CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

Smart Tech Calibration & Services Co., Ltd.

14/506 Moo 3, Rangsit-Nakhon Nayok Road, Lam Phak Kut,
Thanyaburi, Pathum Thani 12110, Thailand

Fulfills the requirements of

ISO/IEC 17025:2017

In the field of

CALIBRATION

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.

Jason Stine, Vice President

Expiry Date: 25 April 2028

Certificate Number: AC-3093

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

Smart Tech Calibration & Services Co., Ltd.

14/506 Moo 3, Rangsit-Nakhon Nayok Road, Lam Phak Kut,
Thanyaburi, Pathum Thani 12110, Thailand

Mr. Chayut Wongleang +66 21143148
stcal.md@gmail.com

CALIBRATION

ISO/IEC 17025 Accreditation Granted: **22 April 2026**

Certificate Number: **AC-3093** Certificate Expiry Date: **25 April 2028**

Acoustics and Vibration

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Sound Level Meter[1]	1 kHz 94 dB 114 dB	 0.4 dB 0.4 dB	Comparison to Sound Calibrator

Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
pH Meter[1]	2.00 pH 4.00 pH 7.00 pH 10.00 pH	0.01 pH 0.01 pH 0.01 pH 0.015 pH	Comparison to Standard pH Solutions
Conductivity Meter[1]	84 µS/cm 1 413 µS/cm 12.88 mS/cm	1.2 µS /cm 20 µS /cm 0.18 mS/cm	Comparison to Standard Conductivity Solution
Turbidity Meter[1]	0.5 NTU 20 NTU 100 NTU 1 000 NTU	0.013 NTU 0.21 NTU 0.91 NTU 8.1 NTU	Comparison to Standard Turbidity Solutions

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Total Dissolved Solids (TDS) Meter [1]	100 mg/L 1 000 mg/L	0.32 mg/L 2.2 mg/L	Comparison to Standard TDS Solutions
Refractometer[1]	5 % Brix 10 % Brix 20 % Brix 30 % Brix 50 % Brix 60 % Brix	0.18 % Brix 0.19 % Brix 0.21 % Brix 0.23 % Brix 0.26 % Brix 0.26 % Brix	Comparison to Standard Sucrose Solutions
Refractometer - Refractive Index[1]	1.340 27 nD 1.347 82 nD 1.363 84 nD 1.381 14 nD 1.420 07 nD 1.441 88 nD	0.000 29 nD 0.000 29 nD 0.000 33 nD 0.000 35 nD 0.000 43 nD 0.000 43 nD	Comparison to Standard Sucrose Solutions

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of RTD Indicating Devices – Source/Measure[1]	RTD (Pt100) (-200 to 0) °C (0 to 400) °C (400 to 650) °C	 0.16 °C 0.28 °C 0.55 °C	Simulation using Fluke 744 Process Calibrator
Electrical Simulation of RTD Indicating Devices – Measure[1]	RTD (Pt100) (-200 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 600) °C	 0.16 °C 0.18 °C 0.21 °C 0.24 °C 0.27 °C	Simulation using Agilent 34410A 6.5 Digit Multimeter
Electrical Simulation of Thermocouple Indicating Devices – Source/Measure[1]	Type E (-200 to -100) °C (-100 to 0) °C (0 to 1 000) °C Type J (-200 to 0) °C (0 to 600) °C (600 to 900) °C (900 to 1 200) °C	 0.53 °C 0.4 °C 0.31 °C 0.43 °C 0.29 °C 0.32 °C 0.32 °C	Simulation using Fluke 744 Process Calibrator

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

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 K (-200 to 0) °C (0 to 150) °C (150 to 1 100) °C (1 100 to 1 372) °C Type N (-200 to 0) °C (0 to 150) °C (150 to 900) °C (900 to 1 300) °C Type R (0 to 200) °C (200 to 400) °C (400 to 1 760) °C Type S (0 to 200) °C (200 to 1 760) °C Type T (-200 to -100) °C (-100 to 0) °C (0 to 400) °C	 0.55 °C 0.42 °C 0.42 °C 0.49 °C 0.77 °C 0.61 °C 0.63 °C 0.43 °C 1.4 °C 1.1 °C 1.1 °C 1.4 °C 1.3 °C 0.69 °C 0.52 °C 0.4 °C	Simulation using Fluke 744 Process Calibrator
Resistance-Source, High Resistance, Insulation Testers, Resistivity Meters[1] @ (10 to 1 000) V	@1 Ω (1 to 10) Ω @10 Ω (> 10 to 100) Ω @100 Ω (> 100 to 500) Ω (> 0.5 to 1) kΩ @1 kΩ (> 1 to 5) kΩ (> 5 to 10) kΩ @10 kΩ (> 10 to 50) kΩ (> 50 to 100) kΩ	 0.01 Ω 0.027 Ω 0.14 Ω 0.23 Ω 0.002 kΩ 0.01 kΩ 0.02 kΩ 0.03 kΩ	Comparison to Resistance Decade Box

