



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

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CALIBRATION

Valid To: October 31, 2019

Certificate Number: 2336.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations¹:

I. Dimensional

Parameter/Equipment	Range	CMC ^{2, 4} (±)	Comments
Length – Micrometers Depth Gages	Up to 78 in Up to 10 in	11 µin 11 µin	Compared against gage blocks
Gage Blocks – Measuring Equipment Chromium Carbide Steel & Tungsten Chromium Carbide Steel Tungsten	0.5 mm (1 to 10) mm (20 to 100) mm (0.05 to 0.09375) in (0.1 to 1.0) in (0.1 to 1.0) in (0.1 to 1.0) in	44 nm (0.83L + 30) nm (0.93L + 25) nm 2.4 µin (1.6 + 0.60L) µin (1.7 + 0.80L) µin (1.6 + 0.60L) µin	Mahr Federal Comparator 130-38 W1 and master gage block

Parameter/Equipment	Range	CMC ^{2, 4} (±)	Comments
Gage Blocks – Measuring Equipment (cont)			
Chromium Carbide Steel Tungsten	(2.0 to 4) in (2.0 to 4) in (2.0 to 4) in	(1.4 + 0.60L) μin (1.4 + 0.80L) μin (1.2 + 0.80L) μin	Mahr Federal Comparator 130-38 W1 & master gage block
Long – Steel	(5 to 20) in	(3.2 + 0.80L) μin	Federal gage comparator 130B-16 & master gage blocks
Linear Measurements – Precision Tapes, Rulers, Lead Screws, & Other Length Measuring Devices	Up to 110 in	230 μin	HP 5529A, HP 5528A laser systems
Surface Plate ³ – Flatness Only	(8 to 110) in	62 μin	HP 5529A, HP 5528A laser systems
Optical Flat	(0.5 to 6) in diameter	0.90 μin	Plano interferometer, optical flat
Levels – Measure	3 arc°	2.9 arc s	HP 5529A, HP 5528A laser systems
Autocollimator – Measure	3 arc°	0.26 arc s	HP 5529A, HP 5528A laser systems
Calipers	Up to 78 in	2.9 x 10 ² μin	Master gage block
Dial & Test Indicator	Up to 1 in	5.6 x 10 ² μin	Measuring machine

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ² (±)	Comments
DC Voltage – Measure, Calibration of DC Zener Standards & other Voltage Sources, Fixed Points	1.018 V 1 V 10 V	0.29 $\mu\text{V/V}$ 1.1 $\mu\text{V/V}$ 0.1 $\mu\text{V/V}$	Fluke 7001 solid state reference standards (Zener)
DC Voltage – Generate, Calibration of DC Voltage	(-10 to -1.018) V (-1.018 to 1.018) V (1.018 to 10) V	12 μV 0.7 μV 12 μV	Fluke 7001 with Fluke 720A divider
DC Resistance – Measure, Calibration of DC Resistors & DC Resistance Measuring Devices	(1 to 10) $\mu\Omega$ (10 to 100) $\mu\Omega$ 100 $\mu\Omega$ to 1 m Ω (1 to 10) m Ω (10 to 100) m Ω 100 m Ω to 1 Ω 1 Ω (1 to 10) Ω (10 to 100) Ω 100 Ω to 1 k Ω (1 to 10) k Ω 10 k Ω (10 to 100) k Ω (100 to 1000) k Ω (1 to 10) M Ω (10 to 100) M Ω (100 to 1000) M Ω 1 G Ω to 1 T Ω	0.05 % rdg 29 $\mu\Omega/\Omega$ 1.7 $\mu\Omega/\Omega$ 1.2 $\mu\Omega/\Omega$ 0.36 $\mu\Omega/\Omega$ 0.34 $\mu\Omega/\Omega$ 0.32 $\mu\Omega/\Omega$ 0.34 $\mu\Omega/\Omega$ 0.63 $\mu\Omega/\Omega$ 1.2 $\mu\Omega/\Omega$ 4.0 $\mu\Omega/\Omega$ 0.14 $\mu\Omega/\Omega$ 0.29 $\mu\Omega/\Omega$ 4.1 $\mu\Omega/\Omega$ 6.5 $\mu\Omega/\Omega$ 21 $\mu\Omega/\Omega$ 23 $\mu\Omega/\Omega$ 0.050 % rdg	Measurement International 6010B low resistance bridge Measurement International 6000B high resistance bridge
DC Resistance – Measure, Calibration of DC Resistance Measuring Devices	Up to 25 Ω (25 to 400) Ω 400 Ω to 10 k Ω (10 to 100) k Ω 100 k Ω to 1 M Ω	0.97 $\mu\Omega/\Omega$ + 2.5 $\mu\Omega$ 1.3 $\mu\Omega/\Omega$ 1.8 $\mu\Omega/\Omega$ 2.4 $\mu\Omega/\Omega$ 4.7 $\mu\Omega/\Omega$	Standard resistors
DC Voltage – Measure, Calibration of Calibrators	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	7.3 $\mu\text{V/V}$ + 0.01 μV 3.7 $\mu\text{V/V}$ 3.2 $\mu\text{V/V}$ 3.4 $\mu\text{V/V}$ 4.2 $\mu\text{V/V}$ 4.2 $\mu\text{V/V}$	Transfer techniques using automated 4950M multifunction transfer std w/WAVETEK MTS software

