

ภาคผนวก ข

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## เอกสารสอบเทียบเครื่องมือที่ใช้ในการวิเคราะห์



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.

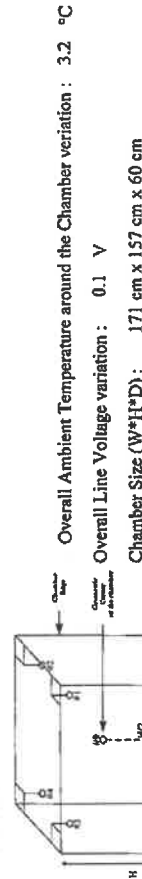


Figure 1 : Sensor Installation Location

Checked by : *Thanagorn*

**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.Kanthat, 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 : *Thanagorn* Approved by : *Aittipong Kanjanawaisit*  
Thanagorn Linnchaicharoen (Calibration Supervisor) Aittipong Kanjanawaisit ( 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 2307702

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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
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

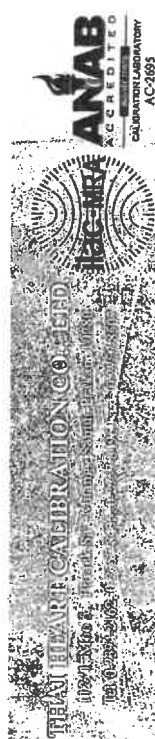
The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence of approximately 95 %.

This certificate will certify of the calibrated equipment only.

End of Certificate

Checked by: *Thanagorn*

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



# CERTIFICATE OF CALIBRATION

Certificate No.: CO-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 Model: CON 2700  
Serial No.: 2657889 ID No.: WWL 0136  
Description: -

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

Calibration Location: Jayhawks 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]*  
Representative of Managing Director

Act as Technical Manager

( ) (Krisyosol K.) ( ) (Sakda Y.)  
( ) (Paiphon K.) ( ) (Onnapa P.)  
( ) (Pongsak H.) ( ) (Niiiphong K.)  
( ) (Kanung C.) ( ) (Nonbhaijai K.)  
( ) (Pramong P.) ( ) (Noppol P.)

(Dr. Ekachai Putititwong)

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

FE-169

REV.02 02/24/21

Certificate No.: CO-1907007/23

Page 2 of total 2 pages

**Reference Method:**

- The calibration method used was CB-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  $\mu\text{S/cm}$  1.425 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 Onnapa  
REV.02 02/24/21

FE-169

# CERTIFICATE OF CALIBRATION

Certificate No.: CO-1808005/23 Page 1 of total 4 pages

Customer: WATER ANALYSIS CENTER CO., LTD.

1/94 Moo 5, T. Kanham,

A.U.-thai, Ayuthaya 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:

Jayhawks Laboratory (CL&GL)

18 August 2023

18 August 2023

21 August 2023

Condition of Artifacts: Used conditions but can be calibrated

Checked by

Approved by

Act as Technical Manager

Representative of Managing Director

( ) (Krisyol K.) ( ) (Sakda Y.) (Dr. Ekachai Puttitwong )

( ) (Paiphan K.) ( ) (Onnapa P.)

( ) (Pongsak H.) ( ) (Nithiphong 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.

FE-169

REV.02 02/24/21

**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	

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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:**

### 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)

### 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	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 :  $25 \pm 0.2^\circ\text{C}$

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%.



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	IO-0911001/22	Nov. 9, 2023	THC
Platinum Resistance Thermometer	5626	4854	C0A30047	Oct. 22, 2023	FLUKE
Liquid Bath	XORTS-40A	XO111019	IO-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)	Uncertainty (± °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

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.02.02/2021

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. Yooyee  
(Ms. Phanee Yooyen)  
Technician

Approved By :

Pratit Chai  
(Mr. Nipon Phungomsak)  
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.



