CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

Transcat-Pittsburgh
454 Berlin Plank Road
Somerset, PA 15501

Fulfills the requirements of

ISO/IEC 17025:2017

and the national standards

ANSI/NCSL Z540-1-1994 (R2002) AND
ANSI/NCSL Z540.3-2006 (R2013)

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: 07 September 2027
Certificate Number: AC-2489.15

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)
ANSI/NCSL Z540.3-2006 (R2013)

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CALIBRATION

Certificate Number: **AC-2489.15** Certificate Expiry Date: **07 September 2027**

Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
pH Meters	4 pH 7 pH 10 pH	0.012 pH 0.011 pH 0.012 pH	Comparison to Accredited Solutions
Conductivity Meters	1 µS 10 µS 100 µS 1 000 µS 1 413 µS 10 000 µS 100 000 µS 150 000 µS 200 000 µS	0.3 µS 0.3 µS 2.1 µS 5 µS 4 µS 44 µS 330 µS 570 µS 670 µS	Comparison to Accredited Solutions

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Source [1]	(0 to 220) mV (0.22 to 2.2) V (2.2 to 11) V (11 to 22) V (22 to 220) V	8.6 µV/V + 0.4 µV 5.1 µV/V + 0.7 µV 4 µV/V + 2.5 µV 3.9 µV/V + 4 µV 6.2 µV/V + 40 µV	Comparison to Fluke 5700A/EP Multiproduct Calibrator
DC Voltage – Source [1]	220 V to 1.1 kV	7.6 µV/V + 0.4 mV	Comparison to Fluke 5700A/5725A Multiproduct Calibrator with Amplifier
DC Voltage – Measure [1]	(0 to 100) mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 500) V (500 to 800) V (800 to 1 000) V	8.3 µV/V + 0.58 µV 5.3 µV/V + 0.58 µV 5.3 µV/V + 0.58 µV 7.7 µV/V + 35 µV 15 µV/V + 0.12 mV 18 µV/V + 0.12 mV 21 µV/V + 0.12 mV	Comparison to Agilent 3458A Opt. 002 8.5 Digit Multimeter
DC High Voltage – Measure [1]	(1 to 10) kV (10 to 20) kV (20 to 70) kV (70 to 100) kV	0.04 % of reading + 92 mV 0.09 % of reading + 2.4 V 0.09 % of reading + 2.4 V 0.17 % of reading + 2.5 V	Comparison to Vitrek 4700 Digital HV Meter, Associated High Voltage Probes
DC Current – Source [1]	(0.22 to 220) µA (0.22 to 2.2) mA (2.2 to 22) mA (22 to 220) mA (0.22 to 2.2) A	40 µA/A + 6 nA 36 µA/A + 7 nA 35 µA/A + 40 nA 48 µA/A + 0.7 µA 84 µA/A + 12 µA	Comparison to Fluke 5700A/EP Multiproduct Calibrator
DC Current – Source [1]	(2.2 to 11) A	0.036 % of reading + 0.48 mA	Comparison to Fluke 5700A/5725A Multiproduct Calibrator with Amplifier
DC Current – Source [1]	(11 to 20.5) A	0.093 % of reading + 0.58 mA	Comparison to Fluke 5522A Multiproduct Calibrator
DC Current – Measure [1]	(0 to 100) µA (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A	33 µA/A + 0.92 nA 29 µA/A + 5.8 nA 29 µA/A + 58 nA 46 µA/A + 0.58 µA 0.013 % of reading + 12 µA	Comparison to Agilent 3458A Opt. 002 8.5 Digit Multimeter

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Measure [1]	(1 to 10) A (10 to 100) A (100 to 300) A	0.012 % of reading + 58 µA 0.059 % of reading + 0.58 mA 0.12 % of reading + 1.7 mA	Comparison to Agilent 3458A Opt. 002 8.5 Digit Multimeter, Guideline Current Shunt
DC Clamp-on Ammeters (Non-Toroidal Type) Transformer Type Sensor [1]	(20 to 150) A (150 to 1 000) A	0.51 % of reading + 0.14 A 0.51 % of reading + 0.5 A	Comparison to Fluke 5520A Multiproduct Calibrator, Fluke 5500A/COIL 50-turn Coil
AC Voltage – Source [1]	Up to 2.2 mV (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz (2.2 to 22) mV (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz (22 to 220) mV (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	 0.16 % of reading + 4 µV 0.1 % of reading + 4 µV 0.078 % of reading + 4 µV 0.13 % of reading + 4 µV 0.17 % of reading + 5 µV 0.33 % of reading + 10 µV 0.47 % of reading + 20 µV 0.58 % of reading + 20 µV 0.042 % of reading + 4 µV 0.03 % of reading + 4 µV 0.014 % of reading + 4 µV 0.03 % of reading + 4 µV 0.058 % of reading + 5 µV 0.12 % of reading + 10 µV 0.16 % of reading + 20 µV 0.27 % of reading + 20 µV 0.028 % of reading + 12 µV 0.011 % of reading + 7 µV 0.008 5 % of reading + 7 µV 0.021 % of reading + 7 µV 0.047 % of reading + 17 µV 0.091 % of reading + 20 µV 0.14 % of reading + 25 µV 0.28 % of reading + 45 µV	Comparison to Fluke 5700A/EP Multiproduct Calibrator

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AC Voltage – Source [1]	(0.22 to 2.2) V		Comparison to Fluke 5700A/EP Multiproduct Calibrator
	(10 to 20) Hz	0.027 % of reading + 40 µV	
	(20 to 40) Hz	0.01 % of reading + 15 µV	
	40 Hz to 20 kHz	0.004 8 % of reading + 8 µV	
	(20 to 50) kHz	0.008 % of reading + 10 µV	
	(50 to 100) kHz	0.012 % of reading + 30 µV	
	(100 to 300) kHz	0.043 % of reading + 80 µV	
	(300 to 500) kHz	0.1 % of reading + 0.2 mV	
	500 kHz to 1 MHz	0.18 % of reading + 0.3 mV	
	(2.2 to 22) V		
	(10 to 20) Hz	0.028 % of reading + 0.4 mV	
	(20 to 40) Hz	0.01 % of reading + 0.15 mV	
	40 Hz to 20 kHz	0.004 9 % of reading + 50 µV	
	(20 to 50) kHz	0.008 3 % of reading + 0.1 mV	
	(50 to 100) kHz	0.011 % of reading + 0.2 mV	
	(100 to 300) kHz	0.03 % of reading + 0.6 mV	
	(300 to 500) kHz	0.1 % of reading + 2 mV	
	500 kHz to 1 MHz	0.17 % of reading + 3.2 mV	
	(22 to 220) V		
	(10 to 20) Hz	0.028 % of reading + 4 mV	
	(20 to 40) Hz	0.01 % of reading + 1.5 mV	
	40 Hz to 20 kHz	0.005 6 % of reading + 0.6 mV	
	(20 to 50) kHz	0.009 3 % of reading + 1 mV	
	(50 to 100) kHz	0.016 % of reading + 2.5 mV	
	(100 to 300) kHz	0.09 % of reading + 16 mV	
	(300 to 500) kHz	0.44 % of reading + 40 mV	
	500 kHz to 1 MHz	0.8 % of reading + 80 mV	
AC Voltage – Source [1]	(220 to 750) V		Comparison to Fluke 5700A/5725A Multiproduct Calibrator with Amplifier
	(30 to 50) kHz	0.061 % of reading + 11 mV	
	(50 to 100) kHz	0.23 % of reading + 45 mV	
	(220 to 1 100) V		
	40 Hz to 1 kHz	0.011 % of reading + 4 mV	
	(1 to 20) kHz	0.017 % of reading + 6 mV	
	(20 to 30) kHz	0.061 % of reading + 11 mV	