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance-Source, High Resistance, Insulation Testers, Resistivity Meters[1] @ (10 to 1 000) V	@100 kΩ (> 100 to 500) kΩ (> 0.5 to 1) MΩ @1 MΩ (> 1 to 5) MΩ (> 5 to 10) MΩ @10 MΩ (> 10 to 50) MΩ (> 50 to 100) MΩ	 0.16 kΩ 0.58 kΩ 0.003 7 MΩ 0.007 3 MΩ 0.007 3 MΩ 0.15 MΩ	Comparison to Resistance Decade Box
High Resistance, Insulation Testers, Resistivity Meters @ (10 to 1 000) V	200 MΩ 500 MΩ 1 GΩ 10 GΩ 100 GΩ	1.2 MΩ 3.2 MΩ 6.1 MΩ 0.096 GΩ 0.85 GΩ	Comparison to Resistance Decade Box
High Resistance, Insulation Testers, Resistivity Meters[1] @ (1 to 10) kV	200 MΩ 500 MΩ 1 GΩ 10 GΩ 100 GΩ	1.4 MΩ 3 MΩ 5.4 MΩ 0.062 GΩ 0.46 GΩ	Comparison to Resistance Decade Box
DC Voltage – Source[1]	Up to 50 mV (> 50 to 200) mV (> 200 to 500) mV (> 0.5 to 2) V (> 2 to 5) V (>5 to 20) V (>20 to 50) V (>50 to 100) V (>100 to 200) V (>200 to 500) V (>500 to 1 000) V	0.35 mV/V + 47 µV 0.35 mV/V + 47 µV 0.35 mV/V + 0.24 mV 0.35 mV/V + 0.47 mV 0.35 mV/V + 1.2 mV 0.35 mV/V + 4.7 mV 0.35 mV/V + 12 mV 0.35 mV/V + 24 mV 0.35 mV/V + 47 mV 0.35 mV/V + 120 mV 0.35 mV/V + 240 mV	Comparison to Multiproduct Calibrator
DC Voltage – Measure[1]	Up to 10 mV (> 10 to 100) mV (> 0.1 to 1) V (> 1 to 10) V (> 10 to 100) V (>100 to 1 000) V	0.06 mV/V + 2.5 µV 0.06 mV/V+ 4.7 µV 0.041 mV/V + 12 µV 0.035 mV/V + 71 µV 0.047 mV/V + 0.8 mV 0.047 mV/V + 9.2 mV	Comparison to Agilent 34410A 6.5 Digit Multimeter

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source[1]	50 Hz, 60 Hz, 400 Hz Up to 50 mV (> 50 to 200) mV (> 20 to 500) mV (> 0.5 to 2) V (> 2 to 5) V (> 5 to 20) V (> 20 to 50) V (> 50 to 100) V (> 100 to 200) V (> 200 to 500) V (> 500 to 1 000) V	 0.58 mV/V + 47 µV 0.58 mV/V + 48 µV 0.58 mV/V + 0.24 mV 0.58 mV/V + 0.47 mV 0.58 mV/V + 1.2 mV 0.58 mV/V + 4.7 mV 0.58 mV/V + 10 mV 0.58 mV/V + 25 mV 0.58 mV/V + 48 mV 0.58 mV/V + 119 mV 0.58 mV/V + 244 mV	Comparison to Multiproduct Calibrator
AC Voltage – Measure[1]	10 Hz to 20 kHz Up to 10 mV (> 10 to 100) mV (> 0.1 to 1) V (> 1 to 10) V (> 10 to 100) V (> 100 to 750) V (20 to 50) kHz Up to 100 mV (> 0.1 to 1) V (> 1 to 10) V (> 10 to 100) V (> 100 to 750) V	 1.5 mV/V + 60 µV 1.2 mV/V + 0.04 mV 1.2 mV/V + 0.4 mV 1.2 mV/V + 3.6 mV 1.2 mV/V + 36 mV 1.2 mV/V + 0.3 V 1.5 mV/V + 0.06 mV 1.2 mV/V + 0.5 mV 1.2 mV/V + 6 mV 1.2 mV/V + 60 mV 1.2 mV/V + 0.45 V	Comparison to Agilent 34410A 6.5 Digit Multimeter
Magnetic Field – Permanent Magnets	(300 to 1 500) G (>1 500 to 3 000) G (>3 000 to 5 000) G (>5 000 to 10 000) G (>10 000 to 15 000) G	1.2 % reading 1.2 % reading 1.2 % reading 1.2 % reading 1.2 % reading	In-house method CPE-04-13, Direct Measurement with Gauss Meter

