

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

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In recognition of a successful assessment to ISO/IEC 17025:2005 to the following Calibration and Measurement Capabilities, accreditation has been granted to **OCS Technologies, Inc.** for the following:

Accreditation Granted Through: **November 27, 2019**

Calibration

Amount of Substance – pH / Conductivity

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
pH Meters ² (Fixed Points)	(4, 7, & 10) pH	0.03 pH	Comparisons to Buffer Solutions

Electrical – Capacitance

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Capacitance – Source ²	(0.19 to 3.3) nF	6 mF/F + 12 pF	Comparisons performed with a Multifunction Calibrator
	(3.3 to 110) nF	3 mF/F + 120 pF	
	(110 to 330) nF	3 mF/F + 350 pF	
	(0.33 to 1.1) μF	3 mF/F + 2 nF	
	(1.1 to 3.3) μF	3mF/F + 4nF	
	(3.3 to 33) μF	5 mF/F + 35 nF	
	(33 to 330) μF	6 mF/F + 350 nF	
	(0.33 to 3.3) mF	6 mF/F + 4 μF	
	(3.3 to 11) mF	6 mF/F + 12 μF	
	(11 to 33) mF	9 mF/F + 35 μF	
(33 to 110) mF	13 mF/F + 120 μF		

Electrical – Current

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
DC Current – Source ²	(0 to 30) μA	180 μA/A + 30 nA	Comparisons performed with a Multifunction Calibrator
	(0 to 3.3) mA	120 μA/A + 60 nA	
	(3.3 to 33) mA	120 μA/A + 300 nA	

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
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	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	Comparisons performed with a Multifunction Calibrator
	(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	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	
	(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	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	
	(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	2.1 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	
	(0.33 to 3) A (10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	2.1 mA/A + 120 μ A 700 μ A/A + 120 μ A 7 mA/A + 1.2 mA 29 mA/A + 5.8 mA	
	(3 to 11) A (45 to 100) Hz 100 Hz 1 kHz (1 to 5) kHz	700 μ A/A + 2.4 mA 1.2 mA/A + 2.4 mA 35 mA/A + 2.4 mA	
	(11 to 20.5) A (45 to 100) Hz 100 Hz 1 kHz (1 to 5) kHz	1.4 mA/A + 5.8 mA 1.7 mA/A + 5.8 mA 35 mA/A + 5.8 mA	

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
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) μ A (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 μ A 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) μ A (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 μ A 11 μ A 110 μ A 1.3 mA 0.38 % of reading	

Electrical – Resistance

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Resistance – Source ²	(0 to 33) Ω (33 to 330) Ω 330 Ω to 33 k Ω (33 to 330) k Ω 330 k Ω to 3.3 M Ω (3.3 to 33) M Ω (33 to 110) M Ω (110 to 330) M Ω 330 M Ω to 1.1 G Ω (1 to 10.05) G Ω 18.24 G Ω	35 $\mu\Omega/\Omega$ + 240 $\mu\Omega$ 33 $\mu\Omega/\Omega$ + 2.4 m Ω 33 $\mu\Omega/\Omega$ + 24 m Ω 37 $\mu\Omega/\Omega$ + 240 m Ω 70 $\mu\Omega/\Omega$ + 2.4 Ω 300 $\mu\Omega/\Omega$ + 24 Ω 600 $\mu\Omega/\Omega$ + 240 Ω 4 m Ω/Ω + 240 Ω 18 m Ω/Ω + 2400 Ω 1.2 % of reading 0.64 G Ω	Comparisons performed with a Multifunction Calibrator
Resistance – Source Fixed Points ²	1.9 m Ω 10 m Ω 100 m Ω 1 Ω 15 Ω 100 G Ω 1 T Ω	0.84 $\mu\Omega$ 4.2 $\mu\Omega$ 37 $\mu\Omega$ 0.29 m Ω 2.8 m Ω 3.5 G Ω 66 G Ω	Comparisons with Fixed Resistors

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
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			Comparisons performed with Multifunction Calibrator and Electronic Indicator
Pt 385, 100 Ω	(-200 to 300) °C (300 to 800) °C	0.18 °C 0.46 °C	
Pt 385, 1 000 Ω	(-200 to 300) °C (100 to 600) °C	0.12 °C 0.14 °C	