AUTOMATION SERVICE CO., LTD.  
CALIBRATION LABORATORY

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

Standard	Lot No	Batch	Cert. No.	Due Date
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. Yooyen  
(Ms. Phanee Yooyen)  
Technician



**Master Calibration Co., Ltd.**  
507 Soi Kauchadumrit, Kwang Samernak, Khet Huaywang, Bangkok 10310  
Tel. : (02) 274 2978-9, (02) 2742987-3 Fax : (02) 274 2518, (02) 274 2989  
Website : www.mastercalibration.com E-mail : callbrate@mastercalibration.com

## 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. Kamliam, A.U.-Thai, Ayutthaya 13210.

Reference Job No. : 23-0729 Received Date : 23 March 2023  
Description : Oven  
Manufacturer : Memmert Model : UF260  
Serial No. : B620.0814 ID. No. : WWL0212  
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 : 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 : ( 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

Checked by : Thanagorn Approved by : Aittipong  
Thanagorn Linchaicharoen Aittipong Kaljanawasit  
(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



Certificate No.: MC 2303684

Page 2 of 3

## The Reference Standard :

Description : Certificate No. Due date  
Data Acquisition/Switch Unit MY41010916 9 March 2024  
With Thermocouple Type "T" ID. No.171 to 179

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.

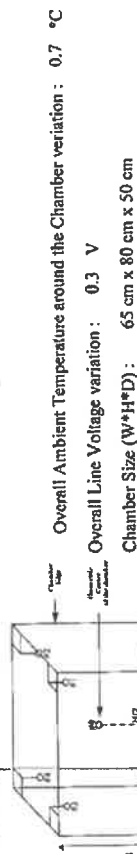


Figure 1.1 Standard Measurement Location

Certificate No.: MC 2303684

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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	
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

Certificate No.: C01223710

Model: BL 210S

Issued Date: 07 December 2022

Serial No. (or ID.): 15908131 (WWL 0022)

Job No.: KSPR2215461

Manufacturer: Sartorius

Pages: 1 of 2

Condition: In condition

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 ± 0.9 °C

Humidity 48 %RH ± 4.9 %RH

Calibration Place:

Water Analysis Center Co., Ltd. (พริตติสโบ๊ท)

1/94 Moo 5, Rojana Industrial Park, Rojana Road,

Tambol Kanham, Amphur U-Thai, Ayuthaya 13210 Thailand

Calibration By:

Mr. Pradit Sitboot

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 Sitboot)

Person in charge

(Mr. Rungrod Jenkitrakulchai)

Authorized signatory

This certificate is issued in 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.

ฉบับนี้ออกให้ในหน่วยวัดตามระบบหน่วยวัดระหว่างประเทศ (SI) และมีความสามารถในการวัดที่เชื่อมโยงกับมาตรฐานสากลหรือห้องปฏิบัติการมาตรฐานระดับชาติที่ได้รับการยอมรับ. ความไม่แน่นอนของการวัดที่ระบุไว้เป็นความไม่แน่นอนมาตรฐานที่คูณด้วยตัวคูณครอบคลุม (k=2) เพื่อให้ความมั่นใจในระดับประมาณ 95%. มันถูกกำหนดขึ้นตามคู่มือการแสดงการไม่แน่นอนในการวัด (GUM). ผลลัพธ์เหล่านี้อาจได้รับผลกระทบจากข้อเบี่ยงเบนจากเงื่อนไขที่กำหนด. ผลลัพธ์เหล่านี้เกี่ยวข้องกับรายการที่ทดสอบ, สอบเทียบ, หรือสุ่มตัวอย่าง. รายงานนี้ไม่ควรจะเผยแพร่ซ้ำโดยไม่ได้รับอนุญาตจาก DKSH Technology Limited.



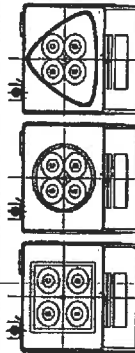
Certificate No.: C01223710

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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 100 (g)

Reference Points (g)				
A	B	C	D	E
-	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

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	0.00012	2.08
2	2.00001	2.0000	0.0000	0.00012	2.08
5	5.00003	5.0000	0.0000	0.00012	2.07
10	10.00002	10.0000	0.0000	0.00013	2.07
20	20.00001	20.0000	0.0000	0.00013	2.06
50	50.00003	50.0000	0.0000	0.00014	2.04
70	70.00004	70.0001	0.0001	0.00017	2.02
100	100.00002	100.0001	0.0001	0.00018	2.01
120	120.00003	120.0001	0.0001	0.00022	2.01
150	150.00005	150.0003	0.0003	0.00024	2.00
200	200.00006	200.0004	0.0003	0.00030	2.00

