

ภาคผนวก ฉ

เอกสารรับรองเครื่องมือการตรวจวัด



Cert.No.: 23CH601  
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## Certificate of Calibration

Equipment : pH Meter  
Manufacturer : Mettler Toledo  
Model : SevenMulti  
Serial No. : 1228145259  
ID No. : LEQ 020  
Condition As-Received: Used Item  
Received Date : 10 May 2023  
Calibration Date : 11 May 2023  
Reference : 2305-0321WN-1  
Submitted by : Saint Envir Co., Ltd.  
30/29-30 Soi Sareethai 68, Sareethai Rd.,  
Minburi Bangkok 10510  
(25 ± 2.5) °C  
(50 ± 15) %  
In - house method :  
- CP-CH5 by direct measurement with standard  
voltage calibrator and direct measurement with  
certified reference material (CRM)  
- CP-CH8 by comparison with standard thermometer

Calibrated by : Warakorn Lemgagrakul

Approved by :   
Approved Signatory

( / ) Malee Bulkrua  
( ) Saithip Meangmai  
( ) Warakorn Lemgagrakul

Issue Date : 16 May 2023

The Uncertainties are for a confidence probability of approximately 95 %

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

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### Condition of this calibration result

1. Reference Standard Instrument : -  
Instrument : -  
1) Document Process Calibrator : Serial No. 54030049 ID No. 130RC116 Cert. No. 22E2769 Due Date 24 Aug 2023  
2) Ref. Standard Thermometer : Serial No. 4982054 ID No. 110RC044 Cert. No. 221306 Due Date 27 Oct 2023  
This certification is traceable to the International System of Unit maintained at:-  
- Traceable to National Institute of Metrology (Thailand), NIMT
2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,  
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	863832	28 Dec 2024
pH 6.987	CPA chem	826589	09 July 2023
pH 10.010	CPA chem	863835	28 Dec 2023

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

### Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
			mV	pH		
pH Meter	4.000	177.48	177.4	4.000	0.058	2.00
S/N.: 1228145259	7.000	0.00	0.0	7.000	0.058	2.00
	10.000	-177.48	-177.5	10.000	0.058	2.00

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### Calibration Results

#### Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement ( $\pm$ )	Coverage factor $k$
pH Electrode S/N.: 1130847	4.008	4.007	177.2	0.0046	2.00
	6.987	6.995	3.4	0.0084	2.00
	10.010	10.004	-171.5	0.0065	2.00

#### Function : Temperature Measurement

(\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLab®Expert Pro  
- Serial No. : 1130847

Dimension of probe;

- Length : 120 mm  
- Diameter : 12 mm  
- Immersion Depth : 100 mm

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement ( $\pm$ °C)	Coverage factor $k$
23.0	23.003	23.1	0.097	0.13	2.00
25.0	25.004	25.1	0.096	0.13	2.00
27.0	27.002	27.1	0.098	0.13	2.00

Remark : - UUC\* = Unit Under Calibration

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

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# Certificate of Calibration

## TEMPERATURE CONTROLLER ENCLOSURES




Certificate No.: MC 2307593

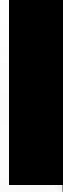
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Customer : Saint Envir Co., Ltd.  
3029-30 Soi Sareethai 68, Sareethai Rd., Minburi, Minburi, BKK 10510.

Reference Job No. : 23-1551 Received Date : 6 July 2023  
Description : Incubator  
Manufacturer : Pattana intercool Model : PT-2SYP(N)  
Serial No. : 30100073 ID. No. : LEQ 007  
Marking : Additionally for the purpose of identification by this laboratory a label marked with this certificate number ( MC 2307593 ) 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 : Saint Envir Co., Ltd. ; Laboratory.  
Environmental Conditions : Ambient Temperature : ( 30.1 to 33.9 ) °C  
Date of Calibration : 6 July 2023 Relative Humidity : ( 41.0 to 56.0 ) %  
Date of Issue : 10 July 2023

