

ภาคผนวก จ

ใบรับรองการสอบเทียบเครื่องมือ



right solutions.
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 | 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 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-May-24 | 18 |
| Water Lab | Total Dissolved Solids 180°C | Electronic Top-Loading Balance | BKK_EN0002 | 8-Feb-23 | 8-Feb-24 | 12 |
| Water Lab | Total Dissolved Solids 180°C | Oven | BKK_EN0273 | 29-Nov-22 | 29-May-24 | 18 |
| Water Lab | BOD | DO Meter | BKK_EN0205 | 3-Aug-22 | 3-Feb-24 | 18 |
| Water Lab | BOD | Incubator | BKK_EN0305 | 5-Apr-23 | 5-Apr-24 | 18 |
| Water Lab | COD | Hot Block | BKK_EN0222 | 25-Apr-23 | 25-Apr-24 | 12 |
| Water Lab | COD | Spectrophotometer | BKK_EN0018 | 15-Sep-23 | 15-Sep-24 | 12 |
| Water Lab | Lead | ICP-MS | BKK_EL0043 | 6-Apr-23 | 6-Oct-24 | 18 |
| Water Lab | Lead | Hot Block | BKK_EL0054 | 22-Sep-23 | 22-Mar-25 | 18 |
| Water Lab | Lead | Chamber (Cold Room) | BKK_EN0167 | 30-Jun-22 | 30-Dec-23 | 18 |



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. 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250 Thailand |
| Ambient Temperature : | (25 ± 2.5) °C |
| Relative Humidity : | (50 ± 15) % |
| Calibration Procedure : | In - house method : - CP-CH5 by direct measurement with standard voltage calibrator and direct measurement 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%

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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 (\pm mV) | Coverage factor <i>k</i> |
|------------------------------|---------------|------------------------|----------------|--------|---|-----------------------------|
| | pH | mV | mV | pH | | |
| pH Meter 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 (mV) | Uncertainty of pH measurement (\pm) | Coverage factor <i>k</i> |
|-------------------------------------|-----------------------------|-------------------|---------------------------|--|-----------------------------|
| pH Electrode 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

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.

This certificate may not be reproduced other than in full except with the prior written approval of the Verification Operation Division Sartorius (Thailand) Co., Ltd.

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

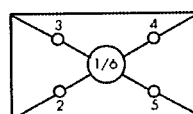
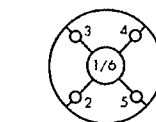
The reproducibility is the ability of a weighing instrument to display nearly identical readouts under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.

| | | |
|-----------------------------|---------|----------|
| 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 (g) | Conventional Mass Value (g) | Displayed Value (g) | Deviation (g) | Uncertainty (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

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. 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

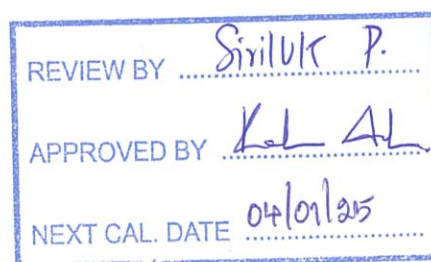
Customer Location : ORGANIC PREPARATION LAB

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

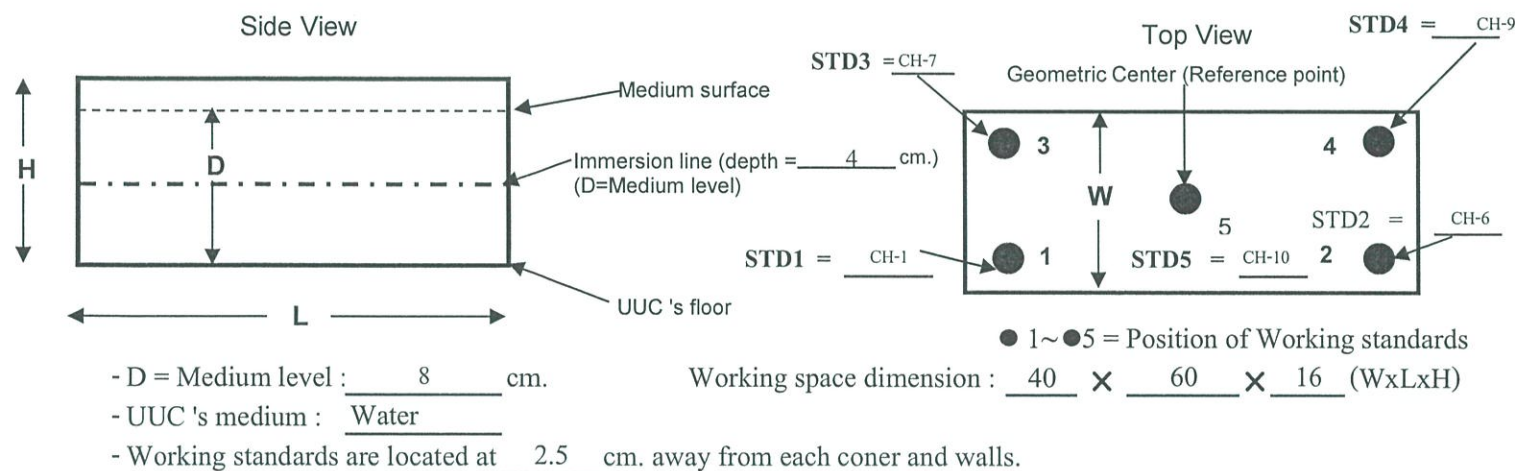
Approved By, _____



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, Thailand.

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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

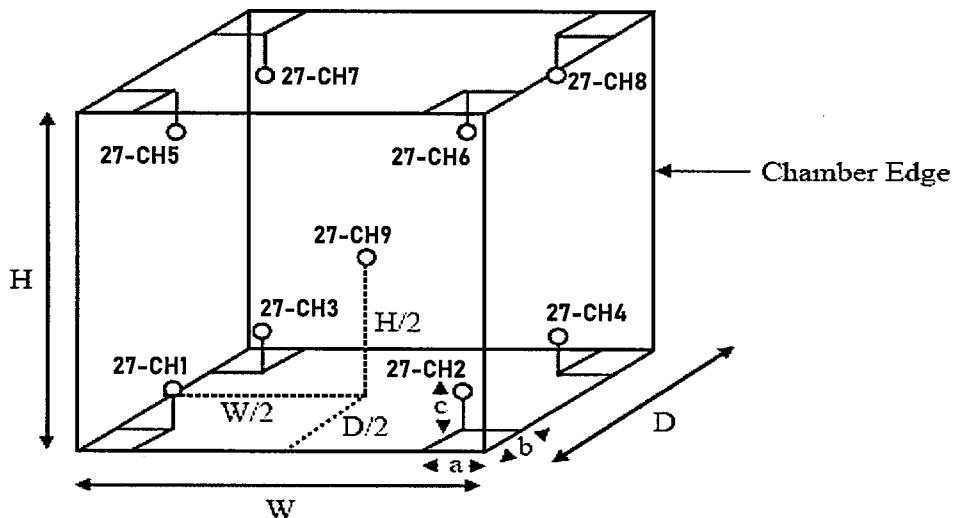
(X) after adjustment

Approved By. Bm Lani

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 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.

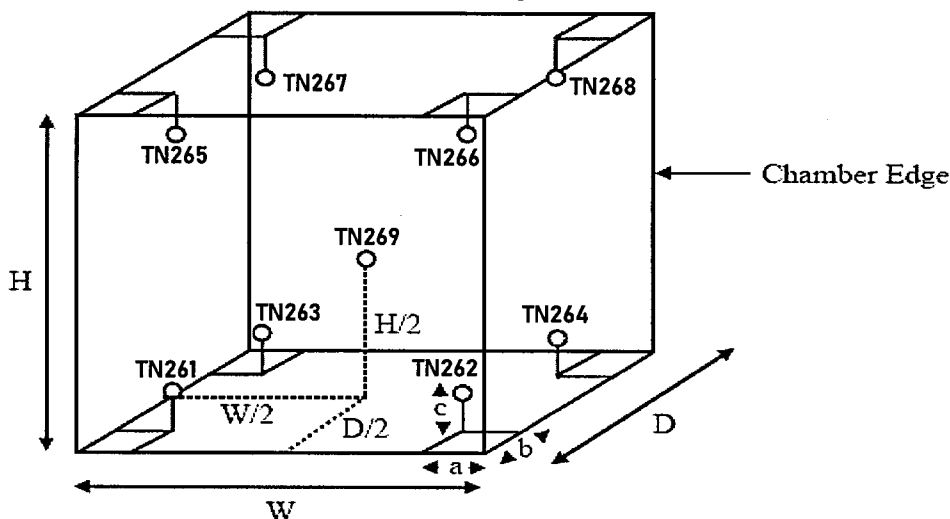
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* which for a t-distribution, providing a level of confidence of approximately 95 % .

