
เอกสารสอบเทียบเครื่องมือที่ใช้ในการวิเคราะห์

CERTIFICATE OF CALIBRATION

Certificate No.: CO-1808005/23

Page 1 of total 4 pages

Customer: WATER ANALYSIS CENTER CO., LTD.

1/94 Moo 5, T. Kanham,

A.U-thai, Ayuthaya 13210

Equipment: pH Meter
Manufacturer: METTLER TOLEDO
Serial No.: B327527211
Description: Model SevenCompact S220
ID No. WWL 0068
Range: 0 - 14 pH, Resolution: 0.01 pH

Environmental Conditions
Ambient Temperature: (20 ± 2) °C
Relative Humidity: (50 ± 10) %
Atmospheric Pressure: -

Calibration Location: Jayhawks Laboratory (CL&GL)

Received Date: 18 August 2023

Calibration Date: 18 August 2023

Date of Issue: 21 August 2023

Condition of Artifacts: Used conditions but can be calibrated

Checked by

Approved by

Act as Technical Manager

Representative of Managing Director

(Dr. Ekachai Puttitwong)

() (Krisyosl K.)

() (Patiphan K.)

() (Pongsak H.)

() (Karung C.)

() (Pramong P.)

() (Sakda Y.)

() (Onnapa P.)

() (Nitiphong K.)

() (Nonthachai K.)

() (Noppol P.)

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Certificate No.: CO-1808005/23

Page 2 of total 4 pages

Reference Method:

- The calibration method used was CP-178 based on an in-house method.

- This certificate can be traceable to the national standards, which is realized the shown measurement units according to the International System of Units (SI Units).

Reference Standard:

| Type | pH Value | Lot No. | Due Date | Traceability |
|----------------------|----------|---------|--------------|--------------|
| pH Standard Solution | 4.01 | 030822 | Feb. 9, 2024 | NIMT |
| | 7.01 | 300522 | Feb. 9, 2024 | |
| | 10.01 | 230822 | Feb. 7, 2024 | |

| Type | Model | Serial No. | Certificate No. | Due Date | Traceability |
|---------------------------------|-------------|-----------------------|-----------------|---------------|--------------|
| Documenting Process Calibrator | 754 | 2630521 | 10-2412001/22 | Dec. 23, 2023 | THC |
| Digital Thermometer with Sensor | 1523 / 5622 | 1709138 / 4605984-005 | 10-0806001/23 | Jun. 8, 2024 | |

Remark: This certificate is traceable to the International System of Unit (SI Unit) through:

- NIMT, National Institute of Metrology (Thailand).

- THC, Thai Heart Calibration Co., Ltd.

Measurement Results:

1. Function Simulated pH Meter

| Standard Applied (mV) | Nominal Value (pH) | UUC Reading | | Uncertainty (± mV) |
|--------------------------|-----------------------|-------------|--------|-----------------------|
| | | pH | mV | |
| 177.48 | 4.00 | 4.01 | 177.4 | 0.060 |
| 0.00 | 7.00 | 7.00 | 0.0 | 0.060 |
| -177.48 | 10.00 | 10.01 | -177.4 | 0.060 |

UUC : Unit Under Calibration

Note : Adjust Curve to simulate pH (4,7,10)

Certificate No.: MC 2307702

The Reference Standard Instrument :

| Description | Certificate No. | Serial No. | Due date | Traceable thru |
|------------------------------------------------|-----------------|------------|------------|----------------|
| Data Acquisition/Switch Unit | MC 2303173 | MY41010916 | 9 Mar 2024 | MCAL |
| With Thermocouple Type "T" ID. No.1771 to 1779 | | | | |

Traceability :

The measurement standard traceable to the international system of units (SI) through certificate as mentioned above

1. Calibration Procedure:

This Instrument was calibration according to TLAS G-20 by comparison with calibrated thermocouple type T under no load condition. The Thermocouples were placed on nine points and located one thermocouple in each of the eight corners of the chamber and was away from the each wall of 5 cm to 10 cm. And placed the ninth thermocouple within 2.5 cm of the geometric center of the chamber.

Temperature Uniformity - the maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady state conditions. The reference sensor should preferably be located at the geometric center of the chamber.

Temperature Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.

Overall Variation - The Difference of the maximum and minimum measured temperatures throughout observation.

