



# CERTIFICATE OF ACCREDITATION

**The ANSI National Accreditation Board**

Hereby attests that

**Garber Metrology Weighing Solutions &  
Precision Calibration**

**520 E. Oregon Road  
Lititz, PA 17543**

Fulfills the requirements of

**ISO/IEC 17025:2017**

and national standard

**ANSI/NCSL Z540-1-1994 (R2002)**

In the field of

**CALIBRATION**

This certificate is valid only when accompanied by a current scope of accreditation document.  
The current scope of accreditation can be verified at [www.anab.org](http://www.anab.org).

A handwritten signature in black ink, appearing to read 'R. Douglas Leonard Jr.', is positioned above a horizontal line.

R. Douglas Leonard Jr., VP, PILR SBU

Expiry Date: 26 January 2023

Certificate Number: AC-1255



This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017.  
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 April 2017).

**SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017  
AND ANSI/NCSL Z540-1-1994 (R2002)**

**Garber Metrology Weighing Solutions & Precision Calibration**

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**CALIBRATION**

Valid to: **January 26, 2023**

Certificate Number: **AC-1255**

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Source <sup>1</sup>	Up to 329.999 9 mV (0.33 to 3.299 99) V (3.3 to 32.999 99) V (30 to 329.999 9) V (100 to 1 020) V	18 $\mu$ V/V + 1 $\mu$ V 11 $\mu$ V/V + 2 $\mu$ V 11 $\mu$ V/V + 20 $\mu$ V 16 $\mu$ V/V + 150 $\mu$ V 17 $\mu$ V/V + 1.5 mV	Fluke 5522A Multiproduct Calibrator
DC Voltage - Measure	(0 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V (100 to 1 000) V	12 $\mu$ V/V + 0.5 $\mu$ V 9.1 $\mu$ V/V + 0.4 $\mu$ V 7.8 $\mu$ V/V + 3 $\mu$ V 9.6 $\mu$ V/V + 50 $\mu$ V 19 $\mu$ V/V + 500 $\mu$ V	HP 3458A 8.5 Digit Multimeter
DC High Voltage – Measure	(1 to 5) kV	0.05 % of reading	Vitrek 4700 High Voltage Meter
DC Current – Source <sup>1</sup>	(0 to 329.999 9) $\mu$ A (0 to 3.299 99) mA (0 to 32.999 9) mA (0 to 329.999) mA (0 to 1.099 99) A (1.1 to 2.999 9) A (0 to 10.999 9) A (11 to 20.5) A	120 $\mu$ A/A + 20 nA 80 $\mu$ A/A + 50 nA 80 $\mu$ A/A + 0.3 $\mu$ A 80 $\mu$ A/A + 2.5 $\mu$ A 160 $\mu$ A/A + 40 $\mu$ A 300 $\mu$ A/A + 40 $\mu$ A 400 $\mu$ A/A + 500 $\mu$ A 800 $\mu$ A/A + 750 $\mu$ A	Fluke 5522A Multiproduct Calibrator
DC Current Measure	Up to 100 nA (0.1 to 1) $\mu$ A (1 to 10) $\mu$ A (10 to 100) $\mu$ A (0.1 to 10) mA	500 $\mu$ A/A 69 $\mu$ A/A 34 $\mu$ A/A 32 $\mu$ A/A 28 $\mu$ A/A	HP 3458A 8.5 Digit Multimeter



