



# National Institute of Metrology (Thailand)

Ministry of Higher Education, Science, Research and Innovation

## Certificate of Calibration

**Certificate No.** : MW-0073-22  
**Issued by** : Flow and Volume of Liquid Laboratory  
Mechanical Metrology Department

Page 1 of 3 pages

**MEASUREMENT ITEM** : TSP&PM10 Calibrator

**MANUFACTURER** : Tisch Environmental, Inc.

**MODEL/TYPE** : TE-5028

**SERIAL NUMBER** : 3945

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

**MEASUREMENT DATE** : October 4, 2022

*The reported measurement result relates only to the measurand and applies only at the time of measurement.*

**Reference:**  
MEC7903-01/22

**Date:**  
October 7, 2022

**Approved by:**

( Wirun Laopornpichayanuwat )

**Performed by:**

( Terdsak Neadkratoke )

*Partial reproduction of this certificate is permitted only with a written permission from NIMT.*



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**ENVIRONMENTAL CONDITIONS:**

Ambient condition in the laboratory are as follows :

Temperature	: $23.0 \pm 2.0$	°C
Relative Humidity	: $55 \pm 15$	%RH

**Calibration Condition:**

Preconditioning	: 24 hours at ambient conditions.
Measurement Condition	: The average values during measurement are 22.9°C and 56 %RH.

**MEASUREMENT METHOD:**

The Orifice gas flow device was calibrated against NIMT's Standard Gas Meter Model DELTA S-Flow G65. The CP-MW 0009 was used as a calibration guideline.

**TABULATION OF RESULTS:**

The tables on the next page give the measured values.

**UNCERTAINTY OF MEASUREMENT:**

The stated uncertainty is the expanded uncertainty which is obtained by multiplying the standard uncertainty by the coverage factor  $k = 2$ . It has been determined in accordance with EA publication EA-4/02M:2013 "Evaluation of the Uncertainty of Measurement in Calibration" and "JCGM 100:2008 Evaluation of measurement data - Guide to the Expression of Uncertainty in Measurement (GUM 1995 with minor corrections)". The value of the measurand lies within the assigned range of values with a probability of 95 %.

**TRACEABILITY:**

This certificate provides a traceability of the measurement to recognized the national standards, and to the realization of the International System of Units (SI).



### MEASUREMENT RESULTS:

The Orifice gas flow device was calibrated by direct comparison method with the Gas Meter standard. The Humid air was used as a medium in the system. The standard conditions are 25°C (298.15 K) and 760 mmHg for standard temperature and standard pressure respectively.

Table 1. The results of  $Q$  actual calibration data

Plate	Flow rate $\text{m}^3/\text{min}$	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	$\Delta p$ _Meter mmHg	$\Delta p$ _Orifice inH <sub>2</sub> O	Y	Actual Flow [ $Q_a$ ] $\text{m}^3/\text{min}$
1	0.697	754.696	22.88	22.67	74.612	1.074	0.649	0.628
2	0.911	754.573	23.01	22.76	46.463	2.013	0.889	0.855
3	0.997	754.499	23.00	22.89	21.430	2.608	1.012	0.969
4	1.068	754.506	22.96	22.95	15.542	3.049	1.094	1.046
5	1.169	754.510	22.96	22.92	15.371	3.642	1.195	1.146

Slope ( $m$ ): 1.06036

Intercept ( $b$ ): -0.01694

Correlation coefficient ( $r$ ): 0.99986

Uncertainty ( $k=2$ ): 0.015  $\text{m}^3/\text{min}$

Table 2. The results of  $Q$  standard calibration data

Plate	Flow rate $\text{m}^3/\text{min}$	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	$\Delta p$ _Meter mmHg	$\Delta p$ _Orifice inH <sub>2</sub> O	Y	Standard Flow [ $Q_{\text{std}}$ ] $\text{m}^3/\text{min}$
1	0.697	754.696	22.88	22.67	74.612	1.074	1.036	0.628
2	0.911	754.573	23.01	22.76	46.463	2.013	1.418	0.855
3	0.997	754.499	23.00	22.89	21.430	2.608	1.615	0.968
4	1.068	754.506	22.96	22.95	15.542	3.049	1.746	1.045
5	1.169	754.510	22.96	22.92	15.371	3.642	1.908	1.145

Slope ( $m$ ): 1.69297

Intercept ( $b$ ): -0.02707

Correlation coefficient ( $r$ ): 0.99986

Uncertainty ( $k=2$ ): 0.016  $\text{m}^3/\text{min}$

End of Certificate of Calibration



## Certificate of Calibration

Certificate Number : SPR22070283-1

Page : 1 of 3

Customer : TNP ENVIRONMENT CO.,LTD.

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

Equipment Name : Sound Level Meter

Manufacturer : Scarlet Tech

Model : ST-25D

Serial Number : 10340942

ID. Number : TNP-F-S23

### Environmental Conditions

Ambient Temperature :  $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$

Relative Humidity :  $50\% \pm 15\%$

Location of Calibration : In-Lab

Calibration Procedure : SP-CPE-04-01

Received Date : 18 Jul 2022

Calibration Date : 21 Jul 2022

Recommend Due Date : 21 Jul 2023

Date of Issue : 22 Jul 2022

### Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Chumpon Dokpikul

Calibration Officer

Approved by :

( Mr.Worapong Sinthusopa )

Authorized Signatory





## Calibration Report

Certificate Number : SPR22070283-1

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### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP. 34/1264	22 Dec 2022

### Traceability

This certification is traceable to the International System of Unit maintained at :  
TISTR - Thailand Institute of Scientific and Technological Research



## Result of Calibration

Certificate No. : SPR22070283-1

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty ( ± )
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty ( ± )
	Fast	Slow	Fast	Slow	
94	94.1	94.1	0.1	0.1	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Select Z

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty ( ± )
	Fast	Slow	Fast	Slow	
94	94.1	94.1	0.1	0.1	0.15
114	113.9	113.9	-0.1	-0.1	0.15

### Note:

The result of calibration was found accurate as show on date and place of calibration only.  
This Certificate is not certified for any commercial transaction.

### Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor  $k = 2.00$ , providing a level of confidence approximately 95%.

- End of Certificate -





## Certificate of Calibration

Certificate Number : SPR22070283-2

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Customer : TNP ENVIRONMENT CO.,LTD.

