

# ภาคผนวก จ

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ใบรับรองการสอบเทียบเครื่องมือ



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right partner.

รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

| Sample Name | Parameter                        | Equipment Name                 | ID No.     | Calibrated Date | Next Cal  | Freq. Calibrate (Months) |
|-------------|----------------------------------|--------------------------------|------------|-----------------|-----------|--------------------------|
| Water Lab   | pH at 25 °C                      | pH meter                       | BKK_EN0072 | 12-Sep-22       | 12-Mar-24 | 18                       |
| Water Lab   | Settleable Solids                | Chamber (Cold Room)            | BKK_EN0167 | 6-Dec-23        | 6-Jun-25  | 18                       |
| Water Lab   | Sulfide                          | Burette                        | BKK_EN0171 | 30-Aug-22       | 1-Mar-24  | 18                       |
| Water Lab   | Sulfide                          | Chamber (Cold Room)            | BKK_EN0167 | 6-Dec-23        | 6-Jun-25  | 18                       |
| Water Lab   | Oil & Grease                     | Electronic Top-Loading Balance | BKK_EN0002 | 8-Feb-23        | 8-Feb-24  | 12                       |
| Water Lab   | Oil & Grease                     | Water Bath                     | BKK_EN0148 | 4-Jul-23        | 4-Jan-25  | 18                       |
| Water Lab   | Total Kjeldahl Nitrogen          | Digestion Unit                 | BKK_EN0366 | 17-May-23       | 17-May-24 | 12                       |
| Water Lab   | Total Kjeldahl Nitrogen          | Discrete analyzer              | BKK_EN0037 | 12-Jul-23       | 12-Jul-24 | 12                       |
| Water Lab   | Total Suspended Solids           | Electronic Top-Loading Balance | BKK_EN0002 | 8-Feb-23        | 8-Feb-24  | 12                       |
| Water Lab   | Total Suspended Solids           | Oven                           | BKK_EN0273 | 29-Nov-22       | 29-Jan-24 | 18                       |
| Water Lab   | Total Dissolved Solids 103-105°C | Electronic Top-Loading Balance | BKK_EN0002 | 8-Feb-23        | 8-Feb-24  | 12                       |
| Water Lab   | Total Dissolved Solids 103-105°C | Oven                           | BKK_EN0273 | 29-Nov-22       | 29-May-24 | 18                       |
| Water Lab   | BOD                              | DO Meter                       | BKK_EN0017 | 16-Dec-23       | 16-May-25 | 18                       |
| Water Lab   | BOD                              | Incubator                      | BKK_EN0272 | 5-Jul-23        | 5-Jul-24  | 12                       |
| Water Lab   | BOD                              | Incubator                      | BKK_EN0305 | 5-Apr-23        | 5-Apr-24  | 18                       |
| Water Lab   | Total Coliform                   | Autoclave                      | BKK_ML0041 | 4-Oct-23        | 4-Apr-25  | 18                       |
| Water Lab   | Total Coliform                   | Incubator                      | BKK_ML0010 | 17-Jul-23       | 17-Jan-25 | 18                       |
| Water Lab   | Total Coliform                   | Hot Air Oven                   | BKK_ML0013 | 21-Nov-22       | 21-May-24 | 18                       |
| Water Lab   | Fecal Coliform                   | Autoclave                      | BKK_ML0041 | 4-Oct-23        | 4-Apr-25  | 18                       |
| Water Lab   | Fecal Coliform                   | Incubator                      | BKK_ML0010 | 17-Jul-23       | 17-Jan-25 | 18                       |
| Water Lab   | Fecal Coliform                   | Hot Air Oven                   | BKK_ML0013 | 21-Nov-22       | 21-May-24 | 18                       |
| Water Lab   | Fecal Coliform                   | Water Bath                     | BKK_ML0056 | 20-Apr-23       | 20-Apr-24 | 12                       |
| Water Lab   | Ammonia Nitrogen                 | Discrete analyzer              | BKK_EN0037 | 12-Jul-23       | 12-Jul-24 | 12                       |
| Water Lab   | Total Alkalinity                 | Burette                        | BKK_EN0171 | 30-Aug-22       | 1-Mar-24  | 18                       |
| Water Lab   | Calcium Hardness                 | Burette                        | BKK_EN0171 | 30-Aug-22       | 1-Mar-24  | 18                       |
| Water Lab   | Residual Free Chlorine           | Chlorine Meter                 | CHM_FS0109 | 21-Nov-23       | 21-Nov-24 | 12                       |
| Water Lab   | Nitrate                          | Ion Chromatography             | BKK_EN0069 | 12-Jan-23       | 12-Jan-24 | 12                       |
| Water Lab   | Chloride                         | Ion Chromatography             | BKK_EN0069 | 12-Jan-23       | 12-Jan-24 | 12                       |
| Water Lab   | <i>Staphylococcus aureus</i>     | Autoclave                      | BKK_ML0041 | 4-Oct-23        | 4-Apr-25  | 18                       |
| Water Lab   | <i>Staphylococcus aureus</i>     | Incubator                      | BKK_ML0010 | 17-Jul-23       | 17-Jan-25 | 18                       |
| Water Lab   | <i>Staphylococcus aureus</i>     | Hot Air Oven                   | BKK_ML0013 | 21-Nov-22       | 21-May-24 | 18                       |
| Water Lab   | <i>Pseudomonas aeruginosa</i>    | Autoclave                      | BKK_ML0041 | 4-Oct-23        | 4-Apr-25  | 18                       |
| Water Lab   | <i>Pseudomonas aeruginosa</i>    | Incubator                      | BKK_ML0010 | 17-Jul-23       | 17-Jan-25 | 18                       |
| Water Lab   | <i>Pseudomonas aeruginosa</i>    | Water Bath                     | BKK_ML0049 | 19-Jan-23       | 19-Jan-24 | 12                       |
| Water Lab   | <i>Pseudomonas aeruginosa</i>    | Hot Air Oven                   | BKK_ML0013 | 21-Nov-22       | 21-May-24 | 18                       |
| Water Lab   | <i>Escherichia coli</i>          | Autoclave                      | BKK_ML0041 | 4-Oct-23        | 4-Apr-25  | 18                       |
| Water Lab   | <i>Escherichia coli</i>          | Incubator                      | BKK_ML0010 | 17-Jul-23       | 17-Jan-25 | 18                       |
| Water Lab   | <i>Escherichia coli</i>          | Hot Air Oven                   | BKK_ML0013 | 21-Nov-22       | 21-May-24 | 18                       |
| Water Lab   | <i>Escherichia coli</i>          | Water Bath                     | BKK_ML0056 | 20-Apr-23       | 20-Apr-24 | 12                       |
| Water Lab   | Cyanuric acid                    | Spectrophotometer              | SGK_CL0038 | 24-Jan-23       | 24-Jan-24 | 12                       |



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert.No.: 22CH1222

Page.: 1 of 2

## Certificate of Calibration

|                         |   |
|-------------------------|---|
| Equipment :             | pH Meter  |
| Manufacturer :          | Mettler Toledo  |
| Model :                 | Seven Compact S220  |
| Serial No. :            | B520948426  |
| ID No. :                | BKK_EN0072  |
| Condition As-Received:  | Used Item   |
| Received Date :         | 09 September 2022   |
| Calibration Date :      | 12 September 2022   |
| Reference :             | 2209-0312DSC-1  |
| Submitted by :          | ALS Laboratory Group (Thailand) Co.,Ltd.<br>104 Phatthanakan 40, Phatthanakan Rd.,<br>Khwaeng Phatthanakan, Khet Suan Luang,<br>Bangkok 10250 Thailand      |
| Ambient Temperature :   | (25 ± 2.5) °C   |
| Relative Humidity :     | (50 ± 15) %   |
| Calibration Procedure : | In - house method :<br>- CP-CH5 by direct measurement with standard<br>voltage calibrator and direct measurement<br>with certified reference material (CRM) |

|                |           |
|----------------|-----------|
| REVIEW BY      | Sinluk P. |
| APPROVED BY    | KL AL     |
| NEXT CAL. DATE | 12/03/24  |

Calibrated by : Warakorn Lerngagtrakul

Approved by :

*Malee*

Approved Signatory

- ( ☒ ) Malee Butkruea  
( ☐ ) Saithip Meangmai  
( ☐ ) Warakorn Lerngagtrakul

Issue Date : 15 September 2022

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written  
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.



Cert. No.: 22CH1222

Page.: 2 of 2

**Condition of this calibration result**

## 1. Reference Standard Instrument : -

| <u>Instrument</u>              | <u>Serial No.</u> | <u>ID No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|--------------------------------|-------------------|---------------|------------------|-----------------|
| 1) Document Process Calibrator | 54030049          | 130RC116      | 22E2769          | 24 Aug 2023     |

This certification is traceable to the International System of Unit maintained at:-

- Traceable to National Institute of Metrology (Thailand), NIMT

2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,  
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

| <u>Buffer Solution</u> | <u>Manufacturer</u> | <u>Lot No.</u> | <u>Exp. date</u> |
|------------------------|---------------------|----------------|------------------|
| pH 4.008               | CPA chem            | 823320         | 20 June 2024     |
| pH 6.985               | CPA chem            | 794122         | 14 Feb 2023      |
| pH 10.008              | CPA chem            | 823323         | 20 June 2023     |

3. This certificate is valid only to the item calibrated on date and place of calibration.

**Calibration Results****Function : mV Measurement****Performing standard curve by Fluke at pH (4,7,10)**

| Unit Under Calibration       | Nominal Value | Standard Voltage Input | Actual Reading |        | Uncertainty of Measurement<br>( $\pm$ mV) | Coverage factor<br><i>k</i> |
|------------------------------|---------------|------------------------|----------------|--------|---|-----------------------------|
|                              | pH            | mV                     | mV             | pH     |   |                             |
| pH Meter<br>S/N.: B520948426 | 4.000         | 177.48                 | 177.4          | 4.000  | 0.058                                     | 2.00                        |
|                              | 7.000         | 0.00                   | 0.0            | 7.000  | 0.058                                     | 2.00                        |
|                              | 10.000        | -177.48                | -177.5         | 10.000 | 0.058                                     | 2.00                        |

**Function : pH Measurement****Performing three buffers standard curve by using buffer nominal pH (4,7,10)**

| Unit Under Calibration              | Standard pH Buffer Solution | Actual pH Reading | Actual mV Reading<br>(mV) | Uncertainty of pH measurement<br>( $\pm$ ) | Coverage factor<br><i>k</i> |
|-------------------------------------|-----------------------------|-------------------|---------------------------|--|-----------------------------|
| pH Electrode<br>S/N.: PCE-86-EX1001 | 4.008                       | 3.999             | 153.9                     | 0.0055                                     | 2.09                        |
|                                     | 6.985                       | 7.017             | -13.7                     | 0.0084                                     | 2.00                        |
|                                     | 10.008                      | 9.996             | -179.0                    | 0.0078                                     | 2.06                        |

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

-o0o-

Malu.

a 1126274



# Metrology

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.

Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6851 , +669 8247 2360

Website : www.scieco.co.th E-Mail : calibrate@scg.com



Certificate No. T232160

Page 1 of 4

## Certificate of Calibration

Equipment : Chamber ( Cooling Room )

Manufacturer : KOLDTECH

Model : KM 320

Serial No. : TBN-1012061/05

Customer Code : BKK\_EN0167

ID No. : T2463A3

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

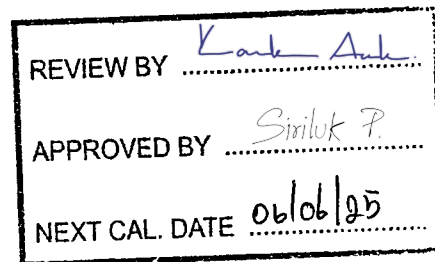
Customer Location : Laboratory

Date of Receipt : 29 November 2023

Calibrated By : Atiphong Rongrat ( Technician )

Approved By : Boonchai Suriyawong / Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 09 JAN 2024



The uncertainties are for a confidence probability of approximately 95%.

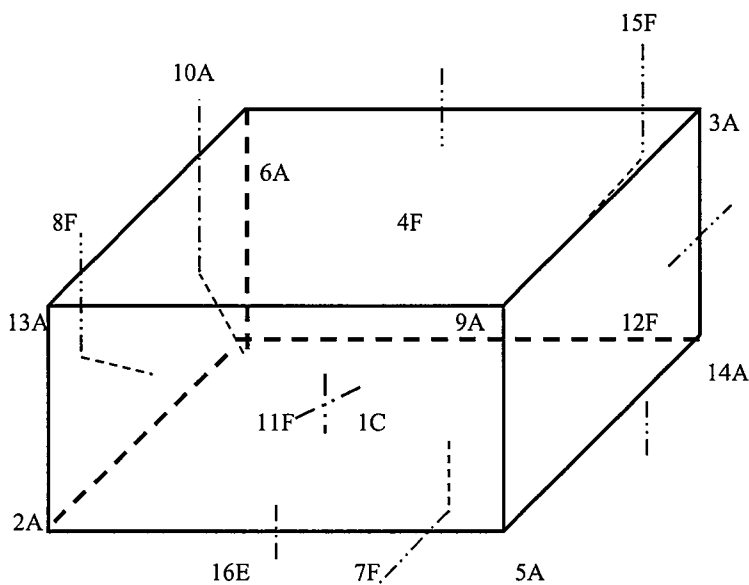
This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrology.



Certificate No. T232160

Page 3 of 4

## Calibration Report



C = Centre , F = Centre of Face , A = Corner , E = Centre of Edge

|     |   |       |
|-----|---|-------|
| 1C  | = | TN161 |
| 2A  | = | TN162 |
| 3A  | = | TN163 |
| 4F  | = | TN164 |
| 5A  | = | TN165 |
| 6A  | = | TN166 |
| 7F  | = | TN167 |
| 8F  | = | TN168 |
| 9A  | = | TN169 |
| 10A | = | TN170 |
| 11F | = | TN171 |

|     |   |       |
|-----|---|-------|
| 12F | = | TN172 |
| 13A | = | TN173 |
| 14A | = | TN174 |
| 15F | = | TN175 |
| 16E | = | TN176 |

Approved By. 

Certificate No. T232160

Page 4 of 4

## Calibration Report

### Measurement Results


| Calibration Point | Average Standard Reading at each position (°C) |       |       |       |       |       |       |       |       |       |       |       |
|-------------------|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|                   | TN161  | TN162 | TN163 | TN164 | TN165 | TN166 | TN167 | TN168 | TN169 | TN170 | TN171 | TN172 |
| 3.0               | 2.83   | 3.34  | 2.95  | 3.46  | 3.45  | 3.76  | 3.25  | 3.46  | 3.39  | 3.50  | 3.58  | 3.42  |
|                   | TN173  | TN174 | TN175 | TN176 |       |       |       |       |       |       |       |       |
|                   | 3.33   | 3.39  | 3.15  | 3.43  |       |       |       |       |       |       |       |       |

| Chamber ( Cooling Room ) |              |         | Temperature Distribution |                  |                 |                    |                          |
|--------------------------|--------------|---------|--------------------------|------------------|-----------------|--------------------|--------------------------|
| Setting (°C)             | Reading (°C) |         | Average (°C)             | Stability (± °C) | Uniformity (°C) | Uncertainty (± °C) | Coverage Factor <i>k</i> |
|                          | Min , Max    | Average |                          |                  |                 |                    |                          |
| 3.0                      | 2.8 , 4.1    | 3.5     | 3.36                     | 1.10             | 2.00            | 1.90               | 2.09                     |

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By. 



