

ภาคผนวก 9

เอกสารสอบเทียบเครื่องมือที่ใช้ในการวิเคราะห์

Mettler-Toledo (Thailand) Limited

846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District

Bangna District, Bangkok 10260

+662 723 0382

MT-TH.ServiceSupport@mt.com



NSC-TISI-TIS 17025
CALIBRATION 0062

Accuracy Calibration Certificate

Customer

Company: WATER INDEX & CONSULTANT CO., LTD.
Address: 229/7-8 Soi Charansanitwong 95/1, Charansanitwong Rd., Bang-aor
City: Bangphlat **Contact:** Nungruthai Sairat
Zip / Postal: 10700
State / Province: Bangkok
Order Number: 
0 3 3 3 6 4 0 4 2 1

Weighing Device

Manufacturer: Mettler Toledo **Terminal Model:** N/A
Model: MS204TS/00 **Terminal Serial No.:** N/A
Serial No.: B724237367 **Terminal Asset No.:** N/A
Instrument Type: Weighing Instrument **Building:** Office
Asset Number: 300EI7 **Floor:** 2
Room: Laboratory

Range	Max. Capacity	Readability (d)
1	220 g	0.0001 g

Procedure

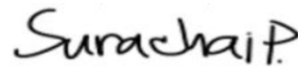
Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)
METTLER TOLEDO Work Instruction: CP/W002/20

This calibration certificate contains measurements for As Found and As Left calibrations.

The sensitivity/span of the weighing instrument was adjusted before As Found and As Left calibrations with a built-in weight.

In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

	Temperature		Humidity	
As Found	Start: 27.0 °C	End: 26.6 °C	Start: 49.9 %	End: 48.3 %
As Left	Start: 26.3 °C	End: 26.0 °C	Start: 43.1 %	End: 42.6 %

As Found Calibration Date: 08-Oct-2025 **Calibrator:** 
As Left Calibration Date: 08-Oct-2025
Issue Date: 10-Oct-2025
Surachai Pidkanpai

Approved Signatory:

Technical Manager / Head of Calibration Center

Measurement Results

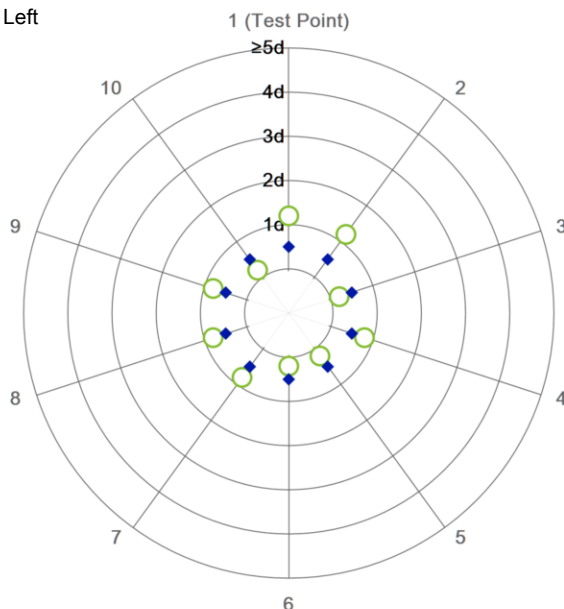
Repeatability

Test Load: 100 g

	As Found	As Left
1	99.9997 g	100.0001 g
2	99.9997 g	100.0002 g
3	99.9998 g	100.0001 g
4	99.9999 g	100.0001 g
5	99.9998 g	100.0002 g
6	99.9998 g	100.0001 g
7	99.9999 g	100.0001 g
8	99.9999 g	100.0002 g
9	99.9999 g	100.0002 g
10	99.9998 g	100.0002 g

Standard Deviation	0.00008 g	0.00005 g
--------------------	-----------	-----------

○ As Found
◆ As Left



The "d" in the graph represents the readability of the range/interval in which the test was performed.

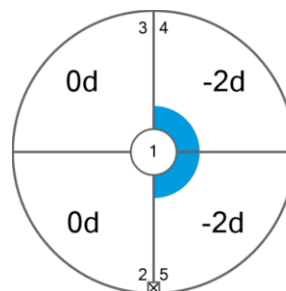
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

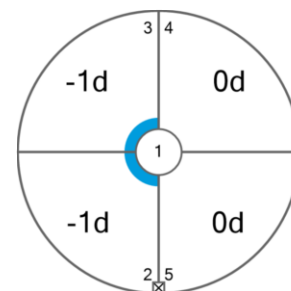
Test Load: 100 g

Position	As Found	As Left
1	99.9999 g	100.0001 g
2	99.9999 g	100.0000 g
3	99.9999 g	100.0000 g
4	99.9997 g	100.0001 g
5	99.9997 g	100.0001 g

Maximum Deviation	0.0002 g	0.0001 g
-------------------	----------	----------



As Found



As Left

The "d" in the graph represents the readability of the range/interval in which the test was performed.

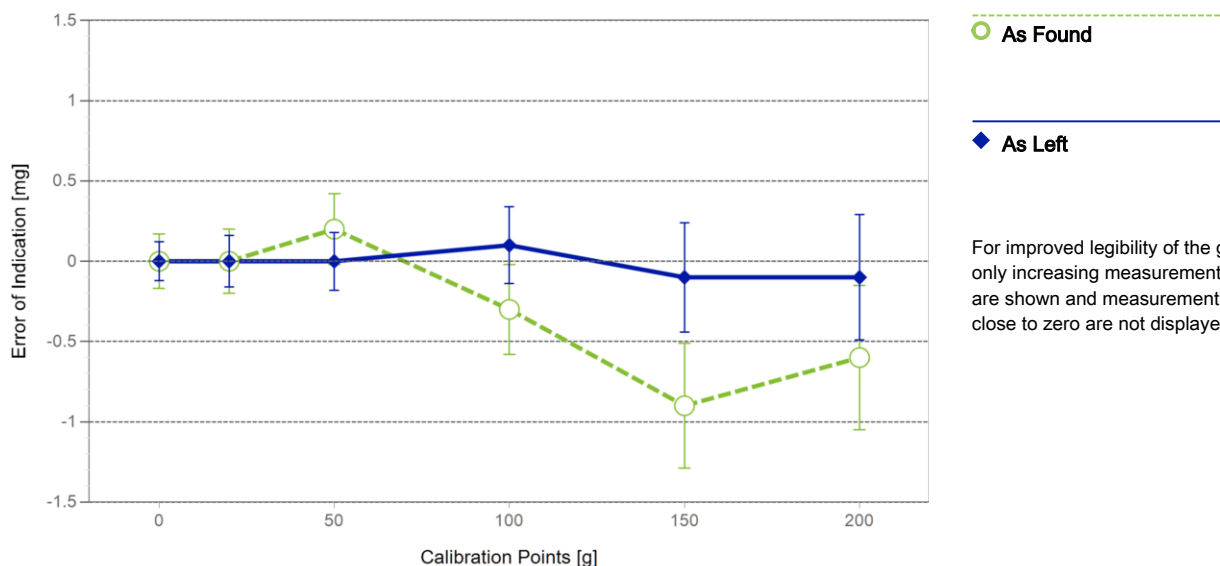
Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.17 mg	2
2	0.0500 g	0.0499 g	-0.0001 g	0.18 mg	2
3	0.1000 g	0.0999 g	-0.0001 g	0.18 mg	2
4	0.5000 g	0.4999 g	-0.0001 g	0.18 mg	2
5	1.0000 g	0.9999 g	-0.0001 g	0.18 mg	2
6	10.0000 g	10.0001 g	0.0001 g	0.19 mg	2
7	20.0000 g	20.0000 g	0.0000 g	0.20 mg	2
8	50.0000 g	50.0002 g	0.0002 g	0.22 mg	2
9	100.0000 g	99.9997 g	-0.0003 g	0.28 mg	2
10	150.0001 g	149.9992 g	-0.0009 g	0.39 mg	2
11	200.0001 g	199.9995 g	-0.0006 g	0.45 mg	2

As Left

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.12 mg	2
2	0.0500 g	0.0500 g	0.0000 g	0.13 mg	2
3	0.1000 g	0.1001 g	0.0001 g	0.13 mg	2
4	0.5000 g	0.5001 g	0.0001 g	0.14 mg	2
5	1.0000 g	1.0001 g	0.0001 g	0.14 mg	2
6	10.0000 g	10.0001 g	0.0001 g	0.15 mg	2
7	20.0000 g	20.0000 g	0.0000 g	0.16 mg	2
8	50.0000 g	50.0000 g	0.0000 g	0.18 mg	2
9	100.0000 g	100.0001 g	0.0001 g	0.24 mg	2
10	150.0001 g	150.0000 g	-0.0001 g	0.34 mg	2
11	200.0001 g	200.0000 g	-0.0001 g	0.39 mg	2



The expanded measurement uncertainty is reported as the standard measurement uncertainty multiplied by the coverage factor k such that the coverage probability corresponds to approximately 95 %.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.
The results of this calibration certificate relate only to the calibrated item.

Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML E2

Weight Set No.:	WS105	Date of Issue:	14-Apr-2025
Certificate Number:	C515828262	Calibration Due Date:	02-Oct-2026

Thermo Hygrometer

Equipment No.:	IN308	Date of Issue:	18-Dec-2024
Certificate Number:	SG-H-01070/67	Calibration Due Date:	17-Dec-2025

Remarks

FACT adjustment functionality activated
Equipment condition: Good
Next calibration according to customer's procedure
Calibration data not decide by calibration laboratory

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with $k=2$ in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: $1.5 \cdot 10^{-6} / K$

Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

Linearization of Uncertainty Equation

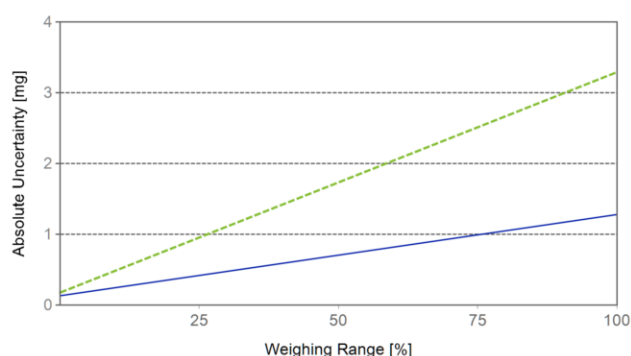
Range			As Found	As Left
	d	Max		
1	0.0001 g	220 g	$U_1 = 0.18 \text{ mg} + 0.0142 \text{ mg/g} \cdot R$	$U_1 = 0.13 \text{ mg} + 0.00522 \text{ mg/g} \cdot R$

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

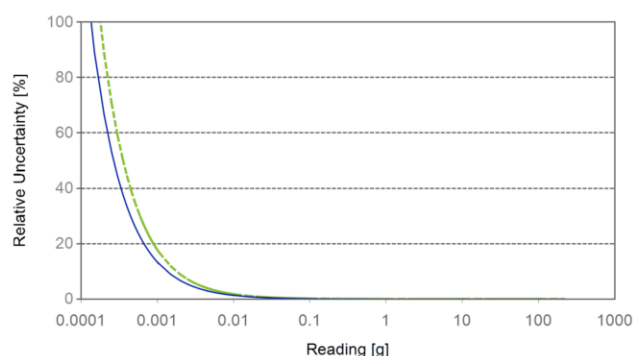
The linear approximation of the uncertainty in use should be regarded as information only. The underlying distribution of the errors of indication does not stipulate a stable approximation function [applies to As Found equation].

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found		As Left	
0.0220 g	0.18 mg	0.82%	0.13 mg	0.59%
0.2200 g	0.18 mg	0.083%	0.13 mg	0.060%
2.2000 g	0.21 mg	0.0096%	0.14 mg	0.0064%
22.0000 g	0.49 mg	0.0022%	0.24 mg	0.0011%
220.0000 g	3.3 mg	0.0015%	1.3 mg	0.00058%



As Found



As Left



Are you looking for some clarifications on the terms and graphs in your ACC calibration certificate? Do you know how to leverage its full value?

More information at:
► www.mt.com/ACC-Cert-Info



GWP™ Certificate



Process Requirements

Weighing Tolerance	1%
Smallest Net Weight	0.0150 g
Safety Factor	As found = 1; As left = 2

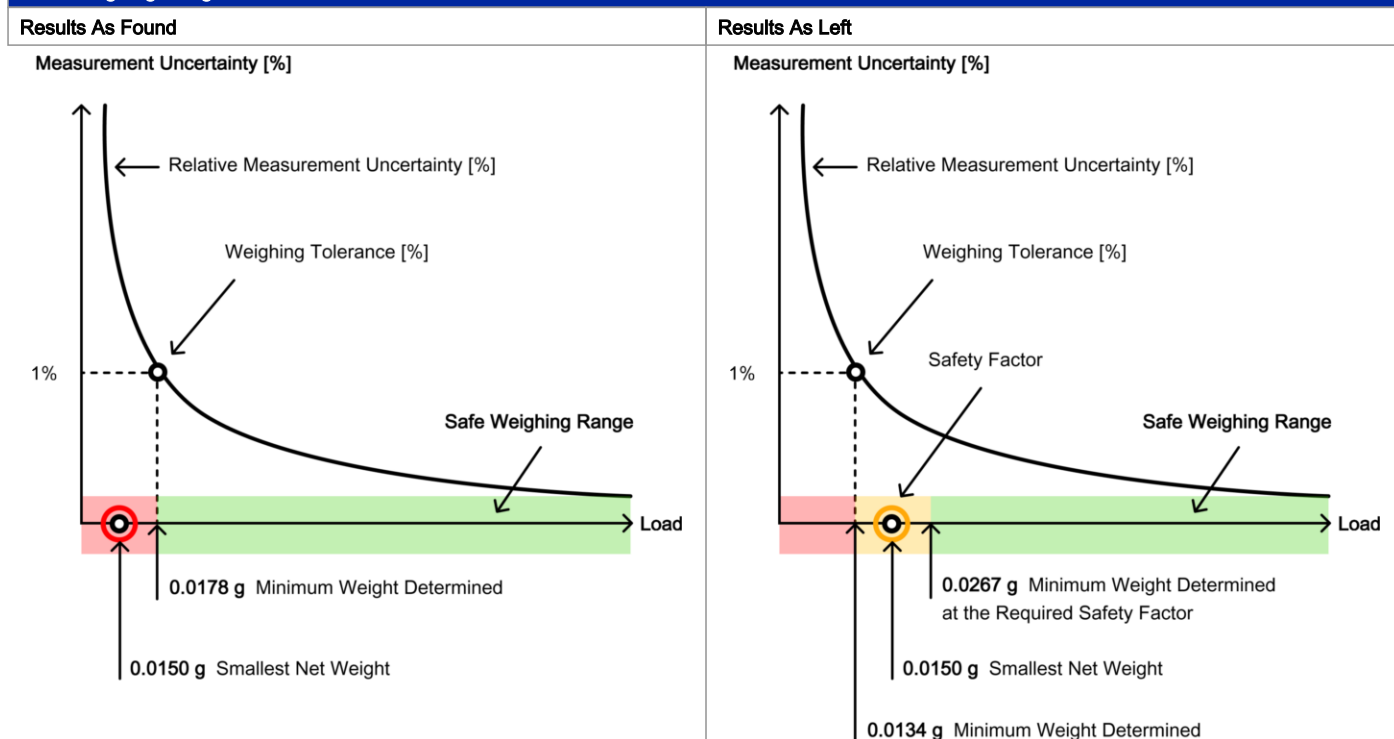
Results As Found

Minimum Weight Determined	0.0178 g	 The instrument does not meet the process requirements.
Measurement Uncertainty at the Smallest Net Weight	1.2%	

Results As Left

Minimum Weight Determined at the Safety Factor	0.0267 g	 The instrument meets the weighing tolerance but does not meet the safety factor requirements.
Minimum Weight Determined	0.0134 g	
Measurement Uncertainty at the Smallest Net Weight	0.89%	

Safe Weighing Range



Are you looking for some clarifications on the terms and Safe Weighing Range graph?

