

ภาคผนวก จ

เอกสารสอบเทียบ





Certificate of Calibration

Certificate Number : SPR22030059-1

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

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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

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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 -



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

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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 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

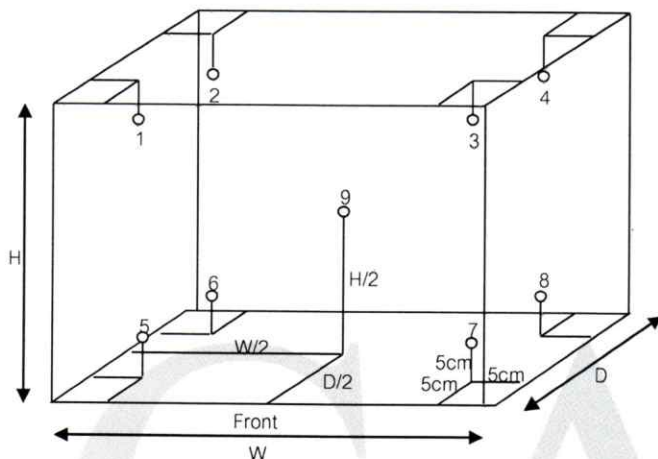
Page : 2 of 2

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



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 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

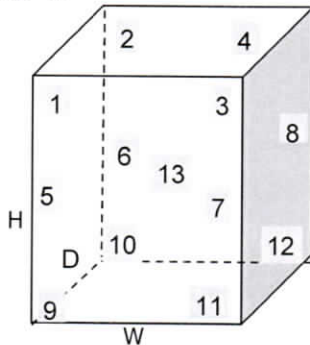
The Reference Standard Instrument :-

<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

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

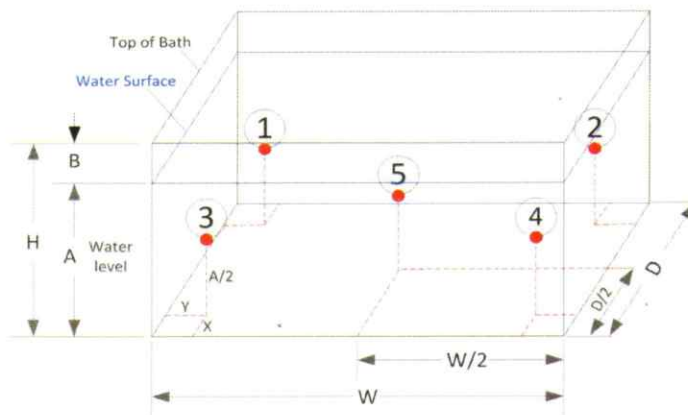
Certificate No. : CT-22-01-22708

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

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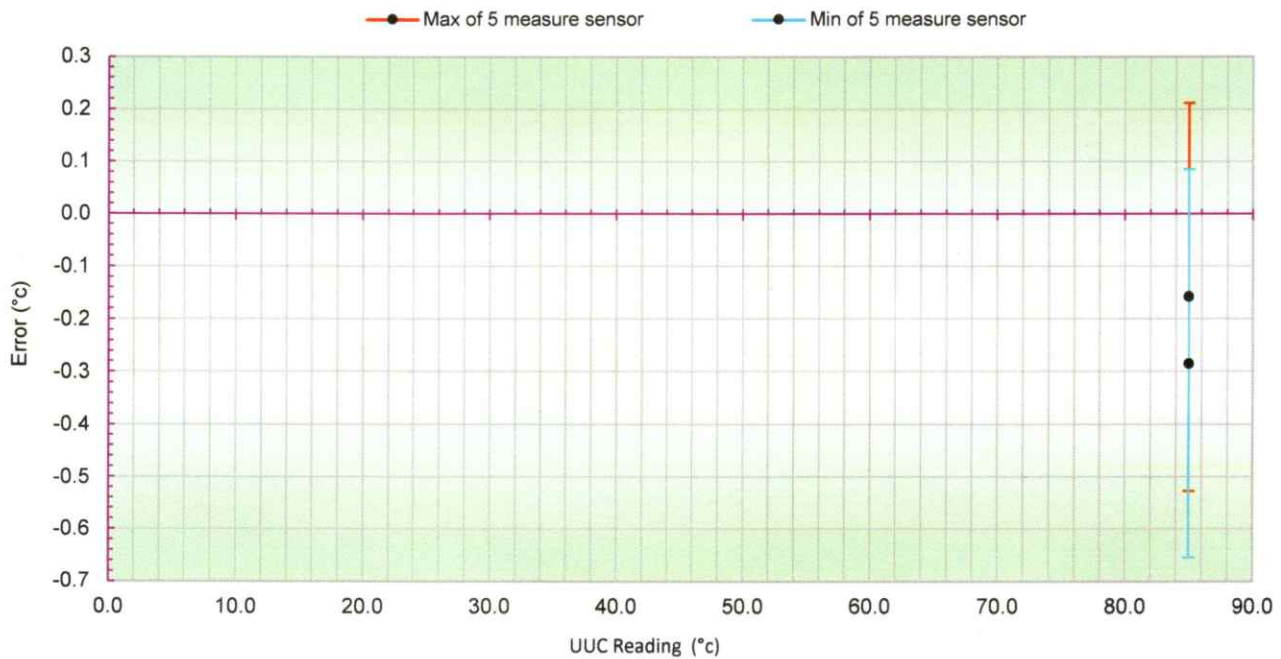
Section 3 : Possible of temperature in chamber. Show minimum and maximum of the average values and Include with uncertainty of measurement. , The average values is average of each position standard sensor throughout observation time.

