

Mettler-Toledo (Thailand) Limited
846/4 - 846/5 Lasalle Road
Bangna Tai, Bangna, Bangkok 10260
THAILAND
www.mt.com



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 2 9 0 7 7 8 2

Weighing Device

Manufacturer: Mettler Toledo **Instrument Type:** Weighing Instrument
Model: MS204TS/00 **Asset Number:** 300EI7
Serial No.: B724237367 **Terminal Model:** N/A
Building: Office **Terminal Serial No.:** N/A
Floor: 2 **Terminal Asset No.:** N/A
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 calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.

The sensitivity/span of the weighing instrument was adjusted before calibration 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: 26.5 °C	End: 26.1 °C	Start: 55.1 %	End: 54.1 %

As Found Calibration Date: 11-Oct-2023 **Calibrator:** 
As Left Calibration Date: N/A
Issue Date: 12-Oct-2023
Approved Signatory: 
Technical Manager / Head of Calibration Center

Measurement Results

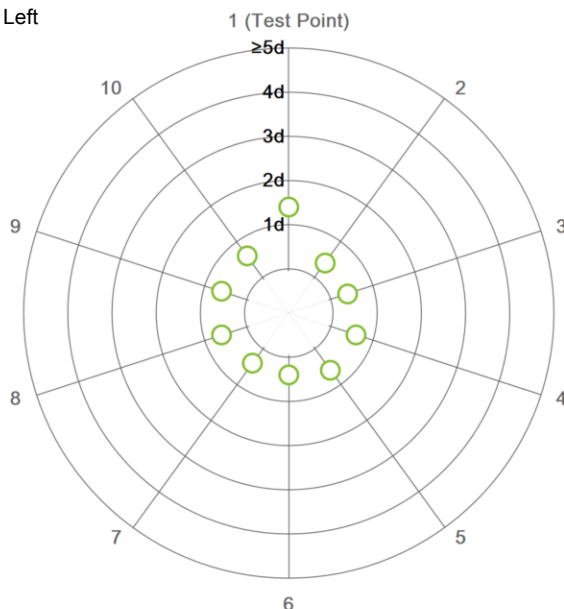
Repeatability

Test Load: 100 g

	As Found	As Left
1	100.0001 g	N/A
2	100.0000 g	N/A
3	100.0000 g	N/A
4	99.9999 g	N/A
5	99.9999 g	N/A
6	100.0000 g	N/A
7	100.0000 g	N/A
8	99.9999 g	N/A
9	99.9999 g	N/A
10	99.9999 g	N/A

Standard Deviation	0.00007 g	N/A
--------------------	-----------	-----

○ As Found
◆ As Left



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

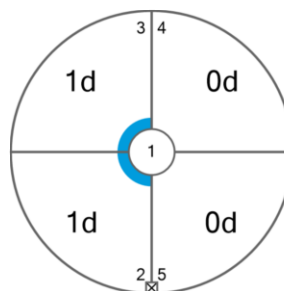
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0000 g	N/A
2	100.0001 g	N/A
3	100.0001 g	N/A
4	100.0000 g	N/A
5	100.0000 g	N/A

