



PERRY JOHNSON LABORATORY ACCREDITATION, INC.

Certificate of Accreditation

Perry Johnson Laboratory Accreditation, Inc. has assessed the Laboratory of:

ENV Services, Inc./Pro-Lab
2880 Bergey Road, Suite K, Hatfield, PA 19440

(Hereinafter called the Organization) and hereby declares that Organization is accredited in accordance with the recognized International Standard:

ISO/IEC 17025:2017
And meets the requirements of ANSI/NCSL Z540-3-1994

This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system
(as outlined by the joint ISO-ILAC-IAF Communiqué dated April 2017):

***Chemical, Electrical, Mechanical, Mass, Force & Weighing Devices,
Thermodynamic & Time & Frequency Calibration***
(As detailed in the supplement)

Accreditation claims for such testing and/or calibration services shall only be made from addresses referenced within this certificate. This Accreditation is granted subject to the system rules governing the Accreditation referred to above, and the Organization hereby covenants with the Accreditation body's duty to observe and comply with the said rules.

For PJLA:

Tracy Szerszen
President

Initial Accreditation Date:

March 30, 2016

Issue Date:

January 18, 2023

Expiration Date:

February 28, 2025

Accreditation No.:

78961

Certificate No.:

L23-49-1

Perry Johnson Laboratory
Accreditation, Inc. (PJLA)
755 W. Big Beaver, Suite 1325
Troy, Michigan 48084

The validity of this certificate is maintained through ongoing assessments based on a continuous accreditation cycle. The validity of this certificate should be confirmed through the PJLA website: www.pjilabs.com



Certificate of Accreditation: Supplement

ENV Services, Inc./Pro-Lab

2880 Bergey Road, Suite K, Hatfield, PA 19440
 Contact Name: Michael Parente Phone: 215-997-5080

Accreditation is granted to the facility to perform the following calibrations:

Chemical

MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE OR NOMINAL DEVICE SIZE AS APPROPRIATE	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY (\pm)	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED	
Equipment to Source (Carbon Dioxide) CO ₂ ^O	3 %	1 % of reading	Manufacturer's Procedure using Reference Calibration Gases	
	5 %	0.51 % of reading		
	10 %	0.71 % of reading		
	15 %	0.81 % of reading		
Equipment to Source O ₂ ^O	10 %	0.42 % of reading		
	20.8 %	0.42 % of reading		
Equipment to Measure (Carbon Dioxide) CO ₂ ^{FO}	Up to 3%	0.76 % of reading		Manufacturer's Procedure using Comparison to Bacharach (O ₂ /CO ₂) and Vaisala (CO ₂) Meters
	>3 % to 5 %	0.58 % of reading		
	>5 % to 10 %	1.3 % of reading		
	>10 % to 15 %	0.2.4 % of reading		
Equipment to Measure (Oxygen) O ₂ ^{FO}	0 to 100%	0.67 of reading		
Conductivity Meter ^{FO}	10 μ S	0.81 μ S	Manufacturer's Procedure using Standard Reference Materials	
	100 μ S	2.2 μ S		
	1 000 μ S	5.2 μ S		
	10 mS	40 mS		
	100 mS	370 mS		
pH Meters ^{FO}	4 pH	0.02	Manufacturer's Procedure using Buffers	
	7 pH	0.03		
	10 pH	0.02		

Dimensional

MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE OR NOMINAL DEVICE SIZE AS APPROPRIATE	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY (\pm)	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED
Calipers ^{FO}	0 in to 12 in	(290 + 1L) μ in	ENV WI 4372 Comparison to Gage Blocks
Micrometers ^{FO}	0.01 in to 20 in	(81 + 5.0L) μ in	ENV WI 36585 Comparison to Gage Blocks



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Equipment to Measure DC Voltage ^{FO}	10 mV to 100 mV	7 μ V/V + 0.3 μ V	Keysight 3458A w/opt 002 Manufacturer Procedures Vitrek 4700 and HVL-35 Manufacturer Procedures
	> 0.1 V to 1 000 mV	8 μ V/V + 0.3 μ V	
	> 1 V to 10 V	8 μ V/V + 0.5 μ V	
	> 10 V to 100 V	9 μ V/V + 30 μ V	
	> 100 V to 1 000 V	9 μ V/V + 0.1 μ V + 12 (V _{IN} /1 000) ²	
	Up to 1 000 V	0.004 % of reading + 0.01 V + 0.6 R	
	> 1 000 V to 5 000 V	0.01 % of reading + 1.6 V + 0.6 R	
	>5000 V to 10 000 V >10 000 V to 30 000 V	0.01 % of reading + 3.5 V + 0.6 R 0.01 % of reading + 22 V + 0.6 R	
Equipment to Output DC Voltage ^{FO}	0 mV to 330 mV	16 μ V/V + 1 μ V	Fluke 5520A Manufacturer Procedures
	> 330 mV to 3.3 V	9 μ V/V + 2 μ V	
	> 3.3 V to 33 V	9 μ V/V + 16 μ V	
	> 33 V to 330 V	14 μ V/V + 120 μ V	
	> 330 V to 1 000 V	14 μ V/V + 1.2 mV	
Equipment to Measure DC Current ^{FO}	> 0 nA to 100 nA	34 μ A/A + 0.000 04 pA	Keysight 3458A w/opt 002 Manufacturer Procedures
	> 100 nA to 1 μ A	25 μ A/A + 0.000 04 pA	
	> 1 μ A to 10 μ A	25 μ A/A + 0.000 1 pA	
	> 10 μ A to 100 μ A	25 μ A/A + 0.000 8 pA	
	> 100 μ A to 1 mA	25 μ A/A + 0.005 nA	
	> 1 mA to 10 mA	26 μ A/A + 0.05 nA	
	> 10 mA to 100 mA > 100 mA to 1 A	41 μ A/A + 0.5 μ A 120 μ A/A + 10 μ A	
Equipment to Measure DC Resistance ^{FO}	0 Ω to 10 Ω	20 $\mu\Omega/\Omega$ + 0.000 05 $\mu\Omega$	Keysight 3458A w/opt 002 Manufacturer Procedures
	> 10 Ω to 100 Ω	15 $\mu\Omega/\Omega$ + 0.000 5 $\mu\Omega$	
	> 100 Ω to 1k Ω	13 $\mu\Omega/\Omega$ + 0.000 5 $\mu\Omega$	
	> 1 k Ω to 10 k Ω	13 $\mu\Omega/\Omega$ + 0.005 m Ω	
	> 10 k Ω to 100 k Ω	13 $\mu\Omega/\Omega$ + 0.05 m Ω	
	> 100 k Ω to 1 M Ω	18 $\mu\Omega/\Omega$ + 2 Ω	
	> 1 M Ω to 10 M Ω	53 $\mu\Omega/\Omega$ + 100 Ω	
	> 10 M Ω to 100 M Ω > 100 M Ω to 1 G Ω	150 $\mu\Omega/\Omega$ + 1 000 Ω 5 100 $\mu\Omega/\Omega$ + 10 000 Ω	



