

ภาคผนวก ข

เอกสารสอบเทียบเครื่องมือที่ใช้ในการวิเคราะห์



THAI HEART CALIBRATION CO., LTD.
112/1 Moo 3, Phrak Sa, Muang, Satun Province 10240
Tel. 0-2344 2142, 0-2327 8415, 0-2327 8416 Fax. 0-2327 8307



CERTIFICATE OF CALIBRATION

Certificate No.: C0-1608001/24 Page 1 of total 4 pages

Customer: WATER ANALYSIS CENTER CO., LTD.
1/94 Moo 5, T.Kanham,
A.U-thai, Ayutthaya 13210

Equipment: pH Meter
Manufacturer: METTLER TOLEDO Model: SevenCompact S220
Serial No.: B327527211 ID No.: WWL 0068
Description: Range: 0 - 14 pH, Resolution: 0.01 pH

Environmental Conditions: Ambient Temperature: $(20 \pm 2) ^\circ\text{C}$
Relative Humidity: $(50 \pm 10) \%$
Atmospheric Pressure: -

Calibration Location: Jayhawk Laboratory (CL&GL)

Received Date: 16 August 2024

Calibration Date: 16 August 2024

Date of Issue: 19 August 2024

Condition of Artifacts: Used conditions but can be calibrated

Checked by:

Act as Technical Manager

Approved by:

Representative of Managing Director

(Dr. Ekachai Puitiwong)

() (Krisyost K.) () (Sakda Y.)
() (Patiphan K.) () (Onnapa P.)
() (Pongsak H.) () (Nilphong K.)
() (Kanung C.) () (Nonthachai K.)
() (Pratong P.) () (Noppol P.)

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FE-169

REV.02 02/24/21



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Certificate No.: C0-1608001/24

Page 2 of total 4 pages

Reference Method:

- The calibration method used was CP-178 based on an in-house method.

- This certificate can be traceable to the national standards, which is realized the shown measurement units according to the International System of Units (SI Units).

Reference Standard:

Type	pH Value	Lot No.	Due Date	Traceability
pH Standard Solution	4.01	150823	Feb. 9, 2025	NIMT
	7.01	180723	Jan. 12, 2025	
	10.01	160823	Jan. 16, 2025	

Type	Serial No.	Certificate No.	Due Date	Traceability
Documenting Process Calibrator	2630521	10-2312001/23	Dec. 24, 2024	THC
Digital Thermometer with Sensor	1709138 / 4605984-005	10-0806001/24	Jun. 7, 2025	

Remark: This certificate is traceable to the International System of Unit (SI Unit) through:

- NIMT, National Institute of Metrology (Thailand).
- THC, Thai Heart Calibration Co., Ltd.

Measurement Results:

1. Function Simulated pH Meter

Standard Applied (mV)	Nominal Value (pH)	UUC Reading		Uncertainty ($\pm$ mV)
		pH	mV	
177.48	4.00	4.01	177.3	0.060
0.00	7.00	7.00	-0.1	0.060
-177.48	10.00	10.01	-177.4	0.060

UUC: Unit Under Calibration

Note: Adjust Curve to simulate pH (4,7,10)

Calibrated by: Athipat

REV.02 02/24/21

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Certificate No.: C0-1608001/24

Page 3 of total 4 pages

Measurement Results (Cont.):

2. Calibration of pH Electrode (Serial No.: 3222623)

pH Standard Solution (pH)	Measured Value		Uncertainty ($\pm$ pH)
	(pH)	(mV)	
4.01	4.01	186.1	0.013
7.01	7.01	9.3	0.013
10.01	10.00	-164.5	0.013

Note: Adjust Curve to Buffer Solution pH (4,7,10)

Temperature stability of micro bath: $25 \pm 0.2^\circ\text{C}$

The above 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%.



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Certificate No.: C0-1608001/24

Page 4 of total 4 pages

Reference Method:

- The calibration method used was CP-096 based on an in-house method.

- The temperature scale used was an ITS-90.

- This certificate can be traceable to the national standards, which is realized the shown measurement units according to the International System of Units (SI Units).