Electrical – Voltage

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
DC Volts – 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 Volts – Source ²	(33 to 330) V (330 to 1 000) V	21 μV/V + 1.3 μV 21 μV/V + 13 μV	
AC Volts – 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	
	(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	580 μV/V + 10 μV 170 μV/V + 11 μV 190 μV/V + 10 μV 410 μV/V + 13 μV 930 μV/V + 39 μV 2.4 mV/V + 87 μV	
	(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	350 μV/V + 100 μV 180 μV/V + 150 μV 220 μV/V + 120 μV 350 μV/V + 68 μV 810 μV/V + 180 μV 2.8 mV/V + 840 μV	

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks	
AC Volts – Source ²	(3.3 to 33) V (10 to 45) Hz	350 μ V/V + 890 μ V	Comparisons performed with Multifunction Calibrator	
	45 Hz to 10 kHz (10 to 20) kHz	180 μ V/V + 910 μ V 280 μ V/V + 910 μ V		
	(20 to 50) kHz (50 to 100) kHz	410 μ V/V + 840 μ V 1.1 mV/V + 2.1 mV		
(33 to 330) V	45 Hz to 1 kHz	220 μ V/V + 5.2 mV		
	(1 to 10) kHz	240 μ V/V + 7.8 mV		
	(10 to 20) kHz	290 μ V/V + 7.4 mV		
	(20 to 50) kHz	350 μ V/V + 7.4 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 Volts – Measure ²	(0 to 1) V	14 μ V	Measured with an 8 ½ Digit Multimeter	
	(1 to 10) V	130 μ V		
	(10 to 100) V	1.5 mV		
	(100 to 1 000) V	15 mV		
AC Volts – Measure ² 45 Hz to 1 kHz	(1 to 10) mV	4 μ V	Measured with an 8 ½ Digit Multimeter	
	(10 to 100) mV	12 μ V		
	100 mV to 1 V (1 to 10) V	120 μ V 1.2 mV		
	(10 to 100) V	28 mV		
	(100 to 700) V	380 mV		
DC High Voltage – Measure ²	(0.5 to 2) kV	0.03 V/kV + 16 V	Comparisons performed with a Precision HV Meter	
	(2 to 40) kV	0.34 V/kV + 20 V		
	(40 to 70) kV	0.1% of reading		
AC High Voltage – Measure ² 50 Hz to 60 Hz	(0.5 to 2) kV	0.13 V/kV + 9 V		
	(2 to 25) kV	4.5 V/kV + 79 V		
	(25 to 70) kV	0.2 % of reading		
Thermocouple Millivolt Simulation ² Type J	(-220 to 400)	0.51 °C	Comparisons performed with Multifunction Calibrator and Thermocouple Indicator	
	(401 to 800)	0.77 °C		
	(801 to 1 180)	1.2 °C		
Type K	(-200 to 400)	0.5 °C		
	(401 to 800)	0.76 °C		
	(801 to 1 370)	1.3 °C		
Type T	(-250 to 0)	0.35 °C		Comparisons performed with Multifunction Calibrator and Thermocouple Indicator
	(1 to 380)	0.44 °C		
Type E	(-100 to 400)	0.44 °C		
	(401 to 990)	1.1 °C		
Type R	(0 to 1 767)	0.93 °C		
Type S	(0 to 1 767)	0.85 °C		

Length – Artifacts and Standards 1D

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
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	
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

Length – Artifacts and Standards 2D

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Thread Plug Gages – Straight Major Diameter	(0.06 to 6) in	53 μin	P&W LabMaster Universal and ASME Grade 00 Gage Blocks with Thread Wires
	(4 thru 80) TPI	78 μin	

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Thread Plug Gages 3/4 TPF Pitch Diameter	(0.3 to 6) in	69 μin	P&W LabMaster Universal and ASME Grade 00 Gage Blocks with Thread Wires
	(8 thru 27) TPI	90 μin	
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

Length – Hand Tools and Precision Gages 1D

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
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
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

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
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

Length – Hand Tools and Precision Gages 2D

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Optical Comparators ² X and Y Axis Linearity Magnification Angle	(0 to 12) in	190 μin	Comparisons to Optical Comparator Scale and Gage Blocks
	10x, 20x, 31.5x, 50x, 62.5x, 100x	190 μin	
	5°, 10°, 15°, 20°, 25°, 30°	0.12°	Comparison performed with Angle Blocks
Protractors Angle Level	0°, 5°, 10°, 15°, 20°, 25°, 30°	0.12 °	Comparisons performed with Angle Blocks and Surface Plate
	(0 to 90) °	0.27 °	
	0 °	0.27 °	Digital Protractor
Bore Gages – 3 point ^{2,6}	(0.125 to 7) in	(110 + 9L) μin	Comparisons performed with Customer Ring Gages calibrated by OCS

