ภาคผนวก ฉ

เอกสารสอบเทียบ



METROLOGY SYSTEM (THAILAND) CO.,LTD.

Certificate of Calibration

Certificate Number : SPR22040163-1 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 : PONPE
Model : PONPE 520PH
Serial Number : 5860316
ID. Number : N/A

Environmental Conditions

Ambient Temperature	: 23 °C ± 2 °C	Received Date	: 19 Apr 2022
Relative Humidity	: 50 % ± 15 %	Calibration Date	: 20 Apr 2022
Location of Calibration	: In-Lab	Recommend Due Date	: 20 Apr 2023
Calibration Procedure	: SP-CPC-04-01	Date of Issue	: 21 Apr 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).

[redacted]

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 ต่อสาย www.สอบเทียบเครื่องมือวัด.com

Calibration Report

Certificate Number : SPR22040163-1

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Standard pH Solution	PH016.L5	Lot No.800640	61236172	07 Mar 2023
Standard pH Solution	PH107.L5	Lot No.800638	61243095	07 Mar 2023
Standard pH Solution	PH020.L5	Lot No.800639	61203372	07 Mar 2023

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)

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METROLOGY SYSTEM (THAILAND) CO.,LTD.

Result of Calibration

Certificate No. : SPR22040163-1

Range : 4 to 10 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	7.01	0.026	0.012
10.011	10.00	-0.011	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 -

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

NSC-TISI-TIS17025
CALIBRATION 0008

Cert.No.: 22CH1128
Page.: 1 of 3

Certificate of Calibration

Equipment :	pH Meter
Manufacturer :	Horiba
Model :	LAQUA-PH1100
Serial No. :	B80A0042
ID No. :	TNP.LAB.02
Condition As-Received:	Used Item
Received Date :	24 August 2022
Calibration Date :	25 August 2022
Reference :	208-0843WN-1
Submitted by :	TNP ENVIRONMENT CO.,LTD 332/173 Moo 3, Bang Rak Phatthana, Bang Bua Thong, Nonthaburi 11110
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) - CP-CH8 by comparison with standard thermometer

[redacted]

Issue Date : 29 August 2022

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0044697

Condition of this calibration result

1. Reference Standard Instrument : -

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	46530031	130RC098	21E3245	07 Oct 2022
2) Ref. Standard Thermometer	4982054	110RC044	21I1201	26 Oct 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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	823320	20 June 2024
pH 6.985	CPA chem	794122	14 Feb 2023
pH 10.008	CPA chem	823323	20 June 2023

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

Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor *k*
	pH	mV	mV	pH		
pH Meter	4.00	177.48	177.4	4.01	0.058	2.00
S/N.: B80A0042	7.00	0.00	0.0	7.00	0.058	2.00
	10.00	-177.48	-177.5	10.01	0.058	2.00

[redacted]

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Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor *k*
pH Electrode	4.008	4.01	153.9	0.0086	2.05
S/N.: 9X0B0575	6.985	6.99	-18.8	0.012	2.05
	10.008	10.01	-190.3	0.011	2.05

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 961X5S
- Serial No. : 9X0B0575

Dimension of probe;

- Length : 87 mm.
- Diameter : 12 mm.
- Immersion Depth : 80 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor *k*
20.0	20.003	20.0	-0.003	0.13	2.00
25.0	25.002	25.0	-0.002	0.13	2.00
30.0	30.004	30.0	-0.004	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

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[redacted]

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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TEL. 0-2717-3000-29 FAX. 0-2719-9484

NSC-TISI-TIS17025
CALIBRATION 0008

Cert.No.: 23CH126

Certificate of Calibration

Equipment :	pH Meter
Manufacturer :	Adwa
Model :	AD 12
Serial No. :	1328
ID No. :	TNP.LAB.13
Condition As-Received:	Used Item
Received Date :	27 January 2023
Calibration Date :	30 January 2023
Reference :	2301-0937WN-2
Submitted by :	TNP ENVIRONMENT CO.,LTD 332/173 Moo 3, Bang Rak Phatthana, Bang Bua Thong, Nonthaburi 11110
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)

[redacted]

Issue Date : 31 January 2023

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0050390

Condition of this calibration result

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	826588	09 July 2024
pH 6.987	CPA chem	826589	09 July 2023
pH 10.008	CPA chem	826590	09 July 2023

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

Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (±)	Coverage factor *k*
pH Electrode	4.008	4.01	N/A	0.0085	2.05
S/N.: 1328	6.987	6.99	N/A	0.011	2.00
	10.008	10.02	N/A	0.0095	2.00

Remark - pH meter does not have voltage mode.
- Can not connect the BNC because the plug does not match with the socket.
- N/A = Not Available

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

-o0o-

[redacted]

a 1144644

Harikul Science Co.,Ltd.
694 Soi Ratchadanivet 24 , Pracharatbamphen,
Samsaennok , Huaikhwang, Bangkok 10310
Tel: 0-2274-2456 Fax: 0-2274-2443
Email: info@harikul.com www.harikul.com

CERT.No.: HS-T031D

Certificate of Calibration

Calibration Date :	22 Apr 22	Model	: YSI 4010-2W
Submitted by :	PINTHONG UTILITIES COMPANY LIMITED	S/N	: 22051520
	789 Moo1 Nong koh-Laen Chabang Rd,	Probe	: YSI 4100
	Nong-kham Sriracha Chonburi Thailand 20230	S/N	: 22C102711
		ID NO.	: -
Avg Room Temp :	20 °C	Air Temp ref	: S/N. E00522
Avg Water Temp :	20 °C	Barometric ref	: S/N. E00522
Air Pressure :	757.00 mmHg	Water Temp ref	: S/N. 11431
Salinity :	0 ppt		
		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.

[redacted]

CAL
Calibratech Co.,Ltd.
7/106-7 Moo 2, Sukhaprachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120
Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech_cal@yahoo.com, calibratech_cal@hotmail.com

NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : **65-400557-1** **Page : 1 of 2**

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

Equipment : Digital Thermometer (Pocket)
Temperature Indicator
Manufacturer : Extech Model : 39240
Range : N/A °C Resolution : 0.1 °C
Serial No. : PONPE5877172 ID No. : TNP.LAB.34-2564

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

Date of Received : 28 October 2022
Date of Calibration : 29 October 2022
Date of Issue : 29 October 2022
Calibrated by : Chortip Samchusri

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4003 by compared with PRT in the liquid bath at the constant controlled temperature.
The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

ID No.	Cert. No.	Due Date	Traceability
400001	TT-0016-22	07 Feb 2024	National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

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

[redacted]

The Uncertainties are for a confidence probability of approximately 95%

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7/106-7 Moo 2, Sukhaprachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120
Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech_cal@yahoo.com, calibratech_cal@hotmail.com

Certificate of Calibration

Certificate No. : 65-400557-1

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Immersion Depth (mm.)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (±°C)
100	20.0019	19.9	0.1	0.18
100	30.0022	29.9	0.1	0.22
100	40.0021	39.9	0.1	0.22

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)
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NSC-TISI-TIS17025
CALIBRATION 0008

Certificate of Calibration

Certificate No. : 22H1779
Page : 1 of 2

Equipment :	Digital Thermo-Hygrometer
Manufacturer:	Extech
Model :	448514
Serial No.:	PONPE 5816745
ID No.:	TNP.LAB.04
Condition As-Received:	Used Item
Received Date:	24 August 2022
Calibration Date:	27 August 2022
Reference:	2208-0843WN
Ambient Temperature:	(25 ± 3) °C
Relative Humidity:	(50 ± 20) %

This certificate may not be reproduced other than in full, except with the prior written approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.

Submitted by: TNP ENVIRONMENT CO.,LTD

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

Procedure used: Calibration were conducted using in-house calibration procedure CP-H03 according to comparison with standard chilled mirror sensor for humidity measurement function and comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

Condition of this result of calibration

1.Reference standards instuments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Chilled Mirror Hygrometer Sensor	Dew Prime II	31863	19714	17 Sep 2022
2) Standard Humidity/Temperature Meter	400	10240757	TH-0125-21	13 Dec 2022

2.The 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 maintained at:-

-National Institute of Standards and Technology (NIST) , The United States of America

-National Institute of Metrology Thailand (NIMT)

[redacted]

B 0295353

Result of Calibration:- Without Adjustment

Function: Humidity measurement.

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	50.1	47	-3.1	1.6

Result of Calibration:- Without Adjustment

Function: Temperature measurement for indoor sensor.

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.02	20.1	0.08	0.42
25.03	25.4	0.37	0.42

UUC* : Unit Under Calibration

The reported uncertainty of measurement was base on standard uncertainty multiplied by coverage factor k = 2.00, providing confidence level approximately 95%.

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[redacted]

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 ตำบลคูคต อำเภอลำลูกกา จังหวัดปทุมธานี 12130
Tel. 02-9877200 Fax. 02-9877205

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%

[redacted]

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

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บริษัท ไมโครเทค คาลิเบรชั่น แลบบอราทอรี่ จำกัด

Certificate of Calibration

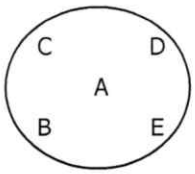
Description	:	Electronic Balance	**Serial Number**	:	D316301848	**Resolution**	:
Manufacturer	:	Shimadzu	**ID. /Control Number**	:	TNP.LAB.30	**Order No.**	: 1398 - 22
Model	:	AP225WD	**Made In**	:	Philippines	**Received Date**	: APR 18, 2022
Unit	:	g	**Capacity**	:	220 g	**Calibration Date**	: APR 18,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

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

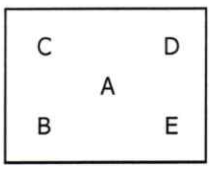
Range : 200 g

3. Effect of Center Loadding

(X)



( )



Nominal Load g	UUC* Reading A g	B g	C g	D g	E g	Maximum Difference 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……..

