



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.

A handwritten signature in black ink, appearing to read 'R. Douglas Leonard Jr.', is positioned above a horizontal line.

R. Douglas Leonard Jr., VP, PILR SBU

Expiry Date: 01 March 2022

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.
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Corydon, IN 47112

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CALIBRATION AND DIMENSIONAL MEASUREMENT

Valid to: **March 1, 2022**

Certificate Number: **ACT-1317**

CALIBRATION

Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
pH Meters ¹	4, 7, 10 pH	0.4 % of reading + 0.008 pH	Accredited pH Solutions
Refractometers ^{1,2}	0 Brix	(0.28 + 0.6R) Brix	Distilled Water

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Source ¹	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 μ V/V + 1 μ V 8.1 μ V/V + 3.7 μ V 9.3 μ V/V + 16 μ V 14 μ V/V + 0.12 mV 14 μ V/V + 1.2 mV	Multiproduct Calibrator
DC Voltage – Measure ¹	(10 to 100) mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 1 000) V	3.3 μ V/V + 0.74 μ V 2.1 μ V/V + 1.3 μ V 2.4 μ V/V + 5.8 μ V 3.8 μ V/V + 96 μ V 14 μ V/V - 1.1 mV	Precision Digital Multimeter
DC High Voltage – Measure ¹	Up to 6 kV (6 to 40) kV	5.8 mV/V + 6.1 V 30 mV/V	Digital Multimeter, High Voltage Probe



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Source ¹	Up to 330 μ 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 μ A/A + 16 nA 74 nA/A + 60 nA 77 nA/A + 0.2 μ A 80 nA/A + 3.1 μ A 0.16 mA/A + 32 μ A 0.3 mA/A + 31 μ A 0.39 mA/A + 0.39 mA 1 mA/A + 0.75 mA	Multiproduct Calibrator
DC Current Clamp-on Meters ¹	(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 ¹	Up to 100 nA (0.1 to 1) μ A (1 to 10) μ A (10 to 100) μ 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 μ A 66 μ A/A + 9.6 μ 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 ¹	Up to 11 Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω (0.33 to 1.1) k Ω (1.1 to 3.3) k Ω (3.3 to 11) k Ω (11 to 33) k Ω (33 to 110) k Ω (110 to 330) k Ω (0.33 to 1.1) M Ω (1.1 to 3.3) M Ω (3.3 to 11) M Ω (11 to 33) M Ω (33 to 110) M Ω (110 to 330) M Ω (0.33 to 1.1) G Ω	15 $\mu\Omega/\Omega$ + 0.96 m Ω 23 $\mu\Omega/\Omega$ + 1.2 m Ω 22 $\mu\Omega/\Omega$ + 1.1 m Ω 22 $\mu\Omega/\Omega$ + 1.6 m Ω 22 $\mu\Omega/\Omega$ + 1.6 m Ω 25 $\mu\Omega/\Omega$ + 16 m Ω 22 $\mu\Omega/\Omega$ + 16 m Ω 22 $\mu\Omega/\Omega$ + 0.16 Ω 22 $\mu\Omega/\Omega$ + 0.16 Ω 25 $\mu\Omega/\Omega$ + 1.6 Ω 25 $\mu\Omega/\Omega$ + 1.6 Ω 47 $\mu\Omega/\Omega$ + 24 Ω 0.1 m Ω/Ω + 39 Ω 0.2 m Ω/Ω + 1.9 k Ω 0.39 m Ω/Ω + 2.3 k Ω 2.3 m Ω/Ω + 78 k Ω 12 m Ω/Ω + 0.38 M Ω	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 ¹	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 ¹	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 650) °C (650 to 1 000) °C Type J (-210 to -100) °C (-100 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 Type N (-250 to -100) °C (-100 to -25) °C (-25 to 410) °C (410 to 1 300) °C	0.34 °C 0.27 °C 0.23 °C 0.26 °C 0.23 °C 0.2 °C 0.24 °C 0.39 °C 0.66 °C 0.39 °C 0.12 °C 0.16 °C 0.21 °C 0.13 °C 0.18 °C 0.26 °C 0.14 °C 0.2 °C 0.31 °C 0.31 °C 0.17 °C 0.15 °C 0.21 °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 ¹	Type R (0 to 250) °C	0.44 °C	Multiproduct Calibrator
	(250 to 400) °C	0.27 °C	
	(400 to 1 000) °C	0.26 °C	
	(1 000 to 1 767) °C	0.31 °C	
	Type S (0 to 250) °C	0.37 °C	
	(250 to 1 400) °C	0.28 °C	
	(1 400 to 1 767) °C	0.36 °C	
	Type T (-250 to -150) °C	0.49 °C	
	(-150 to 0) °C	0.19 °C	
	(0 to 120) °C	0.12 °C	
	(120 to 400) °C	0.11 °C	
	Type U (-200 to 0) °C	0.43 °C	
	(0 to 600) °C	0.21 °C	
Electrical Simulation of RTD Indicating Devices – Source ¹	Cu 427, 10 Ω (-100 to 260) °C	0.24 °C	Multiproduct Calibrator
	Pt 385, 100 Ω (-200 to 0) °C	0.003 6 % of reading + 0.08 °C	
	(0 to 100) °C	0.009 6 % of reading + 0.08 °C	
	(100 to 400) °C	0.003 3 % of reading + 0.09 °C	
	(400 to 630) °C	0.11 °C	
	(630 to 800) °C	0.007 6 % of reading + 0.21 °C	
	Pt 385, 200 Ω (-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		



