SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005,
ANSI/NCSL Z540-1-1994 & ANSI/NCSL Z540.3-2006

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CALIBRATION

Valid To: July 31, 2018 Certificate Number: 1346.01

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

I. Chemical

Parameter/Equipment	Range	CMC[2] (±)	Comments
pH – Measuring Equipment[3, 8]	(4, 7, 10) pH	0.016 pH	Buffer solutions
Electrolytic Conductivity – Measuring Equipment[3,8]	≈10 µS/cm ≈100 µS/cm ≈1000 µS/cm ≈10 000 µS/cm	0.53 µS/cm 2.4 µS/cm 23 µS/cm 0.23 mS/cm	Conductivity solutions

II. Dimensional

Parameter/Equipment	Range	CMC[2, 7] (±)	Comments
Length[3] – 1 D 2 D	 Up to 8 in Up to 8 in x 4 in	 0.06 % + 350 µin 0.085 % + 400 µin	Optical comparator
Angle[3] – Measure & Measuring Equipment	Up to 60º	5.8”	Sine bar/plate w/ gage blocks

Parameter/Equipment	Range	CMC[2, 4, 7] (±)	Comments
Bore Gages – Bore Micrometer, Bore Indicators, Air Gage Systems	Up to 6 in	(0.7*R* + 4*L*) µin	Plain cylindrical ring gages
Gage Blocks	Up to 4 in (5 to 20) in	(1.8 + 1.9*L*) µin (4.6 + 1.8*L*) µin	Gage blocks, gage block comparator
Hand Tools[3, 8] – Indicators Micrometers Depth Gages Height Gages Calipers	Up to 1 in (1 to 6) in (1 to 72) in (1 to 72) in (1 to 72) in (1 to 120) in	2.7 µin/in + 5.1 µin	Gage blocks
Height Master	Up to 24 in	(39 + 6.7*L*) µin	Gage blocks w/ electronic amplifier
Length Standards – Micrometer, Gaging Fixtures-Single Axis, Others	Up to 48 in	(10 + 8*L*) µin	Gage blocks, electronic indicator, UMM
Optical Comparators[3] –			Comparison to master
Linear Travel	Up to 30 in	(3*L* + 130) µin	Scales
Magnification	10x to 100x	0.17 %	Magnification checker and spheres
Plain Cylindrical Plug Gages, Pin Gages	Up to 10 in	(1.8 + 7.4*L*) µin	UMM, gage blocks
Plain Cylindrical Ring Gages	(0.125 to 10) in	(1 + 7.5*D*) µin	UMM, gage blocks

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Thread Plugs –			
Simple Pitch Diameter	Up to 10 in	(70 + 3.9*D*) µin	UMM, thread wires, gage blocks
Major Diameter	Up to 10 in	(38 + 5.3*D*) µin	
Thread Rings (Adjustable)	Up to 4 in	0.00023 in	Class X thread setting plugs
NPT Plugs –			
Simple Pitch Diameter	Up to 3 in	(70 + 2*D*) µin	UMM, thread wires, sine block, indicator
Step		160 µin	
NPT Rings –			
Pitch Diameter (Standoff)	Up to 3 in	250 µin	NPT master plugs
Thickness		150 µin	Indicator

III. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2, 5, 6] (±)	Comments
DC Voltage[3, 8] – Measure	Up to 100 mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 1000) V	10 µV/V + 0.37 µV 6.1 µV/V + 0.37 µV 5.8 µV/V + 0.59 µV 8.7 µV/V + 37 µV 8.7 µV/V + 0.12 mV	Agilent 3458A
DC Voltage[3, 8] – Generate	(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	6.8 µV/V + 0.4 µV 3.7 µV/V + 0.7 µV 4.9 µV/V + 2.9 µV 4.9 µV/V + 4.3 µV 3.7 µV/V + 48 µV 4.7 µV/V + 0.48 mV	Fluke 5720A w/ 5725A

