



# CERTIFICATE OF ACCREDITATION

**The ANSI National Accreditation Board**

Hereby attests that

**Instrument Calibration and Technical Services, Inc.**

**5312 Peters Creek Road, Suite E  
Roanoke, VA 24019**

Fulfills the requirements of

**ISO/IEC 17025:2017**

and national standards

**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: 11 November 2022

Certificate Number: AC-1195



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)**

**Instrument Calibration and Technical Services, Inc.**

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**CALIBRATION**

Valid to: **November 11, 2022**

Certificate Number: **AC-1195**

**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 220 mV (0.22 to 2.2) V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1 100) V	2.9 $\mu$ V 16 $\mu$ V 55 $\mu$ V 0.11 mV 1.6 mV 11 mV	Fluke 5730A Multifunction Calibrator
DC Voltage - Measure <sup>1</sup>	Up to 100 mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 1 000) V	0.1 $\mu$ V 13 $\mu$ V 0.12 mV 1.4 mV 14 mV	HP 3458A 8.5 Digit Multimeter
DC High Voltage – Measure <sup>1</sup>	Up to 100 V (100 to 200) V (0.2 to 1) kV (1 to 4) kV (4 to 9) kV	72 mV 0.11 V 0.39 V 1.5 V 3.8 V	Vitrek 4700 High Voltage Meter
	(9 to 10) kV (10 to 30) kV	12 V 30 V	Vitrek 4700 High Voltage Meter, Vitrek HVL-35 High Voltage Probe
	(30 to 50) kV (50 to 70) kV (70 to 90) kV	43 V 1.2 kV 1.2 kV	Vitrek 4700 High Voltage Meter, Vitrek HVL-100 High Voltage Probe



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source <sup>1</sup>	Up to 2.2 mV		Fluke 5730A Multifunction Calibrator
	(10 to 20) Hz	6.6 $\mu$ V	
	(20 to 40) Hz	6.1 $\mu$ V	
	40 Hz to 20 kHz	2.6 $\mu$ V	
	(20 to 50) kHz	6.5 $\mu$ V	
	(50 to 100) kHz	8.5 $\mu$ V	
	(100 to 300) kHz	17 $\mu$ V	
	(300 to 500) kHz	33 $\mu$ V	
	500 kHz to 1 MHz	39 $\mu$ V	
	(2.2 to 22) mV		
	(10 to 20) Hz	14 $\mu$ V	
	(20 to 40) Hz	8.8 $\mu$ V	
	40 Hz to 20 kHz	8.4 $\mu$ V	
	(20 to 50) kHz	12 $\mu$ V	
	(50 to 100) kHz	22 $\mu$ V	
	(100 to 300) kHz	47 $\mu$ V	
	(300 to 500) kHz	73 $\mu$ V	
	500 kHz to 1 MHz	0.12 mV	
	(22 to 220) mV		
	(10 to 20) Hz	94 $\mu$ V	
	(20 to 40) Hz	39 $\mu$ V	
	40 Hz to 20 kHz	27 $\mu$ V	
	(20 to 50) kHz	48 $\mu$ V	
	(50 to 100) kHz	0.13 mV	
	(100 to 300) kHz	0.23 mV	
	(300 to 500) kHz	0.47 mV	
	500 kHz to 1 MHz	0.92 mV	
	(0.22 to 2.2) V		
(10 to 20) Hz	0.82 mV		
(20 to 40) Hz	0.31 mV		
40 Hz to 20 kHz	0.14 mV		
(20 to 50) kHz	0.23 mV		
(50 to 100) kHz	0.31 mV		
(100 to 300) kHz	1.1 mV		
(300 to 500) kHz	3.4 mV		
500 kHz to 1 MHz	5.7 mV		

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source <sup>1</sup>	(2.2 to 22) V (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) V (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 (220 to 1 100) V (15 to 50) Hz 50 Hz to 1 kHz	8.2 mV 3.1 mV 1.4 mV 2.3 mV 3 mV 8.8 mV 34 mV 52 mV 77 mV 28 mV 17 mV 27 mV 48 mV 0.28 V 1.4 V 2.5 V 0.46 V 0.12 V	Fluke 5730A Multifunction Calibrator
AC Voltage – Measure <sup>1</sup>	Up to 10 mV 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (10 to 100) mV 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz 100 mV to 1 V 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (1 to 10) V 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (10 to 100) V 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz	1.2 μV 1.2 μV 2.1 μV 21 μV 4 μV 7 μV 0.21 mV 30 μV 50 μV 2 mV 0.2 mV 0.5 mV 20 mV 3.1 mV 5 mV	HP 3458A 8.5 Digit Multimeter