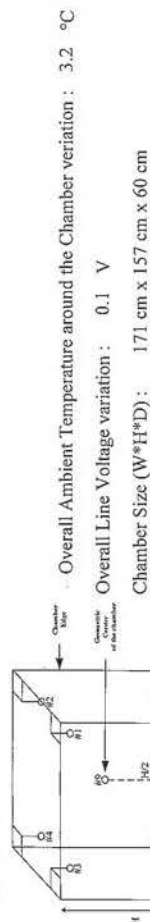


Figure 1 : Sensor Installation Location

Checked by : Thanagim

Certificate of Calibration

TEMPERATURE CONTROLLER ENCLOSURES



Certificate No.: MC 2307702

Customer : Water Analysis Center Co., Ltd.

1/94 Moo 5, T.Kantham, A.U.-Thai, Ayuthaya 13210.

Reference Job No. : 23-1577 Received Date : 11 July 2023

Description : Refrigerator

Manufacturer : SANDEN INTERCOOL Model : SEC-1500SBD

Serial No. : SEC1500201A-0708-00304 ID. No. : WWL0038

Marking : Additionally for the purpose of identification by this laboratory a label marked with this certificate number (MC 2307702) has been attached to the case.

Method : In-House calibration procedure MWI-T-033 this method is reference to

TLAS G-20 "Temperature Controlled Enclosures".

Location of Calibration : Water Analysis Center Co., Ltd. ; Laboratory.

Environmental Conditions : Ambient Temperature : (25.3 to 25.9) °C

Relative Humidity : (65.2 to 67.9) %

Date of Calibration : 11 July 2023 Date of Issue : 12 July 2023

Checked by : Thanagim
Thanagom Linchaicharoen
(Calibration Supervisor)

Approved by : Aittipong
Aittipong Kanjanawasit
(Technical Manager)

The uncertainties are for a confidence probability of approximately 95%

This certificate is issued in accordance with the conditions of accreditation granted by the National Standardization Council of Thailand-Office of the National Standardization Council that has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of Master Calibration Co.,Ltd.

Certificate No.: MC 2307702

Page 3 of 3

2. Result of calibration :

Temperature Measurement Accuracy Test

| Indicating Temperature (°C) | Measured Temperature (°C) at Spread Locations | | | | | | | | | Uncertainty (±°C) |
|-----------------------------|-----------------------------------------------|-----|-----|-----|-----|-----|-----|-----|---------|-------------------|
| | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 | Ref. #9 | |
| 2.5 | 4.4 | 4.2 | 4.2 | 4.2 | 4.0 | 3.9 | 4.1 | 4.0 | 3.8 | 0.86 |

Chamber Characterization Result

| Controller Temperature (°C) | Indicating Temperature (°C) | Temperature Stability (±°C) | Temperature Uniformity (°C) | Overall Variation (°C) |
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|------------------------|
| 2.0 | 2.5 | 1.50 | 1.01 | 3.3 |

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95 %.

This certificate will certify of the calibrated equipment only.

End of Certificate

Checked by: *Thanagorn*

[MCF-Q-077 ; Rev.6 ; Date : 22/04/2021]



THAI HEART CALIBRATION CO., LTD.
102/1 Moo 5, Pridi Ban Heng, Samut Prakan 10280
Tel. 0-2634-2102, 0-2637-8375, 0-2637-8394, 0-2637-8395



CERTIFICATE OF CALIBRATION

Certificate No.: C0-1907007/23 Page 1 of total 2 pages

Customer: WATER ANALYSIS CENTER CO., LTD.
1/94 Moo 5, T.Kanham,
A.U-thai, Ayutthaya 13210

Equipment: Conductivity Meter
Manufacturer: EUTECH Model: CON 2700
Serial No. 2657889 ID No. WWL 0136
Description: -

Environmental Conditions: Ambient Temperature: (20 ± 2) °C
Relative Humidity: (50 ± 10) %
Atmospheric Pressure: -

Calibration Location: Jayhawks Laboratory (CL&GL)
Received Date: 19 July 2023
Calibration Date: 19 July 2023
Date of Issue: 20 July 2023

Condition of Artifacts: Used conditions but can be calibrated

Checked by: *[Signature]* Approved by: *[Signature]*
Act as Technical Manager Representative of Managing Director

() (Krisyos K.) () (Sakda Y.)
() (Patiphan K.) (✓) (Onnapa P.)
() (Pongsak H.) () (Nitiphong K.)
() (Kanung C.) () (Nonthachai K.)
() (Pramong P.) () (Noppol P.)