Parameter/Equipment	Range	CMC ² (±)	Comments
DC Voltage – Measure, Calibration of Calibrators (cont)	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	3.2 $\mu\text{V/V}$ + 0.01 μV 1.1 $\mu\text{V/V}$ 0.70 $\mu\text{V/V}$ 0.70 $\mu\text{V/V}$ 1.1 $\mu\text{V/V}$ 1.2 $\mu\text{V/V}$	DMM 8508 using lab view automation technique
DC Voltage – Generate, Calibration of DMM	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	7.8 $\mu\text{V/V}$ + 0.01 μV 3.2 $\mu\text{V/V}$ 1.6 $\mu\text{V/V}$ 5.3 $\mu\text{V/V}$ 2.5 $\mu\text{V/V}$ 2.3 $\mu\text{V/V}$	Fluke 5700 series calibrator
DC Current – Measure, Calibration of Calibrators	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	25 $\mu\text{A/A}$ + 0.10 nA 18 $\mu\text{A/A}$ 17 $\mu\text{A/A}$ 21 $\mu\text{A/A}$ 38 $\mu\text{A/A}$	Transfer techniques using automated 4950M multifunction transfer std w/WAVETEK MTS software
with Amplifier	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 (3 to 5) A (5 to 10) A	5.3 $\mu\text{A/A}$ + 1.2 nA 7.7 $\mu\text{A/A}$ 10 $\mu\text{A/A}$ 10 $\mu\text{A/A}$ 4.5 $\mu\text{A/A}$ 4.7 $\mu\text{A/A}$ 4.3 $\mu\text{A/A}$	DMM 8505 & standard resistor 742 using lab view automation technique
DC Current – Generate, Calibration of DMM	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	14 $\mu\text{A/A}$ + 1.2 nA 13 $\mu\text{A/A}$ 14 $\mu\text{A/A}$ 15 $\mu\text{A/A}$ 20 $\mu\text{A/A}$	Fluke 5700 series calibrator
Resistance – Measure, Fixed Points, Calibration of Calibrators	10 Ω 100 Ω 1 k Ω 10 k Ω 100 k Ω 1 M Ω 10 M Ω 100 M Ω	13 $\mu\Omega/\Omega$ 8.3 $\mu\Omega/\Omega$ 6.1 $\mu\Omega/\Omega$ 6.0 $\mu\Omega/\Omega$ 11 $\mu\Omega/\Omega$ 19 $\mu\Omega/\Omega$ 31 $\mu\Omega/\Omega$ 0.032 % rdg	Transfer techniques using automated 4950M multifunction transfer std w/WAVETEK MTS software

