# ภาคผนวกที่ 4

## เอกสารสอบเทียบเครื่องมือ

right solutions.
right partner.

## รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

| Sample Name | Parameter | Equipment Name | ID No. | Calibrated Date | Next Cal | Freq. Calibrate (Months) |
|---|---|---|---|---|---|---|
| Rayong Lab | pH at 25 °C | pH meter | RYG_EN0183 | 19-Jan-24 | 19-Jan-25 | 12 |
| Rayong Lab | BOD | DO meter with Sensor | RYG_EN0032 | 24-Jul-23 | 24-Jan-25 | 18 |
| Rayong Lab | BOD | Incubator | RYG_EN0154 | 29-May-23 | 29-Nov-24 | 18 |
| Rayong Lab | Total Suspended Solids | Electronic Balance | RYG_EN0002 | 22-Feb-24 | 22-Feb-25 | 12 |
| Rayong Lab | Total Suspended Solids | Hot Air Oven | RYG_EN0010 | 20-Oct-22 | 20-Apr-24 | 18 |
| Rayong Lab | Oil & Grease | Electronic Balance | RYG_EN0002 | 22-Feb-24 | 22-Feb-25 | 12 |
| Rayong Lab | Oil & Grease | Hot Air Oven | RYG_EN0006 | 20-Oct-22 | 20-Apr-24 | 18 |
| Rayong Lab | Oil & Grease | Water Bath | RYG_EN0061 | 20-Oct-22 | 20-Apr-24 | 18 |
| Rayong Lab | Ammonia Nitrogen | SPECTROPHOTOMETER | RYG_EN0037 | 18-Sep-23 | 18-Mar-25 | 18 |
| Rayong Lab | Nitrate | Spectrophotometer | RYG_EN0037 | 18-Sep-23 | 18-Mar-25 | 18 |
| Rayong Lab | Nitrite | Spectrophotometer | RYG_EN0037 | 18-Sep-23 | 18-Mar-25 | 18 |
| Rayong Lab | Salinity | Conductivity meter | RYG_EN0029 | 4-Sep-23 | 4-Mar-25 | 18 |
| Rayong Lab | Total Kjeldahl Nitrogen | Block Digestion Unit | RYG_EN0188 | 11-Mar-24 | 11-Mar-25 | 12 |
| Rayong Lab | Total Kjeldahl Nitrogen | pH Meter | RYG_EN0152 | 14-Dec-23 | 14-Dec-24 | 12 |
| Rayong Lab | Total Nitrogen | Spectrophotometer | RYG_EN0037 | 18-Sep-23 | 18-Mar-25 | 18 |
| Water Lab | Total Phosphorus | Digestion Unit | BKK_EN0366 | 17-May-23 | 17-May-24 | 12 |
| Water Lab | Total Phosphorus | Discrete analyzer | BKK_EN0037 | 12-Jul-23 | 12-Jul-24 | 12 |
| Water Lab | Sulfide | Burette | BKK_EN0171 | 27-Feb-24 | 27-Aug-25 | 18 |
| Water Lab | Sulfide | Chamber (Cooling Room) | BKK_EN0167 | 6-Dec-23 | 6-Jun-25 | 18 |
| Water Lab | Copper | ICP-MS | BKK_EL0026 | 12-Dec-23 | 13-Jun-25 | 18 |
| Water Lab | Copper | Hot Block | BKK_EL0054 | 22-Sep-23 | 22-Mar-25 | 18 |
| Water Lab | Copper | Chamber (Cooling Room) | BKK_EN0167 | 6-Dec-23 | 6-Jun-25 | 18 |
| Water Lab | Zinc | ICP-MS | BKK_EL0026 | 12-Dec-23 | 13-Jun-25 | 18 |
| Water Lab | Zinc | Hot Block | BKK_EL0054 | 22-Sep-23 | 22-Mar-25 | 18 |
| Water Lab | Zinc | Chamber (Cooling Room) | BKK_EN0167 | 6-Dec-23 | 6-Jun-25 | 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 |

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

NSC-TISI-TIS17025
CALIBRATION 0008



# Certificate of Calibration

| | |
|---|---|
| **Equipment :** | pH Meter |
| **Manufacturer :** | Mettler Toledo |
| **Model :** | SevenCompact S220 |
| **Serial No. :** | C104059460 |
| **ID No. :** | RYG_EN0183 |
| **Condition As-Received:** | Used Item |
| **Received Date :** | 18 January 2024 |
| **Calibration Date :** | 19 January 2024 |
| **Reference :** | 2401-0579DSC-2 |
| **Submitted by :** | ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)<br>616/10 Moo 5, T.Maenam Khu,<br>A.Pluakdaeng, Rayong 21140, Thailand |
| **Ambient Temperature :** | (25 ± 2.5) °C |
| **Relative Humidity :** | (50 ± 15) % |
| **Calibration Procedure :** | In - house method :<br>- CP-CH5 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)<br>- CP-CH8 by comparison with themperature standard |

REVIEW BY N.Bamrit
APPROVED BY
NEXT CAL. DATE 19/01/25

**Calibrated by :** Warakorn Lerngagtrakul

**Approved by :**

Approved Signatory

( ✓ ) Saithip Meangmai
( ) Warakorn Lerngagtrakul
( ) Ponpan Paipim

**Issue Date :** 24 January 2024

**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.

**Condition of this calibration result**

1. Reference Standard Instrument

| Instrument | Serial No. | ID No. | Cert. No. | Due Date |
|---|---|---|---|---|
| 1) Document Process Calibrator | 54030049 | 130RC116 | 23E2802 | 27 Aug 2024 |
| 2) Ref. Standard Thermometer | 4982054 | 110RC044 | 23I908 | 26 July 2024 |

This certification is traceable to the International System of Unit maintained through:-
- Technology Promotion Association (Thailand-Japan)

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

| Buffer Solution | Manufacturer | Lot No. | Exp. date |
|---|---|---|---|
| pH 4.008 | CPA chem | 940102 | 27 Nov 2025 |
| pH 6.986 | CPA chem | 940104 | 02 Nov 2024 |
| pH 9.997 | CPA chem | 940106 | 02 Nov 2024 |

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 ( ±mV ) | Coverage factor *k* |
|---|---|---|---|---|---|---|
| | pH | mV | mV | pH | | |
| pH Meter | 4.000 | 177.48 | 177.4 | 4.000 | 0.058 | 2.00 |
| S/N.: C104059460 | 7.000 | 0.00 | 0.0 | 7.000 | 0.058 | 2.00 |
| | 10.000 | -177.48 | -177.5 | 10.000 | 0.058 | 2.00 |

Saithip

**Calibration Results**

**Function : pH Measurement**

**Performing three buffers standard curve by using buffer nominal pH (4.01,7.00,10.01)**

| Unit Under Calibration | Standard pH Buffer Solution | Actual pH Reading | Actual mV Reading (mV) | Uncertainty of pH Measurement (±) | Coverage factor *k* |
|---|---|---|---|---|---|
| pH Electrode | 4.008 | 4.013 | 176.0 | 0.0054 | 2.07 |
| S/N.: 3225367 | 6.986 | 6.983 | 2.2 | 0.0084 | 2.00 |
| | 9.997 | 9.996 | -174.1 | 0.0065 | 2.00 |

**Function : Temperature Measurement**

**( * ) Without adjustment**

This equipment was connected with Temperature Probe;

- Model : InLab®Expert Pro-ISM
- Serial No. : 3225367

Dimension of probe

- Length : 120 mm.
- Diameter : 12 mm.
- Immersion Depth : 100 mm.

| Calibration Point ( °C ) | Standard Temperature ( °C ) | UUC* Reading ( °C ) | Error ( °C ) | Uncertainty of measurement ( ± °C ) | Coverage factor *k* |
|---|---|---|---|---|---|
| 25.0 | 25.001 | 25.2 | 0.199 | 0.13 | 2.00 |

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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NSC-TISI-TIS17025
CALIBRATION 0008

# Certificate of Calibration

**Certificate No. :** 24E289
**Page :** 1 of 2

| | |
|---|---|
| **Equipment :** | pH Meter |
| **Manufacturer:** | Mettler Toledo |
| **Model :** | SevenCompact S220 |
| **Serial No.:** | C104059460 |
| **ID No.:** | RYG_EN0183 |
| **Condition As-Received:** | Used Item |
| **Received Date:** | 18 January 2024 |
| **Calibration Date:** | 23 January 2024 |
| **Reference:** | 2401-0579DSC |
| **Ambient Temperature:** | ( 23 ± 2 ) °C |
| **Relative Humidity:** | ( 50 ± 10 ) % |

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**Submitted by:** ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,
Rayong 21140, Thailand

**Procedure used:** Calibration were conducted using calibration procedure No. CP-E17 According to EURAMET cg-15.

**Condition of this result of calibration**

1.Reference standards instruments :

| Instrument | Model | Serial No. | Certificate No. | Due Date |
|---|---|---|---|---|
| 1) Multi-Product Calibrator | 5500A | 6315011 | E2U2300035 | 29 May 2024 |

2.This result of calibration was made on requested at the point specified by customer.

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

4.This Certification is traceable to the International System of Unit maintained through:-

-NA Caltechnologies Co.,Ltd., ANAB Accredited No. Calibration AC-2658

**Calibrated by :** Wutchareeporn Wongchutikrane
**Issue Date :** 24 January 2024

**Approved Signatory :**
[ ] Phalinee Prabpaipal
[✓] Nuntawat Khamchai
[ ] Pongsagorn Boonyaporn

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**Result of calibration** :- (*) Without adjustment ( ) After adjustment

**Function:** DC voltage measurement **Range:** 2000 mV

| Standard Value ( mV ) | UUC* Reading ( mV ) | Error ( mV ) | Uncertainty ( ± μV ) |
|---|---|---|---|
| -200.0000 | -200.0 | 0.0 | 68 |
| -150.0000 | -150.0 | 0.0 | 65 |
| -100.0000 | -100.0 | 0.0 | 63 |
| -50.0000 | -50.0 | 0.0 | 61 |
| 0.0000 | 0.0 | 0.0 | 58 |
| 50.0000 | 50.0 | 0.0 | 61 |
| 100.0000 | 99.9 | -0.1 | 63 |
| 150.0000 | 149.9 | -0.1 | 65 |
| 200.0000 | 199.9 | -0.1 | 68 |

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

**UUC* = Unit Under Calibration.**

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# Certificate of Testing

| | |
|---|---|
| **Equipment :** | DO Meter |
| **Manufacturer :** | YSI |
| **Model :** | 5000-115V |
| **Serial No. :** | 15E102796 |
| **ID No. :** | RYG_EN0032 |
| **Received Date :** | 21 July 2023 |
| **Test Date :** | 24 July 2023 |
| **Reference :** | 2307-0713DSC-1 |
| **Submitted by :** | ALS Laboratory Group (Thailand) Co.,Ltd.<br>Rayong Branch<br>616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,<br>Rayong 21140, Thailand |
| **Laboratory Condition :** | Temperature ( 25 ± 5 ) °C<br>Humidity (50 ± 20) % |
| **Test Procedure :** | In - house method : CP-CH9<br>by Comparison Technique with Azide Modification Method |
| **Tested by :** | Walalak Sirithean |
| **Approved by :** | Saithip<br>Approved Signatory |

REVIEW BY N.Bamkit
APPROVED BY
NEXT CAL. DATE 24/01/25

( ) Malee Butkruea
(✓) Saithip Meangmai
( ) Warakorn Lerngagtrakul

**Issue Date :** 26 July 2023

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**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).

| Instruments | Serial No. | ID No. | Certificate No. | Due Date |
|---|---|---|---|---|
| 1) Burette | - | 130BU10 | 23CG1172 | 22 Mar 2025 |
| 2) Balance | 1126143764 | 140RC004 | 22MM50 | 20 Sep 2023 |

