



THE AMERICAN ASSOCIATION FOR
LABORATORY ACCREDITATION

ACCREDITED LABORATORY

A2LA has accredited

MASSACHUSETTS METROLOGY AND INSTRUMENT SERVICE Rockland, MA

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 30th day of April 2009.

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

President
For the Accreditation Council
Certificate Number 1411.01
Valid to April 30, 2011

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

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

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CALIBRATION

Valid to: April 30, 2011

Certificate Number: 1411.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations¹:

I. Chemical

Parameter/Equipment	Range	Best Uncertainty ² (\pm)	Comments
pH Measuring Instruments ³	4, 7, 10 pH	0.01 pH	Precision pH buffer solutions

II. Dimensional

Parameter/Equipment	Range	Best Uncertainty ^{2,4} (\pm)	Comments
Calipers ³	Up to 6 in (6 to 44) in	$(0.6R + 4.5L) \mu\text{in}$	Gage blocks
Micrometers ³	(0 to 1) in (1 to 44) in	$(10 + 0.6R) \mu\text{in}$ $(4.5L + 0.6R) \mu\text{in}$	Gage blocks
Height Gages ³	(0 to 1) in (1 to 44) in	$(10 + 0.6R) \mu\text{in}$ $(4.5L + 0.6R) \mu\text{in}$	Gage blocks

Parameter/Equipment	Range	Best Uncertainty ^{2,4} (\pm)	Comments
Dial Indicators ³	Up to 1 in (1 to 4) in	$(10 + 0.6R) \mu\text{in}$ $(4.5L + 0.6R) \mu\text{in}$	Gage blocks
Depth Gages ³	Up to 1 in (1 to 4) in	$(10 + 0.6R) \mu\text{in}$ $(4.5L + 0.6R) \mu\text{in}$	Gage blocks
Pin Gages ³	(0.007 to 0.05) in (0.051 to 0.25) in (0.26 to 0.35) in (0.36 to 0.45) in (0.46 to 0.55) in (0.56 to 0.65) in (0.66 to 0.75) in	20 μin 26 μin 46 μin 54 μin 62 μin 71 μin 80 μin	Laser-Micrometer and master pins
Footage/Yardage ³	(1 to 99.9) ft Minimum 100 ft	0.02 ft 0.02 % of rdg	Linear measurement system
Rulers/Tape Measures ³	Up to 300 in	$(4.5L + 0.6R) \mu\text{in}$	Gage blocks

III. Electrical – DC/Low Frequency

Parameter/Equipment	Range	Best Uncertainty ^{2,5} (\pm)	Comments
DC Voltage – Measure ³	(0 to 110) mV (0.11 to 1.1) V (1.1 to 11) V (11 to 110) V (110 to 300) V	0.025 % + 16 μV 0.025 % + 55 μV 0.025 % + 550 μV 0.05 % + 5.5 mV 0.05 % + 0.01 V	Fluke 743B
DC Voltage – Generate ³	(0 to 110) mV (0.11 to 1.1) V (1.1 to 15) V	0.01 % + 5 μV 0.01 % + 55 μV 0.01 % + 750 μV	Fluke 743B
DC Current – Measure ³	(0 to 30) mA (30 to 110) mA (0 to 300) A 300 A to 2 kA	0.01 % + 4 μA 0.01 % + 16 μA 0.11 % 1.3 % + 0.3 A	Fluke 743B Current shunts power meter

Parameter/Equipment	Range	Best Uncertainty ^{2,5} (±)	Comments
DC Current – Generate ³	(0.1 to 22) mA	0.01 % + 3 μA	Fluke 743B
AC Current – Measure ³	(0 to 1000) A (1000 to 2000) A	0.5 % 1.3 % + 3 A	Power Analyzer Hoike Amp Probe
Plating Rectifiers and DC Power Supplies ³	(0 to 300) A	0.11 %	Fluke 743B & current shunts
Resistance – Measure ³	Up to 11 Ω (11 to 110) Ω (110 to 1100) Ω (1100 to 11 000) Ω	0.05 % + 0.05 Ω 0.05 % + 0.05 Ω 0.05 % + 0.5 Ω 0.1 % + 10 Ω	Fluke 743B
Resistance – Generate ³	Up to 11 Ω (11 to 110) Ω (110 to 1100) Ω (1100 to 11 000) Ω	0.01 % + 0.02 Ω 0.01 % + 0.04 Ω 0.02 % + 0.5 Ω 0.03 % + 5 Ω	Fluke 743B
Electrical Calibration of Thermocouple Indicators and Indicating Systems – mV Simulation ³			Fluke 743B
Type B	(800 to 1820) °C	0.82 °C	
Type C	(0 to 800) °C (800 to 1200) °C (1200 to 1800) °C (1800 to 2316) °C	0.6 °C 0.7 °C 0.9 °C 1.3 °C	
Type E	(-200 to -100) °C (-100 to 600) °C (600 to 1000) °C	0.3 °C 0.3 °C 0.2 °C	
Type J	(-100 to 1200) °C	0.2 °C	
Type K	(-100 to 1372) °C	0.3 °C	
Type L	(-100 to 900) °C	0.2 °C	
Type N	(-100 to 900) °C (900 to 1300) °C	0.5 °C 0.3 °C	

