

ภาคผนวก จ

เอกสารสอบเทียบ





Thermology Co., Ltd.

96/177-96/178 Moo 6, T. La-harn, A. Bangbuathong, Nonthaburi 11110
Tel : 0 2191 6479 Fax : 0 2191 6480 website : www.thermology.co



CALIBRATION CERTIFICATE

Date of Issue Jun 28, 2024

Cert No. 24/2419

Site Calibration

Order No. 24060337

Customer Bureau Veritas AQ Lab (Thailand) Limited
111 Thailand Science Park
Moo 9 Paholyothin Rd., Klong 1, Klong Luang, Pathumthani 12120 Thailand

Place of Calibration Prepare Culture Media

Description Autoclave

Model VE-65

Serial No. 7202

ID.No. CHM000206

Date of Receipt Jun 26, 2024

Date of Calibration Jun 26, 2024

Environment

Temperature (Min) 22.1 °C (Max) 25.5 °C

Relative Humidity (Min) 42.7 %RH (Max) 56.3 %RH

Calibration Method

WI-22 : The reference thermometer was placing into the chamber and measurement based on BS-2646.

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

This certificate is issued in accordance with the conditions of Thermology Laboratory. The traceability to recognised national standard and the unit of measurement realised at corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of laboratory.



CALIBRATION CERTIFICATE

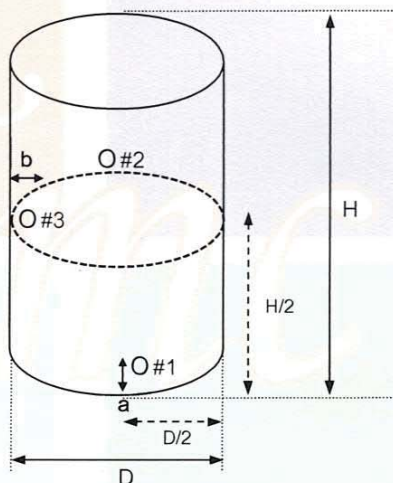
Date of Issue Jun 28, 2024

Cert No. 24/2419

Site Calibration

Order No. 24060337

Results (without adjustment)



Position of reference thermometers were placed

Note.

- 1). Duration of the holding time was 45 minutes.
- 2). Stability - greatest one half of difference between max peak and min peak of each reference probe measured temperature obtained during the calibration interval.
- 3). 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.



CALIBRATION CERTIFICATE

Date of Issue Jun 28, 2024

Cert No. 24/2419

Site Calibration

Order No. 24060337

Results (without adjustment)

UUC Setting (°C)	UUC Reading		Reference Thermometer (°C)		Stability ±(°C)	Uniformity (°C)	Uncertainty ±(°C)
	(°C)	(KPa)					
115.0	115.3	179.6	Position 1	115.58	0.25	0.15	0.70
			Position 2	115.58			
			Position 3	115.48			

UUC Setting (°C)	UUC Reading		Reference Thermometer (°C)		Stability ±(°C)	Uniformity (°C)	Uncertainty ±(°C)
	(°C)	(KPa)					
121.0	121.4	211.0	Position 1	121.59	0.20	0.13	0.70
			Position 2	121.60			
			Position 3	121.52			

Standard

1) Standard Datalogger with RTD Model. HiTemp. 140-PT S/N. R32397, Certificate No. QR23-1962, Calibrated by Quality Reborn Co., Ltd., ONAC Calibration No. 0292. Due Date Aug 07, 2024.

2) Standard Datalogger with RTD Model. HiTemp. 140-PT S/N. R32398, Certificate No. QR23-1963, Calibrated by Quality Reborn Co., Ltd., ONAC Calibration No. 0292. Due Date Aug 07, 2024.

3) Standard Datalogger with RTD Model. HiTemp. 140-PT S/N. R32399, Certificate No. QR23-1964, Calibrated by Quality Reborn Co., Ltd., ONAC Calibration No. 0292. Due Date Aug 07, 2024.

This certificate is traceable to SI unit.





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CALIBRATION CERTIFICATE

Date of Issue Jun 28, 2024

Cert No. 24/2419

Site Calibration

Order No. 24060337

The stability and uniformity was taken into account in the measurement uncertainty stated.

The above results are valid exclusively for calibration samples as mentioned in the report.

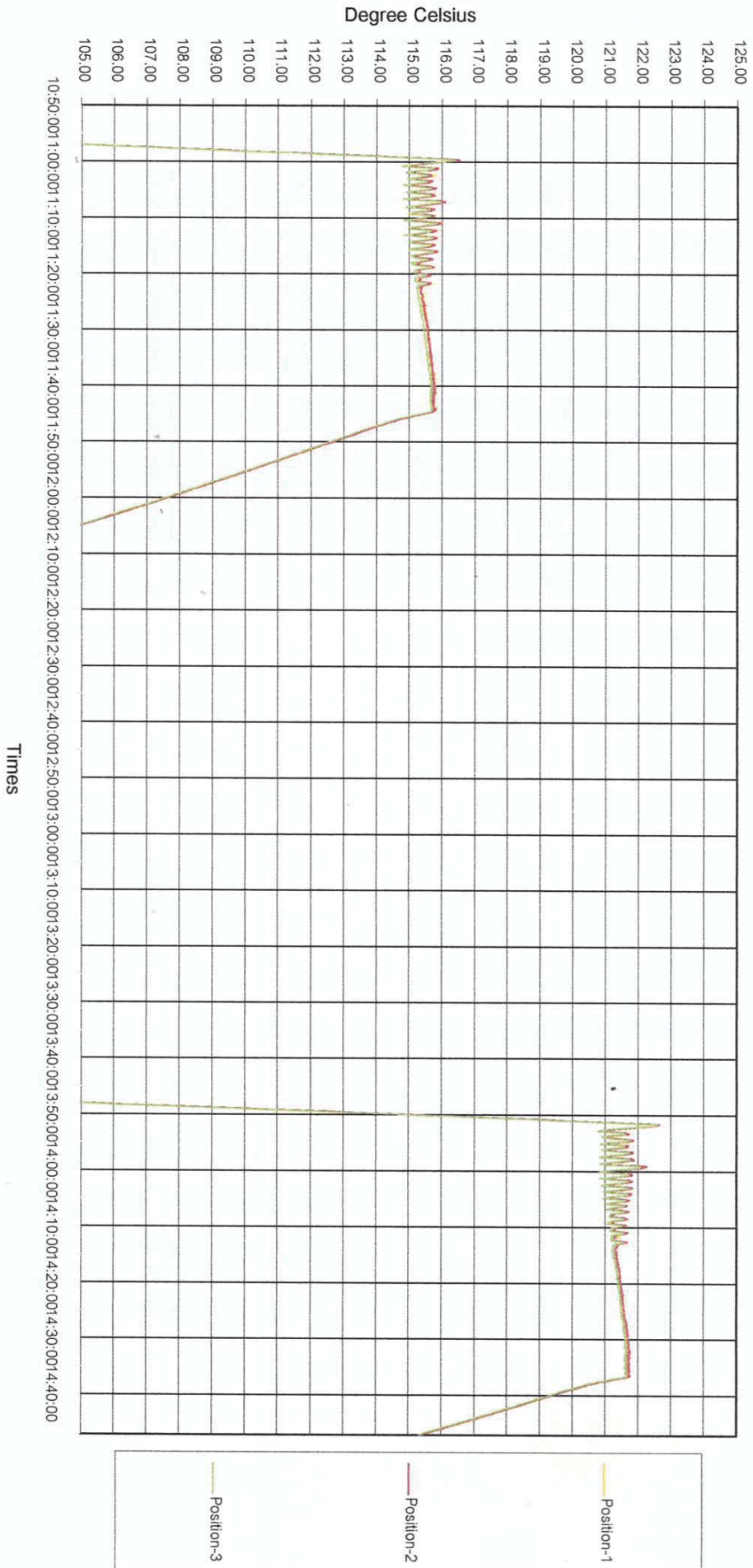
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with ONAC requirements.