2. Standard Material :-

| Material | Manufacturer | Lot.No. | Assay |
|---|---|---|---|
| Sodium Thiosulfate pentahydrate | Merck | AM1763316 | 100.2% |

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

**Dissolved Oxygen Probe No.:** 15E100464

| Titration Method (Azide Modification Method) (mg/L) | DO Meter Reading (mg/L) | Standard Deviation (mg/L) |
|---|---|---|
| 8.18 | 8.17 | 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

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NSC-TISI-TIS17025
CALIBRATION 0008



# Certificate of Calibration

| | |
|---|---|
| **Equipment :** | DO Meter with Sensor |
| **Manufacturer :** | YSI |
| **Model :** | 5000-115V |
| **Serial No. :** | 15E102796 |
| **ID No. :** | RYG_EN0032 |
| **Submitted by :** | ALS Laboratory Group (Thailand) Co.,Ltd.<br>Rayong Branch<br>616/10 Moo 5 T. Maenam Khu, A. Pluakdaeng,<br>Rayong 21140 Thailand |
| **Location :** | TPA On Site Calibration Laboratory |
| **Received Order :** | 25 July 2023 |
| **Calibrated Date :** | 27 July 2023 |
| **Ambient Temperature :** | ( 26 ± 10 ) °C |
| **Relative Humidity :** | ( 50 ± 30 ) % |
| **AC Line Voltage :** | ( 220 ± 22 ) V |
| **Calibrated by :** | Preecha Hlahib |
| **Approved by :** | Approved Signatory |

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

**Issue Date :** 31 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.

**Equipment :** DO Meter with Sensor **Cert. No.:** 23LM125

**Condition As-Received :** Used Item 

**Reference :** 2307-0713DSC-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:-

| Instrument | Serial No. | Cert. No. | Traceable | Due Date |
|---|---|---|---|---|
| 1) Digital Thermometer | 2188080 | 22I1285 | TPA | 21 Oct 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.

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

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

**Function :** Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 1228475367

| Calibration Point ( °C ) | Immersion Depth ( mm ) | Standard Temperature ( °C ) | UUC* Reading ( °C ) | Error ( °C ) | Uncertainty ( ± °C ) | Coverage Factor *k* |
|---|---|---|---|---|---|---|
| 20.00 | 100 | 20.011 | 19.91 | -0.101 | 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 %.

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NSC-TISI-TIS17025
CALIBRATION 0008

**Cert. No.:** 23TM962


# Certificate of Calibration

| | |
|---|---|
| **Equipment :** | Low Temp. Incubator |
| **Manufacturer :** | Memmert |
| **Model :** | IPP750 |
| **Serial No. :** | V818.0084 |
| **ID No. :** | RYG_EN0154 |
| **Submitted by :** | ALS Laboratory Group (Thailand) Co.,Ltd.<br>(Rayong Branch)<br>616/10 Moo 5 T. Maenam Khu,<br>A. Pluakdaeng, Rayong 21140 Thailand |
| **Location :** | BOD Room |
| **Received Order :** | 29 May 2023 |
| **Calibration Date :** | 29 May 2023 |
| **Ambient Temperature :** | ( 26 ± 10 ) °C |
| **Relative Humidity :** | ( 50 ± 30 ) % |
| **Calibrated by :** | Man Pattanapongpaiboon |
| **Approved by :** | Approved Signatory |

REVIEW BY N. Bamrit
APPROVED BY D. Suwit
NEXT CAL. DATE 29/11/24

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

**Issue Date :** 7 June 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.

**Equipment :** Low Temp. Incubator
**Condition As-Received :** Used Item
**Reference :** 2305-0898OC-2

**Cert. No.:** 23TM962


**Procedure Used :-**

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**

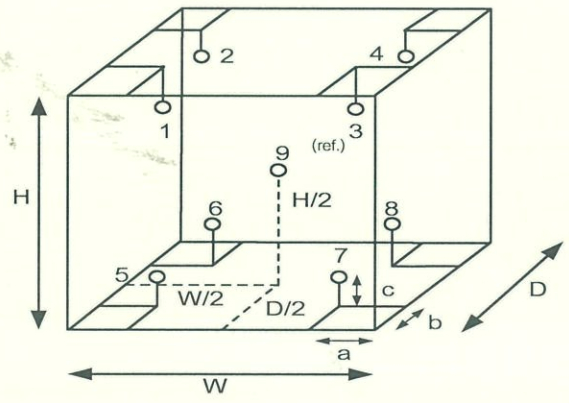
1. Reference standard instrument:-

| Instrument | Model | Serial No. | Cert. No. | Due Date |
|---|---|---|---|---|
| 1 ) Data Acquisition | 34972A | MY57013711 | 22LM93 | 02 Jul 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
**Fresh air setting :** Close

| Environment during calibration | | |
|---|---|---|
| | Beginning | Finished |
| Temp. ( °C ) | 23 | 23 |
| REL.Humid. ( % ) | 54 | 56 |
| AC Supply ( Volt ) | 223 | 222 |




| Position : | Ref. Std. ID No.: |
|---|---|
| 1 | 18-18RTD-01 |
| 2 | 18-18RTD-02 |
| 3 | 18-18RTD-03 |
| 4 | 18-18RTD-04 |
| 5 | 18-18RTD-05 |
| 6 | 18-18RTD-10 |
| 7 | 18-18RTD-07 |
| 8 | 22-18RTD-08 |
| 9 (ref.) | 18-18RTD-09 |

**Probe Installation Details :**

| | | |
|---|---|---|
| a = | 10 | cm |
| b = | 10 | cm |
| c = | 10 | cm |

**Dimension of Chamber :**

| | | |
|---|---|---|
| D = | 0.60 | m |
| W = | 1.0 | m |
| H = | 1.2 | m |
| Capacity = | 0.75 | $m^3$ |

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**Equipment :** Low Temp. Incubator
**Condition As-Received :** Used Item
**Reference :** 2305-0898OC-2
**Result of Calibration :-** ( * ) Without Adjustment
**Function of UUC* :** Temperature Source
**Fresh air setting :** Close

**Cert. No.:** 23TM962


| Calibration Point ( °C ) | UUC* Setting ( °C ) | UUC* Reading ( °C ) | Temperature stability ( ± °C ) | Temperature uniformity ( °C ) | Overall Variation ( °C ) | Coverage Factor *k* |
|---|---|---|---|---|---|---|
| 20.0 | 20.0 | 20.0 | 0.019 | 0.72 | 1.0 | 2 |

| Calibration Point ( °C ) | Measured Temperature ( °C ) Position | | | | | | | | | Uncertainty ( ±°C ) |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 (ref.) | |
| 20.0 | 19.547 | 19.780 | 19.487 | 19.529 | 19.408 | 20.139 | 20.112 | 20.406 | 20.116 | 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 %.

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**Sartorius (Thailand) Co., Ltd.**
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Tel: +66 2643 8361-6 , e-mail: service.thailand@sartorius.com

NSC-TISI-TIS 17025
CALIBRATION 0426

# Certificate of Calibration

REVIEW BY Thanitall.
APPROVED BY
NEXT CAL. DATE 22/02/2025

| | | | |
|---|---|---|---|
| Model Number : | MSE224S-100-DU | Certificate No. : | 24BCI0069 |
| Description : | Analytical Balance | Issued Date : | Friday, February 23, 2024 |
| Serial Number : | 0026207038 | Reference No. : | 229196 |
| ID No. : | RYG_EN0002 | | |
| Manufacturer : | Sartorius | Page No. : | 1 0f 2 |

Customer Name : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenam Khu, A.Pluak Daeng, Rayong 21140, Thailand.

Calibrated Place : ALS Laboratory Group (Thailand) Co., Ltd.(Balance Room)
616/10 Moo 5 T.Maenam Khu, A.Pluakdaeng, Rayong.21140, Thailand.

Calibrated By : Mr.Chonchai Inthana
Calibration Date : Thursday, February 22, 2024

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 : | 24.2 °C | ± | 5.0 °C |
| Humidity : | 57.0 % RH | ± | 10.0 % RH |
| Pressure | _ | ± | _ |

*Reasons for calibration*

☐ New Installation ☐ Service / Repaired ☑ Re-calibration/ Maintenance

*Equipment 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 | Cetificate No. | Due Date |
|---|---|---|---|---|
| YCS011-522-00 | Sartorius weight set 1mg - 5000g E2,YCS011-522-00 | TCS | M2308197S | 23-Aug-2025 |
| MHB-382SD | Humidity/Barometer/Temp Lutron MHB-382SD | DKSH | C19231845 | 23-Aug-2024 |
| | | | | |

This certificate relate and apply this equipment only.
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Mr.chonchai Intrhana(Technical Manager)

STAMP

SOP FM 33 03 February 2022

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129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310
Tel: +66 2643 8361-6 Fax: +66 2643-8367, e-mail: service.thailand@sartorius.com

SARTORIUS

# Certificate of Calibration

| | | | |
|---|---|---|---|
| Model Number : | MSE224S-100-DU | Certificate No. : | 24BCI0069 |
| Description : | Analytical Balance | Issued Date : | Friday, February 23, 2024 |
| Serial Number : | 0026207038 | Reference No. : | 229196 |
| ID No. : | RYG_EN0002 | | |
| Manufacturer : | Sartorius | Page No. : | 2 of 2 |

## Calibration Results : Without Adjustment

### Repeatability

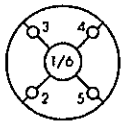
*The reproducibility is the ability of a weighing instrument to display nearly identical readouts under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.*

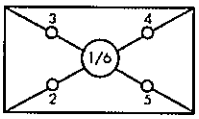
| Nominal Value : (Low Load) | | |
|---|---|---|
| 20 g | 20.0000 | 199.9999 |
| Tolerance | 20.0000 | 200.0000 |
| *0.0001* g | 20.0001 | 200.0000 |
| | 20.0000 | 199.9999 |
| | 20.0001 | 200.0000 |
| Nominal Value : (High Load) | 19.9999 | 200.0000 |
| 200 g | 20.0000 | 200.0000 |
| Tolerance | 20.0000 | 199.9999 |
| *0.0001* g | 19.9999 | 200.0001 |
| | 19.9999 | 200.0000 |
| *Standard Deviation* | 0.00007 | 0.00006 |

### 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 maximim 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 : 100 g
Tolerance *0.0004* g




| | Difference |
|---|---|
| 1 | – |
| 2 | -0.0001 |
| 3 | -0.0001 |
| 4 | 0.0000 |
| 5 | -0.0001 |
| 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 | 0.00018 |
| 0.05 | 0.0500 | 0.0500 | 0.0000 | 0.00018 |
| 0.1 | 0.1000 | 0.1000 | 0.0000 | 0.00018 |
| 0.5 | 0.5000 | 0.5000 | 0.0000 | 0.00018 |
| 1 | 1.0000 | 1.0000 | 0.0000 | 0.00018 |
| 5 | 5.0000 | 5.0000 | 0.0000 | 0.00018 |
| 10 | 10.0000 | 10.0000 | 0.0000 | 0.00018 |
| 20 | 20.0000 | 20.0000 | 0.0000 | 0.00024 |
| 50 | 50.0000 | 49.9999 | -0.0001 | 0.00019 |
| 100 | 100.0000 | 100.0000 | 0.0000 | 0.00023 |
| 200 | 200.0000 | 199.9999 | -0.0001 | 0.00032 |

End of Report.