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
Electrical Calibration of Thermocouple Indicators and Indicating Systems – mV Simulation (cont) ³			Fluke 743B
Type R	(100 to 1767) °C	0.9 °C	
Type S	(200 to 1400) °C (1400 to 1767) °C	0.9 °C 1 °C	
Type T	(-200 to 0) °C (0 to 400) °C	0.4 °C 0.3 °C	
Type U	(0 to 600) °C	0.3 °C	
Electrical Calibration of RTD Indicators and Indicating Systems ³ –			Fluke 743B
Pt 385, 1000 Ω	(-200 to 0) °C (0 to 400) °C (400 to 630) °C	0.1 °C 0.2 °C 0.4 °C	
Pt 385, 100 Ω	(-200 to 0) °C (0 to 400) °C (400 to 800) °C	0.1 °C 0.2 °C 0.4 °C	
Pt 3926, 100 Ω	(-200 to 0) °C (0 to 630) °C	0.1 °C 0.2 °C	

IV. Fluid Quantities

Parameter/Equipment	Range	Best Uncertainty ^{2,4,5} (±)	Comments
Gas Flow Measuring Devices ³ –			Bois Drycal ML500 primary flow standard
Standardized Flow	(5 to 50 000) sccm (0.005 to 50) slpm	0.41 % of reading + 0.6R 0.41 % of reading + 0.6R	
Volumetric Flow	(5 to 50 000) ccm (0.005 to 50) lpm	0.26 % of reading + 0.6R 0.26 % of reading + 0.6R	

Parameter/Equipment	Range	Best Uncertainty ^{2,5} (±)	Comments
Pipettes ³ , Burettes ³ Dilutors ³ , Dispensers ³	(10 to 20) (21 to 40) (41 to 100) (101 to 200) (201 to 300) (301 to 500) (501 to 1000) (1001 to 2000) (2001 to 5000) (5001 to 10 000) (10 000 to 20 000) (20 001 to 60 000)	0.1 µL 0.2 µL 0.25 µL 0.51 µL 0.76 µL 1.1 µL 2.1 µL 4.2 µL 11 µL 21 µL 42 µL 130 µL	Gravimetric method using analytical balance and ASTM class 1 mass standards

V. Mechanical

Parameter/Equipment	Range	Best Uncertainty ^{2,5} (±)	Comments
Pressure – Measuring Equipment ³	(0 to 5) inH ₂ O	0.003 in H ₂ O	Heise PTE1 & module
	(4 to 1114) inH ₂ O	0.025 % of reading	Ametek RK-1100WG pneumatic dead weight tester
	(0 to 15) psia	0.0037 psia	Heise PTE1 & module
	(-415 to 1660) inH ₂ O	1 inH ₂ O	Heise PTE1 & module
	(0 to 60) psig	0.037 psig	Heise PTE1 & module
	(10 to 11 000) psig	0.025 % of reading	Ametek T-50-01 dead weight tester
	(11 000 to 12 000) psig	0.027 % of reading	
	(12 000 to 13 000) psig	0.029 % of reading	
	(13 000 to 13 950) psig	0.031 % of reading	
(13 950 to 20 000) psig	20 psig	Heise 20 000 psig test gauge and pump	
Vacuum – Measuring Equipment ³	Up to 30 in Hg	0.0076 in Hg	Heise PTE1 and module
	(0 to 1) Torr	0.28 % of reading	MKS 626A Baratron and Fluke 743B

