



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017
ANSI/NCSL Z540-1-1994 & ANSI/NCSL Z540.3-2006

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CALIBRATION

Valid To: March 31, 2021

Certificate Number: 2516.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations^{1,12}:

I. Chemical

Parameter/Equipment	Range	CMC ^{2, 13} (\pm)	Comments
pH – Measuring Equipment ^{3, 8}	(4, 7, 10) units	0.016 units	Buffer solutions
Electrolytic Conductivity – Measuring Equipment	$\approx 10 \mu\text{S/cm}$ $\approx 100 \mu\text{S/cm}$ $\approx 1000 \mu\text{S/cm}$ $\approx 10\,000 \mu\text{S/cm}$	0.73 $\mu\text{S/cm}$ 2.4 $\mu\text{S/cm}$ 23 $\mu\text{S/cm}$ 0.23 mS/cm	Conductivity solutions

II. Dimensional

Parameter/Equipment	Range	CMC ^{2, 13} (±)	Comments
Angle – Measure ⁸	Up to 60°	5.8”	Gage blocks and sine bar
Angle – Measuring Equipment ⁸	5°, 15°, 30°, 45°	5.2”	Angle blocks
Bore Gages, Bore Micrometers and Holtests ^{3, 8}	Up to 20 in	2.3 µin/in + 28 µin	Plain ring gages
Chamfer Gages ^{3, 8}	Up to 1 in (1 to 2) in	350 µin 410 µin	Master chamfer rings
Coordinate Measuring Machines ^{3, 8} –			
Repeatability	(0.75 to 1) in	26 µin	Sphere
Linear Accuracy	Up to 40 in	2.0 µin/in + 36 µin	Step gage/gage blocks
Squareness	Up to 18 in	5.6 µin/in + 23 µin	Square
Volumetric Performance	600 mm	120 µin	Ball Bar ¹¹
Crimping Tools –			
Crimp Height	Up to 0.5 in	0.0002 in	Pin gages
Pull Test	Up to 288 lbf	0.023 %	Weights and customer-supplied cables and crimps
Diameter, External ^{8, 9} –			
Cylindrical Gauging – Pin, Thread/Gear Wire and Plug Gages, Datum Spheres, Steel Balls	Up to 20 in Up to 4 in ⁹	2.2 µin/in + 9.2 µin 16 µin ⁹	ULM THV w/ gage blocks

Parameter/Equipment	Range	CMC ^{2, 13} (±)	Comments
Diameter, Internal ⁸ – Plain Ring Gages	(0.02 to 0.13) in (0.13 to 0.8) in (0.8 to 20) in	2.2 μin/in + 33 μin 16 μin 2.2 μin/in + 16 μin	ULM w/ ruby balls Ring comparator ULM w/ gage blocks
Flatness ^{8,9}	3”	4.0 μin	Optical flat
Gage Blocks	(0.005 to 4) in (4 to 20) in	1.9 μin/in + 2.3 μin 2.3 μin/in + 4.0 μin	Comparison to gage blocks
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	2.9 μin/in + 5.8 μin	Gage blocks
Height Master ^{3, 8} and Height gages – Displacement – Length Height Master Micrometer Head	Up to 24 in Up to 2 in	3 μin/in + 45 μin 17 μin	Gage blocks, linear amplifier Gage blocks, linear amplifier
Fixture Gages ⁸ – (Inspection fixtures, Hard Tooling, Functional gages) 1D 2D Volumetric	Up to 24 in Up to 60 in X to Y 24 in x 24 in X to Z or Y to Z 24 in x 20 in 20 in x 20 in x 24 in	230 μin 3.9 μin/in + 25 μin 350 μin 390 μin 700 μin	CMM, optical comparator, gage blocks and linear amplifier, hand tools

Parameter/Equipment	Range	CMC ^{2, 13} (\pm)	Comments
Linear Scales ^{3, 8} – Machine Tools and Linear Scales, Glass Scales, Optical Magnifiers	Up to 1 in (1 to 6) in (6 to 12) in (12 to 144) in Up to 40 in	200 μ in 280 μ in 490 μ in 9.2 μ in/in + 380 μ in 1.6 μ in/in	Optical comparator Doppler laser
Length Standards ^{8, 9} (Micrometer Standards, End rods, Step Gages)	Up to 4 in ⁹ Up to 20 in (20 to 80) in	16 μ in ⁹ 2.2 μ in/in + 8.0 μ in 1.8 μ in/in + 15 μ in	ULM, gage blocks, linear amplifier
Optical Comparators ^{3, 8} – Linear Travel Magnification Angle	Up to 24 in 10x to 100x 0° to 360°	10 μ in/in + 74 μ in 0.016 % 1.7 arc minute	Glass scales, master balls
Surface Roughness Testers ^{3, 8} – (Profilometers)	\approx 16 Ra \approx 120 Ra	2.7 μ in 4.8 μ in	Surface roughness standards
Radius Gages ⁸	Up to 1 in (1 to 6) in (6 to 12) in	250 μ in 350 μ in 600 μ in	Optical comparator
Sieves & Sieve Cloths ⁸	20 μ m to 26.5 mm	4.6 μ m/mm + 2.6 μ m	ASTM E11 w/ optical comparator
Squareness ⁸	90°	8.8 μ in/in + 10 μ in	Master square
Rules ⁸ and Tapes ^{3, 8}	Up to 120 in Up to 100 ft	(120 + 10L) μ in 35 μ in/in + 0.031 in	Optical comparator, Master tapes and scales

