CERTIFICATE OF ACCREDITATION

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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.

Jason Stine, Vice President

Expiry Date: 26 January 2025
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)

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CALIBRATION

Valid to: **January 26, 2025** Certificate Number: **AC-1255**

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Source [1]	Up to 220 mV 220 mV to 2.2 V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1 100) V	7.5 µV/V + 0.4 µV 5 µV/V + 0.7 µV 3.5 µV/V + 2.5 µV 3.5 µV/V + 4 µV 5 µV/V + 40 µV 6.5 µV/V + 0.4 mV	Fluke 5730A Multiproduct Calibrator
DC Voltage – Measure [1]	(0 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V (100 to 1 000) V	7.5 µV/V + 0.2 µV 2.9 µV/V + 0.3 µV 2.9 µV/V + 0.5 µV 4.3 µV /V + 30 nV 4.4 µV/V + 0.5 mV	Fluke 8588A 8.5 Digit Multimeter
DC High Voltage – Measure [1]	(1 to 10) kV (10 to 40) kV	0.04 % of reading 0.39 % of reading + 10 V	Vitrek 4700 High Voltage Meter, Fluke 5322A Safety Tester w/ High Voltage Probe
DC Current – Source [1]	Up to 220 µA 220 µA to 2.2 mA (2.2 to 22) mA (22 to 220) mA 220 mA to 2.2 A	40 µA/A + 6 nA 35 µA/A + 7 nA 35 µA/A + 40 nA 45 µA/A + 0.7 µA 80 µA/A + 12 µA	Fluke 5730A Multiproduct Calibrator
DC Current – Source [1]	(2.2 to 2.999 9) A (0 to 10.999 9) A (11 to 20.5) A	0.3 mA/A + 40 µA 0.4 mA/A + 0.5 mA 0.8 mA/A + 0.75 mA	Fluke 5522A Multiproduct Calibrator
DC Current – Measure [1]	Up to 100 nA (0.1 to 1) µA	0.5 mA/A 69 µA/A	HP 3458A 8.5 Digit Multimeter

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Measure [1]	(1 to 10) µA (10 to 100) µA 100 µA to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A (1 to 10) A (10 to 30) A	27 µA/A + 0.4 nA 9.8 µA/A + 0.4 nA 9.2 µA/A + 4 nA 14 µA/A + 40 nA 57 µA/A + 0.1 µA 0.13 mA/A + 1 µA 0.23 mA/A + 4 µA 0.55 mA/A + 0.44 mA	Fluke 8588A 8.5 Digit Multimeter
DC Current – Source Clamp-on Meters [1]	(10 to 50) A (50 to 100) A (100 to 500) A	0.17 A 0.2 A 1.2 A	Transmille EA002 Coil Adapter, Fluke 5522A Multiproduct Calibrator
Resistance – Source [1] (Fixed Artifacts)	0 Ω 1 Ω 1.9 Ω 10 Ω 19 Ω 100 Ω 190 Ω 1 kΩ 1.9 kΩ 10 kΩ 19 kΩ 100 kΩ 190 kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	40 µΩ 95 µΩ 0.18 mΩ 0.23 mΩ 0.44 mΩ 1 mΩ 1.9 mΩ 6.5 mΩ 12.4 mΩ 65 mΩ 0.12 Ω 0.85 Ω 1.6 Ω 13 Ω 34 Ω 0.4 kΩ 0.9 kΩ 10 kΩ	Fluke 5730A Multiproduct Calibrator
Resistance – Measure [1]	Up to 1 Ω (1 to 10) Ω (10 to 100) Ω 100 Ω to 1 kΩ (1 to 10) kΩ (10 to 100) kΩ 100 kΩ to 1 MΩ (1 to 10) MΩ (10 to 100) MΩ 100 MΩ to 1 GΩ	17 µΩ/Ω + 4 µΩ 10.1 µΩ/Ω + 14 µΩ 9.2 µΩ/Ω + 50 µΩ 9.1 µΩ/Ω + 0.5 mΩ 9.2 µΩ/Ω + 5 mΩ 9.3 µΩ/Ω + 50 mΩ 10.6 µΩ/Ω + 1 Ω 19 µΩ/Ω + 0.1 kΩ 0.12 mΩ/Ω + 10 kΩ 1.3 mΩ/Ω + 1 MΩ	Fluke 8588A 8.5 Digit Multimeter

