in	(18 + 7*D*) µin	P&W Labmaster™, master rings
Dial Indicators[3]	Up to 4 in	(76 + 91*L*) µin	Gage blocks
Feeler Gages	Up to 0.05 in	(18 + 7*L*) µin	P&W Labmaster™, gage block masters

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Gage Balls	(0.125 to 1) in	(20 + 7*D*) µin	P&W Labmaster™, gage block masters
Gage Blocks	(0.005 to 12) in	(4.7+ 3.0*L*) µin	P&W Labmaster™, gage block masters
Height Gages[3]	Up to 40 in	(600 + 41*L*) µin	Gage blocks
Snap Gages	(0.25 to 14) in (14 to 24) in	(18 + 7*L*) µin (55 + 8*L*) µin	P&W Labmaster™, master rings Gage blocks
Bore Gage	Up to 2 in	58 µin	Master rings
Micrometers[3] – Outside	Up to 6 in (< 6 to 60) in	(55 + 8*L*) µin (530 + 5*L*) µin	Gage blocks
Optical Comparator[3] – Axis Linearity Magnification Angle	 12 in (10, 20, 50, 100, 125, 250) x Up to 360°	 (260 + 0.5*L*) µin (620 + 0.5*L*) µin 0.3°	Glass master scales, angle blocks
Rules[3]	Up to 72 in	0.6*R*	Gage blocks
Thread Plugs – Pitch Diameter Major Diameter	 Up to 4 in Up to 4 in	 (88 + 6*D*) µin (13 + 8*D*) µin	P&W Labmaster™, gage block masters, thread wire masters
Thread Wires	Up to 0.500 in diameter	(31 + 6*D*) µin	P&W Labmaster™, gage block masters, plug gage masters

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Protractors	Up to 360°	0.08°	Sine plate and gage blocks
Surface Plates[3] –			
Flatness	Up to 144 in	(72 + 0.3*L*) µin	Planekator
Repeatability	Up to 144 in	49 µin	Repeat-O-Meter

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2, 5, 6] (±)	Comments
DC Voltage – Generate[3]	(0 to 330) mV 330 mV to 3.3 V (3.3 to 33) V (33 to 330) V (100 to 1000) V	20 µV/V + 1 µV 11 µV/V + 2 µV 12 µV/V + 20 µV 18 µV/V + 150 µV 18 µV/V + 1.5 mV	Fluke 5522A
DC Voltage – Measure[3]	(0 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V (100 to 1000) V (1 to 9) kV	14 µV/V + 3 µV 7 µV/V + 0.3 µV 6 µV/V + 0.05 µV 10 µV/V + 0.3 µV 9 µV/V + 0.1 µV 0.081 %	Hewlett Packard 3458A opt 002 Vitrek 4700
DC Current – Measure[3]	(0 to 100) nA 100 nA to 1µA (1 to 10) µA (10 to 100) µA 100 µA to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A (1 to 10) A (10 to 100) A (100 to 500) A (500 to 1000) A (1000 to 1500) A	58 µA/A + 40 pA 89 µA/A + 40 pA 66 µA/A + 100 pA 29 µA/A + 800 pA 25 µA/A + 5 nA 25 µA/A + 50 nA 40 µA/A + 500 nA 120 µA/A + 10 µA 0.29 % 0.29 % 1.4 % 2.9 % 4.3 %	Hewlett Packard 3458A opt 002 Empro Shunt w/ Agilent 3458A