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
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TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert.No.: 22CG3154

Page.: 1 of 2

## Certificate of Calibration

|                         |  |
|-------------------------|--|
| Equipment :             | Burette  |
| Capacity :              | 50 mL  |
| Serial No. :            | -  |
| ID. No. :               | BKK_EN0171   |
| Manufacturer :          | Witeg  |
| Made in :               | Germany  |
| Submitted by :          | ALS Laboratory Group (Thailand) Co.,Ltd.<br>104 Phatthanakan 40, Phatthanakan Rd.<br>Khwaeng Phatthanakan, Khet Suan Luang<br>Bangkok 10250 Thailand |
| Ambient Temperature :   | (20 ± 2.5) °C  |
| Relative Humidity :     | (50 ± 10) %  |
| Barometric Pressure :   | 759 mmHg   |
| Calibration Procedure : | ASTM E 542 - 01  |
| Calibrated by :         | Panward Pramklam   |

|                |                   |
|----------------|-------------------|
| REVIEW BY      | <i>Sin'luk P.</i> |
| APPROVED BY    | <i>KLAL</i>       |
| NEXT CAL. DATE | <i>29/03/2024</i> |

Approved by :

Approved Signatory

- ( ) Pornthippa Tameyakul  
( ) Malee Butkruea  
(☒) Ponpan Paipim  
( ) Srisuda Khamtha

Issue Date :

31 August 2022

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0044607



Equipment : Burette  
Received Date : 26 August 2022  
Condition As-Received : Used Item  
Calibration Date : 30 August 2022  
Reference : 2208-0918DSC-2

Cert.No.: 22CG3154

Page.: 2 of 2

**Condition of this result of calibration**

1. Reference Standard Instruments :

| <u>Instruments</u>   | <u>Model</u> | <u>Serial No.</u> | <u>ID. No.</u> | <u>Certificate No.</u> | <u>Traceability</u> | <u>Due date</u> |
|----------------------|--------------|-------------------|----------------|------------------------|---------------------|-----------------|
| 1) Balance           | AE200S       | N03679            | 140RC001       | 21MM429                | NIMT                | 22 Sep 2022     |
| 2) Thermo-Hygrograph | THDX-CE      | 00016540          | 140EC001       | 22H1243                | NIST,NIMT           | 09 June 2023    |
| 3) Thermometer       | -            | 1594592           | 140EC010       | 22I181                 | NIMT                | 10 Feb 2023     |

This certification is traceable to SI Unit

2. The certificate is valid only to the item calibrated on date and place of calibration.  
3. True value is converted to true volume at the standard temperature of 20 °C

**Calibration result :**

| <b>Nominal capacity<br/>( mL )</b> | <b>Reading<br/>( mL )</b> | <b>Uncertainty<br/>( <math>\pm</math> mL )</b> | <b>k<br/>Factor</b> |
|------------------------------------|---------------------------|--|---------------------|
| 50                                 | 49.9959                   | 0.010  | 2.00                |

**Remark** mL = cm<sup>3</sup>

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

-o0o-

**a 1123908**

**Sartorius (Thailand) Co., Ltd.**

129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310

Tel: +66 2643 8361-6, e-mail: service.thailand@sartorius.com

**SARTORIUS**

# Certificate

## of Calibration

|                |                   |
|----------------|-------------------|
| REVIEW BY      | <u>Sirilut P.</u> |
| APPROVED BY    | <u>LL AL</u>      |
| NEXT CAL. DATE | <u>8/2/24</u>     |

Model Number : MSE224S-100-DUDescription : Analytical BalanceSerial Number : 26207042ID No. : BKK\_EN0002Manufacturer : SartoriusCertificate No. : 23BCI0072Issued Date : Monday, February 13, 2023Reference No. : 203245Page No. : 1 of 2Customer Name : ALS Laboratory Group (Thailand)Co., Ltd.104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250.Calibrated Place : Balance RoomCalibrated By : Mr. Chonchai InthanaCalibration Date : Wednesday, February 08, 2023**Calibration**Procedure No. : This calibration was conducted by  
Using in-house calibration procedure number (WI-003)Based on UKAS LAB 14 : 2019**Metrological data :**Capacity : 220 g Readability : 0.0001 g**Ambients Conditions:**Temperature : 23.2 °C ± 5.0 °CHumidity : 60.0 % RH ± 10.0 % RHPressure : — ± —**Reasons for calibration**☐ New Installation ☐ Service / Repaired ☒ Re-calibration/ MaintenanceEquipment Condition: ☒ Good Operate ☐ Fair**Measurement Method****UKAS Publication Ref :Lab 14**

The measurement uncertainty stated is the expended 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). The calibration certificate documents the traceability to National Standards, which realise the unit of measurement according to the International Standard System of Units (SI). Report of Tolerance came form list of Sartorius Metrological Specifications.

**Traceability:**

| Model Number  | Description  | Traceability | Certificate No. | Due Date    |
|---------------|--|--------------|-----------------|-------------|
| YCS011-522-00 | Sartorius weight set 1mg - 5000g E2, YCS011-522-00 | SPC-RT       | C02212565       | 14-Sep-2023 |
| MHB-382SD     | Humidity/Barometer/Temp Lutron MHB-382SD           | DKSH         | C19220444       | 5-Sep-2023  |

This certificate relate and apply this equipment only.

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SOP FM 33 03 February 2022

  
Mr. Chonchai Inthana (Technical Manager)S  
T  
A  
M  
P

# Certificate of Calibration

Model Number : MSE224S-100-DU  
 Description : Analytical Balance  
 Serial Number : 26207042  
 ID No. : BKK\_EN0002  
 Manufacturer : Sartorius

Certificate No. : 23BCI0072  
 Issued Date : Monday, February 13, 2023  
 Reference No. : 203245  
 Page No. : 2 of 2

## Calibration Results : Without Adjustment

### Repeatability

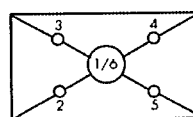
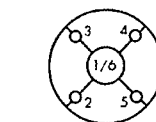
The reproducibility is the ability of a weighing instrument to display nearly identical readouts under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.

|                             |         |          |
|-----------------------------|---------|----------|
| Nominal Value : (Low Load)  | 20.0000 | 200.0000 |
| 20 g                        | 20.0000 | 199.9999 |
| Tolerance                   | 20.0000 | 200.0000 |
| 0.0001 g                    | 20.0000 | 199.9999 |
|                             | 20.0001 | 200.0000 |
|                             | 20.0000 | 200.0000 |
| Nominal Value : (High Load) | 20.0000 | 199.9999 |
| 200 g                       | 20.0000 | 199.9999 |
| Tolerance                   | 20.0000 | 200.0000 |
| 0.0001 g                    | 20.0000 | 199.9999 |
|                             | 20.0001 | 199.9999 |
| Standard Deviation          | 0.00004 | 0.00005  |

### Eccentricity (Off-center loading error)

The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R76).

Nominal value : 50 g  
 Tolerance 0.0004 g



#### Difference

|   |         |
|---|---------|
| 1 | —       |
| 2 | -0.0001 |
| 3 | 0.0000  |
| 4 | 0.0001  |
| 5 | 0.0000  |
| 6 | —       |

### Linearity

The linearity, also called linearity error. Describes the deviation of the characteristic curve of a weighing instrument from the linear slope.

Tolerance 0.0002 g

| Nominal Value<br>(g) | Conventional Mass Value<br>(g) | Displayed Value<br>(g) | Deviation<br>(g) | Uncertainty<br>(g) |
|----------------------|--------------------------------|------------------------|------------------|--------------------|
| 0.01                 | 0.0100                         | 0.0100                 | 0.0000           | 0.00014            |
| 0.1                  | 0.1000                         | 0.1000                 | 0.0000           | 0.00014            |
| 1                    | 1.0000                         | 1.0000                 | 0.0000           | 0.00014            |
| 2                    | 2.0000                         | 2.0000                 | 0.0000           | 0.00014            |
| 5                    | 5.0000                         | 5.0000                 | 0.0000           | 0.00014            |
| 10                   | 10.0000                        | 10.0000                | 0.0000           | 0.00014            |
| 20                   | 20.0000                        | 20.0000                | 0.0000           | 0.00014            |
| 50                   | 50.0000                        | 50.0000                | 0.0000           | 0.00015            |
| 100                  | 100.0000                       | 100.0000               | 0.0000           | 0.00019            |
| 200                  | 200.0000                       | 199.9999               | -0.0001          | 0.00030            |

End of Report.



# Metrological Center

## SCI ECO Services Company Limited

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Bangkok Tel : +668 9205 6851 , +669 8247 2360

Website : www.scieco.co.th E-Mail : calibrate@scg.com



Certificate No. T231303

Page 1 of 3

## Certificate of Calibration

Equipment : Liquid Bath ( Water )

Manufacturer : MEMMERT

Model : WNB29

Serial No. : L611.0135

Customer Code : BKK\_EN0148

ID No. : T6455A4

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,  
Khet Suan Luang, Bangkok 10250

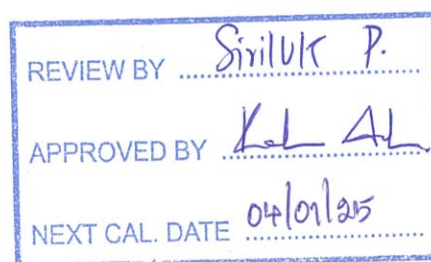
Customer Location : ORGANIC PREPARATION LAB

Date of Receipt : 27 June 2023

Calibrated By : Sujjar Naknakred ( Site Calibration Manager )

Approved By : Bm Loi / Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 11 JUL 2023



The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which 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 standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

Certificate No. T231303

Page 2 of 3

## Calibration Report

**Equipment** : Liquid Bath ( Water )  
**Date of Calibration** : 4 July 2023  
**Environment** : Temperature : 22.2-22.5 °C  
Line Voltage : 221.6-224.8 V  
Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

1. This equipment was calibrated by insert five resistance thermometer detectors into its water bath , the other one thermocouple type T use for ambient temperature measurement . The calibration was done in according to WI-T36 ( based on ASTM E715-80 ( Reapproved 2001 ) ).

All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

2. Reference Standard Instrument :

| Instrument  | Model   | Instrument No.             | Certificate No. | Due Date      |
|-------------|---------|----------------------------|-----------------|---------------|
| RTD         | 100 OHM | M18 (CH1,CH6-CH7,CH9-CH10) | T230545         | 10 April 2024 |
| DATA LOGGER | 34970A  | T149                       | T230545         | 10 April 2024 |

3. This certificate is traceable to :

National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TISI-TIS 17025 CALIBRATION 0244.)

4. Condition of calibrated item : good

Equipment Description :

Time Constant 3 Hour 45 Minute At 60 °C

5. Adjustment :

( X ) without adjustment

( ) after adjustment

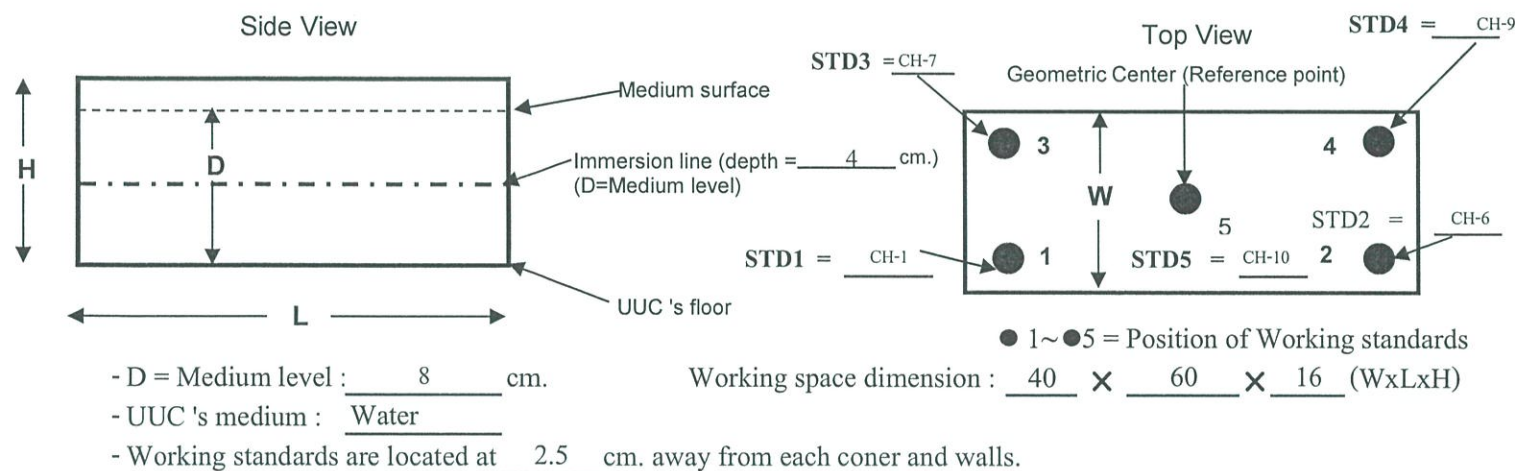
Approved By, \_\_\_\_\_



Certificate No. T231303

Page 3 of 3

## Calibration Report



### Measurement Results:

| Calibration Point | Average Standard Reading at each position (°C) |       |       |       |       |
|-------------------|--|-------|-------|-------|-------|
|                   | CH-1   | CH-6  | CH-7  | CH-9  | CH-10 |
| 60                | 60.03  | 60.06 | 60.24 | 60.11 | 60.18 |
| 85                | 84.79  | 84.83 | 85.42 | 85.05 | 85.20 |
| 95                | 93.71  | 93.83 | 94.62 | 94.15 | 94.42 |


| Liquid Bath ( Water ) |              |         | Temperature Distribution |                 |                  |                   |                          |
|-----------------------|--------------|---------|--------------------------|-----------------|------------------|-------------------|--------------------------|
| Setting (°C)          | Reading (°C) |         | Average (°C)             | Stability (±°C) | Uniformity (±°C) | Uncertainty (±°C) | Coverage Factor <i>k</i> |
|                       | Min , Max    | Average |                          |                 |                  |                   |                          |
| 61.0                  | 60.9 , 61.1  | 61.0    | 60.12                    | 0.13            | 0.19             | 0.29              | 2.04                     |
| 86.0                  | 85.8 , 86.2  | 86.0    | 85.06                    | 0.19            | 0.47             | 0.44              | 2.17                     |
| 95.0                  | 94.6 , 95    | 94.9    | 94.15                    | 0.32            | 0.65             | 0.55              | 2.13                     |

\* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By 



# Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110

Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

Website : www.scieco.co.th

E-Mail : calibrate@scg.co.th

Certificate No. T230902

Page 1 of 5

## Certificate of Calibration

Equipment : Digestion Unit

Manufacturer : SCP Science

Model : DigiPRER HT

Serial No. : HTC1120480658

Customer Code : BKK\_EN0366

ID No. : T2635A5

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

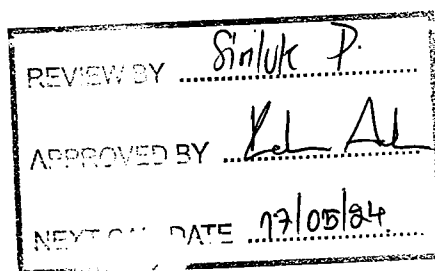
Customer Location : Wet Chemistry Lab 1

Date of Receipt : 10 May 2023

Calibrated By : Sujjar Naknakred ( Site Calibration Manager )

Approved By : [Signature] / Boonchai Suriyawong ( Site Calibration Manager )

Date of Issue : 29 MAY 2023



The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which 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 standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.



# Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110

Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

Website : www.scieco.co.th

E-Mail : calibrate@scg.co.th

Certificate No. T230902

Page 2 of 5

## Calibration Report

Equipment : Digestion Unit  
Date of Calibration : 17 May 2023  
Environment : Temperature : 23.9 - 26.3 °C  
Line Voltage : 221.8 - 225.9 V  
Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

1. This equipment was calibrated by insert four standard thermocouples type S into its chamber , the other one thermocouple type T use for ambient temperature measurement . The calibration was done in according to WI-T10.

#### 2. Reference Standard Instrument :

| Instrument  | Model  | Instrument No.    | Certificate No. | Due Date      |
|-------------|--------|-------------------|-----------------|---------------|
| TC          | Type S | M20A1-(CH17-CH20) | T230547         | 18 April 2024 |
| DATA LOGGER | 34970A | T149              | T230547         | 18 April 2024 |

#### 3. This certificate is traceable to :

National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TISI-TIS 17025 CALIBRATION 0244.)

#### 4. Condition of calibrated item : good

##### Equipment Description :

Time Constant 1 Hour 54 Minute At 380 °C  
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available

#### 5. Adjustment :

( X ) without adjustment

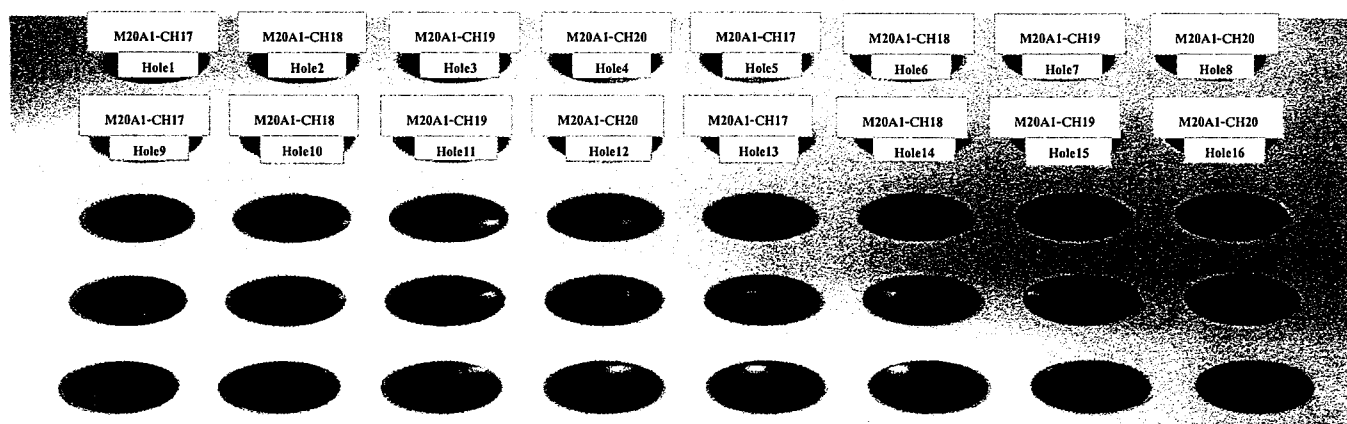
( ) after adjustment

Approved By

Certificate No. T230902

Page 3 of 5

## Calibration Report



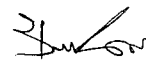
FRONT

### Measurement Results

| Cal. Point | Setting | Reading       | STD.           | Position of Standards at Block |            |            |            |            |            |            |            |
|------------|---------|---------------|----------------|--------------------------------|------------|------------|------------|------------|------------|------------|------------|
| (°C)       | (°C)    | (°C)          | Reading        | Hole1                          | Hole2      | Hole3      | Hole4      | Hole5      | Hole6      | Hole7      | Hole8      |
|            |         |               |                | M20A1-CH17                     | M20A1-CH18 | M20A1-CH19 | M20A1-CH20 | M20A1-CH17 | M20A1-CH18 | M20A1-CH19 | M20A1-CH20 |
| 380.0      | 380.0   | 379.4 - 380.7 | Max °C         | 377.3                          | 379.0      | 379.2      | 380.2      | 377.5      | 379.5      | 380.7      | 380.1      |
|            |         |               | Min °C         | 376.8                          | 378.6      | 378.9      | 379.9      | 377.0      | 379.0      | 380.2      | 379.6      |
|            |         |               | Average °C     | 377.0                          | 378.8      | 379.1      | 380.0      | 377.3      | 379.2      | 380.4      | 379.9      |
|            |         |               | Stability ± °C | 0.2                            | 0.2        | 0.2        | 0.2        | 0.3        | 0.3        | 0.2        | 0.2        |

| Cal. Point | Setting | Reading       | STD.           | Position of Standards at Block |            |            |            |            |            |            |            |
|------------|---------|---------------|----------------|--------------------------------|------------|------------|------------|------------|------------|------------|------------|
| (°C)       | (°C)    | (°C)          | Reading        | Hole9                          | Hole10     | Hole11     | Hole12     | Hole13     | Hole14     | Hole15     | Hole16     |
|            |         |               |                | M20A1-CH17                     | M20A1-CH18 | M20A1-CH19 | M20A1-CH20 | M20A1-CH17 | M20A1-CH18 | M20A1-CH19 | M20A1-CH20 |
| 380.0      | 380.0   | 379.4 - 380.7 | Max °C         | 377.1                          | 378.9      | 379.7      | 379.9      | 379.3      | 379.6      | 379.5      | 377.4      |
|            |         |               | Min °C         | 376.7                          | 378.5      | 379.3      | 379.5      | 378.9      | 379.1      | 379.0      | 377.0      |
|            |         |               | Average °C     | 376.9                          | 378.7      | 379.5      | 379.7      | 379.1      | 379.4      | 379.3      | 377.2      |
|            |         |               | Stability ± °C | 0.2                            | 0.2        | 0.2        | 0.2        | 0.2        | 0.3        | 0.3        | 0.2        |

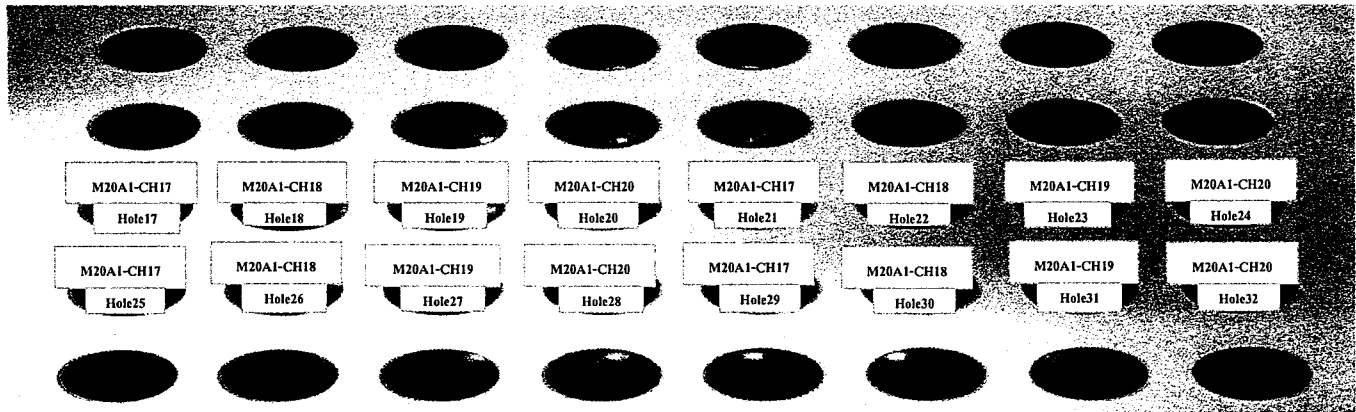
Approved By.



Certificate No. T230902

Page 4 of 5

## Calibration Report




FRONT

### Measurement Results

| Cal. Point | Setting | Reading       | STD.           | Position of Standards at Block |            |            |            |            |            |            |            |
|------------|---------|---------------|----------------|--------------------------------|------------|------------|------------|------------|------------|------------|------------|
| (°C)       | (°C)    | (°C)          | Reading        | Hole17                         | Hole18     | Hole19     | Hole20     | Hole21     | Hole22     | Hole23     | Hole24     |
|            |         |               |                | M20A1-CH17                     | M20A1-CH18 | M20A1-CH19 | M20A1-CH20 | M20A1-CH17 | M20A1-CH18 | M20A1-CH19 | M20A1-CH20 |
| 380.0      | 380.0   | 379.4 - 380.7 | Max °C         | 378.4                          | 380.1      | 380.1      | 380.0      | 379.1      | 379.8      | 379.6      | 377.8      |
|            |         |               | Min °C         | 377.8                          | 379.6      | 379.7      | 379.3      | 378.6      | 379.2      | 379.2      | 377.3      |
|            |         |               | Average °C     | 378.1                          | 379.9      | 379.9      | 379.7      | 378.9      | 379.5      | 379.4      | 377.5      |
|            |         |               | Stability ± °C | 0.3                            | 0.3        | 0.2        | 0.3        | 0.3        | 0.3        | 0.2        | 0.2        |

| Cal. Point | Setting | Reading       | STD.           | Position of Standards at Block |            |            |            |            |            |            |            |
|------------|---------|---------------|----------------|--------------------------------|------------|------------|------------|------------|------------|------------|------------|
| (°C)       | (°C)    | (°C)          | Reading        | Hole25                         | Hole26     | Hole27     | Hole28     | Hole29     | Hole30     | Hole31     | Hole32     |
|            |         |               |                | M20A1-CH17                     | M20A1-CH18 | M20A1-CH19 | M20A1-CH20 | M20A1-CH17 | M20A1-CH18 | M20A1-CH19 | M20A1-CH20 |
| 380.0      | 380.0   | 379.4 - 380.7 | Max °C         | 377.9                          | 379.4      | 380.1      | 380.1      | 379.3      | 379.6      | 378.9      | 377.3      |
|            |         |               | Min °C         | 377.4                          | 378.9      | 379.7      | 379.7      | 378.8      | 378.9      | 378.4      | 376.7      |
|            |         |               | Average °C     | 377.7                          | 379.2      | 379.9      | 379.9      | 379.0      | 379.3      | 378.6      | 377.0      |
|            |         |               | Stability ± °C | 0.3                            | 0.3        | 0.2        | 0.2        | 0.3        | 0.4        | 0.3        | 0.3        |

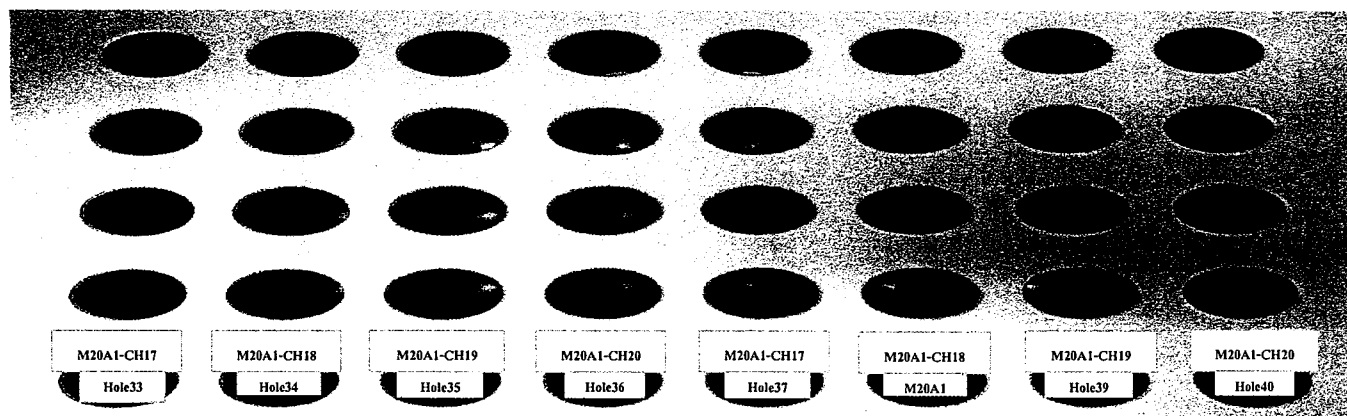
Approved By.



Certificate No. T230902

Page 5 of 5

## Calibration Report



FRONT

### Measurement Results

| Cal. Point | Setting | Reading       | STD.           | Position of Standards at Block |            |            |            |            |            |            |            |
|------------|---------|---------------|----------------|--------------------------------|------------|------------|------------|------------|------------|------------|------------|
| (°C)       | (°C)    | (°C)          | Reading        | Hole33                         | Hole34     | Hole35     | Hole36     | Hole37     | Hole38     | Hole39     | Hole40     |
|            |         |               |                | M20A1-CH17                     | M20A1-CH18 | M20A1-CH19 | M20A1-CH20 | M20A1-CH17 | M20A1-CH18 | M20A1-CH19 | M20A1-CH20 |
| 380.0      | 380.0   | 379.4 - 380.7 | Max °C         | 377.7                          | 378.0      | 378.3      | 379.0      | 378.2      | 378.5      | 377.3      | 377.4      |
|            |         |               | Min °C         | 377.3                          | 377.6      | 377.9      | 378.6      | 377.7      | 378.1      | 376.9      | 377.0      |
|            |         |               | Average °C     | 377.5                          | 377.8      | 378.1      | 378.8      | 378.0      | 378.3      | 377.1      | 377.2      |
|            |         |               | Stability ± °C | 0.2                            | 0.2        | 0.2        | 0.2        | 0.2        | 0.2        | 0.2        | 0.2        |

 The expanded uncertainty of temperature measurement was  $\pm 1.85$  °C

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

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

 Approved By. 