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AC Voltage – Measure [1]	Up to 10 mV		Comparison to Agilent 3458A Opt. 002 8.5 Digit Multimeter
	(1 to 40) Hz	0.04 % of reading + 3.5 µV	
	40 Hz to 1 kHz	0.03 % of reading + 1.2 µV	
	(1 to 20) kHz	0.04 % of reading + 1.2 µV	
	(20 to 50) kHz	0.15 % of reading + 1.2 µV	
	(50 to 100) kHz	0.59 % of reading + 1.2 µV	
	(100 to 300) kHz	4.6 % of reading + 2.3 µV	
	(0.3 to 1) MHz	1.5 % of reading + 5.8 µV	
	(1 to 4) MHz	8.1 % of reading + 8.1 µV	
	(10 to 100) mV		
	(1 to 40) Hz	0.013 % of reading + 4.6 µV	
	40 Hz to 1 kHz	0.009 7 % of reading + 2.3 µV	
	(1 to 20) kHz	0.017 % of reading + 2.3 µV	
	(20 to 50) kHz	0.038 % of reading + 2.3 µV	
	(50 to 100) kHz	0.093 % of reading + 2.3 µV	
	(100 to 300) kHz	0.36 % of reading + 12 µV	
	300 kHz to 1 MHz	1.2 % of reading + 12 µV	
	(1 to 2) MHz	1.8 % of reading + 12 µV	
	(2 to 4) MHz	4.7 % of reading + 81 µV	
	(4 to 8) MHz	4.7 % of reading + 92 µV	
	(8 to 10) MHz	17 % of reading + 0.12 mV	
	(0.1 to 1) V		
	(1 to 40) Hz	0.008 8 % of reading + 46 µV	
	40 Hz to 1 kHz	0.008 3 % of reading + 23 µV	
	(1 to 20) kHz	0.017 % of reading + 23 µV	
	(20 to 50) kHz	0.036 % of reading + 23 µV	
	(50 to 100) kHz	0.093 % of reading + 23 µV	
	(100 to 300) kHz	0.35 % of reading + 0.12 mV	
	300 kHz to 1 MHz	1.2 % of reading + 0.12 mV	
	(1 to 2) MHz	1.8 % of reading + 0.12 mV	
	(2 to 4) MHz	4.6 % of reading + 81 µV	
	(4 to 8) MHz	4.6 % of reading + 0.92 mV	
	(8 to 10) MHz	17 % of reading + 1.2 mV	

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AC Voltage – Measure [1]	(1 to 10) V		Comparison to Agilent 3458A Opt. 002 8.5 Digit Multimeter
	(1 to 40) Hz	0.01 % of reading + 0.46 mV	
	40 Hz to 1 kHz	0.023 % of reading + 0.23 mV	
	(1 to 20) kHz	0.017 % of reading + 0.23 mV	
	(20 to 50) kHz	0.036 % of reading + 0.23 mV	
	(50 to 100) kHz	0.093 % of reading + 0.23 mV	
	(100 to 300) kHz	0.35 % of reading + 1.2 mV	
	300 kHz to 1 MHz	1.2 % of reading + 1.2 mV	
	(1 to 2) MHz	1.8 % of reading + 1.2 mV	
	(2 to 4) MHz	4.6 % of reading + 8.1 mV	
	(4 to 8) MHz	4.6 % of reading + 9.2 mV	
	(8 to 10) MHz	17 % of reading + 12 mV	
	(10 to 100) V		
	(1 to 40) Hz	0.024 % of reading + 4.6 mV	
	40Hz to 1 kHz	0.024 % of reading + 2.3 mV	
	(1 to 20) kHz	0.024 % of reading + 2.3 mV	
	(20 to 50) kHz	0.041 % of reading + 2.3 mV	
	(50 to 100) kHz	0.14 % of reading + 2.3 mV	
	(100 to 300) kHz	0.46 % of reading + 12 mV	
	300 kHz to 1 MHz	1.7 % of reading + 12 mV	
	(100 to 700) V		
	(1 to 40) Hz	0.048 % of reading + 46 mV	
	40 Hz to 1 kHz	0.048 % of reading + 23 mV	
	(1 to 20) kHz	0.071 % of reading + 23 mV	
	(20 to 50) kHz	0.19 % of reading + 23 mV	
	(50 to 100) kHz	0.35 % of reading + 23 mV	
AC High Voltage – Measure [1]	(0.7 to 10) kV		Comparison to Vitrek 4700 Digital HV Meter, Associated High Voltage Probes
	(20 to 100) Hz	0.14 % of reading + 0.37 V	
	(100 to 400) Hz	0.48 % of reading + 0.17 V	
	(10 to 30) kV		
	(30 to 70) Hz	0.11 % of reading + 2.4 V	
	(70 to 200) Hz	0.7 % of reading + 2.4 V	
	(200 to 450) Hz	1.4 % of reading + 2.4 V	
	(30 to 50) kV		
	(30 to 70) Hz	0.13 % of reading + 2.5 V	
	(70 to 200) Hz	0.7 % of reading + 2.5 V	
	(200 to 450) Hz	2.9 % of reading + 2.5 V	
	(50 to 70) kV		
	(30 to 70) Hz	0.16 % of reading + 2.6 V	
	(70 to 200) Hz	1.2 % of reading + 2.6 V	

