

Scope of Accreditation For American Calibration, Inc.

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In recognition of a successful assessment to ISO/IEC 17025:2005, accreditation is granted to **American Calibration, Inc.** to perform the following Calibrations:

Accreditation granted through: **May 6, 2012**

Calibration

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

Calibration Parameter/Equipment ¹	Range	Calibration and Measurement Capability(+/-) ^{2,3}	Remarks
Bore Gage	0.0001 in resolution (1 to 8) in	180 μin	Bore Gage Calibrator
Calipers	0.0005 in resolution (0.05 to 8) in	460 μin	Gage Blocks
	0.001 in resolution (0.05 to 12) in	800 μin	
	0.001 in resolution (12 to 59) in	(1600 + 10.03L) μin	End Measuring Rods
Outside Micrometer	0.001 in resolution (0 to 1) in	1600 μin	Gage Blocks
	0.0001 in resolution (0 to 1) in	180 μin	
	0.00005 in resolution (0 to 1) in	140 μin	
	0.0001 in resolution (0 to 20) in	810 + 17.163L	Gage Blocks and End Measuring Rod
Depth Micrometer	0.0001 in resolution (0 to 12) in	140 μin	Gage Blocks
	0.001 in resolution (0 to 12) in	1200 μin	
Dial Indicator	0.00005 in resolution (0 to 2) in	61 μin	Indicator Calibrator
	0.0001 in resolution (0 to 2) in	110 μin	
	0.001 in resolution (0 to 2) in	1200 μin	

Calibration Parameter/Equipment ¹	Range	Calibration and Measurement Capability(+/-) ^{2,3}	Remarks
Height Gages	0.00005 in resolution Up to 12 in	180 μin	Gage Blocks
	0.00005 in resolution (12 to 20) in	840 μin	Measuring Rods
Extensometer	0.00005 in resolution Up to 2 in	140 μin	Micrometer Head
Measuring Tables	0.005 in resolution Up to 59 in	0.01 in	Measuring Rods

Length - Dimensional Metrology – Artifacts and Standards 1D

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) ^{2,3}	Remarks
Gage Blocks	Up to 4 in	(4 + 2.33L) μin	Ref Blocks and Comparator
Laser Micrometer ¹	1 μin Resolution Up to 2 in	23 μin	XXX Pin Gage
Snap Gages ¹	(0.05 to 4) in	22 μin	Gage Blocks
Pin Gages / Plug Gages ¹	Up to 1.9 in	46 μin	Laser Micrometer
Pin Gages / Plug Gages	Up to 2 in (1.9 to 18) in	(5.2 + 10D) μin (4 + 11D) μin	ULM
Plain Rings	(0 to 12) in	85 μin	Gage Blocks and ULM
Thread Plugs Pitch Diameter	Up to 8 in (5 to 100) TPI	(74 μin + 7.6L) μin	Wires and ULM
Thread Rings	Up to 2 in	460 μin	Reference Thread Plug
Thread Wires	Up to 0.14434 in	(12 + 27D) μin	ULM
Measuring Rods ¹	Up to 12 in (12 to 20) in	(15 + 1.4L) μin (39 + 5L) μin	
Surface Plate Flatness ¹	From 12in X 12in to 10 ft x 16 ft	Closure Error + 12 μin + 0.42 μin/in _D	Electronic Levels “in _D ” = longest diagonal of plate in inches
Surface Plate Repeat ¹	NA	36 μin	Repeat-o-meter

Length - Dimensional Metrology – Hand Tools and Precision Gages 2D

Calibration Parameter/Equipment ¹	Range	Calibration and Measurement Capability(+/-) ²	Remarks
Optical Comparators Magnification	10x & 100x	210 μin	Glass Scale
Optical Comparators Linearity	10 μin Resolution (0 to 6) in	120 μin	
Optical Comparators Angularity	(0 to 30) degrees	0° 2' 10"	Angle Blocks
Microscopes	(0 to 2) in	160 μin	Glass Scale

Length - Dimensional Metrology – Hand Tools and Precision Gages 3D

Calibration Parameter/Equipment ¹	Range	Calibration and Measurement Capability(+/-) ^{2,3}	Remarks
CMM Linear Accuracy	(0.5 to 24.5) in	(90 + 9.24L) μin	Step Gage
CMM Volumetric Accuracy	Up to 25 in	(0.88 + 23.56L) μin	Ball Bars
CMM Squareness	(0.25 to 11.75) in	210 μin	Square and Indicator

