



# PERRY JOHNSON LABORATORY ACCREDITATION, INC.

## Certificate of Accreditation

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

***ENV Services, Inc./Pro-Lab***  
***4758 Research Drive, San Antonio, TX 78240***

*(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, Dimensional, Electrical, Light, 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:*

August 30, 2016

*Issue Date:*

January 18, 2023

*Expiration Date:*

February 28, 2025

*Accreditation No.:*

78961

*Certificate No.:*

L23-49-2

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](http://www.pjilabs.com)*

## 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 Measure (Carbon Dioxide) CO <sub>2</sub> <sup>FO</sup>	Up to 3%	0.76 % of reading	Manufacturer's Procedure using Comparison to Bacharach (O <sub>2</sub> /CO <sub>2</sub> ) and Vaisala (CO <sub>2</sub> ) Meters
	>3% to 5%	0.58 % of reading	
	>5% to 10%	1.3 % of reading	
	>10% to 15%	2.4 % of reading	
Equipment to Measure (Oxygen) O <sub>2</sub> <sup>FO</sup>	0 % to 100 %	0.67 % of reading	
Equipment to Source (Carbon Dioxide) CO <sub>2</sub> <sup>F</sup>	3 %	0.71%	Manufacturer's Procedure using Reference Calibration Gases
	5 %	0.51%	
	10%	1.3%	
	15%	0.51%	
Equipment to Source (Oxygen) O <sub>2</sub> <sup>F</sup>	10 %	0.52%	
	20.8%	0.65%	
Conductivity Meters	10 $\mu$ S	0.81 $\mu$ S	Manufacturer's Procedure using Standard Reference Materials
	100 $\mu$ S	2.2 $\mu$ S	
	1 000 $\mu$ S	5.2 $\mu$ S	
	10 mS	40 $\mu$ S	
	100 mS	370 $\mu$ S	
pH Meters <sup>FO</sup>	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 <sup>FO</sup>	0.01 in to 20 in	(220 + 22L) $\mu$ in	ENV Work Instruction 4372 Comparison to Gage Blocks
Micrometers <sup>FO</sup>	0.01 in to 20 in	(81 + 5.0L) $\mu$ in	

## 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 Output DC Voltage <sup>FO</sup>	0 mV to 330 mV	60 $\mu$ V/V + 3 $\mu$ V	Fluke 5500A Manufacturer Procedures
	>330 mV to 3.3 V	50 $\mu$ V/V + 5 $\mu$ V	
	> 3.3V to 33 V	50 $\mu$ V/V + 50 $\mu$ V	
	> 33 V to 330 V	55 $\mu$ V/V + 500 $\mu$ V	
	>330 V to 1 000 V	55 $\mu$ V/V + 1 500 $\mu$ V	
Equipment to Measure DC Voltage <sup>FO</sup>	10 mV to 100 mV	7 $\mu$ V/V + 3 $\mu$ V	Keysight 3458A w/opt 002 Manufacturer Procedures
	> 0.1 V to 1 V	8 $\mu$ V/V + 0.3 $\mu$ V	
	> 1 V to 10 V	8 $\mu$ V/V + 0.05 $\mu$ V	
	> 10 V to 100 V	9 $\mu$ V/V + 0.3 $\mu$ V	
	> 100 V to 1 000 V	9 $\mu$ V/V + 1.2 mV + 12 (V <sub>IN</sub> /1 000) <sup>2</sup>	