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure <sup>1</sup>	(100 V to 1 000) V 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz	40 mV 13 mV 13 mV	HP 3458A 8.5 Digit Multimeter
AC High Voltage – Measure <sup>1</sup>	Up to 1 kV 10 mHz to 600 Hz (1 to 9) kV 10 mHz to 600 Hz	1.5 V 13 V	Vitrek 4700 High Voltage Meter
	(9 to 10) kV 10 mHz to 600 Hz (10 to 30) kV 10 mHz to 600 Hz	17 V 37 V	Vitrek 4700 High Voltage Meter, Vitrek HVL-35 High Voltage Probe
	(30 to 70) kV 10 mHz to 600 Hz	0.58 kV	Vitrek 4700 High Voltage Meter, Vitrek HVL-100 High Voltage Probe
DC Current – Source <sup>1</sup>	Up to 220 $\mu$ A (0.22 to 2.2) mA (2.2 to 22) mA (22 to 220) mA (0.22 to 2.2) A	0.12 $\mu$ A 0.12 $\mu$ A 1.1 $\mu$ A 14 $\mu$ A 0.25 mA	Fluke 5730A Multifunction Calibrator
	(2.2 to 3) A (3 to 11) A (11 to 20.5) A	1.4 mA 7 mA 24 mA	Fluke 5520A Multifunction Calibrator
DC Current – Source Clamp-On Meters <sup>1</sup>	(10 to 50) A (50 to 100) A (100 to 250) A (250 to 500) A (500 to 1 000) A	0.3 mA 0.96 mA 3.6 mA 6.4 mA 24 mA	Fluke 5520A Multifunction Calibrator, Fluke 5500A/COIL 50-turn Coil
DC Current - Measure <sup>1</sup>	(0.1 to 1) $\mu$ A (1 to 10) $\mu$ A (10 to 100) $\mu$ A (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A	0.82 nA 0.9 nA 3.4 nA 25 nA 0.25 $\mu$ A 4.2 $\mu$ A 0.13 $\mu$ A	HP 3458A 8.5 Digit Multimeter
	(1 to 10) A (10 to 100) A	0.041 % of reading 0.041% of reading	HP 3458A 8.5 Digit Multimeter, Rubicon 1166 Current Shunt



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source <sup>1</sup>	Up to 220 $\mu$ A		Fluke 5730A Multifunction Calibrator
	(10 to 20) Hz	0.1 $\mu$ A	
	(20 to 40) Hz	65 nA	
	40 Hz to 1 kHz	43 nA	
	(1 to 5) kHz	0.12 $\mu$ A	
	(5 to 10) kHz	0.43 $\mu$ A	
	(0.22 to 2.2) mA		
	(10 to 20) Hz	0.83 $\mu$ A	
	(20 to 40) Hz	0.56 $\mu$ A	
	40 Hz to 1 kHz	0.36 $\mu$ A	
	(1 to 5) kHz	0.77 $\mu$ A	
	(5 to 10) kHz	4.3 $\mu$ A	
	(2.2 to 22) mA		
	(10 to 20) Hz	8.3 $\mu$ A	
	(20 to 40) Hz	5.6 $\mu$ A	
	40 Hz to 1 kHz	3.6 $\mu$ A	
	(1 to 5) kHz	7.1 $\mu$ A	
	(5 to 10) kHz	40 $\mu$ A	
	(22 to 220) mA		
	(10 to 20) Hz	83 $\mu$ A	
(20 to 40) Hz	56 $\mu$ A		
40 Hz to 1 kHz	35 $\mu$ A		
(1 to 5) kHz	68 $\mu$ A		
(5 to 10) kHz	0.35 mA		
(0.22 to 2.2) A			
45 Hz to 1 kHz	0.82 mA		
(1 to 5) kHz	1.4 mA		
(5 to 10) kHz	21 mA		
AC Current – Source <sup>1</sup>	Up to 220 $\mu$ A		Fluke 5520A Multifunction Calibrator
	(10 to 30) kHz	4.1 $\mu$ A	
	220 $\mu$ A to 2.2 mA		
	(10 to 30) kHz	26 $\mu$ A	
	(2.2 to 22) mA		
	(10 to 30) kHz	0.11 mA	
	(22 to 220) mA		
	(10 to 30) kHz	1.3 mA	
(2.2 to 3) A			
(10 to 45) Hz	6.4 mA		
45 Hz to 1kHz	2.2 mA		
(1 to 5) kHz	22 mA		
(5 to 10) kHz	88 mA		