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.: 22TW178

Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : 5100
Serial No. : 15L103204
ID No. : BKK_EN0205
Received Date : 02 August 2022
Test Date : 03 August 2022
Reference : 2208-0060DSC-1

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

Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
Test Procedure : In - house method : CP-CH9
by Comparison Technique with Azide Modification Method

Tested by : Walalak Sirithean

Approved by :

Malee

Approved Signatory

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

Issue Date : 4 August 2022

| | |
|----------------|-------------------|
| REVIEW BY | <i>Siriluk P.</i> |
| APPROVED BY | <i>KL AL</i> |
| NEXT CAL. DATE | <i>03/02/24</i> |



Cert.No.: 22TW178

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 | 21CG1389 | 25 Mar 2023 |
| 2) Balance | 1126143764 | 140RC004 | 21MM430 | 21 Sep 2022 |

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.: 17A100064

| Titration Method (Azide Modification Method) (mg/L) | DO Meter Reading (mg/L) | Standard Deviation (mg/L) |
|---|-------------------------------|------------------------------|
| 8.06 | 8.07 | 0.0045 |

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

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Maler

a 1119718



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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Cert. No.: 22LM107

Page.: 1 of 2

Certificate of Calibration

Equipment : DO Meter with Sensor

Manufacturer : YSI

Model : 5100

Serial No. : 15L103204

ID No. : BKK_EN0205

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

Location : TPA On Site Calibration Laboratory

Received Order : 2 August 2022

Calibrated Date : 4 August 2022

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

AC Line Voltage : (220 ± 22) V

Calibrated by : Man Pattanapongpaiboon

Approved by : Malee Butkruea
Approved Signatory

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

Issue Date : 9 August 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 0044131



Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2208-0060DSC-2

Cert. No.: 22LM107

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>Model</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|------------------------|--------------|-------------------|------------------|-----------------|
| 1) Digital Thermometer | 1502A | A52847 | 21I1144 | 20 Oct 2022 |

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 : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 18C100772

| <u>Calibration Point</u> (°C) | <u>Immersion Depth</u> (mm) | <u>Standard Temperature</u> (°C) | <u>UUC* Reading</u> (°C) | <u>Error</u> (°C) | <u>Uncertainty</u> (± °C) | <u>Coverage Factor</u> <i>k</i> |
|------------------------------------|----------------------------------|---------------------------------------|-------------------------------|------------------------|--------------------------------|------------------------------------|
| 20.00 | 60 | 20.002 | 19.93 | -0.072 | 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-

Mahu.

a 1120698



Metrological Center

SCI ECO Services Company Limited

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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

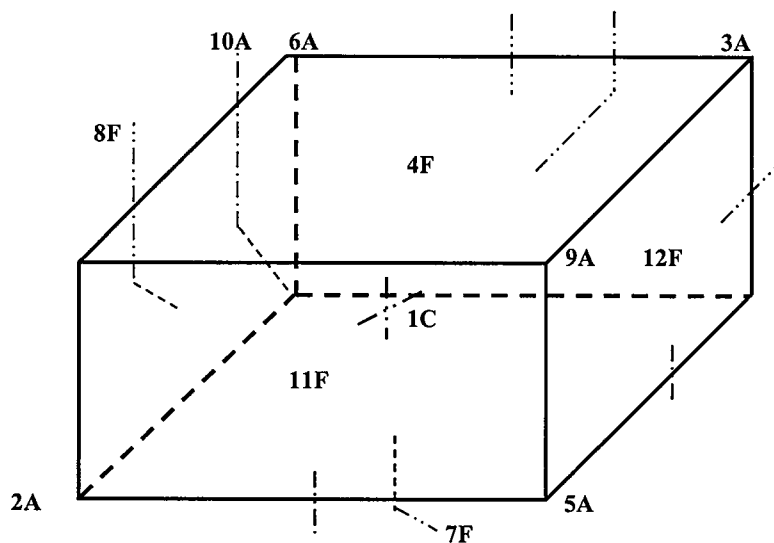
(X) after adjustment

Approved By. 

Certificate No T230683

Calibration Report

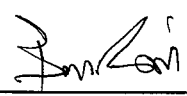
Page 3 of 4



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 | | | | | | | | |

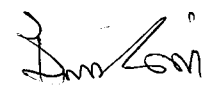
| Chamber (Incubator) | | | Temperature Distribution | | | | |
|-----------------------|--------------|---------|--------------------------|------------------|-----------------|--------------------|----------------------|
| Setting (°C) | Reading (°C) | | Average (°C) | Stability (± °C) | Uniformity (°C) | Uncertainty (± °C) | Coverage 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. 



Metrological Center

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E-Mail : calibrate@scg.co.th

Certificate No. T230760

Page 1 of 5

Certificate of Calibration

Equipment : HOT BLOCK

Manufacturer : Environmental Express

Model : B3000- 240

Serial No. : 2017CODW116

Customer Code : BKK_EN0222

ID No. : T6769A4

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

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

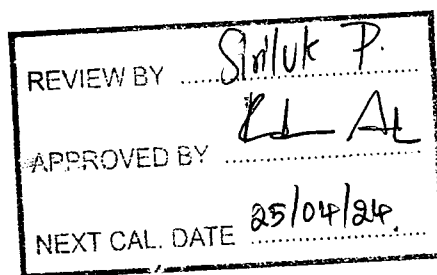
Customer Location : Wet Chemistry Lab2

Date of Receipt : 21 April 2023

Calibrated By : Watcharasak Puttarat (Technician)

Approved By :  / Sujjar Naknakred (Site Calibration Manager)

Date of Issue : 12 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.



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Certificate No. T230760

Page 2 of 5

Calibration Report

Equipment : HOT BLOCK
Date of Calibration : 25 April 2023
Environment : Temperature : 22.9-24.4 °C
Line Voltage : 222.7-227.8 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert 20 standard thermocouples type T into its chamber , the other one standard thermocouples type T 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 |
|-------------|--------|----------------|-----------------|----------------|
| TC | TYPE T | TN121-TN130 | T222122 | 5 October 2023 |
| TC | TYPE T | TN131-TN140 | T222122 | 5 October 2023 |
| DATA LOGGER | 34970A | T150 | T222122 | 5 October 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

Equipment Description :

Time Constant 1 Hour 32 Minute At 150 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

(X) without adjustment

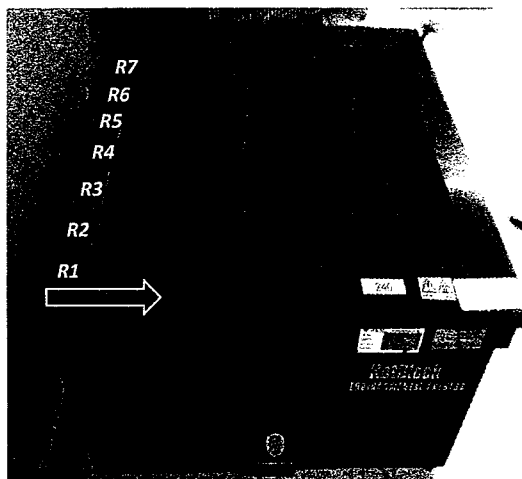
() after adjustment

Approved By _____

Certificate No. T230760

Page 3 of 5


Calibration Report



| Row | Hole | | | | | | | |
|-----|------|-----|-----|-----|-----|-----|-----|-----|
| R7 | H49 | H50 | H51 | H52 | H53 | H54 | H55 | H56 |
| R6 | H41 | H42 | H43 | H44 | H45 | H46 | H47 | H48 |
| R5 | H33 | H34 | H35 | H36 | H37 | H38 | H39 | H40 |
| R4 | H25 | H26 | H27 | H28 | H29 | H30 | H31 | H32 |
| R3 | H17 | H18 | H19 | H20 | H21 | H22 | H23 | H24 |
| R2 | H9 | H10 | H11 | H12 | H13 | H14 | H15 | H16 |
| R1 | H1 | H2 | H3 | H4 | H5 | H6 | H7 | H8 |

