

ภาคผนวก ข

เอกสารสอบเทียบเครื่องมือที่ใช้ในการวิเคราะห์



547 Soi Rachadaniwat, Kwang Samenok, Khet Huiywang, Bangkok 10310
Tel. : (02) 274 2978-9, (02) 2742987-8 Fax : (02) 274 2518, (02) 274 2989
Website : www.mastercalibration.com E-mail : calibrate@mastercalibration.com

MASTER CALIBRATION CO.,LTD.

Certificate No.: MC 2307702

Page 2 of 3

The Reference Standard Instrument :

Description	Certificate No.	Serial No.	Due date	Traceable thru
Data Acquisition/Switch Unit	MC 2303173	MY41010916	9 Mar 2024	MCAL
With Thermocouple Type "T" ID. No.17/1 to 17/9				

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.

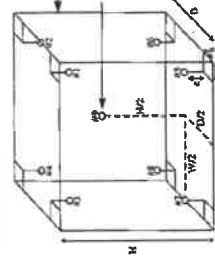


Figure 1 Sensor Installation Location

Overall Ambient Temperature around the Chamber variation : 3.2 °C
Overall Line Voltage variation : 0.1 V
Chamber Size (W*H*D) : 171 cm x 157 cm x 60 cm

Checked by : *Thanagim*

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

Master Calibration Co.,Ltd.

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MASTER CALIBRATION CO.,LTD.

Certificate of Calibration

TEMPERATURE
CONTROLLER ENCLOSURES



Certificate No.: MC 2307702

Page 1 of 3



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

Reference Job No. : 23-1577 Received Date : 11 July 2023
Description : Refrigerator
Manufacturer : SANDEN INTERCOOL Model : SEC-1500SBD
Serial No. : SEC1500201A-0708-00304 ID. No. : WWL0038
Marking : Additionally for the purpose of identification by this laboratory a label marked with this certificate number (MC 2307702) has been attached to the case.
Method : In-House calibration procedure MWI-T-033 this method is reference to TLAS G-20 "Temperature Controlled Enclosures".
Location of Calibration : Water Analysis Center Co., Ltd. ; Laboratory.
Environmental Conditions : Ambient Temperature : (25.3 to 25.9) °C

Date of Calibration : 11 July 2023 Date of Issue : 12 July 2023
Relative Humidity : (65.2 to 67.9) %

Checked by : *Thanagim* Approved by : *Aittipong*
Thanagorn Limchatcharoen Aittipong Kanjanawasi
(Calibration Supervisor) (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 2307702

Page 3 of 3

2. Result of calibration :

Temperature Measurement Accuracy Test

Indicating Temperature (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (±°C)
	#1	#2	#3	#4	#5	#6	#7	#8	Ref. #9	
2.5	4.4	4.2	4.2	4.2	4.0	3.9	4.1	4.0	3.8	0.86

Chamber Characterization Result

Controller Temperature (°C)	Indicating Temperature (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
2.0	2.5	1.50	1.01	3.3

The 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 %.

This certificate will certify of the calibrated equipment only.

End of Certificate

Checked by: *Thanayon*



THAI HEART CALIBRATION CO., LTD.
109/13 Moo 5, T. Kanham, A. Uthai, Ayutthaya 13210
Tel : 02-091-9102, 02-091-9103, 02-091-9104



CERTIFICATE OF CALIBRATION

Certificate No.: C0-1907007/23 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 EUTECH
Serial No. 2657889
Description .
Model CON 2700
ID No. WWL 0136

Environmental Conditions Ambient Temperature: (20 ± 2) °C
Relative Humidity: (50 ± 10) %
Atmospheric Pressure: -

Calibration Location Jayhawk Laboratory (CL&GL)
Received Date 19 July 2023
Calibration Date 19 July 2023
Date of Issue 20 July 2023

Condition of Artifacts Used conditions but can be calibrated

Checked by *[Signature]* **Approved by** *[Signature]*

Act as Technical Manager

Representative of Managing Director

(Dr. Ekachai Puttitwong)

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

This calibration certificate shall not be reproduced other than in full except with the prior written approval of the Thai Heart Calibration Co., Ltd.