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment		
AC Current – Source <sup>1</sup>	(3 to 11) A (45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	10 mA 15 mA 0.39 A	Fluke 5520A Multifunction Calibrator		
	(11 to 20.5) A (45 to 100) Hz 100 Hz to 1kHz (1 to 5) kHz	34 mA 41 mA 0.79 A			
AC Current – Source Clamp-on Meters <sup>1</sup>	(10 to 50) A (45 to 60) Hz (60 to 400) Hz	0.27 A 0.64 A	Fluke 5520A Multifunction Calibrator, Fluke 5500A/COIL 50-turn Coil		
	(50 to 100) A (45 to 60) Hz (60 to 400) Hz	0.49 A 1.2 A			
	(100 to 250) A (45 to 60) Hz (60 to 400) Hz	1.5 A 3.3 A			
	(250 to 500) A (45 to 60) Hz (60 to 400) Hz	2.8 A 6.5 A			
	(500 to 1 000) A (45 to 60) Hz (60 to 400) Hz	5.6 A 13 A			
	AC Current – Measure <sup>1</sup>	Up to 100 $\mu$ A (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz		4.2 $\mu$ A 4.2 $\mu$ A 4.2 $\mu$ A	HP 3458A 8.5 Digit Multimeter
		(0.1 to 1) mA (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz		3.4 $\mu$ A 3 $\mu$ A 2.9 $\mu$ A	
		(1 to 10) mA (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz		22 $\mu$ A 9.7 $\mu$ A 9.4 $\mu$ A	

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure <sup>1</sup>	(10 to 100) mA (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.2 mA 93 $\mu$ A 58 $\mu$ A	HP 3458A 8.5 Digit Multimeter
	(0.1 to 1) A (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	4 mA 3.6 mA 3.7 mA	
Resistance – Source <sup>1</sup> Simulated (Fixed)	0 $\Omega$ 1 $\Omega$ 1.9 $\Omega$ 10 $\Omega$ 19 $\Omega$ 100 $\Omega$ 190 $\Omega$ 1 k $\Omega$ 1.9 k $\Omega$ 10 k $\Omega$ 19 k $\Omega$ 100 k $\Omega$ 190 k $\Omega$ 1 M $\Omega$ 1.9 M $\Omega$ 10 M $\Omega$ 19 M $\Omega$ 100 M $\Omega$	65 $\mu$ $\Omega$ 0.13 m $\Omega$ 0.24 m $\Omega$ 0.32 m $\Omega$ 0.6 m $\Omega$ 1.4 m $\Omega$ 2.7 m $\Omega$ 9.4 m $\Omega$ 18 m $\Omega$ 96 m $\Omega$ 0.18 $\Omega$ 1.2 $\Omega$ 2.7 $\Omega$ 18 $\Omega$ 57 $\Omega$ 0.54 k $\Omega$ 1.3 k $\Omega$ 16 k $\Omega$	Fluke 5730A Multifunction Calibrator
Resistance – Source <sup>1</sup> Simulated (Variable)	(0 to 11) $\Omega$ (11 to 33) $\Omega$ (33 to 110) $\Omega$ (110 to 330) $\Omega$ (0.33 to 1.1) k $\Omega$ (1.1 to 3.3) k $\Omega$ (3.3 to 11) k $\Omega$ (11 to 33) k $\Omega$ (33 to 110) k $\Omega$ (110 to 330) k $\Omega$ (0.33 to 1.1) M $\Omega$ (1.1 to 3.3) M $\Omega$ (3.3 to 11) M $\Omega$ (11 to 33) M $\Omega$	1.8 m $\Omega$ 3 m $\Omega$ 5.1 m $\Omega$ 13 m $\Omega$ 31 m $\Omega$ 0.11 $\Omega$ 0.31 $\Omega$ 1.1 $\Omega$ 3.1 $\Omega$ 13 $\Omega$ 46 $\Omega$ 0.26 k $\Omega$ 1.6 k $\Omega$ 16 k $\Omega$	Fluke 5520A Multifunction Calibrator