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Source [1] (Simulation)	(220 to 399.9) pF	0.004 % of reading + 10 pF	Fluke 5522A Multiproduct Calibrator
	(0.4 to 1.099 9) nF	0.004 % of reading + 10 pF	
	(1.1 to 3.299 9) nF	0.004 % of reading + 10 pF	
	(3.3 to 10.999 9) nF	0.002 % of reading + 10 pF	
	(11 to 32.999 9) nF	0.002 % of reading + 10 pF	
	(33 to 109.999) nF	0.002 % of reading + 10 pF	
	(110 to 329.999) nF	0.002 % of reading + 0.3 nF	
	(0.33 to 1.099 99) µF	0.002 % of reading + 1 nF	
	(1.1 to 3.299 99) µF	0.002 % of reading + 3 nF	
	(3.3 to 10.999 9) µF	0.002 % of reading + 10 nF	
	(11 to 32.999 9) µF	0.003 % of reading + 30 nF	
	(33 to 109.999) µF	0.004 % of reading + 0.1 µF	
	(110 to 329.999) µF	0.004 % of reading + 0.3 µF	
	(0.33 to 1.099 99) mF	0.004 % of reading + 1 µF	
	(1.1 to 3.299 99) mF	0.004 % of reading + 3 µF	
	(3.3 to 10.999 9) mF	0.004 % of reading + 10 µF	
	(11 to 32.999 9) mF	0.006 % of reading + 30 µF	
	(33 to 110) mF	0.009 % of reading + 0.1 mF	
Capacitance – Measure [1]	Up to 1 nF	1.8 nF/F + 1 pF	Fluke 8588A 8.5 Digit Multimeter
	(1 to 10) nF	0.81 mF/F + 2 pF	
	(10 to 100) nF	0.49 mF/F + 10 pF	
	100 nF to 1 µF	0.41 mF/F + 0.1 nF	
	(1 to 10) µF	0.42 mF/F + 1 nF	
	(10 to 100) µF	0.61 mF/F + 10 nF	
	100 µF to 1 mF	0.62 mF/F + 0.1 µF	
	(1 to 10) mF	0.71 mF/F + 1 µF	
	(10 to 100) mF	0.71 mF/F + 10 µF	
AC Voltage – Source [1]	Up to 2.2 mV		Fluke 5730A Multiproduct Calibrator
	(10 to 20) Hz	0.24 mV/V + 4 µV	
	(20 to 40) Hz	90 µV/V + 4 µV	
	40 Hz to 20 kHz	80 µV/V + 4 µV	
	(20 to 50) kHz	0.2 mV/V + 4 µV	
	(50 to 100) kHz	0.5 mV/V + 5 µV	
	(100 to 300) kHz	1.1 mV/V + 10 µV	
	(300 to 500) kHz	1.4 mV/V + 20 µV	
	500 kHz to 1 MHz	2.7 mV/V + 20 µV	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source [1]	(2.2 to 22) mV		Fluke 5730A Multiproduct Calibrator
	(10 to 20) Hz	0.24 mV/V + 4 µV	
	(20 to 40) Hz	90 µV/V + 4 µV	
	40 Hz to 20 kHz	80 µV/V + 4 µV	
	(20 to 50) kHz	0.2 mV/V + 4 µV	
	(50 to 100) kHz	0.5 mV/V + 5 µV	
	(100 to 300) kHz	1.1 mV/V + 10 µV	
	(300 to 500) kHz	1.4 mV/V + 20 µV	
	500 kHz to 1 MHz	2.7 mV/V + 20 µV	
	(22 to 220) mV		
	(10 to 20) Hz	0.24 mV/V + 12 µV	
	(20 to 40) Hz	90 µV/V + 7 µV	
	40 Hz to 20 kHz	60 µV/V + 7 µV	
	(20 to 50) kHz	0.12 mV/V + 7 µV	
	(50 to 100) kHz	0.31 mV/V + 17 µV	
	(100 to 300) kHz	0.66 mV/V + 20 µV	
	(300 to 500) kHz	1.4 mV/V + 25 µV	
	500 kHz to 1 MHz	2.7 mV/V + 45 µV	
	220 mV to 2.2 V		
	(10 to 20) Hz	0.24 mV/V + 40 µV	
	(20 to 40) Hz	90 µV/V + 15 µV	
	40 Hz to 20 kHz	40 µV/V + 8 µV	
	(20 to 50) kHz	70 µV/V + 10 µV	
	(50 to 100) kHz	90 µV/V + 30 µV	
	(100 to 300) kHz	0.34 mV/V + 80 µV	
	(300 to 500) kHz	1 mV/V + 0.2 mV	
	500 kHz to 1 MHz	1.7 mV/V + 0.3 mV	
	(2.2 to 22) V		
	(10 to 20) Hz	0.24 mV/V + 0.4 mV	
	(20 to 40) Hz	90 µV/V + 0.15 mV	
	40 Hz to 20 kHz	40 µV/V + 50 µV	
	(20 to 50) kHz	70 µV/V + 0.1 mV	
	(50 to 100) kHz	80 µV/V + 0.2 mV	
	(100 to 300) kHz	0.25 mV/V + 0.6 mV	
	(300 to 500) kHz	1 mV/V + 2 mV	
	500 kHz to 1 MHz	1.5 mV/V + 3.2 mV	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source [1]	(22 to 220) V		Fluke 5730A Multiproduct Calibrator
	(10 to 20) Hz	0.24 mV/V + 4 mV	
	(20 to 40) Hz	90 µV/V + 1.5 mV	
	40 Hz to 20 kHz	50 µV/V + 0.6 mV	
	(20 to 50) kHz	80 µV/V + 1 mV	
	(50 to 100) kHz	0.15 mV/V + 2.5 mV	
	(100 to 300) kHz	0.9 mV/V + 16 mV	
	(300 to 500) kHz	4.4 mV/V + 40 mV	
	500 kHz to 1 MHz	8 mV/V + 80 mV	
	(220 to 1 100) V		