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

NSC-TISI-TIS17025
CALIBRATION 0008

**Cert. No.:** 22TM1517
**Page :** 1 of 3

# Certificate of Calibration

| | |
|---|---|
| **Equipment :** | Hot Air Oven |
| **Manufacturer :** | Memmert |
| **Model :** | UFE 500 |
| **Serial No. :** | G511.1572 |
| **ID No. :** | RYG_EN0010 |
| **Submitted by :** | ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)<br>616/10 Moo 5 T. Maenam Khu,<br>A. Pluakdaeng,<br>Rayong 21140 Thailand |
| **Location :** | Oven Room |
| **Received Order :** | 20 October 2022 |
| **Calibration Date :** | 20 October 2022 |
| **Ambient Temperature :** | ( 26 ± 10 ) °C |
| **Relative Humidity :** | ( 50 ± 30 ) % |
| **Calibrated by :** | Man Pattanapongpaiboon |

REVIEW BY Thanitall.
APPROVED BY D.
NEXT CAL. DATE 20/04/24

**Approved by :** Malu.

Approved Signatory

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

**Issue Date :** 2 November 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.

**Equipment :** Hot Air Oven
**Condition As-Received :** Used Item
**Reference :** 2210-0376OC-2

**Cert. No.:** 22TM1517


**Procedure Used :-**

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

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

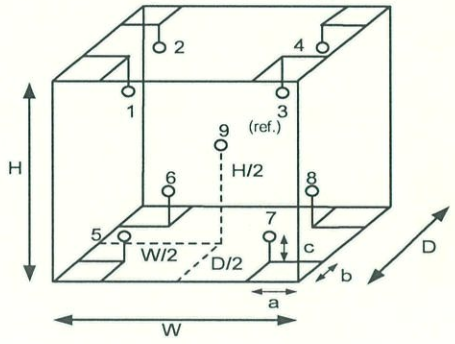
1. Reference standard instrument:-

| Instrument | Model | Serial No. | Cert. No. | Due Date |
|---|---|---|---|---|
| 1 ) Data Acquisition | 34972A | MY49023932 | 22LM97 | 29 Jul 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
**Fresh air setting :** Close

| Environment during calibration | | |
|---|---|---|
| | Beginning | Finished |
| Temp. ( °C ) | 25 | 25 |
| REL.Humid. ( % ) | 54 | 59 |
| AC Supply ( Volt ) | 223 | 225 |




| Ref. Std. ID No.: @ Calibration Point | | |
|---|---|---|
| Position : | ( 180 ) °C | ( 104 ) °C |
| 1 | 21-16TC-01 | 20-16RTD-01 |
| 2 | 21-16TC-02 | 20-16RTD-02 |
| 3 | 21-16TC-03 | 20-16RTD-03 |
| 4 | 21-16TC-04 | 20-16RTD-04 |
| 5 | 21-16TC-05 | 22-16RTD-05 |
| 6 | 21-16TC-06 | 20-16RTD-06 |
| 7 | 21-16TC-07 | 20-16RTD-07 |
| 8 | 21-16TC-08 | 22-16RTD-08 |
| 9 (ref.) | 21-16TC-09 | 22-16RTD-09 |

**Probe Installation Details :**

| | | |
|---|---|---|
| a = | 5.0 | cm |
| b = | 5.0 | cm |
| c = | 5.0 | cm |

**Dimension of Chamber :**

| | | |
|---|---|---|
| D = | 0.40 | m |
| W = | 0.56 | m |
| H = | 0.48 | m |
| Capacity = | 0.11 | $m^3$ |

Malu.

**Equipment :** Hot Air Oven
**Condition As-Received :** Used Item
**Reference :** 2210-0376OC-2
**Result of Calibration :-** ( * ) Without Adjustment
**Function of UUC* :** Temperature Source
**Fresh air setting :** Close



| Calibration Point ( °C ) | UUC* Setting ( °C ) | UUC* Reading ( °C ) | Temperature stability ( ± °C ) | Temperature uniformity ( °C ) | Overall Variation ( °C ) | Uncertainty ( ±°C ) | Coverage Factor *k* |
|---|---|---|---|---|---|---|---|
| 104.0 | 104.0 | 104.0 | 0.076 | 0.52 | 0.60 | 0.42 | 2 |
| 180.0 | 180.0 | 180.0 | 0.13 | 0.88 | 1.2 | 1.1 | 2 |

| Calibration Point ( °C ) | Measured Temperature ( °C ) Position | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 (ref.) |
| 104.0 | 103.768 | 103.734 | 103.723 | 103.800 | 104.215 | 104.131 | 104.132 | 103.740 | 103.747 |
| 180.0 | 179.723 | 179.359 | 179.439 | 179.489 | 180.361 | 180.114 | 180.131 | 180.243 | 179.605 |

**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-**

Malee .

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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TEL. 0-2717-3000-27 FAX. 0-2719-9484

NSC-TISI-TIS17025
CALIBRATION 0008

**Cert. No.:** 22TM1492
**Page :** 1 of 3

# Certificate of Calibration

| | |
|---|---|
| **Equipment :** | Hot Air Oven |
| **Manufacturer :** | Memmert |
| **Model :** | UM 400 |
| **Serial No. :** | b495.0899 |
| **ID No. :** | RYG_EN0006 |
| **Submitted by :** | ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)<br>616/10 Moo 5, T. Maenam Khu,<br>A. Pluakdaeng,<br>Rayong 21140, Thailand |
| **Location :** | Oven Room |
| **Received Order :** | 20 October 2022 |
| **Calibration Date :** | 20 October 2022 |
| **Ambient Temperature :** | ( 26 ± 10 ) °C |
| **Relative Humidity :** | ( 50 ± 30 ) % |
| **Calibrated by :** | Preecha Hlahib |

REVIEW BY Thanitall.
APPROVED BY D-
NEXT CAL. DATE 20/04/24

**Approved by :** Malu.
Approved Signatory

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

**Issue Date :** 2 November 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.

**Equipment :** Hot Air Oven
**Condition As-Received :** Used Item
**Reference :** 2210-0376OC-1

**Cert. No.:** 22TM1492


**Procedure Used :-**

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**

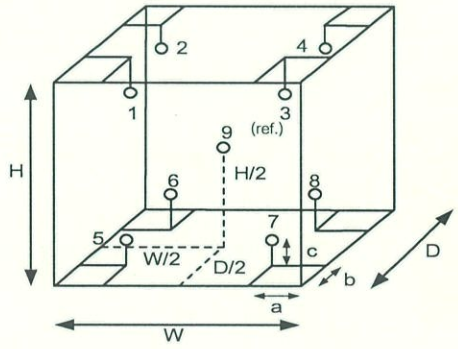
1. Reference standard instrument:-

| Instrument | Model | Serial No. | Cert. No. | Due Date |
|---|---|---|---|---|
| 1 ) Data Acquisition | 34970A | MY44035217 | 21LM30 | 23 Dec 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 of UUC* :** Temperature Source
**Fresh air setting :** Close

| Environment during calibration | | |
|---|---|---|
| | Beginning | Finished |
| Temp. ( °C ) | 28 | 29 |
| REL.Humid. ( % ) | 43 | 47 |
| AC Supply ( Volt ) | 220 | 221 |




| Position : | Ref. Std. ID No.: |
|---|---|
| 1 | 18-10RTD-01 |
| 2 | 18-10RTD-02 |
| 3 | 18-10RTD-03 |
| 4 | 18-10RTD-04 |
| 5 | 18-10RTD-05 |
| 6 | 18-10RTD-06 |
| 7 | 18-10RTD-07 |
| 8 | 18-10RTD-08 |
| 9 (ref.) | 18-10RTD-09 |

**Probe Installation Details :**

| | | |
|---|---|---|
| a = | 5.0 | cm |
| b = | 5.0 | cm |
| c = | 5.0 | cm |

**Dimension of Chamber :**

| | | |
|---|---|---|
| D = | 0.33 | m |
| W = | 0.40 | m |
| H = | 0.40 | m |
| Capacity = | 0.053 | $m^3$ |

Malu .

**Equipment :** Hot Air Oven **Cert. No.:** 22TM1492

**Condition As-Received :** Used Item **Page :** 3 of 3

**Reference :** 2210-0376OC-1

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

**Function of UUC* :** Temperature Source

**Fresh air setting :** Close

| Calibration Point ( °C ) | UUC* Setting ( °C ) | UUC* Reading ( °C ) | Temperature stability ( ± °C ) | Temperature uniformity ( °C ) | Overall Variation ( °C ) | Uncertainty ( ±°C ) | Coverage Factor *k* |
|---|---|---|---|---|---|---|---|
| 70.0 | 70.0 | 70.0 | 0.079 | 0.47 | 0.77 | 0.42 | 2 |

| Calibration Point ( °C ) | Measured Temperature ( °C ) Position | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 (ref.) |
| 70.0 | 70.262 | 69.995 | 70.079 | 70.177 | 70.664 | 70.039 | 70.688 | 70.149 | 70.328 |

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

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

**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 observatior

**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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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
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NSC-TISI-TIS17025
CALIBRATION 0008

**Cert. No.:** 22TM1491
**Page :** 1 of 3

# Certificate of Calibration

| | |
|---|---|
| **Equipment :** | Water Bath |
| **Manufacturer :** | Memmert |
| **Model :** | WNB22 |
| **Serial No. :** | L513.0648 |
| **ID No. :** | RYG_EN0061 |
| **Submitted by :** | ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)<br>616/10 Moo 5, T. Maenam Khu,<br>A. Pluakdaeng,<br>Rayong 21140, Thailand |
| **Location :** | Wet Chemistry Lab |
| **Received Order :** | 20 October 2022 |
| **Calibration Date :** | 20 October 2022 |
| **Ambient Temperature :** | ( 26 ± 10 ) °C |
| **Relative Humidity :** | ( 50 ± 30 ) % |
| **Calibrated by :** | Preecha Hlahib |

REVIEW BY Thanitall.
APPROVED BY
NEXT CAL. DATE 20/04/24

**Approved by :**

Approved Signatory

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

**Issue Date :** 2 November 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.

**Equipment :** Water Bath **Cert. No.:** 22TM1491

**Condition As-Received :** Used Item 

**Reference :** 2210-0376OC-4

**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:-

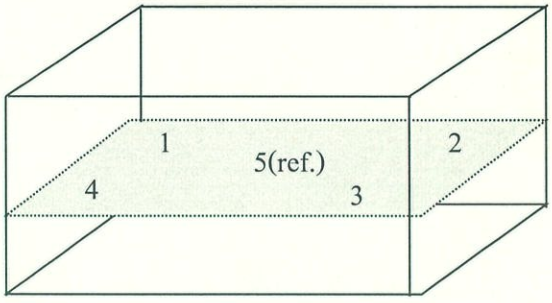
| Instrument | Model | Serial No. | Cert. No. | Due Date |
|---|---|---|---|---|
| 1 ) Data Acquisition | 34970A | MY44035217 | 21LM30 | 23 Dec 2022 |

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 of UUC* :** Temperature Source

| | Environmental | | AC Voltage Supply |
|---|---|---|---|
| | ( °C ) | ( %R.H. ) | ( Volt ) |
| **Beginning of Calibration** | 24 | 53 | 222 |
| **Finished of Calibration** | 24 | 50 | 221 |




Front

| Position : | Ref. Std. S/N.: |
|---|---|
| 1 | N37P300726 |
| 2 | N37P300727 |
| 3 | N37P300728 |
| 4 | N37P300729 |
| 5(ref.) | N37P300730 |

Malu .

**Equipment :** Water Bath
**Condition As-Received :** Used Item
**Reference :** 2210-0376OC-4
**Result of Calibration :-** ( * ) Without Adjustment
**Function of UUC* :** Temperature Source

**Cert. No.:** 22TM1491


| Calibration point ( °C ) | UUC* Setting ( °C ) | UUC* Reading ( °C ) | Average* Standard Reading ( °C ) Position | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 (ref.) |
| 85.0 | 85.0 | 85.0 | 84.527 | 84.563 | 84.628 | 84.516 | 84.580 |

| Calibration point ( °C ) | Uniformity ( °C ) | Stability ( ± °C ) | Uncertainty ( ± °C ) | Coverage Factor *k* |
|---|---|---|---|---|
| 85.0 | 0.12 | 0.081 | 0.18 | 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-**

Malu -

DKSH

NSC-TISI-TIS 17025
Calibration 0087

# Certificate of Calibration

| | | | |
|---|---|---|---|
| **Equipment:** | SPECTROPHOTOMETER | Certificate No.: | C06230441 |
| Model: | DR6000 | Issued Date: | 19 September 2023 |
| Serial No. (or ID.): | 1627845 (RYG_EN0037) | Job No.: | WO-00005382 |
| Manufacturer: | HACH | Page: | 1 of 3 |
| Condition: | In Condition | | |

**Customer:** ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenam Khu,
A.Pluakdaeng, Rayong 21140, Thailand.

REVIEW BY N. Bamrat
APPROVED BY D.
NEXT CAL. DATE 18/3/25

| | | | | | |
|---|---|---|---|---|---|
| **Environment Condition:** | Temperature | 23.9 | °C | ± | 0.2 °C |
| | Humidity | 65.3 | %RH | ± | 1.4 %RH |

**Calibration Place:** ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch) (Wet Chemistry)
616/10 Moo 5 T.Maenam Khu,
A.Pluakdaeng, Rayong 21140, Thailand.