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source [1]	Up to 220 µA		Comparison to Fluke 5700A/EP Multiproduct Calibrator
	(10 to 20) Hz	0.031 % of reading + 16 nA	
	(20 to 40) Hz	0.019 % of reading + 10 nA	
	40 Hz to 1 kHz	0.015 % of reading + 8 nA	
	(1 to 5) kHz	0.03 % of reading + 12 nA	
	(5 to 10) kHz	0.11 % of reading + 65 nA	
	(0.22 to 2.2) mA		
	(10 to 20) Hz	0.03 % of reading + 40 nA	
	(20 to 40) Hz	0.018 % of reading + 35 nA	
	40 Hz to 1 kHz	0.013 % of reading + 35 nA	
	(1 to 5) kHz	0.021 % of reading + 0.11 µA	
	(5 to 10) kHz	0.11 % of reading + 0.65 µA	
	(2.2 to 22) mA		
	(10 to 20) Hz	0.039 % of reading + 0.4 µA	
	(20 to 40) Hz	0.019 % of reading + 0.35 µA	
	40 Hz to 1 kHz	0.014 % of reading + 0.35 µA	
	(1 to 5) kHz	0.021 % of reading + 0.5 µA	
	(5 to 10) kHz	0.11 % of reading + 5 µA	
	(22 to 220) mA		
	(10 to 20) Hz	0.033 % of reading + 0.4 µA	
	(20 to 40) Hz	0.018 % of reading + 0.35 µA	
	40 Hz to 1 kHz	0.014 % of reading + 0.35µA	
	(1 to 5) kHz	0.021 % of reading + 0.55 µA	
	(5 to 10) kHz	0.11 % of reading + 5 µA	
	(0.22 to 2.2) A		
	20 Hz to 1 kHz	0.027 % of reading + 35 µA	
	(1 to 5) kHz	0.046 % of reading + 80 µA	
	(5 to 10) kHz	0.7 % of reading + 0.16 mA	
	(2.2 to 11) A		
	(40 to 100) Hz	0.048 % of reading + 0.17 mA	
	(1 to 5) kHz	0.096 % of reading + 0.38 mA	
	(5 to 10) kHz	0.36 % of reading + 0.75 mA	
AC Current – Source [1]	(11 to 20) A		Comparison to Fluke 5522A Multiproduct Calibrator
	(45 to 100) Hz	0.095 % of reading + 3.9 mA	
	100 Hz to 1 kHz	0.12 % of reading + 3.9 mA	
	(1 to 5) kHz	2.3 % of reading + 3.9 mA	

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source [1] Extended Frequency Ranges	(29 to 330) µA (10 to 30) kHz (0.33 to 3.3) mA (10 to 30) kHz (3.3 to 33) mA (10 to 30) kHz (33 to 330) mA (10 to 30) kHz	1.2 % of reading + 0.31 µA 0.78 % of reading + 0.47 µA 0.31 % of reading + 3.1 µA 0.31 % of reading + 0.16 mA	Comparison to Fluke 5522A Multiproduct Calibrator
AC Clamp-on Ammeters (Toroidal Type) Transformer Type Sensor [1]	(20 to 150) A (45 to 65) Hz (65 to 440) Hz (150 to 1 000) A (45 to 65) Hz (65 to 440) Hz	0.34 % of reading + 26 mA 0.95 % of reading + 47 mA 0.38 % of reading + 0.12 A 1.2 % of reading + 0.22 A	Comparison to Fluke 5522A Multiproduct Calibrator, Fluke 5500A/COIL 50-turn Coil
AC Clamp-on Ammeters (Non-Toroidal Type) Hall Effect Sensor [1]	(20 to 150) A (45z to 65) Hz (65 to 440) Hz (150 to 1 000) A (45 to 65) Hz (65 to 440) Hz	0.66 % of reading + 0.25 A 1.2 % of reading + 0.25 A 0.68 % of reading + 0.90 A 1.4 % of reading + 0.92 A	Comparison to Fluke 5522A Multiproduct Calibrator, Fluke 5500A/COIL 50-turn Coil
AC Current – Measure [1]	Up to 100 µA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 1 kHz (0.1 to 1) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (1 to 10) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (10 to 100) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.46 % of reading + 35 nA 0.17 % of reading + 35 nA 0.072 % of reading + 35 nA 0.072 % of reading + 35 nA 0.46 % of reading + 0.23 µA 0.17 % of reading + 0.23 µA 0.07 % of reading + 0.23 µA 0.038 % of reading + 0.23 µA 0.46 % of reading + 2.3 µA 0.17 % of reading + 2.3 µA 0.071 % of reading + 2.3 µA 0.038 % of reading + 2.3 µA 0.48 % of reading + 23 µA 0.17 % of reading + 23 µA 0.071 % of reading + 23 µA 0.037 % of reading + 23 µA	Comparison to Agilent 3458A Opt. 002 8.5 Digit Multimeter

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure [1]	(0.1 to 1) A (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	 0.46 % of reading + 0.23 mA 0.19 % of reading + 0.23 mA 0.097 % of reading + 0.23 mA 0.12 % of reading + 0.23 mA	Comparison to Agilent 3458A Opt. 002 8.5 Digit Multimeter
AC Current – Measure [1]	(1 to 3) A 10 Hz to 5 kHz (5 to 10) kHz (3 to 10) A 10 Hz to 5 kHz	 0.24 % of reading + 0.1 mA 1.2 % of reading + 0.1 mA 0.81 % of reading + 0.4 mA	Comparison to Fluke 8846A 6.5 Digit Multimeter
Resistance – Source [1] (Simulation)	(0 to 11) Ω (11 to 33) Ω (33 to 111) Ω (110 to 330) Ω (0.33 to 1.1) kΩ (1.1 to 3.3) kΩ (3.3 to 11) kΩ (11 to 33) kΩ (33 to 110) kΩ (110 to 330) kΩ (0.33 to 1.1) MΩ (1.1 to 3.3) MΩ (3.3 to 11) MΩ (11 to 33) MΩ (33 to 110) MΩ (110 to 330) MΩ (0.33 to 1.1) GΩ	32 μΩ/Ω + 0.78 mΩ 24 μΩ/Ω + 1.2 mΩ 22 μΩ/Ω + 1.1 mΩ 22 μΩ/Ω + 1.6 mΩ 22 μΩ/Ω + 1.6 mΩ 22 μΩ/Ω + 1.6 mΩ 22 μΩ/Ω + 1.6 mΩ 22 μΩ/Ω + 0.16 Ω 22 μΩ/Ω + 0.16 Ω 27 μΩ/Ω + 1.6 Ω 26 μΩ/Ω + 1.6 Ω 66 μΩ/Ω + 23 Ω 0.1 mΩ/Ω + 39 Ω 0.19 mΩ/Ω + 1.9 kΩ 0.41 mΩ/Ω + 2.3 kΩ 2.3 mΩ/Ω + 78 kΩ 0.12 Ω/Ω + 0.39 MΩ	Comparison to Fluke 5522A Multiproduct Calibrator
Resistance – Source [1] (Variable Artifact)	(10 to 100) MΩ (0.1 to 1) GΩ (1 to 10) GΩ (10 to 100) GΩ (0.1 to 1) TΩ	0.082 % of reading 0.24 % of reading 0.42 % of reading 0.82 % of reading 2.4 % of reading	Comparison to High Resistance Decade Box (up to 5 kV)
Resistance – Measure [1]	(0 to 10) Ω (10 to 100) Ω (0.1 to 1) kΩ (1 to 10) kΩ (10 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ (10 to 100) MΩ (0.1 to 1) GΩ	18 μΩ/Ω + 58 μΩ 15 μΩ/Ω + 0.58 mΩ 13 μΩ/Ω + 0.58 mΩ 12 μΩ/Ω + 5.8 mΩ 13 μΩ/Ω + 58 mΩ 21 μΩ/Ω + 2.3 Ω 62 μΩ/Ω + 0.12 kΩ 0.59 % of reading + 1.2 kΩ 0.82 % of reading + 12 kΩ	Comparison to Agilent 3458A Opt. 002 8.5 Digit Multimeter

