

ภาคผนวก จ

เอกสารสอบเทียบ



Certificate No.: T/O 640120

Date of issue : 5-Oct-2021

Equipment Description : Refrigerator
Equipment Model : P1010
Equipment Serial No. : P1010-1020-0005
I.D. No. or Control No. : -
Manufacturer : Entech Industrial Solution Co.,Ltd.
Customer Name : TNP ENVIRONMENT CO.,LTD.
Customer Address : 332/173 Moo 3 Tambon Bang Rak Phatthana, Amphoe Bang Bua Thong,
Nonthaburi 11110
Total pages of certificate : 2 pages
Instrument Receiving Date : 5-Oct-2021
Receiving No. : O-210132
Environmental Conditions : All of the measurement were carried out in the working area
Temperature : (25 ± 15) °C
Humidity : (55 ± 30) % RH
Voltage : (220 ± 22) VAC
Calibration Place : 332/173 Moo 3 Tambon Bang Rak Phatthana, Amphoe Bang Bua Thong,
Nonthaburi 11110
Calibration Procedure No. : WI-CL-18-C

The calibration certificate expended uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k , which for a normal distribution corresponds to a coverage probability of approximately 95%

*The standard uncertainty of measurement has been determined in accordance with M 3003
The expression uncertainty and confidence in measurement.*

This certificate is applied only to item under test environmental condition.

*This calibration certificate may not be reproduced other than in full except with the permission of the issuing laboratory.
Calibration certificates without signature and seal are not valid.*

This calibration certificate documents are traceability to national standards, which realize the unit of measurement according to the International system of units (SI).

Date of Calibration : 5-Oct-2021



Mr. Kittipong Kaewsai
Calibration Engineer



Ms. Nongluck Wongsettee
Technical Manager

Certificate No. : T/O 640120

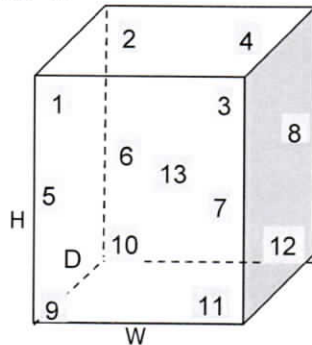
The Reference Standard Instrument :-

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert No.</u>
1) Data logger with RTD Probe	Agilent 34972A	MY49017365	PSL-T 0688-1/64

Measured room conditions

Temperature :	Minimum: 31.3 °C	Maximum: 33.4 °C
Humidity :	Minimum: 56.8 %RH	Maximum: 60.5 %RH
Voltage :	Minimum: 219.7 VAC	Maximum: 223.4 VAC
Fresh Air Setting:	off	

Sensor Position :



Working Space of chamber :

(Inside Dimensions) W x D x H : 1560 mm x 500 mm x 1380 mm

Sensor Installation Details :

- Sensor Number 1 to 12 installed approximately 50 mm From each wall.
- Sensor Number 13 installed approximately geometric of the chamber.

Results : The measurement results of the calibration were reported in the table below.

(*) Without adjustment

() After adjustment

UUC* Setting	UUC* Reading	Temperature Reading of Standard Sensor								
(°C)	(°C)	Sensor Position								
4.0	4.0	1	2	3	4	5	6	7	8	9
		4.13	4.12	3.97	4.05	4.35	4.22	4.26	4.28	3.97
		Sensor Position								
		10	11	12	13					
		4.23	4.28	4.38	3.96					

UUC* Setting	UUC* Reading	Temperature Uniformity	Temperature Stability	Overall Variation	Uncertainty of Measurement	Coverage Factor
(°C)	(°C)	(°C)	(± °C)	(°C)	(± °C)	K
4.0	4.0	0.88	0.83	1.79	1.1	2

UUC* = Unit Under Calibration

Remark :-

- Temperature reading of Standard Sensors shown in the table were taken from the average of Standard reading at each position.
- Temperature Uniformity was calculated from the difference between the maximum and minimum of actual temperature reading from all reference sensors at the same time.
- Temperature Stability was calculated from the maximum stability of nine positions, and formula of Stability is [(Maximum Temperature Value - Minimum Temperature Value) / 2]
- Overall Variation was calculated from the difference between the maximum and minimum measured temperature throughout observation time.

End of Report

CERT.No.: HS-T031D

Certificate of Calibration

Calibration Date : 22 Apr 22

Submitted by : PINTHONG UTILITIES COMPANY LIMITED

789 Moo1 Nong koh-Laen Chabang Rd,

Nong-kham Sriracha Chonburi Thailand 20230

Avg Room Temp : 20 °C

Avg Water Temp : 20 °C

Air Pressure : 757.00 mmHg

Salinity : 0 ppt

Model : YSI 4010-2W

S/N : 22051520

Probe : YSI 4100

S/N : 22C102711

ID NO. : -

Air Temp ref : S/N. E00522

Barometric ref : S/N. E00522

Water Temp ref : S/N. 11431

Technician : Kittipong M.