**Calibration By:** Mr.Nattapat Rungrueang

**Calibration Date:** 18 September 2023

**The Method used:** In house method, CAL-WI-24, base on ASTM E 275-08 and ASTM E 387-04

**Traceability:** This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Starna Scientific Limited.

The standard for Wavelength Certificate No. 111583 and 111584
The standard for Photometric Certificate No. 9114984 and 111588
The standard for Stray light Certificate No. 111586 and 111585
The standard for Spectral resolution Certificate No. 111587

(Mr. Nattapat Rungrueang)
Person in charge

(Mr. Nitinun Srihawan)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

## Calibration Results:

### Without Adjustment

**Wavelength Accuracy (nm), The spectral bandwidth of Std at 2 nm and UUC at 2 nm**

| Standard Wavelength | Unit Under Calibration | Correction | Uncertainty |
|---|---|---|---|
| 418.61 | 418.3 | 0.31 | 0.13 |
| 536.66 | 536.6 | 0.06 | 0.13 |
| 637.98 | 638.3 | -0.32 | 0.13 |
| 748.48 | 748.7 | -0.22 | 0.13 |
| 807.03 | 807.4 | -0.37 | 0.13 |

**Photometric Accuracy (Absorbance)**

| Wavelength | Standard absorbance | Unit Under Calibration | Correction | Uncertainty |
|---|---|---|---|---|
| 420 nm | 0.0000 | 0.000 | 0.0000 | 0.0045 |
| | 0.2930 | 0.289 | 0.0040 | 0.0045 |
| | 0.5168 | 0.519 | -0.0022 | 0.0045 |
| | 1.0298 | 1.029 | 0.0008 | 0.0045 |
| 440 nm | 0.0000 | 0.000 | 0.0000 | 0.0045 |
| | 0.2867 | 0.283 | 0.0037 | 0.0045 |
| | 0.5073 | 0.509 | -0.0017 | 0.0045 |
| | 1.0083 | 1.007 | 0.0013 | 0.0045 |
| 465 nm | 0.0000 | 0.000 | 0.0000 | 0.0045 |
| | 0.2516 | 0.250 | 0.0016 | 0.0045 |
| | 0.4595 | 0.462 | -0.0025 | 0.0045 |
| | 0.9334 | 0.933 | 0.0004 | 0.0045 |
| 546.1 nm | 0.0000 | 0.000 | 0.0000 | 0.0045 |
| | 0.2461 | 0.245 | 0.0011 | 0.0045 |
| | 0.4652 | 0.466 | -0.0008 | 0.0045 |
| | 0.9468 | 0.946 | 0.0008 | 0.0045 |
| 590 nm | 0.0000 | 0.000 | 0.0000 | 0.0045 |
| | 0.2594 | 0.259 | 0.0004 | 0.0045 |
| | 0.5040 | 0.505 | -0.0010 | 0.0045 |
| | 1.0032 | 1.002 | 0.0012 | 0.0045 |
| 635 nm | 0.0000 | 0.000 | 0.0000 | 0.0045 |
| | 0.2579 | 0.257 | 0.0009 | 0.0045 |
| | 0.4971 | 0.497 | 0.0001 | 0.0045 |
| | 0.9720 | 0.971 | 0.0010 | 0.0045 |

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DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

## Calibration Results:

### Without Adjustment

**Photometric Accuracy (Absorbance)**

| Wavelength | Standard absorbance | Unit Under Calibration | Correction | Uncertainty |
|---|---|---|---|---|
| 235 nm | 0.0000 | 0.000 | 0.0000 | 0.0080 |
| | 0.7355 | 0.737 | -0.0015 | 0.0080 |
| 257 nm | 0.0000 | 0.000 | 0.0000 | 0.0080 |
| | 0.8574 | 0.857 | 0.0004 | 0.0080 |
| 313 nm | 0.0000 | 0.000 | 0.0000 | 0.0080 |
| | 0.2864 | 0.290 | -0.0036 | 0.0080 |
| 350 nm | 0.0000 | 0.000 | 0.0000 | 0.0080 |
| | 0.6374 | 0.637 | 0.0004 | 0.0080 |

**Stray light ***

| Standard: cut-off | UUC: Wavelength (nm) | UUC: Transmission (%T) | Absorbance ( A) |
|---|---|---|---|
| 260.62 +/- 0.11 nm | 260.6 | 1.3 | 1.886 |
| 391.44 +/- 0.11 nm | 391.4 | 1.3 | 1.886 |

**Spectral Resolution ***

| Nominal Concentration 0.02 % v/v | Peak | Trough | Ratio | SBW |
|---|---|---|---|---|
| Standard Wavelength ( nm ) | 268.66 | 266.69 | 1.38 | 2.00 |
| UUC: Wavelength (nm) | 268.2 | 266.1 | | |
| Std Absorbance ( A) | 0.4566 | 0.2780 | | |
| Absorbance ( A) | 0.413 | 0.300 | | |

* Calibration Marked " Not TISI Accredited " in this Certificate have been included for completeness.

**The End of Certificate**

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
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Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

# ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00005382

ชนิดเครื่องมือ: SPECTROPHOTOMETER รุ่น: DR6000 หมายเลขเครื่อง: 1627845

| ตรวจสอบ (รับ) 18 Sep 2023 ปกติ | ตรวจสอบ (รับ) 18 Sep 2023 ไม่ปกติ | รายการตรวจเช็ค | ตรวจสอบ (ส่ง) 18 Sep 2023 ปกติ | ตรวจสอบ (ส่ง) 18 Sep 2023 ไม่ปกติ | หมายเหตุ |
|---|---|---|---|---|---|
| | | ***General*** | | | |
| ☑ | ☐ | 1. ความสมบูรณ์เครื่อง | ☑ | ☐ | |
| ☑ | ☐ | 2. ความสะอาด ( ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง) | ☑ | ☐ | |
| ☑ | ☐ | 3. สวิทช์ ปิด – เปิด เครื่อง (On-Off Swicth) | ☑ | ☐ | |
| ☑ | ☐ | 4. ปุ่มกด (Keypad) | ☑ | ☐ | |
| ☑ | ☐ | 5. หน้าจอ (Display, Screen Contrast) | ☑ | ☐ | |
| | | ***Spectrophotometer*** | | | |
| ☐ | ☐ | 6. แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC | ☐ | ☐ | |
| ☐ | ☐ | 7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control) | ☐ | ☐ | |
| ☑ | ☐ | 8. ความยาวคลื่น (Wavelength Check) | ☑ | ☐ | * |
| ☑ | ☐ | 9. แหล่งกำเนิดแสง (UV < 3,000 hour) | ☑ | ☐ | 9.2 Hours |
| ☑ | ☐ | 10. แหล่งกำเนิดแสง (Visible < 5,000 hour) | ☑ | ☐ | 741.5 Hours |
| ☑ | ☐ | 11. ช่องวัดหลายตัวอย่าง (Carousel Module) | ☑ | ☐ | |
| | | ***pH Meter and Conductivity Meter*** | | | |
| ☐ | ☐ | 12. อิเล็คโทรด ( Electrode and Connection Cable ) | ☐ | ☐ | |
| ☐ | ☐ | 13. ระดับสารละลายใน Electrode (Level KCl ) | ☐ | ☐ | |
| ☐ | ☐ | 14. ฝาปิดกันปลาย Electrode (Dust Protection Hood) | ☐ | ☐ | |
| ☐ | ☐ | 15. ขาจับอิเล็คโทรด (Stand) | ☐ | ☐ | |
| | | ***Turbidimeter*** | | | |
| ☐ | ☐ | 16. ค่าความขุ่นที่ต่ำสุด (No Sample) | ☐ | ☐ | |
| ☐ | ☐ | 17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่เกิน 3.0) | ☐ | ☐ | |
| | | ***Automatic titrator*** | | | |
| ☐ | ☐ | 18. สภาพ Piston Burettes | ☐ | ☐ | |
| ☐ | ☐ | 19. Function Rinsing and Dosing | ☐ | ☐ | |
| ☐ | ☐ | 20. ระบบท่อสายยางและอุปกรณ์ประกอบ | ☐ | ☐ | |

เพิ่มเติม/ข้อแนะนำ : *656.1nm=656.1nm

*486.0nm=485.5nm

Mr.Nattapat Rungrueang

Service Engineer

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

NSC-TISI-TIS17025
CALIBRATION 0008

**Cert.No.:** 23CH1088
**Page.:** 1 of 2

# Certificate of Calibration

| | |
|---|---|
| **Equipment :** | Conductivity Meter |
| **Manufacturer :** | Mettler Toledo |
| **Model :** | S230 |
| **Serial No. :** | B241407147 |
| **ID No. :** | RYG_EN0029 |
| **Condition As-Received:** | Used Item |
| **Received Date :** | 01 September 2023 |
| **Calibration Date :** | 04 September 2023 |
| **Reference :** | 2309-0010DSC-7 |
| **Submitted by :** | ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch<br>616/10 Moo 5, T.Maenam Khu,<br>A.Pluakdaeng, Rayong 21140, Thailand |
| **Ambient Temperature :** | (25 ± 2.5) °C |
| **Relative Humidity :** | (50 ± 15) % |
| **Calibration Procedure:** | In -house method :<br>- CP-CH6 : based on direct measurement by using certified reference material (CRM) |
| **Calibrated by :** | Warakorn Lerngagtrakul |
| **Approved by :** | Approved Signatory |

REVIEW BY Thanitall.
APPROVED BY
NEXT CAL. DATE 04/03/25

( ✓ ) Saithip Meangmai
( ) Warakorn Lerngagtrakul
( ) Ponpan Paipim

**Issue Date :** 7 September 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.

**Condition of this result of calibration**

1. Reference Standard Instrument :-

| Instrument | Serial No. | ID No. | Certificate No. | Due date |
|---|---|---|---|---|
| 1) Thermometer | 9549224 | 130RC003 | 23I435 | 10 Apr 2024 |

- This Certification is traceable to SI Throught Technology Promotion Association (Thailand - Japan)

2. Certified Reference Materials :-

- Conductivity calibration solution, CPA chem Ltd., The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

| Conductivity Solution | Manufacturer | Lot No. | Exp. date |
|---|---|---|---|
| 84.000 µS/cm | CPA Chem | 885120 | 28 Mar 2024 |
| 1413.0 µS/cm | CPA Chem | 913596 | 14 July 2024 |
| 12.880 mS/cm | CPA Chem | 885123 | 28 Mar 2024 |

- Control Conductivity calibration solution temperature by Water bath (25±0.1) $^{\circ}$C

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

**Calibration results**

**Function : Conductivity Measurement**

**( * ) After Adjustment at 1413.0 µS/cm**

**Conductivity Electrode Serial No.: 5823251000**

| Standard Conductivity Solution | Before Adjustment UUC* Reading | After Adjustment UUC* Reading | Uncertainty of Measurement ( ± ) | Coverage factor k |
|---|---|---|---|---|
| 84.000 µS/cm | 83.8 µS/cm | 85.3 µS/cm | 0.62 µS/cm | 2.00 |
| 1413.0 µS/cm | 1388 µS/cm | 1413 µS/cm | 9.2 µS/cm | 2.00 |
| 12.880 mS/cm | 12.41 mS/cm | 12.63 mS/cm | 0.086 mS/cm | 2.00 |

**Remark** **- UUC* = Unit Under Calibration**

**- Cell constant = 0.545371 cm$^{-1}$**

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-**

DKSH

# Certificate of Calibration

Represent to Certificate of Calibration No. C29240007

| | | | |
|---|---|---|---|
| **Equipment:** | Block Digestion Unit | Certificate No.: | C29240011 |
| Model: | KT-20s | Issued Date: | 22 March 2024 |
| Serial No. (or ID.): | 5720210009/5770200073 | Job No.: | WO-00020429 |
| Manufacturer: | Gerhardt | Page: | 1 of 4 |
| Condition: | In Condition | Digestion Block: | 20 holes. |

**Customer:** ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenam Khu, A.Pluakdaeng, Rayong 21140, Thailand.

**Environment Condition:**

| | | | |
|---|---|---|---|
| Temperature: | 25 °C | ± | 0.7 °C |
| Humidity: | 54 %RH | ± | 4.1 %RH |
| Voltage: | 225 VAC | ± | 1.7 VAC |

REVIEW BY N.Bamnt
APPROVED BY
NEXT CAL. DATE 11/03/25

**Calibration Place:** ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
( Wet Chemistry Lab )
616/10 Moo 5 T.Maenam Khu, A.Pluakdaeng, Rayong 21140, Thailand.