บริษัท ดับเบิล เอส ไดแอกโนสติกส์ จำกัด  
DOUBLE S DIAGNOSTICS CO., LTD.

4 ซอยอุดมสุข 14 แขวงบางนา เขตบางนา กรุงเทพมหานคร 10260 โทรศัพท์: (02) 747-7009 โทรสาร: (02) 747-7008  
4 Soi Udomsuk 14, Bangna, Bangkok 10260 Tel. (02) 747-7009 Fax: (02) 747-7008

Maintenance Plan YEAR : 2023

| เดือน | Jan | Feb | Mar | Apr | May | Jun | Jul        | Aug | Sep | Oct | Nov | Dec |
|-------|-----|-----|-----|-----|-----|-----|------------|-----|-----|-----|-----|-----|
| รวม   |     |     |     |     |     |     | 12/7<br>ck |     |     |     |     |     |

**Periodical maintenance check list for Konelab**

|   | 6M                                  | 12M                                 | Note! |
|---|-------------------------------------|-------------------------------------|-------|
| 1.Diluent-wash tubing change                              | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |       |
| 2.ISE tubing change                                       | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | none  |
| 3.Syringe check/change                                    |                                     | <input checked="" type="checkbox"/> |       |
| 4.Dispensing check/ change                                |                                     | <input checked="" type="checkbox"/> |       |
| 5.Waste tubing change when necessary                      |                                     | <input checked="" type="checkbox"/> |       |
| 6.Lamp check/change                                       | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |       |
| 7.Mixer paddle/paddle change(not Konelab20)               |                                     | <input checked="" type="checkbox"/> |       |
| 8.ISE needles check/change                                |                                     | <input checked="" type="checkbox"/> | none  |
| 9.Pump tubing check/ chance                               | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |       |
| 10.Broken/worn out part check /change                     |                                     | <input checked="" type="checkbox"/> |       |
| 11.Peristaltic pump check /cleaning/ lubrication          | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |       |
| 12.Heating check  |                                     | <input checked="" type="checkbox"/> |       |
| 13.Cooling check  |                                     | <input checked="" type="checkbox"/> |       |
| 14.Dispenser mechanic check/adjustment                    | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |       |
| 15.Cuvette transfer mechanic check/adjustment             | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |       |
| 16.Dispenser movement check/adjustment                    | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |       |
| 17.Sample/reagent register check/adjustment               | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |       |
| 18.Dispensing tubing tightness check                      | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |       |
| 19.Photometer and optics cleaning/check/adjustment        | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |       |
| 20.Workstation PC cleaning if necessary                   | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |       |
| 21.Mechanic cleaning/lubrication                          | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |       |
| 22.Instrument cleaning if necessary                       | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |       |
| 23.Complete analyzer testing with waterblank/QC or sample | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |       |
| 24.Test parameters/Adjustment/config. Save to USB key     | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |       |
| 25.UPS Test   | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |       |

Place: ALS LAB Instrument: k90 Aquakem  
Date/Time: 12/7/66 Serial no: 22781  
Service done by: ๑๗๖๕ Install date:  
Signature of customer: ๑๗๖๕ Date/Time: 12/7/66

Laboratory  
Analyzer User

7/12/2023 21:21

-----

Performed 7/12/2023  
Lot W166

=====

ACCEPTANCE CRITERIA

=====

|                                | Result | Limit        | Warning |
|--------------------------------|--------|--------------|---------|
| Temperature (?C)               | 37.7   | 37.0 +/- 1.0 |         |
| Dispensing ratio               | 16.4   | 14.8 - 17.2  |         |
| CV%                            | 1.17   | <1.7         |         |
| Photometric noise              |        |              |         |
| Max SD L340_2 (mA)             | 0.19   | <2.0         |         |
| Max SD L340_4 (mA)             | 1.06   | <3.0         |         |
| Linearity of photometer        |        |              |         |
| Slope                          | 1.0188 | 0.94 - 1.06  |         |
| Curvature                      | 0.0035 | +/- 0.02     |         |
| Max bias from linear fit (mA)  | 3.2    | <15.0        |         |
| Max delta %                    | -2.0   | +/- 6.0      |         |
| Linearity of sample dispensing |        |              |         |
| Proport. volume XDISP2 (?l)    | 2.06   | 1.96 - 2.16  |         |
| Proport. volume XDISP4 (?l)    | 4.13   | 3.85 - 4.40  |         |
| XDISP2 CV%                     | 0.58   | <2.0         |         |
| XDISP4 CV%                     | 0.70   | <2.0         |         |
| XDISP10 CV%                    | 0.59   | <2.0         |         |
| Needle 0 ?l volume             |        |              |         |
| Average (A)                    | 0.009  | <0.050       |         |
| Standard deviation (A)         | 0.002  | <0.005       |         |
| Volume (?l)                    | 0.06   | <0.32        |         |

=====

OTHER INFORMATION

=====

| Dispensing ratio |            | Photom., noise: SD (mA) |               |
|------------------|------------|-------------------------|---------------|
| Posit            | Result (A) | Posit                   | L340_2 L340_4 |
| 1                | 0.1592     | 1                       | 0.07 0.64     |
| 2                | 0.1624     | 2                       | 0.09 1.06     |
| 3                | 0.1631     | 3                       | 0.14 0.50     |
| 4                | 0.1631     | 4                       | 0.13 0.53     |
| 5                | 0.1625     | 5                       | 0.19 0.38     |
| 6                | 0.1650     | 6                       | 0.02 0.64     |

7/12/2023 21:21

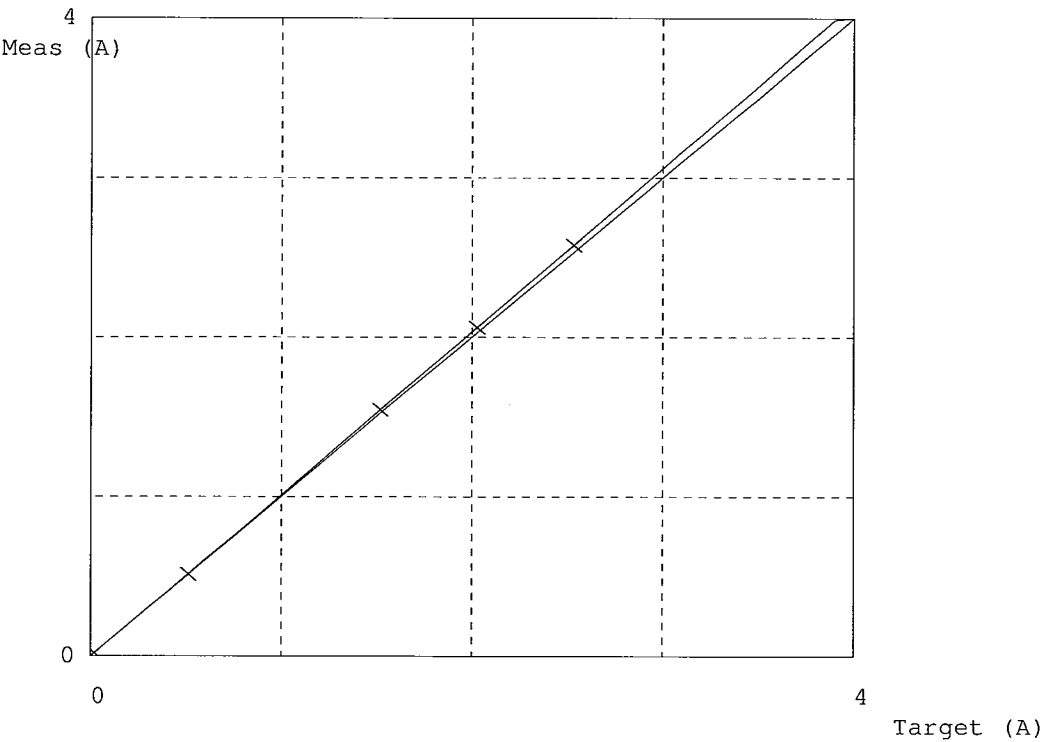
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Linearity of sample dispensing

|         |                |
|---------|----------------|
| Test    | Absorbance (A) |
| XDISP2  | 0.311          |
| XDISP4  | 0.616          |
| XDISP10 | 1.478          |

Linearity of photometer

|       |            |          |           |         |
|-------|------------|----------|-----------|---------|
| L340_ | Target (A) | Meas (A) | Delta (A) | Delta % |
| 1     | 0.001      | 0.005    | -0.004    | -394.7  |
| 2     | 0.512      | 0.519    | -0.007    | -1.5    |
| 3     | 1.523      | 1.550    | -0.027    | -1.8    |
| 4     | 2.027      | 2.066    | -0.039    | -1.9    |
| 5     | 2.532      | 2.582    | -0.050    | -2.0    |





# Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.

Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6851 , +669 8247 2360

Website : www.scieco.co.th E-Mail : calibrate@scg.com



Certificate No. T222502

Page 1 of 4

## Certificate of Calibration

Equipment : Chamber ( Oven )

Manufacturer : Memmert

Model : UF 450

Serial No. : B7170531

Customer Code : BKK\_EN0273

ID No. : T8042A4

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

Customer Location : Oven Room

Date of Receipt : 23 November 2022

Calibrated By : Sujjar Naknakred ( Site Calibration Manager )

Approved By :  /Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 09 DEC 2022

|                |           |
|----------------|-----------|
| REVIEW BY      | Sinluk P. |
| APPROVED BY    | KL AL     |
| NEXT CAL. DATE | 29/05/24  |

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which 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 standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

Certificate No. T222502

Page 2 of 4

## Calibration Report

**Equipment** : Chamber ( Oven )  
**Date of Calibration** : 29 November 2022  
**Environment** : Temperature : 29.1-29.6 °C  
Line Voltage : 221.3-223.2 V  
Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

1. This equipment was calibrated by insert nine resistance thermometer detectors and nine standard thermocouples type T into its chamber , the other one resistance thermometer detector use for ambient temperature measurement .  
The calibration was done in according to WI-T20 ( based on ASTM E145-94 ( Reapproved 2001) and AS2853-1986 ).  
All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

2. Reference Standard Instrument :

| Instrument  | Model   | Instrument No. | Certificate No. | Due Date         |
|-------------|---------|----------------|-----------------|------------------|
| RTD         | 100 ohm | 27-(CH1-10)    | T210004         | 30 December 2022 |
| TC          | TYPE T  | TN261-TN270    | T210010         | 30 December 2022 |
| DATA LOGGER | 34970A  | T149           | T210004         | 30 December 2022 |

3. This certificate is traceable to :

National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TISI-TIS 17025 CALIBRATION 0244.)

4. Condition of calibrated item : good

Equipment Description :

Time Constant 1 Hour 49 Minute At 104 °C  
Fresh Air Damper ☒ Open ☐ Min ☐ Medium ☒ Max  
☐ Close  
☐ Not Available

5. Adjustment :

( ) without adjustment

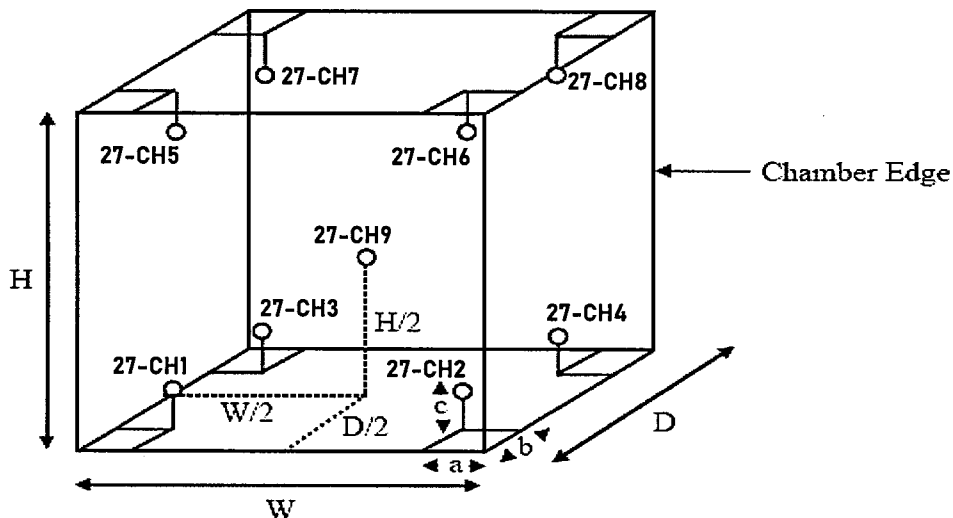
( X ) after adjustment

Approved By. Bm Loi

Certificate No. T222502

Page 3 of 4

## Calibration Report



**Remark :**

Internal Dimensions of Chamber : W (Width) = 104 cm. , H (Height) = 72 cm. and D (Depth) = 60 cm.  
 Size of Installed Standard sensor number 27-CH1 to number 27-CH8 : a = 5 cm. ,b = 5 cm. and c = 5 cm.  
 Size of Installed Standard sensor number 27-CH9 : W/2 = 104 cm./2 , H/2 = 72 cm./2 and D/2 = 60cm./2

**Measurement Results**

| Average Standard Reading at each position ( °C ) |        |        |        |        |        |        |        |        |        |
|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Calibration Point                                | 27-CH1 | 27-CH2 | 27-CH3 | 27-CH4 | 27-CH5 | 27-CH6 | 27-CH7 | 27-CH8 | 27-CH9 |
| 104  | 104.07 | 103.60 | 103.45 | 104.02 | 104.47 | 103.57 | 104.59 | 103.78 | 104.18 |


| Chamber ( Oven ) |                |         | Temperature Distribution |                    |                   |                      |                             |
|------------------|----------------|---------|--------------------------|--------------------|-------------------|----------------------|-----------------------------|
| Setting ( °C )   | Reading ( °C ) |         | Average ( °C )           | Stability ( ± °C ) | Uniformity ( °C ) | Uncertainty ( ± °C ) | Coverage<br>Factor <i>k</i> |
|                  | Min , Max      | Average |                          |                    |                   |                      |                             |
| 104.0            | -              | 104.0   | 103.97                   | 0.07               | 0.70              | 0.42                 | 2.00                        |

\* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

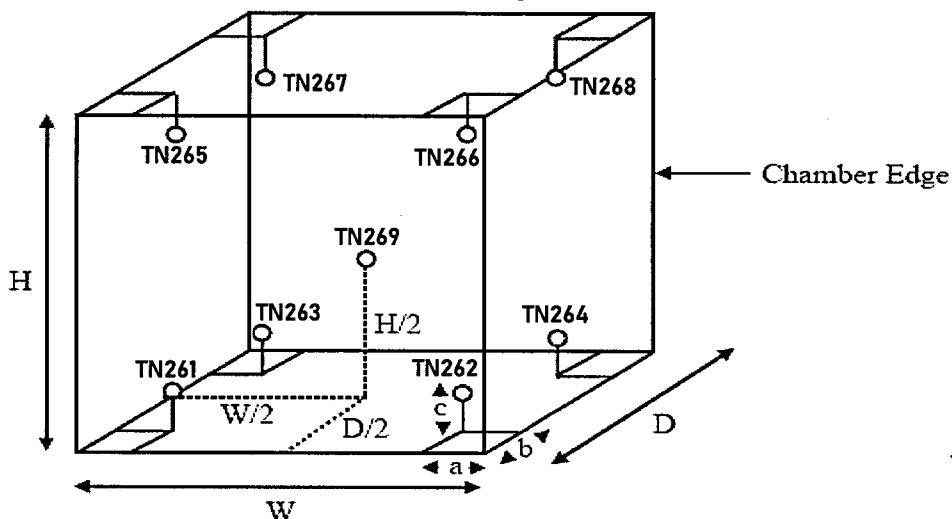
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By. 