**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Source <sup>1</sup> Simulated (Variable)	(33 to 110) MΩ (110 to 330) MΩ (330 to 1 100) MΩ	72 kΩ 1.6 MΩ 16 MΩ	Fluke 5520A Multifunction Calibrator
Resistance – Measure <sup>1</sup>	Up 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 (100 to 300) MΩ	6.4 mΩ 2.2 mΩ 13 mΩ 0.13 Ω 1.3 Ω 21 Ω 0.7 kΩ 59 kΩ 0.59 MΩ	HP 3458A 8.5 Digit Multimeter
Capacitance – Source <sup>1</sup> Simulated (Variable)	(0.19 to 1.1) nF (1.1 to 3.3) nF (3.3 to 11) nF (11 to 110) nF (110 to 330) nF (0.33 to 1.1) μF (1.1 to 3.3) μF (3.3 to 11) μF (11 to 33) μF (33 to 110) μF (110 to 330) μF (0.33 to 1.1) mF	18 pF 23 pF 44 pF 0.34 nF 1.3 nF 7.2 nF 15 nF 72 nF 0.2 μF 0.69 μF 2.1 μF 6.4 μF	Fluke 5520A Multifunction Calibrator
DC Power – Source <sup>1</sup> (Derived)	33 mV to 1 000 V (0.33 to 330) mA (0.33 to 3) A (3 to 20) A	42 mW 1.4 W 24W	Fluke 5520A Multifunction Calibrator
AC Power – Source <sup>1</sup> (Derived) (45 to 65) Hz Power Factor = 1	(33 to 330) mV (3.3 to 9) mA (9 to 33) mA (33 to 90) mA (90 to 330) mA (330 to 900) mA (0.9 to 2.2) A (2.2 to 4.5) A (4.5 to 20) A	0.12 mW 0.12 mW 0.16 mW 0.22 mW 0.63 mW 1.2 mW 4.6 mW 12 mW	Fluke 5520A Multifunction 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 <sup>1</sup> (Derived) (45 to 65) Hz Power Factor = 1	330 mV to 1 020 V (3.3 to 9) mA (9 to 33) mA (33 to 90) mA (90 to 330) mA (330 to 900) mA (0.9 to 2.2) A (2.2 to 4.5) A (4.5 to 11) A	15 mW 49 mW 0.17 W 0.49 W 1.9 W 3.4 W 14 W 31 W	Fluke 5520A Multifunction Calibrator
Oscilloscopes <sup>1</sup> Amplitude – DC into 50 Ω load into 1 MΩ load  Amplitude – Square Wave into 50 Ω load into 50 Ω load  Leveled Sine Wave Amplitude into 50 Ω load (Reference 50 kHz)  Flatness into 50 Ω load (Relative to 50 kHz)  Time Marker into to 50 Ω load  Rise Time into 50 Ω load	(0 to 6.6) V (0 to 130) V  1 mV to 6.6 Vp-p 1 mV to 130 Vp-p  5 mV to 5.5 V 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (600 to 1 100) MHz  5 mV to 5.5 V 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (600 to 1 100) MHz  50 ms to 5 s 1 ns to 20 ms  ≤ 300 ps	19 mV 38 mV  3.3 mV 15 mV  3.8 mV 37 mV 56 mV 0.52 V  13 mV 3.2 mV 3.4 mV 4.1 mV  0.7 μs 20 ps  8.3 ps	Fluke 5520A/SC1100 Multifunction Calibrator