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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 ¹	Pt 3916, 100 Ω		Multiproduct Calibrator
	(-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		
AC Voltage – Source ¹	(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	90 nV/V + 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	14 nV/V + 0.12 mV	
	45 Hz to 10 kHz	87 μV	
	(10 to 20) kHz	98 μV	
	(20 to 50) kHz	0.26 nV/V + 0.12 mV	
	(50 to 100) kHz	0.79 nV/V + 0.29 mV	
	(100 to 500) kHz	1.1 mV	
	(3.3 to 33) V		
	(10 to 45) Hz	0.39 μV/V + 1.3 mV	
	45 Hz to 10 kHz	2.5 nV/V + 0.87 mV	
(10 to 20) kHz	68 nV/V + 1.1 mV		
(20 to 50) kHz	98.1 nV/V + 1.4 mV		
(50 to 100) kHz	0.21 nV/V + 3.7 mV		



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source ¹	(33 to 330) V (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (330 to 1 020) V 45 Hz to 10 kHz	0.11 mV/V + 5.6 mV 0.64 μV/V + 11 mV 0.87 μV/V + 13 mV 0.9 mV/V + 95 mV 2 mV/V + 50 mV 75 μV/V + 89 mV	Multiproduct Calibrator
AC Voltage – Measure ¹	(1 to 10) mV (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (10 to 100) mV (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (0.3 to 1) MHz (1 to 2) MHz (0.1 to 1) V (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz	69 nV/V + 3.3 μV 98.9 nV/V + 2.1 μV 96.9 nV/V + 1.6 μV 0.36 nV/V + 2.7 μV 1.9 nV/V + 7.5 μV 5.5 μV 0.11 μV/V + 3.3 μV 97.4 nV/V + 5.8 μV 2.3 nV/V + 4 μV 1.8 nV/V + 8 μV 8.5 nV/V + 12 μV 59 μV 0.1 mV 15 mV/V + 10 μV 0.65 μV/V + 39 μV 0.53 nV/V + 25 μV 30 μV 42 μV 80 μV 0.31 mV 0.87 mV 15 mV/V + 10 μV	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 Voltage – Measure ¹	(10 to 100) V (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	12 nV/V + 3.4 mV 0.26 nV/V + 3.5 mV 0.26 nV/V + 3.5 mV 12 nV/V + 4.8 mV 97.8 nV/V + 11 mV 4 mV/V + 10 mV 15 mV/V + 10 mV	Precision Digital Multimeter
	(100 to 700) V (1 to 40) Hz 40 Hz to 1 kHz (1 to 200) kHz (20 to 50) kHz (50 to 100) kHz	0.40 mV/V + 40 mV 0.55 nV/V + 47 mV 0.6 mV/V + 20 mV 1.3 mV/V + 20 mV 3 mV/V + 20 mV	
AC High Voltage – Measure ¹	Up to 6 kV Up to 500 Hz	6.3 mV/V + 6.7 mV	Digital Multimeter, High Voltage Probe
	Up to 6 kV 500 Hz to 1 kHz	30 mV/V	
	Up to 40 kV 60 Hz	75 mV/V	
AC Current – Source ¹	(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	1.7 μ A/A + 58 nA 1.2 μ A/A + 78 nA 0.97 μ A/A + 78 nA 2.3 μ A/A + 0.12 μ A 6.2 μ A/A + 0.15 μ A 16 mA/A + 0.4 μ A	Multiproduct 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	1.6 μ A/A + 0.12 μ A 0.97 μ A/A + 0.12 μ A 0.77 μ A/A + 0.12 μ A 1.6 μ A/A + 0.15 μ A 3.9 μ A/A + 0.23 μ A 10 mA/A + 0.6 μ A	
	(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	1.4 μ A/A + 1.6 μ A 0.7 μ A /A + 1.5 μ A 0.31 μ A /A + 1.5 μ A 0.62 μ A /A + 1.5 μ A 1.6 μ A/A + 2.3 μ A 4 mA/A + 4 μ A	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source ¹	(33 to 330) mA (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 ¹	(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 ¹	(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

