

ภาคผนวก จ

เอกสารการสอบเทียบเครื่องมือที่ใช้ในการวิเคราะห์



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)

CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES

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

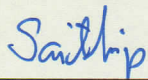
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert.No.: 23CH951

Page.: 1 of 2

Certificate of Calibration

| | |
|---|---|
| Equipment : | pH Meter |
| Manufacturer : | Eutech |
| Model : | pH 700 |
| Serial No. : | 2858459 |
| ID No. : | LB-Eq-027 |
| Condition As-Received: | Used Item |
| Received Date : | 04 August 2023 |
| Calibration Date : | 07 August 2023 |
| Reference : | 2308-0115WN-1 |
| Submitted by : | Special Lab Envi And Consultant Co.,Ltd 47/91-93, 96 Moo 3 Thambon Tha-it, Pakkret Nonthaburi 11120 |
| Ambient Temperature : | (25 ± 2.5) °C |
| Relative Humidity : | (50 ± 15) % |
| Calibration Procedure : | In - house method : - CP-CH5 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM) |
| Calibrated by : | Warakorn Lerngagtrakul |
| Approved by : |  Approved Signatory |
| (<input checked="" type="checkbox"/>) Saihip Meangmai | |
| () Warakorn Lerngagtrakul | |
| () Ponpan Paipim | |
| Issue Date : | 16 August 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 0057105



Cert. No.: 23CH951

Page.: 2 of 2

Condition of this calibration result

1. Reference Standard Instrument : -

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

This certification is traceable to the International System of Unit maintained 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

| <u>Buffer Solution</u> | <u>Manufacturer</u> | <u>Lot No.</u> | <u>Exp. date</u> |
|------------------------|---------------------|----------------|------------------|
| pH 4.008 | CPA chem | 863832 | 28 Dec 2024 |
| pH 6.986 | CPA chem | 863833 | 28 Dec 2023 |
| pH 10.010 | CPA chem | 863835 | 28 Dec 2023 |

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

Calibration Results

Function : mV Measurement

Performing standard curve by Fluke at pH (4,7,10)

| Unit Under Calibration | Nominal Value | Standard Voltage Input | Actual Reading | | Uncertainty of Measurement (±mV) | Coverage factor k |
|---------------------------|---------------|------------------------|----------------|-------|---------------------------------------|----------------------|
| | pH | mV | mV | pH | | |
| pH Meter S/N.: 2858459 | 4.00 | 177.48 | 177.5 | 4.01 | 0.058 | 2.00 |
| | 7.00 | 0.00 | 0.1 | 7.00 | 0.058 | 2.00 |
| | 10.00 | -177.48 | -177.4 | 10.01 | 0.058 | 2.00 |

Function : pH Measurement

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

| Unit Under Calibration | Standard pH Buffer Solution | Actual pH Reading | Actual mV Reading (mV) | Uncertainty of pH measurement (±) | Coverage factor k |
|-------------------------------|-----------------------------|-------------------|-----------------------------|--|----------------------|
| pH Electrode S/N.: 3101624 | 4.008 | 4.01 | 170.7 | 0.0085 | 2.05 |
| | 6.986 | 6.99 | -2.0 | 0.011 | 2.00 |
| | 10.010 | 10.01 | -178.2 | 0.0096 | 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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Saithip

a 1174396



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)

CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES

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

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



Cert. No.: 23LM132

Page.: 1 of 2

Certificate of Calibration

Equipment : pH Meter with Sensor

Manufacturer : Eutech

Model : pH 700

Serial No. : 2858459

ID No. : LB-Eq-027

Submitted by : Special Lab Envi And Consultant Co.,Ltd.
47/91-93 Moo 3 Thambon Tha-it,
Pakkret,
Nonthaburi 11120

Location : TPA On Site Calibration Laboratory

Received Order : 04 August 2023

Calibrated Date : 09 August 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

() Ponpan Paipim

(✓) Suwit Imjai

Issue Date : 17 August 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 0057254



Equipment : pH Meter with Sensor

Cert. No.: 23LM132

Condition As-Received : New Item

Page.: 2 of 2

Reference : 2308-0115WN-2

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

| <u>Instrument</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Traceable</u> | <u>Due Date</u> |
|------------------------|-------------------|------------------|------------------|-----------------|
| 1) Digital Thermometer | 2188080 | 2211285 | 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.: PH5TEMB01P

| <u>Calibration</u> <u>Point</u> (°C) | <u>Immersion</u> <u>Depth</u> (mm) | <u>Standard</u> <u>Temperature</u> (°C) | <u>UUC*</u> <u>Reading</u> (°C) | <u>Error</u> (°C) | <u>Uncertainty</u> (± °C) | <u>Coverage</u> <u>Factor</u> <i>k</i> |
|--|--|---|---|------------------------|--------------------------------|--|
| 25.0 | 100 | 25.002 | 25.0 | -0.002 | 0.16 | 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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Signature

a 1175376



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

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

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

Cert.No.: 23TW41

Page.: 1 of 2

Certificate of Testing

| | |
|-------------------------------|---|
| Equipment : | DO Meter |
| Manufacturer : | Hanna |
| Model : | HI98193 |
| Serial No. : | 03030056991 |
| ID No. : | LB-Eq-014 |
| Received Date : | 16 February 2023 |
| Test Date : | 17 February 2023 |
| Reference : | 2302-0616WN-1 |
| Submitted by : | Special Lab Envi And Consultant Co.,Ltd 47/91 Moo 3 Thambon Tha-it, Pakkret, Nonthaburi 11120 |
| Laboratory Condition : | Temperature (25 ± 5) °C Humidity (50 ± 20) % |
| Test Procedure : | In - house method : CP-CH9 by Comparison Technique with Azide Modification Method |
| Tested by : | Walalak Sirithean |

Approved by :

Approved Signatory

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

Issue Date : 20 February 2023

B 0307483



Cert.No.: 23TW41

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

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

| <u>Instruments</u> | <u>Serial No.</u> | <u>ID No.</u> | <u>Certificate No.</u> | <u>Due Date</u> |
|--------------------|-------------------|---------------|------------------------|-----------------|
| 1) Burette | - | 130BU10 | 21CG1389 | 25 Mar 2023 |
| 2) Balance | 1126143764 | 140RC004 | 22MM50 | 20 Sep 2023 |

