SCOPE OF ACCREDITATION TO ISO 17025:2005

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CALIBRATION

Valid To: February 29, 2020 Certificate Number: 2133.01

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 – Length	Up to 1 in (>1 to 6) in	3.6 µin (5.0 + 0.5*L*) µin	P&W Labmaster™ & master gage blocks
Hand Tools – Angular Measurement[3]	Up to 180 Degrees	76 sec	Angle blocks
Micrometers[3] – Inside, Outside, Depth	Up to 20 in	(0.6*R* + 10*L*) µin	Gage blocks
Calipers[3] – Outside, Inside, Depth & End Face	Up to 48 in	(0.6*R* + 5.0*L*) µin	Gage blocks
Dial Indicators[3]	0.015 in (>0.015 to 4) in	(0.6*R* + 43) µin (0.6*R* + 90) µin	P&W model C Supermicrometer™
Dial Indicators	0.015 in (>0.015 to 4) in	(0.6*R* + 29) µin (0.6*R* + 59) µin	P&W model C Supermicrometer™

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Height Gages[3]	(1 to 24) in	(65 + 1.0*L*) µin	Gage blocks
Plug/Pin Gages	(0.005 to 10) in	(22 + 10*D*) µin	P&W universal Supermicrometer™, grade 1 gage blocks
Plain Rings	(0.25 to 9) in	(20 + 7.0*D*) µin	P&W universal Supermicrometer™, grade 1 gage blocks
Tape Measure[3] (Steel)	Up to 100 ft	0.037 in	Gage blocks & reference ruler
Rulers[3]	Up to 40 in	0.013 in	Gage blocks & reference ruler
Generic Test Fixtures –			
Linear Measurement	Up to 10 in	36 µin	P&W Model C™
	Up to 7 in	150 µin	Optical comparator
Angular Measurement	(0 to 360) °	10 minutes	
Radius Measurement	Up to 7 in	240 µin	
Volumetric	(18 x 20 x 16) in	530 µin	CMM
X, Y, Z Linear	(18 x 20 x 16) in	340 µin	CMM
Thread Plug Gages	Up to 2 in (2 to 8) in	73 µin (73 + 18*D*) µin	Measurement over wires
Surface Plates[3] –			
Flatness	(20 to 70) in Diagonal (80 to 161) in Diagonal	(45 + 1*D*) µin 160 µin	Planakator
Repeat Reading	Up to 0.001 in	25 µin	Repeatometer

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
DC Voltage[3] – Measure	Up to 200 mV 200 mV to 2V (2 to 20) V (20 to 200) V (200 to 1000) V (1 to 10) kV	4.5 µV/V + 0.1 µV 3.3 µV/V + 0.4 µV 3.3 µV/V + 4.0 µV 5.8 µV/V + 40 µV 5.8 µV/V + 0.5 mV 0.18 %	Fluke 8508A/01 HP 3456A w/ divider
DC Voltage[3] – Generate Fixed Point	Up to 220 mV 220 mV to 2.2 V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1100) V 10 V	7.8 µV/V + 0.4 µV 5.3 µV/V + 0.7 µV 4.0 µV/V + 2.5 µV 5.4 µV/V + 4.0 µV 6.6 µV/V + 40 µV 7.7 µV/V + 400 µV 2.0 parts in 10^6 V	Fluke 5720A/03 Fluke 7000 & 7000N
DC Current[3] – Measure	Up to 200 µA 200 µA to 2 mA (2 to 20) mA (20 to 200) mA 200 mA to 2.0 A (2 to 20) A	37 µA/A + 0.4 nA 13 µA/A + 4.0 nA 14 µA/A + 40 nA 48 µA/A + 0.8 µA 0.018 % + 16 µA 0.039 % + 400 µA	Fluke 8508A/01
DC Current[3] – Generate	Up to 220 µA 220 µA to 2.2 mA (2.2 to 22) mA (22 to 220) mA 220 mA to 2.2 A (2.2 to 10) A (10 to 20) A (20 to 1000) A	42 µA/A + 6.0 nA 41 µA/A + 7.0 nA 37 µA/A + 40 nA 47 µA/A + 10 µA 81 µA/A + 49 µA 0.037 % + 480 nA 21 mA 0.65 %	Fluke 5720A w/ 5725A Fluke 5520 Fluke 5520 w/ coil

