CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

Miracle International Technology Company Limited
214 Bangwaek Rd., Bangphai, Bangkae
Bangkok, 10160 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: 06 September 2027

Certificate Number: AC-3237

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

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CALIBRATION

ISO/IEC 17025 Accreditation Granted: **03 September 2025**

Certificate Number: **AC-3237** Certificate Expiry Date: **06 September 2027**

Acoustics and Vibration

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Vibration Meters			
Acceleration @ 160 Hz	Up to10 m/s² (>10 to 20) m/s² (>20 to 30) m/s²	0.36 m/s² 0.7 m/s² 1 m/s²	Comparison to Vibration Calibrator 91 00D
Velocity @ 160 Hz	Up to10 mm/s (>10 to 20) mm/s (>20 to 30) mm/s	0.36 mm/s 0.7 mm/s 1 mm/s	
Displacement @ 150 Hz	Up to 5 µm (>5 to 10) µm (>10 to 30) µm	0.6 µm 0.67 µm 1.2 µm	
[1] Sound Level	94 dB 114 dB	0.48 dB 0.48 dB	Comparison to Standard Sound Level Calibrator

Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1,2] Conductivity	147 µS/cm 1 413 µS/cm 12 880 µS/cm	0.91 µS/cm 8.3 µS/cm 0.08 mS/cm	Comparison to Standard Solutions using a certified reference material (CRM)

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Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1,2] pH meter	4.01 pH 7.01 pH 10.01 pH	0.007 2 pH 0.007 2 pH 0.006 1 pH	Comparison to Standard Solutions using a certified reference material (CRM)
[1] Gas Dividers	Oxygen in Nitrogen 1 cmol/mol 18 cmol/mol 21 cmol/mol	 0.022 cmol/mol 0.19 cmol/mol 0.22 cmol/mol	Comparison to Standard Gas using a certified reference material (CRM)
Hydrometer	(0.625 to 2.000 0) g/cm^3	0.000 3 g/cm^3	Indirect Verification using Standard Electronic Balance and Tridecane in a Volumetric Flask
[1] Dissolved Oxygen Meter	(6 to 13) mg/l	0.03 mg/l	Zero Oxygen Solution and comparison with DO Reference Value
[1] Refractometer Brix	5 % Brix 10% Brix 20% Brix 30% Brix 40% Brix 50% Brix 60% Brix	0.021% Brix 0.021% Brix 0.051% Brix 0.061% Brix 0.071% Brix 0.091% Brix 0.091% Brix	Direct Measurement to Standard Solutions
[1] Refractometer Refractive Index	1.340 26 nD 1.347 82 nD 1.363 84 nD 1.381 15 nD 1.399 86 nD 1.420 09 nD 1.441 93 nD	0.000 091 nD 0.000 091 nD 0.000 091 nD 0.000 091 nD 0.000 1 nD 0.000 1 nD 0.000 1 nD	Direct Measurement to Standard Solutions

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] pH meter Electrical Simulation	414.12 mV 177.48 mV 0 mV -177.48 mV -414.12 mV	0.16 mV 0.11 mV 0.06 mV 0.11 mV 0.16 mV	Millivolt Simulation using Voltage Calibrator

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Thermocouple-Temperature Calibrator Measure/Source	Type J (-210 to 1 200) °C Type K (-200 to 1 372) °C Type T (-250 to 400) °C Type E (-250 to 1 000) °C Type N (-200 to 1 300) °C Type R, S (0 to 1 767) °C Type B (600 to 1 820) °C	0.14 °C 0.15 °C 0.14 °C 0.14 °C 0.17 °C 0.27 °C 0.25 °C	Millivolt Simulation using Multi-Product Calibrators
[1] RTD Temperature Calibrator Measure	Pt 100 (Pt395, Pt385) (-200 to 600) °C	0.024 °C	Resistance Simulation using Digital Multimeter
[1] Temperature Indicator/ Controller/Transmitter RTD Control Valve (0 to 1 00) %	(-200 to 800) °C Up to 20 mA Up to 10 V	0.04 °C 0.019 % of reading 0.021 % of reading	Resistance Simulation using Multi-Product Calibrators
[1] Source-DC Voltage	(0 to 330) mV (0.33 to 3.3) V (3.3 to 33) V (33 to 330) V (330 to 1 000) V	16 µV/V + 1.9 µV 8.7 µV/V + 7.9 µV 9.4 µV/V + 78 µV 15 µV/V + 0.78 mV 15 µV/V + 1.5 mV	Comparison to High Performance Multi-Product Calibrators
[1] Source-AC Voltage @ (45 Hz to 1 kHz)	(1.0 to 33) mV (33 to 330) mV (0.33 to 3.3) V (3.3 to 33) V (33 to 330) V (330 to 1 000) V	0.12 mV/V + 4.8 µV 0.12 mV/V + 16 µV 0.12 mV/V + 0.12 mV 0.12 mV/V + 0.9 mV 0.15 mV/V + 7.8 mV 0.24 mV/V + 12 mV	Comparison to High Performance Multi-Product Calibrators
[1] Source-DC Current	(0 to 330) µA (0.33 to 3.3) mA (3.3 to 33) mA (33 to 330) mA (330 to 1.1) A (1.1 to 3) A (3 to 1) A (1 to 20) A	0.12 mA/A+ 1 8 nA 78 µA/A + 40 nA 78 µA/A + 0.21 µA 78 µA/A + 2.1 µA 0.16 mA/A + 32 µA 0.3 mA/A + 37 µA 0.39 mA/A + 0.41 mA 0.78 mA/A + 0.6 mA	Comparison to High Performance Multi-Product Calibrators