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



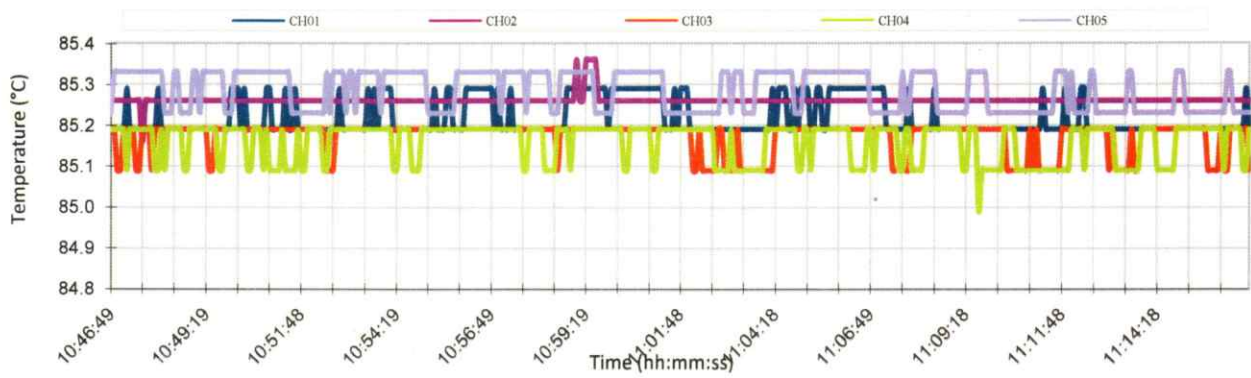
Approved Signatory : 

Certificate No. : CT-22-01-22708

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

(5.1) Temperature Distribution at UUC Reading 85.0 °C



Approved Signatory :

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

Certificate of Calibration

Certificate No. : 64-400234-1

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 TC probe
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 : 30 April 2021

Date of Calibration : 05 May 2021

Date of Issue : 05 May 2021

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

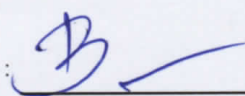
1. Platinum Resistance Thermometer (PRT)

ID No.	Cert. No.	Due Date	Traceability
400001	TT-0016-20	04 Mar 2022	National Institute of Metrology Thailand (NIMT)
400002	TT-0050-20	18 Jun 2022	National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
400003	19E134	06 Jun 2021	National Institute of Metrology Thailand (NIMT)
400004	19E134	06 Jun 2021	National Institute of Metrology Thailand (NIMT)

Approved by :



(Bunjerd Masri)

Supervisor



Certificate of Calibration

Certificate No. : 64-400234-1

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	4.0027	4.2	-0.2	0.18
130	104.0024	104.3	-0.3	0.45
130	150.0031	150.2	-0.2	0.58
130	180.0024	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	250.0017	249.3	0.7	1.2
124	350.0042	347.8	2.2	1.5

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.: 21TW44

Page.: 1 of 2

Certificate of Testing

Equipment :	DO Meter
Manufacturer :	Hanna
Model :	HI98193
Serial No. :	03030056991
ID No. :	LB-Eq-014
Received Date :	05 March 2021
Test Date :	05 March 2021
Reference :	2103-0294WN-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
Calibrated by :	Walalak Sirithean
Approved by :	 Approved Signatory
<input checked="" type="checkbox"/> Malee Butkruea <input type="checkbox"/> Saithip Meangmai <input type="checkbox"/> Warakorn Lerngagtrakul	
Issue Date :	8 March 2021



Cert.No.: 21TW44

Page.: 2 of 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)
8.02	8.05	0.0084

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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Certificate of Calibration

Certificate No. : 64-200127-1

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 : (25.7 to 25.9) °C
Relative Humidity : (68.6 to 71.5) %
Air Pressure : 1012.0 mbar

Date of Received : 30 April 2021

Date of Calibration : 30 April 2021

Date of Issue : 06 May 2021

Calibrated by : Akaradath Thippichai

Calibration Method : In-house method CAL-M2001 based on UKAS Publication ref : LAB 14
Edition 5, July 2015

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

Standard Weights

ID No.	Cert. No.	Due Date	Traceability
E261-E2624	C02204101	17 Nov 2021	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. : 64-200127-1

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	0.0001	0.00011
0.01	0.0000	0.00011
0.1	0.0000	0.00011
0.5	-0.0001	0.00011
2	0.0000	0.00011
5	0.0000	0.00012
10	0.0001	0.00012
50	0.0000	0.00014
100	0.0000	0.00020
200	0.0001	0.00038

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

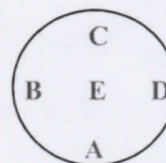
This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.11$, providing a level of confidence of approximately 95%