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure ¹	(1 to 10) mA		Precision Digital Multimeter
	(10 to 20) Hz	2.7 μ A/A + 1.4 μ A	
	(20 to 45) Hz	0.99 μ A/A + 1.5 μ A	
	(45 to 100) Hz	0.38 μ A/A + 1.6 μ A	
	100 Hz to 5 kHz	0.19 μ A/A + 1.6 μ A	
	(5 to 20) kHz	0.38 μ A/A + 1.6 μ A	
	(20 to 50) kHz	2.7 μ A/A + 2.7 μ A	
	(50 to 100) kHz	6 mA/A + 15 μ A	
	(10 to 100) mA		
	(10 to 20) Hz	2.7 μ A/A + 15 μ A	
	(20 to 45) Hz	0.99 μ A/A + 15 μ A	
	(45 to 100) Hz	0.38 μ A/A + 16 μ A	
	100 Hz to 5 kHz	0.19 μ A/A + 16 μ A	
	(5 to 20) kHz	0.38 μ A/A + 16 μ A	
	(20 to 50) kHz	2.7 μ A/A + 28 μ 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 ¹	(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) μ F	1.9 mF/F + 0.91 nF	
	(1.3 to 3.3) μ F	1.5 mF/F + 5.6 nF	
	(3.3 to 11) μ F	2 mF/F + 8.8 nF	
	(11 to 33) μ F	2.6 mF/F + 53 nF	
	(33 to 110) μ F	3.4 mF/F + 88 nF	
	(110 to 330) μ F	2.9 mF/F + 0.52 μ F	
	(0.33 to 1.1) mF	3.4 mF/F + 0.88 μ F	
(1.1 to 3.3) mF	3.2 mF/F + 4.9 μ F		



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Electrical – DC/Low Frequency

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

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes ¹ 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	(0 to 100) G	1 % of reading + 0.074 G	Helmholtz Coil. Current Source
Magnetic Particle Unit ^{1,3} 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 ²	Up to 30 in	(0.25 - 0.001X)''	Angle Generator
Bore Gages ^{1,2}	Up to 8 in	(2.1 + 4.4L) μin	Master Ring, Indicator Checker, Universal Length Measuring Machine
Calipers ^{1,2}	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 ^{1,2} 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 ^{1,2}	± 1 000''	0.7''	Gage Blocks, Sine Plate