Parameter/Range	Frequency	CMC[2, 6] (±)	Comments
Inductance – Generate			
100 µH	100 Hz to 10 kHz	0.26 µH	General Radio 1482-x standard inductors
1 mH		0.0011 mH	
10 mH		0.011 mH	
100 mH		0.11 mH	
1 H	100 Hz to 1 kHz	0.0011 H	
10 H		0.011 H	

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Resistance[3] – Measure	Up to 2 Ω	18 µΩ/Ω + 4 µΩ	Fluke 8508A
	(2 to 20) Ω	11 µΩ/Ω + 14 µΩ	
	(20 to 200) Ω	9.0 µΩ/Ω + 50 µΩ	
	200 Ω to 2 kΩ	9.2 µΩ/Ω + 0.5 mΩ	
	(2 to 20) kΩ	9.3 µΩ/Ω + 5 mΩ	
	(20 to 200) kΩ	9.5 µΩ/Ω + 50 mΩ	
	200 kΩ to 2 MΩ	12 µΩ/Ω + 1 Ω	
	(2 to 20) MΩ	31 µΩ/Ω + 100 Ω	
	(20 to 200) MΩ	0.013 % + 10 kΩ	
	200 MΩ to 2 GΩ	0.063 % + 1 MΩ	
	(1 to 10) kΩ	1.0 parts in 10^6 Ω	Thomas 1 Ω & Guildline 9975

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Resistance[3] – Generate	Up 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 (110 to 330) MΩ 330 MΩ to 1.1 GΩ	42 µΩ/Ω + 0.001 Ω 32 µΩ/Ω + 0.0015 Ω 30 µΩ/Ω + 0.0014 Ω 29 µΩ/Ω + 0.002 Ω 30 µΩ/Ω + 0.002 Ω 29 µΩ/Ω + 0.02 Ω 30 µΩ/Ω + 0.02 Ω 30 µΩ/Ω + 0.2 Ω 30 µΩ/Ω + 0.2 Ω 34 µΩ/Ω + 2 Ω 34 µΩ/Ω + 2 Ω 65 µΩ/Ω + 30 Ω 0.014 % 0.034 % 0.055 % 0.35 % 1.6 %	Fluke 5520A
Resistance[3] – Generate Fixed Points	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	96 µΩ/Ω 96 µΩ/Ω 24 µΩ/Ω 28 µΩ/Ω 11 µΩ/Ω 11 µΩ/Ω 9.3 µΩ/Ω 9.4 µΩ/Ω 10 µΩ/Ω 10 µΩ/Ω 13 µΩ/Ω 13 µΩ/Ω 22 µΩ/Ω 23 µΩ/Ω 42 µΩ/Ω 62 µΩ/Ω 0.011 %	Fluke 5720A
	1 Ω	0.7 µΩ/Ω	Thomas 1 Ω

Parameter/Range	Frequency	CMC[2, 6] (±)	Comments
AC Current[3] – Generate			
Up to 220 µA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.029 % + 16 nA 0.019 % + 10 nA 0.015 % + 8 nA 0.035 % + 12 nA 0.12 % + 65 nA	Fluke 5720A
(0.22 to 2.2) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.027 % + 40 nA 0.018 % + 35 nA 0.015 % + 35 nA 0.03 % + 110 nA 0.12 % + 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	0.029 % + 400 nA 0.019 % + 350 nA 0.017 % + 350 nA 0.023 % + 550 nA 0.12 % + 5 mA	
(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	0.029 % + 4.0 µA 0.021 % + 3.5 µA 0.018 % + 2.5 µA 0.024 % + 3.5 µA 0.12 % + 10 µA	
220 mA to 2.2 A	(20 to 1000) Hz (1 to 5) kHz (5 to 10) kHz	0.029 % + 35 µA 0.047 % + 80 µA 0.74 % + 160 µA	Fluke w/ 5725A
(2.2 to 11) A	(40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz	0.049 % + 170 µA 0.097 % + 380 µA 0.37 % + 750 µA	Fluke 5720A w/ 5725A
(11 to 20.5) A	(45 to 100) Hz 100 Hz to 1 kHz	0.15 % + 5 mA 0.22 % + 5 mA	Fluke 5520A LCOMP off
(20.5 to 1000) A	(45 to 65) Hz	0.27 % + 5 mA	Fluke 5520 & coil

