



CERTIFICATE OF ACCREDITATION

ANSI-ASQ National Accreditation Board

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

This is to certify that

OCS Technologies, Inc.

(dba: Ohio Counting Scale / Omni Calibration Services)

14901 Emery Avenue

Cleveland OH 44135

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

ISO/IEC 17025:2005

while demonstrating technical competence in the field of

CALIBRATION & DIMENSIONAL MEASUREMENT

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

L1152-1

Certificate Number


ANAB Approval

Certificate Valid: 06/27/2018-11/27/2019
Version No. 002 Issued: 06/27/2018



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

OCS Technologies, Inc.
 (dba: Ohio Counting Scale / Omni Calibration Services)

14901 Emory Avenue
 Cleveland, OH 44135
 Joseph Gunn 216-741-0224

CALIBRATION

Valid to: **November 27, 2019**

Certificate Number: **L1152-1**

Chemical Quantities

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
pH Meters ² (Fixed Points)	(4, 7, & 10) pH	0.03 pH	Comparisons to Buffer Solutions

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Capacitance – Source ²	(0.19 to 3.3) nF (3.3 to 110) nF (110 to 330) nF (0.33 to 1.1) μF (1.1 to 3.3) μF (3.3 to 33) μF (33 to 330) μF (0.33 to 3.3) mF (3.3 to 11) mF (11 to 33) mF (33 to 110) mF	6 mF/F + 12 pF 3 mF/F + 120 pF 3 mF/F + 350 pF 3 mF/F + 2 nF 3mF/F + 4nF 5 mF/F + 35 nF 6 mF/F + 350 nF 6 mF/F + 4 μF 6 mF/F + 12 μF 9 mF/F + 35 μF 13 mF/F + 120 μF	Comparisons performed with a Multifunction Calibrator
DC Current – Source ²	(0 to 30) μA (0 to 3.3) mA (3.3 to 33) mA	180 μA/A + 30 nA 120 μA/A + 60 nA 120 μA/A + 300 nA	Comparisons performed with a Multifunction Calibrator

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
DC Current – Source ²	(33 to 330) mA 330 mA to 1.1 A (1.1 to 3) A (3 to 11) A (11 to 20.5) A	120 μ A/A + 14 μ A 230 μ A/A + 48 μ A 440 μ A/A + 48 μ A 580 μ A/A + 600 μ A 1.2 mA/A + 880 μ A	Comparisons performed with a Multifunction Calibrator
	(20 to 1 000) A	9 mA/A + 0.6 mA	Using 50 turn coil
AC Current – Source ²	(29 to 330) μ A (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz (0.33 to 3.3) mA (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 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 10) kHz (10 to 30) kHz (33 to 330) mA (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	2.4 mA/A + 120 nA 1.8 mA/A + 120 nA 1.5 mA/A + 120 nA 3.5 mA/A + 170 nA 9.3 mA/A + 230 nA 19 mA/A + 460 nA 2.4 mA/A + 170 nA 1.5 mA/A + 170 nA 1.2 mA/A + 170 nA 230 nA/A + 230 nA 5.8 mA/A + 350 nA 12 mA/A + 690 nA 2.1 mA/A + 2.3 μ A 1.1 mA/A + 2.3 μ A 470 mA/A + 2.3 μ A 930 μ A/A + 2.3 μ A 2.4 μ A/A + 3.5 μ A 4.7 mA/A + 4.6 μ A 2.1 mA/A + 27 μ A 1.1 mA/A + 27 μ A 470 μ A/A + 27 μ A 1.2 mA/A + 60 μ A 2.4 mA/A + 120 μ A 4.7 mA/A + 240 μ A	Comparisons performed with a Multifunction Calibrator