# Certificate of Accreditation: Supplement

## ENV Services, Inc./Pro-Lab

4758 Research Drive, San Antonio, TX 78240  
 Contact Name: Michael Parente Phone: 215-997-5080

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

### 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 DC Current <sup>FO</sup>	> 0 nA to 100 nA	35 $\mu$ A/A + 0.000 04 pA	Keysight 3458A w/opt 002 Manufacturer Procedures
	> 100 nA to 1 $\mu$ A	25 $\mu$ A/A + 0.000 04 pA	
	> 1 $\mu$ A to 10 $\mu$ A	25 $\mu$ A/A + 0.000 1 pA	
	> 10 $\mu$ A to 100 $\mu$ A	25 $\mu$ A/A + 0.000 8 pA	
	> 100 $\mu$ A to 1 mA	25 $\mu$ A/A + 0.005 nA	
	> 1 mA to 10 mA	26 $\mu$ A/A + 0.05 nA	
	> 10 mA to 100 mA	41 $\mu$ A/A + 0.5 $\mu$ A	
	> 100 mA to 1 A	120 $\mu$ A/A + 10 $\mu$ A	
Equipment to Measure DC Resistance <sup>FO</sup>	0 $\Omega$ to 10 $\Omega$	20 $\mu\Omega/\Omega$ + 0.000 05 $\mu\Omega$	Fluke 5500A Manufacturer Procedures
	> 10 $\Omega$ to 100 $\Omega$	15 $\mu\Omega/\Omega$ + 0.000 5 $\mu\Omega$	
	> 100 $\Omega$ to 1k $\Omega$	13 $\mu\Omega/\Omega$ + 0.000 5 $\mu\Omega$	
	> 1 k $\Omega$ to 10 k $\Omega$	13 $\mu\Omega/\Omega$ + 0.005 m $\Omega$	
	> 10 k $\Omega$ to 100 k $\Omega$	13 $\mu\Omega/\Omega$ + 0.05 m $\Omega$	
	> 100 k $\Omega$ to 1 M $\Omega$	18 $\mu\Omega/\Omega$ + 2 $\Omega$	
	> 1 M $\Omega$ to 10 M $\Omega$	53 $\mu\Omega/\Omega$ + 100 $\Omega$	
	> 10 M $\Omega$ to 100 M $\Omega$	150 $\mu\Omega/\Omega$ + 1 000 $\Omega$	
	> 100 M $\Omega$ to 1 G $\Omega$	5 100 $\mu\Omega/\Omega$ + 10 000 $\Omega$	
Equipment to Output DC Resistance <sup>FO</sup>	0 $\Omega$ to 11 $\Omega$	0.01% of output + 0.01 $\Omega$	Fluke 5500A Manufacturer Procedures
	> 11 $\Omega$ to 33 $\Omega$	0.01% of output + 0.015 $\Omega$	
	> 33 $\Omega$ to 110 $\Omega$	0.01% of output + 0.015 $\Omega$	
	> 110 $\Omega$ to 330 $\Omega$	0.01% of output + 0.02 $\Omega$	
	> 330 $\Omega$ to 1.1 k $\Omega$	0.01% of output + 0.06 $\Omega$	
	> 1.1 k $\Omega$ to 3.3 k $\Omega$	0.01% of output + 0.06 $\Omega$	
	> 3.3 k $\Omega$ to 11 k $\Omega$	0.01% of output + 0.6 $\Omega$	
	> 11 k $\Omega$ to 33 k $\Omega$	0.01% of output + 0.6 $\Omega$	
	> 33 k $\Omega$ to 110 k $\Omega$	0.01% of output + 6 $\Omega$	
	> 110 k $\Omega$ to 330 k $\Omega$	0.01% of output + 6 $\Omega$	
	> 330 k $\Omega$ to 1.1 M $\Omega$	0.02% of output + 55 $\Omega$	
	> 1.1 M $\Omega$ to 3.3 M $\Omega$	0.02% of output + 55 $\Omega$	
	> 3.3 M $\Omega$ to 11 M $\Omega$	0.06% of output + 550 $\Omega$	
	> 11 M $\Omega$ to 33 M $\Omega$	0.1% of output + 550 $\Omega$	
	> 33 M $\Omega$ to 110 M $\Omega$	0.5% of output + 5 500 $\Omega$	
> 110 M $\Omega$ to 330 M $\Omega$	0.5% of output + 16 500 $\Omega$		



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Equipment to Output DC Current <sup>FO</sup>	330 $\mu$ A to 3.3 mA	0.12 % + 0.05 $\mu$ A	Fluke 5500A Manufacturer Procedures
	> 3.3mA to 33 mA	0.01 % of output + 0.25 $\mu$ A	
	> 33 mA to 330 mA	0.01 % of output + 3.3 $\mu$ A	
	> 330 mA to 2.2 A	0.03 % of output + 44 $\mu$ A	Fluke 5500A and 5500A Coil Manufacturer Procedures
	> 2.2 A to 11 A	0.06 % of output + 330 $\mu$ A	
	> 20 A to 110 A	0.61 % of output + 1.1 A	
	> 110 A to 550 A	0.61 % of output + 1.2 A	
Temperature Calibration, Indication, and Control Equipment used with RTD Pt 385, 100 $\Omega$ <sup>FO</sup>	-200 $^{\circ}$ C to -80 $^{\circ}$ C	0.04 $^{\circ}$ C	Fluke 5500A Electrical Simulation of RTD Output Manufacturer Procedures
	> -80 $^{\circ}$ C to 0 $^{\circ}$ C	0.04 $^{\circ}$ C	
	> 0 $^{\circ}$ C to 100 $^{\circ}$ C	0.05 $^{\circ}$ C	
	> 100 $^{\circ}$ C to 300 $^{\circ}$ C	0.07 $^{\circ}$ C	
	> 300 $^{\circ}$ C to 400 $^{\circ}$ C	0.08 $^{\circ}$ C	
	> 400 $^{\circ}$ C to 630 $^{\circ}$ C	0.09 $^{\circ}$ C	
	> 630 $^{\circ}$ C to 800 $^{\circ}$ C	0.18 $^{\circ}$ C	
Temperature Calibration, Indication, and Control Equipment used with RTD Pt 3916, 100 $\Omega$ <sup>FO</sup>	-200 $^{\circ}$ C to -190 $^{\circ}$ C	0.19 $^{\circ}$ C	
	> -190 $^{\circ}$ C to -80 $^{\circ}$ C	0.03 $^{\circ}$ C	
	> -80 $^{\circ}$ C to 0 $^{\circ}$ C	0.04 $^{\circ}$ C	
	> 0 $^{\circ}$ C to 100 $^{\circ}$ C	0.05 $^{\circ}$ C	
	> 100 $^{\circ}$ C to 260 $^{\circ}$ C	0.05 $^{\circ}$ C	
	> 260 $^{\circ}$ C to 300 $^{\circ}$ C	0.06 $^{\circ}$ C	
	> 300 $^{\circ}$ C to 400 $^{\circ}$ C	0.07 $^{\circ}$ C	
	> 400 $^{\circ}$ C to 600 $^{\circ}$ C	0.08 $^{\circ}$ C	
Temperature Calibration, Indication and Control Equipment used with Thermocouple Type B <sup>FO</sup>	600 $^{\circ}$ C to 800 $^{\circ}$ C	0.34 $^{\circ}$ C	Fluke 5500A Electrical Simulation of Thermocouple Output Manufacturer Procedures
	800 $^{\circ}$ C to 1 000 $^{\circ}$ C	0.26 $^{\circ}$ C	
	1 000 $^{\circ}$ C to 1 550 $^{\circ}$ C	0.23 $^{\circ}$ C	
	1 550 $^{\circ}$ C to 1 820 $^{\circ}$ C	0.26 $^{\circ}$ C	
Temperature Calibration, Indication and Control Equipment used with Thermocouple Type C <sup>FO</sup>	0 $^{\circ}$ C to 150 $^{\circ}$ C	0.23 $^{\circ}$ C	
	150 $^{\circ}$ C to 650 $^{\circ}$ C	0.20 $^{\circ}$ C	
	650 $^{\circ}$ C to 1 000 $^{\circ}$ C	0.24 $^{\circ}$ C	
	1 000 $^{\circ}$ C to 1 800 $^{\circ}$ C	0.39 $^{\circ}$ C	