More information at:

► www.mt.com/GWP-Cert-Info



Minimum Weight

As Found Minimum Weight Table: Minimum weights for different weighing tolerances and safety factors

Weighing Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.1802 g	0.3657 g	0.5566 g	0.9559 g	2.0696 g
0.2%	0.0895 g	0.1802 g	0.2723 g	0.4605 g	0.9559 g
0.5%	0.0357 g	0.0715 g	0.1075 g	0.1802 g	0.3657 g
1%	0.0178 g	0.0357 g	0.0536 g	0.0895 g	0.1802 g
2%	0.0089 g	0.0178 g	0.0268 g	0.0446 g	0.0895 g
5%	0.0036 g	0.0072 g	0.0107 g	0.0178 g	0.0357 g

Result:



Fail

The instrument does not meet the process requirements.

As Left Minimum Weight Table: Minimum weights for different weighing tolerances and safety factors

Weighing Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.1341 g	0.2695 g	0.4064 g	0.6846 g	1.4068 g
0.2%	0.0669 g	0.1341 g	0.2016 g	0.3378 g	0.6846 g
0.5%	0.0267 g	0.0535 g	0.0803 g	0.1341 g	0.2695 g
1%	0.0134 g	0.0267 g	0.0401 g	0.0669 g	0.1341 g
2%	0.0067 g	0.0134 g	0.0201 g	0.0334 g	0.0669 g
5%	0.0027 g	0.0054 g	0.0081 g	0.0134 g	0.0267 g

Result:



Warning

The instrument meets the weighing tolerance but does not meet the safety factor requirements.

The minimum weight values are calculated from the measurement uncertainty in use equation for various weighing tolerances and safety factors. At the minimum weight, the relative uncertainty in use equals the weighing tolerance divided by the safety factor. If "N/A" is shown in the minimum weight table, no appropriate value could be calculated.

METTLER TOLEDO is not responsible for the definition of the process requirements. The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.



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



Certificate of Calibration

Cert.No.: 25CH1413

Page.: 1 of 3

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : SevenDirect SD20
Serial No. : C238831431
ID No. : E-030
Condition As-Received: Used Item
Received Date : 02 December 2025
Calibration Date : 04 December 2025
Reference : 2512-0072WN-1
Submitted by : WATER INDEX & CONSULTANT CO.,LTD.
229/7-8 Soi Charan Sanit Wong 95/1,
Charan Sanit Wong Rd., Bang-aor,
Bangphlat, Bangkok 10700

Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with DC voltage
standard and direct measurement with
certified reference material (CRM)
- CP-CH8 by comparison with temperature standard

Calibrated by : Walalak Sirithean

Approved by : _____
Approved Signatory

() Chakrit Waewwanjua
() Ponpan Paipim
(✓) Saithip Meangmai

Issue Date : 04 December 2025

The Uncertainties are for a confidence probability of approximately 95%

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



Cert.No.: 25CH1413

Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Document Process Calibrator	54030049	130RC116	25E2743	25 Aug 2026
2) Ref. Standard Thermometer	4982054	110RC044	25I708	03 July 2026

- This measurement result is traceable to SI through Technology Promotion Association (Thailand - Japan)

2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

<u>Buffer Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
pH 4.007	CPA chem	1114384	12 June 2027
pH 6.965	CPA chem	1066667	18 Jan 2026
pH 10.010	CPA chem	1135355	16 Aug 2026

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

Calibration Results

Function : mV Measurement

Performing standard curve by Document Process Calibrator at pH (4,7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor <i>k</i>
	pH	mV	mV	pH		
pH Meter S/N.: C238831431	4.000	177.48	177.4	4.000	0.058	2.00
	7.000	0.00	0.0	7.000	0.058	2.00
	10.000	-177.48	-177.5	10.000	0.058	2.00



Cert.No.: 25CH1413

Page.: 3 of 3

Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement ($\pm$)	Coverage factor k
pH Electrode S/N.: 2256471	4.007	4.016	158.2	0.0044	2.00
	6.965	6.966	-15.6	0.0084	2.00
	10.010	10.012	-190.6	0.0065	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLab Expert Pro-ISM

- Serial No. : 2256471

Dimension of probe

- Length : 120 mm.

- Diameter : 12 mm.

- Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement ($\pm$ °C)	Coverage factor k
23.0	23.001	23.2	0.199	0.13	2.00
25.0	25.001	25.2	0.199	0.13	2.00
27.0	27.001	27.2	0.199	0.13	2.00

Remark - UUC* = Unit Under Calibration

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

-o0o-



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



Certificate of Calibration

Cert.No.: 25CH601

Page.: 1 of 3

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : SevenCompact S220
Serial No. : B614308589
ID No. : E-049
Condition As-Received: Used Item
Received Date : 23 May 2025
Calibration Date : 26 May 2025
Reference : 2505-0758WN-20
Submitted by : WATER INDEX & CONSULTANT CO.,LTD.
229/7-8 Soi Charan Sanit Wong 95/1,
Charan Sanit Wong Rd., Bang-aor,
Bangphlat, Bangkok 10700
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with DC voltage
standard and direct measurement with
certified reference material (CRM)
- CP-CH8 by comparison with temperature standard
Calibrated by : Warakorn Lerngagtrakul
Approved by : _____
Approved Signatory
() Chakrit Waewwanjua
() Ponpan Paipim
(✓) Saithip Meangmai
Issue Date : 27 May 2025

The Uncertainties are for a confidence probability of approximately 95%

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



Cert.No.: 25CH601

Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Document Process Calibrator	54030049	130RC116	24E2759	25 Aug 2025
2) Ref. Standard Thermometer	4982054	110RC044	24I757	14 Jul 2025

- This measurement result is traceable to SI through Technology Promotion Association (Thailand - Japan)

2. Certified Reference Materials :The measurement results are traceable to SI through Hach Lenge GmbH Ltd.,
Deutsche Akkreditierungsstelle, Accredited No.D-RM-15184-01-00
: The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

<u>Buffer Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
pH 4.007	CPA chem	1066665	18 Jan 2027
pH 7.000	Hach Lenge GmbH	C03232	02 Dec 2026
pH 10.010	CPA chem	1066669	18 Jan 2026

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

Calibration Results

Function : mV Measurement

Performing standard curve by Document Process Calibrator at pH (4,7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor <i>k</i>
	pH	mV	mV	pH		
pH Meter S/N.: B614308589	4.000	177.48	177.5	4.000	0.058	2.00
	7.000	0.00	0.1	7.000	0.058	2.00
	10.000	-177.48	-177.3	10.000	0.058	2.00



Cert.No.: 25CH601

Page.: 3 of 3

Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement ($\pm$)	Coverage factor k
pH Electrode S/N.: 6195824	4.007	4.006	158.6	0.0044	2.00
	7.000	7.000	-17.2	0.0084	2.00
	10.010	10.003	-193.6	0.0065	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLab®Expert Pro-ISM

- Serial No. : 6195824

Dimension of probe

- Length : 120 mm.

- Diameter : 12 mm.

- Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement ($\pm$ °C)	Coverage factor k
23.0	23.003	23.1	0.097	0.13	2.00
25.0	25.002	25.2	0.198	0.13	2.00
27.0	27.003	27.2	0.197	0.13	2.00

Remark - UUC* = Unit Under Calibration

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

-o0o-



CRYSTAL CALIBRATION SALES AND SERVICE CO., LTD.