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Source[1]	Up to 100 µA (> 100 to 500) µA (> 0.5 to 2) mA (> 2 to 5) mA (> 5 to 20) mA (> 20 to 50) mA (> 50 to 200) mA (> 200 to 500) mA (> 0.5 to 1) A (> 1 to 5) A (> 5 to 10) A (> 10 to 20) A	0.58 mA/A + 0.12 µA 0.58 mA/A + 0.13 µA 0.58 mA/A + 0.9 µA 0.58 mA/A + 1.4 µA 0.58 mA/A + 5 µA 0.58 mA/A + 12 µA 0.58 mA/A + 0.07 mA 0.58 mA/A + 0.18 mA 0.58 mA/A + 0.31 mA 0.58 mA/A + 4.8 mA 0.58 mA/A + 5.1 mA 0.58 mA/A + 6 mA	Comparison to Multiproduct Calibrator
DC Current - Source Clamp-On Ammeters[1]	Up to 50 A (> 50 to 100) A (> 100 to 250) A (> 200 to 500) A (> 500 to 1 000) A	0.58 mA/A + 0.2 A 0.58 mA/A + 0.33 A 0.58 mA/A + 0.84 A 0.58 mA/A + 1.7 A 0.58 mA/A + 2.9 A	Comparison to Multiproduct Calibrator, Current Coil
DC Current – Measure[1]	Up to 1 mA (> 1 to 10) mA (> 10 to 100) mA (> 0.1 to 1) A (> 1 to 3) A (> 3 to 5) A (> 5 to 30) A	0.6 mA/A + 0.1 µA 0.6 mA/A + 2.5 µA 0.6 mA/A + 6.5 µA 1.2 mA/A + 0.12 mA 1.8 mA/A + 0.75 mA 3.5 mA/A + 4.2 mA 3.5 mA/A + 4.2 mA	Comparison to Agilent 34410A 6.5 Digit Multimeter, Agilent 34330A Current Shunt
AC Current – Source[1]	50 Hz, 60 Hz, 400 Hz (Up to 2) mA (>2 to 5) mA (> 5 to 20) mA (> 20 to 50) mA (> 50 to 200) mA (> 200 to 500) mA (> 0.5 to 1) A (> 1 to 5) A (> 5 to 10) A 50 Hz, 60 Hz (> 10 to 12) A 400 Hz (> 10 to 12) A	 1.2 mA/A + 1.6 µA 1.2 mA/A + 2.8 µA 1.2 mA/A + 0.009 mA 1.2 mA/A + 0.021 mA 1.2 mA/A + 0.08 mA 1.2 mA/A + 0.21 mA 1.2 mA/A + 0.4 mA 1.2 mA/A + 4.9 mA 1.2 mA/A + 5.6 mA 1.2 mA/A + 6.8 mA 1.2 mA/A + 13 mA	Comparison to Multiproduct Calibrator