2. Standard Material :-

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

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: KC1N20CDJ

| Titration Method (Azide Modification Method) (mg/L) | DO Meter Reading (mg/L) | Standard Deviation (mg/L) |
|---|---------------------------------------|-------------------------------------|
| 8.12 | 8.13 | 0.0045 |

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

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Malu

a 1148751

1. Block Digestion

ผู้ผลิต HANON รุ่น SH 220F Serial No. SH 322290127 รหัสเครื่อง LB-Eq-011

วันที่ทวนสอบ 2 ธค ๖๓ ๒๕๖๓ ทวนสอบครั้งต่อไป 1 กรกฎาคม ๒๕๖๔

2. Digital Thermometer with TC Probe

ผู้ผลิต Thermo Scientific รุ่น Temp 10k Serial No. 4008958 รหัสเครื่อง LB-Eq-013

ความละเอียด 0.1 °C วันที่สอบเทียบ 8 เมษายน ๒๕๖๓ สอบเทียบครั้งต่อไป 7 เมษายน ๒๕๖๔

3. ผลการทวนสอบ (ช่วงเวลา ๐๙.๐๐ น. - ๑๘.๓๐ น.)

อุณหภูมิห้อง ๒๕ - ๒๗ °C ความชื้นสัมพัทธ์ ๕๐ - ๕๖ %

| ว/ด/ป | Position No. | Set point (°C) | อุณหภูมิที่อ่านได้จากเครื่อง (°C) | อุณหภูมิที่อ่านได้เทอร์โมมิเตอร์ (°C) | | | Error | เกณฑ์การยอมรับ | สรุปผลการทวนสอบ | | ผู้ทวนสอบ |
|---------|--------------|----------------|-----------------------------------|---------------------------------------|----------------|----------------------|-------|----------------|-----------------|---------|-----------|
| | | | | ครั้งที่ 1 (A) | ครั้งที่ 2 (B) | ค่าเฉลี่ยของอุณหภูมิ | | | ผ่าน | ไม่ผ่าน | |
| ๒/๑๖/๖๓ | 1 | 250 | 252 | ๒๕๒.๔ | ๒๕๒.๑ | ๒๕๒.๒ | + 2.2 | ± 5 | ✓ | | ฟางเชษฐ์ |
| | 2 | | | ๒๕๐.๓ | ๒๕๐.๖ | ๒๕๐.๔ | + 0.4 | ± 5 | ✓ | | |
| | 3 | | | ๒๔๙.๙ | ๒๕๐.๖ | ๒๕๐.๑ | + 0.1 | ± 5 | ✓ | | |
| | 4 | | | ๒๕๑.๗ | ๒๕๑.๒ | ๒๕๑.๔ | + 1.4 | ± 5 | ✓ | | |
| | 5 | | | ๒๕๐.๖ | ๒๕๐.๗ | ๒๕๐.๗ | + 0.7 | ± 5 | ✓ | | |
| | 6 | | | ๒๕๒.๖ | ๒๕๒.๐ | ๒๕๒.๓ | + 2.2 | ± 5 | ✓ | | |
| | 7 | | | ๒๕๐.๑ | ๒๕๐.๖ | ๒๕๐.๔ | + 0.4 | ± 5 | ✓ | | |
| | 8 | | | ๒๕๑.๑ | ๒๕๑.๓ | ๒๕๑.๒ | + 1.2 | ± 5 | ✓ | | |
| | 9 | | | ๒๕๑.๓ | ๒๕๐.๙ | ๒๕๑.๑ | + 1.1 | ± 5 | ✓ | | |
| | 10 | | | ๒๕๐.๙ | ๒๕๑.๑ | ๒๕๑.๐ | + 1.0 | ± 5 | ✓ | | |
| | 11 | | | ๒๕๐.๔ | ๒๕๐.๗ | ๒๕๐.๖ | + 0.6 | ± 5 | ✓ | | |
| | 12 | | | ๒๔๙.๘ | ๒๕๐.๑ | ๒๕๐.๐ | 0.0 | ± 5 | ✓ | | |
| | 13 | | | ๒๔๙.๙ | ๒๕๐.๑ | ๒๕๐.๐ | 0.0 | ± 5 | ✓ | | |
| | 14 | | | ๒๕๐.๑ | ๒๕๐.๔ | ๒๕๐.๒ | + 0.2 | ± 5 | ✓ | | |
| | 15 | | | ๒๕๒.๑ | ๒๕๒.๐ | ๒๕๒.๑ | + 2.1 | ± 5 | ✓ | | |
| | 16 | | | ๒๕๑.๓ | ๒๕๑.๗ | ๒๕๑.๕ | + 1.5 | ± 5 | ✓ | | |
| | 17 | | | ๒๕๐.๗ | ๒๕๐.๖ | ๒๕๐.๗ | + 0.7 | ± 5 | ✓ | | |
| | 18 | | | ๒๕๐.๘ | ๒๕๐.๙ | ๒๕๐.๙ | + 0.9 | ± 5 | ✓ | | |
| | 19 | | | ๒๕๐.๙ | ๒๕๐.๓ | ๒๕๐.๖ | + 0.6 | ± 5 | ✓ | | |
| | 20 | | | ๒๕๐.๑ | ๒๕๐.๓ | ๒๕๐.๒ | + 0.2 | ± 5 | ✓ | | |

Certificate of Calibration

Certificate No. : 66-400192-1

Page : 1 of 2

Submitted by : Special Lab Envi and Consultant Co., Ltd.
47/91 Moo 3, Tambol Tha-it, Pakkret, Nonthaburi 11120

Equipment : Digital Thermometer with Thermocouple probe Type K
Temperature Indicator
Manufacturer : Thermo Scientific Model : TEMP 10K
Range : -250 °C to 1372 °C Resolution : 0.1 °C
Serial No. : 4008958 ID No. : LB-Eq-013

Environment : Ambient Temperature : (23 ± 2) °C
Relative Humidity : (50 ± 15) %
Line Voltage : (220 ± 22) VAC

Date of Received : 06 April 2023

Date of Calibration : 08 April to 10 April 2023

Date of Issue : 10 April 2023

Calibrated by : Chortip Samchusri

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4003 by compared with PRT in the liquid bath at the constant controlled temperature.