Reference Standard Instruments:

Type	Serial No.	Cert. No.	Due Date	Traceability
Thermometer Readout	B7C853	10-0911001/23	Nov. 8, 2024	THC
Platinum Resistance Thermometer	4854	C0A30047	Oct. 22, 2025	FLUKE
Liquid Bath	XO111019	10-2405001/23	May 25, 2025	THC

Remark: This certificate is traceable to the International System of Unit (SI Unit) through:

- THC, Thai Heart Calibration Co., Ltd.
- FLUKE, Fluke Corporation, U.S.A.

Measurement Results:

(X) Without Adjustment

Dimension of probe: Diameter 4 mm, Sensor Type: RTD (PT100)

Immersion Depth (mm.)	Standard Reading ($^\circ\text{C}$)	UUC Reading ($^\circ\text{C}$)	Correction ($^\circ\text{C}$)	Uncertainty ($\pm$ $^\circ\text{C}$)
120	22.00	22.2	-0.20	0.065
120	25.00	25.2	-0.20	0.065
120	28.00	28.2	-0.20	0.065

UUC: Unit Under Calibration

The above 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 -

Calibrated by: Athipat

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Calibrated by: Pongsak

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THAI HEART CALIBRATION CO., LTD.
1271 Moo 5, Phrak Sa, Muang, Samut Prakan 10580
Tel. 0-2594-3143, 0-2594-8437, 0-2771-8999 Fax. 0-2771-8595



CERTIFICATE OF CALIBRATION

Certificate No.: C0-1607004/24 Page 1 of total 2 pages

Customer: WATER ANALYSIS CENTER CO., LTD.
1/94 Moo 5, T.Kanham,
A.U-thai, Ayutthaya 13210

Equipment: Conductivity Meter
Manufacturer: ELUTECH Model: CON 2700
Serial No.: 2657889 ID No.: WW1. 0136
Description:

Environmental Conditions: Ambient Temperature: $(20 \pm 2) ^\circ\text{C}$
Relative Humidity: $(50 \pm 10) \%$
Atmospheric Pressure:

Calibration Location: Jayhawk Laboratory (CL&GI.)

Received Date: 16 July 2024

Calibration Date: 18 July 2024

Date of Issue: 18 July 2024

Condition of Artifacts: Used conditions but can be calibrated

Checked by:

Act as Technical Manager

Approved by:

Representative of Managing Director

() (Kriyosol K.) () (Sakda Y.)
() (Patiphan K.) (✓) (Onnapa P.)
() (Pongsak H.) () (Nitiphong K.)
() (Kanung C.) () (Nonthachai K.)
() (Pramong P.) () (Noppol P.)

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Tel. 0-2594-3143, 0-2594-8437, 0-2771-8999 Fax. 0-2771-8595



Certificate No.: C0-1607004/24

Page 2 of total 2 pages

Reference Method:

- The calibration method used was CP-177 based on an in-house method.

- This certificate can be traceable to the national standards, which is realized the shown measurement units according to the International System of Units (SI Units).

Reference Standard :

Material	Batch Value	Lot Number	Due Date	Traceability
Conductivity Standard Solution	147.1 $\mu\text{S}/\text{cm}$	S230330005	Nov. 9, 2024	SCP Science
	1.423 mS/cm	S231129006	May 13, 2025	SCP Science

Remark: This certificate is traceable to the International System of Unit (SI Unit) through:

- SCP Science.

Measurement Results: (Probe Serial No.: 93X219065)

Conductivity Standard Solution	Measured Value	Correction	Uncertainty ($\pm$)
147.1 $\mu\text{S}/\text{cm}$	149.0 $\mu\text{S}/\text{cm}$	-1.9 $\mu\text{S}/\text{cm}$	2.5 $\mu\text{S}/\text{cm}$
1.423 mS/cm	1.425 mS/cm	-0.002 mS/cm	0.0052 mS/cm

Note : Adjustment points: 147.1 $\mu\text{S}/\text{cm}$ 1.423 mS/cm

The above 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 -

Calibrated by: Athipat
REV.02 02/24/21

FE-169



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39/1 Soi 82, Sukhapibien 5 Rd., O ngoon,
Saimal, Bangkok 10220, Thailand
Tel. (662) 909-8820 (Audio 10 lines) www.imcinstrument.com