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current - Source Clamp-On Ammeters[1]	50 Hz, 60 Hz Up to 50 A (> 50 to 100) A (> 100 to 250) A (> 200 to 500) A (> 500 to 600) A	 1.2 mA/A + 0.22 A 1.2 mA/A + 0.38 A 1.2 mA/A + 1.1 A 1.2 mA/A + 2.0 A 1.2 mA/A + 2.3 A	Comparison to Multiproduct Calibrator, Current Coil
AC Current – Measure[1]	10 Hz to 1 kHz Up to 0.1 mA (> 0.1 to1) mA (> 1.0 to 10) mA (> 10 to 100) mA (> 0.1 to 1) A (> 1 to 3) A 50 Hz to 60 Hz (> 3 to 5) A (> 5 to 30) A	 1.2 mA/A + 0.5 µA 1.2 mA/A + 0.5 µA 1.2 mA/A + 5 µA 1.2 mA/A + 50 µA 1.2 mA/A + 0.5 mA 1.2 mA/A + 2.0 mA 3.5 mA/A + 0.05 A 1.2 mA/A + 2.0 mA	Comparison to Agilent 34410A 6.5 Digit Multimeter, Agilent 34330A Current Shunt
DC/AC Cutoff Current – Measure[1]	DC Up to 50 mA (> 50 to 100) mA AC @ (50, 60) Hz Up to 50 mA (> 50 to 100) mA	 0.02 mA 0.3 mA 0.07 mA 0.22 mA	Comparison to Fluke 289 Digital Multimeter
Resistance – Source[1]	Up to 10 Ω (> 10 to 50) Ω (> 50 to 100) Ω (> 100 to 500) Ω (> 500 to 1 000) Ω (> 1 to 2) kΩ (> 2 to 5) kΩ (> 5 to 10) kΩ (> 10 to 20) kΩ (> 20 to 50) kΩ (> 50 to 100) kΩ (> 100 to 200) kΩ (> 200 to 500) kΩ (> 0.5 to 1) MΩ (> 1 to 2) MΩ (> 2 to 5) MΩ (> 5 to 10) MΩ (> 10 to 20) MΩ	5.8 mΩ/Ω + 0.024 Ω 5.8 mΩ/Ω + 0.024 Ω 1.2 mΩ/Ω + 0.025 Ω 1.2 mΩ/Ω + 0.026 Ω 1.2 mΩ/Ω + 0.065 Ω 1.2 mΩ/Ω + 0.074 Ω 1.2 mΩ/Ω + 0.11 Ω 1.2 mΩ/Ω + 0.61 Ω 1.2 mΩ/Ω + 0.71 Ω 1.2 mΩ/Ω + 1.1 Ω 1.2 mΩ/Ω + 6.1 Ω 1.2 mΩ/Ω + 8.4 Ω 1.2 mΩ/Ω + 0.017 kΩ 1.2 mΩ/Ω + 0.07 kΩ 1.2 mΩ/Ω + 0.32 kΩ 1.2 mΩ/Ω + 0.56 kΩ 1.2 mΩ/Ω + 5.9 kΩ 1.2 mΩ/Ω + 6.1 kΩ	Comparison to Multiproduct Calibrator

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Measure[1]	Up to 100 Ω (> 100 to 1 000) Ω (> 1.0 to 10) kΩ (> 10 to 100) kΩ (> 0.1 to 1) MΩ (> 1 to 10) MΩ (> 10 to 100) MΩ (> 100 to 1 000) MΩ	0.12 mΩ/Ω + 5 mΩ 0.12 mΩ/Ω + 15 mΩ 0.12 mΩ/Ω + 0.15 Ω 0.12 mΩ/Ω + 1.6 Ω 0.15 mΩ/Ω + 25 Ω 0.47 mΩ/Ω + 0.28 kΩ 0.93 mΩ /Ω + 8.3 kΩ 0.93 mΩ /Ω + 15 kΩ	Comparison to Agilent 34410A 6.5 Digit Multimeter
DC High Voltage – Measure[1]	Up to 1 kV (> 1 to 2) kV (> 2 to 2.5) kV (> 2.5 to 5) kV (> 5 to 10) kV	0.024 kV 0.047 kV 0.058 kV 0.12 kV 0.24 kV	Comparison to Digital Multimeter Fluke 289, Fluke 80K-40 High Voltage Probe
AC High Voltage – Measure[1]	50 Hz Up to 1 kV (> 1 to 2) kV (> 2 to 2.5) kV (> 2.5 to 5) kV (> 5 to 10) kV	 0.058 kV 0.12 kV 0.15 kV 0.29 kV 0.58 kV	Comparison to Digital Multimeter Fluke 289, Fluke 80K-40 High Voltage Probe
Oxidation Reduction Potential (ORP) Meter without Electrode[1]	(-1 999 to 1 999) mV	0.9 mV	Comparison to Document Process Calibrator
Solar Power Meter (Electrical Input)	(0 to 100) mV (4 to 20) mA	0.02 mV 0.01 mA	Comparison to Document Process Calibrator

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Caliper (External/Internal/Depth) [1]	Up to 300 mm (> 300 to 500) mm (> 500 to 600) mm (> 600 to 1 000) mm	18 µm 25 µm 36 µm 42 µm	Comparison to Gauge Block Set (Steel) per JIS B 7507
Height Gauge Dial and Digital[1]	Up to 200 mm (> 200 to 300) mm (> 300 to 600) mm (> 600 to 1 000) mm	16 µm 18 µm 36 µm 42 µm	Comparison to Gauge Block Set (Steel) per JIS B 7517

