



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

WESTERN STATES CALIBRATION
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CALIBRATION

Valid To: February 29, 2024

Certificate Number: 2904.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations^{1, 7}:

I. Dimensional

Parameter/Equipment	Range	CMC ^{2, 4} (\pm)	Comments
Calipers ³	Up to 6 in (6 to 72) in	370 μ in (340 + 6.6L) μ in	Gage blocks
Cylindrical Ring Gages	(0.04 to 14) in	(6.4 + 12L) μ in	Pratt & Whitney Labmaster TM , gage blocks, ring gages
Dial & Test Indicators ³	Up to 0.2 in Up to 4 in Up to 0.05 in Up to 1 in	7.6 μ in + 0.6R (7.6 + 15L) μ in + 0.6R 24 μ in + 0.6R 140 μ in + 0.6R	Gage blocks Indicator tester
Gage Blocks	Up to 4 in	(3.4 + 2L) μ in	Federal gage block comparator, gage blocks

Parameter/Equipment	Range	CMC ^{2,4} (\pm)	Comments
Indicator Testers	Up to 1 in Up to 0.05 in	62 $\mu\text{in} + 0.6R$ 17 $\mu\text{in} + 0.6R$	Gage blocks, digital indicator
Height Masters	Up to 24 in	8.4 $\mu\text{in}/\text{in} + 41 \mu\text{in}$	Gage blocks, amplifier, lever gage head, surface plate
Height Gages ³	Up to 24 in: 0.001 in resolution 0.0005 in resolution 0.0001 in resolution	650 μin 420 μin 120 μin	Gage blocks, surface plate
Linear Measurements – Outside	Up to 13 in (13 to 48) in	(3.9 + 7.2L) μin (7 + 19L) μin	Pratt & Whitney Labmaster TM , gage blocks Pratt & Whitney UMM
Three Dimensional – Length			
Dimension 1 (X)	Up to 23.5 in	(130 + 3.9L) μin	OGP Flash 500
Dimension 2 (Y)	Up to 23.5 in	(130 + 3.9L) μin	
Dimension 3 (Z)	Up to 4 in	150 μin	
Micrometers ³ –			
Outside Diameter	Up to 6 in (6 to 36) in	(27 + 3.2L) $\mu\text{in} + 0.6R$ (16 + 5.2L) $\mu\text{in} + 0.6R$	Gage blocks, optical flat
Inside Diameter	Up to 48 in	(18 + 7L) $\mu\text{in} + 0.6R$	Pratt & Whitney UMM
Hole Micrometer	Up to 4 in	200 μin	Ring gages

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Micrometers ³ – (cont)			
Depth	Up to 12 in	(66 + 7L) μin	Gage blocks, optical flat, surface plate
Anvil / Spindle Flatness	Up to 1 in	8 μin	Optical parallels
Pin/Plug Gages	Up to 1 in	21 μin	Pratt & Whitney Labmaster™, gage blocks
Thread Plug Gage, Plain & Truncated –			
Major Diameter	Up to 4 in / (4 to 80) TPI	95 μin	Pratt & Whitney Supermic™, thread wires
Pitch Diameter	Up to 4 in / (4 to 80) TPI	100 μin	
Thread Rings	Up to 2 in	360 μin	Thread setting plugs
Thread Wires	(4 to 80) TPI	14 μin	Pratt & Whitney Labmaster™
Surface Plates ³	Up to 200 in Diagonal Repeat Reading	32 μin	Repeat-o-meter
	Up to 34 in Diagonal Flatness	70 μin	
	(34 to 200) in Diagonal Flatness	12 √DL	Electronic levels
	Temperature Gradient	0.13 °F	Thermometer
Laser Micrometers ³	Up to 1 in	(17 + 17L) μin	Pin gages
Surface Roughness Testers ³	Ra Up to 120 μin	3.3 μin	Roughness standards

Parameter/Equipment	Range	CMC ^{2, 4, 8} (±)	Comments
Surface Roughness Specimens ³	Ra Up to 120 μin	3.3 μin	Surface roughness tester, roughness standard
Steel Rulers & Tape Measures	6 in (Push/Pull) 10 cm (Push/Pull) Up to 40 in (40 to 1200) in	590 μin + 0.6R 15 μm + 0.6R (770 + 18L) μin (1300 + 2.6L) μin	Lixer LM101-ISO Octagon MSTC-1000
Angle – Measure	Up to 360°	0.0075°	OGP Flash 500