Certificate No.: CO-190700723

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	147.8 $\mu\text{S/cm}$	S220611005	Dec. 6, 2023	SCP Science
	1.425 mS/cm	S220812006	May 31, 2024	

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 ($\pm$)
147.8 $\mu\text{S/cm}$	147.5 $\mu\text{S/cm}$	0.3 $\mu\text{S/cm}$	2.5 $\mu\text{S/cm}$
1.425 mS/cm	1.427 mS/cm	-0.002 mS/cm	0.0051 mS/cm

Note : Adjustment points: 147.8 $\mu\text{S/cm}$ 1.425mS/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 Onnapa
REV.02 02/24/21

FE-169

CERTIFICATE OF CALIBRATION

Page 1 of total 4 pages

Certificate No.: CO-180800523

Customer
WATER ANALYSIS CENTER CO., LTD.
1/94 Moo 5, T.Kanhnam,
A.U-thai, Ayuthaya 13210

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

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 18 August 2023
Calibration Date 18 August 2023
Date of Issue 21 August 2023
Condition of Artifacts Used conditions but can be calibrated

Checked by [Signature]
Approved by [Signature]

Act as Technical Manager
() (Krisyosl K.) () (Sakda Y.)
() (Patiphan K.) () (Onnapa P.)
() (Pongsak H.) () (Nitipong K.)
() (Kanung C.) () (Nonthachai K.)
() (Pramong P.) () (Noppol P.)
Representative of Managing Director
(Dr. Ekachai Putitwong)

This calibration certificate shall not be reproduced other than in full except with the prior written approval of the Thai Heart Calibration Co., Ltd.
REV.02 02/24/21
FE-169

Certificate No.: C0-1808005/23

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	030822	Feb. 9, 2024	NIMT
	7.01	300522	Feb. 9, 2024	
	10.01	230822	Feb. 7, 2024	

Type	Model	Serial No.	Certificate No.	Due Date	Traceability
Documenting Process Calibrator	754	2630521	10-2412001/22	Dec. 23, 2023	THC
Digital Thermometer with Sensor	1523 / 5622	1709138 / 4605984-005	10-0806001/23	Jun. 8, 2024	

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 (± mV)
		pH	mV	
177.48	4.00	4.01	177.4	0.060
0.00	7.00	7.00	0.0	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)

Certificate No.: C0-1808005/23

Measurement Results (Cont.):

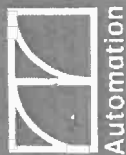
2. Calibration of pH Electrode (Serial No.: 3222623)

pH Standard Solution (pH)	Measured Value		Uncertainty (± pH)
	(pH)	(mV)	
4.01	4.01	180.0	0.013
7.01	7.00	4.0	0.013
10.01	10.01	-172.0	0.013

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

Temperature stability of micro bath : 25 ± 0.2°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%.



AUTOMATION SERVICE CO., LTD.

CALIBRATION LABORATORY

Cert. No. WAC-065
Page 1 of 2

SV 201003/2023

Certificate No.: C0-1808005/23

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	Model	Serial No.	Cert. No.	Due Date	Traceability
Thermometer Readout	1529-R	B7C853	10-0911001/22	Nov. 9, 2023	THC
Platinum Resistance Thermometer	5626	4854	C0A30047	Oct. 22, 2023	FLUKE
Liquid Bath	XORTS-40A	XO111019	10-2405001/23	May 25, 2025	THC

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

- THC, Thai Heat 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 (°C)	UUC Reading (°C)	Correction (°C)
120	22.00	22.2	-0.20
120	25.00	25.2	-0.20
120	28.00	28.2	-0.20

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 Pongsak
REV.02 02/24/21

FE-169

CERTIFICATE OF CALIBRATION

Instrument : DO Meter
Model : DO-31P
Serial No. : 780065
Manufacturer : TOA-DKK
Measuring Range : 0.00 ~ 20.00 mg/l

Machine : -
Location : -

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

Date Of Received : 05 / 01 / 2023
Date Of Calibration : 05 / 01 / 2023

Ambient Condition : Temperature 25 °C
Humidity 50 % RH

Calibrated By :

P. Yooyen
(Ms. Phanee Yooyen)
Technician

Approved By :

Mr. Nipon Phungsomsak
Technical Manager

Date Of Issue :

09 / 01 / 2023

This Certificate may not be reproduced other than in full, except with the prior written approval of the head of the industrial instruments calibration center.