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Equipment to Output DC Resistance ^{FO}	0 Ω to 11 Ω	40 $\mu\Omega/\Omega$ + 0.01 Ω	Fluke 5520A Manufacturer Procedures
	> 11 Ω to 33 Ω	30 $\mu\Omega/\Omega$ + 0.012 Ω	
	> 33 Ω to 110 Ω	28 $\mu\Omega/\Omega$ + 0.012 Ω	
	> 110 Ω to 330 Ω	28 $\mu\Omega/\Omega$ + 0.016 Ω	
	> 330 Ω to 1.1 k Ω	28 $\mu\Omega/\Omega$ + 0.1 Ω	
	> 1.1 k Ω to 3.3 k Ω	28 $\mu\Omega/\Omega$ + 0.16 Ω	
	> 3.3 k Ω to 11 k Ω	28 $\mu\Omega/\Omega$ + 0.078 Ω	
	> 11 k Ω to 33 k Ω	28 $\mu\Omega/\Omega$ + 0.78 Ω	
	> 33 k Ω to 110 k Ω	28 $\mu\Omega/\Omega$ + 0.78 Ω	
	> 110 k Ω to 330 k Ω	32 $\mu\Omega/\Omega$ + 7.8 Ω	
	> 330 k Ω to 1.1 M Ω	32 $\mu\Omega/\Omega$ + 7.8 Ω	
	> 1.1 M Ω to 3.3 M Ω	60 $\mu\Omega/\Omega$ + 120 Ω	
	> 3.3 M Ω to 11 M Ω	130 $\mu\Omega/\Omega$ + 200 Ω	
	> 11 M Ω to 33 M Ω	250 $\mu\Omega/\Omega$ + 2 000 Ω	
	> 33 M Ω to 110 M Ω	500 $\mu\Omega/\Omega$ + 2 400 Ω	
> 110 M Ω to 330 M Ω	3 000 $\mu\Omega/\Omega$ + 78 000 Ω		
> 330 M Ω to 1.1 G Ω	15 000 $\mu\Omega/\Omega$ + 390 000 Ω		
Equipment to Output DC Current ^{FO}	1 nA	0.008 % of reading	Keithley Current Source Manufacturer Procedures
	> 1 nA to 10 nA	0.055 % of reading	
	> 10 nA to 100 nA	0.55 % of reading	
	> 100 nA to 1 μ A	0.003 % of reading	
	> 1 μ A to 330 μ A	120 $\mu\Omega/\Omega$ + 0.02 μ A	Fluke 5520A Manufacturer Procedures
	> 330 μ A to 3.3 mA	78 μ V/V + 0.04 μ A	
	> 3.3 mA to 33 mA	78 μ V/V + 0.19 μ A	
	> 33 mA to 330 mA	78 μ V/V + 1.94 μ A	
	> 330 mA to 1.1 A	160 μ V/V + 31 μ A	
	> 1.1 A to 3 A	300 μ V/V + 31 μ A	
	> 3 A to 11 A	390 μ V/V + 0.39 mA	
	> 11 A to 20 A	780 μ V/V + 0.59 mA	
	> 20 A to 150 A	0.61 % output + 0.16 A	Fluke 5520A and 5500A Coil Manufacturer Procedures
	> 150 A to 1 000 A	0.62 % output + 0.58 A	



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Temperature Calibration, Indication, and Control Equipment used with RTD Pt 385, 100 Ω ^{FO}	-200 °C to 0 °C	0.04 °C	Fluke 5520A Electrical Simulation of RTD Output Manufacturer Procedures
	> 0 °C to 100 °C	0.05 °C	
	> 100 °C to 300 °C	0.07 °C	
	> 300 °C to 400 °C	0.08 °C	
	> 400 °C to 630 °C	0.09 °C	
	> 630 °C to 800 °C	0.18 °C	
Temperature Calibration, Indication, and Control Equipment used with RTD Pt 3926, 100 Ω ^{FO}	-200 °C to 0 °C	0.04 °C	Fluke 5520A Electrical Simulation of Thermocouple Output Manufacturer Procedures
	> 0 °C to 100 °C	0.05 °C	
	> 100 °C to 300 °C	0.07 °C	
	> 300 °C to 400 °C	0.08 °C	
	> 400 °C to 630 °C	0.09 °C	
Temperature Calibration, Indication, and Control Equipment used with RTD Pt 3916, 100 Ω ^{FO}	-200 °C to -190 °C	0.19 °C	Fluke 5520A Electrical Simulation of Thermocouple Output Manufacturer Procedures
	> -190 °C to -80 °C	0.03 °C	
	> -80 °C to 0 °C	0.04 °C	
	> 0 °C to 100 °C	0.05 °C	
	> -200 °C to -190 °C	0.19 °C	
	> -190 °C to -80 °C	0.03 °C	
	> 300 °C to 400 °C	0.07 °C	
	> 400 °C to 600 °C	0.08 °C	
Temperature Calibration, Indication and Control Equipment used with Thermocouple Type B ^{FO}	600 °C to 800 °C	0.34 °C	Fluke 5520A Electrical Simulation of Thermocouple Output Manufacturer Procedures
	800 °C to 1 000 °C	0.26 °C	
	1 000 °C to 1 550 °C	0.23 °C	
	1 550 °C to 1 820 °C	0.26 °C	
Temperature Calibration, Indication and Control Equipment used with Thermocouple Type C ^{FO}	0 °C to 150 °C	0.23 °C	Fluke 5520A Electrical Simulation of Thermocouple Output Manufacturer Procedures
	150 °C to 650 °C	0.20 °C	
	650 °C to 1 000 °C	0.24 °C	
	1 000 °C to 1 800 °C	0.39 °C	
	1 800 °C to 2 316 °C	0.65 °C	