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Surface Finish Standards ^{3,8}	≈ 16 Ra ≈ 120 Ra > 120 Ra	3.0 μin 5.2 μin 4.4 μin + 12 %	Surface finish standards w/ surface texture analyzers
Surface Plates ³ – Overall Flatness Repeat Readings	Up to 170 in diagonal Up to 0.0002 inch	1.5D μin 28 μin	Doppler Laser Repeat-A-Meter
Thread Gauging, External ⁸ –			
Plug Gages, Discs Major Diameter	Up to 1 in (>1 to 8) in	23 μin 3.0 μin/in + 13 μin	ULM Gage blocks, contact method
Pitch Diameter Up to 8 in	29 ° 55 ° 60 °	6.1 μin/in + 72 μin 6.1 μin/in + 81 μin 14 μin/in + 120 μin	Master wires
National Pipe (NPT) Pitch Diameter	Up to 3 in	18 μin/in + 72 μin	
Step	Up to 4 in	41 μin	Gage blocks, linear amplifier
Thread Gauging, Internal ⁸ –			
Ring Gages: Minor Diameter	Up to 0.5 in Up to 3.2 in	350 μin (180 + 17L) μin	Hole micrometer, pins Master ring
Pitch Diameter: Up to 8 in (Adj.) (1.1 to 12) (Fixed)	29° 7/45°, 55°, 60° 29°, 7/45°, 55°, 60°	(200 + 55L) μin (160 + 45L) μin (70 + 2.2L) μin	Master plug set (functional fit only) T-ball measurements

III. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2, 5, 6, 7} (\pm)	Comments
DC Voltage ^{3, 8} – Generate	Up 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 μ V/V + 0.40 μ V 3.7 μ V/V + 0.80 μ V 4.9 μ V/V + 3.0 μ V 4.9 μ V/V + 4.3 μ V 3.7 μ V/V + 48 μ V 4.7 μ V/V + 0.48 mV	Fluke 5720A
DC Voltage – Generate ^{3, 8} , Fixed Points	10 V	1.3 μ V/V	Fluke 732B
DC Voltage – Generate & Measure ^{3, 8}	Up to 1000 V	2.1 μ V/V	Fluke 732B w/ 752A and Agilent 3458A
DC Voltage– Measure ^{3, 8}	Up to 100 mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 1000) V	9.5 μ V/V + 0.37 μ V 6.1 μ V/V + 0.37 μ V 5.8 μ V/V + 0.60 μ V 8.7 μ V/V + 37 μ V 8.7 μ V/V + 0.12 mV	Agilent 3458A
DC High Voltage– Measure ^{3, 8}	(1 to 60) kV	0.13 %	Ross VD60 w/ HP 8842A
DC Current – Generate ^{3, 8}	Up to 200 pA (0.2 to 200) nA Up to 220 μ A (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 (20.5 to 150) A (150 to 1000) A (2 to 20) A (20 to 120) A 120 A to 5 kA	1.9 % + 13 fA 0.35 % + 13 fA 35 μ A/A + 6.0 nA 31 μ A/A + 7.0 nA 30 μ A/A + 41 nA 41 μ A/A + 0.71 μ A 77 μ A/A + 12 μ A 0.034 % + 0.48 mA 0.10 % + 0.91 A 0.58 % + 0.16 A 0.60 % + 0.58 A 0.04 % 0.06 % 0.9 %	Keithley 617 and voltage source Fluke 5720A Fluke 5520A Fluke 5520A w/ coil Fluke 5522A, 52120A w/ coil

Parameter/Equipment	Range	CMC ^{2,6,7} (\pm)	Comments
DC Current – Measure ^{3,8}	Up to 200 pA (0.2 to 200) nA	1.9 % + 13 fA 0.35 % + 13 fA	Keithley 617
	Up to 100 μ A (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A	17 μ A/A + 0.80 nA 17 μ A/A + 5.0 nA 17 μ A/A + 50 nA 31 μ A/A + 0.50 μ A 0.010 % + 10 μ A	Agilent 3458A
	(1 to 10) A (10 to 100) A (100 to 1200) A	0.31 mA 0.012 % 0.05 %	w/ L&N 4222 w/ L&N 4223 w/ RAM shunt
Resistance – Generate ^{3,8}	Up to 10.9999 Ω (11 to 32.9999) Ω (33 to 109.9999) Ω (110 to 329.9999) Ω (0.33 to 1.099999) k Ω (1.1 to 3.299999) k Ω (3.3 to 10.99999) k Ω (11 to 32.99999) k Ω (33 to 109.999) k Ω (110 to 329.999) k Ω	40 $\mu\Omega/\Omega$ + 1.0 m Ω 30 $\mu\Omega/\Omega$ + 2.0 m Ω 28 $\mu\Omega/\Omega$ + 2.0 m Ω 28 $\mu\Omega/\Omega$ + 4.0 m Ω 28 $\mu\Omega/\Omega$ + 13 m Ω 28 $\mu\Omega/\Omega$ + 13 m Ω 28 $\mu\Omega/\Omega$ + 30 m Ω 28 $\mu\Omega/\Omega$ + 0.30 Ω 28 $\mu\Omega/\Omega$ + 0.30 Ω 32 $\mu\Omega/\Omega$ + 2.0 Ω	Fluke 5520A, 4-wire
	(0.33 to 1.09999) M Ω (1.1 to 3.29900) M Ω (3.3 to 10.9999) M Ω (11 to 32.9999) M Ω (33 to 109.9999) M Ω (110 to 329.9999) M Ω (330 to 1100) M Ω	32 $\mu\Omega/\Omega$ + 2.2 Ω 60 $\mu\Omega/\Omega$ + 39 Ω 0.013 % + 63 Ω 0.025 % + 2.5 k Ω 0.050 % + 3.0 k Ω 0.30 % + 0.10 M Ω 1.5 % + 0.50 M Ω	Fluke 5520A, 2-wire

