



CERTIFICATE OF ACCREDITATION

ANSI National Accreditation Board

11617 Coldwater Road, Fort Wayne, IN 46845 USA

This is to certify that

Imperial Metrology, Inc.
301 Hurricane Creek Road
Piedmont, SC 29673

has been assessed by ANAB and meets the requirements of international standard

ISO/IEC 17025:2005

and national standards

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

while demonstrating technical competence in the field of

**CALIBRATION AND DIMENSIONAL
MEASUREMENT**

Refer to the accompanying Scope of Accreditation for information regarding the types of activities to which this accreditation applies

ACT-1235

Certificate Number


ANAB Approval

Certificate Valid Through: 09/18/2020
Version No. 013 Issued: 03/05/2019



This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. 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).



ANSI National Accreditation Board

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005, ANSI/NCSL Z540-1-1994 (R2002) AND ANSI/NCSL Z540.3-2006 (R2013)

Imperial Metrology, Inc.

301 Hurricane Creek Road
Piedmont, SC 29673
Glen Morton 864-422-1435

CALIBRATION AND DIMENSIONAL MEASUREMENT

Valid to: September 18, 2020

Certificate Number: ACT-1235

CALIBRATION

Acoustics and Vibration

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Sound Level Meters 94 & 114 dB rev2 x 10 ⁻⁵ Pa @1kHz	94 dB 114 dB	0.6 dB 0.7 dB	Dwyer SMC-1

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Source ¹	(0 to 330) mV 330 mV to 3.3 V (3.3 to 33) V (33 to 330) V (330 to 1 000) V	6 μ V/V + 5 μ V 11 μ V/V + 2 μ V 13 μ V/V + 16 μ V 18 μ V/V + 13 μ V 15 μ V/V + 2 mV	Fluke 5520A/11
DC Voltage – Measure ¹	(0 to 100) mV 100 mV to 1V (1 to 10) V (10 to 100) V (100 to 1 000) V	57 μ V/mV + 3.6 μ V 7.9 μ V/V + 1.7 μ V 7.3 μ V/V + 2.2 μ V 5.3 μ V/V + 37 μ V 13 μ V/V + 0.14 V	Agilent 3458A
DC High Voltage Measure ¹	(1 to 35) kV (20 to 100) kV	3.8 V + 2.3 % of reading 6.4 V + 0.12 % of reading	DMM and High Voltage Probe
	(2.1 to 24) kV	7.4 V + 2 % of reading	Sensitive Research ESH-29

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Source ¹ Range Locked	(0 to 330) μ A (0 to 3.3) mA (0 to 33) mA (0 to 330) mA (0 to 3) A (0 to 20) A	12 nA/A + 16 nA 77 nA/A + 39 nA 78 nA/A + 0.2 μ A 78 nA/A + 2 μ A 0.3 μ A/A + 66 μ A 0.24 mA/A + 0.4 mA	Fluke 5520A/11
DC Current – Measure ¹	(0 to 100) μ A 100 μ A to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A	12 pA/ μ A + 5.9 nA 0.2 μ A/mA + 5.8 μ A 30 nA/mA + 62 nA 49 nA/mA + 0.6 μ A 0.2 mA/A + 12 μ A	Agilent 3458A
	(1 to 3) A	1.8 mA/A	Agilent 34401
	(3 to 10) A	1.5 mA/A + 77 μ A	Fluke 45
	(3 to 30) A (30 to 150) A	0.2 mA/A + 5.1 mA 0.1 mA/A + 18 mA	Current Shunts w/ Agilent 34401A
AC Voltage – Source ¹	(3.3 to 33) mV (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 450) kHz (33 to 330) mV (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz 330 mV to 3.3 V (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 90) kHz	0.2 μ V/V + 7.4 μ V 0.2 μ V/V + 7.4 μ V 41 nV/V + 8.6 μ V 1.2 μ V/V + 7 μ V 4.2 μ V/V + 13 μ V 9.3 μ V/V + 58 μ V 0.3 μ V/V + 4 μ V 0.2 μ V/V + 0.2 μ V 0.2 μ V/V + 9 μ V 0.4 μ V/V + 9.3 μ V 0.9 μ V/V + 37 μ V 2.3 μ V/V + 82 μ V 0.3 mV/V + 1 mV 0.2 mV/V + 0.5 mV 0.2 mV/V + 91 μ V 0.3 mV/V + 59 μ V 0.7 mV/V + 0.2 mV	Fluke 5520A/11