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units

1. Platinum Resistance Thermometer (PRT)

| ID No. | Cert. No. | Due Date | Traceability |
|--------|------------|-------------|---|
| 400001 | TT-0016-22 | 07 Feb 2024 | National Institute of Metrology Thailand (NIMT) |
| 400016 | TT-0059-21 | 02 Jun 2023 | National Institute of Metrology Thailand (NIMT) |

2. Standard Digital Thermometer

| ID No. | Cert. No. | Due Date | Traceability |
|--------|-----------|-------------|---|
| 400003 | 21E1850 | 14 Jun 2023 | National Institute of Metrology Thailand (NIMT) |
| 400004 | 21E1850 | 14 Jun 2023 | National Institute of Metrology Thailand (NIMT) |

Approved by :

(Bunjerd Masri)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-400192-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement with Thermocouple probe Type K

Model : Type K Sheath Material : Teflon
Diameter : 2 mm. Length : 1500 mm.
Serial No. : N/A ID No. : SL-39

| Immersion Depth (mm.) | Standard Reading (° C) | UUC Reading (° C) | Correction (° C) | Uncertainty (± ° C) |
|----------------------------|-----------------------------|------------------------|-----------------------|--------------------------|
| 130 | 3.0036 | 3.5 | -0.5 | 0.18 |
| 130 | 20.0024 | 20.4 | -0.4 | 0.18 |
| 130 | 104.0011 | 104.3 | -0.3 | 0.45 |
| 130 | 150.0027 | 150.2 | -0.2 | 0.58 |
| 130 | 180.0040 | 180.0 | 0.0 | 0.65 |

Model : AD-1218-230 Sheath Material : Stainless
Diameter : 3.5 mm. Length : 230 mm.
Serial No. : N/A ID No. : SL-40

| Immersion Depth (mm.) | Standard Reading (° C) | UUC Reading (° C) | Correction (° C) | Uncertainty (± ° C) |
|----------------------------|-----------------------------|------------------------|-----------------------|--------------------------|
| 124 | 379.9914 | 379.3 | 0.7 | 1.5 |
| 124 | 400.0011 | 399.2 | 0.8 | 1.6 |

Remark

UUC : Unit Under Calibration

This result of calibration was found accurate as shown on date and place of calibration only.

This 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%

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CALIBRATION CERTIFICATE

Date of Issue Jun 23, 2023

Cert No. 23/2342

Site Calibration

Order No. 23060302

Customer SPECIAL LAB ENVI AND CONSULTANT CO., LTD.
47/91 Moo 3 Tha-It, Pak Kret, Nonthaburi, 11120.

Place of Calibration 1350, 1352 Sutthisarnwinitchai Rd, Dindaeng, Bangkok 10400. (Calibration Room)

Description Oven

Model UF30

Serial No. B123.0544

ID.No. -

Date of Receipt Jun 20, 2023

Date of Calibration Jun 20, 2023

Environment

Temperature (Min) 23.1 °C (Max) 25.3 °C

Relative Humidity (Min) 46.3 %RH (Max) 78.9 %RH

Calibration Method

WI-17 : The reference thermometer was placed into the chamber and measurement was performed based on AS-2853.

The temperature scale in use at this laboratory is the International Temperature Scale of 1990.

Standard

1) Data Acquisition with Sensor Model 34972A S/N. MY49007789, Certificate No. QR23-0024, Calibrated by Quality Reborn Co., Ltd., ONAC Calibration No. 0292. Due Date Jan 10, 2024.

This certificate is traceable to SI unit.

D.M.



CALIBRATION CERTIFICATE

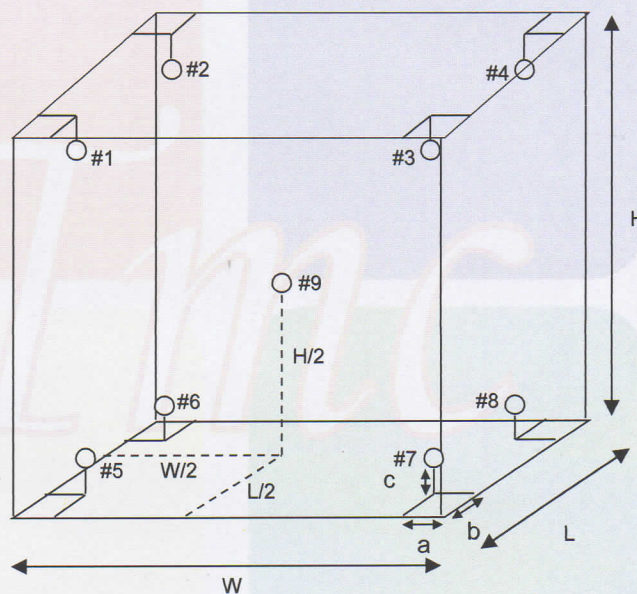
Date of Issue Jun 23, 2023

Cert No. 23/2342

Site Calibration

Order No. 23060302

Results (without adjustment)



Position of reference thermometers were placed

Note.

- 1). Dimension (W x L x H) is 40 x 25 x 32 cm.
- 2). Stability - greatest one half of difference between max peak and min peak of each reference probe measured temperature obtained during the calibration interval.
- 3). Uniformity - the maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady state conditions. The reference sensor should preferably be located at the geometric center of the chamber.



CALIBRATION CERTIFICATE

Date of Issue Jun 23, 2023

Cert No. 23/2342

Site Calibration

Order No. 23060302

Results (without adjustment)

| UUC Setting (°C) | UUC Reading (°C) | Reference Thermometer (°C) | | Stability ± (°C) | Uniformity (°C) | Uncertainty ± (°C) |
|--------------------------|--------------------------|----------------------------------|---------|-----------------------|----------------------|-------------------------|
| 104.0 | 104.0 | Position 1 | 104.544 | 0.058 | 0.704 | 0.30 |
| | | Position 2 | 103.789 | | | |
| | | Position 3 | 103.396 | | | |
| | | Position 4 | 103.886 | | | |
| | | Position 5 | 104.031 | | | |
| | | Position 6 | 103.886 | | | |
| | | Position 7 | 103.342 | | | |
| | | Position 8 | 103.939 | | | |
| | | Position 9 | 103.867 | | | |

| UUC Setting (°C) | UUC Reading (°C) | Reference Thermometer (°C) | | Stability ± (°C) | Uniformity (°C) | Uncertainty ± (°C) |
|--------------------------|--------------------------|----------------------------------|---------|-----------------------|----------------------|-------------------------|
| 150.0 | 150.0 | Position 1 | 151.388 | 0.052 | 1.248 | 0.41 |
| | | Position 2 | 150.037 | | | |
| | | Position 3 | 149.313 | | | |
| | | Position 4 | 149.849 | | | |
| | | Position 5 | 150.519 | | | |
| | | Position 6 | 150.188 | | | |
| | | Position 7 | 149.370 | | | |
| | | Position 8 | 150.383 | | | |
| | | Position 9 | 150.201 | | | |