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Temperature Calibration, Indication, and Control Equipment used with Thermocouple Type E <sup>FO</sup>	-250 °C to -100 °C	0.55 °C	Fluke 5500A Electrical Simulation of Thermocouple Output Manufacturer Procedures
	> -100 °C to -25 °C	0.28 °C	
	> -25 °C to 350 °C	0.27 °C	
	> 350 °C to 650 °C	0.28 °C	
	> 650 °C to 1 000 °C	0.31 °C	
Temperature Calibration, Indication, and Control Equipment used with Thermocouple Type J <sup>FO</sup>	-210 °C to -100 °C	0.36 °C	Fluke 5500A Electrical Simulation of Thermocouple Output Manufacturer Procedures
	> -100 °C to -30 °C	0.28 °C	
	> -30 °C to 150 °C	0.27 °C	
	> 150 °C to 760 °C	0.29 °C	
	> 760 °C to 1 200 °C	0.33 °C	
Temperature Calibration, Indication, and Control Equipment used with Thermocouple Type K <sup>FO</sup>	-210 °C to -100 °C	0.40 °C	
	> -100 °C to -25 °C	0.29 °C	
	> -25 °C to 120 °C	0.28 °C	
	> 120 °C to 1 000 °C	0.35 °C	
	> 1 000 °C to 1 372 °C	0.46 °C	
Temperature Calibration, Indication and Control Equipment used with Thermocouple Type L <sup>FO</sup>	(-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 <sup>FO</sup>	-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 <sup>FO</sup>	0 °C to 250 °C	0.62 °C	
	> 250 °C to 400 °C	0.42 °C	
	> 400 °C to 1 000 °C	0.40 °C	
	> 1 000 °C to 1 767 °C	0.46 °C	



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Temperature Calibration, Indication, and Control Equipment used with Thermocouple Type S <sup>FO</sup>	0 °C to 250 °C	0.52 °C	Fluke 5500A Electrical Simulation of Thermocouple Output Manufacturer Procedures
	> 250 °C to 1 000 °C	0.43 °C	
	> 1 000 °C to 1 400 °C	0.44 °C	
	> 1 400 °C to 1 767 °C	0.43 °C	
Temperature Calibration, Indication, and Control Equipment used with Thermocouple Type T <sup>FO</sup>	-250 °C to -150 °C	0.67 °C	
	> -150 °C to 0 °C	0.33 °C	
	> 0 °C to 120 °C	0.28 °C	
	> 120 °C to 400 °C	0.27 °C	
Temperature Calibration, Indication, and Control Equipment used with Thermocouple Type U <sup>FO</sup>	-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) <sup>FO</sup>			Keysight 3458 A w/opt 002 Manufacturer Procedures
1 Hz to 40 Hz	1 mV to 10 mV	0.03 % of reading + 3 $\mu$ V	
> 40 Hz to 1 kHz	1 mV to 10 mV	0.02 % of reading + 1.1 $\mu$ V	
> 1 kHz to 20 kHz	1 mV to 10 mV	0.03 % of reading + 1.1 $\mu$ V	
> 20 kHz to 50 kHz	1 mV to 10 mV	0.1 % of reading + 1.1 $\mu$ V	
> 50 kHz to 100 kHz	1 mV to 10 mV	0.5 % of reading + 1.1 $\mu$ V	
> 100 kHz to 300 kHz	1 mV to 10 mV	4 % of reading + 2 $\mu$ V	