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source ¹	(3.3 to 33) V		Fluke 5520A/11
	(10 to 45) Hz	0.3 mV/V + 1 mV	
	45 Hz to 10 kHz	0.2 mV/V + 0.7 mV	
	(10 to 20) kHz	0.2 mV/V + 1.1 mV	
	(20 to 50) kHz	0.4 mV/V + 0.7 mV	
	(50 to 90) kHz	1 mV/V + 2 mV	
	(33 to 330) V		
	45 Hz to 1 kHz	0.3 μ V/V + 69 mV	
	(1 to 10) kHz	0.2 mV/V + 7 mV	
	(10 to 20) kHz	0.3 mV/V + 7 mV	
AC Voltage – Measure ¹	(20 to 50) kHz	0.4 mV/V + 4.4 mV	Agilent 3458A
	(330 to 1 000) V		
	45 Hz to 1 kHz	0.3 mV/V + 40 mV	
	(1 to 5) kHz	0.3 mV/V + 14 mV	
	(5 to 10) kHz	0.4 mV/V + 15 mV	
	Up to 10 mV		
	(1 to 40) Hz	7.9 μ V	
	40 Hz to 1 kHz	0.13 μ V/mV + 4.1 μ V	
	(1 to 20) kHz	0.25 μ V/mV + 3.9 μ V	
	(20 to 50) kHz	1.2 μ V/mV + 3.5 μ V	
	(50 to 100) kHz	5.6 μ V/mV + 6.2 μ V	
	(100 to 300) kHz	50 μ V/mV + 3.4 μ V	
	(10 to 100) mV		
	(1 to 40) Hz	0.5 μ V/mV + 19 μ V	
	40 Hz to 1 kHz	0.3 μ V/mV + 3.8 μ V	
	(1 to 20) kHz	0.3 μ V/mV + 25 μ V	
	(20 to 50) kHz	0.4 μ V/mV + 10 μ V	
	(50 to 100) kHz	0.5 μ V/mV + 55 μ V	
	(100 to 300) kHz	4 mV/mV + 29 μ V	
	100 mV to 1V		
	(1 to 40) Hz	0.4 mV	
	40 Hz to 1 kHz	34 μ V/V + 85 μ V	
	(1 to 20) kHz	0.2 mV/V + 1 μ V	
	(20 to 50) kHz	77 μ V/V + 37 μ V	
	(50 to 100) kHz	1 mV/V + 5.4 μ V	
	(100 to 300) kHz	25 mV/V + 9 nV	
	300 kHz to 1MHz	27 mV/V + 10 nV	

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 (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 2 MHz	57 $\mu\text{V/V} + 1.1 \text{ mV}$ 64 $\mu\text{V/V} + 0.5 \text{ mV}$ 53 $\mu\text{V/V} + 0.3 \text{ mV}$ 72 $\mu\text{V/V} + 0.3 \text{ mV}$ 0.9 $\text{mV/V} + 0.2 \text{ mV}$ 3.5 $\text{mV/V} + 1.1 \text{ mV}$ 12 $\text{mV/V} + 1 \text{ mV}$	Agilent 3458A
	(10 to 100) V (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz 100 V to 1 kV 40 Hz to 1 kHz 1 kHz to 20 kHz	0.1 $\text{mV/V} + 12 \text{ mV}$ 0.3 $\text{mV/V} + 2 \text{ mV}$ 2.8 $\text{mV/V} + 10 \mu\text{V}$ 0.1 $\text{mV/V} + 3.5 \text{ mV}$ 0.7 $\text{mV/V} + 1 \text{ mV}$ 1 $\text{mV/V} + 1 \text{ mV}$	
AC High Voltage Measure ¹	(1 to 35) kV (20 to 90) kV	3.3 V + 5.8% of reading 56 V + 1.1 % of reading	DMM and High Voltage Probe
	(2.1 to 24) kV	7 V + 2.1% of reading	Sensitive Research ESH-29
AC Current – Source ¹	(33 to 330) μA (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 30) kHz 330 μA to 3.3 mA (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 30) kHz (3.3 to 33) mA (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 30) kHz	2.3 $\text{nA/A} + 0.1 \mu\text{A}$ 1.4 $\text{nA/A} + 0.1 \mu\text{A}$ 1.5 $\text{nA/A} + 99 \text{ nA}$ 3.4 $\text{nA/A} + 0.2 \mu\text{A}$ 18 $\text{nA/A} + 0.5 \mu\text{A}$ 2.3 $\mu\text{A/A} + 0.2 \mu\text{A}$ 1.4 $\mu\text{A/A} + 0.3 \mu\text{A}$ 11 $\mu\text{A/A} + 0.3 \mu\text{A}$ 10 $\mu\text{A/A} + 0.7 \mu\text{A}$ 13 $\mu\text{A/A} + 33 \text{ nA}$ 2.1 $\mu\text{A/A} + 1.9 \mu\text{A}$ 1.1 $\mu\text{A/A} + 2.1 \mu\text{A}$ 0.5 $\mu\text{A/A} + 2.2 \mu\text{A}$ 1 $\mu\text{A/A} + 0.6 \mu\text{A}$ 4.1 $\mu\text{A/A} + 19 \mu\text{A}$	Fluke 5520A/11