Parameter/Equipment	Range	Best Uncertainty ^{2, 4, 5} (\pm)	Comments
Precision and Analytical Scales & Balances ³	Up to 2000 lbs	0.01 % + 0.6R	ASTM Class F weights (stacks of 25 and 50's)
	0.001 lb	0.12 % + 0.6R	ASTM Class F 30 pound mixed weight set
	0.002 lb	0.072 % + 0.6R	
	0.005 lb	0.04 % + 0.6R	
	0.010 lb	0.024 % + 0.6R	
	0.02 lb	0.015 % + 0.6R	
	0.05 lb	0.015 % + 0.6R	
	0.1 lb	0.015 % + 0.6R	
	0.2 lb	0.015 % + 0.6R	
	0.5 lb	0.015 % + 0.6R	
	1 lb	0.011 % + 0.6R	
	2 lb	0.007 % + 0.6R	
	5 lb	0.007 % + 0.6R	
	10 lb	0.007 % + 0.6R	
	0.001 g	0.0098 mg + 0.6R	ASTM Class 1 weights
	0.002 g	0.0089 mg + 0.6R	
	0.005 g	0.0011 mg + 0.6R	
	0.01 g	0.0016 mg + 0.6R	
	0.02 g	0.0013 mg + 0.6R	
	0.05 g	0.0018 mg + 0.6R	
	0.10 g	0.0015 mg + 0.6R	
	0.20 g	0.0031 mg + 0.6R	
	0.50 g	0.0028 mg + 0.6R	
	1 g	0.0065 mg + 0.6R	
	2 g	0.013 mg + 0.6R	
	5 g	0.011 mg + 0.6R	
	10 g	0.013 mg + 0.6R	
	20 g	0.053 mg + 0.6R	
	50 g	0.055 mg + 0.6R	
	100 g	0.06 mg + 0.6R	
	200 g	0.052 mg + 0.6R	
	300 g	0.04 mg + 0.6R	
	500 g	0.12 mg + 0.6R	
1000 g	0.13 mg + 0.6R		
2000 g	1.6 mg + 0.6R		
3000 g	2.8 mg + 0.6R		
5000 g	4.2 mg + 0.6R		

Parameter/Equipment	Range	Best Uncertainty ^{2,5} (±)	Comments
Force Gages/Load Cells – Tension/Compression ³	Up to 100 lbf (101 to 500) lbf (501 to 1000) lbf (1001 to 2000) lbf	0.01 % rdg + 0.007 lbs 0.015 % rdg + 0.011 lbs 0.015 % rdg + 0.02 lbs 0.015 % rdg + 0.027 lbs	Class F weights
	Up to 100 g (101 to 500) g (501 to 1000) g (1001 to 4000) g (4001 to 7000) g (7001 to 10000) g (10001 to 12000) g	0.01 % rdg + 0.007 g 0.015 % rdg + 0.011 g 0.015 % rdg + 0.02 g 0.015 % rdg + 0.1 g 0.015 % rdg + 0.15 g 0.015 % rdg + 0.23 g 0.015 % rdg + 0.27 g	Class 1 metric weights
Tachometer ³ –			
Optical/Electrical	Up to 99 999 rpm	0.01 % rdg + 0.6 SG	Fluke 743B frequency output
Digital/Mechanical	Up to 1000 rpm (1001 to 2000) rpm (2001 to 3000) rpm (3001 to 4000) rpm (4001 to 5000) rpm (5001 to 6000) rpm	0.93 rpm 1.1 rpm 1.1 rpm 1.2 rpm 1.3 rpm 1.4 rpm	Variable speed drive tachometer standard

VI. Thermodynamics

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
Temperature Calibration of Thermocouples ³ –			
Ice Point Reference	0.00 °C	0.006 °C	Using Temperature baths, blocks, environmental chamber or high temperature furnace monitored by PRT & indicator or thermocouple & indicator Output measured by Fluke 743B
Thermocouples –			
Type B	(600 to 1100) °C (1101 to 1200) °C	1.7 °C 1.8 °C	
Type C	(0 to 661) °C (662 to 1100) °C (1101 to 1200) °C	0.75 °C 1.5 °C 1.7 °C	

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
Temperature Calibration of Thermocouples ³ – (cont.)			Temperature baths, blocks, environmental chamber or high temperature furnace monitored by PRT & indicator or thermocouple & indicator
Thermocouples –			Output measured by Fluke 743B
Type E	(-80 to 550) °C (551 to 661) °C (662 to 1000) °C	0.31 °C 0.41 °C 1.4 °C	
Type J	(-80 to 550) °C (551 to 661) °C (662 to 1100) °C (1101 to 1200) °C	0.31 °C 0.41 °C 1.4 °C 1.6 °C	
Type K	(-80 to 550) °C (551 to 661) °C (662 to 1100) °C (1101 to 1200) °C	0.31 °C 0.41 °C 1.4 °C 1.6 °C	
Type L	(-80 to 550) °C (551 to 661) °C (662 to 900) °C	0.31 °C 0.41 °C 1.4 °C	
Type N	(-80 to 550) °C (551 to 661) °C (662 to 1100) °C (1101 to 1200) °C	0.58 °C 0.65 °C 1.5 °C 1.6 °C	
Type R	(100 to 550) °C (551 to 661) °C (662 to 1100) °C (1101 to 1200) °C	1 °C 1.1 °C 1.7 °C 1.8 °C	
Type S	(100 to 550) °C (551 to 661) °C (662 to 1100) °C (1101 to 1200) °C	0.9 °C 0.94 °C 1.6 °C 1.7 °C	
Type T	(-80 to 550) °C	0.31 °C	
Type U	(-80 to 550) °C (551 to 600) °C	0.31 °C 0.42 °C	