**Calibration By:** Mr. Thanathorn Phunook

**Calibration Date:** *11 March 2024*

**The Method used:** In house method, base on by comparison with standard

**Traceability:** This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through N.M. Technical Center Laboratory (NTL) Certificate No.: TC22/0080

(Mr. Thanathorn Phunook)
Person in charge

(Mr. Udon Srichana)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

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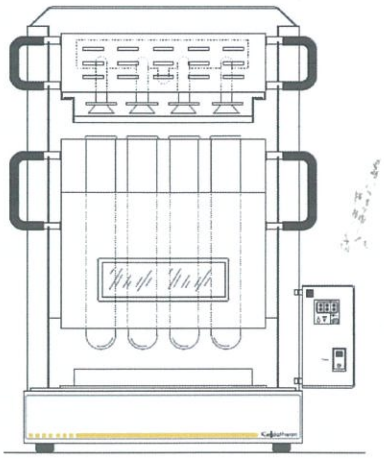
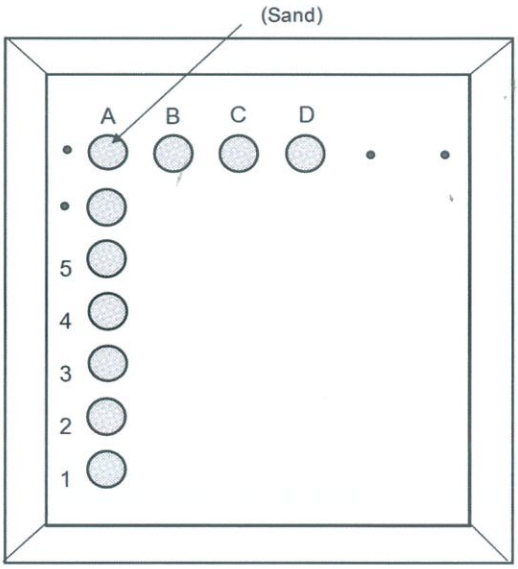


Fig. 1.: Front view




Location of standard

Fig. 2.: Digestion block

## Definitions

*Indicating Temperature*: The average reading of indicating device which forms the integral part of the Digestion block.

*Measured Temperature*: The average reading of working standard at any positions or location.

## Calibration Results:

### Pre Calibrtion

| Locations | Desired (°C) | Setting (°C) | Indicating (°C) | Measured Temperature (°C) | Correction of UUC. (°C) | Uncertainty (± °C) |
|---|---|---|---|---|---|---|
| A1 | 380 | 380 | 380 | 401.5 | 21.5 | 1.5 |
| A2 | | | | 401.2 | 21.2 | 1.5 |
| A3 | | | | 399.1 | 19.1 | 1.5 |
| A4 | | | | 397.8 | 17.8 | 1.5 |
| A5 | | | | 395.1 | 15.1 | 1.5 |
| B1 | | | | 396.6 | 16.6 | 1.5 |
| B2 | | | | 396.1 | 16.1 | 1.5 |
| B3 | | | | 392.9 | 12.9 | 1.5 |
| B4 | | | | 391.6 | 11.6 | 1.5 |
| B5 | | | | 390.7 | 10.7 | 1.5 |
| C1 | | | | 395.3 | 15.3 | 1.5 |
| C2 | | | | 395.6 | 15.6 | 1.5 |
| C3 | | | | 392.8 | 12.8 | 1.5 |
| C4 | | | | 391.7 | 11.7 | 1.5 |
| C5 | | | | 390.3 | 10.3 | 1.5 |
| D1 | | | | 397.6 | 17.6 | 1.5 |
| D2 | | | | 396.6 | 16.6 | 1.5 |
| D3 | | | | 395.0 | 15.0 | 1.5 |
| D4 | | | | 394.2 | 14.2 | 1.5 |
| D5 | | | | 393.6 | 13.6 | 1.5 |

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Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

## Calibration Results:

### Without adjustment

| Locations | Desired (°C) | Setting (°C) | Indicating (°C) | Measured Temperature (°C) | Correction of UUC. (°C) | Uncertainty (± °C) |
|---|---|---|---|---|---|---|
| A1 | 380 | 365 | 365 | 382.5 | 17.5 | 1.5 |
| A2 | | | | 382.4 | 17.4 | 1.5 |
| A3 | | | | 382.1 | 17.1 | 1.5 |
| A4 | | | | 379.7 | 14.7 | 1.5 |
| A5 | | | | 378.3 | 13.3 | 1.5 |
| B1 | | | | 380.1 | 15.1 | 1.5 |
| B2 | | | | 380.1 | 15.1 | 1.5 |
| B3 | | | | 378.5 | 13.5 | 1.5 |
| B4 | | | | 378.3 | 13.3 | 1.5 |
| B5 | | | | 379.1 | 14.1 | 1.5 |
| C1 | | | | 380.1 | 15.1 | 1.5 |
| C2 | | | | 380.1 | 15.1 | 1.5 |
| C3 | | | | 378.9 | 13.9 | 1.5 |
| C4 | | | | 378.2 | 13.2 | 1.5 |
| C5 | | | | 377.3 | 12.3 | 1.5 |
| D1 | | | | 380.5 | 15.5 | 1.5 |
| D2 | | | | 380.6 | 15.6 | 1.5 |
| D3 | | | | 378.1 | 13.1 | 1.5 |
| D4 | | | | 378.7 | 13.7 | 1.5 |
| D5 | | | | 377.7 | 12.7 | 1.5 |

**The End of Certificate**

# ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00020429

ชนิดเครื่องมือ: Block Digestion Unit รุ่น: KT-20s

หมายเลขเครื่อง: 5720210009/5770200073

| ตรวจสอบ (รับ) | | รายการตรวจเช็ค | ตรวจสอบ (ส่ง) | | หมายเหตุ |
|---|---|---|---|---|---|
| 11 Mar 2024 | | | 11 Mar 2024 | | |
| ปกติ | ไม่ปกติ | | ปกติ | ไม่ปกติ | |
| | | *General* | | | |
| ☑ | ☐ | 1. สายไฟ | ☑ | ☐ | |
| ☑ | ☐ | 2. การทำงาน Main Switch | ☑ | ☐ | |
| ☑ | ☐ | 3. การทำงาน Selector Key | ☑ | ☐ | |
| ☑ | ☐ | 4. การแสดงผล Display | ☑ | ☐ | |
| ☑ | ☐ | 5. สภาพ Hole | ☑ | ☐ | |
| ☐ | ☐ | 6. สภาพฝาปิด | ☐ | ☐ | ไม่มี |
| ☑ | ☐ | 7. สภาพตัวเครื่อง | ☑ | ☐ | |
| ☑ | ☐ | 8. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง | ☑ | ☐ | |

ข้อแนะนำ : _____

_____

_____

Mr. Thanathorn Phunook

Service Engineer

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
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NSC-TISI-TIS17025
CALIBRATION 0008

# Certificate of Calibration

**Certificate No. :** 23E3924
**Page :** 1 of 2

| | |
|---|---|
| **Equipment :** | pH Meter |
| **Manufacturer:** | Mettler Toledo |
| **Model :** | SevenExcellence |
| **Serial No.:** | B834291445 |
| **ID No.:** | RYG_EN0152 |
| **Condition As-Received:** | Used Item |
| **Received Date:** | 08 December 2023 |
| **Calibration Date:** | 14 December 2023 |

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| | |
|---|---|
| **Reference:** | 2312-0151DSC |
| **Ambient Temperature:** | ( 23 ± 2 ) °C |
| **Relative Humidity:** | ( 50 ± 10 ) % |

**Submitted by:** ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch
616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,
Rayong 21140, Thailand

**Procedure used:** Calibration were conducted using calibration procedure No. CP-E17 according to EURAMET cg-15.

**Condition of this result of calibration**

1.Reference standards instruments :

| Instrument | Model | Serial No. | Certificate No. | Due Date |
|---|---|---|---|---|
| 1) Multi-Product Calibrator | 5502A | 2435802 | EE-0041-23 | 26 Apr 2024 |

2.This result of calibration was made on requested at the point specified by customer.

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

4.This Certification is traceable to the International System of Unit maintained through:-

-National Institute of Metrology Thailand (NIMT)

REVIEW BY ..... N. Bamrit .....
APPROVED BY .....
NEXT CAL. DATE ..... 14/12/24 .....

**Calibrated by :** Napachanok Prasomsoosiri
**Issue Date :** 15 December 2023

**Approved Signatory :** _____

[ ] Phalinee Prabpaipal
[✓] Nuntawat Khamchai
[ ] Pongsagorn Boonyaporn

B 0331106

**Result of calibration :-** (*) Without adjustment ( ) After adjustment

**Function:** DC voltage measurement **Range:** 2000 mV

| Standard Value ( mV ) | UUC* Reading ( mV ) | Error ( mV ) | Uncertainty ( ± μV ) |
|---|---|---|---|
| -200.0000 | -199.9 | 0.1 | 68 |
| -150.0000 | -150.0 | 0.0 | 65 |
| -100.0000 | -100.0 | 0.0 | 63 |
| -50.0000 | -50.0 | 0.0 | 61 |
| 0.0000 | 0.0 | 0.0 | 58 |
| 50.0000 | 50.0 | 0.0 | 61 |
| 100.0000 | 100.0 | 0.0 | 63 |
| 150.0000 | 150.0 | 0.0 | 65 |
| 200.0000 | 199.9 | -0.1 | 68 |

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

**UUC*= Unit Under Calibration.**

**-o0o-**

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NSC-TISI-TIS17025
CALIBRATION 0008

**Cert.No.:** 23CH1574
**Page.:** 1 of 3

# Certificate of Calibration

| | |
|---|---|
| **Equipment :** | pH Meter |
| **Manufacturer :** | Mettler Toledo |
| **Model :** | SevenExcellence |
| **Serial No. :** | B834291445 |
| **ID No. :** | RYG_EN0152 |
| **Condition As-Received:** | Used Item |
| **Received Date :** | 08 December 2023 |
| **Calibration Date :** | 15 December 2023 |
| **Reference :** | 2312-0151DSC-3 |
| **Submitted by :** | ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch<br>616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,<br>Rayong 21140, Thailand |
| **Ambient Temperature :** | (25 ± 2.5) °C |
| **Relative Humidity :** | (50 ± 15) % |
| **Calibration Procedure :** | In - house method :<br>- CP-CH5 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)<br>- CP-CH8 by comparison with standard thermometer |
| **Calibrated by :** | Warakorn Lerngagtrakul |
| **Approved by :** | Approved Signatory |

