

Scope of Accreditation For CAL TEC LABS, INC.

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In recognition of a successful assessment to ISO/IEC 17025:2005, accreditation is granted to **CAL TEC LABS, INC.** to perform the following **Calibrations**:

Accreditation granted through: **April 16, 2011**

Calibration

Length - Dimensional Metrology – Hand Tools and Precision Gages 1D

Calibration Parameter/Equipment	Range	Best Measurement Capability (+/-) ²	Remarks
Height Gages	0 in to 24 in	(85 + 12L) μin	Compared with Height Master
Outside Micrometers ¹	0 in to 48 in	(19 + 15L) μin	Compared with Gage Blocks, Length Standards
Inside Micrometers ¹	0.5 in to 40 in	(16 + 14L) μin	Compared with Length Machine & Length Standard
Depth Micrometers ¹	0 in to 12 in	(95 + 9L) μin	Compared with Depth Master, Gage Blocks
Dial Indicators ^{1,6}	0 in to 2 in	61 μin	Compared with indicator Calibrator
Calipers ¹	0 in to 24 in	(116 + 16L) μin	Compared with Cal Master

Length - Dimensional Metrology – Artifacts and Standards 1D

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) ²	Remarks
Gage Blocks	0.005 in to 4 in	(2.5 + 3.3L) μ in	Compared with Gage block comparator & Gage Blocks
Length Standards	1 in to 48 in	(41 + 15L) μ in	Compared with Length Std. & Length Std. Calibrator
Pin Gages ^{1,6}	0.012 in to 2 in	75.2 μ in	Compared with Laser Micrometer
Plain Plug Gages ^{1,6}	0.012 in to 2 in	75.6 μ in	
Linear Measurement ⁶	0 in to 40 in	31 μ in	Compared with Linear Laser System

Length - Dimensional Metrology – Other

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) ²	Remarks
Thread Plugs ⁶ Pitch Diameter	0 in to 2 in	88 μ in	Compared with SuperMic. Laser attachment & Thread wires
Surface Roughness Gage	μ in/ μ m	7.33 μ in	Compared with Precision Roughness Specimen

Mass – Scale and Balances

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) ²	Remarks
Lab Balances ^{1,4} (0.001 g Resolution)	0 g to 5 000 g	0.46 mg	Calibration Methods per NIST Handbook 44 and Cal Tec Labs, Inc. calibration procedures
Bench Scales, Floor Scales (0.1 lb Resolution)	0 lb to 200 lb	0.37 lb	

Mass – Pressure

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) ²	Remarks
Pressure ^{1,3,6}	0 psi to 300 psi	1.4 psi	Compared with Portable Pressure Calibrator
Pressure ^{1,3,6}	100 psi to 10 000 psi	0.82 % of Reading	Compared with Deadweight pressure system

Mass – Torque

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) ²	Remarks
Torque ^{1,3}	0 ozf · in to 100 ozf · in	1.52 ozf · in	Compared with Torque Calibrator
Torque ^{1,3}	0 lbf · in to 100 lbf · in	2.9 lbf · in	
Torque ^{1,3}	0 lbf · ft to 600 lbf · ft	3.34 lbf · ft	

Mass – Flow

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) ²	Remarks
Gas Flow Meters ^{1,3,6}	0 SCCM to 20 SCCM	0.75 SCCM	Compared with MKS Mass Flow System
Gas Flow Meters ^{1,3,6}	20 SCCM to 100 SCCM	1.5413 SCCM	
Gas Flow Meters ^{1,3,6}	100 SCCM to 500 SCCM	5.14 SCCM	
Gas Flow Meters ^{1,3,6}	0 SLM to 2 SLM	0.025 SLM	
Gas Flow Meters ^{1,3,6}	2 SLM to 10 SLM	0.49 SLM	
Gas Flow Meters ^{1,3,6}	10 SLM to 50 SLM	1.12 SLM	
Gas Flow Meters ^{1,3,6}	50 SLM to 400 SLM	4.27 SLM	