Maximum Deviation	0.0001 g	N/A
-------------------	----------	-----



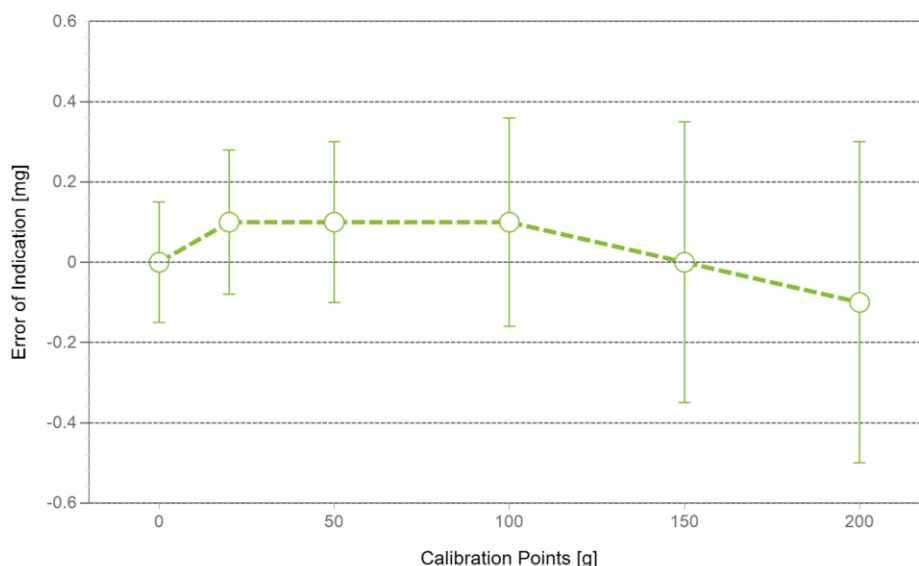
As Found

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	0.15 mg	2
2	0.0500 g	0.0500 g	0.0000 g	0.16 mg	2
3	0.1000 g	0.1000 g	0.0000 g	0.16 mg	2
4	0.5000 g	0.5000 g	0.0000 g	0.16 mg	2
5	1.0000 g	1.0000 g	0.0000 g	0.16 mg	2
6	10.0000 g	10.0000 g	0.0000 g	0.17 mg	2
7	20.0000 g	20.0001 g	0.0001 g	0.18 mg	2
8	50.0000 g	50.0001 g	0.0001 g	0.20 mg	2
9	99.9999 g	100.0000 g	0.0001 g	0.26 mg	2
10	149.9999 g	149.9999 g	0.0000 g	0.35 mg	2
11	200.0000 g	199.9999 g	-0.0001 g	0.40 mg	2



○ As Found

◆ As Left

For improved legibility of the graphics only increasing measurement points are shown and measurement points close to zero are not displayed.

The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k – which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of 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.:	WS54	Date of Issue:	15-Jun-2022
Certificate Number:	179958	Calibration Due Date:	14-Dec-2023

Thermo Hygrometer

Equipment No.:	IN306	Date of Issue:	10-Jan-2023
Certificate Number:	23H4	Calibration Due Date:	03-Jan-2024

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

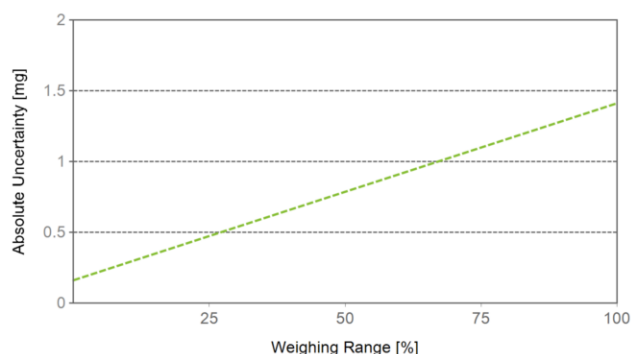
Linearization of Uncertainty Equation

Range			As Found	As Left
	d	Max		
1	0.0001 g	220 g	$U_1 = 0.16 \text{ mg} + 0.00569 \text{ mg/g} \cdot R$	N/A

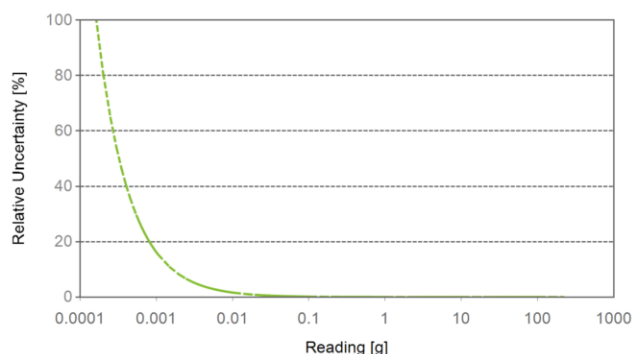
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

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

Net Indication	As Found		As Left	
0.0220 g	0.16 mg	0.73%	N/A	N/A
0.2200 g	0.16 mg	0.073%	N/A	N/A
2.2000 g	0.17 mg	0.0078%	N/A	N/A
22.0000 g	0.29 mg	0.0013%	N/A	N/A
220.0000 g	1.4 mg	0.00064%	N/A	N/A



As Found



As Left

CALIBRATION REPORT




Cert. Number
BTC-T-07/66
Page 1 of 4 pages

Issued By B.T.METROLOGY CO.,LTD.
Date of Issue 3 September 2023

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

Approved Signatory


P.Prasitamate

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 : 25 August 2023

Instrument – Description : COD REACTOR
Id. Number : 134E02
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

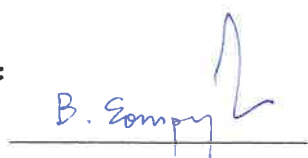
The temperature scale in use is the International Temperature Scale of 1990 (ITS-90).
The Uncertainties of report based on a standard uncertainty Multiplied by a coverage factor $k=2$,
Providing level of confidence approximately 95%
All Tests pass standard tolerance.