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Temperature Calibration, Indication, and Control Equipment used with Thermocouple Type E ^{FO}	-250 °C to -100 °C	0.45 °C	Fluke 5520A Electrical Simulation of Thermocouple Output Manufacturer Procedures
	> -100 °C to -25 °C	0.26 °C	
	> -25 °C to 350 °C	0.26 °C	
	> 350 °C to 650 °C	0.26 °C	
	> 650 °C to 1 000 °C	0.28 °C	
Temperature Calibration, Indication, and Control Equipment used with Thermocouple Type J ^{FO}	-210 °C to -100 °C	0.31 °C	
	> -100 °C to -30 °C	0.26 °C	
	> -30 °C to 150 °C	0.26 °C	
	> 150 °C to 760 °C	0.27 °C	
	> 760 °C to 1 200 °C	0.29 °C	
Temperature Calibration, Indication, and Control Equipment used with Thermocouple Type K ^{FO}	-210 °C to -100 °C	0.35 °C	
	> -100 °C to -25 °C	0.27 °C	
	> -25 °C to 120 °C	0.26 °C	
	> 120 °C to 1 000 °C	0.31 °C	
	> 1 000 °C to 1 372 °C	0.39 °C	
Temperature Calibration, Indication and Control Equipment used with Thermocouple Type L ^{FO}	(-200 to -100) °C	0.29 °C	
	(-100 to 800) °C	0.20 °C	
	(800 to 900) °C	0.13 °C	
Temperature Calibration, Indication and Control Equipment used with Thermocouple Type N ^{FO}	-200 °C to -100 °C	0.31 °C	
	-100 °C to -25 °C	0.17 °C	
	-25 °C to 120 °C	0.15 °C	
	120 °C to 410 °C	0.14 °C	
	410 °C to 1 300 °C	0.21 °C	
Temperature Calibration, Indication, and Control Equipment used with Thermocouple Type R ^{FO}	0 °C to 250 °C	0.5 °C	
	> 250 °C to 400 °C	0.36 °C	
	> 400 °C to 1 000 °C	0.35 °C	
	> 1 000 °C to 1 767 °C	0.39 °C	
Temperature Calibration, Indication, and Control Equipment used with Thermocouple Type S ^{FO}	0 °C to 250 °C	0.43 °C	
	> 250 °C to 1 000 °C	0.36 °C	
	> 1 000 °C to 1 400 °C	0.37 °C	
	> 1 400 °C to 1 767 °C	0.43 °C	



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Temperature Calibration, Indication, and Control Equipment used with Thermocouple Type T ^{FO}	-250 °C to -150 °C	0.54 °C	Fluke 5520A Electrical Simulation of Thermocouple Output Manufacturer Procedures	
	> -150 °C to 0 °C	0.3 °C		
	> 0 °C to 120 °C	0.26 °C		
	> 120 °C to 400 °C	0.26 °C		
Temperature Calibration, Indication, and Control Equipment used with Thermocouple Type U ^{FO}	-200 °C to 0 °C	0.43 °C		
	0 °C to 600 °C	0.21 °C		
Equipment to Measure AC Voltage (at the listed frequencies) ^{FO}				Keysight 3458 A w/opt 002 Manufacturer Procedures
1 Hz to 40 Hz	1 mV to 10 mV	0.03 % of reading + 3 μ V		
> 40 Hz to 1 kHz	1 mV to 10 mV	0.02 % of reading + 1.1 μ V		
> 1 kHz to 20 kHz	1 mV to 10 mV	0.03 % of reading + 1.1 μ V		
> 20 kHz to 50 kHz	1 mV to 10 mV	0.1 % of reading + 1.1 μ V		
> 50 kHz to 100 kHz	1 mV to 10 mV	0.5 % of reading + 1.1 μ V		
> 100 kHz to 300 kHz	1 mV to 10 mV	4 % of reading + 2 μ V		
Equipment to Measure AC Voltage (at the listed frequencies) ^{FO}				
1 Hz to 40 Hz	> 10 mV to 100 mV	0.01 % of reading + 4 μ V		
> 40 Hz to 1 kHz	> 10 mV to 100 mV	0.007 % of reading + 2 μ V		
> 1 kHz to 20 kHz	> 10 mV to 100 mV	0.014 % of reading + 2 μ V		
> 20 kHz to 50 kHz	> 10 mV to 100 mV	0.03 % of reading + 2 μ V		
> 50 kHz to 100 kHz	> 10 mV to 100 mV	0.08 % of reading + 2 μ V		
> 100 kHz to 300 kHz	> 10 mV to 100 mV	0.3 % of reading + 10 μ V		
> 0.3 MHz to 1 MHz	> 10 mV to 100 mV	1 % of reading + 10 μ V		
> 1 MHz to 2 MHz	> 10 mV to 100 mV	1.5 % of reading + 10 μ V		