H: STANDARD THERMOCOUPLE TYPE T

| | | | | | | | | | | | | | | | | | | | | |
|----|---|-------|-----|---|-------|-----|---|-------|-----|---|-------|-----|---|-------|-----|---|-------|-----|---|-------|
| H1 | = | TN121 | H9 | = | TN129 | H17 | = | TN137 | H25 | = | TN125 | H33 | = | TN133 | H41 | = | TN121 | H49 | = | TN129 |
| H2 | = | TN122 | H10 | = | TN130 | H18 | = | TN138 | H26 | = | TN126 | H34 | = | TN134 | H42 | = | TN122 | H50 | = | TN130 |
| H3 | = | TN123 | H11 | = | TN131 | H19 | = | TN139 | H27 | = | TN127 | H35 | = | TN135 | H43 | = | TN123 | H51 | = | TN131 |
| H4 | = | TN124 | H12 | = | TN132 | H20 | = | TN140 | H28 | = | TN128 | H36 | = | TN136 | H44 | = | TN124 | H52 | = | TN132 |
| H5 | = | TN125 | H13 | = | TN133 | H21 | = | TN121 | H29 | = | TN129 | H37 | = | TN137 | H45 | = | TN125 | H53 | = | TN133 |
| H6 | = | TN126 | H14 | = | TN134 | H22 | = | TN122 | H30 | = | TN130 | H38 | = | TN138 | H46 | = | TN126 | H54 | = | TN134 |
| H7 | = | TN127 | H15 | = | TN135 | H23 | = | TN123 | H31 | = | TN131 | H39 | = | TN139 | H47 | = | TN127 | H55 | = | TN135 |
| H8 | = | TN128 | H16 | = | TN136 | H24 | = | TN124 | H32 | = | TN132 | H40 | = | TN140 | H48 | = | TN128 | H56 | = | TN136 |

 Approved By. 



SCG
CEMENT-BUILDING MATERIALS

Metrological Center

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E-Mail : calibrate@scg.co.th

Certificate No. T230760

Page 4 of 5

Calibration Report

Measurement Results

| | | | Average Standard Reading at each position (° C) | | | | | | | | | |
|-------------------|---------|---------|---|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Calibration Point | | | TN121 | TN122 | TN123 | TN124 | TN125 | TN126 | TN127 | TN128 | TN129 | TN130 |
| Point | Setting | Max | 149.31 | 149.49 | 149.73 | 148.49 | 149.26 | 149.81 | 149.42 | 148.86 | 148.78 | 149.19 |
| 150 | 150.0 | Min | 149.14 | 149.31 | 149.54 | 148.36 | 149.08 | 149.65 | 149.22 | 148.65 | 149.07 | 149.07 |
| | | Average | 149.23 | 149.40 | 149.64 | 148.43 | 149.16 | 149.73 | 149.33 | 148.76 | 148.71 | 149.13 |
| | | | TN131 | TN132 | TN133 | TN134 | TN135 | TN136 | TN137 | TN138 | TN139 | TN140 |
| | | Max | 149.90 | 150.18 | 150.18 | 149.16 | 148.89 | 149.72 | 149.28 | 149.50 | 150.01 | 149.32 |
| | | Min | 149.78 | 150.06 | 149.69 | 149.03 | 148.76 | 149.49 | 149.12 | 149.37 | 149.90 | 149.23 |
| | | Average | 149.84 | 150.12 | 149.76 | 149.09 | 148.81 | 149.62 | 149.19 | 149.43 | 149.95 | 149.27 |
| | | | TN121 | TN122 | TN123 | TN124 | TN125 | TN136 | TN127 | TN128 | TN129 | TN130 |
| | | Max | 149.88 | 149.14 | 149.20 | 150.02 | 148.75 | 149.57 | 149.21 | 149.18 | 150.13 | 148.91 |
| | | Min | 149.67 | 148.94 | 148.98 | 149.83 | 148.58 | 149.43 | 149.06 | 149.01 | 149.91 | 148.72 |
| | | Average | 149.78 | 149.05 | 149.11 | 149.94 | 148.67 | 149.51 | 149.13 | 149.10 | 150.03 | 148.83 |
| | | | TN131 | TN132 | TN133 | TN134 | TN135 | TN136 | TN137 | TN138 | TN139 | TN140 |
| | | Max | 149.42 | 149.52 | 149.13 | 148.94 | 148.84 | 150.16 | 149.42 | 149.54 | 149.66 | 150.08 |
| | | Min | 149.27 | 149.36 | 148.99 | 148.81 | 148.70 | 149.99 | 149.27 | 149.39 | 149.52 | 149.97 |
| | | Average | 149.36 | 149.45 | 149.06 | 148.88 | 148.76 | 150.08 | 149.36 | 149.48 | 149.60 | 150.03 |
| | | | TN121 | TN122 | TN123 | TN124 | TN125 | TN126 | TN127 | TN128 | TN129 | TN130 |
| | | Max | 149.21 | 149.16 | 149.50 | 148.68 | 148.58 | 149.81 | 149.06 | 150.40 | 148.46 | 149.24 |
| | | Min | 149.03 | 148.93 | 149.27 | 148.48 | 148.42 | 149.62 | 148.78 | 150.26 | 148.14 | 149.04 |
| | | Average | 149.12 | 149.04 | 149.39 | 148.57 | 148.51 | 149.72 | 148.93 | 150.33 | 148.29 | 149.14 |
| | | | TN131 | TN132 | TN133 | TN134 | TN135 | TN136 | | | | |
| | | Max | 148.79 | 148.23 | 149.03 | 149.09 | 148.46 | 149.25 | | | | |
| | | Min | 148.49 | 147.98 | 148.88 | 148.94 | 148.29 | 149.12 | | | | |
| | | Average | 148.61 | 148.06 | 148.94 | 149.02 | 148.35 | 149.19 | | | | |

Approved By. _____



Metrological Center

SCI ECO Services Company Limited

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E-Mail : calibrate@scg.co.th

Certificate No. T230760

Page 5 of 5

Calibration Report

Measurement Results

| HOT BLOCK | | | Temperature Distribution | |
|--------------|--------------|---------|--------------------------|-------------------------|
| Setting (°C) | Reading (°C) | | Stability (\pm °C) | Uncertainty (\pm °C) |
| | Min , Max | Average | | |
| 150.0 | 150 , 150.1 | 150.0 | 0.20 | 0.82 |

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. _____

Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-307/22
Equipment UV/Vis Spectrophotometer
Model UV-1800
Manufacturer Shimadzu
Serial No. A11454908533CD
ID No. BKK_EN0018
Date of receipt 16 September 2022
Date of calibration 16 September 2022
Date of issue 23 September 2022

REVIEW BY *Shiruk P.*
APPROVED BY *Kw An*
16/9/23
NEXT CAL. DATE *23/9/22*

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

Address 104 Soi Phatthanakan 40, Phatthanakan Road, Phatthanakan, Suan Luang, Bangkok 10250

Temperature (22.1-23.3) °C (On site)

Humidity (58.8-63.2) %RH (On site)

Equipment condition Good Operation

Calibration Location Organic Prep

Calibration Procedure In-house method WI-UV-702-01 based on ASTM E275-01

Traceability Wavelength Accuracy is traceable to certificate No. 95917 and 95918
Photometric Accuracy is traceable to certificate No. 95924 and 95937
Stray Light is traceable to certificate No. 95908
The above certificate are traceable to SI unit through Starna Scientific Ltd.
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr.Waruth Janphung

Approved by



Mr.Kanchit Choothep
Technical Manager

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.
Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced
except in full, without written approval of the Bara Scientific Co., Ltd.

Certificate of Calibration

Certificate No.

BSCC-UV-307/22

Number of Page(s)

2 of 3

Calibration Results:

1.Wavelength Accuracy

| Certified Wavelength (nm) | UUC (nm) | Error (nm) | Uncertainty (\pm nm) |
|---------------------------|----------|------------|-------------------------|
| 241.70 | 241.65 | -0.05 | 0.18 |
| 334.02 | 333.92 | -0.10 | 0.18 |
| 418.53 | 418.46 | -0.07 | 0.18 |
| 572.99 | 572.96 | -0.03 | 0.18 |
| 879.41 | 879.17 | -0.24 | 0.18 |

2.Photometric Accuracy (UV)

| Wavelength (nm) | Certified Absorbance (A) | UUC (A) | Error (A) | Uncertainty (\pm A) |
|-----------------|--------------------------|---------|-----------|------------------------|
| 235 | 0.0000 | 0.0000 | 0.0000 | 0.0075 |
| | 0.7467 | 0.7461 | -0.0006 | 0.0075 |
| 257 | 0.0000 | 0.0000 | 0.0000 | 0.0075 |
| | 0.8662 | 0.8647 | -0.0015 | 0.0075 |
| 313 | 0.0000 | 0.0000 | 0.0000 | 0.0075 |
| | 0.2904 | 0.2911 | 0.0007 | 0.0075 |
| 350 | 0.0000 | 0.0000 | 0.0000 | 0.0075 |
| | 0.6429 | 0.6426 | -0.0003 | 0.0075 |

