



World Class Accreditation

The American Association for Laboratory Accreditation

Accredited Laboratory

A2LA has accredited

CHERMAC SERVICES CORPORATION

Edmond, OK

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 16th day of September 2009.





Peter Meyer

President & CEO
For the Accreditation Council
Certificate Number 1166.01
Valid to June 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 until: June 30, 2011

Certificate Number: 1166.01

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 ^{2,4} (±)	Comments
Micrometer ³	(0 to 12) in	72 µin	Gage blocks, optical flats
	(>12 to 18) in	580 µin	
	(>18 to 40) in	(720 + 6.5L) µin	Length standards
Caliper ³	(0 to 24) in	300 µin	Gage blocks, surface plate, steel balls
	(24 to 40) in	590 µin	
Indicators	0.000020 in	38 µin	Federal OMD-400B-5
	0.000050 in	44 µin	
	0.000100 in	62 µin	
	0.000500 in	130 µin	
	0.001000 in	250 µin	
	0.000050 in	130 µin	Starrett 716
	0.000100 in	140 µin	
	0.000500 in	280 µin	
	0.001000 in	520 µin	



Parameter/Equipment	Range	CMC ^{2,4} (\pm)	Comments
Indicators (cont.) 0.000020 in 0.000050 in 0.000100 in 0.000500 in 0.001000 in	(0 to 10.0) in (0 to 10.0) in (0 to 10.0) in (0 to 10.0) in (0 to 10.0) in	8 $\mu\text{in} + 0.25R$ 8 $\mu\text{in} + 0.25R$ 8 $\mu\text{in} + 0.25R$ 8 $\mu\text{in} + 0.25R$ 8 $\mu\text{in} + 0.25R$	Gage Blocks
Gage Blocks	(0 to 4) in	(4.9 + 0.7L) μin	Comparator, gage blocks, optical flat
Step Gages	(0 to 50) in	(80 + 8.5L) $\mu\text{in/in}$	Reference bar, gaging amplifier
Diameter ³ – Cylinders, Wires and Disks	(0 to 10) in (0 to 16) in	(23 + 8L) $\mu\text{in/in}$ (10 + 9.8L) $\mu\text{in/in}$	Gage blocks, Supermicrometer ^{TM, 7}
Thread Plug – 60° Major Diameter and Pitch Diameter	(0 to 10) in	160 μin	Thread wires, super micrometer, gage blocks
Thread Rings – Minor Diameter and Pitch Diameter	(0 to 8) in	68 μin	Plain rings, ULM
Plain Rings	(0 to 8) in	32 μin	Gage blocks, ULM
Angle – Measuring Equipment	(0 to 180)°	15" + 0.58R	Gage blocks, surface plate, angle blocks, level
Surface Plate ³	4 ft \times 8 ft	1.6 arc sec + 3 % reading	Talyvel 4 electronic level system

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Optical Comparators ³ –			
Linearity	(0 to 12) in	58 μin + 0.58R	Master glass scale
Magnification	10×, 20×, 50×	0.012 % of reading	Magnification checker
Table Angular Alignment	(0 to 12) in	82 μin	Dial indicator

II. Dimensional Testing

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Length Standards	(0 to 10) in (0 to 16) in	100 μin (10 + 9.8L) μin	Gage blocks, supermic TULM
Height Gages/Length Rods	(0 to 5) in (0 to 10) in (0 to 20) in (0 to 30) in (0 to 40) in (0 to 5) in (0 to 10) in (0 to 20) in (0 to 30) in (0 to 40) in (0 to 50) in	69 μin 87 μin 120 μin 130 μin 170 μin 46 μin 56 μin 85 μin 120 μin 150 μin 190 μin	Trimos height standard Starrett reference bar & transfer stand

III. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2,5,6} (±)	Comments
DC Voltage – Generate ³	(0 to 300) mV (0 to 3.3) V (0 to 33) V (30 to 300) V (100 to 1000) V (1 to 100) kV	20 μV/V + 1 μV 11 μV/V + 2 μV 12 μV/V + 15 μV 18 μV/V + 150 μV 18 μV/V + 1.5 mV 0.11 %	Fluke 5520A Ross VD120Y, Keithley 2002

Peter Abney

Parameter/Equipment	Range	CMC ² (±)	Comments
Resistance – Measure ³	(0.1 to 20) Ω (2 to 200) Ω (0.02 to 2) kΩ (0.2 to 20) kΩ (2 to 200) kΩ (0.02 to 2) MΩ (0.2 to 20) MΩ (2 to 200) MΩ (0.02 to 2) GΩ	17 μΩ/Ω + 012 mΩ 17 μΩ/Ω + 0.8 mΩ 9 μΩ/Ω + 0.8 mΩ 9 μΩ/Ω + 8 mΩ 35 μΩ/Ω + 180 mΩ 65 μΩ/Ω + 1 Ω 0.025 % + 12 Ω 0.055 % + 600 Ω 0.21 % + 30 kΩ	Keithley 2002
Electrical Calibration of Thermocouple Indicating Systems ³ –			
Type E	-250 °C to -100 °C -100 °C to 650 °C 650 °C to 1000 °C	0.5 °C 0.16 °C 0.21 °C	Fluke 5520A
Type J	-210 °C to -100 °C -100 °C to 760 °C 760 °C to 1200 °C	0.27 °C 0.17 °C 0.23 °C	
Type K	-200 °C to -100 °C -100 °C to 120 °C 120 °C to 1000 °C 1000 °C to 1372 °C	0.33 °C 0.18 °C 0.28 °C 0.4 °C	
Type R	0 °C to 250 °C 250 °C to 400 °C 400 °C to 1000 °C 1000 °C to 1767 °C	0.57 °C 0.35 °C 0.33 °C 0.4 °C	
Type S	0 °C to 250 °C 250 °C to 1400 °C 1400 °C to 1767 °C	0.47 °C 0.37 °C 0.46 °C	
Type T	-250 °C to -150 °C -150 °C to 0 °C 0 °C to 120 °C 120 °C to 400 °C	0.63 °C 0.2 °C 0.16 °C 0.14 °C	

Parameter/Equipment	Range	CMC ^{2,5} (±)	Comments
Electrical Simulation of RTDs 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	0.05 °C 0.05 °C 0.07 °C 0.09 °C 0.10 °C 0.12 °C 0.23 °C	Fluke 5520A
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	0.05 °C 0.05 °C 0.07 °C 0.09 °C 0.10 °C 0.12 °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	0.25 °C 0.04 °C 0.05 °C 0.06 °C 0.07 °C 0.08 °C 0.09 °C 0.10 °C 0.23 °C	
Pt 385 (1000 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	0.03 °C 0.03 °C 0.04 °C 0.05 °C 0.06 °C 0.07 °C 0.07 °C 0.23 °C	

Parameter/Range	Frequency	CMC ² (±)	Comments
Capacitance – Measure			
10 aF to 11.1 μF	100 Hz to 1 kHz	0.01 % of reading + 0.03 nF	GenRad 1620 A, ESI SC1000