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บริษัท ไมโครเทค คาลิเบรชั่น แลบบอราทอรี่ จำกัด

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 basd 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

MCL Microtech Calibration Laboratory Co.,Ltd บริษัท ไมโครเทค คาลิเบรชั่น แลบบอราทอรี่ จำกัด

CAL
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Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech_cal@yahoo.com, calibratech_cal@hotmail.com

NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : **65-400665-1**

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 : (27.0 to 28.0 °C
Relative Humidity : (40 to 45) %
Line Voltage : (228.0 to 230.0) V

Date of Received : 26 December 2022
Date of Calibration : 26 December 2022
Date of Issue : 28 December 2022
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	65-400548-1	26 Apr 2023	National Institute of Metrology Thailand (NIMT)

Approved b[redacted]

The Uncertainties are for a confidence probability of approximately 95%

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Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech_cal@yahoo.com, calibratech_cal@hotmail.com

Certificate of Calibration

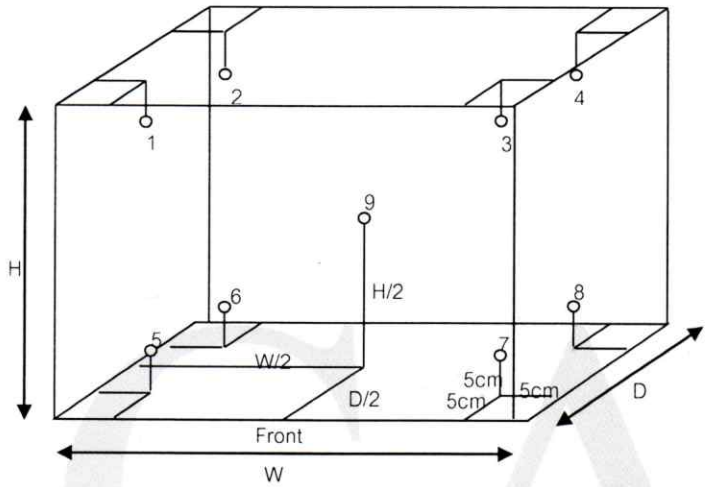
Certificate No. : 65-400665-1

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 m^3

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (±°C)
			1	2	3	4	5	6	7	8	9	
104.0	104.0	104.0	104.2	104.1	104.2	104.0	103.8	103.9	103.9	103.9	104.0	0.69
180.0	180.0	180.0	179.6	179.6	179.7	179.8	180.2	179.5	179.0	179.8	180.5	1.0

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
104.0	104.0	104.0	0.4	0.1	0.7
180.0	180.0	180.0	1.7	0.3	2.0

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%

- o0o -

[redacted]

ENTECH
Where Solutions Begin

Calibration Certificate

NSC-TISI-TIS 17025
CALIBRATION 0157

Certificate No.: T/O 650134
Date of issue : 11-Oct-2022

Equipment Description	:	Refrigerator
Equipment Model	:	P1010
Equipment Serial No.	:	P1010-1020-0005
I.D. No. or Control No.	:	TNP.LAB.01
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	:	10-Oct-2022
Receiving No.	:	O-220115
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 : 10-Oct-2022

[redacted]

Entech Industrial Solution Co.,Ltd.
17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210 THAILAND Tel. 0-2779-8888 Calibration@entech.co.th
Tax ID : 0105536035591 www.entech.co.th

ENTECH
Where Solutions Begin

Calibration Certificate

NSC-TISI-TIS 17025
CALIBRATION 0157

Certificate No. : T/O 650134

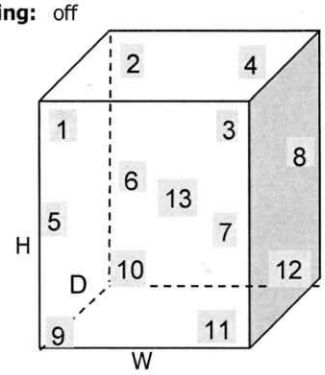
The Reference Standard Instrument :-

Instrument	Model	Serial No.	Cert No.	
1) Data logger with RTD Probe	Agilent 34972A	MY60008352	PSL-T 0524-3/65	4-Apr-2023

Measured room conditions

Temperature :	Minimum:	30.4 °C	Maximum:	31.6 °C
Humidity :	Minimum:	51.4 %RH	Maximum:	56.7 %RH
Voltage :	Minimum:	220.1 VAC	Maximum:	223.2 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								
		Sensor Position								
(°C)	(°C)	1	2	3	4	5	6	7	8	9
4.0	4.0	4.52	4.36	4.21	4.00	4.52	4.20	4.77	4.39	4.07
		Sensor Position								
		10	11	12	13					
		4.16	4.17	4.54	4.07					

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	1.07	0.93	2.23	1.2	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

Entech Industrial Solution Co.,Ltd.
17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210 THAILAND Tel. 0-2779-8888 Calibration@entech.co.th
Tax ID : 0105536035591 www.entech.co.th

Calibration Certificate

Cert. No. : CT-23-01-23295

Issued date : 24 January 2023

Equipment : Water Bath , Manufacturer : MLAB , Model : WBN30
S/N = 0347 , Customer ID = -

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

Received Date : 20 January 2023
Calibrated by : Mr.Apiwat Mungsamak
Calibrated Date : 20 January 2023

Ref. Job No. : SO6601-00020
Cert. prepare by : Ms.Nattanicha Panumram
Approved by : Mr.Montree Ruschasetkul

Calibration Place : ห้องปฏิบัติการ2
Environment Condition : Temperature 28.5 ± 2.7 (°c) , Humidity 57.5 ± 14.5 (%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	10/2023
2	Thermo Hygrometer	MTEC-CE-0183	TP-50	06/2023

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.



44 Soi ChokChai 4 Soi 40 ,LadPrao ,Bangkok ,Tel.: 0-2538-9205 ,0-2935-7096 ,Fax. : 0-2931-4015 ,Email : contact@mtec.co.th , www.mtec.co.th

Certificate No. : CT-23-01-23295

Calibration Result :

Condition of UUC :

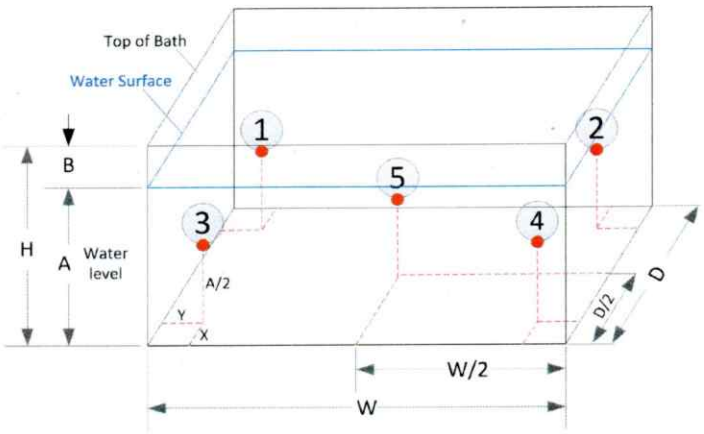
1) Adjust Condition : Without Adjustment
2) Lid Cover : Flat Sheet (Plastic , from
3) Circulation : without circulation
4) X ,Y = 5 cm. , B ~ 3 cm.

(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 througout observation time.



Pic 1 : Position of each sensor No.

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	85.30	85.30	84.83	84.76	85.51	0.627	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	1.34	0.45	1.64

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

Approved Signato [redacted]

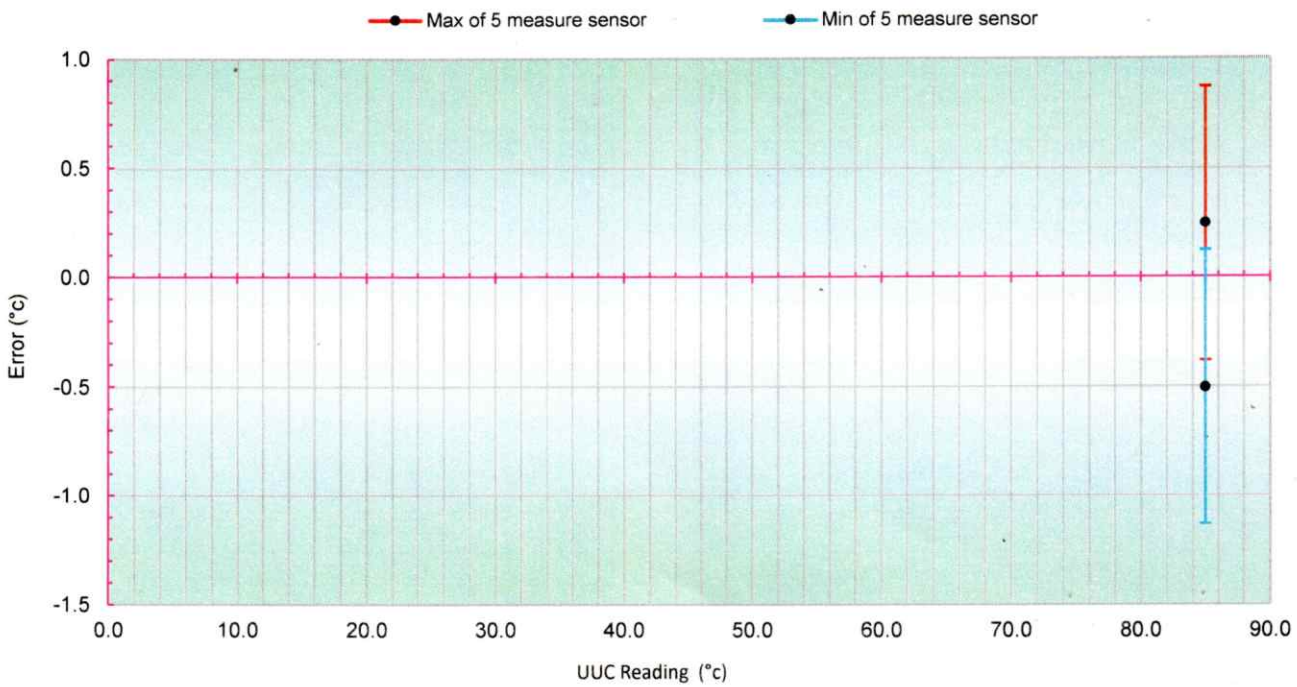
Section 3 : Possible of temperature in chamber. Show minimium and maximum of the average values and Include with uncertainty of measurement. , The average values is average of each position standard sensor througout observation time.