*CNR = Customer not request

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Certificate of Calibration

Certificate No. **BSCC-UV-307/22**

Number of Page(s)

3 of 3

Calibration Results:

3. Photometric Accuracy (Visible)

| Wavelength (nm) | Certified Absorbance (A) | UUC (A) | Error (A) | Uncertainty ($\pm A$) |
|-----------------|--------------------------|---------|-----------|-------------------------|
| 420.0 | 0.0000 | 0.0000 | 0.0000 | 0.0042 |
| | 0.5783 | 0.5777 | -0.0006 | 0.0042 |
| | 0.7628 | 0.7635 | 0.0007 | 0.0046 |
| | 1.0206 | 1.0230 | 0.0024 | 0.0042 |
| 440.0 | 0.0000 | 0.0000 | 0.0000 | 0.0042 |
| | 0.5621 | 0.5618 | -0.0003 | 0.0042 |
| | 0.7455 | 0.7460 | 0.0005 | 0.0048 |
| | 0.9985 | 1.0005 | 0.0020 | 0.0042 |
| 465.0 | 0.0000 | 0.0000 | 0.0000 | 0.0042 |
| | 0.5227 | 0.5219 | -0.0008 | 0.0042 |
| | 0.6880 | 0.6884 | 0.0004 | 0.0051 |
| | 0.9487 | 0.9503 | 0.0016 | 0.0042 |
| 546.1 | 0.0000 | 0.0000 | 0.0000 | 0.0042 |
| | 0.5207 | 0.5199 | -0.0008 | 0.0042 |
| | 0.6973 | 0.6971 | -0.0002 | 0.0049 |
| | 0.9959 | 0.9964 | 0.0005 | 0.0042 |
| 590.0 | 0.0000 | 0.0000 | 0.0000 | 0.0042 |
| | 0.5544 | 0.5534 | -0.0010 | 0.0042 |
| | 0.7253 | 0.7242 | -0.0011 | 0.0050 |
| | 1.0942 | 1.0943 | 0.0001 | 0.0042 |
| 635.0 | 0.0000 | 0.0000 | 0.0000 | 0.0042 |
| | 0.5616 | 0.5606 | -0.0010 | 0.0042 |
| | 0.6927 | 0.6921 | -0.0006 | 0.0053 |
| | 1.0881 | 1.0885 | 0.0004 | 0.0042 |

*CNR = Customer not request

4. Stray Light*

| Standard cut-off wavelength (nm) | Unit Under Calibration(UUC) | | |
|-------------------------------------|-----------------------------|-------------------|----------------|
| | Wavelength (nm) | Transmission (%T) | Absorbance (A) |
| 200.96 \pm 0.11nm | 200.30 | 0.9505 | 2.0229 |

The Stray light transmission reference is less than 1.0%T and Stray light absorbance reference is greater than 2.00A

*Stray Light not NSC-ONSC Accredited.

The measurement uncertainty is base on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

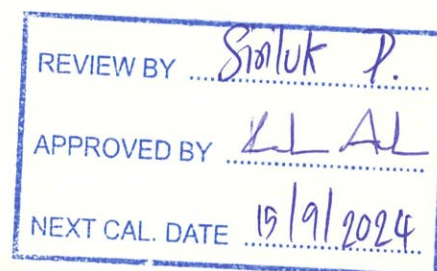
*****End of Certificate*****

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.
Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced
except in full, without written approval of the Bara Scientific Co., Ltd.

Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-367/23
Equipment UV/Vis Spectrophotometer
Model UV-1800
Manufacturer Shimadzu
Serial No. A11454908533CD
ID No. BKK_EN0018
Date of receipt 15 September 2023
Date of calibration 15 September 2023
Date of issue 22 September 2023



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

Address 104 Soi Phattanakan 40, Phattanakan Road, Phattanakan, Suan Luang, Bangkok 10250

Temperature (23.4 - 24.7) °C (On site)
Humidity (55.5 - 61.2) %RH (On site)

Equipment condition Good Operation

Calibration Location Organic Prep

Calibration Procedure In-house method WI-UV-702-01 based on ASTM E275-01

Traceability Wavelength Accuracy is traceable to certificate No. 95917 and 95918
Photometric Accuracy is traceable to certificate No. 95937 and 95924
Stray Light is traceable to certificate No. 95908
The above certificate are traceable to SI unit through Starna Scientific Ltd.
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr.Wanchana Janloey

Approved by



Mr.Kanchit Choothep
Technical Manager

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.
Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced
except in full, without written approval of the Bara Scientific Co., Ltd.

Certificate of Calibration

Certificate No.

BSCC-UV-367/23

Number of Page(s)

2 of 3

Calibration Results:

1.Wavelength Accuracy

| Certified Wavelength (nm) | UUC (nm) | Error (nm) | Uncertainty (\pm nm) |
|------------------------------|----------|------------|-------------------------|
| 241.70 | 241.67 | -0.03 | 0.18 |
| 334.02 | 334.03 | 0.01 | 0.18 |
| 418.53 | 418.59 | 0.06 | 0.18 |
| 572.99 | 573.14 | 0.15 | 0.18 |
| 879.41 | 879.21 | -0.20 | 0.18 |

2.Photometric Accuracy (UV)

| Wavelength (nm) | Certified Absorbance (A) | UUC (A) | Error (A) | Uncertainty (\pm A) |
|--------------------|-----------------------------|---------|-----------|------------------------|
| 235 | 0.0000 | 0.0000 | 0.0000 | 0.0075 |
| | 0.7467 | 0.7460 | -0.0007 | 0.0075 |
| 257 | 0.0000 | 0.0000 | 0.0000 | 0.0075 |
| | 0.8662 | 0.8646 | -0.0016 | 0.0075 |
| 313 | 0.0000 | 0.0000 | 0.0000 | 0.0075 |
| | 0.2904 | 0.2908 | 0.0004 | 0.0075 |
| 350 | 0.0000 | 0.0001 | 0.0001 | 0.0075 |
| | 0.6429 | 0.6415 | -0.0014 | 0.0075 |

*CNR = Customer not request

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.
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Certificate of Calibration

Certificate No. **BSCC-UV-367/23**

Number of Page(s)

3 of 3

Calibration Results:

3. Photometric Accuracy (Visible)

| Wavelength (nm) | Certified Absorbance (A) | UUC (A) | Error (A) | Uncertainty ($\pm A$) |
|-----------------|--------------------------|---------|-----------|-------------------------|
| 420.0 | 0.0000 | 0.0000 | 0.0000 | 0.0042 |
| | 0.5783 | 0.5793 | 0.0010 | 0.0042 |
| | 0.7628 | 0.7624 | -0.0004 | 0.0042 |
| | 1.0206 | 1.0216 | 0.0010 | 0.0042 |
| 440.0 | 0.0000 | 0.0000 | 0.0000 | 0.0042 |
| | 0.5621 | 0.5625 | 0.0004 | 0.0042 |
| | 0.7455 | 0.7452 | -0.0003 | 0.0042 |
| | 0.9985 | 0.9989 | 0.0004 | 0.0042 |
| 465.0 | 0.0000 | 0.0000 | 0.0000 | 0.0042 |
| | 0.5227 | 0.5229 | 0.0002 | 0.0042 |
| | 0.6880 | 0.6873 | -0.0007 | 0.0042 |
| | 0.9487 | 0.9486 | -0.0001 | 0.0042 |
| 546.1 | 0.0000 | 0.0000 | 0.0000 | 0.0042 |
| | 0.5207 | 0.5211 | 0.0004 | 0.0042 |
| | 0.6973 | 0.6960 | -0.0013 | 0.0042 |
| | 0.9959 | 0.9944 | -0.0015 | 0.0042 |
| 590.0 | 0.0000 | 0.0000 | 0.0000 | 0.0042 |
| | 0.5544 | 0.5538 | -0.0006 | 0.0042 |
| | 0.7253 | 0.7236 | -0.0017 | 0.0042 |
| | 1.0942 | 1.0925 | -0.0017 | 0.0042 |
| 635.0 | 0.0000 | 0.0000 | 0.0000 | 0.0042 |
| | 0.5616 | 0.5612 | -0.0004 | 0.0042 |
| | 0.6927 | 0.6909 | -0.0018 | 0.0042 |
| | 1.0881 | 1.0866 | -0.0015 | 0.0042 |

*CNR = Customer not request

4. Stray Light*

| Standard cut-off wavelength (nm) | Unit Under Calibration(UUC) | | |
|----------------------------------|-----------------------------|-------------------|----------------|
| | Wavelength (nm) | Transmission (%T) | Absorbance (A) |
| 200.96 \pm 0.11nm | 200.55 | 0.9770 | 2.0104 |

The Stray light transmission reference is less than 1.0%T and Stray light absorbance reference is greater than 2.00A

*Stray Light not NSC-ONSC Accredited.