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
AC Current – Source ²	(0.33 to 3) A (10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (3 to 11) A (45 to 100) Hz 100 Hz 1 kHz (1 to 5) kHz (11 to 20.5) A (45 to 100) Hz 100 Hz 1 kHz (1 to 5) kHz	2.1 mA/A + 120 μA 700 μA/A + 120 μA 7 mA/A + 1.2 mA 29 mA/A + 5.8 mA 700 μA/A + 2.4 mA 1.2 mA/A + 2.4 mA 35 mA/A + 2.4 mA 1.4 mA/A + 5.8 mA 1.7 mA/A + 5.8 mA 35 mA/A + 5.8 mA	Comparisons performed with a Multifunction Calibrator
AC Current – Source ²	(20 to 1 000) A (45 to 65) Hz (65 to 440) Hz	7.2 mA/A + 590 mA 7.8 mA/A + 590 mA	Comparisons performed with a Multifunction Calibrator and using 50 turn coil
DC Current – Measure ²	(0 to 100) μA (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A (1 to 30) A	4.2 nA 38 nA 380 nA 6 μA 0.16 mA 0.38 % of reading	Comparisons performed with a 8 ½ Digit Multimeter and Current Shunt for > 1 A
AC Current – Measure ² 40 Hz to 1 kHz	(0 to 100) μA (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A (1 to 30) A	114 nA 1.1 μA 11 μA 110 μA 1.3 mA 0.38 % of reading	Comparisons performed with a 8 ½ Digit Multimeter and Current Shunt for > 1 A
Resistance – Source ²	(0 to 33) Ω (33 to 330) Ω 330 Ω to 33 kΩ (33 to 330) kΩ 330 kΩ to 3.3 MΩ (3.3 to 33) MΩ (33 to 110) MΩ (110 to 330) MΩ	35 μΩ/Ω + 240 μΩ 33 μΩ/Ω + 2.4 mΩ 33 μΩ/Ω + 24 mΩ 37 μΩ/Ω + 240 mΩ 70 μΩ/Ω + 2.4 Ω 300 μΩ/Ω + 24 Ω 600 μΩ/Ω + 240 Ω 4 mΩ/Ω + 240 Ω	Comparisons performed with a Multifunction Calibrator

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Resistance – Source ²	330 MΩ to 1.1 GΩ (1 to 10.05) GΩ 18.24 GΩ	18 mΩ/Ω + 2400 Ω 1.2 % of reading 0.64 GΩ	Comparisons performed with a Multifunction Calibrator
Resistance – Source Fixed Points ²	1.9 mΩ 10 mΩ 100 mΩ 1 Ω 15 Ω 100 GΩ 1 TΩ	0.84 μΩ 4.2 μΩ 37 μΩ 0.29 mΩ 2.8 mΩ 3.5 GΩ 66 GΩ	Comparisons with Fixed Resistors
Resistance – Measure ²	(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	23 μΩ/Ω + 71 μΩ 22 μΩ/Ω + 360 μΩ 17 μΩ/Ω + 8 μΩ 17 μΩ/Ω + 2.3 mΩ 17 μΩ/Ω + 7.8 mΩ 21 μΩ/Ω + 5.4 Ω 76 μΩ/Ω + 44 Ω 650 μΩ/Ω + 450 Ω 6.3 mΩ/Ω + 23 kΩ	Measured with a 8 ½ Digit Multimeter
RTD Resistance Simulation ²	Pt 385, 100 Ω (-200 to 300) °C (300 to 800) °C Pt 385, 1 000 Ω (-200 to 300) °C (100 to 600) °C	0.18 °C 0.46 °C 0.12 °C 0.14 °C	Comparisons performed with Multifunction Calibrator and Electronic Indicator
DC Voltage – Source ²	(0 to 330) mV 330 mV to 3.3 V (3.3 to 33) V	24 μV/V + 3 μV 13 μV/V + 14 μV 14 μV/V + 140 μV	Comparisons performed with Multifunction Calibrator
DC Voltage – Source ²	(33 to 330) V (330 to 1 000) V	21 μV/V + 1.3 μV 21 μV/V + 13 μV	
AC Voltage – Source ²	(1 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 500) kHz	930 μV/V + 8 μV 180 μV/V + 8 μV 240 μV/V + 8 μV 1.2 μV/V + 8 μV 4.1 μV/V + 15 μV 9.3 mV/V + 58 μV	Comparisons performed with Multifunction Calibrator