ANSI National Accreditation Board

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current Measure	(10 to 100) mA (0.1 to 1) A	45 $\mu$ A/A 140 $\mu$ A/A	HP 3458A 8.5 Digit Multimeter
Resistance – Source <sup>1</sup>	Up to 10.999 9 $\Omega$ (11 to 32.999 9) $\Omega$ 33 $\Omega$ to 109 k $\Omega$ (0.11 to 1.099 99) M $\Omega$ (1.1 to 3.299 9) M $\Omega$ (3.3 to 10.999 9) M $\Omega$ (11 to 32.999 9) M $\Omega$ (33 to 109.999 9) M $\Omega$ (110 to 329.999 9) M $\Omega$ (330 to 1 100) M $\Omega$	31 $\mu\Omega/\Omega$ 23 $\mu\Omega/\Omega$ 22 m $\Omega/k\Omega$ 25 $\Omega/M\Omega$ 47 $\Omega/M\Omega$ 101 $\Omega/M\Omega$ 194 $\Omega/M\Omega$ 389 $\Omega/M\Omega$ 2.3 k $\Omega/M\Omega$ 12 k $\Omega/M\Omega$	Fluke 5522A Multiproduct Calibrator
Resistance - Measure	(1 to 10) $\Omega$ (10 to 100) $\Omega$ (0.1 to 1) k $\Omega$ (1 to 10) k $\Omega$ (10 to 100) k $\Omega$ (0.1 to 1) M $\Omega$ (1 to 10) M $\Omega$	330 $\mu\Omega/\Omega$ 1.8 m $\Omega/k\Omega$ 19 $\mu\Omega/\Omega$ 160 $\mu\Omega/\Omega$ 1.6 m $\Omega/k\Omega$ 26 $\mu\Omega/\Omega$ 810 $\mu\Omega/\Omega$	HP 3458A 8.5 Digit Multimeter
Capacitance – Source <sup>1</sup>	(220 to 399.9) pF (0.4 to 1.099 9) nF (1.1 to 3.299 9) nF (3.3 to 10.999 9) nF (11 to 32.999 9) nF (33 to 109.999) nF (110 to 329.999) nF (0.33 to 1.099 99) $\mu$ F (1.1 to 3.299 99) $\mu$ F (3.3 to 10.999 9) $\mu$ F (11 to 32.999 9) $\mu$ F (33 to 109.999) $\mu$ F (110 to 329.999) $\mu$ F (0.33 to 1.099 99) mF (1.1 to 3.299 99) mF (3.3 to 10.999 9) mF (11 to 32.999 9) mF (33 to 110) mF	0.004 % of reading + 10 pF 0.004 % of reading + 0.01 nF 0.004 % of reading + 0.01 nF 0.002 % of reading + 0.01 nF 0.002 % of reading + 0.01 nF 0.002 % of reading + 0.01 nF 0.002 % of reading + 0.3 nF 0.002 % of reading + 1 nF 0.002 % of reading + 3 nF 0.002 % of reading + 10 nF 0.003 % of reading + 30 nF 0.004 % of reading + 0.1 $\mu$ F 0.004 % of reading + 0.3 $\mu$ F 0.004 % of reading + 1 $\mu$ F 0.004 % of reading + 3 $\mu$ F 0.004 % of reading + 10 $\mu$ F 0.006 % of reading + 30 $\mu$ F 0.009 % of reading + 0.1 mF	Fluke 5522A Multiproduct Calibrator

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source <sup>1</sup>	(1 to 32.999) mV		Fluke 5522A Multiproduct Calibrator
	(10 to 45) Hz	0.6 $\mu$ V/mV + 6 $\mu$ V	
	45 Hz to 10 kHz	0.2 $\mu$ V/mV + 6 $\mu$ V	
	(10 to 20) kHz	0.2 $\mu$ V/mV + 6 $\mu$ V	
	(20 to 50) kHz	0.8 $\mu$ V/mV + 6 $\mu$ V	
	(50 to 100) kHz	2.7 $\mu$ V/mV + 12 $\mu$ V	
	(100 to 500) kHz	6.2 $\mu$ V/mV + 50 $\mu$ V	
	(33 to 329.999) mV		
	(10 to 45) Hz	0.2 $\mu$ V/mV + 8 $\mu$ V	
	45 Hz to 10 kHz	0.1 $\mu$ V/mV + 8 $\mu$ V	
	(10 to 20) kHz	0.1 $\mu$ V/mV + 8 $\mu$ V	
	(20 to 50) kHz	0.3 $\mu$ V/mV + 8 $\mu$ V	
	(50 to 100) kHz	0.6 $\mu$ V/mV + 32 $\mu$ V	
	(100 to 500) kHz	1.6 $\mu$ V/mV + 70 $\mu$ V	
	(0.33 to 3.299 99 V)		
	(10 to 45) Hz	240 $\mu$ V/V + 50 $\mu$ V	
	45 Hz to 10 kHz	120 $\mu$ V/V + 60 $\mu$ V	
	(10 to 20) kHz	150 $\mu$ V/V + 60 $\mu$ V	
	(20 to 50) kHz	230 $\mu$ V/V + 50 $\mu$ V	
	(50 to 100) kHz	540 $\mu$ V/V + 0.1 mV	
	(100 to 500) kHz	1.9 mV/V + 0.6 mV	
	(3.3 V to 32.999 9) V		
	(10 Hz to 45) Hz	240 $\mu$ V/V + 650 $\mu$ V	
	45 Hz to 10 kHz	120 $\mu$ V/V + 600 $\mu$ V	
(10 to 20) kHz	190 $\mu$ V/V + 600 $\mu$ V		
(20 to 50) kHz	270 $\mu$ V/V + 600 $\mu$ V		
(50 to 100) kHz	700 $\mu$ V/V + 1.6 mV		
(33 to 329.999) V			
(10 Hz to 45) Hz	150 $\mu$ V/V + 2 mV		
45 Hz to 10 kHz	160 $\mu$ V/V + 6 mV		
(10 to 20) kHz	200 $\mu$ V/V + 6 mV		
(20 to 50) kHz	230 $\mu$ V/V + 6 mV		
(50 to 100) kHz	1.6 mV/V + 50 mV		
(330 to 1 020) V			
45 Hz to 1 kHz	240 $\mu$ V/V + 10 mV		
(1 to 5) kHz	200 $\mu$ V/V + 10 mV		
(5 to 10) kHz	240 $\mu$ V/V + 10 mV		