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

Equipment Name : Sound Level Meter

Manufacturer : Scarlet Tech

Model : ST-25D

Serial Number : 10340944

ID. Number : TNP-F-S24

### Environmental Conditions

Ambient Temperature :  $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$

Received Date : 18 Jul 2022

Relative Humidity :  $50\% \pm 15\%$

Calibration Date : 21 Jul 2022

Location of Calibration : In-Lab

Recommend Due Date : 21 Jul 2023

Calibration Procedure : SP-CPE-04-01

Date of Issue : 22 Jul 2022

### Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Chumpon Dokpikul

Calibration Officer

Approved by :

( Mr.Worapong Sinthusopa )

Authorized Signatory



## Calibration Report

Certificate Number : SPR22070283-2

Page : 2 of 3

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP. 34/1264	22 Dec 2022

### Traceability

This certification is traceable to the International System of Unit maintained at :  
TISTR - Thailand Institute of Scientific and Technological Research





## Result of Calibration

Certificate No. : SPR22070283-2

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Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty ( ± )
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty ( ± )
	Fast	Slow	Fast	Slow	
94	94.1	94.1	0.1	0.1	0.15
114	114.1	114.1	0.1	0.1	0.15

Select Z

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty ( ± )
	Fast	Slow	Fast	Slow	
94	94.1	94.1	0.1	0.1	0.15
114	114.1	114.1	0.1	0.1	0.15

### Note:

The result of calibration was found accurate as show on date and place of calibration only.  
This Certificate is not certified for any commercial transaction.

### Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor  $k = 2.00$ , providing a level of confidence approximately 95%.

– End of Certificate –



THAI CALIBRATION SERVICES CO., LTD.

19/8 Moo 9 Soi Raiking 30 Puttamonton 5 Rd., Sampran, Nakornpatom 73210

Tel. 0-3439-7682-5 Fax: 0-3439-7687

www.thaical.com E-mail : info@thaical.com, lab@thaical.com



## CALIBRATION CERTIFICATE

Certificate No. T2009048N

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**Customer** TNP ENVIRONMENT CO.,LTD.  
332/173 Moo 3, Tambon Bang Rak Phatthana,  
Amphor Bang Bua Thong, Nonthaburi 11110

**Equipment** Digital Thermo-hygrometer  
**Manufacturer** EXTECH  
**Model** 445814  
**Serial No.** PONPE5816745  
**Order No.** 62T3213-1  
**Place of Calibration** Temperature and Humidity Calibration Laboratory

**Ambient Temperature**  $(23 \pm 3) ^\circ\text{C}$   
**Relative Humidity**  $(50 \pm 20) \%$

**Date of Received** 25-Sep-2020

**Date of Calibration** 28-Sep-2020 to 29-Sep-2020  
**Date of Issue** 30-Sep-2020  
**Condition As-Receive** Good working conditions

Calibrated By :

Anurak Deewongwan  
Technician

Approved By :

Kittipong Kongwatmai  
Approved Signatory

This certificate may not be reproduced, except with the prior written approval of the head of TCS calibration laboratory.





# THAI CALIBRATION SERVICES CO., LTD.

19/8 Moo 9 Soi Raiking 30 Puttamonthon 5 Rd., Sampran, Nakornpatom 73210

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www.thaical.com E-mail : info@thaical.com, lab@thaical.com



## CALIBRATION CERTIFICATE

Certificate No. T2009048N

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### Calibration Method

The Thermo-Hygrometer was calibrated by comparison against a calibrated standard thermo-hygrometer in a chamber which was controlled at the calibration temperature and relative humidity; all measurement are traceable to recognised National Standards.

The temperature scale in use at the Laboratory is the International Temperature Scale of 1990.

### Condition of Reference Standard

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due-Date</u>
1. Standard Thermo Hygrometer/	Dew Master	36555	TT-0042-20	22-May-22
Sensor and Temperature Probe	-	3408CRX	TH-0024-20	21-May-22

**Results** (without adjustment) : The results obtained are reported below

#### : TEMPERATURE

STANDARD TEMPERATURE (°C)	READING TEMPERATURE (°C)	CORRECTION (°C )	UNCERTAINTY ( ± ) ( °C )
14.98	14.8	+0.18	0.55
29.98	30.6	-0.62	0.55
45.01	45.6	-0.59	0.55

**Results** (without adjustment) : The results obtained are reported below

#### : HUMIDITY

STANDARD TEMPERATURE (°C)	STANDARD HUMIDITY (%RH)	READING HUMIDITY (%RH)	CORRECTION (%RH )	UNCERTAINTY ( ± ) ( %RH )
24.99	29.96	28	+1.96	1.9
24.99	60.00	61	-1.00	2.1
24.98	89.94	88	+1.94	2.9

### Traceability of the reference standard

This certificate is traceable to SI unit through NIMT, NSC-TISI-TIS 17025 accredited no. Calibration 0144.

### Uncertainty of Measurement

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k=2.00$ , which for a normal distribution corresponds to a coverage probability of approximately 95% (confidence level).

**This report will certify of the calibrated equipment only.**

--End--

## CERTIFICATE OF CALIBRATION

### FOR

NOMENCLATURE : DISSOLVED OXYGEN METER  
MANUFACTURER : AMTAST  
MODEL / TYPE : DO900  
SERIAL NO. : DO900X20081036/23205  
CLID. NO. : 272100481  
JOB CONTROL NO. : 210216015369

CUSTOMER : TNP ENVIRONMENT CO., LTD.  
332/173 MOO 3 TAMBON BANG RAK PHATTANA,  
AMPHOE BANG BUA THONG, NONTHABURI 11110

DATE OF RECEIVED : 16 February 2021

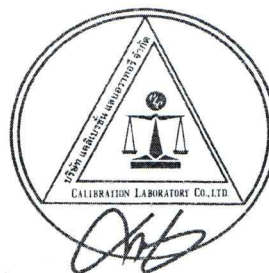
DATE OF ISSUED : 18 February 2021

Report of calibration screening must not be taken in part. Except complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Prapaporn Khanchalee  
Calibration Engineer



Approved By : Mongkol Yotsoontorn  
Authorized Signatory  
18 February 2021



This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q21015369

F3-011-04/01-12

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@clccalibration



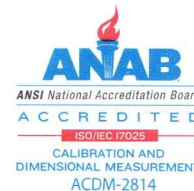


**CLC**  
Accredited  
ISO/IEC 17025

# CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yeak 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230

Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



## REPORT OF CALIBRATION

### FOR

**NOMENCLATURE** : **DISSOLVED OXYGEN METER**  
**MANUFACTURER** : **AMTAST**  
**MODEL / TYPE** : **DO900**  
**SERIAL NO.** : **DO900X20081036/23205**  
**DATE OF CALIBRATION** : **17 February 2021**

#### ENVIRONMENT CONDITIONS :

Temperature :  $(25 \pm 2.5) ^\circ\text{C}$

Relative Humidity :  $(50 \pm 15) \% \text{RH}$

#### PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPCH-06** by direct measurement with Dissolved Oxygen which maintained by the Calibration Laboratory Co., Ltd.

