



CERTIFICATE OF ACCREDITATION

ANSI-ASQ National Accreditation Board

500 Montgomery Street, Suite 625, Alexandria, VA 22314, 877-344-3044

This is to certify that

Alliance Calibration
11402 Reading Road
Cincinnati, OH 45241

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

ISO/IEC 17025:2005

and national standard

ANSI/NCSL Z540-1-1994 (R2002)

while demonstrating technical competence in the field of

CALIBRATION

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

L2181-1

Certificate Number


ANAB Approval

Certificate Valid: 07/24/2018-09/15/2020
Version No. 004 Issued: 07/24/2018



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).



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

Alliance Calibration
11402 Reading Road
Cincinnati, OH 45241
Sidney Taylor 513-769-1200

CALIBRATION

Valid to: September 15, 2020

Certificate Number: L2181-1

Acoustics and Vibration

Table with 4 columns: Parameter/Equipment, Range, Expanded Uncertainty of Measurement (+/-), Reference Standard, Method, and/or Equipment. Row 1: Accelerometer Sensitivity with ranges from (0 to 5 000) mV/g to (5 001 to 10 000) Hz and uncertainties from 1.7% to 2.3%.

Chemical Quantities

Table with 4 columns: Parameter/Equipment, Range, Expanded Uncertainty of Measurement (+/-), Reference Standard, Method, and/or Equipment. Rows include pH Meters (4, 7, 10 pH) and Conductivity Meters (1, 10, 100, 1 000 µS).



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Source	(330 to 400) pF	14 pF	Fluke 5500A Multiproduct Calibrator
Capacitance – Source ³	(0.4 to 1.1) nF @ 1 kHz (1.1 to 3.3) nF @ 1 kHz (3.3 to 11) nF @ 1 kHz (11 to 33) nF @ 1 kHz (33 to 110) nF @ 1 kHz (110 to 330) nF @ 1 kHz (0.33 to 1.1) μF @ 100 Hz (1.1 to 3.3) μF @ 100 Hz (3.3 to 11) μF @ 100 Hz (11 to 33) μF @ 100 Hz (33 to 110) μF @ 50 Hz (110 to 330) μF @ 50 Hz (330 to 1 100) μF @ 50 Hz	(0.11 + 0.007 4x) nF (0.013 + 0.005 7X) nF (0.013 + 0.005 7X) nF (0.12 + 0.002 9X) nF (0.11 + 0.003 1X) nF (0.34 + 0.003 0X) nF (0.001 2 + 0.002 9X) μF (0.002 6 + 0.003 6X) μF (0.012 + 0.004 2X) μF (0.003 5 + 0.004 7X) μF (0.11 + 0.005 9X) μF (0.31 + 0.008 5X) μF (0.45 + 0.011X) μF	Fluke 5500A Multiproduct Calibrator
Capacitance - Measure	(0.2 to 2) nF (2 to 20) nF (20 to 200) nF (0.2 to 2) μF (2 to 20) μF (20 to 200) μF	0.017 nF + 0.85 % of Reading 0.066 nF + 1.2 % of Reading 1 nF + 0.74% of Reading 0.010 μF + 0.74 % of Reading 0.11 μF + 0.71 % of Reading 0.66 μF + 1.2 % of Reading	Tenma 72-8150 Capacitance Meter
DC Current – Measure ³	Up to 3A	(0.005 3 + 0.001 2X) mA	Agilent 34401A Multimeter
	(3 to 10) A	0.52 % of reading	Fluke 87 Multimeter
	(10 to 200) A (200 to 500) A	(1 + 0.021X) A (0.51 + 0.023X) A	Fluke 336 Clamp Meter