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
Temperature Calibration of RTDs ³ – Pt 385, 1000 Ω Pt 3916, 100 Ω Pt 385, 100 Ω Pt 3926, 100 Ω	(-80 to 0) °C (0 to 400) °C (400 to 630) °C (-80 to 0) °C (0 to 360) °C (-80 to 0) °C (0 to 400) °C (401 to 660) °C (661 to 800) °C (-80 to 0) °C (0 to 630) °C	0.3 °C 0.5 °C 0.8 °C 0.3 °C 0.5 °C 0.3 °C 0.5 °C 0.8 °C 1.6 °C 0.3 °C 0.5 °C	Temperature baths, blocks, environmental chamber or high temperature furnace monitored by PRT & indicator or thermocouple & indicator Output measured by Fluke 743B
Temperature – Measure ³	(-200 to 200) °C (201 to 400) °C (401 to 660) °C	0.013 °C 0.02 °C 0.29 °C	Hart 5628 PRT Hart 1502A indicator
Calibration of Temperature Chambers – Profiling at One Internal Chamber Location ³	(-200 to 660) °C (661 to 800) °C (801 to 1100) °C (1100 to 1200) °C (1201 to 1450) °C	0.029 °C 0.87 °C 1.3 °C 1.4 °C 2.1 °C	PRT or thermocouples with indicator
Calibration of Ovens – Profiling at Multiple Internal Chamber Locations ³	(-80 to -20) °C (-20 to 20) °C (20 to 300) °C (301 to 550) °C (551 to 661) °C (662 to 1100) °C (1100 to 1200) °C	0.2 °C 0.22 °C 0.18 °C 0.23 °C 0.45 °C 1.6 °C 1.8 °C	Temperature data acquisition system & thermocouples calibrated as a set. ASTM-E145 ASTM-D5374 ASTM-D5423 And similar standards
Thermal Lag Time (Time Constants) ³	5 s to 60 m	0.4 s	Chronometer ASTM-E145 ASTM-D5374 ASTM-D5423 And similar standards
Rate of Ventilation ³	2 to 300 air changes/hr	3.3 % of Air Changes/Hour	Power Meter ASTM-E145 ASTM-D5374 ASTM-D5423 And similar standards

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
Thermometers and Temperature Sensors with Attached Indicators ³	(-80 to -20) °C (-20 to 20) °C (20 to 300) °C (301 to 550) °C (551 to 661) °C (662 to 1100) °C (1100 to 1200) °C	0.036 °C 0.059 °C 0.02 °C 0.063 °C 0.29 °C 1.4 °C 1.6 °C	Hart 5628 PRT and 1502A indicator and type S TC and Fluke 743B and temperature baths, dry blocks, ovens and furnaces
Infrared Thermometers ³	(20 to 50) °C (50 to 310) °C	0.28 °C 0.55 % of reading	Hart 5628 PRT, Hart 1502A indicator and Raytek black body
Relative Humidity – Measure ³	Up to 90 % RH (91 to 100) % RH	1 % RH 2 % RH	Direct measurement with a Vaisala humidity reference standard
Humidity Measuring Equipment – Calibration of Hygrometers and RH Indicators, Transmitters and Transducers ³	Up to 90 % RH (91 to 100) % RH	1.1 % RH 2.1 % RH	RH chamber monitored by a Vaisala humidity reference standard

VII. Time & Frequency

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
Timers & Stopwatches ³	5 s to 24 hr	0.48 s	NIST time
	5 s to 24 hr	0.54 s	Chronometer standard

¹ This laboratory offers commercial calibration service and on-site calibration service.

² Best Uncertainties represent expanded uncertainties using a coverage factor $k = 2$ which provides a level of confidence of approximately 95 %. The uncertainties achievable on a customer's site can be expected to be larger than the Best Measurement Capabilities (BMC) that the accredited laboratory has been assigned as Best Uncertainty 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 uncertainty introduced by the item being calibrated, (e.g. resolution) must also be considered and this, on its own, could result in the calibration uncertainty being larger than the BMC.

³ On-site calibration service is available for this calibration. The uncertainties achievable on a customer's site can normally be expected to be larger than the Best Measurement Capabilities (BMC) that the accredited laboratory has been assigned as Best Uncertainty 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 uncertainty introduced by the item being calibrated, (e.g. resolution) must also be considered and this, on its own, could result in the calibration uncertainty being larger than the BMC.

⁴ In the statement of best uncertainty, L is the numerical value of the nominal length of the device measured in inches. In the statement of best uncertainty, R is the numerical value of the resolution of the device in microinches.

⁵ In the statement of best uncertainty, percentages are percentages of reading, unless otherwise indicated.