45/48 Soi Salathammasop31, Salathammasop Rd.,
Salathammasop, 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. : 25-0692-002

Issue Date : 18 June 2025

Work Order No. : 25/0692

Customer Name : Water Index & Consultant Co., Ltd
229/7-8 Soi Charan Sanit Wong 95/1, Charan Sanit Wong Rd.,
Bang-aor, Bangphlat, Bangkok 10700

Date of Received : 2 June 2025

Date of Calibration : 2 June 2025

Instrument Details : Description : Temperature Controlled Enclosures [Refrigerator]
Manufacturer : S-Cool
Model : SSM163T
Serial No. : 144201410
ID No. : E-015
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. Wuttinun Yindeepot
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.

PAGE 1/3

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

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





CERTIFICATE OF CALIBRATION

Issue Date : 18 June 2025

Certificate No. : 25-0692-002

Work Order No. : 25/0692

Details of Calibration

1. Reference Standards Instrument

Instrument	Model	Serial No./Ins No.	Certificate No.	Due Date
Data Acquisition unit	34972A	MY49018270	25-0008-001	18 January 2026
Sensor type	RTD	CH # 301-309	25-0008-001	18 January 2026

2. Certificate traceable

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

3. Condition of item

: Used

4. Calibration site

: On - Site

5. Result of Calibration

: Without adjustment

6. Evaluate Condition

: Time Constant : - Hour 49 Minute At cal. point 3 °C
Air vent : Off
Fan speed status : Fixed Fan Speed

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 10 cm

9. Dimensions of chamber

: W = 1.2 m ; D = 0.4 m ; H = 1.2 m

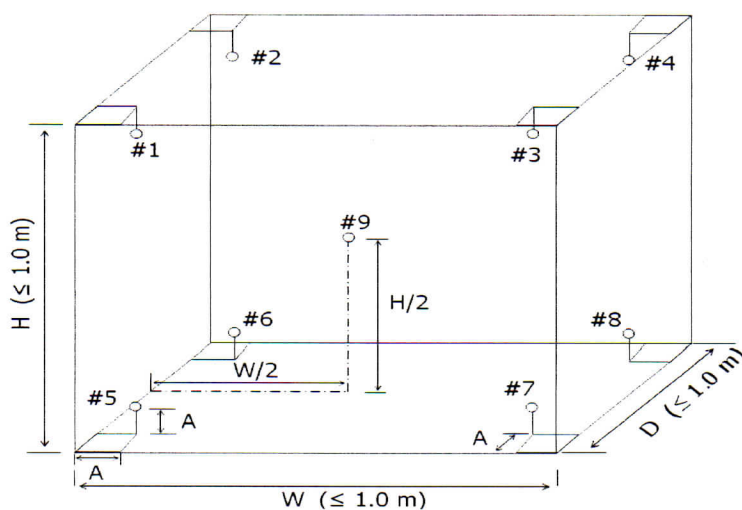


Diagram of Chamber



CRYSTAL CALIBRATION SALES AND SERVICE CO., LTD.

45/48 Soi Salathammasop31, Salathammasop Rd.,
Salathammasop, Thawewatthana, Bangkok 10170 Thailand
Tel : 0-2408-8474-5 Fax : 0-2408-8477 Email : info@crystalcal.com www.crystalcal.com



CERTIFICATE OF CALIBRATION

Issue Date : 18 June 2025

Certificate No. : 25-0692-002

Work Order No. : 25/0692

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	
3.0	3.06	3.22	3.30	3.36	3.38	3.33	3.11	2.83	3.21	0.30

Table 2 : Reporting of Performance check

Calibration Point (°C)	Indicator Set Point (°C)	Indicator Reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
		MAX	MIN	Average			
3.0	3.0	3.0	3.0	3.0	0.10	0.43	0.72

Note

Calibrate items it good condition and this report customer request and accepted in certificate

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 throughtout 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%.



CRYSTAL CALIBRATION SALES AND SERVICE CO., LTD.

45/48 Soi Salathammasop31, Salathammasop Rd.,
Salathammasop, 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. : 25-0692-003

Issue Date : 18 June 2025

Work Order No. : 25/0692

Customer Name : Water Index & Consultant Co., Ltd
229/7-8 Soi Charan Sanit Wong 95/1, Charan Sanit Wong Rd.,
Bang-aor.Bangphlat, Bangkok 10700

Date of Received : 2 June 2025

Date of Calibration : 2 June 2025

Instrument Details : Description : Temperature Controlled Enclosures [Refrigerator]
Manufacturer : Accuplus
Model : i250
Serial No. : 1250402-0110-0303
ID No. : E-001
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. Wuttinun Yindeepot
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.

PAGE 1/3

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

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





CRYSTAL CALIBRATION SALES AND SERVICE CO., LTD.

45/48 Soi Salathammasop31, Salathammasop Rd.,

Salathammasop, Thawewatthana, Bangkok 10170 Thailand

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



CERTIFICATE OF CALIBRATION

Issue Date : 18 June 2025

Certificate No. : 25-0692-003

Work Order No. : 25/0692

Details of Calibration

1. Reference Standards Instrument

Instrument	Model	Serial No./Ins No.	Certificate No.	Due Date
Data Acquisition unit	34972A	MY49024826	24-1288-013	19 October 2025
Sensor type	RTD	CH # 101 - 109	24-1288-013	19 October 2025

2. Certificate traceble

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

3. Condition of item

: Used

4. Calibration site

: On - Site

5. Result of Calibration

: Without adjustment

6. Evaluate Condition

: Time Constant : - Hour 49 Minute At cal. point 20 °C
Air vent : Off
Fan speed status : Fixed Fan Speed

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 = 0.5 m ; D = 0.5 m ; H = 0.9 m

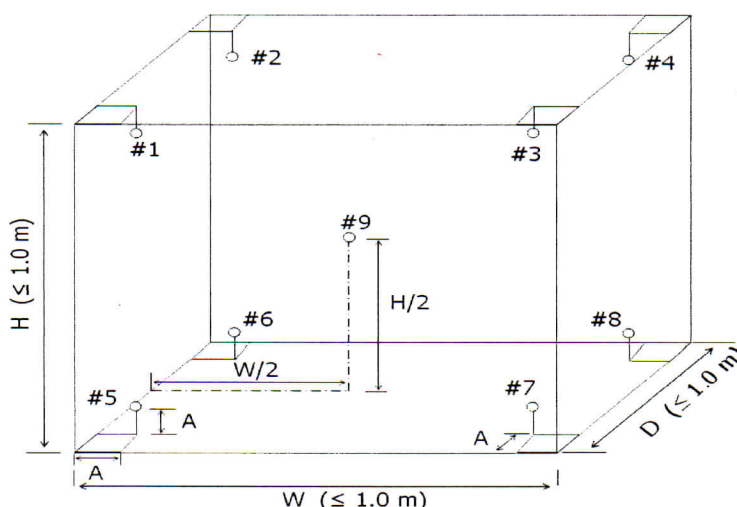


Diagram of Chamber

**CRYSTAL CALIBRATION SALES AND SERVICE CO., LTD.**

45/48 Soi Salathammasop31, Salathammasop Rd.,
 Salathammasop, Thawewatthana, Bangkok 10170 Thailand
 Tel : 0-2408-8474-5 Fax : 0-2408-8477 Email : info@crystalcal.com www.crystalcal.com



CERTIFICATE OF CALIBRATION

Issue Date : 18 June 2025

Certificate No. : 25-0692-003

Work Order No. : 25/0692

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	
20.0	20.03	20.15	19.93	20.32	20.13	20.26	20.12	20.18	19.91	0.37

Table 2 : Reporting of Performance check

Calibration Point (°C)	Indicator Set Point (°C)	Indicator Reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
		MAX	MIN	Average			
20.0	20.0	20.0	20.0	20.0	0.25	0.69	0.79

Note

Calibrate items it good condition and this report customer request and accepted in certificate

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 throughtout 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%.



CRYSTAL CALIBRATION SALES AND SERVICE CO., LTD.