Tractability Information

Reference Standards Description	Serial Number	Certificate Number	Cal. Date	Due Date.
STD Thermometer with Probe, PRT	1912	22-65/0709	7-9/September/2022	7-9/September/2023
Equipment Description	Serial Number	Certificate Number	Cal. Date	Dule Date.
Data logger With Probe (RTD : 01-10)	MY49020096	BTC-T-001-66	1/February/2023	1/February/2024
	Maker: Agilent	Model: 34972A	Make in USA	

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 National Institute of Metrology (Thailand), NIMT through Reference Standard Laboratory of Thailand Institute of Scientific and Technological Research (TISTR), No. Calibration 0260.(Laboratories was Accreditation by TISI According to ITS ISO / IEC 17025

Calibrated By:



(Mr. Boonlue Somprajob)

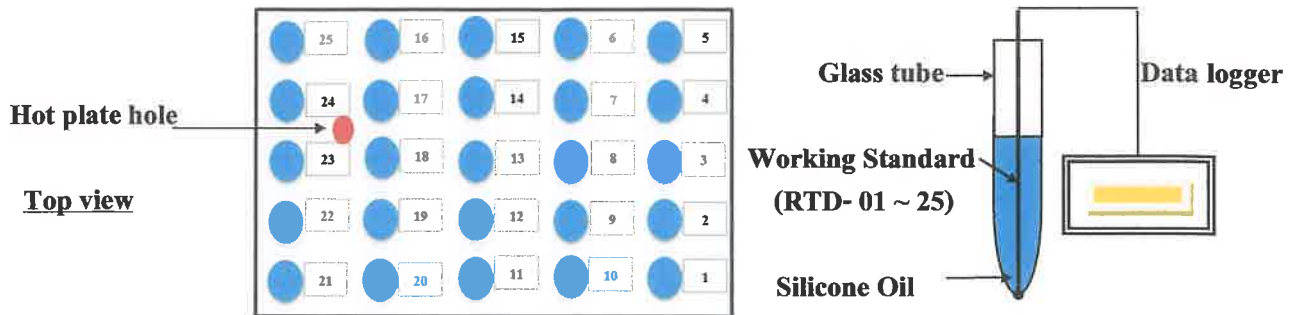
Date of Calibration : 2 September 2023

CALIBRATION REPORT

Cert. Number
BTC-T-07/66
Page 2 of 4 pages

Issued By B.T.METROLOGY CO.,LTD.
Date of Issue 3 September 2023

Appendix A.



Calibrated By:

B. Somprajob

(Mr. Boonlue Somprajob)

Date of Calibration : 2 September 2023

CALIBRATION REPORT

Cert. Number
BTC-T-07/66
Page 3 of 4 pages

Issued By B.T.METROLOGY CO.,LTD.
Date of Issue 3 September 2023

Hole No. (Position)	Max (°C)	Min (°C)	Mid-Range (°C)	Difference (°C)	Uncertainty of measurement (\pm °C)
1	149.1	149.1	149.1	0.0	0.5
2	149.2	149.2	149.2	0.0	
3	150.8	150.7	150.8	0.1	
4	149.8	149.7	149.8	0.0	
5	149.2	149.2	149.2	0.0	
6	149.3	149.3	149.3	0.0	
7	150.8	150.8	150.8	0.0	
8	150.4	150.4	150.4	0.0	
9	150.8	150.8	150.8	0.0	
10	149.6	149.6	149.6	0.0	
11	149.1	149.1	149.1	0.0	
12	150.6	150.6	150.6	0.0	
13	151.0	151.0	151.0	0.0	
14	151.0	151.0	151.0	0.0	
15	149.2	149.2	149.2	0.0	
16	149.3	149.3	149.3	0.0	
17	149.6	149.6	149.6	0.0	
18	150.2	150.1	150.2	0.0	
19	150.3	150.3	150.3	0.0	
20	149.5	149.5	149.5	0.0	
21	149.7	149.7	149.7	0.0	
22	149.4	149.4	149.4	0.0	
23	149.7	149.7	149.7	0.0	
24	150.0	150.0	150.0	0.0	
25	149.3	149.2	149.3	0.0	
Hot plate hole	150.3	149.6	150.0	0.6	

Calibrated By:



(Mr. Boonlue Somprajob)

Date of Calibration : 2 September 2023

CALIBRATION REPORT



Cert. Number
BTC-T-07/66

Page 4 of 4 pages

Issued By B.T.METROLOGY CO.,LTD.
Date of Issue 3 September 2023

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	149.1-151.0	149.9	151.0	149.1	0.3	1.9	1.9

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:

B. Somprajob
(Mr. Boonlue Somprajob)

Date of Calibration : 2 September 2023



Inctech Metrological Center Co.Ltd.