(Dr. Ekachai Putitwong)

This calibration certificate shall not be reproduced other than in full except with the prior written approval of the Thai Heart Calibration Co., Ltd.

FE-169

REV.02 02/24/21



THC
Calibration Services



ANAB
ACCREDITED

Certificate No.: C0-1907007/23

Page 2 of total 2 pages

Reference Method:

- The calibration method used was CP-177 based on an in-house method.
- This certificate can be traceable to the national standards, which is realized the shown measurement units according to the International System of Units (SI Units).

Reference Standard :

| Material | Batch Value | Lot Number | Due Date | Traceability |
|--------------------------------|------------------|------------|--------------|--------------|
| Conductivity Standard Solution | 147.8 μ S/cm | S220611005 | Dec. 6, 2023 | SCP Science |
| | 1.425 mS/cm | S220812006 | May 31, 2024 | |

Remark: This certificate is traceable to the International System of Unit (SI Unit) through:

- SCP Science.

ภาคผนวก ข-5

Measurement Results: (Probe Serial No. : 93X219065)

| Conductivity Standard Solution | Measured Value | Correction | Uncertainty (\pm) |
|--------------------------------|------------------|----------------|-----------------------|
| 147.8 μ S/cm | 147.5 μ S/cm | 0.3 μ S/cm | 2.5 μ S/cm |
| 1.425 mS/cm | 1.427 mS/cm | -0.002 mS/cm | 0.0051 mS/cm |

Note : Adjustment points: 147.8 μ S/cm 1.425mS/cm

The above reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -

Calibrated by Onnapa
REV.02.02/24/21

FE-169



AUTOMATION SERVICE CO.,LTD.
CALIBRATION LABORATORY

SV 201005/2024

Cert. No. WAC-065
Page 1 of 2

CERTIFICATE OF CALIBRATION

Instrument : DO Meter
Model : DO-31P
Serial No. : 780065
Manufacturer : TOA-DKK
Measuring Range : 0.00 ~ 20.00 mg/l

Machine : -
Location : -

Customer : Water Analysis Center Co.,Ltd.
1/94 Moo.5 T.Kanham, A.U-Thai
Ayuthaya 13210 Thailand

Date Of Received : 11 / 01 / 2024
Date Of Calibration : 11 / 01 / 2024

Ambient Condition : Temperature 26 $^{\circ}$ C
Humidity 58 % RH

Calibrated By : P. Yooyen
(Ms. Phanee Yooyen)
Technician

Approved By : N. Phung
(Mr. Nipon Phungsomsak)
Technical Manager

Date Of Issue : 15 / 01 / 2024

This Certificate may not be reproduced other than in full, except with the prior written approval of the head of the industrial instruments calibration center.



AUTOMATION SERVICE CO., LTD.
CALIBRATION LABORATORY

Instrument : DO Meter
Model : DO-31P
Serial No. : 780065

Cert. No. WAC-065
Page 2 of 2

Calibrate Procedure

- ☐ This instrument was calibrated by comparison with standard solution (PH/ORP)
☐ This instrument was calibrated by comparison with scattering plate value (Turbidity)
☐ This instrument was calibrated by comparison with conductivity (Conductivity)
☒ This instrument was calibrated by comparison with Sodium sulfite anhydrous (DO)

Condition of this result of calibration

1). Reference Standard Solution

| Standard | Lot No | Batch | Cert. No. | Due Date |
|----------------------|----------|-------|-----------|----------|
| Sodium Sulfite Power | 408K1405 | - | - | - |

2). Traceability This certification is traceable to

- ☒ Kanto Chemical Co.,INC.
☐ DKK Corporation

Result Of Calibration

| Standard Solution (mg/l) at 25.7°C | Before Adjust | | After Adjust | |
|---------------------------------------|---------------|-------|--------------|-------|
| | Indicator | Error | Indicator | Error |
| Zero | 0.00 | +0.10 | 0.00 | - |
| Span | 8.02 | -1.57 | 8.02 | - |