#### REFERENCE STANDARD USED :

Dissolved Oxygen, Sigma-Alorich Product ID QC3077-500ML .

#### TRACEABILITY :

The measurements are traceable to International System of Units (SI) , through Sigma-Alorich.

Lot LRAC4478, Due Date January 2022.

#### UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k = 2,00$  which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2013)"

Certificate No. Q21015369

F3-011-04/01-12

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@clccalibration



**CLC**  
Accredited  
ISO/IEC 17025

# CALIBRATION LABORATORY CO., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yeak 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230

Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



## CONDITION OF CALIBRATION ITEM : GOOD

## MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment

The table in the following gives the calibration results and associated measurement uncertainties of Dissolved Oxygen Meter.

### CALIBRATION DATA

Nominal Value ( mg/L )	DUC Reading ( mg/L )	Correction ( mg/L )	Uncertainty ( mg/L )
8.49	8.51	-0.02	± 0.31

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 006 Page 4 of 57

**This report is valid for the above stated instrument/s only.**

**### End of Certificate ###**

Certificate No. Q21015369

F3-011-04/01-12

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@clccalibration

**ITSS****CALIBRATION LABORATORY****Inter Temp Service and Supply Co., Ltd.**

11 Moo 4 Klongsonton-noon, Ladkrabang, Bangkok 10520 Thailand

Tel: +66 (0) 2557 1073 Fax: +66 (0) 2557 1074 <http://www.itsscallab.com>

## CALIBRATION CERTIFICATE

**Issued Date** : 10 February 2021**Site Calibration****Certificate No. :** 21S0011**Order Item No.:** 2102-019**Page :** 1 of 3

**Customer** : TNP ENVIRONMENT CO., LTD.  
332/173 Moo 3, T. Bang Rak Phatthana, A. Bang Bua Thong,  
Nonthaburi 11110

**Instrument Name** : Incubator  
**Model** : SMART i250  
**Serial No.** : 0410-0121-0003  
**ID No.** : -  
**Manufacturer** : Accuplus  
**Receipt Date** : 9 February 2021  
**Calibration Date** : 9 February 2021

**Location of Calibration** : Entech Industrial Solution Co., Ltd.  
17/121 Soi Ngamwongwan 47 Yak 48 , Toongsonghong,  
Laksi, Bangkok 10210 Thailand

**Environmental Conditions** : Temperature  $25^{\circ}\text{C} \pm 15^{\circ}\text{C}$   
: Relative Humidity  $55\% \pm 25\%$

**Calibration Method Used** :

This instrument was calibrated by measured temperature with standard data acquisition unit with RTD Sensor in difference location of chamber. The position of sensor installation and calibration procedure refer to TLAS G-20.


**Traceability of Measurement** :

This Calibration Certificate is traceable to international and/or national standards which realize the units of measurement according to the International System of Units (SI) as follows:

- The calibration laboratory of Inter Temp Service & Supply Co., Ltd.

**Calibrated by :** Mr. Surachai Russamee

**Approved by :**

  
( Mr. Pornsak Anuchartibud )  
Laboratory Manager



The uncertainties are for confidence probability of approximately 95%.

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### Details of Calibration

1. Reference Standard Equipment Used :

Equipment	Mfg/Model	Serial No.	Cert. No.	Due Date
Data Acquisition	Agilent/34970A	MY44051674	20T2372	3 October 2021
Multiplexer Module	Agilent/34901A	MY41049790	20T2372	3 October 2021
RTD Sensor	Thermology/Pt100	LAB-0059 to LAB-0068	20T2372	3 October 2021

2. The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the long-term stability of the instrument.

3. Condition of calibration item : normal condition, no indication for any damage or malfunction

4. Internal Dimension of Chamber ( W x H x D ) = 50 cm. x 110 cm. x 48 cm.

5. Sensors at each corner and wall ; a , b , c are approximately 5 cm. to 10 cm.

### Result of Calibration

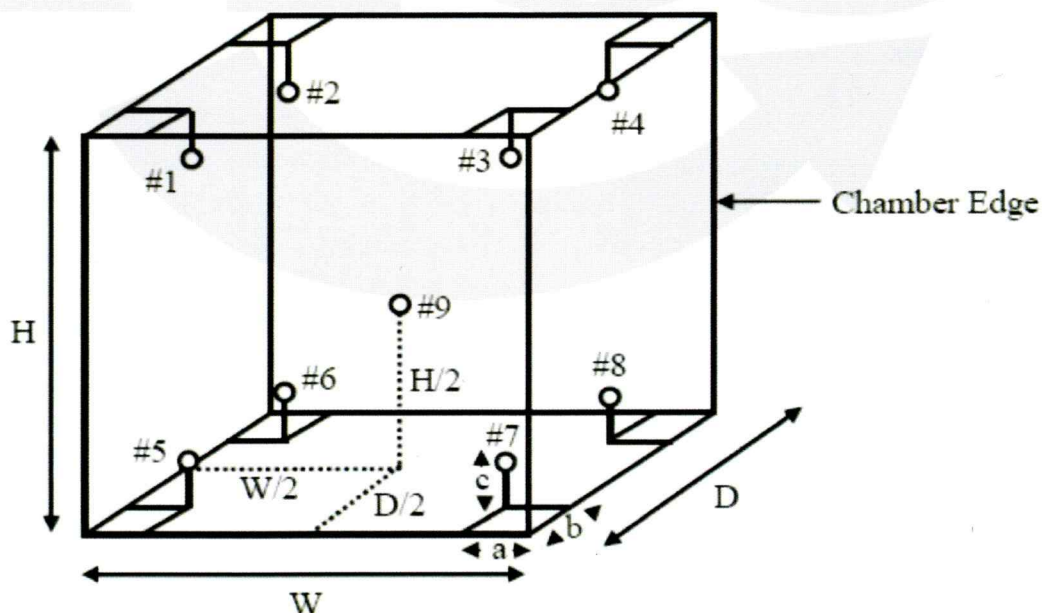
Function :



Temperature Generator (Without Adjustment)

### Environmental of Calibration

	Initial	End
Temperature	25.3 °C	25.1 °C
Relative Humidity	51 %	47 %
AC Line Voltage	220.0 V	220.0 V



*[Signature]*





### Uncertainty of Measurement

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k=2$ , providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with NAC requirements.