39/1 Soi 82, Sukhapiban 5 Rd., O ngoen,

Saimai, Bangkok 10220, Thailand

Tel. (662) 909-8820 (Auto 10 lines) www.imcinstrument.com



Calibration Cert. # 3884.01
ISO/IEC 17025

Certificate of Calibration

Certificate No. : MT23-4455

Page : 1 of 2

Customer : Water Index & Consultant Co., Ltd.

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

Description : Hot Air Oven

Manufacturer : Memmert

Model : SM400

Serial No. : B4921010

Identification No. : ID146E94

Calibration Place : Customer Laboratory

Order No. : 1954/23

Received date : Jun 16, 2023

Calibration date : Jun 16, 2023

Environment Condition :

Temperature : (25+/-10) °C

Humidity : (50+/-30) %RH

Calibration Method : Calibration were conducted using In-house calibration procedure *CP-MT-006* According to comparison with LXI Data Acquisition Switch Unit with sensor. The calibration methods based on Euramet Calibration Guide No.20 - guidelines on the Calibration of Temperature and/or Humidity Controlled Enclosures.

Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
LXI Data Acquisition Switch Unit with Sensor	34972A	MY57003222	MT22-5466	Oct 06, 2023

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

Traceability : This measurement are traceable to the International System of Unit (SI), through
National Institute of Metrology Thailand (NIMT)

The reported uncertainty of measurement was based on standard uncertainty multiplied by coverage factor $k = 2$,
providing a level of confidence of not less than 95%



Calibrated by : Mr.Jiraphan Sreebannasarn

Issue date : Jun 29, 2023

Approved by :

(Mr.Panuwat Phuklan)

This calibration certificate shall not be reproduced other than in full except with the prior written approval of Inctech Metrological Center Co.,Ltd

Certificate No. : MT23-4455

Page : 2 of 2

Function : Temperature measurement

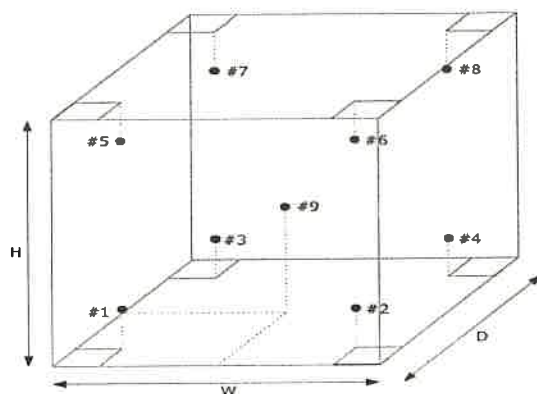
Result : Without adjustment

Calibration point : 104, 110, 120, 150, 180 °C

Resolution : 0.1 °C

Calibration point (°C)	Temperature of UUC* at each position (°C)									Uncertainty of measurement (+/- °C)
	Ch.1	Ch.2	Ch.3	Ch.4	Ch.5	Ch.6	Ch.7	Ch.8	Ch.9	
104	104.254	104.197	104.293	104.296	104.358	104.318	104.305	104.263	104.253	0.44
110	110.317	110.129	110.231	110.241	110.318	110.408	110.248	110.304	110.293	0.44
120	120.389	120.258	120.199	120.301	120.232	120.245	120.233	120.291	120.242	0.44
150	149.936	149.356	149.539	149.662	149.719	149.576	149.704	149.451	149.745	0.44
180	180.567	180.190	180.582	180.349	180.254	180.300	180.307	180.317	180.288	0.47

Setting temperature (°C)	Indicating Temperature (°C)	Measured stability (+/- °C)	Measured uniformity (°C)	Overall variation (°C)
104.0	104.0	0.19	0.43	0.65
110.0	110.0	0.17	0.47	0.52
120.0	120.0	0.23	0.52	0.65
150.0	150.0	0.17	0.62	0.81
180.0	180.0	0.36	0.73	1.0



- #1 Lower Left Front
- #2 Lower Right Front
- #3 Lower Left Rear
- #4 Lower Right Rear
- #5 Upper Left Front
- #6 Upper Right Front
- #7 Upper Left Rear
- #8 Upper Right Rear
- #9 Geometric Center

Front view
UUC* = Unit under calibration

Uniformity = Maximum and Minimum difference of measured temperature at any probes and the measured temperature at the reference and same time.

Overall Variation = Difference of temperature value between the maximum and minimum any time.

Stability = One half of the maximum difference of measured temperatures at any one probe.



