



# CERTIFICATE OF ACCREDITATION

**The ANSI National Accreditation Board**

Hereby attests that

**Accu-Chek, Inc.**  
**1015 Old Forest Road NW**  
**Corydon, IN 47112**  
**(and satellite site as shown on the scope)**

Fulfills the requirements of

**ISO/IEC 17025:2017**

and national standards

**ANSI/NCSL Z540-1-1994 (R2002)**

In the fields of

**CALIBRATION and DIMENSIONAL MEASUREMENT**

This certificate is valid only when accompanied by a current scope of accreditation document.  
The current scope of accreditation can be verified at [www.anab.org](http://www.anab.org).

R. Douglas Leonard Jr., VP, PILR SBU

Expiry Date: 01 March 2024  
Certificate Number: ACT-1317



This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017.  
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory  
quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).

**SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017**

**AND**

**ANSI/NCSL Z540-1-1994 (R2002)**

**Accu-Chek, Inc.**

1015 Old Forest Road NW  
Corydon, IN 47112

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**CALIBRATION AND DIMENSIONAL MEASUREMENT**

Valid to: **March 1, 2024**

Certificate Number: **ACT-1317**

**CALIBRATION**

**Chemical Quantities**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
pH Meters <sup>1</sup>	4 pH 7 pH 10 pH	0.02 pH 0.02 pH 0.03 pH	Accredited pH Solutions
Refractometers <sup>1,2</sup>	0 Brix	0.000 6 Brix	Distilled Water

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Source <sup>1</sup>	Up to 330 mV (0.33 to 3.3) V (3.3 to 33) V (33 to 330) V (330 to 1 000) V	15 $\mu$ V/V + 1 $\mu$ V 8.1 $\mu$ V/V + 3.7 $\mu$ V 9.3 $\mu$ V/V + 16 $\mu$ V 14 $\mu$ V/V + 0.12 mV 14 $\mu$ V/V + 1.2 mV	Multiproduct Calibrator
DC Voltage – Measure <sup>1</sup>	(10 to 100) mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 1 000) V	3.3 $\mu$ V/V + 0.74 $\mu$ V 2.1 $\mu$ V/V + 1.3 $\mu$ V 2.4 $\mu$ V/V + 5.8 $\mu$ V 3.8 $\mu$ V/V + 96 $\mu$ V 14 $\mu$ V/V - 1.1 mV	Precision Digital Multimeter



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**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC High Voltage – Measure <sup>1</sup>	Up to 6 kV (6 to 40) kV	5.8 mV/V + 6.1 V 30 mV/V	Digital Multimeter, High Voltage Probe
DC Current – Source <sup>1</sup>	Up to 330 $\mu$ A (0.33 to 3.3) mA (3.3 to 33) mA (33 to 330) mA (0.33 to 1.1) A (1.1 to 3) A (3 to 11) A (11 to 20) A	0.12 $\mu$ A/A + 16 nA 74 nA/A + 60 nA 77 nA/A + 0.2 $\mu$ A 80 nA/A + 3.1 $\mu$ A 0.16 mA/A + 32 $\mu$ A 0.3 mA/A + 31 $\mu$ A 0.39 mA/A + 0.39 mA 1 mA/A + 0.75 mA	Multiproduct Calibrator
DC Current Clamp-on Meters <sup>1</sup>	(20 to 200) A (200 to 1 000) A	7.8 mA/A - 0.36 A 3.9 mA/A + 0.51 A	Multiproduct Calibrator, 50-turn Coil
DC Current – Measure <sup>1</sup>	Up to 100 nA (0.1 to 1) $\mu$ A (1 to 10) $\mu$ A (10 to 100) $\mu$ A (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A	0.58 nA 0.58 nA 0.59 nA 0.77 nA 8.4 nA/A + 7.1 nA 8.4 nA/A + 71 nA 18 nA/A + 0.68 $\mu$ A 66 $\mu$ A/A + 9.6 $\mu$ A	Precision Digital Multimeter
	(1 to 60) A	0.6 mA/A	Precision Digital Multimeter w/ Shunt
	(60 to 1 000) A	15 mA/A + 2 A	Clamp-on Meter
Resistance – Source <sup>1</sup>	Up to 11 $\Omega$ (11 to 33) $\Omega$ (33 to 110) $\Omega$ (110 to 330) $\Omega$ (0.33 to 1.1) k $\Omega$ (1.1 to 3.3) k $\Omega$ (3.3 to 11) k $\Omega$ (11 to 33) k $\Omega$ (33 to 110) k $\Omega$ (110 to 330) k $\Omega$ (0.33 to 1.1) M $\Omega$ (1.1 to 3.3) M $\Omega$ (3.3 to 11) M $\Omega$ (11 to 33) M $\Omega$ (33 to 110) M $\Omega$ (110 to 330) M $\Omega$ (0.33 to 1.1) G $\Omega$	15 $\mu\Omega/\Omega$ + 0.96 m $\Omega$ 23 $\mu\Omega/\Omega$ + 1.2 m $\Omega$ 22 $\mu\Omega/\Omega$ + 1.1 m $\Omega$ 22 $\mu\Omega/\Omega$ + 1.6 m $\Omega$ 22 $\mu\Omega/\Omega$ + 1.6 m $\Omega$ 22 $\mu\Omega/\Omega$ + 16 m $\Omega$ 22 $\mu\Omega/\Omega$ + 16 m $\Omega$ 22 $\mu\Omega/\Omega$ + 0.16 $\Omega$ 22 $\mu\Omega/\Omega$ + 0.16 $\Omega$ 25 $\mu\Omega/\Omega$ + 1.6 $\Omega$ 25 $\mu\Omega/\Omega$ + 1.6 $\Omega$ 46 $\mu\Omega/\Omega$ + 24 $\Omega$ 0.1 m $\Omega/\Omega$ + 39 $\Omega$ 0.2 m $\Omega/\Omega$ + 1.9 k $\Omega$ 0.39 m $\Omega/\Omega$ + 2.3 k $\Omega$ 2.3 m $\Omega/\Omega$ + 78 k $\Omega$ 12 m $\Omega/\Omega$ + 0.38 M $\Omega$	Multiproduct Calibrator



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Measure <sup>1</sup>	Up to 10 Ω (10 to 100) Ω (0.1 to 1 kΩ (1 to 10) kΩ (10 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ (10 to 100) MΩ (0.1 to 1) GΩ	0.6 mΩ/Ω + 94 μΩ 7.9 μΩ/Ω + 0.43 mΩ 6.6 μΩ/Ω + 0.92 mΩ 6.6 μΩ/Ω + 9.3 mΩ 6.6 μΩ/Ω + 0.13 Ω 10 μΩ/Ω + 2.5 Ω 33 μΩ/Ω + 0.12 kΩ 0.32 mΩ/Ω + 8.5 kΩ 3.3 mΩ/Ω + 0.24 MΩ	Precision Digital Multimeter
Electrical Simulation of Thermocouple Indicating Devices – Source/Measure <sup>1</sup>	Type B (600 to 800) °C (800 to 1 000) °C (1 000 to 1 550) °C (1 550 to 1 820) °C Type C (0 to 150) °C (150 to 650) °C (650 to 1 000) °C (1 000 to 1 800) °C (1 800 to 2 316) °C 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 -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1 200) °C Type K (-200 to -100) °C (-100 to 120) °C (120 to 1 000) °C (1 000 to 1 372) °C	0.34 °C 0.26 °C 0.23 °C 0.26 °C 0.23 °C 0.2 °C 0.24 °C 0.39 °C 0.65 °C 0.38 °C 0.12 °C 0.11 °C 0.12 °C 0.16 °C 0.21 °C 0.12 °C 0.11 °C 0.13 °C 0.18 °C 0.25 °C 0.13 °C 0.2 °C 0.31 °C	Multiproduct Calibrator