CALIBRATION CERTIFICATE

Date of Issue Jun 23, 2023

Cert No. 23/2342

Site Calibration

Order No. 23060302

Results (without adjustment)

| UUC Setting (°C) | UUC Reading (°C) | Reference Thermometer (°C) | | Stability ± (°C) | Uniformity (°C) | Uncertainty ± (°C) |
|--------------------------|--------------------------|----------------------------------|---------|---------------------------|--------------------------|-----------------------------|
| 180.0 | 180.0 | Position 1 | 181.507 | 0.059 | 1.693 | 0.49 |
| | | Position 2 | 179.668 | | | |
| | | Position 3 | 178.772 | | | |
| | | Position 4 | 179.371 | | | |
| | | Position 5 | 180.334 | | | |
| | | Position 6 | 179.830 | | | |
| | | Position 7 | 178.855 | | | |
| | | Position 8 | 180.323 | | | |
| | | Position 9 | 179.876 | | | |

The stability and uniformity was taken into account in the measurement uncertainty stated.

The above results are valid exclusively for calibration samples as mentioned in the report.

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%. The uncertainty evaluation has been carried out in accordance with ONAC requirements.

APPROVED SIGNATORY :

☐ MR. PRAJUCKPETCH THONGSOOKCHOTE

☒ MR. DAMRONG MULSING

☐ MR. JATURAPAT THONGSOOKCHOTE

Certificate of Calibration

Certificate No. : 66-400220-2

Page : 1 of 2

Submitted by : Special Lab Envi and Consultant Co., Ltd.
47/91 Moo 3 Thambol Tha-it, Pakkret, Nonthaburi 11120

Equipment : Air Chamber (Incubator)
Manufacturer : Lovibond Model : FKU 1800
Range : N/A °C Resolution : 0.1 °C
Serial No. : 0914643-01 ID No. : LB-Eq-004

Environment : On site calibration was carried out at the Laboratory, Special Lab Envi and Consultant Co., Ltd.
Ambient Temperature : (29.0 to 29.6) °C
Relative Humidity : (40 to 45) %
Line Voltage : (226.0 to 226.5) V

Date of Received : 24 April 2023

Date of Calibration : 24 April 2023

Date of Issue : 26 April 2023

Calibrated by : Permpoon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units
Standard Digital Thermometer with RTD Probe

| ID No. | Cert. No. | Due Date | Traceability |
|-----------------|-------------|-------------|---|
| 400046 & 400042 | 66-400066-1 | 02 Aug 2023 | National Institute of Metrology Thailand (NIMT) |

Approved by :



(Bunjerd Masri)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-400220-2

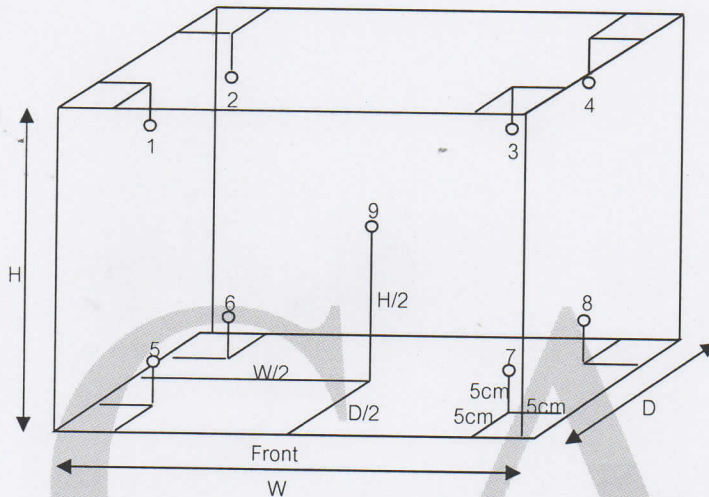
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber
 $W = 0.55 \text{ m}$
 $D = 0.73 \text{ m}$
 $H = 0.50 \text{ m}$
Capacity = 0.20 m^3

| Test Point (°C) | Setting Temperature (°C) | Indicating Temperature (°C) | Measured Temperature (°C) @ Sensor No. | | | | | | | | | Uncertainty (± °C) |
|--------------------|-----------------------------|--------------------------------|--|-------|-------|-------|-------|-------|-------|-------|-------|-----------------------|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| 20.0 | 19.9 | 19.9 | 20.35 | 20.35 | 20.23 | 20.25 | 20.12 | 20.12 | 20.14 | 20.28 | 20.08 | 0.42 |

| Test Point (°C) | Setting Temperature (°C) | Indicating Temperature (°C) | Measured Uniformity (°C) | Measured Stability (°C) | Overall Variation (°C) |
|--------------------|-----------------------------|--------------------------------|-----------------------------|----------------------------|---------------------------|
| 20.0 | 19.9 | 19.9 | 0.37 | 0.16 | 0.6 |

Remark The uncertainty is not combine uniformity of the air chamber

This result of calibration was found accurate as shown on date and place of calibration only.