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
AC Voltage – Source ²	(33 to 330) mV		Comparisons performed with Multifunction Calibrator
	(10 to 45) Hz	580 $\mu\text{V/V} + 10 \mu\text{V}$	
	45 Hz to 10 kHz	170 $\mu\text{V/V} + 11 \mu\text{V}$	
	(10 to 20) kHz	190 $\mu\text{V/V} + 10 \mu\text{V}$	
	(20 to 50) kHz	410 $\mu\text{V/V} + 13 \mu\text{V}$	
	(50 to 100) kHz	930 $\mu\text{V/V} + 39 \mu\text{V}$	
	(100 to 500) kHz	2.4 mV/V + 87 μV	
	(0.33 to 3.3) V		
	(10 to 45) Hz	350 $\mu\text{V/V} + 100 \mu\text{V}$	
	45 Hz to 10 kHz	180 $\mu\text{V/V} + 150 \mu\text{V}$	
	(10 to 20) kHz	220 $\mu\text{V/V} + 120 \mu\text{V}$	
	(20 to 50) kHz	350 $\mu\text{V/V} + 68 \mu\text{V}$	
	(50 to 100) kHz	810 $\mu\text{V/V} + 180 \mu\text{V}$	
	(100 to 500) kHz	2.8 mV/V + 840 μV	
	(3.3 to 33) V		
	(10 to 45) Hz	350 $\mu\text{V/V} + 890 \mu\text{V}$	
	45 Hz to 10 kHz	180 $\mu\text{V/V} + 910 \mu\text{V}$	
	(10 to 20) kHz	280 $\mu\text{V/V} + 910 \mu\text{V}$	
(20 to 50) kHz	410 $\mu\text{V/V} + 840 \mu\text{V}$		
(50 to 100) kHz	1.1 mV/V + 2.1 mV		
(33 to 330) V			
45 Hz to 1 kHz	220 $\mu\text{V/V} + 5.2 \text{ mV}$		
(1 to 10) kHz	240 $\mu\text{V/V} + 7.8 \text{ mV}$		
(10 to 20) kHz	290 $\mu\text{V/V} + 7.4 \text{ mV}$		
(20 to 50) kHz	350 $\mu\text{V/V} + 7.4 \text{ mV}$		
(50 to 100) kHz	2.4 mV/V + 58 mV		
(330 to 1 000) V			
45 Hz to 1 kHz	2.4 mV/V + 58 mV		
(1 to 5) kHz	2.4 mV/V + 58 mV		
(5 to 10) kHz	2.4 mV/V + 58 mV		
DC Voltage – Measure ²	(0 to 1) V	14 μV	Measured with an 8 ½ Digit Multimeter
	(1 to 10) V	130 μV	
	(10 to 100) V	1.5 mV	
	(100 to 1 000) V	15 mV	
AC Voltage – Measure ² 45 Hz to 1 kHz	(1 to 10) mV	4 μV	Measured with an 8 ½ Digit Multimeter
	(10 to 100) mV	12 μV	
	100 mV to 1 V	120 μV	
	(1 to 10) V	1.2 mV	
	(10 to 100) V	28 mV	
	(100 to 700) V	380 mV	



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
DC High Voltage – Measure ²	(0.5 to 2) kV (2 to 40) kV (40 to 70) kV	0.03 V/kV + 16 V 0.34 V/kV + 20 V 0.1% of reading	Comparisons performed with a Precision HV Meter
AC High Voltage – Measure ² 50 Hz to 60 Hz	(0.5 to 2) kV (2 to 25) kV (25 to 70) kV	0.13 V/kV + 9 V 4.5 V/kV + 79 V 0.2 % of reading	
Oscilloscopes ²			Comparisons performed with a Multifunction Calibrator and an Oscilloscope
DC Voltage (50Ω)	1 mV to 6.6 V	2.9 mV/V + 47 μV 600 μV/V + 47 μV	
DC Voltage (1MΩ)	1 mV to 130 V		
AC Voltage (50Ω) (Peak to Peak)	1 mV to 6.6 V	2.9 mV/V + 47 μV	
AC Voltage (1MΩ) (Peak to Peak)	1 mV to 130 V	1.2 mV/V + 47 μV	
Leveled Sinewave 50kHz to 600MHz	5 mV to 5.5 V	47 mV/V + 120 μV	
Time Markers	2 ns to 20 ms 50 ms to 5 s	3 μs/s 2 ms/s + 29 μs	
Wave Gen. (50Ω) (Peak to Peak)	1.8 mV to 2.5 V	35 mV/V + 120 μV	
Wave Gen. (1MΩ) (Peak to Peak)	1.8 mV to 55 V	35 mV/V + 120 μV	
Edge Characteristics: (1 kHz to 10 MHz into 50 Ω) Amplitude Rise time	5 mV to 2.5 V 1 nS to 1 μs	23 mV/V + 240 μV 350 ps	
Millivolt Simulation of Thermocouple Indicators ²	Type J (-220 to 400) °C (401 to 800) °C (801 to 1 180) °C Type K (-200 to 400) °C (401 to 800) °C (801 to 1 370) °C	0.51 °C 0.77 °C 1.2 °C 0.5 °C 0.76 °C 1.3 °C	Comparisons performed with Multifunction Calibrator and Thermocouple Indicator

