

Certificate of Calibration

Certificate No. : 66-400274-1

Page : 1 of 2

Submitted by : Environmental & Resource Development Co., Ltd.
115/35-36 Moo 3 Tambon Bang Duea, Amphoe Mueang Pathumthani, Pathumthani 12000

Equipment : Air Chamber (Refrigerator)
Manufacturer : Sanden Intercool Model : SRR3-0687 AR
Range : N/A °C Resolution : 1 °C
Serial No. : SRR3675A-221100298 R ID No. : ERD NO. 01

Environment : On site calibration was carried out at the Laboratory,
Environmental & Resource Development Co., Ltd.
Ambient Temperature : (26.5 to 27.0) °C
Relative Humidity : (40 to 45) %
Line Voltage : (232.0 to 233.0) V

Date of Received : 19 May 2023

Date of Calibration : 19 May 2023

Date of Issue : 27 May 2023

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

ID No.	Cert. No.	Due Date	Traceability
400029 & 400043	66-400226-1	27 Oct 2023	National Institute of Metrology Thailand (NIMT)

Approved by :



(Bunjerd Masri)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-400274-1

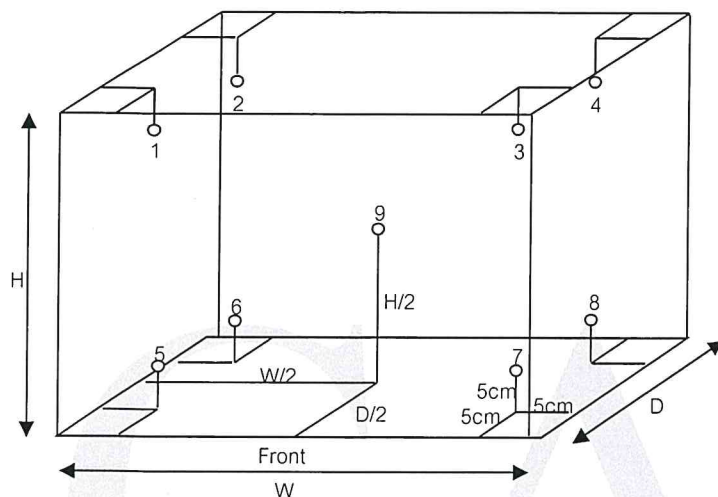
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



Inside of Chamber

W = 0.58 m

D = 0.56 m

H = 1.45 m

Capacity = 0.47 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
4	4	4	4.49	4.38	4.47	4.00	4.28	4.27	4.18	4.21	4.16	1.3

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
4	4	4	0.76	0.64	1.5

Remark The uncertainty is not combine uniformity of the air chamber

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%

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Certificate of Calibration

Certificate No. : 66-420046-1

Page : 1 of 2

Submitted by : Environmental & Resource Development Co., Ltd.
115/35-36 Moo 3 Tambon Bang Duea, Amphoe Mueang Pathumthani, Pathumthani 12000

Equipment : pH Meter with electrode

pH meter

Manufacturer : Hanna

Model : HI 5221

Range : -2.00 pH to 20.00 pH

Resolution : 0.01 pH

Serial No. : 06210023101

ID No. : ERD NO. 03

Electrode

Model : HI1131

Serial No. : 08180B0N

ID No. : ERD NO. 03

Environment : On site calibration was carried out at the Laboratory,
Environmental & Resource Development Co., Ltd.

Ambient Temperature : (25.0 to 26.0)° C

Relative Humidity : (40 to 46) %

Date of Received : 19 May 2023

Date of Calibration : 19 May 2023

Date of Issue : 27 May 2023

Calibrated by : Bunjerd Masri

Calibration Method : In-house method CAL-M4201 direct measurement by using standard voltage calibrator and using certified reference material (CRM)

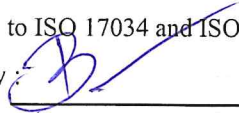
Reference Standard Instruments : This certification is traceable to the International System of Units

1. Multiproduct Calibrator

ID No.	Cert. No.	Due Date	Traceability
400005	SG-E-00473/64	27 Aug 2023	National Institute of Metrology Thailand (NIMT)