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. : 23-0806-004

Issue Date : 25 June 2023

Work Order No. : 23/0806

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 : 16 June 2023

Date of Calibration : 16 June 2023

Instrument Details : Description : pH meter
Manufacturer : Mettler Toledo
Model : Seven Compact
Serial No. : N/A
ID No. : B614308589
Resolution : 0.01 pH
Location : Laboratory

Calibration Method : This instrument was calibrated by in-house calibration procedure no. CWI-C-02 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)

Environmental Condition


Temperature : Area Monitoring between 15°C to 40°C

Humidity : Area Monitoring between 30%RH to 85%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)

Calibrated by : Mr. Kritsada Kaewwangpa
Calibration Engineer

Approved by : 
(Mr. Anuwat Yaklermjit)
Laboratory Manager

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

Crystal Calibration Sales and Service Co., Ltd.

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

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



PAGE 1/2

**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. : 23-0806-004

Issue Date : 25 June 2023

Work Order No. : 23/0806

Details of Calibration**1. Certified Reference Material / Certified of Instrument**

Certified Reference Material	CRM Code	Lot no.	Expire Date
1.1 Buffer Solution pH 4.00	TRM-S-2027	030822	27 February 2024
1.2 Buffer Solution pH 7.00	TRM-S-2034	300522	27 February 2024
1.3 Buffer Solution pH 10.00	TRM-S-2031	230822	27 February 2024

Instrument	Certificate no.	Serial No. / ID No.	Due Date
1.4 DC Source Calibrator	22E2172	316A14010055	4 July 2023

2. This certificate traceable to the international unit (SI)

Buffer solution no. 1.1 traceable to : Nation Institute of Metrology (Thailand)
Buffer solution no. 1.2 traceable to : Nation Institute of Metrology (Thailand)
Buffer solution no. 1.3 traceable to : Nation Institute of Metrology (Thailand)
Instrument no. 1.4 traceable to : Technology Promotion Association (Thailand-Japan) NAC Calibration No. 0008

3. Condition of item : Used

4. Calibration location : On-site

Result of Calibration

Measurement Function : mV Measurement
Performing : Standard curve by Voltage calibrator at pH ()

Normal value pH	Applied DC voltage mV	Average indicator reading		Uncertainty (±) mV	Coverage Factor k
		mV	pH		
0	414.0	414.0	0.00	0.20	2.00
2	295.7	175.1	2.00	0.20	2.00
4	177.4	175.9	4.00	0.20	2.00
7	0.0	176.7	7.00	0.20	2.00
9	-118.2	177.5	9.00	0.20	2.00
10	-177.4	0.0	10.00	0.20	2.00
12	-295.7	-177.5	12.00	0.20	2.00
14	-414.0	-141.1	14.00	0.20	2.00



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. : 23-0806-004

Issue Date : 25 June 2023

Work Order No. : 23/0806

Result of calibration

Measurement Function : pH Measurement with electrode

Performing : Three buffer standard curve using buffer nominal pH (4, 7, 10)

STD buffer solution pH @ 25 °C	Average indicator reading			Uncertainty (\pm) pH	Coverage factor k
	pH	mV	pH correction		
4.01	3.99	139.5	0.02	0.020	2.00
7.01	7.01	-37.4	0.00	0.020	2.00
10.00	10.01	-195.8	-0.01	0.020	2.00

Note : 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 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. : 23-0806-007

Work Order No. : 23/0806

Issue Date : 25 June 2023

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

Date of Received : 16 June 2023

Date of Calibration : 16 June 2023

Instrument Details : Description : Temperature Controlled Enclosures [Refrigerator]
Manufacturer : Accuplus
Model : i250
Serial No. : 1250402-0110-0303
ID No. : N/A
Resolution : 0.1 °C
Location : Laboratory

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 Salathammassop 31, Salathammassop Rd., Salathammassop, 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. : 23-0806-007

Issue Date : 25 June 2023

Work Order No. : 23/0806

Details of Calibration

1. Reference Standards Instrument

Instrument	Model	Serial No./Ins No.	Certificate No.	Due Date
Data Acquisition unit	34972A	MY49018270	22-1787-001	02 January 2024
Sensor type	RTD	CH # 101-109	22-1787-001	02 January 2024

2. Certificate traceble

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

3. Condition of item

: Used

4. Calibration site

: On - Site

5. Result of Calibration

: Without adjustment

6. Evaluate Condition

: Time Constant : - Hour 33 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 10 cm