Thermology

Autoclave

Cert.No. 24/2419

Model: VE-65 S/N. 7202 ID.No. CHM000206





CALIBRATION CERTIFICATE

Date of Issue Jun 28, 2024

Cert No. 24/2418

Site Calibration

Order No. 24060337

Customer Bureau Veritas AQ Lab (Thailand) Limited
111 Thailand Science Park
Moo 9 Paholyothin Rd., Klong 1, Klong Luang, Pathumthani 12120 Thailand

Place of Calibration Incubation Room

Description Water Bath

Model SC100

Serial No. 0152187501160414

ID.No. CHM000205

Date of Receipt Jun 24, 2024

Date of Calibration Jun 24, 2024

Environment

Temperature	(Min)	22.8	°C	(Max)	25.2	°C
Relative Humidity	(Min)	44.1	%RH	(Max)	58.5	%RH
Line Voltage	(Min)	227.2	VAC	(Max)	229.6	VAC

Calibration Method

WI-18 : The reference thermometer was placed into the chamber and measurement was performed based on AS-2853.

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

Standard

1) Data Acquisition with Sensor Model 34972A S/N. MY49007789, Certificate No. QR24-0186, Calibrated by Quality Reborn Co., Ltd., ONAC Calibration No. 0292. Due Date Jan 23, 2025.

This certificate is traceable to SI unit.



CALIBRATION CERTIFICATE

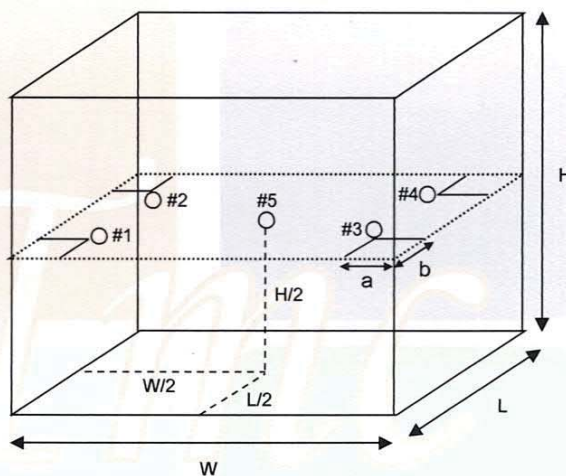
Date of Issue Jun 28, 2024

Cert No. 24/2418

Site Calibration

Order No. 24060337

Results (without adjustment)



Position of reference thermometers were placed

Note.

- 1). Dimension ($W \times L \times H$) is 30 x 34 x 20 cm.
- 2). Stability - greatest one half of difference between max peak and min peak of each reference probe measured temperature obtained during the calibration interval.
- 3). 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.



CALIBRATION CERTIFICATE

Date of Issue Jun 28, 2024

Cert No. 24/2418

Site Calibration

Order No. 24060337

Results (without adjustment)

Cal Point (°C)	UUC Setting (°C)	UUC Reading (°C)	Reference Thermometer (°C)		Stability \pm (°C)	Uniformity (°C)	Uncertainty \pm (°C)
44.5	44.5	44.5	Position 1	44.490	0.020	0.043	0.13
			Position 2	44.494			
			Position 3	44.491			
			Position 4	44.499			
			Position 5	44.503			

The stability and uniformity was taken into account in the measurement uncertainty stated.

The above results are valid exclusively for calibration samples as mentioned in the report.

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 ONAC requirements.

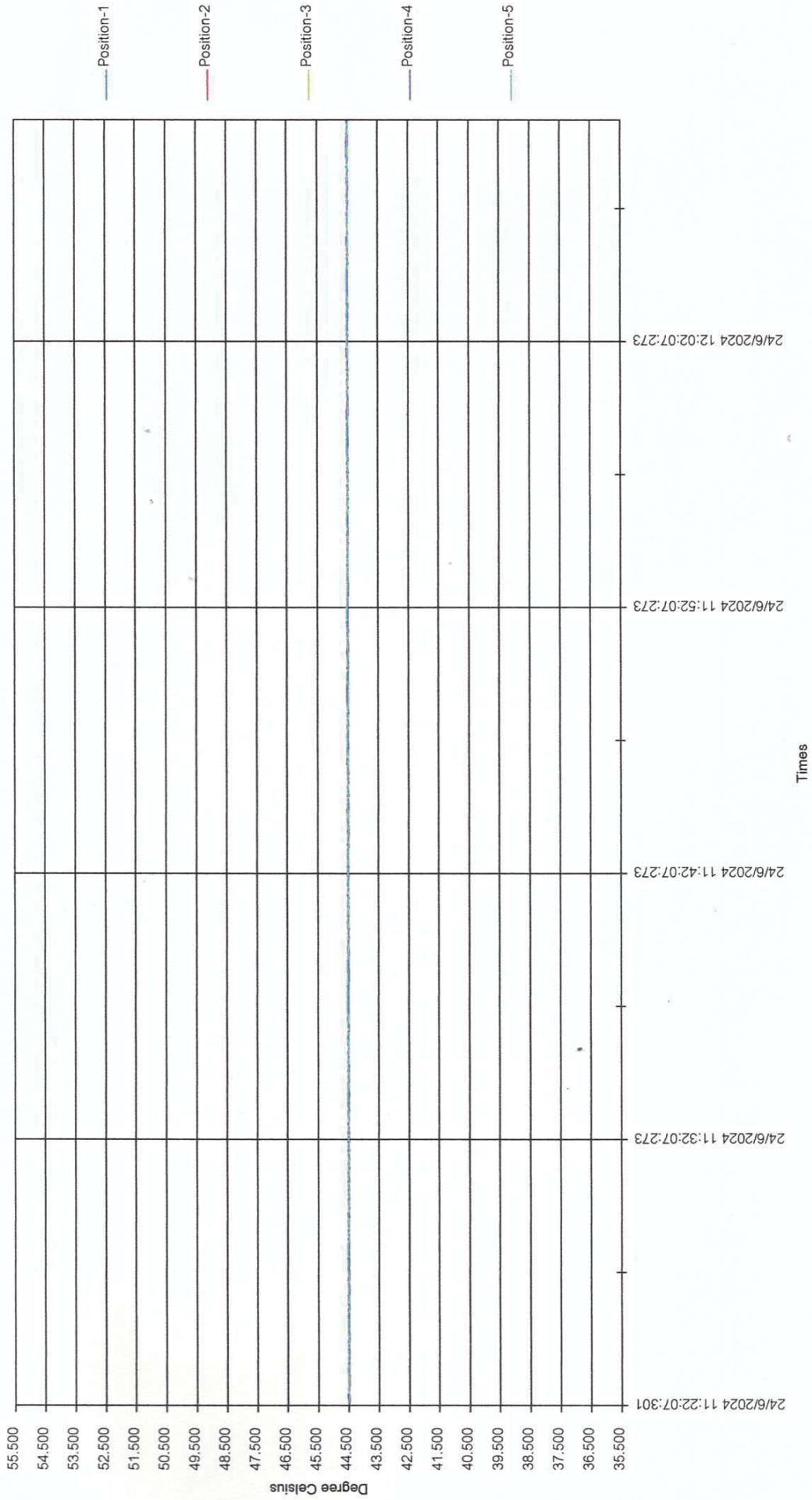
APPROV



Cert.No. 24/2418

Water Bath

Model. SC100 S/N. 0152187501160414 ID.No. CHM000205





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CALIBRATION CERTIFICATE

Date of Issue Jun 28, 2024

Cert No. 24/2415

Site Calibration

Order No. 24060337

Customer Bureau Veritas AQ Lab (Thailand) Limited
111 Thailand Science Park
Moo 9 Paholyothin Rd., Klong 1, Klong Luang, Pathumthani 12120 Thailand

Place of Calibration Incubation Room

Description Incubator

Model IN110

Serial No. D415.0797

ID.No. CHM000181

Date of Receipt Jun 24, 2024

Date of Calibration Jun 24, 2024

Environment

Temperature (Min) 22.8 °C (Max) 25.2 °C

Relative Humidity (Min) 44.1 %RH (Max) 58.5 %RH

Calibration Method

WI-17 : The reference thermometer was placed into the chamber and measurement was performed based on AS-2853.