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Outside /Inside Micrometer[1]	(0 to 25) mm (> 25 to 50) mm (> 50 to 75) mm (> 75 to 100) mm (> 100 to 125) mm (> 125 to 150) mm (> 150 to 175) mm (> 175 to 200) mm (> 200 to 225) mm (> 225 to 250) mm (> 250 to 275) mm (> 275 to 300) mm (> 300 to 325) mm (> 325 to 350) mm (> 350 to 375) mm (> 375 to 400) mm (> 400 to 425) mm (> 425 to 450) mm (> 450 to 475) mm (> 475 to 500) mm	1 µm 1.6 µm 2.3 µm 3 µm 6.8 µm 7.2 µm 7.6 µm 8 µm 8.5 µm 9 µm 9.6 µm 11 µm 11 µm 12 µm 12 µm 13 µm 13 µm 14 µm 15 µm 16 µm	Comparison to Gauge Block Set (Steel) per JIS B 7502
Dial and Digital Thickness Gauge[1]	Up to 25 mm (> 25 to 50) mm (> 50 to 75) mm (> 75 to 100) mm	1.5 µm 1.9 µm 2.5 µm 3 µm	Comparison to Gauge Block Set
Dial and Digital Depth Gauge[1]	Up to 300 mm (> 300 to 450) mm (> 450 to 600) mm	16 µm 18 µm 21 µm	Comparison to Gauge Block Set per JIS B 7518
Coating Thickness Gauge[1]	50 µm 100 µm 250 µm 500 µm 1 000 µm 1 793 µm 2 726 µm 3 893 µm 4 694 µm	0.5 µm 0.5 µm 0.8 µm 0.8 µm 0.8 µm 2.9 µm 3.5 µm 5.6 µm 5.2 µm	Comparison to Master Calibration Foil
Caliper Gauge (External/Internal) [1]	Up to 10 mm (> 10 to 20) mm (> 20 to 50) mm (> 50 to 100) mm	3 µm 3.2 µm 6.1 µm 12 µm	Comparison to Gauge Block Set

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Ultrasonic Thickness Gauge[1]	Up to 50 mm (50 to 100) mm (100 to 200) mm (200 to 300) mm	0.006 mm 0.007 mm 0.008 mm 0.01 mm	Comparison to Gauge Block Set
Cylinder Gauge/ Bore Gauge	Up to 1.5 mm	3.5 µm	Comparison to Calibration Tester per JIS-B 7515
Dial Test Indicator[1]	Up to 1.5 mm	3.5 µm	Comparison to Calibration Tester per JIS-B 7533
Dial Gauge & Digital Indicator[1]	Up to 25 mm	4 µm	Comparison to Calibration Tester per JIS-B 7503
Metallic Measuring Tapes	(0 to 1 000) mm (> 1 000 to 2 000) mm (> 2 000 to 3 000) mm (> 3000 to 5 000) mm (> 5 000 to 10 000) mm (> 10 000 to 20 000) mm (> 20 000 to 30 000) mm (> 30 000 to 40 000) mm (> 40 000 to 50 000) mm	0.014 mm + 0.016 mm/m 0.055 mm 0.081 mm 0.14 mm 0.27 mm 0.54 mm 0.8 mm 1.1 mm 1.4 mm	Comparison with tape and scale measuring machine
Rulers	(0 to 100) mm (> 100 to 200) mm (> 200 to 300) mm (> 300 to 400) mm (> 400 to 500) mm (> 500 to 600) mm (> 600 to 700) mm (> 700 to 800) mm (> 800 to 900) mm (> 900 to 1 000) mm (> 1 000 to 1 500) mm (> 1 500 to 2 000) mm	0.003 mm 0.007 mm 0.01 mm 0.013 mm 0.016 mm 0.019 mm 0.022 mm 0.024 mm 0.028 mm 0.03 mm 0.043 mm 0.055 mm	Comparison with tape and scale measuring machine
Steel Ball	Up to 10 mm	3 µm	Standard Micrometer

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Holtest[1]	8 mm 12 mm 16 mm 20 mm 30 mm 50 mm 100 mm	1.8 µm 1.8 µm 1.8 µm 1.8 µm 2.3 µm 2.3 µm 4.8 µm	Comparison to Ring Gauges

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Scales, Balances (0.000 1 g Resolution)	(10 to 20) mg (> 20 to 50) mg (> 0.05 to 5) g (> 5 to 20) g (> 20 to 100) g	0.13 mg 0.16 mg 0.17 mg 0.27 mg 0.37 mg	Comparison to OIML Class F1, M1 weights using internal calibration procedure
Scales, Balances (0.000 1 g Resolution) [1]	(> 100 to 200) g (> 200 to 300) g	0.64 mg 1.2 mg	
Scales, Balances (0.001 g Resolution) [1]	(> 300 to 500) g (> 500 g to 1000) g (> 1000 to 2000) g	1.8 mg 3.3 mg 12 mg	
Scales, Balances (0.01 g Resolution) [1]	(> 2000 to 5000) g	23 mg	
Scales, Balances (0.001 kg Resolution) [1]	(> 5 to 10) kg (> 10 to 20) kg	88 mg 0.14 g	
Scales, Balances (0.01 kg Resolution) [1]	(> 20 to 30) kg (> 30 to 60) kg (> 60 to 100) kg (> 100 to 150) kg (> 150 to 200) kg	8.2 g 8.2 g 8.3 g 8.3 g 17 g	
Scales, Balances (0.02 kg Resolution) [1]	(> 200 to 300) kg	20 g	
Scales, Balances (0.05 kg Resolution) [1]	(> 300 to 400) kg (> 400 to 600) kg	41 g 42 g	
Scales, Balances (0.1 kg Resolution) [1]	(> 600 to 1 000) kg	83 g	