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Source ³	Up to 3.3 mA (3.3 to 33) mA (33 to 330) mA (0.33 to 2.2) A (2.2 to 11) A (11 to 200) A (200 to 500) A	(0.000 086 + 0.000 14X) mA (0.000 32 + 0.000 12X) mA (0.002 9 + 0.000 12X) mA (0.000 051 + 0.000 35X) A (0.000 4 + 0.000 7X) A (0.11 + 0.002 2X) A (0.11 + 0.002 2X) A	Fluke 5500A Multiproduct Calibrator w/ Coil
AC Current – Measure ³ 40 Hz to 1 kHz	10 mA to 1 A (1 to 3) A	(0.000 69 + 0.001X) A 0.31 % of reading	Agilent 34401A Multimeter
AC Current – Measure ³ (45 to 65) Hz	(3 to 10) A	0.52 % of reading	Fluke 87 Multimeter
	(10 to 200) A (200 to 500) A	(1 + 0.021X) A (0.64 + 0.023X) A	Fluke 336 Clamp Meter
AC Current – Source ³	Up to 0.33 mA (1 to 10) kHz (0.33 to 3.3) mA (1 to 10) kHz (3.3 to 33) mA (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	(0.000 62 + 0.000 9X) mA (0.000 77 + 0.001X) mA (0.012 + 0.000 94X) mA (0.0079 + 0.000 94X) mA (0.036 + 0.006 9X) mA (0.005 8 + 0.006 9X) mA	Fluke 5500A Multiproduct Calibrator
AC Current – Source ³	(33 to 330) mA (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (0.33 to 2.2) A (10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (2.2 to 11) A (45 to 65) Hz (65 to 500) Hz 500 Hz to 1 kHz (11 to 200) A (45 to 65) Hz (200 to 500) A (45 to 65) Hz	(0.043 + 0.001 1X) mA (0.04 + 0.001X) mA (0.036 + 0.002 3X) mA (0.035 + 0.006 9X) mA (0.000 36 + 0.002 3X) A (0.000 3 + 0.001 2X) A (0.000 35 + 0.008 7X) A (0.002 7 + 0.000 68X) A (0.002 4 + 0.001 2X) A (0.004 8 + 0.003 3X) A (0.58) A (0.22 + 0.001 7X) A	Fluke 5500A Multiproduct Calibrator w/ Coil



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Power – Measure ³	Up to 33 W (33 to 330) W (330 to 11 000) W	(0.000 005 + 0.001X) W 0.1% of reading 0.1% of reading	Fluke 5500A Multiproduct Calibrator
AC Power – Measure ³	(45 to 65) Hz Up to 33 W (33 to 330) W (330 to 11 000) W	(0.000 001 9 + 0.002 9X) W 0.17% of reading 0.17% of reading	
Resistance – Measure ³	Up to 100 Ω (100 to 1 000) Ω (1 to 10) kΩ (10 to 100) kΩ (0.1 to 1 MΩ) (1 to 10) MΩ (10 to 100) MΩ (0 to 5 000) mΩ	(0.004 7 + 0.000 088X) Ω (0.000 3 + 0.000 13X) Ω (0.000 015 + 0.000 12X) kΩ 0.012 % of reading (0.000 001 9 + 0.000 1X) MΩ 0.05 % of reading (0.03 + 0.009 1X) MΩ (0.004 4 + 0.000 17X) MΩ	Agilent 34401A Multimeter
Resistance – Source ³	Up to 11 Ω (11 to 33) Ω (33 to 110) 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	(0.007 + 0.000 14X) Ω (0.012 + 0.000 14X) Ω (0.012 + 0.000 1X) Ω (0.012 + 0.000 1X) Ω (0.000 069 + 0.000 1X) kΩ (0.000 076 + 0.000 11X) kΩ (0.000 7 + 0.000 1X) kΩ (0.000 62 + 0.000 12X) kΩ (0.008 4 + 0.000 12X) kΩ (0.006 9 + 0.000 14X) kΩ (0.000 064 + 0.000 17X) MΩ (0.000 079 + 0.000 17X) MΩ (0.000 64 + 0.000 69X) MΩ (0.000 64 + 0.001 2X) MΩ (0.006 4 + 0.005 8X) MΩ (0.01 + 0.005 9X) MΩ	Fluke 5500A Multiproduct Calibrator
Resistance – Source ³	500 μΩ 5 mΩ 50 mΩ 500 mΩ 5 Ω	(0.001 3 + 0.005 8X) mΩ	Fluke 5500A Multiproduct Calibrator, Agilent 34401A Multimeter Shunts
RTD Resistance Simulation Pt 385, 100 Ω	(-200 to 800) °C	0.058 °C	Fluke 5500A Multiproduct Calibrator