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**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple Indicating Devices – Source/Measure <sup>1</sup>	Type 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 400) °C (400 to 1 000) °C (1 000 to 1 767) °C Type S (0 to 250) °C (250 to 1 000) °C (1 000 to 1 400) °C (1 400 to 1 767) °C Type T (-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C Type U (-200 to 0) °C (0 to 600) °C	0.31 °C 0.17 °C 0.15 °C 0.14 °C 0.21 °C 0.44 °C 0.26 °C 0.26 °C 0.31 °C 0.36 °C 0.28 °C 0.29 °C 0.35 °C 0.48 °C 0.12 °C 0.12 °C 0.11 °C 0.43 °C 0.21 °C	Multiproduct Calibrator
Electrical Simulation of RTD Indicating Devices – Source <sup>1</sup>	Cu 427, 10 Ω (-100 to 260) °C Pt 385, 100 Ω (-200 to 0) °C (0 to 100) °C (100 to 400) °C (400 to 630) °C (630 to 800) °C	0.24 °C 0.003 6 % of reading + 0.08 °C 0.009 6 % of reading + 0.08 °C 0.003 3 % of reading + 0.09 °C 0.11 °C 0.007 6 % of reading + 0.21 °C	



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**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of RTD Indicating Devices – Source <sup>1</sup>	Pt 385, 200 Ω		Multiproduct Calibrator
	(-200 to 0) °C	0.008 % of reading + 0.08 °C	
	(0 to 260) °C	0.008 % of reading + 0.08 °C	
	(260 to 400) °C	0.016 % of reading + 0.09 °C	
	(400 to 630) °C	0.004 1 % of reading + 0.14 °C	
	Pt 385, 500 Ω		
	(-200 to 260) °C	0.002 2 % of reading + 0.07 °C	
	(260 to 400) °C	0.004 7 % of reading + 0.08 °C	
	(400 to 630) °C	0.006 4 % of reading + 0.07 °C	
	Pt 385, 1 kΩ		
	(-200 to 260) °C	0.002 4 % of reading + 0.07 °C	
	(260 to 400) °C	0.009 8 % of reading + 0.05 °C	
	(400 to 600) °C	0.08 °C	
	(600 to 630) °C	0.19 °C	
	Pt 3916, 100 Ω		
	(-200 to -190) °C	0.007 3 % of reading + 0.22 °C	
	(-190 to 100) °C	0.07 °C	
	(100 to 400) °C	0.005 7 % of reading + 0.07 °C	
	(400 to 600) °C	0.007 7 % of reading + 0.11 °C	
	(600 to 630) °C	0.019 % of reading + 0.07 °C	
	Pt 3926, 100 Ω		
(-200 to 0) °C	0.006 8 % of reading + 0.07 °C		
(0 to 100) °C	0.008 6 % of reading + 0.08 °C		
(100 to 400) °C	0.004 5 % of reading + 0.09 °C		
(400 to 630) °C	0.12 % of reading		
Ni 385, 120 Ω			
(-80 to 100) °C	0.09 °C		
(100 to 260) °C	0.006 6 % of reading + 0.13 °C		



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source <sup>1</sup>	(1 to 33) mV		Multiproduct Calibrator
	(10 to 45) Hz	47 nV/V + 9.1 μV	
	45 Hz to 10 kHz	48 nV/V + 5.8 μV	
	(10 to 20) kHz	1.4 nV/V + 6.2 μV	
	(20 to 50) kHz	12 μV	
	(50 to 100) kHz	36 μV	
	(100 to 500) kHz	0.1 mV	
	(33 to 330) mV		
	(10 to 45) Hz	15 μV	
	45 Hz to 10 kHz	10 μV	
	(10 to 20) kHz	11 μV	
	(20 to 50) kHz	16 μV	
	(50 to 100) kHz	47 μV	
	(100 to 500) kHz	0.11 mV	
	(0.33 to 3.3) V		
	(10 to 45) Hz	0.12 mV	
	45 Hz to 10 kHz	87 μV	
	(10 to 20) kHz	98 μV	
	(20 to 50) kHz	0.12 mV	
	(50 to 100) kHz	0.29 mV	
	(100 to 500) kHz	1.1 mV	
	(3.3 to 33) V		
	(10 to 45) Hz	1.3 mV	
	45 Hz to 10 kHz	0.87 mV	
	(10 to 20) kHz	1.1 mV	
	(20 to 50) kHz	1.4 mV	
	(50 to 100) kHz	3.7 mV	
	(33 to 330) V		
(10 to 45) Hz	0.11 mV/V + 5.6 mV		
45 Hz to 10 kHz	0.64 μV/V + 11 mV		
(10 to 20) kHz	0.87 μV/V + 13 mV		
(20 to 50) kHz	0.9 mV/V + 95 mV		
(50 to 100) kHz	2 mV/V + 50 mV		
(330 to 1 020) V			
45 Hz to 10 kHz	75 μV/V + 89 mV		



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure <sup>1</sup>	(1 to 10) mV		Precision Digital Multimeter
	(1 to 40) Hz	69 nV/V + 3.3 μV	
	40 Hz to 1 kHz	-1.12 nV/V + 2.1 μV	
	(1 to 20) kHz	-3.9 nV/V + 1.6 μV	
	(20 to 50) kHz	0.36 nV/V + 2.7 μV	
	(50 to 100) kHz	1.9 nV/V + 7.5 μV	
	(100 to 300) kHz	5.5 μV	
	(10 to 100) mV		
	(1 to 40) Hz	0.11 μV/V + 3.3 μV	
	40 Hz to 1 kHz	-2.6 nV/V + 5.8 μV	
	(1 to 20) kHz	2.3 nV/V + 4 μV	
	(20 to 50) kHz	1.8 nV/V + 8 μV	
	(50 to 100) kHz	8.5 nV/V + 12 μV	
	(100 to 300) kHz	59 μV	
	(0.3 to 1) MHz	0.1 mV	
	(1 to 2) MHz	15 mV/V + 10 μV	
	(0.1 to 1) V		
	(1 to 40) Hz	0.65 μV/V + 39 μV	
	40 Hz to 1 kHz	0.53 nV/V + 25 μV	
	(1 to 20) kHz	30 μV	
(20 to 50) kHz	42 μV		
(50 to 100) kHz	80 μV		
(100 to 300) kHz	0.31 mV		
300 kHz to 1 MHz	0.87 mV		
(1 to 2) MHz	15 mV/V + 10 μV		
AC Voltage – Measure <sup>1</sup>	(10 to 100) V		Precision Digital Multimeter
	(1 to 40) Hz	12 nV/V + 3.4 mV	
	40 Hz to 1 kHz	0.26 nV/V + 3.5 mV	
	(1 to 20) kHz	0.26 nV/V + 3.5 mV	
	(20 to 50) kHz	12 nV/V + 4.8 mV	
	(50 to 100) kHz	97.8 nV/V + 11 mV	
	(100 to 300) kHz	4 mV/V + 10 mV	
	300 kHz to 1 MHz	15 mV/V + 10 mV	
	(100 to 700) V		
	(1 to 40) Hz	0.4 mV/V + 40 mV	
	40 Hz to 1 kHz	0.55 nV/V + 47 mV	
	(1 to 200) kHz	0.6 mV/V + 20 mV	
	(20 to 50) kHz	1.3 mV/V + 20 mV	
	(50 to 100) kHz	3 mV/V + 20 mV	