Certificate of Calibration

Certificate No. : MT24-7016
Page : 1 of 2

Customer : Water Analysis Center Co.,Ltd.
Address : 1/94 Moo 5 , Rojana Industrial Park . T.Kanham, A.U-Thai, Ayutthaya 13210

Description : Refrigerator
Manufacturer : B.T.Metrollogy Co.,Ltd
Model : REF 940L
Serial No. : BT-03-09-09
Identification No. : WWL 0043
Calibration Place : Customer Laboratory

Order No. : 2601/24
Received date : Aug 02, 2024
Calibration date : Aug 02, 2024
Environment Condition :
Temperature : $(25 \pm 10) ^\circ\text{C}$
Humidity : $(50 \pm 30) \% \text{RH}$

Calibration Method : Calibration were conducted using In-house calibration procedure CP-MT-005 According to comparison with LXI Data Acquisition Switch Unit with sensor The calibration methods based on Euramet Calibration Guide No.20 - guidelines on the Calibration of Temperature and/or Humidity Controlled Enclosures

Reference Standard Instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
LXI Data Acquisition Switch Unit with Sensor	34972A	MY49020096	MT23-7163	Nov 30, 2024

The effect that the result relate only to the items calibrated. It was found accurate as shown on date and place of calibration only.

Traceability : This measurement are traceable to the International System of Unit (SI), through National Institute of Metrology Thailand (NIMT)

The reported expanded uncertainty of measurement was based on standard uncertainty multiplied coverage factor $k = 2$, providing a level of confidence of not less than 95%



Calibrated by : Mr.Yuttakorn Jamniansan

Approved by :

(Mr.Panuwat Phukian)

Issue date : Aug 09, 2024

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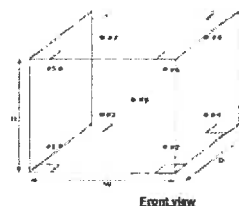
Certificate No. : MT24-7016
Page : 2 of 2

Function : Temperature measurement
Calibration point : $20 ^\circ\text{C}$

Result : Without adjustment
Resolution : $0.1 ^\circ\text{C}$

Calibration point ($^\circ\text{C}$)	Temperature of UUC* at each position ($^\circ\text{C}$)									Uncertainty of measurement ($\pm$ $^\circ\text{C}$)
	Ch.1	Ch.2	Ch.3	Ch.4	Ch.5	Ch.6	Ch.7	Ch.8	Ch.9	
20	20.344	20.056	20.405	20.375	20.193	20.010	20.245	20.090	20.037	0.41

Setting temperature ($^\circ\text{C}$)	Indicating Temperature ($^\circ\text{C}$)	Measured stability ($\pm$ $^\circ\text{C}$)	Measured uniformity ($^\circ\text{C}$)	Overall variation ($^\circ\text{C}$)
20.0	20.0	0.30	0.68	0.66



#1 Lower Left Front
#2 Lower Right Front
#3 Lower Left Rear
#4 Lower Right Rear
#5 Upper Left Front
#6 Upper Right Front
#7 Upper Left Rear
#8 Upper Right Rear
#9 Geometric Center

Front view

UUC* = Unit under calibration

Uniformity = Maximum and Minimum difference of measured temperature at any probes and the measured temperature at the reference and same time.

Overall Variation = Difference of temperature value between the maximum and minimum any time.

Stability = One half of the maximum difference of measured temperatures at any one probe

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Professional Calibration & Services Co., Ltd.
50/588, 50/589 Moo 5, Pongthasarakomayok Rd., Bangyotho, Thanyaburi
Pathumthani 12130 Thailand
Tel : (+662) 561 4641 (Auto) (9line)
Email : info@p-cal.com www.p-cal.com



Certificate of Calibration

Certificate Number : PL61070/24
Control Number : PCAL174170
Customer Control : WWL 0073
Description : Dissolved Oxygen Meter
Manufacturer : YSI
Model : YSI 5000
Serial Number : 14C100917
Customer : Water Analysis Center Co., Ltd.
1/64 Moo 5 T.Kanham A.U-Thai Ayutthaya 13210 Thailand

Page 1 of 3



Date of Receipt : 02-Dec-24
Date of Calibration : 02-Dec-24
Environment : Temperature 20 °C ± 2 °C
Relative Humidity 50 % ± 20 %
Calibration Method : Calibration Procedure Number CP-PL83
Calibration Results : See data attached

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

This certificate is issued in accordance with ISO/IEC 17025 and the conditions of accreditation granted by the Accreditation Body 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. The results relate only to the item calibrated.