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

This certificate is issued in accordance with the conditions of Thermology Laboratory. The traceability to recognised national standard and the unit of measurement realised at corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of laboratory.



CALIBRATION CERTIFICATE

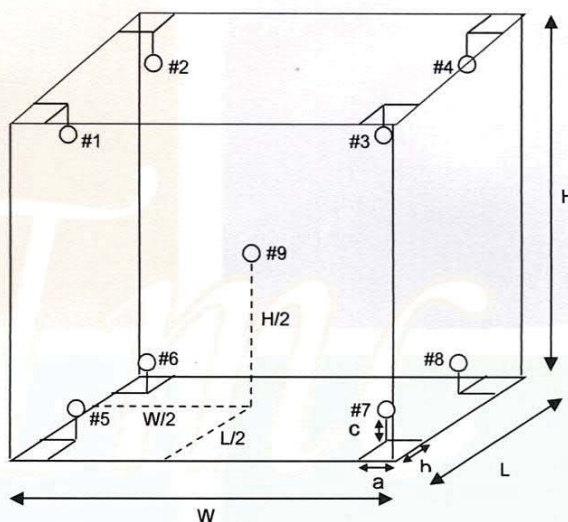
Date of Issue Jun 28, 2024

Cert No. 24/2415

Site Calibration

Order No. 24060337

Results (without adjustment)



Position of reference thermometers were placed

Note.

- 1). Dimension ($W \times L \times H$) is 56 x 40 x 48 cm.
- 2). Stability - greatest one half of difference between max peak and min peak of each reference probe measured temperature obtained during the calibration interval.
- 3). 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.



CALIBRATION CERTIFICATE

Date of Issue Jun 28, 2024

Cert No. 24/2415

Site Calibration

Order No. 24060337

Results (without adjustment)

Cal Point (°C)	UUC Setting (°C)	UUC Reading (°C)	Reference Thermometer (°C)		Stability \pm (°C)	Uniformity (°C)	Uncertainty \pm (°C)
35.0	35.0	35.0	Position 1	35.138	0.067	0.253	0.30
			Position 2	35.099			
			Position 3	35.075			
			Position 4	35.187			
			Position 5	35.173			
			Position 6	34.988			
			Position 7	34.878			
			Position 8	34.965			
			Position 9	34.970			

The stability and uniformity was taken into account in the measurement uncertainty stated.

The above results are valid exclusively for calibration samples as mentioned in the report.

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 ONAC requirements.



Incubator		
Model. IN110	S/N. D415.0797	ID.No. CHM000181





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert.No.: 23CHO565

Page.: 1 of 3

Certificate of Calibration

Equipment :	Spectrophotometer
Manufacturer :	Merck
Model :	Prove 100
Serial No. :	1904113676
ID No. :	S2019025
Condition As-Received:	Used Item
Received Date :	21 September 2023
Calibration Date :	21 September 2023
Reference :	2309-0483OC-2
Submitted by :	SGS (Thailand) Limited 1/209, 1/211 Moo 1, Ban Chang, Ban Chang, Rayong 21130
Calibration Place :	Spectrophotometry Lab
Ambient Temperature :	(23.8 - 20.9) °C (On-Site)
Relative Humidity :	(50.1 - 50.2) % (On-Site)
Calibration Procedure :	In - house method : CP-OCH4 based on ASTM E 275-01

Calibrated by:

Kanokit Pongthong

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.



Cert. No. : 23CHO565

Page : 2 of 3

Condition of calibration result

1. Reference Standard Material :

<u>Material</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due date</u>
1. Absorbance Standard set	39130	106269	10 Oct 2024
2. Wavelength Standard set	36730	98330	19 Jan 2024
3. Wavelength Standard set	36730	98331	19 Jan 2024

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

3. This certificate is traceable to the International System of Unit maintained through :

- Starna Scientific Ltd.

4. Spectral BandWidth : 4 nm

Scan Speed : - nm/min

Calibration Results : without adjustment

Wavelength Accuracy

Certified Values of Reference Material (nm)	UUC Reading (nm)	Uncertainty of Measurement (\pm nm)	Coverage Factor <i>k</i>
418.48	418.5	0.15	2.00
513.70	513.1	0.14	2.00
536.90	536.3	0.14	2.00
637.94	637.6	0.14	2.00
879.70	878.8	0.15	2.00



Cert. No. : 23CHO565

Page : 3 of 3

Calibration Results : without adjustment

Photometric Accuracy

Wavelength (nm)	Certified Values of Reference Material (Abs)	UUC Reading (Abs)	Uncertainty of Measurement (\pm Abs)	Coverage Factor <i>k</i>
440.0	Zero	0.000	0.0028	2.00
	0.5645	0.563	0.0028	2.00
	0.6988	0.698	0.0028	2.00
	1.0017	1.001	0.0028	2.00
546.1	Zero	0.000	0.0028	2.00
	0.5281	0.527	0.0028	2.00
	0.6962	0.696	0.0028	2.00
	0.9984	0.998	0.0028	2.00
635.0	Zero	0.000	0.0028	2.00
	0.5699	0.569	0.0028	2.00
	0.7606	0.760	0.0028	2.00
	1.0927	1.092	0.0028	2.00

Remark

- Each individual filter is measured against the empty filter holder (blank) used to zero the spectrophotometer

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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Verification COD Reactor

Equipment Name	Dri-Block Heater-Digital	Temperature Ver	150±2 °C
Serial No.	000827-A	Model	DB 200/3
Reference Standard	Thermocouple Type K	Certificate No.	21/4272
Calibration Date	10/03/2023	Next Cal. Date	10/03/2024

Left											
Hole 1				Hole 2				Hole 3			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	151.1	-0.36	150.7	1	150.6	-0.36	150.2	1	151.4	-0.36	151.0
2	150.8	-0.36	150.4	2	151.7	-0.36	151.3	2	151.3	-0.36	150.9
3	151.2	-0.36	150.8	3	151.1	-0.36	150.7	3	151.7	-0.36	151.3
		Mean	150.67			Mean	150.77			Mean	151.11
		SD	0.208			SD	0.551			SD	0.208
		%RSD	0.138			%RSD	0.365			%RSD	0.138
Hole 4				Hole 5				Hole 6			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	151.7	-0.36	151.3	1	150.5	-0.36	150.1	1	151.5	-0.36	151.1
2	151.6	-0.36	151.2	2	151.3	-0.36	150.9	2	151.4	-0.36	151.0
3	151.5	-0.36	151.1	3	150.6	-0.36	150.2	3	150.5	-0.36	150.1
		Mean	151.24			Mean	150.44			Mean	150.77
		SD	0.100			SD	0.436			SD	0.551
		%RSD	0.066			%RSD	0.290			%RSD	0.365
Hole 7				Hole 8				Hole 9			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	151.3	-0.36	150.9	1	151.7	-0.36	151.3	1	150.5	-0.36	150.1
2	151.0	-0.36	150.6	2	150.5	-0.36	150.1	2	151.2	-0.36	150.8
3	151.3	-0.36	150.9	3	151.4	-0.36	151.0	3	150.8	-0.36	150.4
		Mean	150.84			Mean	150.84			Mean	150.47
		SD	0.173			SD	0.624			SD	0.351
		%RSD	0.115			%RSD	0.414			%RSD	0.233
Hole 10				Hole 11				Hole 12			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	151.6	-0.36	151.2	1	151.5	-0.36	151.1	1	150.7	-0.36	150.3
2	151.6	-0.36	151.2	2	151.2	-0.36	150.8	2	151.6	-0.36	151.2
3	150.8	-0.36	150.4	3	151.5	-0.36	151.1	3	151.2	-0.36	150.8
		Mean	150.97			Mean	151.04			Mean	150.81
		SD	0.462			SD	0.173			SD	0.451
		%RSD	0.306			%RSD	0.115			%RSD	0.299

Verified By	Hatairat L.	Approved By	Jaisri R.
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Verification COD Reactor