	(15 to 50) Hz	0.3 mV/V + 16 mV	
	50 Hz to 1 kHz	70 µV/V + 3.5 mV	
AC Voltage – Measure [1]	Up to 10 mV		Fluke 8588A 8.5 Digit Multimeter
	1 Hz to 2 kHz	0.29 mV/V + 1.1 µV	
	(2 to 10) kHz	0.37 mV/V + 1.1 µV	
	(10 to 30) kHz	0.38 mV/V + 1.1 µV	
	(30 to 100) kHz	3 mV/V + 1.1 µV	
	(100 to 300) kHz	10 mV/V + 4 µV	
	300 kHz to 1 MHz	20 mV/V + 4 µV	
	(10 to 100) mV		
	1 Hz to 2 kHz	88 µV/V + 0.5 µV	
	(2 to 10) kHz	0.13 mV/V + 0.5 µV	
	(10 to 30) kHz	0.23 mV/V + 1.0 µV	
	(30 to 100) kHz	0.53 mV/V + 5.0 µV	
	(100 to 300) kHz	2.1 mV/V + 30 µV	
	300 kHz to 1 MHz	11 mV/V + 0.1 mV	
	(1 to 2) MHz	15.4 mV/V + 0.5 mV	
	(2 to 4) MHz	41 mV/V + 1 mV	
	(4 to 8) MHz	84 mV/V + 1 mV	
	(8 to 10) MHz	0.16 V/V + 1 mV	
	100 mV to 1 V		
	1 Hz to 2 kHz	76 µV/V + 5 µV	
	(2 to 10) kHz	0.12 mV/V + 5 µV	
	(10 to 30) kHz	0.23 mV/V + 10 µV	
	(30 to 100) kHz	0.53 mV/V + 50 µV	
	(100 to 300) kHz	2.1 mV/V + 0.3 mV	
	300 kHz to 1 MHz	10 mV/V + 1 mV	
	(1 to 2) MHz	15 mV/V + 5 mV	
	(2 to 4) MHz	40 mV/V + 10 mV	
	(4 to 8) MHz	82 mV/V + 10 mV	
	(8 to 10) MHz	0.15 V/V + 10 mV	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure [1]	(1 to 10) V		Fluke 8588A 8.5 Digit Multimeter
	1 Hz to 2 kHz	76 µV/V + 50 µV	
	(2 to 10) kHz	0.12 mV/V + 50 µV	
	(10 to 30) kHz	0.13 mV/V + 0.1 mV	
	(30 to 100) kHz	0.53 mV/V + 0.5 mV	
	(100 to 300) kHz	2.1 mV/V + 3 mV	
	300 kHz to 1 MHz	10 mV/V + 10 mV	
	(1 to 2) MHz	15 mV/V + 50 mV	
	(2 to 4) MHz	40 mV/V + 0.1 V	
	(4 to 8) MHz	82 mV/V + 0.1 V	
	(8 to 10) MHz	0.15 V/V + 0.1 V	
	(10 to 100) V		
	1 Hz to 2 kHz	90 µV/V + 0.5 mV	
	(2 to 10) kHz	0.11 mV/V + 0.5 mV	
	(10 to 30) kHz	0.23 mV/V + 1 mV	
	(30 to 100) kHz	0.59 mV/V + 5 mV	
	(100 to 300) kHz	3.7 mV/V + 50 mV	
	300 kHz to 1 MHz	10.1 mV/V + 0.5 V	
	(100 to 1 000) V		
	1 Hz to 2 kHz	0.11 mV/V + 25 mV	
	(2 to 10) kHz	0.11 mV/V + 25 mV	
	(10 to 30) kHz	0.23 mV/V + 25 mV	
	(30 to 100) kHz	0.59 mV/V + 0.1 V	
AC High Voltage – Measure [1]	(50 to 60) Hz (1 to 5) kV	0.15 % of reading	Vitrek 4700 High Voltage Meter
AC Current – Source [1]	Up to 220 µA		Fluke 5730A Multiproduct Calibrator
	(10 to 20) Hz	0.25 mA/A + 16 nA	
	(20 to 40) Hz	0.16 mA/A + 10 nA	
	40 Hz to 1 kHz	0.1 mA/A + 8 nA	
	(1 to 5) kHz	0.28 mA/A + 12 nA	
	(5 to 10) kHz	1.1 mA/A + 65 nA	
	220 µA to 2.2 mA		
	(10 to 20) Hz	0.25 mA/A + 40 nA	
	(20 to 40) Hz	0.16 mA/A + 35 nA	
	40 Hz to 1 kHz	0.1 mA/A + 35 nA	
	(1 to 5) kHz	0.2 mA/A + 0.11 µA	
	(5 to 10) kHz	1.1 mA/A + 0.65 µA	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source [1]	(2.2 to 22) mA		Fluke 5730A Multiproduct Calibrator
	(10 to 20) Hz	0.25 mA/A + 0.4 µA	
	(20 to 40) Hz	0.16 mA/A + 0.35 µA	
	40 Hz to 1 kHz	0.1 mA/A + 0.35 µA	
	(1 to 5) kHz	0.2 mA/A + 0.55 µA	
	(5 to 10) kHz	1.1 mA/A + 5 µA	
	(22 to 220) mA		
	(10 to 20) Hz	0.25 mA/A + 4 µA	
	(20 to 40) Hz	0.16 mA/A + 3.5 µA	
	40 Hz to 1 kHz	0.1 mA/A + 2.5 µA	
	(1 to 5) kHz	0.2 mA/A + 3.5 µA	
	(5 to 10) kHz	1.1 mA/A + 10 µA	
	220 mA to 2.2 A		
	20 Hz to 1 kHz	0.24 mA/A + 35 µA	
	(1 to 5) kHz	0.45 µA/A + 80 µA	
	(5 to 10) kHz	7 mA/A + 0.16 mA	
AC Current – Source [1]	(1.1 to 2.999) A		Fluke 5522A Multiproduct Calibrator
	(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	
AC Current – Measure [1]	Up to 10 µA		Fluke 8588A 8.5 Digit Multimeter
	1Hz to 2 kHz	2 mA/A + 2.5 nA	
	(2 to 10) kHz	2 mA/A + 2.5 nA	
	(10 to 30) kHz	2 mA/A + 2.5 nA	
	(10 to 100) µA		
	1 Hz to 2 kHz	0.28 mA/A + 5 nA	