Parameter/Equipment	Range	CMC ^{2,5,7} (±)	Comments	
Resistance – Generate ^{3,8} (cont)				
Fixed Points	0.1 mΩ	0.29 %	Shunt	
	1 mΩ	93 μΩ/Ω	Standard resistors L&N 4221,4222, 4223 Fluke 742A's	
	10 mΩ	65 μΩ/Ω		
	100 mΩ	75 μΩ/Ω		
	1 Ω	6.9 μΩ/Ω		
	(1.9, 10) Ω	7.2 μΩ/Ω		
	100 Ω	4.7 μΩ/Ω		
	1 kΩ	6.9 μΩ/Ω		
	10 kΩ	5.2 μΩ/Ω		
	19 kΩ	6.1 μΩ/Ω		
	100 kΩ	6.8 μΩ/Ω		
	1 MΩ	8.7 μΩ/Ω		
	10 MΩ	15 μΩ/Ω		
	19 MΩ	19 μΩ/Ω		
Fixed Points	0 Ω	41 μΩ		Fluke 5720A
	1 Ω	80 μΩ/Ω + 6.3 μΩ		
	1.9 Ω	80 μΩ/Ω + 11 μΩ		
	10, 19 Ω	21 μΩ/Ω + 120 μΩ		
	100, 190 Ω	21 μΩ/Ω + 1.2 mΩ		
	1, 1.9 kΩ	7.5 μΩ/Ω + 58 mΩ		
	10, 19 kΩ	7.5 μΩ/Ω + 0.58 Ω		
	100, 190 kΩ	9 μΩ/Ω + 0.9 Ω		
	1 MΩ	15 μΩ/Ω + 5 Ω		
	1.9 MΩ	16 μΩ/Ω + 13 Ω		
	10 MΩ	31 μΩ/Ω + 70 Ω		
	19 MΩ	39 μΩ/Ω + 0.16 kΩ		
	100 MΩ	95 μΩ/Ω + 0.84 kΩ		

Parameter/Equipment	Range	CMC ^{2,6,7} (\pm)	Comments
Resistance – Measure ^{3,8}	Up to 10 Ω (10 to 100) Ω (100 to 1000) Ω (1 to 10) k Ω (10 to 100) k Ω (100 to 1000) k Ω (1 to 10) M Ω (10 to 100) M Ω (0.1 to 1) G Ω	18 $\mu\Omega/\Omega$ + 58 $\mu\Omega$ 12 $\mu\Omega/\Omega$ + 0.58 m Ω 9.5 $\mu\Omega/\Omega$ + 5.8 m Ω 9.5 $\mu\Omega/\Omega$ + 58 m Ω 9.7 $\mu\Omega/\Omega$ + 0.58 Ω 15 $\mu\Omega/\Omega$ + 2.3 Ω 58 $\mu\Omega/\Omega$ + 0.12 k Ω 0.058 % + 1.2 k Ω 0.59 % + 12 k Ω	Agilent 3458A
	(0.1 to 1) Ω (1 to 1.9) Ω (1.9 to 10) Ω (10 to 100) Ω (0.1 to 1) k Ω (1 to 10) k Ω (10 to 19) k Ω (19 to 100) k Ω (0.1 to 1) M Ω (1 to 10) M Ω (10 to 19) M Ω (19 to 100) M Ω	60 $\mu\Omega/\Omega$ 16 $\mu\Omega/\Omega$ 13 $\mu\Omega/\Omega$ 14 $\mu\Omega/\Omega$ 14 $\mu\Omega/\Omega$ 4.8 $\mu\Omega/\Omega$ 4.8 $\mu\Omega/\Omega$ 4.8 $\mu\Omega/\Omega$ 7.2 $\mu\Omega/\Omega$ 10 $\mu\Omega/\Omega$ 13 $\mu\Omega/\Omega$ 19 $\mu\Omega/\Omega$	Resistance transfer method using Fluke 742A Reference Resistors

AC Voltage – Measure^{3,13} w/ Fluke 5790A

Voltage	Frequency								
	9.5 Hz	(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
2.2 mV		0.15%	0.066%	0.038%	0.073%	0.140%	0.270%	0.30%	0.50%
7 mV		0.061%	0.018%	0.013%	0.025%	0.052%	0.100%	0.15%	0.29%
22 mV		0.032%	0.018%	0.016%	0.022%	0.049%	0.099%	0.14%	0.29%
70 mV	0.26%	0.027%	0.013%	0.012%	0.019%	0.044%	0.078%	0.12%	0.26%
220 mV	0.26%	0.025%	0.010%	0.008%	0.018%	0.043%	0.076%	0.12%	0.26%
700 mV	0.55%	0.025%	0.009%	0.005%	0.008%	0.011%	0.035%	0.091%	0.55%
2.2 V	0.55%	0.024%	0.009%	0.005%	0.008%	0.012%	0.036%	0.092%	0.55%
7 V	0.14%	0.024%	0.009%	0.004%	0.008%	0.011%	0.033%	0.10%	0.14%
22 V	0.15%	0.024%	0.009%	0.004%	0.008%	0.012%	0.034%	0.10%	0.16%
70 V		0.024%	0.009%	0.005%	0.008%	0.015%	0.081%	0.42%	0.70%
220V		0.029%	0.010%	0.005%	0.009%	0.016%	0.082%	0.42%	
700 V			0.027%	0.013%	0.041%	0.140%			
1000 V			0.028%	0.013%	0.039%				