Parameter/Equipment	Range	CMC ^{2, 5} (±)	Comments
Resistance – Measure, Fixed Points, Calibration of Calibrators (cont)	1 Ω 1.9 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 19 kΩ 100 kΩ 1 MΩ 10 MΩ 19 MΩ	10 μΩ/Ω 10 μΩ/Ω 10 μΩ/Ω 8.3 μΩ/Ω 7.7 μΩ/Ω 7.5 μΩ/Ω 5.5 μΩ/Ω 7.8 μΩ/Ω 11 μΩ/Ω 19 μΩ/Ω 29 μΩ/Ω	DMM 8505 and standard resistor 742 using lab view automation technique
Resistance – Generate, Fixed Points, Calibration of DMM	10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ	12 μΩ/Ω 8.6 μΩ/Ω 8.0 μΩ/Ω 7.9 μΩ/Ω 8.1 μΩ/Ω 11 μΩ/Ω 22 μΩ/Ω 0.032 % rdg	Fluke 5700 series calibrator
Capacitance – Measure, @ 1 kHz	(10 to 100) pF (100 to 1000) pF	(2.6 x 10 ⁻² c + 1.5) μF/F 4.4 μF/F	Andeen-Hagerling 2500A
Capacitance – Generate, @ 1 kHz, Fixed Points	10 pF 100 pF 1000 pF	1.3 μF/F 3.1 μF/F 3.3 μF/F	Andeen Hagerling 1100 & Genrad 1404A

Parameter/Range	Frequency	CMC ² (±)	Comments
AC Current – Generate, Calibration of DMM			
Up to 220 μA	(1 to 10) kHz	210 μA/A + 0.10 nA	Fluke 5700 series calibrator
220 μA to 2.2 mA	(1 to 10) kHz	97 μA/A	
(2.2 to 22) mA	(1 to 10) kHz	120 μA/A	
(22 to 220) mA	(1 to 10) kHz	110 μA/A	
220 mA to 2.2 A	40 Hz to 10 kHz	140 μA/A	

Parameter/Range	Frequency	CMC ² (±)	Comments
AC Voltage – Generate, Calibration of DMM			
(2.2 to 22) mV	(1 to 20) kHz (20 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	40 $\mu\text{V/V} + 0.10 \mu\text{V}$ 85 $\mu\text{V/V}$ 200 $\mu\text{V/V}$ 400 $\mu\text{V/V}$	Fluke 5700A series calibrator
(22 to 220) mV	(1 to 20) kHz (20 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	35 $\mu\text{V/V}$ 100 $\mu\text{V/V}$ 220 $\mu\text{V/V}$ 440 $\mu\text{V/V}$	
220 mV to 2.2 V	(1 to 20) kHz (20 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	25 $\mu\text{V/V}$ 48 $\mu\text{V/V}$ 130 $\mu\text{V/V}$ 330 $\mu\text{V/V}$	
(2.2 to 22) V	10 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	240 $\mu\text{V/V}$ 21 $\mu\text{V/V}$ 39 $\mu\text{V/V}$ 120 $\mu\text{V/V}$ 300 $\mu\text{V/V}$	
(22 to 220) V	(1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	24 $\mu\text{V/V}$ 32 $\mu\text{V/V}$ 44 $\mu\text{V/V}$	
(220 to 1000) V	1 kHz	35 $\mu\text{V/V}$	

Parameter/Range	Frequency	CMC ² (±)	Comments
AC Voltage – Measure, Calibration of Calibrators			
Up to 2.2 mV	(1 to 20) kHz	0.50 % rdg + 0.10 µV	Transfer techniques using automated 4950M multifunction transfer std. w/ WAVETEK MTS software
(2.2 to 22) mV	40 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.050 % rdg 0.050 % rdg 0.092 % rdg 0.12 % rdg 0.18 % rdg	
(22 to 220) mV	40 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.017 % rdg 0.017 % rdg 0.047 % rdg 0.074 % rdg 0.13 % rdg	
220 mV to 2.2 V	40 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	51 µV/V 34 µV/V 69 µV/V 0.018 % rdg 0.080 % rdg	
(2.2 to 22) V	40 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	43 µV/V 37 µV/V 61 µV/V 0.018 % rdg 0.075 % rdg	
(22 to 220) V	40 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz	55 µV/V 40 µV/V 94 µV/V	
(220 to 1000) V	50 Hz to 1 kHz	56 µV/V	