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Electrical – DC/Low Frequency

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Electrical Simulation of Thermocouple Indicating Devices – Source/Measure [1]	Type B		Comparison to Fluke 5522A Multiproduct Calibrator
	(600 to 800) °C	0.35 °C	
	(800 to 1 000) °C	0.28 °C	
	(1 000 to 1 550) °C	0.24 °C	
	(1 550 to 1 820) °C	0.26 °C	
	Type E		
	(-250 to -100) °C	0.39 °C	
	(-100 to -25) °C	0.13 °C	
	(-25 to 350) °C	0.12 °C	
	(350 to 650) °C	0.13 °C	
	(650 to 1 000) °C	0.17 °C	
	Type J		
	(-210 to -100) °C	0.21 °C	
	(-100 to -30) °C	0.13 °C	
	(-30 to 150) °C	0.12 °C	
	(150 to 760) °C	0.14 °C	
	(760 to 1 200) °C	0.18 °C	
	Type K		
	(-200 to -100) °C	0.26 °C	
	(-100 to -25) °C	0.15 °C	
	(-25 to 120) °C	0.13 °C	
	(120 to 1 000) °C	0.21 °C	
	(1 000 to 1 372) °C	0.31 °C	
	Type N		
	(-200 to -100) °C	0.31 °C	
	(-100 to -25) °C	0.18 °C	
	(-25 to 120) °C	0.15 °C	
	(120 to 410) °C	0.15 °C	
	(410 to 1 300) °C	0.21 °C	
	Type R		
	(0 to 250) °C	0.46 °C	
	(250 to 400) °C	0.29 °C	
	(400 to 1 000) °C	0.26 °C	
	(1 000 to 1 767) °C	0.32 °C	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple Indicating Devices – Source/Measure [1]	Type S (0 to 250) °C (250 to 1 000) °C (1 000 to 1 400) °C (1 400 to 1 767) °C Type T (-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	 0.45 °C 0.30 °C 0.29 °C 0.36 °C 0.49 °C 0.19 °C 0.13 °C 0.12 °C	Comparison to Fluke 5522A Multiproduct Calibrator
Electrical Simulation of RTD Indicating Devices – Source [1]	Pt 385, 100 Ω (-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 800) °C	 0.039 °C 0.039 °C 0.054 °C 0.07 °C 0.078 °C 0.093 °C 0.18 °C	Comparison to Fluke 5522A Multiproduct Calibrator
DC Power – Source [1]	(0.33 to 330) mA 11 µW to 1.1 mW (1.1 to 110) mW (0.11 to 110) W (110 to 330) W (0.33 to 3) A 11 µW to 110 mW (0.11 to 990) W 1 W to 3 kW (3 to 20.5) A 99 mW to 0.99 W 0.99 W to 6.8 kW (6.8 to 20.5) kW	 0.024 % of reading 0.027 % of reading 0.024 % of reading 0.018 % of reading 0.044 % of reading 0.053 % of reading 0.01 % of reading 0.088 % of reading 0.07 % of reading 0.04 % of reading	Comparison to Fluke 5522A Multiproduct Calibrator

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Source [1,5] (10 to 65) Hz (PF=1)	(3.3 to 9.0) mA (0.11 to 3) mW 3 mW to 9 W (9 to 33) mA (0.3 to 10) mW 10 mW to 33 W (33 to 90) mA (1 to 30) mW 30 mW to 90 W (90 to 330) mA (3 to 100) mW (0.1 to 300) W (0.33 to 0.9) A (11 to 300) mW (0.3 to 900) W (0.9 to 2.2) A (30 to 720) mW 0.72 W to 2 kW (2.2 to 4.5) A 80 mW to 1.4 W 1.4 W to 4.5 kW (4.5 to 20.5) A (0.15 to 6.7) W 6.7 W to 20 kW	 0.13 % of reading 0.077 % of reading 0.089 % of reading 0.077 % of reading 0.071 % of reading 0.057 % of reading 0.089 % of reading 0.078 % of reading 0.071 % of reading 0.081 % of reading 0.089 % of reading 0.079 % of reading 0.088 % of reading 0.18 % of reading 0.17 % of reading 0.17 % of reading	Comparison to Fluke 5522A Multiproduct Calibrator
Phase – Source [1]	(0 to 180)° (10 to 65) Hz (65 to 500) Hz 500 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	 0.11° 0.21° 0.39° 1.9° 3.9° 7.8°	Comparison to Fluke 5522A Multiproduct Calibrator
Capacitance – Source [1] (Simulation)	10 Hz to 10 kHz (220 to 400) pF (0.4 to 1.1) nF 10 Hz to 3 kHz (1.1 to 3.3) nF 10 Hz to 1 kHz (3.3 to 11) nF (11 to 33) nF (33 to 110) nF	 0.4 % of reading + 7.8 pF 0.4 % of reading + 7.8 pF 0.4 % of reading + 7.8 pF 0.21 % of reading + 7.8 pF 0.2 % of reading + 78 pF 0.21 % of reading + 78 pF	Comparison to Fluke 5522A Multiproduct Calibrator

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Source [1] (Simulation)	10 Hz to 1 kHz (110 to 330) nF (10 to 600) Hz (0.33 to 1.1) µF (10 to 300) Hz (1.1 to 3.3) µF (10 to 150) Hz (3.3 to 11) µF (10 to 120) Hz (11 to 33) µF (10 to 80) Hz (33 to 110) µF DC to 50 Hz (110 to 330) µF DC to 20 Hz (0.33 to 1.1) mF DC to 6 Hz (1.1 to 3.3) mF DC to 2 Hz (3.3 to 11) mF DC to 0.6 Hz (11 to 33) mF DC to 0.2 Hz (33 to 110) mF	0.2 % of reading + 0.23 nF 0.21 % of reading + 0.78 nF 0.21 % of reading + 2.3 nF 0.2 % of reading + 7.8 nF 0.32 % of reading + 23 nF 0.37 % of reading + 78 nF 0.38 % of reading + 0.23 µF 0.35 % of reading + 0.78 µF 0.35 % of reading + 2.3 µF 0.35 % of reading + 7.8 µF 0.58 % of reading + 23 µF 0.85 % of reading + 78 µF	Comparison to Fluke 5522A Multiproduct Calibrator
Capacitance – Measure [1]	60 Hz to 1 kHz Up to 10 pF (10 to 100) pF (0.1 to 1) µF (1 to 100) µF (0.1 to 1) mF	0.47 % of reading + 14 fF 0.062 % of reading + 14 fF 0.027 % of reading + 14 fF 0.035 % of reading + 18 fF 0.24 % of reading + 18 fF	Comparison to GR 1689-9700 5 Precision Impedance Meter
Scope Voltage – Source [1] DC Signal into 50 Ω into 1 MΩ	 (-5.0 to 5.0) V (-200 to 200) V	 0.023 % of reading + 19 µV 0.023 % of reading + 19 µV	Comparison to Fluke 9500B Oscilloscope Calibrator