Eccentric error

Load test : 50 g

A B C D E

-0.0006 0.0001 0.0006 -0.0002 0.0000 g



Repeatability

Load test : 200 g

Stdev. : 0.00005 g

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Certificate of Calibration

Certificate No. : 64-400224-2

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. : N/A

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

Ambient Temperature : (26.0 to 26.5) °C

Relative Humidity : (50 to 60) %

Line Voltage : (226.0 to 226.5) V

Date of Received : 30 April 2021

Date of Calibration : 30 April 2021

Date of Issue : 03 May 2021

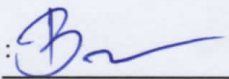
Calibrated by : Permpoon Chanpu

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 Thermocouple probe

ID No.	Cert. No.	Due Date	Traceability
400029 & 400032	64-400106-1	30 Sep 2021	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. : 64-400224-2

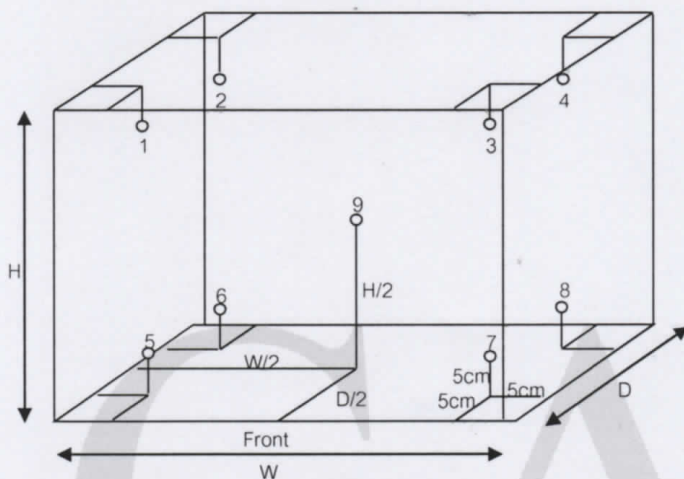
Page : 2 of 2

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 m

D = 0.73 m

H = 0.50 m

Capacity = 0.20 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	
20.0	19.3	19.3	20.2	20.1	20.1	20.1	20.1	20.1	20.0	20.0	20.0	0.69

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
20.0	19.3	19.3	0.4	0.4	0.8

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



Certificate of Calibration

Certificate No. : 64-400224-1

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 : FKU 1800
Range : N/A °C Resolution : 0.1 °C
Serial No. : 0925481-19 ID No. : N/A

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

Ambient Temperature : (26.0 to 27.0) °C

Relative Humidity : (50 to 60) %

Line Voltage : (226.0 to 226.5) V

Date of Received : 30 April 2021

Date of Calibration : 30 April 2021

Date of Issue : 03 May 2021

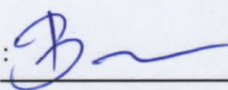
Calibrated by : Permpon Chanpu

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 & 400030	64-400104-1	29 Sep 2021	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. : 64-400224-1

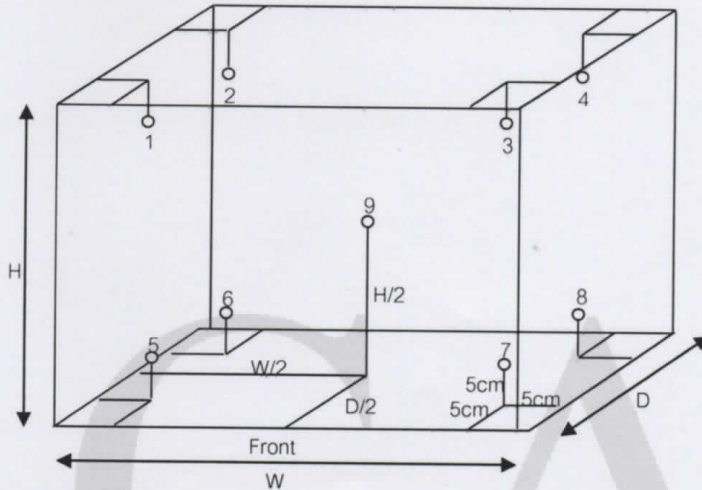
Page : 2 of 2

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 = 0.55 m

D = 0.73 m

H = 0.50 m

Capacity = 0.20 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	
30.0	30.4	30.4	30.0	30.0	30.1	30.1	30.1	30.0	30.0	30.0	30.0	0.75
35.0	35.4	35.4	34.9	34.9	34.9	35.1	35.0	35.0	34.9	35.0	35.0	0.75
37.0	37.4	37.4	36.9	36.9	37.0	37.1	37.0	37.0	36.9	37.0	37.0	0.72

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
30.0	30.4	30.4	0.3	0.5	0.9
35.0	35.4	35.4	0.4	0.5	1.1
37.0	37.4	37.4	0.4	0.4	0.9

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





CALIBRATION CERTIFICATE

Date of Issue Jun 16, 2021

Cert No. 21/2298

Site Calibration

Order No. 21060260

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

Place of Calibration ห้องปฏิบัติการวิเคราะห์คุณภาพน้ำทางเคมี

Description Oven

Model UN30

Serial No. B120.0284

ID.No. LB-Eq-037

Date of Receipt Jun 11, 2021

Date of Calibration Jun 11, 2021

Environment

Temperature (Min) 31.2 °C (Max) 35.4 °C

Relative Humidity (Min) 50.5 %RH (Max) 64.3 %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. MY49025696, Certificate No. QR20-0994, Calibrated by Quality Reborn Co., Ltd., ONAC Calibration No. 0292.