This 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%

- o0o -

B



Certificate of Calibration

Certificate No. : 66-200145-1

Page : 1 of 2

Submitted by : Special Lab Envi and Consultant Co., Ltd.
47/91 Moo 3, Tambol Tha-It, Pakkret, Nonthaburi 11120

Equipment : Electronic Balance
Manufacturer : AND Model : GR-200
Serial No. : 14245322 ID No. : LB-Eg-016
Capacity : 210 g Resolution : 0.0001 g

Environment : On site calibration was carried out at the Laboratory, Special Lab Envi and Consultant Co., Ltd.
Ambient Temperature : (29.4 to 29.7) °C
Relative Humidity : (50.9 to 51.5) %
Air Pressure : 1011.0 mbar

Date of Received : 24 April 2023

Date of Calibration : 24 April 2023

Date of Issue : 26 April 2023

Calibrated by : Akaradath Thippichai

Calibration Method : In-house method CAL-M2001 based on UKAS Publication ref : LAB 14
Edition 7 - November 2022

Reference Standard Instruments : This certification is traceable to the International System of Units

Standard Weights

| ID No. | Cert. No. | Due Date | Traceability |
|------------|-----------|-------------|--|
| E261-E2624 | C02222345 | 10 Nov 2023 | National Institute of Metrology (Thailand), (NIMT) |

Approved by :



(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-200145-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

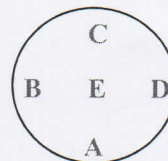
| Nominal Value (g) | Correction (g) | Uncertainty \pm (g) |
|----------------------|-------------------|--------------------------|
| 0.001 | 0.0000 | 0.00010 |
| 0.01 | 0.0000 | 0.00011 |
| 0.1 | 0.0000 | 0.00011 |
| 0.5 | 0.0000 | 0.00010 |
| 2 | 0.0000 | 0.00011 |
| 5 | -0.0001 | 0.00011 |
| 10 | 0.0000 | 0.00012 |
| 50 | -0.0001 | 0.00014 |
| 100 | -0.0001 | 0.00020 |
| 200 | 0.0000 | 0.00038 |

This result of calibration was found accurate as shown on date and place of calibration only.

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.06$, providing a level of confidence of approximately 95%

Eccentric error

Load test : 50 g
 A B C D E
 -0.0003 0.0001 0.0004 0.0000 0.0000 g



Repeatability

Load test : 200 g
 Stdev. : 0.00005 g

- o0o -

Handwritten signature





BECTHAI BANGKOK EQUIPMENT & CHEMICAL CO., LTD.
CALIBRATION LABORATORY

300 Phaholyothin Road, Phayathai, Bangkok 10400, Thailand Tel: +66 2615-2929 Fax: +66 2615-2350-1
E-mail: bkk@becthai.com Website: www.becthai.com



Certificate No. : CAL-23-297

Page : 1 of 3

CERTIFICATE OF CALIBRATION

| | | |
|-----------------------|---|--|
| Equipment | : | Spectrophotometer |
| Manufacturer | : | Thermo Scientific |
| Model | : | Genesys 20 |
| Serial No. | : | 3SGT041007 |
| ID No. | : | LB-Eq-029 |
| Customer | : | Special Lab Envi And Consultant Co., Ltd. |
| | : | 47/91-93 Moo 3, Tambol Tait , Amphur Pakrad, |
| | : | Nonthaburi, 11120. |
| Location | : | Becthai Laboratory (Bangkok) |
| Date of Receipt | : | 3 May 2023 |
| Date of Calibration | : | 3 May 2023 |
| Date of Issue | : | 3 May 2023 |
| Ambient Temperature | : | (25±10) °C |
| Relative Humidity | : | (60±20) % |
| Condition As-Received | : | Used Item |

Calibrated by

(Mr.Somphop Duangnguan)

Calibration Engineer

Approved by

(Ms. Jintana Sangthaijaroenlap)

Calibration Manager

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

This certificate may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

Indicated values are valid for the state of the Spectrophotometer at the time of calibration only.



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CALIBRATION LABORATORY

300 Phaholyothin Road, Phayathai, Bangkok 10400, Thailand Tel: +66 2615-2929 Fax: +66 2615-2350-1
E-mail: bkk@becthai.com Website: www.becthai.com



Certificate No. : CAL-23-297

Page : 2 of 3

CALIBRATION REPORT

Conditions of this result of calibration

1. Reference Standard Material :

| <u>Material</u> | <u>Model</u> | <u>Serial No.</u> | <u>Cert.No.</u> | <u>Due date</u> |
|------------------------|--------------|-------------------|-----------------|-----------------|
| Holmium Glass Filter | RM-HG | 12705 | 98236 | 12 Feb 24 |
| Didymium Glass Filter | RM-DG | 13498 | 98233 | 12 Feb 24 |
| Neutral Density Filter | RM-1N2N3N | 8323 | 98259 | 13 Feb 24 |

2. Traceability : This certification is traceable to the International System of Unit maintained at;
The Starna Scientific Ltd. Accredited Calibration Laboratory No. 0659.

3. Method of calibration :

The calibration procedure was carried out according to ASTM E275-08 (2022) and ASTM E925-09 (2014).

4. Result of calibration :

(☒) without adjustment

(☐) after adjustment

5. Equipment Specifications:

| | | |
|----------------------|-----|--------|
| Spectral Bandwidth : | 5 | nm |
| Data Interval : | 1 | nm |
| Scan Speed : | N/A | nm/min |



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300 Phaholyothin Road, Phayathai, Bangkok 10400, Thailand Tel: +66 2615-2929 Fax: +66 2615-2350-1
E-mail: bkk@becthai.com Website: www.becthai.com



Certificate No. : CAL-23-297

Page : 3 of 3

CALIBRATION REPORT

Wavelength Calibration

| Certified Values of Reference Material (nm) | Nominal Value (nm) | UUC* Reading (nm) | Error (nm) | Uncertainty of Measurement (\pm nm) |
|--|-----------------------|----------------------|---------------|---|
| 418.40 | 418 | 418 | -0.40 | 0.59 |
| 537.00 | 537 | 537 | 0.00 | 0.59 |
| 638.00 | 638 | 638 | 0.00 | 0.59 |