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Scope Voltage – Source [1]			
Square Wave			Comparison to Fluke 9500B Oscilloscope Calibrator, Fluke 9530 Active Head, Fluke 9560 Active Head
10 Hz to 100 kHz			
into 50 Ω	40 µVp-p to 1 mVp-p	0.78 % of reading + 7.8 µV	
	1 mVp-p to 5 Vp-p	0.078 % of reading + 7.8 µV	
10 Hz to 10 kHz			
into 1 MΩ	40 µVp-p to 1 mVp-p	0.78 % of reading + 7.8 µV	
10 Hz to 100 kHz			
into 1 MΩ	1 mVp-p to 200 Vp-p	0.078 % of reading + 7.8 µV	
Scope – Time Markers [1]			
100 mVp-p to 1 Vp-p			Comparison to Fluke 9500B Oscilloscope Calibrator, Fluke 9530 Active Head, Fluke 9560 Active Head
(into 50 Ω)			
Square Wave	9.009 1 ns to 83 µs	0.19 µs/s	
	83 µs to 55 s	2.3 µs/s	
Sine Wave	450.5 ps to 9.009 ns	0.19 µs/s	
Pulse	900.91 ns to 83 µs	0.19 µs/s	
	83 µs to 55 s	2.3 µs/s	
Triangle Wave	900.91 ns to 83 µs	0.19 µs/s	
	83 µs to 55 s	2.3 µs/s	
Scope Rise Time – Source [1,4]			
(into 50 Ω)			Comparison to Fluke 9500B Oscilloscope Calibrator with Fluke 9530 Active Head
10 Hz to 2 MHz	5 mVp-p to 3 Vp-p		
	500 ps (Nominal)	290 ps	
	150 ps (Nominal)	34 ps	
10 Hz to 1 MHz	25 mVp-p to 2 Vp-p		
	70 ps (Nominal)	21 ps	
Scope Leveled Sine Wave – Source [1]			
(50 kHz Ref. Frequency)			Comparison to Fluke 9500B Oscilloscope Calibrator with Fluke 9530 Active Head
into 50 Ω	5 mVp-p to 5 Vp-p		
	50 kHz to 10 MHz	1.2 % of reading	

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Scope Bandwidth/Flatness – Source [1] into VSWR (1.2:1) (wrt Reference Frequency)	5 mVp-p to 5 Vp-p 100 mHz to 300 MHz (300 to 550) MHz 5 mVp-p to 3 Vp-p 550 MHz to 1.1 GHz (1.1 to 2.5) GHz 5 mVp-p to 2 Vp-p (2.5 to 3.2) GHz	 1.6 % of reading 1.9 % of reading 2.7 % of reading 3.1 % of reading 3.1 % of reading	Comparison to Fluke 9500B Oscilloscope Calibrator, Fluke 9530 Active Head
Scope Input Impedance – Measure [1]	(10 to 40) Ω (40 to 90) Ω (90 to 150) Ω (50 to 800) kΩ 800 kΩ to 1.2 MΩ (1.2 to 12) MΩ	0.39 % of reading 0.083 % of reading 0.39 % of reading 0.39 % of reading 0.083 % of reading 0.39 % of reading	Comparison to Fluke 9500B Oscilloscope Calibrator
Scope Input Capacitance – Measure [1]	(1 to 35) pF (35 to 95) pF	1.6 % of reading + 0.19 pF 2.3 % of reading + 0.19 pF	Comparison to Fluke 9500B Oscilloscope Calibrator

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Relative Power – Sinewave Flatness [1] (Relative Power)	10 MHz to 18 GHz (-40 to 0) dBm (0 to 10) dBm (10 to 20) dBm 50 MHz to 26.5 GHz (-40 to 00) dBm (0 to 10) dBm (10 to 20) dBm	 0.21 dB 0.34 dB 0.51 dB 0.25 dB 0.39 dB 0.56 dB	Comparison to Agilent E4419B EPM Power Meter, Agilent E4412A Power Sensor, Agilent E4413A Power Sensor

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Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Absolute Power – Measure [1] 100 pW to 100 mW	10 MHz to 1 GHz (-70 to -60) dBm (-60 to -50) dBm (-50 to -40) dBm (-40 to 0) dBm (0 to 10) dBm (10 to 20) dBm 1 GHz to 18 GHz (-70 to -60) dBm (-60 to -50) dBm (-50 to -40) dBm (-40 to 0) dBm (0 to 10) dBm (10 to 20) dBm 50 MHz to 26.5 GHz (-70 to -60) dBm (-60 to -50) dBm (-50 to -40) dBm (-40 to 0) dBm (0 to 10) dBm (10 to 20) dBm	 6.9 dB 1.4 dB 0.24 dB 0.17 dB 0.34 dB 0.51 dB 6.9 dB 1.4 dB 0.25 dB 0.19 dB 0.36 dB 0.53 dB 6.9 dB 1.4 dB 0.27 dB 0.22 dB 0.39 dB 0.56 dB	Comparison to Agilent E4419B EPM Power Meter, Agilent E4412A Power Sensor, Agilent E4413A Power Sensor
Amplitude Modulation – AM Depth Measure [1] Rate 50 Hz to 10 kHz Rate: 20 Hz to 10 kHz Rate: 50 Hz to 50 kHz Rate: 20 Hz to 100 kHz Rate: 50 Hz to 50 kHz Rate 20 Hz to 100 kHz	 (5 to 99) % Depth (0.15 to 10) MHz (> 0 to 99) % Depth (0.15 to 10) MHz (5 to 99) % Depth (0.01 to 1.3) GHz (> 0 to 99) % Depth (0.01 to 1.3) GHz (5 to 99) % Depth (1.3 to 26.5) GHz (> 0 to 99) % Depth (1.3 to 26.5) GHz	 2.4 % Depth 3.5 % Depth 1.4 % Depth 3.5 % Depth 1.9 % Depth 3.5 % Depth	Comparison to HP 8902A Measuring Receiver, HP 11722A Power Sensor