	(2 to 10) kHz	0.53 mA/A + 5 nA	
	(10 to 30) kHz	0.74 mA/A + 5 nA	
	(30 to 100) kHz	4 mA/A + 10 nA	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure [1]	100 µA to 1 mA		Fluke 8588A 8.5 Digit Multimeter
	1 Hz to 2 kHz	0.28 mA/A + 50 nA	
	(2 to 10) kHz	0.53 mA/A + 50 nA	
	(10 to 30) kHz	0.74 mA/A + 50 nA	
	(30 to 100) kHz	4 mA/A + 0.1 µA	
	(1 to 10) mA		
	1 Hz to 2 kHz	0.28 mA/A + 0.5 µA	
	(2 to 10) kHz	0.53 mA/A + 0.5 µA	
	(10 to 30) kHz	0.74 mA/A + 0.5 µA	
	(30 to 100) kHz	4 mA/A + 1 µA	
	(10 to 100) mA		
	1 Hz to 2 kHz	0.28 mA/A + 5 µA	
	(2 to 10) kHz	0.52 mA/A + 5 µA	
	(10 to 30) kHz	0.74 mA/A + 5 µA	
	100 mA to 1 A		
	1 Hz to 2 kHz	0.3 mA/A + 0.1 mA	
	(2 to 10) kHz	0.55 mA/A + 0.1 mA	
	(10 to 30) kHz	0.79 mA/A + 0.1A	
	(1 to 10) A		
	10 Hz to 2 kHz	0.84 mA/A + 1 mA	
	(2 to 10) kHz	0.84 mA/A + 1mA	
	(10 to 30) A		
	10 Hz to 2 kHz	0.8 mA/A + 12 mA	
	2 kHz to 10 kHz	1.2 mA/A + 12 mA	
AC Current – Source Clamp-on Meters [1]	60 Hz		Transmille EA002 Coil Adapter, Fluke 5522A Multiproduct Calibrator
	(10 to 100) A	0.19 A	
	(100 to 500) A	1.19 A	
Oscilloscopes [1]			Fluke 5522A Multiproduct Calibrator with 1 100 MHz Scope Option
Amplitude – DC			
50 Ω load	0 V	12 mV	
	6 V	12 mV	
1 MΩ load	0 V	12 mV	
	66 V	43 mV	
	130 V	76 mV	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes [1]			
Amplitude – Square wave			
into 50 Ω load	0.1 Vp-p		
	10 kHz	5.9 mV	
	1 Vp-p		
	10 kHz	5.9 mV	
	5 Vp-p		
	10 kHz	15 mV	
into 1 MΩ load	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	
Leveled Sine Flatness (relative to 50 kHz)			Fluke 5522A Multiproduct Calibrator with 1 100 MHz Scope Option
into 50 Ω load	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	
Rise Time			
1 MHz	1 Vp-p		
	Up to 400 ps	8.3 ps	
10 MHz	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 [1] Time Markers	 2 ns 20 ms 50 ms 5 s	 10 ps 12 µs 10 µs 40 ms	Fluke 5522A Multiproduct Calibrator with 1 100 MHz Scope Option
Electrical Simulation of RTD Indicating Devices [1]	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 [1]	Pt 3926, 100 Ω		Fluke 5522A Multiproduct Calibrator
	(-200 to -80) °C	0.04 °C	
	(-80 to 0) °C	0.04 °C	
	(0 to 100) °C	0.05 °C	
	(100 to 300) °C	0.07 °C	
	(300 to 400) °C	0.08 °C	
	(400 to 630) °C	0.09 °C	
	Pt 3916, 100 Ω		
	(-200 to -190) °C	0.19 °C	
	(-190 to -80) °C	0.03 °C	
	(-80 to 0) °C	0.04 °C	
	(0 to 100) °C	0.05 °C	
	(100 to 260) °C	0.05 °C	
	(260 to 300) °C	0.06 °C	
	(300 to 400) °C	0.07 °C	
	(400 to 600) °C	0.08 °C	
	(600 to 630) °C	0.18 °C	
	PtNi 385, 120 Ω		
	(-80 to 0) °C	0.06 °C	
	(0 to 100) °C	0.06 °C	
	(100 to 260) °C	0.11 °C	
Electrical Simulation of Thermocouple – Measure/Source [1]	Type B		Fluke 5522A Multiproduct Calibrator
	(600 to 800) °C	0.34 °C	
	(800 to 1 000) °C	0.26 °C	
	(1 000 to 1 550) °C	0.23 °C	
	(1 550 to 1 820) °C	0.26 °C	
	Type C		
	(0 to 150) °C	0.23 °C	
	(150 to 650) °C	0.2 °C	
	(650 to 1 000) °C	0.24 °C	
	(1 000 to 1 800) °C	0.39 °C	
	(1 800 to 2 316) °C	0.65 °C	
	Type E		
	(-250 to -100) °C	0.39 °C	
	(-100 to -25) °C	0.12 °C	
	(-25 to 350) °C	0.11 °C	
	(350 to 650) °C	0.12 °C	
	(650 to 1 000) °C	0.16 °C	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple – Measure/Source [1]	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	
Electrical Simulation of Thermocouple – Measure/Source [1]	Type U		Fluke 5522A Multiproduct Calibrator
	(-200 to 0) °C	0.43 °C	
	(0 to 600) °C	0.21 °C	