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Equipment to Measure AC Voltage (at the listed frequencies) <sup>FO</sup>			Keysight 3458 A w/opt 002 Manufacturer Procedures
1 Hz to 40 Hz	10 mV to 100 mV	0.01 % of reading + 4 $\mu$ V	
> 40 Hz to 1 kHz	10 mV to 100 mV	0.007 % of reading + 2 $\mu$ V	
> 1 kHz to 20 kHz	10 mV to 100 mV	0.014 % of reading + 2 $\mu$ V	
> 20 kHz to 50 kHz	10mV to 100 mV	0.03 % of reading + 2 $\mu$ V	
> 50 kHz to 100 kHz	10 mV to 100 mV	0.08 % of reading + 2 $\mu$ V	
> 100 kHz to 300 kHz	10 mV to 100 mV	0.3 % of reading + 10 $\mu$ V	
> 0.3 MHz to 1 MHz	10 mV to 100 mV	1.0 % of reading + 10 $\mu$ V	
> 1 MHz to 2 MHz	10 mV to 100 mV	1.5 % of reading + 10 $\mu$ V	
Equipment to Measure AC Voltage (at the listed frequencies) <sup>FO</sup>			
1 Hz to 40 Hz	> 100 mV to 1 V	0.007 % of reading + 40 $\mu$ V	
> 40 Hz to 1 kHz	> 100 mV to 1 V	0.007 % of reading + 20 $\mu$ V	
> 1 kHz to 20 kHz	> 100 mV to 1 V	0.014 % of reading + 20 $\mu$ V	
> 20 kHz to 50 kHz	> 100 mV to 1 V	0.03 % of reading + 20 $\mu$ V	
> 50 kHz to 100 kHz	> 100 mV to 1 V	0.08 % of reading + 20 $\mu$ V	
> 100 kHz to 300 kHz	> 100 mV to 1 V	0.3 % of reading + 100 $\mu$ V	
> 0.3 MHz to 1 MHz	> 100 mV to 1 V	1 % of reading + 100 $\mu$ V	
> 1 MHz to 2 MHz	> 100 mV to 1 V	1.5 % of reading + 100 $\mu$ V	
Equipment to Measure AC Voltage (at the listed frequencies) <sup>FO</sup>			
1 Hz to 40 Hz	> 1 V to 10 V	0.007 % of reading + 400 $\mu$ V	
> 40 Hz to 1 kHz	> 1 V to 10 V	0.007 % of reading + 200 $\mu$ V	
> 1 kHz to 20 kHz	> 1 V to 10 V	0.014 % of reading + 200 $\mu$ V	
> 20 kHz to 50 kHz	> 1 V to 10 V	0.03 % of reading + 200 $\mu$ V	
> 50 kHz to 100 kHz	> 1 V to 10 V	0.08 % of reading + 200 $\mu$ V	
> 100 kHz to 300 kHz	> 1 V to 10 V	0.30 % of reading + 1 mV	
> 0.3 MHz to 1 MHz	> 1 V to 10 V	1.0 % of reading + 1 mV	
> 1 MHz to 2 MHz	> 1 V to 10 V	1.5 % of reading + 1 mV	
Equipment to Measure AC Voltage (at the listed frequencies) <sup>FO</sup>			
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	



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Equipment to Measure AC Voltage (at the listed frequencies) <sup>F0</sup>			Keysight 3458 A w/opt 002 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	
60 Hz	1 000 V to 30 000 V	0.12 % of reading + 0.2 V + 0.6 R	
Equipment to Output AC Voltage (at the listed frequencies) <sup>F0</sup>			Fluke 5500A Manufacturer Procedures
10 Hz to 45 Hz	> 1 mV to 33 mV	0.36 % of output + 20 $\mu$ V	
> 45 Hz to 10 kHz	> 1 mV to 33 mV	0.17 % of output + 20 $\mu$ V	
> 10 kHz to 20 kHz	> 1 mV to 33 mV	0.20 % of output + 20 $\mu$ V	
> 20 kHz to 50 kHz	> 1 mV to 33 mV	0.25 % of output + 20 $\mu$ V	
> 50 kHz to 100 kHz	> 1 mV to 33 mV	0.35 % of output + 33 $\mu$ V	
> 100 kHz to 500 kHz	> 1 mV to 33 mV	1.0 % of output + 60 $\mu$ V	
Equipment to Output AC Voltage (at the listed frequencies) <sup>F0</sup>			
10 Hz to 45 Hz	> 33 mV to 330 mV	0.25 % of output + 50 $\mu$ V	
> 45 Hz to 10 kHz	> 33 mV to 330 mV	0.05 % of output + 20 $\mu$ V	
> 10 kHz to 20 kHz	> 33 mV to 330 mV	0.10 % of output + 20 $\mu$ V	
> 20 kHz to 50 kHz	> 33 mV to 330 mV	0.16 % of output + 40 $\mu$ V	
> 50 kHz to 100 kHz	> 33 mV to 330 mV	0.24 % of output + 170 $\mu$ V	
> 100 kHz to 500 kHz	> 33 mV to 330 mV	0.70 % of output + 330 $\mu$ V	
Equipment to Output AC Voltage (at the listed frequencies) <sup>F0</sup>			
10 Hz to 45 Hz	> 330 mV to 3.3 V	0.15 % of output + 250 $\mu$ V	
> 45 Hz to 10 kHz	> 330 mV to 3.3 V	0.03 % of output + 60 $\mu$ V	
> 10 kHz to 20 kHz	> 330 mV to 3.3 V	0.08 % of output + 60 $\mu$ V	
> 20 kHz to 50 kHz	> 330 mV to 3.3 V	0.14 % of output + 300 $\mu$ V	
> 50 kHz to 100 kHz	> 330 mV to 3.3 V	0.24 % of output + 1 700 $\mu$ V	
> 100 kHz to 500 kHz	> 330 mV to 3.3 V	0.50 % of output + 3 300 mV	