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Millivolt Simulation of Thermocouple Indicators ²	Type T (-250 to 0) °C	0.35 °C	Comparisons performed with Multifunction Calibrator and Thermocouple Indicator
	(1 to 380) °C	0.44 °C	
	Type E (-100 to 400) °C	0.44 °C	
	(401 to 990) °C	1.1 °C	
	Type R (0 to 1 767) °C	0.93 °C	
	Type S (0 to 1 767) °C	0.85 °C	

Length – Dimensional Metrology

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Gage Blocks ⁶ Chrome Carbide	(0.01 to 4) in	(5 + 1.5L) μin	P&W LabMaster Universal and Fed GGG Grade 0.5 Gage Blocks
Gage Blocks ⁶ Steel, Ceramic, Tungsten Carbide	(0.01 to 4) in	(5.6 + 3.1L) μin	P&W LabMaster Universal and ASME Grade 00 Gage Blocks
Gage Blocks ⁶ Steel	(5 to 12) in	(4 + 3.1L) μin	
Plug /Pin Gages & Master Discs ⁶ Class XXX, XX, X, Y, Z, ZZ	(0.01 to 0.06) in	11 μin	P&W LabMaster Universal and ASME Grade 00 Gage Blocks
	(0.06 to 1) in	8 μin	
	(1 to 12) in	(3.2 + 4D) μin	
Pin Gages ² Class ZZ	(0.01 to 2) in	78 μin	Comparisons with Laser Micrometer
Micrometer/Length/End Standards ⁶	(1 to 12) in	(4 + 4.2L) μin	P&W LabMaster Universal and ASME Grade 00 Gage Blocks
Ring Gages ⁶	(0.04 to 1) in	18 μin	P&W LabMaster Universal, ASME Grade 00 Gage Blocks and Master Rings
	(1 to 12) in	(8.4 + 3.9D) μin	



Length – Dimensional Metrology

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Spheres/Precision Balls: Diameter	(0.1 to 3) in	15 μin	P&W LabMaster Universal and ASME Grade 00 Gage Blocks
Thread Wires ³ 2 TPI to 120 TPI	(0.004 to 0.29) in	13 μin	P&W LabMaster Universal and ASME Grade 00 Gage Blocks
Thread Plug Gages – Straight Major Diameter Pitch Diameter	(0.06 to 6) in (4 thru 80) TPI	53 μin 78 μin	P&W LabMaster Universal and ASME Grade 00 Gage Blocks with Thread Wires
Thread Plug Gages ³ / ₄ TPF Pitch Diameter	(0.3 to 6) in (8 thru 27) TPI	69 μin 90 μin	P&W LabMaster Universal and ASME Grade 00 Gage Blocks with Thread Wires
Thread Ring Gages - Functional Pitch Diameter	(0.06 to 12) in (4 thru 80) TPI	89 μin	In Accordance with ASME B1.2, Paragraph 5.1.1; the Ring is Sized to a Plug with the Plug's Uncertainty Given. Class X or W Set Plugs to be Used as Available
Angle Blocks	(0 to 90) °	0.006 °	Vision System
Micrometers ^{2,6}	(0 to 4) in (4 to 80) in	(98 + 4L) μin (58 + 10L) μin	Comparisons performed with Gage Blocks
Calipers ^{2,6} (OD, ID, depth)	(0 to 4) in (4 to 80) in	(100 + 4L) μin (300 + 4L) μin	
Height Gages ^{2,6}	(0 to 4) in (4 to 60) in	(170 + 2L) μin (280 + 8L) μin	
Chamfer Gages ²	(0 to 0.75) in	0.001 in	Sharp Edge Ring Gages / Surface Plate
Dial/Test Indicators ²	(0 to 1) in	81 μin	Comparisons performed with Indicator Calibrator
Dial/Test Indicators	(0 to 1) in	18 μin	P&W LabMaster Universal and ASME Grade 00 Gage Blocks
	(1 to 4) in	293 μin	
Micrometer Heads	(0 to 1) in	18 μin	P&W LabMaster Universal