This certificate is traceable to SI unit.



CALIBRATION CERTIFICATE

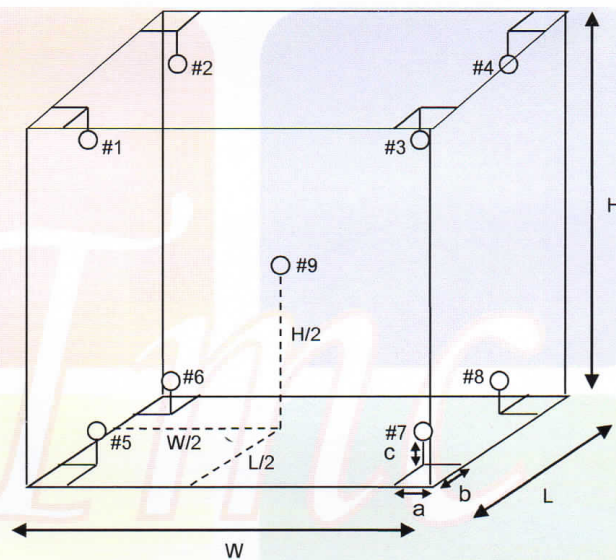
Date of Issue Jun 16, 2021

Cert No. 21/2298

Site Calibration

Order No. 21060260

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.

D. M.



CALIBRATION CERTIFICATE

Date of Issue Jun 16, 2021

Cert No. 21/2298

Site Calibration

Order No. 21060260

Results (without adjustment)

UUC Setting (°C)	UUC Reading (°C)	Reference Thermometer (°C)		Stability \pm (°C)	Uniformity (°C)	Uncertainty \pm (°C)
104.0	104.0	Position 1	104.589	0.106	0.594	0.38
		Position 2	104.512			
		Position 3	104.266			
		Position 4	104.387			
		Position 5	103.588			
		Position 6	104.471			
		Position 7	103.648			
		Position 8	104.105			
		Position 9	104.115			

UUC Setting (°C)	UUC Reading (°C)	Reference Thermometer (°C)		Stability \pm (°C)	Uniformity (°C)	Uncertainty \pm (°C)
150.0	150.0	Position 1	150.553	0.128	0.957	0.43
		Position 2	150.608			
		Position 3	150.268			
		Position 4	150.416			
		Position 5	149.027			
		Position 6	150.325			
		Position 7	149.213			
		Position 8	149.792			
		Position 9	149.752			

D.Mi



CALIBRATION CERTIFICATE

Date of Issue Jun 16, 2021

Cert No. 21/2298

Site Calibration

Order No. 21060260

Results (without adjustment)

UUC Setting (°C)	UUC Reading (°C)	Reference Thermometer (°C)		Stability ± (°C)	Uniformity (°C)	Uncertainty ± (°C)
180.0	180.0	Position 1	180.383	0.227	1.154	0.50
		Position 2	180.550			
		Position 3	180.165			
		Position 4	180.367			
		Position 5	178.940			
		Position 6	180.593			
		Position 7	179.157			
		Position 8	179.900			
		Position 9	179.632			