Parameter/Range	Frequency	CMC ² (±)	Comments
Capacitance – Generate ³			
0 to 1.11111 μF	1 kHz	0.05 % + 0.5 pF	GenRad 1413, Fluke 5520A
(0.19 to 1.0999) nF	10 Hz to 10 kHz	0.5 % + 0.01 nF	
(1.1 to 3.3) nF	10 Hz to 3 kHz	0.5 % + 0.01 nF	
(3.3 to 11) nF	10 Hz to 1 kHz	0.25 % + 0.01 nF	
(11 to 110) nF	10 Hz to 1 kHz	0.25 % + 0.1 nF	
(110 to 330) nF	10 Hz to 1 kHz	0.25 % + 0.3 nF	
(0.33 to 1.1) μF	(10 to 600) Hz	0.25 % + 1 nF	
(1.1 to 3.3) μF	(10 to 300) Hz	0.25 % + 3 nF	
(3.3 to 11) μF	(10 to 150) Hz	0.25 % + 10 nF	
(11 to 33) μF	(10 to 120) Hz	0.4 % + 30 nF	
(33 to 110) μF	(10 to 80) Hz	0.45 % + 100 nF	
(110 to 330) μF	(0 to 50) Hz	0.45 % + 300 nF	
(0.33 to 1.1) mF	(0 to 20) Hz	0.45 % + 1 μF	
(1.1 to 3.3) mF	(0 to 6) Hz	0.45 % + 3 μF	
(3.3 to 11) mF	(0 to 2) Hz	0.45 % + 10 μF	
(11 to 33) mF	(0 to 0.6) Hz	0.75 % + 30 μF	
(33 to 110) mF	(0 to 0.2) Hz	1.1 % + 100 μF	
AC Voltage – Generate ³			
(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	0.08 % + 6 μV 0.015 % + 6 μV 0.02 % + 6 μV 0.1 % + 6 μV 0.35 % + 12 μV 0.8 % + 50 μV	Fluke 5520A
(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	0.030 % + 8 μV 0.013 % + 8 μV 0.015 % + 8 μV 0.035 % + 8 μV 0.080 % + 32 μV 0.2 % + 70 μV	
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	0.030 % + 50 μV 0.012 % + 25 μV 0.019 % + 50 μV 0.030 % + 50 μV 0.070 % + 130 μV 0.24 % + 600 μV	
(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	0.030 % + 650 μV 0.015 % + 200 μV 0.024 % + 600 μV 0.035 % + 600 μV 0.090 % + 1.6 mV	

Peter Abney

Parameter/Range	Frequency	CMC ² (±)	Comments
AC Voltage – Generate ³ (cont)			
(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	0.030 % + 650 μV 0.015 % + 200 μV 0.024 % + 600 μV 0.035 % + 600 μV 0.090 % + 1.6 mV	Fluke 5520A
(33 to 330) V	45 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.019 % + 2 mV 0.020 % + 6 mV 0.025 % + 6 mV 0.030 % + 6 mV 0.2 % + 50 mV	
(330 to 1020) V	45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.030 % + 10 mV 0.025 % + 10 mV 0.030 % + 10 mV	
AC Voltage – Generate ³			
(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	0.08 % + 6 μV 0.015 % + 6 μV 0.02 % + 6 μV 0.1 % + 6 μV 0.35 % + 12 μV 0.8 % + 50 μV	Fluke 5520A
(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	0.030 % + 8 μV 0.013 % + 8 μV 0.015 % + 8 μV 0.035 % + 8 μV 0.080 % + 32 μV 0.2 % + 70 μV	
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	0.030 % + 50 μV 0.012 % + 25 μV 0.019 % + 50 μV 0.030 % + 50 μV 0.070 % + 130 μV 0.24 % + 600 μV	