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple Indicating Devices – Source/Measure <sup>1</sup>	Type E (-175 to -155) °C (-155 to -90) °C (-90 to 15) °C (15 to 890) °C (890 to 950) °C Type J (-210 to -105) °C (-105 to -50) °C (-50 to 990) °C (990 to 1 100) °C Type K (-200 to -195) °C (-195 to -115) °C (-115 to -55) °C (-55 to 1 000) °C (1 000 to 1 200) °C Type R (0 to 45) °C (45 to 160) °C (160 to 380) °C (380 to 775) °C (775 to 1 600) °C Type S (0 to 45) °C (45 to 105) °C (105 to 310) °C (310 to 615) °C (615 to 1 700) °C Type T (-250 to -150) °C (-150 to -135) °C (-135 to -40) °C (-40 to 100) °C (100 to 300) °C	0.13 °C 0.1 °C 0.09 °C 0.07 °C 0.08 °C 0.34 °C 0.11 °C 0.08 °C 0.08 °C 0.05 °C 0.15 °C 0.11 °C 0.08 °C 0.1 °C 0.66 °C 0.48 °C 0.36 °C 0.32 °C 0.28 °C 0.57 °C 0.47 °C 0.4 °C 0.35 °C 0.31 °C 0.73 °C 0.29 °C 0.15 °C 0.15 °C 0.08 °C	Ectron 1140A Thermocouple Simulator
Electrical Simulation of Thermocouple Indicating Devices – Source/Measure <sup>1</sup>	Type E (-250 to -175) °C (950 to 1 000) °C Type J (1 100 to 1 200) °C Type K (1 200 to 1 372) °C	0.58 °C 0.25 °C 0.27 °C 0.47 °C	Fluke 5520A Multifunction Calibrator

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple Indicating Devices – Source/Measure <sup>1</sup>	Type R (1 600 to 1 767) °C	0.47 °C	Fluke 5520A Multifunction Calibrator
	Type S (1 700 to 1 767) °C	0.58 °C	
	Type T (300 to 400) °C	0.17 °C	

**Length – Dimensional Metrology**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Micrometers <sup>1,2</sup>	Up to 4 in (4 to 12) in	(29 + 0.8L) μin (52 + 5.2L) μin	Gage Blocks
Calipers <sup>1,2</sup>	Up to 6 in (6 to 12) in (12 to 36) in	(289 + 0.29L) μin (404 + 40L) μin (558 + 5L) μin	
Dial Indicators <sup>1,2</sup>	Up to 1 in	(45 + 2.5L) μin	
Height Gages <sup>1,2</sup>	Up to 4 in (4 to 20) in (20 to 24) in	(221 + 55L) μin (562 + 1.4L) μin (582 + 2.2L) μin	
V Blocks <sup>1</sup>			
Parallelism	(-0.004 to 0.004) in	120 μin	Indicator, Surface Plate, Cylindrical Square, Gage Pins
Perpendicularity	(-0.004 to 0.004) in	170 μin	
V-Centrality	(-0.004 to 0.004) in	120 μin	
Pin Gages	Up to 0.1 in (0.1 to 0.15) in (0.15 to 0.2) in (0.2 to 0.3) in (0.3 to 0.4) in (0.4 to 0.5) in (0.5 to 0.6) in (0.6 to 0.7) in (0.7 to 0.8) in (0.8 to 0.9) in (0.9 to 1.0) in	28 μin 28 μin 28 μin 28 μin 30 μin 28 μin 29 μin 30 μin 29 μin 29 μin 28 μin	Pratt & Whitney Model C Supermicrometer