Calibration Details

Calibration Point	100% air sat. (@20 °C, DO = 9.09 mg/l)	(status)	(status)
Measurement 1 (mg/l)	9.05	(PASS)	-
Measurement 2 (mg/l)	9.05	(PASS)	-
Measurement 3 (mg/l)	9.05	(PASS)	-
Measurement 4 (mg/l)	9.03	(PASS)	-
Measurement 5 (mg/l)	9.03	(PASS)	-
Measurement 6 (mg/l)	9.01	(PASS)	-
Measurement 7 (mg/l)	9.01	(PASS)	-
Measurement 8 (mg/l)	9.00	(PASS)	-
Measurement 9 (mg/l)	9.00	(PASS)	-
Measurement 10 (mg/l)	9.01	(PASS)	-

Mean Measurement	9.02	mg/l	-	-
Inaccuracy	0.07	mg/l	-	-

Overall Status (PASS)

Manufacturer Specification

Accuracy = +/- 0.2 mg/l

- 1) This certificate is issued based on the result that are found as shown on date and place of test only.
- 2) The calibration procedure followed in accordance with Harikul Science Co., Ltd.
- 3) This result shall not be used for advertising purpose.



Technician Signature



Laboratory Manager

Calibration Certificate

Cert. No. : CT-22-01-22708

Page : 1 of 4

Issued date : 27 January 2022

Equipment : Water Bath , Manufacturer : MLAB , Model : WBN30
S/N = 0347 , Customer ID = TNP LAB.10

Client : TNP ENVIRONMENT CO.,LTD.
332/173 Moo 3 Bang Rak Phatthana, Bang Bua Thong, Nonthaburi 11110

Received Date : 24 January 2022

Ref. Job No. : SO6501-00045

Calibrated by : Mr.Pramot Srisukum

Cert. prepare by : Ms.Nattanicha Panumram

Calibrated Date : 24 January 2022

Approved by : Mr.Montree Ruschasetkul

Calibration Place : ห้องปฏิบัติการ2

Environment Condition : Temperature 25.9 ± 0.8 (°c) , Humidity 43.5 ± 9.5 (%RH)

Calibration Method : In-house method based on ASTM E715-80 (Reapproved 2006) , (MTEC WI No. # WICAL-02-003-R01)

Reference Standard Instrument :

No	Instrument	code	Model	Due date
1	Temperature Data Logger	MTEC-CE-0175	MLAB	10/2021
2	Thermo Hygrometer	MTEC-CE-0173	TH-03A	06/2022

Condition of certificate :

(1) This certificate is traceable to International System of units (SI Units). , (2) This certificate was certified only for the instrument we calibrated. , (3) This result of calibration was found accurate as show on date and place of calibration only. , (4) The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k =$ (see result table) , providing a level of confidence of approximately 95%. , (5) This certificate may not be reproduced other than in full, except with the prior written approval of the head of Calibration Division, Metrology Technical Co.,Ltd.



Approved Signatory

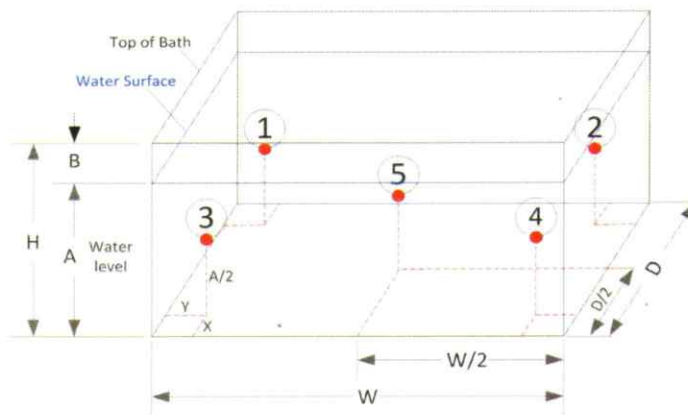
Certificate No. : CT-22-01-22708

Calibration Result :

Page : 2 of 4

Condition of UUC :

- 1) Adjust Condition : Without Adjustment
- 2) Lid Cover : Flat Sheet (Plastic , from
- 3) Circulation : without circulation
- 4) X ,Y = 5 cm. , B ~ 3 cm.



Pic 1 : Position of each sensor No.

(1) The quoted uncertainty include with " Stability".

(2) Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors , for at least half an hour after reaching sted state.

(3) Uniformity = The maximum difference of measured temperatures at two any sensor which are observed at the same time.

(4) Overall variation = The difference of the maximum and the minimum measured temperature throughtout observation time.

Section 1 : Report of Temperature distribution

Unit : (°c)

Calibration Point	UUC Setting (*)	UUC Reading (*)	Measured Temperature @ Sensor No.					Uncertainty (±)	k (**)
			#1	#2	#3	#4	#5		
85	85	85.0	85.22	85.26	85.17	85.16	85.28	0.370	2

(*) = The average of 30 values in each point , (**) = Coverage factor (k) value

Section 2 : Report of Chamber Performance

Unit : (°c)

Calibration Point	UUC Setting (*)	UUC Reading (*)	Temperature Uniformity	Temperature Stability (± °c)	Temperature Overall Variation
85	85	85.0	0.34	0.10	0.37

(*) = The average of 30 values in each point

Approved Signatory : 