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Extensometers ¹	(0 to 1) in	100 μin	Extensometer Calibrator
Extrusion Plastometers ¹			
Bore Diameter	Up to 0.25 in	130 μin	Depth Micrometers, Caliper, Pin Gages, Gage Blocks
Piston Diameter / Length	Up to 1 in	100 μin	
Gage Blocks ²	Up to 1 in (1 to 4) in	2.6 μin (1.6 + 0.94L) μin	Comparator, Master Gage Blocks
	(4 to 20) in	(4.4 + 0.63L) μin	LVDT, Master Gage Blocks
Glass Scales ²	Up to 12 in	(9.1 + 2.3L) μin	Measuring Microscope, Gage Blocks
Height Gages ^{1,2}	Up to 24 in (24 to 72) in	(44 + 3.4L) μin (550 + 1.5L) μin	Gage Blocks, Surface Plate
Indicators ^{1,2}			
(0.000 02 in resolution)	Up to 12 in	(3.8 + 91L) μin	Gage Blocks, Universal Length Measuring Machine
(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 ^{1,2}			
(0.001 in resolution)	Up to 0.25 in	(580 + 0.005 2L) μin	Gage Blocks
(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 ¹	Up to 15 in Up to 72 in	150 μin 730 μin	Surface Plate, Gage Blocks,
Measuring Microscopes ^{1,2}	Up to 12 in	(25 + 1.3L) μin	Laser Interferometer, Gage Blocks
Micrometers ^{1,2}	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 ^{1,2} 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 μin	Glass Scales, Glass Rule
Pi Tapes ²	Up to 96 in diameter	$(78 + 6D) \mu\text{in}$	Cylindrical Masters, CMM
Pin Gages ^{1,2}	Up to 1 in	$(42 + 1.4L) \mu\text{in}$	Bench Micrometer
Plain Plug Gages ²	Up to 20 in	$(3.6 + 3.6D) \mu\text{in}$	Gage Blocks, Universal Length Measuring Machine
Thread Plug Gages ² 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 ²	(0.08 to 18) in	$(12 + 0.21D) \mu\text{in}$	Universal Length Measuring Machine, Master Rings
Roughness Standards ¹	Up to 250 μin	4.7 μin	Profilometer
Steel Rules, Linear Scales ^{1,2}	Up to 72 in	$(76 + 11L) \mu\text{in}$	Measuring Microscope
Surface Analyzers ^{1,2}	Up to 123 μin	$(4 + 0.0027X) \mu\text{in}$	Roughness Standard
Surface Plates ^{1,2} 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 μin	Repeat O Meter
Tape Measures ^{1,2}	Up to 300 ft	$(76 + 11L) \mu\text{in}$	Measuring Microscope
Thread Measuring Wires	Up to 80 TPI	11 μin	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 ² Minor Diameter	Up to 8 in	$(38 + 0.88D) \mu\text{in}$	Universal Length Measuring Machine
Pitch Diameter	Up to 8 in	84 μin	
Adjustable Thread Rings ² 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.

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	Weights
Durometers ^{1,2} (Spring Force)	Scales A & D	$(0.33 + 0.001 4X)$ duro	Duro-calibrator
Force ¹ (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 ¹	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 ¹	(100 to 940) HK Repeatability under force Error	0.31 % of reading 0.69 % of reading 0.15 μm	Indirect Verification per ASTM E92 using Hardness Test Blocks,
Leeb Hardness Tester ¹	783 HLD	16 HLD	Indirect Verification per ASTM A596 using Leeb Test Block.

Mass and Mass Related

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



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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 ¹	(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		
Vickers Hardness Tester ¹	(100 to 940) HV	0.86 % of reading	Indirect Verification per ASTM E92 using Hardness Test Blocks.
	Repeatability under force Error	0.086 % of reading 0.16 µm	
Masses	(1 to 200) g	(0.002 2 + 0.002 8 g) mg	Comparison to ASTM E617 Class 1 weights, ASTM E617 Class 2 weights, ASTM E617 Class 3 weights, using Precision Balances.
	(200 to 500) g	(0.25 + 0.001 8 g) mg	
	500 g to 5 lb	(-0.87 + 0.003 5 g) mg	Comparison to Master Load Cell
	(5 to 10) lb	(4.2 + 0.002 5 lb) mg	
	(10 to 50) lb	(5.5 + 0.76 kg) mg	
	(50 to 100) lb	(-110 + 5.9 kg) mg	
	(1 to 1 000) lb	0.36 lb	
Pressure Gages and Transducers ¹	(-15 to 15) psig	0.002 psi	Pressure Calibrator, Deadweight Tester
	(10 to 50) psig	0.004 psi	
	(50 to 500) psig	0.043 psi	
	(200 to 800) psig	0.016 psi	
	(800 to 16 000) psig	2 psi	