Electricity and Magnetism – Voltage

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) ²	Remarks
DC Voltage-Source ^{1,3,5}	0 mV to 320 mV 320 mV to 3.2 V 3.2 V to 32 V 32 V to 320 V 320 V to 1000 V	35.9 μV + 4.16 μV/V 193 μV + 41.6 μV/V 209 μV + 416 μV/V 23.2 mV + 4.48 mV/V 69 mV + 19.95 mV/V	Comparison to multifunction calibrator
DC Voltage –Measure ^{1,3,5}	0 mV to 100 mV 100 mV to 1 V 1 V to 10 V 10 V to 100 V 100 V to 1 000 V	7.6 μV + 1 μV/V 4.1 μV + 0.6 μV/V 4.1 μV + 0.1 μV/V 6.6 μV + 0.6 μV/V 6.6 μV + 0.6 μV/V	Comparison to long scale DMM
AC Voltage – Source ^{1,3,5} 0 V to 10 mV	10 Hz to 3 kHz 3 kHz to 10 kHz 10 kHz to 30 kHz 30 kHz to 50 kHz 50 kHz to 100 kHz	95.2 μV + 384 μV/V 95.2 μV + 512 μV/V 95.3 μV + 960 μV/V 130.4 μV + 1.96 mV/V 141.5 μV + 5.12 mV/V	Comparison to multifunction calibrator

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) ²	Remarks
10 mV to 32 mV	10 Hz to 3 kHz 3 kHz to 10 kHz 10 kHz to 30 kHz 30 kHz to 50 kHz 50 kHz to 100 kHz	95.9 μ V + 96 μ V/V 95.9 μ V + 128 μ V/V 96.9 μ V + 240 μ V/V 133.2 μ V + 480 μ V/V 153.9 μ V + 1.6 mV/V	Comparison to multifunction calibrator
32 mV to 320 mV	10 Hz to 3 kHz 3 kHz to 10 kHz 10 kHz to 30 kHz 30 kHz to 50 kHz 50 kHz to 100 kHz	172 μ V + 19.2 μ V/V 172 μ V + 25.6 μ V/V 214.5 μ V + 48 μ V/V 316.8 μ V + 96 μ V/V 655.2 μ V + 256 μ V/V	
320 mV to 3.2 V	10 Hz to 3 kHz 3 kHz to 10 kHz 10 kHz to 30 kHz 30 kHz to 50 kHz 50 kHz to 100 kHz	114.9 mV + 192 μ V/V 114.9 mV + 256 μ V/V 97.7 mV + 480 μ V/V 131.9 mV + 960 μ V/V 130.6 mV + 2.56 μ V/V	
3.2 V to 32 V	10 Hz to 3 kHz 3 kHz to 10 kHz 10 kHz to 30 kHz 30 kHz to 50 kHz 50 kHz to 100 kHz	120.9 mV + 1.96 mV/V 121.7 mV + 2.56 mV/V 122.7 mV + 4.8 mV/V 176.7 mV + 9.6 mV/V 220.6 mV + 32 mV/V	
32 V to 105 V	10 Hz to 3 kHz 3 kHz to 10 kHz 10 kHz to 30 kHz 30 kHz to 50 kHz 50 kHz to 100 kHz	72.4 mV + 6.3 mV/V 86.3 mV + 8.4 mV/V 102.1 mV + 15.8 mV/V 175.5 mV + 31.5 mV/V 383.6 mV + 105 mV/V	
105 V to 320 V	40 Hz to 1 kHz 1 kHz to 3 kHz 3 kHz to 10 kHz 10 kHz to 20 kHz 20 kHz to 30 kHz	678.7 mV + 19.2 mV/V 743.9 mV + 19.2 mV/V 307.8 mV + 32 mV/V 471.4 mV + 48 mV/V 517.9 mV + 64 mV/V	
320 V to 800 V	40 Hz to 1 kHz 1 kHz to 3 kHz 3 kHz to 10 kHz 10 kHz to 20 kHz 20 kHz to 30 kHz	2.3 V + 63 mV/V 2.5 V + 63 mV/V 3.2 V + 105 mV/V 3.4 mV + 158 mV/V 3.6 V + 210 mV/V	
800 V to 1050 V	40 Hz to 1 kHz 1 kHz to 3 kHz 3 kHz to 10 kHz 10 kHz to 20 kHz	2.6 V + 126 mV/V 2.8 V + 126 mV/V 2 V + 210 mV/V 2.4 V + 315 mV/V	