Parameter/Equipment	Range	CMC[2, 5, 6] (±)	Comments
DC Current – Generate[3]	(0 to 330) µA (0 to 3.3) mA (0 to 33) mA (0 to 330) mA (0 to 1.1) A (1.1 to 3) A (0 to 11) A (11 to 20.5) A (20.5 to 150) A (150 to 1000) A	0.26 % + 0.02 µA 0.029 % + 0.05 µA 0.011 % + 0.25 µA 0.024 % + 2.5 µA 0.024 % + 40 µA 0.039 % + 40 µA 0.055 % + 500 µA 0.10 % + 750 µA 0.38 % 0.31 %	Fluke 5522A Fluke 5522A w/ 5500A/Coil
Resistance – Generate[3]	(0 to 11) Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω (0.33 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 (0.33 to 1.1) MΩ (1.1 to 3.3) MΩ (3.3 to 11) MΩ (11 to 33) MΩ (33 to 110) MΩ (110 to 330) MΩ (0.33 to 1.1) GΩ 100 MΩ to 1 TΩ	41 µΩ/Ω + 0.001 Ω 30 µΩ/Ω + 0.0015 Ω 29 µΩ/Ω + 0.0014 Ω 28 µΩ/Ω + 0.002 Ω 28 µΩ/Ω + 0.002 Ω 28 µΩ/Ω + 0.02 Ω 28 µΩ/Ω + 0.02 Ω 28 µΩ/Ω + 0.2 Ω 28 µΩ/Ω + 0.2 Ω 32 µΩ/Ω + 2 Ω 33 µΩ/Ω + 2 Ω 60 µΩ/Ω + 30 Ω 0.013 % + 50 Ω 0.025 % + 2.5 kΩ 0.051 % + 3 kΩ 0.30 % + 100 kΩ 1.5 % + 500 kΩ 2.4 %	Fluke 5522A IET HRRS-5kV
Resistance – Measure[3]	(0 to 10) Ω (10 to 100) Ω 100 Ω to 1 kΩ (1 to 10) kΩ (10 to 100) kΩ 100 kΩ to 1 MΩ (1 to 10) MΩ (10 to 100) MΩ 100 MΩ to 1 GΩ	22 µΩ/Ω + 50 µΩ 18 µΩ/Ω + 0.5 µΩ 11 µΩ/Ω + 0.5 mΩ 11 µΩ/Ω + 5 mΩ 11 µΩ/Ω + 50 mΩ 19 µΩ/Ω + 2 Ω 61 µΩ/Ω + 100 Ω 0.052 % + 1 kΩ 0.52 % + 10 kΩ	Hewlett Packard 3458A opt 002

Parameter/Range	Frequency	CMC[2, 6] (±)	Comments
Capacitance – Generate[3]			
(220 to 399.9) pF	(10 to 10 000) Hz	0.41 % + 10 pF	Fluke 5522A
(0.4 to 1.0999) nF	(10 to 10 000) Hz	0.39 % + 0.01 nF	
(1.1 to 3.2999) nF	(10 to 3000) Hz	0.39 % + 0.01 nF	
(3.3 to 10.9999) nF	(10 to 1000) Hz	0.20 % + 0.01 nF	
(11 to 32.9999) nF	(10 to 1000) Hz	0.19 % + 0.01 nF	
(33 to 109.999) nF	(10 to 1000) Hz	0.19 % + 0.01 nF	
(110 to 329.999) nF	(10 to 1000) Hz	0.19 % + 0.03 nF	
(0.33 to 1.099 99) µF	(10 to 600) Hz	0.56 % + 1 nF	
(1.1 to 3.299 99) µF	(10 to 300) Hz	0.26 % + 3 nF	
(3.3 to 10.9999) µF	(10 to 150) Hz	0.20 % + 10 nF	
(11 to 32.9999) µF	(10 to 120) Hz	0.31 % + 30 nF	
(33 to 109.999) µF	(10 to 80) Hz	0.35 % + 100 nF	
(110 to 329.999) µF	(0 to 50) Hz	0.35 % + 300 nF	
(0.33 to 1.099 99) mF	(0 to 20) Hz	0.35 % + 1 µF	
(1.1 to 3.299 99) mF	(0 to 6) Hz	0.35 % + 3 µF	
(3.3 to 10.9999) mF	(0 to 2) Hz	0.35 % + 10 µF	
(11 to 32.9999) mF	(0 to 0.6) Hz	0.60 % + 30 µF	
(33 to 110) mF	(0 to 0.2) Hz	0.43 % + 100 µF	
AC Voltage – Generate[3]			
(1 to 33) mV	(10 to 45) Hz	0.10 % + 6 µV	Fluke 5522A
	45 Hz to 10 kHz	0.042 % + 6 µV	
	(10 to 20) kHz	0.046 % + 6 µV	
	(20 to 50) kHz	0.12 % + 6 µV	
	(50 to 100) kHz	0.39 % + 12 µV	
	(100 to 500) kHz	0.95 % + 50 µV	
(33 to 330) mV	(10 to 45) Hz	0.042 % + 8 µV	
	(45 Hz to 10 kHz)	0.032 % + 8 µV	
	(10 to 20) kHz	0.033 % + 8 µV	
	(20 to 50) kHz	0.046 % + 8 µV	
	(50 to 100) kHz	0.094 % + 32 µV	
	(100 to 500) kHz	0.22 % + 70 µV	
(0.33 to 3.3) V	(10 to 45) Hz	0.041 % + 50 µV	
	45 Hz to 10 kHz	0.031 % + 60 µV	
	(10 to 20) kHz	0.034 % + 60 µV	
	(20 to 50) kHz	0.041 % + 50 µV	
	(50 to 100) kHz	0.078 % + 130 µV	
	(100 to 500) kHz	0.26 % + 600 µV	