Unit : (°c)

Calibration Point	UUC Setting(*)	UUC Reading(*)	Possible of **Minimum** temperature in chamber	Possible **Maximum** temperature in chamber
85	85	85.0	84.13	86.13

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

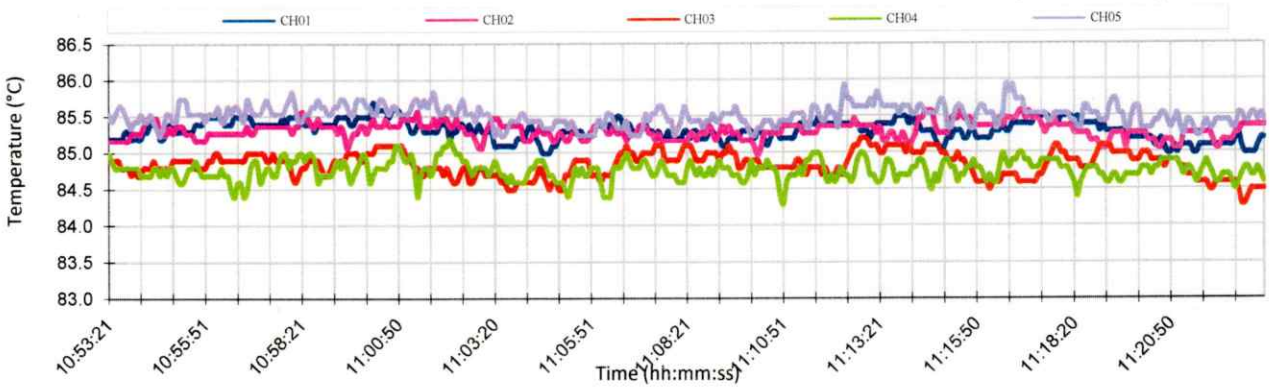
Section 4 : Trend of acuuracy



Approved Signator [redacted]

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

(5.1) Temperature Distribution at UUC Reading 85.0 °c



Approved Signat[redacted]

Sartorius (Thailand) Co., Ltd.
129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310
Tel: +66 2643 8361-6 , e-mail: service.thailand@sartorius.com

NSC-TISI-TIS 17025
CALIBRATION No.0426

SARTORIUS

Certificate of Calibration

Model Number : SECURA224-1S
Description : Analytical Balance
Serial Number : 41305301
Manufacturer : Sartorius

Certificate No. : 22BCI0160
Issued Date : Tuesday, June 21, 2022
Reference No. : 186783
Page No. : 1 0f 2

Customer Name : TNP Environment Co., Ltd.
332/173 Moo 3,Bang Rak Phatthana Bang Bua Thong, Nonthaburi 11110 Thailand.

Calibrated Place : Weighing Room

Calibrated By : [redacted]
Calibration Date : Thursday, June 16, 2022

Calibration Procedure No. : This calibration was conducted by
Using in-house calibration procedure number (WI-003)
Based on UKAS LAB 14 : 2019

Metrological data :

Capacity : 220 g Readability 0.0001 g

Ambients Conditions:

Temperature : 23.8 °C ± 5.0 °C
Humidity : 66.5 % RH ± 10.0 % RH
Pressure _ ± _

Reasons for calibration

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

Equipment Condition: ☑ Good Operate ☐ Fair

Measurement Method UKAS Publication Ref :Lab 14

The measurement uncertainty stated is the expended uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). The calibration certificate documents the traceability to National Standards, which realise the unit of measurement according to the International Standard System of Units (SI).

Traceability:

Model Number	Description	Traceability	Cetificate No.	Due Date
YCS011-522-00	Sartorius weight set 1mg - 5000g E2,YCS011-522-00	SPC-RT	C02212565	14-Sep-2023
MHB-382SD	Humidity/Barometer/Temp Lutron MHB-382SD	SPC-RT	C19210498	31-Aug-2022

This certificate relate and apply this equipment only.
This certificate may not be reproduced other than in full except with the prior written approval of the Verification Operation Division Sartorius (Thailand) Co., Ltd.

SOP FM 33 03 February 2022

[redacted]

STAMP

SARTORIUS (THAILAND) CO., LTD. sartorius ISO/IEC 17025 Cert no. 13007 / C219

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

SARTORIUS

Certificate of Calibration

Model Number : SECURA224-1S
Description : Analytical Balance
Serial Number : 41305301
Manufacturer : Sartorius

Certificate No. : 22BCI0160
Issued Date : Tuesday, June 21, 2022
Reference No. : 186783

Calibration Results : Without Adjustment

Repeatability

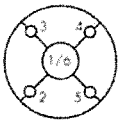
The reproducibility is the ability of a weighing instrument to display nearly identical readouts under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.

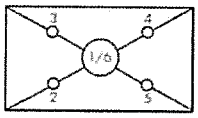
Nominal Value : (Low Load) 20 g	20.0000	200.0001
Tolerance *0.0001* g	20.0000	200.0000
	20.0000	200.0001
	20.0000	200.0000
	20.0000	200.0000
Nominal Value : (High Load) 200 g	20.0000	200.0000
	20.0000	200.0000
Tolerance *0.0001* g	20.0000	200.0001
	20.0001	200.0000
	20.0000	200.0000
Standard Deviation	0.00003	0.00005

Eccentricity (Off-center loading error)

The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximim capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R76).

Nominal value : 50 g
Tolerance *0.0004* g





	Difference
1	–
2	0.0000
3	0.0000
4	0.0000
5	0.0000
6	–

Linearity

The linearity, also called linearity error. Describes the deviation of the characteristic curve of a weighing instrument from the linear slope.

Tolerance *0.0002* g

Nominal Value (g)	Conventional Mass Value (g)	Displayed Value (g)	Deviation (g)	Uncertainty (g)
0.01	0.0100	0.0100	0.0000	0.00013
0.1	0.1000	0.1000	0.0000	0.00013
1	1.0000	1.0000	0.0000	0.00013
2	2.0000	2.0000	0.0000	0.00013
5	5.0000	5.0000	0.0000	0.00013
10	10.0000	10.0000	0.0000	0.00013
20	20.0000	20.0000	0.0000	0.00013
50	50.0000	50.0000	0.0000	0.00014
100	100.0000	100.0000	0.0000	0.00019
200	200.0000	200.0000	0.0000	0.00030

End of Report.

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484

NSC-TISI-TIS17025
CALIBRATION 0008

Certificate of Calibration

Certificate No. : 23T238
Page : 1 of 2

Equipment :	Liquid-in Glass Thermometer
Manufacturer:	SK
Model :	-
Serial No.:	-
ID No.:	TNP.LAB.12
Condition As-Received:	Used Item
Received Date:	27 January 2023
Calibration Date:	07 February 2023 to 10 February 2023
Reference:	2301-0937WN
Ambient Temperature:	(25 ± 3) °C
Relative Humidity:	(50 ± 20) %

This certificate may not be reproduced other than in full, except with the prior written approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.

Submitted by: TNP ENVIRONMENT CO.,LTD

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

Procedure used: Calibration were conducted using in-house calibration procedure CP-T02 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into liquid bath temperature controller. The temperature scale used was based on ITS-90.

Condition of this result of calibration

1.Reference standards instuments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Digital Thermometer	1529	A7A609	22I1274	17 Oct 2023
2) Industrial Platinum Resistance Thermometer	5627-12	571975	22I1274	17 Oct 2023

2.The UUC* was immersed into liquid bath temperature controller and the top about 12 mm of the liquid column above the bath medium in every calibration points.

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

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

-National Institute of Metrology Thailand (NIMT)

[redacted]

B 0307331

Result of Calibration:- Without Adjustment
Function: Temperature measurement.
Type: Total Immersion
Scale Division: 1 °C
Reference point (0 °C) Error = -0.9681 °C, with Uncertainty of Measurement of ± 0.16 °C

UUC* Reading (°C)	Standard Temperature (°C)	Error (°C)	Uncertainty of Measurement (± °C)
20	21.4342	-1.4342	0.16
30	31.5544	-1.5544	0.16
40	41.1382	-1.1382	0.16

Note: UUC* : Unit Under Calibration
The UUC* readings were made under magnification and resolved to one tenth of one scale division.

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

-o0o-

[redacted]

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	Total phosphorus	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	Escherichia coli Staphylococus aureus	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 Staphylococus 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.

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484

NSC-TISI-TIS17025
CALIBRATION 0008

Certificate of Calibration

Equipment :	Electronic Balance
Manufacturer :	Mettler Toledo
Model :	XSR205
Serial No. :	C009071872
ID No. :	UAE.WAO.012/2563
Submitted by :	United Analyst and Engineering Consulant Co.,Ltd. 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phakhanong, Bangkok 10260
Location :	Balance Room
Received order :	26 April 2022
Calibration Date :	26 April 2022
Ambient Temperature :	15 °C to 40 °C
Relative Humidity :	30 % to 90 %

[redacted]

Issue Date : 29 April 2022

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

20040716
เอกสารไม่ควบคุม

Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2204-0542OC-1

Procedure used :-

Calibration were conducted using in-house calibration procedure CP-OB01 according to direct measurement method against standard weight.

Condition of this result of calibration

1. Reference standard instruments:-

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	15884	-	70RC138	MM-0009-21	3 Feb 2023

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This result of calibration was made on requested at the point specified by customer.
4. This certificate is not certified for any commercial transaction.
5. This certification is traceable to the International System of Unit.

