



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

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CALIBRATION

Valid To: February 29, 2020

Certificate Number: 2109.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory at the location listed above to perform the following calibrations^{1, 5}:

I. Chemical

Parameter/Equipment	Range	CMC ² (±)	Comments
pH Meter, Fixed Points ³	(4, 7, 10) pH	0.03 pH	Buffer solutions
Conductivity Cell/Probe, Fixed Points ³	10 µS/cm 100 µS/cm 1000 µS/cm	0.29 µS/cm 2.2 µS/cm 4.5 µS/cm	Conductivity reference solutions

II. Dimensional

Parameter/Equipment	Range	CMC ^{2, 4} (±)	Comments
Calipers ³	Up to 6 in (6 to 40) in	(29 + 1.7L) µin (290 + 0.12L) µin	Gage blocks, long blocks, surface plate
Micrometers ³	Up to 2 in (2 to 20) in	30 µin (18 + 2.8L) µin	Gage blocks

Parameter/Equipment	Range	CMC ^{2, 4} (\pm)	Comments
Indicators ³	Up to 0.015 in (0.015 to 0.5) in (0.5 to 1) in	14 μ in 29 μ in 33 μ in	Gage blocks
Pin and Plug Gages ³	Up to 1 in (1 to 4)	(6.1 + 1.8L) μ in (5.1 + 2.7L) μ in	Gage blocks, bench micrometer
Feeler/Taper Gages ³	Up to 1 in	(6.1 + 1.8L) μ in	Gage blocks, bench micrometer
Height Masters ³	Up to 38 in	(7.4 + 3.4L) μ in	Gage blocks, electronic indicator
Height ³	Up to 1 in (1 to 36) in	4.9 μ in (2.2 + 2.7L) μ in	Gage/long blocks, surface plate
Gage Blocks	Up to .09 in (0.05 to 4) in Up to 20 mm (20 to 100) mm	2.9 μ in (2.2 + .68L) μ in 0.07 μ m (0.04 μ m + 1.3L) mm	Reference gage blocks, gage block comparator

III. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2, 6} (\pm)	Comments
DC Voltage – Generate ³	(0 to 202) mV (0.2 to 2.02) V (2 to 20.2) V (20 to 202) V (200 to 1025) V	0.02 μ V/mV + 2.4 μ V 11 μ V/V + 3.1 μ V 9.7 μ V/V + 27 μ V 15 μ V/V + 59 μ V 14 μ V/V + 2.8 mV	Multifunction calibrator
DC Voltage – Measure ³	(0 to 100) mV (0.1 to 1) V (1 to 10) V (10 to 100) V (0.1 to 1) kV	4.4 μ V 0.14 μ /mV + 1.6 μ V 13 μ V/V + 3.2 μ V 12 μ V/V + .71 mV 18 μ V/V + 1 mV	8.5 digit precision multimeter