Parameter/Range	Frequency	CMC[2, 6] (±)	Comments
AC Current[3] – Measure			
Up to 200 µA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.033 % + 20 nA 0.05 % + 20 nA 0.075 % + 20 nA 0.47 % + 20 nA	Fluke 8508A
200 µA to 2 mA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.032 % + 200 nA 0.031 % + 200 nA 0.081 % + 200 nA 0.42 % + 200 nA	
(2 to 20) mA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.032 % + 2 µA 0.043 % + 2 µA 0.076 % + 2 µA 0.42 % + 2 µA	
(20 to 200) mA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz	0.032 % + 20 µA 0.031 % + 20 µA 0.085 % + 20 µA	
200 mA to 2 A	10 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz	0.063 % + 200 µA 0.074 % + 200 µA 0.31 % + 200 µA	
(2 to 20) A	10 Hz to 2 kHz (2 to 10) kHz	0.083 % + 2 mA 0.26 % + 2 mA	

Parameter/Range	Frequency	CMC[2, 6] (±)	Comments
AC Voltage[3] – Generate			
Up to 2.2 mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.028 % + 4 µV 94 µV/V + 4 µV 84 µV/V + 4 µV 0.03 % + 4 µV 0.06 % + 5 µV 0.12 % + 10 µV 0.15 % + 20 µV 0.28 % + 20 µV	Fluke 5720A
(2.2 to 22) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.028 % + 4 µV 94 µV/V + 4 µV 84 µV/V + 4 µV 0.03 % + 4 µV 0.06 % + 5 µV 0.12 % + 10 µV 0.15 % + 20 µV 0.28 % + 20 µV	
(22 to 220) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.028 % + 12 µV 94 µV/V + 7 µV 84 µV/V + 7 µV 0.03 % + 7.0 µV 0.06 % + 17 µV 0.12 % + 20 µV 0.15 % + 25 µV 0.28 % + 45 µV	
(0.22 to 2.2) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.028 % + 40 µV 94 µV/V + 15 µV 48 µV/V + 8 µV 79 µV/V + 10 µV 0.02 % + 300 µV 0.05 % + 80 µV 0.14 % + 200 µV 0.21 % + 300 µV	

Parameter/Range	Frequency	CMC[2, 6] (±)	Comments
AC Voltage[3] (cont) – Generate			
(2.2 to 22) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.028 % + 400 µV 95 µV/V+ 150 µV 54 µV/V + 50 µV 90 µV/V + 100 µV 0.02 % + 200 µV 0.035 % + 600 µV 0.14 % + 2 mV 0.19 % + 3.2 mV	Fluke 5720A
(22 to 220) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.028 % + 4 mV 0.012 % + 1.5 mV 62 µV/V + 0.6 mV 90 µV/V + 1 mV 0.018 % + 2.5 mV 0.091 % + 16 mV 0.48 % + 40 mV 0.85 % + 80 mV	Fluke 5720A, Volt-Hertz limitation over 100 kHz. Max output is 2.2×10^7 V-Hz.
(220 to 1100) V	(15 to 50) Hz 50 Hz to 1 kHz	0.031 % + 16 mV 0.008 % + 3.5 mV	Max 250 V for (15 to 50) Hz
(220 to 750) V	(30 to 50) kHz (50 to 100) kHz	0.062 % + 11 mV 0.24 % + 45 mV	Fluke 5720A w/ 5725A
(220 to 1100) V	(1 to 20) kHz (20 to 30) kHz	0.017 % + 6 mV 0.062 % + 11 mV	