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Equipment to Output AC Voltage (at the listed frequencies) <sup>FO</sup>			Fluke 5500A Manufacturer Procedures
10 Hz to 45 Hz	> 3.3 V to 33 V	0.15 % of output + 2 500 $\mu$ V	
> 45 Hz to 10 kHz	> 3.3 V to 33 V	0.04 % of output + 600 $\mu$ V	
> 10 kHz to 20 kHz	> 3.3 V to 33 V	0.08 % of output + 2 600 $\mu$ V	
> 20 kHz to 50 kHz	> 3.3 V to 33 V	0.19 % of output + 5 000 $\mu$ V	
> 50 kHz to 100 kHz	> 3.3 V to 33 V	0.24 % of output + 17 000 $\mu$ V	
Equipment to Output AC Voltage (at the listed frequencies) <sup>FO</sup>			
45 Hz to 1 kHz	> 33 V to 330 V	0.05 % of output + 6.6 mV	
> 1 kHz to 10 kHz	> 33 V to 330 V	0.08 % of output + 15 mV	
> 10 kHz to 20 kHz	> 33 V to 330 V	0.09 % of output + 33 mV	
Equipment to Output AC Voltage (at the listed frequencies) <sup>FO</sup>			
45 Hz to 1 kHz	> 330 V to 1 000 V	0.05 % of output + 80 mV	
> 1 kHz to 5 kHz	> 330 V to 1 000 V	0.2 % of output + 100 mV	
> 5 kHz to 10 kHz	> 330 V to 1 000 V	0.2 % of output + 500 mV	
Equipment to Measure AC Current (at the listed frequencies) <sup>FO</sup>			Keysight 3458 A w/opt 002 Manufacturer Procedures
10 Hz to 20 Hz	5 $\mu$ A to 100 $\mu$ A	0.4 % of reading + 30 nA	
> 20 Hz to 45 Hz	5 $\mu$ A to 100 $\mu$ A	0.15 % of reading + 30 nA	
> 45 Hz to 100 Hz	5 $\mu$ A to 100 $\mu$ A	0.06 % of reading + 30 nA	
> 100 Hz to 5 kHz	5 $\mu$ A to 100 $\mu$ A	0.06 % of reading + 30 nA	
Equipment to Measure AC Current (at the listed frequencies) <sup>FO</sup>			
10 Hz to 20 Hz	> 100 $\mu$ A to 1 mA	0.4 % of reading + 200 nA	
> 20 Hz to 45 Hz	> 100 $\mu$ A to 1 mA	0.15 % of reading + 200 nA	
> 45 Hz to 100 Hz	> 100 $\mu$ A to 1 mA	0.06 % of reading + 200 nA	
> 100 Hz to 5 kHz	> 100 $\mu$ A to 1 mA	0.03 % of reading + 200 nA	
> 5 kHz to 20 kHz	> 100 $\mu$ A to 1 mA	0.06 % of reading + 200 nA	
> 20 kHz to 50 kHz	> 100 $\mu$ A to 1 mA	0.4 % of reading + 400 nA	
> 50 kHz to 100 kHz	> 100 $\mu$ A to 1 mA	0.55 % of reading + 1.5 nA	



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## ENV Services, Inc./Pro-Lab