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage - Measure	Up to 10 mV		HP 3458A 8.5 Digit Multimeter
	(1 to 40) Hz	220 $\mu$ V/V + 5.8 $\mu$ V	
	40 Hz to 1 kHz	160 $\mu$ V/V + 5.8 $\mu$ V	
	(1 to 20) kHz	180 $\mu$ V/V + 5.8 $\mu$ V	
	(20 to 50) kHz	260 $\mu$ V/V + 5.8 $\mu$ V	
	(50 to 100) kHz	420 $\mu$ V/V + 5.8 $\mu$ V	
	(100 to 300) kHz	630 $\mu$ V/V + 5.8 $\mu$ V	
	10mV to 10 V		
	(1 to 40) Hz	200 $\mu$ V/V + 9.2 $\mu$ V	
	40 Hz to 1 kHz	130 $\mu$ V/V + 9.2 $\mu$ V	
	(1 to 20) kHz	130 $\mu$ V/V + 9.2 $\mu$ V	
	(20 to 50) kHz	140 $\mu$ V/V + 9.2 $\mu$ V	
	(50 to 100) kHz	150 $\mu$ V/V + 9.2 $\mu$ V	
	(100 to 300) kHz	180 $\mu$ V/V + 9.2 $\mu$ V	
	300 kHz to 1 MHz	560 $\mu$ V/V + 20 $\mu$ V	
	(1 to 2) MHz	1.3 mV/V + 120 $\mu$ V	
	(10 to 100) V		
	(1 to 40) Hz	1.4 mV/V + 300 $\mu$ V	
40 Hz to 1 kHz	1.1 mV/V + 100 $\mu$ V		
(20 to 50) kHz	4.0 mV/V + 200 $\mu$ V		
(50 to 100) kHz	10 mV/V + 200 $\mu$ V		
(100 to 300) kHz	36 mV/V + 1 mV		
300 kHz to 1 MHz	120 mV/V + 5 mV		
100 V to 1 kV			
(1 to 40) Hz	28 mV/V + 1 mV		
40 Hz to 1 kHz	26 mV/V + 1 mV		
(1 to 20) kHz	26 mV/V + 1 mV		
(20 to 50) kHz	43 mV/V + 1 mV		
(50 to 100) kHz	142 mV/V + 1 mV		
AC High Voltage – Measure	(50 to 60) Hz (1 to 5) kV	0.15 % of reading	Vitretek 4700 High Voltage Meter
AC Current – Source <sup>1</sup>	(29 to 329.99) $\mu$ A (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	0.16 % of reading + 0.1 $\mu$ A 0.11 % of reading + 0.1 $\mu$ A 0.1 % of reading + 0.1 $\mu$ A 0.23 % of reading + 0.2 $\mu$ A 0.62 % of reading + 0.2 $\mu$ A 1.2 % of reading + 0.4 $\mu$ A	Fluke 5522A Multiproduct Calibrator