This certificate shall not be reproduced other than in full except without the prior written approval of the Head of Calibration Laboratory of Professional Calibration & Services Co., Ltd.

Calibrated By

Authorized Signature

Ms. Supattra Mungkarnam

(Mr. Jinnong Junphong)

06-Dec-24

Issued Date

CALIBRATION REPORT

Professional Calibration & Services Co., Ltd.

Certificate No. : PL61070/24

Page : 3 of 3

Calibration Results

Dissolved Oxygen Calibration

Description of Meter : Range 0 to 60 mg/l
Resolution 0.01 mg/l
Description of Electrode : Manufacturer YSI
Model 5910
Serial No 13C160067
Type Electrochemical (Membrane)

Calibration Point	Standard Value	USC Reading	UUC Error	Uncertainty (u)
0 mg/l	0.000 mg/l	0.00 mg/l	0.00 mg/l	0.03 mg/l
8 mg/l	8.454 mg/l	8.43 mg/l	-0.02 mg/l	0.05 mg/l
9 mg/l	9.020 mg/l	9.02 mg/l	0.00 mg/l	0.05 mg/l

Notes :

- 1). Calibration results that carry the double asterisk (**) are not accredited. Calibrations marked as such on this Certificate have been included for completeness.

...End...

CALIBRATION REPORT

Professional Calibration & Services Co., Ltd.

Certificate Number : PL61070/24

Page 2 of 3

Equipment Standards Used

Description	Serial No.	Traceability to	Certificate No.	Cal. Due Date
Zero Oxygen Solution Set	-	NIST	5055023	01-May-28

Condition as received : Normal

Definitions :-

* NIST - National Institute of Standard and Technology



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Saimai, Bangkok 10220, Thailand
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Certificate of Calibration

Certificate No. : MT25-S161

Page : 1 of 2

Customer : Water Analysis Center Co., Ltd.
Address : 1/64 Moo 5 , Rojana Industrial Park , T.Kanham, A.U-Thai, Ayutthaya 13210

Description : Hot Air Oven
Manufacturer : Memmert
Model : UF260
Serial No. : B620.0814
Identification No. : WWL 0212
Calibration Piece : Customer Laboratory

Order No. : 1011/25
Received date : Mar 23, 2025
Calibration date : Mar 20, 2025
Environment Condition :
Temperature : (25±10) °C
Humidity : (50±10) %RH

Calibration Method : Calibration were conducted using in-house calibration procedure CP-MT-006 According to comparison with LXI Data Acquisition Switch Unit with sensor. The calibration methods based on Euramet Calibration Guide No.20 - guidelines on the Calibration of Temperature and/or Humidity Controlled Enclosures.

Reference Standard Instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
LXI Data Acquisition Switch Unit with Sensor	34972A	6Y49028922	MT24-8770	Nov 22, 2025

The effect that the result relate only to the items calibrated, it was found accurate as shown on date and place of calibration only.

Traceability : This measurement are traceable to the International System of Unit (SI), through National Institute of Metrology Thailand (NIMT)

The reported expanded uncertainty of measurement was based on standard uncertainty multiplied coverage factor $k = 2$, providing a level of confidence of not less than 95%

Calibrated by : Mr. Yuttakorn Jamneansri

Approved by :

(Mr. Parawut Phukden)
Issue date : Mar 28, 2025

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Certificate No. : MT25-3161

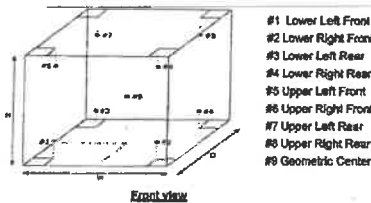
Page : 2 of 2

Function : Temperature measurement
Calibration point : 104, 180 °C

Result : Without adjustment
Resolution : 0.1 °C

Calibration point (°C)	Temperature of UUC* at each position (°C)								Uncertainty of measurement (± °C)
	Ch.1	Ch.2	Ch.3	Ch.4	Ch.5	Ch.6	Ch.7	Ch.8	
104	103.767	103.648	104.174	103.905	104.000	104.047	104.160	103.891	0.32
180	179.673	179.787	179.782	179.908	179.881	179.615	179.520	179.806	0.50

Setting temperature (°C)	Indicating Temperature (°C)	Measured stability (± °C)	Measured uniformity (°C)	Overall variation (°C)
104.0	104.0 to 104.2	0.13	0.75	0.80
180.0	180.0 to 180.3	0.39	0.58	0.81



UUC* = Unit under calibration

Uniformity = Maximum and Minimum difference of measured temperature at any probes and the measured temperature at the reference and same time.