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Source-AC current @ (45 Hz to 1 kHz)	(29 to 330) µA (0.33 to 3.3) mA (3.3 to 33) mA (33 to 333) mA (0.33 to 1.1) A (1.1 to 3) A (3 to 11) A (11 to 20) A	0.97 mA/A + 80 nA 0.78 mA/A + 0.13 µA 0.32 mA/A + 1.6 µA 0.32 mA/A + 1 6 µA 0.39 mA/A + 97 µA 0.47 mA/A + 97 µA 0.47 mA/A + 1.6 mA 1.2 mA/A + 4.1 mA	Comparison to High Performance Multi-Product Calibrators
[1] Source-DC Resistance	(0 to 11) Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω 330 Ω to 1.1 kΩ (1.1 to 3.3) kΩ (3.3 to 11) kΩ (1 1 to 33) kΩ (33 to 110) kΩ (110 to 330) kΩ 330 kΩ to 1.1 MΩ (1.1 to 3.3) MΩ (3.3 to 11) MΩ (11 to 33) MΩ	32 µΩ/Ω + 0.8 mΩ 24 µΩ/Ω + 1.3 mΩ 22 µΩ/Ω + 1.4 mΩ 22 µΩ/Ω + 1.8 mΩ 22 µΩ/Ω + 6 mΩ 22 µΩ/Ω + 1 8 mΩ 22 µΩ/Ω + 60 mΩ 22 µΩ/Ω + 0.19 Ω 25 µΩ/Ω + 0.63 Ω 25 µΩ/Ω + 1.9 Ω 25 µΩ/Ω + 6.2 Ω 47 µΩ/Ω + 27 Ω 0.1 mΩ/Ω + 71 Ω 0.2 mΩ/Ω + 3 kΩ	Comparison to High Performance Multi-Product Calibrators
[1] Source-DC Resistance	(33 to 110) MΩ (110 to 330) MΩ (330 to 1 100) MΩ	0.39 mΩ/Ω + 3 kΩ 2.4 mΩ/Ω + 80 kΩ 12 mΩ/Ω + 0.4 MΩ	Comparison to High Performance Multi-Product Calibrators
[1] Source-Capacitance	(0.19 to 0.4) nF 10 Hz to 10 kHz (0.4 to 1.1) nF 10 Hz to 10 kHz (1.1 to 3.3) nF 10 Hz to 3 kHz (3.3 to 11) nF 10 Hz to 1 kHz (11 to 33) nF 10 Hz to 1 kHz (33 to 110) nF 10 Hz to 1 kHz (110 to 330) nF 10 Hz to 1 kHz	0.39 % of reading + 8 pF 0.39 % of reading + 11 pF 0.39 % of reading + 8 pF 0.2 % of reading + 12 pF 0.2 % of reading + 83 pF 0.2 % of reading + 0.12 nF 0.2 % of reading + 0.66 nF	Comparison to High Performance Multi-Product Calibrators

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Source-Capacitance	(0.33 to 1.1) µF (10 to 600) Hz (1.1 to 3.3) µF (10 to 300) Hz (3.3 to 11) µF (10 to 150) Hz (1 1 to 33) µF (10 to 120) Hz (33 to 110) µF (10 to 80) Hz (110 to 330) µF Up to 50 Hz (0.330 to 1.1) mF Up to 20 Hz (1.1 to 3.3) mF Up to 6 Hz (3.3 to 11) mF Up to 2 Hz (11 to 33) mF Up to 0.6 Hz (33 to 110) mF Up to 0.2 Hz	0.2 % of reading + 1.1 nF 0.2 % of reading + 6.6 nF 0.2 % of reading + 11 nF 0.32 % of reading + 26nF 0.35 % of reading + 80 nF 0.35 % of reading + 0.63 µF 0.35 % of reading +0.97 µF 0.35 % of reading + 2.4 µF 0.35 % of reading + 7.8 µF 0.59 % of reading + 24 µF 0.86 % of reading + 78 µF	Comparison to High Performance Multi-Product Calibrators
[1] Source-DC Current Clamp Meter (All types of clamps)	(0 to 3.3) mA (3.3 to 33) mA (33 to 330) mA 330 mA to 1.1 A (1.1 to 3) A (3 to 11) A (11 to 20) A	79 µA/A + 14 µA 79 µA/A + 14 µA 78 µA/A + 0.13 mA 0.16 mA /A + 1.4 mA 0.4 mA/A + 1.4 mA 0.4 mA/A + 14 mA 0.78 mA/A + 14 mA	Comparison to High Performance Multi-Product Calibrators
[1] Source-AC Current Clamp Meter (All types of clamps)	45 Hz to 1 kHz (>29 to 330) µA (0.33 to 3.3) mA (3.3 to 33) mA (33 to 330) mA 330 mA to 1.1 A (1.1 to 3) A (3 to 11) A (11 to 20) A	1.2 mA/A + 0.1 µA 1 mA/A + 0.6 µA 0.7 mA/A + 6 µA 0.7 mA/A + 0.1 µA 1.4 mA/A + 0.6 mA 1.4 mA/A + 0.6 mA 0.8 mA/A + 6 mA 1.2 mA/A + 7 mA	Comparison to High Performance Multi-Product Calibrators

