



The American Association for Laboratory Accreditation

World Class Accreditation

Accredited Laboratory

A2LA has accredited

J.A. KING & COMPANY, LLC

Whitsett, NC

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 April 2009.





Peter Meyer

President & CEO
For the Accreditation Council
Certificate Number 1741.02
Valid to May 31, 2011
Revised: January 21, 2010

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: May 31, 2011

Certificate Number: 1741.02

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

I. Dimensional

Parameter/Equipment	Range	CMC ^{2,7} (±)	Comments
Angle Plates and Squares	Up to 12 in	142 μin	B&S 7033-2 dial indicator
Bore Gages	Up to 6 in	(0.6R + 22 + 3L) μin	Ring gages
Calipers ³	Up to 12 in (13 to 60) in	(0.6R + 1.7 + 2.3L) μin (0.6R + 65 + 7.6L) μin	Gage blocks w/micrometer standards
Caliper Master	Up to 12 in	(5.7 + 1.2L) μin	P&W labmaster
Cylindrical Measure – Plain Rings	Up to 14 in	(5.7 + 1.2L) μin	P & W lab master universal
Pins, Plain Plugs, Discs, Spheres – External Diameter	Up to 13 in	(5.7 + 1.2L) μin	
Combination Squares/Protractors/ Angle Gages	Up to 180° Up to 24 in	0.3° 500 μin	Optical comparator

Parameter/Equipment	Range	CMC ^{2,7} (±)	Comments
Feeler/Thickness Gages	Up to 1 in	75 µin	Fowler mini-horizontal
Gage Blocks	Up to 4.0 in (4.1 to 12) in	(2.8 + 1.4L) µin (5.7 + 1.2L) µin	Federal gage block comparator P & W lab master universal
Hand Tools ³ – Depth Gages, Snap Gages, Fixture Gages	(0.015 to 1) in (0.015 to 6) in (0.015 to 12) in (0.015 to 24) in	(2.9 + 9.5L + 0.6R) µin	Gage blocks
Height Gages ³	Up to 20.0 in (20 to 48) in	106 µin 180 µin	Gage blocks
Linear Indicators ³ Dial and Test	Up to 0.1 in (0.1 to 0.5) in (0.5 to 4) in Up to 12 in	(0.6R + 13) µin (0.6R + 61) µin (0.6R + 1.6 + 2.4L) µin (0.6R + 5.7 + 1.2L) µin	Federal indicator calibrator Gage blocks P&W labmaster
Micrometers ³ – Outside Inside	Up to 36 in Up to 60 in	(0.6R + 1.6 + 2.4L) µin (0.6R + 86 + 2.3L) µin	Gage blocks B&S 6' UltraMic
Micrometer Standards	Up to 60 in	(44 + 5.7L) µin	B&S 6' UltraMic
Micrometer Head	Up to 2 in	(0.6R + 1.6 + 2.4L) µin	Gage blocks
Micrometer Master	Up to 12 in	(5.7 + 1.2L) µin	P&W labmaster
Pin Gages ³	Up to 1 inch	75 µin	Fowler mini-horizontal
Protractor & Angle Indicators	1°, 2°, 3°, 4°, 5°, 10°, 15°, 20°, 25°, 30° 45°, 60°, 75°, 90°	0.06° 0.061°	Sine bar & gage blocks angle block set

Parameter/Equipment	Range	CMC ^{2,7} (±)	Comments
Optical Comparator ³ – X-Y Linearity Magnification Angle	(0 to 12) in 10x to 250x 0° to 90°	150 µin 200 µin 0.1 degree	Glass master scales Angle block set
Radius Gages	Up to 2 in	350 µin	Optical comparator
Steel Rules	Up to 72 in	(320 + 19L) µin	Optical comparator
Tape Measures	(Up to 25) ft	(320 + 19L) µin	Optical comparator
Thread Plugs Major Diameter Pitch Diameter	Up to 7 in Up to 7 in	(5.7 + 1.2L) µin (79 + 0.2L) µin	P & W lab master universal w/ thread wires