### Result of Calibration

Function : Temperature Generator (Without Adjustment)

#### Reporting of Temperature Distribution

Indicating Temperature (°C)	Measured Temperature (°C) @ Probe No. ( Probe No.#9 is REF )									Uncertainty of Meas. ( ± °C )
	#1	#2	#3	#4	#5	#6	#7	#8	#9	
20.1	20.367	20.295	20.342	20.315	20.179	20.211	20.026	20.039	20.094	0.45

#### Reporting of Temperature Enclosure Performance

Setting Temperature (°C)	Indicating Temperature (°C)	Measured* Uniformity (°C)	Measured** Stability ( ± °C )	Overall*** Variation (°C)
20.0	20.1	0.320	0.330	0.920

### Measured Uniformity\*

The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location (# 9) 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.

### Measured Stability\*\*

One-half of the greatest maximum difference of measured temperatures at any one sensor, for at least half an hour after reaching steady state or after one achieved complete cycle of control whichever comes first. The specific check of temperature stability at specific positions or locations of working space within the chamber according to the way of use should be specified.

### Overall Variation\*\*\*

The difference of the maximum and the minimum measured temperatures throughout observation time.

- o0o -






CRYSTAL CALIBRATION SALES AND SERVICE CO., LTD.

45/48 Soi Salathammassop31, Salathammassop Rd.,  
Salathammassop, Thawewatthana, Bangkok 10170 Thailand

Tel : 0-2408-8474-5 Fax : 0-2408-8477 Email : info@crystalcal.com www.crystalcal.com



## CERTIFICATE OF CALIBRATION

Certificate No. : 20-1357-001

Work Order No. : 20/1357

Issue Date : 30 December 2020

Customer Name : TNP ENVIRONMENT CO., LTD.  
332/173 Moo 3 Tambon Bang Rak Phatthana,  
Amphoe Bang Bua Thong, Nonthaburi 11110

Date of Received : 28 December 2020

Date of Calibration : 28 December 2020

Instrument Details : Description : Temperature Controlled Enclosures [Hot Air Oven]  
Manufacturer : memmert  
Model : UF75  
Serial No. : B320.0251  
ID No. : N/A  
Resolution : 0.1 °C  
Location : Service Room

Calibration Method : This instrument was calibrated by insert standard thermometer into the chamber according to calibration procedure no. CWI-T-10 follow up to TLAS G-20-1/02-08 (E) : Guidelines for Calibration and Checks of Temperature Controlled Enclosures.


Environmental Conditions :

Temperature : Area Monitoring between 15°C to 40°C  
Humidity : Area Monitoring between 30%RH to 85%RH  
Line Voltage : Area Monitoring 220 VAC  $\pm$  10%

Traceability of Measurement :

This certificate of calibration documents the traceability to national standard, which realize the unit of measurement according to the International system of Units (SI) and The temperature scale in use at this laboratory is The International Temperature scale of 1990.

Calibrated by : Mr. Kritsada Kaewwangpa  
Calibration Engineer

Approved by :   
( Mr. Anuwat Yaklermjit )  
Laboratory Manager

This certificate may not be reproduced other than in full except with the prior written approval of Crystal Calibration Sales and Service co., Ltd.

Crystal Calibration Sales and Service Co., Ltd.

45/48 Salathommasop 31, Salathommasop Rd., Salathommasop, Thawewatthana, Bangkok 10170

Phone : 0-2408-8474 Fax : 0-2408-8477 <http://www.crystalcal.com> Email : info@crystalcal.com



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# CERTIFICATE OF CALIBRATION

Issue Date : 30 December 2020

Certificate No. : 20-1357-001

Work Order No. : 20/1357

## Details of Calibration

### 1. Reference Standards Instrument

Instrument	Model	Serial No./Ins No.	Certificate No.	Due Date
Data Acquisition unit	34972A	MY49024826	20-1162-015	25 November 2021
Sensor type	RTD	RTD# 101-109	20-1162-015	25 November 2021

### 2. Certificate traceable

: This certificate traceable to The International System of Unit refer to  
Crystal Calibration Sales and Service Co., Ltd. , NAC Calibration No. 0260

### 3. Condition of item

: New

### 4. Calibration site

: On - Site

### 5. Result of Calibration

: Without adjustment

### 6. Evaluate Condition

: **Time Constant** : - Hour 33 Minute At cal. point 104 °C  
**Air vent** : Off  
**Fan speed status** : Open Fan Speed 100 %

### 7. Calibration note

: The results reported in this certificate refer to the condition of instrument on the process  
into the steady state of chamber

