
เอกสารสอบเทียบเครื่องมือที่ใช้ในการวิเคราะห์



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & 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
(25 ± 2.5) °C
(50 ± 15) %
Ambient Temperature :
Relative Humidity :
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 Lernagatrakul

Approved by : 
Approved Signatory

(✓) Sathip Meangmai
() Warakorn Lernagatrakul
() 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 : -
Instrument **Serial No.** **ID No.** **Cert. No.** **Due Date**
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

Buffer Solution	Manufacturer	Lot No.	Exp. date
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	Coverage factor
	pH	mV	mV	pH	(±mV)	k
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 Buffer Solution	Actual pH Reading	Actual mV Reading	Uncertainty of pH measurement	Coverage factor
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 %.

-o0o-

Sathip

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



NSC-TS17817223
CALIBRATION 1998

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

() Ponthippa 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
Condition As-Received : New Item
Reference : 2308-0115WN-2

Cert. No.: 23LM132
Page.: 2 of 2

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPT) 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 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

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
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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a 1175376

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-I, 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 ± 2) °C

Relative Humidity : (50 ± 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

The Uncertainties are for a confidence probability of approximately 95%

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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

Remarks

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%

- odo -






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, Pakkred, 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 ± (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

0.0000

g



Repeatability

Load test

:

200

g

Sidev.

:

0.00005

g

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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 : Chorip 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 Mastr)

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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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 : Walaiak Sirithean

Approved by : 
Approved Signatory

(/) Malee Bulkrua
(/) Sathip Meangmai
(/) Warakorn Lemgagrakul

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).

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1) Burette	-	130BU10	21CG1389	25 Mar 2023
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.: 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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a 1148751



Certificate of Calibration

Certificate No. : 66-400220-1

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 : PKU 1800

Range : N/A °C

Resolution : 0.1 °C

Serial No. : 0925481-19

ID No. : LB-Eq-005

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 : 24 April 2023

Date of Calibration : 24 April 2023

Date of Issue : 26 April 2023

Calibrated by : Permporn Chianpu

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.

Traceability


400046 & 400047 66-400066-2

National Institute of Metrology Thailand (NIMT)

Due Date

03 Aug 2023

The Uncertainties are for a confidence probability of approximately 95%
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Approved by : 
(Bunjerd Masri)
Supervisor



Certificate of Calibration

Certificate No. : 66-400220-1

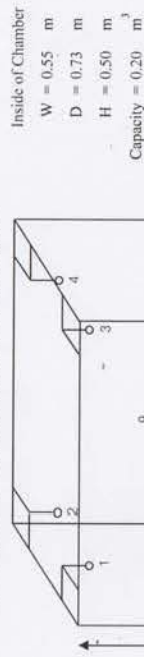
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



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	
30.0	30.0	30.0	30.30	30.42	30.25	30.34	30.43	30.48	30.30	30.44	30.01	0.31
35.0	35.0	35.0	35.06	35.48	34.86	35.50	35.46	35.52	35.04	35.51	35.06	0.32
37.0	37.0	37.0	37.08	37.47	36.92	37.48	37.45	37.56	37.06	37.56	37.05	0.33

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
30.0	30.0	30.0	0.48	0.04	0.5
35.0	35.0	35.0	0.49	0.05	0.7
37.0	37.0	37.0	0.57	0.06	0.7

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%

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Thermology Co., Ltd.

96/177-96/178 Moo 6, T. La-harn, A. Bangbua Thong, Nonthaburi 11110
Tel. 0 2191 6479 Fax : 0 2191 6480 website : www.thermology.co



CALIBRATION CERTIFICATE

Date of Issue
Site Calibration

Jun 23, 2023

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

Cert No. 23/2342
Order No. 23060302

Place of Calibration

1350, 1352 Suthisarnwinitchai 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.

Page 1 of 4

This certificate is issued in accordance with the conditions of Thermology Laboratory. The traceability to recognised national standard and the unit of measurement realised at corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of laboratory.

DN



Thermology Co., Ltd.

96/177-96/178 Moo 6, T. La-harn, A. Bangbua Thong, Nonthaburi 11110
Tel. 0 2191 6479 Fax : 0 2191 6480 website : www.thermology.co



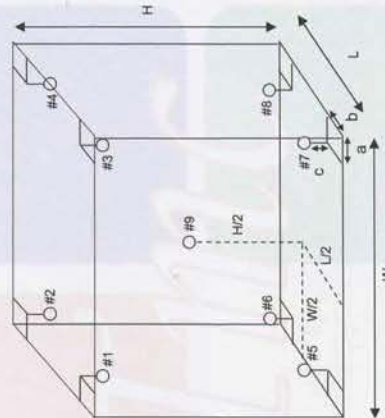
CALIBRATION CERTIFICATE

Date of Issue
Site Calibration

Jun 23, 2023

Cert No. 23/2342
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.

