The American Association for Laboratory Accreditation

World Class Accreditation

Accredited Laboratory

A2LA has accredited

RICHARD J. BAGAN, INC.

Columbia City, IN

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 17th day of February 2009.

President & CEO
For the Accreditation Council
Certificate Number 1625.01
Valid to January 31, 2011
REVISED: September 28, 2009

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: January 31, 2011 Certificate Number: 1625.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations[1]:

I. Chemical

Parameter/Equipment	Range	CMC[2] (±)	Comments
pH Meter/Probe Calibration[3]	4, 7, 10 pH units 0 to 14 pH units	0.027 pH units 0.068 pH units	pH buffer Comparison to pH meter
Conductivity Meter/Probe Calibration[3] – Discrete points	10 µS 100 µS 1000 µS 10 000 µS 100 000 µS	0.71 µS 2.9 µS 5.1 µS 78 µS 370 µS	Conductivity solutions

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II. Dimensional

Parameter/Equipment	Range	CMC[2] (±)	Comments
Length Standards	(0 to 18) in (18 to 48) in	13 µin + 10 µin/in 42 µin + 5.5 µin/in	Measuring machine, gage blocks
Length Standards[3]	(0 to 1) in (1 to 7) in (7 to 24) in	120 µin 130 µin 200 µin	Bench micrometer, gage blocks
Angle Blocks[3]	0.25° to 60°	0.0043°	Gage blocks/sine bar, electronic probe
Cylindrical Diameter –			
Outside	(0 to 5) in (5 to 18) in	24 µin + 0.43 µin/in 110 µin	Measuring machine, plug gage
	(18 to 24) in	290 µin	Height gage
Inside	(0.1 to 0.5) in (0.5 to 2.5) in (2.5 to 8) in (8 to 48) in	26 µin 18 µin + 1.5 µin/in 26 µin + 2 µin/in 250 µin + 2.4 µin/in	Measuring machine, ring gage Gage blocks, universal comparator
Cylindrical Diameter[3] –			
Outside	(0 to 24) in	480 µin	Height gage
Inside	(8 to 48) in	210 µin + 9 µin/in	Gage blocks, universal comparator
Protractors[3]	0° to 90°	0.012°	Gage blocks/sine bar
Flatness Measurements[3]	(0 to 2) in diameter To 10 in length	4 µin 35 µin	Optical flat Electronic probe
Parallel Measurements[3]	(0 to 1) in diameter To 10 in length	5.7 µin 38 µin	Optical parallels Electronic probe

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Surface Finish Meters[3] – Profilometers	(19 to 122) Ra	1.8 µin + 0.1 µin/µin	Roughness specimens
Micrometers[3] –	Up to 3 in (3 to 48) in	20 µin + 35 µin/in 64 µin + 1.5 µin/in	Gage blocks
Micrometer Heads		8.2 µin	Electronic probe
Laser Micrometers	Up to 2 in	32 µin	Pin / plug gages
Bore Micrometers	(0.25 to 5) in	8.5 µin/in + 60 µin	Ring gages
Bench Micrometers	(0 to 12) in	17 µin	Gage blocks
Gage Blocks	(0 to 1) in (2 to 4) in	3 µin + 0.5 µin/in 2.2 µin + 0.75 µin/in	Dimensional comparator
Surface Plates[3] –			
Flatness	Up to 107*D* in	(23 + 0.69*D*) µin	Electronic level system *D* = diagonal inches
Repeatability	Up to 0.015 in	30 µin	Repeatability gage
Levels – Electronic Level Systems	---	0.22 arc seconds	Gage blocks
Levels[3] – Bubble Vial	---	0.62*R*	Gage blocks
Calipers[3]	(0 to 12) in (12 to 72) in	540 µin 980 µin	Gage blocks
Height/Depth Gages	(0 to 24) in (24 to 72) in	(21 + 7*L*) µin 150 µin + 16 µin/in	Gage blocks
Height/Depth Gages[3]	(0 to 24) in (24 to 72) in	130 µin + 13 µin/in 150 µin + 16 µin/in	Gage blocks