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source <sup>1</sup>	(0.33 to 3.299 9) mA		Fluke 5522A Multiproduct Calibrator
	(10 to 20) Hz	0.16 % of reading + 0.2 $\mu$ A	
	(20 to 45) Hz	0.1 % of reading + 0.2 $\mu$ A	
	45 Hz to 1 kHz	0.08 % of reading + 0.2 $\mu$ A	
	(1 to 5) kHz	0.16 % of reading + 0.2 $\mu$ A	
	(5 to 10) kHz	0.39 % of reading + 0.3 $\mu$ A	
	(10 to 30) kHz	0.78 % of reading + 0.6 $\mu$ A	
	(3.3 to 32.999) mA		
	(10 to 20) Hz	0.14 % of reading + 2 $\mu$ A	
	(20 to 45) Hz	0.07 % of reading + 2 $\mu$ A	
	45 Hz to 1 kHz	0.03 % of reading + 2 $\mu$ A	
	(1 to 5) kHz	0.06 % of reading + 2 $\mu$ A	
	(5 to 10) kHz	0.2 % of reading + 3 $\mu$ A	
	(10 to 30) kHz	0.3 % of reading + 4 $\mu$ A	
	(33 to 329.999) mA		
	(10 to 20) Hz	0.2 % of reading + 20 $\mu$ A	
	(20 to 45) Hz	0.07 % of reading + 20 $\mu$ A	
	45 Hz to 1 kHz	0.03 % of reading + 20 $\mu$ A	
	(1 to 5) kHz	0.08 % of reading + 50 $\mu$ A	
	(5 to 10) kHz	0.2 % of reading + 0.1 mA	
	(10 to 30) kHz	0.3 % of reading + 0.2 mA	
	(0.33 to 1.099 9) A		
	(10 to 45) Hz	0.14 % of reading + 0.1 mA	
	45 Hz to 1 kHz	0.04 % of reading + 0.1 mA	
(1 to 5) kHz	0.05 % of reading + 1 mA		
(5 to 10) kHz	1.9 % of reading + 5 mA		
(1.1 to 2.999) A			
(10 to 45) Hz	0.14 % of reading + 0.1 mA		
45 Hz to 1 kHz	0.04 % of reading + 0.1 mA		
(1 to 5) kHz	0.5 % of reading + 1 mA		
(5 to 10) kHz	1.9 % of reading + 5 mA		
(3 to 10.999) A			
(45 to 100) Hz	0.05 % of reading + 2 mA		
100 Hz to 1 kHz	0.08 % of reading + 2 mA		
(1 to 5) kHz	2.3 % of reading + 2 mA		
(11 to 20.5) A			
(45 to 100) Hz	0.09 % of reading + 5 mA		
100 Hz to 1 kHz	0.12 % of reading + 5 mA		
(1 to 5) kHz	2.3 % of reading + 5 mA		

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current - Measure	90 $\mu$ A		Fluke 8846A 6.5 Digit Multimeter
	10 Hz	0.19 $\mu$ A	
	5 kHz	0.16 $\mu$ A	
	10 kHz	0.94 $\mu$ A	
	0.9 mA		
	10 Hz	0.001 2 mA	
	5 kHz	0.001 2 mA	
	10 kHz	0.005 3 mA	
	9 mA		
	10 Hz	0.005 3 mA	
	5 kHz	0.005 3 mA	
	10 kHz	0.023 mA	
	90 mA		
	10 Hz	0.053 mA	
	20 Hz Filter	0.053 mA	
	40 Hz	0.053 mA	
	100 Hz	0.053 mA	
	200 Hz Filter	0.08 mA	
	200 Hz	0.053 mA	
	1 kHz	0.053 mA	
5 kHz	0.26 mA		
10 kHz	0.26 mA		
1A			
20 Hz	0.28 mA		
5 kHz	0.17 mA		
3A			
45 Hz	0.88 mA		
1 kHz	0.85 mA		
10A			
45 Hz	2.4 mA		
1 kHz	2.4 mA		