Equipment Name	Dri-Block Heater Digital	Temperature Ver	150±2 °C
Serial No.	000827-A	Model	DB 200/3
Reference Standard	Thermocouple Type K	Certificate No.	21/4272
Calibration Date	10/03/2023	Next Cal. Date	10/03/2024

Middle

Hole 1				Hole 2				Hole 3			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	151.2	-0.36	150.8	1	150.7	-0.36	150.3	1	151.1	-0.36	150.7
2	151.5	-0.36	151.1	2	151.7	-0.36	151.3	2	151.6	-0.36	151.2
3	151.6	-0.36	151.2	3	150.8	-0.36	150.4	3	150.9	-0.36	150.5
		Mean	151.07			Mean	150.71			Mean	150.84
		SD	0.208			SD	0.551			SD	0.361
		%RSD	0.138			%RSD	0.365			%RSD	0.239

Hole 4				Hole 5				Hole 6			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	151.5	-0.36	151.1	1	151.6	-0.36	151.2	1	150.5	-0.36	150.1
2	150.7	-0.36	150.3	2	151.2	-0.36	150.8	2	150.6	-0.36	150.2
3	151.6	-0.36	151.2	3	151.2	-0.36	150.8	3	151.2	-0.36	150.8
		Mean	150.91			Mean	150.97			Mean	150.41
		SD	0.493			SD	0.231			SD	0.379
		%RSD	0.327			%RSD	0.153			%RSD	0.252

Hole 7				Hole 8				Hole 9			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	151.5	-0.36	151.1	1	151.5	-0.36	151.1	1	151.2	-0.36	150.8
2	150.5	-0.36	150.1	2	151.7	-0.36	151.3	2	150.9	-0.36	150.5
3	150.8	-0.36	150.4	3	151.1	-0.36	150.7	3	151.4	-0.36	151.0
		Mean	150.57			Mean	151.07			Mean	150.81
		SD	0.513			SD	0.306			SD	0.252
		%RSD	0.341			%RSD	0.202			%RSD	0.167

Hole 10				Hole 11				Hole 12			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	151	-0.36	150.6	1	151.5	-0.36	151.1	1	151.2	-0.36	150.8
2	150.6	-0.36	150.2	2	150.6	-0.36	150.2	2	150.5	-0.36	150.1
3	151.5	-0.36	151.1	3	151.0	-0.36	150.6	3	151.1	-0.36	150.7
		Mean	150.67			Mean	150.67			Mean	150.57
		SD	0.451			SD	0.451			SD	0.379
		%RSD	0.299			%RSD	0.299			%RSD	0.251

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Verification COD Reactor

Equipment Name	Dri-Block Heater Digital	Temperature Ver	150±2 °C
Serial No.	000827/A	Model	DB 200/3
Reference Standard	Thermocouple Type K	Certificate No.	21/4272
Calibration Date	10/03/2023	Next Cal. Date	10/03/2024

Right

Hole 1				Hole 2				Hole 3			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	149.9	-0.36	149.5	1	150.3	-0.36	149.9	1	151.0	-0.36	150.6
2	151.1	-0.36	150.7	2	151.0	-0.36	150.6	2	151.0	-0.36	150.6
3	150.9	-0.36	150.5	3	149.9	-0.36	149.5	3	150.4	-0.36	150.0
	Mean	150.27			Mean	150.04			Mean	150.44	
	SD	0.643			SD	0.557			SD	0.346	
	%RSD	0.428			%RSD	0.371			%RSD	0.230	

Hole 4				Hole 5				Hole 6			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	150.8	-0.36	150.4	1	150.0	-0.36	149.6	1	150.5	-0.36	150.1
2	151.0	-0.36	150.6	2	150.0	-0.36	149.6	2	150.8	-0.36	150.4
3	150.9	-0.36	150.5	3	150.7	-0.36	150.3	3	149.8	-0.36	149.4
	Mean	150.54			Mean	149.87			Mean	150.01	
	SD	0.100			SD	0.404			SD	0.513	
	%RSD	0.066			%RSD	0.270			%RSD	0.342	

Hole 7				Hole 8				Hole 9			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	150.8	-0.36	150.4	1	151.1	-0.36	150.7	1	150.2	-0.36	149.8
2	150.9	-0.36	150.5	2	150.7	-0.36	150.3	2	150.2	-0.36	149.8
3	151.0	-0.36	150.6	3	151.1	-0.36	150.7	3	149.9	-0.36	149.5
	Mean	150.54			Mean	150.61			Mean	149.74	
	SD	0.100			SD	0.231			SD	0.173	
	%RSD	0.066			%RSD	0.153			%RSD	0.116	

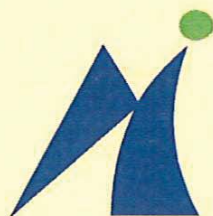
Hole 10				Hole 11				Hole 12			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	150.6	-0.36	150.2	1	150.5	-0.36	150.1	1	150.9	-0.36	150.5
2	150.5	-0.36	150.1	2	150.9	-0.36	150.5	2	150.0	-0.36	149.6
3	149.9	-0.36	149.5	3	151.1	-0.36	150.7	3	150.5	-0.36	150.1
	Mean	149.97			Mean	150.47			Mean	150.11	
	SD	0.379			SD	0.306			SD	0.451	
	%RSD	0.252			%RSD	0.203			%RSD	0.300	

Confidential - Not to be photocopied except by permission of the Laboratory Quality Manager or nominee.

สรุปผลการ Verify

ปรับอุณหภูมิ 154.0 °C แต่ยังคงมีอุณหภูมิ 150 ± 1 °C ทนจน

Confidential - Not to be photocopied except by permission of the Laboratory Quality Manager or nominee.



ARCHEMICA

Certificate of Calibration

Aquion RFIC : Anion System (ID#1054)

**This certificate is to verify that instrument below are calibrated
by
Archemica Lab Co.,Ltd.**

Aquion

S/N 220380025

AS-DV

S/N 2203880170

For



Applications Chemist



MAINTENANCE AND TEST CERTIFICATE MODEL

Avio220 Max

Customer : <u>SGS(Thailand)Limited</u>	Date Tested: <u>January 10, 2024</u>
<u>Rayong Branch</u>	Recommendation Recertification
Address : <u>1/209 , 1/211 Moo 1,</u>	Period <u>6</u> Months
<u>T. Banchang, A. Banchang</u>	Recertification Due: <u>July 10, 2024</u>
<u>Rayong 21130</u>	Date Last Certified: <u>N/A</u>
User Name <u>Khun Saijai Ruangsawat</u>	Visit Number: <u>10F2 W</u>
Phone: <u>+66(0)38685260-64</u>	PerkinElmer Phone: <u>02-719-6420 ext 206</u>
Email: <u>saijai.ruangsawat@sgs.com</u>	PerkinElmer Fax: <u>02-318-5597</u>

CONFIGURATION TESTED

MODEL	SERIAL NUMBER	SOFTWARE
<u>AVIO200 MAX</u>	<u>M79S2304111</u>	<u>Syngristix V5</u>
<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>
TESTED EQUIPMENT	CALIBRATION NUMBER	EXPIRATION
<u>IPV Methods</u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
<u>Multielement Standard</u>	<u>N069-1579</u>	<u>30-Dec-24</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>30-Nov-24</u>
<u> </u>	<u> </u>	<u> </u>
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
<u>2 % HNO3</u>	<u> </u>	<u> </u>
<u>10 % HNO3</u>	<u> </u>	<u> </u>