Parameter/Equipment	Range	CMC[2] (±)	Comments
Dial, Digital, and Test Indicators –	Resolution: 10 µin	6.5 µin	Measuring machine, gage blocks
Dial, Digital, and Test Indicators[3] –	Resolution: 50 µin 0.0001 in 0.0005 in 0.001 in	 32 µin 58 µin 290 µin 580 µin	Gage blocks
Thread Plugs – Pitch Diameter Major Diameter	 Up to 4 in Up to 4 in	 120 µin 67 µin	Gage blocks, thread wires, measuring machine
Thread Plugs[3] – Pitch Diameter Major Diameter	 Up to 2 in Up to 2 in	 0.0002 in 0.0001 in	Gage blocks, thread wires, bench micrometer
Taper Thread Plug – Pitch Diameter Major Diameter Notch Length	 (0 to 2) in (0 to 2) in (0 to 2) in	 130 µin 90 µin 120 µin	Gage blocks, thread wires, measuring machine Height gage
Taper Thread Plug[3] – Pitch Diameter Major Diameter Notch Length	 (0 to 2) in (0 to 2) in (0 to 2) in	 200 µin 180 µin 120 µin	Gage blocks, thread wires, measuring machine Height gage

Parameter/Equipment	Range	CMC[2] (±)	Comments
Thread Wires –			
Inch	(4 to 80) tpi	27 µin	UMM
Metric	(0.2 to 10) pitch	0.69 µm	
Adjustable Thread Rings[3] –			
Pitch Diameter	(0.25 to 0.5) in	300 µin	Master set plugs and three point bore micrometer
Minor Diameter	(0.25 to 0.5) in	140 µin	
Optical Comparators[3] –			
Length Radius / Diameter Angle	Up to 6 in Up to 1 in 0° to 360°	0.000 22 in 0.0005 in 0.014°	Glass artifact
Magnification	10× 20× 31.25× 50× 62.5× 100×	0.02× 0.014× 0.015× 0.011× 0.012× 0.016×	Glass artifact and glass magnification scale
Gage Block Comparator –	(0 to 200) µin	3 µin	Gage blocks
Force	(0 to 1.47) N	0.029 N	Somfy force gage
Sine Bars –			
Length	(5 to 10) in	70 µin	UMM
Parallelism		38 µin	Electronic probe
Cylindrical Squares –			
Squareness	(4 to 20) in	25 µin	Electronic probe

Parameter/Equipment	Range	CMC[2] (±)	Comments
Torque Arms	(2 to 24) in (24 to 48) in	250 µin + 2.4 µin/in 0.000 99 in	Dimensional comparison
Thickness Gages[3]	(0.0009 to 0.06) in	20 µin + 0.035 in/in	Thickness films and gage blocks

III. Dimensional Testing

Parameter/Equipment	Range	CMC[2] (±)	Comments
One Dimensional Length[3]	Up to 12 in (12 to 72) in Up to 300 mm (300 to 1800) mm	0.0013 in 0.012 in 0.034 mm 0.59 mm	Digital scale Steel ruler Digital scale Steel ruler
Angle[3]	(0 to 360)°	0.039°	Optical comparator
Diameter/Radius[3]	Up to 6 in	0.000 29 in	Optical comparator
Wire Cloth and Sieves	(0.020 to 12.5) mm	4.4 µm	Optical comparator

IV. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
DC Voltage – Measure, Fixed Point	10 V	1 µV/V	Zener array, scanner and detector
DC Voltage – Measure	(0 to 200) mV (0.2 to 2) V (2 to 20) V (20 to 200) V (200 to 1000) V	5.9 µV/V + 130 nV 3.6 µV/V + 480 nV 3.6 µV/V + 4.7 µV 5.3 µV/V + 50 µV 5.2 µV/V + 760 µV	Fluke 8508A