The measurement uncertainty is base on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

*****End of Certificate*****

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.
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Agilent Technologies

Agilent Technologies (Thailand) Limited
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Fax: +662 632 4334
Email: ccc-smt@agilent.com
Website: www.agilent.com/chem

Customer Contact:

ALS Laboratory Group (Thailand) Co
Ltd
Head Office
104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan
TAX ID : 0105540004859
bounced-imchom.chanattagarn@alsglobal.com
227158760519

Invoice To:

ALS Laboratory Group (Thailand) Co
Ltd
Head Office
104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan

Delivery Site:

ALS Laboratory Group (Thailand) Co
Ltd
Head Office
104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan

Location:

Room
Bldg
Lab
Dept

SERVICE REPORT

| | |
|--|--|
| Customer Purchase Order Number: | Customer Number: 70371013 |
| Service Request: | Service Request Date: |
| Service Order: 6006068207 | Service Confirmation: 6904837529 |

| |
|----------------------------------|
| REVIEW BY <u>Anchalee K.</u> |
| APPROVED BY <u>Santana N.</u> |
| NEXT CAL. DATE <u>06/10/2024</u> |

Direct Inquiries to:

Contact Name: Customer Contact Center
Contact E-mail: ccc-smt@agilent.com
Contact Telephone: +662 637 6363
Contact Fax: +662 632 4334

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Tax ID : 0105542068218

Citibank N.A. Bangkok Branch
399 Interchange 21 Building, Sukhumvit Road, Klongtoey Nau
Sub-district, Wattana District, Bangkok 10110 Thailand
Acc. No: 012-4452-007,
THB:Krung Thai Bank PCL
Siam Square Br.,416/1-2 Rama I Rd.,Pathumwan, BKK 10330
Thailand

ORIGINAL

Service Confirmation Number: 6904837529

Service Confirmation Date: 06.04.2023

Service Instrument:

| Model Number | Model Description | Serial Number | System Handle | Parent Asset |
|--------------|-----------------------------------|---------------|---------------|--------------|
| SYS-IM-7900 | ICPMS 7900 System | | | |
| G8410A | SPS 4 Autosampler | AU15430722 | ICP MS 7900 | SYS-IM-7900 |
| G8411A | ISIS 3 for Agilent 7850/7900/8900 | JP15510227 | ICP MS 7900 | SYS-IM-7900 |
| G3292A | PSC 6106T Chiller | 2U15A1948 | ICP MS 7900 | SYS-IM-7900 |
| G8403A | Agilent 7900 ICP-MS | JP15471169 | ICP MS 7900 | SYS-IM-7900 |

Service Items:

| Item | Service/Part # | Description | Qty | Entitlement | Service Start | Service End |
|------|----------------|--------------------------------------|------|---------------------------------------|---------------|-------------|
| 1000 | EOQ | Enterprise Operational Qualification | 1.00 | Agreement Entitlement - 100 % covered | 06.04.2023 | 06.04.2023 |
| 1010 | 5185-5850 | ICP-MS Checkout Solutions | 1.00 | Agreement Entitlement - 100 % covered | | |

Additional Information:

Service Confirmation Number: 6904837529

Service Confirmation Date: 06.04.2023

Service Information:

Problem Description:

WU-S-OQ-ICP MS 7900-5001143313

Service Provided:

Test OQ control of instrument ICPMS = BKK_EL0043. After done all instrument test all Pass.

Service Overview Code:

Reason Code: Scheduled Service

Diagnosis Code: Scheduled Service

Resolution Code: Scheduled Service

Reported Hours:

6.0

Travel Hours:

1.0

**Customer Field Service
Representative Name:**

Panthep Kurasathain

**Customer Field Service
Representative Signature:**



Date:

06 Apr 2023

Customer Name:

Anchalee Khamjan

Customer Signature:



Date:

06 Apr 2023

Additional Comments:



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. T220730

Page 1 of 6

Certificate of Calibration

| | |
|-------------------|---|
| Equipment | : HEATING BLOCK |
| Manufacturer | : Environmental Express |
| Model | : SC 196 |
| Serial No. | : 6974CECW3285 |
| Customer Code | : BKK_EL0054 |
| ID No. | : T5306A3 |
| Customer | : ALS Laboratory Group (Thailand) Co.,Ltd. |
| | 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250 |
| Customer Location | : Acid Digestion Lab |
| Date of Receipt | : 30 March 2022 |
| Calibrated By | : Watcharapon Sangtong (Technician) |
| Approved By | :  / Sujjar Naknakred (Site Calibration Manager) |
| Date of Issue | : 12 APR 2022 |

| | |
|----------------|--------------|
| REVIEW BY | Tattaporn C. |
| APPROVED BY | Santun. |
| NEXT CAL. DATE | 7/10/23 |

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

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

Website : www.scieco.co.th

E-Mail : calibrate@scg.co.th

Certificate No. T220730

Page 2 of 6

Calibration Report

Equipment : HEATING BLOCK
Date of Calibration : 7 April 2022
Environment : Temperature : 21.8-23.1 °C
Line Voltage : 221.6-226.3 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert nine standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20.

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 |
|-------------|--------|----------------|-----------------|--------------|
| TC | TYPE T | TN221-TN230 | T210008 | 08 June 2022 |
| TC | TYPE T | TN231-TN240 | T210008 | 08 June 2022 |
| DATA LOGGER | 34970A | T149 | T210008 | 08 June 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 2 Hour 25 Minute At 95 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