Photometric Calibration for Visible

| Wavelength (nm) | Certified Values of Reference Material (A) | UUC* Reading (A) | Error (A) | Uncertainty of Measurement (\pm A) |
|--------------------|---|---------------------|--------------|--|
| 420.0 | Zero | 0.000 | 0.0000 | 0.0028 |
| | 0.5716 | 0.572 | 0.0004 | 0.0044 |
| | 0.7358 | 0.733 | -0.0028 | 0.0040 |
| | 1.0713 | 1.073 | 0.0017 | 0.0039 |
| 440.0 | Zero | 0.000 | 0.0000 | 0.0028 |
| | 0.561 | 0.560 | -0.0010 | 0.0042 |
| | 0.718 | 0.714 | -0.0040 | 0.0037 |
| | 1.0459 | 1.044 | -0.0019 | 0.0037 |
| 465.0 | Zero | 0.000 | 0.0000 | 0.0028 |
| | 0.5111 | 0.513 | 0.0019 | 0.0044 |
| | 0.6618 | 0.661 | -0.0008 | 0.0035 |
| | 0.9635 | 0.966 | 0.0025 | 0.0034 |
| 546.1 (546.0) | Zero | 0.000 | 0.0000 | 0.0028 |
| | 0.5222 | 0.523 | 0.0008 | 0.0036 |
| | 0.6687 | 0.668 | -0.0007 | 0.0031 |
| | 0.9768 | 0.978 | 0.0012 | 0.0043 |
| 590.0 | Zero | 0.000 | 0.0000 | 0.0028 |
| | 0.5541 | 0.554 | -0.0001 | 0.0035 |
| | 0.6975 | 0.696 | -0.0015 | 0.0031 |
| | 1.0206 | 1.021 | 0.0004 | 0.0045 |
| 635.0 | Zero | 0.000 | 0.0000 | 0.0028 |
| | 0.5398 | 0.543 | 0.0032 | 0.0035 |
| | 0.6658 | 0.667 | 0.0012 | 0.0033 |
| | 0.9741 | 0.977 | 0.0029 | 0.0045 |

Remark : Each individual filter is measured against the empty filter holder (blank) used to zero the Spectrophotometer.

Note:

UUC* : Unit Under Calibration

- End of Report -

Certificate of Calibration

Page : 1 of 2

Certificate No. : 66-400240-1

Submitted by : Special Lab Envi and Consultant Co., Ltd.
47/91-93 Moo 3, Tambol Tha-It, Pakkret, Nonthaburi 11120

Equipment : Air Chamber (Refrigerator)

Manufacturer : Frozen

Model : CC-2288F

Range : N/A °C

Resolution : 1 °C

Serial No. : CC-2288F-1163-003

ID No. : LB-Eq-046

Environment : On site calibration was carried out at the Laboratory, Special Lab Envi and Consultant Co., Ltd.

Ambient Temperature : (31.0 to 32.0) °C

Relative Humidity : (40 to 45) %

Line Voltage : (226.0 to 226.5) V

Date of Received : 02 May 2023

Date of Calibration : 02 May 2023

Date of Issue : 02 May 2023

Calibrated by : Permpoon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units

Standard Digital Thermometer with RTD Probe

ID No.

Cert. No.

Due Date

Traceability

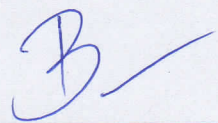
400046 & 400047

66-400066-2

03 Aug 2023

National Institute of Metrology Thailand (NIMT)

Approved by :



(Bunjerd Masri)

Supervisor

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Certificate of Calibration

Certificate No. : 66-400240-1

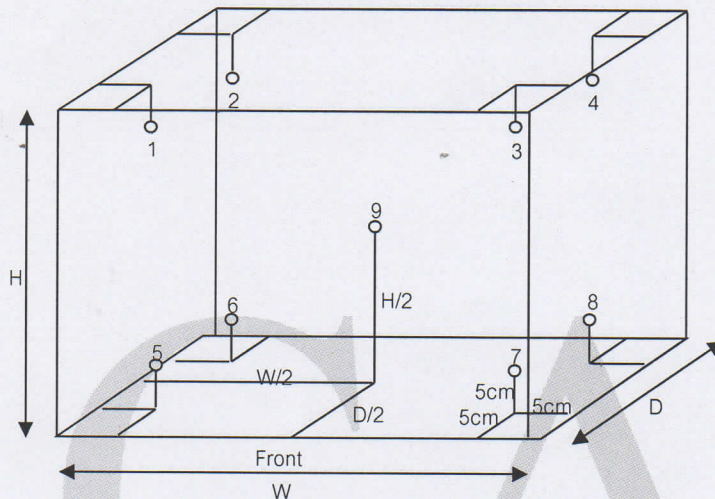
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 1.02 m

D = 0.47 m

H = 1.48 m

Capacity = 0.71 m³

| Test Point (°C) | Setting Temperature (°C) | Indicating Temperature (°C) | Measured Temperature (°C) @ Sensor No. | | | | | | | | | Uncertainty (± °C) |
|--------------------|-----------------------------|--------------------------------|--|------|------|------|------|------|------|------|------|-----------------------|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| 3 | 3 | 3 | 3.21 | 2.53 | 2.23 | 2.38 | 3.74 | 4.12 | 2.20 | 2.05 | 3.01 | 0.83 |

| Test Point (°C) | Setting Temperature (°C) | Indicating Temperature (°C) | Measured Uniformity (°C) | Measured Stability (°C) | Overall Variation (°C) |
|--------------------|-----------------------------|--------------------------------|-----------------------------|----------------------------|---------------------------|
| 3 | 3 | 3 | 1.17 | 0.25 | 2.5 |

Remark The uncertainty is not combine uniformity of the air chamber

This result of calibration was found accurate as shown on date and place of calibration only.

This 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%

- o0o -



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Certificate of Calibration

Certificate No. : 65-410141-1

Page : 1 of 2

Submitted by : Special Lab Envi and Consultant Co., Ltd.
47/91 Moo 3, Tambol Tha-It, Pakkret, Nonthaburi 11120

Equipment : Digital Thermo-Hygrometer

| | | | |
|---------------------|----------------------|--------------|-----------|
| Manufacturer : | Testo | Model : | 608-H1 |
| Range Temperature : | 0 °C to 50 °C | Resolution : | 0.1 °C |
| Range Humidity : | 10 %R.H. to 95 %R.H. | Resolution : | 0.1 %R.H. |
| Serial No. : | 2083236817 | ID No. : | LB-Eq-042 |

Environment : Ambient Temperature : $(23 \pm 2) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15) \%$

Date of Received : 07 December 2022

Date of Calibration : 09 December 2022

Date of Issue : 09 December 2022

Calibrated by : Chortip Samchusri

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4013 by compared with standard probe sensor humidity/temperature into humidity/temperature chamber.