DO Electrode No. OE270AA(S) S/N 111F0029

Calibrated By

P. Yooyen

(Ms. Phanee Yooyen)
Technician



Intech Metrological Center Co.Ltd.
39/1 Soi 82, Sukhapiban 5 Rd., O ngoen,
Salmal, Bangkok 10220, Thailand
Tel. (662) 909-8820 (Auto 10 lines) www.imcinstrument.com



Certificate of Calibration

Certificate No. : MT24-3208
Page : 1 of 2

Customer : Water Analysis Center Co.,Ltd.
Address : 1/94 M.5, Rojana Industrial Park, T.Kanham, A.U-Thai, Ayuthaya 13210

Description : Hot Air Oven
Manufacturer : Memmert
Model : UF 260
Serial No. : B620.0814
Identification No. : WWL 0212
Calibration Place : Customer Laboratory

Order No. : 1152/24
Received date : Mar 22, 2024
Calibration date : Mar 22, 2024
Environment Condition :
Temperature : (25 \pm 10) °C
Humidity : (50 \pm 30) %RH

Calibration Method : Calibration were conducted using In-house calibration procedure CP-MT-006 According to comparison with LXI Data Acquisition Switch Unit with sensor. The calibration methods based on Euramet Calibration Guide No.20 - guidelines on the Calibration of Temperature and/or Humidity Controlled Enclosures.

Reference Standard Instruments :

| Instrument | Model | Serial No. | Certificate No. | Due Date |
|----------------------------------------------|--------|------------|-----------------|--------------|
| LXI Data Acquisition Switch Unit with Sensor | 34972A | MY49020096 | MT23-7163 | Nov 30, 2024 |

The effect that the result relate only to the items calibrated. It was found accurate as shown on date and place of calibration only.

Traceability : This measurement are traceable to the International System of Unit (SI), through National Institute of Metrology Thailand (NIMT)

The reported expanded uncertainty of measurement was based on standard uncertainty multiplied by coverage factor 2, providing a level of confidence of not less than 95%



Calibrated by : Mr. Yuttakorn Jamneansri

Approved by : (Mr. Panuwat Phuklan)

Issue date : Apr 10, 2024

This calibration certificate shall not be reproduced other than in full except with the prior written approval of Intech Metrological Center Co.,Ltd

Rev.03 / Feb 2024

Automation Service Co.,Ltd. 929 829/1 Soi Pattanakarn30, Pattanakarn Rd., Suanluang, Suanluang, Bangkok 10250
Tel. : 02-319-9094 ext. 721,725 | E-mail : iso@automation.co.th, service@automation.co.th | www.automation.co.th

FM-MT-013

Function

Calibration point

: Temperature measurement

: 104, 180 °C

Certificate No. : MT24-3208

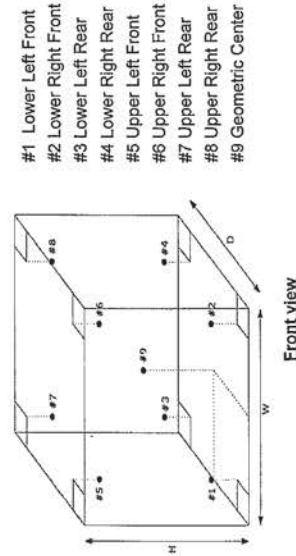
Page : 2 of 2

Result : Without adjustment

Resolution : 0.1 °C

| Calibration point (°C) | Temperature of UUC* at each position (°C) | | | | | | | | | Uncertainty of measurement (+/- °C) |
|------------------------|-------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|-------------------------------------|
| | Ch.1 | Ch.2 | Ch.3 | Ch.4 | Ch.5 | Ch.6 | Ch.7 | Ch.8 | Ch.9 | |
| 104 | 103.494 | 103.933 | 103.871 | 103.988 | 103.990 | 104.081 | 103.843 | 104.217 | 104.022 | 0.45 |
| 180 | 179.985 | 179.953 | 180.047 | 179.985 | 179.908 | 180.088 | 180.065 | 180.273 | 180.105 | 0.54 |

| Setting temperature (°C) | Indicating Temperature (°C) | Measured stability (+/- °C) | Measured uniformity (°C) | Overall variation (°C) |
|--------------------------|-----------------------------|-----------------------------|--------------------------|------------------------|
| 104.0 | 104.0 | 0.34 | 0.66 | 1.3 |
| 180.0 | 180.0 | 0.41 | 0.86 | 1.2 |



UUC* = Unit under calibration

Uniformity = Maximum and Minimum difference of measured temperature at any probes and the measured temperature at the reference and same time.