II. Electrical – DC/Low Frequency

Parameter/Range	Frequency	CMC ^{2, 6} (±)	Comments
AC Current – Generate (32 to 330) μA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.23 % + 130 nA 0.18 % + 120 nA 0.15 % + 130 nA 0.38 % + 180 nA 0.93 % + 250 nA 1.9 % + 550 nA	Fluke 5520A
(0.33 to 3.3) mA	(10 to 20) Hz (20 to 1) kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.04 % + 25 μA 0.04 % + 17 μA 0.07 % + 17 μA 0.27 % + 18 μA 0.04 % + 17 μA	
(3.3 to 33) mA	(10 to 20) Hz (20 to 1) kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.04 % + 25 μA 0.04 % + 17 μA 0.07 % + 17 μA 0.27 % + 18 μA 0.04 % + 18 μA	

Parameter/Range	Frequency	CMC ^{2,6} (±)	Comments
AC Current – Generate (cont)			
(33 to 330) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.21 % + 33 µA 0.11 % + 37 µA 0.05 % + 29 µA 0.11 % + 110 µA 0.23 % + 130 µA 0.47 % + 260 µA	Fluke 5520A
(0.33 to 1.1) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.21 % + 150 µA 0.06 % + 150 µA 0.69 % + 1.3 mA 2.9 % + 6.6 mA	
(1.1 to 3) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.21 % + 0.30 mA 0.02 % + 6.9 mA 0.05 % + 1.3 mA 2.9 % + 7.8 mA	
(3 to 11) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz	0.07 % + 3.5 mA 0.13 % + 2.4 mA 3.6 % + 5 mA	
(11 to 20.5) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.07 % + 48 mA 0.16 % + 11 mA 3.4 % + 30 mA	
Clamp Meters			
(20.5 to 1000) A	(45 to 400) Hz	0.35 % + 0.26 A	Fluke 5500A/coil & 5520A
AC Current – Measure			
(29 to 199.99) µA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.025 % + 24 nA 0.017 % + 60 nA 0.041 % + 13 nA 0.23 % + 16 nA	Fluke 8508A
(0.2 to 1.9999) mA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	22 µA/A + 770 nA 0.025 % + 360 nA 0.029 % + 660 nA 0.23 % + 390 nA	

Parameter/Range	Frequency	CMC ^{2,6} (±)	Comments
AC Current – Measure (cont)			
(2 to 19.999) mA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	88 µA 0.016 % + 2 µA 0.041 % + 2 µA 0.23 % + 2 µA	Fluke 8508A
(20 to 199.99) mA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz	900 µA 0.017 % + 12 µA 0.031 % + 27 µA	
(0.2 to 1.9999) A	10 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz	0.036 % + 180 µA 0.040 % + 190 µA 0.18 % + 110 µA	
(2 to 19.999) A	10 Hz to 2 kHz (2 to 10) kHz	0.053 % + 960 µA 0.15 % + 2 mA	
AC Voltage – Generate			
(1 to 33) mV	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	0.041 % + 45 µV 63 µV/V + 24 µV 32 µV/V + 42 µV 0.11 % + 14 µV 0.37 % + 29 µV 0.9 % + 77 µV	Fluke 5520A
(33 to 330) mV	(10 to 45) Hz 45 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	0.011 % + 45 µV 0.017 % + 13 µV 0.042 % + 14 µV 0.094 % + 40 µV 0.23 % + 110 µV	
(0.33 to 3.3) V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	0.03 % + 420 µV 0.02 % + 95 µV 0.03 % + 89 µV 0.04 % + 120 µV 0.09 % + 200 µV 0.01 % + 1.1 mV	
(3.3 to 33) V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.03 % + 4.2 mV 0.02 % + 1 mV 0.03 % + 900 µV 0.04 % + 4 mV 0.2 % + 3.8 mV	