Reference Standard Instruments : This certification is traceable to the International System of Units

Digital Indicator with Standard Probe Temp&Hum

| ID No. | Cert. No. | Due Date | Traceability |
|-----------------|---------------|-------------|---|
| 400034 & 400035 | SG-H-00713/65 | 07 Jan 2023 | Success Gateway Co., Ltd., Accredited by TISI Calibration No.0268 |

Approved by :

(Bunjerd Masri)

Supervisor

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Certificate of Calibration

Certificate No. : 65-410141-1

Page : 2 of 2

UUC Condition As-Received : Good

Result of Calibration : Without Adjustment

Function : Temperature measurement

Reference Humidity @ 50 %R.H.

| Standard Temperature (°C) | UUC Reading (°C) | Correction (°C) | Uncertainty (± °C) |
|--------------------------------|-----------------------|----------------------|-------------------------|
| 24.99 | 25.0 | 0.0 | 0.46 |

Result of Calibration : Without Adjustment

Function : Humidity measurement

Reference Temperature @ 25 °C

| Standard Humidity (%R.H.) | UUC Reading (%R.H.) | Correction (%R.H.) | Uncertainty (± %R.H) |
|--------------------------------|--------------------------|-------------------------|---------------------------|
| 49.98 | 56.0 | -6.0 | 2.2 |

Remark

UUC : Unit Under Calibration

This result of calibration was found accurate as shown on date and place of calibration only.

This 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%

- 000 -

B



Certificate of Calibration

Certificate No. : 66-410081-1

Page : 1 of 2

Submitted by : Special Lab Envi and Consultant Co., Ltd.
47/91-93,96 Moo 3,Tambol Tha-It, Pakkret, Nonthaburi 11120

Equipment : Digital Thermo-Hygrometer

Manufacturer : Testo

Model : 608-H1

Range Temperature : 0 °C to 50 °C Resolution : 0.1 °C

Range Humidity : 10 %R.H. to 95 %R.H. Resolution : 0.1 %R.H.

Serial No. : 2083236817

ID No. : LB-Eg-042

Environment : Ambient Temperature : $(23 \pm 2) ^\circ\text{C}$ Relative Humidity : $(50 \pm 15) \%$

Date of Received : 03 August 2023

Date of Calibration : 09 August 2023

Date of Issue : 09 August 2023

Calibrated by : Chortip Samchusri

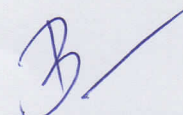
Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4013
by compared with standard probe sensor humidity/temperature into humidity/temperature chamber.

Reference Standard Instruments : This certification is traceable to the International System of Units

Digital Indicator with Standard Probe Temp&Hum

| ID No. | Cert. No. | Due Date | Traceability |
|-----------------|---------------|-------------|---|
| 400034 & 400035 | SG-H-00502/66 | 06 Jan 2024 | Success Gateway Co., Ltd., Accredited by TISI Calibration No.0268 |

Approved by :



(Bunjerd Masri)

Supervisor

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Certificate of Calibration

Certificate No. : 66-410081-1

Page : 2 of 2

UUC Condition As-Received : Good

Result of Calibration : Without Adjustment

Function : Temperature measurement

Reference Humidity @ 50 %R.H.

| Standard Temperature (°C) | UUC Reading (°C) | Correction (°C) | Uncertainty (± °C) |
|--------------------------------|-----------------------|----------------------|-------------------------|
| 25.01 | 25.0 | 0.0 | 0.46 |

Result of Calibration : Without Adjustment

Function : Humidity measurement

Reference Temperature @ 25 °C

| Standard Humidity (%R.H.) | UUC Reading (%R.H.) | Correction (%R.H.) | Uncertainty (± %R.H.) |
|--------------------------------|--------------------------|-------------------------|----------------------------|
| 49.97 | 57.0 | -7.0 | 2.2 |

Remark

UUC : Unit Under Calibration

This result of calibration was found accurate as shown on date and place of calibration only.

This 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%

- o0o -



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Certificate of Calibration

Certificate No. : 66-300220-6

Page : 1 of 2

Submitted by : Special Lab Envi and Consultant Co.,Ltd.
47/91 Moo 3, Tambol Tha-It, Pakkret, Nonthaburi 11120

Equipment : Buret
Manufacturer : Witeg Class : A
Capacity : 25 ml Graduation : 0.1 ml
ID No. : LB-Gw-001

Environment : Ambient Temperature : (20 ± 3) °C
Relative Humidity : (60 ± 15) %
Air Pressure : 1009.7 mbar.

Date of Received : 06 April 2023

Date of Calibration : 18 April 2023

Date of Issue : 18 April 2023

Calibrated by : Areerat Sombun

Calibration Method : In-house method CAL-M3001 based on ASTM E 542-01

Reference Standard Instruments : This certification is traceable to the International System of Units

Electronic Balance

| ID No. | Cert. No. | Due Date | Traceability |
|--------|-------------|-------------|---|
| 241005 | 65-200370-4 | 02 Jun 2023 | National Institute of Metrology (Thailand) (NIMT) |

Approved by :



(Wipa Tovadee)

Supervisor

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Certificate of Calibration

Certificate No. : 66-300220-6

Page : 2 of 2

Result of Calibration : This result of true Volume is referred to standard temperature at 20 °C

UUC Condition As-Received : Good

Delivery Time : 40.55 sec.

| Nominal Volume (ml) | Measuring Volume (ml) |
|-----------------------|-------------------------|
| 10 | 10.0121 |
| 20 | 20.0086 |
| 25 | 25.0116 |

Uncertainty of measurement with in \pm 0.0066 ml

This result of calibration was found accurate as shown on date and place of calibration only.

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.00$,
providing a level of confidence of approximately 95%

- o0o -

D.