Instrument : DO Meter
Model : DO-31P
Serial No. : 780065

Cert. No. WAC-065
Page 2 of 2

Calibrate Procedure

- ☐ This instrument was calibrated by comparison with standard solution (PH/ORP)
- ☐ This instrument was calibrated by comparison with scattering plate value (Turbidity)
- ☐ This instrument was calibrated by comparison with conductivity (Conductivity)
- ☒ This instrument was calibrated by comparison with Sodium sulfite anhydrous (DO)

Condition of this result of calibration

1). Reference Standard Solution

<u>Standard</u>	<u>Lot No</u>	<u>Batch</u>	<u>Cert. No.</u>	<u>Due Date</u>
Sodium Sulfite Power	1.06657.0500	K54224057	-	30 Sep 2023

2). **Traceability** This certification is traceable to

- ☒ Merck KGaA 64271 Darmstadt
☐ DKK Corporation

Result Of Calibration

Standard Solution		Before Adjust		After Adjust	
(mg/l) at 24.1°C		Indicator	Error	Indicator	Error
Zero	0.00	0.05	+ 0.05	0.00	-
Span	8.25	7.13	- 1.12	8.25	-

DO Electrode No. OE270AA(5) S/N 111F0029

Calibrated By P. Vooyen
(Ms. Phanee Vooyen)
Technician

Certificate of Calibration

**TEMPERATURE
CONTROLLER ENCLOSURES**



Certificate No.: MC 2303684

Page 1 of 3



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

Reference Job No. : 23-0729 Received Date : 23 March 2023

Description
: Oven

Manufacturer	: Memmert	Model	: UF260
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Serial No.	: B620.0814	ID. No.	: WWJ.0212
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Marking : Additionally for the purpose of identification by this laboratory a label marked with this certificate number (MC 2303684) has been attached to the case.

Method

TLAS G-20 "Temperature Controlled Enclosures"

Location of Calibration : Water Analysis Center Co., Ltd. : Laboratory.

Environmental Conditions : Ambient Temperature : (27.1 to 29.3) °C

Relative Humidity : (38.0 to 72.2) %

Date of Calibration	: 23 March 2023	Date of Issue	: 24 March 2023
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Checked by: Thunagorn
Thunagorn Limchaicharon
(Calibration Supervisor)

Approved by: Aitipong
Aitipong Karjanwasit
(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

Certificate No.: MC 2303684

Page 2 of 3

The Reference Standard :

Description
Data Acquisition/Switch Unit
With Thermocouple Type " T " ID. No.17/1 to 17/9

Certificate No. Serial No. Due date
MC 2303173 MY41010916 9 March 2024

This certificate is traceable to the International system of units maintained at:

- Master Calibration Co., Ltd.

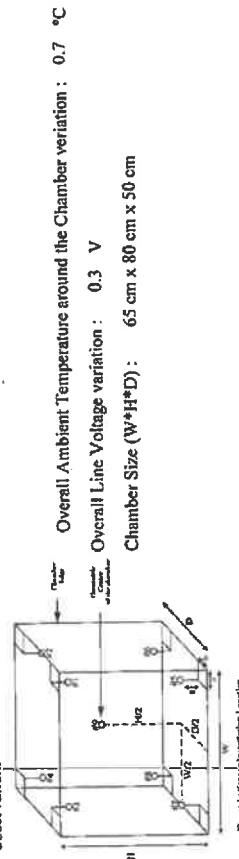
1. Calibration Procedure:

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.



Certificate No.: MC 2303684

Page 3 of 3

2. Result of calibration :

Temperature Measurement Accuracy Test

Indicating Temperature (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (±°C)
	#1	#2	#3	#4	#5	#6	#7	#8	Ref. #9	
104	103.7	103.9	103.6	103.8	103.7	104.2	104.1	104.2	104.3	0.58
180	179.4	179.8	179.4	179.7	179.4	179.9	179.8	180.2	180.0	1.3

Chamber Characterization Result

Controller Temperature (°C)	Indicating Temperature (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
104	104	0.32	0.84	1.2
180	180	0.4	0.9	1.3

The 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 %.