Page 2 of 4

DN



Thermology Co., Ltd.

96/177-96/178 Moo 6, T. La-harn, A. Bangpuathong, Nonthaburi 11110
Tel : 0 2191 6479 Fax : 0 2191 6480 website : www.thermology.co



CALIBRATION CERTIFICATE

Date of Issue Jun 23, 2023
Site Calibration

Cert No. 23/2342
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			

Page 3 of 4

D.M.



Thermology Co., Ltd.

96/177-96/178 Moo 6, T. La-harn, A. Bangpuathong, Nonthaburi 11110
Tel : 0 2191 6479 Fax : 0 2191 6480 website : www.thermology.co



CALIBRATION CERTIFICATE

Date of Issue Jun 23, 2023
Site Calibration

Cert No. 23/2342
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 : D.M.

- [] MR. PRAJUCKETCH THONGSOOKCHOTE
[x] MR. DAMRONG Mulsing
[] MR. JATURAPAT THONGSOOKCHOTE

Page 4 of 4

Certificate of Calibration

Certificate No. : 66-400220-3

Page : 1 of 2

Submitted by :

Special Lab Envi and Consultant Co., Ltd.

47/91 Moo 3 Thambol Tha-it, Pakkret, Nonthaburi 11120

Equipment :

Water Bath

Manufacturer : Memmert

Model : WNB22

Range : N/A °C

Resolution : 0.1 °C

Serial No. : L520.0201

ID No. : LB-Eq-041

Environment :

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

Ambient Temperature : (34.0 to 35.0) °C

Relative Humidity : (44 to 48) %

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 :

This instrument was calibrated by In-house method CAL-M4006 based on ASTM E715-80

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 & 400024

66-400184-2

06 Oct 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. : 66-400220-3

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement



Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.					Uncertainty (± °C)	Measured Uniformity (°C)	Measured Stability (°C)
			1	2	3	4	5			
62.0	62.0	62.0	61.87	61.87	61.86	61.85	61.85	0.18	0.07	0.05
85.0	85.0	85.0	84.87	84.91	84.90	84.87	84.86	0.18	0.12	0.06
95.0	95.0	95.0	95.08	95.07	95.08	95.07	95.08	0.18	0.04	0.03
100.0	CCC	101.0	100.87	100.97	101.15	100.80	100.77	0.21	0.45	0.06

Remark: The uncertainty is not combine uniformity of the water bath

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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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



NSC-TS-175 1925
CALIBRATION 1931

Certificate No. : CAL-23-555

Page : 1 of 3

CERTIFICATE OF CALIBRATION

Equipment : Spectrophotometer
Manufacturer : Merck
Model : Prove 100
Serial No. : 1809112938
ID No. : LB-Eq-031
Customer : Special Lab Envi And Consultant Co., Ltd.
: 47/91-93 Moo 3, Tambol Tail,
: Amphur Pakrad, Nonthaburi, 11120.
Location : Becthai Laboratory (Nakorn Pathom)
Date of Receipt : 11 August 2023
Date of Calibration : 11 August 2023
Date of Issue : 11 August 2023
Ambient Temperature : (25±10) °C
Relative Humidity : (60±20) %
Condition As-Received : Used Item

Calibrated by

Nopparat

(Ms. Nopparat Suntaratayan)

Calibration Engineer

Approved by

Anusit Boonmee

(Mr. Anusit Boonmee)

Calibration Engineer

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.