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Mass Determination[1]	50 mg 100 mg 200 mg 500 mg 1 g 2 g 5 g 10 g 20 g 50 g 100 g 200 g 500 g 1 kg 2 kg 5 kg 10 kg 20 kg	85 µg 89 µg 89 µg 99 µg 96 µg 0.11 mg 0.12 mg 0.13 mg 0.16 mg 0.22 mg 0.34 mg 0.68 mg 2.6 mg 3.7 mg 12 mg 21 mg 89 mg 0.11 g	Comparison to OIML Class F1, and M1 weights, Electronic Balance using internal procedure based on OIML R111-1
[1] Moisture Analyzer/Balance Mass [1]	Up to 20 g (20 to 70) g (70 to 110) g	0.6 mg 0.65 mg 0.72 mg	Comparison to OIML Class F1 weights using internal calibration procedure
Force - Push-Pull Gauge, Force Gauge, Tension Gauge, Tensile Gauge[1]	Up to 29.4) N (> 29.4 to 98) N (> 98 to 196) N (> 196 to 294) N (> 294 to 392) N (> 392 to 490) N	0.058 N 0.3 N 0.6 N 0.6 N 0.6 N 0.6 N	Comparison to OIML Class F1, and M1 weights
Pressure Gauge (Pneumatic & Hydraulic) – Gauge Pressure Digital Pressure Gauge, Vacuum Gauge, Pressure Transducer, Manometer, Pressure Switch[1]	(-90 to 0) kPa (> 0 to 34) kPa (> 34 to 70) kPa (> 70 to 200) kPa (> 200 to 690) kPa (> 0.69 to 6.9) MPa (> 6.9 to 68) MPa	0.1 kPa 0.03 kPa 0.13 kPa 0.24 kPa 0.4 kPa 4 kPa 41 kPa	Comparison to Pressure Calibrator

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Pressure Transmitter[1]	(-90 to 0) kPa (> 0 to 70) kPa (> 70 to 200) kPa (> 200 to 690) kPa (> 0.69 to 6.9) MPa (> 6.9 to 68) MPa	0.12 kPa 0.17 kPa 0.23 kPa 1.5 kPa 6.3 kPa 61 kPa	Comparison to Pressure Calibrator and Electrical Process Calibrator
Volume Flow Meter (Water flow) [1]	(Up to 8.33) l/s (> 8.33 to 16.67) l/s (> 16.67 to 30.56) l/s	0.73 % of reading 0.4 % of reading 0.4 % of reading	Comparison to Ultrasonic flow meter Water flow in ambient conditions
Air Velocity - Anemometer	(2.5 to 5) m/s (> 5 to 7.5) m/s (> 7.5 to 10) m/s (> 10 to 15) m/s (> 15 to 20) m/s	0.15 m/s 0.2 m/s 0.26 m/s 0.38 m/s 0.5 m/s	Comparison to Standard Anemometer
Glass Volumetric Apparatus – Glass Volumetric flask, Cylinder, Beaker[1]	5 ml 10 ml 25 ml 50 ml 100 ml 200 ml 250 ml 500 ml 1 000 ml 2 000 ml	0.003 ml 0.005 9 ml 0.015 ml 0.03 ml 0.058 ml 0.07 ml 0.088 ml 0.1 ml 0.19 ml 0.37 ml	Internal procedure CPM-04-14 based on ASTM E542-01:2012 using Electronic Balance, OIML Class F1 weights
Glass Volumetric Apparatus – Glass Measuring Pipettes, Graduated Pipette, Volumetric Pipette [1]	(0.5 to 5) ml 10 ml 25 ml 50 ml 100 ml	0.003 1 ml 0.006 ml 0.015 ml 0.03 ml 0.06 ml	Internal procedure CPM-04-12 based on ASTM E542-01:2012 using Electronic Balance, OIML Class F1 weights
Piston Operated Pipette, Micro Pipette, Auto Pipette[1]	(100 to 200) µl (> 200 to 500) µl (> 500 to 1 000) µl (> 1 to 2) ml (> 2 to 5) ml (> 5 to 10) ml	0.25 µl 0.27 µl 0.31 µl 0.42 µl 1.1 µl 1.8 µl	Internal Procedure CPM-04-19 based on ISO 8655-6:2022 using Analytical Balance