Certificate No. : CT-22-01-22708

Page : 3 of 4

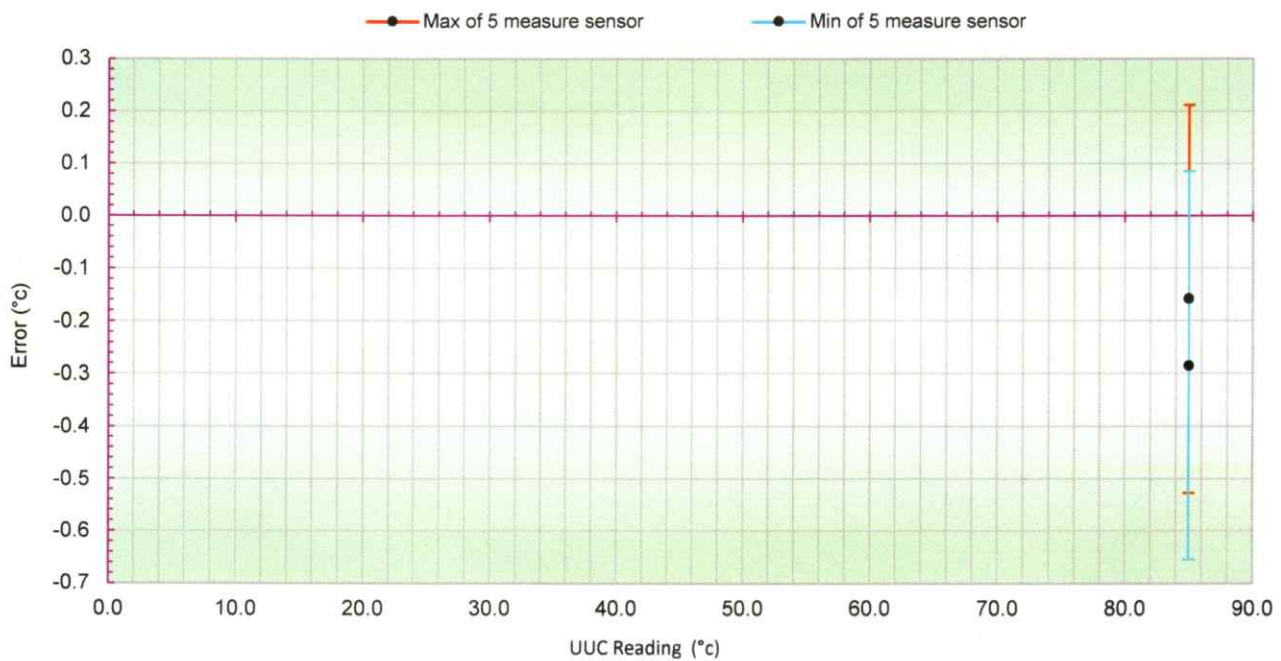
Section 3 : Possible of temperature in chamber. Show minimum and maximum of the average values and Include with uncertainty of measurement. , The average values is average of each position standard sensor throughout observation time.

Unit : (°C)

Calibration Point	UUC Setting (*)	UUC Reading (*)	Possible of Minimum temperature in chamber	Possible Maximum temperature in chamber
85	85	85.0	84.79	85.65

(*) = The average of 30 values in each point

Section 4 : Trend of accuracy



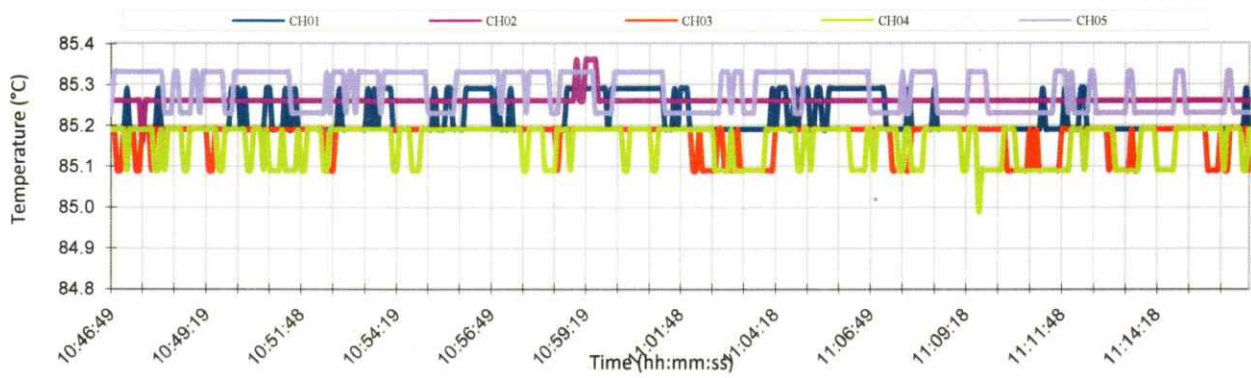
Approved Signatory : 

Certificate No. : CT-22-01-22708

Page : 4 of 4

Section 5 : Graph report for Temperature distribution , not include uncertainty of measurement

(5.1) Temperature Distribution at UUC Reading 85.0 °C



Approved Signatory :

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Customer Name : TNP ENVIRONMENT CO.,LTD.
Customer Address : 332/173 Moo 3 Tambon Bang Rak Phatthana, Amphoe Bang Bua Thong,
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Total pages of certificate : 2 pages
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Mr. Kittipong Kaewsai
Calibration Engineer



Ms. Nongluck Wongsettee
Technical Manager

Certificate No. : T/O 640120

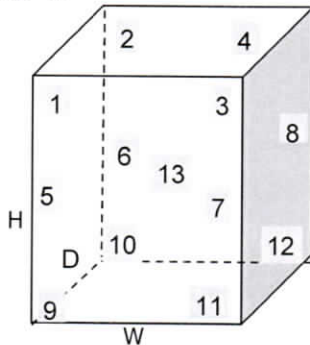
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<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert No.</u>
1) Data logger with RTD Probe	Agilent 34972A	MY49017365	PSL-T 0688-1/64

Measured room conditions

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Humidity :	Minimum: 56.8 %RH	Maximum: 60.5 %RH
Voltage :	Minimum: 219.7 VAC	Maximum: 223.4 VAC
Fresh Air Setting:	off	

Sensor Position :



Working Space of chamber :

(Inside Dimensions) W x D x H : 1560 mm x 500 mm x 1380 mm

Sensor Installation Details :

- Sensor Number 1 to 12 installed approximately 50 mm From each wall.
- Sensor Number 13 installed approximately geometric of the chamber.

