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## 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 Range : 0 - 14 pH, Resolution : 0.01 pH

Model SevenCompact S220

ID No. WWL 0068

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 )

( ) ( Krisyosil K. ) ( ) ( Sakda Y. )

( ) ( Patiphan K. ) ( ) ( Onnapa P. )

( ) ( Pongsak H. ) ( ) ( Nitiphong K. )

( ) ( Kanung C. ) ( ) ( Nonthachai K. )

( ) ( Pramong P. ) ( ) ( Noppol P. )

Certificate No.: CO-1808005/23

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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<br>(mV) | Nominal Value<br>(pH) | UUC Reading |        | Uncertainty<br>(± 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)

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

Certificate No.: C0-1808005/23

Page 3 of total 4 pages

Measurement Results (Cont.):

2. Calibration of pH Electrode (Serial No.: 3222623)

| pH Standard Solution<br>(pH) | Measured Value |        | Uncertainty<br>(± pH) |
|------------------------------|----------------|--------|-----------------------|
|                              | (pH)           | (mV)   |                       |
| 4.01                         | 4.01           | 180.0  | 0.013                 |
| 7.01                         | 7.00           | 4.0    | 0.013                 |
| 10.01                        | 10.01          | -172.0 | 0.013                 |

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

Temperature stability of micro bath : 25 ± 0.2°C

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%.

Certificate No.: C0-1808005/23

Page 4 of total 4 pages

Reference Method:

- The calibration method used was CP-096 based on an in-house method.
- The temperature scale used was an ITS-90.
- 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 Instruments:

| Type                            | Model     | Serial No. | Cert. No.     | Due Date      | Traceability |
|---------------------------------|-----------|------------|---------------|---------------|--------------|
| Thermometer Readout             | 1529-R    | B7C853     | 10-0911001/22 | Nov. 9, 2023  | THC          |
| Platinum Resistance Thermometer | 5626      | 4854       | C0A30047      | Oct. 22, 2023 | FLUKE        |
| Liquid Bath                     | XORTS-40A | XO111019   | 10-2405001/23 | May 25, 2025  | THC          |

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

- THC, Thai Heart Calibration Co., Ltd.
- FLUKE, Fluke Corporation, U.S.A.

Measurement Results:

(X) Without Adjustment

Dimension of probe : Diameter 4 mm. Sensor Type : RTD (PT100)

| Immersion Depth (mm.) | Standard Reading (°C) | UUC Reading (°C) | Correction (°C) | Uncertainty (± °C) |
|-----------------------|-----------------------|------------------|-----------------|--------------------|
| 120                   | 22.00                 | 22.2             | -0.20           | 0.065              |
| 120                   | 25.00                 | 25.2             | -0.20           | 0.065              |
| 120                   | 28.00                 | 28.2             | -0.20           | 0.065              |

UUC : Unit Under Calibration

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 Pongsak  
REV.02 02/24/21

Certificate No.: MC 2307702

Page 2 of 3

**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.17/1 to 17/9 |                 |            |            |                |

**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.

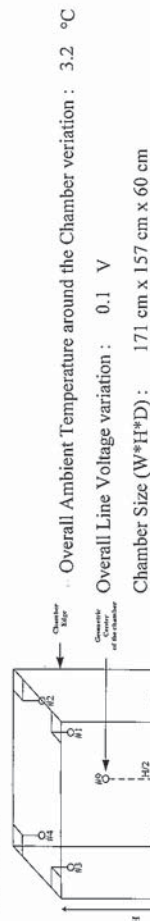


Figure 1 : Sensor Installation Location

Checked by : **Thanagorn**

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

# 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 : **Thanagorn**  
Thanagorn Limchaicharoen  
( 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.

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

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: *Thanyan*

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



THAI HEART CALIBRATION CO., LTD.  
102/11 Moo 5, Phraek Sai, Bangna Suburb, Bangkok 10700  
Tel. 0-2394-9109, 0-2394-9108, 0-2394-9107, 0-2394-9106  
Fax 0-2394-9105, 0-2394-9104, 0-2394-9103, 0-2394-9102



# 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  
**Serial No.** 2657889  
**Description** -  
**Model** CON 2700  
**ID No.** WWL 0136

**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]*  
Representative of Managing Director

Act as Technical Manager

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

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

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 µS/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.