( ) Saithip Meangmai
( ) Warakorn Lerngagtrakul
(✓) Ponpan Paipim

**Issue Date :** 19 December 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.

**Condition of this calibration result**

1. Reference Standard Instrument : -

| Instrument | Serial No. | ID No. | Cert. No. | Due Date |
|---|---|---|---|---|
| 1) Document Process Calibrator | 54030049 | 130RC116 | 23E2802 | 27 Aug 2024 |
| 2) Ref. Standard Thermometer | 4982054 | 110RC044 | 23I908 | 26 July 2024 |

This certification is traceable to the International System of Unit maintained through:-
- Technology Promotion Association (Thailand-Japan)

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

| Buffer Solution | Manufacturer | Lot No. | Exp. date |
|---|---|---|---|
| pH 4.008 | CPA chem | 913598 | 14 July 2025 |
| pH 6.986 | CPA chem | 931959 | 01 Oct 2024 |
| pH 9.997 | CPA chem | 940106 | 02 Nov 2024 |

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 | Coverage factor |
|---|---|---|---|---|---|---|
| | pH | mV | mV | pH | ( ±mV ) | *k* |
| pH Meter | 4.000 | 177.48 | 177.3 | 4.000 | 0.058 | 2.00 |
| S/N.: B834291445 | 7.000 | 0.00 | -0.1 | 7.000 | 0.058 | 2.00 |
| | 10.000 | -177.48 | -177.5 | 10.000 | 0.058 | 2.00 |

**Calibration Results**

**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 ( ± ) | Coverage factor *k* |
|---|---|---|---|---|---|
| pH Electrode | 4.008 | 4.013 | 184.1 | 0.0045 | 2.00 |
| S/N.: 3225368 | 6.986 | 6.998 | 8.7 | 0.0084 | 2.00 |
| | 9.997 | 10.002 | -164.7 | 0.0088 | 2.11 |

**Function : Temperature Measurement**

**( * ) Without adjustment**

This equipment was connected with Temperature Probe;

- Model : InLab®Expert Pro-ISM
- Serial No. : 3225368

Dimension of probe;

- Length : 120 mm
- Diameter : 12 mm
- Immersion Depth : 100 mm

| Calibration Point ( °C ) | Standard Temperature ( °C ) | UUC* Reading ( °C ) | Error ( °C ) | Uncertainty of measurement ( ± °C ) | Coverage factor *k* |
|---|---|---|---|---|---|
| 25.0 | 25.003 | 24.3 | -0.703 | 0.13 | 2.00 |

**Remark : - 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-**

# 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 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** | : | _____ **/ Boonchai Suriyawong ( Site Calibration Manager )** |
| **Date of Issue** | : | 29 MAY 2023 |

REVIEW BY Sirilak P.

APPROVED BY

NEXT CAL. DATE 17/05/24

**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.**

# 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**



# 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**_____

# Metrological Center

SCI ECO Services Company Limited

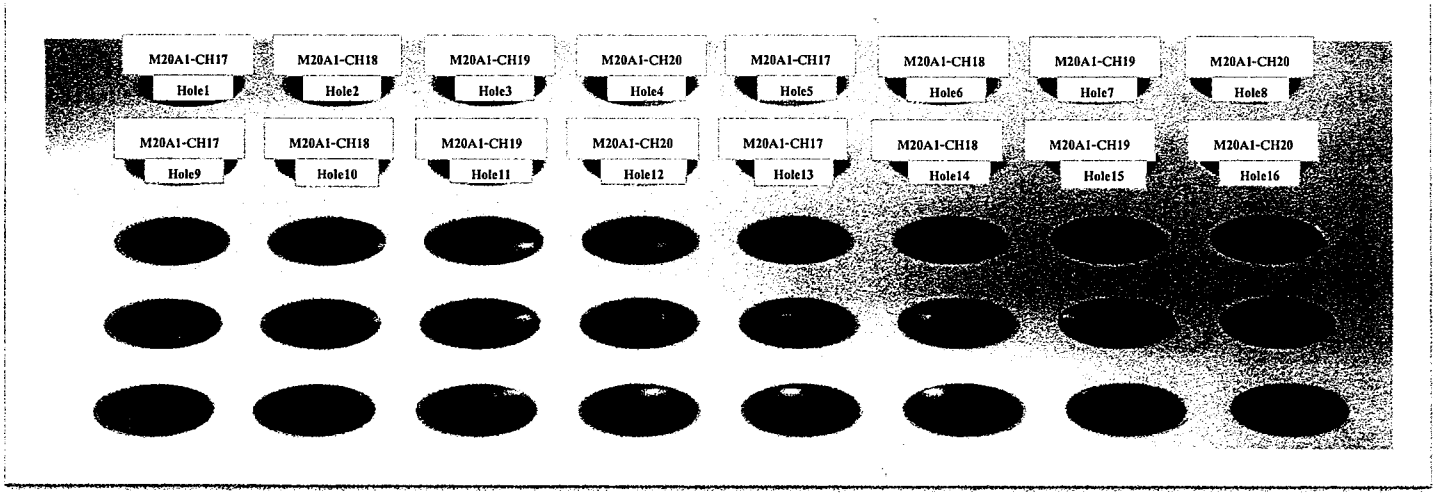
33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110

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


**Certificate No. T230902** 

# Calibration Report




**FRONT**

## Measurement Results

| Cal. Point | Setting | Reading | STD. | Position of Stardards at Block | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ($^{o}$C) | ($^{o}$C) | ($^{o}$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 $^{o}$C | 377.3 | 379.0 | 379.2 | 380.2 | 377.5 | 379.5 | 380.7 | 380.1 |
| | | | Min $^{o}$C | 376.8 | 378.6 | 378.9 | 379.9 | 377.0 | 379.0 | 380.2 | 379.6 |
| | | | Average $^{o}$C | **377.0** | **378.8** | **379.1** | **380.0** | **377.3** | **379.2** | **380.4** | **379.9** |
| | | | Stability ± $^{o}$C | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.2 | 0.2 |

| Cal. Point | Setting | Reading | STD. | Position of Stardards at Block | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ($^{o}$C) | ($^{o}$C) | ($^{o}$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 $^{o}$C | 377.1 | 378.9 | 379.7 | 379.9 | 379.3 | 379.6 | 379.5 | 377.4 |
| | | | Min $^{o}$C | 376.7 | 378.5 | 379.3 | 379.5 | 378.9 | 379.1 | 379.0 | 377.0 |
| | | | Average $^{o}$C | **376.9** | **378.7** | **379.5** | **379.7** | **379.1** | **379.4** | **379.3** | **377.2** |
| | | | Stability ± $^{o}$C | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.2 |

**Approved By.**

# Metrological Center

SCI ECO Services Company Limited

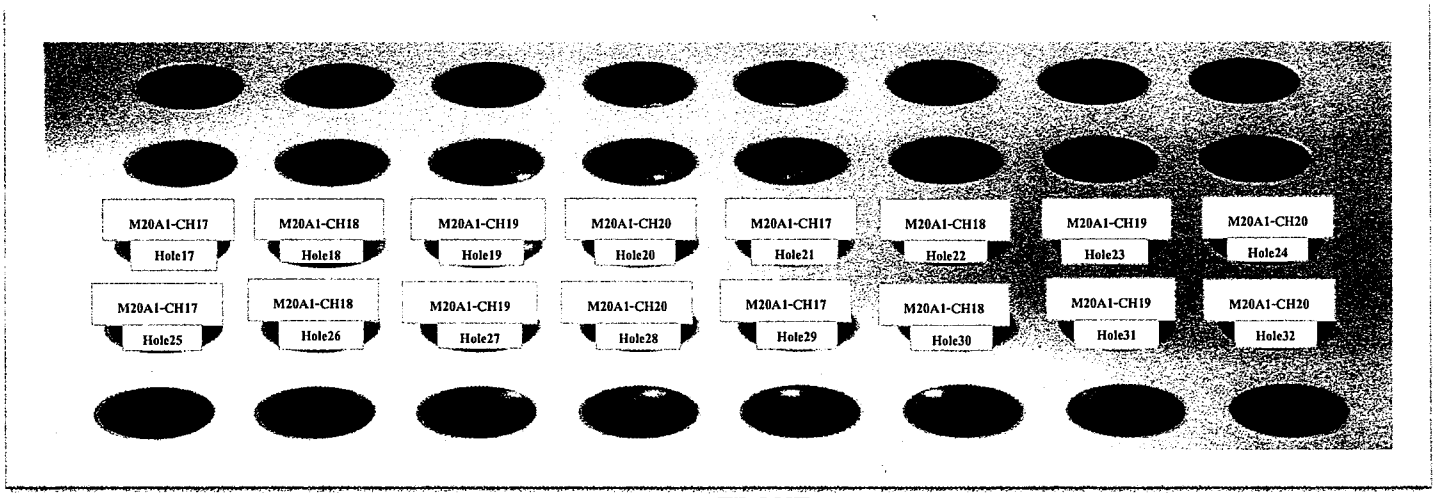
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Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

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


**Certificate No. T230902** 

# Calibration Report




**FRONT**

## Measurement Results

| Cal. Point | Setting | Reading | STD. | Position of Stardards at Block | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Hole17 | Hole18 | Hole19 | Hole20 | Hole21 | Hole22 | Hole23 | Hole24 |
| (°C) | (°C) | (°C) | Reading | 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 Stardards at Block | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Hole25 | Hole26 | Hole27 | Hole28 | Hole29 | Hole30 | Hole31 | Hole32 |
| (°C) | (°C) | (°C) | Reading | 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.**

# Metrological Center

SCI ECO Services Company Limited

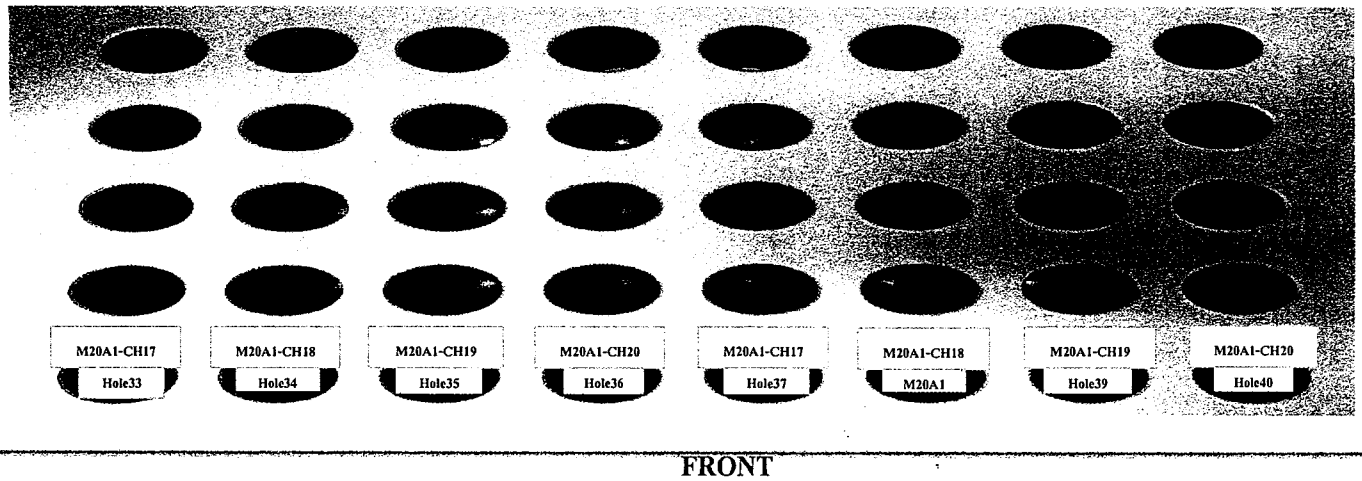
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Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