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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC High Voltage – Measure <sup>1</sup>	Up to 6 kV Up to 500 Hz Up to 6 kV 500 Hz to 1 kHz Up to 40 kV 60 Hz	6.3 mV/V + 6.7 mV  30 mV/V  75 mV/V	Digital Multimeter, High Voltage Probe
AC Current – Source <sup>1</sup>	(29 to 330) $\mu$ 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	1.7 $\mu$ A/A + 58 nA 1.2 $\mu$ A/A + 78 nA 0.97 $\mu$ A/A + 78 nA 2.3 $\mu$ A/A + 0.12 $\mu$ A 6.2 $\mu$ A/A + 0.15 $\mu$ A 16 mA/A + 0.4 $\mu$ A  1.6 $\mu$ A/A + 0.12 $\mu$ A 0.97 $\mu$ A/A + 0.12 $\mu$ A 0.77 $\mu$ A/A + 0.12 $\mu$ A 1.6 $\mu$ A/A + 0.15 $\mu$ A 3.9 $\mu$ A/A + 0.23 $\mu$ A 10 mA/A + 0.6 $\mu$ A  1.4 $\mu$ A/A + 1.6 $\mu$ A 0.7 $\mu$ A/A + 1.5 $\mu$ A 0.31 $\mu$ A/A + 1.5 $\mu$ A 0.62 $\mu$ A/A + 1.5 $\mu$ A 1.6 $\mu$ A/A + 2.3 $\mu$ A 4 mA/A + 4 $\mu$ A	Multiproduct Calibrator

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source <sup>1</sup>	(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 (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 (10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (11 to 20.5) A (45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	1.4 mA/A + 16 μA 0.7 mA /A + 16 μA 0.31 mA /A + 16 μA 0.77 mA/A + 39 μA 1.6 mA/A + 78 μA 4 mA/A + 0.2 mA 1.4 mA/A + 80 μA 0.34 mA /A + 0.45 mA 5.5 mA/A – 1.7 mA 25 mA/A + 5 mA 0.6 mA/A + 2 mA 1 mA/A + 2 mA 30 mA/A + 2 mA 1.2 mA/A + 5 mA 1.5 mA/A + 5 mA 30 mA/A + 5 mA	Multiproduct Calibrator
AC Current Clamp-on Meters <sup>1</sup>	(20 to 40) A (45 to 400) Hz (40 to 400) A (45 to 400) Hz (400 to 1 000) A (45 to 100) Hz	0.28 mA/A + 0.29 mA 6.1 mA/A + 0.11 A 4.4 mA/A + 0.77 A	Multiproduct Calibrator, 50-turn Coil
AC Current – Measure <sup>1</sup>	(5 to 100) μA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (0.1 to 1) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	2.7 nA/A + 21 nA 1 nA/A + 21 nA 0.39 nA/A + 22 nA 0.39 nA/A + 22 nA 2.7 μA/A + 0.15 μA 0.99 μA/A + 0.15 μA 0.38 μA/A + 0.16 μA 0.19 μA/A + 0.16 μA 0.38 μA/A + 0.16 μA 2.7 μA/A + 0.28 μA 6 mA/A + 1.5 μA	Precision Digital Multimeter



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure <sup>1</sup>	(1 to 10) mA		Precision Digital Multimeter
	(10 to 20) Hz	2.7 $\mu$ A/A + 1.4 $\mu$ A	
	(20 to 45) Hz	0.99 $\mu$ A/A + 1.5 $\mu$ A	
	(45 to 100) Hz	0.38 $\mu$ A/A + 1.6 $\mu$ A	
	100 Hz to 5 kHz	0.19 $\mu$ A/A + 1.6 $\mu$ A	
	(5 to 20) kHz	0.38 $\mu$ A/A + 1.6 $\mu$ A	
	(20 to 50) kHz	2.7 $\mu$ A/A + 2.7 $\mu$ A	
	(50 to 100) kHz	6 mA/A + 15 $\mu$ A	
	(10 to 100) mA		
	(10 to 20) Hz	2.7 $\mu$ A/A + 15 $\mu$ A	
	(20 to 45) Hz	0.99 $\mu$ A/A + 15 $\mu$ A	
	(45 to 100) Hz	0.38 $\mu$ A/A + 16 $\mu$ A	
	100 Hz to 5 kHz	0.19 $\mu$ A/A + 16 $\mu$ A	
	(5 to 20) kHz	0.38 $\mu$ A/A + 16 $\mu$ A	
	(20 to 50) kHz	2.7 $\mu$ A/A + 28 $\mu$ A	
	(50 to 100) kHz	6 mA/A + 0.15 mA	
	(0.1 to 1) A		
	(10 to 20) Hz	2.7 mA/A + 0.15 mA	
	(20 to 45) Hz	1.1 mA/A + 0.16 mA	
(45 to 100) Hz	0.51 mA/A + 0.16 mA		
100 Hz to 1 kHz	0.65 mA/A + 0.16 mA		
(5 to 20) kHz	2 mA/A + 0.15 mA		
(20 to 50) kHz	10 mA/A + 0.4 mA		
	(20 to 2 000) A		Clamp-on Meter
	(60 to 100) Hz	53 mA/A + 4.5 A	
Capacitance – Source <sup>1</sup>	(190 to 400) pF	5 mF/F + 1 pF	Multiproduct Calibrator
	(0.4 to 1.1) nF	4 mF/F	
	(1.1 to 3.3) nF	3.6 mF/F	
	(3.3 to 11) nF	1.9 mF/F	
	(11 to 33) nF	1.7 mF/F	
	(33 to 110) nF	1.9 mF/F	
	(110 to 330) nF	1.4 mF/F + 0.57 nF	
	(0.33 to 1.1) $\mu$ F	1.9 mF/F + 0.91 nF	
	(1.3 to 3.3) $\mu$ F	1.5 mF/F + 5.6 nF	
	(3.3 to 11) $\mu$ F	2 mF/F + 8.8 nF	
	(11 to 33) $\mu$ F	2.6 mF/F + 53 nF	
	(33 to 110) $\mu$ F	3.4 mF/F + 88 nF	
	(110 to 330) $\mu$ F	2.9 mF/F + 0.52 $\mu$ F	
	(0.33 to 1.1) mF	3.4 mF/F + 0.88 $\mu$ F	
(1.1 to 3.3) mF	3.2 mF/F + 4.9 $\mu$ F		