Results : The measurement results of the calibration were reported in the table below.
(*) Without adjustment () After adjustment

UUC* Setting	UUC* Reading	Temperature Reading of Standard Sensor								
(°C)	(°C)	Sensor Position								
4.0	4.0	1	2	3	4	5	6	7	8	9
		4.13	4.12	3.97	4.05	4.35	4.22	4.26	4.28	3.97
		Sensor Position								
		10	11	12	13					
		4.23	4.28	4.38	3.96					

UUC* Setting	UUC* Reading	Temperature Uniformity	Temperature Stability	Overall Variation	Uncertainty of Measurement	Coverage Factor
(°C)	(°C)	(°C)	(± °C)	(°C)	(± °C)	K
4.0	4.0	0.88	0.83	1.79	1.1	2

UUC* = Unit Under Calibration

Remark :-

- Temperature reading of Standard Sensors shown in the table were taken from the average of Standard reading at each position.
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- Overall Variation was calculated from the difference between the maximum and minimum measured temperature throughout observation time.

End of Report



Certificate of Calibration

Page : 1 of 3

332/173 Moo.3, Bang Rak Phatthana, Bang Bua Thong, Nonthaburi
11110

ID. Number : TNP.LAB.02

Date of Issue : 25 Sep 2021

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Authorized Signatory



Calibration Report

Certificate Number : SPR21090365-2

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Standard pH Solution	PH016.L5	Lot No.734191	61218918	07 Mar 2022
Standard pH Solution	PH107.L5	Lot No.743070	61220744	29 Apr 2022
Standard pH Solution	PH020.L5	Lot No.734193	61214484	07 Mar 2022

Traceability

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

C.P.A. Chem - ANAB#AT-1836 (ISO/IEC 17025:2017) and ANAB#AR-1835 (ISO/IEC 17034:2016)



Result of Calibration

Certificate No. : SPR21090365-2

Page : 3 of 3

Range : 0 to 14 pH

Resolution : 0.01 pH

pH Measurement @ 25 °C

Unit : pH

Standard Solution	UUC Reading	Error	Uncertainty (±)
4.008	4.01	0.002	0.012
6.984	6.99	0.006	0.012
10.011	10.02	0.009	0.013

Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

– End of Certificate –



Certificate of Calibration

Certificate Number : SPR21090365-2

Page : 1 of 3

Customer : TNP ENVIRONMENT CO.,LTD.

332/173 Moo.3, Bang Rak Phatthana, Bang Bua Thong, Nonthaburi
11110

Equipment Name : pH Meter

Manufacturer : Horiba

Model : LAQUA-PH1100

Serial Number : B80A0042

ID. Number : TNP.LAB.02

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$

Relative Humidity : $50\% \pm 15\%$

Location of Calibration : In-Lab

Calibration Procedure : SP-CPC-04-01

Received Date : 23 Sep 2021

Calibration Date : 24 Sep 2021

Recommend Due Date : 24 Sep 2022

Date of Issue : 25 Sep 2021

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Kijja Visitsilp

Calibration Officer

Approved by :

(Mr.Worapong Sinthusopa)

Authorized Signatory



Calibration Report

Certificate Number : SPR21090365-2

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Standard pH Solution	PH016.L5	Lot No.734191	61218918	07 Mar 2022
Standard pH Solution	PH107.L5	Lot No.743070	61220744	29 Apr 2022
Standard pH Solution	PH020.L5	Lot No.734193	61214484	07 Mar 2022

Traceability

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

C.P.A. Chem - ANAB#AT-1836 (ISO/IEC 17025:2017) and ANAB#AR-1835 (ISO/IEC 17034:2016)



Result of Calibration

Certificate No. : SPR21090365-2

Page : 3 of 3

Range : 0 to 14 pH

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pH Measurement @ 25 °C

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4.008	4.01	0.002	0.012
6.984	6.99	0.006	0.012
10.011	10.02	0.009	0.013

Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

– End of Certificate –

Certificate of Calibration

Certificate No. : 65-420007-1

Page : 1 of 2

Submitted by : TNP Environment Co.,Ltd.

332/173 Moo 3 Bang Rak Phatthana, Bang Bua Thong, Nonthaburi 11110

Equipment : pH Meter (Pocket)

pH meter

Manufacturer : Adwa

Model : AD 12

Range : -2.00 to 16.00 pH

Resolution : 0.01 pH

Serial No. : 1328

ID No. : TNP-LAB-13-2564

Environment : Ambient Temperature : $(25 \pm 2) ^\circ \text{C}$

Relative Humidity : $(50 \pm 15) \%$

Date of Received : 01 February 2022

Date of Calibration : 02 February 2022

Date of Issue : 02 February 2022


Calibrated by : Bunjerd Masri

Calibration Method : In-house method CAL-M4201 direct measurement by using certified reference material (CRM)

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

Standard Buffer Solution

pH	Cert. No.	Lot No.	Exp. Date	Traceability
4.004	61218215	769926	15 May 2022	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.985	61223875	769927	15 May 2022	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
9.963	61208865	769928	15 May 2022	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by : 
(Bunjerd Masri)

Supervisor

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 Calibratech Co.,Ltd.