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Measure ³	Up to 1 V (1 to 10) V (10 to 100) V (100 to 1 000) V	(0.000 003 8 + 0.000 07X) V (0.000 01 + 0.000 046X) V 0.006 1 % of reading 0.006 6 % of reading	Agilent 34401A Multimeter
	(1 to 80) kV	0.12 % of reading	Ross Engineering HV Probe
DC Voltage – Source ³	(0 to 330) mV (0.33 to 3.3) V (3.3 to 33) V (33 to 330) V (0.3 to 1) kV	(0.004 4 + 0.000 073X) mV (0.000 001 8 + 0.000 065X) V (0.000 13 + 0.000 044X) V (0.000 025 + 0.000 055X) V (0.016 + 0.000 039X) V	Fluke 5500A Multiproduct Calibrator
AC Voltage – Measure ³	Up to 1 V 10 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	(0.046 + 0.000 7X) mV (0.102 + 0.001 5X) mV (0.11 + 0.006 9X) mV (0.58 + 0.046X) mV	Agilent 34401A Multimeter
AC Voltage – Measure ³	(1 to 750) V 10 Hz to 20 kHz (20 to 50) kHz	0.11 % of reading (0.000 7 + 0.002 1X) V	
AC Voltage – Measure ³	(1 to 80) kV @ 60 Hz	(0.006 2 + 0.012X) kV	Ross Engineering HV Probe
AC Voltage – Source ³	Up 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 (0.33 to 3.3) V (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	(0.058 + 0.002 9X) mV (0.05 + 0.000 48X) mV (0.049 + 0.001 1X) mV (0.052 + 0.001 8X) mV (0.11 + 0.003 1X) mV (0.23 + 0.008 7X) mV (0.000 3 + 0.001 7X) V (0.000 071 + 0.000 35X) V (0.000 071 + 0.000 92X) V (0.000 35 + 0.001 6X) V (0.002 + 0.002 8X) V (0.003 8 + 0.005 8X) V	Fluke 5500A Multiproduct Calibrator



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source ³	(3.3 to 33) V (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (33 to 330) V 40 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz (330 to 1 000) V 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	(0.003 1 + 0.001 7X) V (0.000 72 + 0.000 46X) V (0.003 + 0.000 92X) V (0.005 8 + 0.002 2X) V (0.02 + 0.002 8X) V (0.008 1 + 0.000 58X) V (0.015 + 0.000 92X) V (0.001 3 + 0.001X) V (0.086 + 0.000 59X) V (0.11 + 0.002 3X) V (0.58 + 0.002 3X) V	Fluke 5500A Multiproduct Calibrator
Thermocouple Millivolt Simulation	Type E (-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1 000) °C Type J (-210 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1 200) °C Type K (-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1 000) °C (1 000 to 1 372) °C Type N (-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1 300) °C Type R (0 to 250) °C (250 to 1 767) °C	0.58 °C 0.19 °C 0.17 °C 0.21 °C 0.25 °C 0.19 °C 0.17 °C 0.2 °C 0.3 °C 0.39 °C 0.22 °C 0.19 °C 0.3 °C 0.47 °C 0.47 °C 0.26 °C 0.22 °C 0.26 °C 0.32 °C 0.76 °C 0.39 °C	Fluke 5500A Multiproduct Calibrator



Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Thermocouple Millivolt Simulation	Type S (0 to 250) °C (250 to 1 400) °C (1 400 to 1 767) °C	0.56 °C 0.44 °C 0.53 °C	Fluke 5500A Multiproduct Calibrator
	Type T (-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.73 °C 0.28 °C 0.19 °C 0.17 °C	
Oscilloscopes Time Base	(2 to 10) ns 20 ns to 1 μs (2 to 50) μs (0.1 to 5 000) ms	0.003 ps 0.003 ns 0.039 ns + 0.000 2 % of reading 0.2 ms + 0.2 % of reading	Fluke 5500A-SC600 Multiproduct Calibrator
Oscilloscopes Bandwidth	50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz	4.3 % of reading 4.9 % of reading 7.3 % of reading	
Oscilloscopes Amplitude	(0 to 5) V pp	0.35 mV + 2.3 % of reading	