Parameter/Range	Frequency	CMC ² (±)	Comments
AC Voltage – Measure, Calibration of Calibrators (cont)			
Up to 2.2 mV	10 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	200 µV/V + 0.10 µV 200 µV/V 220 µV/V 300 µV/V 360 µV/V 1300 µV/V	5790A AC measurement standard
(2.2 to 22) mV	10 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	70 µV/V 40 µV/V 85 µV/V 200 µV/V 250 µV/V 400 µV/V	
(22 to 220) mV	10 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	36 µV/V 19 µV/V 76 µV/V 120 µV/V 130 µV/V 230 µV/V	
220 mV to 2.2 V	10 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	30 µV/V 7 µV/V 14 µV/V 90 µV/V 90 µV/V 240 µV/V	
(2.2 to 22) V	10 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	28 µV/V 11 µV/V 16 µV/V 85 µV/V 90 µV/V 240 µV/V	
(22 to 220) V	10 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz	41 µV/V 14 µV/V 21 µV/V	
600 V with Amplifier	(50 to 100) kHz	55 µV/V	
1000 V	(1 to 20) kHz	25 µV/V	

Parameter/Range	Frequency	CMC ² (±)	Comments
AC Current – Measure, Calibration of Calibrators 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 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	(1 to 10) kHz (1 to 10) kHz (1 to 10) kHz (1 to 10) kHz 40 Hz to 10 kHz (1 to 10) kHz (1 to 10) kHz (1 to 10) kHz (1 to 10) kHz (1 to 10) kHz	0.072 % + 0.10 nA 0.057 % rdg 0.058 % rdg 0.057 % rdg 0.015 % rdg 72 µA/A + 0.10 nA 63 µA/A 70 µA/A 70 µA/A 75 µA/A	Transfer techniques using automated 4950M multifunction transfer std. w/ WAVETEK MTS software 5790A AC measurement standard, AC current shunt
AC Current – Measure, Calibration of Calibrators with Amplifier (2.2 to 5.0) A (5.0 to 10.0) A	(1 to 10) kHz (1 to 10) kHz	77 µA/A 100 µA/A	5790A AC measurement standard, AC current shunt
Oscilloscope Calibrations – Bandwidth DC Voltage (1 MΩ) AC Voltage (1 MΩ) Time Base Sweep Rate (Generate)	Up to 600 MHz (1 to 100) mV (0.1 to 1) V (1 to 10) V (10 to 200) V (1 to 100) mV (0.1 to 1) V (1 to 10) V (10 to 200) V 2 ns to 2 µs (2 to 20) µs (20 to 200) µs (0.20 to 2) ms (2 to 20) ms 20 ms to 10 s	$1.9 \times 10^{-2} V_{(p-p)}$ 0.042 mV 0.059 mV 0.36 mV 17 mV 0.10 mV 0.88 mV 8.3 mV 91 mV $5.8 \times 10^{-10} s$ $5.8 \times 10^{-9} s$ $5.8 \times 10^{-8} s$ $5.8 \times 10^{-7} s$ $5.8 \times 10^{-6} s$ $5.8 \times 10^{-5} s$	Fluke 9500B oscilloscope calibrator with Fluke 95530 active head

III. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC ² (±)	Comments
RF Power – Measure, Calibration of RF Power Calibration Factors	100 kHz to <50 MHz (0.05 to <9.6) GHz (9.6 to <15.75) GHz (15.75 to 18) GHz	0.9 % rdg 1.0 % rdg 1.1 % rdg 1.3 % rdg	Tegam RF power measurement system with M1110, 1110 WPC thermistor mounts
Attenuation – Measure, Calibration of Attenuators			
Type N Coaxial	(10 to 500) MHz	0.09 dB 0.09 dB 0.09 dB 0.09 dB 0.09 dB 0.10 dB 0.11 dB	Agilent 8510C network analyzer with type-N & 3.5 mm verification & calibration kits: 85055A/85053B 85054B/85052A or N5222A opt 219PNA network analyzer & N6490C electronic calibration kit
3 dB	>500 MHz to 2 GHz	0.07 dB	
6 dB		0.08 dB	
10 dB		0.08 dB	
20 dB		0.08 dB	
30 dB		0.09 dB	
40 dB		0.13 dB	
50 dB		0.11 dB	
3 dB	>2 to 18) GHz	0.10 dB	
6 dB		0.10 dB	
10 dB		0.10 dB	
20 dB		0.10 dB	
30 dB		0.11 dB	
40 dB		0.12 dB	
50 dB		0.11 dB	
Type 3.5 mm Coaxial			
3 dB		0.12 dB	
6 dB		0.13 dB	
10 dB		0.12 dB	
20 dB		0.11 dB	
30 dB		0.15 dB	
40 dB		0.12 dB	

Parameter/Range	Frequency	CMC ² (±)	Comments
Calibration of Power Meters – 3 µW 10 µW 30 µW 100 µW 300 µW 1.0 mW 3.0 mW 10.00 mW 30.00 mW 100.00 mW Power Reference 1 mW	10 MHz to 18 GHz	0.65 % of rdg 0.58 % of rdg 0.62 % of rdg 0.58 % of rdg 0.59 % of rdg 0.58 % of rdg 0.61 % of rdg 0.58 % of rdg 0.61 % of rdg 0.58 % of rdg 1.2 % of rdg	HP 11683A, range calibrator, DMM

IV. Fluid Quantities

Parameter/Equipment	Range	CMC ² (±)	Comments
Liquid Flow – Measure Precision Turbine Flow Meters & Rotameters	(0.2 to 4.3) gpm (4.4 to 300) gpm	0.17 % IV 0.32 % IV	Cox 311AHT
Gas Flow – Measure Precision Gas Flow Meters, Sonic Nozzles, & Laminar Air Flow Devices	(0.01 to <10) slpm (10 to 700) slpm	0.39 % IV 0.20 % IV	Brooks 1050 Bell Prover (5 cu ft)

V. Ionizing Radiation

Parameter/Equipment	Range	CMC ² (±)	Comments
Gamma Radiation – Measuring Equipment	(1 to < 40) mR (40 to < 100) mR (0.10 to 12) R	11 % of rdg 2.8 % of rdg 2.5 % of rdg	JL Shepherd ionization chambers with Cs ¹³⁷ source

VI. Mechanical

Parameter/Equipment	Range	CMC ² (±)	Comments
Pneumatic Pressure – Measure (Absolute)			
Calibration of Precision Absolute Pressure Transducers & Gauges	(2.5 to 25) psi (10 to 100) psi (100 to 1000) psi	0.0018 psi + 0.0028 % rdg 0.0018 psi + 0.0022 % rdg 0.0018 psi + 0.0044 % rdg	Ruska 2465 and vacuum reference
Schwien Manometer (Absolute & Gauge) Calibration of Precision Absolute Pressure Transducers & Gauges	(0.5 to 110) inHg	0.003 inHg + 0.0016 % rdg	Schwien 110 inHg mercury manometer and vacuum reference
Piston Areas (Cross Float)	(100 to 1500) psi (>1500 to 10 000) psi	5.4 x 10 ⁻⁶ in ² 5.0 x 10 ⁻⁷ in ²	NIST calibrated pistons