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Equipment to Measure AC Voltage (at the listed frequencies) ^{FO}			Keysight 3458 A w/opt 002 Manufacturer Procedures
1 Hz to 40 Hz	> 100 mV to 1 V	0.007 % of reading + 40 μ V	
> 40 Hz to 1 kHz	> 100 mV to 1 V	0.007 % of reading + 20 μ V	
> 1 kHz to 20 kHz	> 100 mV to 1 V	0.014 % of reading + 20 μ V	
> 20 kHz to 50 kHz	> 100 mV to 1 V	0.03 % of reading + 20 μ V	
> 50 kHz to 100 kHz	> 100 mV to 1 V	0.08 % of reading + 20 μ V	
> 100 kHz to 300 kHz	> 100 mV to 1 V	0.3 % of reading + 100 μ V	
> 0.3 MHz to 1 MHz	> 100 mV to 1 V	1 % of reading + 100 μ V	
> 1 MHz to 2 MHz	> 100 mV to 1 V	1.5 % of reading + 100 μ V	
Equipment to Measure AC Voltage (at the listed frequencies) ^{FO}			
1 Hz to 40 Hz	> 1 V to 10 V	0.007 % of reading + 400 μ V	
> 40 Hz to 1 kHz	> 1 V to 10 V	0.007 % of reading + 200 μ V	
> 1 kHz to 20 kHz	> 1 V to 10 V	0.014 % of reading + 200 μ V	
> 20 kHz to 50 kHz	> 1 V to 10 V	0.03 % of reading + 200 μ V	
> 50 kHz to 100 kHz	> 1 V to 10 V	0.08 % of reading + 200 μ V	
Equipment to Measure AC Voltage (at the listed frequencies) ^{FO}			
1 Hz to 40 Hz	> 10 V to 100 V	0.02 % of reading + 4 mV	
> 40 Hz to 1 kHz	> 10 V to 100 V	0.02 % of reading + 2 mV	
> 1 kHz to 20 kHz	> 10 V to 100 V	0.02 % of reading + 2 mV	
> 20 kHz to 50 kHz	> 10 V to 100 V	0.035 % of reading + 2 mV	
> 50 kHz to 100 kHz	> 10 V to 100 V	0.12 % of reading + 10 mV	
Equipment to Measure AC Voltage (at the listed frequencies) ^{FO}			Vitrek 4700 and HVL-35 Manufacturer Procedures
1 Hz to 40 Hz	> 100 V to 1 000 V	0.04 % of reading + 40 mV	
> 40 Hz to 1 kHz	> 100 V to 1 000 V	0.04 % of reading + 20 mV	
> 1 kHz to 20 kHz	> 100 V to 1 000 V	0.06 % of reading + 20 mV	
> 20 kHz to 50 kHz	> 100 V to 1 000 V	0.12 % of reading + 20 mV	
> 50 kHz to 100 kHz	> 100 V to 1 000 V	0.3 % of reading + 20 mV	
50 Hz to 60 Hz	1 000 V	0.004 % of reading + 1.3V + 0.6R	
400 Hz	1 000 V	0.004 % of reading + 7.3V + 0.6R	
50 HZ to 60 Hz	>1 000 V to 5 000 V	0.03 % of reading + 5 V +0.6R	
50 HZ to 60 Hz	>5 000 V to 10 000V	0.02% of reading+ 10 V +0.6R	
50 HZ to 60 Hz	>10 000V to 30 000V	0.02% of reading+ 42 V +0.6R	



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Equipment to Output AC Voltage (at the listed frequencies) ^{FO}			Fluke 5520A Manufacturer Procedures
10 Hz to 45 Hz	> 1 mV to 33 mV	0.063 % of reading + 5 μ V	
> 45 Hz to 10 kHz	> 1 mV to 33 mV	0.014 % of reading + 5 μ V	
> 10 kHz to 20 kHz	> 1 mV to 33 mV	0.016 % of reading + 5 μ V	
> 20 kHz to 50 kHz	> 1 mV to 33 mV	0.078 % of reading + 5 μ V	
> 50 kHz to 100 kHz	> 1 mV to 33 mV	0.28 % of reading + 9 μ V	
> 100 kHz to 500 kHz	> 1 mV to 33 mV	0.63 % of reading + 39 μ V	
Equipment to Output AC Voltage (at the listed frequencies) ^{FO}			
10 Hz to 45 Hz	> 33 mV to 330 mV	0.024 % of reading + 6 μ V	
> 45 Hz to 10 kHz	> 33 mV to 330 mV	0.012 % of reading + 6 μ V	
> 10 kHz to 20 kHz	> 33 mV to 330 mV	0.013 % of reading + 6 μ V	
> 20 kHz to 50 kHz	> 33 mV to 330 mV	0.028 % of reading + 6 μ V	
> 50 kHz to 100 kHz	> 33 mV to 330 mV	0.062 % of reading + 25 μ V	
> 100 kHz to 500 kHz	> 33 mV to 330 mV	0.16 % of reading + 54 μ V	
Equipment to Output AC Voltage (at the listed frequencies) ^{FO}			
10 Hz to 45 Hz	> 330 mV to 3.3 V	0.024 % of reading + 39 μ V	
> 45 Hz to 10 kHz	> 330 mV to 3.3 V	0.012 % of reading + 47 μ V	
> 10 kHz to 20 kHz	> 330 mV to 3.3 V	0.015 % of reading + 47 μ V	
> 20 kHz to 50 kHz	> 330 mV to 3.3 V	0.024 % of reading + 39 μ V	
> 50 kHz to 100 kHz	> 330 mV to 3.3 V	0.055 % of reading + 97 μ V	
> 100 kHz to 500 kHz	> 330 mV to 3.3 V	0.19 % of reading + 0.47 mV	
Equipment to Output AC Voltage (at the listed frequencies) ^{FO}			
10 Hz to 45 Hz	> 3.3 V to 33 V	0.024 % of reading + 0.51 mV	
> 45 Hz to 10 kHz	> 3.3 V to 33 V	0.012 % of reading + 0.47 mV	
> 10 kHz to 20 kHz	> 3.3 V to 33 V	0.019 % of reading + 0.47 mV	
> 20 kHz to 50 kHz	> 3.3 V to 33 V	0.028 % of reading + 0.47 mV	
> 50 kHz to 100 kHz	> 3.3 V to 33 V	0.07 % of reading + 0.13 mV	