Checked by :   
Thanagorn Linchaicharoen  
( Calibration Supervisor )

Approved by :   
Aitipong Kijjathawast  
( 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 2307593

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### The Reference Standard Instrument :

Description	Certificate No.	Serial No.	Due date	Traceable thru
Data Acquisition/Switch Unit	MC 2301 270	MY44020009	9 Mar 2024	MCAL
With Thermocouple Type " T " ID. No.28/1 to 28/9				

### Traceability :

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

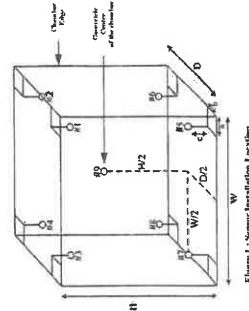
### 1. Calibration Procedure:

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 : 2.6 °C  
Overall Line Voltage variation : 0.1 V  
Chamber Size (W\*H\*D) : 110 cm x 140 cm x 60 cm

Checked by :

Certificate No.: MC 2307593

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## 2. Result of calibration :

This Chamber Reading From : Digital Thermometer, Manufacturer : SHIMAX, Model : MAC3D

### 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	
20.0	21.8	22.0	20.4	20.4	19.6	19.6	19.6	19.7	19.6	0.53

### Chamber Characterization Result

Controller Temperature (°C)	Indicating Temperature (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
20.0	20.0	0.25	2.60	2.8

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 certificate will certify of the calibrated equipment only.**

End of Certificate

Checked by :

# Certificate of Calibration

## TEMPERATURE CONTROLLER ENCLOSURES



Certificate No.: MC 2307598

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Customer : Saint Envir Co., Ltd.

30/29-30 Soi Sareethai 68, Sareethai Rd., Minburi, Minburi, BKK 10510.

Reference Job No. : 23-1551 Received Date : 6 July 2023  
Description : Oven  
Manufacturer : Memmert Model : UF 110  
Serial No. : B417.1773 ID. No. : LEQ 064  
Marking : Additionally for the purpose of identification by this laboratory a label marked with this certificate number ( MC 2307598 ) 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 : Saint Envir Co., Ltd. ; Laboratory.

Environmental Conditions : Ambient Temperature : ( 30.1 to 34.3 ) °C

Relative Humidity : ( 37.0 to 56.0 ) %

Date of Calibration : 6 July 2023 Date of Issue : 10 July 2023

Checked by :

Thanagorn Limchachoen

( Calibration Supervisor )

Approved by :

Attipong Kaljanawasit

( 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 2307598

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### The Reference Standard Instrument :

Description	Certificate No.	Serial No.	Due date	Traceable thru
Data Acquisition/Switch Unit	MC 2301270	MY44020009	9 Mar 2024	MCAL
With Thermocouple Type " T " ID. No.25/1 to 25/4 and 25/6 to 25/10				

### Traceability :

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

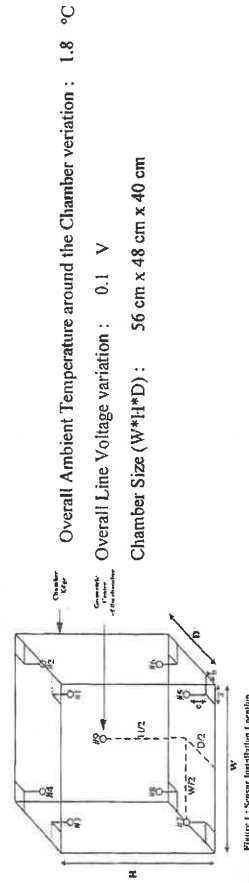
### 1. Calibration Procedure:

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.



Checked by :



Certificate No.: MC 2307598

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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	
104.0	103.9	103.7	104.1	103.5	104.2	103.8	104.3	103.8	104.1	0.45

#### Chamber Characterization Result

Controller Temperature (°C)	Indicating Temperature (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
104.0	104.0	0.18	0.73	1.0

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 :