Parameter/Equipment	Range	CMC ² (±)	Comments
Pneumatic Pressure – Measure, Calibration of Precision Pressure Transducers & Gauges	(2.5 to 25) psi (10 to 100) psi (100 to 1000) psi	0.0018 psi + 0.0025 % rdg 0.0018 psi + 0.0021 % rdg 0.0018 psi + 0.0043 % rdg	Ruska 2465 standard deadweight piston gauge
	(10 to <1000) psi (1000 to 1500) psi (1500 to 2000) psi (1500 to <10 000) psi	0.060 psi + 0.0035 % rdg 0.080 psi + 0.0035 % rdg 0.080 psi + 0.0043 % rdg 0.30 psi + 0.0043 % rdg	Ruska 2480 standard deadweight piston gauge
Fixed Point	10 000 psi	0.70 psi + 0.0043 % rdg	
Pressure –Measure, Calibration of Pressure Gauges ³	(0.25 to 100) psi (100 to 2000) psi (2000 to 10 000) psi	0.0031 psi 0.10 psi 0.50 psi	King Nutronics 3689A-3666-3461 standard pressure calibrator
Differential Pressure – Measure & Measuring Equipment	(0 to 24) in H ₂ O	0.020 % FS	Hook gage FS = full scale
Hydraulic Pressure – Measure, Calibration of Precision Pressure Transducers & Gauges	(10 to 1500) psi (1500 to <10 000) psi	0.013 psi + 0.0026 % rdg 0.013 psi + 0.0037 % rdg	Ruska 2480 deadweight piston gauge
Fixed Point	10 000 psi	0.060 psi + 0.0037 % rdg	
Pressure – Measure, Calibration of Oxygen Pressure Gauges	(0 to <30) psi (0 to 3000) psi	0.66 % FS 0.36 % FS	King Nutronics 3461-1-104
Force – Measuring Equipment, Calibration of Load Cells & Other Force Devices	(100 to 12 000) lbf (500 to 100 000) lbf	0.0089 % rdg 0.30 % FS	Morehouse 12 000 lbf dead weight machine Morehouse 100 000 lbf loading frame load cells

Parameter/Equipment	Range	CMC ² (±)	Comments
Torque – Measure Calibration of Torque Stations	(3.75 to 50) in·lbf (50 to 150) in·lbf (150 to 400) in·lbf (400 to 1000) in·lbf (1000 to 1500) in·lbf (1500 to 3000) in·lbf (3000 to 7200) in·lbf (7200 to 12 000) in·lbf (12 000 to 24 000) in·lbf	0.48 in·lbf 0.68 in·lbf 1.6 in·lbf 4.1 in·lbf 6.2 in·lbf 13 in·lbf 23 in·lbf 38 in·lbf 74 in·lbf	Standard weights and arms
Torque Measuring Equipment – Calibration of torque Wrenches CW & CCW	(3.75 to 50) in·lbf (50 to 150) in·lbf (150 to 400) in·lbf (400 to 1000) in·lbf (1000 to 1500) in·lbf (1500 to 3000) in·lbf (3000 to 7200) in·lbf (7200 to 12 000) in·lbf (12 000 to 24 000) in·lbf	0.57 in·lbf 3.0 in·lbf 5.4 in·lbf 12 in·lbf 17 in·lbf 34 in·lbf 25 in·lbf 39 in·lbf 100 in·lbf	Torque station
Vibration – Measure Accelerometer Sensitivity	(20 to 100) Hz (100 to 2000) Hz (2000 to 10 000) Hz	0.6 % IV 0.3 % IV 2.9 % IV	Endevco 28959FV portable vibration calibrator
Vacuum – Measure	(0.001 to 0.003) mmHg (>0.003 to 0.006) mmHg (>0.006 to 0.007) mmHg (>0.007 to 0.01) mmHg (>0.010 to 0.050) mmHg (>0.050 to 0.070) mmHg (>0.070 to 0.10) mmHg (>0.10 to 0.20) mmHg (>0.20 to 1.0) mmHg	12 % IV 8.4 % IV 6.2 % IV 3.1 % IV 1.5 % IV 1.7 % IV 0.90 % IV 0.61 % IV 0.64 % IV	Capacitance manometers