Parameter/Range	Frequency	CMC ^{2,6} (±)	Comments
AC Voltage – Generate (cont)			
(33 to 330) V	45 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.03 % + 7.2 mV 0.03 % + 11 mV 0.04 % + 10 mV 0.04 % + 26 mV 0.22 % + 110 mV	Fluke 5520A
(330 to 1020) V	45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.04 % + 55 mV 0.03 % + 30 mV 0.04 % + 30 mV	
AC Voltage – Measure			
(0.2 to 1.9999) V	(40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	53 μV/V + 21 μV 15 μV/V + 200 μV 22 μV/V + 200 μV 0.013 % + 29 μV 0.033 % + 130 μV 0.18 % + 2 mV 0.58 % + 13 mV	Fluke 8508A
(2 to 19.999) V	(40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	58 μV/V + 120 μV 56 μV/V + 140 μV 64 μV/V + 200 μV 0.013 % + 260 μV 0.033 % + 2 mV 0.18 % + 13 mV 0.5 % + 160 mV	
(20 to 199.99) V	(40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	55 μV/V + 2 mV 22 μV/V + 10 mV 66 μV/V + 2 mV 0.013 % + 3 mV 0.034 % + 12 mV 0.18 % + 130 mV 0.58 % + 2 V	
(200 to 1050) V	40 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	64 μV/V + 17 mV 0.013 % + 27 mV 0.033 % + 140 mV	

Parameter/Equipment	Range	CMC ^{2,6} (\pm)	Comments
DC Current – Generate	(0 to 329.999) μ A (0 to 3.299 99) mA (0 to 32.9999) mA (0 to 329.999) mA (0 to 1.099 99) A (1.1 to 2.999 99) A (0 to 10.0000) A (11 to 20.5) A	0.010 % + 77 nA 63 μ A 170 μ A 31 μ A/A + 130 μ A 12 mA 130 mA 130 mA 130 mA	Fluke 5520A
Clamp Meters	(20.5 to 55) A (55 to 1000) A	0.65 A 0.65% + 0.35 A	Fluke 5500A/coil & 5520A
DC Current – Measure	(0 to 199.990 00) μ A (0.2 to 1.9999) mA (2 to 19.999) mA (20 to 199.99) mA (0.2 to 1.9999) A (2 to 19.999) A	2 μ A/A + 6 nA 6 μ A/A + 8 nA 5 μ A/A + 160 μ A 28 μ A/A + 1 μ A 0.02 % + 18 μ A 0.03 % + 230 μ A	Fluke 8508A
DC Voltage – Generate	(0 to 329.9999) mV (0 to 3.299 999) V (0 to 32.999 99) V (30 to 329.9999) V (100 to 1000.000) V	32 μ V 8.2 μ V/V + 21 μ V 12 μ V/V + 110 μ V 0.01 μ V/V + 2 mV 0.54 μ V/V + 5.2 mV	Fluke 5520A
DC Voltage – Measure	(0.0001 to 199.990 00) mV (0.2 to 1.9999) V (2 to 19.999) V (20 to 199.99)V (200 to 1050.00) V	3 μ V/V + 190 nV 2 μ V/V + 2 μ V 1 μ V/V + 180 μ V 4 μ V/V + 33 μ V 4 μ V/V + 420 μ V	Fluke 8508A
Resistance – Measure	(0 to 1.9999) Ω (2 to 19.999) Ω (20 to 199.99) Ω 200 Ω to 1.9999 k Ω (2 to 19.999) k Ω (20 to 199.99) k Ω 200 k Ω to 1.9999 M Ω (2 to 19.999) M Ω (20 to 199.99) M Ω 200 M Ω to 1.9999 G Ω	5 $\mu\Omega/\Omega$ + 24 $\mu\Omega$ 2 $\mu\Omega/\Omega$ + 280 $\mu\Omega$ 2 $\mu\Omega/\Omega$ + 2 m Ω 40 $\mu\Omega/\Omega$ + 3 m Ω 3 $\mu\Omega/\Omega$ + 110 m Ω 3 $\mu\Omega/\Omega$ + 83 m Ω 1 $\mu\Omega/\Omega$ + 16 Ω 6 $\mu\Omega/\Omega$ + 380 Ω 250 k Ω 0.061 % + 2 M Ω	Fluke 8508A