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Equipment to Output AC Voltage (at the listed frequencies) ^{FO}			Fluke 5520A Manufacturer Procedures
45 Hz to 1 kHz	> 33 V to 330 V	0.012 % of reading + 1.6 mV	
> 1 kHz to 10 kHz	> 33 V to 330 V	0.016 % of reading + 4.7 mV	
> 10 kHz to 20 kHz	> 33 V to 330 V	0.02 % of reading + 4.7 mV	
> 20 kHz to 50 kHz	> 33 V to 330 V	0.024 % of reading + 4.7 mV	
> 50 kHz to 100 kHz	> 33 V to 330 V	0.16 % of reading + 39 mV	
Equipment to Output AC Voltage (at the listed frequencies) ^{FO}			
45 Hz to 1 kHz	> 330 V to 1 020 V	0.023 % of reading + 78 mV	
> 1 kHz to 5 kHz	> 330 V to 1 020 V	0.02 % of reading + 78 mV	
> 5 kHz to 10 kHz	> 330 V to 1 020 V	0.024 % of reading + 78 mV	
Equipment to Measure AC Current (at the listed frequencies) ^{FO}			Keysight 3458 A w/opt 002 Manufacturer Procedures
10 Hz to 20 Hz	5 μ A to 100 μ A	0.4 % of reading + 30 nA	
> 20 Hz to 45 Hz	5 μ A to 100 μ A	0.15 % of reading + 30 nA	
> 45 Hz to 100 Hz	5 μ A to 100 μ A	0.06 % of reading + 30 nA	
> 100 Hz to 5 kHz	5 μ A to 100 μ A	0.06 % of reading + 30 nA	
Equipment to Measure AC Current (at the listed frequencies) ^{FO}			
10 Hz to 20 Hz	> 100 μ A to 1 mA	0.4 % of reading + 200 nA	
> 20 Hz to 45 Hz	> 100 μ A to 1 mA	0.15 % of reading + 200 nA	
> 45 Hz to 100 Hz	> 100 μ A to 1 mA	0.06 % of reading + 200 nA	
> 100 Hz to 5 kHz	> 100 μ A to 1 mA	0.03 % of reading + 200 nA	
> 5 kHz to 20 kHz	> 100 μ A to 1 mA	0.06 % of reading + 200 nA	
> 20 kHz to 50 kHz	> 100 μ A to 1 mA	0.4 % of reading + 400 nA	
> 50 kHz to 100 kHz	> 100 μ A to 1 mA	0.55 % of reading + 1.5 nA	
Equipment to Measure AC Current (at the listed frequencies) ^{FO}			
10 Hz to 20 Hz	> 1 mA to 10 mA	0.4 % of reading + 2 μ A	
> 20 Hz to 45 Hz	> 1 mA to 10 mA	0.15 % of reading + 2 μ A	
> 45 Hz to 100 Hz	> 1 mA to 10 mA	0.06 % of reading + 2 μ A	
> 100 Hz to 5 kHz	> 1 mA to 10 mA	0.03 % of reading + 2 μ A	
> 5 kHz to 20 kHz	> 1 mA to 10 mA	0.06 % of reading + 2 μ A	
> 20 kHz to 50 kHz	> 1 mA to 10 mA	0.4 % of reading + 4 μ A	
> 50 kHz to 100 kHz	> 1 mA to 10 mA	0.55 % of reading + 15 μ A	



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 Contact Name: Michael Parente Phone: 215-997-5080

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Electrical

MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE OR NOMINAL DEVICE SIZE AS APPROPRIATE	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY (\pm)	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED
Equipment to Measure AC Current (at the listed frequencies) ^{FO}			Keysight 3458 A w/opt 002 Manufacturer Procedures
10 Hz to 20 Hz	> 10 mA to 100 mA	0.4 % of reading + 20 μ A	
> 20 Hz to 45 Hz	> 10 mA to 100 mA	0.15 % of reading + 20 μ A	
> 45 Hz to 100 Hz	> 10 mA to 100 mA	0.06 % of reading + 20 μ A	
> 100 Hz to 5 kHz	> 10 mA to 100 mA	0.03 % of reading + 20 μ A	
> 5 kHz to 20 kHz	> 10 mA to 100 mA	0.06 % of reading + 20 μ A	
> 20 kHz to 50 kHz	> 10 mA to 100 mA	0.4 % of reading + 40 μ A	
> 50 kHz to 100 kHz	> 10 mA to 100 mA	0.55 % of reading + 150 μ A	
Equipment to Measure AC Current (at the listed frequencies) ^{FO}			Keysight 3458 A w/opt 002 Manufacturer Procedures
10 Hz to 20 Hz	> 100 mA to 1 A	0.4 % of reading + 200 μ A	
> 20 Hz to 45 Hz	> 100 mA to 1 A	0.16 % of reading + 200 μ A	
> 45 Hz to 100 Hz	> 100 mA to 1 A	0.08 % of reading + 200 μ A	
> 100 Hz to 5 kHz	> 100 mA to 1 A	0.1 % of reading + 200 μ A	
> 5 kHz to 20 kHz	> 100 mA to 1 A	0.3 % of reading + 200 μ A	
> 20 kHz to 50 kHz	> 100 mA to 1 A	1 % of reading + 400 μ A	
Equipment to Output AC Current (at the listed frequencies) ^{FO}			Fluke 5520A Manufacturer Procedures
10 Hz to 20 Hz	29 μ A to 330 μ A	0.4 % of reading + 0.08 μ A	
> 20 Hz to 45 Hz	29 μ A to 330 μ A	0.3 % of reading + 0.08 μ A	
> 45 Hz to 1 kHz	29 μ A to 330 μ A	0.25 % of reading + 0.08 μ A	
> 1 kHz to 5 kHz	29 μ A to 330 μ A	0.6 % of reading + 0.12 μ A	
> 5 kHz to 10 kHz	29 μ A to 330 μ A	1.6 % of reading + 0.16 μ A	
> 10 kHz to 30 kHz	29 μ A to 330 μ A	3.2 % of reading + 0.32 μ A	
Equipment to Output AC Current (at the listed frequencies) ^{FO}			Fluke 5520A Manufacturer Procedures
10 Hz to 20 Hz	> 330 μ A to 3.3 mA	0.4 % of reading + 0.12 μ A	
> 20 Hz to 45 Hz	> 330 μ A to 3.3 mA	0.25 % of reading + 0.12 μ A	
> 45 Hz to 1 kHz	> 330 μ A to 3.3 mA	0.2 % of reading + 0.12 μ A	
> 1 kHz to 5 kHz	> 330 μ A to 3.3 mA	0.4 % of reading + 0.12 μ A	
> 5 kHz to 10 kHz	> 330 μ A to 3.3 mA	1 % of reading + 0.24 μ A	
> 10 kHz to 30 kHz	> 330 μ A to 3.3 mA	2 % of reading + 0.48 μ A	