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Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
FM Modulation – Measure [1] Rate 50 Hz to 10 kHz Rate: 50 Hz to 100 kHz Rate: 20 Hz to 200 kHz	≤ 40 kHz peak 250 kHz to 10 MHz ≤ 400 kHz peak 10 MHz to 26.5 GHz ≤ 400 kHz peak 10 MHz to 26.5 GHz	2.4 % Deviation 1.4 % Deviation 5.8 % Deviation	Comparison to HP 8902A Measuring Receiver, HP 11722A Power Sensor
Phase Modulation – Measure [1] Rate: 200 Hz to 10 kHz	Up to 4 rad 150 kHz to 10 MHz (4 to 40) rad 150 kHz to 10 MHz (40 to 400) rad 150 kHz to 10 MHz	4.2 % of reading + 0.03 rad 4.2 % of reading + 0.03 rad 4.2 % of reading + 0.1 rad	Comparison to HP 8902A Measuring Receiver, HP 11722A Power Sensor
Phase Modulation – Measure [1] Rate: 200 Hz to 10 kHz Rate: 200 Hz to 20 kHz	< 40 Radians Deviation (0.15 to 10) MHz < 40 Radians Deviation (0.01 to 26.5) GHz	4.9% Deviation 3.8% Deviation	Comparison to HP 8902A Measuring Receiver, HP 11722A Power Sensor, HP 11792A Microwave Converter, HP 11793A Microwave Converter
Harmonic Distortion	(-80 to 0) dBc 30 Hz to 6.5 GHz (6.5 to 22) GHz (22 to 26.5) GHz	1.7 dB 2.6 dB 3.4 dB	Comparison to Agilent 8563E Spectrum Analyzer
Total Harmonic Distortion – Measure [1]	(-80 to 0) dB 20 Hz to 20 kHz (20 to 100) kHz	1.1 dB 2 dB	Comparison to Agilent 8903B Audio Analyzer
AM Total Harmonic Distortion – Measure [1]	(-80 to 0) dB 20 Hz to 20 kHz 20 kHz to 100 kHz	1.2 dB 2.3 dB	Comparison to Agilent 8903B Audio Analyzer
Absolute RF Power – Measure [1]	1 mW, 50 MHz Reference	0.43 % of reading	Comparison to Agilent 478A- H75 Coaxial Thermistor Mount, HP 432A Power Meter, Agilent 3458A 8.5 Digit Multimeter

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Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Absolute RF Power – Measure [1]	100 kHz to 2.6 GHz (-20 to -10) dBm (-10 to 0) dBm (0 to 10) dBm (10 to 20) dBm (20 to 30) dBm	 0.11 dB 0.1 dB 0.11 dB 0.11 dB 0.23 dB	Comparison to HP 8902A Measuring Receiver, HP 11722A Power Sensor
Absolute RF Power – Measure [1]	(2.6 to 12.2) GHz (-20 to -10) dBm (-10 to 0) dBm (0 to 10) dBm (10 to 20) dBm (20 to 30) dBm (12.2 to 17.75) GHz (-20 to -10) dBm (-10 to 0) dBm (0 to 10) dBm (10 to 20) dBm (20 to 30) dBm (17.75 to 26.5) GHz (-20 to -10) dBm (-10 to 0) dBm (0 to 5) dBm	 0.14 dB 0.13 dB 0.13 dB 0.14 dB 0.25 dB 0.15 dB 0.14 dB 0.14 dB 0.15 dB 0.25 dB 0.18 dB 0.18 dB 0.18 dB	Comparison to HP 8902A Measuring Receiver, HP 11722A Power Sensor, HP 11792A Microwave Converter, HP 11793A Microwave Converter
Reflection (VSWR) [1,7] 10 MHz to 18 GHz	(Rho) 0.022 to 0.1 0.1 to 0.2 0.2 to 0.3 0.3 to 0.4	(Rho) 0.022 0.027 0.033 0.042	Comparison to VSWR Bridge
Relative Tuned RF Power – Measure [1]	2.5 MHz to 26.5 GHz (-127 to -120) dB (-120 to -110) dB (-110 to -100) dB (-100 to -90) dB (-90 to -80) dB (-80 to -70) dB (-70 to -60) dB (-60 to -50) dB (-50 to -40) dB (-40 to -30) dB (-30 to -20) dB (-20 to -10) dB (-10 to 0) dB	 0.056 dB 0.06 dB 0.064 dB 0.068 dB 0.071 dB 0.074 dB 0.081 dB 0.084 dB 0.22 dB 0.23 dB 0.23 dB 0.23 dB 0.23 dB	Comparison to HP 8902A Measuring Receiver, HP 11722A Power Sensor, HP 11793A Microwave Converter

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Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Amplitude Modulation – AM Depth Measure [1,6]			Comparison to HP 8902A Measuring Receiver HP 8902A, HP 11793A Measuring Receiver Microwave Converter
Rate: 50 Hz to 10 kHz	150 kHz to 10 MHz (5 to 99) % Depth	2.4 % Depth	
Rate: 20 Hz to 10 kHz	150 kHz to 10 MHz (5 to 99) % Depth	3.5 % Depth	
Rate: 50 Hz to 50 kHz	10 MHz to 1.3 GHz (5 to 99) % Depth	1.3 % Depth	
Amplitude Modulation – AM Depth Measure [1,6]			Comparison to HP 8902A Measuring Receiver, HP 11793A Microwave Converter
Rate: 20 Hz to 100 kHz	10 MHz to 1.3 GHz (0 to 99) % Depth	3.5 % Depth	
Rate: 50 Hz to 50 kHz	(1.3 to 26.5) GHz (0 to 99) % Depth	1.8 % Depth	
Rate: 20 Hz to 100 kHz	(1.3 to 26.5) GHz (0 to 99) % Depth	3.5 % Depth	
Frequency Modulation – Deviation Measure [1,6]			Comparison to HP 8902A Measuring Receiver
Rate: 20 Hz to 10 kHz	250 kHz to 10 MHz Dev/Rate ≤ 40 kHz peak	2.3 % Deviation	
Rate: 50 Hz to 100 kHz	10 MHz to 1.3 GHz Dev/Rate ≤ 400 kHz peak	1.2 % Deviation	
Frequency Modulation – Deviation Measure [1,6]			Comparison to HP 8902A Measuring Receiver, HP 11793A Microwave Converter
Rate: 20 Hz to 200 kHz	10 MHz to 1.3 GHz Dev/Rate ≤ 4 kHz peak	5.8 % Deviation	
Rate: 50 Hz to 100 kHz	(1.3 to 26.5) GHz Dev/Rate ≤ 400 kHz peak	1.2 % Deviation	
Rate: 20 Hz to 200 kHz	(1.3 to 26.5) GHz Dev/Rate ≤ 400 kHz peak	5.8 % Deviation	
RF Power – Transfer Measure	(-20 to 10) dBm 100 kHz to 10 MHz > 10 MHz to 10 GHz (> 10 to 18) GHz	 0.97 % of reading 1.2 % of reading 1.5 % of reading	Comparison to Tegam 2505A Microwave Calibration Feed-through Standard, Tegam 1830A RF Power Meter