VII. Thermodynamics

Parameter/Equipment	Range	CMC ² (±)	Comments
Relative Humidity – Measuring Equipment, RH Meters	(10 to 30) % RH (31 to 50) % RH (51 to 75) % RH (76 to 90) % RH	0.32 % RH 0.48 % RH 0.70 % RH 0.92 % RH	Thunder Scientific 2500 humidity generator
Temperature – Measuring Equipment			Hart 1590 bridge and ITS 90 fixed point cells:
SPRTs	-38.8344 °C	0.0016 °C (1.6 mK)	Mercury: TP ITL-M-17724
	0.01 °C	0.0016 °C (1.6 mK)	Water: TPW A-13
	29.7646 °C	0.0016 °C (1.6 mK)	Gallium: ITL-M-17401G
	231.928 °C	0.0019 °C (1.9 mK)	Tin: ITL-M-17699
	419.527 °C	0.0035 °C (3.5 mK)	Zinc: ITL-M-17671
	660.323 °C	0.0030 °C (3.0 mK)	Aluminum: ITL-M-17676
PRTs, RTDs, IPRTs, Thermistors, & Thermometers ³	(-40 to 200) °C (200 to 400) °C (400 to 660) °C	21 mK 36 mK 65 mK	SPRT with bath

Parameter/Equipment	Range	CMC ² (±)	Comments
Temperature – Measuring Equipment ³			
Temperature Probes with Indicators	(-40 to 700) °C	0.020 °C	PRT & drywell/bath or drywell only
Surface Probes	(35 to 400) °C	1.4 °C	Surface probe calibrator
Liquid in Glass Thermometers	(-40 to 500) °C	0.30 °C	PRT and drywell or PRT and bath/furnace
Thermocouples	(-40 to 700) °C	0.20 °C	
Dry Well Calibrators	(-40 to < -25) °C (-25 to 150) °C (>150 to <500) °C (500 to 700) °C	0.38 °C 0.080 °C 0.26 °C 0.41 °C	PRT & drywell PRT
Surface Probe Calibrators	(35 to 200) °C (>200 to 400) °C	0.036 °C 0.049 °C	PRT
Temperature – Measuring Equipment, Hygrometers	(18 to 30) °C (>30 to 35) °C	0.22 °C 0.26 °C	Humidity chamber
Temperature Controlled Chambers ³ –			
Ovens, Incubators, Autoclaves, Furnaces, Freezers, Air & Liquid Baths	(-30 to 0) °C (> 0 to 100) °C (>100 to 300) °C (>300 to 600) °C	0.29 °C 0.21 °C 0.29 °C 0.54 °C	Black stack thermistor & standard thermocouple with indicator & PRT with indicator
Humidity Chambers	(10 to 40) % RH (>40 to 50) % RH (>50 to 70) % RH (>70 to 95) % RH	0.39 % RH 0.54 % RH 0.72 % RH 0.93 % RH	Hygrometer
Infrared Temperature – Measuring Equipment ³	(-15 to 500) °C	1.2 °C	Infrared calibrators

VIII. Time & Frequency

Parameter/Equipment	Range	CMC ² ($\pm$)	Comments
Frequency – Measuring Equipment, Calibration of Cesium Frequency Standards	5, 10 MHz	2.4 parts in 10^{13}	W/NIST FMAS vs GPS
Fixed Points	5, 10 MHz	3.3 parts in 10^{13}	W/FMAS vs Agilent 5071A cesium beam
Stopwatch & Timer Calibration ³	(1 to 3600) s	0.030 s	Waveform generator Keysight 33500B series or equivalent & universal counter Agilent 53132B or equivalent with totalize method

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 and R is the numerical value of the resolution of the device in microinches.

⁵ In the statement of CMC, c is the numerical value of nominal capacitance measured in μF .



Accredited Laboratory

A2LA has accredited

METROLOGY ENGINEERING AND CALIBRATION CENTER (MECC)

Cairo, EGYPT

for technical competence in the field of

Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets the requirements of ANSI/NCSLI 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 8 January 2009).



Presented this 22nd day of December 2017.

A blue ink signature of a person, likely the Vice President of Accreditation Services, written over a horizontal line.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 2336.01
Valid to October 31, 2019
Revised February 19, 2019

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