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Burettes[1]	5 ml 10 ml 25 ml 50 ml 100 ml	0.003 1 ml 0.006 ml 0.015 ml 0.029 ml 0.058 ml	Internal Procedure CPM-04-12 based on ASTM E542-01 using Electronic Balance, OIML Class F1 weights
Viscosity Meter[1] - Dynamic Viscosity (20 to 60) °C	(Nominal): 390 mPa·s (cP) 640 mPa·s (cP) 1 100 mPa·s (cP) 2 100 mPa·s (cP) 4 000 mPa·s (cP) 16 000 mPa·s (cP) 25 000 mPa·s (cP)	 3.4 mPa·s 7 mPa·s 13 mPa·s 29 mPa·s 64 mPa·s 220 mPa·s 520 mPa·s	Comparison to Viscosity Certified Reference Standard
Hand Torque Tool, Torque Wrench, Electronic Torque	Up to 20 N·m (> 20 to 200) N·m (> 200 to 500) N·m	1.2% of Reading 1.2% of Reading 1.2% of Reading	Torque Transducer
Hardness Durometer (Spring Force Only)	Types A, B, E, O Up to 10 N Types C, D, DO Up to 50 N	 0.012 N 0.058 N	Partial Verification using Force Transducer

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature Controlled Chambers - Hot Air Oven, Incubator, Refrigerator, Freezer[1]	(-40 to 0) °C (> 0 to 10) °C (> 10 to 70) °C (> 70 to 200) °C (> 200 to 400) °C	0.25 °C 0.3 °C 0.36 °C 0.7 °C 0.94 °C	Comparison to Agilent 34970A Data Logger with RTD Sensors
Temperature Controlled Enclosures - Hot Air Oven and Furnaces[1]	(> 200 to 400) °C (> 400 to 550) °C (> 550 to 700) °C (> 700 to 1 000) °C	0.94 °C 0.8 °C 2.9 °C 2.9 °C	Comparison to Agilent 34970A Data Logger with Thermocouple sensors
Temperature Controlled Chambers - Autoclave[1]	(105 to 135) °C	0.4 °C	Comparison to Agilent 34970A Data Logger with RTD Sensors

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Liquid Baths, Micro Baths[1]	(-40 to 0) °C (> 0 to 100) °C (> 100 to 200) °C	0.25 °C 0.3 °C 0.3 °C	Comparison to Agilent 34970A Data Logger with RTD Sensors
Analog & Dial Thermometers[1]	(-30 to 0) °C (> 0 to 200) °C (> 200 to 400) °C	0.14 °C 0.15 °C 0.15 °C	Comparison to PRT Standard with Digital Readout
Thermocouple Sensors[1] Types K, J, E, T, N, R, S	(-30 to 200) °C (> 200 to 400) °C (> 400 to 650) °C	0.47 °C 0.47 °C 2 °C	Comparison to PRT Standard with Digital Readout
Temperature Indicator with Thermocouple[1] Types K, J, E, T, N, R, S	(-30 to 0) °C (> 0 to 200) °C (> 200 to 400) °C	0.22 °C 0.22 °C 0.23 °C	Comparison to PRT Standard with Digital Readout
Temperature Indicator with Thermocouple[1] Types K, J, E, T, N, R, S	(> 400 to 550) °C (> 550 to 650) °C	2.0 °C 2.0 °C	Comparison to Thermocouple Standard with Digital Readout
Temperature Indicator with Thermocouple[1] Types R, S	(0 to 200) °C (> 200 to 400) °C	0.18 °C 0.28 °C	Comparison to PRT Standard with Digital Readout
Temperature Indicator with Thermocouple[1] Types R, S	(> 400 to 550) °C (> 550 to 650) °C	2.0 °C 2.0 °C	Comparison to Thermocouple Standard with Digital Readout
Temperature Indicators with RTD or Thermistor Sensor[1]	(-30 to 0) °C (> 0 to 100) °C (> 100 to 150) °C (> 150 to 200) °C (> 200 to 400) °C (> 400 to 650) °C	0.13 °C 0.13 °C 0.2 °C 0.24 °C 0.25 °C 2.0 °C	Comparison to PRT, Thermocouple Standard with Digital Readout
RTD Sensors[1]	(-30 to 0) °C (> 0 to 200) °C (> 200 to 400) °C (> 400 to 600) °C	0.2 °C 0.24 °C 0.34 °C 2.0 °C	Comparison to TC/PRT Standard with Digital Readout, Agilent 34410A 6.5 Digit Multimeter
Liquid in Glass Thermometers[1]	(-30 to 0) °C (> 0 to 200) °C	0.1 °C 0.15 °C	Comparison to PRT Standard, Digital Readout