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source ¹	(33 to 330) mA		Fluke 5520A/11
	(10 to 20) Hz	2.2 μ A/A + 20 μ A	
	(20 to 45) Hz	1.2 μ A/A + 17 μ A	
	45 Hz to 1 kHz	0.5 μ A/A + 23 μ A	
	(1 to 5) kHz	1.2 μ A/A + 58 μ A	
	(5 to 30) kHz	4.7 μ A/A + 0.2 mA	
	330 mA to 1.1 A		
	(10 to 45) Hz	2.1 mA/A + 0.1 mA	
	45 Hz to 1 kHz	0.6 mA/A + 0.1 mA	
	(1 to 5) kHz	6.9 mA/A + 1.2 mA	
	(5 to 10) kHz	29 mA + 5.8 mA	
	(1.1 to 3) A		
	(10 to 45) Hz	2.1 mA/A + 0.1 mA	
	45 Hz to 1 kHz	0.7 mA/A + 72 μ A	
	(1 to 5) kHz	6.9 mA/A + 1.2 mA	
	(5 to 10) kHz	26 mA/A + 8.9 mA	
	(3 to 10) A		Agilent 3458A
	(45 to 100) Hz	0.7 mA/A + 2.3 mA	
	100 Hz to 1 kHz	0.5 mA/A + 4.4 mA	
	(1 to 5) kHz	35 mA/A + 2.3 mA	
	(10 to 20) A		
	(45 to 100) Hz	1.6 mA/A + 5.2 mA	
	100 Hz to 1 kHz	1.9 mA/A + 5.3 mA	
	(1 to 5) kHz	35 mA/A + 5.8 mA	
	Up to 100 μ A		
	(10 to 20) Hz	4.6 nA/ μ A + 39 nA	
AC Current – Measure ¹	(20 to 45) Hz	1.7 nA/ μ A + 42 nA	
	(45 to 100) Hz	0.6 nA/ μ A + 45 nA	
	100 Hz to 1 kHz	0.6 nA/ μ A + 45 nA	
	100 μ A to 1 mA		
	(10 to 20) Hz	8.5 μ A/A	
	(20 to 45) Hz	15 μ A/A	
	(45 to 100) Hz	15 μ A/A	
	100 Hz to 1 kHz	14 μ A/A	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure ¹	(1 to 10) mA		Agilent 34401A
	(10 to 20) Hz	5.6 nA/mA + 2 μ A	
	(20 to 45) Hz	5.7 nA/mA + 0.3 μ A	
	(45 to 100) Hz	5.8 μ A/mA + 80 nA	
	100 Hz to 1 kHz	5.8 μ A/mA + 15 nA	
	(1 to 5) kHz	5.8 μ A/mA + 30 nA	
	(5 to 10) kHz	5.8 μ A/mA + 79 nA	
	(10 to 100) mA		
	(10 to 20) Hz	5.1 μ A/mA + 71 μ A	
	(20 to 45) Hz	5.8 μ A/mA + 40 nA	
	(45 to 100) Hz	5.8 μ A/mA + 12 nA	
	100 Hz to 1 kHz	5.8 μ A/mA + 7 nA	
	(1 to 5) kHz	5.8 μ A/mA + 0.2 μ A	
	(5 to 20) kHz	5.8 μ A/mA + 11 nA	
	100 mA to 1 A		
	(10 to 20) Hz	1.9 mA/A + 5.6 mA	
	(20 to 45) Hz	1.2 mA/A + 5.7 mA	
	(45 to 100) Hz	0.1 mA/A + 5.8 mA	
	100 Hz to 1 kHz	0.2 mA/A + 5.8 mA	
	(1 to 20) kHz	1.2 mA/A + 5.7 mA	
	(1 to 3) A		
	(10 to 20) Hz	4.2 mA/A + 2.8 mA	
	(20 to 45) Hz	1.7 mA/A + 4.4 mA	
	(45 to 100) Hz	1.7 mA/A + 4.4 mA	
	100 Hz to 1 kHz	1.7 mA/A + 4.3 mA	
	(1 to 5) kHz	1.7 mA/A + 4.3 mA	
AC Current – Measure ¹	(3 to 10) A		Fluke 45
	(10 to 20) Hz	3.9 mA/A + 52 mA	
	(20 to 45) Hz	3.9 mA/A + 52 mA	
	(45 to 100) Hz	1 mA/A + 60 mA	
	100 Hz to 1 kHz	1.5 mA/A + 55 mA	
	(1 to 5) kHz	1 mA/A + 0.17 A	
Resistance – Source ¹ Simulation	Up to 11 Ω	46 $\mu\Omega/\Omega$ + 1.2 m Ω	Fluke 5520A/11
	(11 to 33) Ω	33 $\mu\Omega/\Omega$ + 1.8 m Ω	
	(33 to 110) Ω	27 $\mu\Omega/\Omega$ + 1.6 m Ω	
	(110 to 330) Ω	26 $\mu\Omega/\Omega$ + 2.3 m Ω	
	330 Ω to 1.1 k Ω	27 m Ω/Ω + 1.9 m Ω	
	(1.1 to 3.3) k Ω	26 m Ω/Ω + 23 m Ω	
	(3.3 to 11) k Ω	26 m Ω/Ω + 19 m Ω	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Source ¹ Simulation	(11 to 33) kΩ (33 to 110) kΩ (110 to 330) kΩ 330 kΩ to 1.1MΩ (1.1 to 3.3) MΩ (3.3 to 11) MΩ (11 to 33) MΩ (33 to 110) MΩ (110 to 330) MΩ (330 to 1 100) MΩ	26 mΩ/Ω + 0.2 Ω 27 mΩ/Ω + 0.2 Ω 30 mΩ/Ω + 2.8 Ω 36 Ω/MΩ + 3.9 Ω 36 Ω/MΩ + 65 Ω 130 Ω/MΩ + 26 Ω 300 Ω/MΩ + 2.7 kΩ 500 Ω/MΩ + 3.5 kΩ 3.1 kΩ/MΩ + 89 kΩ 15 kΩ/MΩ + 200 kΩ	Fluke 5520A/11
Resistance – Source ¹ Fixed	0.001 Ω 0.01 Ω 0.1 Ω 1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ 1 GΩ 10 GΩ 100 GΩ 1 TΩ	0.000074 Ω 0.0006 Ω 0.0006 Ω 0.0017 mΩ 0.017 Ω 0.035 Ω 0.012 kΩ 0.12 kΩ 0.13 kΩ 0.027 MΩ 0.03 MΩ 0.24 MΩ 0.01 GΩ 0.12 GΩ 1.2 GΩ 0.2 TΩ	Standard Resistors
Resistance – Measure ¹	Up to 10 Ω (10 to 100) Ω 100 Ω to 1 kΩ (1 to 10) kΩ (10 to 100) kΩ 100 kΩ to 1MΩ (1 to 10) MΩ (10 to 100) MΩ 100 MΩ to 1GΩ	14 μΩ/Ω + 0.1 mΩ 17 μΩ/Ω + 0.6 mΩ 78 μΩ/Ω + 0.4 mΩ 15 mΩ/Ω + 5 mΩ 15 mΩ/Ω + 48 mΩ 19 mΩ/Ω + 2.5 Ω 78 Ω/Ω + 98 Ω 660 Ω/Ω + 1.1 kΩ 7.5 kΩ/MΩ + 0.3 MΩ	Agilent 3458A (NPLC 100)

