



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

WESTERN STATES CALIBRATION  
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CALIBRATION

Valid To: February 29, 2012

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<sup>1</sup>:

I. Dimensional

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
Calipers	(0 to 6) in (6 to 72) in	440 µin (400 + 9.3L) µin	Gage blocks
Cylindrical Ring Gages	(0.04 to 1) in (1 to 14) in	14 µin 96 µin	Pratt & Whitney Labmaster, gage blocks
Dial Indicators	(0 to 1) in: 0.0005 in resolution 0.001 in resolution	340 µin 660 µin	Indicator tester
Test Indicators	(0 to 0.050) in: 0.00002 in resolution 0.00005 in resolution 0.0001 in resolution	14 µin 48 µin 74 µin	Indicator tester

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
Indicator Tester –	(0 to 1) in 0.0001 in resolution	84 μin	Gage blocks, amplifier, lever gage head, surface plate
	(0 to 0.05) in 0.00001 in resolution	18 μin	
Height Masters	(0 to 24) in	140 μin	Gage blocks, amplifier, lever gage head, surface plate
Height Gages	(0 to 24) in: 0.001 in resolution 0.0001 in resolution	620 μin 170 μin	Check master, surface plate
Linear Measurements –  Outside	(0.05 to 13) in	(9.3 + 6.7L) μin	Pratt & Whitney Labmaster, gage blocks,
	(13 to 48) in	(15 + 11L) μin	Pratt & Whitney UMM
Micrometers –	Outside Diameter (0 to 6) in 0.00005 in resolution	(53 + 9.6L) μin	Gage blocks, optical flat
	(0 to 36) in 0.0001 in resolution	(67 + 17L) μin	
	Inside Diameter (0 to 48) in	(18 + 7L) μin + 0.6R	Pratt & Whitney UMM
	Hole Micrometer (0 to 4) in	200 μin	Ring gages
	Depth (0 to 12) in 0.0001 in resolution	(66 + 7L) μin	Gage blocks, optical flat, surface plate
	Anvil / Spindle Flatness (0 to 1) in	18 μin	Optical parallels

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
Pin/Plug Gages	(0 to 1) in	21 µin	Pratt & Whitney Labmaster, gage blocks
Thread Plug Gage, Plain and Truncated –			
Major diameter	(0 to 1.5) in / (4 to 80) TPI	27 µin	Pratt & Whitney Supermike, thread wires
Pitch Diameter	(1.5 to 4) in / (4 to 80) TPI	77 µin	
Thread Rings	(0 to 2) in	360 µin	Thread setting plugs
Thread Wires	(4 to 80) TPI	14 µin	Pratt & Whitney Labmaster
Surface Plates <sup>3</sup>	Up to 60 in diagonal Repeat Reading Flatness	32 µin 12 $\sqrt{DL}$	Repeat-o-meter Electronic levels

## II. Electrical – DC/Low Frequency

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

Parameter/Range	Frequency	CMC <sup>2,6,7</sup> (±)	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 21) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz	0.07 % + 48 mA 0.16 % + 11 mA 3.4 % + 30 mA	
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	
(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	