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2,4,5,8} (±)	Comments		
DC Voltage – Measure ³	(0 to 100) mV	11 µV/V + 3 µV	HP 3458A		
	100 mV to 1 V	10 µV/V + 0.3 µV			
	(1 to 10) V	10 µV/V + 0.05 µV			
	(10 to 100) V	12 µV/V + 0.3 µV			
DC Voltage – Measure ³	(100 to 1000) V	27 µV/V + 0.1 µV	Fluke 80K-6 & DMM		
	(1 to 6) kV	1.2 %			
	(6 to 20) kV	2.4 %			
	(20 to 35) kV	1.2 %			
DC Voltage – Measure ³	(35 to 40) kV	2.4 %	Fluke 80K-6 & DMM		
	DC Voltage – Generate ³	(0 to 220) mV		7.9 µV/V + 0.4 µV	Fluke 5700A/EP option
		220 mV to 2.2 V		5.6 µV/V + 0.7 µV	
		(2.2 to 11) V		4.3 µV/V + 2.5 µV	
		(11 to 22) V		4.3 µV/V + 4 µV	
(22 to 220) V		5.6 µV/V + 40 µV			
(220 to 1100) V	7.0 µV/V + 400 µV				

Parameter/Equipment	Range	CMC ^{2, 4, 5, 8} (\pm)	Comments
DC Current – Measure ³	Up to 100 nA 100 nA to 1 μ A (1 to 10) μ A (10 to 100) μ A 100 μ A to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A (1 to 100) A	35 μ A/A + 0.04 nA 25 μ A/A + 0.04 nA 25 μ A/A + 0.1 nA 25 μ A/A + 0.8 nA 25 μ A/A + 5 nA 25 μ A/A + 50 nA 40 μ A/A + 0.5 μ A 0.012 % + 10 μ A 0.015 %	HP 3458A GL 9230A/100 shunt with HP 3458A
DC Current – Generate ³	(0 to 220) μ A 220 μ A to 2.2 mA (2.2 to 22) mA (22 to 220) mA 220 mA to 2.2 A (2.2 to 11) A	40 μ A/A + 6 nA 35 μ A/A + 7 nA 35 μ A/A + 40 nA 45 μ A/A + 0.7 μ A 81 μ A/A + 12 μ A 0.037 % + 480 μ A	Fluke 5700A/EP $\pm (200 I^2)$ μ A/A for $I > 100$ mA $\pm (10 I^2)$ μ A/A for $I > 1$ A Fluke 5700A/EP with Fluke 5725A
Resistance – Measure ³	(0 to 10) Ω (10 to 100) Ω 100 Ω to 1k Ω (1 to 10) k Ω (10 to 100) k Ω 100 k Ω to 1M Ω (1 to 10) M Ω (10 to 100) M Ω 100 M Ω to 1 G Ω	18 $\mu\Omega/\Omega$ + 50 $\mu\Omega$ 15 $\mu\Omega/\Omega$ + 0.5 m Ω 13 $\mu\Omega/\Omega$ + 0.5 m Ω 13 $\mu\Omega/\Omega$ + 5 m Ω 13 $\mu\Omega/\Omega$ + 50 m Ω 18 $\mu\Omega/\Omega$ + 2 Ω 53 $\mu\Omega/\Omega$ + 100 Ω 0.062 % + 1 k Ω 0.51 % + 10 k Ω	HP 3458A
Resistance – Generate ³ Fixed Points	0 Ω (1, 1.9) Ω (10, 19) Ω (100, 190) Ω (1, 1.9, 10, 19) k Ω (100, 190) k Ω 1 M Ω 1.9 M Ω 10 M Ω 19 M Ω 100 M Ω	41 $\mu\Omega$ 97 $\mu\Omega/\Omega$ 24 $\mu\Omega/\Omega$ 11 $\mu\Omega/\Omega$ 8.7 $\mu\Omega/\Omega$ 12 $\mu\Omega/\Omega$ 21 $\mu\Omega/\Omega$ 22 $\mu\Omega/\Omega$ 40 $\mu\Omega/\Omega$ 48 $\mu\Omega/\Omega$ 110 $\mu\Omega/\Omega$	Fluke 5700A/EP option