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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) <sup>FO</sup>			Keysight 3458 A w/opt 002 Manufacturer Procedures
10 Hz to 20 Hz	> 1 mA to 10 mA	0.4 % of reading + 2 $\mu$ A	
> 20 Hz to 45 Hz	> 1 mA to 10 mA	0.15 % of reading + 2 $\mu$ A	
> 45 Hz to 100 Hz	> 1 mA to 10 mA	0.06 % of reading + 2 $\mu$ A	
> 100 Hz to 5 kHz	> 1 mA to 10 mA	0.03 % of reading + 2 $\mu$ A	
> 5 kHz to 20 kHz	> 1 mA to 10 mA	0.06 % of reading + 2 $\mu$ A	
> 20 kHz to 50 kHz	> 1 mA to 10 mA	0.4 % of reading + 4 $\mu$ A	
> 50 kHz to 100 kHz	> 1 mA to 10 mA	0.55 % of reading + 15 $\mu$ A	
Equipment to Measure AC Current (at the listed frequencies) <sup>FO</sup>			Keysight 3458 A w/opt 002 Manufacturer Procedures
10 Hz to 20 Hz	> 10 mA to 100 mA	0.4 % of reading + 20 $\mu$ A	
> 20 Hz to 45 Hz	> 10 mA to 100 mA	0.15 % of reading + 20 $\mu$ A	
> 45 Hz to 100 Hz	> 10 mA to 100 mA	0.06 % of reading + 20 $\mu$ A	
> 100 Hz to 5 kHz	> 10 mA to 100 mA	0.03 % of reading + 20 $\mu$ A	
> 5 kHz to 20 kHz	> 10 mA to 100 mA	0.06 % of reading + 20 $\mu$ A	
> 20 kHz to 50 kHz	> 10 mA to 100 mA	0.4 % of reading + 40 $\mu$ A	
> 50 kHz to 100 kHz	> 10 mA to 100 mA	0.55 % of reading + 150 $\mu$ A	
Equipment to Measure AC Current (at the listed frequencies) <sup>FO</sup>			Keysight 3458 A w/opt 002 Manufacturer Procedures
10 Hz to 20 Hz	> 100 mA to 1 A	0.4 % of reading + 200 $\mu$ A	
> 20 Hz to 45 Hz	> 100 mA to 1 A	0.16 % of reading + 200 $\mu$ A	
> 45 Hz to 100 Hz	> 100 mA to 1 A	0.08 % of reading + 200 $\mu$ A	
> 100 Hz to 5 kHz	> 100 mA to 1 A	0.1 % of reading + 200 $\mu$ A	
> 5 kHz to 20 kHz	> 100 mA to 1 A	0.3 % of reading + 200 $\mu$ A	
Equipment to Output AC Current (at the listed frequencies) <sup>FO</sup>			Fluke 5500A Manufacturer Procedures
10 Hz to 20 Hz	29 $\mu$ A to 330 $\mu$ A	0.31 % of output + 0.15 $\mu$ A	
> 20 Hz to 45 Hz	29 $\mu$ A to 330 $\mu$ A	0.22 % of output + 0.15 $\mu$ A	
> 45 Hz to 1 kHz	29 $\mu$ A to 330 $\mu$ A	0.22 % of output + 0.25 $\mu$ A	
> 1 kHz to 5 kHz	29 $\mu$ A to 330 $\mu$ A	0.44% of output + 0.15 $\mu$ A	
> 5 kHz to 10 kHz	29 $\mu$ A to 330 $\mu$ A	1.3 % of output + 0.15 $\mu$ A	



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Equipment to Output AC Current (at the listed frequencies) <sup>F0</sup>			Fluke 5500A Manufacturer Procedures
10 Hz to 20 Hz	> 330 $\mu$ A to 3.3 mA	0.2 % of output + 0.3 $\mu$ A	
> 20 Hz to 45 Hz	> 330 $\mu$ A to 3.3 mA	0.1 % of output + 0.3 $\mu$ A	
> 45 Hz to 1 kHz	> 330 $\mu$ A to 3.3 mA	0.1 % of output + 0.3 $\mu$ A	
> 1 kHz to 5 kHz	> 330 $\mu$ A to 3.3 mA	0.2 % of output + 0.3 $\mu$ A	
> 5 kHz to 10 kHz	> 330 $\mu$ A to 3.3 mA	0.6 % of output + 0.3 $\mu$ A	
Equipment to Output AC Current (at the listed frequencies) <sup>F0</sup>			
10 Hz to 20 Hz	> 3.3 mA to 33 mA	0.2 % of output + 3 $\mu$ A	
> 20 Hz to 45 Hz	> 3.3 mA to 33 mA	0.1 % of output + 3 $\mu$ A	
> 45 Hz to 1 kHz	> 3.3 mA to 33 mA	0.09 % of output + 3 $\mu$ A	
> 1 kHz to 5 kHz	> 3.3 mA to 33 mA	0.2 % of output + 3 $\mu$ A	
> 5 kHz to 10 kHz	> 3.3 mA to 33 mA	0.6 % of output + 3 $\mu$ A	
Equipment to Output AC Current (at the listed frequencies) <sup>F0</sup>			
10 Hz to 20 Hz	> 33 mA to 330 mA	0.2 % of output + 30 $\mu$ A	
> 20 Hz to 45 Hz	> 33 mA to 330 mA	0.1 % of output + 30 $\mu$ A	
> 45 Hz to 1 kHz	> 33 mA to 330 mA	0.09 % of output + 30 $\mu$ A	
> 1 kHz to 5 kHz	> 33 mA to 330 mA	0.2 % of output + 30 $\mu$ A	
> 5 kHz to 10 kHz	> 33 mA to 330 mA	0.6 % of output + 30 $\mu$ A	
Equipment to Output AC Current (at the listed frequencies) <sup>F0</sup>			
10 Hz to 45 Hz	> 330 mA to 2.2 A	0.2 % of output + 300 $\mu$ A	
> 45 Hz to 1 kHz	> 330 mA to 2.2 A	0.1 % of output + 300 $\mu$ A	
> 1 kHz to 5 kHz	> 330 mA to 2.2 A	0.75 % of output + 300 $\mu$ A	
Equipment to Output AC Current (at the listed frequencies) <sup>F0</sup>			
45 Hz to 65 Hz	> 2.2 A to 11 A	0.06 % of output + 2 000 $\mu$ A	
> 65 Hz to 500 Hz	> 2.2 A to 11 A	0.1 % of output + 2 000 $\mu$ A	
> 500 Hz to 1 kHz	> 2.2 A to 11 A	0.33 % of output + 2 000 $\mu$ A	