MAINTENANCE AND TEST CERTIFICATE MODEL
Avio220 Max

SERIAL NUMBER M79S2304111**DATE TESTED** January 10, 2024**1. MECHANICAL CHECKS**

A. Inspect and clean all fans and filters.

☐ OK

B. Inspect and replace as necessary, all torch components including the RF coil.

☐ OK

C. Inspect all tubing for sign of clacking or leaking.

☐ OK

D. Adjust water and gas pressure regulator settings.

☐ OK

E. Inspect and leak check pneumatics drawers.

☐ OK

F. Clean the exterior of the instrument.

☐ OK**2. OPTICAL CHECKS**

A. Inspect and clean all optical components.

☐ OK

B. As required, check and replace all purgebfilters.

☐ OK

C. Recheck optical alignment.

☐ OK**3. COOLING SYSTEM CHECKS**

A. Perform preventive maintenance on chiller.

☐ OK

B. Flush out the chiller every year.

☐ OK**4. PERFORMANCE CHECKS**

A. Torch View Alignment.

☐ OK

B. Wavelength Calibration.

☐ OK



MAINTENANCE AND TEST CERTIFICATE MODEL

Avio220 Max

SERIAL NUMBER <u>M79S2304111</u>		DATE TESTED <u>January 10, 2024</u>	
PARAMETER	SPECIFICATION		FINAL VALUE
Spectral Resolution : UV			
As 193.696 nm	≤ 0.009 nm	<u>0.00864</u> nm	
Ni 231.604 nm	≤ 0.011 nm	<u>0.01009</u> nm	
Ni 341.476 nm	≤ 0.015 nm	<u>0.01169</u> nm	
Spectral Resolution : VIS			
Ba 455.403 nm	≤ 0.020 nm	<u>0.01776</u> nm	
Precision			
Zn 206.200 nm	% RSD ≤ 1.0 %	<u>0.28</u> %	
Mg 280.271 nm	% RSD ≤ 1.0 %	<u>0.73</u> %	
Mg 285.213 nm	% RSD ≤ 1.0 %	<u>0.61</u> %	
Ba 455.403 nm	% RSD ≤ 1.0 %	<u>0.54</u> %	
Detection Limits : Axial			
Tl 190.801 nm	3(sd)	<u>1.52</u> ppb	
As 193.696 nm	3(sd)	<u>1.4</u> ppb	
Se 196.026 nm	3(sd)	<u>1.53</u> ppb	
Pb 220.353 nm	3(sd)	<u>1.72</u> ppb	
Detection Limits : Radial			
As 193.696 nm	3(sd)	<u>1.69</u> ppb	
Zn 213.857 nm	3(sd)	<u>0.42</u> ppb	
Mn 257.610 nm	3(sd)	<u>0.1</u> ppb	
La 379.478 nm	3(sd)	<u>0.61</u> ppb	
Ba 455.403 nm	3(sd)	<u>0.13</u> ppb	
Ba 493.408 nm	3(sd)	<u>0.1</u> ppb	
BEC : Axial (IB X 1000)/(IS-IB)			
Mn 257.610 nm	≤ 30 ppb	<u>7.83</u> ppb	
BEC : Radial (IB X 1000)/(IS-IB)			
Mn 257.610 nm	≤ 30 ppb	<u>17.57</u> ppb	



MAINTENANCE AND TEST CERTIFICATE MODEL
Avio220 Max

SERIAL NUMBER M79S2304111

DATE TESTED January 10, 2024

Remarks :

Commissioning follow as commissioning performance sheets.

This is to certify that the above tests have been performed and the configuration tested

☒

meets

☐

does not meet

the PerkinElmer Specifications listed on this certificate.

This certificate does not modify PerkinElmer's standard terms and condition of sale,
including warranty terms.



Certificate No.: T/O 660198

Date of issue : 11-Oct-2023

Equipment Description : Refrigerator
Equipment Model : P1010
Equipment Serial No. : P1010-1020-0005
I.D. No. or Control No. : TNP.LAB.01
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 : 9-Oct-2023
Receiving No. : O-230230
Environmental Conditions : All of the measurement were carried out in the working area
Temperature : (25 ± 15) °C
Humidity : (55 ± 30) % RH
Voltage : (220 ± 22) VAC
Calibration Place : 332/173 Moo. 3 Tambon Bang Rak Phatthana, Amphoe Bang Bua Thong,
Nonthaburi 11110
Calibration Procedure No. : This instrument was calibrated by comparison of reference radiation source standard
according to calibration work instration 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

9 Oct 2023

Certificate No. : T/O 660198

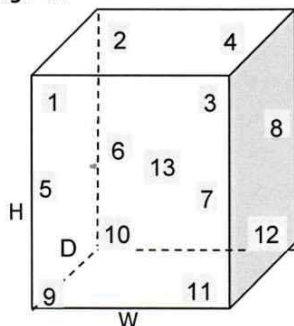
The Reference Standard Instrument :-

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert No.</u>	
1) Data logger with RTD Probe	Agilent 34972A	MY41187730	PSL-T 0651-1/66	21-Apr-2024
		MY60008352	PSL-T 0651-3/66	21-Apr-2024

Measured room conditions

Temperature :	Minimum: 30.8 °C	Maximum: 31.9 °C
Humidity :	Minimum: 50.7 %RH	Maximum: 57.2 %RH
Voltage :	Minimum: 219.8 VAC	Maximum: 223.4 VAC
Fresh Air Setting:	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								
		1	2	3	4	5	6	7	8	9
		4.02	4.35	4.01	4.20	4.37	4.22	4.17	4.39	4.05
		Sensor Position								
		10	11	12	13					
		4.29	4.30	4.28	4.19					

UUC* Setting	UUC* Reading	Temperature Uniformity	Temperature Stability	Overall Variation	Uncertainty of Measurement	Coverage Factor
(°C)	(°C)	(°C)	(± °C)	(°C)	(± °C)	K
4.0	4.1	1.19	1.08	2.47	1.5	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 $[(\text{Maximum Temperature Value} - \text{Minimum Temperature Value}) / 2]$
- Overall Variation was calculated from the difference between the maximum and minimum measured temperature throughout observation time.

End of Report



CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 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



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : pH METER
MANUFACTURER : HORIBA
MODEL / TYPE : LAQUA-PH1100/9615S
SERIAL NO. : B80A0042/9X0B0575
CLID. NO. : 272001452
JOB CONTROL NO. : 230911100397

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

DATE OF RECEIVED : 11 September 2023

DATE OF ISSUED : 14 September 2023

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



the International System of Units (SI)

Certificate No. Q23100397

F3-011-04/01-12

page 1 of 3



@clccalibration

REPORT OF CALIBRATION

FOR

NOMENCLATURE : pH METER
MANUFACTURER : HORIBA
MODEL / TYPE : LAQUA-PH1100/9615S
SERIAL NO. : B80A0042/9X0B0575
DATE OF CALIBRATION : 12 September 2023

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-01**. The calibration was performed by direct measurement with Certified Reference Material (CRM).

REFERENCE STANDARD USED :

1. pH Standard Solution, NIMT TRM CODE TRM-S-2003, TRM CODE TRM-S-2007.
2. pH Standard Solution, Control Company Catalog Number 06664263,11784256, Lot Number CC752722.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI) , through National Institute of Metrology (Thailand).
Lot Number. 040822 , 230822. Due Date 26 April 2024.
2. The measurements are traceable to International System of Units (SI) , through Control Company.
Certificate No. 4288-13355261 , Due Date 06 May 2024.

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:2022)"

Certificate No. Q23100397

F3-011-04/01-12

page 2 of 3



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

pH METER RESULT @ 25 °C

Standard pH Buffer Solution (pH)	pH Meter Reading (pH)	pH Meter Reading (mV)	Correction (pH)	Uncertainty of pH Measurement (\pm pH)	k Factor
4.003	4.01	150.2	-0.007	0.010	2,00
7.000	7.00	-26.1	0.000	0.015	2,06
10.003	10.01	-187.1	-0.007	0.016	2,05

Technical Note. Setting function CAL 3 point (4,7,10).