Parameter/Equipment	Range	CMC[2, 5, 6] (±)	Comments
DC Voltage – Generate, Fixed Points	1 V 10 V	0.57 µV/V 0.81 µV/V	Fluke 732A/B
DC Current[3, 8] – Generate	0.1 nA to 220 µA (0.22 to 2.2) mA (2.2 to 22) mA (22 to 220) mA (0.22 to 2.2) A (2.2 to 11) A (11 to 20.5) A (20 to 150) A (150 to 1000) A	35 µA/A + 6 nA 31 µA/A + 7 nA 30 µA/A + 41 nA 41 µA/A + 0.70 µA 77 µA/A + 12 µA 0.034 % + 0.48 mA 0.10 % + 0.90 mA 0.59 % + 0.16 A 0.59 % + 0.58 A	Fluke 5720A w/ 5725A Fluke 5522A Fluke 5500A/coil
DC Current[3, 8] – Measure	(Up to 100) µA (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A (1 to 10) A (10 to 100) A (30 to 300) A (300 to 1200) A	17 µA/A + 0.80 nA 17 µA/A + 5 nA 17 µA/A + 50 nA 31 µA/A + 0.5 µA 0.010 % + 10 µA 0.31 mA 33 µA/A 56 µA/A 0.051 %	Agilent 3458A w/ L&N 4222 w/ L&N 4361 w/ L&N 4363 w/ RAM shunt
DC Resistance[3, 8] – Generate, Fixed Points	0 Ω 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	40 µΩ 95 µΩ 0.18 mΩ 0.26 mΩ 0.49 mΩ 1.2 mΩ 2.5 mΩ 10 mΩ 19 mΩ 0.10 Ω 0.19 Ω 1.3 Ω 2.5 Ω 21 Ω 42 Ω 0.40 kΩ 0.93 kΩ 13 kΩ	Fluke 5720A

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
DC Resistance[3, 8] – Generate, Fixed Points	0.001 Ω 0.01 Ω 0.1 Ω 1 Ω 10 kΩ 100 MΩ 1 GΩ 10 GΩ 100 GΩ	90 μΩ/Ω 94 μΩ/Ω 84 μΩ/Ω 2.5 μΩ 2.4 μΩ 0.18 % 0.64 % 0.70 % 0.74 %	L&N 4015-B Fluke 742A-1 Fluke 742A-10K IET HRRS-B-5-1M
Resistance[3, 8] – Generate	Up to 10.99 Ω (11 to 32.999) Ω (33 to 109.9999) Ω (110 to 329.9999) Ω 330 Ω to 1.099999 kΩ (1.1 to 3.299999) kΩ (3.3 to 10.99999) kΩ (11 to 32.99999) kΩ (33 to 109.9999) kΩ (110 to 329.9999) kΩ 330 kΩ to 1.09999 MΩ (1.1 to 3.29999) MΩ (3.3 to 10.9999) MΩ (11 to 32.9999) MΩ (33 to 109.9999) MΩ (110 to 329.999) MΩ (330 to 1100) MΩ	40 μΩ/Ω + 1.0 mΩ 30 μΩ/Ω + 1.5 mΩ 28 μΩ/Ω + 1.4 mΩ 28 μΩ/Ω + 2.0 mΩ 28 μΩ/Ω + 2.0 mΩ 28 μΩ/Ω + 20 mΩ 28 μΩ/Ω + 20 mΩ 28 μΩ/Ω + 0.21 Ω 28 μΩ/Ω + 0.21 Ω 32 μΩ/Ω + 2.0 Ω 32 μΩ/Ω + 2.1 Ω 60 μΩ/Ω + 30 Ω 0.013 % + 50 Ω 0.025 % + 2.5 kΩ 0.050 % + 3.0 kΩ 0.30 % + 0.10 MΩ 1.5 % + 0.50 MΩ	Fluke 5522A, 4-wire Fluke 5522A, 2-wire
Resistance[8] – Measure	(0.1 to 1) Ω (1 to 1.9) Ω (1.9 to 10) Ω (10 to 100) Ω (0.1 to 1) kΩ (1 to 10) kΩ (10 to 19) kΩ (19 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ (10 to 19) MΩ (19 to 100) MΩ	60 μΩ/Ω 16 μΩ/Ω 13 μΩ/Ω 14 μΩ/Ω 14 μΩ/Ω 4.8 μΩ/Ω 4.8 μΩ/Ω 4.9 μΩ/Ω 7.3 μΩ/Ω 10 μΩ/Ω 13 μΩ/Ω 20 μΩ/Ω	Fluke 5700A, Agilent 3458A and 742A series resistors