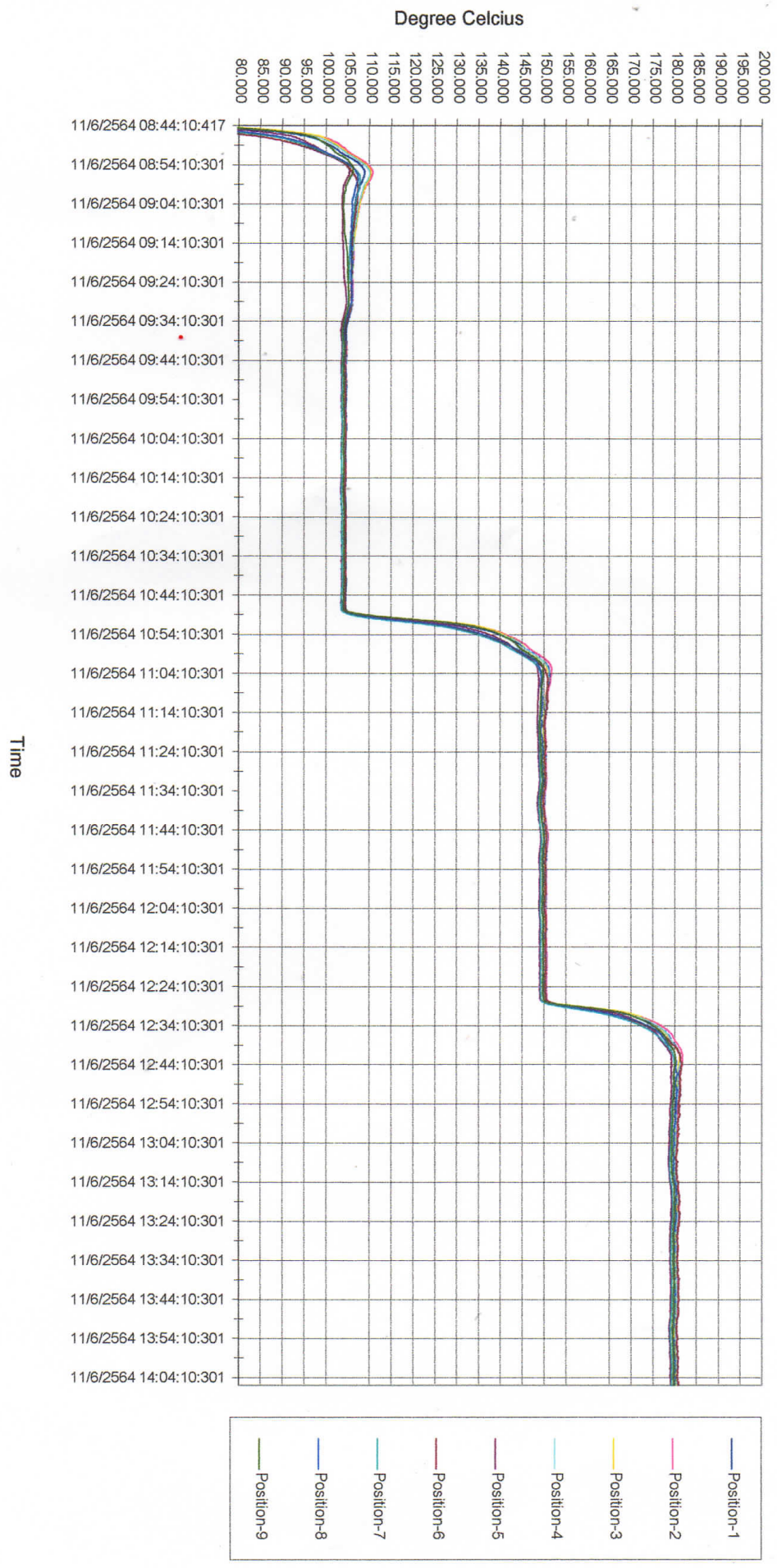
The stability and uniformity was taken into account in the measurement uncertainty stated.

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. DAMRONG MULSING)



Model. UN30 S/N. B120.0284 ID.No. LB-Eq-037

Hot Air Oven

Cert.No. 21/2298



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)

CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES

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

TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert.No.: 21CH1146

Page.: 1 of 3

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 : 23 August 2021
Calibration Date : 3 September 2021
Reference : 2108-0663WN-1
Submitted by : Special Lab Envi And Consultant Co.,Ltd
47/91-93 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 : Saithip Meangmai

Approved by :

Approved Signatory

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

Issue Date : 9 September 2021

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 0031764



Cert. No.: 21CH1146

Page.: 2 of 3

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	43160066	130RC092	21E1223/1	27 Apr 2022

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

- Traceable to National Institute of Metrology (Thailand), NIMT

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

<u>Buffer Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
pH 4.008	CPA chem	754028	28 June 2023
pH 6.866	CPA chem	679462	12 Mar 2022
pH 9.181	CPA chem	754031	20 July 2022

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

Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4,7,9)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor <i>k</i>
pH Electrode S/N.: 3034419	4.008	4.01	169.2	0.0071	2.00
	6.866	6.87	0.5	0.0082	2.00
	9.181	9.18	-134.9	0.013	2.00

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Cert.No.: 21CH1146

Page.: 3 of 3

Calibration Results**Function : mV Measurement****Performing standard curve by Fluke at pH (4,7,9)**

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (\pm mV)	Coverage factor <i>k</i>
	pH	mV	mV	pH		
pH Meter S/N.: 2858459	0.00	414.12	414	0.02	0.58	2.00
	1.00	354.96	355	1.02	0.58	2.00
	2.00	295.80	296	2.02	0.58	2.00
	3.00	236.64	237	3.01	0.58	2.00
	4.00	177.48	177.4	4.01	0.058	2.00
	5.00	118.32	118.3	5.01	0.058	2.00
	6.00	59.16	59.1	6.00	0.058	2.00
	6.86	8.28	8.3	6.86	0.058	2.00
	7.00	0.00	0.0	7.00	0.058	2.00
	8.00	-59.16	-59.1	8.00	0.058	2.00
	9.00	-118.32	-118.3	9.00	0.058	2.00
	9.18	-128.97	-129.0	9.18	0.058	2.00
	10.00	-177.48	-177.5	10.00	0.058	2.00
	11.00	-236.64	-237	11.00	0.58	2.00
	12.00	-295.80	-296	12.00	0.58	2.00
	13.00	-354.96	-355	13.00	0.58	2.00
	14.00	-414.12	-414	14.00	0.58	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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Mali.