() without adjustment

(X) after adjustment

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

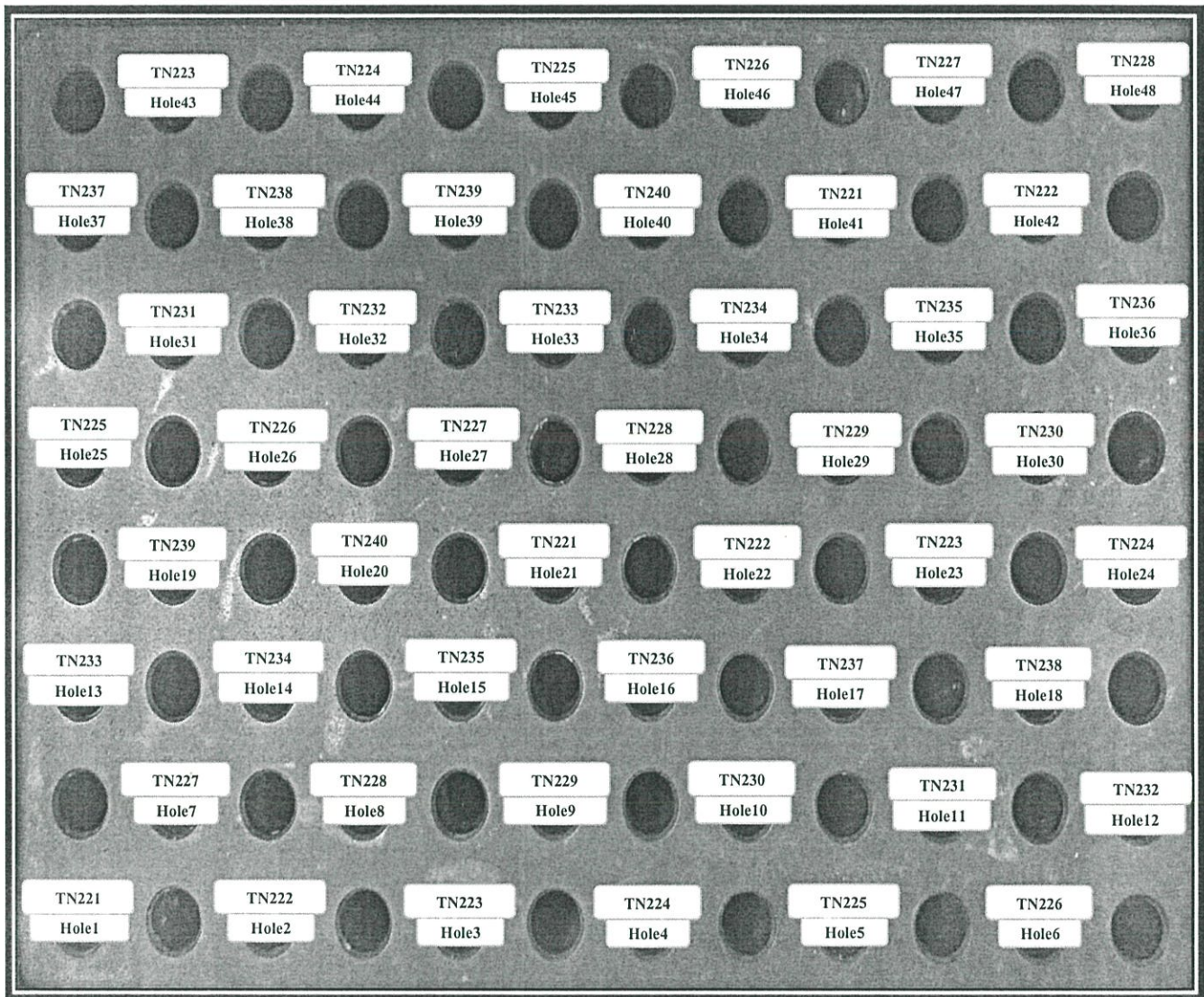
Website : www.scieco.co.th

E-Mail : calibrate@scg.co.th

Certificate No. T220730

Page 3 of 6

Calibration Report



FRONT CONTROL

Approved By. _____

Calibration Report

Measurement Results

| Calibration Point | | Average Standard Reading at each position (° C) | | | | | |
|-------------------------|---------|---|--------------|--------------|--------------|--------------|--------------|
| R1 Hole1-Hole6 | | TN221 | TN222 | TN223 | TN224 | TN225 | TN226 |
| CAL POINT | Max | 93.60 | 93.82 | 94.05 | 94.20 | 94.36 | 94.26 |
| 95 | Min | 93.07 | 93.26 | 93.51 | 93.66 | 93.82 | 93.71 |
| | Average | 93.33 | 93.54 | 93.78 | 93.93 | 94.09 | 93.98 |
| R2 Hole7-Hole12 | | TN227 | TN228 | TN229 | TN230 | TN231 | TN232 |
| | Max | 94.59 | 94.79 | 94.63 | 94.55 | 94.82 | 95.00 |
| | Min | 94.05 | 94.25 | 94.08 | 93.97 | 94.26 | 94.44 |
| | Average | 94.32 | 94.52 | 94.36 | 94.26 | 94.54 | 94.72 |
| R3 Hole13-Hole18 | | TN233 | TN234 | TN235 | TN236 | TN237 | TN238 |
| | Max | 95.03 | 94.54 | 94.78 | 94.84 | 95.06 | 94.73 |
| | Min | 94.46 | 93.98 | 94.20 | 94.28 | 94.49 | 94.18 |
| | Average | 94.74 | 94.26 | 94.49 | 94.56 | 94.78 | 94.45 |
| R4 Hole19-Hole24 | | TN239 | TN240 | TN221 | TN222 | TN223 | TN224 |
| | Max | 94.89 | 94.82 | 95.73 | 95.85 | 95.73 | 96.10 |
| | Min | 94.33 | 94.26 | 95.51 | 95.62 | 95.51 | 95.85 |
| | Average | 94.61 | 94.54 | 95.62 | 95.73 | 95.62 | 95.97 |
| R5 Hole25-Hole30 | | TN225 | TN226 | TN227 | TN228 | TN229 | TN230 |
| | Max | 96.28 | 96.39 | 96.37 | 96.54 | 96.19 | 96.04 |
| | Min | 96.01 | 96.10 | 96.02 | 96.20 | 95.89 | 95.71 |
| | Average | 96.15 | 96.24 | 96.20 | 96.37 | 96.04 | 95.88 |
| R6 Hole31-Hole36 | | TN231 | TN232 | TN233 | TN234 | TN235 | TN236 |
| | Max | 96.84 | 96.97 | 97.03 | 96.48 | 96.33 | 95.76 |
| | Min | 96.53 | 96.65 | 96.71 | 96.08 | 95.98 | 95.43 |
| | Average | 96.68 | 96.81 | 96.87 | 96.28 | 96.16 | 95.60 |
| R7 Hole37-Hole42 | | TN237 | TN238 | TN239 | TN240 | TN221 | TN222 |
| | Max | 96.46 | 96.15 | 96.19 | 96.06 | 96.95 | 97.09 |
| | Min | 96.13 | 95.84 | 95.85 | 95.72 | 96.64 | 96.78 |
| | Average | 96.30 | 95.99 | 96.02 | 95.89 | 96.80 | 96.93 |
| R8 Hole43-Hole48 | | TN223 | TN224 | TN225 | TN226 | TN227 | TN228 |
| | Max | 96.91 | 96.58 | 96.13 | 96.19 | 96.34 | 96.19 |
| | Min | 96.55 | 96.21 | 95.80 | 95.87 | 96.03 | 95.88 |
| | Average | 96.73 | 96.40 | 95.96 | 96.03 | 96.18 | 96.03 |

Approved By.



Calibration Report

Measurement Results

| Calibration Point | | Average Standard Reading at each position (°C) | | | | | |
|-------------------------|---------|--|--------------|--------------|--------------|--------------|--------------|
| R1 Hole1-Hole6 | | TN221 | TN222 | TN223 | TN224 | TN225 | TN226 |
| CAL POINT | Max | 104.47 | 104.65 | 104.79 | 105.31 | 105.47 | 105.46 |
| 105 | Min | 104.15 | 104.27 | 104.45 | 104.98 | 105.14 | 105.20 |
| | Average | 104.31 | 104.46 | 104.62 | 105.15 | 105.31 | 105.33 |
| R2 Hole7-Hole12 | | TN227 | TN228 | TN229 | TN230 | TN231 | TN232 |
| | Max | 105.55 | 105.73 | 105.65 | 105.84 | 105.97 | 106.07 |
| | Min | 105.28 | 105.43 | 105.35 | 105.52 | 105.68 | 105.83 |
| | Average | 105.42 | 105.58 | 105.50 | 105.68 | 105.82 | 105.95 |
| R3 Hole13-Hole18 | | TN233 | TN234 | TN235 | TN236 | TN237 | TN238 |
| | Max | 106.14 | 106.06 | 105.81 | 106.05 | 105.81 | 105.87 |
| | Min | 105.85 | 105.81 | 105.55 | 105.80 | 105.53 | 105.64 |
| | Average | 106.00 | 105.94 | 105.68 | 105.92 | 105.67 | 105.75 |
| R4 Hole19-Hole24 | | TN239 | TN240 | TN221 | TN222 | TN223 | TN224 |
| | Max | 105.86 | 105.60 | 104.44 | 104.51 | 104.28 | 104.78 |
| | Min | 105.61 | 105.37 | 104.27 | 104.35 | 104.12 | 104.61 |
| | Average | 105.74 | 105.48 | 104.35 | 104.43 | 104.20 | 104.69 |
| R5 Hole25-Hole30 | | TN225 | TN226 | TN227 | TN228 | TN229 | TN230 |
| | Max | 104.94 | 104.93 | 104.97 | 105.08 | 104.68 | 104.69 |
| | Min | 104.77 | 104.75 | 104.76 | 104.90 | 104.51 | 104.49 |
| | Average | 104.85 | 104.84 | 104.86 | 104.99 | 104.60 | 104.59 |
| R6 Hole31-Hole36 | | TN231 | TN232 | TN233 | TN234 | TN235 | TN236 |
| | Max | 105.44 | 105.45 | 105.61 | 104.95 | 104.84 | 104.42 |
| | Min | 105.27 | 105.27 | 105.44 | 104.76 | 104.66 | 104.25 |
| | Average | 105.36 | 105.36 | 105.53 | 104.86 | 104.75 | 104.33 |
| R7 Hole37-Hole42 | | TN237 | TN238 | TN239 | TN240 | TN221 | TN222 |
| | Max | 105.17 | 104.70 | 104.59 | 104.51 | 105.22 | 105.53 |
| | Min | 105.00 | 104.53 | 104.41 | 104.35 | 105.04 | 105.37 |
| | Average | 105.08 | 104.62 | 104.50 | 104.43 | 105.13 | 105.45 |
| R8 Hole43-Hole48 | | TN223 | TN224 | TN225 | TN226 | TN227 | TN228 |
| | Max | 105.61 | 105.45 | 105.10 | 104.77 | 104.87 | 105.02 |
| | Min | 105.44 | 105.28 | 104.92 | 104.60 | 104.70 | 104.85 |
| | Average | 105.53 | 105.37 | 105.01 | 104.69 | 104.79 | 104.93 |

Approved By.