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Dry Blocks, Dry Wells[1]	(-40 to 0) °C (> 0 to 400) °C (> 400 to 550) °C (> 550 to 650) °C	0.35 °C 0.36 °C 1.9 °C 1.9 °C	Comparison to PRT Standard with digital Readout
Temperature - Thermo Hygrometer[1]	(-20 to 0) °C (> 0 to 50) °C (> 50 to 100) °C	0.16 °C 0.17 °C 0.17 °C	Comparison to PRT Standard with Digital Readout / Data Logger
Humidity - Thermo Hygrometers[1]	(20 to 40) %RH (> 40 to 60) %RH (> 60 to 90) %RH	1.6 %RH 1.7 %RH 1.8 %RH	Comparison to Humidity Data Logger with sensor
Humidity Controlled Chambers	(20 to 40) %RH (> 40 to 60) %RH (> 60 to 90) %RH	1.6 %RH 1.7 %RH 1.8 %RH	Comparison to Humidity Meter, (Relative humidity in an empty working-volume at a single spot)
Infrared Thermometers[1]	(-15 to 0) °C (>0 to 25) °C (>25 to 50) °C (>50 to 100) °C (>100 to 200) °C (>200 to 300) °C (>300 to 400) °C (>400 to 500) °C	0.9°C 1.1 °C 1.2 °C 1.5 °C 2.3 °C 3.1 °C 3.9 °C 4.9 °C	Comparison to Blackbody Source, Digital Thermometer ε= 0.95, λ = (8 to 14) µm
Moisture Analyzer Temperature[1]	(100 to 200) °C	0.34 °C	Comparison to Digital Thermometer

Photometry and Radiometry

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Illuminance / Lux Meter[1]	(25 to 5 000) lux	4.4 % of reading	Comparison to Standard Lux Meter

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Source[1]	50 Hz 60 Hz 400 Hz	0.058 Hz 0.07 Hz 0.47 Hz	Comparison to Multiproduct Calibrator
Frequency – Source[1]	Up to 5 Hz (5 to 50) Hz (> 50 to 500) Hz (> 0.5 to 10) kHz (> 10 to 50) kHz	0.014 Hz 0.026 Hz 0.12 Hz 0.003 1 kHz 0.005 9 kHz	Comparison to Fluke 744 Process Calibrator
Frequency – Measure[1]	Up to 10 Hz (> 10 to 500) Hz (> 0.5 to 10) kHz (> 10 to 50) kHz	0.061 Hz 0.61 Hz 0.006 1 kHz 0.061 kHz	Comparison to Fluke 744 Process Calibrator
Digital Tachometer[1] (Photo-type)	(5 to 9 000) rpm (> 9 000 to 99 000) rpm	0.058 rpm 0.58 rpm	Comparison to Agilent 33120A Function Generator
Centrifuge Rotational Speed[1]	(5 to 100) rpm (>100 to 500) rpm (>500 to 900) rpm (>900 to 1000) rpm (>1 000 to 2 000) rpm (>2 000 to 3 000) rpm (>3 000 to 5 000) rpm (>5 000 to 9 000) rpm (>9 000 to 10 000) rpm (>10 000 to 12 000) rpm (>12 000 to 15 000) rpm (>15 000 to 20 000) rpm	0.23 rpm 0.43 rpm 0.66 rpm 0.71 rpm 1.3 rpm 1.9 rpm 3.1 rpm 5.4 rpm 7.1 rpm 8.3 rpm 10 rpm 13 rpm	Comparison to Digital Tachometer
Time Interval[1]	Up to 60 min	0.3 s	Comparison to Digital Stopwatch
Frequency Accuracy-Oscillator-Stopwatch, Timers	32 Hz 32.768 kHz	0.01 mHz 6.4 mHz	Comparison to Agilent 53132A Universal Counter

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

Notes:

1. On-site calibration service is available for this parameter, since on-site conditions are typically more variable than those in the laboratory, larger measurement uncertainties are expected on-site than what is reported on the accredited scope.

Jason Stine, Vice President

1899 L Street NW, Suite 1100-A, Washington, DC 20036
414-501-5494
www.anab.org