



SCOPE OF ACCREDITATION TO ISO/IEC 17025-2005

JAPAN QUALITY ASSURANCE ORGANIZATION

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CALIBRATION

Valid To: March 31, 2018

Certificate Number: 1400.04

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations¹:

I. Chemical Quantities

| Parameter/Equipment | Range | CMC ² (±) | Comments |
|--|---|---|--|
| pH Indicator – Instrumental Error Linearity Repeatability | (0 to 14) pH units (0 to 14) pH units (0 to 14) pH units | 0.0080 pH units 0.016 pH units 0.010 pH units | DC voltage |
| pH Detector – Instrumental Error Linearity Repeatability | 4 pH units, 9 pH units 4 pH units, 7 pH units, 9 pH units 4 pH units, 7 pH units 9 pH units | 0.40 mV/pH units 1.1 mV 1.0 mV 2.0 mV | Standard solutions |
| pH Meters – Instrumental Error | 4 pH units (3p) 7 pH units (3p) 9 pH units (3p) 4 pH units, 9 pH units (2p) 7 pH units (2p) 4 pH units, 7 pH units, 9 pH units (1p) | 0.011 pH units 0.012 pH units 0.031 pH units 0.024 pH units 0.014 pH units 0.18 pH units | Standard solutions |
| CO ₂ Monitor | 0 parts in 10 ⁶ 2000 parts in 10 ⁶ 5000 parts in 10 ⁶ | 40 parts in 10 ⁶ 60 parts in 10 ⁶ 80 parts in 10 ⁶ | Standard gas: CO ₂ in N ₂ |

| Parameter/Equipment | Range | CMC ² (±) | Comments |
|--------------------------------|--|------------------------------|---------------------------------|
| CO ₂ Monitor (cont) | 200, 400, 600, 800, 1000 parts in 10 ⁶ | 50 parts in 10 ⁶ | Standard gas and gas divider |
| | 1200, 1400, 1600, 1800 parts in 10 ⁶ | 60 parts in 10 ⁶ | |
| | 500, 1500, 2500, 3000, 3500, 4000, 4500 parts in 10 ⁶ | 110 parts in 10 ⁶ | |

II. Dimensional

| Parameter/Equipment | Range | CMC ² (±) | Comments |
|---------------------------|---|---|---|
| Gauge Block ⁴ | (≥ 0.5 to 100) mm (> 100 to 150) mm (> 150 to 200) mm (> 200 to 250) mm (> 250 to 300) mm (> 300 to 400) mm (> 400 to 500) mm | 0.070 μm 0.090 μm 0.11 μm 0.13 μm 0.15 μm 0.19 μm 0.23 μm | By mechanical comparison |
| Step Gauge ⁴ | ≤ 200 mm (> 200 to 500) mm (> 500 to 700) mm (> 700 to 1000) mm | 1.0 μm 1.6 μm 2.5 μm 3.2 μm | Gauge blocks, surface plate indicators |
| Standard Bar ⁴ | ≤ 300 mm (> 300 to 500) mm (> 500 to 800) mm (> 800 to 1000) mm | 1.0 μm 1.5 μm 2.5 μm 3.0 μm | Comparison to gauge blocks |
| Ring Gauge ⁴ | (≥ 1 to 100) mm (> 100 to 200) mm | 0.8 μm 2.0 μm | IDM Master ring gauge, ULM |