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Gage Blocks [2]	(0.01 to 4) in	(3.1 + 1*L*) µin	Pratt & Whitney LMU-2130 Comparator, Grade 1 Gage Blocks
Long Gage Blocks [2]	(4 to 20) in	(2.5 + 1.2*L*) µin	Pratt & Whitney 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	Pratt & Whitney LMU-2130 Comparator, Grade 1 Gage Blocks
Z-Mike Laser Micrometer	Up to 1 in	31 µin	Class XXX Pins
Pins	Up to 1 in	43 µin	Z-Mike Laser Micrometer
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	Pratt & Whitney LMU-2130 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	Pratt & Whitney LMU-1000M Comparator, Class XXX Plain Rings

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Micrometers [1,2] (OD, ID, Bore, Depth) (0.001 in resolution) (0.000 1 in resolution) (0.000 05 in resolution)	 (0.05 to 72) in (0.05 to 72) in (0.05 to 24) in	 (580 + 1.1*L*) µin (58 + 3.6*L*) µin (29 + 3.4*L*) µin	Grade 2 Gage Blocks, Optical Flat
Calipers [1,2] (Dial, Vernier, & Digital) (0.001 in resolution) (0.000 5 in resolution)	 (0.05 to 120) in (0.05 to 120) in	 (580 + 1.7*L*) µin (290 + 2.6*L*) µin	Grade 2 Gage Blocks, Optical Flat
Indicator Calibrators	Up to 1 in	59 µin	Grade 2 Gage Blocks, Optical Flat
Height Gages [1]	Up to 12 in (12 to 48) in	600 µin 615 µin	Grade 2 Gage Blocks, Optical Flat
Dial and Digital Indicators [1] (0.001 in resolution) (0.000 1 in resolution) (0.000 05 in resolution) (0.000 02 in resolution) (0.000 01 in resolution)	 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
Surface Plates [1,2] Overall Flatness Local Area Flatness (Repeat Reading)	 Up to 16.97 *DL* Up to 21.63 *DL* Up to 60 *DL* Up to 161 *DL* Up to 0.000 02 in	 52 µin 56 µin 240 µin 240 µin 55 µin	In accordance with Fed Spec GGG-P-463 using Planekator, Straight Indicators Repeat-o-Meter
Length Standards [2]	(0.5 to 4) in (5 to 20) in (21 to 42) in (43 to 96) in	(3.9 + 1.5*L*) µin (29 + 0.9*L*) µin (18 + 1*L*) µin (9.7 + 2.1*L*) µin	Pratt & Whitney LMU-2130 Comparator, Pratt & Whitney LMU-1000 Comparator Grade 1 Gage Blocks, Electronic Indicator
Digital Levels [1]	0° 15° 30° 45° 90°	0.06° 0.13° 0.15° 0.15° 0.13°	Grade 2 Gage Blocks, Sine Bar
Parallels	Up to 4 in	10 µin	Pratt & Whitney LMU-2130 Comparator, Grade 1 Gage Blocks