Certificate of Calibration

Certificate No. : 66-210415-1

Page : 1 of 2

Submitted by : Special Lab Envi And Consultant Co, Ltd.
47/91-93,96 Moo 3, Tambol Tha - It, Pakkret, Nonthaburi 11120

Equipment : Weight
Manufacturer : LS Material : Stainless Steel
Weight size : 1 g
ID No. : LB-Eq-034
Assumed density of weight : 7950 kg / m³
Assumed Air density : 1.2 kg / m³

Environment : Ambient Temperature : (20 ± 2) °C
Relative Humidity : (50 ± 10) %
Air Pressure : 1005.9 mbar

Date of Received : 03 August 2023

Date of Calibration : 16 August 2023

Date of Issue : 16 August 2023

Calibrated by : Wuttichai Swatphong

Calibration Method : In-house method CAL-M2101 based on OIML R 111-1 : 2004(E)

Reference Standard Instruments : This certification is traceable to the International System of Units

Standard Weights

| ID No. | Cert. No. | Due Date | Traceability |
|------------|------------|-------------|--|
| E221-E2210 | MM-0042-22 | 21 Mar 2025 | National Institute of Metrology (Thailand), (NIMT) |

Approved by :



(Surachai Promthong)

Laboratory Manager

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Certificate of Calibration

Certificate No. : 66-210415-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

| No. | Nominal Value | Id.Mark | Conventional mass Value | | Measuring Uncertainty |
|-----|---------------|---------|-------------------------|-----------|-----------------------|
| 1 | 1 g | none | 1 g | -0.017 mg | ± 0.023 mg |

This result of calibration was found accurate as shown on date and place of calibration only.

This 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%

- o0o -

CAL



Certificate of Calibration

Certificate No. : 66-210415-2

Page : 1 of 2

Submitted by : Special Lab Envi And Consultant Co, Ltd.
47/91-93,96 Moo 3, Tambol Tha - It, Pakkret, Nonthaburi 11120

Equipment : Weight
Manufacturer : LS Material : Stainless Steel
Weight size : 100 g
ID No. : LB-Eq-035
Assumed density of weight : 7950 kg / m³
Assumed Air density : 1.2 kg / m³

Environment : Ambient Temperature : (20 ± 2) °C
Relative Humidity : (50 ± 10) %
Air Pressure : 1005.9 mbar

Date of Received : 03 August 2023

Date of Calibration : 16 August 2023

Date of Issue : 16 August 2023

Calibrated by : Wuttichai Swatphong

Calibration Method : In-house method CAL-M2101 based on OIML R 111-1 : 2004(E)

Reference Standard Instruments : This certification is traceable to the International System of Units

Standard Weights

| ID No. | Cert. No. | Due Date | Traceability |
|------------|------------|-------------|--|
| E221-E2210 | MM-0042-22 | 21 Mar 2025 | National Institute of Metrology (Thailand), (NIMT) |

Approved by :



(Surachai Promthong)

Laboratory Manager

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Certificate of Calibration

Certificate No. : 66-210415-2

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

| No. | Nominal Value | Id.Mark | Conventional mass Value | | Measuring Uncertainty |
|-----|---------------|---------|-------------------------|----------|-----------------------|
| 1 | 100 g | none | 100 g | -0.20 mg | \pm 0.11 mg |

This result of calibration was found accurate as shown on date and place of calibration only.

This 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%

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CAL

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Certificate of Calibration

Certificate No. : 66-210415-3

Page : 1 of 2

Submitted by : Special Lab Envi And Consultant Co, Ltd.
47/91-93,96 Moo 3, Tambol Tha - It, Pakkret, Nonthaburi 11120

Equipment : Weight

Manufacturer : LS

Material : Stainless Steel

Weight size : 200 g

ID No. : LB-Eq-036

Assumed density of weight : 7950 kg / m³

Assumed Air density : 1.2 kg / m³

Environment : Ambient Temperature : (20 ± 2) °C

Relative Humidity : (50 ± 10) %

Air Pressure : 1005.9 mbar

Date of Received : 03 August 2023

Date of Calibration : 16 August 2023

Date of Issue : 16 August 2023

Calibrated by : Wuttichai Swatphong

Calibration Method : In-house method CAL-M2101 based on OIML R 111-1 : 2004(E)

Reference Standard Instruments : This certification is traceable to the International System of Units

Standard Weights

| ID No. | Cert. No. | Due Date | Traceability |
|------------|------------|-------------|--|
| E221-E2210 | MM-0042-22 | 21 Mar 2025 | National Institute of Metrology (Thailand), (NIMT) |

Approved by :



(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-210415-3

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

| No. | Nominal Value | Id.Mark | Conventional mass Value | | Measuring Uncertainty |
|-----|---------------|---------|-------------------------|----------|-----------------------|
| 1 | 200 g | none | 200 g | +0.11 mg | \pm 0.17 mg |

This result of calibration was found accurate as shown on date and place of calibration only.

This 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%

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CAL

1721



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Certificate of Calibration

Certificate No. : 66-300471-1

Page : 1 of 2

Submitted by : Special Lab Envi and Consultant Co., Ltd.

47/91-93,96 Moo 3, Tambol Tha-It, Pakkret, Nonthaburi 11120

Equipment : Piston Pipette

Manufacturer : sartorius

Model : N/A

Serial No. : 4541601431

ID No. : LB-Eg-045

Capacity : 100 μ l to 1000 μ l Resolution : 5 μ lEnvironment : Ambient Temperature : (20 \pm 3) $^{\circ}$ CRelative Humidity : (55 \pm 10) %

Air Pressure : (1007.6 to 1007.7) mbar.

Date of Received : 03 August 2023

Date of Calibration : 07 August 2023

Date of Issue : 07 August 2023

Calibrated by : Areerat Sombun

Calibration Method : In-house method CAL-M3002 base on ISO 8655-6 : 2002-09

Reference Standard Instruments : This certification is traceable to the International System of Units

Electronic Balance

| ID No. | Cert. No. | Due Date | Traceability |
|--------|-------------|-------------|---|
| 241005 | 66-200196-4 | 02 Dec 2023 | National Institute of Metrology (Thailand) (NIMT) |

Approved by :

(Wipa Tovadee)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-300471-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

| Test Volume (μl) | Measuring Volume at 20 ^o C (μl) | Systematic error (e_s %) | Coeff. of Variation (CV%) | Uncertainty ($\pm \mu\text{l}$) |
|----------------------------------|--|--------------------------------|------------------------------|--------------------------------------|
| 100 | 97.92 | 0.21 | 0.15 | 0.69 |
| 500 | 496.58 | 0.34 | 0.04 | 0.69 |
| 1000 | 997.55 | 0.24 | 0.01 | 0.69 |

e_s : Systematic error (%)

CV : Coefficient of variation (%)

UUC Calibrated by : Blue Tip

This result of calibration was found accurate as shown on date and place of calibration only.

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.00$, providing a level of confidence of approximately 95%

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