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Source-DC Current Clamp Meter (Other type of clamps)	(10 to 16.5) A (16.5 to 150) A (150 to 1 000) A	5.8 mA/A + 28 mA 5.8 mA/A + 0.23A 5.8 mA/A + 1.7 A	Comparison to High Performance Multi-Product Calibrators and 50 Turn Coil
[1] Source-DC Current Clamp Meter (Toroidal-type clamps)	(10 to 6.5) A (16.5 to 150) A (150 to 1 000) A	2.9 mA/A + 15 mA 2.9 mA/A + 0.17 A 3 mA/A + 1.6 A	Comparison to High Performance Multi-Product Calibrators and 50 Turn Coil
[1] Source-AC Current Clamp Meter (Toroidal-type clamps)	(45 Hz to 65 Hz) (10 to 16.5) A (16.5 to 150) A (150 to 1 000) A	 3.3 mA/A + 0.06 A 3.3 mA/A + 0.07 A 3.4 mA/A + 0.8 A	Comparison to High Performance Multi-Product Calibrators and 50 Turn Coil
[1] Source-AC Current Clamp Meter (Other type of clamps)	(45 Hz to 65 Hz) (10 to 16.5) A (16.5 to 150) A (150 to 1 000) A	 6.6 mA/A + 0.09 A 6.6 mA/A + 0.3 A 6.6 mA/A + 1.3 A	Comparison to High Performance Multi-Product Calibrators and 50 Turn Coil
[1] Source -AC Current Clamp Meter (Toroidal-type clamps)	(65 Hz to 440 Hz) (10 to 16.5) A (16.5 to 150) A (150 to 1 000) A	 9.3 mA/A + 77 mA 9.5 mA/A + 83 mA 12 mA/A + 0.8 A	Comparison to High Performance Multi-Product Calibrators and 50 Turn Coil
[1] Source -AC Current Clamp Meter (Other type of clamps)	(65 Hz to 440 Hz) (10 to 1 6.5) A (16.5 to 1 50) A (150 to 1 000) A	 12 mA/A + 84 mA 12 mA/A + 0.3 A 14 mA/A + 1.3 A	Comparison to High Performance Multi-Product Calibrators and 50 Turn Coil
[1] Source-AC Power Measuring Instrument Single Phase (45 Hz to 65 Hz) (330 mV to 1 020 V) PF = 1	(0.001 1 to 9.18) W (3.3 to 8.999) mA (0.003 to 33.6) W (9 to 32.999) mA (0.01 1 to 91.7) W (33 to 89.99) mA (0.03 to 336.5) W (90 to 329.99) mA (0.11 to 917.8) W (0.33 to 0.899 9) A	0.14 % of reading + 1.9 mW 0.09 % of reading + 19 mW 0.14 % of reading + 19 mW 0.09 % of reading + 0.19 W 0.13 % of reading + 0.19 W	Comparison to High Performance Multi-Product Calibrators
[1] Source-AC Power Measuring Instrument Single Phase (45 Hz to 65 Hz) (330 mV to 1 020 V) PF = 1	(0.3 to 2 243.8) W (0.9 to 2.199 9) A (0.8 to 4 589.8) W (2.2 to 4.499 9) A (1.5 to 20 910) W (4.5 to 20.5) A	0.1 % of reading + 1.6 W 0.14 % of reading + 1.9 W 0.12 % of reading + 1.9 W	Comparison to High Performance Multi-Product Calibrators