Certificate of Calibration

Certificate No. : 65-420007-1

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : pH meter with electrode

Performing a three - buffer standard curve using buffer nominal pH (4,7,10)

Adjustment Curve at nominal pH	Standard Buffer (pH)	UUC Reading (pH)	Correction (pH)	Uncertainty (\pm pH)
4, 7	4.004	4.00	0.00	0.011
	6.985	7.00	-0.01	0.012
7,10	6.985	7.00	-0.01	0.012
	9.963	10.00	-0.04	0.015

Remark

1 UUC : Unit Under Calibration

2 pH meter does not have voltage mode because the plug can not BNC socket

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

This reported uncertainty of measurment 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. : 64-400613-1

Page : 1 of 2

Submitted by : TNP Environment Co., Ltd.
332/173 Moo 3 Bang Rak Phatthana, Bang Bua Thong, Nonthaburi 11110

Equipment : Air Chamber (Oven)
Manufacturer : Memmert Model : UF75
Range : N/A °C Resolution : 0.1 °C
Serial No. : B320.0251 ID No. : N/A

Environment : On site calibration was carried out at the Laboratory, TNP Environment Co., Ltd.
Ambient Temperature : (28.0 to 29.0) °C
Relative Humidity : (45 to 50) %
Line Voltage : (228.0 to 230.0) V

Date of Received : 11 December 2021

Date of Calibration : 11 December 2021


Date of Issue : 17 December 2021

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 Thermocouple probe

ID No.	Cert. No.	Due Date	Traceability
400029 & 400032	64-400589-1	25 May 2022	National Institute of Metrology Thailand (NIMT)

Approved by : 
(Bunjerd Masri)
Supervisor

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 Calibratech Co.,Ltd.



Certificate of Calibration

Certificate No. : 64-400613-1

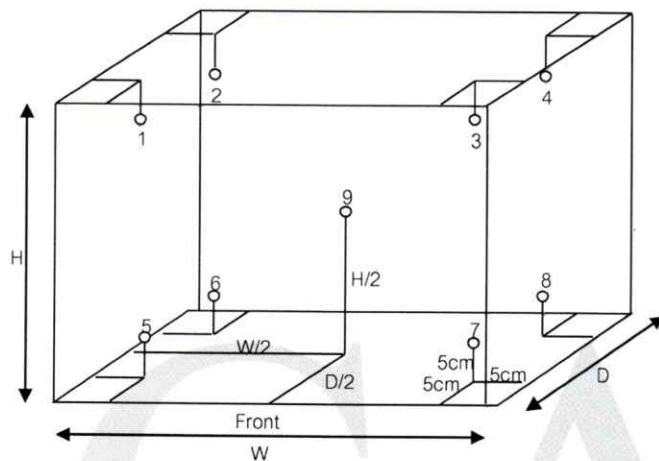
Page : 2 of 2

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 = 0.40 m

D = 0.33 m

H = 0.56 m

Capacity = 0.07 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	
104.0	104.0	104.0	103.7	104.1	104.1	104.1	104.1	103.8	103.7	103.8	104.1	0.70
180.0	180.0	180.0	179.0	179.7	179.8	180.0	180.3	179.6	179.2	179.8	180.4	0.95

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
104.0	104.0	104.0	0.7	0.1	0.7
180.0	180.0	180.0	1.7	0.2	1.7

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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Signature





MCL
Microtech Calibration laboratory



NSC-TISI-TIS 17025
CALIBRATION 0228

53/154 Moo 2, Semafahkarm Road, Tumbon Khukhot, Amphur Lamlukka, Pathumthani 12130

53/154 หมู่ 2 ถนนเสมาฟ้าคราม ตำบลลูกคต อำเภอลำลูกกา จังหวัดปทุมธานี 12130

Tel. 02-9877200 Fax. 02-9877205

Certificate No. : M22 - 1588A

Page : 1 of 4

Certificate of Calibration

Customer : TNP ENVIRONMENT CO.,LTD.
Address : 332/173 Moo 3 Bang Rak Phatthana, Bang Bua Thong, Nonthaburi 11111

Description of Equipment : Electronic Balance
Manufacturer : Shimadzu
Model : AP225WD
Serial Number : D316301848
ID. / Control Number : TNP.LAB.30
Made In : Philippines
Location : On - Site
Environmental Conditions : Temperature (25 +/- 10) °C
Humidity (50 +/- 25) % RH
Atmospheric Pressure (1010 +/- 10) mbar
Calibration Date : APR 18, 2022
Issue Date : APR 20, 2022

Uncertainty of Measurement

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor of $k = 2$. It has been evaluated according to the "Expression of the Uncertainty of Measurement in Calibration (M3003)" which provides a level of confidence approximately 95%.