Overall Variation = Difference of temperature value between the maximum and minimum any time.

Stability = One half of the maximum difference of measured temperatures at any one probe.



Certificate of Calibration

Equipment: Balance
Model: BL 210S
Serial No. (or ID.): 15808131 (WWL 0022)
Manufacturer: Sartorius
Condition: In condition

Certificate No.: C01241754

Issued Date: 05 June 2024

Job No.: WO-00030302

Page: 1 of 2

Customer: Water Analysis Center Co., Ltd.
1/94 Moo 5, Rojana Industrial Park, Rojana Road,
Tambol Kanham, Amphur U-Thai, Ayutthaya 13210 Thailand

Environment Condition: Temperature 26 °C ± 0.2 °C
Humidity 50 %RH ± 2.6 %RH

Calibration Place: Water Analysis Center Co., Ltd. (ห้างเครื่องชั่ง)
1/94 Moo 5, Rojana Industrial Park, Rojana Road,
Tambol Kanham, Amphur U-Thai, Ayutthaya 13210 Thailand

Calibration By: Mr. Polawad Ruamrup

Calibration Date: 05 June 2024

The Method used: In-house method, CAL-WI-47, based on UKAS Lab 14

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Co., Ltd. Certificate No. C02240400

(Mr. Polawad Ruamrup)

Person in charge

(Mr. Rungrod Jenkitrakulchai)

Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 หมู่ที่ 5 ถนนสาย 100 แขวง คลองหลวง อำเภอ คลองหลวง จังหวัด ปทุมธานี 10550
Phone: +66 2039 7000 Email: info.dksh@dksh.com Website: www.dksh.com/asia-thailand

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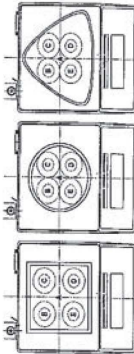
Certificate No.: C01241754

Page: 2 of 2

Calibration Results:

Without Adjustment

Eccentric Error: Weight to be 1/3 or 1/2 of Maximum capacity, taken from the center of the pan as a zero reference.



| Nominal Test Value | Reference Points (g) | | | | |
|--------------------|----------------------|--------|--------|--------|---------|
| | A | B | C | D | E |
| - | 0.0000 | 0.0001 | 0.0001 | 0.0000 | -0.0002 |

Repeatability: Determination of the standard deviation of weighing balance., Readability 0.0001 (g)

| Nominal test value (g) | Standard Deviation |
|------------------------|--------------------|
| 20 | 0.00004 |
| 200 | 0.00006 |

Error of indication from nominal or conventional mass value., Readability 0.0001 (g)

| Nominal Value (g) | Conventional Mass (g) | Displayed Value (g) | Error of Indication (g) | Uncertainty (g) | k |
|-------------------|-----------------------|---------------------|-------------------------|-----------------|------|
| 1 | 1.00001 | 1.0000 | 0.0000 | 0.00011 | 2.04 |
| 2 | 2.00002 | 2.0000 | 0.0000 | 0.00011 | 2.04 |
| 5 | 5.00002 | 5.0000 | 0.0000 | 0.00011 | 2.04 |
| 10 | 10.00001 | 10.0000 | 0.0000 | 0.00011 | 2.04 |
| 20 | 20.00001 | 20.0000 | 0.0000 | 0.00012 | 2.03 |
| 50 | 50.00003 | 50.0000 | 0.0000 | 0.00013 | 2.02 |
| 70 | 70.00004 | 70.0000 | 0.0000 | 0.00016 | 2.01 |
| 100 | 99.99996 | 100.0001 | 0.0001 | 0.00017 | 2.01 |
| 120 | 119.99997 | 120.0002 | 0.0002 | 0.00021 | 2.00 |
| 150 | 149.99999 | 150.0002 | 0.0002 | 0.00024 | 2.00 |
| 200 | 199.99996 | 200.0004 | 0.0004 | 0.00030 | 2.00 |

The End of Certificate

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 หมู่ที่ 9 ตำบลบางนาสวน แขวงคลองสาน เขตปทุมธานี 10260
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Delivering Growth - In Asia and Beyond.