AC Voltage Flatness – Measure^{3,13} @ 50 Ω w/ Fluke 5790A⁸

V _{P-P}	V _{RMS}	Frequency			
		10 Hz to 50 kHz	50 kHz to 1 MHz	(1 to 10) MHz	(10 to 30) MHz
0.005 V	0.00177 V	0.092%	0.21%	0.27%	0.27%
0.0075 V	0.002655 V	0.092%	0.21%	0.27%	0.27%
0.01 V	0.00354 V	0.095%	0.21%	0.28%	0.27%
0.025 V	0.00885 V	0.092%	0.21%	0.27%	0.27%
0.04 V	0.01416 V	0.092%	0.21%	0.26%	0.26%
0.07 V	0.02478 V	0.092%	0.21%	0.26%	0.26%
0.1 V	0.0354 V	0.095%	0.21%	0.26%	0.26%
0.25 V	0.0885 V	0.092%	0.21%	0.26%	0.26%
0.4 V	0.1416 V	0.093%	0.21%	0.23%	0.23%
0.8 V	0.2832 V	0.092%	0.19%	0.23%	0.23%
1.2 V	0.4248 V	0.092%	0.19%	0.23%	0.23%
3.4 V	1.2036 V	0.093%	0.19%	0.22%	0.22%
5.5 V	1.947 V	0.092%	0.19%	0.22%	0.22%

Parameter/Range	Frequency	CMC ^{2, 7, 13} (\pm)	Comments
Inductance – Measure ^{3, 8} 1 μ H to 10 H	(0.1 to 1) kHz	0.2 % + 0.06 μ H	QuadTech 1689M CMC is stated at 1 kHz ¹⁰
Inductance – Generate ³ Fixed Points 100 μ H 1 mH 100 mH 1 H 10 H	400 Hz & 1 kHz	1.2 % 0.13 % 0.083 % 0.083 % 0.17 %	General Radio 1482 series

Parameter/Range	Frequency	CMC ^{2, 7, 13} (\pm)	Comments
AC Voltage – Generate ^{3, 8}			
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	0.022 % + 4.0 μ V 85 μ V/V + 4.0 μ V 75 μ V/V + 4.0 μ V 0.018 % + 4.0 μ V 0.046 % + 5.0 μ V 0.090 % + 10 μ V 0.12 % + 20 μ V 0.25 % + 20 μ V	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	0.022 % + 4.0 μ V 85 μ V/V + 4.0 μ V 75 μ V/V + 4.0 μ V 0.018 % + 4.0 μ V 0.046 % + 5.0 μ V 0.090 % + 10 μ V 0.12 % + 20 μ V 0.25 % + 20 μ V	
(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	0.022 % + 12 μ V 85 μ V/V + 7.0 μ V 75 μ V/V + 7.0 μ V 0.018 % + 7.0 μ V 0.042 % + 17 μ V 0.075 % + 20 μ V 0.12 % + 25 μ V 0.25 % + 45 μ V	
220 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 500 kHz to 1 MHz	0.022 % + 82 μ V 85 μ V/V + 82 μ V 40 μ V/V + 82 μ V 70 μ V/V + 82 μ V 0.011 % + 82 μ V 0.034 % + 82 μ V 0.090 % + 0.22 mV 0.15 % + 0.31 mV	
(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	0.022 % + 0.40 mV 80 μ V/V + 0.15 mV 40 μ V/V + 50 μ V 70 μ V/V + 0.10 mV 95 μ V/V + 0.20 mV 0.026 % + 0.60 mV 0.090 % + 2.0 mV 0.13 % + 3.2 mV	

Parameter/Range	Frequency	CMC ^{2, 7, 13} (\pm)	Comments
AC Voltage – Generate ^{3, 8} (cont)			
(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	0.022 % + 4.0 mV 80 μ V/V + 1.5 mV 47 μ V/V + 0.61 mV 75 μ V/V + 1.0 mV 0.013 % + 2.5 mV 0.080 % + 16 mV 0.42 % + 40 mV 0.70 % + 80 mV	Fluke 5720A * 220 V range subject to 2.2E7 V-Hz limitation
(220 to 1100) V	40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz	80 μ V/V + 4.1 mV 0.013 % + 6.1 mV 0.036 % + 11 mV	
(220 to 750) V	(30 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (500 to 1000) KHz	0.036 % + 11 mV 0.080 % + 45 mV 0.13 % + 83 mV 0.42 % + 91 mV 0.70 % + 1.1 V	
AC High Voltage – Measure ^{3, 8}			
(1 to 42) kVrms	60 Hz	0.30 %	Ross VD60 w/ HP 8842A