2. Standard Buffer Solution

pH	Cert. No.	Lot No.	Exp. Date	Traceability
4.008	61270213	879344	13 Mar 2025	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.986	61267169	879345	13 Mar 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
10.010	61260481	879346	13 Mar 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by : 
(Bunjerd Masri)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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www.calibratech.co.th

Certificate of Calibration

Certificate No. : 66-420046-1

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Result of Calibration :

UUC Condition As-Received : Good

Function : Electrical measurement

pH meter

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

Adjustment Curve at nominal pH	Applied Voltage (mV)	Nominal Value (pH)	UUC Reading		Correction (mV)	Uncertainty (± mV)
			(pH)	(mV)		
4, 7, 10	177.4800	4	4.00	177.5	0.0	0.12
	0.0000	7	7.00	0.0	0.0	0.086
	-177.4800	10	10.00	-177.4	-0.1	0.12

Function : pH meter with electrode

Performing a three - buffer standard curve using buffer nominal pH (4,7,10)

Adjustment Curve at nominal pH	Standard Buffer (pH)	UUC Reading (pH)	Correction (pH)	Uncertainty (± pH)
4, 7, 10	4.008	4.01	0.00	0.0097
	6.986	7.00	-0.01	0.012
	10.010	10.01	0.00	0.014

Remark

UUC : Unit Under Calibration

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%

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Certificate of Calibration

Certificate No. : 66-400275-1

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Submitted by : Environmental & Resource Development Co., Ltd.
115/35-36 Moo 3 Tambon Bang Duea, Amphoe Mueang Pathumthani, Pathumthani 12000

Equipment : Digital Thermometer with Thermistor probe
Temperature Indicator

Manufacturer :	Hanna	Model :	HI 5221
Range :	N/A °C	Resolution :	0.1 °C
Serial No. :	06210023101	ID No. :	ERD NO. 03
Thermistor probe			
Model :	HI7662-W	Sheath Material :	Stainless
Diameter :	3.5 mm.	Length :	110 mm.
Serial No. :	TH 124821	ID No. :	ERD NO. 03

Environment : On site calibration was carried out at the Laboratory,
Environmental & Resource Development Co., Ltd.

Ambient Temperature : (25.0 to 26.0) °C
Relative Humidity : (40 to 46) %
Line Voltage : (232.0 to 233.0) VAC

Date of Received : 19 May 2023

Date of Calibration : 19 May 2023

Date of Issue : 27 May 2023

Calibrated by : Bunjerd Masri

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4003
by compared with PRT in the dry-well calibrator at the constant controlled temperature.

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
400002	TT-0074-22	20 Jun 2024	National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
400033	22E569	22 Feb 2024	National Institute of Metrology Thailand (NIMT)

Approved by: 
(Bunjerd Masri)
Supervisor



Certificate of Calibration

Certificate No. : 66-400275-1

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Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Immersion Depth (mm.)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (±°C)
110	20.004	20.0	0.0	0.19
110	25.008	25.0	0.0	0.19
110	30.002	30.0	0.0	0.19

Remark

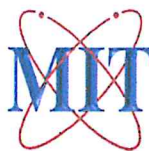
UUC : Unit Under Calibration

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%

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MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

214 Bangwack Rd. Bangpai Bangkae Bangkok 10160
Tel.: 0-2865-4647-8 Fax: 0-2865-4649 <http://www.mit.in.th>



CALIBRATION CERTIFICATE

Certificate No. : L202308355-0002

Date Issued : 07-Sep-23

Customer : Environmental & Resource Development Co., Ltd.
34/304-305 Moo 5 Soi Watpaikheaw Srongprapa Rd. Srikan, Donmuang
Bangkok 10210

Equipment : Digital Thermo- Hygrometer

Manufacturer : Testo

Model : 608-H1

Serial No. : 41346417

ID No./Tag No. : -

Date Received : 31-Aug-23

Date Calibrated : 04-Sep-23

Calibrated by : Mr. Apiwat Peanrungrot

Calibration Method or Calibration Procedure Used

In-house method : CP-19 by comparing against Standard Digital Humidity / Temperature Meter

This certificate is traceable to national standards, which realize the units of measurement according to the International System of Units (SI).

Result of Calibration

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor $k = 2$, providing a level confidence approximately 95 percent.