Parameter/Equipment	Range	CMC[2, 4, 5] (±)	Comments
DC Voltage[3] – Measure	(0 to 100) mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 1000) V	5.5 µV/V + 400 nV 4.2 µV/V + 840 nV 4.2 µV/V + 5.7 µV 6.5 µV/V + 89 µV 5.4 µV/V + 2.0 mV	HP 3458A, opt 002
DC Voltage[3] – HV Measure	(1 to 5) kV (5 to 50) kV (50 to 100) kV	0.083 kV 19 V + 16 V/kV 2.9 kV	Fluke 87 w/80K-40 Sensitive Research ESH Hipotronics KV100A
DC Voltage – Generate Fixed Point	(0 to 220) mV (0.22 to 2.2) V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1 100) V 10 V	9.2 µV/V + 560 nV 5.8 µV/V + 880 nV 4 µV/V + 3.3 µV 4 µV/V + 5.3 µV 5.3 µV/V + 180 µV 7.3 µV/V + 730 µV 1 µV/V	Fluke 5700A Fluke 732A
DC Voltage[3] – Generate	(0 to 330) mV (0.33 to 3.3) V (3.3 to 33) V (33 to 330) V (330 to 1020) V	23 µV/V + 1.3 µV 13 µV/V + 2.5 µV 15 µV/V + 24 µV 22 µV/V + 190 µV 22 µV/V + 1.9 mV	Fluke 5520A
DC Current – Measure	(0 to 200) µA (0.2 to 2) mA (2 to 20) mA (20 to 200) mA (0.2 to 2) A (2 to 20) A (1 to 10) A (10 to 100) A	14 µA/A + 660 pA 15 µA/A + 5.0 nA 16 µA/A + 53 nA 43 µA/A + 200 nA 0.019 % + 28 µA 0.058 % + 1.9 mA 1.2 mA 13 mA	Fluke 8508A Valhalla 2575A

Parameter/Equipment	Range	CMC[2, 4, 5] (±)	Comments
DC Current[3] – Measure	(0 to 100) µA (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A (1 to 10) A (100 to 1000) A	20 µA/A + 1.5 nA 22 µA/A + 7.9 nA 22 µA/A + 81 nA 39 µA/A + 790 nA 0.011 % + 37 µA 23 mA 23 mA	HP 3458A, opt 002 Fluke 45 Fluke 77 /80I-1010 clamp
DC Current – Generate	(0 to 220) µA (0.22 to 2.2) mA (2.2 to 22) mA (22 to 220) mA (0.22 to 2.2) A (2.2 to 11) A (20.5 to 100) A (100 to 1000) A	47 µA/A + 9.3 nA 47 µA/A + 9.5 nA 47 µA/A + 97 nA 53 µA/A + 950 nA 67 µA/A + 41 µA 0.04 % + 560 µA 1.3 A + 27 mA/A 1.5 A + 0.05 µA/A	Fluke 5700A Valhalla 2555A Valhalla 2555A and 10 turn coil
DC Current[3] – Generate	(0 to 330) µA (0.33 to 3.3) mA (3.3 to 33) mA (33 to 330) mA (0.33 to 1.1) A (1.1 to 3) A (3 to 11) A (11 to 20.5) A	0.018 % + 24 nA 0.012 % + 65 nA 0.012 % + 440 nA 0.01 % + 8.5 µA 0.023 % + 51 µA 0.04 % + 200 µA 0.055 % + 920 µA 0.11 % + 3 mA	Fluke 5520A
DC Power[3] – Generate			
(0.33 to 3.3) mA	(0.011 to 1.1) mW (0.11 to 11) mW (1.1 to 110) mW (0.011 to 1.1) W (0.11 to 3.3) W	0.043 % of rdg 94 µW/W 94 µW/W 95 µW/W 80 µW/W	Fluke 5520, opt PQ
(3.3 to 33) mA	(0.11 to 11) mW (1.1 to 110) mW (0.011 to 1.1) W (0.11 to 11) W (1.1 to 33) W	0.043 % of rdg 90 µW/W 90 µW/W 91 µW/W 76 µW/W	