Overall Variation = Difference of temperature value between the maximum and minimum any time.

Stability = One half of the maximum difference of measured temperatures at any one probe.

-00-



Certificate of Calibration

Equipment: Balance
Model: BL210S
Serial No. (or ID.): 15808131 (WWL 0022)
Manufacturer: Sartorius
Condition: In condition

Certificate No.: C01243793
Issued Date: 06 December 2024
Job No.: WO-00053756
Page: 1 of 2

Customer: Water Analysis Center Co., Ltd.
1/94 Moo 5, Rojana Industrial Park, Rojana Road,
Tambol Kanham, Amphur U-Thai, Ayutthaya 13210 Thailand

Environment Condition: Temperature 24 °C ± 0.9 °C
Humidity 53 %RH ± 1.3 %RH

Calibration Place: Water Analysis Center Co., Ltd. (หอพักห้อง)
1/94 Moo 5, Rojana Industrial Park, Rojana Road,
Tambol Kanham, Amphur U-Thai, Ayutthaya 13210 Thailand

Calibration By: Mr. Apiwit Chaosap
Calibration Date: 04 December 2024
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. C02241788

(Mr. Apiwit Chaosap)
Person in charge

(Mr. Adisai Maknoi)
Authorized signatory

This certificate is issued for 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 in this certificate 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. This report shall not be reproduced except in full without approval of DKSH Technology Limited.

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Delivering Growth - In Asia and Beyond.

CAL-FM-C01-14, 12 Sep 2022



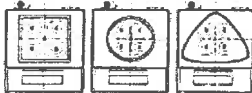
Certificate No.: C01243793

Page: 2 of 2

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 100 (g)				
Reference Points (g)				
A	B	C	D	E
-	0.0001	0.0000	-0.0002	-0.0001

Repeatability: Determination of the standard deviation of weighing balance., Readability 0.0001 (g)

Nominal test value (g)	Standard Deviation
20	0.00005
200	0.00006

Error of Indication from nominal or conventional mass value., Readability 0.0001 (g)

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Error of Indication (g)	Uncertainty (g)	k
1	1.00001	1.0000	0.0000	0.00011	2.04
2	2.00001	2.0000	0.0000	0.00011	2.04
5	5.00001	5.0000	0.0000	0.00011	2.04
10	10.00001	10.0000	0.0000	0.00011	2.04
20	20.00001	20.0000	0.0000	0.00012	2.03
50	50.00000	50.0000	0.0000	0.00013	2.02
70	70.00001	70.0001	0.0001	0.00016	2.01
100	99.99998	100.0001	0.0001	0.00017	2.01
120	119.99997	120.0001	0.0001	0.00021	2.00
150	149.99996	150.0002	0.0002	0.00024	2.00
200	199.99989	200.0007	0.0008	0.00030	2.00

The End of Certificate

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Delivering Growth - In Asia and Beyond.

CAL-FM-C01-14, 12 Sep 2022



MEGAFIL CO., LTD.

99/183 Moo 3 Tambon Bang Rak Noi Amphur Mueang Nonthaburi 11000
Tel. 0-2528-6081-2 Fax. 0-2528-6083, 0-2525-7034
www.megafil.co.th E-mail: megafil.group@gmail.com

BSC Certification Test Report

Page 1 of 6

Certificate No.: M1439/24
Customer Name: LABORATORY WATER ANALYSIS CENTER COMPANY LIMITED
Customer Address: 1/94 Moo 5 Kham Ham Subdistrict,
Uthai District, Phra Nakhon Si Ayutthaya 13210

Equipment: Biological Safety Cabinet Class II Type A2
Manufacturer: Microtech
Model: V6-T
Serial No.: 0972k097272
ID No.: WWL 0084

Were in accordance with ☒ EN 12469 ☐ NSF 49 ☐ Manufacturer's specification

Test Date: 15/10/2024

Due Date: 15/10/2025

or after HEPA filters are replaced or unit is moved

Test by: Mr. Pawut Wongnarakornkul

Approved by:

(Mr. Kridsada Thinhustoci)

Authorized Signatory

Issued Date: 16/10/2024

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

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Megafil Co., Ltd.