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes <sup>1</sup> Amplitude – DC 50 Ω load  1 MΩ load  Amplitude – Square wave into 50 Ω load  into 1 MΩ load  Leveled Sine Flatness (relative to 50 kHz) into 50 Ω load  Rise Time 1 MHz  10 MHz	0 V	12 mV	Fluke 5500A/6 Multiproduct Calibrator with 600 MHz Scope Option
	6 V	12 mV	
	0 V	12 mV	
	66 V	43 mV	
	130 V	76 mV	
	0.1 Vp-p		
	10 kHz	5.9 mV	
	1 Vp-p		
	10 kHz	5.9 mV	
	5 Vp-p		
	10 kHz	15 mV	
	0.1 Vp-p		
	10 kHz	0.43 mV	
	1 Vp-p		
	10 kHz	2.6 mV	
	10 Vp-p		
	10 kHz	6.4 mV	
	10 mVp-p		
50 kHz	0.58 mV		
30 mVp-p			
100 kHz	2.1 mV		
300 MHz	2.6 mV		
600 MHz	5 mV		
5 V p-p			
50 kHz	0.36 mV		
100 kHz	1.7 mV		
300 MHz	2.3 mV		
600 MHz	4.6 mV		
1 Vp-p			
Up to 400 ps	8.3 ps		
0.5 Vp-p			
Up to 400 ps	8.2 ps		
1 Vp-p			
Up to 400 ps	8.2 ps		



**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes <sup>1</sup> Time Markers	2 ns 20 ms 50 ms 5 s	10 ps 12 μs 10 μs 0.04 s	Fluke 5500A/6 Multiproduct Calibrator with 600 MHz Scope Option
Electrical Simulation of RTD Indicating Devices <sup>1</sup>	Cu 427, 10 Ω (-100 to 260) °C 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 Pt 385, 200 Ω (-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C Pt 385, 500 Ω (-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C Pt 385, 1 000 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	0.23 °C  0.04 °C 0.04 °C 0.05 °C 0.07 °C 0.08 °C 0.09 °C 0.18 °C  0.03 °C 0.03 °C 0.03 °C 0.04 °C 0.09 °C 0.1 °C 0.11 °C 0.12 °C  0.03 °C 0.04 °C 0.04 °C 0.05 °C 0.06 °C 0.06 °C 0.07 °C 0.09 °C  0.02 °C 0.02 °C 0.03 °C 0.04 °C 0.05 °C 0.05 °C 0.05 °C 0.18 °C	Fluke 5522A Multiproduct Calibrator

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of RTD Indicating Devices <sup>1</sup>	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 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 PtNi 385, 120 Ω (-80 to 0) °C (0 to 100) °C (100 to 260) °C	0.04 °C 0.04 °C 0.05 °C 0.07 °C 0.08 °C 0.09 °C 0.19 °C 0.03 °C 0.04 °C 0.05 °C 0.05 °C 0.06 °C 0.07 °C 0.08 °C 0.18 °C 0.06 °C 0.06 °C 0.11 °C	Fluke 5522A Multiproduct Calibrator
Electrical Simulation of Thermocouple – Measure/Source <sup>1</sup>	Type B (600 to 800) °C (800 to 1 000) °C (1 000 to 1 550) °C (1 550 to 1 820) °C Type C (0 to 150) °C (150 to 650) °C (650 to 1 000) °C (1 000 to 1 800) °C (1 800 to 2 316) °C Type E (-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1 000) °C	0.34 °C 0.26 °C 0.23 °C 0.26 °C 0.23 °C 0.2 °C 0.24 °C 0.39 °C 0.65 °C 0.39 °C 0.12 °C 0.11 °C 0.12 °C 0.16 °C	Fluke 5522A Multiproduct Calibrator