Parameter/Range	Frequency	CMC[2, 6] (±)	Comments
AC Voltage – Generate[3] (cont)			
(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	0.24 % + 650 µV 0.031 % + 600 µV 0.037 % + 600 µV 0.045 % + 600 µV 0.098 % + 1.6 mV	Fluke 5522A
(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	0.020 % + 2 mV 0.022 % + 6 mV 0.027 % + 6 mV 0.032 % + 6 mV 0.22 % + 50 mV	
(330 to 1020) V	45 Hz to 1 kHz (1 to 5) kHz (5 to 10 kHz	0.031 % + 10 mV 0.026 % + 10 mV 0.031 % + 10 mV	
AC Voltage – Measure[3]			
Up 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 to 300) kHz	0.030 % + 3 µV 0.020 % + 1.1 µV 0.030 % + 1.1 µV 0.10 % + 1.1 µV 0.50 % + 1.1 µV 4.0 % + 2 µV	Hewlett Packard 3458A 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 2) MHz	0.007 % + 4 µV 0.007 % + 2 µV 0.014 % + 2 µV 0.030 % + 2 µV 0.080 % + 2 µV 0.30 % + 10 µV 1.0 % + 10 µV 1.5 % + 10 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	0.007 % + 40 µV 0.007 % + 20 µV 0.014 % + 20 µV 0.030 % + 20 µV 0.080 % + 20 µV 0.30 % + 100 µV 1.0 % + 100 µV 1.5 % + 100 µV	

Parameter/Range	Frequency	CMC[2, 5, 6] (±)	Comments
AC Voltage – Measure[3] (cont)			
(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	0.007 % + 0.4 mV 0.007 % + 0.2 mV 0.014 % + 0.2 mV 0.030 % + 0.2 mV 0.080 % + 0.2 mV 0.30 % + 1 mV 1.0 % + 1 mV 1.5 % + 1 mV	Hewlett Packard 3458A opt 002
(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	0.020 % + 4 mV 0.020 % + 2 mV 0.020 % + 2 mV 0.035 % + 2 mV 0.12 % + 2 mV 0.40 % + 10 mV 1.5 % + 10 mV	
(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	0.040 % + 40 mV 0.040 % + 20 mV 0.060 % + 20 mV 0.12 % + 20 mV 0.30 % + 20 mV	
(0.7 to 9) kV	(50 to 60) Hz	0.15 %	Vitrek 4700
AC Current – Generate[3]			
(29 to 330) µA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.23 % + 0.1 µA 0.32 % + 0.1 µA 0.16 % + 0.1 µA 0.35 % + 0.15 µA 0.86 % + 0.2 µA 1.7 % + 50 µA	Fluke 5522A
(0.33 to 3.3) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.21 % + 0.15 µA 0.13 % + 0.15 µA 0.11 % + 0.1 µA 0.21 % + 0.2 µA 0.51 % + 0.3 µA 1.0 % + 0.6 µA	