The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 008 Page 2,3 of 54

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

End of Certificate

Certificate No. Q23100397

F3-011-04/01-12

page 3 of 3





CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 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



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMO-HYGROMETER
MANUFACTURER : EXTECH INSTRUMENTS
MODEL / TYPE : 445814
SERIAL NO. : PONPE5816745
CLID. NO. : 232303263
JOB CONTROL NO. : 230911100396

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

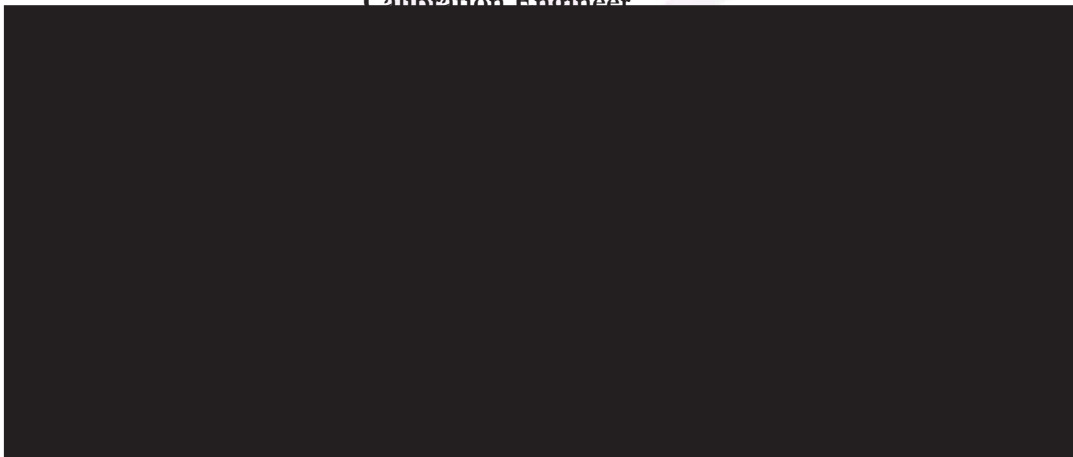
DATE OF RECEIVED : 11 September 2023

DATE OF ISSUED : 15 September 2023

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

Calibrated By : Oranut Kamchatphai

Calibration Engineer



g to the

Certificate No. Q23100396

F3-011-04/01-12

page 1 of 3



@clccalibration

REPORT OF CALIBRATION

FOR

NOMENCLATURE : **DIGITAL THERMO-HYGROMETER**
MANUFACTURER : **EXTECH INSTRUMENTS**
MODEL / TYPE : **445814**
SERIAL NO. : **PONPE5816745**
DATE OF CALIBRATION : **13 September 2023**

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$

Relative Humidity : $(55 \pm 10) \%RH$

PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPTH-11**. The calibration was performed by using Chilled Mirror Hygrometer and Temperature & Humidity Chamber which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Chilled Mirror Hygrometer, Edgetech Model Dew Master S/N. 36151.

Temperature & Humidity Chamber, PGC Model 9141-5114 S/N.0802282.

TRACEABILITY :

The measurements are traceable to International System of Units (SI) , through Thunder Scientific Corporation.

Certificate No. 21028, Due Date 09 December 2023.

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:2022)"

Certificate No. Q23100396

F3-011-04/01-12

page 2 of 3



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 the measuring digital thermo-hygrometer.

CALIBRATION DATA

1. CORRECTION OF TEMPERATURE

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
20.0	20.01	19.9	+0.11	0.27
25.0	25.01	25.2	-0.19	

2. CORRECTION OF HUMIDITY

STD Temperature (° C)	STD Reading (%RH)	DUC Reading (%RH)	Correction (%RH)	Uncertainty ± (%RH)
25	50.0	47	+3.0	0.8

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 008 Page 49 of 54

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

End of Certificate

Certificate No. Q23100396

F3-011-04/01-12

page 3 of 3



Certificate of Calibration

Certificate No. : 67-400049-1

Page : 1 of 2

Submitted by : TNP Environment Co., Ltd.
332/173 Moo 3 Bang Rak Phatthana, Bang Bua Thong, Nonthaburi 11110

Equipment : Liquid in Glass Thermometer

Manufacturer : SK

Model : N/A

Range : 0 °C to 200 °C

Resolution : 1 °C

Serial No. : N/A

Immersion : Total

ID No. : TNP.LAB.12

Environment : Ambient Temperature : (23 ± 2) °C

Relative Humidity : (50 ± 15) %

Line Voltage : (220 ± 22) VAC

Date of Received : 26 January 2024

Date of Calibration : 01 February to 02 February 2024

Date of Issue : 02 February 2024

Calibrated by : Chortip Samchusri

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4001 based on ASTM E77-07 by compared with PRT in the liquid bath at the constant controlled temperature.

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units

1. Platinum Resistance Thermometer (PRT)

ID No.	Cert. No.	Due Date	Traceability
400001	TT-0016-22	07 Feb 2024	National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
400003	23E1866	01 Jun 2025	National Institute of Metrology Thailand (NIMT)
400004	23E1866	01 Jun 2025	National Institute of Metrology Thailand (NIMT)

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 Calibratech Co.,Ltd.



Certificate of Calibration

Certificate No. : 67-400049-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Ice point check : UUC* reading 0 ° C Standard reading 0.8789 ° C

Standard Reading (° C)	UUC Reading (° C)	Correction (° C)	Uncertainty (± ° C)
21.2064	20	1.2	0.31
31.3084	30	1.3	0.31

Remark

UUC : Unit Under Calibration

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

This 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%

- 000 -



Certificate no: H/T 670338

Date of issue : 21-Mar-24

Instrument description	:	Thermo-Hygrometer
Instrument model	:	Extech 445815
Instrument serial no.	:	PONPE5899554
ID no. or control no.	:	TNP.LAB.21
Manufacturer	:	Extech Instruments
Probe description	:	-
Probe model	:	-
Probe serial	:	-
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
Receiving no.	:	L-241004-1
Receiving date.	:	08-Mar-24
Parameter of calibration	:	Temperature Calibration
Condition of UUC.	:	Used
Ambient condition	:	All of the Measurement were carried out the stabilized laboratory Temperature : 23 ± 5 °C Humidity : 55 ± 15 %RH
Calibration place	:	17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210
 Calibration procedure no.	:	 This instrument was calibrated by comparison of indication with the Standard Thermo- hygrometer according to calibration Work Instruction no .WI-CL-11-C

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurent Multiplied by coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

This certificate is applied only to item under test Environmental condition.

This Calibration Certificate may not be reporduced other than in full except with the permission of the issuing laboratory.

Calibration certificates without signature and seal not valid.

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

Date of calibration : 20-Mar-24



Certificate no: H/T 670338

Standard refereces

Standard	Reference No.	Vendor	Due Date
ARALAB 300ECP,Fitoclima	S2023070040-001	MIT	07-Jul-24
Thermo HygroPalm HP 23-A	SG-H-00579/66	Success Gateway	16-Aug-24

Measured room conditions

Temperature : 22.1 °C

Humidity : 55.9 %RH

Pressure : 1019.3 mbar

Calibration results (Without Adjustment)

Reference temperature : - °C

Parameter of standard	Standard values	Mean of UUC.	Error	Uncertainty (±)
Temperature (°C)	19.97	20.1	0.13	0.50
Temperature (°C)	25.02	25.2	0.18	0.50
Temperature (°C)	29.99	30.2	0.21	0.50

Remark : -

End of Report

Certificate no: H 670285

Date of issue : 21-Mar-24

Instrument description : Thermo-Hygrometer
Instrument model : Extech 445815
Instrument serial no. : PONPE5899554
ID no. or control no. : TNP.LAB.21
Manufacturer : Extech Instruments
Probe description : -
Probe model : -
Probe serial : -
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
Receiving no. : L-241004
Receiving date. : 08-Mar-24
Parameter of calibration : Humidity Calibration
Condition of UUC. : Used
Ambient condition : All of the Measurement were carried out the stabilized laboratory
Temperature : 23 ± 5 °C
Humidity : 55 ± 15 %RH
Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210

Calibration procedure no. : This instrument was calibrated by comparison of indication with the Standard Thermo- hygrometer according to calibration Work Instruction no .WI-CL-11-C

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

This certificate is applied only to item under test Environmental condition.

This Calibration Certificate may not be reporduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature and seal not valid.

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

Date of calibration

Certificate no: H 670285

Standard references

Standard	Reference No.	Vendor	Due Date
Thermo HygroPalm HP 23-A	SG-H-00579/66	Success Gateway	16-Aug-24
Hydrogen 2-XL	Performance	Entech	24-Mar-24

Measured room conditions

Temperature : 22.7 °C

Humidity : 56.7 %RH

Pressure : 1013.3 mbar.