Result of calibration ( ) Without Adjustment (*) After Adjustment by Internal Calibration

Range capacity : 0 g to 81 g **Resolution** 0.00001 g
81 g to 220 g **Resolution** 0.0001 g

Before Adjustment :

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
80	80.00004	-0.00004	0.15	2.00
200	199.9999	+0.0001	0.35	2.00

After Adjustment :

1. **Determination of the standard deviation of weighing machine** (n = 10)

Applied Weight (g)	Standard Deviation of Reading (g)
80	0.000008
200	0.00005

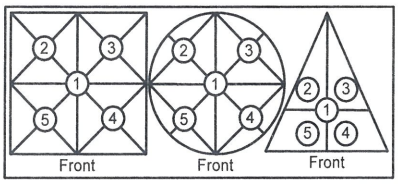
[redacted]

เอกสารไม่ควบคุม

Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2204-0542OC-1

Cert.No.: 22MM210

Result of calibration



2. Effect of off center loading

A mass of 100 g was placed to various position on the pan.
The weighing machine reading error obtained is given in the table

Position 1 (g)	Position 2 (g)	Position 3 (g)	Position 4 (g)	Position 5 (g)	Maximum difference between off-center and central loading (g)
-0.0002	-0.0001	0.0000	-0.0002	-0.0002	0.0002

3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (*k*)
Unload	0.00000	0.00000	0.016	2.13
0.05	0.05001	-0.00001	0.016	2.13
0.1	0.10001	-0.00001	0.017	2.11
1	1.00002	-0.00002	0.019	2.05
5	5.00003	-0.00003	0.026	2.00
20	20.00008	-0.00008	0.049	2.00
50	50.00010	-0.00010	0.080	2.00
80	80.00014	-0.00014	0.15	2.00
100	100.0001	-0.0001	0.21	2.00
150	150.0001	-0.0001	0.29	2.00
200	200.0001	-0.0001	0.35	2.00

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

-o0o-

[redacted]

เอกสารไม่ควบคุม

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Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center

ilac-MRA

THAILAND
NSC-TISI-TIS 17025
CALIBRATION 0061

Calibration Certificate

Certificate No.: 2203120-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhanong, Bangkok 10260

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: AB204-S/FACT

Serial No.: 1129361010

ID No.: UAE.WAS.002/2552

Order No.: 2203120

Operation No.: 2203120-001

Date of Receipt: 1 June 2022

Date of Calibration: 1 June 2022

[redacted]

The uncertainties are for a confidence probability of approximately 95%

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

เอกสารไม่ควบคุม

2008 ซอยอรุณอมรินทร์ 36 ถนนอรุณอมรินทร์ แขวงบางยี่ขัน เขตบางพลัด กรุงเทพมหานคร 10700
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ศูนย์บริการห้องปฏิบัติการอุตสาหกรรมอาหาร
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center

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NSC-TISI-TIS 17025
CALIBRATION 0061

Calibration Report

Certificate No.: **2203120-001-01**

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: AB204-S/FACT

Resolution: 0.0001 g

Serial No.: 1129361010

ID No.: UAE.WAS.002/2552

Capacity: 220 g

Date of Calibration: 1 June 2022

Environment Condition: Ambient Temperature: 19.9 ± 0.3 °C Relative Humidity: 45 ± 1.5 %

Place of Calibration: 108, Balance Room, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	B308068554	TCS	M2201020S	6 January 2023
Standard Weight Class E2	1-500g	B308068128	TCS	M2201021S	6 January 2023
Instrument	**Model**	**Serial No.**	**Calibrated By**	**Certificate No.**	**Due Date**
Thermo-Hygro Meter	PONPE 490	NFI.BTH 010/18	Quality Reborn	QR22-0350	18 February 2023

3. This certification is traceable to SI UNIT

4. This certificate was certified only for the instrument we calibrated.

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

Calibration Results:

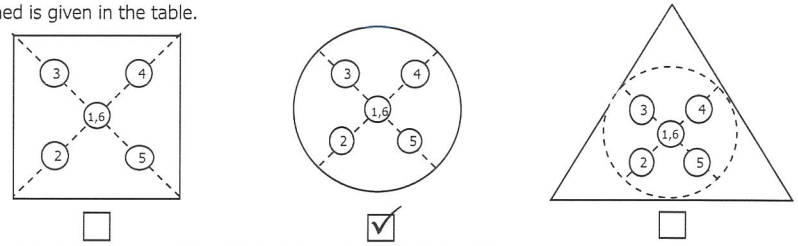
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
100	0.000048
200	0.000052

2. Off-Center Error:

A mass of 50 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



☐ ☑ ☐

1 (g)	2 (g)	3 (g)	4 (g)	5 (g)	6 (g)	(Maximum Difference) (g)
49.9999	49.9998	49.9998	49.9999	49.9998	49.9998	0.0001

[redacted]

เอกสารไม่ควบคุม

2008 ซอยอรุณอมรินทร์ 36 ถนนอรุณอมรินทร์ แขวงบางยี่ขัน เขตบางพลัด กรุงเทพมหานคร 10700
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Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center

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NSC-TISI-TIS 17025
CALIBRATION 0061

Calibration Report

Certificate No.: **2203120-001-01**

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: AB204-S/FACT

Resolution: 0.0001 g

Serial No.: 1129361010

ID No.: UAE.WAS.002/2552

Capacity: 220 g

Date of Calibration: 1 June 2022

Calibration Results: **(Continued)**

Calibration Range: 0 - 200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor *k*
Unload	0.00000	0.0000	0.0000	0.000088	2.00
0.01	0.01000	0.0100	0.0000	0.000088	2.00
0.05	0.05000	0.0499	0.0001	0.000088	2.00
0.1	0.10000	0.1000	0.0000	0.000088	2.00
0.2	0.20000	0.2000	0.0000	0.000088	2.00
0.5	0.50000	0.5000	0.0000	0.000088	2.00
1	1.00000	0.9999	0.0001	0.000088	2.00
2	2.00000	1.9999	0.0001	0.000089	2.00
5	5.00000	5.0000	0.0000	0.000089	2.00
10	9.99998	9.9999	0.0001	0.000092	2.00
20	19.99999	19.9999	0.0001	0.000094	2.00
50	49.99990	49.9999	0.0000	0.00012	2.00
70	69.99989	69.9998	0.0001	0.00014	2.00
100	100.00001	99.9999	0.0001	0.00017	2.00
150	149.99991	149.9997	0.0002	0.00022	2.00
200	200.00007	199.9998	0.0003	0.00030	2.00

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

[redacted]

---------- End ----------

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National Food Institute, Ministry of Industry, Thailand

2008 Soi 36, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phlat District, Bangkok 10700, Thailand.
Tel : +66 (0) 2422 8688 Fax : +66 (0) 2422 8545 Website : www.nfi.or.th E-mail : cal@nfi.or.th

Verification Certificate

Certificate No.: 2202361-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhanong, Bangkok 10260

Equipment: HEATING BLOCK DIGESTION

Manufacturer: FOSS

Model: 2520

Serial No.: 91794469

ID No.: UAE.WAS.011/2560

Order No.: 2202361

Operation No.: 2202361-001

Date of Receipt: 4 April 2022

Date of Calibration: 4-6 April 2022

[redacted]

The uncertainties are for a confidence probability of approximately 95 %.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

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Tel : +66 (0) 2422 8688 Fax : +66 (0) 2422 8545 Website : www.nfi.or.th E-mail : cal@nfi.or.th

Verification Report

Certificate No.: 2202361-001-01

Equipment: HEATING BLOCK DIGESTION

Model: 2520 Serial No.: 91794469

Resolution: 1 °C ID No.: UAE.WAS.011/2560

Manufacturer: FOSS

Date of Calibration: 4-6 April 2022

Location: Laboratory Room, NATIONAL FOOD INSTITUTE

Environment Condition:

Ambient Temperature (25 ± 3) °C

Relative Humidity (55 ± 15) %

Line Voltage (220 ± 10) Volt

Condition of this results of Calibration:

1. This instrument was calibrated by insert standard thermocuples type R into its heating block digestion and compared to temperature obtained from reference standards thermometer at calibrated point.
   - The temperature scale used was based on ITS - 90 .
   - All data show below were final values and the initial data may be obtained upon request.
2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with Thermocouple	34970A/34901A	MY44045576/MY41194453	TC21/0041	24-Apr-2022	N.M. Technical Center Laboratory
	Type R	TC#101-103 / CH#101-103			

3. This certificate is traceable to international system of units (SI Units).
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.
6. Condition of Calibrated item : Good

   UUC* Description

   Time of Record - Hour 30 Minute At 380 °C

7. Result of Calibration : [X] Without adjustment [ ] After adjustment

[redacted]

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Tel : +66 (0) 2422 8688 Fax : +66 (0) 2422 8545 Website : www.nfi.or.th E-mail : cal@nfi.or.th

Verification Report

Certificate No.: 2202361-001-01

Equipment: HEATING BLOCK DIGESTION

Model: 2520 Serial No.: 91794469

Resolution: 1 °C ID No.: UAE.WAS.011/2560

Manufacturer: FOSS

Date of Calibration: 4-6 April 2022

Calibration point: 380 °C

Calibration result:

Reporting of Temperature

Block No.	UUC* Setting (°C)	UUC* Reading (°C)	Stability (±°C)	Standard Thermometer (°C)	Uncertainty (±°C)
1	380	380	0.13	376.48	1.5
2	380	380	0.12	376.58	1.5
3	380	380	0.12	376.51	1.5
4	380	380	0.14	376.70	1.6
5	380	380	0.18	376.81	1.6
6	380	380	0.12	377.23	1.6
7	380	380	0.12	377.37	1.5
8	380	380	0.13	376.68	1.5
9	380	380	0.14	376.72	1.5
10	380	380	0.18	378.97	1.6
11	380	380	0.25	378.79	1.6
12	380	380	0.11	377.14	1.6
13	380	380	0.19	379.65	1.6
14	380	380	0.16	379.61	1.6
15	380	380	0.16	378.66	1.6
16	380	380	0.15	379.18	1.6
17	380	380	0.23	377.39	1.6
18	380	380	0.11	377.71	1.6
19	380	380	0.22	376.64	1.6
20	380	380	0.16	376.56	1.6

Note:

- UUC* = Unit Under Calibration
- Immersion depth of standard thermometer in tube level high of sand is equal heater plate of UUC.
- Stability = One-half of the greatest maximum difference of measured temperatures at one sensors, for at least half an hour after reaching steady state.