CAL-FM-C01-14: 12 Sep 2022



MASTER CALIBRATION CO.,LTD.

Master Calibration Co.,Ltd.

547 Soi Ratchadaminvat, Kwang Sansenok, Khet Huaykwang, Bangkok 10310

Tel : (02) 274 2978-9, (02) 2742987-8 Fax : (02) 274 2518, (02) 274 2989

Website : www.mastercalibration.com E-mail : calibrate@mastercalibration.com

Certificate of Calibration

LIQUID BATH



Certificate No.: MC 2314268

Page 1 of 3



Customer : Water Analysis Center Co., Ltd.
1/94 Moo 5, T.Kantham, A.U.-Thai, Ayutthaya 13210.

Reference Job No. : 23-2833 Received Date : 15 December 2023
Description : Water Bath
Manufacturer : ESSTELL Model : EWB-122D
Serial No. : 20180508122 ID. No. : WWL 0214
Marking : Additionally for the purpose of identification by this laboratory a label marked with this certificate number (MC 2314268) has been attached to the case.
Method : In-House calibration procedure MWI-T-029 this method is reference to ASTM E715 "Liquid Bath".
Location of Calibration : Water Analysis Center Co., Ltd. ; Laboratory.
Environmental Condition : Ambient Temperature : (29.4 to 29.8) °C
Relative Humidity : (49.0 to 52.0) %
Date of Calibration : 15 December 2023 Date of Issue : 19 December 2023

Checked by : Chalermkiet

Chalermkiet Rakphada
(Calibration Engineer)

Approved by : Aittipong

Aittipong Karjanasit
(Technical Manager)

The uncertainties are for a confidence probability of approximately 95%

This certificate is issued in accordance with the conditions of accreditation granted by the National Standardization Council of Thailand-Office of the National Standardization Council that has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of Master Calibration Co.,Ltd.

[MCF-Q-077 ; Rev.6 ; Date : 22/04/2021]

Certificate No.: MC 2314268

Page 2 of 3

Reference Standard Instrument :

| Description | Certificate No. | Serial No. | Due date | Traceable thru |
|----------------------------------------------------------------------------------|-----------------|------------|------------|----------------|
| Data Acquisition/Switch Unit With Thermocouple Type " T " ID. No.27/1 to 27/5 | MC 2301270 | MY44020009 | 9 Mar 2024 | MICAL |

Traceability :

The measurement standard traceable to the international system of units (SI) through certificate as mentioned above

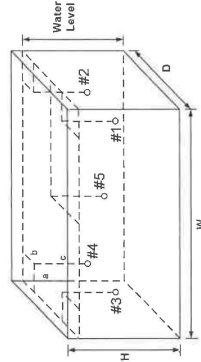
1. Calibration Procedure:

This Instrument was calibration according to ASTM E715 - 2007 by comparison with calibrated sensor under no load condition. The sensor were placed on five points and located one sensor in each of the eight corners of the chamber and was away from the each wall of 5 cm to 10 cm. And placed the five sensor within 2.5 cm of the geometric center of the chamber.

Temperature Uniformity - the maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady state conditions. The reference sensor should preferably be located at the geometric center of the chamber.

Temperature Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.

Overall Variation - The Difference of the maximum and minimum measured temperatures throughout observation.



Checked by : Chalemkij

[MCF-Q-077 ; Rev.6 ; Date : 22/04/2021]

Certificate No.: MC 2314268

Page 3 of 3

2. Result of calibration :

Temperature Measurement Accuracy Test

| Indicating Temperature (°C) | Measured Temperature (°C) at Spread Locations | | | | | Uncertainty (±°C) |
|-----------------------------|-----------------------------------------------|------|------|------|---------|-------------------|
| | #1 | #2 | #3 | #4 | Ref. #5 | |
| 45.0 | 44.5 | 44.4 | 44.5 | 44.5 | 44.6 | 0.45 |

Chamber Characterization Result

| Desired Temperature (°C) | Controller Temperature (°C) | Indicating Temperature (°C) | Temperature Stability (±°C) | Temperature Uniformity (°C) | Overall Variation (°C) |
|--------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|------------------------|
| 44.5 | 45.0 | 45.0 | 0.62 | 0.88 | 1.5 |

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.0$, providing a level of confidence of approximately 95 %.