Parameter/Range	Frequency	CMC[2, 5, 6] (±)	Comments
AC Current – Generate[3] (cont)			
(3.3 to 33) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.19 % + 2 µA 0.10 % + 2 µA 0.053 % + 2 µA 0.090 % + 2 µA 0.21 % + 3 µA 0.41 % + 4 µA	Fluke 5522A
(33 to 330) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.19 % + 20 µA 0.10 % + 20 µA 0.053 % + 20 µA 0.12 % + 50 µA 0.23 % + 100 µA 0.46 % + 200 µA	
(0.33 to 1.1) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.21 % + 100 µA 0.098 % + 100 µA 0.70 % + 1 mA 3.0 % + 5 mA	
(1.1 to 3) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.19 % + 100 µA 0.070 % + 100 µA 0.63 % + 1 mA 2.7 % + 5 mA	
(3 to 11) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.080 % + 2 mA 0.12 % + 2 mA 3.0 % + 2 mA	
(11 to 20.5) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.15 % + 5 mA 0.18 % + 5 mA 3.0 % + 5 mA	
Clamp-On Only			
(20.5 to 150) A (150 to 1000) A	(45 to 65) Hz (45 to 65) Hz	0.42 % 0.44 %	Fluke 5522A w/ 5500A/coil
(20.5 to 150) A (150 to 1000) A	(65 to 440) Hz (65 to 440) Hz	1.2 % 1.2 %	

Parameter/Range	Frequency	CMC[2, 6] (±)	Comments
AC Current – Measure[3]			
(0 to 100) µA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 100 Hz 100 Hz to 5 kHz	0.40 % + 0.03 µA 0.15 % + 0.03 µA 0.060 % + 0.03 µA 0.060 % + 0.03 µA	Hewlett Packard 3458A opt 002
(0.1 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	0.40 % + 0.2 µA 0.15 % + 0.2 µA 0.060 % + 0.2 µA 0.030 % + 0.2 µA 0.060 % + 0.2 µA 0.40 % + 0.4 µA 0.55 % + 1.5 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	0.40 % + 2 µA 0.15 % + 2 µA 0.060 % + 2 µA 0.030 % + 2 µA 0.060 % + 2 µA 0.40 % + 4 µA 0.55 % + 15 µA	
(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	0.40 % + 20 µA 0.15 % + 20 µA 0.060 % + 20 µA 0.030 % + 20 µA 0.060 % + 20 µA 0.40 % + 40 µA 0.55 % + 150 µA	
(0.1 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	0.40 % + 0.2 mA 0.16 % + 0.2 mA 0.080 % + 0.2 mA 0.10 % + 0.2 mA 0.30 % + 0.2 mA 1.0 % + 0.4 mA	