[redacted]

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National Food Institute, Ministry of Industry, Thailand
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Tel : +66 (0) 2422 8688 Fax : +66 (0) 2422 8545 Website : www.nfi.or.th E-mail : cal@nfi.or.th

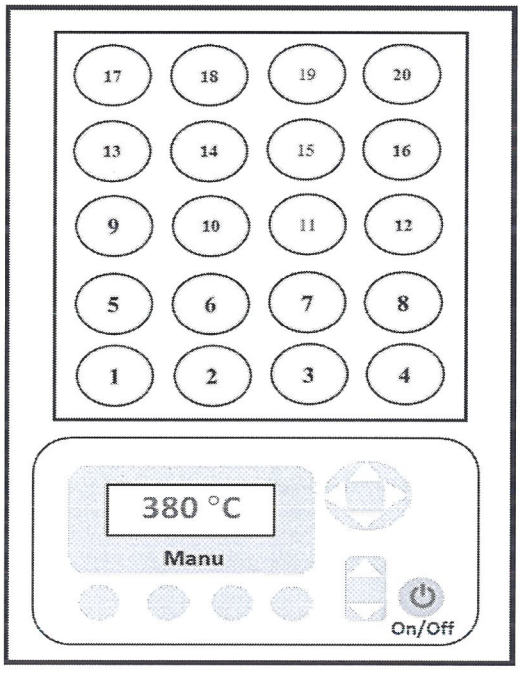
Verification Report

Certificate No.:	2202361-001-01
Equipment:	HEATING BLOCK DIGESTION
	Model: 2520 Serial No.: 91794469
	Resolution: 1 °C ID No.: UAE.WAS.011/2560
	Manufacturer: FOSS
Date of Calibration:	4-6 April 2022

Calibration point:	380 °C
Calibration result:	Continued

Figure 1. Location of Reference Standard and Block Diagram of Digestion Unit

TOP VIEW



Sensor Installation Location

Note:

- UUC* = Unit Under Calibration
- Immersion depth of standard thermometer in tube level high of sand is equal heater plate of UUC.
- Stability = One-half of the greatest maximum difference of measured temperatures at one sensors, for at least half an hour after reaching steady state.

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

--------- **End** ---------

[redacted]

เอกสารไม่ควบคุม

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484

NSC-TISI-TIS17025
CALIBRATION 0008

Certificate of Calibration

Equipment :	Incubator
Manufacturer :	Memmert
Model :	BE 400
Serial No. :	e402.1032
ID No. :	UAE.MIC.001/2546
Submitted by :	United Analyst and Engineering Consultant Co.,Ltd. 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Location :	Microbiology Laboratory
Received Order :	11 July 2022
Calibration Date :	11 July 2022
Ambient Temperature :	(26 ± 10) ^{o}C
Relative Humidity :	(50 ± 30) %

[redacted]

Issue Date : 18 July 2022

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services

เอกสารไม่ควบคุม

Equipment : Incubator
Condition As-Received : Used Item
Reference : 2207-0245OC-2

Cert. No.: 22TM1064

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

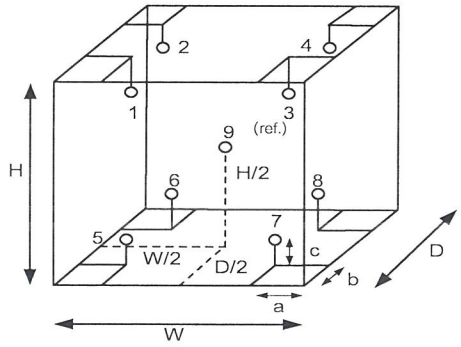
1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34972A	MY57013823	22LM24	26 Feb 2023

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

Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	25	25
REL.Humid. (%)	62	63
AC Supply (Volt)	222	223



Probe Installation Details :

a =	5.0	cm
b =	5.0	cm
c =	5.0	cm

Dimension of Chamber :

D =	0.40	m
W =	0.33	m
H =	0.40	m
Capacity =	0.053	m^3

Position :	Ref. Std. ID No.:
1	21-17RTD-01
2	21-17RTD-02
3	17RTD-03
4	17RTD-04
5	17RTD-05
6	17RTD-06
7	17RTD-07
8	17RTD-08
9 (ref.)	17RTD-09

เอกสารไม่ค[redacted]

Equipment : Incubator
Condition As-Received : Used Item
Reference : 2207-0245OC-2
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 22TM1064

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (±°C)	Coverage Factor *k*
37.0	38.0	38.0	0.092	0.62	0.94	0.30	2
56.0	57.5	57.5	0.083	0.87	1.3	0.42	2

Calibration Point (°C)	Measured Temperature (°C) Position								
	1	2	3	4	5	6	7	8	9 (ref.)
37.0	37.629	37.576	37.476	37.577	36.834	36.997	36.824	37.038	37.387
56.0	56.489	56.520	56.445	56.485	55.291	55.589	55.899	55.591	56.097

Average* : The average of 30 values in each position.
Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor
Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation
UUC* : Unit Under Calibration
Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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

-o0o-

เอกสารไม่ค[redacted]

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484

NSC-TISI-TIS17025
CALIBRATION 0008

Cert. No.: 22TM563

Certificate of Calibration

Equipment :	Incubator
Manufacturer :	Memmert
Model :	IPP 260
Serial No. :	V615.0187
ID No. :	UAE.MIC.003/2559
Submitted by :	United Analyst and Engineering Consultant Co.,Ltd. 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Location :	Microbiology Laboratory
Received Order :	7 April 2022
Calibration Date :	7 April 2022
Ambient Temperature :	(26 ± 10) °C
Relative Humidity :	(50 ± 30) %

[redacted]

Issue Date : 18 April 2022

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม

A 0040248

Equipment : Incubator
Condition As-Received : Used Item
Reference : 2204-0016OC-1

Cert. No.: 22TM563

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44067817	21LM10	20 Jul 2022

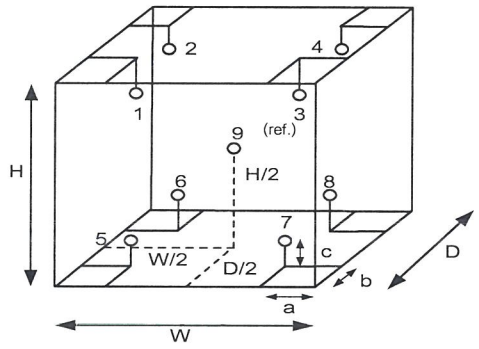
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	26	26
REL.Humid. (%)	60	62
AC Supply (Volt)	220	220



Position :	Ref. Std. ID No.:
1	15RTD2/11
2	15RTD2/12
3	15RTD2/13
4	15RTD2/14
5	15RTD2/15
6	15RTD2/16
7	15RTD2/17
8	15RTD2/18
9 (ref.)	15RTD2/19

Probe Installation Details :

a =	5.0	cm
b =	5.0	cm
c =	5.0	cm

Dimension of Chamber :

D =	0.50	m
W =	0.64	m
H =	0.80	m
Capacity =	0.26	m^3

[redacted]

เอกสารไม่ควบคุม
a 1104310

Equipment : Incubator
Condition As-Received : Used Item
Reference : 2204-0016OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 22TM563

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (±°C)	Coverage Factor *k*
35.0	35.0	35.0	0.12	0.53	0.79	0.30	2

Calibration Point (°C)	Measured Temperature (°C) Position								
	1	2	3	4	5	6	7	8	9 (ref.)
35.0	35.170	35.167	34.938	34.844	34.816	34.854	34.584	34.730	34.780

Average* : The average of 30 values in each position.
Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.
Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.
UUC* : Unit Under Calibration
Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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

-o0o-

[redacted]

เอกสารไม่ควบคุม
a 1104309

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484

NSC-TISI-TIS17025
CALIBRATION 0008

Certificate of Calibration

Equipment :	Water Bath
Manufacturer :	Memmert
Model :	WNE 14
Serial No. :	L414.1407
ID No. :	UAE.MIC.006/2558
Submitted by :	United Analyst and Engineering Consultant Co.,Ltd. 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Location :	Microbiology Laboratory
Received Order :	7 April 2022
Calibration Date :	7 April 2022
Ambient Temperature :	(26 ± 10) °C
Relative Humidity :	(50 ± 30) %

[redacted]

Issue Date : 18 April 2022

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม

Equipment : Water Bath **Cert. No.:** 22TM565

Condition As-Received : Used Item

Reference : 2204-0016OC-4

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT04 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

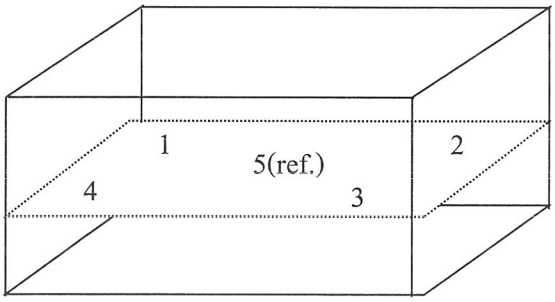
Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44067817	21LM10	20 Jul 2022

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	26	62	220
Finished of Calibration	26	65	220



Front

Position :	Ref. Std. ID No.:
1	70RC143
2	70RC144
3	70RC145
4	70RC146
5(ref.)	70RC147

เอกสารไม่ค[redacted]

Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2204-0016OC-4
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 22TM565

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C) Position				
			1	2	3	4	5 (ref.)
44.5	44.5	44.5	44.424	44.409	44.478	44.470	44.581

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor *k*
44.5	0.22	0.039	0.15	2

Average* : The average of 30 values in each position.
Uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
Stability : One-half of the greatest maximum difference of measured temperature at any one probe.
UUC* : Unit Under Calibration
Note : The reported uncertainty of measurement was included stability and excluded uniformity.