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Equipment to Output AC Current (at the listed frequencies) ^{FO}			Fluke 5520A Manufacturer Procedures
10 Hz to 20 Hz	> 3.3 mA to 33 mA	0.36 % of reading + 1.6 μ A	
> 20 Hz to 45 Hz	> 3.3 mA to 33 mA	0.18 % of reading + 1.6 μ A	
> 45 Hz to 1 kHz	> 3.3 mA to 33 mA	0.08 % of reading + 1.6 μ A	
> 1 kHz to 5 kHz	> 3.3 mA to 33 mA	0.16 % of reading + 1.6 μ A	
> 5 kHz to 10 kHz	> 3.3 mA to 33 mA	0.4 % of reading + 2.4 μ A	
> 10 kHz to 30 kHz	> 3.3 mA to 33 mA	0.8 % of reading + 3.2 μ A	
Equipment to Output AC Current (at the listed frequencies) ^{FO}			
10 Hz to 20 Hz	> 33 mA to 330 mA	0.36 % of reading + 16 μ A	
> 20 Hz to 45 Hz	> 33 mA to 330 mA	0.18 % of reading + 16 μ A	
> 45 Hz to 1 kHz	> 33 mA to 330 mA	0.08 % of reading + 16 μ A	
> 1 kHz to 5 kHz	> 33 mA to 330 mA	0.2 % of reading + 40 μ A	
> 5 kHz to 10 kHz	> 33 mA to 330 mA	0.4 % of reading + 80 μ A	
> 10 kHz to 30 kHz	> 33 mA to 330 mA	0.8 % of reading + 160 μ A	
Equipment to Output AC Current (at the listed frequencies) ^{FO}			
10 Hz to 45 Hz	> 330 mA to 1.1 A	0.36 % of reading + 80 μ A	
> 45 Hz to 1 kHz	> 330 mA to 1.1 A	0.1 % of reading + 80 μ A	
> 1 kHz to 5 kHz	> 330 mA to 1.1 A	1.2 % of reading + 800 μ A	
> 5 kHz to 10 kHz	> 330 mA to 1.1 A	5 % of reading + 4 000 μ A	
Equipment to Output AC Current (at the listed frequencies) ^{FO}			
10 Hz to 45 Hz	> 1.1 A to 3 A	0.36 % of reading + 80 μ A	
> 45 Hz to 1 kHz	> 1.1 A to 3 A	0.12 % of reading + 80 μ A	
> 1 kHz to 5 kHz	> 1.1 A to 3 A	1.2 % of reading + 800 μ A	
> 5 kHz to 10 kHz	> 1.1 A to 3 A	5 % of reading + 4 000 μ A	



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Equipment to Output AC Current (at the listed frequencies) ^{FO}			Fluke 5520A Manufacturer Procedures
45 Hz to 100 Hz	> 3 A to 11 A	0.12 % of reading + 1 600 μ A	
> 100 Hz to 1 kHz	> 3 A to 11 A	0.2 % of reading + 1 600 μ A	
> 1 kHz to 5 kHz	> 3 A to 11 A	6 % of reading + 1 600 μ A	
Equipment to Output AC Current (at the listed frequencies) ^{FO}			
45 Hz to 100 Hz	> 11 A to 20.5 A	0.24 % of reading + 4 000 μ A	
> 100 Hz to 1 kHz	> 11 A to 20.5 A	0.3 % of reading + 4 000 μ A	
> 1 kHz to 5 kHz	> 11 A to 20.5 A	6 % of reading + 4 000 μ A	
Equipment to Output AC Current (at the listed frequencies) ^{FO}			5520A and 5500 A Coil Manufacturer Procedures
45 to 65 Hz	10 A to 16.5 A	0.45 % of reading + 0.01A	
> 45 to 65 Hz	> 16.5 A to 145 A	0.40 % of reading + 0.03A	
> 45 to 65 Hz	> 145 A to 1 025 A	0.45 % of reading + 0.1A	
> 65 to 440 Hz	> 10 A to 16.5 A	0.94 % of reading + 0.02A	
> 65 to 440 Hz	> 16.5 A to 145 A	0.94 % of reading + 0.06A	
> 65 to 440 Hz	> 145 A to 1 025 A	0.98 % of reading + 0.21A	
Equipment to Output Levelled Sine Wave (at the listed frequencies) ^{FO}			Fluke 5520A/SC1100 Manufacturer Procedures
50 kHz Reference Amplitude ^{FO}	50 kHz to 100 MHz	2.8 % of reading + 233 μ V	
	> 100 MHz to 300 MHz	3.1 % of reading + 233 μ V	
	> 300 MHz to 600 MHz	4.7 % of reading + 233 μ V	
5 mV (pk-pk) to 5 V (pk-pk) Relative to 50 kHz Reference Flatness ^{FO}	50 kHz to 100 MHz	1.2 % of reading + 78 μ V	
	> 100 MHz to 300 MHz	1.6 % of reading + 78 μ V	
	> 300 MHz to 600 MHz	3.1 % of reading + 78 μ V	
Equipment to Output Capacitance ^{FO}			Fluke 5520A Manufacturer Procedures
	0.19 nF to 0.399 9 nF	0.39 % of reading + 0.008 nF	
	0.4 nF to 1.099 9 nF	0.39 % of reading + 0.008 nF	
	1.1 nF to 3.299 9 nF	0.39 % of reading + 0.008 nF	
	3.3 nF to 10.999 9 nF	0.19 % of reading + 0.008 nF	
	11 nF to 32.999 9 nF	0.19 % of reading + 0.08 nF	
	33 nF to 109.999 nF	0.19 % of reading + 0.08 nF	
	110 nF to 329.999 nF	0.19 % of reading + 0.23 nF	
	0.33 μ F to 1.099 99 μ F	0.19 % of reading + 0.8 nF	
	1.1 μ F to 3.299 99 μ F	0.19 % of reading + 2.3 nF	