Parameter/Equipment	Range	CMC ^{2,6} (±)	Comments
Resistance – Generate	(0 to 10.9999) Ω (11 to 32.999) Ω (33 to 109.9999) Ω (110 to 329.9999) Ω 330 Ω to 1.099 999 kΩ (1.1 to 3.299 999) kΩ (3.3 to 10.999 99) kΩ (11 to 32.999 99) kΩ (33 to 109.9999) kΩ (110 to 329.9999) kΩ 330 kΩ to 1.099 999 MΩ (1.1 to 3.299 999) MΩ (3.3 to 10.999 99) MΩ (11 to 32.999 99) MΩ (33 to 109.9999) MΩ (110 to 329.9999) MΩ (330 to 1100) MΩ	37 μΩ/Ω + 0.0017 Ω 32 μΩ/Ω + 0.0023 Ω 30 μΩ/Ω + 0.0022 Ω 34 μΩ/Ω + 0.0031 Ω 32 μΩ/Ω + 0.0048 Ω 19 μΩ/Ω + 0.12 Ω 30 μΩ/Ω + 0.072 Ω 42 μΩ/Ω + 0.035 Ω 19 Ω 36 μΩ/Ω + 3.2 Ω 13 μΩ/Ω + 68 Ω 60 μΩ/Ω + 85 Ω 0.011 % + 960 Ω 0.03 % + 4.3 kΩ 0.01 % + 18 kΩ 0.36 % + 130 kΩ 1.8 % + 580 kΩ	Fluke 5520A
Capacitance – Generate	(1.1 to 3.2999) nF (3.3 to 10.999) nF (11 to 32.999) nF (33 to 109.999) nF (110 to 229.999) nF (0.3 to 1.0999) μF (1.1 to 10.9999) μF	0.39 % + 0.04 nF 0.22 % + 0.04 nF 0.23 % + 0.18 nF 0.29 % + 0.17 nF 0.2 % + 1.2 nF 0.29 % + 1.6 nF 0.2 % + 12 nF	Fluke 5520A
Electrical Simulation of Thermocouples ³ –			
Type E	(-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C	0.85 °C 0.64 °C 0.01 % + 0.52 °C 0.01 % + 0.61 °C 0.01 % + 0.55 °C	Fluke 5520A
Type J	(-210 to -100) °C (-100 to -30) °C (-30 to 760) °C	1.1 °C 0.48 °C 0.12 °C	
Type K	(-200 to 1372) °C	0.33 °C	
Type N	(-200 to 1300) °C	0.29 °C	
Type R	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.01 % + 0.31 °C 0.32 °C 0.01 % + 0.22 °C 0.01 % + 0.22 °C	

Parameter/Equipment	Range	CMC ^{2, 6} (\pm)	Comments
Electrical Simulation of Thermocouples – (cont)			
Type S	(0 to 250) °C (250 to 1000) °C (1000 to 1400) °C (1400 to 1767) °C	0.01 % + 0.31 °C 0.32 °C 0.23 °C 0.01 % + 0.17 °C	Fluke 5520A
Type T	(-250 to 120) °C (120 to 400) °C	0.11 °C 0.01 % + 0.11 °C	

III. Mechanical

Parameter/Equipment	Range	CMC ^{2, 4, 5, 8} (\pm)	Comments
Force – Measuring Equipment ³	(0 to 300) lbf (100 to 25 000) lbf	0.032 % + 0.0008 lbf 0.025 % + 2.7 lbf	Class F weights, Class S-1 weights Load cells
Vacuum – Measuring Equipment ³	(0 to 29.5) inHg	0.014 inHg	Mensor CPG2500
Gage Pressure – Measuring Equipment ³	(0 to 7.5) psi (7.5 to 15) psi (15 to 250) psi (250 to 500) psi (500 to 10 000) psi	0.0011 psi + 0.6R 0.0019 psi + 0.6R 0.032 psi + 0.6R 0.06 psi + 0.6R 0.02 %	Mensor CPG2500 Pressurements limited W2200-3-P dead weight tester
Indirect Verification of Hardness Testers ³	HRBW: Low Medium High HRC: Low Medium High	0.76 HRBW 0.75 HRBW 0.69 HRBW 0.65 HRC 0.66 HRC 0.61 HRC	ASTM E18