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

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เอกสารไม่ค[redacted]

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484

NSC-TISI-TIS17025
CALIBRATION 0008

Certificate of Calibration

Equipment :	Water Bath
Manufacturer :	Memmert
Model :	WNE 14
Serial No. :	L414.1410
ID No. :	UAE.MIC.007/2558
Submitted by :	United Analyst and Engineering Consultant Co.,Ltd. 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Location :	Microbiology Laboratory
Received Order :	7 April 2022
Calibration Date :	7 April 2022
Ambient Temperature :	(26 ± 10) °C
Relative Humidity :	(50 ± 30) %

[redacted]

Issue Date : 18 April 2022

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม

Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2204-0016OC-5

Cert. No.: 22TM564

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT04 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

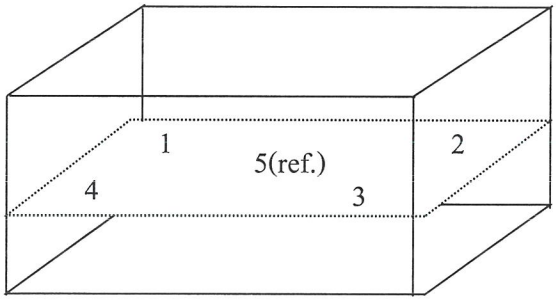
Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44067817	21LM10	20 Jul 2022

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	26	60	220
Finished of Calibration	26	62	220



Front

Position :	Ref. Std. ID No.:
1	70RC143
2	70RC144
3	70RC145
4	70RC146
5(ref.)	70RC147

เอกสารไม่ควร[redacted]

Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2204-0016OC-5
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 22TM564

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C) Position				
			1	2	3	4	5 (ref.)
44.5	44.5	44.5	44.498	44.530	44.542	44.635	44.591

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor *k*
44.5	0.16	0.068	0.15	2

Average* : The average of 30 values in each position.
Uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
Stability : One-half of the greatest maximum difference of measured temperature at any one probe.
UUC* : Unit Under Calibration
Note : The reported uncertainty of measurement was included stability and excluded uniformity.

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

-o0o-

เอกสารไม่ควบ

Calibration Certificate ID
TH2058-096-040722-ACC-TH

METTLER TOLEDO

Mettler-Toledo (Thailand) Ltd.
846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+66 2723 0382
MT-TH.ServiceSupport@mt.com

NSC-TISI-TIS 17025
CALIBRATION 0062

Accuracy Calibration Certificate

Customer

Company:	United Analyst and Engineering Consultant Co., Ltd.		
Address:	3 Soi Udom Suk 41, Sukhumvit Rd., Bang Chak		
City:	Phra Khanong	**Contact:**	Suwit Chotnok
Zip / Postal:	10260		
State / Province:	Bangkok		
Order Number:	*0332401494*		

Weighing Device

Manufacturer:	Mettler Toledo	**Instrument Type:**	Weighing Instrument
Model:	MS603S/01	**Asset Number:**	UAE.MIC.008/2553
Serial No.:	B007010311	**Terminal Model:**	N/A
Building:	N/A	**Terminal Serial No.:**	N/A
Floor:	2	**Terminal Asset No.:**	N/A
Room:	Balance Room (206)		

Range	Max. Capacity	Readability (d)
1	620 g	0.001 g

Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)
METTLER TOLEDO Work Instruction: CP/W002/20

This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.

The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.

In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

	Temperature		Humidity	
As Found	Start: 22.8 °C	End: 23.0 °C	Start: 49.9 %	End: 58.3 %

As Found Calibration Date: 07-Apr-2022
As Left Calibration Date: N/A
Issue Date: 08-Apr-2022

Calibrator:

Approved Signatory:

[redacted]

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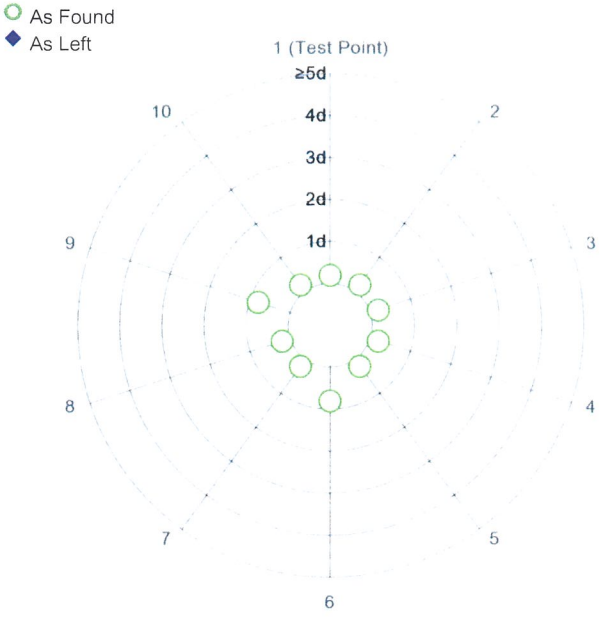
Measurement Results

Repeatability

Test Load: 200 g

	As Found	As Left
1	200.001 g	N/A
2	200.001 g	N/A
3	200.001 g	N/A
4	200.001 g	N/A
5	200.001 g	N/A
6	200.000 g	N/A
7	200.001 g	N/A
8	200.001 g	N/A
9	200.000 g	N/A
10	200.001 g	N/A

Standard Deviation	0.0004 g	N/A



The "d" in the graph represents the readability of the range/interval in which the test was performed.

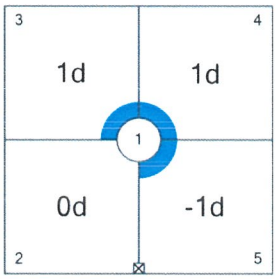
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 200 g

Position	As Found	As Left
1	200.001 g	N/A
2	200.001 g	N/A
3	200.002 g	N/A
4	200.002 g	N/A
5	200.000 g	N/A

Maximum Deviation	0.001 g	N/A



As Found

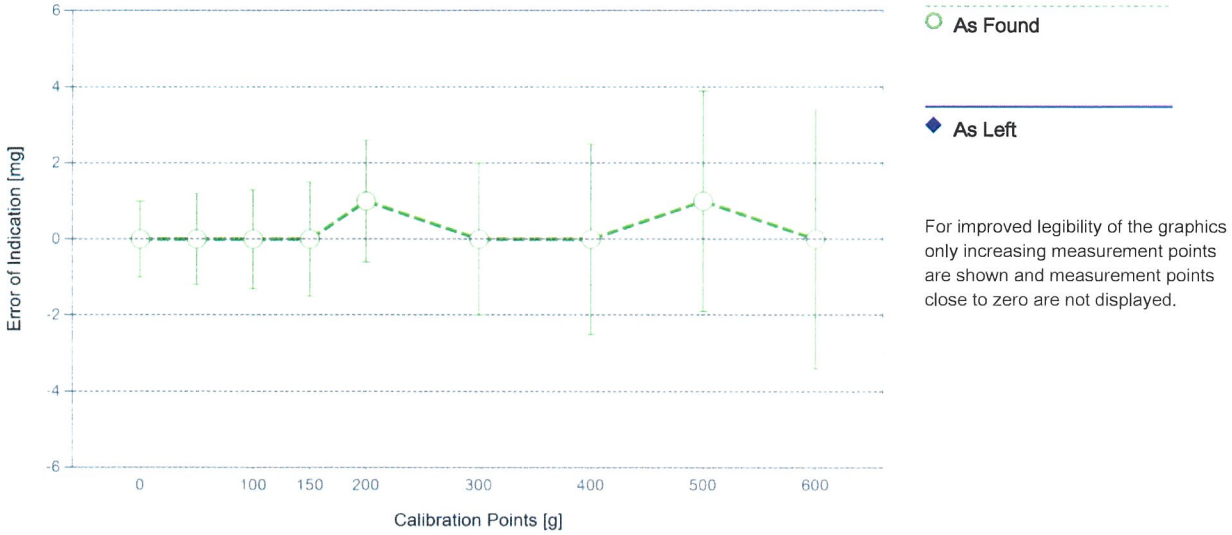
The "d" in the graph represents the readability of the range/interval in which the test was performed.

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Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.000 g	0.000 g	0.000 g	1.0 mg	2
2	0.500 g	0.500 g	0.000 g	1.2 mg	2
3	1.000 g	1.000 g	0.000 g	1.2 mg	2
4	50.000 g	50.000 g	0.000 g	1.2 mg	2
5	100.000 g	100.000 g	0.000 g	1.3 mg	2
6	150.000 g	150.000 g	0.000 g	1.5 mg	2
7	200.000 g	200.001 g	0.001 g	1.6 mg	2
8	300.001 g	300.001 g	0.000 g	2.0 mg	2
9	400.001 g	400.001 g	0.000 g	2.5 mg	2
10	500.001 g	500.002 g	0.001 g	2.9 mg	2
11	600.001 g	600.001 g	0.000 g	3.4 mg	2



For improved legibility of the graphics only increasing measurement points are shown and measurement points close to zero are not displayed.