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Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Scales and Balances ¹ (0.000 01 g resolution)	Up to 80 g (80 to 200) g	0.2 µg/g + 5.8 µg 0.8 µg/g + 0.13 mg	ASTM E617 Class 1 weights and NIST Handbook 44 utilized for the calibration of the weighing system.
Scales and Balances ¹ (0.000 1 g resolution)	Up to 80 g (80 to 200) g	1.8 µg/g + 58 µg 0.9 µg/g + 0.13 mg	
Scales and Balances ¹ (0.000 01 g resolution)	Up to 5 000 g	0.7 µg/g + 1.5 mg	
Scales and Balances ¹ (0.000 1 g resolution)	Up to 5 000 g	0.8 µg/g + 1.6 mg	
Scales and Balances ¹ (0.001 g resolution)	Up to 5 000 g	0.9 µg/g + 1.7 mg	
Weighing Systems ¹ (0.000 01 lb resolution)	Up to 2 000 lb	0.005 9 % of reading + 0.000 01 lb	Class F weights and NIST Handbook 44 utilized for the calibration of the weighing system.
Weighing Systems ¹ (0.000 02 lb resolution)	Up to 2 000 lb	0.005 9 % of reading + 0.000 02 lb	
Weighing Systems ¹ (0.000 05 lb resolution)	Up to 2 000 lb	0.005 9 % of reading + 0.000 03 lb	
Weighing Systems ¹ (0.000 1 lb resolution)	Up to 2 000 lb	0.005 9 % of reading + 0.000 1 lb	
Weighing Systems ¹ (0.000 2 lb resolution)	Up to 2 000 lb	0.005 9 % of reading + 0.000 2 lb	
Weighing Systems ¹ (0.000 5 lb resolution)	Up to 2 000 lb	0.005 8 % of reading + 0.000 3 lb	
Weighing Systems ¹ (0.001 lb resolution)	Up to 2 000 lb	0.005 8 % of reading + 0.001 lb	
Weighing Systems ¹ (0.002 lb resolution)	Up to 2 000 lb	0.005 8 % of reading + 0.002 lb	
Weighing Systems ¹ (0.005 lb resolution)	Up to 2 000 lb	0.005 7 % of reading + 0.003 lb	
Weighing Systems ¹ (0.01 lb resolution)	Up to 2 000 lb	0.005 6 % of reading + 0.01 lb	
Weighing Systems ¹ (0.02 lb resolution)	Up to 800 lb (800 to 2 000) lb	0.004 6 % of reading + 0.01 lb 0.005 8 % of reading + 0.01 lb	
Weighing Systems ¹ (0.05 lb resolution)	Up to 800 lb (800 to 2 000) lb	0.003 3 % of reading + 0.03 lb 0.005 5 % of reading + 0.1 lb	