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Source ¹ Simulation	(0.19 to 0.4) nF (0.4 to 1.1) nF (1.1 to 3.3) nF (3.3 to 11) nF (11 to 33) nF (33 to 110) nF (110 to 330) nF (0.33 to 1.1) μ F	5.3 pF/nF + 13 pF 5.4 pF/nF + 13 pF 6.1 pF/nF + 14 pF 3 pF/nF + 15 pF 2.9 pF/nF + 0.1 nF 3 pF/nF + 0.1 nF 3.9 pF/nF + 0.2 nF 2.7 nF/ μ F + 1.4 nF	Fluke 5520A/11
Capacitance – Source ¹ Simulation	(1.1 to 3.3) μ F (3.3 to 11) μ F (11 to 33) μ F (33 to 110) μ F (110 to 330) μ F (0.33 to 1.1) mF (1.1 to 3.3) mF (3.3 to 11) mF (11 to 33) mF (33 to 110) mF	3 nF/ μ F + 3.4 nF 2.7 nF/ μ F + 1.4 nF 4.5 nF/ μ F + 38 nF 5.1 nF/ μ F + 0.1 μ F 5.1 nF/ μ F + 0.4 μ F 86 nF/ μ F + 0.6 mF 4.8 μ F/mF + 5.7 μ F 4 μ F/mF + 25 μ F 8.4 μ F/mF + 49 μ F 14 μ F/mF + 75 μ F	Fluke 5520A/11
Capacitance – Source ¹ Fixed 1 kHz	0.001 μ F (0.01 to 1) μ F	0.000 02 μ F 23 nF/ μ F + 0.2 nF	Standard Capacitor Decade Capacitor
Inductance – Source ¹ Variable 1 kHz	(1 to 1 000) mH (1 to 10) H	0.01 mH/mH + 0.015 mH 9 mH/H + 7 mH	Decade Inductor
Electrical Simulation of RTD Indicating Devices ¹	Pt 385, 100 Ω (-200 to -80) $^{\circ}$ C (-80 to 0) $^{\circ}$ C (0 to 100) $^{\circ}$ C (100 to 300) $^{\circ}$ C (300 to 400) $^{\circ}$ C (400 to 630) $^{\circ}$ C (630 to 800) $^{\circ}$ C Pt 385, 1000 Ω (-200 to 0) $^{\circ}$ C (0 to 100) $^{\circ}$ C (100 to 260) $^{\circ}$ C (260 to 300) $^{\circ}$ C (300 to 600) $^{\circ}$ C (600 to 630) $^{\circ}$ C	0.07 $^{\circ}$ C 0.07 $^{\circ}$ C 0.08 $^{\circ}$ C 0.09 $^{\circ}$ C 0.10 $^{\circ}$ C 0.13 $^{\circ}$ C 0.23 $^{\circ}$ C 0.03 $^{\circ}$ C 0.05 $^{\circ}$ C 0.05 $^{\circ}$ C 0.09 $^{\circ}$ C 0.08 $^{\circ}$ C 0.26 $^{\circ}$ C	Fluke 5520A/11