The End of Certificate

ฉบับนี้ออกให้ในหน่วยวัดตามระบบหน่วยวัดระหว่างประเทศ (SI) และมีความสามารถในการวัดที่เชื่อมโยงกับมาตรฐานสากลหรือห้องปฏิบัติการมาตรฐานระดับชาติที่ได้รับการยอมรับ. ความไม่แน่นอนของการวัดที่ระบุไว้เป็นความไม่แน่นอนมาตรฐานที่คูณด้วยตัวคูณครอบคลุม (k=2) เพื่อให้ความมั่นใจในระดับประมาณ 95%. มันถูกกำหนดขึ้นตามคู่มือการแสดงการไม่แน่นอนในการวัด (GUM). ผลลัพธ์เหล่านี้อาจได้รับผลกระทบจากข้อเบี่ยงเบนจากเงื่อนไขที่กำหนด. ผลลัพธ์เหล่านี้เกี่ยวข้องกับรายการที่ทดสอบ, สอบเทียบ, หรือสุ่มตัวอย่าง. รายงานนี้ไม่ควรจะเผยแพร่ซ้ำโดยไม่ได้รับอนุญาตจาก DKSH Technology Limited.

## 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.Kanbarm, 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. Prawdorn Keawkida

**Approved by :**   
(Mr. Kridsada Thinnasat)  
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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**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. ☒ MGF's Specifications

MGF'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

( 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 : 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

1. 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
2. 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.
3. 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.
4. 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. : M1333/23

Result Summary

Downflow Pattern test	<input checked="" type="checkbox"/> Accept	<input type="checkbox"/> Non-Conforming
View screen retention test	<input checked="" type="checkbox"/> Accept	<input type="checkbox"/> Non-Conforming
Work opening edge retention test	<input checked="" type="checkbox"/> Accept	<input type="checkbox"/> Non-Conforming
Sash/window seal test	<input checked="" type="checkbox"/> Accept	<input type="checkbox"/> Non-Conforming

5. Site Installation

Sash Alarm.	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> N/A
Interlock System.	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> N/A
Exhaust System Performance	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> 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/m<sup>2</sup> when measures at work floor surface.

mW/m<sup>2</sup>

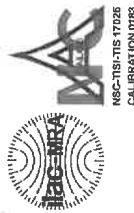
690	1490	1520	720
440	960	970	430

Remark :

-000-

# 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

Method : with this certificate number ( MC 2213617 ) has been attached to the case.  
In-House calibration procedure MWI-T-033 this method is reference to

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  
Thanagorn Limchatcharoen  
( Calibration Supervisor )

Approved by : Aitipong  
Aitipong K. Luja Wwasit  
( 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 2213617

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### 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.

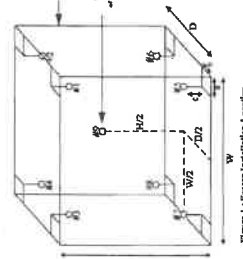
### 1. Calibration Procedure:

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.



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

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

Certificate No.: MC 2213617

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	
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 : Thanapon

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



## LIQUID BATH

Certificate No.: MC 2213615

Page 1 of 3



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

Reference Job No. : 22-2848 Received Date : 12 December 2022  
Description : Water Bath  
Manufacturer : ESSTEEL 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 : Thanapon Approved by : Aitipong  
Thanapon Linchatcharoen Aitipong Kaljanawasit  
( 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

Page 2 of 3

## 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.

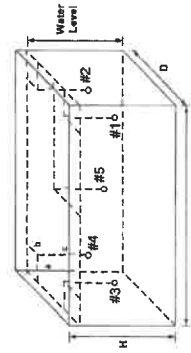
## 1. Calibration Procedure:

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.