Calibrated by : Sarawut Khrueapan

Approved by : 

(Precha Pavachot)

Laboratory Manager

Certificate of Calibration

Description : Electronic Balance	Serial Number : D316301848	Resolution : 0.0001,0.00001 g
Manufacturer : Shimadzu	ID. /Control Number : TNP.LAB.30	Order No. : 1398 - 22
Model : AP225WD	Made In : Philippines	Received Date : APR 18, 2022
Unit : g	Capacity : 220 g	Calibration Date : APR 18, 2022

Result of Calibration : Without Adjustment **Resolution** : 0.0001,0.00001 g
Range : 200 g

2. Departure From Nominal Value

Nominal Value g	UUC* Reading g	UUC* Error g	Uncertainty of Measurement +/- g
0	0.00000	0.00000	0.00013
0.1	0.10003	0.00003	0.00013
0.2	0.20002	0.00002	0.00022
0.5	0.50002	0.00002	0.00043
1	1.00002	0.00002	0.00043
2	2.00005	0.00005	0.00043
5	5.00007	0.00007	0.00068
10	10.00006	0.00006	0.00068
20	20.00003	0.00003	0.00068
50	49.99997	-0.00003	0.00068
100	99.99999	-0.00001	0.00068
200	199.9999	-0.0001	0.00068

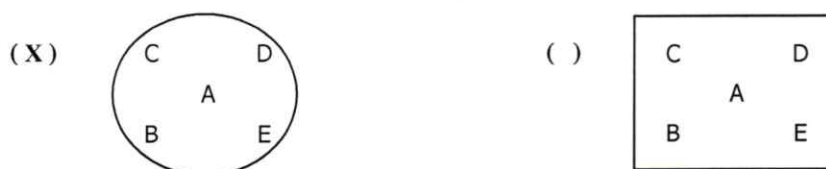
UUC* = Unit Under Calibration

Certificate of Calibration

Description : Electronic Balance	Serial Number : D316301848	Resolution :
Manufacturer : Shimadzu	ID. /Control Number : TNP.LAB.30	Order No. : 1398 - 22
Model : AP225WD	Made In : Philippines	Received Date : APR 18, 2022
Unit : g	Capacity : 220 g	Calibration Date : APR 18, 2022

Result of Calibration : Without Adjustment **Resolution** : 0.0001, 0.00001 g

Range : 200 g

3. Effect of Center Loading


Nominal Load g	UUC* Reading					Maximum Difference g
	A g	B g	C g	D g	E g	
50	49.99997	49.99997	49.99995	49.99996	49.99996	0.00002

A Mass of 50 g Was Placed to Various Position on The Pan.

The Weighing Machine Reading Error Obtained Is Given In Table

4. Effect Tare Function

Nominal Tare Weight g	Standard Weight g		UUC* Reading g	UUC* Error g
	Tare		0.00000	0.00000
	100	at 20 % 20.0000	20.0001	0.0001
	at 100 %	100.0000	100.0002	0.0002

UUC* = Unit Under Calibration

..... END.....

Certificate of Calibration

Description : Electronic Balance	Serial Number : D316301848	Resolution : 0.0001,0.00001 g
Manufacturer : Shimadzu	ID. /Control Number : TNP.LAB.30	Order No. : 1398 - 22
Model : AP225WD	Made In : Philippines	Received Date : APR 18, 2022
Unit : g	Capacity : 220 g	Calibration Date : APR 18, 2022

Calibration Method

The Electronic balance was measured using standard weight following to in house calibration method MCL-CP14 and based on UKAS LAB 14: Edition 5 July 2015

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

Reference Standard

Description	Model	Serial No.	Certificate No.	Due Date
Standard Weight Set	50 mg - 2 kg	N/A	B0-0805057/20	MAY 09, 2021

Traceability of Measurement

The measurements are traceable to international system of units (SI)

The certificate is traceable to through Thai Heart Calibration Co.,Ltd.

Range : 200 g

Resolution : 0.0001,0.00001 g

1. Repeatability of Balance

Nominal Value g	Standard Deviation of Reading g
0	0.00000
200	0.0000



Certificate of Calibration

Certificate Number : SPR21090365-1

Page : 1 of 3

Customer : TNP ENVIRONMENT CO.,LTD.

332/173 Moo.3, Bang Rak Phatthana, Bang Bua Thong, Nonthaburi
11110

Equipment Name : Temperature and Humidity

Manufacturer : Extech

Model : 445814

Serial Number : PONPE5816745

ID. Number : TNP.LAB.04

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$

Received Date : 23 Sep 2021

Relative Humidity : $50\% \pm 15\%$

Calibration Date : 24 Sep 2021

Location of Calibration : In-Lab

Recommend Due Date : 24 Sep 2022

Calibration Procedure : SP-CPT-04-13

Date of Issue : 25 Sep 2021

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr. Prayoon Topart

Calibration Officer

Approved by :

(Mr. Worapong Sinthusopa)

Authorized Signatory



Calibration Report

Certificate Number : SPR21090365-1

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Humidity Chamber	TH-80S	N/A	SPR21020224-9	04 Mar 2022
THERMO-HYGROMETER	5020A	A47046	PSL-H 302/63	30 Sep 2021

Traceability

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

SP Metrology - SP Metrology system (Thailand) Co.Ltd.

TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR21090365-1

Page : 3 of 3

Temperature Accuracy in the Measurement.

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
25.0	25.006	25.0	-0.006	0.50

Humidity Accuracy in the Measurement. (25 °C)

Unit : %RH

Humidity Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
50.0	50.02	49	-1.02	1.6

Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2$, providing a level of confidence approximately 95%.

- End of Certificate -



Certificate of Calibration

Certificate Number : SPR22030059-2

Page : 1 of 3

Customer : TNP ENVIRONMENT CO.,LTD.