Length – Dimensional metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Gage Blocks ³	(0.005 to 1) in 2 in 3 in 4 in	(2.9 + 3.7L) μin 10 μin 13 μin 16 μin	Gage Blocks, Gage Block Comparator
	(5 to 20) in	(5.6 + 3L) μin	Universal Machine Gage Blocks
Plain Plug Gage ³	(0.007 to 10) in	(8.6 + 3.3L) μin	Universal Machine
Height/Step Master ³	(0 to 36) in	(9.6 + 4.1L) μin	Gage Blocks, Surface Plate, Indicator
Height Master (Travel) ³	(0 to 1) in	(15 + 12L) μin	Gage Blocks, Surface Plate, Indicator
Micrometer Standard ³	(0.5 to 26) in (26 to 48) in	(0.087 + 5.3L) μin (68 + 3.5L) μin	Universal Machine

Length – Dimensional metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Plain Ring Gages ³	(0.15 to 10) in	(19 + 2.4L) μin	Universal Machine
Thread Wire ²	(0.007 to 0.2) in	13 μin	Universal Machine XX Cylinder
Pin Gage ³	(0.011 to 2) in	(30 + 0.45L) μin	Super Micrometer
Thickness Gage (Leaf) ³	(0 to 1) in	(31 + 3L) μin	Super Micrometer
Tape Measures	Up to 50 ft	0.056 in	Master Tape
Steel Rules ³	Up to 72 in	(0.010 + 0.000 1L) in	Master Ruler
Plastic Shim Stock ^{3,4}	(1 to 50) mils	(0.0067 + 0.004 5L) mils	Bench Micrometer
Thread Plug Gages ³ Major Diameter Pitch Diameter (4 to 80) TPI	(0.06 to 8) in	(0.000 026 + 0.000 023L) in (85 + 2.1L) μin	Super Micrometer Thread Wires
Thread Ring Gages ³ Minor Diameter Pitch Diameter (Adjustable) Tactile Fit (Set to Plug)	(0.06 to 0.25) in (0.25 to 2) in (2 to 8) in (0.06 to 8) in (4 to 80) TPI	(351 + 11L) μin (186 + 18L) μin (351 + 11L) μin N/A	Tri-anvil Micrometers Vision System Set Plugs
Radius Gage ³	(0.015 6 to 2) in	(0.000 27 + 0.000 002 8L) in	Vision System
Spheres ³	(0.013 2 to 2) in	(14 + 2.5L) μin	Universal Machine
Squares ³	(2 to 18) in	(31 + 1.4L) μin	Grade AA Square Gage Blocks
Surface Plate Overall Flatness ^{1,3} Local Area Flatness (Repeat Reading) ¹	(8 to 68) in diagonal (34 to 161) in diagonal Up to 0.001 in	41 μin (6 + 5.8L) μin 41 μin	Planekator Level System Repeat-o-meter
Roughness Specimens	Up to 400 μin Ra	4.4 μin	Profilometers
Gages and Fixtures ³ , 2D Length	Up to 10 in	(220 + 6.6L) μin	Vision System
Gages and Fixtures ³ , 2D Diameter	Up to 8 in	(210 + 16L) μin	Vision System