Calibration results (Without Adjustment)

Reference temperature : 25.0 °C

Parameter of standard	Standard values	Mean of UUC.	Error	Uncertainty (±)
Humidity (%RH)	35.09	31	-4.09	1.3
Humidity (%RH)	50.03	48	-2.03	1.5
Humidity (%RH)	64.97	68	3.03	1.5

Remark : -

End of Report



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No. : 23M455

Page : 1 of 2

Equipment : Standard Weight Set

Manufacturer: -

Model : Class:F1

Serial No.: 15022021-01

ID No.: TNP.LAB.25

Condition As-Received: Used Item

Received Date: 02 March 2023

Calibration Date: 04 March 2023

Reference: 2303-0104WN

Submitted by: TNP ENVIRONMENT CO.,LTD.

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1015.25 mbar

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except with the prior written approval of the head of
Corporate Services 3: Equipment Calibration and Testing Services.

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

Procedure used: Calibration were conducted using in-house calibration procedure CP-M01 according to comparison method against standard weights on the basis of weighings at an average air density of 1.2 kg/m³ and a temperature of 23.4 °C material density of weight is 8000 kg/m³.

Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Standard Weight Set (E2)	73336	20026	MM-0018-22	28 Feb 2024
2) Standard Weight Set (E2)	73338	20028	MM-0019-22	28 Feb 2024

2.This certificate is not certified for any commercial transaction.

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

4.This Certification is traceable to the International System of Unit maintained at:-

-National Institute of Metrology Thailand (NIMT)



Cert No.: 23M455

Page: 2 of 2

Result of calibration

Nominal Value	Conventional mass		Uncertainty of Measurement (\pm)	Maximum Permissible error (\pm)
	Before Adjustment	After Adjustment		
200 g	199.99986 g	-	0.30 mg	1.0 mg
100 g	100.00015 g	-	0.16 mg	0.50 mg
50 g	50.00015 g	-	0.10 mg	0.30 mg
20 g	20.000116 g	-	0.080 mg	0.25 mg
10 g	10.000041 g	-	0.060 mg	0.20 mg
5 g	5.000010 g	-	0.050 mg	0.16 mg
2 g	1.999936 g	-	0.040 mg	0.12 mg
1 g	0.999973 g	-	0.030 mg	0.10 mg
200 mg	200.059 mg	200.007 mg	0.020 mg	0.060 mg
100 mg	100.037 mg	99.981 mg	0.016 mg	0.050 mg

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 %.

-o0o-



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 : sale@thaicalibration.com, lab@thaicalibration.com



CALIBRATION CERTIFICATE

Certificate No.S2306518S

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 : Shimadzu

Order No. : 66S2523-1

Model : AP225WD

Ambient temperature : $(26.9 \pm 5.0) ^\circ\text{C}$

Accuracy class : -

Relative humidity : $(52.0 \pm 10.0) \%$

Capacity : 10 g / 220 g

Received date : 21-Jun-2023

Resolution : 0.00001 g / 0.0001 g

Date of calibration : 21-Jun-2023

Serial No. : D316301848

Date of issue : 24-Jun-2023

ID No. : TNP.LAB.30

Condition of the balance : Good working conditions

Place of calibration : ห้อง LAB

Calibration method

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

Condition of reference standard weight

Instrument	Nominal value	Serial No.	Certificate No.	Due-date	Density (kg/m ³)
1 Standard weight set	1 mg to 2 kg	15885+15849	M2210001S	8-Oct-2023	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 : Aekhasak Silarut
Technician

Appr

Chonlatee Pongwatvisanon

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except with the prior written approval of the head of TCS calibration laboratory.



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

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

www.thaical.com E-mail : sale@thaicalibration.com, lab@thaicalibration.com



CALIBRATION CERTIFICATE

Certificate No.S2306518S

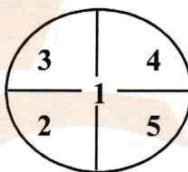
page 2 of 2

The repeatability of indication

Nominal Value (g)	Standard Deviation of reading (g)	Maximum difference between successive reading (g)	n
100	0.000005	0.00001	5
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	100.0000
Point 2	100.0002
Point 3	100.0001
Point 4	100.0000
Point 5	100.0001
Eccentric Value	0.0002



The error of indication

Nominal Value (g)	Value of Reference Standard Weight (g)	Balance Reading (g)	Correction (g)	Uncertainty (±) (g)	k
Unload	0.00000	0.00000	0.00000	0.000016	2.32
0.1	0.10000	0.10003	-0.00003	0.000019	2.10
0.5	0.50000	0.50001	-0.00001	0.000023	2.04
1	1.00001	1.00000	+0.00001	0.000026	2.00
5	5.00000	5.00001	-0.00001	0.000038	2.00
10	9.99999	10.00001	-0.00002	0.000046	2.00
20	20.0000	20.0000	0.0000	0.000085	2.00
50	50.0000	50.0001	-0.0001	0.00011	2.00
100	100.0000	100.0000	0.0000	0.00018	2.00
200	200.0000	200.0004	-0.0004	0.00034	2.00

Remark : Adjustment, External weight nominal value 100 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--



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 : sale@thaicalibration.com, lab@thaicalibration.com



CALIBRATION CERTIFICATE

Certificate No.S2306519S

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 :	Sartorius	Order No. :	66S2523-2
Model :	SECURA224-1S	Ambient temperature :	$(26.8 \pm 5.0) ^\circ\text{C}$
Accuracy class :	-	Relative humidity :	$(52.0 \pm 10.0) \%$
Capacity :	220 g	Received date :	21-Jun-2023
Resolution :	0.0001 g	Date of calibration :	21-Jun-2023
Serial No. :	0041305301	Date of issue :	24-Jun-2023
ID No. :	TNP.LAB.31	Condition of the balance :	Good working conditions
Place of calibration :	ห้อง LAB		

Calibration method

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


Condition of reference standard weight

Instrument	Nominal value	Serial No.	Certificate No.	Due-date	Density (kg/m ³)
1 Standard weight set	1 mg to 2 kg	15885+15849	M2210001S	8-Oct-2023	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 : Aekhasak Silarut
Technician

Approved Signatory : 
Chonlatee Pongwatvisanon

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

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CALIBRATION CERTIFICATE

Certificate No.S2306519S

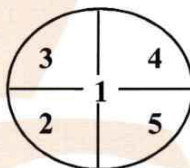
page 2 of 2

The repeatability of indication

Nominal Value (g)	Standard Deviation of reading (g)	Maximum difference between successive reading (g)	n
200	0.00000	0.0000	5

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

Position	Balance Reading (g)
Point 1	100.0000
Point 2	100.0000
Point 3	100.0000
Point 4	99.9998
Point 5	99.9998
Eccentric Value	0.0002



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	0.000082	2.00
0.1	0.1000	0.1000	0.0000	0.000083	2.00
0.5	0.5000	0.5000	0.0000	0.000084	2.00
1	1.0000	0.9999	+0.0001	0.000085	2.00
5	5.0000	5.0000	0.0000	0.000090	2.00
10	10.0000	10.0000	0.0000	0.000094	2.00
20	20.0000	20.0001	-0.0001	0.00011	2.00
50	50.0000	50.0001	-0.0001	0.00013	2.00
100	100.0000	100.0000	0.0000	0.00019	2.00
200	200.0000	199.9998	+0.0002	0.00033	2.00

Remark : Without adjustment

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--

CERT.No.: HS-U039F

Certificate of Calibration

Calibration Date : 20 Jun 23

Submitted by : TNP ENVIRONMENT COMPANY LIMITED.

332/173 Moo. 3, Tambon Bang Rak Phatthana,

Amphoe Bang Bua Thong, Nonthaburi 11110

Avg Room Temp : 20 °C

Avg Water Temp : 20 °C

Air Pressure : 757.00 mmHg

Salinity : 0 ppt

Model : YSI 4010-2W

S/N : 22051520

Probe : YSI 4100

S/N : 22C102711

ID NO. : -

Air Temp ref : S/N. E00522

Barometric ref : S/N. E00522

Water Temp ref : S/N. 11431

Technician : Kittipong M.