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)

CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES

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

TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 21TM1547

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 Tambon Tha-it,
Pakkret,
Nonthaburi 11120

Location : TPA Chemistry Calibration Laboratory

Received Order : 23 August 2021

Calibrated Date : 27 August 2021

Ambient Temperature : (26 \pm 10) °C

Relative Humidity : (50 \pm 30) %

AC Line Voltage : (220 \pm 22) V

Calibrated by : Kunchit Promprat

Approved by :

Malee

Approved Signatory

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

Issue Date :

31 August 2021

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 0031535



Equipment : pH Meter with Sensor

Condition As-Received : Used Item

Reference : 2108-0663WN-2

Cert. No.: 21TM1547

Page.: 2 of 2

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Digital Thermometer	1523	2188080	2011389	20 Nov 2021

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

3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, ID No.: SL-33/1

<u>Calibration Point</u> (°C)	<u>Immersion Depth</u> (mm)	<u>Standard Temperature</u> (°C)	<u>UUC* Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (±°C)	<u>Coverage Factor</u> <i>k</i>
25.0	100	25.0	25.000	0.000	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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Malu.

Certificate of Calibration

Certificate No. : 64-400224-3

Page : 1 of 2

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

Equipment : Air Chamber (Refrigerator)

Manufacturer : Frozen

Model : CC-280C

Range : N/A °C

Resolution : 0.1 °C

Serial No. : 2081307016

ID No. : N/A

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

Ambient Temperature : (28.9 to 29.8) °C

Relative Humidity : (58 to 64) %

Line Voltage : (226.0 to 226.5) V

Date of Received : 30 April 2021

Date of Calibration : 30 April 2021

Date of Issue : 30 April 2021

Calibrated by : Bunjerd Masri

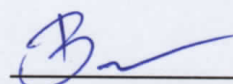
Calibration Method : CAL-M4004, TLAS G-20

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
400022 & 400023	64-400101-1	01 Sep 2021	National Institute of Metrology Thailand (NIMT)

Approved by :


(Bunjerd Masri)

Supervisor



Certificate of Calibration

Certificate No. : 64-400224-3

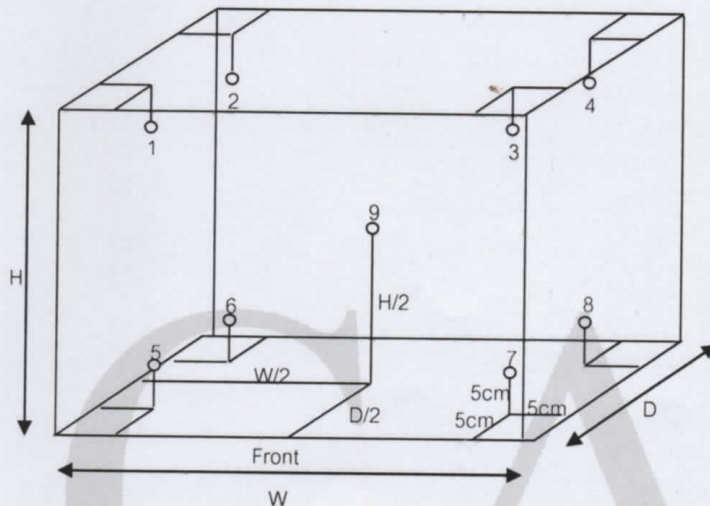
Page : 2 of 2

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	
4.0	4.0	4.0	4.1	4.1	4.2	4.0	4.2	4.6	3.9	3.8	3.9	0.58

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
4.0	4.0	4.0	0.8	0.2	1.0

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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PinAAcle 900F Preventive Maintenance Report

Company Name: SPECIAL LAB ENVI & CONSULTANT

Instrument Location: PAKKRET NONTABURI 11120

Instrument Serial No.: PFBS17082303

Date: 03-Sep-2021

PinAAcle 900F Preventive Maintenance (PM)

Company Name:	SPECIAL LAB ENVI & CONSULTANT		
Address (Instrument Location):	PAKKRET NONTHABURI 11120		
Serial Number:	PFBS17082303	PM Number:	1 of 1
Customer Name (if applicable):	K. Fhatiha	Telephone Number:	(092) 283-9054
Customer Support Engineer Name:	K. Weerayoot keadpon	Service Order Number:	WO-00925451
Date PM Performed: (DD-MMM-YYYY)	03-Sep-2021	Next PM Due Date: (DD-MMM-YYYY)	03-Sep-2022
Standard Labor Hours to Complete PM :		5 hours	

Part Number	Release	Publication Date	
09370145 Rev.9	A	January 2018	

Scope

The purpose of this PM is to ensure the continued functionality of the PinAAcle 900F by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer.

The customer should save their method before the PM begins.

General Instructions:

The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM.

Always check with the customer before making any changes that may affect the customer's analysis or calibration, including a current back-up of system software and/or data files.

The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer.

Update the PM sticker and instrument logbook as required.