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) ²	Remarks
AC Voltage – Measure ^{1,3,5} 0 V to 100 mV	1 Hz to 10 Hz 10 Hz to 40 Hz 40 Hz to 100 Hz 100 Hz to 2 kHz 2 kHz to 10 kHz 10 kHz to 30 kHz 30 kHz to 100 kHz	123 μV + 70 μV/V 123 μV + 20 μV/V 105 μV + 20 μV/V 104 μV + 10 mV/V 103 μV + 20 mV/V 304 μV + 40 mV/V 706 μV + 100 mV/V	Comparison to long scale DMM
1 V to 100 V	1 Hz to 10 Hz 10 Hz to 40 Hz 40 Hz to 100 Hz 100 Hz to 2 kHz 2 kHz to 10 kHz 10 kHz to 30 kHz 30 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz	105 μV + 60 μV/V 104 μV + 10 μV/V 82 μV + 10 μV/V 63 μV + 10 mV/V 82 μV + 10 mV/V 201 μV + 20 mV/V 501 μV + 100 mV/V 1.22 % + 0.45 % applied V 3.06 % + 1.41 % applied V	
100 V to 1000 V	1 Hz to 10 Hz 10 Hz to 40 Hz 40Hz to 10kHz 10 kHz to 30 kHz 30 kHz to 100 kHz	104 μV + 70 μV/V 104 μV + 20 μV/V 85 μV + 20 μV/V 284 μV + 40 mV/V 539 μV + 200 mV/V	

Electricity and Magnetism – Resistance

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) ²	Remarks
Resistance-Source ^{1,3,5}	0 Ω to 40 Ω 40 Ω to 4 kΩ 4 kΩ to 40 kΩ 40 kΩ to 400 kΩ 400 kΩ to 4 MΩ 4 MΩ to 40 MΩ 40 MΩ to 400 MΩ	70 mΩ + 500 μΩ/Ω 104 mΩ + 150 μΩ/Ω 802 mΩ + 150 μΩ/Ω 71 Ω + 180 μΩ/Ω 266 Ω + 200 μΩ/Ω 142 kΩ + 500 μΩ/Ω 161 kΩ + 600 μΩ/Ω	Comparison to multifunction calibrator
Resistance - Measure	0 Ω to 10 Ω 10 Ω to 100 Ω 100 Ω to 1 kΩ 1 kΩ to 10 kΩ 10 kΩ to 100 kΩ 100 kΩ to 1 MΩ 1 MΩ to 10 MΩ 10 MΩ to 100 MΩ 100 MΩ to 1 GΩ	13 μΩ + 2 μΩ/Ω 9 μΩ + 3 μΩ/Ω 7 mΩ + 0.8 mΩ/kΩ 7 mΩ + 0.8 mΩ/kΩ 7 mΩ + 0.8 mΩ/kΩ 12 Ω + 1.2 Ω/MΩ 13 Ω + 20 Ω/MΩ 47 Ω + 200 Ω/MΩ 47 Ω + 200 Ω/MΩ	Comparison to long scale DMM

Electricity and Magnetism – Current

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) ²	Remarks	
DC Current- Source ^{1,3,5}	0 µA to 320 µA 320 µA to 3.2 mA 3.2 mA to 32 mA 32 mA to 320 mA 0.32 A to 3.2 A 3.2 A to 10.5 A 10.5 A to 20 A 20 A to 750 A	300 nA + 11 nA/A 71 µA + 83 nA/A 84 µA + 900 nA/A 519 µA + 9.6 µA/A 122 mA + 118 µA/A 107 mA + 940 µA/A 142 mA + 4.5 mA/A	Comparison to multifunction calibrator	
		1.99 % applied V	Wavetek 50 turn coil	
DC Current-Measure ^{1,3,5}	0 µA to 100 µA 100 µA to 1 mA 1 mA to 10 mA 10 mA to 100 mA 100 mA to 1 A	26 µA + 2 µA/A 26 µA + 2 µA/A 26 µA + 2 µA/A 51 µA + 5 µA/A 151 µA + 10 µA/A	Comparison to long scale DMM	
AC Current – Source ^{1,3,5}	0 A to 32 µA	268 µA + 900 nA/A 455 µA + 1.9 µA/A 461 µA + 6 µA/A 521 µA + 9 µA/A	Comparison to multifunction calibrator	
32 µA to 320 µA	10 Hz to 3 kHz 3 kHz to 10 kHz 10 kHz to 20 kHz 20 kHz to 30 kHz	268 µA + 300 nA/A 455 µA + 600 nA/A 461 µA + 2 µA/A 521 µA + 3 µA/A		
320 µA to 32 mA	10 Hz to 3 kHz 3 kHz to 10 kHz 10 kHz to 20 kHz 20 kHz to 30 kHz	258 µA + 3.2 µA/A 455 µA + 6.4 µA/A 461 µA + 12.8 µA/A 521 µA + 22 µA/A		
32 mA to 320 mA	10 Hz to 3 kHz 3 kHz to 10 kHz 10 kHz to 20 kHz 20 kHz to 30 kHz	758 µA + 32 µA/A 820 µA + 48 µA/A 768 µA + 64 µA/A 859 µA + 96 µA/A		
320 mA to 3.2 A	10 Hz to 3 kHz 3 kHz to 10 kHz	210 mA + 480 µA/A 460 mA + 2.56 mA/A		
3.2 A to 10.5 A	10 Hz to 3 kHz 3 kHz to 10 kHz	320 mA + 3 mA/A 593 mA + 10 mA/A		
10.5 A to 20 A	10 Hz to 3 kHz 3 kHz to 10 kHz	472 mA + 6.9 mA/A 602 mA + 23 mA/A		
20 A to 750 A	10 Hz to 30 kHz	1.67 % of Reading		Comparison to multifunction calibrator and 50 turn coil