Parameter/Range	Frequency	CMC[2, 6] (±)	Comments
AC Voltage – Measure			
600 µV to 2.2 mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz	0.22 % + 1.3 µV 0.079 % + 1.3 µV 0.048 % + 1.3 µV 0.088 % + 2.0 µV 0.14 % + 2.5 µV 0.26 % + 4.0 µV 0.27 % + 8.0 µV	Fluke 5790A/03
Flatness – 500 kHz to 30 MHz (Relative to 1 kHz)	500 kHz to 1.2 MHz (1.2 to 2) MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz	0.08 % + 1.0 µV 0.08 % + 1.0 µV 0.19 % + 1.0 µV 0.4 % + 1.0 µV 0.75 % + 2.0 µV	
(2.2 to 7) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz	0.092 % + 1.3 µV 0.042 % + 1.3 µV 0.025 % + 1.3 µV 0.06 % + 2.0 µV 0.08 % + 2.5 µV 0.16 % + 4.0 µV 0.17 % + 8.0 µV	
Flatness – 500 kHz to 30 MHz (Relative to 1 kHz)	500 kHz to 1.2 MHz (1.2 to 2) MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz	0.08 % + 1.0 µV 0.08 % + 1.0 µV 0.19 % + 1.0 µV 0.4 % + 1.0 µV 0.75 % + 1.0 µV	
(7 to 22) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz	0.033 % + 1.3 µV 0.021 % + 1.3 µV 0.014 % + 1.3 µV 0.025 % + 2.0 µV 0.035 % + 2.5 µV 0.086 % + 4.0 µV 0.092 % + 8.0 µV	
Flatness – 500 kHz to 30 MHz (Relative to 1 kHz)	500 kHz to 1.2 MHz (1.2 to 2) MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz	0.08 % 0.08 % 0.19 % 0.4 % 0.75 %	

Parameter/Range	Frequency	CMC[2, 6] (±)	Comments
AC Voltage–Measure (cont)			
(22 to 70) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz	0.028 % + 1.5 µV 0.017 % + 1.5 µV 75 µV/V + 1.5 µV 0.017 % + 2 µV 0.032 % + 2.5 µV 0.057 % + 4 µV 0.075 % + 8 µV	Fluke 5790A/03
(70 to 220) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz	0.023 % + 1.5 µV 95 µV/V + 1.5 µV 47 µV/V + 1.5 µV 75 µV/V + 2 µV 0.019 % + 2.5 µV 0.028 % + 4 µV 0.042 % + 8 µV	
(220 to 700) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz	0.024 % + 1.5 µV 81 µV/V + 1.5 µV 40 µV/V + 1.5 µV 56 µV/V + 2 µV 98 µV/V + 2.5 µV 0.024 % + 4 µV 0.05 % + 8 µV	
700 mV to 2.2 V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz	0.03 % 68 µV/V 29 µV/V 53 µV/V 79 µV/V 0.019 % 0.031 %	

Parameter/Range	Frequency	CMC[2, 6] (±)	Comments
AC Voltage – Measure (cont)			
22 mV to 7 V	500 kHz to 1.2 MHz	0.06 %	Fluke 5790A/03
	(1.2 to 2) MHz	0.06 %	
Flatness –	(2 to 10) MHz	0.12 %	
500 kHz to 30 MHz	(10 to 20) MHz	0.17 %	
(Relative to 1 kHz)	(20 to 30) MHz	0.38 %	
(2.2 to 7) V	(10 to 20) Hz	0.03 %	
	(20 to 40) Hz	73 µV/V	
	40 Hz to 20 kHz	28 µV/V	
	(20 to 50) kHz	56 µV/V	
	(50 to 100) kHz	90 µV/V	
	(100 to 300) kHz	0.03 %	
	(300 to 500) kHz	0.06 %	
Flatness –			
10 Hz to 500 kHz	(10 to 30) Hz	0.12 %	
(Relative to 1 kHz)	2.2 mV to 7 V		
	(30 to 120) kHz	0.059 %	
	2.2 mV to 7 V		
	(120 to 500) kHz	0.12 %	
	(2.2 to 22) mV		
	(120 to 500) kHz	0.077 %	
	(22 to 70) mV		
	(120 to 500) kHz	0.059 %	
	(70 to 220) mV		
	(120 to 500) kHz	0.045 %	
	(220 to 700) mV		
	(120 to 500) kHz	0.035 %	
	700 mV to 7 V		