| Parameter/Equipment | Range | CMC ² (±) | Comments |
|---|--|--|---|
| Rules & Tape Measure ⁴ | | | |
| Rule | ≤ 1m (> 1 to 5) m | 11 μm 11L μm | Master scales, laser In the statement of best uncertainty, <i>L</i> is the numerical value of the nominal length of the device measured in meters. |
| Rule (End Gauge) | ≤ 3 m | 0.040 mm | |
| Steel Tape Measure | ≤ 5 m (> 5 to 100) m | 0.080 mm 0.016L mm | |
| Convex Rule | ≤ 5.5 m (> 5.5 to 10.5) m (> 10.5 to 15) m | 0.20 mm 0.30 mm 0.40 mm | |
| Plug and Pin Gauge ⁴ | (≥ 1 to 100) mm | 0.90 μm | Gauge blocks, ULM, master pins and laser scan |
| Caliper ⁴ | ≤ 200 mm (> 200 to 300) mm (> 300 to 600) mm (> 600 to 1000) mm | 0.030 mm 0.040 mm 0.050 mm 0.070 mm | Gauge blocks, step gauges |
| Micrometer ⁴ | ≤ 25 mm (> 25 to 50) mm (> 50 to 150) mm (> 150 to 200) mm (> 200 to 300) mm (> 300 to 400) mm (> 400 to 500) mm | 0.6 μm 2.0 μm 3.0 μm 4.0 μm 5.0 μm 6.0 μm 7.0 μm | Gauge blocks |
| Dial Gauge ⁴ | ≤ 5 mm (> 5 to 20) mm (> 20 to 50) mm (> 50 to 100) mm | 1.0 μm 1.3 μm 1.8 μm 2.1 μm | Dial gauge calibrator, inspection machine for indicator |
| Electrical Comparator ⁴ | ≤ 5 mm | 0.16 μm | Gauge blocks, inspection machine for indicator |
| Digital Measuring Instrument ⁴ | ≤ 100 mm | 0.90 μm | Gauge blocks, inspection machine for indicator |



| Parameter/Equipment | Range | CMC ² (±) | Comments |
|---|-------------------------|----------------------|---|
| Textile Tape Measure ⁴ | ≤ 5 m (> 5 to 100) m | 0.28 mm 0.056L mm | Master scales, laser In the statement of best uncertainty, <i>L</i> is the numerical value of the nominal length of the device measured in meters. |
| Screw Plug Gauge ⁴ Pitch Diameter Major Diameter | ≤ 30 mm | 3.1 μm 1.0 μm | ULM Three wires for screw thread measuring |

III. Electrical – DC/Low Frequency

| Parameter/Equipment | Range | CMC ² (±) | Comments |
|--|---|---|-------------------------------|
| Electrical Simulation of Temperature Indicators ⁴ Thermocouples Type R (Internal Reference Junction) | (-50 to < -40) °C (-40 to < -30) °C (-30 to < -20) °C (-20 to < -10) °C (-10 to < 10) °C (10 to < 40) °C (40 to < 90) °C (90 to < 200) °C (200 to < 400) °C (400 to 1768) °C | 1.4 °C 1.3 °C 1.2 °C 1.1 °C 1.0 °C 0.90 °C 0.80 °C 0.70 °C 0.60 °C 0.50 °C | Digital multimeter, ice point |
| (External Reference Junction) | (-50 to < -40) °C (-40 to < -20) °C (-20 to < -10) °C (-10 to < 20) °C (20 to < 60) °C (60 to < 200) °C (200 to 1768) °C | 1.1 °C 1.0 °C 0.90 °C 0.80 °C 0.70 °C 0.60 °C 0.50 °C | |