Length - Dimensional Metrology – Other

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) ²	Remarks
Profilometers ¹	Up to 120 μin	3.1 μin	Roughness Standard

Mass – Pressure

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) ²	Remarks
Pressure ¹	(0 to 300) psig	1.2 psi	Pressure Calibrator / Comparison to high accuracy gage
	(300 to 10 000) psig	41 psi	

Mass – Vacuum

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) ²	Remarks
Vacuum ¹	(-760 to 0) mmHg	(0.68% + 0.86) mmHg	Pressure Calibrator

Mass – Force

Calibration Parameter/Equipment ¹	Range	Calibration and Measurement Capability(+/-) ²	Remarks
Force Gauges	(0 to 100) lbs	0.0008 lbs + 0.008% rdg	Dead Weights
Force Machines Tension Compression	(6 to 60) klbF	12 lbf	Comparison with ASTM E74 Load Cell and Indicator
	(6 to 60) klbF	16 lbf	

Mass – Torque

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) ²	Remarks
Torque Wrenches ¹	(25 to 250) lbf-ft	1.9 lbf-ft	Torque Wrench Cal Sys
	(80 to 800) lbf-ft	2 lbf-ft	

Mass – Hardness

Calibration Parameter/Equipment ¹	Range	Calibration and Measurement Capability(+/-) ²	Remarks
Rockwell Hardness Testers	HR15N Low Middle High	1.3 HR15N 1.3 HR15N 0.89 HR15N	Indirect verification according to ASTM E18
	HR30N Low Middle High	1.4 HR30N 1.4 HR30N 1 HR30N	

Calibration Parameter/Equipment ¹	Range	Calibration and Measurement Capability(+/-) ²	Remarks
Rockwell Hardness Testers	HR45N Low Middle High	1.4 HR45N 1.4 HR45N 1.3 HR45N	Indirect verification according to ASTM E18
	HRA Low Middle High	1.3 HRA 1.3 HRA 0.7 HRA	
	HRBw Low Middle High	2 HRBw 1.4 HRBw 1.4 HRBw	
	HRC Low Middle High	1.3 HRC 1.3 HRC 1.3 HRC	
	HR15Tw Low Middle High	2 HR15Tw 1.4 HR15Tw 1.3 HR15Tw	
	HR30Tw Low Middle High	1.9 HR30Tw 1.3 HR30Tw 1.3 HR30Tw	
	HR45Tw Low Middle High	1.9 HR45Tw 1.3 HR45Tw 1.4 HR45Tw	
Brinell Hardness Testers	HRBw 3000 Kgf	0.057mm	Indirect verification according to ASTM E10
Micro-Hardness Indentation Testers (Knoop and Vickers)	Repeatability under force (1 to 500) gf: (100 to 250) HK 650 HK and up (100 to 240) HV 600 HV and up Error	 1.41% 1.47% 1.8% 1.71% 1.5%	Indirect verification according to ASTM E384 Best uncertainty is stated as the repeatability (as defined in ASTM E384)

Mass – Scale and Balances

Calibration Parameter/Equipment ¹	Range	Calibration and Measurement Capability(+/-) ²	Remarks
Weighing Systems 0.005 Resolution	(0 to 10) lb	1.3 g + 76 mg / lb	Comparison to ASTM Class 3 & NIST Class F Weights per NIST Handbook 44
	(10 to 50) lb	1.8 g + 77 mg / lb	
Weighing Systems 0.02 Resolution	(50 to 250) lb	21 g + 115 mg / lb	