Certificate No. T222502

Page 4 of 4

## Calibration Report



**Remark :**

Internal Dimensions of Chamber : W (Width) = 104 cm. , H (Height) = 72 cm. and D (Depth) = 60 cm.

Size of Installed Standard sensor number TN261 to number TN268 : a = 5 cm. ,b = 5 cm. and c = 5 cm.

Size of Installed Standard sensor number TN269 : W/2 = 104 cm./2 , H/2 = 72 cm./2 and D/2 = 60cm./2

**Measurement Results**

| Calibration Point | Average Standard Reading at each position ( ° C ) |        |        |        |        |        |        |        |        |
|-------------------|---|--------|--------|--------|--------|--------|--------|--------|--------|
|                   | TN261   | TN262  | TN263  | TN264  | TN265  | TN266  | TN267  | TN268  | TN269  |
| 180               | 179.14  | 179.17 | 179.65 | 179.26 | 180.41 | 179.64 | 181.18 | 180.99 | 180.36 |

| Chamber ( Oven ) |                 |         | Temperature Distribution |                     |                    |                       |                          |
|------------------|-----------------|---------|--------------------------|---------------------|--------------------|-----------------------|--------------------------|
| Setting ( ° C )  | Reading ( ° C ) |         | Average ( ° C )          | Stability ( ± ° C ) | Uniformity ( ° C ) | Uncertainty ( ± ° C ) | Coverage Factor <i>k</i> |
|                  | Min , Max       | Average |                          |                     |                    |                       |                          |
| 180.0            | -               | 180.0   | 179.98                   | 0.38                | 1.78               | 1.10                  | 2.00                     |

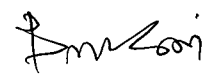
\* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* which for a t-distribution, providing

a level of confidence of approximately 95 % .

Approved By. 



**TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)**  
**CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES**

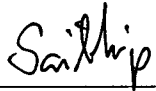
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250



TEL. 0-2717-3000 FAX. 0-2719-9484

**Cert.No.:** 23TW243

**Page.:** 1 of 2

## Certificate of Testing

|   |  |
|---|--|
| <b>Equipment :</b>  | DO Meter   |
| <b>Manufacturer :</b>   | YSI  |
| <b>Model :</b>  | 5000-230V  |
| <b>Serial No. :</b>   | 09J101147  |
| <b>ID No. :</b>   | BKK_EN0017   |
| <b>Received Date :</b>  | 15 November 2023   |
| <b>Test Date :</b>  | 16 November 2023   |
| <b>Reference :</b>  | 2311-0505DSC-4   |
| <b>Submitted by :</b>   | ALS Laboratory Group (Thailand) Co.,Ltd.<br>104 Phatthanakan 40, Phatthanakan Rd.,<br>Khwaeng Phatthanakan, Khet Suan Luang,<br>Bangkok 10250 Thailand |
| <b>Laboratory Condition :</b>   | Temperature ( $25 \pm 5$ ) °C<br>Humidity ( $50 \pm 20$ ) %  |
| <b>Test Procedure :</b>   | In - house method : CP-CH9<br>by Comparison Technique with Azide Modification Method   |
| <b>Tested by :</b>  | Walalak Sirithean  |
| <b>Approved by :</b>  | <br>Approved Signatory   |
| (✓) Saithip Meangmai<br>( ) Warakorn Lerngagtrakul<br>( ) Ponpan Paipim |  |
| <b>Issue Date :</b>   | 17 November 2023   |

|                |   |
|----------------|---|
| REVIEW BY      |  |
| APPROVED BY    |  |
| NEXT CAL. DATE | 16/05/25  |



Cert.No.: 23TW243

Page.: 2 of 2

**Condition of this result of calibration**

1. Reference Standard Instruments :

This certification is traceable to the International System of Unit through the reference standards laboratory of Industrial Calibration Center, Technology Promotion Association (Thailand-Japan).

| <u>Instruments</u> | <u>Serial No.</u> | <u>ID No.</u> | <u>Certificate No.</u> | <u>Due Date</u> |
|--------------------|-------------------|---------------|------------------------|-----------------|
| 1) Burette         | -                 | 130BU10       | 23CG1172               | 22 Mar 2025     |
| 2) Balance         | 1124013382        | 140RC006      | 23MM18                 | 20 Feb 2024     |

2. Standard Material :-

| <u>Material</u>                 | <u>Manufacturer</u> | <u>Lot.No.</u> | <u>Assay</u> |
|---------------------------------|---------------------|----------------|--------------|
| Sodium Thiosulfate pentahydrate | Merck               | AM1763316      | 100.2%       |

**Result :** Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 16K100498

| <b>Titration Method<br/>(Azide Modification Method)<br/>(mg/L)</b> | <b>DO Meter<br/>Reading<br/>(mg/L)</b> | <b>Standard Deviation<br/>(mg/L)</b> |
|--|--|--------------------------------------|
| 8.18   | 8.18                                   | 0.0055                               |

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency, The environmental impact control and present to organization it may concerned. Intend to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full, without written approval of the laboratory

-o0o-

*Saitthip*

**a 1190297**



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 23LM192

Page.: 1 of 2

## Certificate of Calibration

**Equipment :** DO Meter with Sensor

**Manufacturer :** YSI

**Model :** 5000-230V

**Serial No. :** 09J101147

**ID No. :** BKK\_EN0017

**Submitted by :** ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand

**Location :** TPA Chemistry Calibration Laboratory

**Received Order :** 15 November 2023

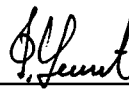
**Calibrated Date :** 16 November 2023

**Ambient Temperature :** ( 26 ± 10 ) °C

**Relative Humidity :** ( 50 ± 30 ) %

**AC Line Voltage :** ( 220 ± 22 ) V

**Calibrated by :** Kunchit Promprat

**Approved by :**   
Approved Signatory

( ) Pornthippa Tameyakul  
( ) Ponpan Paipim  
(✓) Suwit Imjai

**Issue Date :** 17 November 2023

**The Uncertainties are for a confidence probability of approximately 95%**

This certificate may not be reproduced other than in full, except with the prior written  
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0060730



**Equipment :** DO Meter with Sensor  
**Condition As-Received :** Used Item  
**Reference :** 2311-0505DSC-10

**Cert. No.:** 23LM192

**Page.:** 2 of 2

**Procedure Used :-**

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer ( IPRT ) into Temperature Bath.

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-

| <u>Instrument</u>      | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Traceable</u> | <u>Due Date</u> |
|------------------------|-------------------|------------------|------------------|-----------------|
| 1) Digital Thermometer | 3240076           | 231305           | TPA              | 15 Mar 2024     |

2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

**Remark :** TPA : Technology Promotion Association ( Thailand - Japan )

**Result of Calibration :-** ( \* ) Without Adjustment

**Function :** Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 16K100498

| <u>Calibration Point</u><br>( °C ) | <u>Immersion Depth</u><br>( mm ) | <u>Standard Temperature</u><br>( °C ) | <u>UUC* Reading</u><br>( °C ) | <u>Error</u><br>( °C ) | <u>Uncertainty</u><br>( ± °C ) | <u>Coverage Factor</u><br><i>k</i> |
|------------------------------------|----------------------------------|---------------------------------------|-------------------------------|------------------------|--------------------------------|------------------------------------|
| 20.0                               | 60                               | 19.997                                | 19.93                         | -0.067                 | 0.15                           | 2.00                               |

**UUC\* :** Unit Under Calibration

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

-o0o-

**a 1190298**



# Metrological Center

## SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.

Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6851 , +669 8247 2360

Website : www.scieco.co.th

E-Mail : calibrate@scg.com



Certificate No. T231342

Page 1 of 4

## Certificate of Calibration

Equipment : Chamber ( Incubator )

Manufacturer : MEMMERT

Model : ICP 750

Serial No. : F818.0033

Customer Code : BKK\_EN0272

ID No. : T8041A4

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

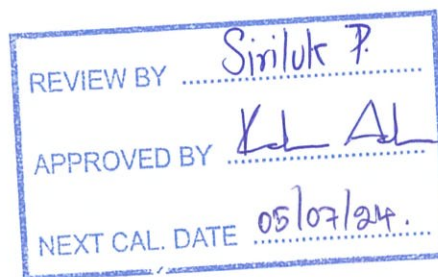
Customer Location : Wet Chemistry Lab 2

Date of Receipt : 3 July 2023

Calibrated By : Sujjar Naknakred ( Site Calibration Manager )

Approved By : Boonchai / Boonchai Suriyawong ( Assistant Calibration Manager )

Date of Issue : 11 JUL 2023



The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which 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 standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

Certificate No. T231342

Page 2 of 4

## Calibration Report

**Equipment** : Chamber ( Incubator )  
**Date of Calibration** : 5-6 July 2023 ( Finished Time 4:30 PM )  
**Environment** : Temperature 26.9-30.3 °C  
Line Voltage 221.7-225.5 V

### Condition of this results of test. :

1. This instrument was calibrated by insert 12 standard resistance thermometer into its chamber and test according to WI-T20 ( based on ASTM E145-94 ( Reapproved 2001 ) and AS2853-1986. )

All data show below were final values and the initial data may be obtained upon request.

The temperature scale used was based on ITS - 90.

2. Reference Standard Instrument :

| Instrument  | Model   | Instrument No. | Certificate No. | Due Date      |
|-------------|---------|----------------|-----------------|---------------|
| RTD         | 100 ohm | 27-(CH1-10)    | T230543         | 10 April 2024 |
| RTD         | 100 ohm | 28-(CH1-10)    | T230543         | 10 April 2024 |
| DATA LOGGER | 34970A  | T149           | T230543         | 10 April 2024 |

3. This certificate is traceable to :

National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TISI-TIS 17025 CALIBRATION 0244. )

4. Condition of calibrated item : good

UUC Description :

Time Constant 6 Hour 35 Minute At 20 °C  
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available

5. Result of test :

( ) without adjustment

( X ) after adjustment

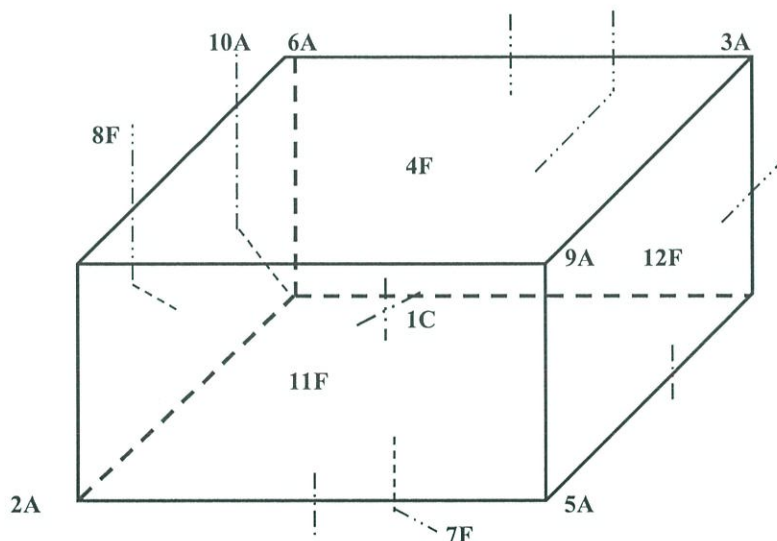
Approved By \_\_\_\_\_



Certificate No T231342

## Calibration Report

Page 3 of 4



C = Centre , F = Centre of Face , A = Corner , E = Centre of Edge

|     |   |         |
|-----|---|---------|
| 1C  | = | 27-CH1  |
| 2A  | = | 27-CH2  |
| 3A  | = | 27-CH3  |
| 4F  | = | 27-CH4  |
| 5A  | = | 27-CH5  |
| 6A  | = | 27-CH6  |
| 7F  | = | 27-CH7  |
| 8F  | = | 27-CH8  |
| 9A  | = | 27-CH9  |
| 10A | = | 27-CH10 |

|     |   |        |
|-----|---|--------|
| 11F | = | 28-CH1 |
| 12F | = | 28-CH2 |

Approved By. 

Certificate No. T231342

## Calibration Report

Page 4 of 4

### Measurement Results

| Calibration Point | Average Standard Reading at each position (°C) |        |        |        |        |        |        |        |        |         |
|-------------------|--|--------|--------|--------|--------|--------|--------|--------|--------|---------|
|                   | 27-CH1   | 27-CH2 | 27-CH3 | 27-CH4 | 27-CH5 | 27-CH6 | 27-CH7 | 27-CH8 | 27-CH9 | 27-CH10 |
| 20.0              | 19.82  | 19.80  | 20.32  | 19.78  | 19.77  | 19.65  | 20.11  | 19.69  | 19.78  | 20.18   |
|                   | 28-CH1   | 28-CH2 |        |        |        |        |        |        |        |         |
|                   | 20.02  | 19.81  |        |        |        |        |        |        |        |         |

| Chamber ( Incubator ) |              |         | Temperature Distribution |                  |                 |                    |          |
|-----------------------|--------------|---------|--------------------------|------------------|-----------------|--------------------|----------|
| Setting (°C)          | Reading (°C) |         | Average (°C)             | Stability (± °C) | Uniformity (°C) | Uncertainty (± °C) | Coverage |
|                       | Min , Max    | Average |                          |                  |                 |                    | Factor k |
| 20.0                  | 19.9 , 20.1  | 20.0    | 19.98                    | 0.06             | 0.61            | 0.38               | 2.00     |

\* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By. 



# Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.

Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6851 , +669 8247 2360

Website : www.scieco.co.th E-Mail : calibrate@scg.com



Certificate No. T230683

Page 1 of 4

## Certificate of Calibration

**Equipment** : Chamber ( Incubator )

**Manufacturer** : MEMMERT

**Model** : ICP 750

**Serial No.** : F818.0075

**Customer Code** : BKK\_EN0305

**ID No.** : T9571A4

**Customer** : ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

**Customer Location** : Wet Chemistry Lab 2

**Date of Receipt** : 30 March 2023

**Calibrated By** : Sujjar Naknakred ( Site Calibration Manager )

**Approved By** :  / Boonchai Suriyawong ( Assistant Calibration Manager )

**Date of Issue** : 10 APR 2023

|                |           |
|----------------|-----------|
| REVIEW BY      | Sinluk P. |
| APPROVED BY    | KL AL     |
| NEXT CAL. DATE | 05/04/24  |

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which 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 standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

Certificate No. T230683

Page 2 of 4

## Calibration Report

**Equipment** : Chamber ( Incubator )  
**Date of Calibration** : 5 April 2023 ( Finished Time 4:30 PM )  
**Environment** : Temperature 22.9-28.6 °C  
Line Voltage 221.7-225.5 V

### Condition of this results of test. :

1. This instrument was calibrated by insert 12 standard resistance thermometer into its chamber and test according to WI-T20 ( based on ASTM E145-94 ( Reapproved 2001 ) and AS2853-1986. )

All data show below were final values and the initial data may be obtained upon request.