### 8. Sensors Installation Diagram

: When ; Sensor installation location in Chamber @ Working Space

A = Distance between sensor and wall of chamber is 5 cm

### 9. Dimensions of chamber

: W = 0.4 m ; D = 0.33 m ; H = 0.56 m

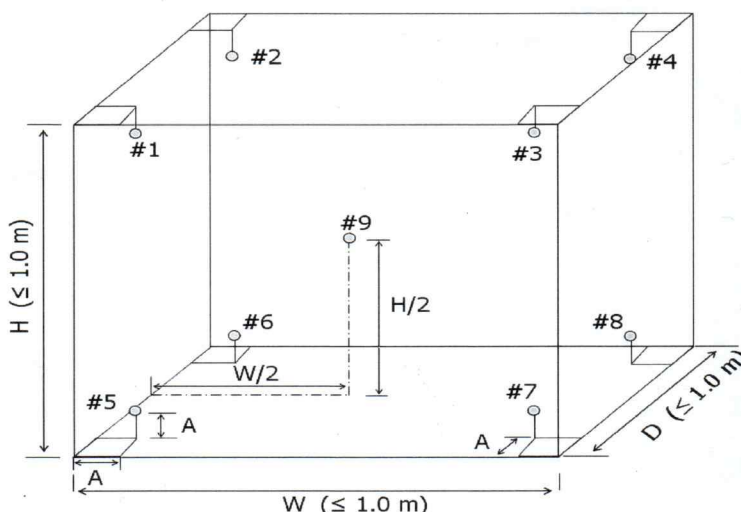


Diagram of Chamber





# CERTIFICATE OF CALIBRATION

Issue Date : 30 December 2020

Certificate No. : 20-1357-001

Work Order No. : 20/1357

## Result of Temperature Distribution and Performance Check

Table1 : Reporting of Temperature Distribution

Calibration point (°C)	Average Measured Temperature (°C) @ Sensor No. (Sensor No.9 is REF)									Uncertainty ± (°C)
	#1	#2	#3	#4	#5	#6	#7	#8	#9	
104.0	104.01	103.74	103.91	103.78	103.69	103.59	103.47	103.98	103.85	0.24
180.0	179.82	179.37	179.57	179.41	179.90	179.15	179.02	179.88	179.74	0.65

Table 2 : Reporting of Performance check

Indicator Set Point (°C)	Indicator Reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
	MAX	MIN	Average			
104.0	104.0	104.0	104.0	0.06	0.43	0.64
180.0	180.0	179.9	180.0	0.21	0.79	1.14

### Note

The reference sensor is preferably located of the geometric center of chamber

The measured temperature data readout by software "Benchlink Datalogger 3"

The quoted uncertainty include " Stability " and " Loading effect (20% of Temp Uniformity) "

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

Uniformity - the maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady state conditions.

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

Indicating Temperature - the average reading of indicating device that forms the integral part of the enclosure.

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

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%.





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ISO/IEC 17025

# CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yeak 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230  
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



NSC-TISI-TIS 17025  
CALIBRATION 0059  
CLC

## CERTIFICATE OF CALIBRATION

### FOR

NOMENCLATURE : pH METER  
MANUFACTURER : HORIBA  
MODEL / TYPE : LAQUA-PH1100/9615S  
SERIAL NO. : B80A0042/9X0B0575  
CLID. NO. : 272001452  
JOB CONTROL NO. : 200916082309

CUSTOMER : TNP ENVIRONMENT CO., LTD.  
332/173 MOO 3 BANGRAK PHATTHANA,  
NONTABURI, BANG BUA THONG, 11120

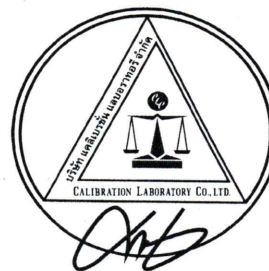
DATE OF RECEIVED : 16 September 2020

DATE OF ISSUED : 21 September 2020

Report of calibration screening must not be taken in part. Except complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Sukgasem Seehanart  
Tanawan Seenam-Ngoen  
Calibration Engineer

Approved By : Mongkol Yotsoontorn  
Authorized Signatory  
21 September 2020



This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to  
the International System of Units (SI)

Certificate No. Q20082309

F3-011-04/01-12

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## REPORT OF CALIBRATION FOR

NOMENCLATURE : pH METER  
MANUFACTURER : HORIBA  
MODEL / TYPE : LAQUA-PH1100/9615S  
SERIAL NO. : B80A0042/9X0B0575  
DATE OF CALIBRATION : 17 September 2020

### ENVIRONMENT CONDITIONS :

Temperature :  $(25 \pm 2.5) ^\circ\text{C}$

Relative Humidity :  $(50 \pm 15) \% \text{ RH}$

### PROCEDURE USED :

This instrument was calibrated under procedure No. **WI-305-128, 238** by direct measurement with Certified Reference Material (CRM), Document Process Calibrator and comparison with Calibration Bath, Precision Thermometer and IPRT which maintained by the Calibration Laboratory Co., Ltd.

### REFERENCE STANDARD USED :

1. Document Process Calibrator , Fluke Model 702 S/N. 6630202.
2. pH Standard Solution , TRM CODE TRM-S-2003 , TRM CODE TRM-S-2005 , TRM CODE TRM-S-2007.
3. Calibration Bath, Kambic Model OB-22/2 ULT S/N. 17115653.
4. Precision Thermometer, ASL Model F200-A-8 S/N. 014433/03 with IPRT, ASL Model T100-250-1D S/N. L0193A-1-1.

### TRACEABILITY :

1. The measurements are traceable to International System of Units (SI) , through Calibration Laboratory Co., Ltd.  
Certificate No. Q20009312, Due Date 04 February 2021.
2. The measurements are traceable to International System of Units (SI) , through National Institute of Metrology (Thailand).  
Lot Number. 280319 , 280119 , 080719. Due Date 16 June 2021.
3. The measurements are traceable to International System of Units (SI) , through Calibration Laboratory Co., Ltd.  
Certificate No. Q20008277, Due Date 05 February 2021.
4. The measurements are traceable to International System of Units (SI) , through National Institute of Metrology (Thailand).  
Certificate No. ER-0032-20, TT-0129-19. Due Date 09 April 2021, 07 November 2020.

### UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor complies with the table which for a normal distribution corresponds to a coverage probability of approximately 95 %.  
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2013)"

Certificate No. **Q20082309**

**F3-011-04/01-12**

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Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



NSC-TISI-TIS 17025  
CALIBRATION 0059  
CLC

## CONDITION OF CALIBRATION ITEM : GOOD

## MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment

The table in the following gives the calibration results and associated measurement uncertainties of pH meter.