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


**Certificate No. T230902** 

# Calibration Report




**FRONT**

## Measurement Results

| Cal. Point | Setting | Reading | STD. | Position of Stardards at Block | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Hole33 | Hole34 | Hole35 | Hole36 | Hole37 | Hole38 | Hole39 | Hole40 |
| (°C) | (°C) | (°C) | Reading | 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 ± 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 ดับเบิ้ล เอส ไดแอคนอสติคส์ จำกัด
DOUBLE S DIAGNOSTICS CO., LTD.
4 ซอยอุดมสุข 14 แขวงบางนา เขตบางนา กรุงเทพฯ 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| รอบ | | | | | | | 12/7 CK | | | | | |

## Periodical maintenace check list for Konelab

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

**Place:** ALS LAB **Instrument:** k90 Aqualeem

**Date/Time:** 12/7/66 **Serial no:** 22781

**Service done by:** [illegible] **Install date:**

**Signature of customer:** [illegible] **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

| Posit | Result (A) |
|---|---|
| 1 | 0.1592 |
| 2 | 0.1624 |
| 3 | 0.1631 |
| 4 | 0.1631 |
| 5 | 0.1625 |
| 6 | 0.1650 |

Photom. noise: SD (mA)

| Posit | L340_2 | L340_4 |
|---|---|---|
| 1 | 0.07 | 0.64 |
| 2 | 0.09 | 1.06 |
| 3 | 0.14 | 0.50 |
| 4 | 0.13 | 0.53 |
| 5 | 0.19 | 0.38 |
| 6 | 0.02 | 0.64 |

Laboratory
Analyzer User

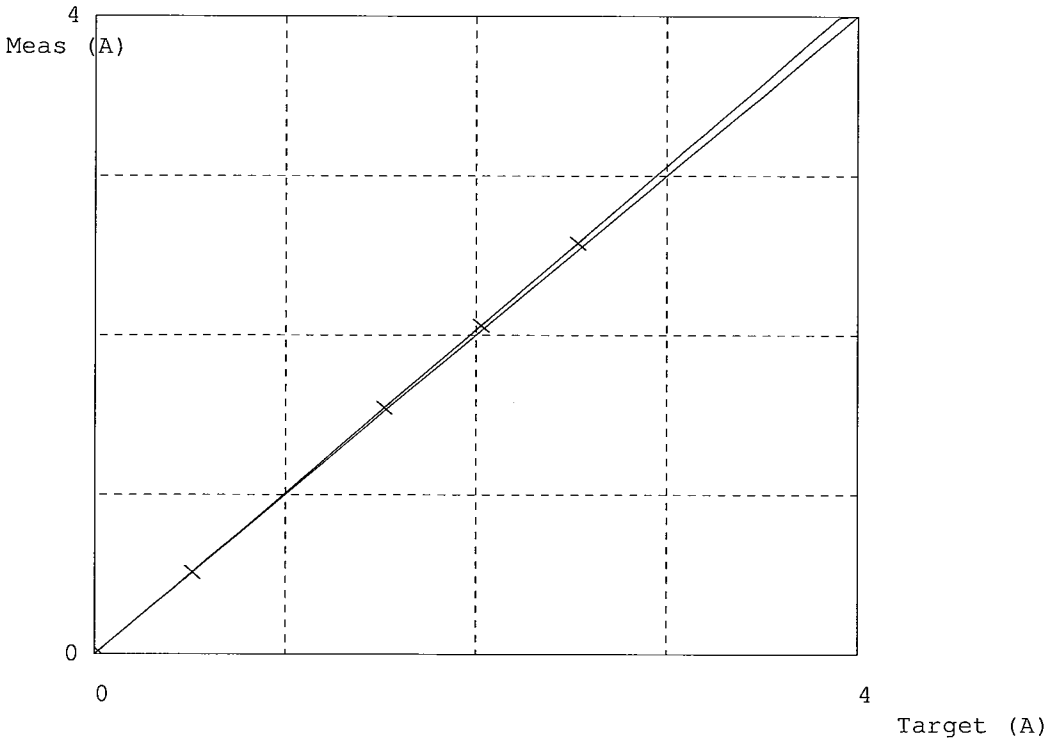
7/12/2023 21:21

## 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 |



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

NSC-TISI-TIS17025
CALIBRATION 0008

# Certificate of Calibration

**Cert.No.:** 24CG952
**Page.:** 1 of 2

| | |
|---|---|
| **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 :** | 760 mmHg |
| **Calibration Procedure :** | ASTM E 542 - 01 |
| **Calibrated by :** | Natcha Chayyingcheiw |

REVIEW BY ..... Siriluk P.
APPROVED BY .....
NEXT CAL DATE..... 27/08/25

**Approved by :**

Approved Signatory

( ) Unnopphol Harachai
(✓) Srisuda Khamtha
( ) Sa-ngeunkam Wongsa

**Issue Date :** 27 February 2024

**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.

**Equipment :** Burette
**Received Date :** 23 February 2024
**Condition As-Received :** New Item
**Calibration Date :** 27 February 2024
**Reference :** 2402-0757DSC-1

**Cert.No.:** 24CG952


**Condition of this result of calibration**

1. Reference Standard Instruments :

| Instruments | Model | Serial No. | ID. No. | Certificate No. | Traceability | Due date |
|---|---|---|---|---|---|---|
| 1) Balance | XP205DR | 1126143764 | 140RC004 | 23MM538 | TPA | 15 Sep 2024 |
| 2) Thermo-Hygrograph | THDX-CE | 00016540 | 140EC001 | 23H1275 | TPA | 09 June 2024 |
| 3) Thermometer | - | 0834181 | 140EC005 | 23I948 | TPA | 10 Aug 2024 |

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 $^{\circ}$C

**Calibration result :**

| Nominal capacity ( mL ) | Reading ( mL ) | Uncertainty ( ± mL ) | *k* Factor |
|---|---|---|---|
| 50 | 50.0032 | 0.010 | 2.00 |

**Remark** mL = $cm^3$

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-**

# 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


NSC-TISI-TIS 17025
CALIBRATION 0244

**Certificate No. T232160**



# 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.<br>104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,<br>Khet Suan Luang, Bangkok 10250 |
| **Customer Location** | : | Laboratory |
| **Date of Receipt** | : | 29 November 2023 |
| **Calibrated By** | : | Atiphong Rongrat ( Technician ) |
| **Approved By** | : | _____ / Boonchai Suriyawong (Site Calibration Manager) |
| **Date of Issue** | : | 09 JAN 2024 |

REVIEW BY .....
APPROVED BY Siriluk P.
NEXT CAL. DATE 06/06/25

**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 Metrology.**

**Certificate No. T232160**

# Calibration Report

**Equipment** : **Chamber ( Cooling Room )**
**Date of Calibration** : **6 December 2023**
**Environment** : **Temperature : 23.4-24.9 °C**
**Line Voltage : 221.4-230.2 V**
**Relative Humidity : 55 - 65 %RH**

**Condition of this results of calibration :**

1. Thisequipment was calibrated by insert 16 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 | T230773 | 10 April 2024 |
| TC | TYPE T | TN171-TN180 | T230773 | 10 April 2024 |
| DATA LOGGER | 34970A | T149 | T230773 | 10 April 2024 |

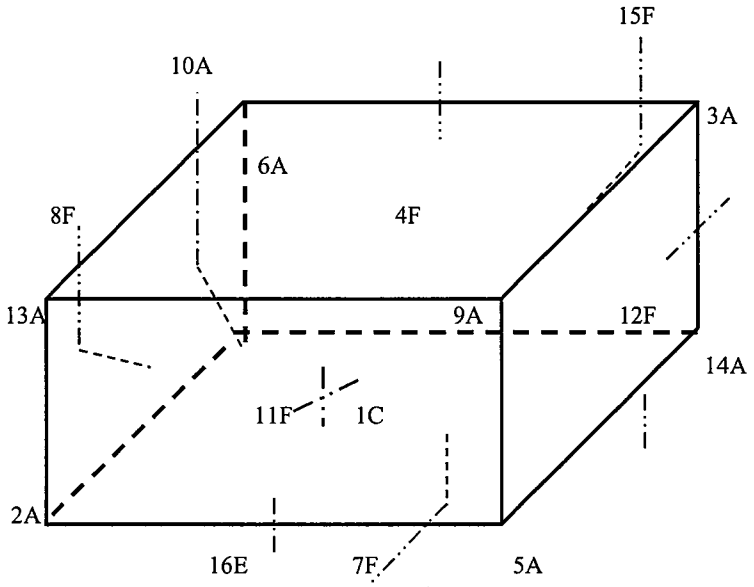
3. This certificate is traceable to :
   National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TISI-TIS 17025 CALIBRATION 0244.)
4. Condition of calibrated item : good
   Equipment Description :
   Time Constant 1 Hour 30 Minute At 3 °C
   Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
   ☐ Close
   ☒ Not Available
5. Adjustment :
   ( X ) without adjustment ( ) after adjustment

**Approved By.** _____

**Certificate No. T232160**



# 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.** _____

SCG

# Metrology

SCI ECO Services Company Limited

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

NSC-TISI-TIS 17025
CALIBRATION 0244



# Calibration Report

## Measurement Results

| | Average Standard Reading at each position (°C) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Calibration Point | 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 *k* |
| | 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.** _____

Agilent Technologies

Agilent Technologies (Thailand) Limited
U CHU LIANG BLDG. 22/F UNIT A,D
968 RAMA 4 ROAD, SILOM, BANGRAK
Bangkok 10500 Thailand

Tel. +662 637 6363
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

Chanattagarn.lmchom@alsglobal.com
27603068

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

# SERVICE REPORT

| | |
|---|---|
| **Customer Purchase Order Number:** | **Customer Number:** 70371013 |
| **Service Request:** | **Service Request Date:** |
| **Service Order:** 6006041263 | **Service Confirmation:** 6905338201 |

REVIEW BY Supakwan N.
APPROVED BY Sawitn N.
NEXT CAL. DATE 13/06/2025

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

**Location:**
**Room**
**Bldg**
**Lab**
**Dept**

**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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Bangkok 10500 Thailand
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:** 6905338201

**Service Confirmation Date:** 12.12.2023

**Service Instrument:**

| Model Number | Model Description | Serial Number | System Handle | Parent Asset |
|---|---|---|---|---|
| SYS-IM-7700-E | ICPMS 7700 System Enhanced | | ICP MS 7700 (HPLC) | |
| G1316A | 1260 Thermostatted Column Compartment | DEACN12300 | ICP MS 7700 (HPLC) | SYS-IM-7700-E |
| G1329B | 1260 Standard Autosampler | DEAAC11098 | ICP MS 7700 (HPLC) | SYS-IM-7700-E |
| G1311B | 1260 Quaternary Pump | DEAB704380 | ICP MS 7700 (HPLC) | SYS-IM-7700-E |
| G3281A | Agilent 7700x ICP-MS | JP12091612 | ICP MS 7700 (HPLC) | SYS-IM-7700-E |

**Service Items:**

| Item | Service/Part # | Description | Qty | Entitlement | Service Start | Service End |
|---|---|---|---|---|---|---|
| 1000 | EOQ | Enterprise Operational Qualification | 1.00 | Agreement Entitlement - 100 % covered | 12.12.2023 | 12.12.2023 |
| 1010 | 5185-5850 | ICP-MS Checkout Solutions | 1.00 | Agreement Entitlement - 100 % covered | | |

**Additional Information:**

**Service Confirmation Number:** 6905338201

**Service Confirmation Date:** 12.12.2023

**Service Information:**

| | | |
|---|---|---|
| **Problem Description:**<br>WU-OQ-IM/HPLC-7700-5001143313 | | |
| **Service Provided:**<br>Perform OQ Hardware control test CSD logon, Autosample , ISIS , Auto tune , BG and Stability. After done the instrument BKK_EL0026 calibrated pass all. | | |
| **Service Overview Code:**<br>Reason Code: Scheduled Service<br>Diagnosis Code: Scheduled Service<br>Resolution Code: Scheduled Service | | |
| **Reported Hours:**<br>6.0 | **Travel Hours:**<br>1.0 | |
| **Customer Field Service Representative Name:**<br>**Panthep Kurasathain** | **Customer Field Service Representative Signature:** | **Date:**<br>**12 Dec 2023** |
| **Customer Name:**<br>**Supakwan Mak** | **Customer Signature:** | **Date:**<br>**12 Dec 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 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 Sawitree 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.