| Parameter/Equipment | Range | CMC ² (±) | Comments |
|--|---------------------|----------------------|-------------------------------|
| Electrical Simulation of Temperature Indicators ⁴ (cont) | | | |
| Thermocouples | | | Digital multimeter, ice point |
| Type K | | | |
| (Internal Reference Junction) | (-270 to < -260) °C | 11 °C | |
| | (-260 to < -250) °C | 3.3 °C | |
| | (-250 to < -240) °C | 1.9 °C | |
| | (-240 to < -230) °C | 1.3 °C | |
| | (-230 to < -220) °C | 1.0 °C | |
| | (-220 to < -210) °C | 0.90 °C | |
| | (-210 to < -200) °C | 0.80 °C | |
| | (-200 to < -190) °C | 0.70 °C | |
| | (-190 to < -170) °C | 0.60 °C | |
| | (-170 to < -140) °C | 0.50 °C | |
| | (-140 to < -70) °C | 0.40 °C | |
| | (-70 to 1180) °C | 0.30 °C | |
| | (>1180 to 1372) °C | 0.40 °C | |
| (External Reference Junction) | (-270 to < -260) °C | 4.9 °C | |
| | (-260 to < -250) °C | 1.5 °C | |
| | (-250 to < -240) °C | 0.90 °C | |
| | (-240 to < -230) °C | 0.60 °C | |
| | (-230 to < -220) °C | 0.50 °C | |
| | (-220 to < -190) °C | 0.40 °C | |
| | (-190 to 1372) °C | 0.30 °C | |
| Type E | | | |
| (Internal Reference Junction) | (-270 to < -260) °C | 7.2 °C | |
| | (-260 to < -250) °C | 2.2 °C | |
| | (-250 to < -240) °C | 1.4 °C | |
| | (-240 to < -230) °C | 1.0 °C | |
| | (-230 to < -220) °C | 0.80 °C | |
| | (-220 to < -210) °C | 0.70 °C | |
| | (-210 to < -180) °C | 0.60 °C | |
| | (-180 to < -150) °C | 0.50 °C | |
| | (-150 to < -90) °C | 0.40 °C | |
| | (-90 to 1000) °C | 0.30 °C | |
| (External Reference Junction) | (-270 to < -260) °C | 2.3 °C | |
| | (-260 to < -250) °C | 0.70 °C | |
| | (-250 to < -240) °C | 0.50 °C | |
| | (-240 to < -230) °C | 0.40 °C | |
| | (-230 to 1000) °C | 0.30 °C | |



| Parameter/Equipment | Range | CMC ² (±) | Comments |
|---|--|---|-------------------------------|
| Electrical Simulation of Temperature Indicators ⁴ (cont) | | | |
| Type J (Internal Reference Junction) | (-210 to < -200) °C (-200 to < -190) °C (-190 to < -160) °C (-160 to < -100) °C (-100 to 1200) °C | 0.70 °C 0.60 °C 0.50 °C 0.40 °C 0.30 °C | Digital multimeter, ice point |
| (External Reference Junction) | (-210 to 1200) °C | 0.30 °C | |
| Type T (Internal Reference Junction) | (-270 to < -260) °C (-260 to < -250) °C (-250 to < -240) °C (-240 to < -230) °C (-230 to < -220) °C (-220 to < -210) °C (-210 to < -190) °C (-190 to < -160) °C (-160 to < -120) °C (-120 to < -50) °C (-50 to 400) °C | 7.6 °C 2.3 °C 1.4 °C 1.1 °C 0.90 °C 0.80 °C 0.70 °C 0.60 °C 0.50 °C 0.40 °C 0.30 °C | |
| (External Reference Junction) | (-270 to < -260) °C (-260 to < -250) °C (-250 to < -240) °C (-240 to < -230) °C (-230 to < -210) °C (-210 to 400) °C | 3.4 °C 1.0 °C 0.70 °C 0.50 °C 0.40 °C 0.30 °C | |
| Resistance Temperature Devices | (-200 to -100) °C (> -100 to 0) °C (> 0 to 100) °C (> 100 to 260) °C (> 260 to 390) °C (> 390 to 640) °C (> 640 to 850) °C | 0.020 °C 0.021 °C 0.045 °C 0.050 °C 0.055 °C 0.060 °C 0.065 °C | Decade resistor |