Length – Dimensional Metrology

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Indicating Snap Gages ^{2,6}	(0 to 4) in (4 to 40) in	(100 + 4L) μin (560 + 6L) μin	Comparisons performed with Gage Blocks
Bore Gages – 2 Point ^{2,6}	(0.125 to 4) in (4 to 40) in	(100 + 4L) μin (260 + 8L) μin	Comparisons performed with Gage Blocks and End Caps
Rules & Tape Measures ²	(0 to 72) in (6 to 100) ft	0.02 in 0.026 % of reading	Comparisons performed with Gage Blocks
Bench Micrometer ²	(0.1 to 2) in	24 μin	Comparisons performed with ASME Grade 0 Gage Blocks
Laser Micrometers ²	(0.06 to 1) in	61 μin	Master Plug Gages
Optical Comparators ²			
X and Y Axis Linearity	(0 to 12) in	190 μin	Comparisons to Optical Comparator Scale and Gage Blocks Comparison performed with Angle Blocks
Magnification	(10, 20, 31.25, 50, 62.5, & 100) x	190 μin	
Angle	(5, 10, 15, 20, 25, & 30) °	0.12°	
Protractors			Comparisons performed with Angle Blocks and Surface Plate Digital Protractor
Angle	(0, 5, 10, 15, 20, 25, & 30) ° (0 to 90) °	0.12 ° 0.27 °	
Level	0 °	0.27 °	
Bore Gages – 3 Point ^{2,6}	(0.125 to 7) in	(110 + 9L) μin	Comparisons performed with Customer Ring Gages calibrated by OCS

Mass and Mass Related

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Force –Tension & Compression ^{1,2,7}	(0.05 to 500) lbf (501 to 6 000) lbf	0.045 % of reading 0.093 % of reading	Reference Weights

Mass and Mass Related

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
(Force Gages, Load Cells with Indicators, Testing Machines)	(17 to 200) lbf (50 to 2 000) lbf (46 to 1 000) lbf (200 to 10 000) lbf	0.18 lbf 0.23 lbf 0.27 lbf 0.5 lbf	Morehouse Precision Load Cell
	(10 000 to 20 000) lbf	59 lbf	Force Indicator and Load Cell
Force Testing Machine Crosshead Travel	(0.1 to 6) in	0.002 in	Digital Caliper
Force Testing Machine Crosshead Speed	(0.5 to 12) in/min	0.04 in/min	Digital Stopwatch/Caliper
Bench Micrometer Contact Force	(2 to 32) ozf (32 to 40) ozf	0.8 ozf 2.2 ozf	Force Gages
Direct Verification of Durometers – Spring Force Indenter Extension, Diameter, Tip Radius Indenter Tip Angle	Type A, B, C, D, DO, O, OO (0 to 0.2) in (0 to 45) °	1.1 Duros 250 μin 0.2 °	ASTM D2240 with Balance / ASTM Class 6 Test Weights Vision System Vision System
Rockwell Hardness Testers ²	HRC Low Middle High HRBW Low Middle High HRA Low Middle High	0.38 HRC 0.35 HRC 0.32 HRC 0.71 HRBW 0.72 HRBW 0.73 HRBW 0.48 HRA 0.39 HRA 0.53 HRA	Indirect Verification per ASTM E18