Parameter/Range	Frequency	CMC[2, 6] (±)	Comments
AC Voltage – Measure (cont)			
(7 to 22) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz	0.03 % 69 µV/V 30 µV/V 53 µV/V 90 µV/V 0.022 % 0.045 %	Fluke 5790A/03
(22 to 70) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.03 % 73 µV/V 36 µV/V 62 µV/V 100 µV/V 0.024 % 0.05 % 0.14 %	
(70 to 220) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz	0.03 % 73 µV/V 36 µV/V 73 µV/V 0.011 % 0.03 % 0.06 %	
(220 to 700) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	0.03 % 0.013 % 46 µV/V 0.015 % 0.06 %	
(700 to 1000) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	0.03 % 0.013 % 50 µV/V 0.015 % 0.06 %	
(1 to 10) kV	(45 to 65) Hz	0.85 %	

Parameter/Range	Frequency	CMC[2, 5] (±)	Comments
Capacitance – Measure 100 pF to 1000 µF	12.5 Hz to 10 kHz	0.18 %	Genrad 1689

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Phase[3] – Generate	(10 to 65) Hz (65 to 500) Hz 500 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.1° 0.25° 0.5° 2.5° 5° 10°	Fluke 5520A
Capacitance[3] – Generate	(0.19 to 3.3) nF (3.3 to 11) nF (11 to 110) nF (110 to 330) nF (0.33 to 1.1) µF (1.1 to 3.3) µF (3.3 to 11) µF (11 to 33) µF (33 to 110) µF (110 to 330) µF (0.33 to 1.1) mF (1.1 to 3.3) mF (3.3 to 11) mF (11 to 33) mF (33 to 110) mF	0.6 % + 0.01 nF 0.33 % + 0.01 nF 0.26 % + 0.1 nF 0.26 % + 0.3 nF 0.28 % + 1 nF 0.26 % + 3 nF 0.28 % + 10 nF 0.42 % + 30 nF 0.47 % + 100 nF 0.47 % + 300 nF 0.45 % + 1 µF 0.47 % + 3 µF 0.47 % + 10 µF 0.78 % + 30 µF 1.3 % + 100 µF	Fluke 5520A

Parameter/Equipment	Range	CMC[2] (±)	Comments
Electrical Simulation of Thermocouples & Thermocouple Indicators[3] –			
Type B	600 to 800) °C (800 to 1000) °C (1000 to 1550) °C (1550 to 1820) °C	0.44 °C 0.34 °C 0.3 °C 0.33 °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	0.3 °C 0.26 °C 0.31 °C 0.5 °C 0.84 °C	
Type E	(-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C	0.5 °C 0.16 °C 0.14 °C 0.16 °C 0.21 °C	
Type J	(-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1200) °C	0.27 °C 0.16 °C 0.14 °C 0.17 °C 0.23 °C	
Type K	(-200 to -100) °C (-100 to -25) °C (-25 °C to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.33 °C 0.18 °C 0.16 °C 0.26 °C 0.4 °C	
Type L	(-200 to -100) °C (-100 to 800) °C (800 to 900) °C	0.37 °C 0.26 °C 0.17 °C	
Type N	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1300) °C	0.4 °C 0.22 °C 0.19 °C 0.18 °C 0.27 °C	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Electrical Simulation of Thermocouples & Thermocouple Indicators – (cont)			
Type R	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.57 °C 0.35 °C 0.33 °C 0.4 °C	Fluke 5520A
Type S	(0 to 250) °C (250 to 1000) °C (1000 to 1400) °C (1400 to 1767) °C	0.47 °C 0.36 °C 0.37 °C 0.46 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.63 °C 0.24 °C 0.16 °C 0.14 °C	
Type U	(-200 to 0) °C (0 to 600) °C	0.56 °C 0.27 °C	