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Measure-DC Voltage	(0 to 200) mV >200 mV to 2 V (>2 to 20) V (>20 to 200) V (>200 to 1 000) V	22 µV/V + 0.002 8 mV 12 µV/V + 0.007 5 mV 14 µV /V + 0.28 mV 0.026 mV/V + 0.96 mV 0.026 mV/V + 5.9 mV	Comparison to 8 1⁄2 Digital Multimeter
[1] Measure-AC Voltage @ (50 to 100) Hz	(0 to 0.2) V (>0.2 to 2) V (>2 to 20) V (>20 to 200) V (>200 to 750) V	0.041 % of reading + 68 µV 0.029 % of reading + 0.36 mV 0.041 % of reading + 6.8 mV 0.035 % of reading + 68 mV 0.058 % of reading + 0.15 V	Comparison to 8 1⁄2 Digital Multimeter
[1] Measure-DC Current	Up to 25 mA >25 mA to 0.21 A (>0.21 to 2.1) A	1.3 µA 0.18 mA 1.8 mA	Comparison to 8 1⁄2 Digital Multimeter
[1] Measure-AC Current @ (50 to 100) Hz	(0 to 200) µA >200 µA to 2 mA (>2 mA to 20) mA (>20 mA to 200) mA >200 mA to 2 A	12 µA/A +0.005 8 µA 15 µA/A +0.079 µA 35 µA/A +47 µA 0.35 mA/A +46 µA 4.7 mA/A +58 µA	Comparison to 8 1⁄2 Digital Multimeter
[1] Measure-Resistance	Up to 10 Ω (>10 to 100) Ω >100 Ω to 1 kΩ (>1 to 10) kΩ (>10 to 100) kΩ >100 kΩ to 1 MΩ (>1 to 10) MΩ (>10 to 100) MΩ >100 MΩ to 1 GΩ	20 µΩ/Ω + 0.15 m Ω 20 µΩ/Ω + 0.93 m Ω 10 µΩ/Ω + 1.3 m Ω 10 µΩ/Ω + 0.06 Ω 0.041 mΩ/Ω + 0.24 Ω 0.076 mΩ/Ω + 0.12 kΩ 0.29 mΩ/Ω + 0.13 kΩ 0.64 mΩ/Ω + 0.7 kΩ 2.4 mΩ/Ω + 0.061 MΩ	Comparison to 8 1⁄2 Digital Multimeter
[1] DC High Voltage Source	500 V to 1 kV (>1 to 10) kV	0.59 % of reading 0.59 % of reading	Comparison to Standard True RMS Multimeter With High Voltage Probe
[1] AC High Voltage Source	@ 50 Hz 500 V to 1 kV (>1 to 10) kV	0.66 % of reading 0.6 % of reading	
[1] Insulation Tester (Test Voltage 50 V, 100 V, 125 V, 250 V, 500 V, 1000 V, 2.5 kV, 5 kV)	100 MΩ 200 MΩ 300 MΩ 400 MΩ 500 MΩ 1 GΩ 2 GΩ	0.75 MΩ 1.4 MΩ 1.8 MΩ 2.1 MΩ 2.4 MΩ 0.01 GΩ 0.1 GΩ	Comparison to Standard High Voltage Resistors

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Earth Tester/Earth Clamp	Up to 10 Ω (>10 to 100) Ω (>100 to 1 000) Ω (>1 000 to 3 000) Ω	19 mΩ 60 mΩ 0.6 Ω 1.5 Ω	Comparison to Standard Decade Resistance
[1] Pyranometer & Solar Meter	Irradiance @ (300 to 1 000) W/m^2 Sensitivity (4 to 200) µV/W/m^2	 2 % of reading	Comparison to Standard Pyranometer & Solar Tester
[1] Measure- Three-Phase Power Meter (ACV, AC A, AC Power, AC Energy) PF= 0.5 to 1.0 @ 50 Hz	AC Voltage Up to 400 V AC Current Up to 20 A AC Power, Up to 4.5 kW AC Energy 0.010 89 Wh to 200 kWh	 0.48 V 0.009 2 A 6.9 W 0.15 % of Reading	Comparison to Standard Three Phase KWH Meter Calibrator
[1] Measure-Electric Vehicle Supply Equipment (DC/AC V, DC/AC A, DC/AC Power, DC/AC Energy)	DC Voltage 30 V to 1000 V DC Current 1 A to 300 A DC Power 0.03 kW to 300 kW DC Energy Up to 300 kWh (1.08 GJ) AC Voltage 50 V to 480 V AC Current 1 A o 80 A AC Power @50 Hz 0.05 kW to 38.4 kW AC Active Energy Up to 76.8 kWh (276 MJ)	 0.018 % of Reading 0.02 % of Reading 0.023 % of Reading 0.06 % of Reading 0.025 % of Reading 0.023 % of Reading 0.028 % of Reading 0.06 % of Reading	Comparison to Standard Portable Tester for EV DC/AC Charging Station
[1] Magnet Bar	(10 to 100) G (100 to 500) G (500 to 5 000) G (5 000 to 15 000) G	0.6 G 1.2 G 1.2 G 10 G	Comparison to Standard Gauss –Tesla Meter