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
DC Power[3] – Generate (cont)			
(33 to 330) mA	(1.1 to 110) mW (0.011 to 1.1) W (0.11 to 11) W (1.1 to 110) W (11 to 330) W	0.043 % of rdg 91 µW/W 91 µW/W 92 µW/W 77 µW/W	Fluke 5520, opt PQ
(0.33 to 3) A	(11 to 990) mW (0.11 to 9.9) W (1.1 to 99) W (11 to 990) W (0.11 to 3) kW	0.05 % of rdg 0.028 % of rdg 0.028 % of rdg 0.028 % of rdg 0.027 % of rdg	
(3 to 20.5) A	(0.099 to 6.7) W (0.99 to 6.7) W (9.9 to 670) W (0.099 to 6.8) kW (0.99 to 20.9) kW	0.082 % of rdg 0.071 % of rdg 0.071 % of rdg 0.071 % of rdg 0.07 % of rdg	
Thermocouple Indicators[3] –			
Type: B	(600 to 800) °C (800 to 1000) °C (1000 to 1550) °C (1550 to 1820) °C	0.52 °C 0.41 °C 0.36 °C 0.4 °C	Fluke 5520A
Type: C	(0 to 150) °C (150 to 650) °C (650 to 1000) °C (1000 to 1800) °C (1800 to 2316) °C	0.36 °C 0.32 °C 0.37 °C 0.59 °C 0.98 °C	
Type: E	(-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C	0.59 °C 0.21 °C 0.19 °C 0.21 °C 0.26 °C	
Type: J	(-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1200) °C	0.33 °C 0.21 °C 0.18 °C 0.22 °C 0.28 °C	
Type: K	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.4 °C 0.23 °C 0.21 °C 0.32 °C 0.47 °C	

Parameter/Equipment	Range	CMC[2] (±)	Comments
Thermocouple Indicators (cont)[3] –			
Type: N	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1300) °C	0.47 °C 0.27 °C 0.24 °C 0.23 °C 0.33 °C	Fluke 5520A
Type: R	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.67 °C 0.43 °C 0.41 °C 0.48 °C	
Type: S	(0 to 250) °C (250 to 1000) °C (1000 to 1400) °C (1400 to 1767) °C	0.56 °C 0.44 °C 0.45 °C 0.55 °C	
Type: T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.74 °C 0.29 °C 0.21 °C 0.19 °C	
Type: U	(-200 to 0) °C (0 to 600) °C	0.66 °C 0.33 °C	
RTD Indicators[3] –			
Pt 385, 100 Ω	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 800) °C	0.06 °C 0.059 °C 0.083 °C 0.11 °C 0.12 °C 0.12 °C 0.27 °C	Fluke 5520A
Pt 385, 200 Ω	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.048 °C 0.048 °C 0.048 °C 0.06 °C 0.15 °C 0.16 °C 0.17 °C 0.19 °C	

Parameter/Equipment	Range	CMC[2] (±)	Comments
RTD Indicators[3] (cont) –			
Pt 385, 500 Ω	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.048 °C 0.06 °C 0.06 °C 0.071 °C 0.095 °C 0.095 °C 0.11 °C 0.13 °C	Fluke 5520A
Pt 385, 1 kΩ	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.036 °C 0.036 °C 0.048 °C 0.06 °C 0.071 °C 0.083 °C 0.083 °C 0.28 °C	
PtNi 385, 120 Ω	(-80 to 0) °C (0 to 100) °C (100 to 260) °C	0.095 °C 0.095 °C 0.017 °C	
Pt 3916, 100 Ω	(-200 to -190) °C (-190 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.048 °C 0.048 °C 0.06 °C 0.071 °C 0.083 °C 0.095 °C 0.11 °C 0.12 °C 0.28 °C	
Pt 3926, 100 Ω	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C	0.06 °C 0.06 °C 0.083 °C 0.11 °C 0.12 °C 0.15 °C	
Cu 427, 10 Ω	-100 °C to 260 °C	0.36 °C	