45/48 Soi Salathammasop31, Salathammasop Rd.,
Salathammasop, 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. : 25-0692-004

Issue Date : 18 June 2025

Work Order No. : 25/0692

Customer Name : Water Index & Consultant Co., Ltd
229/7-8 Soi Charan Sanit Wong 95/1, Charan Sanit Wong Rd.,
Bang-aor.Bangphlat, Bangkok 10700

Date of Received : 2 June 2025

Date of Calibration : 2 June 2025

Instrument Details : Description : Temperature Controlled Enclosures [Refrigerator]
Manufacturer : Memmert
Model : SM400
Serial No. : B4921010
ID No. : E-017
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. Wuttinun Yindeept
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 Soi Salathammasop31, Salathammasop Rd.,

Salathammasop, Thawewatthana, Bangkok 10170 Thailand

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



CERTIFICATE OF CALIBRATION

Issue Date : 18 June 2025

Certificate No. : 25-0692-004

Work Order No. : 25/0692

Details of Calibration

1. Reference Standards Instrument

Instrument	Model	Serial No./Ins No.	Certificate No.	Due Date
Data Acquisition unit	34972A	MY49018270	25-0008-001	18 January 2026
Sensor type	RTD	CH # 101 - 109	25-0008-001	18 January 2026

2. Certificate traceble : This certificate traceable to The International System of Unit refer to
Crystal Calibration Sales and Service Co., Ltd. , NSC-ONSC Calibration No. 0260
3. Condition of item : Used
4. Calibration site : On - Site
5. Result of Calibration : Without adjustment
6. Evaluate Condition : Time Constant : - Hour 49 Minute At cal. point 104 °C
Air vent : Off
Fan speed status : Fixed Fan Speed
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 = 0.4 m

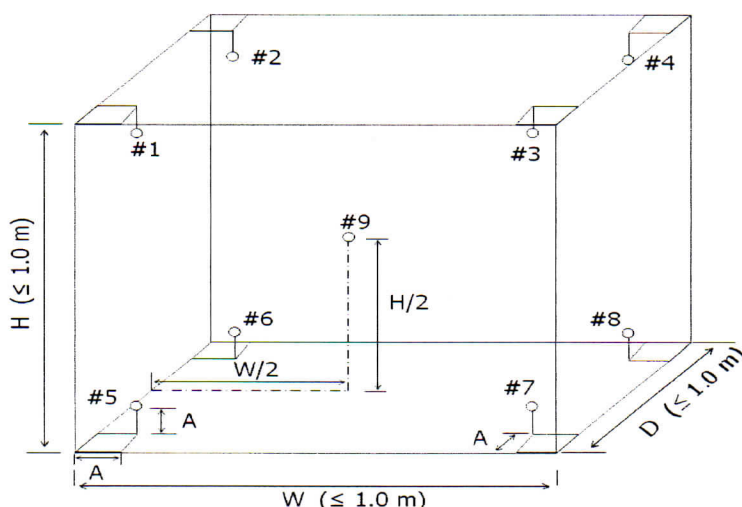


Diagram of Chamber



CERTIFICATE OF CALIBRATION

Certificate No. : 25-0692-004

Issue Date : 18 June 2025

Work Order No. : 25/0692

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	104.43	104.39	104.70	103.96	104.94	103.73	104.98	104.29	104.18	0.47
110.0	110.48	110.33	110.63	109.90	110.88	109.81	110.92	110.33	110.22	0.47
120.0	120.57	120.50	120.67	119.99	120.85	119.66	120.96	120.32	120.20	0.65
150.0	150.24	149.68	150.11	149.39	150.47	149.07	150.55	149.53	149.72	0.65
180.0	181.01	180.60	181.31	180.13	181.13	179.90	181.30	180.46	180.34	0.68

Table 2 : Reporting of Performance check

Calibration Point (°C)	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	104.0	0.26	1.07	1.73
110.0	110.0	110.0	110.0	110.0	0.24	1.13	1.67
120.0	120.0	120.0	120.0	120.0	0.26	1.17	1.72
150.0	150.0	150.0	150.0	150.0	0.24	1.00	1.73
180.0	180.0	180.0	180.0	180.0	0.45	1.55	2.12

Note

Calibrate items in good condition and this report customer request and accepted in certificate

The reference sensor is preferably located at 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%.



CRYSTAL CALIBRATION SALES AND SERVICE CO., LTD.

45/48 Soi Salathammasop31, Salathammasop Rd.,
Salathammasop, 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. : 25-0692-005

Issue Date : 15 June 2025

Work Order No. : 25/0692

Customer Name : Water Index & Consultant Co., Ltd
229/7-8 Soi Charan Sanit Wong 95/1, Charan Sanit Wong Rd.,
Bang-aor, Bangphlat, Bangkok 10700

Date of Received : 2 June 2025

Date of Calibration : 5 June 2025

Instrument Details : Description : Digital Thermo hygrometer
Manufacturer : Digicon
Model : Th-02A
Serial No. : 1718B0744392
ID No. : E-073
Location : Humidity and Temperature Laboratory

Calibration Method : This instrument was calibrated by comparison of indication with Standard Chilled Mirror Hygrometer and Standard Thermometer into Temperature and Humidity Chamber controller according to calibration procedure no. CWI-H-01

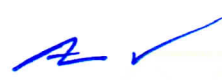
Environmental Condition

Temperature : Laboratory Control at $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$
Humidity : Laboratory Control at $55\%\text{RH} \pm 20\%\text{RH}$

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 : Miss Ketmanee Srisuwan
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.

PAGE 1/2

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





CRYSTAL CALIBRATION SALES AND SERVICE CO., LTD.

45/48 Soi Salathammasop31, Salathammasop Rd.,
Salathammasop, 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. : 25-0692-005

Issue Date : 15 June 2025

Work Order No. : 25/0692

Details of Calibration

1. Reference Standards Instrument

Instrument	Serial No. / ID no.	Certification	Due Date
1.1 Dew point hygrometer	2204151 / CMH-02	TH-0107-24	29 August 2025
1.2 Digital Thermometer with RTD	15000016 / RTD-11	24-1288-003	01 October 2025

2. Certificate traceable : This certificate traceable to The International System of Unit refer to
No. 1.1 National Institute of Metrology (Thailand), NAC Calibration no. 0144
No. 1.2 Crystal Calibration Sales and Service Co., Ltd. , NAC Calibration No. 0260

3. Condition of item : Used

4. Calibration location : Permanent

Result of Calibration

1. Temperature Measurement : Without Adjustment Resolution of UUC : 0.1 °C

Calibration Point (°C)	Average Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty ± (°C)
20	20.032	20.3	+ 0.27	0.45
25	25.056	25.3	+ 0.24	0.45
30	30.112	29.8	+ 0.31	0.45

2. Humidity Measurement : Without Adjustment Resolution of UUC : 1 %RH

Calibration Point (%RH)	Calculated Standard Reading (%RH)	UUC Reading (%RH)	Correction (%RH)	Uncertainty ± (%RH)
50	50.25	51	- 0.75	2.0
60	60.35	61	- 0.65	2.0
70	70.65	71	- 0.35	2.0

- Note : 1. Process calibration humidity measurement Reference temperature control at 25°C
2. Calculated STD humidity refer to dew-point temperature and convert to humidity by magnus's Equation
3. Calibrate items it good condition and this report customer request and accepted in certificate

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%.



CRYSTAL CALIBRATION SALES AND SERVICE CO., LTD.

45/48 Soi Salathammasop31, Salathammasop Rd.,
Salathammasop, 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. : 25-0692-006

Issue Date : 15 June 2025

Work Order No. : 25/0692

Customer Name : Water Index & Consultant Co., Ltd
229/7-8 Soi Charan Sanit Wong 95/1, Charan Sanit Wong Rd.,
Bang-aor, Bangphlat, Bangkok 10700

Date of Received : 2 June 2025

Date of Calibration : 5 June 2025

Instrument Details : Description : Digital Thermo hygrometer
Manufacturer : Digicon
Model : Th-02A
Serial No. : 1718B0744383
ID No. : E-074
Location : Humidity and Temperature Laboratory

Calibration Method : This instrument was calibrated by comparison of indication with Standard Chilled Mirror Hygrometer and Standard Thermometer into Temperature and Humidity Chamber controller according to calibration procedure no. CWI-H-01

Environmental Condition

Temperature : Laboratory Control at $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$
Humidity : Laboratory Control at $55\%\text{RH} \pm 20\%\text{RH}$

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 : Miss Ketmanee Srisuwan
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.