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**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Source <sup>1</sup>	(3.3 to 11) mF (11 to 33) mF (33 to 110) mF	3.7 mF/F + 8 μF 11 mF/F - 20 μF 27 mF/F + 0.53 mF	Multiproduct Calibrator
Oscilloscopes <sup>1</sup>			
Amplitude DC Signal into 50 Ω load	(1 to 25) mV (25 to 110) mV (0.11 to 2.2) V (2.2 to 6.6) V	2.3 mV/V + 30 μV 2 mV/V + 35 μV 2.2 mV/V - 0.63 μV 1.8 mV/V + 0.91mV	Multiproduct Calibrator
into 1 MΩ load	(1 to 25) mV (25 to 110) mV (0.11 to 2.2) V (2.2 to 5) V (5 to 11) V (11 to 130) V	0.72 mV/V + 30 μV 0.62 mV/V + 29 μV 0.87 mV/V - 18 μV 56 μV/V + 2.8 mV 0.98 mV/V - 1.9 mV 0.32 mV/V + 4.3 mV	
Amplitude Square Wave into 50 Ω load	(1 to 25) mV (25 to 110) mV 110 mV to 2.2 V (2.2 to 6.6) V	2 mV/V + 31 μV 2.1 mV/V + 28 μV 2.2 mV/V + 18 μV 1.8 mV/V + 0.88 mV	
into 50 Ω load	(1 to 25) mV (25 to 110) mV 110 mV to 2.2 V (2.2 to 11) V (11 to 130) V	0.87 mV/V + 32 μV 0.99 mV/V + 32 μV 1.1 mV/V + 16 μV 1.1 mV/V + 73 μV 0.7 mV/V + 5.2 mV	
Leveled Sine Wave (50 kHz reference) into 50 Ω load	5 mVp-p to 5.5 Vp-p 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz	16 mV/V + 0.23 mV 31 mV/V + 0.23 mV 47 mV/V + 0.23 mV	
Time Marker Sine Wave	1 ns 5 ns 10 ns	2.1 ps 7 ps 8.3 ps	



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes <sup>1</sup>			
Time Marker	10 ns	6.1 ps	Multiproduct Calibrator
Square Wave	10 μs	5.8 ns	
	20 ms	5.8 ns	
	50 ms	6.5 μs	
	100 ms	59 μs	
	200 ms	68 μs	
	500 ms	0.21 ms	
Spike	20 ns	5.8 ps	
	20 μs	5.8 ns	
	20 ms	5.8 μs	
	50 ms	6.5 μs	
	100 ms	59 μs	
	200 ms	68 μs	
	500 ms	0.21 ms	
	1 s	0.98 ms	
	2 s	3.2 ms	
	5 s	20 ms	
20 % Duty Cycle-Square	100 ns	58 ps	
	100 μs	5.8 ns	
	20 ms	5.8 μs	
Edge Rise Time into 50 Ω load	1 kHz to 1 MHz	0.1 ns	
Amplitude into 50 Ω load	(5 to 250) mVp-p	20 mV/V + 0.2 mV	
	250 mVp-p to 2.5 Vp-p	0.11 V/V – 22 mV	

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes <sup>1</sup> Wave Generator Amplitude (Sine, Square, Triangle) into 1 MΩ load	10 Hz to 10 kHz 1.8 mV to 55 V	23 mV/V + 78 μV	Multiproduct Calibrator
into 50 Ω load	10 Hz to 10 kHz 1.8 mV to 2.5 V	23 mV/V + 80 μV	
Frequency into 50 Ω load	10 Hz to 10 kHz	0.58 mHz/Hz + 7.4 mHz	
into 1 MΩ load	10 Hz to 10 kHz	0.58 mHz/Hz + 7.4 mHz	
Magnetometer/Gaussmeter, Hall-effect Probes	Up to 100 G	1 % of reading + 0.074 G	Helmholtz Coil. Current Source
Magnetic Particle Unit <sup>1,3</sup> DC Current Meter	Up to 20 000 A	8.3 A	Current Timer/Meter

**Length – Dimensional Metrology**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Autocollimators <sup>2</sup>	Up to 30 min	(0.25 - 0.001X)''	Angle Generator
Bore Gages <sup>1,2</sup>	Up to 8 in	(2.1 + 4.4L) μin	Master Ring, Indicator Checker, Universal Length Measuring Machine
Calipers <sup>1,2</sup>	Up to 6 in (6 to 24) in (24 to 72) in	(290 + 0.27L) μin (290 + 0.92L) μin (250 + 2.6L) μin	Gage Blocks
Coordinate Measuring Machines <sup>1,2</sup> Linear Accuracy	Up to 120 in	(55 + 5L) μin	Laser Interferometer, Ball Bar, Sphere
Volumetric Accuracy	Up to 120 in	(122 + 5L) μin	
Repeatability	Up to 120 in	(53 + 5L) μin	
Electronic Levels <sup>1,2</sup>	± 1 000''	0.6''	Gage Blocks, Sine Plate

**Length – Dimensional Metrology**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Extensometers <sup>1</sup>	(0 to 1) in	100 μin	Extensometer Calibrator
Extrusion Plastometers <sup>1</sup>	Up to 0.25 in	130 μin	Depth Micrometers, Caliper, Pin Gages, Gage Blocks
Bore Diameter	Up to 1 in	100 μin	
Piston Diameter / Length	Up to 1 in (1 to 4) in	2.6 μin (1.6 + 0.94L) μin	Comparator, Master Gage Blocks
Gage Blocks <sup>2</sup>	(4 to 20) in	(4.4 + 0.63L) μin	LVDT, Master Gage Blocks
Glass Scales <sup>2</sup>	Up to 12 in	(9.1 + 2.3L) μin	Measuring Microscope, Gage Blocks, ULM
Height Gages <sup>1,2</sup>	Up to 24 in (24 to 72) in	(44 + 3.4L) μin (550 + 1.5L) μin	Gage Blocks, Surface Plate
Indicators <sup>1,2</sup>			Gage Blocks, Universal Length Measuring Machine
(0.000 02 in resolution)	Up to 12 in	(3.8 + 91L) μin	
(0.000 05 in resolution)	Up to 12 in	(3.6 + 4.3L) μin	
(0.000 1 in resolution)	Up to 12 in	(3.7 + 2.7L) μin	
(0.000 5 in resolution)	Up to 12 in	(3.4 + 4.2L) μin	
(0.001 in resolution)	Up to 12 in	(580 + 0.25L) μin	
Dial Test Indicators <sup>1,2</sup>			Gage Blocks
(0.001 in resolution)	Up to 0.25 in	(580 + 0.005 2L) μin	
(0.000 5 in resolution)	Up to 0.25 in	(290 + 0.01L) μin	
(0.000 1 in resolution)	Up to 0.25 in	(58 + 0.047L) μin	
(0.000 05 in resolution)	Up to 0.25 in	(29 + 0.093L) μin	
Machinist Levels <sup>1</sup>	Up to 15 in Up to 72 in	150 μin 730 μin	Surface Plate, Gage Blocks,
Measuring Microscopes <sup>1,2</sup>	Up to 12 in	(25 + 1.3L) μin	Laser Interferometer, Gage Blocks, Glass Master
Micrometers <sup>1,2</sup>	Up to 6 in (6 to 24) in (24 to 72) in	(21 + 0.58L) μin (44 + 3.4L) μin (550 + 1.5L) μin	Gage Blocks, Universal Length Measuring Machine