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Component List

Component / Specific Model	Serial #	Configuration Notes

Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
B0501696	Fan Filters	1
N3160156	O-Ring Kits for Sampling Introduction (Stainless Steels Nebulizer)	N/A
N3160157	O-Ring Kits for Sampling Introduction (Plastic Nebulizer)	2
N9301714	Replacement Acetylene Filter Cartridge	1
TH001022	Replacement Air Filter Cartridge	2

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quality	Batch/Lot #	Expired Date (MM/YY)
N9300183	1000 mg/L Copper Standard	AR	25-20CUY1	30-Jan-2022

Additional Reagents and Standards Required for PM (Customer Support Solution)				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
N/A	DI Water	250 ml.	AR	AR
N/A	0.5% HNO ₃	250 ml.	AR	AR

Additional Tools Required for PM			
Part Number (if applicable)	Description	Quantity	Serial #
N1013000	0.2A Neutral density filter	1	5503530856
N1013002	1.0A Neutral density filter	1	5503555491
03030997	System 2 EDL Driver	1	03030997
N3050605	As System 2 EDL	1	16148
N3050121	Cu Lumina HCL	1	021913-020070
N3050109	Ba Lumina HCL	1	102416-040160
N3050139	K Lumina HCL	1	110716-010060
N3050152	Ni Lumina HCL	1	100516-030190

Procedure Checklist

Use (✓) to check off those steps in the checklist that have been completed.

1. General:

- ☒ Review the instrument performance with the customer and document any recent problems.
- ☒ Inspect the customer log book and make any appropriate PM entries.
- ☒ Perform general inspection of system for cleanliness.

2. PC Instrument Software:

- ☒ Instrument Software user files/databases archived, packed, and/or deleted as needed.

3. Mechanical:

- ☒ Inspect and clean all fans and filters. Replace filters if necessary
- ☒ Inspect all gas lines for leaks and/or wear. Replace if needed.
- ☒ Clean exterior of the instrument.
- ☒ Inspect the burner head, burner chamber, and nebulizer. Clean if needed as stated in the Hardware Guide.
- ☒ Check burner head dimensions with the feeler gauge as stated in the Hardware Guide in the Maintenance chapter section on cleaning the burner head and checking sloth width. Replace if out of specification
- ☒ Check the condition of the end cap, burner head, and nebulizer O-rings. Replace if necessary.
- ☒ Check the drain system for signs of wear. Replace worn or damaged parts.
- ☒ Visually check for proper flame conditions when igniting the Air-C₂H₂ and N₂O-C₂H₂ flames (if applicable).

4. Electrical:

- ☒ Inspect PC boards. Clean if necessary.
- ☒ Carefully check all internal and external cable connections.
- ☒ Check instrument firmware revisions upgrade to current levels (if necessary)
- ☒ Run Diagnostics Test within the Advanced function of the Spectrometer page. Check the results in the service log folder in the Spectrometer BM Log Viewer.

5. Optics:

- ☒ Inspect and clean the sample compartment windows, if needed.
- ☒ Inspect optics. Clean or replace if necessary,

6. Gasses:

- ☒ Verify that the Gasses supplied to the instrument are within the pressure and purity specifications found in the PinAAcle 900 Series Pre-installation Checklist SDB.
- ☒ Verify that the acetylene filter and air filter element is dry. Replace if necessary.

7. Flame Interlock Check:

Description: Check to ensure that all safety interlocks are closed.

Parameter	Specification	Test Results	Pass/Fail
Flame Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Drain Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Nebulizer Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
C ₂ H ₂ Pressure Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Air Pressure Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Burner Head Sensor	Choosing Nitrous Oxide as the oxidant should trigger an interlock shuts down	Active	Passed

8. After PM Performance tests:

8.1 Detector Linearity with Barium

Description: Ensures that the detector is linear in the Visible Range.

Parameter	Specification	Certificate Value at 553.6 nm (Abs.)	Test Results	Pass/Fail
1.0 A ND Filter	± 5% from Cert.	0.9798	0.9766	Passed
0.2 A ND Filter	± 5% from Cert.	0.2042	0.1989	Passed

8.2 Baseline Noise at 1.0 Absorbance with Barium

Description: Ensures that a high absorbance will not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0015	Passed

8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.001	0.0002	Passed

8.4 D₂ Background Compensation with Copper

Description: Verifies the instruments ability to compensate for Background absorption.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0079	Passed

8.5 AA-BG Baseline Noise with Copper

Description: Ensures that background correction does not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0004	Passed

8.6 AA-BG Baseline Noise with Arsenic

Description: Ensures that background correction does not produce excessive noise at a low wavelength.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0011	Passed

8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

Standard Copper Sensitivity	Specification	Results (Abs.)	Pass/Fail
5 mg/L Sensitivity SS Neb (if applicable)	> 0.250 Abs.	NA	Not Applicable
2 mg/L Sensitivity HS Neb (if applicable)	> 0.250 Abs.	0.3221	Passed

10. Review:

- ☒ Review with the customer PM work performed.
- ☒ Review with the customer routine maintenance procedures.
- ☒ Discuss recommended customer supplied materials to have on hand.
- ☒ Attach PM sticker.

Additional Comments

Additional Comments Regarding the PM

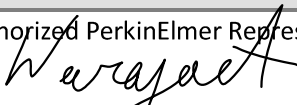
Review

The preventive maintenance checks and if applicable performance tests for PinAAcle 900F have been completed.

This PinAAcle 900F Passes ☒ Fails ☐ the preventive maintenance.

Review of Preventive Maintenance:

Authorized PerkinElmer Representative:



Date:

03-Sep-2021

(DD-MMM-YYYY)

Authorized Customer Representative:

Date:

(DD-MMM-YYYY)



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

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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.