Parameter/Range	Frequency	CMC ^{2, 7, 13} (±)	Comments
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
220 µA 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 % + 40 nA 0.014 % + 36 nA 0.011 % + 36 nA 0.025 % + 0.11 µA 0.090 % + 0.65 µA	
(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 % + 0.41 µA 0.014 % + 0.36 µA 0.011 % + 0.36 µA 0.025 % + 0.56 µA 0.090 % + 5.0 µA	
(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 % + 4.0 µA 0.014 % + 4.0 µA 0.011 % + 3.0 µA 0.018 % + 4.0 µA 0.090 % + 10 µA	
220 mA to 2.2 A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.024 % + 35 µA 0.039 % + 80 µA 0.60 % + 0.16 mA	
(2.2 to 11) A	40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.040 % + 0.19 mA 0.085 % + 0.39 mA 0.33 % + 0.75 mA	
(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 5520A
(16.5 to 150) A (150 to 1000) A	60 Hz (45 to 65) Hz 60 Hz (45 to 65) Hz	0.37 % + 0.029 A 1.0 % + 0.031 A	Fluke 5520A w/ coil
(16.5 to 150) A (150 to 1000) A	(65 to 440) Hz (65 to 440) Hz	1.0 % + 0.031 A 0.95 % + 0.12 A	
Up to 20 A	(10 to 65) Hz (65 to 300) Hz 300 Hz to 1 kHz	0.62 % 0.49 % 0.38 %	Fluke 52120A

Parameter/Range	Frequency	CMC ^{2, 7, 13} (±)	Comments
AC Current – Generate ^{3, 8} (cont)			
(20 to 120) A	(10 to 65) Hz (65 to 300) Hz 300 Hz to 1 kHz	0.29 % 0.29 % 0.29 %	Fluke 52120A
120 A to 6 kA	(10 to 65) Hz (65 to 300) Hz 300 Hz to 1 kHz	0.97 % 0.95 % 0.94 %	Fluke 52120A w/ coil
AC Current – Measure ^{3, 8}			
10 µA to 20A	10 Hz to 10 kHz	0.013 %	Fluke 5790A w/ A40s
(5 to 100) µA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 5 kHz	0.46 % + 35 nA 0.15 % + 30 nA 0.060 % + 30 nA	Agilent 3458A
(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 % + 0.20 µA 0.15 % + 0.20 µA 0.060 % + 0.20 µA 0.030 % + 0.20 µA 0.060 % + 0.20 µA 0.40 % + 0.40 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 % + 2.0 µA 0.15 % + 2.0 µA 0.060 % + 2.0 µA 0.030 % + 2.0 µA 0.060 % + 2.0 µA 0.40 % + 4.0 µA 0.55 % + 15 µA	
(10 to 100) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz	0.40 % + 0.02 mA 0.15 % + 0.02 mA 0.06 % + 0.02 mA	

Parameter/Range	Frequency	CMC ^{2, 4, 6, 7, 13} (\pm)	Comments
AC Current – Measure ^{3, 8} (cont)			
(10 to 100) mA	100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.03 % + 0.02 mA 0.06 % + 0.02 mA 0.40 % + 0.04 mA 0.55 % + 0.04 mA	Agilent 3458A
(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 0.160 % + 0.2 mA 0.080 % + 0.2 mA 0.10 % + 0.2 mA 0.30 % + 0.2 mA 1.0 % + 0.4 mA	
AC Resistance – Generate ^{3, 8}			
0.1 Ω 1 Ω 10 Ω (0.1, 1, 10, 100) k Ω	DC to 13 MHz	1.2 % + 0.6R 0.12 % + 0.6R 0.11 % + 0.6R 0.032 % + 0.6R	Agilent 16074A AC

Parameter/Range	Frequency	CMC ^{2, 7, 13} (±)	Comments
Oscilloscopes ^{3, 8} –			
Risetime – Generate	10 Hz to 2 MHz (420 to 540) ps	20 ps	Fluke 9500B with 9510 Active Head
	10 Hz to 2 MHz (125 to 175) ps	17 ps	Fluke 9500B with 9530 Active Head
	10 Hz to 1 MHz (59 to 81) ps	14 ps	Fluke 9500B with 9560 Active Head
	10 Hz to 1 MHz (13 to 17) ps	3.4 ps	Tektronix, Step Gen. 067-1338-00
Risetime – Measure	7 ps to 540 ps	8 ps	Tektronix 80E01
Bandwidth (Flatness)	50 kHz to 300 MHz	3.4 %	Fluke 9500B
	(300 to 550) MHz	3.5 %	
	(0.55 to 1.1) GHz	4.4 %	
	(0.11 to 3.2) GHz	5.3 %	
	(3.2 to 6.0) GHz	5.6 %	
	100 kHz to 4.2 GHz	1.4 %	
(4.2 to 18) GHz	1.9 %	Signal generator w/ power sensor	
(18 to 26.5) GHz	3.0 %		
(26.5 to 50) GHz	4.1 %		
Phase Angle – Generate ^{3, 8}			
(0.0 to 360)° (0.05 to 120) V	(1 to 1000) Hz	6.2 m°	Clarke-Hess 5500, m° = milli degree
	(1.01 to 6.25) kHz	12 m°	
	(6.26 to 50) kHz	17 m°	
	(50.01 to 100) kHz	46 m°	
Phase Angle – Measure ^{3, 8}			
(0.0 to 360)° (0.01 to 120) V	20 Hz to 10 kHz	81 m°	Krohn-Hite 6500
	(10 to 40) kHz	0.29°	
	(40 to 100) kHz	0.98°	