- Overall Ambient Temperature around the Chamber variation : 1.7 °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 : *Thanyon*

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

Certificate No.: MC 2213615

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	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

Page 2 of 3

**The Reference Standard :**

Description	Certificate No.	Serial No.	Due date
Temperature Recorder RTD 100 Ohm	MC 2114437	M79251	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:

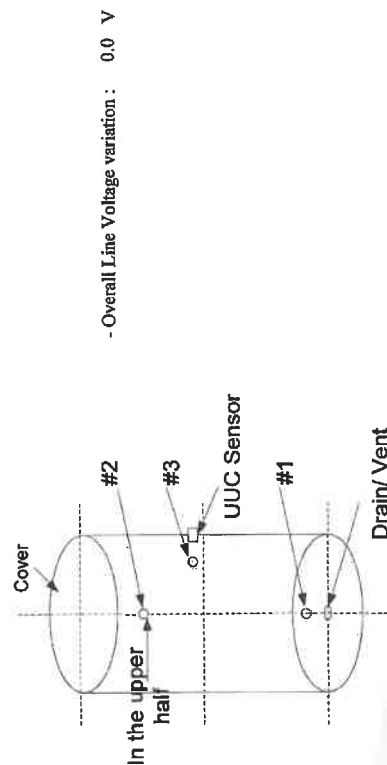
- Master Calibration Co., Ltd

**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*

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

**Master Calibration Co.,Ltd.**

547 Soi Ratchadavint, Kwang Sametnok, 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*

**AUTOCCLAVE**



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: *Aitipong*  
Thanagorn Limchaicharoen Aitipong Kaikanwasit  
( Calibration Supervisor ) ( Technical Manager )

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

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

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.

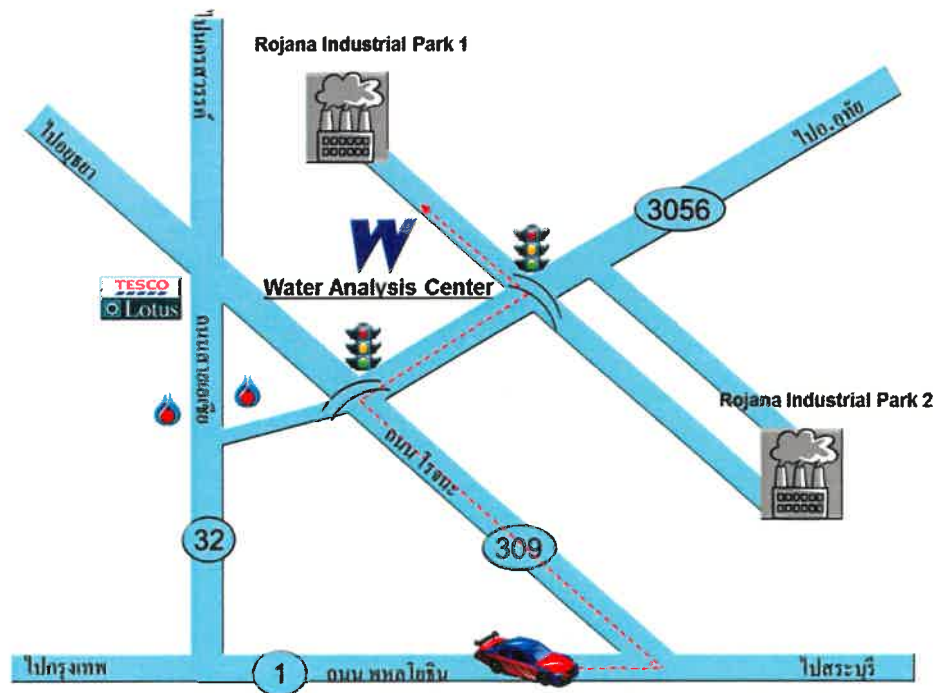
End of Certificate

Checked by : *Thanyon*









บริษัท ศูนย์วิเคราะห์น้ำ จำกัด

1/94 หมู่ที่ 5 ต.คานหาม อ.อุทัย จ.พระนครศรีอยุธยา 13210

โทรศัพท์ 035-800593, 081-9917119 โทรสาร 035-800594

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