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Resistance[3, 8] – Measure	(0 to 1) Ω (1 to 10) Ω (10 to 100) Ω (100 to 1000) Ω (1 to 10) kΩ (10 to 100) kΩ (100 to 1000) kΩ (1 to 10) MΩ (10 to 100) MΩ (0.1 to 1) GΩ	82 μΩ/Ω + 2.4 μΩ 17 μΩ/Ω + 58 μΩ 12 μΩ/Ω + 0.58 mΩ 9.4 μΩ/Ω + 0.58 mΩ 9.5 μΩ/Ω + 5.8 mΩ 9.7 μΩ/Ω + 58 mΩ 15 μΩ/Ω + 2.3 Ω 58 μΩ/Ω + 0.12 kΩ 0.058 % + 1.2 kΩ 0.6 % + 12 kΩ	Agilent 34420A, Agilent 3458A

Parameter/Range	Frequency	CMC[2, 5] (±)	Comments
AC Voltage[3, 8] – 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 (0.5 to 1) MHz (1 to 10) MHz (10 to 20) MHz (20 to 30) MHz	0.022 % + 4 μV 0.009 % + 4 μV 0.008 % + 4 μV 0.018 % + 4 μV 0.046 % + 5 μV 0.09 % + 10 μV 0.12 % + 20 μV 0.25 % + 20 μV 0.30 % + 3 μV 0.50 % + 3 μV 1.5 % + 3 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 (0.5 to 1) MHz (1 to 10) MHz (10 to 20) MHz (20 to 30) MHz	0.022 % + 4 μV 0.009 % + 4 μV 0.008 % + 4 μV 0.018 % + 4 μV 0.046 % + 5 μV 0.090 % + 10 μV 0.12 % + 20 μV 0.25 % + 20 μV 0.20 % + 3 μV 0.40 % + 3 μV 1.0 % + 3 μV	

Parameter/Range	Frequency	CMC[2, 5] (±)	Comments
AC Voltage[3, 8] – Generate (cont)			
(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 (0.5 to 1) MHz (1 to 10) MHz (10 to 20) MHz (20 to 30) MHz	0.022 % + 12 µV 0.009 % + 7 µV 0.008 % + 7 µV 0.018 % + 7 µV 0.042 % + 17 µV 0.075 % + 20 µV 0.12 % + 25 µV 0.25 % + 45 µV 0.20 % + 3.0 µV 0.40 % + 3.0 µV 1.0 % + 3.0 µV	Fluke 5720A
(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 (0.5 to 1) MHz (1 to 10) MHz (10 to 20) MHz (20 to 30) MHz	0.022 % + 40 µV 0.009 % + 15 µV 0.004 % + 8.0 µV 0.007 % + 10 µV 0.011 % + 30 µV 0.034 % + 80 µV 0.090 % + 0.20 mV 0.15 % + 0.30 mV 0.20 % + 6.5 µV 0.40 % + 6.5 µV 1.0 % + 6.5 µV	
(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 (0.5 to 1) MHz	0.022 % + 0.40 mV 0.008 % + 0.15 mV 0.004 % + 0.05 mV 0.007 % + 0.10 mV 0.010 % + 0.20 mV 0.026 % + 0.6 mV 0.090 % + 2.0 mV 0.13 % + 3.2 mV	
(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 (0.5 to 1) MHz	0.022 % + 4.0 mV 0.008 % + 1.5 mV 0.005 % + 0.60 mV 0.008 % + 1.0 mV 0.013 % + 2.5 mV 0.080 % + 16 mV 0.42 % + 40 mV 0.70 % + 80 mV	*220 V range subject to 2.2E7 V-Hz limitation