Parameter/Equipment	Range	CMC ^{2,13} (±)	Comments
Distortion ^{3,8}	20 Hz to 20 kHz (20 to 100) kHz	1.2 dB 2.4 dB	Agilent 8903A
	100 kHz to 2.5 GHz	1.8 dB	Agilent E4448A
	(2.5 to 26.5) GHz	2.6 dB	Agilent E4448A
Electrical Calibration of Thermocouple Indicators –			
Type E	(-250 to -200) °C	0.25 °C	Fluke 7526A
	(-200 to -100) °C	0.12 °C	
	(-100 to 0) °C	0.09 °C	
	(0 to 600) °C	0.08 °C	
	(600 to 1000) °C	0.1 °C	
Type J	(-210 to -100) °C	0.14 °C	
	(-100 to 800) °C	0.09 °C	
	(800 to 1200) °C	0.1 °C	
Type K	(-250 to -200) °C	0.46 °C	
	(-200 to -100) °C	0.16 °C	
	(-100 to 500) °C	0.1 °C	
	(500 to 800) °C	0.1 °C	
	(800 to 1372) °C	0.13 °C	
Type N	(-250 to -200) °C	0.73 °C	
	(-200 to -100) °C	0.23 °C	
	(-100 to 0) °C	0.12 °C	
	(0 to 100) °C	0.11 °C	
	(100 to 800) °C	0.1 °C	
	(800 to 1300) °C	0.12 °C	

Parameter/Equipment	Range	CMC ^{2,13} (±)	Comments
Electrical Calibration of Thermocouple Indicators – (cont)			
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	Fluke 7526A
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	
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	
Type U	(-200 to 0) °C (0 to 200) °C (200 to 600) °C	0.16 °C 0.1 °C 0.1 °C	

Parameter/Equipment	Range	CMC ^{2,13} (±)	Comments
Electrical Calibration of RTDs Indicators ³ –			
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	
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	
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	

Parameter/Equipment	Range	CMC ^{2, 7, 13} (±)	Comments
Electrical Calibration of RTDs Indicators ³ – (cont)			Fluke 7526A
Ni 385, 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	
Electrical Conductivity Meters (IACS)	Up to 16 % (>16 to 35) % (>35 to 62) % (>62 to 104) %	2.2 % 1.1 % 0.38 % IACS 1.0 % IACS	Conductivity standards

IV. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC ^{2, 7, 13} (±)	Comments
Power Meter – Power Reference ^{3, 8} @ 1 mW	50 MHz	1.9 %	Agilent 432A w/ 478A
Relative Power (Tuned RF Level) ^{3, 8} – Measure	100 kHz to 50 GHz		Agilent E4448A
(0 to -10) dB		0.018 dB	
(-10 to -20) dB		0.019 dB	
(-20 to -30) dB		0.019 dB	
(-30 to -40) dB		0.056 dB	
(-40 to -50) dB		0.056 dB	
(-50 to -60) dB		0.057 dB	
(-60 to -70) dB		0.057 dB	
(-70 to -80) dB		0.094 dB	
(-80 to -90) dB		0.094 dB	
(-90 to -100) dB		0.095 dB	
(-100 to -110) dB		0.096 dB	
(-110 to -120) dB		0.096 dB	
(-120 to -130) dB		0.097 dB	

Parameter/Range	Frequency	CMC ^{2, 7, 13} (±)	Comments
Amplitude Modulation – Measure ^{3, 8} Depth: (5 to 99) % (5 to 20) % (20 to 99) % (5 to 20) % (20 to 99) % (5 to 20) % (20 to 99) % (5 to 20) % (20 to 99) %	100 kHz to 10 MHz 10 MHz to 3 GHz 10 MHz to 3 GHz (3 to 26.5) GHz (3 to 26.5) GHz (26.5 to 31.15) GHz (26.5 to 31.15) GHz (31.15 to 50) GHz (31.15 to 50) GHz	0.75 % 2.5 % 0.50 % 4.5 % 1.5 % 6.8 % 1.9 % 2.6 % 6.0 %	E4448A opt 233
Phase Modulation ^{3, 8} – Mod Rate: (0.2 to 20) kHz 0.3 rad < Dev ≤ 0.7 rad Dev > 0.7 rad 0.6 rad < Dev ≤ 2.0 rad Dev > 2.0 rad 1.2 rad < Dev ≤ 4.0 rad Dev > 4.0 rad 1.3 rad < Dev ≤ 4.0 rad Dev > 4.0 rad 2.4 rad < Dev ≤ 8.0 rad Dev > 8.0 rad	100 kHz to 6.6 GHz (6.6 to 13.2) GHz (13.2 to 26.5) GHz (26.5 to 31.5) GHz (31.5 to 50) GHz	3.0 % 1.0 % 3.0 % 1.0 % 3.0 % 1.0 % 3.0 % 1.0 %	E4448A opt 233
Transmission ^{3, 8} S ₁₂ /S ₂₁ – Measure Linear Phase Linear Mag. Linear Phase Linear Mag.	Type-N Connectors 300 kHz to 2 GHz (2 to 6) GHz	(± 0.76 to ± 39)° (± 0.11 to ± 8.2) dB (± 2.1 to ± 15)° (± 0.25 to ± 1.9) dB	Agilent N5230A VNA w/ 85032B calibration kit