Parameter/Equipment	Range	CMC ^{2, 4, 5, 8} (\pm)	Comments
Scales & Balances ³	Up to 400 g 400 g to 37 kg (37 to 136) kg	0.094 mg + 0.6R 0.082 g + 0.6R 0.032 % + 0.035 g	Class F weights, Class S-1 weights, ASTM Class 1 weights
Mass	Up to 80 g (80 to 220) g 220 g to 31 kg	0.24 mg 0.54 mg 180 mg	Electronic balances & class S1 weights
Torque – Measure	20 ozf·in to 1000 lbf·ft	0.89 %	Digital torque load cells
Torque – Measuring Equipment	20 ozf·in to 1000 lbf·ft	0.092 %	Calibration arms & weights

IV. Optical

Parameter/Equipment	Range	CMC ^{2, 4, 8} (\pm)	Comments
Light Source – Measure	(108 to 32000) cd	6.4 % + 3.2 cd	Radiometer; visible light W lamps
Light/Lux Meter – Measuring Equipment	(108 to 32000) cd	6.4 % + 3.2 cd + 0.6R	

V. Thermodynamics

Parameter/Equipment	Range	CMC ^{2, 8} (\pm)	Comments
Temperature – Measure ³	(-200 to 0) °C (0 to 100) °C	0.37 °C 0.058 °C	Hart Scientific black stack with thermistor probe
	(100 to 420) °C	0.063 °C	PRT

Parameter/Equipment	Range	CMC ^{2, 5, 8} (\pm)	Comments
Temperature – Measuring Equipment ³	(-40 to 0) °C (0 to 100) °C	0.37 °C 0.058 °C	Hart Scientific black stack with thermistor probe & temperature bath
	(100 to 420) °C	0.075 °C	PRT & dry well Thunder Scientific 2500
Infrared Thermometers ⁵	(35 to 500) °C	0.36 % + 0.33 °C	Fluke 4181 precision IR calibrator $\epsilon = 0.95, \lambda = (8 \text{ to } 14) \mu\text{m}$
Relative Humidity – Measuring Equipment ³	(10 to 80) % RH	0.77 % RH	Thunder Scientific 2500 humidity generator

VI. Time & Frequency

Parameter/Equipment	Range	CMC ^{2, 8} (\pm)	Comments
Frequency – Measuring Equipment	10 MHz reference	0.0069 Hz	GPS reference
	0.01 Hz to 2 MHz	0.0097 Hz	
Frequency – Measure	DC Coupled	0.0097 Hz	GPS reference w/ HP 53132A
	AC Coupled 50 Ω	0.0097 Hz	
	1 M Ω	0.0097 Hz	

¹ This laboratory offers commercial 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. Please note the actual measurement uncertainties achievable on a customer's site can normally be expected to be larger than the CMC found on the A2LA Scope. Allowance must be made for aspects such as the environment at the place of calibration and for other possible adverse effects such as those caused by transportation of the calibration equipment. The usual allowance for the actual uncertainty introduced by the item being calibrated, (e.g. resolution) must also be considered and this, on its own, could result in the actual measurement uncertainty achievable on a customer's site being larger than the CMC.
- ⁴ In the statement of CMC, L is the numerical value of the nominal length of the device measured in inches; R is the numerical value of the resolution of unit under test; and DL is the diagonal length of the unit under test in inches.
- ⁵ In the statement of CMC, percentages are to be read as percent of reading, unless noted otherwise.
- ⁶ The stated measured values are determined using the indicated instrument (see Comments). This capability is suitable for the calibration of the devices intended to measure or generate the measured value in the ranges indicated. CMC's are expressed as either a specific value that covers the full range or as a percent or fraction of the reading plus a fixed floor specification.
- ⁷ This scope meets A2LA's *P112 Flexible Scope Policy*.
- ⁸ 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

WESTERN STATES CALIBRATION

Salt Lake City, UT

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/NCSL 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 April 2017).



Presented this 24th day of January 2022.

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

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 2904.01
Valid to February 29, 2024

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