Parameter/Range	Frequency	CMC[2, 5, 6] (±)	Comments
AC Voltage[3, 8] – Generate (cont)			
(220 to 1100) V	(15 to 50) Hz 50 Hz to 1 kHz	0.026 % + 16 mV 0.006 % + 3.5 mV	Fluke 5720A
(220 to 750) V	(1 to 20) kHz (20 to 30) kHz (30 to 50) kHz (50 to 100) kHz	0.013 % + 6.0 mV 0.036 % + 11 mV 0.036 % + 11 mV 0.13 % + 45 mV	
AC Voltage[3, 8] – Measure			
(0.1 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 % + 3.3 µV 0.020 % + 1.8 µV 0.030 % + 1.8 µV 0.10 % + 1.8 µV 0.50 % + 1.8 µV 4.0 % + 1.8 µV	Agilent 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 (0.3 to 1) MHz (1 to 2) MHz	0.007 % + 10 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 1V	(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 (0.3 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 % + 0.10 mV 1.0 % + 0.10 mV 1.5 % + 0.10 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 (0.3 to 1) MHz (1 to 2) MHz	0.007 % + 0.40 mV 0.007 % + 0.20 mV 0.014 % + 0.20 mV 0.030 % + 0.20 mV 0.080 % + 0.20 mV 0.30 % + 1.0 mV 1.0 % + 1.0 mV 1.5 % + 1.0 mV	

Parameter/Range	Frequency	CMC[2, 5, 6] (±)	Comments
AC Voltage[3, 8] – Measure (cont)			
(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 (0.3 to 1) MHz	0.02 % + 4.0 mV 0.02 % + 2.0 mV 0.02 % + 2.0 mV 0.04 % + 2.0 mV 0.12 % + 2.0 mV 0.40 % + 10 mV 1.5 % + 10 mV	Agilent 3458A
(100 to 707) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.04 % + 40 mV 0.04 % + 20 mV 0.06 % + 20 mV 0.12 % + 20 mV 0.30 % + 20 mV	
AC Current – Generate [3, 8]			
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	0.023 % + 16 nA 0.014 % + 10 nA 0.011 % + 8.0 nA 0.025 % + 12 nA 0.090 % + 65 nA	Fluke 5720A w/ 5725A
	(10 to 30) kHz	1.6 % + 0.40 µA	Fluke 5522A
(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	0.023 % + 41 nA 0.014 % + 36 nA 0.011 % + 36 nA 0.025 % + 0.11 µA 0.090 % + 0.65 µA	Fluke 5720A w/ 5725A
	(10 to 30) kHz	1.0 % + 0.60 µA	Fluke 5522A
(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	0.023 % + 0.40 µA 0.014 % + 0.36 µA 0.011 % + 0.36 µA 0.025 % + 0.56 µA 0.090 % + 5.0 µA	Fluke 5720A w/ 5725A
	(10 to 30) kHz	0.40 % + 4.0 µA	Fluke 5522A

Parameter/Range	Frequency	CMC[2, 5, 6, 7] (±)	Comments
AC Current[3, 8] – Generate (cont)			
(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	0.023 % + 4.1 µA 0.014 % + 3.6 µA 0.011 % + 2.6 µA 0.018 % + 3.6 µA 0.090 % + 10 µA	Fluke 5720A w/ 5725A
	(10 to 30) kHz	0.40 % + 0.20 mA	Fluke 5522A
(0.22 to 2.2) A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.024 % + 36 µA 0.039 % + 80 µA 0.60 % + 0.16 mA	Fluke 5720A w/ 5725A
(2.2 to 11) A	40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.040 % + 0.18 mA 0.085 % + 0.39 mA 0.33 % + 0.75 mA	Fluke 5720A w/ 5725A
(11 to 20.5) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.12 % + 5.1 mA 0.15 % + 5.1 mA 3.0 % + 5.1 mA	Fluke 5522A
(16.5 to 150) A	(45 to 65) Hz (65 to 440) Hz	0.38 % + 0.029 A 1.0 % + 0.031 A	Fluke 5522A w/ Fluke 5500A coil
(150 to 1025) A	(45 to 65) Hz (65 to 440) Hz	1.0 % + 0.031 A 1.0 % + 0.12 A	
AC Current – Measure[3, 8]			
(5 to 100) µA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz	0.40 % + 0.03 µA 0.15 % + 0.03 µA 0.061 % + 0.03 µA	Agilent 3458A
(0.1 to 100) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz (0.1 to 5) kHz	0.40 % + 0.02 % 0.15 % + 0.02 % 0.061 % + 0.02 % 0.031 % + 0.02 %	
(0.1 to 1) A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz (0.1 to 5) kHz	0.40 % + 0.2 mA 0.16 % + 0.2 mA 0.081 % + 0.2 mA 0.10 % + 0.2 mA	
100 mA to 20 A	Up to 1 kHz (1 to 5) kHz	0.039 % + 0.032 %**F* 0.041 % + 0.032 %**F*	Agilent 3458A w/ Fluke Y5020 *F* is the applied frequency