Parameter/Range	Frequency	CMC ^{2, 7, 13} (±)	Comments
Reflection ^{3, 8} S ₁₁ /S ₂₂ – Measure			
Linear Phase Linear Mag.	Type-N Connectors: 300 kHz to 2 GHz	(± 2.4 to ± 13) ^o (± 0.33 to ± 0.36)dB	Agilent N5230A VNA w/ 85032B calibration kit
Linear Phase Linear Mag.	(2 to 6) GHz	(± 12 to ± 35) ^o (± 1.1 to ± 1.6) dB	
Single Side-Band Phase Noise – Measure ^{3, 8}	Carrier: 1 MHz to 50 GHz		Agilent E4448A option 226
Noise Floor :	Offset Freq:		
-110 dB	10 Hz	1.5 dB	
-110 dB	100 Hz	1.5 dB	
-130 dB	1 kHz	1.5 dB	
-140 dB	10 kHz	1.5 dB	
-150 dB	100 kHz	1.5 dB	
-155 dB	1 MHz	1.5 dB	
-155 dB	10 MHz	1.5 dB	
-155 dB	100 MHz	1.5 dB	

V. Fluid Quantities

Parameter/Equipment	Range	CMC ^{2, 7, 13} (±)	Comments
Gas Flow ^{3, 8}	Up to 1 sccm (1 to 10) sccm (10 to 100) sccm (0.1 to 1) slm (1 to 10) slm (10 to 100) slm	0.24 % + 0.006 sccm 0.33 % + 0.006 sccm 0.27 % + 0.006 sccm 0.27 % + 0.0006 slm 0.27 % + 0.006 slm 0.65 % + 0.006 slm	Flow standards
Liquid Flow ^{3, 8}	0.1 mL/min (0.5 to 20) mL/min	2 % + 0.6 µL/min 0.84 % + 0.6 µL/min	Comparator, Stopwatch, Distilled Water – Gravimetric Method

Parameter/Equipment	Range	CMC ^{2, 7, 13} (\pm)	Comments
Viscosity ³ – Ford, Dip and Other Viscosity Cups	Cup Nos. 1 through 5	2.8 %	ASTM D1200-94, D4212-93, ISO 2431
Volumetric Glassware and Volumetric Apparatus	10 mL 25 mL 50 mL 100 mL 250 mL 500 mL 1 L 2.5 L 5 L 10 L 15 L 20 L	0.0098 mL 0.024 mL 0.049 mL 0.098 mL 0.24 mL 0.49 mL 0.98 mL 2.4 mL 4.8 mL 9.8 mL 15 mL 20 mL	Gravimetric Method w/ Electronic Balance and Thermometer

VI. Magnetic Quantities

Parameter/Equipment	Range	CMC ² (\pm)	Comments
DC Gauss Meters ^{3, 8}	10 G 20 G	0.62 G 0.62 G	R.B. Annis Gauss standards

VII. Mechanical

Parameter/Equipment	Range	CMC ^{2, 13} (\pm)	Comments
Mass Measurement ⁸	Up to 30 g (30 to 160) g (160 to 620) g 620 g to 4 kg (4 to 5) kg (5 to 10) kg (10 to 20) kg (20 to 50) kg	0.12 mg 0.55 mg 3.2 mg 34 mg 66 mg 76 mg 0.23 g 0.41 g	Direct weighing Substitution method: Class 1 mass Class 3 mass

Parameter/Equipment	Range	CMC ^{2,4,7,13} (\pm)	Comments
Scales and Balances ^{3,8}	(1 to 10) mg (10 to 100) mg (0.1 to 1) g (1 to 10) g (10 to 3200) g	0.045 % + 0.6R 0.089 % + 0.6R 0.020 % + 0.6R 0.00040 % + 0.6R 0.00028 % + 0.6R	Class 1 weights
	(3.2 to 22) kg (22 to 55) kg	0.001 % + 0.6R 0.001 % + 0.6R	Class 3 weights
	Up to 1000 lb Up to 4800 lb	0.023 % 0.10 %	Class F weights
Force – Tension and Compression ³	Up to 1400 lbf	0.023 %	Deadweight method
	(1 to 2) klb (2 to 5) klb (5 to 10) klb (10 to 25) klb	4.6 lbf 4.8 lbf 5.2 lbf 10 lbf	Load cells
Torque ³ – Tools (Gages and drivers)	(0.5 to 215) ozf·in 5 lbf·in to 250 lbf·ft (250 to 1000) lbf·ft	0.51 % 0.30 % + 0.6R 0.24 % + 0.6R	Torque tester
	Testers and Transducers (2 to 100) ozf·in (6 to 250) lbf·in (20 to 250) lbf·ft (250 to 1000) lbf·ft	0.030 % + 0.05 ozf·in 0.030 % + 0.12 lbf·in 0.030 % + 0.08 lbf·ft 0.030 % + 0.20 lbf·ft	Torque arm and weights
Pressure ^{3,8}	(0.5 to 23) psia	0.01 % + 0.00003 psi	Pressure calibration system
	(23 to 1015) psia	0.010 % + 0.6R	Pressure calibrator
	(1000 to 5000) psig (5000 to 10 000) psig	0.035 % + 2.5 psig 0.035 % + 8.3 psig	Pressure calibrator with Fluke 700 series
	(10 to 30) kpsi	25 psi	Heise 901A