PAGE 1/2

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



**CRYSTAL CALIBRATION SALES AND SERVICE CO., LTD.**

45/48 Soi Salathammasop31, Salathammasop Rd.,

Salathammasop, 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. : 25-0692-006

Issue Date : 15 June 2025

Work Order No. : 25/0692

Details of Calibration**1. Reference Standards Instrument**

Instrument	Serial No. / ID no.	Certification	Due Date
1.1 Dew point hygrometer	2204151 / CMH-02	TH-0107-24	29 August 2025
1.2 Digital Thermometer with RTD	15000016 / RTD-11	24-1288-003	01 October 2025

- 2. Certificate traceable** : This certificate traceable to The International System of Unit refer to
 No. 1.1 National Institute of Metrology (Thailand), NAC Calibration no. 0144
 No. 1.2 Crystal Calibration Sales and Service Co., Ltd. , NAC Calibration No. 0260

3. Condition of item : Used**4. Calibration location** : Permanent**Result of Calibration****1. Temperature Measurement :** Without Adjustment Resolution of UUC : 0.1 °C

Calibration Point (°C)	Average Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty ± (°C)
20	20.032	19.7	+ 0.33	0.45
25	25.056	24.8	+ 0.26	0.45
30	30.112	29.7	+ 0.41	0.45

2. Humidity Measurement : Without Adjustment Resolution of UUC : 1 %RH

Calibration Point (%RH)	Calculated Standard Reading (%RH)	UUC Reading (%RH)	Correction (%RH)	Uncertainty ± (%RH)
40	40.63	41	- 0.37	2.0
50	50.25	51	- 0.75	2.0
60	60.35	61	- 0.65	2.0

Note : 1. Process calibration humidity measurement Reference temperature control at 25°C

2. Calculated STD humidity refer to dew-point temperature and convert to humidity by magnus's Equation

3. Calibrate items it good condition and this report customer request and accepted in certificate

A ✓

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%.



CRYSTAL CALIBRATION SALES AND SERVICE CO., LTD.

45/48 Soi Salathammasop31, Salathammasop Rd.,
Salathammasop, 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. : 25-0692-007

Issue Date : 18 June 2025

Work Order No. : 25/0692

Customer Name : Water Index & Consultant Co., Ltd
229/7-8 Soi Charan Sanit Wong 95/1, Charan Sanit Wong Rd.,
Bang-aor, Bangphlat, Bangkok 10700

Date of Received : 2 June 2025

Date of Calibration : 6 June 2025

Instrument Details : Description : Digital Thermometer with TC type K
Manufacturer : CHY
Model : 502A
Serial No. : 56000360
ID No. : E-035
Resolution : 0.1 °C
Location : Temperature and Humidity Calibration Laboratory

Calibration Method : This instrument was calibrated by comparison of indication with Standard Thermometer into calibration bath temperature controller according to calibration procedure no. CWI-T-09

Environmental Condition

Temperature : Laboratory Control at 23°C ± 3°C
Humidity : Laboratory Control at 55%RH ± 20%RH

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. Thichakorn Srisupob
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 Salathammasop 31, Salathammasop Rd., Salathammasop, Thawewatthana, Bangkok 10170

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





CRYSTAL CALIBRATION SALES AND SERVICE CO., LTD.

45/48 Soi Salathammasop31, Salathammasop Rd.,
Salathammasop, 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. : 25-0692-007

Issue Date : 18 June 2025

Work Order No. : 25/0692

Details of Calibration

1. Reference Standards Instrument

Instrument	Serial No. / ID No.	Certification	Due Date
Thermometer Readout	28270002	24-1569-001	5-Dec-2025
Platinum Resistance Thermometers (PRT)	885515	24-1569-001	5-Dec-2025
Digital thermometer with TC	MY41192490	25/2024	1-May-2026

2. Certificate traceable : This certificate traceable to The International System of Unit (SI unit)

3. Condition of equipment : Used

4. Calibration site : Permanent

Result of Calibration

Calibration result : Without Adjustment

Chanel T1

Calibration point (°C)	STD. Value (°C)	UUC Reading (°C)	Correction value (°C)	Uncertainty ± (°C)
0	0.021	0.0	+ 0.021	0.60
3	3.005	3.2	- 0.195	0.60
20	20.012	19.7	+ 0.312	0.60

Chanel T2

Calibration point (°C)	STD. Value (°C)	UUC Reading (°C)	Correction value (°C)	Uncertainty ± (°C)
0	0.021	0.0	+ 0.021	0.60
380*	380.9	381.5	- 0.6	2.0

Note : (*) not accredit TISI

Calibrate items it good condition and this report customer request and accepted in certificate

Immersion Depth : 130 mm

UUC : Unit Under Calibration.

The quoted uncertainty include Inhomogeneity of thermocouple (UUC)

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%.



CRYSTAL CALIBRATION SALES AND SERVICE CO., LTD.

45/48 Soi Salathammasop31, Salathammasop Rd.,
Salathammasop, 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. : 25-0692-007

Issue Date : 18 June 2025

Work Order No. : 25/0692

Customer Name : Water Index & Consultant Co., Ltd
229/7-8 Soi Charan Sanit Wong 95/1, Charan Sanit Wong Rd.,
Bang-aor. Bangphlat, Bangkok 10700

Date of Received : 2 June 2025

Date of Calibration : 6 June 2025

Instrument Details : Description : Digital Thermometer with RTD
Manufacturer : CHY
Model : 804U
Serial No. : 090034
ID No. : E-026
Resolution : 0.1 °C
Location : Temperature and Humidity Calibration Laboratory

Calibration Method : This instrument was calibrated by comparison of indication with Standard Thermometer into calibration bath temperature controller according to calibration procedure no. CWI-T-09

Environmental Condition

Temperature : Laboratory Control at 23°C ± 3°C
Humidity : Laboratory Control at 55%RH ± 20%RH

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 : Miss Phiraya Prawabut
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 Salathammasop 31, Salathammasop Rd., Salathammasop, Thawewatthana, Bangkok 10170

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





CRYSTAL CALIBRATION SALES AND SERVICE CO., LTD.

45/48 Soi Salathammasop31, Salathammasop Rd.,
Salathammasop, 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. : 25-0692-007

Issue Date : 18 June 2025

Work Order No. : 25/0692

Details of Calibration

1. Reference Standards Instrument

Instrument	Serial No. / ID No.	Certification	Due Date
Thermometer Readout	28270002	24-1569-001	5-Dec-2025
Platinum Resistance Thermometers (PRT)	885515	24-1569-001	5-Dec-2025

2. Certificate traceable : This certificate traceable to The International System of Unit (SI unit)

3. Condition of equipment : Used

4. Calibration site : Permanent

Result of Calibration

Calibration result : Without Adjustment

Calibration point (°C)	STD. Value (°C)	UUC Reading (°C)	Correction value (°C)	Uncertainty ± (°C)
104	104.008	103.9	+ 0.108	0.25
150	149.989	149.7	+ 0.289	0.25
180	179.978	179.7	+ 0.278	0.25

Note :

Calibrate items it good condition and this report customer request and accepted in certificate

Immersion Depth : 130 mm

UUC : Unit Under Calibration.

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%.



CRYSTAL CALIBRATION SALES AND SERVICE CO., LTD.