Parameter/Range	Frequency	CMC[2, 7] (±)	Comments
Capacitance[3, 8] – Generate, Fixed Points			
100 pF to 1.1 µF	1 kHz	0.03 %	GenRad 1423-A
Capacitance[3, 8] – Measure			
50 pF to 1 µF	120 Hz, 1 kHz	0.24 % + 0.19 pF	GenRad 1657
Inductance[3, 8] – Measure			
10 µH to 10 H	120 Hz, 1 kHz	0.25 %	GenRad 1657

Parameter/Equipment	Range	CMC[2] (±)	Comments
Electrical Calibration of RTDs[3] Indicating Systems & Measure –			
Pt 385, 100 Ω	(-200 to 80) °C (-80 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 800) °C	0.013 °C 0.02 °C 0.024 °C 0.026 °C 0.033 °C 0.038 °C	Fluke 7526A
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	0.013 °C 0.015 °C 0.017 °C 0.022 °C 0.026 °C 0.032 °C	
Pt 3916, 100 Ω	(-200 to -190) °C (-190 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.01 °C 0.013 °C 0.015 °C 0.017 °C 0.022 °C 0.026 °C 0.031 °C 0.033 °C	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Electrical Calibration of RTDs[3] Indicating Systems & Measure – (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 630) °C	0.053 °C 0.056 °C 0.06 °C 0.06 °C 0.069 °C 0.071 °C 0.088 °C	Fluke 7526A
Pt 385, 500 Ω	(-200 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C	0.026 °C 0.028 °C 0.034 °C 0.038 °C 0.045 °C	
Pt 385, 1000 Ω	(-200 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C	0.015 °C 0.018 °C 0.024 °C 0.026 °C 0.033 °C	
Ni 120, 120 Ω	(-80 to 260) °C	0.009 °C	
Cu 427, 10 Ω	(-100 to 260) °C	0.11 °C	
SPRT	(-200 to 660) °C	0.06 °C	
Thermocouple[3] – Indicating Systems & Measure			
Type B	(600 to 800) °C (800 to 1550) °C 1550 to 1820) °C	0.35 °C 0.28 °C 0.22 °C	Fluke 7526A
Type C	(0 to 1000) °C (1000 to 1800) °C (1800 to 2000) °C (2000 to 2316) °C	0.16 °C 0.23 °C 0.26 °C 0.35 °C	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Thermocouple[3] – Indicating Systems & Measure (cont)			
Type E	(-250 to -200) °C (-200 to -100) °C (-100 to 0) °C (0 to 600) °C (600 to 1000) °C	0.25 °C 0.12 °C 0.09 °C 0.08 °C 0.1 °C	Fluke 7526A
Type J	(-210 to -100) °C (-100 to 800) °C (800 to 1200) °C	0.14 °C 0.09 °C 0.1 °C	
Type K	(-250 to -200) °C (-200 to -100) °C (-100 to 500) °C (500 to 800) °C (800 to 1372) °C	0.46 °C 0.16 °C 0.1 °C 0.1 °C 0.13 °C	
Type L	(-200 to -100) °C (-100 to 900) °C	0.1 °C 0.09 °C	
Type N	(-250 to -200) °C (-200 to -100) °C (-100 to 0) °C (0 to 100) °C (100 to 800) °C (800 to 1300) °C	0.73 °C 0.23 °C 0.12 °C 0.11 °C 0.1 °C 0.12 °C	
Type R	(50 to -25) °C (-25 to 0) °C (0 to 100) °C (100 to 400) °C (400 to 600) °C (600 to 1000) °C (1000 to 1600) °C (1600 to 1767) °C	0.55 °C 0.45 °C 0.39 °C 0.28 °C 0.22 °C 0.21 °C 0.19 °C 0.23 °C	
Type S	(-50 to -25) °C (-25 to 0) °C (0 to 100) °C (100 to 400) °C (400 to 600) °C (600 to 1000) °C (1000 to 1600) °C (1600 to 1767) °C	0.51 °C 0.43 °C 0.38 °C 0.29 °C 0.23 °C 0.22 °C 0.22 °C 0.26 °C	