**Length – Dimensional Metrology**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Optical Comparators <sup>1,2</sup> Linearity	Up to 20 in	$(95 + 19L) \mu\text{in}$	Glass Scales
X-Y Axis Squareness	Up to 30 in	$(59 + 3L) \mu\text{in}$	Glass Scales
Magnification	10x, 20x, 31.25x, 61.25x, 100x	800 $\mu\text{in}$	Glass Scales, Glass Rule
Pi Tapes <sup>2</sup>	Up to 96 in diameter	$(78 + 6D) \mu\text{in}$	Cylindrical Masters, CMM
Pin Gages <sup>1,2</sup>	Up to 1 in	$(42 + 1.4L) \mu\text{in}$	Bench Micrometer
Plain Plug Gages <sup>2</sup>	Up to 20 in	$(3.6 + 3.6D) \mu\text{in}$	Gage Blocks, Universal Length Measuring Machine
Thread Plug Gages <sup>2</sup> Major Diameter	Up to 8 in	$(3.6 + 3.6D) \mu\text{in}$	Universal Length Measuring Machine, Thread Wires
Pitch Diameter	Up to 8 in	$(19 + 3.1D) \mu\text{in}$	
Plain Ring Gages <sup>2</sup>	(0.02 to 18) in	$(4.2 + 1.4D) \mu\text{in}$	Universal Length Measuring Machine, Master Rings
Roughness Standards <sup>1</sup>	Up to 250 $\mu\text{in}$	4.7 $\mu\text{in}$	Profilometer
Steel Rules, Linear Scales <sup>1,2</sup>	Up to 72 in	$(76 + 11L) \mu\text{in}$	Measuring Microscope
Surface Analyzers <sup>1,2</sup>	Up to 123 $\mu\text{in}$	$(4 + 0.0027X) \mu\text{in}$	Roughness Standard
Surface Plates <sup>1,2</sup> Overall Flatness	(6 x 6) to (18 x 18) in (18 x 24) to (72 x 144) in	$4.3\sqrt{DL} \mu\text{in}$	In accordance with Fed Spec GGG-P-463 using Height Stand – LVDT Electronic Levels, Autocollimator
Local Area Flatness (repeat readings)	0.002 in	30 $\mu\text{in}$	Repeat O Meter
Tape Measures <sup>1,2</sup>	Up to 300 ft	$(76 + 11L) \mu\text{in}$	Measuring Microscope
Thread Measuring Wires	Up to 80 TPI	11 $\mu\text{in}$	Universal Length Measuring Machine, 0.750 Roll, 0.125 Roll



### Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Solid Thread Rings <sup>2</sup> Minor Diameter	Up to 8 in	$(38 + 0.88D) \mu\text{in}$	Universal Length Measuring Machine
Pitch Diameter	Up to 8 in	84 $\mu\text{in}$	
Adjustable Thread Rings <sup>2</sup> Minor Diameter Pitch Diameter	Up to 8 in	$(38 + 0.88D) \mu\text{in}$	Universal Length Measuring Machine, Master Setting Plugs In accordance with ASME B1.2, para 5.1.1: the ring is sized to a plug, with the plug's uncertainty given.
Universal Length Measuring Machines <sup>2</sup> Linearity	Up to 20 in	$(6.7 + 8.6L) \mu\text{in}$	Master Gage Blocks
Anvil Parallelism	Up to 0.5 in	8.2 $\mu\text{in}$	Reference Sphere
Anvil Force	Up to 8 ozf	0.35 ozf	Force Gage
Coating Thickness Gages	Up to 156 mils	0.004 7 mils	Thickness Standards

### Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Duro-calibrators A-Scale D-Scale	(0 to 822) gf (0 to 10) gf	0.07 gf 0.42 gf	Master Weights
Durometers <sup>1,2</sup> Spring Force	Scales A & D	$(0.33 + 0.001 4X) \text{ duro}$	Duro-calibrator
Force <sup>1</sup> (Compression / Tension)	(0 to 2 000) lbf	0.015 % of reading	NIST Class F Weights
	(0 to 150 000) lbf	0.11 % of reading	Comparison to Master Load Cell
Brinell Hardness Testers <sup>1</sup>	3 000 kgf 1 500 kgf 500 kgf	8.4 HBW 3.7 HBW 1.1 HBW	Indirect Verification per ASTM E10 using Hardness Test Blocks.
Knoop Hardness Tester <sup>1</sup>	(100 to 940) HK Repeatability under force Error	0.31 % of reading 0.69 % of reading 0.15 $\mu\text{m}$	Indirect Verification per ASTM E92 using Hardness Test Blocks,

**Mass and Mass Related**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Leeb Hardness Tester <sup>1</sup>	783 HLD	16 HLD	Indirect Verification per ASTM A596 using Leeb Test Block.
Rockwell Hardness and Superficial Hardness Testers <sup>1</sup>	(20 to 65) HRA (70 to 78) HRA (80 to 84) HRA  (40 to 59) HRBW (60 to 79) HRBW (80 to 100) HRBW  (20 to 30) HRC (35 to 55) HRC (60 to 65) HRC  (40 to 48) HRD (51 to 67) HRD (71 to 75) HRD  (70 to 79) HRE (84 to 90) HRE (93 to 100) HRE  (60 to 75) HRF (80 to 90) HRF (94 to 100) HRF  (30 to 50) HRG (55 to 75) HRG (80 to 94) HRG  HRR Low HRR High  HRS Low HRS High  HRT	0.29 HRA 0.24 HRA 0.29 HRA  0.82 HRBW 0.66 HRBW 0.59 HRBW  0.42 HRC 0.34 HRC 0.31 HRC  0.63 HRD 0.55 HRD 0.51 HRD  0.55 HRE 0.58 HRE 0.57 HRE  0.69 HRF 0.58 HRF 0.54 HRF  0.58 HRG 0.53 HRG 0.45 HRG  0.58 HRR 0.44 HRR  0.66 HRS 0.5 HRS  1.2 HRT	Indirect Verification per ASTM E18 using Hardness Test Blocks.