IV. Mechanical

| Parameter/Equipment | Range | CMC ^{2, 3, 5} (±) | Comments |
|--|-------------------|----------------------------|--|
| Scales and Balances ^{3,4, 5} Electronic Type | (>60 to 500) kg | 73 µg/g | Comparison with Class E2, F1 and M2 weights. |
| | (>2 to 60) kg | 2.3 µg/g | |
| | (1 to 2) kg | 0.86 µg/g | |
| | (>500 to <1) kg | 0.96 µg/g | |
| | 500 g | 0.98 µg/g | |
| | (>200 to <500) g | 1.1 µg/g | |
| | 200 g | 0.93 µg/g | |
| | (>100 to <200) g | 1.5 µg/g | |
| | 100 g | 1.2 µg/g | |
| | (>50 to <100) g | 1.8 µg/g | |
| | 50 g | 1.3 µg/g | |
| | (>20 to <50) g | 2.5 µg/g | |
| | 20 g | 2.2 µg/g | |
| | (>10 to <20) g | 5.2 µg/g | |
| | 10 g | 3.2 µg/g | |
| | (>5 to <10) g | 7.7 µg/g | |
| | 5 g | 5.1 µg/g | |
| | (>2 to <5) g | 13 µg/g | |
| | 2 g | 10 µg/g | |
| | (>1 to <2) g | 28 µg/g | |
| | 1 g | 17 µg/g | |
| | (>500 to <1) g | 43 µg/g | |
| | 500 mg | 32 µg/g | |
| | (>200 to <500) mg | 61 µg/g | |
| | 200 mg | 51 µg/g | |
| | (>100 to <200) mg | 0.14 mg/g | |
| | 100 mg | 80 µg/g | |
| | (>50 to <100) mg | 0.20 mg/g | |
| | 50 mg | 0.13mg/g | |
| | (>20 to <50) mg | 0.32 mg/g | |
| | 20 mg | 0.26 mg/g | |
| | (>10 to <20) mg | 0.83 mg/g | |
| | 10 mg | 0.44 mg/g | |
| 9 mg | 1.2 mg/g | | |
| 8 mg | 1.4 mg/g | | |
| 7 mg | 1.1 mg/g | | |
| 6 mg | 1.2 mg/g | | |
| 5 mg | 0.72 mg/g | | |
| 4 mg | 1.8 mg/g | | |
| 3 mg | 2.4 mg/g | | |
| 2 mg | 1.8 mg/g | | |
| 1 mg | 3.6 mg/g | | |



| Parameter/Equipment | Range | CMC ^{2,5} (±) | Comments |
|---|-------------------|------------------------|---|
| Scales & Balances ^{3,4} Mechanical Type | (>60 to 500) kg | 0.16 mg/g | Comparison with Class E2, F1 and M2 weights. |
| | 60 kg | 0.21 mg/g | |
| | (>6 to <60) kg | 0.13 mg/g | |
| | 6 kg | 0.21 mg/g | |
| | (5 to <6) kg | 0.10 mg/g | |
| | (1 to <5) kg | 2.3 µg/g | |
| | (>500 to <1) kg | 4.5 µg/g | |
| | 500 g | 5.0 µg/g | |
| | (>200 to <500) g | 6.6 µg/g | |
| | 200 g | 1.5 µg/g | |
| | (>100 to <200) g | 2.0 µg/g | |
| | 100 g | 2.5 µg/g | |
| | (>50 to <100) g | 4.4 µg/g | |
| | 50 g | 7.0 µg/g | |
| | (>20 to <50) g | 11 µg/g | |
| | 20 g | 2.2 µg/g | |
| | (>10 to <20) g | 5.2 µg/g | |
| | 10 g | 3.3 µg/g | |
| | (>5 to <10) g | 7.8 µg/g | |
| | 5 g | 5.1 µg/g | |
| | (>2 to <5) g | 13 µg/g | |
| | 2 g | 10 µg/g | |
| | (>1 to <2) g | 28 µg/g | |
| | 1 g | 17 µg/g | |
| | (>500 to <1) g | 43 µg/g | |
| | 500 mg | 32 µg/g | |
| | (>200 to <500) mg | 61 µg/g | |
| | 200 mg | 51 µg/g | |
| | (>100 to <200) mg | 0.14 mg/g | |
| | 100 mg | 81 µg/g | |
| | (>50 to <100) mg | 0.20 mg/g | |
| | 50 mg | 0.13 mg/g | |
| (>20 to <50) mg | 0.32 mg/g | | |
| 20 mg | 0.27 mg/g | | |
| (>10 to <20) mg | 0.83 mg/g | | |
| 10 mg | 0.46 mg/g | | |
| 9 mg | 1.2 mg/g | | |
| 8 mg | 1.4 mg/g | | |
| 7 mg | 1.1 mg/g | | |
| 6 mg | 1.3 mg/g | | |
| 5 mg | 0.76 mg/g | | |
| 4 mg | 1.9 mg/g | | |
| 3 mg | 2.5 mg/g | | |
| 2 mg | 1.9 mg/g | | |
| 1 mg | 3.8 mg/g | | |