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Thermocouple[3] – Indicating Systems & Measure (cont)			
Type T	(-250 to -200) °C (-200 to -100) °C (-100 to 0) °C (0 to 200) °C (200 to 400) °C	0.35 °C 0.16 °C 0.11 °C 0.09 °C 0.09 °C	Fluke 7526A
Type U	(-200 to 0) °C (0 to 200) °C (200 to 600) °C	0.16 °C 0.1 °C 0.1 °C	
Distortion[3, 8]	20 Hz to 20 kHz (20 to 100) kHz	1.0 dB 2.0 dB	Agilent 8903A
Oscilloscopes[3, 8] –			
Risetime	Single Sided	< 125 ps ± 12 ps	Fluke 5522A-SC1100
Bandwidth	50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (0.6 to 1.1) GHz	1.9 % + 0.10 mV 2.3 % + 0.10 mV 4.2 % + 0.10 mV 5.1 % + 0.10 mV	

IV. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC[2, 7] (±)	Comments
Return Loss[3] (VSWR)			Agilent 8902A with:
	5 MHz to 2 GHz (2 to 12.5) GHz (12.5 to 18) GHz	0.11 dB 0.53 dB 0.85 dB	Wiltron 60NF50 Wiltron 58A50
Power Meter[3] – Power Reference @ 1 mW	50 MHz	1.9 %	Power transfer using Agilent 432A, 478A-H76
Power Accuracy	3 μW to 100 mW	0.29 %	Range calibrator

Parameter/Range	Frequency	CMC[2, 5] (±)	Comments
Relative Power[3] – Measure			
(0 to -10) dB	10 MHz to 26.5 GHz	0.046 dB	Agilent 8902A
(-10 to -20) dB	10 MHz to 26.5 GHz	0.053 dB	
(-20 to -30) dB	10 MHz to 26.5 GHz	0.080 dB	
(-30 to -40) dB	10 MHz to 26.5 GHz	0.098 dB	
(-40 to -50) dB	10 MHz to 26.5 GHz	0.11 dB	
(-50 to -60) dB	10 MHz to 26.5 GHz	0.12 dB	
(-60 to -70) dB	10 MHz to 26.5 GHz	0.13 dB	
(-70 to -80) dB	10 MHz to 26.5 GHz	0.17 dB	
(-80 to -90) dB	10 MHz to 26.5 GHz	0.18 dB	
(-90 to -100) dB	10 MHz to 26.5 GHz	0.19 dB	
(-100 to -110) dB	10 MHz to 26.5 GHz	0.19 dB	
(-110 to -120) dB	10 MHz to 26.5 GHz	0.21 dB	
Absolute Power[3] – Measure			Agilent 437B/E4418B:
(-70 to -30) dBm	10 MHz to 18 GHz	2.7 %	Agilent 8484A, N-type
(-30 to +10) dBm	100 kHz to 4.2 GHz	1.4 %	
	(4.2 to 18) GHz	1.9 %	Agilent 8482A, N-type
	(18 to 26.5) GHz	2.4 %	Agilent 8481A, N-type Agilent 8485A, 3.5 mm
(+10 to +20) dBm	100 kHz to 4.2 GHz	3.3 %	
	(4.2 to 18) GHz	3.5 %	Agilent 8482A, N-type
	(18 to 26.5) GHz	3.8 %	Agilent 8481A, N-type Agilent 8485A, 3.5 mm
Amplitude Modulation[3]	(20 to 50) kHz	1.4 %	Agilent 8902A
	50 kHz to 100 kHz	3.6 %	
Frequency Modulation[3]			
Dev: Up to 400 kHz	(20 to 50) Hz	5.8 %	Agilent 8902A
	50 Hz to 100 kHz	1.4 %	
	(100 to 200) kHz	5.8 %	
Phase Modulation[3]	200 Hz to 10 kHz	4.7 %	Agilent 8902A
	200 Hz to 20 kHz	3.5 %	