Parameter/Equipment	Range	CMC ^{2, 4, 5, 8} (±)	Comments
Capacitance – Generate ³	50 pF to 1.2 µF	0.62 % + 5 pF	GenRad 1412-BC Fluke 5500A
	(0.33 to 11) nF	0.51 % + 0.01 nF	
	(11 to 110) nF	0.26 % + 0.1 nF	
	(110 to 330) nF	0.26 % + 0.3 nF	
	(0.33 to 1.1) µF	0.26 % + 1 nF	
	(1.1 to 3.3) µF	0.36 % + 3 nF	
	(3.3 to 11) µF	0.36 % + 10 nF	
	(11 to 33) µF	0.41 % + 30 nF	
	(33 to 110) µF	0.51 % + 100 nF	
	(110 to 330) µF 330 µF to 1.1 mF	0.71 % + 300 nF 1.1 % + 300 nF	
Inductance – Generate	100 mH	0.14 %	GenRad 1482-L GenRad 1491-G Decade inductor
	100 µH steps	2.4 % per step	
	1 mH steps	2.4 % per step	
	10 mH steps	1.9 % per step	
	100 mH steps 1 H steps	0.97 % per step 0.97 % per step	

Parameter/Range	Frequency	CMC ^{2, 5, 8} (±)	Comments	
AC Voltage – Measure ³	Up to 10 mV	(1 to 40) Hz	0.031 % of rdg + 0.03 % of rng	HP 3458A
		40 Hz to 1 kHz	0.022 % of rdg + 0.01 % of rng	
		(1 to 20) kHz	0.031 % of rdg + 0.01 % of rng	
		(20 to 50) kHz	0.11 % of rdg + 0.01 % of rng	
		(50 to 100) kHz	0.51 % of rdg + 0.01 % of rng	
	(100 to 300) kHz	4.1 % of rdg + 0.02 % of rng		
	10 mV to 10V	(1 to 40) Hz	0.008 % of rdg + 0.004 % of rng	
		40 Hz to 1 kHz	0.008 % of rdg + 0.002 % of rng	
		(1 to 20) kHz	0.015 % of rdg + 0.002 % of rng	
		(20 to 50) kHz	0.031 % of rdg + 0.002 % of rng	
		(50 to 100) kHz	0.081 % of rdg + 0.002 % of rng	
	(100 to 300) kHz	0.31 % of rdg + 0.01 % of rng		
	(10 to 100) V	(1 to 40) Hz	0.021 % of rdg + 0.004 % of rng	
		40 Hz to 1 kHz	0.021 % of rdg + 0.002 % of rng	
		(1 to 20) kHz	0.021 % of rdg + 0.002 % of rng	
(20 to 50) kHz		0.036 % of rdg + 0.002 % of rng		
(50 to 100) kHz		0.13 % of rdg + 0.002 % of rng		
(100 to 300) kHz	0.41 % of rdg + 0.01 % of rng			

Parameter/Range	Frequency	CMC ^{2, 5, 8} (±)	Comments
AC Voltage – Measure ³ (cont)			
(100 to 1000) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.041 % of rdg + 0.004 % of rng 0.041 % of rdg + 0.002 % of rng 0.061 % of rdg + 0.002 % of rng 0.13 % of rdg + 0.002 % of rng 0.31 % of rdg + 0.002 % of rng	HP 3458A
	(1 to 6) kV (6 to 40) kV	1.2 % of rdg 6 % of rdg	Fluke 80K-6 & DMM Fluke 80K-40 & DMM
AC Voltage – Generate ³			
(0 to 2.2) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.024 % + 4 μV 91 μV/V + 4 μV 81 μV/V + 4 μV 0.02 % + 4 μV 0.05 % + 5 μV 0.11 % + 10 μV 0.14 % + 20 μV 0.27 % + 20 μV	Fluke 5700A/EP option w/5725A
(2.2 to 22) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.024 % + 4 μV 91 μV/V + 4 μV 81 μV/V + 4 μV 0.02 % + 4 μV 0.05 % + 5 μV 0.11 % + 10 μV 0.14 % + 20 μV 0.27 % + 20 μV	
(22 to 220) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.024 % + 12 μV 91 μV/V + 7 μV 81 μV/V + 7 μV 0.02 % + 17 μV 0.046 % + 5 μV 0.09 % + 20 μV 0.14 % + 25 μV 0.27 % + 45 μV	