Parameter/Range	Frequency	CMC ^{2, 6} (\pm)	Comments
AC Voltage – Generate ³			
(0 to 200) mV	(10 to 45) Hz (45 to 1 000) Hz (1 to 20) kHz (20 to 100) kHz (100 to 500) kHz	0.94 μ V/mV + 21 μ V 0.18 μ V/mV + 19 μ V 0.23 μ V/mV + 33 μ V 0.99 μ V/mV + 0.14 mV 4.7 μ V/mV + 0.16 mV	Multifunction calibrator
(0.2 to 2) V	(10 to 45) Hz (45 to 1 000) Hz (1 to 20) kHz (20 to 100) kHz (100 to 1000) kHz	0.59 mV/V + 0.22 mV 0.18 mV/V + 0.15 mV 95 μ V/V + 0.17 mV 0.69 mV/V + 0.63 mV 3.4 mV/V + 0.8 mV	
(2 to 20) V	(10 to 45) Hz (45 to 1000) Hz (1 to 20) kHz (20 to 100) kHz	0.61 mV/V + 1.8mV 0.19 mV/V + 1.2 mV 0.24 mV/V + 1.9 mV 0.72 mV/V + 3.2 mV	
(20 to 200) V	(30 to 45) Hz (45 to 1 000) Hz (1 to 10) kHz (10 to 40) kHz (40 to 100) kHz	0.58 mV/V + 24 mV 0.17 mV/V + 14 mV 0.23 mV/V + 19 mV 0.38 mV/V + 34 mV 2.3 mV/V + 62 mV	
(200 to 1000) V	(30 to 45) Hz (45 to 1 000) Hz (1 to 10) kHz (10 to 20) kHz	0.63 mV/V + 0.25 V 0.23 mV/V + 85 mV 0.28 mV/V + 0.16 V 0.34 mV/V + 0.24 V	
AC Voltage – Measure ³			
(0 to 100) mV	(10 to 40) Hz (40 to 200) Hz (200 to 2 000) Hz (2 to 20) kHz (20 to 100) kHz	0.23 μ V/mV + 0.12 mV 0.12 μ V/mV + 43 μ V 0.09 μ V/mV + 43 μ V 0.13 μ V/mV + 60 μ V 0.35 μ V/mV + 0.18 mV	8.5 digit precision multimeter
(0.1 to 1) V	(10 to 40) Hz (40 to 200) Hz (200 to 2 000) Hz (2 to 20) kHz (20 to 100) kHz (100 to 1 000) kHz	0.22 mV/V + 0.8 mV 0.11 mV/V + 0.35 mV 85 μ V/V + 0.48 mV 0.55 mV/V + 89 μ V 0.46 mV/V + 1.2 mV 12 mV/V + 29 mV	

Parameter/Range	Frequency	CMC ^{2, 6} (\pm)	Comments
AC Voltage – Measure ³ (cont)			
(1 to 10) V	(40 to 200) Hz (200 to 2 000) Hz (2 to 20) kHz (20 to 100) kHz	0.12 mV/V + 3.2 mV 0.53 mV/V + 0.26 mV 0.15 mV/V + 4.7 mV 0.46 mV/V + 12 mV	8.5 digit precision multimeter
(10 to 100) V	(10 to 40) Hz (40 to 200) Hz (200 to 2 000) Hz (2 to 200) kHz	0.31 mV/V + 81 mV 0.14 mV/V + 34 mV 0.11 mV/V + 33 mV 0.13 mV/V + 80 mV	
(0.1 to 1) kV	(40 to 200) Hz (200 to 2 000) Hz (2 to 50) kHz	0.15 mV/V + 0.28 V 38 μ V/V + 1.1 mV 0.26 mV/V + 1.1 mV	

Parameter/Equipment	Range	CMC ^{2, 6} (\pm)	Comments
DC Current – Generate ³	(0 to 202) μ A (0.2 to 2.02) mA (2 to 20.2) mA (20 to 202) mA (0.2 to 20) A (20 to 30) A	17 nA/ μ A + 12 nA 60 nA/mA + 35 nA 61 nA/mA + 0.23 μ A 78 nA/mA + 2 μ A 0.35 mA/A + 0.47 mA 0.57 mA/A + 1.1 mA	Multifunction calibrator
DC Current – Simulate ³	(30 to 60) A (60 to 300) A (300 to 1 500) A	9.8 mA/A + 0.11 mA 9.8 mA/A + 0.12 A 5.2 mA/A + 1.4 A	Multifunction calibrator 3,10, 50 turn coil
DC Current – Measure ³	(0 to 100) μ A (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A (1 to 10) A (10 to 30) A	0.11 nA/ μ A + 14 nA 95 pA/ μ A + 16 nA 1 μ A/mA + 25 nA 0.15 μ A/mA + 0.16 μ A 0.45 mA/A + 13 μ A 0.83 mA/A + 0.63 mA 1.2 mA/A + 7.3 mA	8.5 digit precision multimeter