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
AC Voltage – Measure			
(0 to 200) mV	(1 to 10) Hz (10 to 40) Hz (40 to 100) Hz (0.1 to 2) kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz	0.019 % + 18 µV 0.016 % + 5 µV 0.013 % + 5.2 µV 0.013 % + 2.5 µV 0.013 % + 5 µV 0.036 % + 9.5 µV 0.049 % + 130 µV	Fluke 8508A
(0.2 to 2) V	(1 to 10) Hz (10 to 40) Hz (40 to 100) Hz (0.1 to 2) kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz (0.3 to 1) MHz	0.016 % + 170 µV 0.012 % + 45 µV 0.011 % + 26 µV 78 µV/V + 25 µV 0.011 % + 25 µV 0.024 % + 52 µV 0.043 % + 740 µV 0.35 % + 2.4 mV 1.2 % + 24 mV	
(2 to 20) V	(1 to 10) Hz (10 to 40) Hz (40 to 100) Hz (0.1 to 2) kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz (0.3 to 1) MHz	0.016 % + 16 mV 0.013 % + 340 µV 0.011 % + 280 µV 78 µV/V + 260 µV 0.011 % + 250 µV 0.024 % + 480 µV 0.058 % + 2.5 mV 0.35 % + 24 mV 1.2 % + 240 mV	
(20 to 200) V	(1 to 10) Hz (10 to 40) Hz (40 to 100) Hz (0.1 to 2) kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz (0.3 to 1) MHz	0.017 % + 15 mV 0.013 % + 3.5 mV 0.011 % + 2.5 mV 85 µV/V + 2.4 mV 0.011 % + 2.5 mV 0.024 % + 4.8 mV 0.059 % + 24 mV 0.35 % + 240 mV 1.2 % + 2.4 V	
(200 to 1000) V	(1 to 10) Hz (10 to 40) Hz (0.04 to 10) kHz (10 to 30) kHz (30 to 100) kHz	0.018 % + 81 mV 0.015 % + 24 mV 0.012 % + 24 mV 0.024 % + 47 mV 0.061 % + 240 mV	

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
AC Voltage[3] – Measure			
(0 to 10) mV	(1 to 40) Hz (0.04 to 1) kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.034 % + 3.7 µV 0.023 % + 1.5 µV 0.034 % + 1.5 µV 0.12 % + 1.8 µV 0.58 % + 1.8 µV 4.6 % + 4.4 µV	HP 3458A, Opt 002
(10 to 100) mV	(1 to 40) Hz (0.04 to 1) kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (0.3 to 1) MHz	59 µV/V + 9 µV 58 µV/V + 6.1 µV 0.014 % + 5.6 µV 0.032 % + 5.8 µV 0.052 % + 62 µV 0.25 % + 140 µV 1.1 % + 160 µV	
(0.1 to 1) V	(1 to 40) Hz (0.04 to 1) kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (0.3 to 1) MHz	55 µV/V + 110 µV 70 µV/V + 40 µV 0.015 % + 39 µV 91 µV/V + 710 µV 0.065 % + 380 µV 0.32 % + 400 µV 1.2 % + 270 µV	
(1 to 10) V	(1 to 40) Hz (0.04 to 1) kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (0.3 to 1) MHz	54 µV/V + 1.1 mV 65 µV/V + 480 µV 0.015 % + 400 µV 0.029 % + 890 µV 0.09 % + 530 µV 0.34 % + 2.2 mV 1.2 % + 2.8 mV	
(10 to 100) V	(1 to 40) Hz (0.04 to 1) kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (0.3 to 1) MHz	0.021 % + 7.7 mV 0.022 % + 4 mV 0.022 % + 3.9 mV 0.04 % + 3.9 mV 0.14 % + 4.8 mV 0.46 % + 15 mV 1.8 % + 17 mV	
(100 to 700) V	(1 to 40) Hz (0.04 to 1) kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.046 % + 55 mV 0.045 % + 37 mV 0.068 % + 38 mV 0.14 % + 43 mV 0.35 % + 43 mV	