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) ²	Remarks
AC Current – Measure ^{1,3,5} 0 μA to 100 μA	10 Hz to 5 kHz	253 μA +100 μA/A	Comparison to long scale DMM
100 μA to 1 mA	10 Hz to 5 kHz	215 μA + 100 μA/A	
1 mA to 10 mA	10 Hz to 5 kHz	216 μA + 100 μA/A	
10 mA to 100 mA	10 Hz to 5 kHz	216 μA + 100 μA/A	
100 mA to 1 A	10Hz to 1kHz	508 μA + 200 μA/A	

Electricity and Magnetism – Electrical Temperature Simulation

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) ²	Remarks
Temperature Simulation TC Type E ^{1,6}	-250 °C to 1000 °C	1.88 °C	Comparison to multifunction calibrator
Temperature Simulation TC Type J ^{1,6}	-210 °C to 1200 °C	1.83 °C	
Temperature Simulation TC Type K ^{1,6}	-250 °C to 1372 °C	2 °C	
Temperature Simulation TC Type T ^{1,6}	-250 °C to 400 °C	1.92 °C	

Electricity and Magnetism / Time and Frequency – Oscilloscopes

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) ²	Remarks
Oscilloscope Functions ^{1,3,6} Bandwidth	50 kHz to 600 MHz	2.7 % of Reading	Reference set at 50 KHz Comparison performed with multifunction calibrator
Risetime	5 ns to 100ms	2.9 % of Reading	Comparison performed with multifunction calibrator
Timing	10 ns to 5s	2.5 % of Reading	

Time and Frequency – Frequency / Period

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) ²	Remarks
Frequency – Source ^{1,6}	10 Hz to 300 MHz	1.53 % of Reading	Comparison to multifunction calibrator
Frequency - Source ^{1,6}	100 MHz to 3 200 MHz	1.71 % Reading	Comparison to Frequency Generator
Frequency – Measure	10 Hz to 3 200 MHz	2.23 % Reading	

Thermodynamic – Thermodynamic Devices (all)

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) ²	Remarks
Temperature Source ^{1,6}	0 °C to 500 °C	0.99 °C	Comparison to Dry Block Calibrator, Fluke Process Calibrator & RTD
Temperature Measure ^{1,6}	-200 °C to 500 °C	1.32 °C	

Notes:

- 1) Laboratory offers calibration services at the laboratory's own facilities and at the client or other agreed upon facilities.
- 2) Best uncertainties represent expanded uncertainties at approximately the 95% confidence level using a coverage factor of k=2.
- 3) When ranges overlap the uncertainty for the overlapping specifications will be lower of the 2 uncertainties.
- 4) The uncertainty associated when calibration a balance/scale is dependent on local conditions, such as the resolutions of the unit being calibrated and the environment, which the balance/scale is operating in. Therefore, a statement of the best measurement capability can be misleading. The class of the weights by the laboratory for each range is identified in the BMC column to clarify the measurement being made by the laboratory.
- 5) Uncertainties stated as fractional part of reading plus floor.
- 6) Uncertainty value applies to entire range identified for these measurements.
- 7) *L* = length in inches, *D* = diameter in inches.

Approved by: _____ Date: April 29, 2008



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