Parameter/Range	Frequency	CMC ² (±)	Comments
AC Voltage – Generate ³ (cont)			
(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	0.030 % + 650 μV 0.015 % + 200 μV 0.024 % + 600 μV 0.035 % + 600 μV 0.090 % + 1.6 mV	Fluke 5520A
(33 to 330) V	45 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.019 % + 2 mV 0.020 % + 6 mV 0.025 % + 6 mV 0.030 % + 6 mV 0.2 % + 50 mV	
(330 to 1020) V	45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.030 % + 10 mV 0.025 % + 10 mV 0.030 % + 10 mV	
AC Voltage – Measure ³			
(2 to 200) mV	(20 to 50) Hz (50 to 100) Hz 100 Hz to 10 kHz (10 to 30) kHz (30 to 50) kHz (50 to 100) kHz (100 to 200) kHz 200 kHz to 1 MHz (1 to 2) MHz	0.25 % + 0.03 mV 0.07 % + 0.03 mV 0.02 % + 0.02 mV 0.03 % + 0.02 mV 0.05 % + 0.02 mV 0.3 % + 0.03 mV 0.75 % + 0.05 mV 2 % + 0.2 mV 5 % + 0.4 mV	Keithley 2002
200 mV to 2 V	(20 to 50) Hz (50 to 100) Hz 100 Hz to 10 kHz (10 to 30) kHz (30 to 50) kHz (50 to 100) kHz (100 to 200) kHz 200 kHz to 1 MHz (1 to 2) MHz	0.25 % + 0.03 mV 0.07 % + 0.03 mV 0.02 % + 0.2 mV 0.03 % + 0.2 mV 0.05 % + 0.2 mV 0.3 % + 0.3 mV 0.75 % + 0.5 mV 2 % + 2 mV 5 % + 4 mV	

Parameter/Range	Frequency	CMC ^{2,5,6} (±)	Comments
AC Voltage – Measure ³ (cont)			
(2 to 200) V	(20 to 50) Hz (50 to 100) Hz 100 Hz to 10 kHz (10 to 30) kHz (30 to 50) kHz (50 to 100) kHz (100 to 200) kHz 200 kHz to 1 MHz	0.25 % + 0.03 V 0.07 % + 0.03 V 0.04 % + 0.03 V 0.05 % + 0.03 V 0.07 % + 0.03 V 0.03 % + 0.03 V 0.75 % + 0.03 V 4 % + 0.05 V	Keithley 2002
(7.5 to 750) V	(20 to 50) Hz (50 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 50) kHz (50 to 100) kHz	0.25 % + 0.11 V 0.1 % + 0.11 V 0.05 % + 0.11 V 0.06 % + 0.11 V 0.08 % + 0.11 V 0.1 % + 0.11 V 0.5 % + 0.11 V	
750 V to 80 kV	50 Hz to 60 Hz	0.53 % + 0.011 V	Keithley 2002 with Ross VD120Y
AC Current – Generate ³			
(29 to 330) µA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.2 % + 0.1 µA 0.15 % + 0.1 µA 0.13 % + 0.1 µA 0.3 % + 0.15 µA 0.8 % + 0.2 µA 1.6 % + 0.4 µA	Fluke 5520A
330 µA 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 (10 to 30) kHz	0.2 % + 0.15 µA 0.13 % + 0.15 µA 0.1 % + 0.15 µA 0.2 % + 0.2 µA 0.5 % + 0.3 µA 1 % + 0.6 µA	
(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 (10 to 30) kHz	0.18 % + 2 µA 0.09 % + 2 µA 0.04 % + 2 µA 0.08 % + 2 µA 0.2 % + 3 µA 0.4 % + 4 µA	

Parameter/Range	Frequency	CMC ^{2, 5, 6} (\pm)	Comments
AC Current – Generate ³ (cont)			
(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 (10 to 30) kHz	0.18 % + 20 μ A 0.09 % + 20 μ A 0.04 % + 20 μ A 0.1 % + 50 μ A 0.2 % + 100 μ A 0.4 % + 200 μ A	Fluke 5520A
330 mA to 3 A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.18 % + 100 μ A 0.05 % + 100 μ A 0.6 % + 1 mA 2.5 % + 5 mA	
(3 to 11) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.06 % + 2 mA 0.1 % + 2 mA 3 % + 2 mA	
(11 to 20.5) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.12 % + 5 mA 0.15 % + 5 mA 3 % + 5 mA	
(20 to 1000) A	45 Hz to 1 kHz	0.6 % + 5 mA	5520A, 5500A/coil
AC Current – Measure ³			
(10 to 200) μ A	(20 to 50) Hz (50 to 200) Hz 200 Hz to 1 kHz (1 to 10) kHz	0.35 % + 0.03 μ A 0.2 % + 0.03 μ A 0.4 % + 0.03 μ A 0.5 % + 0.03 μ A	Keithley 2002
100 μ A to 2 mA	(20 to 50) Hz (50 to 200) Hz 200 Hz to 10 kHz (10 to 30) kHz (30 to 50) kHz (50 to 100) kHz	0.3 % + 0.3 μ A 0.15 % + 0.3 μ A 0.12 % + 0.3 μ A 0.25 % + 0.3 μ A 0.3 % + 0.3 μ A 0.5 % + 0.3 μ A	
(1 to 20) mA	(20 to 50) Hz (50 to 200) Hz 200 Hz to 10 kHz (10 to 30) kHz (30 to 50) kHz (50 to 100) kHz	0.3 % + 3 μ A 0.15 % + 3 μ A 0.12 % + 3 μ A 0.25 % + 3 μ A 0.3 % + 3 μ A 0.5 % + 3 μ A	