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple – Measure/Source <sup>1</sup>	Type J		Fluke 5522A Multiproduct Calibrator
	(-210 to -100) °C	0.21 °C	
	(-100 to -30) °C	0.12 °C	
	(-30 to 150) °C	0.11 °C	
	(150 to 760) °C	0.13 °C	
	(760 to 1 200) °C	0.18 °C	
	Type K		
	(-200 to -100) °C	0.26 °C	
	(-100 to -25) °C	0.14 °C	
	(-25 to 120) °C	0.12 °C	
	(120 to 1 000) °C	0.2 °C	
	(1 000 to 1 372) °C	0.31 °C	
	Type L		
	(-200 to -100) °C	0.29 °C	
	(-100 to 800) °C	0.2 °C	
	(800 to 900) °C	0.13 °C	
	Type N		
	(-200 to -100) °C	0.31 °C	
	(-100 to -25) °C	0.17 °C	
	(-25 to 120) °C	0.15 °C	
	(120 to 410) °C	0.14 °C	
	(410 to 1 300) °C	0.21 °C	
	Type R		
	(0 to 250) °C	0.44 °C	
	(250 to 400) °C	0.27 °C	
	(400 to 1 000) °C	0.26 °C	
	(1 000 to 1 767) °C	0.31 °C	
	Type S		
(0 to 250) °C	0.36 °C		
(250 to 1 000) °C	0.28 °C		
(1 000 to 1 400) °C	0.29 °C		
(1 400 to 1 767) °C	0.36 °C		
Type T			
(-250 to -150) °C	0.49 °C		
(-150 to 0) °C	0.19 °C		
(0 to 120) °C	0.12 °C		
(120 to 400) °C	0.11 °C		
Type U			
(-200 to 0) °C	0.43 °C		
(0 to 600) °C	0.21 °C		

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Power <sup>1</sup>	Up to 10 W (20 to 50) W 100 W (200 to 900) W	2 mW 10 mW 20 mW 0.45 W	Fluke 5500A Multiproduct Calibrator
AC Power <sup>1,3</sup>	60 Hz (5 to 50) W 100 W 200 W 390 W 550 W 900 W 400 Hz 100 W 1 kHz 100 W 5 kHz 100 W	40 mW 80 mW 0.16 W 0.31 W 0.44 W 0.72 W 81 mW 100 mW 0.56 W	Fluke 5500A Multiproduct Calibrator

**Length – Dimensional Metrology**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Gage Blocks	Up to 1 in (1 to 4) in (4 to 10) in (10 to 13) in	3.7 μin 5.1 μin 7.8 μin 7.8 μin	Pratt & Whitney LMU-2130 Comparator, Grade 1 Gage Blocks
Gage Blocks - Long	(12 to 16) in (16 to 20) in	31 μin 35 μin	LMU-1000M Comparator, Grade 0 Gage Blocks
Thread Measuring Wires (4 to 120) TPI	(0.004 81 to 0.144 352) in	8.8 μin	Pratt & Whitney LMU-2130 Comparator, Grade 1 Gage Blocks
Plain Plugs/Pin Gages	(0.004 to 1) in (1 to 4) in (4 to 12) in	6.8 μin 9.7 μin 19 μin	
Z-Mike Laser Micrometer	Up to 1 in	31 μin	Class XXX Pins
Pins	Up to 1 in	43 μin	Z-Mike Laser Micrometer

**Length – Dimensional Metrology**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Thread Plugs (Pitch Diameter)	Up to 1 in (1 to 3) in (3 to 7.5) in	14 μin 35 μin 61 μin	Pratt & Whitney LMU-2130 Comparator, Grade 1 Gage Blocks, Thread Measuring Wires
Thread Plugs (Pitch Diameter)	(7.5 to 12) in	71 μin	LMU-1000M Comparator Grade 1 Gage Blocks Thread Measuring Wires
NPT Thread Plugs (Pitch Diameter)	Up to 1 in (1 to 3) in (3 to 6) in	16 μin 18 μin 29 μin	Pratt & Whitney LMU-2130 Comparator, Grade 1 Gage Blocks, Thread Measuring Wires
Thread Rings	Up to 1 in (1 to 4) in (4 to 8) in	20 μin 35 μin 59 μin	Pratt & Whitney LMU-2130 Comparator, Class XXX Plain Rings
Plain Rings	(0.04 to 1) in (1 to 4) in (4 to 8) in (8 to 12) in	12 μin 15 μin 25 μin 32 μin	Pratt & Whitney LMU-2130 Comparator, Class XXX Plain Rings
Plain Rings	(12 to 18) in	33 μin	LMU-1000M Comparator, Class XXX Plain Rings
Micrometers <sup>1</sup> (OD, ID, Bore, Depth)	Up to 1 in (1 to 10) in (10 to 48) in	84 μin 140 μin 170 μin	Grade 2 Gage Blocks, Optical Flat
Calipers <sup>1</sup> (Dial, Vernier, & Digital)	Up to 6 in (6 to 12) in (12 to 48) in (48 to 120) in	580 μin 580 μin 585 μin 610 μin	
Indicator Calibrators	Up to 1 in	59 μin	
Height Gages <sup>1</sup>	Up to 12 in (12 to 48) in	600 μin 615 μin	
Indicators <sup>1</sup> Dial and Digital Resolution: 0.001 in 0.000 1 in 0.000 05 in 0.000 02 in 0.000 01 in	Up to 6 in Up to 0.5 in Up to 0.05 in Up to 0.02 in Up to 0.01 in	290 μin 140 μin 58 μin 34 μin 14 μin	Grade 2 Gage Blocks, Indicator Calibrator