| Parameter/Equipment | Range | CMC ^{2, 6} (±) | Comments |
|--|--|--|--|
| Force-Measuring Device ⁴ Proving Ring, Standardizing Box, Load Cell, Push-Pull Gauge, etc. | Compression 0.1 N to 3 MN Tension 0.1 N to 300 kN | 0.030 % 0.030 % | Calibration method per JIS B 7728 (ISO 376) or JIS B 7721 or JIS B 7602 or ASTM E74 weights, force calibration machine |
| Graduated Cylinders, Internal & External ⁴ | 5 ml ≤ 20 ml ≤ 25 ml ≤ 50 ml ≤ 100 ml ≤ 200 ml ≤ 300 ml ≤ 500 ml ≤ 1000 ml ≤ 2000 ml | 0.030 ml 0.066 ml 0.078 ml 0.14 ml 0.25 ml 0.51 ml 0.75 ml 1.6 ml 3.0 ml 6.0 ml | Mass method |
| Flasks ⁴ – Internal External | 10 ml ≤ 25 ml ≤ 50 ml ≤ 100 ml ≤ 200 ml ≤ 500 ml ≤ 1000 ml ≤ 2000 ml ≤ 3000 ml ≤ 5000 ml ≤ 10 000 ml 10 ml ≤ 25 ml ≤ 50 ml ≤ 100 ml ≤ 200 ml ≤ 500 ml ≤ 1000 ml ≤ 2000 ml ≤ 3000 ml ≤ 5000 ml ≤ 10 000 ml | 0.016 ml 0.020 ml 0.030 ml 0.050 ml 0.070 ml 0.13 ml 0.20 ml 0.30 ml 0.70 ml 1.0 ml 2.0 ml 0.030 ml 0.030 ml 0.040 ml 0.070 ml 0.090 ml 0.15 ml 0.30 ml 0.40 ml 0.80 ml 1.3 ml 2.5 ml | Mass method |



| Parameter/Equipment | Range | CMC ^{2, 6} (±) | Comments |
|--|---|--|---------------------|
| Volumetric Pipette, External ⁴ | 1 ml ≤ 2 ml ≤ 5 ml ≤ 10 ml ≤ 20 ml ≤ 50 ml ≤ 100 ml ≤ 200 ml | 0.0060 ml 0.0090 ml 0.016 ml 0.023 ml 0.025 ml 0.030 ml 0.040 ml 0.070 ml | Mass method |
| Graduated Pipette ⁴ | 1 ml ≤ 2 ml ≤ 5 ml ≤ 10 ml ≤ 25 ml ≤ 50 ml | 0.0070 ml 0.010 ml 0.020 ml 0.025 ml 0.050 ml 0.10 ml | Mass method |
| Buret, External ⁴ | 5 ml ≤ 10 ml ≤ 25 ml ≤ 50 ml ≤ 100 ml | 0.010 ml 0.020 ml 0.030 ml 0.040 ml 0.060 ml | Mass method |
| Pressure Balances ⁴ – Air Pressure Oil Pressure | Gauge pressure (8 to 5000) kPa Absolute pressure (8 to 350) kPa Gauge pressure (0.1 to 1) MPa (>1 to 100) MPa | Larger of 0.0045 % or 1.4 Pa Larger of 0.0055 % or 6.6 Pa 1.0 kPa Larger of 0.0065 % or 0.65 kPa | Pressure balances |
| Liquid Column Manometer ⁴ – | Gauge pressure (2 to 20) kPa Gauge pressure (>20 to 220) kPa | 0.010 kPa 0.10 kPa | Pressure controller |