Parameter/Range	Frequency	CMC ^{2, 5, 6} (±)	Comments
AC Current – Measure ³ (cont)			
(10 to 200) mA	(20 to 50) Hz (50 to 200) Hz 200 Hz to 1 kHz (1 to 10) kHz (10 to 30) kHz (30 to 50) kHz (50 to 100) kHz	0.3 % + 0.03 mA 0.15 % + 0.03 mA 0.12 % + 0.03 mA 0.15 % + 0.03 mA 0.5 % + 0.03 mA 1 % + 0.03 mA 3 % + 0.03 mA	Keithley 2002
100 mA to 2 A	(20 to 50) Hz (50 to 200) Hz 200 Hz to 1 kHz (1 to 10) kHz (10 to 30) kHz (30 to 50) kHz	0.35 % + 0.3 mA 0.2 % + 0.3 mA 0.3 % + 0.3 mA 0.45 % + 0.3 mA 1.5 % + 0.3 mA 4 % + 0.3 mA	
(2 to 30) A	45 Hz to 1 kHz (1 to 5) kHz	0.6 % + 0.04 A 8.2 % + 0.04 A	Fluke 187 Agilent 34330A
Oscilloscopes –			
Vertical Amplitude ³ Into 50 Ω Into 1 MΩ	(-6.6 to 6.6) V (-130 to 130) V	0.25 % + 40 μV 0.1 % + 40 μV	Fluke 5520A-SC600
Leveled Sine Wave ³ Absolute Relative to 50 kHz Relative to 50 kHz Relative to 50 kHz	5.0 mV to 5.5 V 50 kHz 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz	2 % + 300 μV 1.5 % + 100 μV 2 % + 100 μV 4 % + 100 μV	
Time Marker ³	5 s to 50 ms 20 ms to 2 ns	(25 + <i>t</i> *1000) parts in 10 ⁶ 2.5 parts in 10 ⁶	<i>t</i> is time
Rise Time ³	≤ 300 ps	+0 ps / -100 ps	

IV. Mechanical

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Direct Verification of Durometers – A and D Scales	(0 to 822) g	4.6 g (A scale) 12 g (D scale)	Durocalibrator
Force Verification of Testing Machines ³	(0 to 500) lbf (501 to 30 000) lbf (30 000 to 50 000) lbf	0.88 % of reading 0.15 % of reading 0.58 % of reading	ASTM E4, load cells
Pressure ³	(3 to 850) inH ₂ O (20 to 15 000) psi (0 to 10 000) psi (0 to 1000) psi (0 to 100) psi (0 to 30 psi)	0.015 % of reading 0.025 % of reading ± 2.5 psi ± 0.25 psi ± 0.025 psi ± 0.0075 psi	Ruska T9000-850 Ametek T-155-1 GE DPI-330
Vacuum ³	(0 to 28) inHg	0.021 inHg	Heise digital gage
Torque Wrenches ³	(0 to 2000) ft·lb	1.0 % of reading	CDI Multitest System
Viscometers ³	100 cp 1000 cp 5000 cp 12 500 cp 30 000 cp 100 000 cp	0.29 % of stated volume 0.38 % of stated volume 0.38 % of stated volume 0.44 % of stated volume 0.44 % of stated volume 0.44 % of stated volume	Manufacturers reagent
Balances	(0 to 4000) g (0 to 20 000)g	30 mg + 0.6R 120 mg + 0.6R	Verification with ASTM E617 Class 1, 2, 3, & 4 weights