MG-FM-7.8-001, R00 (01/07/19)

Certificate No. : M1439/24

Procedure Used :
European Standard EN12469 : 2000 has the status of British Standard,
Biotechnology Performance criteria for microbiological safety cabinets.
NSF International Standard / American National Standard NSF / ANSI 49-2008
Biosafety Cabinet : Design, Construction, Performance and Field Certification.
Australian Standard : AS 1807.23-2000 Determination of intensity of radiation
from germicidal ultraviolet lamps.
Manufacturer's specification.

1. Downflow velocity test.

Measurement Information

No. of Rows	No. of Readings	Grid Spacing Front-Back	Grid Spacing Side-Side	Probe height Above sash
2	8	1/4, 3/4	1/8, 3/8	100mm

Measurement Data. (m/s.)

0.37	0.43	0.41	0.39
0.36	0.35	0.32	0.34

Average velocity 0.37 m/s (73 FPM.) Velocity range 0.35-0.50 m/s (69-98 FPM.)

Uniformity(EN: +1-20%avg.) 0.30 - 0.44 m/s (58 - 88 FPM.)

Supply filter dimension 24 x 72 (inch x inch) Supply filter area 10.69 SQ.FT

Downflow volume (Q) 780 CFM.

Result Summary ☒ Pass ☐ Fail

Equipment used : Thermo Anemometer Model 425 S/N : 02968605 Calibration date : 10/05/2024

Certificate No. : M1439/24

2. Inflow velocity test.

Select method : ☐ DIM ☒ Exhaust velocity. ☐ MFG's Specifications

MFG's Specifications method

0.54	0.57	0.55	0.54	0.55
0.56	0.55	0.56	0.57	0.54
0.59	0.53	0.54	0.57	0.56
0.53	0.6	0.56	0.55	0.58
0.55	0.58	0.54	0.53	0.55

(m/s.)

Average Inflow velocity 0.47 m/s (93 FPM.) Velocity range 0.40 m/s (79 FPM.)

Inflow dimension 8 x 72 (inch x inch) Inflow area 4.00 SQ.FT

Inflow volume(Q) 372 CFM

Result Summary ☒ Pass ☐ Fail

Adjustments Required ☐ Fan Speed ☐ Damper

Equipment used : Thermo Anemometer Model 425 S/N : 02968605 Calibration date : 10/05/2024

3. HEPA filter leak test.

Measurement Data

HEPA Filter	PAO Upstream Conc.(calculated)	Specification	Measured leak penetration
Supply HEPA Filter	18 µg/L	<0.01%	<0.01%
Exhaust HEPA Filter	18 µg/L	<0.01%	<0.01%

Certificate No. : M1439/24

Leak location

Supply HEPA Filter
Back



Exhaust HEPA Filter
Back



Result Summary ☒ Pass ☐ Fail

Equipment used : Aerosol Photometer Model TDA-2H S/N : 20138 Calibration date : 08/05/2024

Equipment used : Smoke Generator Model TDA-6C S/N : 20192

4. Airflow smoke patterns test

Measurement Information

- Downflow Pattern test : Smoke shall be passed from one end of the cabinet to the other, along the centerline of the work surface, at a height of 4 inch (10 cm) above the top of the access opening
- View screen retention test : Smoke shall be passed from one end of the cabinet to the other, 1.0 in (2.5 cm) behind the view screen, at a height 6.0 inch (15 cm) above the top of the access opening.
- Work opening edge retention test : Smoke shall be passed along the entire perimeter of the work opening. Particular attention should be paid to corners and vertical edges.
- Sash/window seal test : Smoke shall be passed up the inside of the window 2 in (5 cm) from the sides and along the top of the work area.