| Parameter/Equipment | Range | CMC ^{2,6,7} (±) | Comments |
|-----------------------------|--|---|--|
| Pressure Gauge ⁴ | | | |
| Air Pressure | Gauge pressure (8 to 100) kPa (> 100 to 500) kPa (> 500 to 5000) kPa | 0.0040 kPa 0.0040 % 0.0060 % | Pressure balances |
| | Absolute pressure (8 to 100) kPa (> 100 to 350) kPa | 0.0050 kPa 0.0050 % | |
| Air Pressure | Gauge pressure (-100 to 0) kPa (> 0 to 100) kPa (> 100 to 500) kPa (> 500 to 700) kPa (> 700 to 5000) kPa | 0.016 kPa 0.014 kPa 0.014 % 0.022 % 0.018 % | Pressure controller |
| | Absolute pressure (8 to 100) kPa (> 100 to 350) kPa | 0.015 kPa 0.015 % | |
| | Gauge pressure (-20 to <-15) kPa (-15 to <-10) kPa (-10 to <-7.5) kPa (-7.5 to <-1) kPa (-1 to 1) kPa (> 1 to 7.5) kPa (> 7.5 to 10) kPa (> 10 to 15) kPa (> 15 to 20) kPa | 1.8 Pa 1.5 Pa 1.2 Pa 0.75 Pa 0.55 Pa 0.75 Pa 1.2 Pa 1.5 Pa 1.8 Pa | Low pressure controller |
| | Differential pressure (-20 to <-15) kPa (-15 to <-10) kPa (-10 to <-7.5) kPa (-7.5 to <-1) kPa (-1 to 1) kPa (> 1 to 7.5) kPa (> 7.5 to 10) kPa (> 10 to 15) kPa (> 15 to 20) kPa | 1.8 Pa 1.5 Pa 1.2 Pa 0.75 Pa 0.50 Pa 0.75 Pa 1.2 Pa 1.5 Pa 1.8 Pa | [Line pressure : 100 kPa±5kPa (absolute pressure)] |



| Parameter/Equipment | Range | CMC ^{2, 6} (±) | Comments |
|---|--|---|--|
| Pressure Gauge ⁴ (cont) | | | |
| Air Pressure | Absolute pressure (75 to 115) kPa | 0.050 kPa | Digital pressure gauge |
| Oil Pressure | Gauge pressure (0.1 to 1) MPa (1 to 100) MPa | 1.0 kPa Larger of 0.008 % or 0.80 kPa | Pressure balances |
| | Gauge pressure (0 to 100) MPa | 0.20 MPa | Digital pressure gauge |
| Torque Measuring Devices ^{3, 4} | | | |
| Torque Meter, Torque Tester, Torque Checker, Torque Gauge, etc. | 2 N·m to 10 kN·m | 0.040 % | Torque calibration machine |
| | 40 mN·m to 1 kN·m | 0.20 % | Reference torque meter |
| | 20 mN·m to 100 N·m | 0.20 % | Lever-Mass-System (moment - arm and weights) |
| Torque Tools ^{3, 4} | | | |
| Torque Wrench, Torque Screwdriver, Torque Gauge | 200 mN·m to 500 N·m | 0.40 % | Torque wrench tester torque meter |

| Parameter/Range | Frequency | CMC ^{2, 6} (±) | Comments |
|--|----------------------------------|-------------------------|---|
| Vibration Meter – | | | |
| Acceleration (10 to 500) m/s ² | (5 to <10) Hz (0.01 to 2) kHz | 5.0 % 3.0 % | Secondary vibration calibration system |
| Velocity Up to 100 mm/s | (5 to <10) Hz (0.01 to 2) kHz | 4.0 % 3.0 % | |
| Displacement Up to 10 mm | (5 to <10) Hz (10 to 160) Hz | 4.0 % 3.0 % | |



| Parameter/Range | Frequency | CMC ^{2,6} (±) | Comments |
|---|--|--|--|
| Vibration Exciter with Accelerometer ³ – | | | |
| Acceleration (10 to 500) m/s ² | (5 to <10) Hz (0.01 to 5) kHz | 5.0 % 4.0 % | Vibration meter, accelerometer and counter |
| Velocity Up to 100 mm/s | (5 to <10) Hz (10 to 80) Hz (>80 to 160) Hz (>0.16 to 1) kHz (>1 to 3) kHz | 6.0 % 4.0 % 5.0 % 7.0 % 12 % | |
| Displacement Up to 10 mm | (5 to 40) Hz (>40 to 100) Hz (>100 to 160) Hz (>160 to 315) Hz | 4.0 % 5.0 % 10 % 17 % | |
| Frequency | (5 to <10) Hz (10 to <20) Hz (20 to <30) Hz (0.03 to 5) kHz | 0.12 % 0.06 % 0.03 % 0.02 % | |