This certificate will certify of the calibrated equipment only.

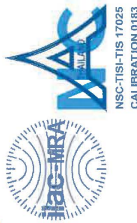
End of Certificate

Checked by : Chalemkij

[MCF-Q-077 ; Rev.6 ; Date : 22/04/2021]

Certificate of Calibration

TEMPERATURE CONTROLLER ENCLOSURES



Page 1 of 3

Certificate No.: MC 2314270

Customer : Water Analysis Center Co., Ltd.
1/94 Moo 5, T.Kantham, A.U-Thai, Ayutthaya 13210.

Reference Job No. : 23-2833 Received Date : 15 December 2023
Description : Incubator
Manufacturer : Memmert Model : IN260
Serial No. : D619/0170 ID. No. : WWL 0192
Marking : Additionally for the purpose of identification by this laboratory a label marked with this certificate number (MC 2314270) has been attached to the case.
Method : In-House calibration procedure MWI-T-033 this method is reference to TLAS G-20 "Temperature Controlled Enclosures".
Location of Calibration : Water Analysis Center Co., Ltd. ; Laboratory.
Environmental Conditions : Ambient Temperature : (25.2 to 25.6) °C
Relative Humidity : (65.4 to 66.2) %
Date of Calibration : 15 December 2023 Date of Issue : 19 December 2023

Checked by : **Chalermkrit**
Chalermkrit Rakphada
(Calibration Engineer)

Approved by : **Aittipong**
Aittipong Kanjanawasit
(Technical Manager)

The uncertainties are for a confidence probability of approximately 95%

This certificate is issued in accordance with the conditions of accreditation granted by the National Standardization Council of Thailand-Office of the National Standardization Council that has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of Master Calibration Co.,Ltd.

Certificate No.: MC 2314270

Page 2 of 3

Reference Standard Instrument :

Description : Certificate No. : Serial No. : Due date : Traceable thru :
Data Acquisition/Switch Unit MC 2214032 MY41029992 26 Dec 2023 MCAL
With Thermocouple Type " T " ID. No.31/1 to 31/9

Traceability :

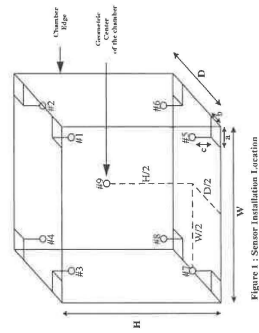
The measurement standard traceable to the international system of units (SI) through certificate as mentioned above

1. Calibration Procedure:

This Instrument was calibration according to TLAS G-20 by comparison with calibrated thermocouple type T under no load condition. The Thermocouples were placed on nine points and located one thermocouple in each of the eight corners of the chamber and was away from the each wall of 5 cm to 10 cm. And placed the ninth thermocouple within 2.5 cm of the geometric center of the chamber.

Temperature Uniformity - the maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady state conditions. The reference sensor should preferably be located at the geometric center of the chamber.
Temperature Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.

Overall Variation - The Difference of the maximum and minimum measured temperatures throughout observation.



Overall Ambient Temperature around the Chamber variation : 0.4 °C
Overall Line Voltage variation : 0.0 V
Chamber Size (W*H*D) : 65 cm x 80 cm x 50 cm

Figure 1 : Sensor Installation Location

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Certificate No.: MC 2314270

Page 3 of 3

2. Result of calibration :

Temperature Measurement Accuracy Test

| Indicating Temperature (°C) | Measured Temperature (°C) at Spread Locations | | | | | | | | | Uncertainty (±°C) |
|-----------------------------------|-----------------------------------------------|------|------|------|------|------|------|------|---------|----------------------|
| | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 | Ref. #9 | |
| 35.0 | 35.2 | 35.2 | 35.2 | 35.2 | 35.1 | 35.1 | 35.0 | 35.1 | 35.1 | 0.44 |

Chamber Characterization Result

| Desired Temperature (°C) | Controller Temperature (°C) | Indicating Temperature (°C) | Temperature Stability (±°C) | Temperature Uniformity (°C) | Overall Variation (°C) |
|--------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|------------------------------|
| 35.0 | 35.0 | 35.0 | 0.13 | 0.21 | 0.4 |

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95 %.

This certificate will certify of the calibrated equipment only.

End of Certificate

Checked by : Chalermkit