The temperature scale used was based on ITS - 90.

2. Reference Standard Instrument :

| Instrument  | Model   | Instrument No. | Certificate No. | Due Date         |
|-------------|---------|----------------|-----------------|------------------|
| RTD         | 100 ohm | 37-(CH1-10)    | T222493         | 28 November 2023 |
| RTD         | 100 ohm | 36-(CH1-10)    | T222493         | 28 November 2023 |
| DATA LOGGER | 34970A  | T193           | T222493         | 28 November 2023 |

3. This certificate is traceable to :

National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TISI-TIS 17025 CALIBRATION 0244. )

4. Condition of calibrated item : good

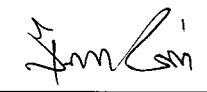
UUC Description :

Time Constant 2 Hour 24 Minute At 20 °C  
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available

5. Result of test :

( ) without adjustment

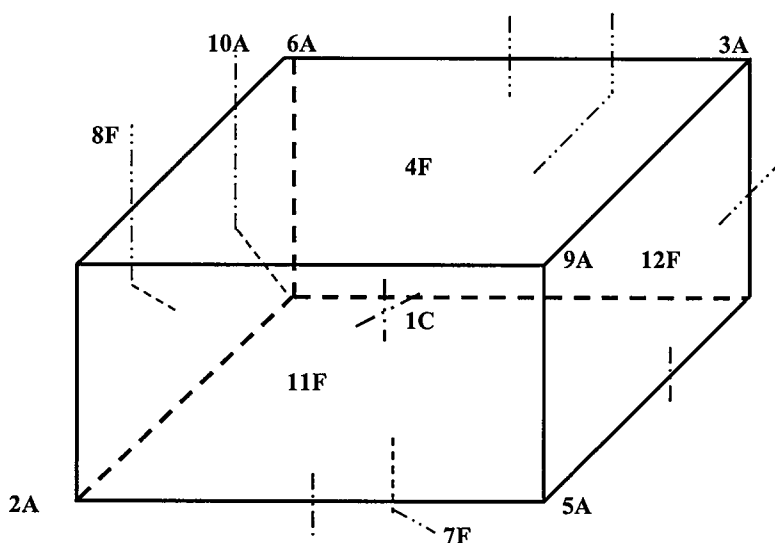
( X ) after adjustment

Approved By. 

Certificate No T230683

## Calibration Report

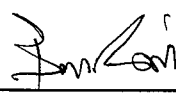
Page 3 of 4



C = Centre , F = Centre of Face , A = Corner , E = Centre of Edge

|     |   |        |
|-----|---|--------|
| 1C  | = | 37CH1  |
| 2A  | = | 37CH2  |
| 3A  | = | 37CH3  |
| 4F  | = | 37CH4  |
| 5A  | = | 37CH5  |
| 6A  | = | 37CH6  |
| 7F  | = | 37CH7  |
| 8F  | = | 37CH8  |
| 9A  | = | 37CH9  |
| 10A | = | 37CH10 |

|     |   |       |
|-----|---|-------|
| 11F | = | 36CH1 |
| 12F | = | 36CH2 |

Approved By. 

Certificate No. T230683

## Calibration Report

Page 4 of 4

### Measurement Results

| Average Standard Reading at each position (°C) |       |       |       |       |       |       |       |       |       |        |
|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| Calibration Point                              | 37CH1 | 37CH2 | 37CH3 | 37CH4 | 37CH5 | 37CH6 | 37CH7 | 37CH8 | 37CH9 | 37CH10 |
| 20.0   | 20.32 | 20.28 | 20.17 | 20.22 | 20.22 | 20.04 | 20.17 | 19.74 | 20.31 | 19.93  |
|  | 36CH1 | 36CH2 |       |       |       |       |       |       |       |        |
|  | 20.14 | 20.20 |       |       |       |       |       |       |       |        |
| Calibration Point                              | 37CH1 | 37CH2 | 37CH3 | 37CH4 | 37CH5 | 37CH6 | 37CH7 | 37CH8 | 37CH9 | 37CH10 |
| 25   | 25.28 | 25.15 | 25.13 | 25.13 | 25.20 | 25.02 | 25.11 | 24.79 | 25.20 | 25.26  |
|  | 36CH1 | 36CH2 |       |       |       |       |       |       |       |        |
|  | 25.13 | 24.94 |       |       |       |       |       |       |       |        |

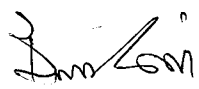
| Chamber ( Incubator ) |              |         | Temperature Distribution |                  |                 |                    |                      |
|-----------------------|--------------|---------|--------------------------|------------------|-----------------|--------------------|----------------------|
| Setting (°C)          | Reading (°C) |         | Average (°C)             | Stability (± °C) | Uniformity (°C) | Uncertainty (± °C) | Coverage<br>Factor k |
|                       | Min , Max    | Average |                          |                  |                 |                    |                      |
| 20.0                  | 19.9 , 20.1  | 20.0    | 20.02                    | 0.09             | 0.54            | 0.38               | 2.00                 |
| 25.0                  | 24.9 , 25.1  | 25.0    | 25.03                    | 0.03             | 0.51            | 0.38               | 2.00                 |

\* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By 



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 23TM1408

Page : 1 of 4

## Certificate of Calibration

Equipment : Autoclave

Manufacturer : TOMY

Model : SX-700

Serial No. : 48134190

ID No. : BKK\_ML0041

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand

Location : Media Preparation Room

Received Order : 03 October 2023

Calibration Date : 04 October 2023

Ambient Temperature : ( 26 ± 10 ) °C

Relative Humidity : ( 50 ± 30 ) %

Calibrated by : Khit Ruttanaprapachai

Approved by :

Approved Signatory

( ) Pornthippa Tameyakul

( ☒ ) Ponpan Paipim

( ) Suwit Imjai

Issue Date : 11 October 2023

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written  
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0059272



Equipment : Autoclave  
Condition As-Received : Used Item  
Reference : 2310-0006OC-6

Cert. No.: 23TM1408

Page : 2 of 4

**Procedure Used :-**

Calibration were conducted using in-house calibration procedure CP-OT03 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-

| <u>Instrument</u>    | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Traceable</u> | <u>Due Date</u> |
|----------------------|-------------------|------------------|------------------|-----------------|
| 1 ) Data Acquisition | MY57013823        | 23LM66           | TPA              | 25 Mar 2024     |

2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

4. This result of calibration covers laboratory autoclaves for the sterilization of goods and material which could be infected with organisms categorized as Hazard Group 1, 2 and 3\*\*

(\*\* = Categorization of pathogens according to hazard and categories of containment, second edition, 1990 )

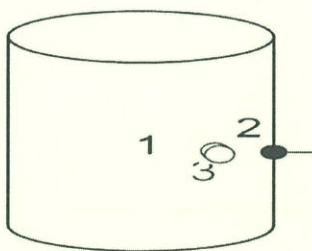
It does not cover autoclaves for use with material infect with organisms in Hazard Group 4, for which complete containment and sterilization of infected condensate is considered to be essential.

This result of calibration does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical or veterinary purposes which are directly concerned with patient care, or those used for fabrics subjected to sterilization which are required to be dry at the end of cycle.

**Remark :** TPA : Technology Promotion Association ( Thailand - Japan )

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source



|                          | Environmental |           |          |
|--------------------------|---------------|-----------|----------|
|                          | ( °C )        | ( %R.H. ) | ( Volt ) |
| Beginning of Calibration | 26            | 64        | 221      |
| Finished of Calibration  | 27            | 67        | 222      |

| <u>Position</u> | <u>Description</u> | <u>Ref. Std. ID No.:</u> |
|-----------------|--------------------|--------------------------|
| 1 =             | Center of chamber  | 19-17TC-08               |
| 2 =             | Temperature sensor | 19-17TC-09               |
| 3 =             | Exhaust port       | 19-17TC-10               |



Equipment : Autoclave  
Condition As-Received : Used Item  
Reference : 2310-0006OC-6  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source

Cert. No.: 23TM1408

Page : 3 of 4

Operating parameter Set : Temperature = 108 °C  
Sterilization period = 10 minute

| UUC*<br>Setting<br>( °C ) | UUC*<br>Reading<br>( °C ) | Position | Average*<br>Standard Reading<br>( °C ) | Stability<br>( ± °C ) | Pressure<br>Reading<br>( MPa ) | Uncertainty<br>( ± °C ) | Coverage<br>Factor<br><i>k</i> |
|---------------------------|---------------------------|----------|--|-----------------------|--------------------------------|-------------------------|--------------------------------|
| 108                       | 108                       | 1        | 108.352                                | 0.12                  | 0.04                           | 0.90                    | 2                              |
|                           |                           | 2        | 108.263                                |                       |                                |                         |                                |
|                           |                           | 3        | 108.140                                |                       |                                |                         |                                |

Operating parameter Set : Temperature = 115 °C  
Sterilization period = 20 minute

| UUC*<br>Setting<br>( °C ) | UUC*<br>Reading<br>( °C ) | Position | Average*<br>Standard Reading<br>( °C ) | Stability<br>( ± °C ) | Pressure<br>Reading<br>( MPa ) | Uncertainty<br>( ± °C ) | Coverage<br>Factor<br><i>k</i> |
|---------------------------|---------------------------|----------|--|-----------------------|--------------------------------|-------------------------|--------------------------------|
| 115                       | 115                       | 1        | 115.376                                | 0.13                  | 0.08                           | 0.90                    | 2                              |
|                           |                           | 2        | 115.297                                |                       |                                |                         |                                |
|                           |                           | 3        | 115.157                                |                       |                                |                         |                                |

Operating parameter Set : Temperature = 118 °C  
Sterilization period = 10 minute

| UUC*<br>Setting<br>( °C ) | UUC*<br>Reading<br>( °C ) | Position | Average*<br>Standard Reading<br>( °C ) | Stability<br>( ± °C ) | Pressure<br>Reading<br>( MPa ) | Uncertainty<br>( ± °C ) | Coverage<br>Factor<br><i>k</i> |
|---------------------------|---------------------------|----------|--|-----------------------|--------------------------------|-------------------------|--------------------------------|
| 118                       | 118                       | 1        | 118.083                                | 0.11                  | 0.09                           | 0.90                    | 2                              |
|                           |                           | 2        | 118.037                                |                       |                                |                         |                                |
|                           |                           | 3        | 117.954                                |                       |                                |                         |                                |

**Average\*** : The average of 30 values in each position.

**Stability** : One-half of the greatest maximum difference of measured temperature at any one probe.

**UUC\*** : Unit Under Calibration

**Note** : The reported uncertainty of measurement was included stability and excluded uniformity .



Equipment : Autoclave  
Condition As-Received : Used Item  
Reference : 2310-0006OC-6  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source

Cert. No.: 23TM1408

Page : 4 of 4

Operating parameter Set : Temperature = 121 °C  
Sterilization period = 30 minute

| UUC*<br>Setting<br>( °C ) | UUC*<br>Reading<br>( °C ) | Position | Average*<br>Standard Reading<br>( °C ) | Stability<br>( ± °C ) | Pressure<br>Reading<br>( MPa ) | Uncertainty<br>( ± °C ) | Coverage<br>Factor<br><i>k</i> |
|---------------------------|---------------------------|----------|--|-----------------------|--------------------------------|-------------------------|--------------------------------|
| 121                       | 121                       | 1        | 121.186                                | 0.17                  | 0.11                           | 0.91                    | 2                              |
|                           |                           | 2        | 121.082                                |                       |                                |                         |                                |
|                           |                           | 3        | 120.980                                |                       |                                |                         |                                |

**Average\*** : The average of 30 values in each position.

**Stability** : One-half of the greatest maximum difference of measured temperature at any one probe.

**UUC\*** : Unit Under Calibration

**Note** : The reported uncertainty of measurement was excluded stability.

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

-o0o-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
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TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 23TM1146

Page : 1 of 3

## Certificate of Calibration

**Equipment :** Incubator

**Manufacturer :** SHEL-LAB

**Model :** 1915A

**Serial No. :** 0200599

**ID No. :** BKK\_ML0010

**Submitted by :** ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthakan Rd.,  
Khwawng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand

**Location :** Incubation & Micrological Reading

**Received Order :** 17 July 2023  
**Calibration Date :** 17 July 2023  
**Ambient Temperature :** ( 26 ± 10 ) °C  
**Relative Humidity :** ( 50 ± 30 ) %

**Calibrated by :** Man Pattanapongpaiboon

|                |             |
|----------------|-------------|
| REVIEW BY      | Sithichok   |
| APPROVED BY    | [Signature] |
| NEXT CAL. DATE | 17/01/25    |

**Approved by :**

*Malu.*

Approved Signatory

- ( ) Pornthippa Tameyakul  
( / ) Malee Butkruea  
( ) Suwit Imjai

**Issue Date :**

24 July 2023

**The Uncertainties are for a confidence probability of approximately 95%**

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0056489



**Equipment :** Incubator  
**Condition As-Received :** Used Item  
**Reference :** 2307-0285OC-1  
**Procedure Used :-**

**Cert. No.:** 23TM1146

**Page :** 2 of 3

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector ( RTD ).