Parameter/Equipment	Range	CMC ^{2, 6} (\pm)	Comments
AC Current – Generate ³			
(20 to 202) μ A	(10 to 45) Hz (45 to 1000) (1 to 10) kHz (10 to 30) kHz	2.3 nA/ μ A + 0.3 μ A 0.79 nA/ μ A + 0.18 μ A 12 nA/ μ A + 0.23 μ A 21 nA/ μ A + 0.42 μ A	Multifunction calibrator
(.2 to 2.02) mA	(10 to 45) Hz (45 to 1000) (1 to 10) kHz (10 to 30) kHz	2.3 μ A/mA + 0.27 μ A 0.71 μ A/mA + 0.24 μ A 5.7 μ A/mA + 0.49 μ A 11 μ A/mA + 0.85 μ A	
(2 to 20.2) mA	(10 to 45) Hz (45 to 1000) (1 to 10) kHz (10 to 30) kHz	2.3 μ A/mA + 3.5 μ A 2.9 μ A/mA + 3.5 μ A 3.0 μ A/mA + 3.5 μ A 5.9 μ A/mA + 4.6 μ A	
(20 to 202) mA	(10 to 45) Hz (45 to 1000) (1 to 10) kHz (10 to 30) kHz	2.3 μ A/mA + 35 μ A 0.50 μ A/mA + 23 μ A 5.5 μ A/mA + 53 μ A 7.9 μ A/mA + 0.27 mA	
(.2 to 2.02) A	(10 to 45) Hz (45 to 1000) kHz (1 to 5) kHz (5 to 10) kHz	2.3 mA/A + 0.37 mA 0.74 mA/A + 0.23 mA 5.8 mA/A + 0.47 mA 6.9 mA/A + 1.3 mA	
(2 to 30) A	(30 to 45) Hz (45 to 100) Hz (100 to 1000) Hz (1 to 5) kHz (5 to 10) kHz	1.7 mA/A + 4.7 mA 1.1 mA/A + 2.1 mA 3.5 mA/A + 4.6 mA 7.0 mA/A + 4.5 mA 35 mA/A + 5.8 mA	
AC Current – Simulate ³			
(30 to 60) Hz	(30 to 60) A (60 to 300) A (300 to 1500) A	6 mA/A + 0.11 A 7.2 mA/A + 0.15 mA 5.7 mA/A + 0.5 A	Multifunction calibrator 3, 10, 50 turn coil

Parameter/Range	Frequency	CMC ^{2, 6} (±)	Comments
AC Current – Measure ³			
(0 to 100) µA	(10 to 40) Hz (40 to 1 000) Hz (1 to 10) kHz	0.54 µA 1.2 µA 1.2 µA	8.5 digit precision multimeter
(0.1 to 1) mA	(10 to 40) Hz (40 to 1 000) Hz (1 to 10) kHz	2.7 µA 2.2 µA 6.3 µA	
(1 to 10) mA	(10 to 40) Hz (40 to 1 000) Hz (1 to 10) kHz	28 µA 17 µA 36 µA	
(10 to 100) mA	(10 to 40) Hz (40 to 1 000) Hz (1 to 10) kHz	0.28 mA 0.17 mA 0.65 mA	
(0.1 to 1) A	(10 to 40) Hz (40 to 1 000) Hz (1 to 10) kHz	2.9 mA 1.6 mA 9.6 mA	
(1 to 10) A	(10 to 40) Hz (40 to 1 000) Hz	0.38 mA/A + 27 mA 0.4 mA/A + 13 mA	
(10 to 30) A	(10 to 40) Hz (40 to 1000) Hz	0.37 mA/A + 73 mA 0.54 mA/A + 30 mA	