Certificate No. T220730

Page 5 of 6

Calibration Report

Measurement Results:

| HEATING BLOCK | | | Temperature Distribution | |
|---------------|---------------|---------|--------------------------|-------------------------|
| Setting (°C) | Reading (°C) | | Stability (\pm °C) | Uncertainty (\pm °C) |
| | Min , Max | Average | | |
| 100.0 | 100.0 , 100.4 | 100.1 | 0.29 | 0.83 |
| 105.0 | 105.0 , 105.4 | 105.1 | 0.20 | 0.79 |

* 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. T231676

Page 1 of 6

Certificate of Calibration**Equipment : HEATING BLOCK****Manufacturer : Environmental Express****Model : SC 196****Serial No. : 6974CECW3285****Customer Code : BKK_EL0054****ID No. : T5306A3****Customer : ALS Laboratory Group (Thailand) Co.,Ltd.**

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

Customer Location : Acid Digestion Lab**Date of Receipt : 13 September 2023****Calibrated By : Sanee Musikawan (Site Calibration Manager)****Approved By :  / Sujjar Naknakred (Site Calibration Manager)****Date of Issue : 26 SEP 2023**

| | |
|----------------|--------------|
| REVIEW BY | Tattaporn C. |
| APPROVED BY | Saenit N. |
| NEXT CAL. DATE | 22/03/25 |

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. T231676

Page 2 of 6

Calibration Report

Equipment : HEATING BLOCK
Date of Calibration : 22 September 2023
Environment : Temperature : 21.8-23.1 °C
Line Voltage : 221.6-226.3 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert 20 standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20.

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 |
|-------------|--------|----------------|-----------------|-----------------|
| TC | TYPE T | TN21-TN30 | T230014 | 17 January 2024 |
| TC | TYPE T | TN31-TN40 | T230014 | 17 January 2024 |
| DATA LOGGER | 34970A | T151 | T230014 | 17 January 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 :

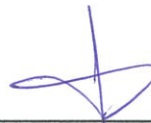
Time Constant 2 Hour 20 Minute At 95 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

() without adjustment

(X) after adjustment

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

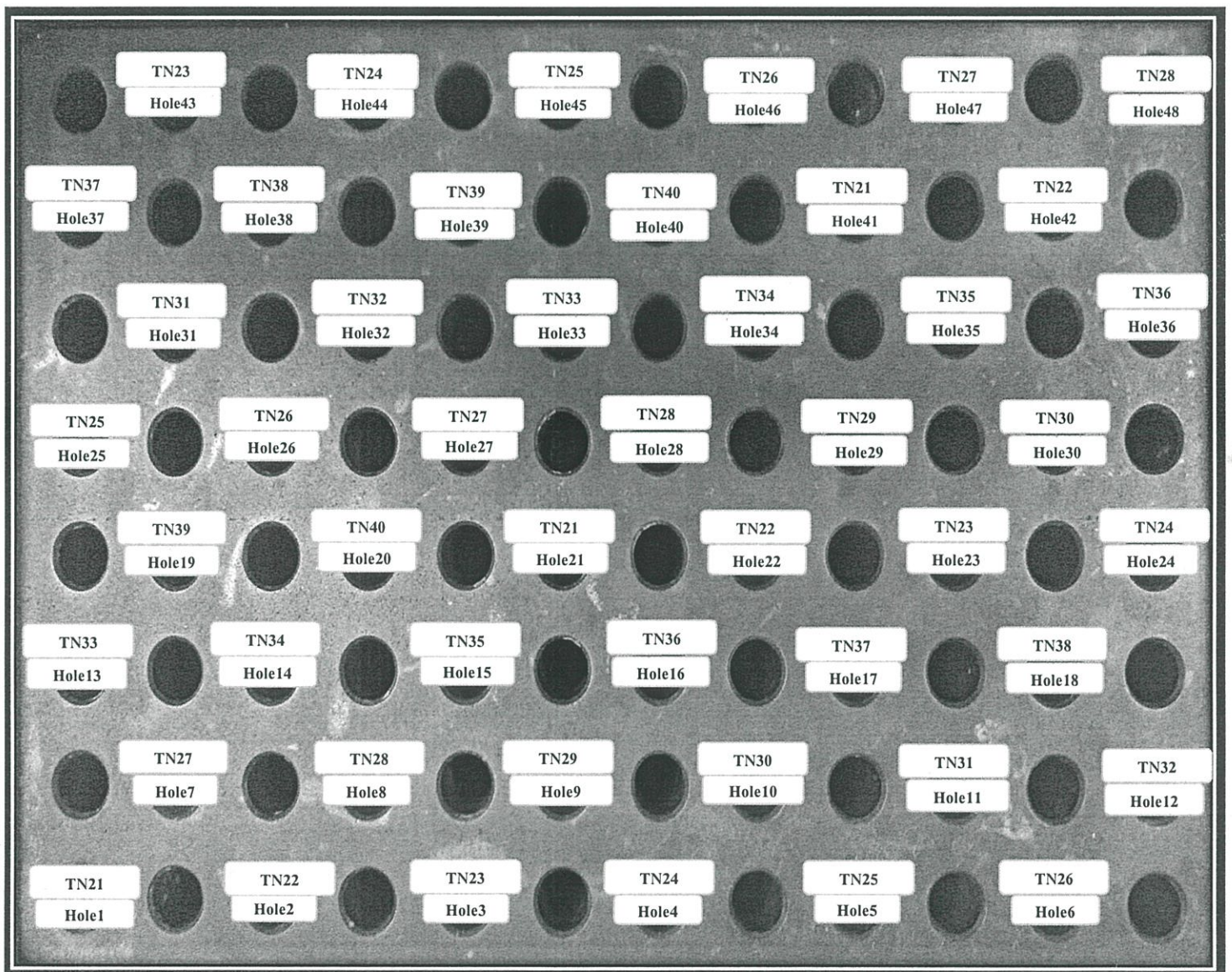
Website : www.scieco.co.th

E-Mail : calibrate@scg.co.th

Certificate No. T231676

Page 3 of 6

Calibration Report



FRONT CONTROL

Approved By. _____

Certificate No T231676

Page 4 of 6

Calibration Report

Measurement Results

| Calibration Point | | Average Standard Reading at each position (° C) | | | | | |
|-------------------------|---------|---|-------------|-------------|-------------|-------------|-------------|
| R1 Hole1-Hole6 | | TN21 | TN22 | TN23 | TN24 | TN25 | TN26 |
| CAL POINT | Max | 95.01 | 94.41 | 95.20 | 95.41 | 94.51 | 95.17 |
| 95 | Min | 94.57 | 93.95 | 94.75 | 94.92 | 94.00 | 94.72 |
| | Average | 94.79 | 94.18 | 94.98 | 95.17 | 94.26 | 94.95 |
| R2 Hole7-Hole12 | | TN27 | TN28 | TN29 | TN30 | TN31 | TN32 |
| | Max | 95.36 | 95.43 | 95.19 | 95.16 | 95.35 | 94.97 |
| | Min | 94.94 | 94.95 | 94.72 | 94.71 | 94.90 | 94.57 |
| | Average | 95.15 | 95.19 | 94.96 | 94.94 | 95.13 | 94.77 |
| R3 Hole13-Hole18 | | TN33 | TN34 | TN35 | TN36 | TN37 | TN38 |
| | Max | 95.37 | 95.50 | 95.22 | 95.21 | 95.33 | 95.31 |
| | Min | 94.99 | 95.09 | 94.78 | 94.82 | 94.88 | 94.96 |
| | Average | 95.18 | 95.30 | 95.00 | 95.02 | 95.11 | 95.13 |
| R4 Hole19-Hole24 | | TN39 | TN40 | TN21 | TN22 | TN23 | TN24 |
| | Max | 95.59 | 94.42 | 94.52 | 94.24 | 94.63 | 94.67 |
| | Min | 95.21 | 94.06 | 94.13 | 93.88 | 94.28 | 94.27 |
| | Average | 95.40 | 94.24 | 94.33 | 94.06 | 94.45 | 94.47 |
| R5 Hole25-Hole30 | | TN25 | TN26 | TN27 | TN28 | TN29 | TN30 |
| | Max | 95.19 | 95.38 | 92.93 | 95.30 | 95.14 | 95.03 |
| | Min | 94.83 | 95.03 | 92.56 | 94.95 | 94.79 | 94.70 |
| | Average | 95.01 | 95.20 | 92.75 | 95.12 | 94.96 | 94.87 |
| R6 Hole31-Hole36 | | TN31 | TN32 | TN33 | TN34 | TN35 | TN36 |
| | Max | 94.63 | 94.90 | 94.77 | 94.31 | 94.24 | 93.87 |
| | Min | 94.24 | 94.55 | 94.44 | 93.98 | 93.92 | 93.56 |
| | Average | 94.43 | 94.72 | 94.60 | 94.14 | 94.08 | 93.71 |
| R7 Hole37-Hole42 | | TN37 | TN38 | TN39 | TN40 | TN21 | TN22 |
| | Max | 94.30 | 94.44 | 94.04 | 93.81 | 94.89 | 95.35 |
| | Min | 93.95 | 94.05 | 93.67 | 93.48 | 94.39 | 94.90 |
| | Average | 94.13 | 94.24 | 93.86 | 93.65 | 94.64 | 95.12 |
| R8 Hole43-Hole48 | | TN23 | TN24 | TN25 | TN26 | TN27 | TN28 |
| | Max | 95.99 | 95.63 | 95.28 | 95.29 | 95.45 | 94.87 |
| | Min | 95.57 | 95.15 | 94.82 | 94.84 | 94.99 | 94.48 |
| | Average | 95.78 | 95.39 | 95.05 | 95.07 | 95.22 | 94.68 |