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Electrical Simulation of RTD[3] –			
Pt 385, 100 Ω	(-200 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C	0.052 °C 0.072 °C 0.092 °C 0.13 °C 0.13 °C	Fluke 5520A
Pt 3926, 100 Ω	(-200 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C	0.052 °C 0.072 °C 0.092 °C 0.11 °C 0.13 °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	0.26 °C 0.041 °C 0.051 °C 0.061 °C 0.072 °C 0.082 °C 0.092 °C 0.11 °C 0.24 °C	
AC Power, Low Frequency[3] –			
3.3 mA to 21 A (45 to 65) Hz	(33 to 330) mV (0.33 to 1020) V	0.16 % 0.14 %	Fluke 5520A
DC Power[3]–			
(0.33 to 30) mA (0.33 to 3) A (3 to 21) A	33 mV to 1020 V 33 mV to 1020 V 33 mV to 1020 V	0.025 % 0.024 % 0.09 %	Fluke 5520A

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Oscilloscope[3] –			
Squarewave Signal			
(50 Ω at 1 kHz)	1 mV to 6.6 V	0.28 % + 48 µV	Fluke 5520A/SC600
(1 MΩ at 1 kHz)	1 mV to 130 V	0.12 % + 48 µV	
Leveled Sine Wave			
Amplitude	50 kHz reference	2.4 % + 300 µV	
	50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz	4.2 % + 300 µV 4.7 % + 300 µV 7 % + 300 µV	
	(600 to 3200) MHz	7.7 % + 300 µV	Fluke 9500B/9530
Flatness (Rel. to 50 kHz)	50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz	1.8 % + 100 µV 2.5 % + 100 µV 4.7 % + 100 µV	Fluke 5520A/SC600
	(600 to 3200) MHz	7 % + 100 µV	Fluke 9500B/9530
Time Marker (50 Ω Source and Period)	5 s to 50 ms 20 ms to 2 ns	26 ns + 0.07 ms 2.6 µs/s	Fluke 5520A/SC600
Rise Time	≤ 350 ps	+0 / -100 ps	

III. Fluid Quantities

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Liquid Flow[3]	(0 to 10) GPM water	0.25 %	Direct comparison using micro motion flow meter

IV. Mechanical

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Pressure, Nitrogen[3] –			
Gage/ABS	(0.2 to 25) psi (1.7 to 100) psi (2 to 1000) psi	20 parts in 10^6 psi	Ruska piston gage
Pressure, Hydraulic[3]	(1000 to 10 000) psi	0.05 % + 0.10 psi	Ametek TQ-100 DWT
Negative Gage	(-14.5 to 0) psi	30 parts in 10^6 psi	Ruska piston gage
Barometric	(10 to 16) psia	0.01 %	DHI RPM4
Low	(0.01 to 2) in H_2O (2 to 10) in H_2O	0.00034 in H_2O 0.0021 in H_2O	Micro tector Hook gage
Balances/Scales[3]	(1 to 500) mg (1 to 100) g (200 to 1000) g (1 to 10) kg (10 to 450) kg	0.017 mg 0.18 mg 1.7 mg 17 mg 0.022 kg	NIST Class F, ASTM Class 1 or 2 weights
Mass – Weight Sets, Fixed Point	1 mg 2 mg 3 mg 5 mg 10 mg 20 mg 30 mg 50 mg 100 mg 200 mg 300 mg 500 mg 1 g 2 g 3 g 5 g	0.002 mg 0.002 mg 0.0022 mg 0.002 mg 0.002 mg 0.002 mg 0.0022 mg 0.002 mg 0.0021 mg 0.0021 mg 0.0024 mg 0.003 mg 0.0045 mg 0.0044 mg 0.0059 mg 0.0044 mg	Calibration to ASTM E617 by double substitution method w/ E1 & ASTM E-617 Class 0 to 7 weights NIST Handbook 105-1 w/ Class F weights Mettler MX5 Mettler XP205 Sartorius CCE2004 Mettler XP26003L