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-

| <u>Instrument</u>    | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Traceable</u> | <u>Due Date</u> |
|----------------------|-------------------|------------------|------------------|-----------------|
| 1 ) Data Acquisition | MY49001451        | 23LM27           | TPA              | 25 Feb 2024     |

2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

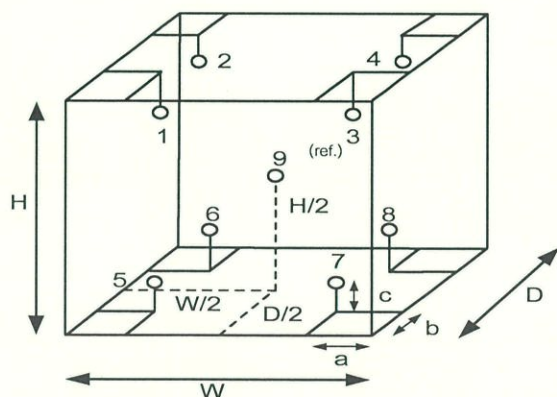
**Remark :** TPA : Technology Promotion Association ( Thailand - Japan )

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

**Fresh air setting :** Close

| Environment during calibration |           |          |
|--------------------------------|-----------|----------|
|                                | Beginning | Finished |
| Temp. ( °C )                   | 24        | 24       |
| REL.Humid. ( % )               | 54        | 56       |
| AC Supply ( Volt )             | 221       | 223      |



| Position : | Ref. Std. ID No.: |
|------------|-------------------|
| 1          | 19RTD-2/1         |
| 2          | 19RTD-2/2         |
| 3          | 19RTD-2/3         |
| 4          | 19RTD-2/4         |
| 5          | 19RTD-2/5         |
| 6          | 19RTD-2/6         |
| 7          | 19RTD-2/7         |
| 8          | 19RTD-2/8         |
| 9 (ref.)   | 19RTD-2/9         |

**Probe Installation Details :**

a = 10 cm  
 b = 10 cm  
 c = 10 cm

**Dimension of Chamber :**

D = 0.50 m  
 W = 0.75 m  
 H = 1.2 m  
 Capacity = 0.45 m<sup>3</sup>

*Malu.*



Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2307-0285OC-1  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 23TM1146

Page : 3 of 3

| Calibration Point<br>( °C ) | UUC* Setting<br>( °C ) | UUC* Reading<br>( °C ) | Temperature stability<br>( ± °C ) | Temperature uniformity<br>( °C ) | Overall Variation<br>( °C ) | Coverage Factor<br><i>k</i> |
|-----------------------------|------------------------|------------------------|-----------------------------------|----------------------------------|-----------------------------|-----------------------------|
| 35.0                        | 35.0                   | 35.0                   | 0.055                             | 0.30                             | 0.44                        | 2                           |

| Calibration<br>Point<br>( °C ) | Measured Temperature ( °C ) |        |        |        |        |        |        |        |          | Uncertainty<br><br>( ± °C ) |
|--------------------------------|-----------------------------|--------|--------|--------|--------|--------|--------|--------|----------|-----------------------------|
|                                | Position                    |        |        |        |        |        |        |        |          |                             |
|                                | 1                           | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9 (ref.) |                             |
| 35.0                           | 34.888                      | 34.933 | 34.815 | 34.813 | 35.064 | 35.019 | 35.156 | 35.141 | 35.087   | 0.30                        |

**Average\*** : The average of 30 values in each position.

**Temperature stability** : One-half of the greatest maximum difference of measured temperature at any one sensor.

**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.

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

**UUC\*** : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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

-o0o-

Malu.



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TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 22TM1571

Page : 1 of 3

## Certificate of Calibration

Equipment : Hot Air Oven

Manufacturer : Binder

Model : ED 240/E2

Serial No. : 00-15533

ID No. : BKK\_ML0013

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand

Location : Media Preparation Room

Received Order : 21 November 2022

Calibration Date : 21 November 2022

Ambient Temperature : ( 26 ± 10 ) °C

Relative Humidity : ( 50 ± 30 ) %

Calibrated by : Krisda Malee

Approved by :

*Malee*

Approved Signatory

( ) Pornthippa Tameyakul

(✓) Malee Butkruea

( ) Suwit Imjai

Issue Date : 29 November 2022

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written  
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0048150



Equipment : Hot Air Oven  
 Condition As-Received : Used Item  
 Reference : 2211-0623OC-1

Cert. No.: 22TM1571

Page : 2 of 3

**Procedure Used :-**

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T.

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-

| Instrument           | Model  | Serial No. | Cert. No. | Due Date    |
|----------------------|--------|------------|-----------|-------------|
| 1 ) Data Acquisition | 34970A | MY44067817 | 22LM121   | 22 Aug 2023 |

2. This certificate is valid only to the item calibrated on date and place of calibration.

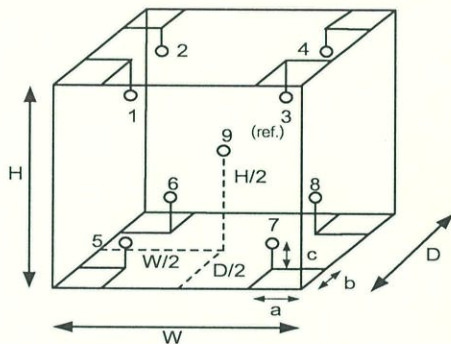
3. This certification is traceable to the International System of Unit.

**Result of Calibration :-** ( \* ) After Adjustment

**Function of UUC\* :** Temperature Source

**Fresh air setting :** Not Available

| Environment during calibration |           |          |
|--------------------------------|-----------|----------|
|                                | Beginning | Finished |
| Temp. ( °C )                   | 26        | 26       |
| REL.Humid. ( % )               | 53        | 55       |
| AC Supply ( Volt )             | 219       | 220      |



| Position : | Ref. Std. ID No.: |
|------------|-------------------|
| 1          | 21-15TC-01        |
| 2          | 21-15TC-02        |
| 3          | 21-15TC-03        |
| 4          | 21-15TC-04        |
| 5          | 21-15TC-05        |
| 6          | 21-15TC-06        |
| 7          | 21-15TC-07        |
| 8          | 21-15TC-08        |
| 9 (ref.)   | 21-15TC-09        |

**Probe Installation Details :**

a = 5.0 cm  
 b = 5.0 cm  
 c = 5.0 cm

**Dimension of Chamber :**

D = 0.50 m  
 W = 0.80 m  
 H = 0.60 m  
 Capacity = 0.24 m<sup>3</sup>

*Malu.*



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2211-0623OC-1  
Result of Calibration :- ( \* ) After Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Not Available

Cert. No.: 22TM1571

Page : 3 of 3

| Calibration Point<br>( °C ) | UUC* Setting<br>( °C ) | UUC* Reading<br>( °C ) | Temperature stability<br>( ± °C ) | Temperature uniformity<br>( °C ) | Overall Variation<br>( °C ) | Uncertainty<br>( ± °C ) | Coverage Factor<br><i>k</i> |
|-----------------------------|------------------------|------------------------|-----------------------------------|----------------------------------|-----------------------------|-------------------------|-----------------------------|
| 180                         | 180                    | 180                    | 0.70                              | 1.5                              | 2.9                         | 1.4                     | 2                           |

| Calibration Point<br>( °C ) | Measured Temperature ( °C ) |         |         |         |         |         |         |         |          |
|-----------------------------|-----------------------------|---------|---------|---------|---------|---------|---------|---------|----------|
|                             | Position                    |         |         |         |         |         |         |         |          |
|                             | 1                           | 2       | 3       | 4       | 5       | 6       | 7       | 8       | 9 (ref.) |
| 180                         | 179.520                     | 180.585 | 178.855 | 179.482 | 178.827 | 179.938 | 179.074 | 180.199 | 180.068  |

**Average\*** : The average of 30 values in each position.

**Temperature stability** : One-half of the greatest maximum difference of measured temperature at any one sensor.

**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.

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

**UUC\*** : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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

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*Malu*



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TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 22TM677

Page.: 1 of 3

## Certificate of Calibration

**Equipment :** Water Bath  
**Manufacturer :** Memmert  
**Model :** WNE 45  
**Serial No. :** L712.0429  
**ID No. :** BKK\_ML0056  
**Submitted by :** ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang ,  
Bangkok 10250 Thailand  
**Location :** Incubator & Microbiological Reading  
**Received Order :** 20 May 2022  
**Calibration Date :** 20 May 2022  
**Ambient Temperature :** ( 26 ± 10 ) °C  
**Relative Humidity :** ( 50 ± 30 ) %

**Calibrated by :** Preecha Hlahib

**Approved by :**

  
Approved Signatory

- ( ) Pornthippa Tameyakul  
( ) Malee Butkruea  
( ☒ ) Suwit Imjai

**Issue Date :** 24 May 2022

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0041433



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2205-0404OC-1

Cert. No.: 22TM677

Page.: 2 of 3

**Procedure Used :-**

Calibration were conducted using in-house calibration procedure CP-OT04 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer ( IPRT ).

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-

**Instrument**

**Model**

**Serial No.**

**Cert. No.**

**Due Date**

1 ) Data Acquisition

34972A

MY57013823

22LM24

26 Feb 2023

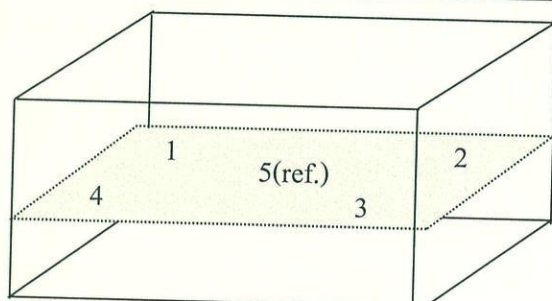
2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

|                          | Environmental |           | AC Voltage Supply<br>( Volt ) |
|--------------------------|---------------|-----------|-------------------------------|
|                          | ( °C )        | ( %R.H. ) |                               |
| Beginning of Calibration | 24            | 47        | 220                           |
| Finished of Calibration  | 24            | 52        | 221                           |



Front

| Position : | Ref. Std.<br>S/N.: |
|------------|--------------------|
| 1          | 4804539-006        |
| 2          | 4804539-007        |
| 3          | 4804539-008        |
| 4          | 4804539-009        |
| 5(ref.)    | 4804539-010        |

*Signature*



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2205-0404OC-1  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source

Cert. No.: 22TM677

Page.: 3 of 3

| Calibration<br>point<br>( °C ) | UUC*<br>Setting<br>( °C ) | UUC*<br>Reading<br>( °C ) | Average* Standard Reading ( °C ) |        |        |        |          |
|--------------------------------|---------------------------|---------------------------|----------------------------------|--------|--------|--------|----------|
|                                |                           |                           | Position                         |        |        |        |          |
|                                |                           |                           | 1                                | 2      | 3      | 4      | 5 (ref.) |
| 44.5                           | 44.4                      | 44.4                      | 44.539                           | 44.497 | 44.476 | 44.506 | 44.507   |

| Calibration<br>point<br>( °C ) | Uniformity<br>( °C ) | Stability<br>( ± °C ) | Uncertainty<br>( ± °C ) | Coverage<br>Factor<br><i>k</i> |
|--------------------------------|----------------------|-----------------------|-------------------------|--------------------------------|
| 44.5                           | 0.068                | 0.030                 | 0.15                    | 2                              |

**Average\*** : The average of 30 values in each position.

**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.

**Stability** : One-half of the greatest maximum difference of measured temperature at any one probe.

**UUC\*** : Unit Under Calibration

**Note** : The reported uncertainty of measurement was included stability and excluded uniformity.

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

-o0o-

*Unit*

a 1109673



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TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 23TM637  
Page : 1 of 3

## Certificate of Calibration

Equipment : Water Bath  
Manufacturer : Memmert  
Model : WNE 45  
Serial No. : L712.0429  
ID No. : BKK\_ML0056  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand  
Location : Incubator & Microbiological Reading  
Received Order : 20 April 2023  
Calibration Date : 20 April 2023  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
Calibrated by : Kunchit Promprat

|                |           |
|----------------|-----------|
| REVIEW BY      | Sithichok |
| APPROVED BY    |           |
| NEXT CAL. DATE | 20/4/24   |

Approved by :

Malee

Approved Signatory

- ( ) Pornthippa Tameyakul  
( ✓ ) Malee Butkruea  
( ) Suwit Imjai

Issue Date :

24 April 2023

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0053357



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2304-0253OC-1

Cert. No.: 23TM637

Page : 2 of 3

**Procedure Used :-**

Calibration were conducted using in-house calibration procedure CP-OT04 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer ( IPRT ).

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-

| <u>Instrument</u>    | <u>Model</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|----------------------|--------------|-------------------|------------------|-----------------|
| 1 ) Data Acquisition | 34970A       | MY44073381        | 22LM78/1         | 12 May 2023     |

2. This certificate is valid only to the item calibrated on date and place of calibration.

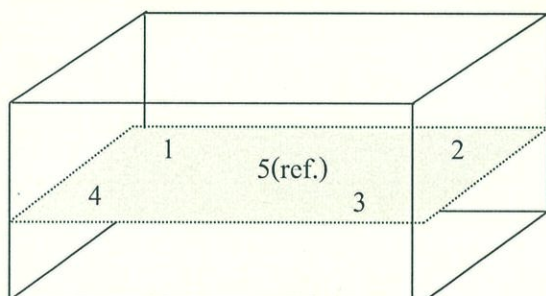
3. This certification is traceable to the International System of Unit.

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

**Heat transfer medium used :** Water

|                          | <u>Environmental</u> |           | <u>AC Voltage Supply</u> |
|--------------------------|----------------------|-----------|--------------------------|
|                          | ( °C )               | ( %R.H. ) | ( Volt )                 |
| Beginning of Calibration | 25                   | 45        | 223                      |
| Finished of Calibration  | 25                   | 43        | 223                      |



Front

| <u>Position :</u> | <u>Ref. Std. S/N.:</u> |
|-------------------|------------------------|
| 1                 | 4803988-006            |
| 2                 | 4803988-007            |
| 3                 | 4804539-014            |
| 4                 | 4804539-015            |
| 5(ref.)           | 4804539-016            |

*Malu*



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2304-0253OC-1  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source

Cert. No.: 23TM637

Page : 3 of 3

| Calibration<br>point<br>( °C ) | UUC*<br>Setting<br>( °C ) | UUC*<br>Reading<br>( °C ) | Average* Standard Reading ( °C ) |        |        |        |          | Uncertainty |
|--------------------------------|---------------------------|---------------------------|----------------------------------|--------|--------|--------|----------|-------------|
|                                |                           |                           | Position                         |        |        |        |          |             |
|                                |                           |                           | 1                                | 2      | 3      | 4      | 5 (ref.) | ( ± °C )    |
| 44.5                           | 44.5                      | 44.5                      | 44.492                           | 44.463 | 44.475 | 44.510 | 44.491   | 0.15        |
| 45.0                           | 45.0                      | 45.0                      | 45.005                           | 44.962 | 44.979 | 45.016 | 44.986   | 0.15        |

| Calibration<br>point<br>( °C ) | Uniformity<br>( °C ) | Stability<br>( ± °C ) | Coverage<br>Factor<br><i>k</i> |
|--------------------------------|----------------------|-----------------------|--------------------------------|
| 44.5                           | 0.051                | 0.022                 | 2                              |
| 45.0                           | 0.080                | 0.026                 | 2                              |

**Average\*** : The average of 30 values in each position.

**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.

**Stability** : One-half of the greatest maximum difference of measured temperature at any one probe.

**UUC\*** : Unit Under Calibration

**Note** : The reported uncertainty of measurement was included stability and excluded uniformity.

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

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Malu

# HACH COMPANY

Hach (Thailand) Limited, Building D Room No. D3 11, 3rd Floor, No. 735/4, Srinakarin Road, Pattanakarn, Suanluang, Bangkok  
 Phone +66 (02) 026-3529 Ext. 0 | Fax +66(02) 026-3572 | [www.sea.hach.com](http://www.sea.hach.com)