Approved By. _____



Certificate No T231676

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Calibration Report

Measurement Results

| Calibration Point | | Average Standard Reading at each position (° C) | | | | | |
|-------------------------|---------|---|-------------|-------------|-------------|-------------|-------------|
| R1 Hole1-Hole6 | | TN21 | TN22 | TN23 | TN24 | TN25 | TN26 |
| CAL POINT | Max | 105.23 | 104.32 | 105.43 | 105.25 | 104.44 | 105.27 |
| 105 | Min | 104.94 | 103.95 | 105.15 | 105.04 | 104.11 | 104.96 |
| | Average | 105.09 | 104.13 | 105.29 | 105.15 | 104.28 | 105.12 |
| R2 Hole7-Hole12 | | TN27 | TN28 | TN29 | TN30 | TN31 | TN32 |
| | Max | 105.30 | 105.12 | 105.18 | 105.22 | 105.12 | 105.16 |
| | Min | 105.11 | 104.92 | 104.96 | 105.00 | 104.92 | 104.97 |
| | Average | 105.20 | 105.02 | 105.07 | 105.11 | 105.02 | 105.06 |
| R3 Hole13-Hole18 | | TN33 | TN34 | TN35 | TN36 | TN37 | TN38 |
| | Max | 105.37 | 105.63 | 105.02 | 104.80 | 104.69 | 105.19 |
| | Min | 105.17 | 105.37 | 104.75 | 104.59 | 104.50 | 105.00 |
| | Average | 105.27 | 105.50 | 104.88 | 104.69 | 104.60 | 105.09 |
| R4 Hole19-Hole24 | | TN39 | TN40 | TN21 | TN22 | TN23 | TN24 |
| | Max | 105.31 | 104.43 | 106.41 | 104.71 | 105.63 | 105.82 |
| | Min | 105.08 | 104.22 | 106.15 | 104.41 | 105.37 | 105.56 |
| | Average | 105.19 | 104.33 | 106.28 | 104.56 | 105.50 | 105.69 |
| R5 Hole25-Hole30 | | TN25 | TN26 | TN27 | TN28 | TN29 | TN30 |
| | Max | 104.95 | 106.26 | 103.34 | 105.78 | 105.59 | 105.87 |
| | Min | 104.67 | 105.96 | 103.08 | 105.56 | 105.36 | 105.68 |
| | Average | 104.81 | 106.11 | 103.21 | 105.67 | 105.48 | 105.77 |
| R6 Hole31-Hole36 | | TN31 | TN32 | TN33 | TN34 | TN35 | TN36 |
| | Max | 104.75 | 104.86 | 104.80 | 105.20 | 104.50 | 104.39 |
| | Min | 104.54 | 104.63 | 104.59 | 105.00 | 104.32 | 104.18 |
| | Average | 104.65 | 104.75 | 104.69 | 105.10 | 104.41 | 104.28 |
| R7 Hole37-Hole42 | | TN37 | TN38 | TN39 | TN40 | TN21 | TN22 |
| | Max | 104.30 | 104.90 | 104.85 | 104.65 | 104.88 | 104.85 |
| | Min | 104.09 | 104.72 | 104.66 | 104.49 | 104.63 | 104.52 |
| | Average | 104.19 | 104.81 | 104.75 | 104.57 | 104.76 | 104.68 |
| R8 Hole43-Hole48 | | TN23 | TN24 | TN25 | TN26 | TN27 | TN28 |
| | Max | 105.71 | 105.85 | 105.39 | 105.61 | 105.42 | 105.19 |
| | Min | 105.45 | 105.61 | 105.14 | 105.27 | 105.18 | 104.94 |
| | Average | 105.58 | 105.73 | 105.27 | 105.44 | 105.30 | 105.07 |

Approved By. _____



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Calibration Report

Measurement Results:

| HEATING BLOCK | | | Temperature Distribution | |
|----------------|----------------|---------|--------------------------|----------------------|
| Setting (°C) | Reading (°C) | | Stability (± °C) | Uncertainty (± °C) |
| | Min , Max | Average | | |
| 100.0 | 100.3 , 100.5 | 100.4 | 0.26 | 0.81 |
| 107.0 | 107.0 , 107.1 | 107.1 | 0.19 | 0.78 |

* 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.co.th



Certificate No. T221644

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Certificate of Calibration

Equipment : Chamber (Cold 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


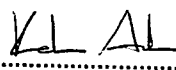
Customer Location : Environmental Laboratory

Date of Receipt : 27 June 2022

Calibrated By : Sujjar Naknakred (Site Calibration Manager)

Approved By :  / Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 04 JUL 2022

| | |
|----------------|---|
| REVIEW BY |  |
| APPROVED BY |  |
| NEXT CAL. DATE | 30/12/23 |

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. T221644

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Calibration Report

Equipment : Chamber (Cold Room)
Date of Calibration : 30 June - 1 July 2022
Environment : Temperature : 18.9-23.7 °C
Line Voltage : 222.9-226.5 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert nine standard thermocouples type T into its chamber , the other one standard thermocouples type T 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 |
|-------------|--------|----------------|-----------------|--------------|
| TC | TYPE T | TN161-TN170 | T210009 | 30 July 2022 |
| TC | TYPE T | TN171-TN180 | T210009 | 30 July 2022 |
| DATA LOGGER | 34970A | T149 | T210009 | 30 July 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 3 Hour - Minute At 3 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

() without adjustment

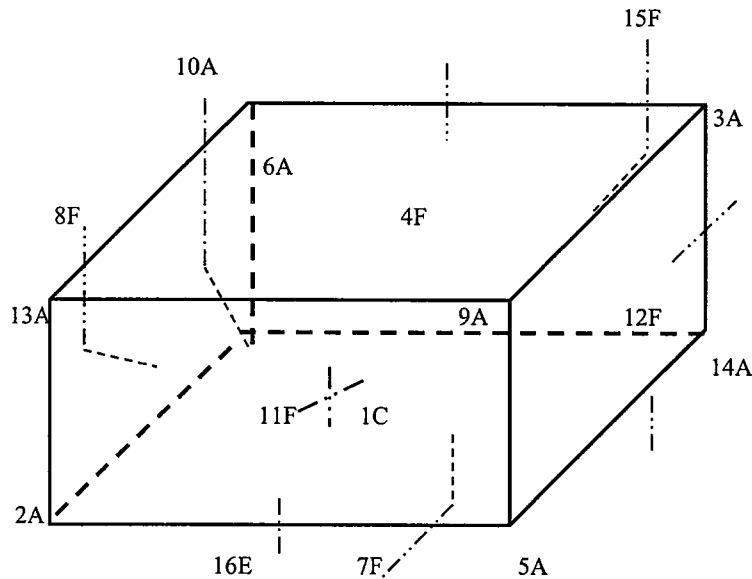
(X) after adjustment

Approved By. 

Certificate No. T221644

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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. T221644

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Calibration Report

Measurement Results:

| Average Standard Reading at each position (°C) | | | | | | | | | | |
|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Calibration Point | TN161 | TN162 | TN163 | TN164 | TN165 | TN166 | TN167 | TN168 | TN169 | TN170 |
| 3 | 2.71 | 2.82 | 2.75 | 2.89 | 2.95 | 3.68 | 3.02 | 2.96 | 3.03 | 2.85 |
| | TN171 | TN172 | TN173 | TN174 | TN175 | TN176 | | | | |
| | 2.97 | 3.02 | 2.89 | 3.04 | 2.97 | 3.33 | | | | |

| Chamber (Cold Room) | | | Temperature Distribution | | | | |
|-----------------------|--------------|---------|--------------------------|------------------|-----------------|--------------------|-----------------|
| Setting (°C) | Reading (°C) | | Average (°C) | Stability (± °C) | Uniformity (°C) | Uncertainty (± °C) | Coverage |
| | Min , Max | Average | | | | | Factor <i>k</i> |
| 3.0 | 2.9 , 4.0 | 3.2 | 2.99 | 1.05 | 1.30 | 1.66 | 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. _____