This report will certify of the calibrated equipment only.

End of Certificate



Certificate of Calibration



Equipment: Balance
Model: BL 210S
Serial No. (or ID.): 15808131 (WML 0022)
Manufacturer: Sartorius
Condition: In condition

Certificate No.: C01223710
Issued Date: 07 December 2022
Job No.: KSPR2215481
Pages: 1 of 2

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

Environment Condition: Temperature 25 °C $\pm$ 0.9 °C
Humidity 48 %RH $\pm$ 4.9 %RH

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

Calibration By: Mr. Pradit Sritboot
Calibration Date: 07 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. C02221864

(Mr. Pradit Sritboot)
Person in charge

(Mr. Rungrod Jenkitrakulchai)
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 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.

1/94 Moo 5, Rojana Industrial Park, Rojana Road,
Tambol Kanham, Amphur U-Thai, Ayuthaya 13210 Thailand

Calibration Result: 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	Reference Points (g)				
	A	B	C	D	E
-	0.0001	0.0001	0.0001	-0.0002	-0.0001

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

Nominal test value (g)	Standard Deviation
20	0.00007
200	0.00007



The End of Certificate

BSC Certification Test Report

Page 1 of 6

Certificate No. : M1333/23

Customer Name : LABORATORY WATER ANALYSIS CENTER COMPANY LIMITED

Customer Address : 1/94 Moo 5 T.Kanham, A.U.-Thai,
Phra Nakhon Si Ayutthaya 13210

Equipment : Biological Safety Cabinet Class II Type A2

Manufacturer : Microtech

Model : V6-T

Serial No : 0972

ID No. : WWL 0084

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

Test Date : 12/10/2023

Due Date : 11/10/2024 or after HEPA filters are replaced or unit is moved

Test by : Mr. Puwadol Kowwila

Approved by : 
(Mr.Kridsada Thinhuafoei)
Authorized Signatory

Issued Date : 16/10/2023

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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Page 2 of 6

Certificate No. : M1333/23

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	100 mm

Measurement Data. (m/s.)

0.35	0.41	0.42	0.41
0.39	0.34	0.35	0.34

Average velocity 0.38 m/s (75 FPM.) Velocity range 0.25-0.50 m/s (49-98 FPM.)

Uniformity(EN: +/-20%avg.) 0.30 - 0.46 m/s (60 - 90 FPM.)

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

Downflow volume (Q) 802 CFM.

Result Summary ☒ Pass ☐ Fail

Equipment used : Thermo Anemometer Model 425 S/N : 03004786 Calibration date : 16/02/2023

Certificate No. : M1333/23

2. Inflow velocity test.

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

	0.56	0.56	0.57	0.56	0.54
	0.59	0.54	0.55	0.56	0.57
	0.57	0.56	0.57	0.54	0.58
	0.56	0.58	0.57	0.58	0.59
	0.57	0.54	0.54	0.55	0.57

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 : 03004786 Calibration date : 16/02/2023

3. HEPA filter leak test.

Measurement Data

HEPA Filter	PAO Upstream Conc.(calculated)	Specification	Measured leak penetration
Supply HEPA Filter	17 µg/L	<0.003%	<0.003%
Exhaust HEPA Filter	17 µg/L	<0.003%	<0.003%

Certificate No. : M1333/23

Leak location

Supply HEPA Filter

Back



Exhaust HEPA Filter

Back



Result Summary ☒ Pass ☐ Fail

Equipment used : Aerosol Photometer Model TDA-2H S/N : 21683 Calibration date : 16/02/2023

Equipment used : Smoke Generator Model TDA-6C S/N : 21623

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.
- Seal/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. : M1333/23

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 เนื่องจากตู้ไม่มีฟังก์ชันนี้

6. Illumination Test (Lighting) : Option

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

Lux

609	959	932	557
861	1439	1486	765

Remark :

Certificate No. : M1333/23

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

690	1490	1520	720
440	960	970	430

Remark :

-000-

Certificate No.: MC 2213617

Certificate of Calibration

TEMPERATURE CONTROLLER ENCLOSURES



Certificate No.: MC 2213617

Page 1 of 3



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

Reference Job No. : 22-2848 Received Date : 12 December 2022
Description : Incubator
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 2213617) has been attached to the case.
Method : In-House calibration procedure MWL-T-033 this method is reference to TLAS G-20 "Temperature Controlled Enclosures".