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 3916, 100 Ω		Fluke 5520A/11
	(-200 to -190) °C	0.28 °C	
	(-190 to -80) °C	0.07 °C	
	(-80 to 0) °C	0.08 °C	
	(0 to 100) °C	0.09 °C	
	(100 to 260) °C	0.07 °C	
	(260 to 300) °C	0.09 °C	
	(300 to 400) °C	0.11 °C	
	(400 to 600) °C	0.11 °C	
	(600 to 630) °C	0.24 °C	
	Pt 3926, 100 Ω		
	(-200 to 0) °C	0.06 °C	
	(0 to 100) °C	0.08 °C	
	(100 to 300) °C	0.09 °C	
	(300 to 400) °C	0.1 °C	
	(400 to 630) °C	0.13 °C	
	Cu 427, 10 Ω		
	(-100 to 260) °C	0.45 °C	
Electrical Simulation of Thermocouples - Measure/Source ¹	Type B		Fluke 5520A/11
	(600 to 800) °C	0.46 °C	
	(800 to 1 000) °C	0.43 °C	
	(1 000 to 1 550) °C	0.34 °C	
	(1 550 to 1 820) °C	0.35 °C	
	Type C		
	(0 to 150) °C	0.33 °C	
	(150 to 650) °C	0.29 °C	
	(650 to 1 000) °C	0.35 °C	
	(1 000 to 1 800) °C	0.52 °C	
	(1 800 to 2 316) °C	0.86 °C	
	Type E		
	(-250 to -100) °C	0.51 °C	
	(-100 to -25) °C	0.25 °C	
	(-25 to 350) °C	0.21 °C	
	(350 to 650) °C	0.21 °C	
	(650 to 1 000) °C	0.31 °C	
	Type J		
	(-210 to -100) °C	0.28 °C	
	(-100 to -30) °C	0.18 °C	
	(-30 to 150) °C	0.19 °C	
	(150 to 760) °C	0.2 °C	
	(760 to 1 200) °C	0.28 °C	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouples - Measure/Source ¹	Type K		Fluke 5520A/11
	(-200 to -100) °C	0.34 °C	
	(-100 to -25) °C	0.18 °C	
	(-25 to 120) °C	0.2 °C	
	(120 to 1 000) °C	0.29 °C	
	(1 000 to 1 372) °C	0.47 °C	
	Type L		
	(-200 to -100) °C	0.39 °C	
	(-100 to 800) °C	0.30 °C	
	(800 to 900) °C	0.21 °C	
	Type N		
	(-200 to -100) °C	0.42 °C	
	(-100 to -25) °C	0.24 °C	
	(-25 to 120) °C	0.22 °C	
	(120 to 410) °C	0.21 °C	
	(410 to 1 300) °C	0.29 °C	
	Type R		
	(0 to 250) °C	0.8 °C	
	(250 to 400) °C	0.7 °C	
	(400 to 1 000) °C	0.7 °C	
	(1 000 to 1 767) °C	0.7 °C	
	Type S		
	(0 to 250) °C	0.7 °C	
	(250 to 1 000) °C	0.7 °C	
	(1 000 to 1 400) °C	0.7 °C	
	(1 400 to 1767) °C	0.7 °C	
	Type T		
	(-250 to -150) °C	0.62 °C	
	(-150 to 0) °C	0.25 °C	
	(0 to 120) °C	0.19 °C	
	(120 to 400) °C	0.18 °C	
	Type U		
	(-200 to 0) °C	0.58 °C	
	(0 to 600) °C	0.32 °C	