Parameter/Range	Frequency	CMC[2, 6] (±)	Comments
Oscilloscopes[3] –			
Square Wave Signal: (1 kHz Input)			
50 Ω Load @ 1 kHz	1 mV to 6.6 V_{pk-pk}	0.19 % + 40 µV	Fluke 5522A
1 MΩ Load @ 1 kHz	1 mV to 130 V_{pk-pk}	0.08 % + 40 µV	SC1100
DC Volt Amplitude:			
50 Ω Load	(0 to 6.6) V	0.19 % + 40 µV	
1 MΩ Load	(0 to 130) V	0.04 % + 40 µV	
Leveled Sine Wave Amplitude	50 kHz (Reference)	1.6 % + 300 µV	
	50 kHz to 100 MHz	2.7 % + 300 µV	
	(100 to 300) MHz	3.1 % + 300 µV	
	(300 to 600) MHz	4.7 % + 300 µV	
	(600 to 1100) MHz	5.4 % + 300 µV	
Flatness (Bandwidth)	50 kHz to 100 MHz	1.2 % + 100 µV	
	(100 to 300) MHz	1.6 % + 100 µV	
	(300 to 600) MHz	3.1 % + 100 µV	
	(600 to 1100) MHz	3.9 % + 100 µV	
Time Marker			
	5 s to 50 ms	(19 + 1000*t*) µs/s	*t* = time in seconds
	20 ms to 1 ns	1.4 µs/s	
Rise Time			
	≥ 300 ps	79 ps	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Electrical Calibration of RTD Indicators[3] –			
Pt 385, 100 Ω	(-200 to -80) °C	0.06 °C	Fluke 5522A
	(-80 to 0) °C	0.06 °C	
	(0 to 100) °C	0.09 °C	
	(100 to 300) °C	0.1 °C	
	(300 to 400) °C	0.1 °C	
	(400 to 630) °C	0.2 °C	
	(630 to 800) °C	0.3 °C	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Electrical Calibration of RTD Indicators[3] – (cont)			
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	0.05 °C 0.05 °C 0.05 °C 0.07 °C 0.2 °C 0.2 °C 0.2 °C 0.2 °C	Fluke 5522A
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	0.05 °C 0.06 °C 0.06 °C 0.07 °C 0.1 °C 0.1 °C 0.1 °C 0.2 °C	
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	0.04 °C 0.04 °C 0.05 °C 0.06 °C 0.08 °C 0.08 °C 0.09 °C 0.3 °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	0.3 °C 0.06 °C 0.06 °C 0.08 °C 0.09 °C 0.1 °C 0.2 °C 0.2 °C 0.2 °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	0.06 °C 0.06 °C 0.09 °C 0.2 °C 0.2 °C 0.2 °C	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Electrical Calibration of RTD Indicators[3] – (cont)			
PtNi 385, 100 Ω	(-80 to 0) °C (0 to 100) °C (100 to 260) °C	0.1 °C 0.1 °C 0.2 °C	Fluke 5522A
Cu 427, 10 Ω	(-100 to 260) °C	0.4 °C	
Thermocouple Simulation [3] –			
Type B	(600 to 800) °C (800 to 1000) °C (1000 to 1550) °C (1550 to 1820) °C	0.49 °C 0.40 °C 0.34 °C 0.36 °C	Fluke 5522A
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 0.17 °C 0.15 °C 0.17 °C 0.22 °C	
Type J	(-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1200) °C	0.24 °C 0.17 °C 0.15 °C 0.18 °C 0.24 °C	
Type K	(-200 to 100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.59 °C 0.19 °C 0.17 °C 0.26 °C 0.40 °C	
Type R	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.63 °C 0.43 °C 0.37 °C 0.43 °C	
Type S	(0 to 250) °C (250 to 1000) °C (1000 to 1400) °C (1400 to 1767) °C	0.52 °C 0.40 °C 0.39 °C 0.48 °C	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Thermocouple Simulation [3] – (cont)			
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.69 °C 0.27 °C 0.19 °C 0.16 °C	Fluke 5522A

III. Mechanical

Parameter/Equipment	Range	CMC[2, 4, 5, 8] (±)	Comments
Torque – Measuring Devices	(0.021 to 250) ft·lbf	(0.079 % + $3 \cdot 10^{-5}$) ft·lbf	Wheels and weights
Torque[3] – Wrenches	(5 to 50) ft·lbf (20 to 200) ft·lbf (50 to 500) ft·lbf (100 to 1000) ft·lbf	0.66 % full scale 0.66 % full scale 0.66 % full scale 0.66 % full scale	Torque transducers
Pressure – Hydraulic	(5 to 10 000) psi	0.6 %	Ashcroft dead weight tester
Force[3] – (Tension and Compression)			
Gages	Up to 1000 lbf	1.7*R*	Verification w/ ASTM class 6 weights
Transducers	Up to 1000 lbf (1000 to 50 000) lbf Up to 500 000 lbf (Compression only)	0.06 % full scale 0.05 % full scale 0.09 % full scale	Load cell and meter
Analytical Balances[3]	(0 to 300) g	0.59 mg	Verification w/ Class 1 weights