Mass and Mass Related

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Superficial Rockwell Hardness Testers ²	HR15N		Indirect Verification per ASTM E18
	Low	0.5 HR15N	
	Middle	0.48 HR15N	
	High	0.43 HR15N	
	HR30N		
	Low	0.73 HR30N	
	Middle	0.73 HR30N	
	High	0.53 HR30N	
	HR15TW		
	Low	0.73 HR15TW	
	Middle	0.64 HR15TW	
	High	0.44 HR15TW	
	HR30TW		
	Low	0.58 HR30TW	
	Middle	0.55 HR30TW	
	High	0.46 HR30TW	
	HR45TW		
	Low	0.64 HR45TW	
Middle	0.67 HR45TW		
High	0.42 HR45TW		
Brinell Hardness Testers at Test Conditions: ²	125 < HBW ≤ 225	4.5 HBW	Indirect Verification per ASTM E10
	10/3 000/15	HBW > 225	
Weights	1 mg to 160 g (160 to 400) g	0.57 mg 3.2 mg	Mass value or deviation reported using High Resolution Scales that have been Calibrated with ASTM Class 1 Test Weights
Weights ²	(0.8 to 10) lb (10 to 27.5) lb (27.5 to 70) lb	0.000 07 lb 0.000 7 lb 0.001 7 lb	Mass value or deviation reported using High Resolution Scales That Have Been calibrated with ASTM Class 3 Test Weights



Mass and Mass Related

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Pressure Transducers, Dial and Digital Pressure Gages, Absolute Pressure Instruments, Low Vacuum Gages ^{2,4} (Pneumatic and Hydraulic)	(0.001 to 1) inH ₂ O (1 to 20) inH ₂ O	0.006 inH ₂ O 0.04 inH ₂ O	Comparisons to a Manometer
	(-0.01 to -14.5) psi (0.2 to 100) psia (0.001 to 3) psi (3 to 15) psi (15 to 60) psi (60 to 120) psi (120 to 180) psi (180 to 240) psi (240 to 300) psi	0.061 psi 0.06 psia 0.005 psi 0.001 7 psi + 0.11% of reading 0.08 psi 0.15 psi 0.22 psi 0.28 psi 0.35 psi	Comparisons to Digital Pressure Gages
Pressure Transducers, Dial and Digital Pressure Gages, Absolute Pressure Instruments, Low Vacuum Gages ^{2,4} (Pneumatic and Hydraulic)	(300 to 1 000) psi (1 000 to 2 000) psi (2 000 to 4 000) psi (4 000 to 6 000) psi (6 000 to 8 000) psi (8 000 to 10 000) psi (10 000 to 30 000) psi	0.66 psi 2.5 psi 4.8 psi 7.1 psi 9.4 psi 12 psi 71 psi	Comparisons to Digital Pressure Gages
Weighing Systems ^{1,2}	(0 to 500) mg	0.12 mg	ASTM E617 Class 1 Weights and NIST Handbook 44 utilized for the calibration of the Weighing System
	(1 to 20) g	0.005 % applied load	
	(21 to 60 000) g	0.000 3 % applied load	
Weighing Systems ^{1,2}	(0.005 to 120 000) lb	0.013 % applied load	NIST Class F Weights and NIST Handbook 44 utilized for the calibration of the Weighing System
Torque Wrenches, Drivers, Screwdrivers including Click Type	(10 to 100) ozf-in (100 to 500) ozf-in	1.9 % of reading	Torque Tester and Torque Cells
	(10 to 100) lbf-in (5 to 50) lbf-ft (50 to 1 000) lbf-ft	1.5 % of reading	
Torque Transducers, Torque Analyzers, Dial Torque Wrenches ²	(3 to 640) ozf-in (7.5 to 1 200) lbf-in (100 to 1 000) lbf-ft	0.13 % of reading + 0.11 ozf-in 0.14 % of reading + 0.05 lbf-in 0.14 % of reading + 0.09 lbf-ft	Torque Arms and ASTM Class 6 Weights



Thermodynamic

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
IR Thermometers ²	(-15 to 100) °C (100 to 200) °C (200 to 350) °C (350 to 500) °C	1.7 °C 1.9 °C 2.8 °C 3.4 °C	Fluke / Hart Scientific 4180 / 4181 Precision IR Calibrators ε= 0.9 to 0.99) λ = (8 to 14) μm
Relative Humidity Probes ²	11.3 % RH 75.5 % RH 95 % RH	1.5 % RH 1.8 % RH 2.3 % RH	Comparisons to Salt Solutions
Humidity Measure	(11 to 75) % RH (75 to 95) % RH	2.5 % RH 3 % RH	Comparisons to a Humidity Indicator and Probe
Temperature Chambers, Drywells, Temperature Baths ²	(-80 to 300) °C (300 to 1 200) °C	0.09 °C 5.8 °C	Measurement with a Platinum Resistance Thermometer and/or Type K TC with display
Temperature Devices - (Liquid in Glass Thermometers, Thermocouples, Bi-Metal Thermometers) ^{2,10}	(-80 to 300) °C	0.09 °C	Comparisons with a Platinum Resistance Thermometer and Bath or Chamber
	(300 to 600) °C	2.8 °C	
	(600 to 1 200) °C	3.1 °C	Dry Block Calibrator