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Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Vernier, Dial, Digital Caliper	(0 to 100) mm (>100 to 150) mm (>150 to 200) mm (>200 to 300) mm	6.4 µm 7.1 µm 8.9 µm 10 µm	Comparison to Standard Gauge Block & Caliper Checker
[1] Micrometer	(0 to 25) mm (> 25 to 50) mm (> 50 to 75) mm (> 75 to 100) mm	0.9 µm 1.3 µm 1.5 µm 1.8 µm	Comparison to Standard Gauge Block
[1] Thickness Gauge / Ultrasonic Thickness Gauge	(0 to13) mm (13 to 100) mm	0.5 µm 2.8 µm	Comparison to Standard Gauge Block
[1] Level Gauge / Level Transmitter	(0 to 1) m (>1 to 5) m (>5 to 10) m (>10 to 15) m (>15 to 20) m (>20 to 30) m	0.000 85 m 0.000 89 m 0.000 99 m 0.001 5 m 0.001 7 m 0.002 m	Comparison to Standard Sounding Tape
[1] Metal Detector	(0.25 to 4.5) mm (>4.5 to 8) mm	0.008 2 mm 0.009 6 mm	Comparison to Standard Metal Ball
[1] Laser Distance Meter	Up to 5 m (>5 to 10) m (>10 to 15) m (>15 to 20) m (>20 to 25) m (>25 to 30) m	0.88 mm 0.99 mm 1.2 mm 1.3 mm 1.6 mm 1.8 mm	Comparison to Standard Sounding Tape
[1] Orifice Plate Diameter	Up to 300 mm	0.024 mm	Comparison to Standard Digital Caliper
[1] Height Gauge	Up to 300 mm	7.7 µm	Comparison to Standard Gauge Block & Caliper Checker
[1] Steel Ball	Up to 25 mm	1 .7 µm	Comparison to Standard Micrometer

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Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Liquid Flow meter (Indicator, Electrical Output) Volumetric Flow	Up to 1 l (>1 to 58) l (>58 to 4 500) l	0.000 5 l + 0.046 % of reading 0.000 5 l + 0.048 % of reading 0.000 5 l + 0.048 % of reading	ISO 4185 & in-house indirect Verification to Weighing Method
Liquid Flow meter (Indicator, Electrical Output) Volumetric Flow rate	Up to 100 l/h (>100 to 3 500) l/h (>3 500 to 350 000) l/h	0.000 25 l/h + 0.048 % of reading 0.000 25 l/h + 0.048 % of reading 0.000 25 l/h + 0.05 % of reading	ISO 4185 & in-house indirect Verification to Weighing Method
Liquid Flow meter (Indicator, Electrical Output) Mass Flow	Up to 1 kg (>1 to 58) kg (>58 to 4500) kg	0.000 2 kg + 0.017 % of reading 0.000 2 kg + 0.016 % of reading 0.000 2 kg + 0.018 % of reading	ISO 4185 & in-house indirect Verification to Weighing Method
Liquid Flow meter (Indicator, Electrical Output) Mass Flow rate	Up to 100 kg/h (>100 to 3 500) kg/h (>3 500 to 350 000) kg/h	0.000 1 kg/h + 0.0055 % of reading 0.000 1 kg/h + 0.017 % of reading 0.000 1 kg/h + 0.022 % of reading	ISO 4185 & in-house indirect Verification to Weighing Method
Liquid Flow Meter (Indicator, Electrical Output) [1] Volumetric Flow Rate	Up to 5 000 l/h (>5 000 to 50 000) l/h (>50 000 to 350 000) l/h	0.000 5 l/h + 0.061 of reading 0.000 5 l/h + 0.073 of reading 0.000 5 l/h + 0.077 of reading	Comparison to Master Meter Flow meter
Liquid Flow Meter (Indicator, Electrical Output) [1] Volumetric Flow	Up to 60 000 l	0.001 l + 0.065 % of reading	Comparison to Master Meter Flow meter
Liquid Flow Meter (Indicator, Electrical Output) [1] Mass Flow Rate	Up to 5 000 kg/h (>5 000 to 50 000) kg/h (>50 000 to 350 000) kg/h	0.000 5 kg/h + 0.062 of reading 0.000 5 kg/h + 0.07 of reading 0.000 5 kg/h + 0.085 of reading	Comparison to Master Meter Flow meter
Liquid Flow Meter (Indicator, Electrical Output) [1] Mass Flow	Up to 60 000 kg	0.001 kg + 0.065 % of reading	Comparison to Master Meter Flow meter
Liquid Flow Meter (Indicator, Electrical Output) [1] Mass & Volumetric Flow	Up to 10 m/s	0.000 34 m/s + 0.17 % of reading	Comparison to Standard Ultrasonic Flow Meter
Gas Flow Meter (Indicator, Electrical Output) Volumetric Flow Rate	Up to 2 l/min (2 to 280) l/min (280 to 1 667) l/min	0.000 43 l/min + 0.43 % of reading 0.24 % of reading 0.36 % of reading	Comparison to Bell Prover Tank, Stopwatch
Gas Flow Meter (Indicator, Electrical Output) Volumetric Flow Rate	(50 to 200) ml/min	0.25 % of reading	Comparison to Piston Prover, Stopwatch