Parameter/Range	Frequency	CMC <sup>2,6,7</sup> (±)	Comments
AC Current – Measure (cont)			
(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	Fluke 8508A
(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 <sup>2,6,7</sup> (±)	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 <sup>2, 6, 7</sup> ( $\pm$ )	Comments
DC Current – Generate	(0 to 329.999) $\mu$ A (0 to 3.29999) mA (0 to 32.9999) mA (0 to 329.999) mA (0 to 1.09999) A (1.1 to 2.99999) A (0 to 10.0000) A (11 to 20.5) A	0.010 % + 77 nA 63 $\mu$ A 170 $\mu$ A 31 $\mu$ A/A + 130 $\mu$ A 12 mA 130 mA 130 mA 130 mA	Fluke 5520A
DC Current – Measure	(0 to 199.99000) $\mu$ 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 $\mu$ A/A + 6 nA 6 $\mu$ A/A + 8 nA 5 $\mu$ A/A + 160 $\mu$ A 28 $\mu$ A/A + 1 $\mu$ A 0.02% + 18 $\mu$ A 0.03% + 230 $\mu$ A	Fluke 8508A
DC Voltage – Generate	(0 to 329.9999) mV (0 to 3.299999) V (0 to 32.99999) V (30 to 329.9999) V (100 to 1000.000) V	32 $\mu$ V 8.2 $\mu$ V/V + 21 $\mu$ V 12 $\mu$ V/V + 110 $\mu$ V 0.01 $\mu$ V/V + 2 mV 0.54 $\mu$ V/V + 5.2 mV	Fluke 5520A
DC Voltage – Measure	(0.0001 to 199.99000) mV (0.2 to 1.9999) V (2 to 19.999) V (20 to 199.99) V (200 to 1050.00) V	3 $\mu$ V/V + 190 nV 2 $\mu$ V/V + 2 $\mu$ V 1 $\mu$ V/V + 180 $\mu$ V 4 $\mu$ V/V + 33 $\mu$ V 4 $\mu$ V/V + 420 $\mu$ V	Fluke 8508A
Resistance – Generate	(0 to 10.9999) $\Omega$ (11 to 32.999) $\Omega$ (33 to 109.9999) $\Omega$ (110 to 329.9999) $\Omega$ 330 $\Omega$ to 1.099999 k $\Omega$ (1.1 to 3.299999) k $\Omega$ (3.3 to 10.99999) k $\Omega$ (11 to 32.99999) k $\Omega$ (33 to 109.9999) k $\Omega$ (110 to 329.9999) k $\Omega$	28 $\mu\Omega/\Omega$ + 0.0018 $\Omega$ 32 $\mu\Omega/\Omega$ + 0.0023 $\Omega$ 30 $\mu\Omega/\Omega$ + 0.0022 $\Omega$ 34 $\mu\Omega/\Omega$ + 0.0031 $\Omega$ 32 $\mu\Omega/\Omega$ + 0.0048 $\Omega$ 19 $\mu\Omega/\Omega$ + 0.12 $\Omega$ 30 $\mu\Omega/\Omega$ + 0.072 $\Omega$ 42 $\mu\Omega/\Omega$ + 0.035 $\Omega$ 19 $\Omega$ 36 $\mu\Omega/\Omega$ + 3.2 $\Omega$	Fluke 5520A

Parameter/Equipment	Range	CMC <sup>2, 5, 6, 7</sup> ( $\pm$ )	Comments
Resistance – Generate (cont)	330 k $\Omega$ to 1.099999 M $\Omega$ (1.1 to 3.299999) M $\Omega$ (3.3 to 10.99999) M $\Omega$ (11 to 32.99999) M $\Omega$ (33 to 109.9999) M $\Omega$ (110 to 329.9999) M $\Omega$ (330 to 1100) M $\Omega$	13 $\mu\Omega/\Omega$ + 68 $\Omega$ 60 $\mu\Omega/\Omega$ + 85 $\Omega$ 0.011 % + 960 $\Omega$ 0.03 % + 4.3 k $\Omega$ 0.01 % + 18 k $\Omega$ 0.36 % + 130 k $\Omega$ 1.8 % + 580 k $\Omega$	Fluke 5520A
Resistance – Measure	(0 to 1.9999) $\Omega$ (2 to 19.999) $\Omega$ (20 to 199.99) $\Omega$ 200 $\Omega$ to 1.9999 k $\Omega$ (2 to 19.999) k $\Omega$ (20 to 199.99) k $\Omega$ 200 k $\Omega$ to 1.9999 M $\Omega$ (2 to 19.999) M $\Omega$ (20 to 199.99) M $\Omega$ 200 k $\Omega$ to 1.9999 G $\Omega$	5 $\mu\Omega/\Omega$ + 24 $\mu\Omega$ 2 $\mu\Omega/\Omega$ + 280 $\mu\Omega$ 2 $\mu\Omega/\Omega$ + 2 m $\Omega$ 40 $\mu\Omega/\Omega$ + 3 m $\Omega$ 3 $\mu\Omega/\Omega$ + 110 m $\Omega$ 3 $\mu\Omega/\Omega$ + 83 m $\Omega$ 1 $\mu\Omega/\Omega$ + 16 $\Omega$ 6 $\mu\Omega/\Omega$ + 380 $\Omega$ 250 k $\Omega$ 0.061 % + 2 M $\Omega$	Fluke 8508A
Electrical Simulation of Thermocouples –			
Type E	(-250 to -100) $^{\circ}\text{C}$ (-100 to -25) $^{\circ}\text{C}$ (-25 to 350) $^{\circ}\text{C}$ (350 to 650) $^{\circ}\text{C}$ (650 to 1000) $^{\circ}\text{C}$	0.85 $^{\circ}\text{C}$ 0.64 $^{\circ}\text{C}$ 0.01 % + 0.52 $^{\circ}\text{C}$ 0.01 % + 0.61 $^{\circ}\text{C}$ 0.01 % + 0.55 $^{\circ}\text{C}$	Fluke 5520A
Type J	(-210 to -100) $^{\circ}\text{C}$ (-100 to -30) $^{\circ}\text{C}$ (-30 to 760) $^{\circ}\text{C}$	1.1 $^{\circ}\text{C}$ 0.48 $^{\circ}\text{C}$ 0.12 $^{\circ}\text{C}$	
Type K	(-200 to -100) $^{\circ}\text{C}$ (-100 to 120) $^{\circ}\text{C}$ (120 to 1000) $^{\circ}\text{C}$ (1000 to 1372) $^{\circ}\text{C}$	0.33 $^{\circ}\text{C}$ 0.31 $^{\circ}\text{C}$ 0.32 $^{\circ}\text{C}$ 0.31 $^{\circ}\text{C}$	
Type R	(0 to 250) $^{\circ}\text{C}$ (250 to 400) $^{\circ}\text{C}$ (400 to 1000) $^{\circ}\text{C}$ (1000 to 1767) $^{\circ}\text{C}$	0.01 % + 0.31 $^{\circ}\text{C}$ 0.32 $^{\circ}\text{C}$ 0.01 % + 0.22 $^{\circ}\text{C}$ 0.01 % + 0.22 $^{\circ}\text{C}$	