### CALIBRATION DATA

#### 1. pH ELECTRODE RESULT @ 25 °C

Standard pH Buffer Solution ( pH )	pH Meter Reading ( pH )	pH Meter Reading ( mV )	Correction ( pH )	Uncertainty of Measurement ( ± pH )	k Factor
4.003	4.00	167.2	+0.003	0.014	2,20
7.025	7.03	-11.0	-0.005	0.014	2,17
10.008	10.01	-181.7	-0.002	0.100	2,05

#### 2. pH SCALES RESULT @ 25 °C

Standard Voltage Input ( mV )	pH Meter Reading		Correction ( mV )	Uncertainty of Measurement ( ± mV )	k Factor
	( mV )	( pH )			
177.48	177.4	4.01	+0.08	0.06	2,00
0.00	-0.1	7.00	+0.10	0.06	2,00
-177.48	-177.5	10.01	+0.02	0.06	2,00

Certificate No. Q20082309

F3-011-04/01-12

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Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



## CALIBRATION DATA

### \*3. TEMPERATURE RESULT

Immersion depth (mm)	Actual Temperature ( °C )	DUC Reading ( °C )	Correction ( °C )	Uncertainty $\pm$ ( °C )
30	20.00	19.9	+0.10	0.07
	25.00	24.9	+0.10	
	30.00	29.9	+0.10	

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor of  $k = 2,00$ .

\* means Calibrations marked " Not TISI Accredited " in this Certificate have been included for completeness.

**This report is valid for the above stated instrument/s only.**

**### End of Certificate ###**

Certificate No. Q20082309

F3-011-04/01-12

page 4 of 4



@clccalibration

**Certificate No.:** T/O 630094

**Date of issue :** 14-Oct-2020

**Equipment Description** : Refrigerator  
**Equipment Model** : P1010  
**Equipment Serial No.** : P1010-1020-0005  
**I.D. No. or Control No.** : -  
**Manufacturer** : Entech Industrial Solution Co.,Ltd.  
**Customer Name** : TNP ENVIRONMENT CO.,LTD.  
**Customer Address** : 332/173 Moo 3 Tambon Bang Rak Phatthana, Amphoe Bang Bua Thong,  
Nonthaburi 11110  
**Total pages of certificate** : 2 pages  
**Instrument Receiving Date** : 7-Oct-2020  
**Receiving No.** : O-200107  
**Environmental Conditions** : All of the measurement were carried out in the working area  
Temperature : ( 25 ± 10 ) °C  
Humidity : ( 55 ± 30 ) % RH  
Voltage : ( 220 ± 22 ) VAC  
**Calibration Place** : (Production Room Floor 1) 17/121 Soi Ngamwongwan 47 Yaek 48 Toongsonghong, Laksi,  
Bangkok 10210 Thailand  
**Calibration Procedure No.** : WI-CL-18-C

*The calibration certificate expended uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k$ , which for a normal distribution corresponds to a coverage probability of approximately 95%*

*The standard uncertainty of measurement has been determined in accordance with M 3003  
The expression uncertainty and confidence in measurement.*

*This certificate is applied only to item under test environmental condition.*

*This calibration certificate may not be reproduced other than in full except with the permission of the issuing laboratory.  
Calibration certificates without signature and seal are not valid.*

*This calibration certificate documents are traceability to national standards, which realize the unit of measurement according to the International system of units (SI).*

**Date of Calibration** : 8-Oct-2020



Mr. Kittipong Kaewsai  
**Calibration Engineer**



Ms. Nongluck Wongsettee  
**Technical Manager**

**Certificate No. : T/O 630094**

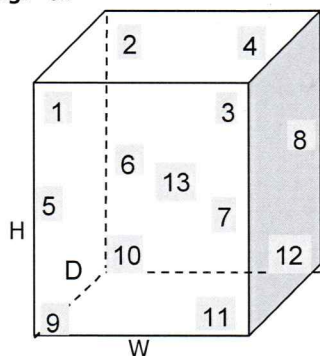
**The Reference Standard Instrument :-**

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert No.</u>
1) Data logger with RTD Probe	Agilent 34972A	MY49017365	PSL-T 923/63

**Measured room conditions**

<b>Temperature :</b>	Minimum: 24.5 °C	Maximum: 25.6 °C
<b>Humidity :</b>	Minimum: 49.5 %RH	Maximum: 60.5 %RH
<b>Voltage :</b>	Minimum: 219.7 VAC	Maximum: 223.4 VAC
<b>Fresh Air Setting:</b>	off	

**Sensor Position :**



**Working Space of chamber :**

(Inside Dimensions) W x D x H : 1560 mm x 500 mm x 1380 mm

**Sensor Installation Details :**

- Sensor Number 1 to 12 installed approximately 50 mm From each wall.
- Sensor Number 13 installed approximately geometric of the chamber.

**Results :** The measurement results of the calibration were reported in the table below.  
(\*) Without adjustment ( ) After adjustment

UUC* Setting	UUC* Reading	Temperature Reading of Standard Sensor								
( °C )	( °C )	Sensor Position								
5.0	5.0	1	2	3	4	5	6	7	8	9
		5.28	5.29	5.23	5.24	5.34	5.39	5.12	5.09	5.15
		Sensor Position								
		10	11	12	13					
		5.32	5.48	5.42	5.02					

UUC* Setting	UUC* Reading	Temperature Uniformity	Temperature Stability	Overall Variation	Uncertainty of Measurement	Coverage Factor K
( °C )	( °C )	( °C )	( ± °C )	( °C )	( ± °C )	
5.0	5.0	1.01	0.78	1.74	1.1	2

**UUC\* = Unit Under Calibration**

**Remark :-**

- Temperature reading of Standard Sensors shown in the table were taken from the average of Standard reading at each position.
- Temperature Uniformity was calculated from the difference between the maximum and minimum of actual temperature reading from all reference sensors at the same time.
- Temperature Stability was calculated from the maximum stability of nine positions, and formula of Stability is [ ( Maximum Temperature Value - Minimum Temperature Value ) / 2 ]
- Overall Variation was calculated from the difference between the maximum and minimum measured temperature throughout observation time.

**End of Report**



# Calibration Certificate

Cert. No. : CT-21-01-21971

Page : 1 of 4

Issued date : 27 January 2021

Equipment : Water Bath , Manufacturer : MLAB , Model : WBN30

S/N = 0347 , Customer ID = -

Client : TNP ENVIRONMENT CO.,LTD.

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

Received Date : 25 January 2021

Ref. Job No. : SO6401-00078

Calibrated by : Mr.Pramot Srisukum

Cert. prepare by : Ms.Pimlada Ittiprawet

Calibrated Date : 25 January 2021

Approved by : Mr.Montree Ruschasetkul

Calibration Place : Laboratory of Metrology Technical Co.,Ltd.