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### Electrical

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Equipment to Output AC Current (at the listed frequencies) <sup>FO</sup>			Fluke 5500A and 5500 A Coil Manufacturer Procedures
45 to 65 Hz	>11 A to 16.5 A	1.2 % of output + 0.29 A	
> 65 to 440 Hz	> 16.5A to 550 A	1.5 % of output + 0.29 A	
45 to 65 Hz	> 11 A to 16.5 A	1.2 % of output + 1.0 A	
> 65 to 440 Hz	> 16.5 A to 550 A	1.5 % of output + 1.0 A	
Oscilloscopes <sup>FO</sup> (at the listed frequencies)			Fluke 5500A/SC300 Manufacturer Procedures
Leveled Sine Wave-Generate 50kHz (Reference)	50 kHz	2 % of output + 200 $\mu$ V	
	50 kHz to 100 MHz	3.5 % of output + 300 $\mu$ V	
	100 MHz to 300 MHz	4 % of output + 300 $\mu$ V	
5 mV to 5.5V			
5 mV <sub>(pk-pk)</sub> to 5 V <sub>(pk-pk)</sub> Relative to 50 kHz Reference Flatness	50 kHz to 100 MHz	1.5 % of output + 100 $\mu$ V	
	> 100 MHz to 300 MHz	2 % of output + 100 $\mu$ V	
DC Into 50 $\Omega$	(0 to 2.2) V	0.25 % of output + 100 $\mu$ V	
Vertical Gain (at the listed frequencies) <sup>FO</sup>			
DC Into 1 M $\Omega$	(0 to 33) V	0.25 % of output + 100 $\mu$ V	
AC Into 50 $\Omega$	4.5 mV <sub>(pk-pk)</sub> to 2.75 V <sub>(pk-pk)</sub>	2 % of output + 200 $\mu$ V	
Time Markers Into 50 $\Omega$ <sup>FO</sup>	5 s to 100 $\mu$ s	(25 + 1 000t) $\mu$ s/s	
	50 $\mu$ s to 2 $\mu$ s	(25 + 15 000t) $\mu$ s/s	
	1 $\mu$ s to 20 ns	25 $\mu$ s/s	
	10 ns to 2 ns	25 $\mu$ s/s	
Equipment to Output Capacitance <sup>FO</sup>	0.19 nF to 0.399 9 nF	0.5 % of output + 0.01 nF	Fluke 5500A Manufacturer Procedures
	0.4 nF to 1.099 9 nF	0.5 % of output + 0.01 nF	
	1.1 nF to 3.299 9 nF	0.5 % of output + 0.01 nF	
	3.3 nF to 10.999 9 nF	0.5 % of output + 0.01 nF	
	11 nF to 32.999 9 nF	0.25 % of output + 0.1 nF	
	33 nF to 109.999 nF	0.25 % of output + 0.1 nF	
	110 nF to 329.999 nF	0.25 % of output + 0.3 nF	
	0.33 $\mu$ F to 1.099 99 $\mu$ F	0.25 % of output + 1 nF	
1.1 $\mu$ F to 3.299 99 $\mu$ F	0.35 % of output + 3 nF		



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### Electrical

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Equipment to Output Capacitance <sup>O</sup>	3.3 $\mu$ F to 10.999 9 $\mu$ F	0.35 % of output + 10 nF	Fluke 5500A Manufacturer Procedures
	11 $\mu$ F to 32.999 9 $\mu$ F	0.4 % of output + 30 nF	
	33 $\mu$ F to 109.999 $\mu$ F	0.5 % of output + 100 nF	
	110 $\mu$ F to 329.999 $\mu$ F	0.7 % of output + 300 nF	
	0.33 mF to 1.099 99 mF	1 % of output + 300 $\mu$ F	

### Mechanical

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
Air Velocity Meters <sup>FO</sup>	30 SFM to 250 SFM	2.3 % of reading + 2.4 SFM	Differential Pressure Method using TSI wind tunnel model 400A
	> 250 SFM to 1 500 SFM	2.3 % of reading + 5.8 SFM	
	> 1 500 SFM to 9 000 SFM	1.2 % of reading + 5.8 SFM	
Photometer-Leakage <sup>F</sup>	0 % to 100 %	0.000 6 % of leakage	Picoamp source, flow meter, DMM Manufacturer Procedure
Pressure Gauges <sup>FO</sup>	Up to 10 Torr	0.13 % of reading	MKS System
	(>10 to 100) Torr	0.14 % of reading	
	(>100 to 1 000) Torr	0.093 % of reading	
	HQS Pressure Modules	(>0 to 0.5) inH <sub>2</sub> O	0.00042 inH <sub>2</sub> O
		(>0.5 to 1) inH <sub>2</sub> O	0.0016 inH <sub>2</sub> O
		(>1 to 5) inH <sub>2</sub> O	0.0036 inH <sub>2</sub> O
		(>5 to 10) inH <sub>2</sub> O	0.0023 inH <sub>2</sub> O
		(>10 to 860) inH <sub>2</sub> O	0.017 % of reading
		Up to 25 psia	0.004 psia
		(>25 to 500) psia	0.015% of reading
		Up to 2 000 psi	1.5 psi
ASME B40.100 Reference	(>2 000 to 5 000) psi	3.3 psi	
Torque Wrenches <sup>FO</sup>	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	