Parameter/Equipment	Range	CMC[2] (±)	Comments
Mass – Weight Sets, Fixed Point (cont)	10 g 20 g 30 g 50 g 100 g 200 g 300 g 500 g 1 kg 2 kg 3 kg 5 kg 10 kg 25 kg	0.018 mg 0.021 mg 0.022 mg 0.027 mg 0.053 mg 0.067 mg 0.15 mg 0.21 mg 0.33 mg 0.64 mg 2.7 mg 4.1 mg 5.2 mg 7.1 mg	Mettler MX5 Mettler XP205 Sartorius CCE2004 Mettler XP26003L
Torque	(2 to 20) in·ozf (15 to 200) in·ozf (4 to 50) in·lbf (30 to 400) in·lbf (80 to 1000) in·lbf (20 to 250) ft·lbf (100 to 1000) ft·lbf	0.063 in·ozf 0.59 in·ozf 0.15 in·lbf 1.2 in·lbf 3.0 in·lbf 0.73 ft·lbf 2.9 ft·lbf	Arm and weights
Torque Wrenches	(2 to 20) in·ozf (15 to 200) in·ozf (4 to 50) in·lbf (30 to 400) in·lbf (80 to 1000) in·lbf (20 to 250) ft·lbf (100 to 1000) ft·lbf	0.24 in·ozf 2.4 in·ozf 0.6 in·lbf 4.8 in·lbf 12 in·lbf 3 ft·lbf 12 ft·lbf	CDI torque system
Force – Compression	(100 to 2000) lbf (1 to 20 000) lbf (5 to 50 000) lbf (10 to 100 000) lbf	0.29 lbf 3.1 lbf 13 lbf 20 lbf	Load cells
Force – Tension	(100 to 2000) lbf	0.3 lbf	Load cells

V. Thermodynamics

Parameter/Equipment	Range	CMC[2] (±)	Comments
Relative Humidity[3]	(10 to 95) % RH	2.0 % RH	Rotronic RH transmitter, Fluke Hydra data logger
Thermometers[3] – Measure and Measuring Equipment	(-197 to 100) °C (100 to 420) °C (-40 to 250) ºF	0.016 °C 0.028 °C 0.05 ºF	Hart 1594A, SPRT
IR Thermometers	(-15 to 120) °C (35 to 500) °C	1.2 °C 1.6 °C	Hart Scientific 4180 Hart Scientific 4181
Welch Allyn Blackbody	(29 to 43) °C	0.072 °C	Master blackbody, SPRT

VI. Time & Frequency

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Frequency – Measuring Equipment Fixed Point	0.01 Hz to 2 MHz 10 MHz	2.6 µHz/Hz + 5 µHz 6.8 parts in 10^{10} Hz	Fluke 5520A Datum ET600
Frequency – Measure	(1 to 40) Hz 40 Hz to 10 MHz	0.052 % 0.011 %	Agilent 3458A
Stopwatches	15 min to 24 hr	300 ms	Datum ET6000

[1] This laboratory offers commercial 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, L is the numerical value of the nominal length of the device measured in inches, R is the numerical value of the resolution of the device in microinches, D is the numerical value of the nominal diameter of the device measured in inches.

[5] In the statement of CMC, the value is defined as the percentage of reading.

[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.

Accredited Laboratory

A2LA has accredited

CALSOURCE

Syracuse, NY

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 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 10th day of July 2018.

President and CEO
For the Accreditation Council
Certificate Number 2133.01
Valid to February 29, 2020

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