Electricity and Magnetism – Voltage

Calibration Parameter/Equipment ¹	Range	Calibration and Measurement Capability(+/-) ²	Remarks
DC Voltage-Source	(0 to 330) mV 330 mV to 3.3 V (3.3 to 33) V (33 to 330) V (330 to 1020) V	3.47 μ V + 0.069 μ V / mV 5.8 μ V + 58 μ V / V 0.22 mV + 0.053 mV / V 0.65 mV + 0.064 mV / V 2.5 mV + 0.063 mV / V	Fluke 5500A
DC Voltage-Measure	(1 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V (100 to 1000) V	8.6 μ V 47 μ V 0.4 mV 4.5 mV 45 mV	Agilent 34401A
DC Voltage-Measure	(1 to 6) kV (6 to 40) kV	74 mV + 2 % rdg 0.87 V + 2 % rdg	High Voltage Divider and DMM
AC Voltage Source (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	0.4 % + 0.025 mVAC 0.17 % + 0.023 mVAC 0.23 % + 0.023 mVAC 0.29 % + 0.024 mVAC 0.4 % + 0.039 mVAC 1.1 % + 0.074 mVAC	Fluke 5500A
AC Voltage Source (33 to 330) 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	0.28 % + 0.072 mVAC 0.057 % + 0.025 mVAC 0.12 % + 0.024 mVAC 0.18 % + 0.048 mVAC 0.28 % + 0.2 mVAC 0.81 % + 0.39 mVAC	
AC Voltage Source 330 mV 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	0.17 % + 0.5 mVAC 0.034 % + 0.089 mVAC 0.092 % + 0.079 mVAC 0.15 % + 0.61 mVAC 0.28 % + 2 mVAC 0.57 % + 3.9 mVAC	
AC Voltage Source (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	0.17 % + 5 mVAC 0.046 % + 0.93 mVAC 0.092 % + 3.1 mVAC 0.22 % + 5.9 mVAC 0.28 % + 20 mVAC	
AC Voltage Source (33 to 330) V	40 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz	0.048 % + 50 mVAC 0.092 % + 19 mVAC 0.1 % + 39 mVAC	
AC Voltage Source (33 to 330) V	40 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz	0.048 % + 50 mVAC 0.092 % + 19 mVAC 0.1 % + 39 mVAC	

Calibration Parameter/Equipment ¹	Range	Calibration and Measurement Capability(+/-) ²	Remarks
AC Voltage Source (330 to 1020) V	45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.053 % + 170 mVAC 0.23 % + 120 mVAC 0.23 % + 580 mVAC	Fluke 5500A
AC Voltage –Measure (1 to 100) mV	10 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 30) kHz	0.2 mV 1.2 mV 6 mV 40 mV	Agilent 34401A
AC Voltage –Measure 100 mV to 1 V	10 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	10 mV 1.7 mV 6.8 mV 45 mV	
AC Voltage –Measure (1 to 10) V	10 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.6 mV 1.2 mV 6 mV 40 mV	
AC Voltage –Measure (10 to 100) V	10 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.6 mV 1.6 mV 6 mV 40 mV	
AC Voltage –Measure (100 to 750) V	10 Hz to 19 kHz (19 to 33) kHz	0.7 V 1.8 mV	
AC Voltage-Measure (1 to 6) kV	60 Hz	1.6 V + 5.5 % rdg	
AC Voltage-Measure (6 to 40) kV	60 Hz	3.3 V + 5.4 % rdg	

Electricity and Magnetism – Resistance

Calibration Parameter/Equipment ¹	Range	Calibration and Measurement Capability(+/-) ²	Remarks
Resistance-Source	(0 to 10.999) Ω	0.014 % + 6.9 mΩ	Fluke 5500A
	(11 to 32.999) Ω	0.014 % + 12 mΩ	
	(33 to 109.999) Ω	0.01 % + 12 mΩ	
	(110 to 329.999) Ω	0.01 % + 12 mΩ	
	(0.33 to 1.09999) kΩ	0.01 % + 69 mΩ	
	(1.1 to 3.29999) kΩ	0.01 % + 70 mΩ	
	(3.3 to 10.9999) kΩ	0.01 % + 0.69 Ω	
	(11 to 32.9999) kΩ	0.01 % + 0.7 Ω	
	(33 to 109.999) kΩ	0.013 % + 6.9 Ω	
	(110 to 329.999) kΩ	0.014 % + 7.02 Ω	
	(0.33 to 1.09999) MΩ	0.017 % + 64 Ω	
	(1.1 to 3.29999) MΩ	0.017 % + 66 Ω	
	(3.3 to 10.9999) MΩ	0.069 % + 0.64 kΩ	
	(11 to 32.9999) MΩ	0.13 % + -0.52 kΩ	
	(33 to 109.999) MΩ	0.58 % + 7 kΩ	
(110 to 329.999) MΩ	0.77 % + -0.1 MΩ		