Length – Dimensional metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Gages and Fixtures, 2D Angle	(0 to 360) °	0.024 °	Vision System
Height Gage ³	(0 to 36) in	(95 + 1.3L) μin	Gage Blocks Surface Plate
Calipers ³	(0 to 60) in (60 to 120) in	(390 + 6L) μin (320 + 6.5L) μin	Gage Blocks
Outside Micrometers ³	(0 to 36) in	(24 + 2.7L) μin	
Depth Micrometers ³	(0 to 12) in	(600 + 0.11L) μin	Gage Blocks Surface Plate
Inside Micrometer ³	(0.1 to 36) in	(580 + 0.6L) μin	
Bore Micrometers ³	(0.15 to 10) in	(26 + 42L) μin	Ring Gages
Bench Micrometer Travel Anvil Flatness Anvil Parallelism	(0 to 1) in	13 μin 6.8 μin 8.6 μin	Gage Blocks Optical Flat Sphere
Indicator ³ 0.001 in resolution 0.000 5 in resolution 0.000 1 in resolution 0.000 05 in resolution 0.000 01 in resolution	(0 to 4) in	(620 + 0.02L) μin (360 + 0.04L) μin (58 + 0.5L) μin (29 + 0.98L) μin (5.3 + 3.2L) μin	Indicator Tester Gage Blocks
Universal Measuring Machine ³	(0 to 24) in	(2.3 + 3.4L) μin	Gage Blocks
Ultrasonic Thickness Gages	(0.005 to 2) in	580 μin	Gage Blocks
Magnetic Coating Thickness Gages ^{3,4}	(1 to 50) mils	(0.055 + 0.003L) mils	Precision Shims Bench Micrometer
Profilometer (Ra)	(0 to 200) μin	3.2 μin	Roughness Standard ASME B46.1-2009
Protractor ³	(0 to 180) °	(0.058 + 0.000 61L) °	Granite Squares Sine Bar
Optical Comparators ³ Magnification Linearity Squareness	5x to 100x (0 to 6) in (0 to 6) in	(140 + 2.6L) μin 140 μin 76 μin	Glass Scale Length Standards Spheres



Length – Dimensional metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Microscopes ³ Stage Travel	(0 to 1) in	(54 + 45L) μin	Gage Blocks
Vision Systems ³ Linearity Angles	(0 to 6) in (0 to 360) °	(86 + 3L) in 0.005 1 °	Glass Scale
CMM Linearity ³	Up to 48 in	(12 + 4.7L) μin	Step Gage and Gage Blocks in accordance with B89.4.10360-2
CMM Repeatability		87 μin	
CMM Volumetric Accuracy	Up to 48 in	96 μin	Ball Bar in accordance with B89.4.1-1997

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Gas Flow Speed (Anemometers)	(490 to 3300) ft/min	2 ft/min + 3.8 % of reading	TSI 9535 VelociCalc Air Velocity Meter
Gas Flow Meter	(50 to 500) CCM Up to 50 SLM (50 to 250) SLM	1.2 CCM + 0.5 % of reading 0.12 SLM + 0.5 % of reading 1.2 SLM + 0.8 % of reading	Alicat Flow Standard
Liquid Flow (gravimetric)	(0.3 to 50) gpm	0.023 gpm + 0.59 % of reading	Scale
Bench Micrometer Measuring Force	(4 to 40) ozf	0.21 ozf	Force Gage
Force Gages ³	1 grf to 45 kgf	(5.7 + 1.1F) gf	Class F Masses
	(0.5 to 50) lbf (50 to 250) lbf	(0.003 2 + 0.000 22W) lbf (0.013 + 0.000 09W) lbf	Class 7 Masses
Load Cells	(10 to 500) lbf (501 to 1 000) lbf (1 001 to 5 000) lbf (5 001 to 20 000) lbf	0.83 lbf + 0.1 % of reading 1.1 lbf + 0.051 % of reading 5.9 lbf + 0.032 % of reading 58 lbf + 0.003 % of reading	Load Cells
Rockwell and Rockwell Superficial Hardness Testers	HRBW Low Middle High	4.6 HRBW 2.2 HRBW 2.5 HRBW	Indirect Verification per ASTM E18



Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Rockwell and Rockwell Superficial Hardness Testers	HRC		Indirect Verification per ASTM E18
	Low	2 HRC	
	Middle	1.9 HRC	
	High	1.1 HRC	
	HRFW		
	Low	1.9 HRFW	
	Middle	1.1 HRFW	
	High	1.4 HRFW	
	HR15N		
	Low	1.7 HR15N	
	Middle	2.2 HR15N	
	High	1.3 HR15N	
	HR30N		
	Low	2 HR30N	
	Middle	2 HR30N	
	High	1.5 HR30N	
	HR45N		
	Low	1.8 HR45N	
	Middle	2.1 HR45N	
	High	1.4 HR45N	
	HR15TW		
	Low	3 HR15TW	
	Middle	1.5 HR15TW	
	High	1.5 HR15TW	
HR30TW			
Low	4.1 HR30TW		
Middle	1.9 HR30TW		
High	1.8 HR30TW		
HR45TW			
Low	2 HR45TW		
Middle	1.6 HR45TW		
High	2.3 HR45TW		
Masses	1g	0.13 mg	Class 1 Masses
	2g	0.22 mg	
	5g	0.19 mg	
	10g	0.22 mg	
	20g	0.25 mg	
	50g	0.49 mg	
	100g	0.77 mg	
	200g	1.3 mg	