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Approved by:

Sarayuth T.
(Mr. Sarayuth Tochua)



Page 1 of 2

Certificate No. : L202308355-0002

Environment : Ambient Temperature : $(25 \pm 2) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15)\%\text{RH}$

Function : Temperature Measurement

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

STD	UUC Reading	UUC Error	Measurement
Reading ($^\circ\text{C}$)	($^\circ\text{C}$)	($^\circ\text{C}$)	Uncertainty ($\pm^\circ\text{C}$)
20.00	20.0	0.00	0.35
25.00	24.9	-0.10	0.35
30.00	29.8	-0.20	0.35

Function : Humidity Measurement

Temperature Control : $(25 \pm 5)^\circ\text{C}$

STD	UUC Reading	UUC Error	Measurement
Reading ($\%\text{RH}$)	($\%\text{RH}$)	($\%\text{RH}$)	Uncertainty ($\pm\%\text{RH}$)
39.98	42.1	2.12	2.5
50.02	52.3	2.28	2.5
60.02	63.5	3.48	2.5

STD = Standard

UUC = Unit Under Calibration

Description of UUC : Range 0 to 50 $^\circ\text{C}$ Internal Sensor / 10 to 95 $\%\text{RH}$

Resolution 0.1 $^\circ\text{C}$ / 0.1 $\%\text{RH}$

Condition As-Received : New Item

The measurement results and statements of conformity with specification only relate to the item calibrated.

Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Certificate No. L202210258-006 for Digital Thermometer with Probe (Fluke) Serial No. 5856603, Due 10-Nov-23

MIT Certificate No. L202209048-008 for Digital Humidity Meter Serial No. F4260117, Due 30-Oct-23

End of Certificate

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



Accuracy Calibration Certificate

Customer

Company: Environmental Resource Development
Address: 115/35-36 Moo3, Bang Duea
City: Mueang Pathumthani **Contact:** Ngamsap Poomdate
Zip / Postal: 12000
State / Province: Pathum Thani
Order Number: 
0 3 7 0 1 9 6 9 1 3

Weighing Device

Manufacturer: Mettler Toledo **Instrument Type:** Weighing Instrument
Model: MS205DU **Asset Number:** ERD No.02
Serial No.: C217935519 **Terminal Model:** N/A
Building: N/A **Terminal Serial No.:** N/A
Floor: 3 **Terminal Asset No.:** N/A
Room: Weighing

Range	Max. Capacity	Readability (d)
1	82 g	0.00001 g
2	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: 25.4 °C	End: 25.6 °C	Start: 54.5 %	End: 54.3 %
As Left	Start: 25.6 °C	End: 25.5 °C	Start: 54.6 %	End: 54.8 %

As Found Calibration Date: 10-Mar-2023 **Calibrator:** 
As Left Calibration Date: 10-Mar-2023
Issue Date: 13-Mar-2023
Approved Signatory: 
Technical Manager / Head of Calibration Center

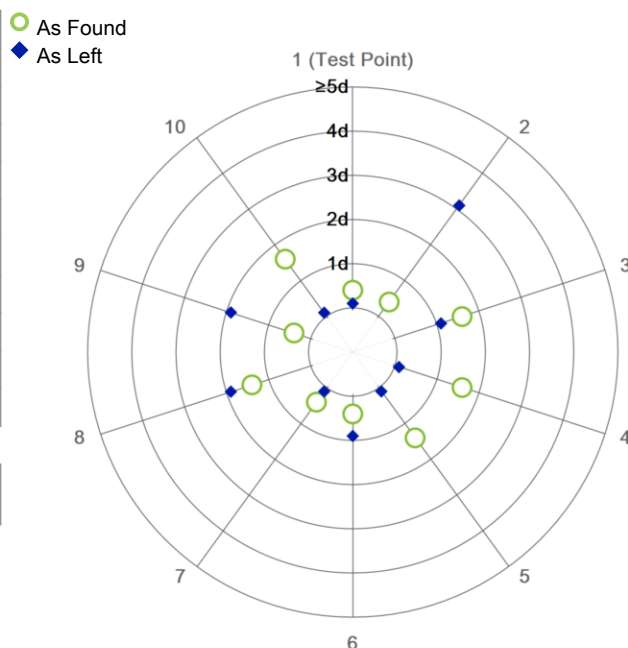
Measurement Results

Repeatability

Test Load: 70 g

	As Found	As Left
1	70.00030 g	70.00002 g
2	70.00030 g	69.99999 g
3	70.00032 g	70.00001 g
4	70.00032 g	70.00002 g
5	70.00029 g	70.00002 g
6	70.00030 g	70.00003 g
7	70.00030 g	70.00002 g
8	70.00029 g	70.00004 g
9	70.00030 g	70.00004 g
10	70.00032 g	70.00002 g

Standard Deviation	0.000012 g	0.000014 g
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The "d" in the graph represents the readability of the range/interval in which the test was performed.