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Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Rockwell Hardness and Superficial Hardness Testers <sup>1</sup>	(70 to 77) HR15N	0.48 HR15N	Indirect Verification per ASTM E18 using Hardness Test Blocks.
	(78 to 88) HR15N	0.42 HR15N	
	(90 to 92) HR15N	0.39 HR15N	
	(42 to 50) HR30N	0.57 HR30N	
	(55 to 73) HR30N	0.46 HR30N	
	(77 to 82) HR30N	0.42 HR30N	
	(20 to 31) HR45N	0.62 HR45N	
	(37 to 61) HR45N	0.52 HR45N	
	(66 to 72) HR45N	0.47 HR45N	
	(74 to 80) HR15TW	0.72 HR15TW	
	(81 to 86) HR15TW	0.62 HR15TW	
	(87 to 93) HR15TW	0.46 HR15TW	
	(43 to 56) HR30TW	0.72 HR30TW	
	(57 to 69) HR30TW	0.6 HR30TW	
(70 to 83) HR30TW	0.54 HR30TW		
(13 to 32) HR45TW	0.64 HR45TW		
(33 to 52) HR45TW	0.58 HR45TW		
(53 to 73) HR45TW	0.57 HR45TW		
Vickers Hardness Tester <sup>1</sup>	(100 to 940) HV Repeatability under force Error	0.86 % of reading 0.086 % of reading 0.16 µm	Indirect Verification per ASTM E92 using Hardness Test Blocks.
Masses	(1 to 200) g (200 to 500) g 500 g to 5 lb (5 to 10) lb (10 to 50) lb (50 to 100) lb	(0.002 2 + 0.002 8 g) mg (0.25 + 0.001 8 g) mg (-0.87 + 0.003 5 g) mg (4.2 + 0.002 5 lb) mg (5.5 + 0.76 kg) mg (-110 + 5.9 kg) mg	Comparison to ASTM E617 Class 1 weights, ASTM E617 Class 2 weights, ASTM E617 Class 3 weights, using Precision Balances.
	(1 to 1 000) lb	0.36 lb	Comparison to Master Load Cell
Pressure Gages and Transducers <sup>1</sup>	(-15 to 15) psig (10 to 50) psig (50 to 500) psig (200 to 800) psig (800 to 16 000) psig	0.002 psi 0.004 psi 0.043 psi 0.016 psi 2 psi	Pressure Calibrator, Deadweight Tester



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**Mass and Mass Related**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Scales and Balances <sup>1</sup> (0.000 01 g resolution)	Up to 80 g (80 to 200) g	0.89 µg/g + 5.8 µg 2.1 µg/g - 0.12 mg	ASTM E617 Class 1 weights and NIST Handbook 44 utilized for the calibration of the weighing system.
Scales and Balances <sup>1</sup> (0.000 1 g resolution)	Up to 80 g (80 to 200) g	0.53 µg/g + 58 µg 2 µg/g - 92 µg	
Scales and Balances <sup>1</sup> (0.000 01 g resolution)	Up to 2 000 g (2 000 to 5 000) g	0.9 µg/g + 5.8 mg 2.1 µg/g - 2.5 mg	
Scales and Balances <sup>1</sup> (0.000 1 g resolution)	Up to 2 000 g (2 000 to 5 000) g	0.87 µg/g + 58 µg 2.1 µg/g - 2.3 mg	
Scales and Balances <sup>1</sup> (0.001 g resolution)	Up to 2 000 g (2 000 to 5 000) g	0.66 µg/g + 0.58 mg 2.1 µg/g - 2.3 mg	
Weighing Systems <sup>1</sup> (0.000 01 lb resolution)	Up to 2 000 lb	0.001 2 % of reading + 0.000 01 lb	Class F weights and NIST Handbook 44 utilized for the calibration of the weighing system.
Weighing Systems <sup>1</sup> (0.000 02 lb resolution)	Up to 2 000 lb	0.001 2 % of reading + 0.000 01 lb	
Weighing Systems <sup>1</sup> (0.000 05 lb resolution)	Up to 2 000 lb	0.001 2 % of reading + 0.000 03 lb	
Weighing Systems <sup>1</sup> (0.000 1 lb resolution)	Up to 2 000 lb	0.001 2 % of reading + 0.000 06 lb	
Weighing Systems <sup>1</sup> (0.000 2 lb resolution)	Up to 2 000 lb	0.001 2 % of reading + 0.000 12 lb	
Weighing Systems <sup>1</sup> (0.000 5 lb resolution)	Up to 2 000 lb	0.001 2 % of reading + 0.000 29 lb	
Weighing Systems <sup>1</sup> (0.001 lb resolution)	Up to 2 000 lb	0.001 2 % of reading + 0.000 58 lb	
Weighing Systems <sup>1</sup> (0.002 lb resolution)	Up to 2 000 lb	0.001 1 % of reading + 0.001 2 lb	
Weighing Systems <sup>1</sup> (0.005 lb resolution)	Up to 800 lb (800 to 2 000) lb	0.000 84 % of reading + 0.002 9 lb 0.001 2 % of reading - 0.000 04 lb	
Weighing Systems <sup>1</sup> (0.01 lb resolution)	Up to 800 lb (800 to 2 000) lb	0.000 63 % of reading + 0.005 8 lb 0.001 1 % of reading + 0.001 7 lb	
Weighing Systems <sup>1</sup> (0.02 lb resolution)	Up to 800 lb (800 to 2 000) lb	0.000 4 % of reading + 0.012 lb 0.000 98 % of reading + 0.006 9 lb	



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**Mass and Mass Related**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Weighing Systems <sup>1</sup> (0.05 lb resolution)	Up to 2 000 lb	0.000 43 % of reading + 0.029 lb	Class F weights and NIST Handbook 44 utilized for the calibration of the weighing system.
Weighing Systems <sup>1</sup> (0.1 lb resolution)	Up to 2 000 lb	0.000 24 % of reading + 0.058 lb	
Weighing Systems <sup>1</sup> (0.2 lb resolution)	Up to 2 000 lb	0.000 12 % of reading + 0.12 lb	
Weighing Systems <sup>1</sup> (0.5 lb resolution)	Up to 2 000 lb	0.000 05 % of reading + 0.29 lb	
Weighing Systems <sup>1</sup> (1 lb resolution)	Up to 2 000 lb	0.000 03 % of reading + 0.58 lb	
Weighing Systems <sup>1</sup> (0.01 lb resolution)	Up to 2 400 lb (2 400 to 6 000) lb	0.003 3 % of reading + 0.005 8 lb 0.002 9 % of reading + 0.015 lb	
Weighing Systems <sup>1</sup> (0.02 lb resolution)	Up to 2 400 lb (2 400 to 6 000) lb	0.003 1 % of reading + 0.012 lb 0.002 9 % of reading + 0.016 lb	
Weighing Systems <sup>1</sup> (0.05 lb resolution)	Up to 6 000 lb	0.002 7 % of reading + 0.029 lb	
Weighing Systems <sup>1</sup> (0.1 lb resolution)	Up to 6 000 lb	0.002 3 % of reading + 0.058 lb	
Weighing Systems <sup>1</sup> (0.2 lb resolution)	Up to 6 000 lb	0.001 7 % of reading + 0.12 lb	
Weighing Systems <sup>1</sup> (0.5 lb resolution)	Up to 6 000 lb	0.000 92 % of reading + 0.29 lb	
Weighing Systems <sup>1</sup> (1 lb resolution)	Up to 6 000 lb	0.000 49 % of reading + 0.6 lb	
Weighing Systems <sup>1</sup> (2 lb resolution)	Up to 6 000 lb	0.000 25 % of reading + 1.2 lb	
Weighing Systems <sup>1</sup> (5 lb resolution)	Up to 6 000 lb	0.000 1 % of reading + 3 lb	
Weighing Systems <sup>1</sup> (10 lb resolution)	Up to 6 000 lb	0.000 051 % of reading + 6 lb	
Weighing Systems <sup>1</sup> (20 lb resolution)	Up to 6 000 lb	0.000 025 % of reading + 12 lb	