9. Dimensions of chamber

: W = 0.5 m ; D = 0.9 m ; H = 0.5 m

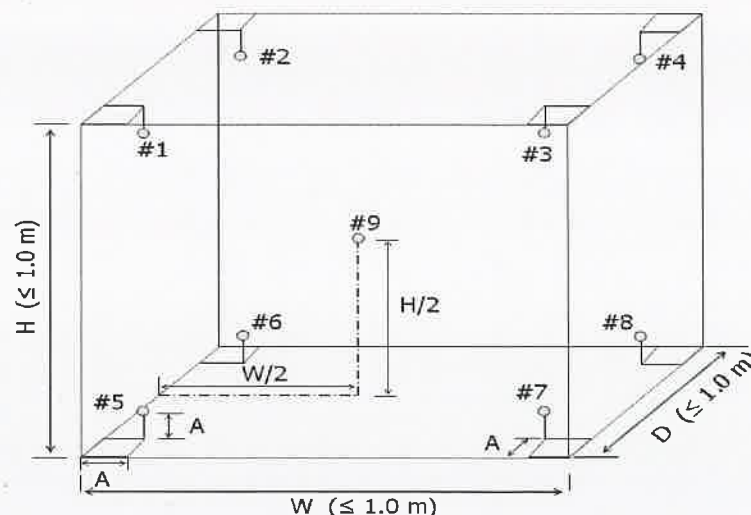


Diagram of Chamber



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 : 25 June 2023

Certificate No. : 23-0806-007

Work Order No. : 23/0806

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	19.95	20.05	20.08	19.97	19.74	20.09	20.41	19.71	19.86	0.59

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	0.43	0.67	1.19

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. : 23-0806-008

Issue Date : 25 June 2023

Work Order No. : 23/0806

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

Date of Received : 16 June 2023

Date of Calibration : 16 June 2023

Instrument Details : Description : Temperature Controlled Enclosures [Refrigerator]
Manufacturer : S-Cool
Model : SSM163T
Serial No. : 144201410
ID No. : N/A
Resolution : 0.1 °C
Location : Laboratory

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

Certificate No. : 23-0806-008

Work Order No. : 23/0806

Issue Date : 25 June 2023

Details of Calibration

1. Reference Standards Instrument

Instrument	Model	Serial No./Ins No.	Certificate No.	Due Date
Data Acquisition unit	34972A	MY49018270	22-1787-001	02 January 2024
Sensor type	RTD	CH # 301-309	22-1787-001	02 January 2024

2. Certificate traceable

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

3. Condition of item

: Used

4. Calibration site

: On - Site

5. Result of Calibration

: Without adjustment

6. Evaluate Condition

: Time Constant : - Hour 33 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 = 0.5 m ; D = 0.9 m ; H = 0.5 m

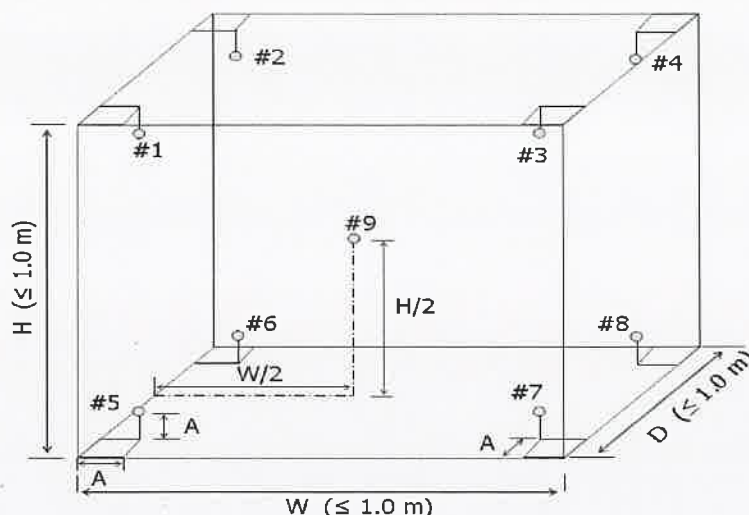


Diagram of Chamber



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

Certificate No. : 23-0806-008

Issue Date : 25 June 2023

Work Order No. : 23/0806

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	3.92	4.06	3.71	2.80	3.29	2.69	2.73	2.93	2.89	0.42

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	0.13	1.24	1.61

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 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. : 23-0806-006

Work Order No. : 23/0806

Issue Date : 25 June 2023

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 : 16 June 2023

Date of Calibration : 18 June 2023

Instrument Details : Description : Digital Thermo hygrometer
Manufacturer : Digicon
Model : TH-02A
Serial No. : 1718B0744392
ID No. : N/A
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 : 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.