Calibration Details

Calibration Point	100% air sat. (@20 °C, DO = 9.09 mg/l)	(status)	(status)
Measurement 1 (mg/l)	9.05	(PASS)	-
Measurement 2 (mg/l)	9.05	(PASS)	-
Measurement 3 (mg/l)	9.04	(PASS)	-
Measurement 4 (mg/l)	9.03	(PASS)	-
Measurement 5 (mg/l)	9.04	(PASS)	-
Measurement 6 (mg/l)	9.04	(PASS)	-
Measurement 7 (mg/l)	9.04	(PASS)	-
Measurement 8 (mg/l)	9.03	(PASS)	-
Measurement 9 (mg/l)	9.03	(PASS)	-
Measurement 10 (mg/l)	9.03	(PASS)	-

Mean Measurement	9.04	mg/l	-	-
Inaccuracy	0.05	mg/l	-	-

Overall Status (PASS)

Manufacturer Specification

Accuracy = +/- 0.2 mg/l

1) This certificate is issued based on the result that are found as shown on date and place of test only.

Certificate of Calibration

Certificate No. : 66-400687-1 **Page : 1 of 2**

Submitted by : TNP Environment Co., Ltd.
332/173 Moo 3 Bang Rak Phatthana, Bang Bua Thong, Nonthaburi 11110

Equipment : Air Chamber (Oven)
 Manufacturer : Memmert Model : UF75
 Range : N/A °C Resolution : 0.1 °C
 Serial No. : B320.0251 ID No. : N/A

Environment : On site calibration was carried out at the Laboratory, TNP Environment Co., Ltd.
 Ambient Temperature : (27.0 to 28.0) °C
 Relative Humidity : (45 to 50) %
 Line Voltage : (228.0 to 230.0) V

Date of Received : 11 December 2023
Date of Calibration : 11 December 2023
Date of Issue : 14 December 2023
Calibrated by : Permpon Chanpu
Calibration Method : CAL-M4004, TLAS G-20
 The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units
 Standard Digital Thermometer with Thermocouple probe

ID No.	Cert. No.	Due Date	Traceability
400046 & 400023	66-400547-1	04 Apr 2024	National Institute of Metrology Thailand (NIMT)

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-400687-1

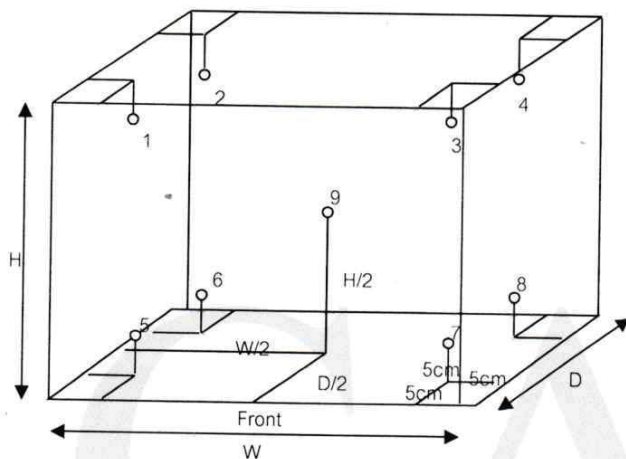
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.40 m

D = 0.33 m

H = 0.56 m

Capacity = 0.07 m³

Test Point (° C)	Setting Temperature (° C)	Indicating Temperature (° C)	Measured Temperature (° C) @ Sensor No.									Uncertainty (± ° C)
			1	2	3	4	5	6	7	8	9	
85.0	85.0	85.0	85.3	85.1	85.2	85.1	85.0	84.8	84.7	84.7	85.0	0.64
104.0	104.0	104.0	104.3	104.2	104.3	104.1	104.0	103.8	103.7	103.7	104.0	0.69
180.0	180.0	180.0	179.5	179.9	180.0	179.8	179.9	179.4	178.9	179.4	180.0	0.95

Test Point (° C)	Setting Temperature (° C)	Indicating Temperature (° C)	Measured Uniformity (° C)	Measured Stability (° C)	Overall Variation (° C)
85.0	85.0	85.0	0.4	0.1	0.8
104.0	104.0	104.0	0.4	0.1	0.8
180.0	180.0	180.0	1.4	0.3	1.6

Remark The uncertainty is not combine uniformity of the air chamber

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

This 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%

- o0o -





ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR23110535-2

Page : 1 of 3

Customer : TNP ENVIRONMENT CO.,LTD.

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

Equipment Name : Water Quality Meter

Manufacturer : Digicon

Model : WA-48SD

Serial Number : T.075714

ID. Number : TNP-LAB-46

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$

Received Date : 30 Nov 2023

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

Calibration Date : 19 Jan 2024

Location of Calibration : In-Lab

Recommend Due Date : 19 Jan 2025

Calibration Procedure : SP-CPC-04-01,
SP-CPC-04-02,

Date of Issue : 20 Jan 2024

Method of Calibration : SP-CPC-04-11

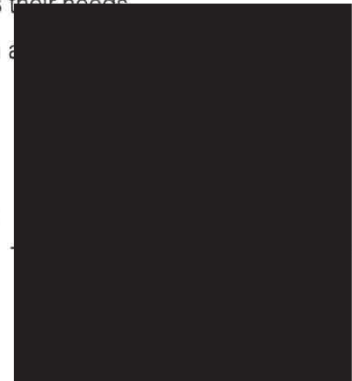
This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical 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.

The calibration certificate shall not be reproduced except in full, without written permission of Metrology System (Thailand).

Calibrated by : Mr.Sarawut Khitmai

Approved by :

Calibration Officer





ID LINE : IEC17025



Calibration Report

Certificate Number : SPR23110535-2

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Zero Oxygen Solution	HI7040L	Lot S0027-23 _	21C31	21 Mar 2028
Standard pH Solution	PH016.L5	Lot No.882984	61267077	20 Mar 2024
Standard pH Solution	PH107.L5	Lot No.882985	61275614	13 Apr 2024
Standard pH Solution	PH020.L5	Lot No.882986	61268050	20 Mar 2024
Conductivity Standard 84 uS/cm	CS84M0S.L5	Lot No.882987	61247444	20 Mar 2024
Conductivity Standard 1413 uS/cm	CS1413M0S.L5	Lot No.882988	61267992	20 Mar 2024
Conductivity Standard 12880 uS/cm	CS1288P1S.L5	Lot No.882989	61247253	20 Mar 2024
Sodium Chloride Standard Solution	RM003461L25	Lot No.841770	97756699	23 Sep 2024

Traceability

This certification is traceable to the International System of Unit maintained at :

HANNA - Hanna Instruments (Thailand) Ltd.

C.P.A. Chem - ANAB#AT-1836 (ISO/IEC 17025:2017) and ANAB#AR-1835 (ISO/IEC 17034:2016)



ID LINE : IEC17025



Result of Calibration

Certificate No. : SPR23110535-2

Page : 3 of 3

pH Measurement @ 25 °C

Unit : pH

Standard Solution	UUC Reading	Error	Uncertainty (±)
4.008	3.98	-0.028	0.014
6.984	7.01	0.026	0.012
10.011	10.02	0.009	0.018

Conductivity Measurement @ 25 °C

Standard Solution	UUC Reading	Error	Uncertainty (±)
84 µS/cm	84.6 µS/cm	0.6 µS/cm	0.60 µS/cm
1.413 mS/cm	1.415 mS/cm	0.002 mS/cm	0.0082 mS/cm
12.88 mS/cm	12.89 mS/cm	0.01 mS/cm	0.075 mS/cm

* Dissolved Oxygen Permanance Test

Unit : mg/L

Actual Standard	UUC Reading	Error	Uncertainty (±)
0.0	0.0	0.0	0.13
5.0	4.9	-0.1	0.13
8.3	8.2	-0.1	0.13

Salinity Measurement

Unit : % Salinity

Actual Standard	UUC Reading	Error	Uncertainty (±)
5.0269	5.04	0.0131	0.015

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.
Calibration Marked (*) "Not ANAB Accredited " in this Certificate have been included for completeness.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2$, providing a level of confidence approximately 95%.

- End of Certificate -