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Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Gas Flow Meter (Indicator, Electrical Output) Volumetric Flow Rate	(2 to 20) ml/min (20 to 50) ml/min (50 to 100) ml/min (100 to 150) ml/min (150 to 200) ml/min (0.20 to 0.5) l/min (0.50 to 2) l/min (2 to 4) l/min (4 to 20) l/min (20 to 50) l/min (50 to 100) l/min (100 to 250) l/m	0.69 % of reading 1.2 % of reading 1.2 % of reading 0.66 % of reading 0.66 % of reading 0.96 % of reading 0.47 % of reading 0.52 % of reading 0.41 % of reading 0.43 % of reading 0.38 % of reading 0.81 % of reading	Comparison to Mass Flow Calibrator
[1] Gas Flow Meter (Indicator, Electrical Output) Volumetric Flow Rate	(50 to 280) l/min	0.32 % of reading	Comparison to CP-24, Laminar Flow Meter
Gas Flow Meter (Indicator, Electrical Output) Volumetric Flow Rate	(2 to 10) l/min (10 to 40) l/min (40 to 160) l/min (160 to 450) l/min	0.45 % of reading 0.31 % of reading 0.33 % of reading 0.52 % of reading	Comparison to CP-157, Laminar Flow meter, Nozzle Flow Calibrator
Air Velocity Meter, Anemometer (Indicator, Electrical Output) Air Velocity Meter	Up to 5 m/s (> 5 to 10) m/s (> 10 to 15) m/s (> 15 to 20) m/s (> 20 to 30) m/s (> 30 to 40) m/s	0.07 m/s 0.068 m/s 0.13 m/s 0.14 m/s 0.18 m/s 0.26 m/s	Comparison to Standard Anemometer in wind tunnel
Air Velocity Meter, Anemometer (Indicator, Electrical Output) [1] Gas / Air Flow Meter (Digital, Electrical Output)	(1 to 25 000) Nm^3/h (1 to 30 000) kg/h	1 % of reading 1 % of reading	Comparison to Thermal Mass Flow Meter; Nm^3/h stands for Normal Cubic Meter per Hour.
[1] Pressure Measuring Instruments (Digital, Analog, Electrical Output)	(-100 to 0) kPa (>0 to 100) kPa (>0 to 400) kPa (> 0 to 2 000) kPa (> 2 000 to 7 000) kPa (> 7 000 to 70 000) kPa	0.019 kPa 0.014 kPa 0.096 kPa 0.58 kPa 4 kPa 40 kPa	Comparison to Reference Pressure Calibrator
[1] Absolute Pressure	(0 to 7 000) mbar (0 to 700) kPa	1.1 mbar (0.11 kPa)	Comparison to Reference Pressure Calibrator

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Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Barometer (Analog, Digital, Transmitter)	(740 to 1 150) mbar (74.5 to 115) kPa	0.36 mbar 0.036 kPa	Comparison to Barometric Pressure Indicator
Pressure Calibrator	(1.5 to 2 000) kPa (2 000 to 7 000) kPa (7 000 to 70 000) kPa	0.014 % of reading 0.017 % of reading 0.015 % of reading	Comparison to Standard Deadweight Tester
[1] Manometer	(>0 to 0.25) kPa (>0 to 2.5) kPa (>0 to 300) kPa (>0 to 700) kPa	0.003 6 kPa 0.02 kPa 0.05 kPa 0.096 kPa	Comparison to Pressure Calibrator
[1] Pressure Switch & Safety Valve	(> 0 to 2 000) kPa (> 2 000 to 7 000) kPa (> 7 000 to 70 000) kPa	0.58 kPa 4 kPa 2 kPa	Comparison to Pressure Calibrator
[1] Electronic Balance	(1 to 500) mg > 500 mg to 1 g (> 1 to 50) g (> 50 to 100) g (> 100 to 200) g (> 200 to 300) g (> 300 to 500) g (> 500 to 600) g (> 600 to 1 000) g (> 1 to 2) kg (> 2 to 5) kg (> 5 to 10) kg (> 10 to 30) kg (> 30 to 60) kg (> 60 to 100) kg (> 100 to 120) kg (> 120 to 150) kg (> 150 to 200) kg (> 200 to 300) kg (> 300 to 500) kg (> 500 to 600) kg (>600 to 1 000) kg (>1 000 to 2 500) kg (> 2 500 to 4 500) kg	30µg 37 µg 0.12 mg 0.23 mg 0.28 mg 0.42 mg 1.2 mg 1.5 mg 3 mg 3.4 mg 6.6 mg 28 mg 33 mg 90 mg 0.31 g 2.6 g 4.9 g 8.8 g 9.2 g 11 g 43 g 96 g 0.17 kg 0.43 kg	Comparison to Standard Weight Set