The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k – which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

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เอกสารไม่ควบคุม

Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML F1

Weight Set No.:	WS55	Date of Issue:	09-Jul-2021
Certificate Number:	CCM-0137-21-C	Calibration Due Date:	07-Jul-2022

Weight Set 2: OIML E2

Weight Set No.:	WS80	Date of Issue:	23-Feb-2022
Certificate Number:	C208581631	Calibration Due Date:	14-Aug-2023

Thermo Hygrometer

Equipment No.:	IN161	Date of Issue:	14-Jun-2021
Certificate Number:	21H1220	Calibration Due Date:	01-Jun-2022

Remarks

FACT adjustment functionality activated

Equipment condition: Good

Next calibration according to customer's procedure

Calibration data not decide by calibration laboratory

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

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เอกสารไม่ควบคุม

Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with k=2 in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: $3.0 \cdot 10^{-6}$ / K

Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

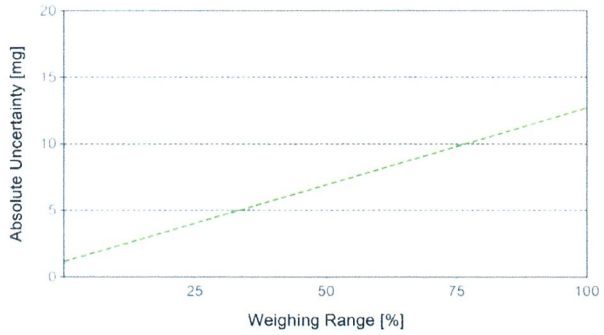
Linearization of Uncertainty Equation

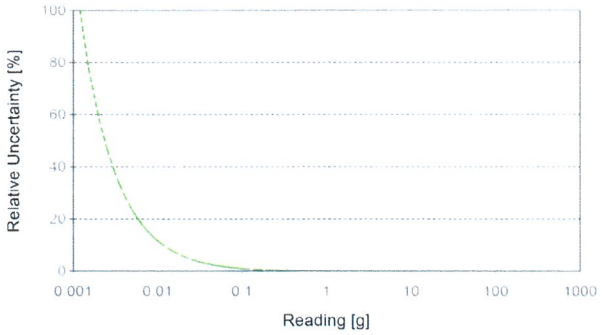
Range			As Found	As Left
	d	Max		
1	0.001 g	620 g	U_1 = 1.2 mg + 0.0186 mg/g · R	N/A

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found		As Left	
0.062 g	1.2 mg	1.9%	N/A	N/A
0.620 g	1.2 mg	0.20%	N/A	N/A
6.200 g	1.3 mg	0.021%	N/A	N/A
62.000 g	2.4 mg	0.0038%	N/A	N/A
620.000 g	13 mg	0.0021%	N/A	N/A





As Found As Left

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เอกสารไม่ควบคุม

DKSH

NSC-TISI-TIS 17025
Calibration 0087

Certificate of Calibration

Equipment:	Balance	Certificate No.:	C01223732
Model:	PX623	Issued Date:	09 December 2022
Serial No. (or ID.):	C236754745	Job No.:	KSPR2215576
Manufacturer:	Ohaus	Page:	1 of 2
Condition:	New		

Customer: United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak Sub-District,
Phrakhanong District, Bangkok, THAILAND 10260

Environment Condition:

Temperature	26 °C	±	0.5 °C
Humidity	53 %RH	±	3.9 %RH

Calibration Place: United Analyst and Engineering Consultant Co., Ltd. (301 Mircobiology Room)
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak Sub-District,
Phrakhanong District, Bangkok, THAILAND 10260

Calibration By: Mr. Adisai Maknoi

Calibration Date: 09 December 2022

The Method used: In-house method, CAL-WI-47, based on UKAS Lab 14

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Co., Ltd. Certificate No. C02221765

[redacted]

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

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

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

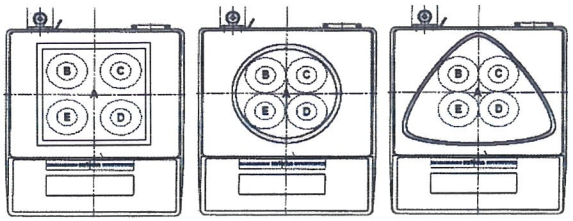
บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

เอกสารไม่ควบคุม

Calibration Results:

Without Adjustment

Eccentric Error: Weight to be 1/3 or 1/2 of Maximum capacity, taken from the center of the pan as a zero reference.



Nominal Test Value 200 (g)

Reference Points (g)				
A	B	C	D	E
-	0.000	0.000	0.000	0.000

Repeatability: Determination of the standard deviation of weighing balance., Readability 0.001 (g)

Nominal test value (g)	Standard Deviation
50	0.0004
500	0.0005

Error of indication from nominal or conventional mass value., Readability 0.001 (g)

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Error of indication (g)	Uncertainty (g)	k
1	1.0000	1.000	0.000	0.0010	2.03
5	5.0001	5.000	0.000	0.0010	2.03
10	10.0001	10.000	0.000	0.0010	2.03
20	20.0001	20.000	0.000	0.0010	2.03
50	50.0001	50.000	0.000	0.0010	2.03
100	100.0001	100.000	0.000	0.0011	2.03
200	200.0004	200.000	0.000	0.0011	2.02
300	300.0005	300.000	-0.001	0.0013	2.01
400	400.0008	400.001	0.000	0.0014	2.01
500	500.0003	500.000	0.000	0.0017	2.00
600	600.0004	600.000	0.000	0.0019	2.00

The End of Certificate

เอกสารไม่ควบคุม

Statements of conformity:

This conformity certificate documents the validity of the following statements of conformity based on the measurement results of corresponding calibration certificate:

The error of indication determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, UKAS Lab14. Therefore, those parameters have not been assessed separately.

Tolerance and Decision rules:

Assessment of the conformity of the measurement device are done based on direct comparison of the relevant measurement results with the tolerances and decision rule are prescribed by the customer.

Decision rule :

- ☐ Choice A — Binary Statement for Simple Acceptance Rule (w = 0), Specific Risk < 50% PFA.
- ☑ Choice B — Non-binary statement with guard band (w = 1 U), Pass or Fail Specific Risk < 2.5% PFA and Condition Pass or Condition Fail Specific Risk < 50% PFA.
- ☐ Choice C — Customer defined, Customers may define arbitrary multiple of r to have applied as guard band (w = r U) .

; PFA – Probability of False Accept

[redacted]

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

เอกสารไม่ควบคุม

Statements of conformity:

Without Adjustment

Readability; 0.001 g

Nominal Value g	Error of indication g	Guard band (w) g	Tolerance (±) g	Conformity
1	0.000	0.0010	0.002	Pass
5	0.000	0.0010	0.010	Pass
10	0.000	0.0010	0.020	Pass
20	0.000	0.0010	0.040	Pass
50	0.000	0.0010	0.100	Pass
100	0.000	0.0011	0.200	Pass
200	0.000	0.0011	0.400	Pass
300	-0.001	0.0013	0.600	Pass
400	0.000	0.0014	0.800	Pass
500	0.000	0.0017	1.000	Pass
600	0.000	0.0019	1.200	Pass

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

The End of Statements of conformity

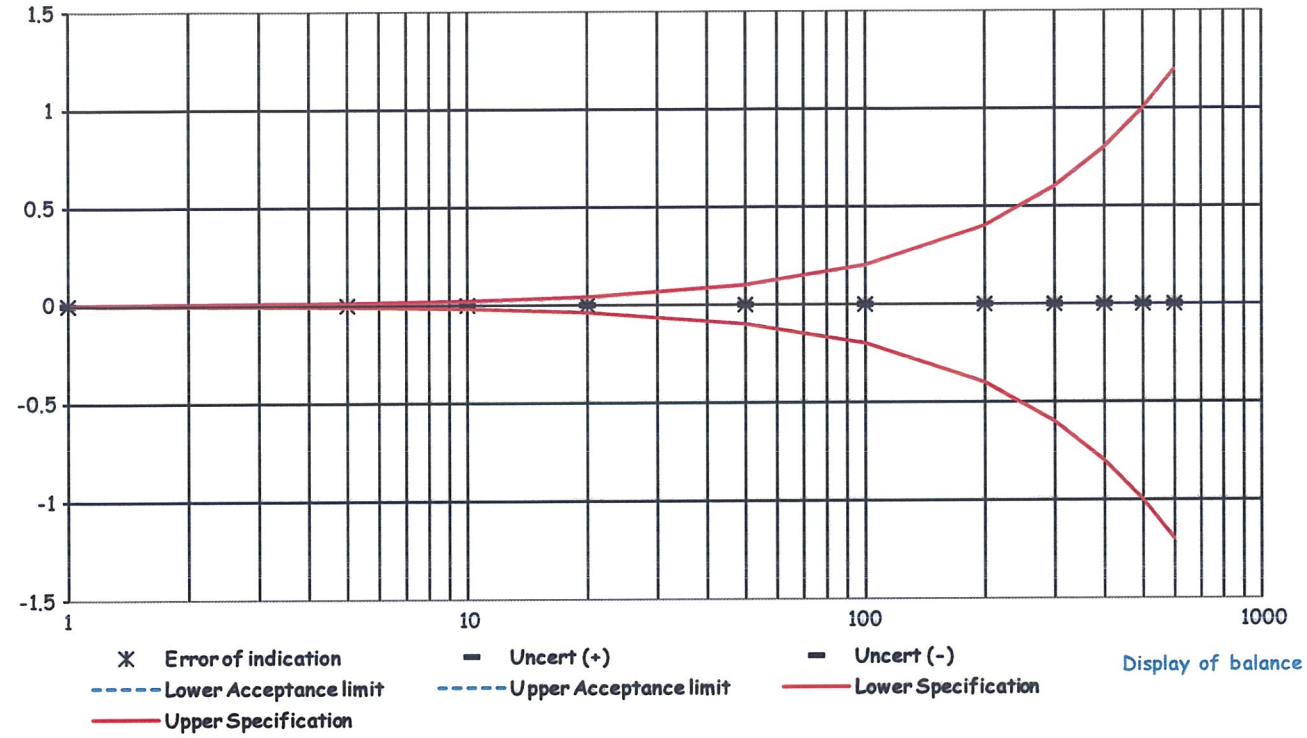
บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

เอกสารไม่ควบคุม

Without Adjustment

Job No.KSPR2215576

Readability:0.001g



เอกสารไม่ควบคุม

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484

NSC-TISI-TIS17025
CALIBRATION 0008

Certificate of Calibration

Equipment :	Autoclave
Manufacturer :	ALP
Model :	CL-40L
Serial No. :	807298
ID No. :	UAE.MIC.019/2560
Submitted by :	United Analyst and Engineering Consultant Co.,Ltd. 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Location :	301 Room
Received Order :	11 July 2022
Calibration Date :	11 July 2022
Ambient Temperature :	(26 ± 10) °C
Relative Humidity :	(50 ± 30) %

[redacted]

Issue Date : 18 July 2022

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม

Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2207-0245OC-7

Cert. No.: 22TM1121

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT03 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T

The temperature scale used was based on ITS-90.