Environment Condition : Temperature  $26.3 \pm 1.9 (^{\circ}\text{C})$  , Humidity  $63.5 \pm 5.5 (\%RH)$ 

Calibration Method : In-house method based on ASTM E715-80 (Reapproved 2006) , (MTEC WI No. # WICAL-02-003-R01 )

**Reference Standard Instrument :**

No	Instrument	code	Model	Due date
1	Temperature Data Logger	MTEC-CE-0175	MLAB	10/2021
2	Thermo Hygrometer	MTEC-CE-0181	TH-03A	06/2021

**Condition of certificate :**

(1) This certificate is traceable to International System of units (SI Units). , (2) This certificate was certified only for the instrument we calibrated. , (3) This result of calibration was found accurate as show on date and place of calibration only. , (4) The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor  $k =$  (see result table ) , providing a level of confidence of approximately 95%. , (5) This certificate may not be reproduced other than in full, except with the prior written approval of the head of Calibration Division, Metrology Technical Co.,Ltd.



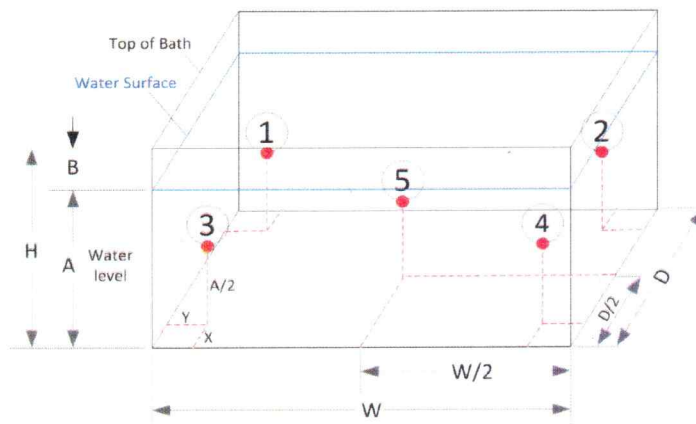
Approved Signatory

**Calibration Result :**

Page : 2 of 4

Condition of UUC :

- 1) Adjust Condition : Without Adjustment
- 2) Lid Cover : Flat sheet of stainless steel
- 3) Circulation : without circulation
- 4) X,Y = 5 cm. , B ~ 3 cm.



Pic 1 : Position of each sensor No.

(1) The quoted uncertainty include with " Stability".

(2) Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors , for at least half an hour after reaching sted state.

(3) Uniformity = The maximum difference of measured temperatures at two any sensor which are observed at the same time.

(4) Overall variation = The difference of the maximum and the minimum measured temperature throughout observation time.

**Section 1 : Report of Temperature distribution**

Unit : ( °c )

Calibration Point	UUC Setting (*)	UUC Reading (*)	Measured Temperature @ Sensor No.					Uncertainty ( ± )	k (**)
			#1	#2	#3	#4	#5		
85	85.0	85.0	85.26	85.27	85.12	85.23	85.26	0.420	2

(\*) = The average of 30 values in each point , (\*\*) = Coverage factor (k) value

**Section 2 : Report of Chamber Performance**

Unit : ( °c )

Calibration Point	UUC Setting (*)	UUC Reading (*)	Temperature Uniformity	Temperature Stability ( ± °c )	Temperature Overall Variation
85	85.0	85.0	0.40	0.20	0.54

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

Approved Signatory : .....

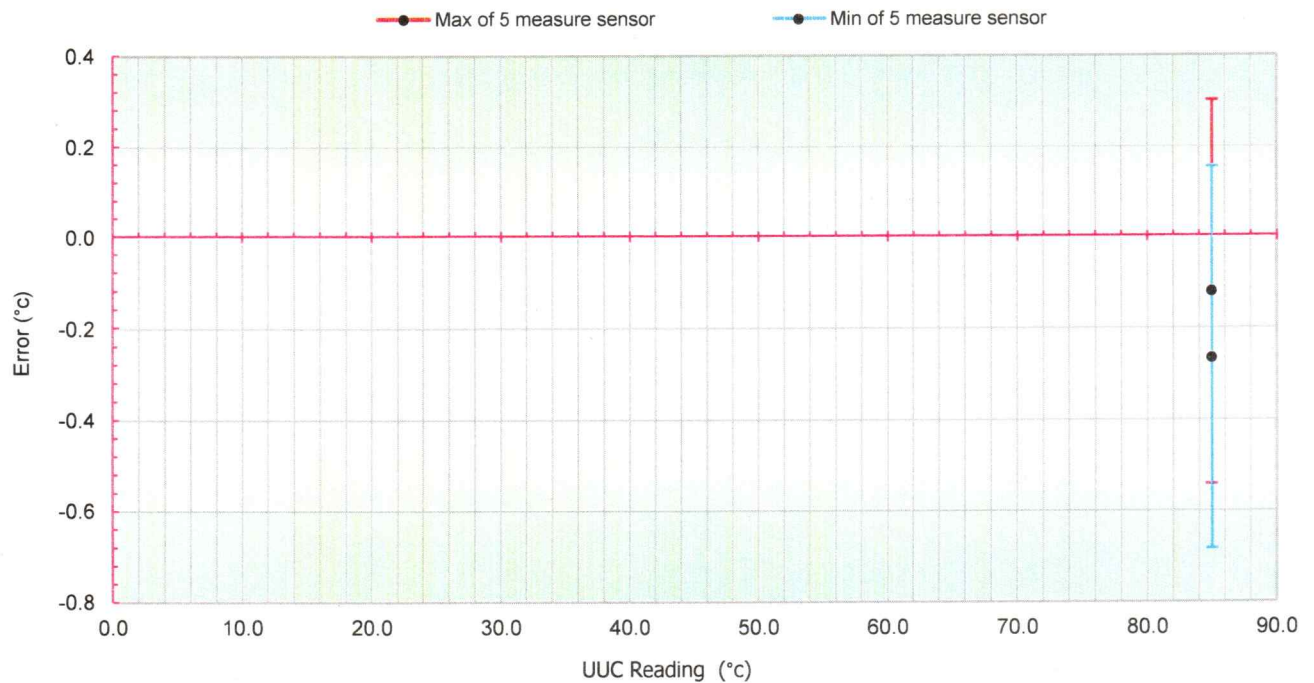
**Section 3 :** Possible of temperature in chamber. Show minimum and maximum of the average values and Include with uncertainty of measurement. , The average values is average of each position standard sensor throughtout observation time.