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Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Mechanical Balance	1 mg to 160 g (> 160 to 300 g > 300 g to 1 0 kg (> 10 to 80) kg (> 80 to 300) kg (> 300 to 600) kg (>600 to 2 500) kg (>2 500 to 4 500) kg	0.3 mg 0.48 mg 26 mg 8.2 g 42g 84 g 0.29 kg 0.31 kg	Comparison to Standard Weight Set
[1] Silo Scale	(0 to 100) kg (> 100 to 500) kg (> 500 to 1 000) kg (>1 000 to 2 500) kg (>2 500 to 4 500) kg	6.1 g 11 g 62 g 80 g 0.11 kg	Comparison to Standard Weight Set
[1] Force Gauge Tension (Push-Pull) Gauge	(0 to 5) N (5 to 50) N (50 to 100) N (100 to 500) N	0.62 mN 6.2 mN 29 mN 64 mN	Indirect verification to Standard Weight
[1] Moisture Balance Balance Scale	(0 to 50) g (50 to 100) g (100 to 200) g (200 to 300) g (300 to 500) g	0.14 mg 0.24 mg 0.47mg 0.7 mg 1.2 mg	Direct Comparison with Standard Weight
[1] Moisture Balance Moisture Content (MC)	(0 to 100) %MC	0.2 %MC	Direct Measurement by Divided Weight
Conventional mass Class M1	10 mg 20 mg 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	29 µg 33 µg 43 µg 52 µg 62 µg 82 µg 0.11 mg 0.13 mg 0.17 mg 0.21 mg 0.26 mg 0.31 mg 0.52 mg 1.1 mg 2.6 mg	Direct Comparison with Standard weight

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Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Conventional mass Class M1	1 kg 2 kg 5 kg 10 kg 20 kg	9.7 mg 14 mg 68 mg 81 mg 0.12 g	Direct Comparison with Standard weight
Conventional mass Class F1	1 mg 2 mg 5 mg 10 mg 20 mg 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	6 µg 6 µg 6 µg 8 µg 10 µg 12 µg 1 6 µg 20 µg 25 µg 30 µg 41 µg 51 µg 62 µg 84 µg 0.12 mg 0.2 mg 0.38 mg 0.63 mg 1.3 mg 2.6 mg 6.3 mg	Direct Comparison with Standard weight
Piston Pipette	(20 to 100) µl (>100 to 1 000) µl (>1 000 to 5 000) µl (>5 000 to 10 000) µl	0.15 µl 0.34 µl 0.58 µl 0.87 µl	Comparison to Standard Electronic Balance

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Moisture Balance Temperature	(50 to 100) °C (>100 to 150) °C (>150 to 200) °C	0.43 °C 0.69 °C 0.82 °C	Comparison to Standard Thermometer

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Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Resistance Thermometer (With Indicator, Electrical Output)	(-80 to -38) °C (> -38 to 0) °C (> 0 to 100) °C (> 100 to 200) °C (> 200 to 300) °C (> 300 to 400) °C (> 400 to 500) °C (> 500 to 600) °C	0.034 °C 0.018 °C 0.017 °C 0.021 °C 0.027 °C 0.036 °C 0.047 °C 0.049 °C	Comparison to Standard Thermometer, Calibration Bath, Dry Block
[1] Thermocouple (With Indicator, Electrical Output)	Type K, E, J, T, N (-80 to -40) °C (> -40 to 50) °C (> 50 to 1 00) °C (> 100 to 1 25) °C (> 125 to 1 50) °C (> 150 to 1 75) °C (> 175 to 200) °C (> 200 to 300) °C (> 300 to 400) °C (> 400 to 450) °C (> 450 to 500) °C (> 500 to 550) °C (> 550 to 600) °C (> 600 to 650) °C (> 650 to 700) °C (> 700 to 800) °C (> 800 to 900) °C (> 900 to 1 000) °C (> 1 000 to 1 200) °C Type R, S (0 to 200) °C (> 200 to 400) °C (> 400 to 650) °C (> 650 to 1 200) °C	 0.34 °C 0.27 °C 0.4 °C 0.48 °C 0.56 °C 0.64 °C 0.73 °C 1.1 °C 1.4 °C 1.6 °C 1.8 °C 2 °C 2.1 °C 2.3 °C 2.7 °C 3 °C 3.4 °C 3.7 °C 4.4 °C 0.2 °C 0.29 °C 0.42 °C 0.72 °C	Comparison to Standard Thermometer, Calibration Bath, Dry Block
[1] Dial Thermometer	(-40 to 0) °C (0 to 400) °C	0.09 °C 0.15 °C	Comparison to Standard Thermometer, Calibration Bath, Dry Block
[1] Liquid in Glass Thermometer	(-40 to 0) °C (>0 to 200) °C	0.041 °C 0.076 °C	Comparison to Standard Thermometer, Calibration Bath