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, Thawewattana, Bangkok 10170 Thailand
Tel : 0-2408-8474-5 Fax : 0-2408-8477 Email : info@crystalcal.com www.crystalcal.com



CERTIFICATE OF CALIBRATION

Certificate No. : 23-0806-006

Issue Date : 25 June 2023

Work Order No. : 23/0806

Details of Calibration

1. Reference Standards Instrument

Instrument	Serial No.	Certification	Due Date
1.1 Chilled Mirror Hygrometer	157966 / 157152	TH-0078-22	02 August 2023
1.2 Digital Thermometer with RTD	15000016 / RTD-11	22-1388-012	20 October 2023

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 Measuremen : Without Adjustment

Resolution of UUC : 0.1 °C

Calibration Point (°C)	Average Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty ± (°C)
22	22.014	21.9	+ 0.11	0.40
25	25.035	25.2	+ 0.16	0.40
28	28.037	28.1	+ 0.06	0.40

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	50.24	51	- 0.76	2.0
60	60.37	61	- 0.63	2.0
70	70.25	72	- 1.75	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. : 23-0806-005

Issue Date : 25 June 2023

Work Order No. : 23/0806

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 : 16 June 2023

Date of Calibration : 18 June 2023

Instrument Details : Description : Digital Thermo hygrometer
Manufacturer : Digicon
Model : TH-02A
Serial No. : 1718B0744383
ID No. : N/A
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 : 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.

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. : 23-0806-005

Issue Date : 25 June 2023

Work Order No. : 23/0806

Details of Calibration

1. Reference Standards Instrument

Instrument	Serial No.	Certification	Due Date
1.1 Chilled Mirror Hygrometer	157966 / 157152	TH-0078-22	02 August 2023
1.2 Digital Thermometer with RTD	15000016 / RTD-11	22-1388-012	20 October 2023

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 Measuremen : Without Adjustment

Resolution of UUC : 0.1 °C

Calibration Point (°C)	Average Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty ± (°C)
20	20.082	19.8	+ 0.282	0.40
25	25.023	24.7	+ 0.323	0.40
30	30.056	29.7	+ 0.356	0.40

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	40.34	39	+ 1.34	2.0
50	50.21	49	+ 1.21	2.0
60	60.48	59	+ 1.48	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



NSC-TISI-TIS 17025
CALIBRATION 0260

CERTIFICATE OF CALIBRATION

Certificate No. : 23-0806-010

Issue Date : 20 June 2023

Work Order No. : 23/0806

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 : 16 June 2023

Date of Calibration : 16 June 2023

Instrument Details : Description : Digital Thermometer with RTD
Manufacturer : Mettler Toledo
Model : SD20
Serial No. : 2256471
ID No. : N/A
Resolution : 0.1 °C
Location : 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 : Area Monitoring between 15°C to 40°C

Humidity : Area Monitoring between 30%RH to 85%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. Kritsada Kaewwangpa
Calibration Engineer

Approved by : 
(Mr. Anuwat Yaklermjit)
Laboratory Manager

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

Crystal Calibration Sales and Service Co., Ltd.

45/48 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. : 23-0806-010

Issue Date : 20 June 2023

Work Order No. : 23/0806

Details of Calibration

1. Reference Standards Instrument

Instrument	Serial No. / ID No.	Certification	Due Date
Thermometer Readout	3490561	22-1787-009	5-Jan-2024
Industrial Thermometer Standard (iPRT)	973798	22-1787-009	5-Jan-2024

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

3. Condition of equipment : Used

4. Calibration site : On-Site

Result of Calibration

Calibration result : Without Adjustment

Calibration point (°C)	STD. Value (°C)	UUC Reading (°C)	Correction value (°C)	Uncertainty ± (°C)
22	22.025	22.1	- 0.0750	0.25
25	25.030	25.1	- 0.0700	0.25
28	28.077	28.1	- 0.0230	0.25

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

Sheath Material : Stainless Steel

ID No. : N/A

S/N No. : C238831431

Immersion Depth : 130 mm

Dimension of Sensor : 15 mm

Length : 130 metres

UUC : Unit Under Calibration.