45/48 Soi Salathammasop31, Salathammasop Rd.,
Salathammasop, 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. : 25-0692-009

Issue Date : 18 June 2025

Work Order No. : 25/0692

Customer Name : Water Index & Consultant Co., Ltd
229/7-8 Soi Charan Sanit Wong 95/1, Charan Sanit Wong Rd.,
Bang-aor, Bangphlat, Bangkok 10700

Date of Received : 2 June 2025

Date of Calibration : 2 June 2025

Instrument Details : Description : Water Bath
Manufacturer : Memmert
Model : D-91126
Serial No. : N920481
ID No. : E-004
Resolution : 0.1 °C
Location : Laboratory

Calibration Method : This instrument was calibrated by insert standard thermometer into the liquid bath according to calibration procedure CWI-T-11 in-house methods based on ASTM E715-80 (Reapproved 2006)

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. Watcharasak Puttarat
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.

PAGE 1/3

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

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





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

Issue Date : 18 June 2025

Certificate No. : 25-0692-009

Work Order No. : 25/0692

Details of calibration

1. Reference Standards Instrument

Instrument	Serial No. / ID No.	Certificate No.	Due Date
Data Acquisition unit	MY49024826	24-1288-013	19 October 2025
Sensor type RTD	Channel 101 to 105	24-1288-013	19 October 2025

2. Certificate traceable

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

3. Condition of item

: Used

4. Calibration site

: On-site

5. Result of Calibration

: Without Adjustment

6. Evaluate Condition

: Time Constant : - Hour 59 Minute At Cal. point 84 °C
Type of Control : PID Control

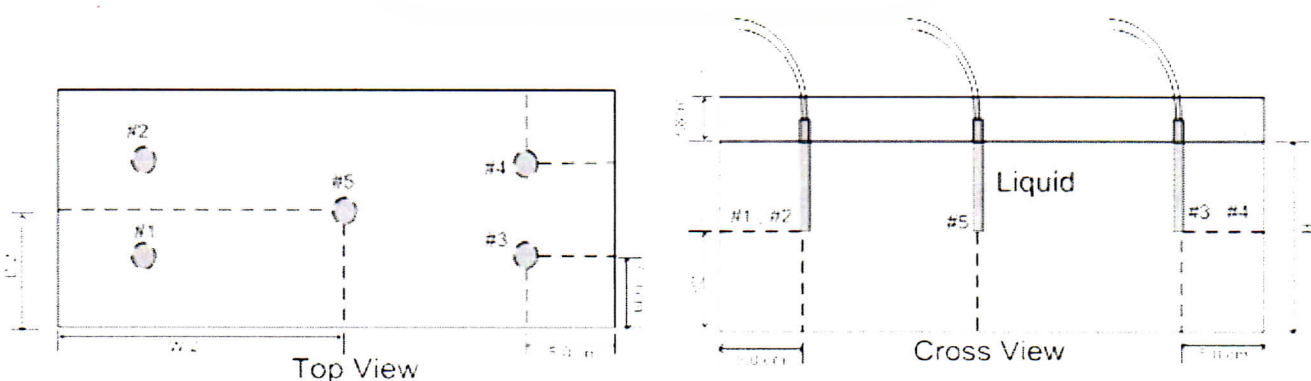
Testing liquid bath use media is Water

7. Calibration note

: The results reported in this certificate refer to the condition of instrument on
the process into the standby state of Liquid Bath

8. Sensors Installation Diagram

:



Position Diagrams



CRYSTAL CALIBRATION SALES AND SERVICE CO., LTD.

45/48 Soi Salathammasop31, Salathammasop Rd.,
Salathammasop, Thawewatthana, Bangkok 10170 Thailand
Tel : 0-2408-8474-5 Fax : 0-2408-8477 Email : info@crystalcal.com www.crystalcal.com



CERTIFICATE OF CALIBRATION

Issue Date : 18 June 2025

Certificate No. : 25-0692-009

Work Order No. : 25/0692

Result of Temperature Distribution and Performance Check

Table 1 : Reporting of Temperature

Calibration point (°C)	Average Measured Temperature (°C) @ Sensor No. (Sensor No.5 is REF)					Uncertainty ± (°C)
	#1	#2	#3	#4	#5	
84.0	84.12	84.17	84.08	84.16	84.22	0.22
95.0	95.21	95.19	95.15	94.95	95.03	0.67

Table 2 : Reporting of Characterization Result

Indicator Set point (°C)	Indicator Reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
	MAX	MIN	Average			
84.0	84.0	84.0	84.0	0.15	0.35	0.40
95.0	95.0	95.0	95.0	0.57	0.62	1.13

Note :

Calibrate items in good condition and this report customer request and accepted in certificate

The reference sensor is preferably located at the center of bath

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

The quoted uncertainty includes "Stability" and excludes "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 bath 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%.



CRYSTAL CALIBRATION SALES AND SERVICE CO., LTD.

45/48 Soi Salathammasop31, Salathammasop Rd.,
Salathammasop, 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. : 25-0692-010

Issue Date : 18 June 2025

Work Order No. : 25/0692

Customer Name : Water Index & Consultant Co., Ltd
229/7-8 Soi Charan Sanit Wong 95/1, Charan Sanit Wong Rd.,
Bang-aor, Bangphlat, Bangkok 10700

Date of Received : 2 June 2025

Date of Calibration : 2 June 2025

Instrument Details : Description : Water Bath
Manufacturer : Nanbei
Model : HWS-28
Serial No. : HWS-2802052024
ID No. : E-057
Resolution : 0.1 °C
Location : Laboratory

Calibration Method : This instrument was calibrated by insert standard thermometer into the liquid bath according to calibration procedure CWI-T-11 in-house methods based on ASTM E715-80 (Reapproved 2006)

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. Watcharasak Puttarat
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.

PAGE 1/3

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

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





CRYSTAL CALIBRATION SALES AND SERVICE CO., LTD.

45/48 Soi Salathammasop31, Salathammasop Rd.,
Salathammasop, Thawewatthana, Bangkok 10170 Thailand
Tel : 0-2408-8474-5 Fax : 0-2408-8477 Email : info@crystalcal.com www.crystalcal.com



CERTIFICATE OF CALIBRATION

Issue Date : 18 June 2025

Certificate No. : 25-0692-010

Work Order No. : 25/0692

Details of calibration

1. Reference Standards Instrument

Instrument	Serial No. / ID No.	Certificate No.	Due Date
Data Acquisition unit	MY49024826	24-1288-013	19 October 2025
Sensor type RTD	Channel 106-110	24-1288-013	19 October 2025

2. Certificate traceble

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

3. Condition of item

: Used

4. Calibration site

: On-site

5. Result of Calibration

: Without Adjustment

6. Evaluate Condition

: Time Constant : - Hour 59 Minute At Cal. point 84 °C
Type of Control : PID Control

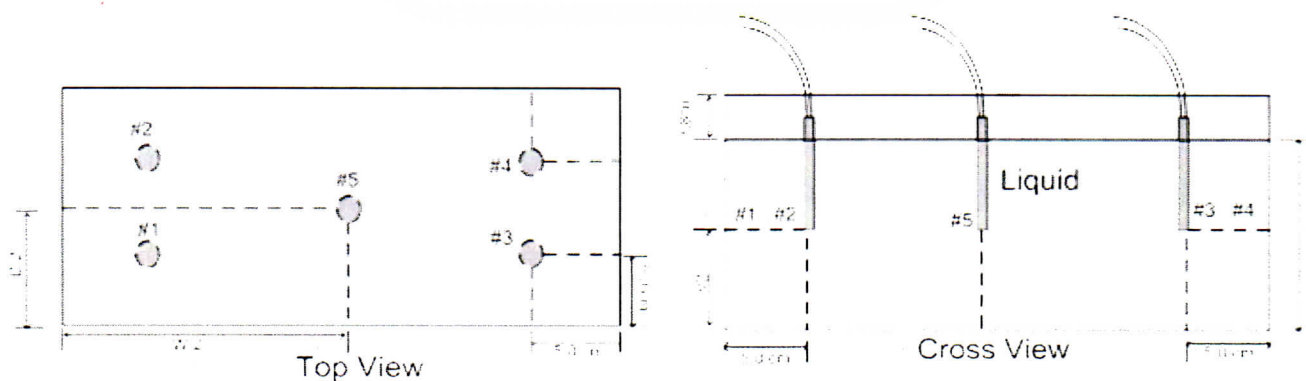
Testing liquid bath use media is Water

7. Calibration note

: The results reported in this certificate refer to the condition of instrument on
the process into the standby state of Liquid Bath