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Equipment to Output Capacitance ^{FO}	3.3 μ F to 10.999 9 μ F	0.19 % of reading + 7.8 nF	Fluke 5520A Manufacturer Procedures
	11 μ F to 32.999 9 μ F	0.31 % of reading + 23 nF	
	33 μ F to 109.999 μ F	0.34 % of reading + 78 nF	
	110 μ F to 329.999 μ F	0.35 % of reading + 233 nF	
	0.33 mF to 1.099 99 mF	0.35 % of reading + 0.8 μ F	
	1.1 mF to 3.299 9 mF	0.35 % of reading + 2 μ F	
	3.3 mF to 10.999 9 mF	0.35 % of reading + 8 μ F	
	11 mF to 32.999 9 mF	0.58 % of reading + 23 μ F	
33 mF to 110 mF	0.85 % of reading + 78 μ F		
Vertical Gain (at the listed frequencies) ^{FO}			Fluke 5520A/SC1100 Manufacturer Procedures
DC Into 50 Ω	0.000 093 V to 6.6 V	0.19 % of reading + 31 μ V	
DC Into 1 M Ω	0.000 093 V to 130 V	0.04 % of reading + 31 μ V	
AC Into 50 Ω	1 mV _(pk-pk) to 6.6 V _(pk-pk)	0.19 % of reading + 78 μ V	
AC Into 1 M Ω	1 mV _(pk-pk) to 130 V _(pk-pk)	0.08 % of reading + 31 μ V	
Time Markers Into 50 Ω ^{FO}	5 s to 50 ms	(20 + 775T) μ s/s	
	20 ms to 100 ns	2 μ s/s	
	30 ns to 20 ns	2 μ s/s	
	10 ns	2 μ s/s	
	5 ns to 2 ns	2 μ s/s	
Equipment to Output Rise Time 5 mV _(pk-pk) to 2.5 V _(pk-pk) (at the listed frequencies) ^{FO}			
Up to 2 MHz	Up to 300 ps	-100 ps	
2 MHz to 10 MHz	Up to 350 ps	-100 ps	
Equipment to Output DC Power ^{FO}	33 mV to 1 020 V	0.023 % watts output	Multi-Function Calibrator
	0.33 mA to 2.999 A		
	33 mV to 1 020 V	0.060 % watts output	
	3 A to 20.5 A		



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Equipment to Output AC Power- ^{FO}	33 mV to 329.999 mV	.11 % watts output	Multi-Function Calibrator
	3.3 mA to 8.999 mA		
	330 mV to 1 020 V	0.097 % watts output	
	3.3 mA to 8.999 mA	0.091 % watts output	
	33 mV to 329.999 mV		
	9 mA to 32.999 mA	0.075 % watts output	
	330 mV to 1 020 V		
	9 mA to 32.999 mA	0.11 % watts output	
	33 mV to 329.999 mV		
	33 mA to 89.99 mA	0.097 % watts output	
	330 mV to 1 020 V		
	33 mA to 89.99 mA	0.085 % watts output	
	33 mV to 329.999 mV		
	90 mA to 329.00 mA	0.068 % watts output	
	330 mV to 1 020 V		
	90 mA to 329.00 mA	0.110 % watts output	
	33 mV to 329.999 mV		
	0.33 A to 0.8999 A	0.094 % watts output	
	330 mV to 1 020 V		
	0.33 A to 0.8999 A	0.094 % watts output	
	33 to 329.999 mV		
	0.9 A to 2.19 A	0.077 % watts output	
	330 mV to 1 020 V		
	0.9 A to 2.19 A	0.110 % watts output	
	33 mV to 329.999 mV		
	2.2 A to 4.49 A	0.102 % watts output	
	330 mV to 1 020 V		
	2.2 A to 4.49 A	0.094 % watts output	
	33 mV to 329.999 mV		
	4.5 A to 11 A	0.085 % watts output	
330 mV to 1 020 V			
4.5 A to 11 A			



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Mechanical

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Balometer ^{FO}	0 inH ₂ O to 15 inH ₂ O	2.4 % of reading	Dead Weight Testers Manufacturer Procedure
Air Velocity Meters ^{FO}	30 SFM to 250 SFM	2.3 % of reading + 5.8 SFM	TSI Wind Tunnel Model 8390 Differential Pressure Method
	> 250 SFM to 1 500 SFM	2.3 % of reading + 25 SFM	
	> 1 500 SFM to 9 000 SFM	1.2 % of reading + 74 SFM	
Photometer-Leakage ^{FO}	0 % to 100 %	0.000 6 % of leakage	Picoamp source, flow meter, DMM Manufacturer Procedure
Pneumatic Pressure-Differential-Gages and Transducers ^{FO}	0 Torr to 10 Torr	0.073 % of reading	MKS Baratron ASME B40.100 Reference
	> 10 Torr to 100 Torr	0.064 % of reading	
Pneumatic Pressure-Absolute- Gages and Transducers ^{FO}	0 Torr to 10 Torr	0.21 % of reading	MKS system ASME B40.100 Reference
	> 10 Torr to 100 Torr	0.14 % of reading	
	> 100 Torr tp 1 000 Torr	0.093 % of reading	Ametek DWT ASME B40.100 Reference Mensor
	10 inH ₂ O to 550 inH ₂ O	0.018 % of reading	
	0 psia to 31.25 psia	0.004 5 psia	
	> 31.25 psia to 500 psia	0.012 % of reading	
Hydraulic-Gages and Transducers ^F	80 psi to 15 000 psi	0.012 %	Ruska deadweight tester ASME B40.100 Reference
Air Flow-Meters and Sensors ^{FO}	0.000 1 to 0.0002 SCFM	2.8 x 10 ⁻⁶ SCFM + 0.6R	ASQ-1 and Laminar Flow Elements Manufacturer Procedure
	>0.0002 SCFM to 0.0011 SCFM	1.2% of reading + 0.6R	
	0.005 to 0.048 SCFM	0.9 % of reading + 0.6R	
	0.158 to 1.634 SCFM	0.9 % of reading + 0.6R	
Piston Operated Volumetric Apparatus- Pipettes, Burettes, Titrators, Dispensers, Diluters ^{FO}	0.2 μ L to 1 μ L	0.013 μ L	Precision Balances Ultra Class Weights Gravimetric Method
	> 1 μ L to 2 μ L	0.014 μ L	
	> 2 μ L to 20 μ L	0.015 μ L	
	> 20 μ L to 100 μ L	0.16 μ L	
	>100 μ L to 200 μ L	0.16 μ L	
	> 200 μ L to 1 000 μ L	0.23 μ L	
	> 1 000 μ L to 5 000 μ L	0.23 μ L	
	> 5 000 μ L to 10 000 μ L	5.7 μ L	
> 10 000 to 50 000 μ L	17 μ L		