Calibration Parameter/Equipment ¹	Range	Calibration and Measurement Capability(+/-) ²	Remarks
Resistance-Measure	(0 to 100) Ω 100 Ω to 1 kΩ (1 to 10) kΩ (10 to 100) kΩ 100 kΩ to 1 MΩ (1 to 10) MΩ (10 to 100) MΩ	10 mΩ 100 mΩ 1 Ω 10 Ω 10 Ω 182.5 Ω 1 kΩ	Agilent 34401A

Electricity and Magnetism – Capacitance

Calibration Parameter/Equipment ¹	Range	Calibration and Measurement Capability(+/-) ²	Remarks
Capacitance- Measure	(1 to 5) nF (5 to 50) nF (50 to 500) nF 500 nF to 5 μF	0.099 nF 0.00096 uF 0.0099 uF 0.15 uF	Fluke 87
Capacitance- Source	(0.33 to 0.4999) nF (0.5 to 1.0999) nF (1.1 to 3.2999) nF (3.3 to 10.999) nF (11 to 32.999) nF (33 to 109.99) nF (110 to 329.99) nF (0.33 to 1.0999) μF (1.1 to 3.2999) μF (3.3 to 10.999) μF (11 to 32.999) μF (33 to 109.99) μF (110 to 329.99) μF (0.33 to 1.1) mF	0.23 % + 0.037 nF 0.41 % + 0.023 nF 0.28 % + 0.063 nF 0.54 % + 0.049 nF 0.48 % + 0.12 nF 0.35 % + 0.52 nF 0.47 % + 0.52 nF 0.35 % + 5.2 nF 0.58 % + 5.1 nF 0.42 % + 51 nF 0.63 % + 47 nF 0.73 % + 140 nF 0.92 % + 460 nF 1.2 % + 850 nF	Fluke 5500A

Electricity and Magnetism – Inductance

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) ²	Remarks
Inductance-Source ¹	Up to 10 mH (10 to 100) mH 100 mH to 1 H (1 to 10) H	3.2 μH + 1.6 mH/H 0.53 μH + 800 μH/H 0.03 μH + 600 μH/H 0.1 H + 600 μH/H	Decade Inductance Substituter

Electricity and Magnetism – Current

Calibration Parameter/Equipment ¹	Range	Calibration and Measurement Capability(+/-) ²	Remarks
DC Current- Measure	(1 to 10) mA (10 to 100) mA 100 mA to 1 A (1 to 3) A	5 μA 50 μA 1 mA 3.6 mA	Agilent 34401A
DC Current- Source	(0 to 3.3) mA (3.3 to 33) mA (33 to 330) mA 330 mA to 2.2 A (2.2 to 11) A	0.013 % + 0.13 μA 0.011 % + 1.2 μA 0.022 % + 12 μA 0.063 % + 0.13 mA 0.045 % + 5.9 mA	Fluke 5500A

Calibration Parameter/Equipment ¹	Range	Calibration and Measurement Capability(+/-) ²	Remarks
AC Current- Source (0.029 to 0.33) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.2 % + 0.62 μAAC 0.083 % + 0.61 μAAC 0.083 % + 0.61 μAAC 0.36 % + 0.65 μAAC 1.2 % + 0.99 μAAC	Fluke 5500A
AC Current- Source (0.33 to 3.3) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.16 % + 3.5 μAAC 0.083 % + 1.9 μAAC 0.083 % + 1.9 μAAC 0.2 % + 1.6 μAAC 0.67 % + 1.1 μAAC	
AC Current- Source (3.3 to 33) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.22 % + 7.5 μAAC 0.11 % + 5.7 μAAC 0.01 % + 230 μAAC 0.23 % + 4.3 μAAC 0.56 % + 57 μAAC	
AC Current- Source (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	0.23 % + 50 μAAC 0.12 % + 36 μAAC 0.1 % + 36 μAAC 0.23 % + 40 μAAC 0.69 % + 30 μAAC	
AC Current- Source 330 mA to 2.2 A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz	0.23 % + 0.37 mAAC 0.12 % + 0.35 mAAC 0.87 % + 0.35 mAAC	
AC Current- Source (2.2 to 11) A	(45 to 100) Hz 100 Hz to 1 kHz	0.052 % + 5.8 mAAC 0.097 % + 5.4 mAAC	
AC Current- Measure (0 to 1) A	50 Hz to 5 kHz	1 mA	
AC Current- Measure (1 to 2) A	50 Hz to 5 kHz	1.5 mA	
AC Current- Measure (2 to 10) A	60 Hz and 400 Hz	18 mA	Fluke 87