V. Thermodynamic

| Parameter/Equipment | Range | CMC ² (±) | Comments |
|-------------------------------------|---|---|--|
| Thermometers – Digital ⁴ | (-100 to < -80) °C (-80 to < -40) °C (-40 to 250) °C (> 250 to 420) °C (> 420 to 500) °C (> 500 to 600) °C (> 600 to 960) °C (> 960 to 1100) °C (> 1100 to 1200) °C | 0.055 °C 0.020 °C 0.015 °C 0.020 °C 0.060 °C 0.16 °C 0.60 °C 0.80 °C 1.6 °C | Standard platinum resistance thermometer, baths Accredited calibrations are only offered for complete systems including the sensor and indicator. |



| Parameter/Equipment | Range | CMC ² (±) | Comments |
|--|--|--|---|
| Platinum Resistance Thermometer Sensors ⁴ | | | Standard platinum resistance thermometer, water triple point cell, baths. |
| (4-wire) | (-60 to < -40) °C (-40 to <0) °C (0 to 250) °C (> 250 to 420) °C (> 420 to 500) °C | 0.025 °C 0.015 °C 0.012 °C 0.050 °C 0.070 °C | (4-wire) Calibration resistance ratio: R(t)/R(0.01) or R(t)/R(0) Calibration value: R(t) |
| (3-wire) | (-60 to < -40) °C (-40 to 0) °C (> 0 to 100) °C (> 100 to 250) °C (> 250 to 420) °C (> 420 to 500) °C | 0.040 °C 0.025 °C 0.030 °C 0.035 °C 0.075 °C 0.080 °C | (3-wire) Calibration value: R(t) Note: R(t): resistance value in calibration temperature R(0.01): resistance value in triple point of water R(0): resistance value in freezing point |
| Thermocouple Sensor ⁴ – | | | |
| Type E | (-100 to 250) °C (> 250 to 500) °C (> 500 to 900) °C | 0.30 °C 0.40 °C 0.50 °C | Indicating thermometers, freezing point, baths, furnace, voltage standard and voltmeter |
| Type J | (-100 to 250) °C (> 250 to 500) °C (> 500 to 800) °C | 0.30 °C 0.40 °C 0.50 °C | Standard platinum resistance thermometers for high temperature |
| Type K | (-100 to 250) °C (> 250 to 500) °C (> 500 to 960) °C (> 960 to 1100) °C (> 1100 to 1200) °C | 0.30 °C 0.40 °C 0.50 °C 1.0 °C 1.6 °C | |



| Parameter/Equipment | Range | CMC ² (±) | Comments |
|---|--|--|--|
| Thermocouple Sensor ⁴ – (cont) | | | |
| Type R | (-60 to < -40) °C (-40 to < 0) °C (0 to 960) °C (> 960 to 1100) °C (> 1100 to 1200) °C | 0.90 °C 0.70 °C 0.50 °C 1.0 °C 1.6 °C | Indicating thermometers, freezing point, baths, furnace, voltage standard and voltmeter |
| Type S | (-60 to < -40) °C (-40 to < 0) °C (0 to 960) °C (> 960 to 1100) °C (> 1100 to 1200) °C | 0.70 °C 0.60 °C 0.50 °C 1.0 °C 1.6 °C | Standard platinum resistance thermometers for high temperature |
| Type T | (-100 to 250) °C (> 250 to 400) °C | 0.30 °C 0.40 °C | |
| Temperature Calibration Instrument ^{3,4} Measure Only (Metrology Wells) | (-100 to < -80) °C (-80 to < -50) °C (-50 to < -40) °C (-40 to 100) °C (> 100 to 250) °C (> 250 to 300) °C (> 300 to 400) °C (> 400 to 500) °C (> 500 to 600) °C (> 600 to 700) °C | 0.09 °C 0.07 °C 0.040 °C 0.030 °C 0.050 °C 0.060 °C 0.070 °C 0.090 °C 0.12 °C 0.15 °C | Standard platinum resistance thermometer, Indicating resistance thermometer, Standard thermocouple, voltage standard and voltmeter |
| Non-Contact Type Thermometer ⁴ (Radiation Thermometer, Infrared Thermograph, et. al.) | (-50 to <0) °C (0 to <35) °C (35 to 100) °C (>100 to 200) °C (>200 to 350) °C (>350 to 500) °C (>500 to 600) °C (>600 to 700) °C (>700 to 800) °C (>800 to 900) °C (>900 to 1000) °C | 1.2 °C $\epsilon = 0.997$ 0.60 °C $\epsilon = 0.997$ 0.60 °C $\epsilon = 0.95$ 0.90 °C $\epsilon = 0.95$ 1.2 °C $\epsilon = 0.95$ 1.4 °C $\epsilon = 0.95$ 1.4 °C $\epsilon = 0.997$ 1.7 °C $\epsilon = 0.997$ 1.8 °C $\epsilon = 0.997$ 1.9 °C $\epsilon = 0.997$ 2.1 °C $\epsilon = 0.997$ | Blackbody, tammann tube (Cavity) and reference PRT |