Parameter/Equipment	Range	CMC ^{2, 6} (±)	Comments
Resistance – Generate Fixed Point ³	0 Ω 0.1 Ω 1 Ω 10 Ω 100 Ω 1k Ω 10 Ω 100 kΩ 1 MΩ 10 MΩ 100 MΩ 1 GΩ	5.8 mΩ 5.8 mΩ 5.8 mΩ 5.8 mΩ 7.5 mΩ 24 mΩ 0.13 Ω 2.2 Ω 32 Ω 1.1 kΩ 0.21 MΩ 12 MΩ	Multifunction calibrator

Parameter/Equipment	Range	CMC ^{2, 6} (\pm)	Comments
Resistance – Generate ³	(0 to 100) Ω (100 to 330) Ω (330 to 1 000) Ω (1 to 3.3) k Ω (3.3 to 10) k Ω (10 to 33) k Ω (33 to 100) k Ω (100 to 330) k Ω (330 to 1 000) k Ω (1 to 3.3) M Ω (3.3 to 10) M Ω (10 to 33) M Ω (33 to 100) M Ω (100 to 330) M Ω (330 to 1 000) M Ω	69 m Ω 0.12 m Ω / Ω + 58 m Ω 0.2 m Ω / Ω + 0.1 Ω 0.12 m Ω / Ω + 59 m Ω 0.12 m Ω / Ω + 41 m Ω 0.12 m Ω / Ω + 33 m Ω 0.12 m Ω / Ω + 0.7 Ω 0.2 m Ω / Ω + 0.2 Ω 0.2 m Ω / Ω + 4.4 Ω 78 Ω /M Ω + 0.23 k Ω 0.13 k Ω /M Ω + 0.12 k Ω 1.3 k Ω /M Ω + 1.4 k Ω 0.26 k Ω /M Ω + 35 k Ω 0.58 k Ω /M Ω + 2.1 k Ω 4.5 k Ω /M Ω + 1.4 M Ω	Multifunction calibrator
Resistance – Measure ³	(0 to 10) Ω (10 to 100) Ω (0.1 to 1) k Ω (1 to 10) k Ω (10 to 100) k Ω (0.1 to 1) M Ω (1 to 10) M Ω (10 to 100) M Ω	10 $\mu\Omega$ / Ω + 15 $\mu\Omega$ 11 $\mu\Omega$ / Ω + 39 $\mu\Omega$ 1.2 m Ω 9.9 m Ω /k Ω + 1.1 m Ω 9.9 m Ω /k Ω + 1.1 m Ω 9.4 m Ω /k Ω + 0.46 Ω 13 Ω /M Ω + 2.3 Ω 11 Ω /M Ω + 4.6 Ω	8.5 digit precision multimeter
Capacitance – Generate ³ @ 1 kHz	1 nF 2 nF 5 nF 10 nF 100 nF 1 μ F 10 μ F	27 pF 32 pF 48 pF 63 pF 0.32 nF 4.8 nF 70 nF	Multifunction calibrator
Capacitance – Generate @ 1 kHz	(0.95 to 9.5) μ F (9.5 to 95) μ F (95 to 950) μ F (0.95 to 9.5) mF (9.5 to 100) mF	82 nF 0.82 μ F 11 μ F 81 μ F 0.87 mF	Multifunction calibrator

Parameter/Equipment	Range	CMC ^{2, 6} (±)	Comments
Inductance – Generate ³ @ 1 kHz	1 mH 10 mH 19 mH 30 mH 50 mH 100 mH 1 H 10 H	64 µH 0.12 mH 0.17 mH 0.23 mH 0.35 mH 0.64 mH 6 mH 58 mH	Multifunction calibrator
Electrical Simulation of Thermocouple ³			
Type J	(-200 to 1200) °C	0.51 °C	Multifunction calibrator, 8.5 digit precision multimeter
Type K	(-140 to 500) °C (500 to 1340) °C	0.41 °C 0.61 °C	
Type T	(-200 to 0) °C (0 to 400) °C	0.41 °C 0.14 °C	
Type R	(-50 to 600) °C	1.2 °C	