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Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Mercury in Glass for retort and Pipe	(-38 to 200)°C	0.12 °C	Comparison to Standard Thermometer, Calibration Bath
[1] Temperature Enclosure	(-50 to 200) °C (>200 to 500) °C	0.11 °C 1.6 °C	Direct measurement using Data Logger & Data Acquisition 34970A with PRT Sensor & TC sensor
[1] Autoclave	(105 to 125) °C	0.11 °C	
[1] Liquid Bath	(-40 to 200) °C	0.11 °C	
[1] Furnace	(70 to 200) °C (>200 to 400) °C (> 400 to 600) °C (> 600 to 1 200) °C	0.9°C 1.7 °C 2.9 °C 5 °C	Comparison to IPRT & Standard Thermocouple
[1] Salt Spray Tester	(-30 to 70) °C	0.37 °C	Comparison to IPRT & Standard Thermocouple
Dry Block	(-80 to 420) °C (>420 to 1 200) °C	0.1 8 °C 1.7 °C	Comparison to IPRT & Standard Thermocouple
[1] Humidity Chamber	(-5 to 60) °C (11.3 to 90) %RH	0.1 7°C 1.5 %RH	Direct measurement using Data Acquisition 34970A with PRT sensor & Humidity sensor
[1] Dew Point (dp) Sensor / Transmitter	(-85 to 70) °C	0.1 °C	Comparison to Standard PRT & Standard dew point
Thermo-Hygrometer (Indicator, Data logger, Transmitter)	(-25 to 60) °C (11.3 to 50) %RH (>50 to 90) %RH	0.19 °C 1.8 %RH 2.1 %RH	Comparison to Standard Thermometer, Chill Miller, Temperature & Humidity Chamber
Thermo-Hygro Graph	(-25 to 60) °C (11.3 to 90) %RH	0.3 °C 2.1 %RH	Comparison to Standard Thermometer, Chill Miller, Temperature & Humidity Chamber
Liquid in Glass thermometer (Air Type)	(-25 to 60) °C	0.37 °C	Comparison to Comparison Technique by Standard PRT
[1] Infrared Thermometer	(-15 to 60) °C (> 60 to 120) °C (> 120 to 300) °C (> 300 to 500) °C	1 °C 1.5 °C 3.8 °C 5.4 °C	Direct measure using Blackbody Source (flat plate) $\varepsilon = 0.95$, $\lambda = (8 \text{ to } 14)$ µm

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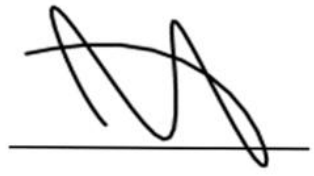
Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Source-Frequency @ 3 V to 1 0 V	(0.01 to 120) Hz (120 to 1 200) Hz (1.2 to 12) kHz (12 to 120) kHz (120 to 1 200) kHz (1.200 to 2.000) MHz	2 µHz/Hz + 58 µHz 2 µHz/Hz + 0.77 mHz 2 µHz/Hz + 7.7 mHz 2 µHz/Hz + 77 mHz 2 µHz/Hz + 0.77 Hz 2 µHz/Hz + 0.77 Hz	Comparison to High Performance Multi-Product Calibrators
[1] Tachometer Photo Type	(6.000 to 99.999) rpm (100.00 to 999.99) rpm (1 000.0 to 9 999.9) rpm (10 000 to 99 999) rpm	2.1 µrpm/rpm + 0.001 2 rpm 2 µrpm/rpm + 0.01 2 rpm 2.8 µrpm/rpm + 0.2 rpm 2.4 µrpm/rpm + 1 .3 rpm	Comparison to Frequency Generator
[1] Tachometer Contact Type	(0.500 to 99.999) rpm (100.00 to 999.99) rpm (1 000.0 to 9 999.9) rpm (10 000 to 1 9 999) rpm	0.17 µrpm/rpm + 0.001 2 rpm 0.17 µrpm/rpm + 0.012 rpm 0.17 µrpm/rpm + 0.58 rpm 0.17 µrpm/rpm + 1.2 rpm	Comparison to Frequency Generator
[1] Centrifuge	(300 to 1 000) rpm (1 000 to 5 000) rpm (5 000 to 10 000) rpm (10 000 to 14 000) rpm	0.18 rpm 0.6 rpm 1.7 rpm 2 rpm	Comparison to Standard Handheld Tachometer
[1] Frequency Accuracy (Stop watch)	2 Hz to 120 MHz	2.8 µHz/Hz	Direct measurement using Programmable Timer / Counter
[1] Timer	(1 to 43 200) s	0.011 s	Comparison to Standard Stopwatch

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. The nominal values listed are approximate.



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