332/173 Moo.3, Bang Rak Phatthana, Bang Bua Thong, Nonthaburi
11110

Equipment Name : Digital Thermo-Hygrometer

Manufacturer : Extech

Model : 445815

Serial Number : PONPE5899555

ID. Number : TNP.LAB.22

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$

Received Date : 03 Mar 2022

Relative Humidity : $50\% \pm 15\%$

Calibration Date : 07 Mar 2022

Location of Calibration : In-Lab

Recommend Due Date : 07 Mar 2023

Calibration Procedure : SP-CPT-04-13

Date of Issue : 08 Mar 2022

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr. Navaporn Uengseng

Approved by :

Calibration Officer

(Mr. Worapong Sinthusopa)

Authorized Signatory



Calibration Report

Certificate Number : SPR22030059-2

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Humidity Chamber	TH-80S	N/A	SPR22010401-8	05 Mar 2023
THERMO-HYGROMETER	5020A	A47046	QR22-0191	02 Feb 2023

Traceability

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

SP Metrology - SP Metrology system (Thailand) Co.Ltd.

Quality Reborn Co., Ltd



Result of Calibration

Certificate No. : SPR22030059-2

Page : 3 of 3

Temperature Accuracy in the Measurement.

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
20.0	20.014	20.5	0.486	0.50
25.0	25.012	25.5	0.488	0.50

Humidity Accuracy in the Measurement. (25 °C)

Unit : %RH

Humidity Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
50.0	50.08	46	-4.08	1.7

Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2$, providing a level of confidence approximately 95%.

- End of Certificate -



Page : 1 of 3

Customer : TNP ENVIRONMENT CO.,LTD.

332/173 Moo.3, Bang Rak Phatthana, Bang Bua Thong, Nonthaburi
11110

Equipment Name : Digital Thermo-Hygrometer

Manufacturer : Extech

Model : 445815

Serial Number : PONPE5899554

ID. Number : TNP.LAB.21

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$

Received Date : 03 Mar 2022

Relative Humidity : 50 % \pm 15 %

Calibration Date : 07 Mar 2022

Location of Calibration : In-Lab

Recommend Due Date : 07 Mar 2023

Calibration Procedure : SP-CPT-04-13

Date of Issue : 08 Mar 2022

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Navaporn Uengseng

Approved by :

Calibration Officer

(Mr.Worapong Sinthusopa)

Authorized Signatory



Calibration Report

Certificate Number : SPR22030059-1

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Humidity Chamber	TH-80S	N/A	SPR22010401-8	05 Mar 2023
THERMO-HYGROMETER	5020A	A47046	QR22-0191	02 Feb 2023

Traceability

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

SP Metrology - SP Metrology system (Thailand) Co.Ltd.

Quality Reborn Co., Ltd



Result of Calibration

Certificate No. : SPR22030059-1

Page : 3 of 3

Temperature Accuracy in the Measurement.

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
20.0	20.014	20.3	0.286	0.50
25.0	25.012	25.3	0.288	0.50

Humidity Accuracy in the Measurement. (25 °C)

Unit : %RH

Humidity Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
50.0	50.08	47	-3.08	1.7

Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2$, providing a level of confidence approximately 95%.

- End of Certificate -

Certificate of Calibration

Certificate No. : 64-400532-1

Page : 1 of 2

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

Equipment : 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 : (29.0 to 31.0) °C
Relative Humidity : (55 to 60) %
Line Voltage : (226.0 to 226.5) V

Date of Received : 20 October 2021

Date of Calibration : 20 October 2021


Date of Issue : 20 October 2021

Calibrated by : Permpon 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
400029 & 400031	64-400433-1	07 Apr 2022	National Institute of Metrology Thailand (NIMT)

Approved by : 
(Bunjerd Masri)
Supervisor



Certificate of Calibration

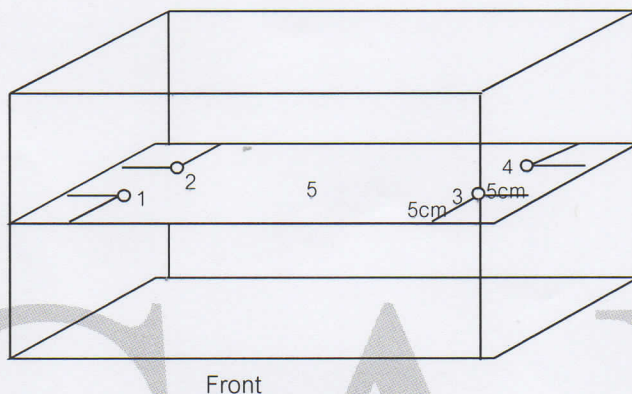
Certificate No. : 64-400532-1

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					Uncertainty (± ° C)	Measured Uniformity (° C)	Measured Stability (° C)
			No.							
			1	2	3	4	5			
62.0	62.0	62.0	61.83	61.81	61.81	61.82	61.83	0.18	0.08	0.04
85.0	85.0	85.0	84.85	84.81	84.84	84.82	84.87	0.18	0.10	0.05
95.0	95.0	95.0	94.86	94.80	94.82	94.80	94.85	0.18	0.10	0.04
100.0	ccc	100.9	100.69	100.74	100.68	100.83	100.69	0.24	0.27	0.14

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

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E-mail: bkk@becthai.com Website: www.becthai.com



Certificate No. : CAL-21-258

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
Date of Receipt : 7 May 2021
Date of Calibration : 7 May 2021
Date of Issue : 7 May 2021
Ambient Temperature : (25±10) °C
Relative Humidity : (60±20) %
Condition As-Received : Used Item

Calibrated by

(Ms. Alisa Lamor)

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 $k=2.00$, 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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E-mail: bkk@becthai.com Website: www.becthai.com



Certificate No. : CAL-21-258

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	24563	90313	2 Mar 23
Neutral Density Filter	RM-1N2N3N	24568	90324	3 Mar 23

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 the Guide to CPM-CAL-02 based on ASTM E275-08 (2013) and-
ASTM E925-09 (2014).