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	3.4 μ in (1.7 + 1.5L) μ in	Mahr 130B-24 Gage Block Comparator, Grade 00 Gage Blocks
Calipers ^{1,2}	(0 to 24) in (24 to 48) in (48 to 80) in	(590 + 7.6L) μ in (780 + 1.4L) μ in (780 + 8.9L) μ in	Gage Blocks
Outside Micrometer ^{1,2}	Up to 36 in	(55 + 27L) μ in	
Inside Micrometer 3-point ^{1,2}	Up to 10 in	(93 + 12L) μ in	
Tubular Inside Micrometer ^{1,2}	Up to 18 in Up to 48 in	(120 + 4.1L) μ in (360 + 3.5L) μ in	Trimos Horizon ULM Trimos V4 Electronic Height Gage
Length Standards ^{1,2}	(0 to 10) in (0 to 40) in (0 to 240) in	(96 + 4.6L) μ in (120 + 6.2L) μ in (59 + 22L) μ in	Trimos Horizon ULM Trimos V4 Elect Height Gage B & S Validator CMM
Feeler Gages/Thickness Shims ^{1,2}	Up to 0.2 in	(25 + 8.7L) μ in	Trimos THV
Indicators ^{1,2} Dial/Digital/Test Incremental Probes/LVDT's	Up to 4 in Up to 1 in	(85 + 12L) μ in (69 + 1.6L) μ in	Gage Blocks
Linear Measurement Devices ^{1,2}	Up to 48 in	(530 + 12L) μ in	
Height Gages ^{1,2}	Up to 48 in	(55 + 3.7L) μ in	
Inclinometers/ Levels ²	Up to 45 °	(1.1 + 0.06L) sec/°	
CMM Spheres & Gage ² Balls (Diameter)	(0.1 to 1) in	21 μ in	Trimos LabConcept Premium ULM
Roundness ² (Geometric Form)	Up to 10 in	3.3 μ in	Federal 6100 Form Scan
Radius Gages ²	Up to 3 in	(120 + 30L) μ in	OGP SmartScope Vision System
Thread Rings – Adjustable ² Minor Diameter Pitch	Up to 6.5 in Up to 6.5 in	(50 + 6.6L) μ in (240 + 79L) μ in	Thread Set Plug or Trimos V4 Thread Set Plug
Thread Pitch Gages – Leaf Style ²	Up to 0.25 in	(130 + 2 400L) μ in	OGP SmartScope Vision System
Thread and Gear Wires ²	Up to 0.15 in	(15 + 15L) μ in	Trimos LabConcept

Length – Dimensional metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Ring Gages ² X Class XX Class	(0.38 to 8) in (0.38 to 8) in	(28 + 6.5L) μin (15 + 5L) μin	Trimos Horizon Trimos LabConcept
Ring Gages ^{1,2} X Class	(0.18 to 4) in	(19 + 6.9L) μin	Trimos THV
Pin Gages ² Z & ZZ Class	Up to 1 in	(38 + 5.9L) μin	Lasermike
Pin Gages ^{1,2} ZZ Class	Up to 1 in	(19 + 8.5L) μin	Trimos THV
Cylindrical Plugs and Pin Gages ² (Z, ZZ, X, Y class)	Up to 8 in	(32 + 3.5L) μin	Trimos Horizon
Cylindrical Plugs and Pin Gages ² (X, XX class)	Up to 8 in	(14 + 6.2L) μin	Trimos LabConcept
Thread Plug Gages ^{1,2} Pitch Diameter Major Diameter	Up to 6 in	(54 + 17L) μin (50 + 17L) μin	Trimos Horizon ULM Trimos Horizon ULM
Steel Rules ^{1,2}	Up to 72 in	(5100 + 15L) μin	Gage Blocks
Tape Measures ²	Up to 120 in	(2200 + 11L) μin	Renishaw LM15 Linear Measuring Device
Optical Comparators ^{1,2}	Up to 12 in X Axis Y Axis	(80 + 23L) μin (77 + 20L) μin	Glass Scales Magnification Scales
Measuring Microscopes ^{1,2}	Up to 2 in X Axis Y Axis	(57 + 10L) μin (61 + 3.3L) μin	Glass Scales
Surface Finish ² (Roughness Gages)	Up to 120 μin	(3.5 + 0.03L) μin	Mahr Contour/Surface Analyzer
Surface Plate ¹ Overall Flatness	(43 to 161) in diagonal	1.5 μin/in + 0.85 μin	Wyler Level System
Local Area Flatness (Repeat Reading)	Up to 0.001 in	33 μin	Indicator/Probe
Surface Texture	(0 to 32) μin (cutoff: 0.03 in)	4.5 μin	Mahr Pocket Surf using ASME B89.3.7-2013
Vision Systems ^{1,2}	12 X 12 in X Axis Y Axis	(65 + 4.2L) μin (69 + 2L) μin	Glass Scales