IV. Frequency

Parameter/Equipment	Range	CMC ^{2, 6} (±)	Comments
Frequency – Measuring Equipment ³	1 Hz to 1 MHz (1 to 10) MHz	1.2 µHz/Hz + 0.24 mHz 1.2 Hz/MHz + 0.22 Hz	Multifunction calibrator
Frequency – Measure ³	1 Hz to 1 MHz	4.2 µHz/Hz + 0.63 Hz	8.5 digit precision multimeter

V. Thermodynamics

Parameter/Equipment	Range	CMC ^{2, 6} (±)	Comments
Humidity – Measuring Equipment @ 23 °C	(10 to 95) %	0.8 %	Humidity generator
Humidity – Measure ³	(10 to 95) %	1.5 %	Humidity probe
Temperature – Measure ³	-80 °C -38 °C 0 °C 30 °C 230 °C 420 °C 660 °C	16 mK 14 mK 11 mK 13 mK 15 mK 16 mK 20 mK	Precision thermometer
Temperature – Laboratory Thermometers ³	(-80 to -25) °C (-25 to 140) °C 0 °C (140 to 250) °C (250 to 420) °C (420 to 660) °C (400 to 1150) °C	23 mK 15 mK 11 mK 29 mK 53 mK 95 mK 1.1 °C	Precision thermometer, dry block calibrator, temperature bath, furnace

VI. Mechanical

Parameter/Equipment	Range	CMC ² (±)	Comments
Scales and Balances ³ – Industrial Scales			NIST Handbook 44
0.0001 lb. Resolution	(0 to 1) lb	0.024 lb	Class F weights
0.001 lb. Resolution	(0 to 10) lb	0.04 lb	
0.01 lb. Resolution	(0 to 50) lb	0.18 lb	
	(0 to 100) lb	0.18 lb	
0.1 lb. Resolution	(0 to 1000) lb	0.53 lb	
0.5 lb Resolution	(0 to 5000) lb	1.3 lb	
1 lb. Resolution	(0 to 10 000) lb	1.8 lb	
	(0 to 20 000) lb	2.5 lb	

Parameter/Equipment	Range	CMC ² (±)	Comments
Scales and Balances ³ (cont) – Industrial Scales with Buildup 1 lb. Resolution 10 lb. Resolution 20 lb. Resolution	(0 to 5 000) lb (0 to 20 000) lb (0 to 100 000) lb	1.3 lb 3.1 lb 10 lb	NIST Handbook 44 Class F weights
Laboratory Balances ³ – Fixed Points	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 10 g 20 g 30 g 50 g 100 g 200 g 300 g 500 g 1000 g 2000 g 5000 g 10 000 g 20 000 g 32 000 g	0.0020 mg 0.0025 mg 0.0015 mg 0.0017 mg 0.0019 mg 0.0017 mg 0.0018 mg 0.0016 mg 0.0017 mg 0.0026 mg 0.0014 mg 0.0025 mg 0.0032 mg 0.0034 mg 0.0035 mg 0.0054 mg 0.0087 mg 0.0096 mg 0.012 mg 0.021 mg 0.040 mg 0.060 mg 0.060 mg 0.15 mg 0.24 mg 0.59 mg 1.2 mg 3.5 mg 16 mg 19 mg	NIST Handbook 44 with OIML Class E2 & ASTM Class 0 and 1 weights
Laboratory Balances ³	(1 to 500) mg (1 to 30) g (50 to 500) g (500 to 5000) g (5 to 10) kg (10 to 32) kg	0.05 µg/mg + 2 µg 0.2 µg/mg + 2.9 µg 0.29 µg/mg + 6.7 µg 0.24 µg/g + 33 µg 0.3 µg/g + 0.5 mg 0.6 mg/g + 45 µg	NIST Handbook 44 with OIML Class E2 & ASTM Class 0 and 1 weights