**Length – Dimensional Metrology**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Surface Plates <sup>1</sup>	Up to (12 X 12) in	52 µin	Planeators, Straight Indicators
Overall Flatness	Up to (12 X 18) in	56 µin	
	Up to (36 x 48) in	240 µin	
	Up to (72 x 144) in	240 µin	
Local Area Flatness (Repeat Reading)	Up to (12 X 18) in	51 µin	Repeat-o-meter
	Up to (36 x 48) in	55 µin	
	Up to (72 x 144) in	55 µin	
Length Standards	Up to 1 in	7 µin	Pratt & Whitney LMU-2130 Comparator, Grade 1 Gage Blocks, Electronic Height Gage
	(1 to 4) in	11 µin	
	(4 to 10) in	19 µin	
Length Standards	(12 to 15) in	36.8 µin	LMU-1000M Comparator Grade 0 Blocks Grade 00 Gage Blocks
	(16 to 19) in	47.5 µin	
	(20 to 42) in	47.5 µin	
Digital Levels	0°	0.06°	Grade 2 Gage Blocks Sine Bar
	15°	0.13°	
	30°	0.15°	
	45°	0.15°	
	90°	0.13°	
Parallels	Up to 4 in	10 µin	Pratt & Whitney LMU-2130 Comparator, Grade 1 Gage Blocks
Optical Comparators X, Y Axis Length	Up to 6 in	900 µin	Glass Scale Standard, Check Balls

**Mass and Mass Related**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Pressure / Vacuum Devices	(0 to 300) psig	0.1 psi	Druck DPI610 Precision Pressure Calibrator
	Up to 30 inHg Up to 100 psi (100 to 150) psi (150 to 1 000) psi (1 000 to 10 000) psi	0.1 inHg 0.1 psi 1 psi 2.2 psi 3.1 psi	Druck DPI610 Precision Pressure Calibrator, Ametek R-110-1 Dead Weight Tester

**Mass and Mass Related**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Torque Tools	(4 to 100) ozf·in (0 to 6) lbf·in (6 to 20) lbf·in (2 to 60) lbf·in (5 to 250) lbf·ft (250 to 600) lbf·ft	0.05 % of reading + 0.01 ozf·in 2.2 % of reading + 0.01 lbf·in 2.2 % of reading + 0.01 lbf·in 2.2 % of reading + 0.01 lbf·in 0.31 % of reading + 0.01 lbf·ft 3.1 % of reading + 0.01 lbf·ft	CDI Sure-test 5000-ST Torque Calibrator
Torque Calibrator	(4 to 50) lbf·in (30 to 400) lbf·in (100 to 1 000) lbf·in (20 to 250) lbf·ft	0.01 lbf·in 0.03 lbf·in 0.13 lbf·in 0.04 lbf·ft	Torque Arms & Class F Weights
Durometers Spring Force Types A, B, E, O Types C, D, DO	Up to 100 units or (0 to 8.05) N [lbf, kgf] (0 to 44.45) N [lbf, gf]	0.02 lbf, 0.009 9 kgf 0.12 lbf, 54 gf	Triple Beam Balance
Pipettes	(2 to 20) µL (20 to 100) µL (100 to 1 250) µL (2 000 to 9 000) µL (9 000 to 10 000) µL	0.2 µL 0.2 µL 1.3 µL 5 µL 7 µL	Balance, Class 1 Weights
Class F Masses	(1 to 2) g (5 to 100) g 200 g 500 g 1 000 g (2 000 to 5 000) g  (0.001 to 0.002) lb (0.005 to 0.2) lb (0.5 to 10) lb (10 to 50) lb	0.3 mg 0.4 mg 13 mg 22 mg 33 mg 56 mg  0.000 000 5 lb 0.000 014 lb 0.000 3 lb 0.001 6 lb	Balance, ASTM E617 Class 3 Weights per NIST HB 105-1
Balances and Scales <sup>1</sup> 0.1 mg resolution	Up to 10 g Up to 200 g	0.2 mg 0.3 mg	ASTM E617 Class 0 Weights per NIST Handbook 44
	(200 to 600) g (600 to 6 000) g	15 mg 22 mg	ASTM E617 Class 1 Weights per NIST Handbook 44
Balances and Scales <sup>1</sup> 0.1 g resolution	Up to 1.2 kg (1.2 to 2) kg (2 to 6) kg (5 to 30) kg	0.1 g 0.1 g 0.2 g 0.2 g	NIST Class F Weights per NIST Handbook 44

### Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Balances and Scales <sup>1</sup>			NIST Class F Weights per NIST Handbook 44
Resolution: 0.000 2 lb	Up to 2 lb	0.000 4 lb	
0.000 5 lb	Up to 5 lb	0.001 lb	
0.001 lb	Up to 10 lb	0.002 lb	
0.005 lb	Up to 20 lb	0.01 lb	
0.002 lb	Up to 25 lb	0.004 lb	
0.005 lb	Up to 50 lb	0.01 lb	
0.01 lb	Up to 100 lb	0.03 lb	
0.05 lb	Up to 150 lb	0.1 lb	
0.05 lb	Up to 500 lb	0.1 lb	
0.2 lb	Up to 1 000 lb	0.3 lb	
0.5 lb	Up to 3 000 lb	0.6 lb	
1 lb	Up to 5 000 lb	1.3 lb	
2 lb	Up to 20 000 lb	2.6 lb	
20 lb	Up to 200 000 lb	27 lb	

### Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature Source	(-5 to 140) °C	0.24 °C	Hart Scientific 9105 Drywell
	(0 to 260) °C	0.69 °C	Hart 6102 Micro-bath
Thermo-hygrometers Temperature Humidity	(0 to 180) °C (30 to 90) %RH	0.5 % of reading + 0.15 °C 0.5 % of reading + 0.9 %RH	Comparison to Vaisala MI70/HMP75 Temp/Humidity Indicator with Probe
Drywell Calibrators	(-40 to 600) °C	0.058 °C	Platinum Resistance Thermometer, Multifunction Reference Thermometer
Temperature Baths	(-40 to 300) °C	0.053 °C	Platinum Resistance Thermometer, Multifunction Reference Thermometer



**Thermodynamic**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RTD 3 Wires & 4 Wire Sensors	(-40 to 400) °C	0.3 °C	Drywell Calibrator, Platinum Resistance Thermometer, Multifunction Reference Thermometer
Infrared Thermometers	50 °C 100 °C 200 °C 300 °C 390 °C	0.62 °C 1.1 °C 1.5 °C 2.4 °C 3.3 °C	Fluke, 4181, Infrared Calibrator (flat plate) $\epsilon = 0.95, \lambda = (8 \text{ to } 14) \mu\text{m}$

**Time and Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency Source/Measure	Up to 100 Hz (1 to 10) kHz 100 kHz (1 to 10) MHz 20 MHz to 1 GHz	19 nHz 16 nHz 24 nHz 17 nHz 30 Hz	MS-1009B Rubidium Oscillator & Marconi 2022A Signal Generator

Calibration and Measurement Capability (CMC) is expressed in terms of the measurement parameter, measurement range, expanded uncertainty of measurement and reference standard, method, and/or equipment. The expanded uncertainty of measurement is expressed as the standard uncertainty of the measurement multiplied by a coverage factor of 2 ( $k=2$ ), corresponding to a confidence level of approximately 95%.

Notes:

1. On-site calibration service is available for this parameter, since on-site conditions are typically more variable than those in the laboratory, larger measurement uncertainties are expected on-site than what is reported on the accredited scope.
2. D = diagonal length in inches.
3. The uncertainty shown is for PF=1 at the frequencies shown. The laboratory can generate power at other power factors and frequencies. The reported uncertainty will increase. Contact laboratory for more information.
4. This scope is formatted as part of a single document including Certificate of Accreditation No. AC-1255.



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