Unit : ( °c )

Calibration Point	UUC Setting (*)	UUC Reading (*)	Possible of Minimum temperature in chamber	Possible Maximum temperature in chamber
85	85.0	85.0	84.70	85.69

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

**Section 4 : Trend of accuracy**



Approved Signatory : \_\_\_\_\_

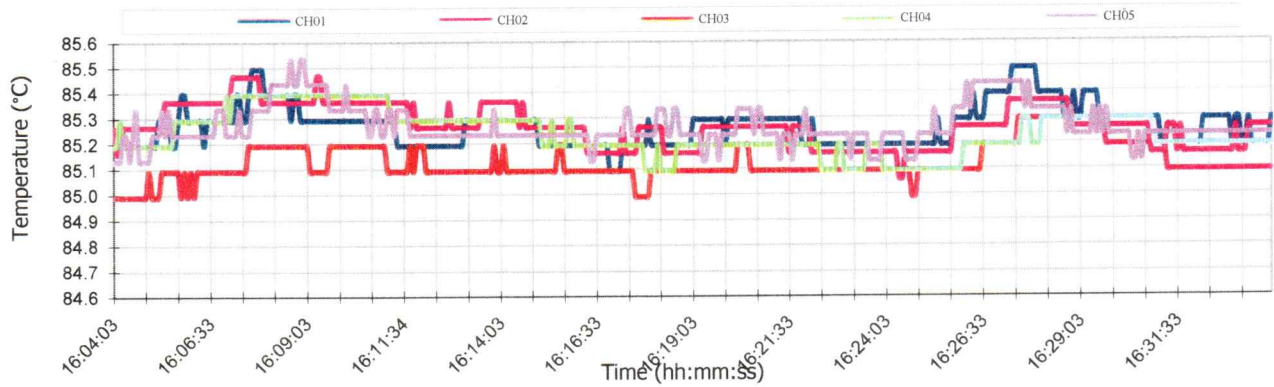


Certificate No. : CT-21-01-21971

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

(5.1) Temperature Distribution at UUC Reading 85.0 °C



Approved Signatory : .....



# THAI CALIBRATION SERVICES CO., LTD.

19/8 Moo 9 Soi Raiking 30 Puttamonthon 5 Rd., Sampran, Nakornpatom 73210

Tel. 0-3439-7682-5 Fax: 0-3439-7687

www.thaical.com E-mail : info@thaical.com, lab@thaical.com



## CALIBRATION CERTIFICATE

Certificate No.S2103796S

page 1 of 2

**Customer :** TNP ENVIRONMENT CO., LTD.  
332/173 Moo 3 Tambon Bang Rak Phatthana,  
Amphoe Bang Bua Thong, Nonthaburi 11110

**Equipment :** Non-automatic weighing instrument (Electronic instrument)

**Manufacturer :** Citizon **Order No. :** 64S1167-1

**Model :** CY204 **Ambient temperature :**  $(30.2 \pm 5.0) ^\circ\text{C}$

**Accuracy class :** - **Relative humidity :**  $(35.5 \pm 10.0) \%$

**Capacity :** 220 g **Received date :** 24-Mar-2021

**Resolution :** 0.0001 g **Date of calibration :** 24-Mar-2021

**Serial No. :** 16405757 **Date of issue :** 25-Mar-2021

**ID No. :** LAB01 **Condition of the balance :** Good working conditions

**Place of calibration :** ห้องเครื่องชั่ง

### Calibration method

This instrument was calibrated according to the EURAMET Calibration Guide No. 18.

### Condition of reference standard weight

<u>Instrument</u>	<u>Nominal value</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due-date</u>	<u>Density (kg/m<sup>3</sup>)</u>
1 Standard weight set	1 mg to 2 kg	15885+15849	M2010001S	8-Oct-2021	7950

### Traceability of the reference standard weight

This certificate is traceable to SI unit through Mass Calibration Laboratory Thai Calibration Services Co., Ltd., NSC-ONSC accredited no. Calibration 0189.

Calibrated By :

Sathaporn Rueangpluppla  
Technician

Approved By :

Somwang Wongduang  
Approved Signatory

This calibration certificate may not be reproduced other than in full,  
except with the prior written approval of the head of TCS calibration laboratory.



# THAI CALIBRATION SERVICES CO., LTD.

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Tel. 0-3439-7682-5 Fax: 0-3439-7687

www.thaical.com E-mail : info@thaical.com, lab@thaical.com



## CALIBRATION CERTIFICATE

Certificate No.S2103796S

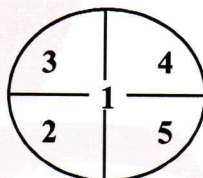
page 2 of 2

### The repeatability of indication

Nominal Value ( g )	Standard Deviation of reading ( g )	Maximum difference between successive reading ( g )	n
200	0.00005	0.0001	5

### The effect of eccentric application of a load on the indication (test load : 100 g)

Position	Balance Reading ( g )
Point 1	100.0002
Point 2	100.0002
Point 3	100.0002
Point 4	100.0005
Point 5	100.0002
Eccentric Value	0.0003



### The error of indication

Nominal Value ( g )	Value of Reference Standard Weight ( g )	Balance Reading ( g )	Correction ( g )	Uncertainty (±) ( g )	k
Unload	0.0000	0.0000	0.0000	0.00016	2.32
0.1	0.1000	0.1000	0.0000	0.00016	2.32
0.2	0.2000	0.2000	0.0000	0.00016	2.32
0.5	0.5000	0.5000	0.0000	0.00016	2.32
1	1.0000	1.0000	0.0000	0.00016	2.28
2	2.0000	2.0000	0.0000	0.00016	2.28
5	5.0000	5.0007	-0.0007	0.00016	2.25
10	10.0000	10.0010	-0.0010	0.00017	2.25
20	20.0000	20.0009	-0.0009	0.00017	2.20
50	50.0000	50.0005	-0.0005	0.00019	2.10
100	100.0000	100.0003	-0.0003	0.00025	2.00
200	199.9998	200.0004	-0.0006	0.00043	2.00

Remark : Adjustment, External weight nominal value 200 g, Standard weight of Lab

### Uncertainty of measurement

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor ( $k$ ), which for a normal distribution corresponds to a coverage probability of approximately 95% (confidence level).

**This report will certify of the calibrated equipment only.**

--End--