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Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Weighing Systems ¹ (0.1 lb resolution)	Up to 800 lb (800 to 2 000) lb	0.002 1 % of reading + 0.1 lb 0.004 7 % of reading + 0.4 lb	Class F weights and NIST Handbook 44 utilized for the calibration of the weighing system.
Weighing Systems ¹ (0.2 lb resolution)	Up to 2 000 lb	0.002 5 % of reading + 0.1 lb	
Weighing Systems ¹ (0.5 lb resolution)	Up to 2 000 lb	0.001 1 % of reading + 0.3 lb	
Weighing Systems ¹ (1 lb resolution)	Up to 2 000 lb	0.000 59 % of reading + 1 lb	
Weighing Systems ¹ (0.01 lb resolution)	Up to 2 400 lb (2 400 to 6 000) lb	0.007 8 % of reading + 0.01 lb 0.000 66 % of reading + 0.18 lb	
Weighing Systems ¹ (0.02 lb resolution)	Up to 2 400 lb (2 400 to 6 000) lb	0.007 9 % of reading + 0.12 lb 0.000 66 % of reading + 0.18 lb	
Weighing Systems ¹ (0.05 lb resolution)	Up to 2 400 lb (2 400 to 6 000) lb	0.007 2 % of reading + 0.03 lb 0.000 66 % of reading + 0.19 lb	
Weighing Systems ¹ (0.1 lb resolution)	Up to 2 400 lb (2 400 to 6 000) lb	0.006 8 % of reading + 0.1 lb 0.000 78 % of reading + 0.2 lb	
Weighing Systems ¹ (0.2 lb resolution)	Up to 2 400 lb (2 400 to 6 000) lb	0.006 9 % of reading + 0.2 lb 0.001 1 % of reading + 0.3 lb	
Weighing Systems ¹ (0.5 lb resolution)	Up to 2 400 lb (2 400 to 6 000) lb	0.001 % of reading + 0.3 lb 0.002 2 % of reading + 0.5 lb	
Weighing Systems ¹ (1 lb resolution)	Up to 2 400 lb (2 400 to 6 000) lb	0.018 % of reading + 1 lb 0.004 3 % of reading + 1 lb	
Weighing Systems ¹ (2 lb resolution)	Up to 2 400 lb (2 400 to 6 000) lb	0.036 % of reading + 2 lb 0.008 6 % of reading + 2 lb	
Weighing Systems ¹ (5 lb resolution)	Up to 2 400 lb (2 400 to 6 000) lb	0.088 % of reading + 3 lb 0.022 % of reading + 5 lb	
Weighing Systems ¹ (10 lb resolution)	Up to 2 400 lb (2 400 to 6 000) lb	0.18 % of reading + 6 lb 0.04 % of reading + 9 lb	

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Weighing Systems ¹ (20 lb resolution)	Up to 2 400 lb (2 400 to 6 000) lb	0.35 % of reading + 12 lb 0.09 % of reading + 18 lb	Class F weights and NIST Handbook 44 utilized for the calibration of the weighing system.
Torque Analyzers ¹	(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 ¹	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 ¹	(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)	(0 to 19 990) $\mu\text{W}/\text{cm}^2$	(3.1 + 0.05X) $\mu\text{W}/\text{cm}^2$	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	(0.19 + 0.05X) fc	
Magnetic Particle Unit ^{1,2,3} Black Light	Up to 19 990 $\mu\text{W}/\text{cm}^2$	(3.1 + 0.05X) $\mu\text{W}/\text{cm}^2$	Comparison to Digital Radiometer
White Light	Up to 199.9 fc	(0.8 + 0.05X) fc	

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Extrusion Plastometers ¹ Temperature	(-30 to 660) °C	0.12 °C	PRT, Temperature Indicator
Infrared Thermometer (non-contact)	(35 to 500) °C	0.25 % of reading + 0.67 °C	Black Body Source (flat plate) $\epsilon = 0.95, \lambda = (8 \text{ to } 14) \mu\text{m}$
Humidity – Measure ¹	(5 to 90) %RH	0.5 %RH	Comparison to Chilled Mirror
Temperature – Measure ¹	(-200 to 660) °C	0.03 °C	PRT, Calibrator
Temperature – Source ¹	(-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 ¹	Up to 1.3 GHz	0.11 nHz	GPS Reference
Timers, Stopwatches ¹	Up to 24 hr	4.4 ms	GPS Reference, Frequency Counter, Function Generator
Magnetic Particle Unit ^{1,3} 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 ^{1,2}	Up to 24 in	$(44 + 3.5L) \mu\text{in}$	Height Measurements utilizing a Height Gage for Dimensional Inspection.
	Up to 20 in	$(1.5 + 3.9L) \mu\text{in}$	Length Measurements utilizing a ULM for Dimensional Inspection.
	Up to 1 in	$(43 + 0.011L) \mu\text{in}$	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 ^{1,2}	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 μin 90 μin	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	$(22 + 0.036L) \mu\text{in}$	Parallelism Measurements utilizing a Measuring Microscope for Dimensional Inspection.
	Up to 0.02 in	86 μin	Squareness Measurements utilizing a Height Gage or LVDT for Dimensional Inspection.
	Up to 0.02 in	18 μin	Squareness Measurements utilizing Laser Interferometer for Dimensional Inspection.
	Up to 0.02 in	14 μin	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 μin	Flatness Measurements utilizing an Autocollimator for Dimensional Inspection.
	Up to 0.02 in	4 μin	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 ^{1,2}	Up to 0.02 in	10 μin	Roundness Measurements utilizing a Roundness Tester for Dimensional Inspection.