Time and Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Tachometers – Non-Contact ²	(0.6 to 1 000) rpm (1 000 to 10 000) rpm (10 000 to 100 000) rpm	0.06 rpm 0.6 rpm 0.65 rpm	Comparisons performed with a Frequency Source and LED
Tachometers – Contact, Centrifuges, RPM Meters ²	(0.6 to 1 000) rpm (1000 to 10 000) rpm (10 000 to 100 000) rpm	1.2 rpm 1.7 rpm 8.2 rpm	Comparisons performed with a Photo/Contact Tachometer
Linear Surface Speed Indicators / Conveyor Belt Speed ²	(3 to 100) ft/min (100 to 300) ft/min (300 to 1 000) ft/min	0.71 ft/min 0.78 ft/min 1.3 ft/min	Comparisons performed with a Contact Tachometer and Wheel
Length - Footage Counter, Yardage Counter	(3 to 100) ft (100 to 300) ft (300 to 1 000) ft	0.75 ft 0.82 ft 1.4 ft	



Time and Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Frequency ² – Source	(10 to 119.99) Hz 120 Hz to 1.199 9 kHz (1.2 to 11.999) kHz (12 to 119.99) kHz 120 kHz to 1.2 MHz	380 μHz 3.7 mHz 0.037 Hz 0.37 Hz 3.7 Hz	Comparisons performed with a Multifunction Calibrator
Timers / Stopwatches ²	1 s to 4 h	0.35 s	Comparisons performed with Reference Stopwatch
	(4 to 24) h	1 s	

DIMENSIONAL MEASUREMENT

Dimensional

Specific Tests and / or Properties Measured	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Outside Diameter Length ^{5,6}	(0.1 to 4) in (4 to 12) in	27 μin (15 + 2.5L) μin	P&W LabMaster Universal and ASME Grade 00 Gage Blocks
Inside Diameter ^{5,6}	(0.1 to 4) in (4 to 12) in	27 μin (15 + 2.5L) μin	
Outside Diameter Length ²	(0.000 5 to 1.5) in	59 μin	Universal Measurement Machine
Outside Diameter Length ²	(0.001 to 1) in	180 μin	Digital Micrometer
Outside Diameter Inside Diameter Length Depth ²	(0.001 to 12) in	0.001 4 in	Digital Caliper
Inside Diameter ⁸	(0.011 to 0.5) in	0.001 2 in	Plug Gages
Vision System Measurements ⁹	<u>Linear X and Y</u> (0 to 1) in (1 to 6) in (6 to 10) in	250 μin 280 μin 330 μin	Vision System
	<u>Angle</u> (0 to 90) °	0.006 °	



Dimensional

Specific Tests and / or Properties Measured	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Angle	(0 to 90) °	0.27 °	Digital Protractor
Level	0 °	0.27 °	

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. The uncertainties for scales, balances, and force gages is highly dependent upon the resolution of the unit under test. The uncertainties presented here do not include the resolution of the unit under test. The resolution will be included in the reported measurement uncertainty at the time of calibration
2. 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.
3. Uncertainty shown is per wire for thread wire sets
4. Pressures from 10 000 psi to 30 000 psi can only be measured with a customer supplied pressure source
5. Micrometer Masters, Caliper Masters, Feeler Gages & shims would be included in this category.
6. L = length in inches, D = diameter in inches
7. Force capabilities are limited to 20 000 lbf in compression and 12 000 lbf in tension at OCS. Customer setup or testing machine may allow for a higher capacity test.
8. Crimp Tools would be included in this category.
9. Radius Gages and Angle Blocks would be included in this category.
10. For thermometers, measurement uncertainty may vary depend on type of thermometer, display resolution and immersion type.
11. This scope is formatted as part of a single document including Certificate of Accreditation No. L1152-1



Vice President