**Mass and Mass Related**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Torque Analyzers <sup>1</sup>	(20 to 110) ozf·in (5 to 60) lbf·in (40 to 450) lbf·in (100 to 1 150) lbf·in (25 to 280) lbf·ft (60 to 680) lbf·ft (200 to 1 200) lbf·ft (1 200 to 2 000) lbf·ft	0.083 ozf·in 0.008 lbf·in 0.009 1 % of reading + 0.009 lbf·in 0.01 % of reading + 0.047 lbf·in 0.009 3 % of reading + 0.009 lbf·ft 0.000 9 % of reading + 0.013 lbf·ft 0.1 % of reading + 0.1 lbf·ft 0.000 5 % of reading + 1.3 lbf·ft	Torque Arms, Torque Wheels, NIST Class F Weights
Torque Wrenches <sup>1</sup>	Up to 100 ozf·in 15 lbf·in to 400 lbf·ft Up to 250 lbf·ft (100 to 600) lbf·ft (400 to 2 000) lbf·ft	0.79 % of reading – 0.02 ozf·in 0.28 % of reading + 0.053 lbf·in 0.26 % of reading + 0.016 lbf·ft 0.25 % of reading + 0.054 lbf·ft 1 % of reading + 1.5 lbf·ft	Torque Analyzer
Viscosity Cups <sup>1</sup>	(34 to 120) cSt	0.44 % of reading + 1 cSt	Viscosity Standards
Volumetric Dispensers	Up to 100 mL Up to 600 mL (600 to 1 000) mL	0.003 1 mL 0.11 mL 0.009 9 % of reading + 0.053 mL	Analytical Balance

**Photometry and Radiometry**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
UV-A Light Meters (typical for NDT Testing)	Up to 19 990 $\mu\text{W}/\text{cm}^2$	5.1 % of reading + 0.008 $\mu\text{W}/\text{cm}^2$	Comparison to Master Digital Radiometer per ASTM E1444 and NADCAP Audit Criteria AC7114/2 rev. G.
Visible Light Meters (typical for NDT Testing)	Up to 4 000 fc	4.9 % of reading + 0.000 002 fc	
Magnetic Particle Unit <sup>1,2,3</sup> Black Light	Up to 19 990 $\mu\text{W}/\text{cm}^2$	5.1 % of reading + 0.008 $\mu\text{W}/\text{cm}^2$	Comparison to Digital Radiometer
White Light	Up to 199.9 fc	4.8 % of reading + 0.49 fc	

**Thermodynamic**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Extrusion Plastometers <sup>1</sup> Temperature	(-30 to 660) °C	0.12 °C	PRT, Temperature Indicator

**Thermodynamic**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Infrared Thermometer (non-contact)	(35 to 50) °C (50 to 300) °C (300 to 500) °C	0.35 °C 0.84 °C 1.3 °C	Black Body Source (flat plate) $\epsilon = 0.95, \lambda = (8 \text{ to } 14) \mu\text{m}$
Humidity – Measure <sup>1</sup>	(5 to 90) %RH	0.5 %RH	Comparison to Chilled Mirror
Temperature – Measure <sup>1</sup>	(-200 to 660) °C	0.03 °C	PRT, Calibrator
Temperature – Source <sup>1</sup>	(-40 to 660) °C	0.5 °C	Dry Block

**Time and Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Source/Measure <sup>1</sup>	Up to 1.3 GHz	0.11 nHz	GPS Reference
Timers, Stopwatches <sup>1</sup>	Up to 24 hr	4.4 ms	GPS Reference, Frequency Counter, Function Generator
Magnetic Particle Unit <sup>1,3</sup> Timer	10 ms to 9.99 s	2 ms	Current Timer/Meter

**DIMENSIONAL MEASUREMENT**

**1 Dimensional**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Dimensional Measurement – 1D <sup>2</sup>	Up to 24 in	(44 + 3.5L) $\mu\text{in}$	Height Measurements utilizing a Height Gage for Dimensional Inspection.
	Up to 20 in	(3.8 + 6.9L) $\mu\text{in}$	Length Measurements utilizing a ULM for Dimensional Inspection.
	Up to 1 in	(47 - 1.4L) $\mu\text{in}$	Length Measurements utilizing a Bench Micrometer for Dimensional Inspection.

**1 Dimensional**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Dimensional Measurement – 1D <sup>2</sup>	Up to 8 in	$(16 + 6.9L) \mu\text{in}$	Length Measurements utilizing a Measuring Microscope for Dimensional Inspection.
	X-axis: Up to 12 in Y-axis: Up to 8 in	150 $\mu\text{in}$ 90 $\mu\text{in}$	Length Measurements utilizing a Optical Comparator for Dimensional Inspection.
	Up to 0.02 in	$(22 + 0.036L) \mu\text{in}$	Parallelism Measurements utilizing a Height Gage or LVDT for Dimensional Inspection.
	Up to 0.02 in	31 $\mu\text{in}$	Parallelism Measurements utilizing a Measuring Microscope for Dimensional Inspection.
	Up to 0.02 in	86 $\mu\text{in}$	Squareness Measurements utilizing a Height Gage or LVDT for Dimensional Inspection.
	Up to 0.02 in	18 $\mu\text{in}$	Squareness Measurements utilizing Laser Interferometer for Dimensional Inspection.
	Up to 0.02 in	14 $\mu\text{in}$	Straightness Measurements utilizing Laser Interferometer for Dimensional Inspection.
	Up to 0.02 in	$(20 + 0.007L) \mu\text{in}$	Flatness Measurements utilizing a Height Gage or LVDT for Dimensional Inspection.
	Up to 0.02 in	45 $\mu\text{in}$	Flatness Measurements utilizing an Autocollimator for Dimensional Inspection.
	Up to 0.02 in	3.3 $\mu\text{in}$	Flatness Measurements utilizing Optical Flats for Dimensional Inspection.



### 1 Dimensional

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Dimensional Measurement – 1D <sup>2</sup>	Up to 0.02 in	10 μin	Roundness Measurements utilizing a Roundness Tester for Dimensional Inspection.
	Up to 4 in (4 to 160) in	(3.6 to 1.2L) μin (3.9 + 1.1L) μin	Length Measurements utilizing Gage Blocks for Dimensional Inspection.

### 2 Dimensional

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Dimensional Measurement – 2D <sup>2</sup>	Up to 0.02 in	(8.9 + 0.005L) μin	Squareness Measurements utilizing a Measuring Microscope for Dimensional Inspection.
	Up to 0.02 in	(43 + 0.95L) μin	Straightness Measurements utilizing a Measuring Microscope for Dimensional Inspection.
	Up to 360°	(8.4 + 0.28X)°	Angle Measurements utilizing a Measuring Microscope for Dimensional Inspection.
	Up to 8 in	(34 + 1.3D) μin	Diameter Measurements utilizing a Measuring Microscope for Dimensional Inspection.