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Optical Comparators [1,2] X, Y Axis Length Angle	 Up to 30 in Up to 360°	 (120 + 5.3*L*) µin 0.06°	 Glass Scale Angle Blocks
Video Measuring Machines [1,2] X,Y Axis Length Z Axis Length Angle	 Up to 30 in Up to 4 in Up to 360°	 (68 + 2.1*L*) µin (210 + 17*L*) µin 0.02°	 Glass Scale Step Gage Angle Blocks
Roughness Specimen	Ra: (0.8 to 500) µin	0.34 % of reading + 1.1 µin	Mitutoyo Surface Roughness Tester, Contour Measuring Machine

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Low Pressure Devices [1] (Pneumatic Gauge Pressure)	(0.01 to 30) inH_2O	0.096 % of reading + 0.001 2 inH_2O	Additel Pressure Module
Hydraulic Pressure Devices [1] (Gauge Pressure)	 (10 to 16 000) psig (16 000 to 20 000) psig	 0.009 4 % of reading 0.015 % of reading + 0.4 psi	Hydraulic Deadweight Testers Fluke P3125 Fluke 3116
Vacuum Devices [1] (Pneumatic)	(-15 to -0.1) psig	0.003 8 psi	Additel 673 Digital Pressure Calibrator
Torque Tools [1]	(20 to 200) ozf·in (5 to 50) lbf·in (40 to 400) lbf·in (100 to 1 000) lbf·in (25 to 250) lbf·ft (50 to 500) lbf·ft (100 to 1 000) lbf·ft (200 to 2 000) lbf·ft	0.11 % of reading + 1.5 ozf·in 0.067 % of reading + 0.48 lbf·in 0.17 % of reading + 1 lbf·in 0.22 % of reading + 1.8 lbf·in 0.2 % of reading + 0.49 lbf·ft 0.27 % of reading + 2.6 lbf·ft 0.21 % of reading + 7.2 lbf·ft 0.056 % of reading + 37 lbf·ft	CDI Sure-test 5000-ST Torque Calibration System
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