Location of Calibration : Water Analysis Center Co., Ltd. ; Laboratory.
Environmental Conditions : Ambient Temperature : (24.3 to 24.6) °C
Relative Humidity : (61.4 to 70.1) %
Date of Calibration : 12 December 2022 Date of Issue : 13 December 2022

Checked by : Thanagorn Approved by : Aitipong
Thanagorn Limchaicharn Aitipong Klunjanawast
(Calibration Supervisor) (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.

The Reference Standard :

Description : Certificate No. : Serial No. : Due date :
Data Acquisition/Switch Unit : MC 2208932 : MY44012056 : 8 August 2023
With Thermocouple Type "T" ID. No. 11/1 to 11/9

This certificate is traceable to the international system of units maintained at:

- Master Calibration Co., Ltd.

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.

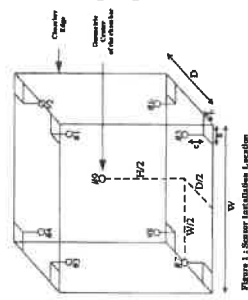


Figure 1 : Sensor Installation Location

Overall Ambient Temperature around the Chamber variation : 1.7 °C
Overall Line Voltage variation : 0.0 V
Chamber Size (W*H*D) : 65 cm x 80 cm x 50 cm

Checked by : Thanagorn

Certificate No.: MC 2213617

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2. Result of calibration :

Temperature Measurement Accuracy Test

Indicating Temperature (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (±°C)
	#1	#2	#3	#4	#5	#6	#7	#8	Ref. #9	
35.0	35.4	35.3	35.2	35.1	35.0	34.9	34.8	34.9	34.9	0.33

Chamber Characterization Result

Controller Temperature (°C)	Indicating Temperature (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
35.0	35.0	0.17	0.63	0.8

The 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 %.

This report will certify of the calibrated equipment only.

End of Certificate

Checked by : Thanayon

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

Certificate of Calibration

LIQUID BATH



Certificate No.: MC 2213615

Page 1 of 3



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

Reference Job No. : 22-2848 Received Date : 12 December 2022
Description : Water Bath
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 2213615) has been attached to the case.
Method : In-House calibration procedure MWI-T-029 this method is reference to ASTM E715 "Liquid Bath".

Location of Calibration : Water Analysis Center Co., Ltd. ; Laboratory.
Environmental Condition : Ambient Temperature : (29.4 to 31.9) °C
Relative Humidity : (46.0 to 52.0) %
Date of Calibration : 12 December 2022 Date of Issue : 13 December 2022

Checked by : Thanayon Approved by : Aittipong
Thanayon Limchaicharoen Aittipong Kaitjansasit
(Calibration Supervisor) (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 2213615

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The Reference Standard :

Description	Certificate No.	Serial No.	Due date
Data Acquisition/Switch Unit With Thermocouple Type " T " ID. No.27/1 to 27/5	MC 2114430	MY44020009	25 February 2023

This certificate is traceable to the international system of units maintained at:

- Master Calibration Co., Ltd.

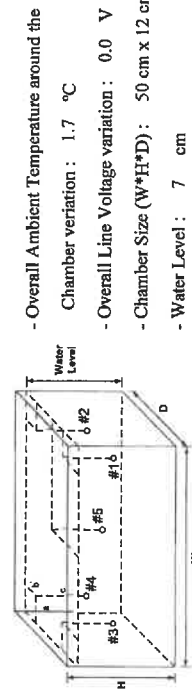
1. Calibration Procedure:

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.



Checked by : *Thanyon*

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

Certificate No.: MC 2213615

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2. Result of calibration :

Temperature Measurement Accuracy Test

Indicating Temperature (°C)	Measured Temperature (°C) at Spread Locations					Uncertainty (±°C)
	#1	#2	#3	#4	Ref. #5	
45.0	44.5	44.5	44.5	44.5	44.6	0.44

Chamber Characterization Result

Controller Temperature (°C)	Indicating Temperature (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
45.0	45.0	0.84	0.57	1.7

The 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 %.