Parameter/Equipment	Range	CMC ^{2,4} (\pm)	Comments
Scales	(0 to 10) lbs (0 to 4.5) kg (0 to 20) lbs (0 to 9 kg) (0 to 50) lbs (0 to 23) kg (0 to 500) lbs (0 to 227) kg (0 to 1000) lbs (0 to 454) kg	0.36 g + 0.6R (8.0 x 10 ⁻⁴ lbs + 0.6R) 0.6 g + 0.6R (1.8 x 10 ⁻³ lbs + 0.6R) 0.6 g + 0.6R (1.8 x 10 ⁻³ lbs + 0.6R) 24 g + 0.6R (0.072 lbs + 0.6R) 48 g + 0.6R (0.14 lbs + 0.6R)	Verification with ASTM E617 Class 6 & NIST 105-1 Class F weights
Indirect Verification of Rockwell Hardness Testers	HRB: Low Middle High HRC: Low Middle High HR15N: Low Middle High HR15T: Low Middle High HRA: Low Middle High HRR: 114	0.87 HRB 0.46 HRB 0.43 HRB 0.73 HRC 0.29 HRC 0.22 HRC 0.45 HR15N 1.07 HR15N 0.89 HR15N 1.18 HR15T 1.24 HR15T 0.90 HR15T 0.30 HRA 0.27 HRA 0.24 HRA 0.66 HRR	ASTM E18

V. Thermodynamics

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Thermometers ³ and Probes ³	-5 °C to 125 °C 35 °C to 600 °C	0.05 °C 0.09 °C	Hart 7102, 1521, probe Hart 9123, 1521, probe
Relative Humidity ³ – LiCl MgCl ₂ NaCl K ₂ SO ₄	11.3 % RH 33.1 % RH 75.3 % RH 97.3 % RH	2.5 % RH 2.5 % RH 2.5 % RH 2.5 % RH	ASTM E104
Infrared Non-Contact ³	50 °C to 500 °C	1.3 °C + 0.6R	Hart 9132 Black Body

VI. Time and Frequency

Parameter/Equipment	Frequency	CMC ² (±)	Comments
Frequency Measuring Equipment – GPS Non-GPS ³	1 μHz to 3 GHz 1 μHz to 3 GHz	15 x 10 ⁻¹⁰ Hz 5 x 10 ⁻¹⁰ Hz/Hz Per Day	Datum 9300 Agilent 53132A Opt 10
Timers / Stopwatches	1 s to 24 hr	38 ms	GPS Receiver

¹ This laboratory offers commercial and field calibration service, 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 In the statement of the CMC, *R* is the resolution of the device under test. In the statement of the CMC, *L* is the numerical value of the nominal length of the device measured in inches.
- ⁵ The measurands stated are generated with the Fluke 55XX series of instruments. This capability is suitable for the calibration of the devices intended to measure the stated measurand in the ranges indicated. The CMCs are expressed as either a specific value that covers the full range or as a fraction of the reading plus a fixed floor specification.
- ⁶ The measurands stated are measured with the Keithley 2002. This capability is suitable for the calibration of the devices intended to generate the measurand in the ranges indicated. The CMCs are expressed as either a specific value that covers the full range or as a combination of the fraction of the reading/output plus a range specification.
- ⁷ "Supermicrometer" is a registered trade mark owned by Pratt & Whitney Measurement Systems, Inc., Connecticut U.S.A.