Parameter/Equipment	Range	CMC ^{2, 13} (±)	Comments
Hardness Testers – Rockwell, Indirect Verification	<p>HRA: Low Medium High</p> <p>HRBW: Low Medium High</p> <p>HRC: Low Medium High</p> <p>HREW: Low Medium High</p> <p>HRRW: Medium High</p> <p>HR15N: Low Medium High</p> <p>HR15TW: Low Medium High</p> <p>HR30N: Low Medium High</p> <p>HR30TW: Low Medium High</p>	<p>0.43 HRA 0.35 HRA 0.18 HRA</p> <p>0.58 HRBW 0.63 HRBW 0.48 HRBW</p> <p>1.0 HRC 0.47 HRC 0.34 HRC</p> <p>1.1 HREW 0.83 HREW 1.1 HREW</p> <p>0.44 HRRW 0.31 HRRW</p> <p>0.89 HR15N 0.77 HR15N 0.22 HR15N</p> <p>0.89 HR15TW 0.77 HR15TW 0.22 HR15TW</p> <p>0.61 HR30N 0.66 HR30N 0.91 HR30N</p> <p>0.78 HR30TW 0.69 HR30TW 0.35 HR30TW</p>	ASTM E18 Hardness Blocks



Parameter/Equipment	Range	CMC ^{2, 13} (±)	Comments
Hardness Testers – Rockwell, Indirect Verification (cont)	HR45N: Low Medium High HR45T: Low Medium High	0.84 HR45N 0.51 HR45N 0.54 HR45N 0.79 HR45T 0.43 HR45T 0.47 HR45T	ASTM E18 hardness blocks
Hardness Testers – Brinell Indirect Verification at Test Conditions ³	≤ 263 HBW > (263 to 591) HBW	2.6 HBW 7.1 HBW	ASTM E10
Equotip (Leeb) Testers ³	≈ 800 LD	18 LD	ASTM A956
Durometer Calibration – Direct Verification ³			ASTM D2240
Indenter Shape and Extension	Orifice Diameter	0.00028 in	Optical comparator
	Indenter extension length	0.00028 in	
	Cone angle Tip radius Indenter thickness	0.09°	
Spring Force	A, B, O, D, C, DO scales	0.43 pts	Shore durocalibrator w/ calibrated weights

VIII. Optical Quantities

Parameter/Equipment	Range	CMC ² (±)	Comments
Gloss Meters ⁸	20° 60° 85°	1.4 GU 1.3 GU 1.3 GU	Gloss standards

Parameter/Equipment	Range	CMC ² (±)	Comments
Gloss Standards ⁸	20°, 60°, 85°	1.5 GU	Gloss standards w/ Gloss meter

IX. Thermodynamics

Parameter/Equipment	Range	CMC ^{2, 7, 13} (±)	Comments
Temperature – Measuring Equipment ^{3, 8}	-78 °C	0.0036 % + 0.071 °C	Hart 5628 PRT, Chub 1529, Isopropanol/Dry ice Slurry
	(-25 to 425) °C	0.0037 % + 0.044 °C	Hart 5628 PRT, Chub 1529, Temperature Baths / Blocks
Temperature – Measure ^{3, 8}	(-196 to 660) °C	0.003 % + 0.041 °C	Hart 5628 PRT & 1529 indicator
	(-40 to 1000) °C	0.34 % + 1.4 °C	Fluke 743B w/ Type K Thermocouple
Infrared Thermometers ^{3, 8}	(-15 to 120) °C	0.36 % + 0.7 °C	Hart 4180 black body Hart 4181 black body $\epsilon = 0.9$ to 1.0 $\lambda = (8$ to 14) μm
	(35 to 500) °C	0.35 % + 0.5 °C	
Relative Humidity – Measuring Equipment ^{3, 8}	(10 to 95) % RH	0.7 % RH	Thunder Scientific 2500
Relative Humidity – Measure ^{3, 8}	(10 to 90) % RH (15 to 25) °C	1.2 % RH	Vaisala HM70 / HMP 77

X. Time & Frequency

Parameter/Equipment	Range	CMC ^{2, 4, 13} (\pm)	Comments
Frequency – Measure ³	10 MHz	4.4 pHz/Hz + 0.6R	GPS receiver
Frequency – Measuring Equipment ³	1 mHz to 50 GHz	4.4 pHz/Hz + 0.1 mHz	GPS receiver w/ generator
Frequency – Measure ³	0.001 Hz to 50 GHz	4.4 pHz/Hz + 0.1 mHz	Counter locked to GPS10 MHz reference

¹ This laboratory offers commercial calibration service and field calibration service. This accreditation covers calibrations performed at the main laboratory listed, as well as the satellite location listed on page 1 of this scope of accreditation which is covered by either footnote 3 or 9.

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. 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.

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 value of the resolution of the device under test; D is the length of the diagonal in inches; M is the source of mismatch uncertainty

⁵ The measurands stated are generated with the Fluke 5700A or 5520A 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 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.
- ⁹ Parameters/instruments identified by notes 3 and 9 can be performed at the satellite location with exceptions as noted. Exceptions: Durometers, Length Standards, Rules and Tapes.
- ¹⁰ Measurement uncertainty at intermediate values is calculated using the Manufacturers Limits of Error Calculator
- ¹¹ Calibration method in accordance to ASME B89.4.1-1997
- ¹² This scope meets A2LA's *P112 Flexible Scope Policy*.
- ¹³ 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

TRESCAL, INC.

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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/NCSLI Z540-1-1994 and the requirements of ANSI/NCSLI Z540.3-2006 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 1st day of June 2019.

A blue ink signature of the Vice President of Accreditation Services.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 2516.01
Valid to March 31, 2021

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