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

| Conductivity Standard Solution | Measured Value | Correction   | Uncertainty ( ± ) |
|--------------------------------|----------------|--------------|-------------------|
| 147.8 µS/cm                    | 147.5 µS/cm    | 0.3 µS/cm    | 2.5 µS/cm         |
| 1.425 mS/cm                    | 1.427 mS/cm    | -0.002 mS/cm | 0.0051 mS/cm      |

Note : Adjustment points: 147.8µS/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

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  
Ayutthaya 13210 Thailand

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

Ambient Condition : Temperature 26 °C  
Humidity 58 % RH

Calibrated By : P. Yooyen  
(Ms. Phance 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

Automation

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<br>(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



Inctech Metrological Center Co.Ltd.  
39/1 Soi 82, Sukhaphan 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.                                       | Order No.             | : 1152/24       |
| Address            | : 1/94 M.5, Rojana Industrial Park, T.Kanham, A.U-Thai, Ayuthaya 13210 | Received date         | : Mar 22, 2024  |
| Description        | : Hot Air Oven                                                         | Calibration date      | : Mar 22, 2024  |
| Manufacturer       | : Memmert                                                              | Environment Condition | :               |
| Model              | : UF 260                                                               | Temperature           | : (25+/-10) °C  |
| Serial No.         | : B620.0814                                                            | Humidity              | : (50+/-30) %RH |
| Identification No. | : WWL 0212                                                             |                       |                 |
| Calibration Place  | : Customer Laboratory                                                  |                       |                 |

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 Inctech Metrological Center Co.,Ltd

Rev.03 / Feb 2024

Automation Service Co.,Ltd. 929 829/1 Soi Pattanakarn30, Pattanakarn Rd., Suanluang, Suanluang, Bangkok 10250  
Tel. : 02-319-9994 ext. 721,725 | E-mail : iso@automation.co.th, service@automation.co.th | www.automation.co.th

FM-MT-013

Function

: Temperature measurement

Calibration point

: 104, 180 °C

Certificate No. : MT24-3208

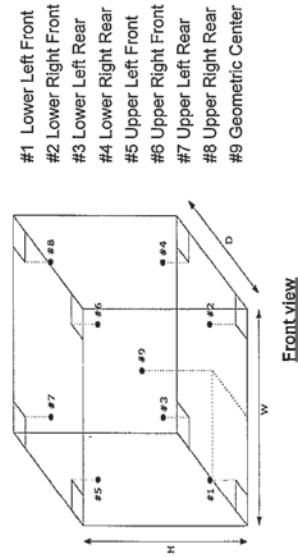
Page : 2 of 2

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 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 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260  
Phone: +66 2039 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-asia-thailand

Delivering Growth - in Asia and Beyond.



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 | 0.0000 | 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

DKSH Technology Limited  
2533 หมู่ 9 ตำบลบางนา อำเภอบางนา จังหวัดกรุงเทพมหานคร 10260  
Phone: +66 2639 7000 Email: info@dksh.com Website: www.dksh.com/vietnam-thailand

Delivering Growth - in Asia and Beyond.

CAL-FM-C01-14-12 Sep 2022



MASTER CALIBRATION CO.,LTD.

Master Calibration Co.,Ltd.

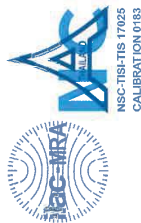
547 Soi Ratchadaminvat, Kwang Sansernok, Khor Huaykwang, Bangkok 10310

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 : Chalermkit 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

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#### Reference Standard Instrument :

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

#### Traceability :

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

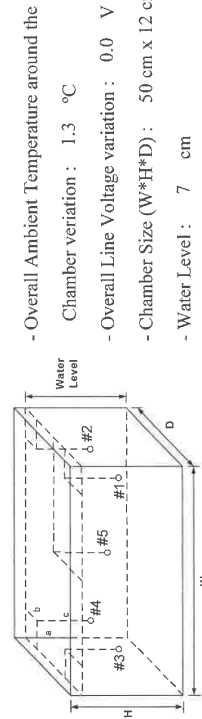
#### 1. Calibration Procedure:

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.



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#### 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.**

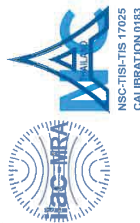
**End of Certificate**

Checked by : Chalermkit

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

## Certificate of Calibration

### TEMPERATURE CONTROLLER ENCLOSURES



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  
Description : Incubator  
Manufacturer : Memmert  
Serial No. : D619/0170  
Model : IN260  
ID. No. : WWL 0192  
Marking :  
Method : Additionally for the purpose of identification by this laboratory a label marked with this certificate number ( MC 2314270 ) has been attached to the case.  
Location of Calibration : In-House calibration procedure MWI-T-033 this method is reference to TLAS G-20 "Temperature Controlled Enclosures".  
Environmental Conditions : Water Analysis Center Co., Ltd. ; Laboratory.  
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 : **Chalermkit**  
Chalermkit 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

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#### Reference Standard Instrument :

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

#### 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.

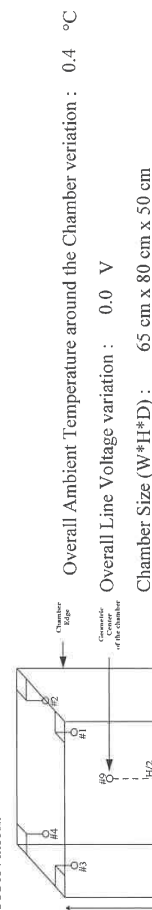


Figure 1 : Sensor Installation Location

Checked by : **Chalermkit**

Certificate No.: MC 2314270

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## 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 : Chalermchai