This report will certify of the calibrated equipment only.

End of Certificate

Checked by : *Thanyon*

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

Certificate No.: MC 2213616

The Reference Standard :

Description	Certificate No.	Serial No.	Due date
Temperature Recorder RTD 100 Ohm	MC 2114437	M79231	17 January 2023
Temperature Recorder RTD 100 Ohm	MC 2114435	M79252	17 January 2023
Temperature Recorder RTD 100 Ohm	MC 2114436	5978194	17 January 2023

This certificate is traceable to the international system of units maintained at:

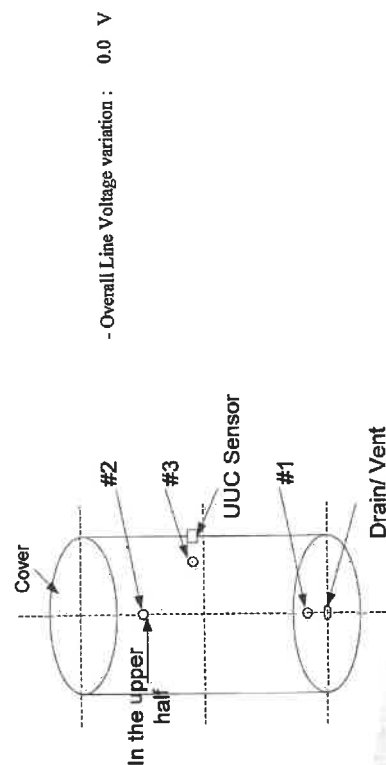
- Master Calibration Co., Ltd.

1. Calibration Procedure:

The equipment list above was calibrated an accuracy of temperature in a chamber of the sterilizer.

The calibration was performed by direct measurement of generated temperatures using the standard thermometer with three temperature sensors. The data was recorded in a period of fifteen minutes of the sterilizing status. The temperature scale used was based on ITS-90.

The calibration of sterilizer was carried out at the point indicated by following the In-house calibration method No. MWI-T-036 based on BS 2646 : 1993 : Part 5 in Tests for performance section.



Checked by : *Thanyom*

Master Calibration Co.,Ltd.

547 Soi Ratchadaniya, Kwang Samenok, Khet Huaykwang, Bangkok 10310
Tel. : (02) 274 2978-9, (02) 2742987-8 Fax : (02) 274 2518, (02) 274 2989
Website : www.mastercalibration.com E-mail : calibrate@mastercalibration.com

Certificate of Calibration

AUTOCLAVE



Certificate No.: MC 2213616

Page 1 of 3



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

Reference Job No. : 22-2848 Received Date : 12 December 2022
Description : Autoclave
Manufacturer : TOMY Model : Autoclave ES-315
Serial No. : 51135128 ID. No. : WWL 0083
Marking : Additionally for the purpose of identification by this laboratory a label marked with this certificate number (MC 2213616) has been attached to the case.
Method : In-House calibration procedure MWI-T-036 this method is reference to based on BS 2646 : 1993 Part 5 "Autoclave".

Location of Calibration : Water Analysis Center Co., Ltd. ; Laboratory.

Environmental Condition : Ambient Temperature : (29.4 to 30.7) °C

Relative Humidity : (49.0 to 52.0) %

Date of Calibration : 12 December 2022 Date of Issue : 13 December 2022

Checked by : *Thanyom* Approved by : *Aittipong*
Thanagorn Limhacharoen Aittipong Kailanwasit
(Calibration Supervisor) (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 2213616

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2. Result of calibration :

Temperature Measurement Accuracy Test

Indicating Temperature (°C)	Measured Temperature (°C) at Spread Locations			Uncertainty (±°C)
	#1	#2	#3	
121	121.94	122.05	122.02	0.60

Characterization Result

Setting Temperature (°C)	Timer Setting (min)	Indicating Temperature (°C)	Indicating Pressure (kPa)	Measured Stability (±°C)	Measured Uniformity (°C)	Overall Variation (°C)
121	15.0	121	120	0.42	0.20	0.90

The 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 %.

This report will certify of the calibrated equipment only.

End of Certificate

Checked by : *Thanyon*