2 Dimensional

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Dimensional Measurement – 2D ^{1,2}	Up to 0.02 in	$(8.9 + 0.005L) \mu\text{in}$	Squareness Measurements utilizing a Measuring Microscope for Dimensional Inspection.
	Up to 0.02 in	$(43 + 0.95L) \mu\text{in}$	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	$(34 + 1.3D) \mu\text{in}$	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 ^{1,2}	X-axis: Up to 40 in Y-axis: Up to 80 in Z-axis: Up to 40 in	$(200 + 4L) \mu\text{in}$ $(200 + 4L) \mu\text{in}$ $(200 + 5L) \mu\text{in}$	CMM utilized for Dimensional Inspection.
	Up to 360 °	0.03 °	Angle Measurements utilizing a CMM for Dimensional Inspection
	Up to 40 in	$(99 + 8.9D) \mu\text{in}$	Diameter 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 ^{1,2}	Up to 0.02 in	73 μin/ft	Flatness Measurements utilizing a CMM for Dimensional Inspection.
	Up to 0.02 in	(22 + 0.036L) μin	Parallelism Measurements utilizing a CMM for Dimensional Inspection.
	Up to 0.02 in	180 μin	Sphericity Measurements utilizing a CMM for Dimensional Inspection.
	Up to 0.02 in	77 μin/ft	Squareness Measurements utilizing a CMM for Dimensional Inspection.
	Up to 0.02 in	47 μin	Straightness Measurements utilizing a CMM for Dimensional Inspection.

Services performed at satellite location

11145 Luschek Drive
Cincinnati, OH 45241

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Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Bore Gages ²	Up to 8 in	(2.1 + 4.4L) μin	Master Ring, Indicator Checker, ULM
Calipers ²	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
Gage Blocks ²	Up to 1 in (1 to 4) in	2.6 μin (1.6 + 0.94L) μin	Comparator, Master Gage Blocks
	(4 to 20) in	(4.4 + 0.63L) μin	LVDT, Master Gage Blocks



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Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Height Gages	Up to 24 in (24 to 72) in	(44 + 3.4L) μin (550 + 1.5L) μin	Gage Blocks, Surface Plate
Indicators ² (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) μin (3.6 + 4.3L) μin (3.7 + 2.7L) μin (3.4 + 4.2L) μin (580 + 0.25L) μin	Gage Blocks, ULM
Dial Test Indicators ² (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) μin (290 + 0.01L) μin (58 + 0.047L) μin (29 + 0.093L) μin	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 ²	Up to 72 in	(76 + 11L) μin	Measuring Microscope
Micrometers ²	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, ULM
Pin Gages ²	Up to 1 in	(42 + 1.4L) μin	Bench Micrometer
Plain Plug Gages	Up to 20 in	(3.6 + 3.6D) μin	ULM, Gage Blocks
Length ²	Up to 4 in Up to 48 in Up to 60 in	(8.7 + 6.1L) μin (13 + 5.2L) μin (24 + 7.4L) μin	ULM, Length Comparator, Gage Blocks
Thread Plug Gages ² Major Diameter	Up to 8 in	(3.6 + 3.6D) μin	ULM, Thread Wires
Pitch Diameter	Up to 8 in	(22 + 4D) μin	
Plain Ring Gages ²	(0.08 to 18) in	(12 + 0.21D) μin	ULM, Master Rings
Adjustable Thread Rings ² Minor Diameter Pitch Diameter	Up to 8 in	(38 + 0.88D) μin	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.
Thread Measuring Wires	Up to 80 TPI	11 μin	ULM, 0.750 Roll, 0.125 Roll

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Roughness Standards	Up to 250 μ in	4.7 μ in	Profilometer
Surface Analyzers ²	Up to 123 μ in	(4 + 0.002 7X) μ in	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; R = resolution of device under test.
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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