### 3 Dimensional

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Dimensional Measurement – 3D <sup>2</sup>	X-axis: Up to 40 in Y-axis: Up to 80 in Z-axis: Up to 40 in	(200 + 4L) μin (200 + 4L) μin (200 + 5L) μin	CMM utilized for Dimensional Inspection.
	Up to 360°	0.03°	Angle Measurements utilizing a CMM for Dimensional Inspection

### 3 Dimensional

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Dimensional Measurement – 3D <sup>2</sup>	Up to 40 in	$(99 + 8.9D) \mu\text{in}$	Diameter Measurements utilizing a CMM for Dimensional Inspection.
	Up to 0.02 in	73 $\mu\text{in/ft}$	Flatness Measurements utilizing a CMM for Dimensional Inspection.
	Up to 0.02 in	$(22 + 0.036L) \mu\text{in}$	Parallelism Measurements utilizing a CMM for Dimensional Inspection.
	Up to 0.02 in	180 $\mu\text{in}$	Sphericity Measurements utilizing a CMM for Dimensional Inspection.
	Up to 0.02 in	77 $\mu\text{in/ft}$	Squareness Measurements utilizing a CMM for Dimensional Inspection.
	Up to 0.02 in	47 $\mu\text{in}$	Straightness Measurements utilizing a CMM for Dimensional Inspection.

### Services performed at satellite location

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### Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Bore Gages <sup>2</sup>	Up to 8 in	$(2.1 + 4.4L) \mu\text{in}$	Master Ring, Indicator Checker, ULM
Calipers <sup>2</sup>	Up to 6 in (6 to 24) in (24 to 72) in	$(290 + 0.27L) \mu\text{in}$ $(290 + 0.92L) \mu\text{in}$ $(250 + 2.6L) \mu\text{in}$	Gage Blocks
Gage Blocks <sup>2</sup>	Up to 1 in (1 to 4) in	2.6 $\mu\text{in}$ $(1.6 + 0.94L) \mu\text{in}$	Comparator, Master Gage Blocks



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Gage Blocks <sup>2</sup>	(4 to 20) in	$(4.4 + 0.63L) \mu\text{in}$	LVDT, Master Gage Blocks
Height Gages	Up to 24 in (24 to 72) in	$(44 + 3.4L) \mu\text{in}$ $(550 + 1.5L) \mu\text{in}$	Gage Blocks, Surface Plate
Indicators <sup>2</sup> (0.000 02 in resolution) (0.000 05 in resolution) (0.000 1 in resolution) (0.000 5 in resolution) (0.001 in resolution)	Up to 12 in	$(3.8 + 91L) \mu\text{in}$ $(3.6 + 4.3L) \mu\text{in}$ $(3.7 + 2.7L) \mu\text{in}$ $(3.4 + 4.2L) \mu\text{in}$ $(580 + 0.25L) \mu\text{in}$	Gage Blocks, ULM
Dial Test Indicators <sup>2</sup> (0.001 in resolution) (0.000 5 in resolution) (0.000 1 in resolution) (0.000 05 in resolution)	Up to 0.25 in	$(580 + 0.005 2L) \mu\text{in}$ $(290 + 0.01L) \mu\text{in}$ $(58 + 0.047L) \mu\text{in}$ $(29 + 0.093L) \mu\text{in}$	Gage Blocks
Machinist Levels	Up to 15 in Up to 72 in	0.000 15 in 0.000 73 in	Surface Plate, Gage Blocks
Linear Scales, Steel Rules <sup>2</sup>	Up to 72 in	$(76 + 11L) \mu\text{in}$	Measuring Microscope
Micrometers <sup>2</sup>	Up to 6 in (6 to 24) in (24 to 72) in	$(21 + 0.58L) \mu\text{in}$ $(44 + 3.4L) \mu\text{in}$ $(550 + 1.5L) \mu\text{in}$	Gage Blocks, ULM
Pin Gages <sup>2</sup>	Up to 1 in	$(42 + 1.4L) \mu\text{in}$	Bench Micrometer
Plain Plug Gages	Up to 20 in	$(3.6 + 3.6D) \mu\text{in}$	ULM, Gage Blocks
Length <sup>2</sup>	Up to 4 in Up to 48 in Up to 60 in	$(8.7 + 6.1L) \mu\text{in}$ $(13 + 5.2L) \mu\text{in}$ $(24 + 7.4L) \mu\text{in}$	ULM, Length Comparator, Gage Blocks
Thread Plug Gages <sup>2</sup> Major Diameter	Up to 8 in	$(3.6 + 3.6D) \mu\text{in}$	ULM, Thread Wires
Pitch Diameter	Up to 8 in	$(22 + 4D) \mu\text{in}$	
Plain Ring Gages <sup>2</sup>	(0.08 to 18) in	$(12 + 0.21D) \mu\text{in}$	ULM, Master Rings
Adjustable Thread Rings <sup>2</sup> Minor Diameter Pitch Diameter	Up to 8 in	$(38 + 0.88D) \mu\text{in}$	ULM, Master Setting Plugs In accordance with ASME B1.2, para 5.1.1: the ring is sized to a plug, with the plug's uncertainty given.

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Thread Measuring Wires	Up to 80 TPI	11 μin	ULM, 0.750 Roll, 0.125 Roll
Roughness Standards	Up to 250 μin	4.7 μin	Profilometer
Surface Analyzers <sup>2</sup>	Up to 123 μin	(4 + 0.002 7X) μin	Roughness Standard


**Mass and Mass Related**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Torque Wrenches	Up to 100 ozf·in 15 lbf·in to 400 lbf·ft Up to 250 lbf·ft (100 to 600) lbf·ft (400 to 2 000) lbf·ft	0.79 % of reading + 0.02 ozf·in 0.28 % of reading + 0.053 lbf·in 0.26 % of reading + 0.016 lbf·ft 0.25 % of reading + 0.054 lbf·ft 1 % of reading + 1.5 lbf·ft	Torque Analyzer

Calibration and Measurement Capability (CMC) is expressed in terms of the measurement parameter, measurement range, expanded uncertainty of measurement and reference standard, method, and/or equipment. The expanded uncertainty of measurement is expressed as the standard uncertainty of the measurement multiplied by a coverage factor of 2 ( $k=2$ ), corresponding to a confidence level of approximately 95%.

Notes:

1. On-site calibration service is available for this parameter, since on-site conditions are typically more variable than those in the laboratory, larger measurement uncertainties are expected on-site than what is reported on the accredited scope.
2.  $L$  = length in inches;  $"$  = arc-second;  $X$  = unit under test reading;  $D$  = diameter in inches;  $DL$  = diagonal length in inches.
3. The parameter, Magnetic Particle Unit, is found in three major parameters: Electrical – DC/Low Frequency; Photo and Radiometry; Time and Frequency.
4. This scope is formatted as part of a single document including Certificate of Accreditation No. ACT-1317.



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