8. Sensors Installation Diagram

:



Position Diagrams



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. : 25-0692-010

Issue Date : 18 June 2025

Work Order No. : 25/0692

Result of Temperature Distribution and Performance Check

Table 1 : Reporting of Temperature

Calibration point (°C)	Average Measured Temperature (°C) @ Sensor No. (Sensor No.5 is REF)					Uncertainty ± (°C)
	#1	#2	#3	#4	#5	
84.0	83.86	84.06	84.01	84.02	84.11	0.19
95.0	94.94	95.20	95.04	95.20	95.19	0.34

Table 2 : Reporting of Characterization Result

Indicator Set point (°C)	Indicator Reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
	MAX	MIN	Average			
84.0	84.0	84.0	84.0	0.11	0.30	0.47
95.0	95.0	95.0	95.0	0.27	0.72	0.75

Note :

Calibrate items it good condition and this report customer request and accepted in certificate

The reference sensor is preferably located of the center of bath

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

The quoted uncertainty include " Stability " and exclude" 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 bath 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%.

CALIBRATION REPORT



Cert. Number
BTC-T-010/68
Page 1 of 4 pages

Issued By B.T.METROLOGY CO.,LTD.

Date of Issue 03 June 2025

B.T.METROLOGY CO.,LTD.
17/166 Soi Prachachun 14 (PEA Village)
Tungsonghong Laksi, Bangkok 10210

Approved Signatory

P.Prasitmate

Customer : Water Index & Consultant Co., Ltd

Address : 229/7-8 Soi Charan Sanit Wong 95/1, Charan Sanit Wong Rd., Bang-aor. Bangphlat, Bangkok 10700

Date of Received : 30 May 2025

Instrument – Description : HEATING BLOCK

Id. Number : E-005

Manufacturer : Lovibond

Model Number : BT125SC

Serial Number : 0980/2426

Calibration Procedure : Indicate temperature of Unit Under Test (UUC) was compared to temperature Obtained from reference standards at calibration point. .

Measurement Method : The thermocouples shall be placed with in the chamber in accordance with the appendix A and the temp. readings of the thermocouples could be found in the appendix A.

Cal. Inform. : Cal. (☒) Only () Adjusted

Location of Calibration : At Customer Location

Environmental Conditions :

Temperature is $27 \pm 3^{\circ}\text{C}$

Relative Humidity is $60 \pm 10\% \text{ Rh}$

Comments

The temperature scale in use is the International Temperature Scale of 1990 (ITS-90).

The Uncertainties of report based on a standard uncertainty Multiplied by a coverage factor $k=2$,

Providing level of confidence approximately 95%

All Tests pass standard tolerance.

Tractability Information

Reference Standards Description

Data logger With Probe (RTD : 01-09)

Serial Number

MY44015287

Maker: Agilent

Certificate Number

BTC-T-001-68

Model: 34972A

Cal. Date

2/January/2025

Due Date.

2/January/2026

☐ This certification is traceable to SI Unit through the reference standard laboratory of In-house B.T.Metrology Calibration Lab. The used to perform this calibration is Traceable to This Certificate is traceable to SI Unit through Photometry and Temperature Standards Laboratory, Industrial Metrology and Testing Service Centre, Thailand Institute of Scientific and Technological Research (TISTR), NSC-ONSC Accreditation No.: Calibration 0015. (Laboratories was Accreditation by TISI According to ITS ISO / IEC 17025)

Calibrated By:

(Mr. Teerapong Somprajob)

Date of Calibration : 02 June 2025

CALIBRATION REPORT

Issued By B.T.METROLOGY CO.,LTD.

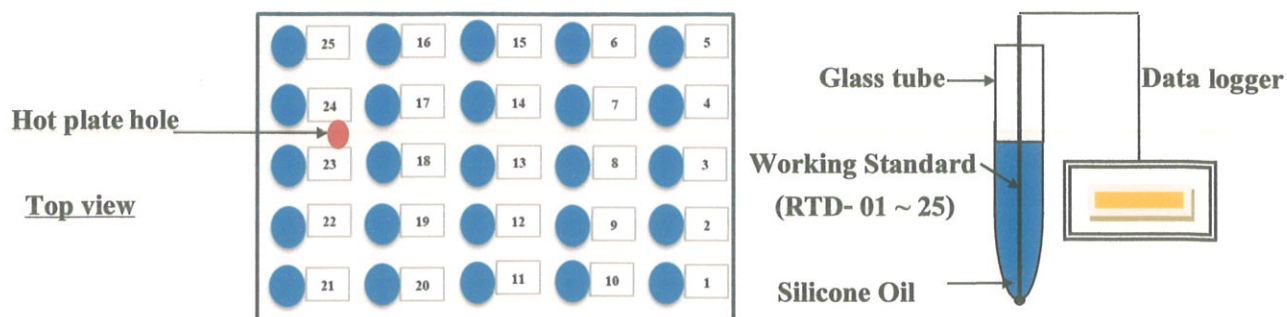
Date of Issue 03 June 2025



Cert. Number
BTC-T-010/68

Page 2 of 4 pages

Appendix A.



Calibrated By:

(Mr. Teerapong Somprajob)

Date of Calibration : 02 June 2025

CALIBRATION REPORT



Cert. Number
BTC-T-010/68

Page 3 of 4 pages

Issued By B.T.METROLOGY CO.,LTD.

Date of Issue 03 June 2025

Hole No. (Position)	Max (°C)	Min (°C)	Mid-Range (°C)	Difference (°C)	Uncertainty of measurement ($\pm$ °C)
1	149.1	149.1	149.10	0.0	0.5
2	149.2	149.2	149.20	0.0	
3	149.8	149.7	149.75	0.0	
4	149.8	149.8	149.80	0.0	
5	149.2	149.2	149.20	0.0	
6	149.3	149.3	149.30	0.0	
7	149.8	149.8	149.80	0.0	
8	150.1	150.1	150.10	0.0	
9	149.8	149.8	149.80	0.0	
10	149.6	149.6	149.60	0.0	
11	149.1	149.1	149.10	0.0	
12	149.6	149.6	149.60	0.0	
13	150.0	150.0	150.00	0.0	
14	150.0	150.0	150.00	0.0	
15	149.3	149.2	149.25	0.0	
16	149.3	149.3	149.30	0.0	
17	149.7	149.7	149.70	0.0	
18	150.2	150.1	150.15	0.0	
19	150.3	150.3	150.30	0.0	
20	149.5	149.5	149.50	0.0	
21	149.7	149.7	149.70	0.0	
22	149.4	149.4	149.40	0.0	
23	149.7	149.7	149.70	0.0	
24	150.0	150.0	150.00	0.0	
25	149.3	149.2	149.25	0.0	
Hot plate hole	150.3	149.6	149.95	0.6	

Calibrated By:

(Mr. Teerapong Somprajob)

Date of Calibration : 02 June 2025

CALIBRATION REPORT



Cert. Number
BTC-T-010/68

Page 4 of 4 pages

Issued By B.T.METROLOGY CO.,LTD.

Date of Issue 03 June 2025

UUC		Average Measured Temperature * (°C)	Measured Temperature		Measured Variation		
Setting (°C)	Reading (°C)		Max (°C)	Min (°C)	Stability (±°C)	Uniformity (°C)	Overall (°C)
150.0	149.1-150.3	149.6	150.3	149.1	0.3	0.9	1.2

Note : - Reference Standards are measurement in tube silicone oil at 240 value record after temperature stability.
- Level high of silicone oil is equal heater plate of UUC.

... end of certificate ...

Calibrated By:

(Mr. Teerapong Somprajob)

Date of Calibration : 02 June 2025