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Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Transfer Measure	(-20 to 10) dBm (10 to 50) MHz > 10 MHz to 4.2 GHz (> 4.2 to 12.2) GHz (> 12.2 to 17.75) GHz (> 17.75 to 33) GHz (> 33 to 44) GHz (> 44 to 50) GHz	 1.5 % of reading 1.5 % of reading 1.8 % of reading 2 % of reading 2.7 % of reading 3.4 % of reading 4.8 % of reading	Comparison to Tegam 2510A Microwave Calibration Feed-through Standard, Tegam 1830A RF Power Meter
Tuned RF Absolute Power – Measure	2.5 MHz to 26.5 GHz (-127 to -120) dB (-120 to -110) dB (-110 to -100) dB (-100 to -90) dB (-90 to -80) dB (-80 to -70) dB (-70 to -60) dB (-60 to -50) dB (-50 to -40) dB (-40 to -30) dB (-30 to -20) dB (-20 to -10) dB (-10 to 0) dB	 0.26 dB 0.26 dB 0.26 dB 0.26 dB 0.26 dB 0.25 dB 0.25 dB 0.25 dB 0.25 dB 0.14 dB 0.14 dB 0.14 dB 0.14 dB	Comparison to HP 8902A Measuring Receiver, HP 11722A Power Sensor, HP 11792A Microwave Converter, HP 11793A Microwave Converter

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Outside Micrometers [1,2]	(0.05 to 1) in (1 to 9) in (4 to 15) in (15 to 40) in	(13 + 1*L*) µin (9 + 4*L*) µin (14 + 4*L*) µin (20 + 4*L*) µin	Comparison to ASME B89 Grade 0 Gage Blocks, ASME B89 Grade 0 Long Blocks
Anvil Flatness [1]	Up to 1 in Diameter	6.3 µin	Comparison to Optical Flats
Anvil Parallelism [1]	Up to 1 in Diameter	6.3 µin	Comparison to Optical Parallel

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Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Calipers [1,2]	(0.05 to 1) in (1 to 9) in (4 to 15) in (15 to 40) in	(13 + 1*L*) µin (9 + 4*L*) µin (14 + 4*L*) µin (20 + 4*L*) µin	Comparison to ASME B89 Grade 0 Gage Blocks, ASME B89 Grade 0 Long Blocks
Jaw Parallelism [1]	Up to 1 in	59 µin	Comparison to Pin Gages
Height Measure, Height Gages [1,2]	(0.05 to 1) in (1 to 9) in (4 to 15) in (15 to 40) in	57 µin (54 + 2*L*) µin (48 + 3*L*) µin (34 + 4*L*) µin	Comparison to ASME B89 Grade 0 Gage Blocks, Gage Amp w/Probe, Surface Plate
Single Axis Length [2]	up to 4 in (4 to 10) in	(15 + 3*L*) µin (14 + 4*L*) µin	Comparison to P&W Supermicrometer®, ASME B89 Grade 0 Gage Blocks
Plain Plugs, Pin Gages [2]	Up to 1 in	(15 + 3 *L*) µin	Comparison to P&W Supermicrometer®, ASME B89 Grade 0 Gage Blocks
Threaded Plug Gage [2] Outer Pitch Diameter, 60° Major Diameter	 Up to 5 in (5 to 10) up to 4 in (4 to 10) in	 110 µin 110 µin (15 + 3 *L*) µin (14 + 4 *L*) µin	Comparison to P&W Supermicrometer®, ASME B89 Grade 0 Gage Blocks, Thread Wires
Rulers and Tapes	up to 25 in (2 to 4) ft (4 to 6) ft (6 to 8) ft (8 to 22) ft (22 to 48) ft (48 to 1 000) ft	0.003 5 in 0.004 5 in 0.006 7 in 0.009 3in 100 µin/in 110 µin/in 120 µin/in	Comparison to Magnified Glass Rule
Surface Plates [1] Local Area Flatness Only	Up to 0.001 in	65 µin	Partial Calibration using Gage Amp w/Probe, Level Plate
Surface Plates [1] Local Area Flatness Only	Up to 0.001 in	33 µin	Partial Calibration using Repeat-o-Meter
Surface Parallelism [1]	Up to 18 in	120 µin	Comparison to Gage Amp w/Probe, Surface Plate

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Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Surface Straightness [1]	Up to 18 in	120 µin	Comparison to Gage Amp w/Probe, Surface Plate

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Force – Source [1]	(0.1 to 915) lbf	0.024 % of reading + 0.001 2 lbf	Comparison to NIST Class F Weights
Torque Wrenches [1]	(0.2 to 10) N·m (0.4 to 20) N·m (2 to 100) N·m (4 to 200) N·m (8 to 400) N·m (25 to 1 100) N·m	1 % of reading 1 % of reading 1 % of reading 1 % of reading 1 % of reading 1 % of reading	Comparison to Stahlwille Torque Transducers
Torque Wrenches [1]	(900 to 2 000) lbf·ft	1.5 % of reading	Comparison to CDI 200-14-02 Torque Transducer
Torque Transducers [1]	0.156 lbf·in to 150 lbf·ft	0.17 % of reading	Comparison to Torque Arms/Wheels, NIST Class F Weights
Pneumatic Pressure – Source/Measure [1] (Absolute)	(0 to 15) psia (15 to 30) psia	0.001 5 psi 0.01 % of reading	Comparison to Mensor CPC6000 Pressure Controller
Pneumatic Pressure – Source/Measure [1] (Absolute)	(30 to 50) psia	0.006 6 % of reading + 0.005 7 psi	Comparison to Fluke 6270A Pressure Controller
Pneumatic Pressure – Source/Measure [1] (Absolute)	(50 to 300) psia (300 to 1 000) psia	0.004 5 % of reading + 0.006 4 psi 0.005 2 % of reading + 0.001 5 psi	Comparison to Fluke PPC4 Pressure Controller
Pneumatic Pressure – Source/Measure [1] (Gauge)	(-14.7 to 0) psig	0.006 2 % of reading + 0.000 1 psi	Comparison to Fluke PPC4 Pressure Controller
Pneumatic Pressure – Source/Measure [1] (Gauge)	(0 to 1) psig	0.000 1 psi	Comparison to Mensor CPC6000 Pressure Controller