Condition of this result of calibration

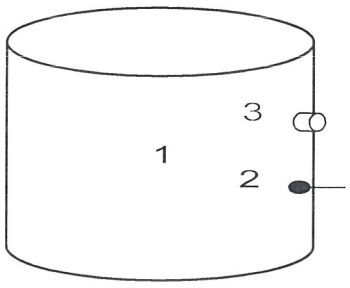
1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44060450	22LM46	28 Mar 2023

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.
4. This result of calibration covers laboratory autoclaves for the sterilization of goods and material which could be infected with organisms categorized as Hazard Group 1, 2 and 3**
(** = Categorization of pathogens according to hazard and categories of containment, second edition, 1990)
It does not cover autoclaves for use with material infect with organisms in Hazard Group 4, for which complete containment and sterilization of infected condensate is considered to be essential.
This result of calibration does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical or veterinary purposes which are directry concerned with patient care, or those used for fabrics subjected to sterilization which are required to be dry at the end of cycle.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source



	Environmental		
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	29	49	220
Finished of Calibration	32	48	220

Position	Description	Ref. Std. ID No.:
1 =	Center of chamber	22-14TC-01
2 =	Temperature sensor	22-14TC-02
3 =	Exhaust port	22-14TC-03

เอกสารไม่ควบ

Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2207-0245OC-7

Cert. No.: 22TM1121

Result of Calibration :- (*) Without Adjustment

Operating parameter Set : Temperature = 115 °C
Sterilization period = 15 minute

UUC* Setting (°C)	UUC* Reading (°C)	Position	Average* Standard Reading (°C)	Stability (± °C)	Pressure Reading (MPa)	Uncertainty (± °C)	Coverage Factor *k*
116	116	1	116.523	0.14	0.08	0.90	2
		2	116.566				
		3	116.440				

Operating parameter Set : Temperature = 121 °C
Sterilization period = 30 minute

UUC* Setting (°C)	UUC* Reading (°C)	Position	Average* Standard Reading (°C)	Stability (± °C)	Pressure Reading (MPa)	Uncertainty (± °C)	Coverage Factor *k*
122	122	1	122.503	0.19	0.12	0.91	2
		2	122.637				
		3	122.558				

Average* : The average of 30 values in each position.
Stability : One-half of the greatest maximum difference of measured temperature at any one probe.
UUC* : Unit Under Calibration
Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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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เอกสารไม่ควร

DQE Services Co.,Ltd.
32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Ladprao, Bangkok 10230
Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com

NSC-TISI-TIS 17025
CALIBRATION 0404

CERTIFICATE OF CALIBRATION

Certificate No. : SP23-007

Customer : United Analyst and Engineering Consultant Co.,Ltd. (Head Office)

Address : 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-1900

Serial No. : 2021-064

ID No. : UAE.WAS.006/2552

Received Date : 6 January 2023

Calibration Date : 6 January 2023

Issue Date : 10 January 2023

Condition Instrument : Used

[redacted]

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

The measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the DQE Services Co., Ltd.

เอกสารไม่ควบคุม

DQE Services Co.,Ltd.
32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Ladprao, Bangkok 10230
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NSC-TISI-TIS 17025
CALIBRATION 0404

REPORT OF CALIBRATION

Certificate No. : SP23-007

Environment Condition : Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 20 %RH

Calibration method : In-house method CP-01 Based on ASTM E275-08

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absobance Standard set	25760	95935	22 October 2023
Absobance Standard set	25757	95929	22 October 2023
Wavelength Standard set	25806	95916	22 October 2023
Wavelength Standard set	25758	95915	22 October 2023

Traceability : This certification is traceable to the International System of Unit maintained at National - Institute of Standards and Technology (NIST) through Starna Scientific Limited

Spectral Band Width of UUC : 4.0 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.

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NSC-TISI-TIS 17025
CALIBRATION 0404

REPORT OF CALIBRATION

Certificate No. : SP23-007

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor *k*
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5787	0.575	0.0037	0.0031	2.00
	1.0490	1.044	0.0050	0.0029	2.00
	2.1900	2.181	0.0090	0.0080	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5607	0.558	0.0027	0.0034	2.00
	1.0247	1.021	0.0037	0.0035	2.00
	2.1229	2.115	0.0079	0.0081	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5236	0.520	0.0036	0.0030	2.00
	0.9634	0.961	0.0024	0.0029	2.00
	1.9763	1.968	0.0083	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5191	0.518	0.0011	0.0031	2.00
	1.0003	1.000	0.0003	0.0033	2.00
	1.9987	1.993	0.0057	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5523	0.552	0.0003	0.0030	2.00
	1.0809	1.082	-0.0011	0.0030	2.00
	2.0391	2.031	0.0081	0.0080	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5601	0.562	-0.0019	0.0032	2.00
	1.0512	1.052	-0.0008	0.0030	2.00
	1.9294	1.923	0.0064	0.0079	2.00

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NSC-TISI-TIS 17025
CALIBRATION 0404

REPORT OF CALIBRATION

Certificate No. : SP23-007

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor *k*
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7478	0.743	0.0048	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8686	0.861	0.0076	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2912	0.291	0.0002	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6448	0.639	0.0058	0.0055	2.00

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NSC-TISI-TIS 17025
CALIBRATION 0404

REPORT OF CALIBRATION

Certificate No. : SP23-007

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor *k*
241.54	240.8	0.74	0.18	2.00
279.40	278.5	0.90	0.18	2.00
288.70	288.0	0.70	0.18	2.00
334.22	333.5	0.72	0.18	2.00
361.26	360.5	0.76	0.18	2.00
418.48	417.8	0.68	0.21	2.00
446.70	445.9	0.80	0.18	2.00
453.20	452.5	0.70	0.18	2.00
460.06	459.5	0.56	0.18	2.00
536.90	536.0	0.90	0.18	2.00
637.94	637.1	0.84	0.18	2.00
440.74	440.0	0.74	0.18	2.00
472.22	471.5	0.72	0.18	2.00
513.70	513.0	0.70	0.18	2.00
528.72	528.0	0.72	0.18	2.00
574.60	574.0	0.60	0.18	2.00
585.48	584.6	0.88	0.20	2.00
684.63	684.0	0.63	0.18	2.00
740.27	740.0	0.27	0.20	2.00
748.28	747.5	0.78	0.18	2.00
807.16	806.5	0.66	0.18	2.00
879.70	879.0	0.70	0.18	2.00

Remark : - UUC = Unit Under Calinration

- N/A = Not Avaiable

- The result expanded uncertainty of measurement U 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%

- * Indicates non TISI accredited

- End of Certificate -

เอกสารไม่ควบคุม

Hanna Instruments (Thailand) Ltd.

410/67-68 Soi Ratchadapisek 24, Ratchadapisek Rd., Samsen-nok,

Huaykwang, Bangkok 10310 Tel: 0-2541-4199 Fax: 0-2541-4198

ANSI National Accreditation Board ACCREDITED ISO/IEC 17025 CALIBRATION LABORATORY AC-3061

Certificate No. : HIT-2219-0480

CERTIFICATE OF CALIBRATION

Equipment :	COD Test Tube Heater		
Meter Model :	HI839800-02	**Serial No. :**	04500052101
Tube Heater :	25 Vial Capacity	**Accuracy :**	±2°C
Temperature Range :	-10 °C to 160 °C	**Temperature of Reaction :**	150°C
Ambient Temperature :	(25 ± 2)°C	**Relative Humidity :**	(50 ± 15)% RH
Manufacturer :	Hanna Instruments	**Made in :**	Romania
Condition As-Received :	Used Product	**Reference :**	RE220588

Customer name : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Rd., Bangchak,
Phrakhanong, Bangkok 10260

Received date : 29 April 2022

Calibrate date : 9 May 2022

Issue date : 10 May 2022

Calibrated Location : Hanna Instruments (Thailand) Ltd.

Calibration Procedure : This calibrator was conducted by using in-house: calibration procedure CP-04 by using certified reference material

[redacted]

Instruments (Thailand) Limited

This certificate was certified only for the instrument we calibrated.

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

** This certificate may not be reproduced other than in full, except with the prior written **

approval of the head of Hanna Instrument (Thailand).

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Condition of this calibration result

Reference Standard Instruments:

Instruments	Model	Serial No.	Certificate No.	Traceable
Data Acquisition Switch Unit	34970A	US37038858	WK2106-154-1	WK Electric Co., Ltd.

Calibration Result:

Measurement Temperature Source Accuracy for COD Reactor

Capacity (Vial)	Nominal Value (°C)	Average Value (°C)	± Uncertainty (°C)	± Tolerance of UUC (°C)	Acceptance Criteria
25 Vial	150.0	150.2	0.55	2	Pass

Figure: Shows the location of the temperature source.

(1A) 149.82°C	(2A) 149.36°C	(3A) 149.92°C	(4A) 149.43°C	(5A) 149.83°C
(1B) 150.45°C	(2B) 150.66°C	(3B) 150.37°C	(4B) 149.66°C	(5B) 150.01°C
(1C) 150.78°C	(2C) 151.30°C	(3C) 151.33°C	(4C) 149.57°C	(5C) 150.52°C
(1D) 151.12°C	(2D) 151.59°C	(3D) 150.80°C	(4D) 149.62°C	(5D) 149.81°C
(1E) 150.69°C	(2E) 149.58°C	(3E) 149.60°C	(4E) 149.24°C	(5E) 149.93°C

Remark: The Acceptance criteria is the error value plus or minus the Measurement Uncertainty, and then Not More than the Tolerance value of UUC, therefore concluded that pass.

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

** End of certificate **

เอกสารไม่ควบคุม