4. Result of calibration :

(☒) without adjustment

(☐) after adjustment

5. Equipment Specifications:

Spectral Bandwidth :	8	nm
Data Interval :	1	nm
Scan Speed :	N/A	nm/min



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

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E-mail: bkk@becthai.com Website: www.becthai.com



Certificate No. : CAL-21-258

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
	0.5824	0.585	0.0026	0.0044
	0.7266	0.729	0.0024	0.0040
	1.0377	1.040	0.0023	0.0040
440.0	Zero	0.000	0.0000	0.0028
	0.5659	0.567	0.0011	0.0042
	0.7126	0.713	0.0004	0.0037
	1.0172	1.017	-0.0002	0.0037
465.0	Zero	0.000	0.0000	0.0028
	0.5256	0.530	0.0044	0.0044
	0.6705	0.674	0.0035	0.0035
	0.9562	0.960	0.0038	0.0034
546.1 (546.0)	Zero	0.000	0.0000	0.0028
	0.5236	0.527	0.0034	0.0036
	0.6962	0.700	0.0038	0.0031
	0.9933	0.997	0.0037	0.0032
590.0	Zero	0.000	0.0000	0.0028
	0.5578	0.562	0.0042	0.0036
	0.7523	0.755	0.0027	0.0031
	1.0747	1.078	0.0033	0.0032
635.0	Zero	0.000	0.0000	0.0028
	0.5655	0.566	0.0005	0.0035
	0.7321	0.733	0.0009	0.0031
	1.0454	1.047	0.0016	0.0031

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 -



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Certificate No. : CAL-21-517

Page : 1 of 3

CERTIFICATE OF CALIBRATION

Equipment	:	Spectrophotometer
Manufacturer	:	Merk
Model	:	Prove 100
Serial No.	:	1809112938
ID No.	:	N/A
Customer	:	Special Lab Envi And Consultant Co., Ltd.
	:	47/91 Moo 3, Tambol Tait ,
	:	Amphur Pakrad, Nonthaburi, 11120.
Location	:	Becthai Laboratory
Date of Receipt	:	21 August 2021
Date of Calibration	:	21 August 2021
Date of Issue	:	21 August 2021
Ambient Temperature	:	(25±10) °C
Relative Humidity	:	(60±20) %
Condition As-Received	:	Used Item

Calibrated by

Kittikorn Boonprapai

(Mr. Kittikorn Boonprapai)

Calibration Engineer

Approved by

Jintana Sangthaijaroenlap

(Ms. Jintana Sangthaijaroenlap)

Calibration Manager

The reported expanded uncertainty of measurement was based on a combined standard uncertainty multiplied by a coverage factor $k=2.00$, 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.



BECTHAI BANGKOK EQUIPMENT & CHEMICAL CO., LTD.
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Certificate No. : CAL-21-517

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	24563	90313	2 Mar 23
Neutral Density Filter	RM-1N2N3N	24568	90324	3 Mar 23

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 the Guide to CPM-CAL-02 based on ASTM E275-08 (2013) and-
ASTM E925-09 (2014).

4. Result of calibration :

(☒) without adjustment

(☐) after adjustment

5. Equipment Specifications:

Spectral Bandwidth :	4	nm
Data Interval :	0.1	nm
Scan Speed :	N/A	nm/min



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

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E-mail: bkk@becthai.com Website: www.becthai.com



Certificate No. : CAL-21-517

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	418.4	-0.08	0.13
536.90	536.90	534.3	-2.60	0.27
637.94	637.94	636.1	-1.84	0.17

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
	0.5824	0.580	-0.0024	0.0044
	0.7266	0.721	-0.0056	0.0041
	1.0377	1.029	-0.0087	0.0040
440.0	Zero	0.000	0.0000	0.0028
	0.5659	0.559	-0.0069	0.0043
	0.7126	0.710	-0.0026	0.0038
	1.0172	1.013	-0.0042	0.0038
465.0	Zero	0.000	0.0000	0.0028
	0.5256	0.522	-0.0036	0.0044
	0.6705	0.673	0.0025	0.0036
	0.9562	0.958	0.0018	0.0035
546.1 (546.0)	Zero	0.000	0.0000	0.0028
	0.5236	0.520	-0.0036	0.0036
	0.6962	0.695	-0.0012	0.0031
	0.9933	0.991	-0.0023	0.0033
590.0	Zero	0.000	0.0000	0.0028
	0.5578	0.557	-0.0008	0.0036
	0.7523	0.752	-0.0003	0.0032
	1.0747	1.072	-0.0027	0.0033
635.0	Zero	0.000	0.0000	0.0028
	0.5655	0.565	-0.0005	0.0036
	0.7321	0.731	-0.0011	0.0032
	1.0454	1.043	-0.0024	0.0031

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 -