ISSUE: 5 REV:4

FM-CAL-33/2

15/05/61



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CALIBRATION LABORATORY

300 Phaholyothin Road, Phayathai, Bangkok 10400, Thailand Tel: +66 2615-2929 Fax: +66 2615-2350-1
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NSC-TS-175 1925
CALIBRATION 1931

Certificate No. : CAL-23-555

Page : 2 of 3

CALIBRATION REPORT

Conditions of this result of calibration

1. Reference Standard Material :

Material	Model	Serial No.	Cert No.	Due date
Holmium Glass Filter	RM-HG	12705	98236	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 Siama 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 :	4	nm
Data Interval :	1	nm
Scan Speed :	N/A	nm/min

ISSUE: 5 REV:4

FM-CAL-33/2

15/05/61

Anusit Boonmee



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300 Phaholyothin Road, Phayathai, Bangkok 10400, Thailand Tel: +66 2615-2929 Fax: +66 2615-2350-1
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Certificate No. : CAL-23-555

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)
418.48	418.48	418	-0.48	0.59
536.90	536.90	537	0.10	0.59
637.94	637.94	638	0.06	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	0.575	0.0034	0.0044
	0.7358	0.737	0.0012	0.0040
	1.0713	1.074	0.0027	0.0039
440.0	Zero	0.000	0.0000	0.0028
	0.561	0.564	0.0030	0.0042
	0.718	0.721	0.0030	0.0037
	1.0459	1.049	0.0031	0.0037
465.0	Zero	0.000	0.0000	0.0028
	0.5111	0.514	0.0029	0.0044
	0.6618	0.664	0.0022	0.0035
	0.9635	0.964	0.0005	0.0034
546.1 (546.0)	Zero	0.000	0.0000	0.0028
	0.5222	0.523	0.0008	0.0036
	0.6687	0.670	0.0013	0.0031
	0.9768	0.977	0.0002	0.0043
590.0	Zero	0.000	0.0000	0.0028
	0.5541	0.554	-0.0001	0.0035
	0.6975	0.697	-0.0005	0.0032
	1.0206	1.020	-0.0006	0.0045
635.0	Zero	0.000	0.0000	0.0028
	0.5398	0.540	0.0002	0.0035
	0.6658	0.665	-0.0008	0.0034
	0.9741	0.974	-0.0001	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 -

ISSUE: 5 REV:4

FM-CAL-33/2

15/05/61



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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 \pm 10) °C
Relative Humidity	: (60 \pm 20) %
Condition As-Received	: Used Item

Calibrated by


(Mr. Somphop Duanguan)
Calibration Engineer

Approved by


(Ms. Jintana Sangthajaroentap)
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.

ISSUE: 5 REV:4

FM-CAL-33/2

15/05/61



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CALIBRATION LABORATORY

300 Phaholyothin Road, Phayathai, Bangkok 10400, Thailand Tel: +66 2615-2929 Fax: +66 2615-2350-1
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Certificate No. : CAL-23-297

Page : 2 of 3

CALIBRATION REPORT

Conditions of this result of calibration

1. Reference Standard Material :

Material	Model	Serial No.	Cert.No.	Due date
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

ISSUE: 5 REV:4

FM-CAL-33/2

15/05/61

Signature



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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 -

ISSUE: 5 REV:4

FM-CAL-33/2

15/05/61

Signature

Certificate of Calibration

Certificate No. : 66-400240-1

Page : 1 of 2

Submitted by :

Special Lab Envi and Consultant Co., Ltd.

47/91-93 Moo 3, Tambol Tha-I, 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 : Permpon 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

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-400240-1

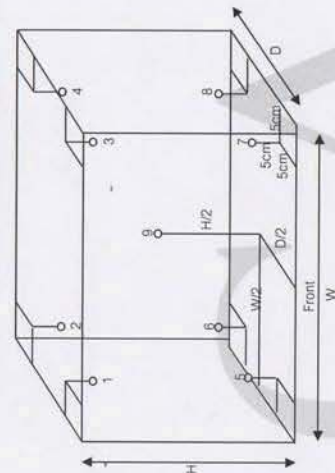
Page : 2 of 2

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
			Measured Uniformity (°C)		Measured Stability (°C)		Overall Variation (°C)					
			3		3		1.17		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%

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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-Ir, Pakkret, Nonthaburi 11120

Equipment

: Piston Pipette

Manufacturer : sartorius

Model : N/A

Serial No. : 4541601431

ID No. : LB-Eg-045

Capacity : 100 µl to 1000 µl Resolution : 5 µl

Environment

: Ambient Temperature : (20 ± 3) °C

Relative Humidity : (55 ± 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. 241005

Certi. No. 66-200196-4

Due Date 02 Dec 2023

Traceability

National Institute of Metrology (Thailand) (NIMT)

Approved by :

(Wipa Towadee)

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 °C (µl)	Systematic error (e _s %)	Coeff. of Variation (CV%)	Uncertainty (± µl)
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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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-Ii, Pakkret, Nonthaburi 11120

Equipment : Buret

Manufacturer : Witteg

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 Towadee)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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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 ± 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%

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