LABX 2303146

## Test Report

|                         |   |   |                   |   |            |
|-------------------------|---|---|-------------------|---|------------|
| Customers               | : | ALS Laboratory Group (Thailand) Co., Ltd. |                   |   |            |
| Equipment               | : | Chlorine Meter                            | Manufacturer      | : | HACH       |
| Controller Model        | : | DR300                                     | ID No.            | : | CHM_FS0109 |
| Controller Serial No.   | : | 22110B000655                              | Sensor Serial No. | : | -          |
| Date of test            | : | 21/11/2023                                | Period            | : | -          |
| Environment temperature | : | 25.0 °C                                   | Humidity          | : | 60.0 %RH   |

## Results

### Instrument Checked

| Item | Characteristic               | Before   | After  | Remark |
|------|------------------------------|--|--|--------|
| 1    | Visual Inspect               | <input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail | <input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail |        |
| 2    | Power Supply (4.5 – 6.0 VDC) | 6.0 VDC  | 6.0 VDC  |        |
| 3    | Display Check                | <input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail | <input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail |        |
| 4    | Keyboard Check               | <input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail | <input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail |        |
| 5    | Function System Program      | <input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail | <input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail |        |

### Warning and Error Checked

| Item | Event      | Before  | After   |
|------|------------|---|---|
| 6    | Error list | <input checked="" type="checkbox"/> None<br><input type="checkbox"/> Appear _____ | <input checked="" type="checkbox"/> None<br><input type="checkbox"/> Appear _____ |

### Check with Standard

| Item | Characteristic                         | Before    | After     | Remark |
|------|--|-----------|-----------|--------|
|      | DPD-CHLORINE-LR                        |           |           |        |
| 7    | Blank ( 0.00 mg/l)                     | 0.00 mg/l | 0.00 mg/l |        |
| 8    | Standard Cl2 No. 1 ( 0.19 ± 0.09 mg/l) | 0.20 mg/l | 0.19 mg/l |        |
| 9    | Standard Cl2 No. 2 ( 0.87 ± 0.10 mg/l) | 0.87 mg/l | 0.87 mg/l |        |
| 10   | Standard Cl2 No. 3 ( 1.55 ± 0.14 mg/l) | 1.56 mg/l | 1.55 mg/l |        |
|      | DPD-CHLORINE-HR                        |           |           |        |
| 11   | Blank ( 0.0 mg/l)                      | 0.0 mg/l  | 0.0 mg/l  |        |
| 12   | Standard Cl2 No. 1 ( 2.3 ± 0.2 mg/l)   | 2.3 mg/l  | 2.3 mg/l  |        |
| 13   | Standard Cl2 No. 2 ( 3.9 ± 0.3 mg/l)   | 3.9 mg/l  | 3.9 mg/l  |        |
| 14   | Standard Cl2 No. 3 ( 6.7 ± 0.6 mg/l)   | 6.7 mg/l  | 6.7 mg/l  |        |

REVIEW BY Chayathorn P.  
 APPROVED BY Maralonn P.  
 NEXT CAL. DATE 21/11/24



Be Right™

## HACH COMPANY

Hach (Thailand) Limited, Building D Room No. D3 11, 3rd Floor, No. 735/4, Srinakarin Road, Pattanakarn, Suanluang, Bangkok  
| Phone +66 (02) 026-3529 Ext. 0 | Fax +66(02) 026-3572 | [www.sea.hach.com](http://www.sea.hach.com)

LABX 2303146

### Summary of checked

- ☒ The instrument can work normally and efficiently. (เครื่องมือวัดสามารถทำงานได้ปกติและมีประสิทธิภาพ)  
☐ The instrument can work but it's requiring to maintenance. (เครื่องมือวัดสามารถทำงานได้แต่ต้องบำรุงรักษา)  
☐ The instrument could not work it's requiring to repair. (เครื่องมือวัดไม่สามารถทำงานได้และต้องการซ่อมบำรุง)

### Remark:

### Standard Equipment Used

| Equipment                         | Equipment I.D. |                   |
|-----------------------------------|----------------|-------------------|
| Standard Chlorine DPD-CHLORINE-LR | Lot No. A3020  | Exp date : Feb-25 |
| Standard Chlorine DPD-CHLORINE-HR | Lot No. A3041  | Exp date : Feb-25 |
| Digital multi meter               | S/N : 21190066 | Due date : Jun-24 |
| Thermo hygrometer                 | S/N : 45146347 | Due date : Aug-24 |

Test By :

WILAILAK S.

( Miss Wilailak Sawangpun )

Service Engineer

Approved by :

( Mr. Suanun Sartyangkool )

Position :

Assistant Service Division Manager



Be Right™



REVIEW BY Aulcharawan S.  
APPROVED BY Sararat M.  
NEXT CAL. DATE 12 Jan 24

## Certificate of Calibration

### ICS-2100: Anion (ID#659)

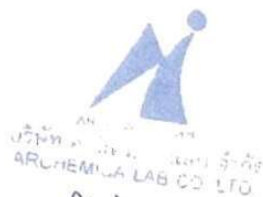
This certificate is to verify that instrument below are calibrated  
by Archemica Lab Co., Ltd.

ICS-2100 S/N: 15010977

AS-HV S/N: 5450A36659

For

**ALS Laboratory Group (Thailand) Co., Ltd.**



Operator Signature: Nutdanai

Date: Jan 12, 2023

(Mr.Nutdanai Laekhwan)

Application Chemist



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 23TM104

Page : 1 of 3

## Certificate of Calibration

|                       |  |
|-----------------------|--|
| Equipment :           | Water Bath   |
| Manufacturer :        | Memmert  |
| Model :               | WB 45  |
| Serial No. :          | L799.0009  |
| ID No. :              | BKK_ML0049   |
| Submitted by :        | ALS Laboratory Group (Thailand) Co.,Ltd.<br>104 Phatthanakan 40, Phatthanakan Rd.,<br>Khwaeng Phatthanakan, Khet Suan Luang,<br>Bangkok 10250 Thailand |
| Location :            | Biochemical Lab  |
| Received Order :      | 19 January 2023  |
| Calibration Date :    | 19 January 2023  |
| Ambient Temperature : | ( 26 ± 10 ) °C   |
| Relative Humidity :   | ( 50 ± 30 ) %  |
| Calibrated by :       | Khit Ruttanaprapachai  |

|                |            |
|----------------|------------|
| REVIEW BY      | SithichokT |
| APPROVED BY    |            |
| NEXT CAL. DATE | 19/01/24   |

Approved by :

Malu.  
Approved Signatory

- ( ) Pornthippa Tameyakul  
( ✓ ) Malee Butkruea  
( ) Suwit Imjai

Issue Date :

2 February 2023

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written  
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0050454



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2301-0577OC-1  
Procedure Used :-

Cert. No.: 23TM104

Page : 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT04 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer ( IPRT ).

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-

| <u>Instrument</u>    | <u>Model</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|----------------------|--------------|-------------------|------------------|-----------------|
| 1 ) Data Acquisition | 34970A       | MY44067817        | 22LM121          | 22 Aug 2023     |

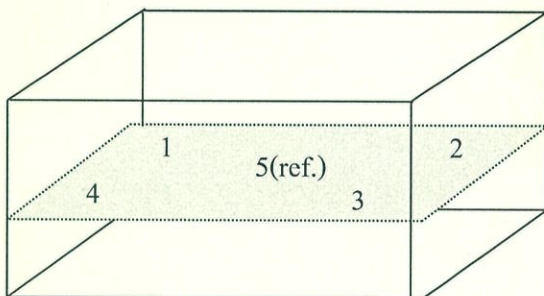
2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

|                          | Environmental |           | AC Voltage Supply |
|--------------------------|---------------|-----------|-------------------|
|                          | ( °C )        | ( %R.H. ) | ( Volt )          |
| Beginning of Calibration | 23            | 53        | 221               |
| Finished of Calibration  | 24            | 57        | 222               |



Front

| Position : | Ref. Std. ID No.: |
|------------|-------------------|
| 1          | 70RC143           |
| 2          | 70RC144           |
| 3          | 70RC145           |
| 4          | 70RC146           |
| 5(ref.)    | 70RC147           |

Malu .



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2301-0577OC-1  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source

Cert. No.: 23TM104

Page : 3 of 3

| Calibration<br>point<br>( °C ) | UUC*<br>Setting<br>( °C ) | UUC*<br>Reading<br>( °C ) | Average* Standard Reading ( °C ) |        |        |        |          |
|--------------------------------|---------------------------|---------------------------|----------------------------------|--------|--------|--------|----------|
|                                |                           |                           | Position                         |        |        |        |          |
|                                |                           |                           | 1                                | 2      | 3      | 4      | 5 (ref.) |
| 42.0                           | 44.9                      | 44.9                      | 41.996                           | 42.005 | 41.974 | 42.021 | 42.036   |

| Calibration<br>point<br>( °C ) | Uniformity<br>( °C ) | Stability<br>( ± °C ) | Uncertainty<br>( ± °C ) | Coverage<br>Factor<br><i>k</i> |
|--------------------------------|----------------------|-----------------------|-------------------------|--------------------------------|
| 42.0                           | 0.11                 | 0.037                 | 0.15                    | 2                              |

**Average\*** : The average of 30 values in each position.

**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.

**Stability** : One-half of the greatest maximum difference of measured temperature at any one probe.

**UUC\*** : Unit Under Calibration

**Note** : The reported uncertainty of measurement was included stability and excluded uniformity.

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

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Malu.



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert.No.: 23CHO30

Page.: 1 of 3

## Certificate of Calibration

Equipment : Spectrophotometer  
Manufacturer : HACH  
Model : DR 3900  
Serial No. : 1687645  
ID No. : SGK\_CL0038  
Condition As-Received: Used Item  
Received Date : 23 January 2023  
Calibration Date : 24 January 2023  
Reference : 2301-0661OC-1  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. Songkhla Branch.  
114/1 Moo 8 , Kanjanavanij Rd.,  
Banphru , Hatyai ,  
Songkhla 90250 , Thailand

Calibration Place : Chemistry Room  
Ambient Temperature : ( 28.3 - 27.3 ) °C (On-Site)  
Relative Humidity : ( 49.6 - 49.9 ) % (On-Site)  
Calibration Procedure : In - house method :  
CP-OCH4 based on ASTM E 275-01

|                |            |
|----------------|------------|
| REVIEW BY      | Ananta B.  |
| APPROVED BY    | Kanitta H. |
| NEXT CAL. DATE | 24/01/24   |

Calibrated by : Kunchit Promprat

Approved by :

*Malee*

Approved Signatory

- (☒) Malee Butkruea  
( ) Saithip Meangmai  
( ) Warakorn Lernagtrakul

Issue Date : 7 February 2023

**The Uncertainties are for a confidence probability of approximately 95%**

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0050506



Cert. No. : 23CHO30

Page : 2 of 3

**Condition of calibration result**

1. Reference Standard Material :

| <u>Material</u>            | <u>Serial No.</u> | <u>Certificate No.</u> | <u>Due date</u> |
|----------------------------|-------------------|------------------------|-----------------|
| 1. Absorbance Standard set | 32593             | 100581                 | 30 Mar 2024     |
| 2. Wavelength Standard set | 29829             | 94776                  | 02 Sep 2023     |
| 3. Wavelength Standard set | 29829             | 94777                  | 02 Sep 2023     |

2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certificate is traceable to the International System of Unit maintained at :

- National Physical Laboratory (NPL), The United Kingdom of Great Britain and Northern Ireland
- National Institute of Standards and Technology (NIST), The United States of America

4. Spectral BandWidth : 5 nm

Scan Speed : - nm/min

**Calibration Results : without adjustment**

**Wavelength Accuracy**

| <b>Certified Values<br/>of Reference Material<br/>( nm )</b> | <b>UUC Reading<br/>( nm )</b> | <b>Uncertainty of<br/>Measurement<br/>( <math>\pm</math> nm )</b> | <b>Coverage<br/>Factor<br/><i>k</i></b> |
|--|-------------------------------|---|---|
| 418.40   | 418                           | 0.59  | 2.00                                    |
| 479.88   | 480                           | 0.59  | 2.00                                    |
| 513.75   | 514                           | 0.59  | 2.00                                    |
| 537.00   | 536                           | 0.59  | 2.00                                    |
| 638.00   | 638                           | 0.59  | 2.00                                    |
| 684.70   | 685                           | 0.59  | 2.00                                    |
| 747.61   | 748                           | 0.59  | 2.00                                    |
| 807.04   | 807                           | 0.59  | 2.00                                    |

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**a 1146846**



Cert. No. : 23CHO30

Page : 3 of 3

**Calibration Results : without adjustment****Photometric Accuracy**

| Wavelength<br>(nm) | Certified Values<br>of Reference Material<br>( Abs ) | UUC Reading<br>( Abs ) | Uncertainty of<br>Measurement<br>( $\pm$ Abs ) | Coverage<br>Factor<br>$k$ |
|--------------------|--|------------------------|--|---------------------------|
| 420.0              | Zero   | 0.000                  | 0.0028   | 2.00                      |
|                    | 0.5701   | 0.568                  | 0.0029   | 2.00                      |
|                    | 0.7147   | 0.712                  | 0.0030   | 2.00                      |
|                    | 1.0031   | 0.999                  | 0.0030   | 2.00                      |
| 440.0              | Zero   | 0.000                  | 0.0028   | 2.00                      |
|                    | 0.5552   | 0.553                  | 0.0029   | 2.00                      |
|                    | 0.7031   | 0.700                  | 0.0030   | 2.00                      |
|                    | 0.9867   | 0.981                  | 0.0029   | 2.00                      |
| 465.0              | Zero   | 0.000                  | 0.0028   | 2.00                      |
|                    | 0.5178   | 0.517                  | 0.0030   | 2.00                      |
|                    | 0.6642   | 0.663                  | 0.0029   | 2.00                      |
|                    | 0.9312   | 0.930                  | 0.0030   | 2.00                      |
| 546.1              | Zero   | 0.000                  | 0.0028   | 2.00                      |
|                    | 0.5195   | 0.517                  | 0.0030   | 2.00                      |
|                    | 0.7007   | 0.698                  | 0.0029   | 2.00                      |
|                    | 0.9833   | 0.979                  | 0.0028   | 2.00                      |
| 590.0              | Zero   | 0.000                  | 0.0028   | 2.00                      |
|                    | 0.5537   | 0.550                  | 0.0030   | 2.00                      |
|                    | 0.7763   | 0.771                  | 0.0029   | 2.00                      |
|                    | 1.0912   | 1.083                  | 0.0028   | 2.00                      |
| 635.0              | Zero   | 0.000                  | 0.0028   | 2.00                      |
|                    | 0.5615   | 0.558                  | 0.0029   | 2.00                      |
|                    | 0.7659   | 0.762                  | 0.0030   | 2.00                      |
|                    | 1.0763   | 1.070                  | 0.0028   | 2.00                      |

**Remark**

- Each individual filter is measured against the empty filter holder (blank) used to zero the spectrophotometer

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

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**a 1146845**