Certificate No. : M1439/24

Result Summary

Downflow Pattern test ☒ Accept ☐ Non-Conforming
View screen retention test ☒ Accept ☐ Non-Conforming
Work opening edge retention test ☒ Accept ☐ Non-Conforming
Sash/window seal test ☒ Accept ☐ Non-Conforming

5. Site installation

Sash Alarm. ☐ Pass ☐ Fail ☒ N/A
Interlock System. ☐ Pass ☐ Fail ☒ N/A
Exhaust System Performance ☐ Pass ☐ Fail ☒ N/A

Remark / Recommendation

ระบบ Site installation ไม่มีการตรวจสอบ เนื่องจากไม่มีฟังก์ชันนี้

6. Illumination Test (Lighting) : Option

Lighting should be adequate for safe working within the cabinet. Illumination measured at the work surface.

Lux

585	936	917	514
649	1400	1465	755

Equipment used : Digital Light Meter Model Easy View 318/N : 160404993 Calibration date : 08/05/2024

Remark :

Certificate No. : M1439/24

7. Ultraviolet Lamp Test (UV) : Option

Ultraviolet radiation where UV Lamp are fitted, the intensity of radiation at a wavelength of 254 nm.
Shall be not less than 400 mW/m² when measures at work floor surface.

mW/m²

630	1450	1480	690
380	920	930	390

Equipment used : UVC LIGHT METER Model UVC-254SD S/N : Q879819 Calibration date : 08/05/2024

Remark :

-000-

Certificate of Calibration

LIQUID BATH

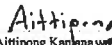


Certificate No.: MC 2413808

Customer : Water Analysis Center Co., Ltd.
1/94 Moo 5, T.Kantham, A.U.-Thai, Ayutthaya 13210.

Reference Job No. : 24-2841 Received Date : 16 December 2024
Description : Water Bath Resolution : 0.1 °C
Manufacturer : ESSTELL Model : EWB-122D
Serial No. : 20180508122 ID. No. : WWL 0214
Marking : Additionally for the purpose of identification by this laboratory a label marked with this certificate number (MC 2413808) has been attached to the case.
Method : In-House calibration procedure MWL-T-029 this method is base on ASTM E 715-2007 "Liquid Bath".
Location of Calibration : Water Analysis Center Co., Ltd. ; Laboratory.
Environmental Conditions : Ambient Temperature : (25.2 to 25.6) °C
Relative Humidity : (49.0 to 51.0) %
Date of Calibration : 16 December 2024 Date of Issue : 18 December 2024

Checked by : 
Chalermkit Rakphada
(Calibration Engineer)

Approved by : 
Aittipong Kanjanawatt
(Technical Manager)

The uncertainties are for a confidence probability of approximately 95%

This certificate is issued in accordance with the conditions of accreditation granted by the National Standardization Council of Thailand-Office of the National Standardization Council that 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 Master Calibration Co., Ltd.

Certificate No.: MC 2413808

Reference Standard Instrument :

Description : Certificate No. : Serial No. : Due date : Traceable thru :
Data Acquisition/Switch Unit MC 2403566 MY44020009 13 Mar 2025 MCAL
With Thermocouple Type " T " ID. No.27/1 to 27/5

Traceability :

The measurement standard traceable to the international system of units (SI) through certificate as mentioned above

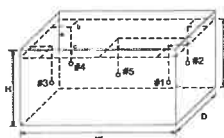
1. Calibration Procedure:

This Instrument was calibration according to ASTM E715 - 2007 by comparison with calibrated sensor under no load condition. The sensor were placed on five points and located one sensor in each of the eight corners of the chamber and was away from the each wall of 5 cm to 10 cm. And placed the five sensor within 2.5 cm of the geometric center of the chamber.

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. The reference sensor should preferably be located at the geometric center of the chamber.

Temperature Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.

Overall Variation - The Difference of the maximum and minimum measured temperatures throughout observation.



- Overall Ambient Temperature around the Chamber variation : 1.1 °C
- Overall Line Voltage variation 0.0 V
- Chamber Size (W*H*D) : 50 cm x 12 cm x 30 cm
- Water Level : 7 cm

Checked by : 

Certificate No.: MC 2413808

2. Result of calibration :

Temperature Measurement Accuracy Test

Indicating Temperature (°C)	Measured Temperature (°C) at Spread Locations					Uncertainty of measurement (±°C)
	#1	#2	#3	#4	Ref. #5	
45.0	44.6	44.6	44.5	44.5	44.4	0.86

Chamber Characterization Result

Desired Temperature (°C)	Controller Temperature (°C)	Indicating Temperature (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
44.5	45.0	45.0	0.85	0.75	1.9

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.0$, providing a level of confidence of approximately 95 %.