Parameter/Equipment	Range	CMC ² (±)	Comments
Mass – Weight Sets, Fixed Point	1 mg	0.00073 mg	Calibration to ASTM E-617-13, OIML R111-1 & NIST 105-1 with OIML E1 and ASTM Class 0
	2 mg	0.00088 mg	
	3 mg	0.00080 mg	
	5 mg	0.00062 mg	
	10 mg	0.00071 mg	
	20 mg	0.00096 mg	
	30 mg	0.0010 mg	
	50 mg	0.0010 mg	
	100 mg	0.0017 mg	
	200 mg	0.0016 mg	
	300 mg	0.0020 mg	
	500 mg	0.0019 mg	
	1 g	0.0014 mg	
	2 g	0.0022 mg	
	3 g	0.0030 mg	
	5 g	0.0030 mg	
	10 g	0.0054 mg	
	20 g	0.0054 mg	
	30 g	0.0086 mg	
	50 g	0.011 mg	
	100 g	0.016 mg	
	200 g	0.027 mg	
	300 g	0.061 mg	
	500 g	0.038 mg	
	1 kg	0.13 mg	
	2 kg	0.35 mg	
	3 kg	0.36 mg	
	5 kg	0.82 mg	
	10 kg	3.2 mg	
	20 kg	5.0 mg	
	25 kg	5.1 mg	
	30 kg	7.3 mg	

Parameter/Equipment	Range	CMC ² (±)	Comments
Mass – Weight Sets, Fixed Point (cont.)	0.0625 lb. (1 oz) 0.125 lb. (2 oz) 0.25 lb. (4 oz) 0.001 lb 0.002 lb 0.005 lb 0.01 lb 0.02 lb 0.05 lb 0.1 lb 0.2 lb 0.5 lb 1 lb 2 lb 5 lb 10 lb 25 lb 50 lb	0.021 mg 0.021 mg 0.055 mg 0.0020 mg (0.0044 µlb) 0.0027 mg (0.0059 µlb) 0.0092 mg (0.020 µlb) 0.0093 mg (0.021 µlb) 0.011 mg (0.024 µlb) 0.018 mg (0.039 µlb) 0.022 mg (0.048 µlb) 0.036 mg (0.080 µlb) 0.24 mg (0.52 µlb) 0.20 mg (0.43 µlb) 0.16 mg (0.36 µlb) 0.79 mg (1.8 µlb) 1.3 mg (2.8 µlb) 7.5 mg (17 µlb) 21 mg (46 µlb)	Calibration to ASTM E-617-13, OIML R111-1 & NIST 105- 1 with OIML E1 and ASTM Class 0
Volume – Pipettes, Burettes, Diluters, Dispensers, Flasks, Repeaters, Syringes, Controllers/Fillers	(0 to 10) µL (10.1 to 20) µL (20.1 to 100) µL (100.1 to 200) µL (200.1 to 1000) µL (1001 to 5000) µL (5001 to 10 000) µL (10 001 to 50 000) µL (50 001 to 100 000) µL	0.06 µL 0.09 µL 0.35 µL 0.69 µL 2.4 µL 12 µL 24 µL 58 µL 120 µL	Gravimetric method using Class 1 analytical balance and ASTM Class 0 mass standards
Hydraulic Gage Pressure ³	(0 to 300) psi (300 to 3000) psi (3000 to 10,000) psi (10,000 to 36,000) psi	0.04 mpsi/psi + 0.01 psi 0.7 psi 5.9 psi 42 psi	Comparator and pressure gages
Pneumatic Gage Pressure ³	(-12.5 to 0) psi (0 to 300) psi (300 to 2700) psi	3.7 mpsi 0.04 mpsi/psi + 0.01 psi 0.7 psi	Comparator and pressure gages

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.

⁵ This scope meets A2LA's *P112 Flexible Scope Policy*.

⁶ 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.