Mass – Force

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Force –Tension & Compression ^{2,7}	(0.1 to 2) lbf (2 to 10) lbf (10 to 50) lbf (50 to 100) lbf	0.002 lbf 0.005 lbf 0.03 lbf 0.05 lbf	Reference Weights

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
(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 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

Mass – Hardness

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Direct Verification of Durometers –			ASTM D2240 with
Spring Force	Type A, B, C, D, DO, O, OO	1.1 Duros	Balance / ASTM Class 6 Test Weights
Indenter Extension, Diameter, Tip Radius	(0 to 0.2) in	250 µin	Vision System
Indenter Tip Angle	(0 to 45) °	0.2 °	Vision System
Indirect Verification of Rockwell Hardness Testers ²	HRC		Indirect Verification per ASTM E18
	Low	0.38 HRC	
	Middle	0.35 HRC	
	High	0.32 HRC	
	HRBW		
	Low	0.71 HRBW	
	Middle	0.72 HRBW	
	High	0.73 HRBW	
	HRA		
	Low	0.48 HRA	
	Middle	0.39 HRA	
	High	0.53 HRA	
	HR15N		
	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		

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Indirect Verification of Superficial Rockwell Hardness Testers ²	HR15TW		Indirect Verification per ASTM E18
	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		
Indirect Verification of Brinell Hardness Testers at Test Conditions: ²	125 < HBW ≤ 225	4.5 HBW	Indirect Verification per ASTM E10
	HBW > 225	6.2 HBW	
10/3 000/15			

Mass – Mass Artifacts

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
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 – Pressure / Low Vacuum

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
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
Pressure Transducers, Dial and Digital Pressure Gages, Absolute Pressure Instruments, Low Vacuum Gages ^{2,4} (Pneumatic and Hydraulic)	(-0.01 to -14.5) psi (0.2 to 100) psia (0.001 to 15) psi (15 to 60) psi (60 to 120) psi (120 to 180) psi (180 to 240) psi (240 to 300) psi (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	0.061 psi 0.06 psia 0.018 psi 0.08 psi 0.15 psi 0.22 psi 0.28 psi 0.35 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

Mass – Scale and Balances

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
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

Mass – Torque

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Torque Wrenches, Drivers, Screwdrivers including Click Type ²	(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

Time and Frequency – Frequency / Period

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
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	
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	

Time and Frequency – Oscilloscopes

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
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	
DC Voltage (1MΩ)	1 mV to 130 V	600 μV/V + 47 μV	
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	3 μs/s	
	50 ms to 5 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	5 mV to 2.5 V	23 mV/V + 240 μV	Comparisons performed with a Multifunction Calibrator and an Oscilloscope
Rise time	1 nS to 1 μs	350 ps	

Thermodynamics – Infrared (IR) Temperature

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
IR Thermometers ²	(-15 to 100) °C (100 to 200) °C (200 to 350) °C (350 to 500) °C	1 °C 1.1 °C 1.7 °C 2.2 °C	Fluke / Hart Scientific 4180 / 4181 Precision IR Calibrator

Thermodynamics – Humidity

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
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

Thermodynamics – Thermodynamic Sources

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
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

Thermodynamics – Thermometers and Probes

Calibration Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
Temperature Devices - (Liquid in Glass Thermometers, Thermocouples, Bi-Metal Thermometers) ²	(-80 to 300) °C	0.09 °C	Comparisons with a Platinum Resistance Thermometer and Bath or Chamber
	(300 to 600) °C	2.8 °C	Dry Block Calibrator
	(600 to 1 200) °C	3.1 °C	

Dimensional Measurement

Length - Dimensional Measurement 1D

Inspection Parameter	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
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

Length - Dimensional Measurement 2D

Inspection Parameter	Range	Expanded Uncertainty of Measurement (+/-)	Remarks
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 °	
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 remarks. 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 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.
- 2) Laboratory offers calibration services at the laboratory's own facilities and at the client or other agreed upon facilities. For calibration at other facilities, Calibration and Measurement capabilities may be higher if a temperature controlled area is not available.
- 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

Approved by: 
R. Douglas Leonard
Chief Technical Officer

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