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### Mechanical

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Pipettes <sup>FO</sup>	0.2 $\mu$ L to 1 $\mu$ L	0.013 $\mu$ L	Mettler-Toledo Precision Balances Ultra-Class Weights  Gravimetric Method
	1 $\mu$ L to 2 $\mu$ L	0.12 $\mu$ L	
	2 $\mu$ L to 20 $\mu$ L	0.13 $\mu$ L	
	10 $\mu$ L to 100 $\mu$ L	0.18 $\mu$ L	
	100 $\mu$ L to 200 $\mu$ L	0.3 $\mu$ L	
	200 $\mu$ L to 1 000 $\mu$ L	1.2 $\mu$ L	
	1 000 $\mu$ L to 5 000 $\mu$ L	1.7 $\mu$ L	
	5 000 $\mu$ L to 10 000 $\mu$ L	5.7 $\mu$ L	
Particle Counters – Flow <sup>FO</sup>	Up to 200 l/m	2.4 % of reading + 0.04 l/m	Mass Flow Meter ISO 21501
Particle Counters- Particle Size <sup>F</sup>	0.3 $\mu$ m, 0.4 $\mu$ m, 0.5 $\mu$ m, 1 $\mu$ m, 3 $\mu$ m 5 $\mu$ m, 10 $\mu$ m	2.8 % of reading	Spheres Voltmeter ISO 21501
Particle Counters- Counting Efficiency <sup>F</sup>	(0.24 to 0.9) $\mu$ m 50% Counting Efficiency 100% Counting Efficiency	3.5 % reading 4.8 % reading	Reference Particle Counter using ISO21501
Air Flow <sup>F</sup>	0.007 6 to 0.0558 SCFM	1.3% reading + 0.6R	Manufacturer's Procedure using Laminar Flow Elements and Pressure Module
	0.156 to 1.72 SCFM	0.99 % reading + 0.6R	

### 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 <sup>FO</sup>	Up 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	





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### 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
Infrared Thermometers and Thermal Video Devices <sup>F</sup>	-30 °C to 150 °C	0.49 °C	Blackbodies Manufacturer Method
	> 150 °C to 300 °C	0.78 °C	
	> 300 °C to 500 °C	0.96 °C	
Relative Humidity – Meters and Sensors <sup>FO</sup>	Up to 30 % RH	0.39 % RH + 0.6R	Thunder Scientific 2500 Manufacturer Method
	> 30 % RH to 95 % RH	0.57 % RH + 0.6R	
Equipment to Source Temperature <sup>FO</sup>	-80 °C to -30 °C	0.015 °C	Fluke 5628 PRT with Fluke 1529-R Readout Baths Manufacturer Method
	-30 °C to 125 °C	0.063 °C	
	125 °C to 419 °C	0.084 °C	
	419 °C to 660 °C	0.19 °C	
Equipment to Measure Temperature <sup>FO</sup>	-196 °C to -38.8 °C	0.009 2 °C	Fluke 5628 PRT with Fluke 1529-R Readout Manufacturer Method
	-38.8 °C to 0 °C	0.008 6 °C	
	0 °C to 156 °C	0.0092 °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	

### Optical

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
Light Meters <sup>FO</sup>	1 fc to 50 fc	2.3 % reading + 1.8 fc	Master Light Meter INS DX-200 Handbook of Photometry Method
	50 fc to 150 fc	2.3 % reading + 3.6 fc	
	150 fc to 500 fc	2.3 % reading + 11 fc	
	500 fc to 1 000 fc	2.3 % reading + 22 fc	
	1 000 fc to 1 500 fc	2.3 % reading + 32 fc	



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### Time & Frequency

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Optical Tachometers <sup>FO</sup>	10 RPM to 300 RPM	0.001 RPM + 0.6 R RPM	Fluke 5500A Various Manufacturer Procedures
	> 300 RPM to 200 000 RPM	0.000 3 % of reading + 0.6 R RPM	
Equipment to Measure Frequency (Fixed Point) <sup>FO</sup>	10 MHz	$(3.7 \times 10^{-8})$ Hz	GPS, Fluke PM6681 Various Manufacturer Procedures
Frequency-Measure (Fixed Point) <sup>FO</sup>	10 MHz	$(6.8 \times 10^{-8})$ Hz	
Stopwatches <sup>FO</sup>	15 s to 24 hr.	0.05 s /day	Timometer NIST 960-12 Reference

1. 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.
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<sup>F</sup> 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<sup>O</sup> 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<sup>FO</sup> would mean that the laboratory performs this calibration at its fixed location and onsite at customer locations.



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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.