This certificate will certify of the calibrated equipment only.

End of Certificate

Checked by : 

Certificate of Calibration

TEMPERATURE CONTROLLER ENCLOSURES



Certificate No.: MC 2413810

Customer : Water Analysis Center Co., Ltd.
1/94 Moo 5, T.Kantham, A.U.-Thai, Ayuthaya 13210.

Reference Job No. : 24-2841 Received Date : 16 December 2024
Description : Incubator Resolution : 0.1 °C
Manufacturer : Memmert Model : IN260
Serial No. : D619.0170 ID. No. : WWL 0192
Marking : Additionally for the purpose of identification by this laboratory a label marked with this certificate number (MC 2413810) has been attached to the case.
Method : In-house calibration procedure MWI-T-033 this method Base on TLAS G-20-1/02-08 "Temperature Controlled Enclosures".
Location of Calibration : Water Analysis Center Co., Ltd. ; Laboratory.
Environmental Conditions : Ambient Temperature : (23.3 to 24.1) °C
Relative Humidity : (54.8 to 64.8) %
Date of Calibration : 16 December 2024 Date of Issue : 18 December 2024

Checked by : *Chalermit*
Chalermit Rakphada
(Calibration Engineer)

Approved by : *Aittipong*
Aittipong Kanjanasit
(Technical Manager)

The uncertainties are for a confidence probability of approximately 95%

This certificate is issued in accordance with the conditions of accreditation granted by the National Standardization Council of Thailand-Office of the National Standardization Council that 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 Master Calibration Co., Ltd.

[MCF-Q-077 ; Rev.6 ; Date : 22/04/2021]

Certificate No.: MC 2413810

Page 2 of 3

Reference Standard Instrument :

Description	Certificate No.	Serial No.	Due date	Traceable thru
Data Acquisition/Switch Unit	MC 2400121	MY59002240	18 Mar 2025	MCAL

With RTD ID. No.10/1 to 10/9

Traceability :

The measurement standard traceable to the international system of units (SI) through certificate as mentioned above

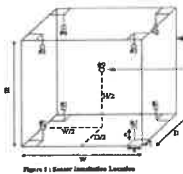
1. Calibration Procedure:

This Instrument was calibration according to TLAS G-20 by comparison with calibrated thermocouple type T under no load condition. The Thermocouples were placed on nine points and located one thermocouple in each of the eight corners of the chamber and was away from the each wall of 5 cm to 10 cm. And placed the ninth thermocouple within 2.5 cm of the geometric center of the chamber.

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. The reference sensor should preferably be located at the geometric center of the chamber.

Temperature Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.

Overall Variation - The Difference of the maximum and minimum measured temperatures throughout observation.



Overall Ambient Temperature around the Chamber variation : 1.2 °C

Overall Line Voltage variation : 0.1 V

Chamber Size (W*H*D) : 65 cm x 80 cm x 50 cm

Figure 1 : Sensor Installation Location

Checked by : *Chalermit*

[MCF-Q-077 ; Rev.6 ; Date : 22/04/2021]

Certificate No.: MC 2413810

Page 3 of 3

2. Result of calibration :

Temperature Measurement Accuracy Test

Indicating Temperature (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (±°C)	* Uncertainty does not include stability. (±°C)
	#1	#2	#3	#4	#5	#6	#7	#8	Ref. #9		
35.0	35.00	35.20	35.00	35.20	34.90	35.00	34.80	34.90	35.00	0.22	0.16

(*) : Non Accredited

Chamber Characterization Result

Desired Temperature (°C)	Controller Temperature (°C)	Indicating Temperature (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
35.0	35.0	35.0	0.08	0.25	0.50

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.0$, providing a level of confidence of approximately 95 %.

This certificate will certify of the calibrated equipment only.

End of Certificate

Checked by : *Chalermit*

[MCF-Q-077 ; Rev.6 ; Date : 22/04/2021]

ภาคผนวก ข-7