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Mechanical

Torque Wrenches and Sensors ^{FO}	1 in lbf to 10 in lbf	0.12 in lbf	Manufacturer's Procedure using Torque Transducers
	>1 in lbf to 100 in lbf	1.2 in lbf	
	>100 in lbf to 250 in lbf	2.9 in lbf	
	>20.8 ft lbf to 250 ft lbf	2.9 ft lbf	

Mass, Force, and Weighing Devices

MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE OR NOMINAL DEVICE SIZE AS APPROPRIATE	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY (\pm)	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED
Scales and Balances ^{FO}	0.024 mg to 500 mg	0.008 mg	Class 1 Weights ASTM E898 Reference
	> 500 mg to 2 g	0.034 mg	
	> 2 g to 20 g	0.039 mg	
	> 20 g to 30 g	0.047 mg	
	> 30 g to 150 g	0.18 mg	
	> 150 g to 600 g	2.5 mg	
	> 600 g to 800 g	12 mg	
	> 800 g to 2 000 g	13 mg	
	> 2 kg to 10 kg	60 mg	
	> 10 kg to 25 kg	2.5 mg	
> 25 kg to 60 kg	5.9 mg		

Thermodynamic

MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE OR NOMINAL DEVICE SIZE AS APPROPRIATE	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY (\pm)	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED
Relative Humidity – Meters and Sensors ^{FO}	Up to 30 % RH	0.63 % RH	Thunder Scientific 2500 Manufacturer Procedure
	> 30 % RH to 95 % RH	0.74 % RH	
Infrared Thermometers and Thermal Video Devices ^{FO}	Up to 100 °C	0.61 °C	Blackbodies Manufacturer Method
	> 100 °C to 300 °C	0.78 °C	
	> 300 °C to 500 °C	0.96 °C	
Equipment to Source Temperature ^{FO}	-196 °C	0.01 °C	PRT, Super thermometer Readouts and Baths Manufacturer Method
	-80 °C to -38 °C	0.015 °C	
	> -38 °C to -10 °C	0.02 °C	
	> -10 °C to 35 °C	0.014 °C	
	> 35 °C to 100 °C	0.02 °C	
	> 100 °C to 120 °C	0.017 °C	
	> 120 °C to 200 °C	0.012 °C	
	> 200 °C to 420 °C	0.021 °C	
	> 420 °C to 480 °C	0.52 °C	PRT, Superthermometer Readout and Dryblock Manufacturer Method
> 480 °C to 590 °C	0.86 °C		



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Equipment to Measure Temperature ^{FO}	-196 °C o -38.8 °C	0.009 2 °C	Burns PRT and Super thermometer Readout Manufacturer Method
	> -38.8 °C to 0 °C	0.008 6 °C	
	> 0 °C to 156 °C	0.009 2 °C	
	> 156 °C to 231 °C	0.009 9 °C	
	> 231 °C to 419 °C	0.02 °C	
	> 419 °C to 660 °C	0.14 °C	

Time & Frequency

MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE OR NOMINAL DEVICE SIZE AS APPROPRIATE	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY (\pm)	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED
Optical Tachometers ^{FO}	10 RPM to 300 RPM	0.001 RPM + 0.6 R RPM	Fluke 5520A Manufacturer Procedure
	> 300 RPM to 200 000 RPM	0.000 3 % of reading + 0.6 R RPM	
Equipment to Measure Frequency (Fixed Point) ^{FO}	10 MHz	(3.7 x 10 ⁻⁸) Hz	GPS, Fluke PM6681 Manufacturer Procedure
Frequency-Measure (Fixed Point) ^{FO}	10 MHz	(6.8 x 10 ⁻⁸) Hz	
Stopwatches ^{FO}	15 s to 24 hr	0.1 s	Timometer NIST 960-12

- The CMC (Calibration and Measurement Capability) stated for calibrations included on this scope of accreditation represents the smallest measurement uncertainty attainable by the laboratory when performing a more or less routine calibration of a nearly ideal device under nearly ideal conditions. It is typically expressed at a confidence level of 95 % using a coverage factor *k* (usually equal to 2). The actual measurement uncertainty associated with a specific calibration performed by the laboratory will typically be larger than the CMC for the same calibration since capability and performance of the device being calibrated and the conditions related to the calibration may reasonably be expected to deviate from ideal to some degree.



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2. The laboratories range of calibration capability for all disciplines for which they are accredited is the interval from the smallest calibrated standard to the largest calibrated standard used in performing the calibration. The low end of this range must be an attainable value for which the laboratory has or has access to the standard referenced. Verification of an indicated value of zero in the absence of a standard is common practice in the procedure for many calibrations but by its definition it does not constitute calibration of zero capacity.
3. The presence of a superscript F means that the laboratory performs calibration of the indicated parameter at its fixed location. Example: Outside Micrometer^F would mean that the laboratory performs this calibration at its fixed location.
4. The presence of a superscript O means that the laboratory performs calibration of the indicated parameter onsite at customer locations. Example: Outside Micrometer^O would mean that the laboratory performs this calibration onsite at the customer's location.
5. The presence of a superscript FO means that the laboratory performs calibration of the indicated parameter both at its fixed location and onsite at customer locations. Example: Outside Micrometer^{FO} would mean that the laboratory performs this calibration at its fixed location and onsite at customer locations.
6. Measurement uncertainties obtained for calibrations performed at customer sites can be expected to be larger than the measurement uncertainties obtained at the laboratories fixed location for similar calibrations. This is due to the effects of transportation of the standards and equipment and upon environmental conditions at the customer site which are typically not controlled as closely as at the laboratories fixed location.
7. The term T represents time in seconds as appropriate to the uncertainty statement.
8. The term L represents length in inches or millimeters as appropriate to the uncertainty statement.
9. The term R represents the resolution of the unit under test as appropriate to the uncertainty statement.