Length – Dimensional metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Torque Arms/Wheels	2.5-inch Arm 5-inch Arm 20-inch Arm 40-inch Arm	1 200 μ in 840 μ in 1 300 μ in 1 400 μ in	B & S CMM

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Pressure – Pneumatic ¹	(0 to 200) psig (0 to 300) psig	0.006 4 psi/psi + 0.02 psi 0.000 014 psi/psi + 0.06 psi	Pneumatic Deadweight Tester (Nitrogen) Druck DPI 611 Calibrator
Vacuum ¹	(0 to -30) inHg	0.000 6 inHg/inHg + 0.06 inHg	Druck DPI 611 Calibrator
Pressure – Hydraulic ¹	(0 to 5 000) psig (0 to 10 000) psig (0 to 40 000) psig	0.000 24 psi/psi + 2.6 psi 0.0004 psi/psi + 0.059 psi 0.000 52 psi/psi + 25 psi	Druck iDOS UPM Deadweight Tester Additel ADT681 Hydraulic Pressure Test Gauge
Rockwell Hardness and Superficial Testers ¹	HRBW Low Middle High HRC Low Middle High HR15N Low Middle High HR30N Low Middle High	1.5 HRBW 0.9 HRBW 0.6 HRBW 0.5 HRC 0.4 HRC 0.4 HRC 0.6 HR15N 0.3 HR15N 0.7 HR15N 0.6 HR30N 0.6 HR30N 0.3 HR30N	Indirect Verification per ASTM E18 using Test Blocks

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Rockwell Hardness and Superficial Testers ¹	HR45N Low Middle High HR15YW Low Mid High	0.5 HR45N 0.5 HR45N 0.4 HR45N 0.4 HR15YW 0.4 HR15YW 0.5 HR15YW	Indirect Verification per ASTM E18 using Test Blocks
Vickers Hardness Testers ¹	272 HV 774 HV	9.1 HV 21.9 HV	Indirect Verification per ASTM E92 using Test Blocks
Knoop Hardness Testers ¹	290 HK 741 HK	15 HK 24 HK	
Brinell Hardness Testers ¹	87 HBW 201 HBW 216 HBW 437 HBW	(1.9 + 0.03 % of Applied) HBW	Indirect Verification per ASTM E10 using Test Blocks
Air Velocity	2.5 m/s 5.0 m/s 10.0 m/s 15.0 m/s	0.041 m/s 0.13 m/s 0.32 m/s 0.51 m/s	Omega WTM-1000 Wind Tunnel w/ Alnor 9535 Air Velocity Meter
Force Gages ¹ Tension and Compression	Up to 250 lbf	0.000 2 lbf/lbf + 0.21 lbf	Class F Weights
Torque Tools ¹	(5 to 50) ozf·in (15 to 200) ozf·in (4 to 50) lbf·in (30 to 400) lbf·in (80 to 1 000) lbf·in (20 to 250) lbf·ft (60 to 600) lbf·ft (100 to 1 000) lbf·ft (200 to 2 000) lbf·ft	0.045 ozf·in + 0.11 % of reading 0.17 ozf·in + 0.4 % of reading 0.045 lbf·in + 0.48 % of reading 0.41 lbf·in + 0.1 % of reading 0.5 lbf·in + 0.1 % of reading 0.17 lbf·ft + 0.1 % of reading 0.51 lbf·ft + 0.15 % of reading 0.65 lbf·ft + 0.1 % of reading 1.6 lbf·ft + 0.1 % of reading	Reference Transducers, Digital Torque Tester

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Torque Transducers Testers ¹	(5 to 50) ozf·in (15 to 200) ozf·in (4 to 50) lbf·in (30 to 400) lbf·in (80 to 1 000) lbf·in (20 to 250) lbf·ft (60 to 600) lbf·ft (100 to 1 000) lbf·ft (200 to 2 000) lbf·ft	0.0063 ozf·in + 0.13 % of reading 0.0032 ozf·in + 0.11 % of reading 0.12 % of reading 0.013 lbf·in + 0.02% of reading 0.15 lbf·in + 0.01 % of reading 0.01 lbf·ft + 0.025 % of reading 0.017 lbf·ft + 0.01 % of reading 0.27 lbf·ft + 0.01 % of reading 0.55 lbf·ft + 0.01 % of reading	Lever Arms & Wheels, Dead Weights
Scales and Balances ¹ Class 6 Weight Set Class 6 & Class F Weights Class F Weights Class F Weights	Up to 2 110 g (0.500 to 30.000) lb (0.5 to 250.0) lb (250 to 1 000) lb	0.000 14 g/g + 0.003 g 0.000 3 lb/lb + 0.003 lb 0.000 03 lb/lb + 0.024 lb 0.000 1 lb/lb + 0.3 lb	Weights NIST HB 44