# 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




## 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

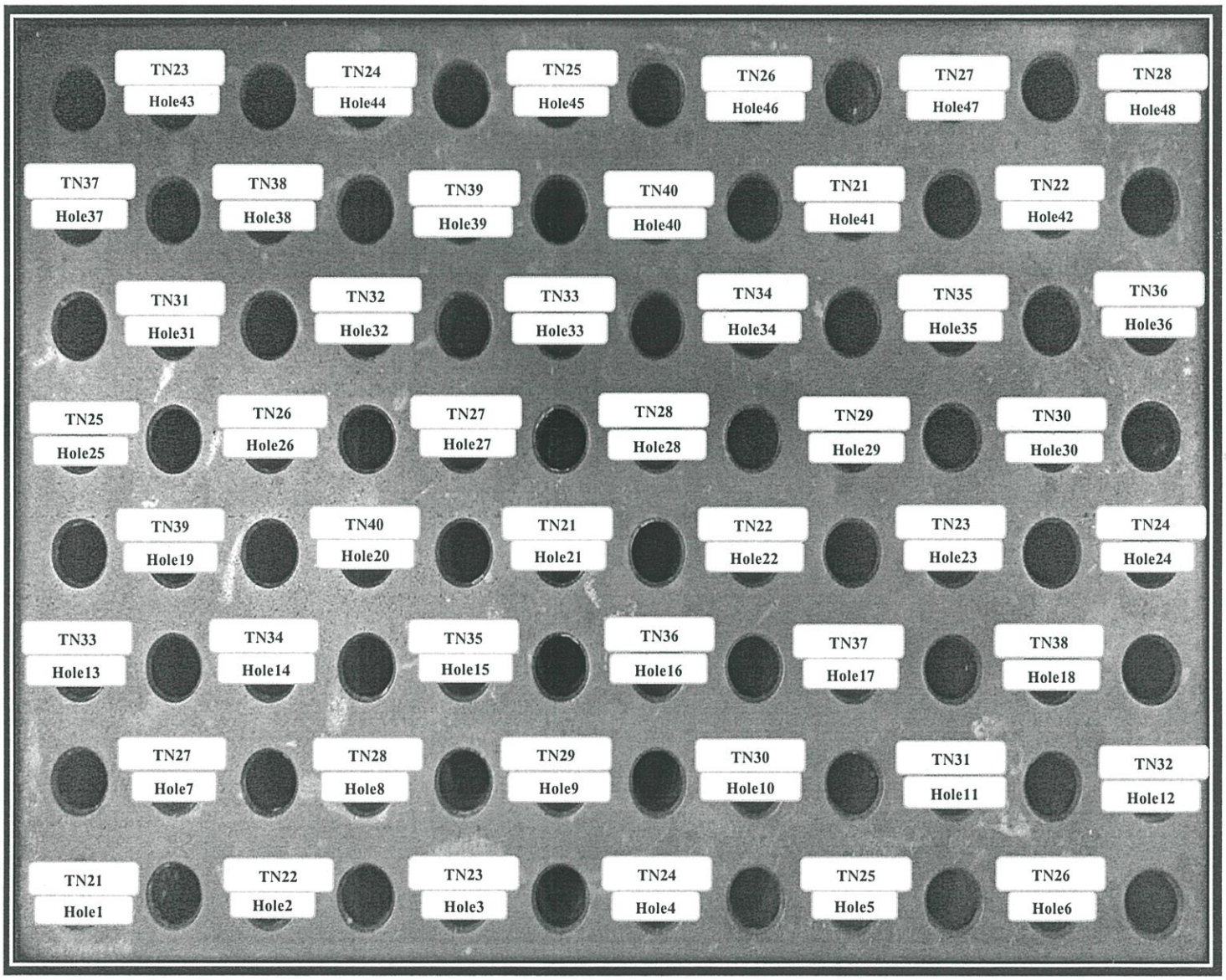
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Website : www.scieco.co.th E-Mail : calibrate@scg.co.th




## Calibration Report




FRONT CONTROL

**Approved By.** _____

# 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




# 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.** _____

# Metrological Center

SCI ECO Services Company Limited

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




# 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.** _____

# 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




# 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.**_____

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

NSC-TISI-TIS17025
CALIBRATION 0008

**Cert. No.:** 23TM1408


# 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.<br>104 Phatthanakan 40, Phatthanakan Rd.,<br>Khwaeng Phatthanakan, Khet Suan Luang,<br>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 ) % |

REVIEW BY Sithichdc
APPROVED BY
NEXT CAL. DATE ~~03/10/24~~ 04/04/25
16/10/23

**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.

**Equipment :** Autoclave **Cert. No.:** 23TM1408

**Condition As-Received :** Used Item 

**Reference :** 2310-0006OC-6

**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:-

| Instrument | Serial No. | Cert. No. | Traceable | Due Date |
|---|---|---|---|---|
| 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 )

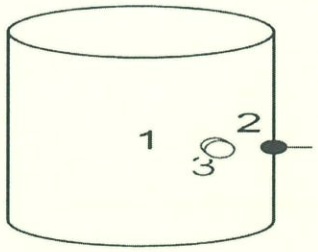
It does not cover autoclaves for use with material infect with organisms in Hazard Group 4, for which complete containment and sterilization of infected condensate is considered to be essential.

This result of calibration does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical or veterinary purposes which are directry 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 |

| Position | Description | Ref. Std. ID No.: |
|---|---|---|
| 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



**Operating parameter Set : Temperature =** 108 °C

**Sterilization period =** 10 minute

| UUC* Setting ( °C ) | UUC* Reading ( °C ) | Position | Average* Standard Reading ( °C ) | Stability ( ± °C ) | Pressure Reading ( MPa ) | Uncertainty ( ± °C ) | Coverage Factor *k* |
|---|---|---|---|---|---|---|---|
| 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* Setting ( °C ) | UUC* Reading ( °C ) | Position | Average* Standard Reading ( °C ) | Stability ( ± °C ) | Pressure Reading ( MPa ) | Uncertainty ( ± °C ) | Coverage Factor *k* |
|---|---|---|---|---|---|---|---|
| 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* Setting ( °C ) | UUC* Reading ( °C ) | Position | Average* Standard Reading ( °C ) | Stability ( ± °C ) | Pressure Reading ( MPa ) | Uncertainty ( ± °C ) | Coverage Factor *k* |
|---|---|---|---|---|---|---|---|
| 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



**Operating parameter Set : Temperature =** 121 °C

**Sterilization period =** 30 minute

| UUC* Setting ( °C ) | UUC* Reading ( °C ) | Position | Average* Standard Reading ( °C ) | Stability ( ± °C ) | Pressure Reading ( MPa ) | Uncertainty ( ± °C ) | Coverage Factor *k* |
|---|---|---|---|---|---|---|---|
| 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
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484

NSC-TISI-TIS17025
CALIBRATION 0008

**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.<br>104 Phatthanakan 40, Phatthakan Rd.,<br>Khwawng Phatthanakan, Khet Suan Luang,<br>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
NEXT CAL. DATE 17/01/25

**Approved by :** Malee.
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

**Cert. No.:** 23TM1146


**Procedure Used :-**

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:-

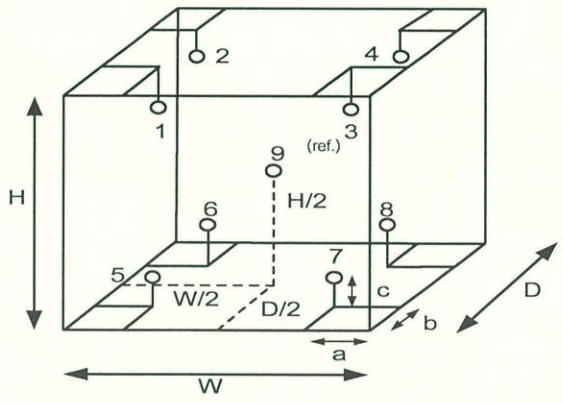
| Instrument | Serial No. | Cert. No. | Traceable | Due Date |
|---|---|---|---|---|
| 1 ) Data Acquisition | MY49001451 | 23LM27 | TPA | 25 Feb 2024 |

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 | $m^3$ |

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


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

| Calibration Point ( °C ) | Measured Temperature ( °C ) Position | | | | | | | | | Uncertainty ( ±°C ) |
|---|---|---|---|---|---|---|---|---|---|---|
| | 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-**

Malee.

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

NSC-TISI-TIS17025
CALIBRATION 0008

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.<br>104 Phatthanakan 40, Phatthanakan Rd.,<br>Khwaeng Phatthanakan, Khet Suan Luang,<br>Bangkok 10250 Thailand |
| **Location :** | Media Preparatiom Room |
| **Received Order :** | 21 November 2022 |
| **Calibration Date :** | 21 November 2022 |
| **Ambient Temperature :** | ( 26 ± 10 ) °C |
| **Relative Humidity :** | ( 50 ± 30 ) % |
| **Calibrated by :** | Krisda Malee |

REVIEW BY Sithichok
APPROVED BY
NEXT CAL. DATE 21/05/24

**Approved by :** Malu.
Approved Signatory

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

**Issue Date :** 29 November 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 0048150

**Equipment :** Hot Air Oven

**Condition As-Received :** Used Item

**Reference :** 2211-0623OC-1

**Cert. No.:** 22TM1571



**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 |

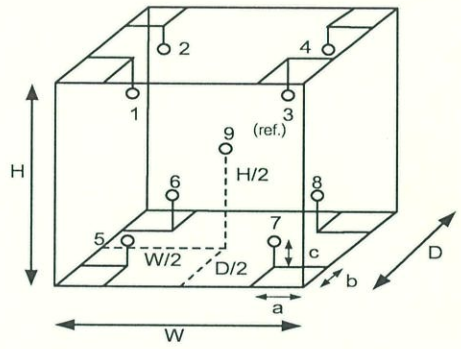
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

**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 | $m^3$ |

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


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

| Calibration Point ( °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 %.

-o0o-

Malu.

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

NSC-TISI-TIS17025
CALIBRATION 0008

**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.<br>104 Phatthanakan 40, Phatthanakan Rd.,<br>Khwaeng Phatthanakan, Khet Suan Luang,<br>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


**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**

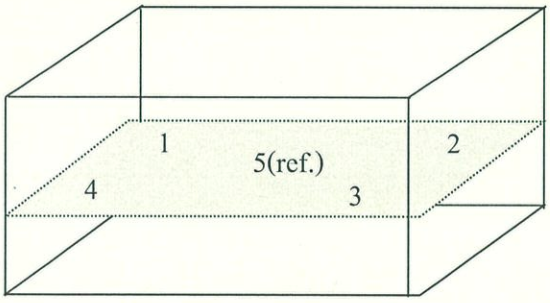
1. Reference standard instrument:-

| Instrument | Model | Serial No. | Cert. No. | Due Date |
|---|---|---|---|---|
| 1 ) Data Acquisition | 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

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




Front

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

**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


| Calibration point ( °C ) | UUC* Setting ( °C ) | UUC* Reading ( °C ) | Average* Standard Reading ( °C ) Position | | | | | Uncertainty ( ± °C ) |
|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 (ref.) | |
| 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 point ( °C ) | Uniformity ( °C ) | Stability ( ± °C ) | Coverage Factor *k* |
|---|---|---|---|
| 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 %.

**-o0o-**