| Parameter/Equipment | Range | CMC ² (±) | Comments |
|--|--|---|-------------------------|
| Infrared Calibrator ⁴ | (0 to 50) °C (>50 to 100) °C (>100 to 200) °C (>200 to 250) °C (>250 to 300) °C (>300 to 400) °C (>400 to 500) °C (>500 to 600) °C (>600 to 700) °C (>700 to 800) °C (>800 to 900) °C (>900 to 1000) °C | 0.60 °C ε = 1.000 0.70 °C ε = 1.000 0.80 °C ε = 1.000 1.0 °C ε = 1.000 1.1 °C ε = 1.000 1.2 °C ε = 1.000 1.3 °C ε = 1.000 1.4 °C ε = 1.000 1.7 °C ε = 1.000 1.8 °C ε = 1.000 1.9 °C ε = 1.000 2.1 °C ε = 1.000 | Radiation thermometer |
| Contact Thermometry ^{3,4} (Surface plates) | (30 to 100) °C (>100 to 200) °C (>200 to 500) °C | 0.60 °C 0.70 °C 0.80 °C | Contact thermometer |
| Hygrometer ⁴ | (25 to 30) % RH (>30 to 50) % RH (>50 to 80) % RH (>80 to 95) % RH | 0.7 % RH 1.0 % RH 1.5 % RH 1.8 % RH | Optical dew point meter |

¹ This laboratory offers commercial calibration service.

² Calibration and Measurement Capability (CMC) is the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation when performing more or less routine calibrations of nearly ideal measurement standards or nearly ideal measuring equipment. Calibration and Measurement Capabilities represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of $k = 2$. The actual measurement uncertainty of a specific calibration performed by the laboratory may be greater than the CMC due to the behavior of the customer's device and to influences from the circumstances of the specific calibration.

³ Field calibration service is available for this calibration and this laboratory meets A2LA R104 – *General Requirements: Accreditation of Field Testing and Field Calibration Laboratories* for these calibrations. Please note the actual measurement uncertainties achievable on a customer's site can normally be expected to be larger than the CMC found on the A2LA Scope. Allowance must be made for aspects such as the environment at the place of calibration and for other possible adverse effects such as those caused by transportation of the calibration equipment. The usual allowance for the actual uncertainty introduced by the item being calibrated, (e.g. resolution) must also be considered and this, on its own, could result in the actual measurement uncertainty achievable on a customer's site being larger than the CMC.

⁴ These calibrations are performed at satellite location SHIKATSU Branch Testing Department, 53-1, Yamaura, Yakushiji, Kitanagoya-shi Aichi 481-0005, Japan. The satellite's phone number is +81 568 23 0023.



⁵ The CMC stated for calibrations performed in the laboratory is applicable for the calibrations performed in the field.

⁶ In the statement of CMC, % is the uncertainty percentage of the relative value of the reading.

A handwritten signature in black ink, appearing to be 'L. L. L.', written in a cursive style.