Thermodynamic

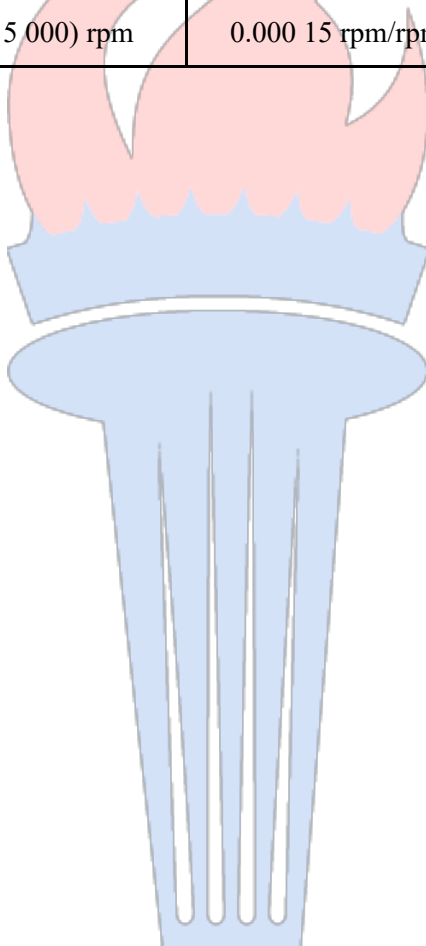
Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Humidity - Source/ Measure	(10 to 90) %RH	0.9% RH + 0.2% of reading	Vaisala HM40/HMP113
Temperature – Measure ¹	(-190 to 420) °C	0.000 9 °C/°C + 0.082 °C	Pt100-385 4-wire RTD w/ Process Calibrator
Temperature – Source/Measure ¹	(-10 to 350) °C	0.001 2 °C/°C + 0.23 °C	Fluke 5520A w/ TC Pt100-385 4-wire RTD Ice Point/Dry Block Calibrator

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Stopwatches and Timers ¹	Up to 1 200 s	480 ms	NIST Time Signal

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency - Source ¹	(0.01 to 119.99) Hz (120 to 1 199.9) Hz (1.2 to 11.999) kHz (12 to 119.99) kHz (120 to 1199.9) kHz (1.2 to 2) MHz (2 to 100) MHz	0.8 μ Hz/Hz + 0.3 mHz 3.1 μ Hz/Hz + 51 μ Hz 2.9 Hz/kHz + 5.8 mHz 2.9 Hz/kHz + 6 mHz 2.9 Hz/kHz + 6 mHz 0.2 Hz/MHz + 58 Hz 3.2 Hz/MHz	Fluke 5520A/11
Frequency – Measure	1 Hz to 10 MHz	0.6 mHz/Hz + 5.4 mHz	Agilent 3458A
Tachometers – Non Contact (Photo) ¹	(60 to 96 000) rpm	0.000 03 rpm/rpm + 0.2 rpm	Fluke 5520A/11
Tachometers – Contact ¹	(250 to 5 000) rpm	0.000 15 rpm/rpm + 2.8 rpm	Ideal Tachometer Tester



DIMENSIONAL MEASUREMENT

Dimensional

Specific Tests and / or Properties Measured	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Inspection by CMM B & S Excel 7-10-7 PC-DMIS CAD ++	X Axis (0 to 28) in Y Axis (0 to 40) in Z Axis (0 to 28) in	10 μ in/in – 6.2 μ in -7.3 μ in/in + 21 μ in -7 μ in/in + 20 μ in	Customer Drawing or CAD Model CMM Application Software
Inspection by CMM B & S Validator PC-DMIS CAD ++	X Axis (0 to 240) in Y Axis (0 to 72) in Z Axis (0 to 96) in	-0.5 μ in/in + 2 300 μ in -4.2 μ in/in + 2 300 μ in -1.2 μ in/in + 2 400 μ in	Customer Drawing or CAD Model CMM Application Software
Inspection by CMM B & S Global PC-DMIS CAD ++	X Axis (0 to 36) in Y Axis (0 to 48) in Z Axis (0 to 32) in	5.7 μ in/in + 23 μ in 7.3 μ in/in + 21 μ in 6.1 μ in/in + 31 μ in	Customer Drawing or CAD Model CMM Application Software

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:

- 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.
- L = length in inches.
- This scope is formatted as part of a single document including Certificate of Accreditation No. ACT-1235.


 Vice President