**Mass and Mass Related**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Pressure Devices <sup>1</sup>	(-13 to 0) psig (0 to 30) psig (30 to 100) psig (100 to 300) psig (300 to 3 000) psig (3 000 to 10 000) psig	0.27 psi 0.02 psi 0.51 psi 0.52 psi 1.1 psi 3.2 psi	Comparison to Additel Precision Pressure Gages, Druck DPI 610 Pressure Calibrator, Pressure Transducers
Torque Tools <sup>1</sup>	Up to 100 lbf·in	0.2 lbf·in	AKO TSD-011 Torque Transducer
	Up to 100 lbf·ft (100 to 200) lbf·ft (200 to 300) lbf·ft (300 to 400) lbf·ft (400 to 500) lbf·ft	0.36 lbf·ft 0.63 lbf·ft 1.5 lbf·ft 0.85 lbf·ft 0.48 lbf·ft	AKO TSD-511 Torque Transducer
Force <sup>1</sup>	Up to 5 lbf (5 to 11) lbf (11 to 50) lbf (50 to 500) lbf	0.002 9 lbf 0.003 1 lbf 0.05 lbf 0.12 lbf	Master Weights
Scales <sup>1</sup>			Master weights and internal calibration procedure utilized in the calibration of these weighing systems.
(0.000 1 g resolution)	Up to 50 g (50 to 100) g (100 to 200) g	8.1 mg 12 mg 0.62 mg	
(0.01 g resolution)	(200 to 300) g (300 to 400) g (400 to 500) g	8.6 mg 11 mg 15 mg	
(0.2 g resolution)	(500 to 1 000) g (1 000 to 2 000) g	0.12 g 0.12 g	
(0.000 5 kg resolution)	(2 to 4) kg	0.29 g	
(0.001 kg resolution)	(4 to 6) kg	0.58 g	
Scales <sup>1</sup>			Master weights and internal calibration procedure utilized in the calibration of these weighing systems.
(0.000 1 lb resolution)	Up to 1 lb (1 to 5) lb	0.000 13 lb 0.000 59 lb	
(0.001 lb resolution)	(5 to 10) lb	0.001 3 lb	
	(10 to 20) lb	0.002 3 lb	
	(20 to 40) lb	0.004 6 lb	
	(40 to 50) lb	0.005 9 lb	

### Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Scales <sup>1</sup> (0.005 lb resolution)  (0.1 lb resolution)  (1 lb resolution)	(50 to 60) lb	0.007 4 lb	Master weights and internal calibration procedure utilized in the calibration of these weighing systems.
	(60 to 70) lb	0.008 lb	
	(70 to 100) lb	0.06 lb	
	(100 to 200) lb	0.09 lb	
	(200 to 400) lb	0.58 lb	
	(400 to 600) lb	0.58 lb	
(600 to 800) lb	0.59 lb		
(800 to 1 000) lb	0.59 lb		
(1 000 to 1 500) lb	0.6 lb		

### Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature – Source <sup>1</sup>	(-38 to 0.1) °C	0.02 °C	Temperature Bath, Hart 5614 Platinum Resistance Thermometer
	(0.1 to 400) °C	0.05 °C	
	(400 to 600) °C	0.24 °C	Dry-well, Isotech 935-14-95H Semi-standard Platinum Resistance Thermometer
Temperature – Measure <sup>1</sup>	(-196 to 0) °C	0.07 °C	Hart 5614 Platinum Resistance Thermometer
	(0 to 100) °C	0.05 °C	
	(100 to 300) °C	0.04 °C	
	(300 to 400) °C	0.08 °C	
	(400 to 600) °C	0.11 °C	Isotech 935-14-95H Semi-standard Platinum Resistance Thermometer
	(600 to 982) °C	1 °C	Tegam Type K Thermocouple Probe
Infrared Thermometers <sup>1</sup>	35 °C	0.46 °C	Fluke 4181 Infrared Calibrator $\epsilon = (0.9 \text{ to } 1.0)$ , $\lambda = (8 \text{ to } 14) \mu\text{m}$
	(35 to 100) °C	0.65 °C	
	(100 to 200) °C	0.89 °C	
	(200 to 350) °C	1.5 °C	
	(350 to 500) °C	2 °C	

**Thermodynamic**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Humidity – Source <sup>1</sup>	(11 to 80) %RH (80 to 94) %RH 33 %RH 75 %RH	1.8 %RH 2.5 %RH 1.6 %RH 1.7 %RH	Vaisala MI70/HMP77 Thermohygrometer, Saturated Salt Solutions


**Time and Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Source <sup>1</sup>	10 MHz	0.12 $\mu$ Hz	Spectracom 8194B GPS Master Oscillator, HP 3225B Function Generator
Frequency – Measure <sup>1</sup>	10 MHz	3.5 Hz	HP 53131A Universal Counter
Stopwatch/Timers <sup>1</sup>	Up to 59 min 59 min to 24 h	5.9 ms 1.1 s	Spectracom 8194B GPS Master Oscillator, HP 3225B Function 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.
3. This scope is formatted as part of a single document including Certificate of Accreditation No. AC-1195.



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