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Pressure Gage	(0 to 30) psig	0.0083 psi + 0.005 % of reading	Druck DPI 802 Pressure Calibrator - Pneumatic
	(10 001 to 15 000) psig	17 psi + 0.005 5 % of reading	Keller Gage-Hydraulic
Vacuum Gage	(-14.5 to 0) psig	0.002 psi + 0.026 % of reading	Druck DPI 802 Pressure Calibrator - Pneumatic
Pressure Devices	(2 to 500) psig	0.000 51 psi + 0.037 % of reading	Dead Weight Tester-Hydraulic
	(500 to 10 000) psig	0.7 psi + 0.033 % of reading	
Precision Scales & Balances Balances	(0.001 to 1 100) g	0.15 mg + 0.000 22 % of reading	Class E2 Masses
Scales	(0.5 to 38) kg	8.3 mg + 0.012 % of reading	Class F Masses
	(0.5 to 500) lb	0.000 55 lb + 0.018 % of reading	Class 7 Weights
Torque Tools	(0.5 to 400) ozf·in (4 to 50) lbf·in (10 to 150) lbf·in (30 to 400) lbf·in (80 to 1 000) lbf·in (10 to 125) lbf·ft (60 to 600) lbf·ft (100 to 1 000) lbf·ft (1 000 to 2 000) lbf·ft	0.33 % of reading 0.38 % of reading 0.33 % of reading 0.33 % of reading 0.33 % of reading 0.36 % of reading 0.34 % of reading 0.59 % of reading 18 lbf·ft + 0.13 % of reading	CDI Torque Tester
Torque Transducers	(5 to 1 000) lbf·ft	0.11 % of reading	Torque Arms & Class F Weights
Pipettes	(10 to 1 000) µL	0.19 µL + 0.07 % of reading	Gravimetric

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Relative Humidity ³	(0 to 80) % RH	(1.2 + 0.005 4T) % RH	Vasaila MI70 / HMP77 Temperature/Humidity Indicator
Temperature Measure	(-70 to 180) °C	0.29 °C	
Temperature Probes and Systems	(-20 to 600) °C	(0.028 + 0.000 64T) °C	Hart Scientific Baths and Drywells and 5609 PRT



Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Liquid in Glass Thermometers (Partial and Total Immersion)	(-20 to 600) °C	(0.087 + 0.000 55T) °C	Hart Scientific Bath, Furnace, and 5609 PRT
Temperature Measure	(-195 to 420) °C (420 to 660) °C	0.069 °C 0.38 °C	5609 PRT
Infrared Source ^{1,3}	(50 to 500) °C	(1 + 0.002T) °C	ICI 500 Blackbody Source $\lambda = (8 \text{ to } 14) \mu\text{m}$, $\epsilon = 0.95$

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Source	1 Hz to 50 MHz (50 to 600) MHz	0.001 8 Hz + 0.000 12% of reading 0.000 18 Hz + 0.000 31% of reading	Fluke 5500A Multiproduct Calibrator, PM5193 Function Generator
	10 MHz	0.002 Hz	GPS Disciplined Oscillator
Frequency – Measure ³	1 Hz to 225 MHz 225 MHz to 3 GHz	(0.008 1 + 0.000 000 000 4X) Hz (0.011+ 0.000 000 000 15X) Hz	HP 53132 Counter
Timers and Stopwatches	(0.1 to 60) min	0.034 s + 0.005 9% of reading	HP 53132 Counter

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. Uncertainty shown is per wire for thread wire sets.
3. L = length in inches, D = diameters in inches, T = temperature / RH applied, X = flow / frequency / volts / ohms / amps / capacitance applied, M = mass applied, F = force in kg, P = pressure applied, V = volume, W = weight in lb.
4. 1 mil = 0.001 in.
5. This scope is formatted as part of a single document including Certificate of Accreditation No. L2181-1.

Vice President