Electricity and Magnetism – Electrical Temperature Simulation

Calibration Parameter/Equipment ¹	Range	Calibration and Measurement Capability(+/-) ²	Remarks
Temperature- Measure	(-200 to 1370) °C	2.3 °C	Fluke 714 w/ Thermocouple Probes
Electrical Calibration of Thermocouple Indicating Systems-Source Type B	(600 to 800) °C (800 to 1000) °C (1000 to 1550) °C (1550 to 1820) °C	0.51 °C 0.39 °C 0.35 °C 0.39 °C	Fluke 5500A
Electrical Calibration of Thermocouple Indicating Systems-Source Type C	(0 to 150) °C (150 to 650) °C (650 to 1000) °C (1000 to 1800) °C (1800 to 2316) °C	0.34 °C 0.30 °C 0.36 °C 0.58 °C 0.97 °C	

Calibration Parameter/Equipment¹	Range	Calibration and Measurement Capability(+/-)²	Remarks
Electrical Calibration of Thermocouple Indicating Systems-Source Type E	(-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C	0.58 °C 0.19 °C 0.16 °C 0.19 °C 0.24 °C	Fluke 5500A
Electrical Calibration of Thermocouple Indicating Systems-Source Type J	(-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1200) °C	0.31 °C 0.19 °C 0.16 °C 0.20 °C 0.27 °C	
Electrical Calibration of Thermocouple Indicating Systems-Source Type K	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.38 °C 0.21 °C 0.19 °C 0.30 °C 0.46 °C	
Electrical Calibration of Thermocouple Indicating Systems-Source Type N	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1300) °C	0.46 °C 0.25 °C 0.22 °C 0.21 °C 0.31 °C	
Electrical Calibration of Thermocouple Indicating Systems-Source Type R	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.66 °C 0.40 °C 0.39 °C 0.46 °C	
Electrical Calibration of Thermocouple Indicating Systems-Source Type S	(0 to 250) °C (250 to 1000) °C (1000 to 1400) °C (1400 to 1767) °C	0.54 °C 0.42 °C 0.43 °C 0.53 °C	
Electrical Calibration of Thermocouple Indicating Systems-Source Type T	(-200 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.73 °C 0.28 °C 0.19 °C 0.16 °C	

Electricity and Magnetism / Time and Frequency – Oscilloscopes

Calibration Parameter/Equipment¹	Range	Calibration and Measurement Capability(+/-)²	Remarks
Square Wave Signal Amplitude into 50 Ω	1.8 mV to 2.2 V	0.58 mV + 2.3 mV / V	Fluke 5500A with SC300
Square Wave Signal Amplitude into 1 MΩ	1.8 mV to 55 V	0.57 mV + 4.1 mV / V	
Time Marker Output into 50 Ω	(5 to 2) s (2 to 1) s 1 s to 500 ms 500 ms to 2 ns	680 μs / s 420 μs / s 370 μs / s 360 μs / s	
Rise Time	< 400 ps	425 ps	
RF Power Measure	100 kHz to 4.2 GHz	1.2 dBm + 23 μdBm / dBm	HP 400E and Agilent E4418B with 8482A Power Sensor

Time and Frequency – Frequency / Period

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) ²	Remarks
Tachometer ¹	(6 to 10 000) rpm via contact	2.5 rpm + 0.67 % rdg	Shimpo DT-205L
	(6 to 10 000) rpm via non-contact	1.5 rpm + 110 ppm	

Amount of Substance – Chemical – Conductivity and pH

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) ²	Remarks
pH Meter ¹	4 pH	0.017 pH	pH Standards
	7 pH	0.024 pH	
	10 pH	0.055 pH	

Thermodynamic-Thermocouples

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) ²	Remarks
Temperature Measuring Systems ¹	0.1 °C Resolution (-15 to 110) °C	0.25 °C	Dry Block Calibrator
	0.1 °C Resolution (50 to 350) °C	0.71 °C	

Notes:

- 1) Laboratory offers calibration services at the laboratory's own facilities and at the client or other agreed upon facilities.
- 2) Calibration and Measurement Capability represents expanded uncertainties at approximately a 95% confidence level using a coverage factor of k=2.
- 3) *L* = Length in inches

Approved by:  Date: June 21, 2010

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