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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



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



Certificate No. : CAL-21-517

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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 -



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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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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



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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 -

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

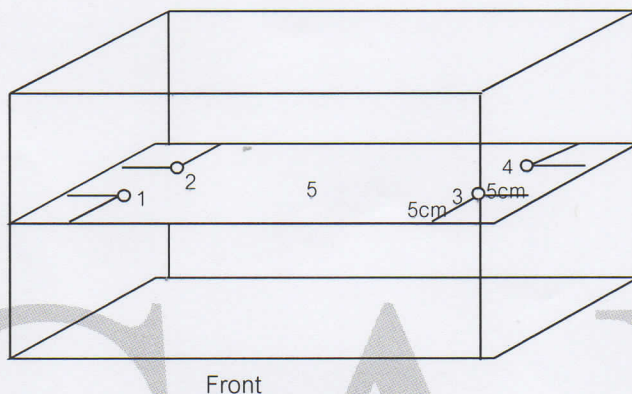
Certificate No. : 64-400532-1

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 No.					Uncertainty (± °C)	Measured Uniformity (°C)	Measured Stability (°C)
			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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รายการใบรับรองสอบเทียบ/ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับตรวจวัดคุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือหลักสำหรับตรวจสอบคุณภาพน้ำ									
1	BOD Incubator	BOD	Arco	UC4-1320 / (UAE.WAO.015/2561)	Technology Promotion Association (Thailand-Japan)	22TM90	17 Feb 22	16 Feb 23	-
2	BOD Incubator		Arco	UC4-1320 / (UAE.WAO.018/2559)	Technology Promotion Association (Thailand-Japan)	21TM1406	17 Aug 21	16 Aug 22	-
3	Analytical Balance (Readability 0.01 mg)	Total Dissolved Solids Suspended solids	Mettler-Toledo	XSR205DU / C009071872	Technology Promotion Association (Thailand-Japan)	22MM210	26 Apr 22	25 Apr 23	-
4	Hot Air Oven		Memmert	UF55 / B216.1666	Technology Promotion Association (Thailand-Japan)	21TM1876	29 Oct 21	28 Oct 22	-
5	Digestor Unit	TKN	FOSS TECATOR	2520auto / 91794469	National Food Institute, Ministry of Industry, Thailand	2202361-001-01	4 Apr 22	3 Apr 23	-
6	Distillation Unit (Kjeldahl Method)		FOSS TECATOR	KT200 / 91790524	FOSS South East Asia	5874	30 Nov 21	29 Nov 22	-
7	Analytical Balance (Readability 0.1 mg)	Fat, Oil & Grease	Mettler-Toledo	AB-204S/FACT / 1129361010	National Food Institute, Ministry of Industry, Thailand	2103270-001-01	11 Jun 21	10 Jun 22	-
8	UV-VIS Spectrophotometer	Ammonia, Cyanuric Acid Nitrate, Total Nitrogen	Hitachi	U-1900 / 2021-064	DQE Services Co.,Ltd.	SP22-007	20 Jan 22	19 Jan 23	-
9	UV-VIS Spectrophotometer		Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP22-008	20 Jan 22	19 Jan 23	-
10	Incubator	Total Coliform Bacteria Fecal Coliform Bacteria	Memmert	IPP 260 / V616.0066	Technology Promotion Association (Thailand-Japan)	21TM1874	28 Oct 21	27 Oct 22	-
11	Incubator		Memmert	IPP 260 / V615.0187	Technology Promotion Association (Thailand-Japan)	22TM563	07 Apr 22	06 Apr 23	-
12	Incubator	Pseudomonas aeruginosa Clodtridium perfringens	Memmert	IN 75 / D317.0307	Technology Promotion Association (Thailand-Japan)	22TM335	17 Feb 22	16 Feb 23	-

รายการใบรับรองสอบเทียบ/ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับตรวจวัดคุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือหลักสำหรับตรวจสอบคุณภาพน้ำ									
13	Incubator	Total Coliform Bacteria Fecal Coliform Bacteria	Memmert	BE400 / e402.1032	Technology Promotion Association (Thailand-Japan)	21TM1358	15 Jul 21	14 Jul 22	-
14	Water Bath	Escherichia coli Staphylococcus aureus	Memmert	WNE 14 / L416.0612	Technology Promotion Association (Thailand-Japan)	22TM334	17 Feb 22	16 Feb 23	-
15	Water Bath	Pseudomonas aeruginosa Clodtridium perfringens	Memmert	WNE 14 / L414.1407	Technology Promotion Association (Thailand-Japan)	22TM565	7 Apr 22	6 Apr 23	-
16	Analytical Balance		Mettler-Toledo	MS603S / B0070110311	Mettler-Toledo (Thailand) Ltd.	TH2058-096-040722-ACC-TH	7 Apr 22	6 Apr 23	-
17	Auto Clave		ALP	CL-40L / 802664	Technology Promotion Association (Thailand-Japan)	22TM89	17 Feb 22	16 Feb 23	-

Due Date of Calibration* : Based on the annual calibration plan. At least 1 time per year.