Handwritten signature

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. : 23-0806-009

Issue Date : 25 June 2023

Work Order No. : 23/0806

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 : 16 June 2023

Date of Calibration : 18 June 2023

Instrument Details : Description : Digital Thermometer with TC type K
Manufacturer : CHY
Model : 502
Serial No. : 56000360
ID No. : N/A
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. Sirisak Hankongkaew
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



PAGE 1/2

**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. : 23-0806-009

Issue Date : 25 June 2023

Work Order No. : 23/0806

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

Instrument	Model	Serial No. / ID No.	Certification	Due Date
Thermometer Readout	1586A	28270002	22-1787-006	5-Jan-2024
Platinum Resistance Thermometers (PRT)	5618B	967446	22-1787-006	5-Jan-2024
Thermometer Readout	1529	B6C635	PSL-T 1174/65	7-Sep-2023
Platinum Resistance Thermometers (PRTs)	5609	02701	PSL-T 1174/65	7-Sep-2023

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

TC-K No. 1 sensor diameter AWG no. 24 Length 2 metre

Calibration point (°C)	STD. Value (°C)	UUC Reading (°C)	Correction value (°C)	Uncertainty ± (°C)
0	0.002	0.0	+ 0.002	0.65
3	3.081	3.5	- 0.419	0.65
20	20.079	20.2	- 0.121	0.65

TC-K No. 2 sensor diameter AWG no. 24 Length 2 metre

Calibration point (°C)	STD. Value (°C)	UUC Reading (°C)	Correction value (°C)	Uncertainty ± (°C)
0	0.002	0.0	+ 0.002	0.65
150	150.793	150.5	+ 0.293	0.65

TC-K No. 3 sensor diameter 3mm Length 2 metre

Calibration point (°C)	STD. Value (°C)	UUC Reading (°C)	Correction value (°C)	Uncertainty ± (°C)
0	0.002	0.0	+ 0.002	0.65
380*	380.781	381.7	- 0.919	0.95

Note : (*) not accredit TISI

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

Immersion Depth : 150 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. : 23-0806-003

Issue Date : 25 June 2023

Work Order No. : 23/0806

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

Date of Received : 16 June 2023

Date of Calibration : 16 June 2023

Instrument Details : Description : Water Bath
Manufacturer : Memmert
Model : N/A
Serial No. : N920481
ID No. : 331502538
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. 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

Certificate No. : 23-0806-003

Issue Date : 25 June 2023

Work Order No. : 23/0806

Details of calibration

1. Reference Standards Instrument

Instrument	Model	Serial No. / ID No.	Certificate No.	Due Date
Data Acquisition unit	34972A	MY57006241	22-1146-008	02 September 2023
Sensor type	RTD	Channel 301 to 305	22-1146-008	02 September 2023

2. Certificate traceable

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

3. Condition of Item

: Used

4. Calibration site

: On-site

5. Result of Calibration

: Without Adjustment

6. Evaluate Condition

: Time Constant : - Hour 59 Minute At Cal. point 85 °C

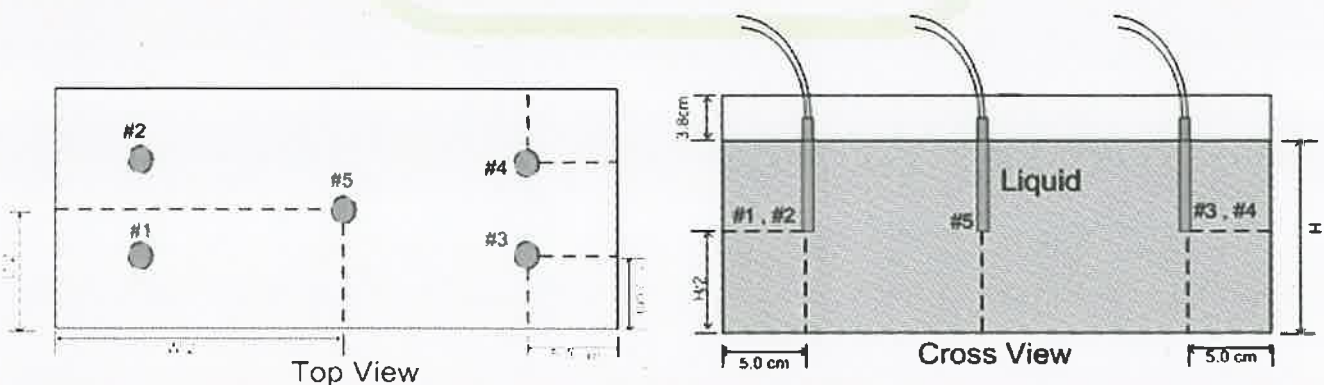
Type of Control : PID Control

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

2✓



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. : 23-0806-003

Issue Date : 25 June 2023

Work Order No. : 23/0806

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	
85.0	84.98	85.42	85.19	85.44	85.18	0.22

Table 2 : Reporting of Characterization Result

Indicator Set point (°C)	Indicator Reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
	MAX	MIN	Average			
85.0	85.0	85.0	85.0	0.15	0.48	0.61

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 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%.