Parameter/Equipment	Range	CMC[2, 4, 5] (±)	Comments
Balances[3]	(300 to 1000) g (1000 to 2000) g (2000 to 10 000) g (10 000 to 20 000) g (20 000 to 40 000) g	0.002 % 0.002 % 0.002 % 0.002 % 0.002 %	Verification with Class 1, 3 and F weights
Mass, Fixed Points	(1, 2, 3, 5) mg (10, 20, 30, 50) mg (100, 200, 300) mg 500 mg 1 g 2 g (3, 4, 5) g (10, 20) g (30, 40) g 50 g 100 g 200 g 300 g (400, 500) g 1 kg (2, 3, 4) kg 5 kg 10 kg 20 kg 25 kg (1/32, 1/16, 1/8) oz (1/4, 1/2) oz (1, 2) oz 4 oz 8 oz 0.001 lb 0.002 lb 0.005 lb 0.01 lb 0.02 lb 0.05 lb 0.1 lb 0.2 lb 1 lb 2 lb (3, 4, 5) lb 10 lb (20, 25) lb 50 lb	0.006 mg 0.006 mg 0.007 mg 0.007 mg 0.01 mg 0.01 mg 0.01 mg 0.02 mg 0.10 mg 0.10 mg 0.10 mg 0.15 mg 20 mg 20 mg 20 mg 20 mg 22 mg 270 mg 250 mg 420 mg 0.000 004 oz 0.000 005 oz 0.000 017 oz 0.000 017 oz 0.000 17 oz 0.000 000 22 lb 0.000 000 15 lb 0.000 0002 lb 0.000 000 15 lb 0.000 000 22 lb 0.000 000 31 lb 0.000 000 57 lb 0.000 000 75 lb 0.000 021 lb 0.000 013 lb 0.000 035 lb 0.000 044 lb 0.0006 lb 0.000 93 lb	Comparison to Class 1 standard weights

Parameter/Equipment	Range	CMC[2, 4, 5] (±)	Comments
Scales[3]	(0 to 200 000) lb	0.02 %	Verification w/ Class F weights
Indirect Verification of Rockwell Hardness Testers[3]	HRC Low Medium High HRBW Low Medium High	 0.69 HRC 0.94 HRC 1.6 HRC 2.2 HRBW 0.66 HRBW 0.66 HRBW	Master blocks
RPM – Measuring Equipment (Non-Contact)[3]	(1 to 99 999) rpm	0.000 29 % + 0.58*R*	Fluke 5522A w/ LED emitter
RPM (Non-Contact) – Measure[3]	(6 to 99 999) rpm	0.033 % + 0.58*R*	Shimpo DT-2100 tachometer

IV. Thermodynamics

Parameter/Equipment	Range	CMC[2, 5, 8] (±)	Comments
Temperature – Measure[3]	(-200 to 0) °C (0 to 350) °C (350 to 704) °C (704 to 1250) °C	3.6 °C 1.7 °C 3.3 °C 5.8 °C	Fluke 744, SLE type T thermocouple Fluke 744, SLE type K thermocouple
Relative Humidity – Measure	(10 to 90) % RH (90 to 98) % RH	2.9 % RH 3.6 % RH	Vaisala HMI-41/HMP -46
Temperature – Thermometers, Temperature Probes	(-20 to 150) °C	0.4 °C	Fluke 1560, Fluke 5699, temperature baths

V. Time & Frequency

Parameter/Equipment	Range	CMC[2] (±)	Comments
Stopwatches[3]	(0.1 to 3600) s (1 to 24) hr	0.071 s 0.50 s	HP 53131A

[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 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.

[4] In the statement of CMC, R is the numerical value of the resolution of the device under test in RPM or in pounds-force or in microinches, and L is the numerical value of the nominal length of the device measured in inches. D is the numerical value of the nominal diameter of the device measured in inches.

[5] In the statement of CMC, percentages are percentage of reading, unless otherwise indicated.

[6] The stated measured values are determined using the indicated instrument (see Comments). This capability is suitable for the calibration of the devices intended to measure or generate the measured value in the ranges indicated. CMCs are expressed as either a specific value that covers the full range or as a fraction/percentage of the reading plus a fixed floor specification.

[7] This scope meets A2LA's *P112 Flexible Scope Policy.*

[8] 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.

Accredited Laboratory

A2LA has accredited

GRAND RAPIDS METROLOGY

Grand Rapids, MI

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 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 23rd day of January 2020.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 1489.01
Valid to October 31, 2021

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