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Durometers Spring Force Only Types A, B, E, O Types C, D, DO	 (0 to 8.05) N (0 to 44.45) N	 0.089 N 0.53 N	Partial Direct Verification per internal procedure CP-0053 using Triple Beam Balance
Class F Mass Determination	(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; NIST HB 105-1
Balances and Scales [1] 0.1 mg resolution	 Up to 10 g Up to 200 g	 0.2 mg 0.3 mg	ASTM E617 Class 0 weights and NIST Handbook 44 utilized in the calibration of the weighing device.
Balances and Scales [1] 0.1 mg resolution	 (200 to 600) g (600 to 6 000) g	 15 mg 22 mg	ASTM E617 Class 0 weights and NIST Handbook 44 utilized in the calibration of the weighing device.
Balances and Scales [1] 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 and NIST Handbook 44 utilized in the calibration of the weighing device.
Balances and Scales [1] 0.000 2 lb resolution 0.000 5 lb resolution 0.001 lb resolution 0.005 lb resolution 0.002 lb resolution 0.005 lb resolution	 Up to 2 lb Up to 5 lb Up to 10 lb Up to 20 lb Up to 25 lb Up to 50 lb	 0.000 4 lb 0.001 lb 0.002 lb 0.01 lb 0.004 lb 0.01 lb	NIST Class F weights and NIST Handbook 44 utilized in the calibration of the weighing device.

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Balances and Scales [1]			NIST Class F weights and NIST Handbook 44 utilized in the calibration of the weighing device.
0.01 lb resolution	Up to 100 lb	0.03 lb	
0.05 lb resolution	Up to 150 lb	0.1 lb	
0.05 lb resolution	Up to 500 lb	0.1 lb	
0.2 lb resolution	Up to 1 000 lb	0.3 lb	
0.5 lb resolution	Up to 3 000 lb	0.6 lb	
1 lb resolution	Up to 5 000 lb	1.3 lb	
2 lb resolution	Up to 20 000 lb	2.6 lb	
20 lb resolution	Up to 200 000 lb	27 lb	
Force Measuring Devices	Up to 1 000 lbf	0.1 % of reading	Morehouse Load Cells with Readout

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature – Source [1] (Temperature Measuring Devices)	(-5 to 140) °C	0.24 °C	Hart Scientific 9105 Drywell
Temperature – Source [1] (Temperature Measuring Devices)	(0 to 260) °C	0.69 °C	Hart 6102 Micro-bath
Thermo-hygrometers			Comparison to Vaisala MI70/HMP75 Temp/Humidity Indicator with Probe
Temperature	(0 to 180) °C	0.5 % of reading + 0.15 °C	
Humidity	(30 to 90) %RH	0.5 % of reading + 0.9 %RH	
Drywell Calibrators [1]	(-40 to 600) °C	0.058 °C	Platinum Resistance Thermometer, Multifunction Reference Thermometer
Temperature Baths [1]	(-40 to 300) °C	0.053 °C	Platinum Resistance Thermometer, Multifunction Reference Thermometer
RTD Probes [1] (3 Wires & 4 Wire Sensors)	(-40 to 400) °C	0.3 °C	Drywell Calibrator' Platinum Resistance Thermometer, Multifunction Reference Thermometer

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
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) Ɛ = 0.95, λ = (8 to 14) µm

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	Motion Software 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. L = length in inches; DL = diagonal length in inches.
3. This scope is formatted as part of a single document including Certificate of Accreditation No. AC-1255.

Jason Stine, Vice President