Parameter/Range	Frequency	CMC ^{2,4,8} (±)	Comments	
AC Voltage – Generate ³ (cont)				
220 mV to 2.2 V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.024 % + 40 μV 90 μV/V + 15 μV 45 μV/V + 8 μV 75 μV/V + 10 μV 0.011 % + 30 μV 0.042 % + 80 μV 0.1 % + 200 μV 0.17 % + 300 μV	Fluke 5700A/EP option w/5725A	
(2.2 to 22) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.024 % + 400 μV 90 μV/V + 150 μV 45 μV/V + 50 μV 75 μV/V + 100 μV 0.01 % + 200 μV 0.028 % + 600 μV 0.1 % + 2 mV 0.15 % + 3.2 mV		
(22 to 220) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.024 % + 4 μV 90 μV/V + 1.5 μV 52 μV/V + 0.6 μV 80 μV/V + 1 μV 0.015 % + 2.5 μV 0.09 % + 16 μV 0.44 % + 40 μV 0.8 % + 80 μV		
(220 to 1100) V	(15 to 50) Hz 50 Hz to 1 kHz	0.038 % + 16 mV 0.024% + 3.5 mV		Fluke 5700A/EP option
(220 to 750) V	40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz (30 to 50) kHz (50 to 100) kHz	0.025 % + 4 mV 0.029 % + 6 mV 0.065 % + 11 mV 0.065 % + 11 mV 0.24 % + 45 mV		Fluke 5700A/EP option w/5725A
AC Current – Measure ³ (0 to 100) μA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz 100 Hz to 5 kHz	0.41 % of rdg + 0.03 % of rng 0.16 % of rdg + 0.03 % of rng 0.07 % of rdg + 0.03 % of rng 0.07 % of rdg + 0.03 % of rng	HP 3458A	

Parameter/Range	Frequency	CMC ^{2, 4, 5, 8} (±)	Comments
AC Current – Measure ³ (cont)			
(0 to 100) µA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.41 % of rdg + 0.02 % of mg 0.16 % of rdg + 0.02 % of mg 0.07 % of rdg + 0.02 % of mg 0.04 % of rdg + 0.02 % of mg	HP 3458A
(1 to 100) mA	(5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.07 % of rdg + 0.02 % of mg 0.41 % of rdg + 0.04 % of mg 0.56 % of rdg + 0.15 % of mg	
100 mA to 1 A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz	0.41 % of rdg + 0.02 % of mg 0.17 % of rdg + 0.02 % of mg 0.09 % of rdg + 0.02 % of mg 0.11 % of rdg + 0.02 % of mg 0.31 % of rdg + 0.02 % of mg 1.1 % of rdg + 0.04 % of mg	
AC Current – Generate ³			
(0 to 220) µA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.025 % + 16 nA 0.016 % + 10 nA 0.012 % + 8 nA 0.028 % + 12 nA 0.11 % + 65 nA	Fluke 5700A/EP option w/5725A
220 µA to 2.2 mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.025 % + 40 nA 0.016 % + 35 nA 0.012 % + 35 nA 0.02 % + 110 nA 0.11 % + 650 nA	
(2.2 to 22) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.025 % + 400 nA 0.016 % + 350 nA 0.012 % + 350 nA 0.02 % + 550 nA 0.11 % + 5 µA	
(22 to 220) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.025 % + 4 µA 0.016 % + 3.5 µA 0.012 % + 2.5 µA 0.02 % + 3.5 µA 0.11 % + 10 µA	
220 mA to 2.2 A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.026 % + 35 µA 0.045 % + 80 µA 0.7 % + 160 µA	
(2.2 to 11) A	40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.046 % + 170 µA 0.095 % + 80 µA 0.36 % + 750 µA	

Parameter/Equipment	Range	CMC ^{2, 5, 8} (±)	Comments
Oscilloscopes ³ – Square Wave Amplitude:			
50 Ω at 1 kHz	1.0 mV to 6.6 V _{pk - pk}	0.26 % + 40 μV	Fluke 5500A SC600
1 MΩ at 1 kHz	1.0 mV to 130 V _{pk - pk}	0.12 % + 40 μV	
DC Voltage Amplitude:			
50 Ω Load	(0 to ±6.6) V	0.25 % + 40 μV	
1 MΩ Load	(0 to ±130) V	0.05 % + 40 μV	
Level Sine Wave:			
Frequency	Up to 600 MHz	3.1 μHz/Hz	
Amplitude	50 kHz Reference	2 % + 300 μV	
	50 kHz to 100 MHz	3.5 % + 300 μV	
	(100 to 300) MHz	4 % + 300 μV	
	(300 to 600) MHz	6 % + 300 μV	
Flatness (Bandwidth)	50 kHz to 100 MHz	1.5 % + 100 μV	<i>t</i> = time in seconds
	(100 to 300) MHz	2 % + 100 μV	
	(300 to 600) MHz	4 % + 100 μV	
Time Markers:	5 s to 50 ms	(25 + 1000 <i>t</i>) μs/s	
Into a 50 Ω Load	20 ms to 2 ns	2.5 μs/s	
Rise Time:			
1 kHz to 2 MHz	≤ 300 ps	(+ 0 ps / -101 ps)	
(2 to 10) MHz	≤ 350 ps		

III. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC ^{2, 8} (±)	Comments
RF Power – Measure			
(-70 to -20) dBm 100 pW to 10μW	10 MHz to 18 GHz	2.0 %	HP437B/8484A/ 11708A
(-20 to 30) dBm 1 μW to 100 mW	100 kHz to 4.2 GHz	2.5 %	HP437B/8482A
(-20 to 30) dBm 1 μW to 100 mW	10 MHz to 18 GHz	2.0 %	HP437B/8481A

IV. Mechanical

Parameter/Equipment	Range	CMC ^{2,8} (±)	Comments
Scales & Balances ³	(1 to 5) g (Up to 10) g (Up to 30) g (Up to 50) g (Up to 100) g (Up to 200) g (Up to 300) g (Up to 500) g (Up to 1000) g (Above 1000) g	0.034 mg + 0.6R 0.050 mg + 0.6R 0.074 mg + 0.6R 0.12 mg + 0.6R 0.25 mg + 0.6R 0.5 mg + 0.6R 0.75 mg + 0.6R 1.2 mg + 0.6R 2.5 mg + 0.6R 2.5 mg per 1000 g + 0.6R	ASTM Class 1 weights (Applied Load)
	(1 to 20 000) g (Above 20 000) g	0.01 % + 0.6R 0.01 % per 20 000 g + 0.6R	Class F weights (Applied Load)
	Up to 1000 lbs (1000 to 120 000) lbs	0.01 % + 0.6R 0.01 % per 1000 lb + 0.6R	Class F weights (Applied Load)
Mass – Fixed Points	1 g 2 g 3 g 5 g 10 g 20 g 30 g 50 g 100 g 200 g 500 g 1 kg 2 kg 4 kg 5 kg 10 kg 1/32 oz 1/16 oz 1/8 oz ¼ oz ½ oz 0.001 lb 0.002 lb 0.005 lb 0.01 lb 0.02 lb 0.05 lb 0.1 lb 0.2 lb	41 µg 41 µg 41 µg 41 µg 60 µg 89 µg 90 µg 150 µg 310 µg 610 µg 1.5 mg 3.1 mg 6.1 mg 19 mg 40 mg 78 mg 4.2 µoz (120 µg) 5.3 µoz (150 µg) 7.1 µoz (200 µg) 8.8 µoz (250 µg) 13 µoz (370 µg) 0.04 µlb (18 µg) 0.04 µlb (18 µg) 0.04 µlb (18 µg) 0.06 µlb (28 µg) 0.09 µlb (41 µg) 0.15 µlb (67 µg) 0.31 µlb (140 µg) 0.62 µlb (280 µg)	Class 1 mass standards