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Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Pneumatic Pressure – Source/Measure [1] (Gauge)	(1 to 1 000) psig	0.006 2 % of reading + 0.000 1 psi	Comparison to Fluke PPC4 Pressure Controller
Hydraulic Pressure – Source/Measure [1] (Gauge)	(15 to 800) psig (800 to 16 000) psig	0.025 % of reading + 0.005 psi 0.02 % of reading + 0.095 psi	Comparison to Fluke P3125-DWT Deadweight Tester
Balances, Scales [1,4] (SI)	Up to 500 mg 500 mg to 5 g 5 g to 10 g 10 g to 30 g 30 g to 16 kg	12 µg 40 µg 58 µg 89 µg 0.000 32 % of reading	ASTM E617 Class 1 weights and internal calibration procedure utilized for the calibration of the weighing system.
Balances, Scales [1,4] (Avoirdupois)	Up to 0.018 oz (0.018 to 0.18) oz (0.18 to 0.35) oz (0.35 to 0.7) oz 0.7 oz to 35 lb	12 µg 40 µg 58 µg 89 µg 0.000 32 % of reading	ASTM E617 Class 1 weights and internal calibration procedure utilized for the calibration of the weighing system.
Balances, Scales [1,4] (SI)	Up to 8 g (8 to 226) g (226 to 453) g 453 g to 5 kg (5 to 6) kg (6 to 415) kg	2 mg 0.024 % of reading 0.018 % of reading 0.012 % of reading 0.01 % of reading 0.012 % of reading	NIST Class F weights and internal calibration procedure utilized for the calibration of the weighing system.
Balances, Scales [1,4] (Avoirdupois)	Up to 0.25 oz (0.25 to 8) oz (0.5 to 1) lb (1 to 11) lb (11 to 14) lb (14 to 915) lb	2 mg 0.024% of reading 0.018% of reading 0.012% of reading 0.010% of reading 0.012% of reading	NIST Class F weights and internal calibration procedure utilized for the calibration of the weighing system.

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature – Source [1] (Thermometers, Probes, etc.)	(-30 to 0) °C (0 to 125) °C (-15 to 50) °C (50 to 100) °C (100 to 350) °C	0.04 °C 0.046 °C 0.59 °C 0.17 °C 0.14 °C	Comparison to Water Baths, Dry-well Calibrators, SPRT

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Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature – Measure [1]	(-195 to 0) °C (0 to 420) °C (420 to 660) °C	0.027 °C 0.007 5 % of reading + 0.027 °C 0.008 % of reading + 0.024 °C	Comparison to Fluke 1523 Reference Thermometer, Fluke 5626 PRT
Humidity – Measure [1] (15 to 25 °C)	(0 to 90) %RH	1.3 % RH	Comparison to Vaisala MI70/HMP76B Temp/Humidity Probe
Infrared Temperature – Measuring Equipment [1]	(-15 to 0) °C (0 °C to 50) °C (50 °C to 100) °C (100 °C to 120) °C (120 °C to 200) °C (200 °C to 350) °C (350 °C to 500) °C	0.8 °C 0.65 °C 0.7 °C 0.76 °C 0.95 °C 1.6 °C 2.1 °C	Comparison to Blackbody Source (Plate) ε = (0.9 to 1) λ = (8 to 14) µm

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Reference [1]	10 MHz	640 pHz/Hz	Comparison to Rubidium Oscillator
Frequency – Measure [1]	10 mHz to 100 kHz 100 kHz to 10 MHz (10 to 100) MHz (100 to 225) MHz	4.8 mHz 0.45 Hz 4.5 Hz 10 Hz	Comparison to HP 53132A Universal Counter, Rubidium Oscillator
Frequency – Measure [1]	225 MHz to 1 GHz (1 to 10) GHz (10 to 50) GHz	0.86 Hz 7.5 Hz 37 Hz	Comparison to Agilent E4448A Spectrum Analyzer, Rubidium Oscillator
Frequency – Source [1]	0.01 Hz to 2 MHz	2 µHz/Hz + 8 µHz	Comparison to Fluke 5522A Multiproduct Calibrator
Frequency – Source [1]	10 mHz to 100 kHz 100 kHz to 20 MHz	2 mHz 18 mHz	Comparison to HP 3325B Synthesizer/Function Generator, Rubidium Oscillator

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Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Source [1]	250 kHz to 1 GHz (1 to 50) GHz	0.74 Hz 37 Hz	Comparison to Agilent E8257D Analog Frequency Generator, Rubidium Oscillator
Stopwatches, Timers [1]	Up to 24 hr	0.02 % of reading + 38 ms	Comparison to Fluke 5522A Multiproduct Calibrator, HP 53132A Universal Counter
Photo Tachometers [1,2]	(10 to 999.9) rpm (1 000 to 99 999) rpm	0.058 % of reading + 0.12 rpm 0.082 % of reading + 1.2 rpm	Comparison to Extech 461995 Laser Tachometer
AC Duty Cycle – Source [1] Square Wave: < 3.3 Vp-p Freq: 0.1 Hz to 100 kHz	(1 to 10) % Duty Cycle 10 µs to 100 s (10 to 49) % Duty Cycle 10 µs to 100 s 50 % Duty Cycle 10 µs to 100 s (51 to 90) % Duty Cycle 10 µs to 100 s (90 to 99) % Duty Cycle 10 µs to 100 s	0.62 % of reading + 78 ns 0.039 % of reading + 78 ns 0.001 6 % of reading + 78 ns 0.039 % of reading + 78 ns 0.62 % of reading + 78 ns	Comparison to Fluke 5522A Multiproduct Calibrator

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; rpm = revolutions per minute.
3. The stated uncertainty is the laboratory's ability to source a fast rise pulse that is approximately 250 ps. In the typical application of measuring rise time of an oscilloscope, this value is one of the contributing factors, but other factors are derived from the DUT. The known source rise time is mathematically removed from the total measured rise time measured on the DUT.
4. The CMC for scales and balances is highly dependent upon the resolution of the unit under test. The CMC presented here does not include the resolution of the unit under test. The resolution will be included in the reported measurement uncertainty at the time of calibration.
5. The uncertainties shown are for the most favorable conditions. There is an increase in uncertainty that corresponds to the laboratory's AC voltage and current uncertainties at different frequencies other than the ones shown. Power factors (PF) other than the one shown contribute to the power uncertainty. PF is related to the cosine of phase. Therefore, uncertainties track the laboratory's phase uncertainty closely at PF near one, but are magnified heavily as PF approaches zero. The lab may also report reactive power, apparent power, and power factor under this accreditation. If needed, contact laboratory for more information regarding uncertainties at frequency and power factor combinations other than the ones shown.
6. In addition to the percent of reading value for the CMC, 1 Least Significant Digit will be added at the time of calibration.
7. This is a unitless measurement.
8. Unless otherwise specified in the far-right column, the calibration procedure/method utilized by the laboratory was developed internally.

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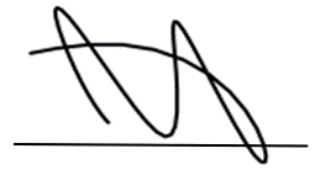

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