Parameter/Equipment	Range	CMC <sup>2,5</sup> (±)	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 <sup>2,5</sup> (±)	Comments
Force – Measuring Equipment	(0 to 300) lbf	0.032 % + 0.036 g	Class F weights, Class S-1 weights
Gage Pressure – Measuring Equipment, Fixed Points	2 psi 50 psi 100 psi 200 psi 300 psi 400 psi 500 psi 1000 psi 2000 psi 4000 psi 6000 psi 8000 psi 10 000 psi	2.0 % 0.08 % 0.02 % 0.02 % 0.02 % 0.02 % 0.02 % 0.02 % 0.02 % 0.02 % 0.02 % 0.01 % 0.02 %	Pressurements Limited W2200-3-P dead weight tester

Parameter/Equipment	Range	CMC <sup>2,5</sup> (±)	Comments
Indirect Verification of Hardness Testers <sup>3</sup>	HRBW:  Low Middle High  HRC:  Low Middle High	0.76 HRBW 0.75 HRBW 0.69 HRBW  0.63 HRC 0.64 HRC 0.61 HRC	ASTM E18
Scales <sup>3</sup>	(0 to 300) lb	0.032 % + 0.035 g	Class F weights, Class S-1 weights
Mass	(10 to 50) lb	2.3 g	Class S1 weights
Torque – Measure	4 in·lb to 250 ft·lb	0.63 %	Digital torque load cells
Torque – Measuring Equipment	4 in·lb to 250 ft·lb	0.092%	Calibration arms & weights

#### IV. Thermodynamics

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Temperature – Measure	(0 to 100) °C	0.058 °C	Hart Scientific black stack w/ 1925-A thermistor probe
Temperature – Measuring Equipment	(0 to 100) °C	0.058 °C	Hart Scientific black stack

## V. Time & Frequency

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Frequency Reference	10 MHz	0.67 Hz	GPS reference
Frequency – Measure	0.1Hz to 225 MHz	0.68 Hz	GPS reference w/ HP 53132A

<sup>1</sup> This laboratory offers commercial calibration service.

<sup>2</sup> Calibration and Measurement Capability (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.

<sup>3</sup> 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.

<sup>4</sup> 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;  $D$  is the numerical value of the nominal diameter of the device measured in inches; and  $DL$  is the diagonal length of the unit under test in inches.

<sup>5</sup> In the statement of CMC, percentages are to be read as percent of reading, unless noted otherwise.

<sup>6</sup> The measurands stated are generated with the Fluke 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.

<sup>7</sup> The measurands stated are measured with the Fluke 8508A. 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.



World Class Accreditation

The American Association for Laboratory Accreditation

# 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 17025:2005 *General Requirements for the Competence of Testing and Calibration Laboratories*. This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994 and any additional program requirements in the field of calibration. **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 28<sup>th</sup> day of December 2009.

A handwritten signature in black ink, appearing to read "Peter Abney".

President & CEO  
For the Accreditation Council  
Certificate Number 2904.01  
Valid to February 29, 2012

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