Parameter/Equipment	Range	CMC ^{2, 8} (±)	Comments
Mass – Fixed Points (cont)	8 oz 1 lb 2 lb 4 lb 5 lb 10 lb 20 lb 25 lb 50 lb	24 μoz (670 μg) 3.1 μlb (1.4 mg) 6.2 μlb (2.8 mg) 16 μlb (7.2 mg) 15 μlb (6.7 mg) 46 μlb (21 mg) 88 μlb (40 mg) 110 μlb (48 mg) 220 μlb (97 mg)	Class 1 mass standards
Torque – Measuring Equipment (Wrenches) ³	5 in·lb to 1000 ft·lb	0.93 %	Sturtevant/ Richmont STT-50I-P; 300I-9-P;150-P, TT- 1000
Torque Testers ³	Up to 2000 ft·lb	0.07 %	Class F weights & torque arms
Force ^{3, 6}	(0.002 to 3000) lbf (3000 to 5000) lbf (5000 to 10 000) lbf (10 000 to 20 000) lbf (20 000 to 50 000) lbf	0.025 % 4.0 lbf 8.0 lbf 15 lbf 40 lbf	Class F weights Load cells with indicator
Pressure ³ – Pneumatic Hydraulic	 (0.5 to 300) psig (5 to 10 000) psig	 0.07 % 0.18 %	 Beamex MC5 Ametek Type 10/Ametek HL-36
Vacuum ³	(0.01 to 30) inHg	0.09 %	Beamex MC5
Speed ³ – Non-Contact: RPM Totalizer/Rate Meters Yardage Meters Contact: RPM Totalizer/Rate Meters Yardage Meters	 (6 to 100 000) rpm (2 to 3300) rpm (1 to 99 999.99) counts (6 to 20 000) rpm (2 to 3300) rpm (1 to 99 999.99) counts	 0.035 % 0.035 % 0.035 % 0.35 % 0.35 % 0.35 %	 Ametek 1726 Ametek 1726

Parameter/Equipment	Range	CMC ^{2, 8} (\pm)	Comments
Speed/RPM/Rate ³ – Simulation	(2.5 to 100 000) RPM	0.002 %	HP 3325A

V. Thermodynamics

Parameter/Equipment	Range	CMC ² (\pm)	Comments
Temperature – Measuring Equipment ³	0 °C to 100 °C 50 °C to 400 °C	0.7 °C 0.8 °C	Hart 9102 drywell Hart 9141 drywell
Temperature – Measure ³	-196 °C to 400 °C	0.18 °C	PRT Probe w/3458A
Plate Temperature – Infrared Devices ³	Ambient to 100 °C 100 °C to 250 °C 250 °C to 400 °C	0.63 °C 0.83 °C 1.1 °C	Hart Scientific 9132 HDRC
RTD ³ – Simulation	-200 °C to 0 °C 0 °C to 850 °C	0.13 °C 0.64 °C	Beamex MC5
Measure	-200 °C to 0 °C 0 °C to 850 °C	0.08 °C 0.33 °C	
Thermocouples ³ – Simulation/Measure	Type J, K, E -200 °C to 1372 °C Type T -250 °C to -200 °C -200 °C to 0 °C 0 °C to 400 °C Type R, S 0 °C to 1768 °C	0.5 °C 0.85 °C 0.37 °C 0.61 °C 0.85 °C	Beamex MC5
Relative Humidity – Measure ³	(10 to 90) % RH	1.6 % RH	Vaisala HMI41/HMP46

VI. Time and Frequency

Parameter/Equipment	Range	CMC ² (±)	Comments
Frequency – Generate	0.01Hz to 5 kHz 5 kHz to 3 GHz	0.44 µHz/Hz 0.44 µHz/Hz	Agilent 3325A R&S Model SME03
Frequency – Measure	(0 to 200) MHz	0.44 µHz/Hz	Racal Dana 1995 w/ R&S Model SME03
Timers and Stopwatches ³	(1 to 3600) s	0.05 s	Racal Dana 1995 w/ Agilent 3325A

¹ This laboratory offers commercial calibration and field calibration services, where noted.

² 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.

³ 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.

⁴ Based on using the standard at the temperature the Fluke 5700A, Fluke 5500A was calibrated ($t_{cal} \pm 5 \text{ }^\circ\text{C}$) and assuming the instrument is zeroed at least every seven days or when the ambient temperature changes more than $5 \text{ }^\circ\text{C}$. For resistance, a zero calibration is performed at least every 12 hours within $\pm 1 \text{ }^\circ\text{C}$ of use.

⁵ Based on using the standard at the temperature the HP 3456A, 3457A, or 3458A was calibrated ($t_{cal} \pm 5 \text{ }^\circ\text{C}$) and a auto-calibration (ACAL) was performed within the previous 24 hours ($\pm 1 \text{ }^\circ\text{C}$ of ambient temperature).

⁶ The standards used do not include the individual load cells calibrated using publish ASTM standards and methods.

⁷ In the statement of Calibration and Measurement Capability, L is the numerical value of the nominal length of the device measured in microinches; R is the numerical value of the resolution of the device in microinches.

⁸ Unless otherwise noted, percentage refers to percent of reading.