V. Mechanical

Parameter/Equipment	Range	CMC[2, 7, 8] (±)	Comments
Balances[3]	1 mg to 220 g	20 µg/g	Class 3 weights
Scales[3]	2 mg to 55 kg	0.020 %	Class F/6 weights
Force Gages	Up to 500 lbf	0.020 %	Class 6/F weights
"Direct Verification" of Durometers[3] –			
Spring Force			
A	(0.55 to 8.05) N	0.6 points	Precision balance
B	(0.55 to 8.05) N	0.6 points	
C	Up to 45.45 N	0.6 points	
D	Up to 45.45 N	0.6 points	
DO	Up to 45.45 N	0.6 points	
E	(0.55 to 8.05) N	0.6 points	
O	(0.55 to 8.05) N	0.6 points	
Indenter Shape			
A	35˚ ± 1/4˚; 0.79 mm ± 0.03 mm	Pass/Fail	Optical comparator
B	30˚ ± 1/2˚; 0.1 mm ± 0.012 mm	Pass/Fail	
C	35˚ ± 1/4˚; 0.79 mm ± 0.03 mm	Pass/Fail	
D	30˚ ± 1/2˚; 0.1 mm ± 0.012 mm	Pass/Fail	
DO	1.19 mm ± 0.05 mm	Pass/Fail	
E	2.5 mm ± 0.04 mm	Pass/Fail	
O	1.19 mm ± 0.05 mm	Pass/Fail	
Pressure Measuring Equipment & Measure –			
Pneumatic	(-12 to 300) psi	0.12 %	Fluke 700PV4 w/ 717 300G
	(0 to 15) psi	0.052 %	Fluke 7526A/725 w/ 700P04
	(1.5 to 710) psi	0.025 %	Bell & Howell CEC 6-201-001 DWT

Parameter/Equipment	Range	CMC[2, 7, 8] (±)	Comments
Pressure Measuring Equipment & Measure – (cont)			
Hydraulic	(0 to 30) psi (0 to 100) psi (0 to 500) psi (0 to 10 000) psi (100 to 10 000) psi	0.05 % 0.05 % 0.06 % 0.094 % 0.12 %	Fluke 7526A/725 w/ 700P05 700P06 700P07 700P31 Ametek deadweight tester
Torque Wrenches	(0 to 2000) ft·lbf	0.4 %	Torque transducers
Torque Transducers	(0 to 2000) ft·lbf	0.16 %	Torque arms, weights

VI. Thermodynamic

Parameter/Equipment	Range	CMC[2, 7, 8] (±)	Comments
Temperature – Measuring Equipment[3, 8]	(-78 to 100) ºC (100 to 400) ºC (400 to 600) ºC	0.069 ºC 0.0821 ºC 0.42 ºC	Hart 1522 w/ 5609 w/ baths
Temperature[3, 8] – Measure	(-200 to 100) ºC (100 to 400) ºC (400 to 670) ºC Up to 1500 ºF	0.043 ºC 0.061 ºC 0.11 ºC 2.8 ºF	Hart 1522 w/ 5609 Fluke 743B w/ Type K
Infrared Thermometers	(-30 to 150) ºC (150 to 500) ºC	0.51 ºC 0.35 % + 0.5 ºC	Hart 9133 black body Hart 4181 black body
Relative Humidity –			
Measuring Equipment	(5 to 95) % RH	1.4 % RH	Kaymont 2000
Measure	(10 to 90) % RH	1.1 % RH	Vaisala HMI41/HMP46

VII. Time & Frequency

Parameter/Equipment	Range	CMC[2, 7, 8] (±)	Comments
Frequency[3] – Measuring Equipment	10 MHz Reference 1 mHz to 26.5 GHz	1.2 parts in 10^{10} MHz 1.2 parts in 10^{10} MHz	Rubidium oscillator Rubidium oscillator and 3325B or 8340B
Frequency[3] – Measure	1 mHz to 26.5 GHz	1.2 parts in 10^{10} MHz	Rubidium oscillator locked to 53132A or 53181A

[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, *L* is the numerical value of the nominal length of the device measured in inches; *D* is the length of the diagonal in inches.

[5] The measurands stated are generated with the Fluke 57XXA or 552XA 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 Agilent/Keysight 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, percentages are percentage of reading unless otherwise indicated.

[8] Uncertainty components that can be reasonably attributed to the Unit Under Test have not been utilized in the calculation of the CMC value for this measurement parameter.

Accredited Laboratory

A2LA has accredited

TRESCAL, INC. D.B.A. MASTER METROLOGY

Towson, MD

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 8 January 2009*).

Presented this 15th day of March 2016.

President and CEO
For the Accreditation Council
Certificate Number 1346.01
Valid to July 31, 2018
Revised July 9, 2018

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