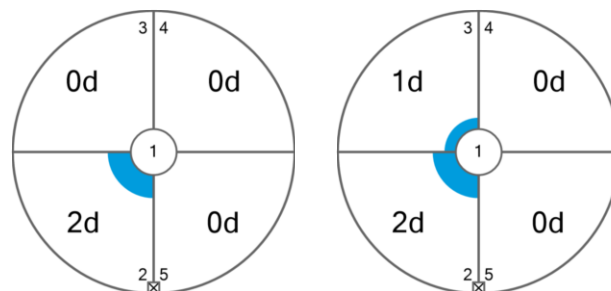
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0004 g	99.9999 g
2	100.0006 g	100.0001 g
3	100.0004 g	100.0000 g
4	100.0004 g	99.9999 g
5	100.0004 g	99.9999 g

Maximum Deviation	0.0002 g	0.0002 g
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As Found

As Left

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

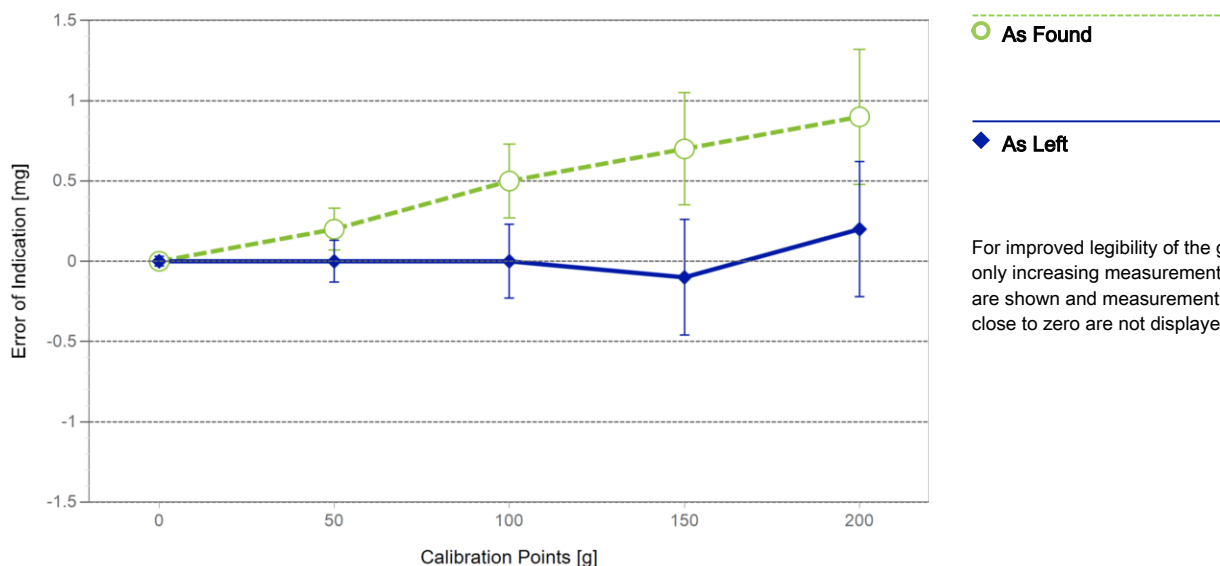
Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.00000 g	0.00000 g	0.00000 g	0.024 mg	2
2	0.01000 g	0.00998 g	-0.00002 g	0.026 mg	2
3	0.05001 g	0.05002 g	0.00001 g	0.027 mg	2
4	0.10001 g	0.10001 g	0.00000 g	0.029 mg	2
5	0.50001 g	0.50000 g	-0.00001 g	0.033 mg	2
6	1.00000 g	1.00001 g	0.00001 g	0.036 mg	2
7	5.00000 g	4.99998 g	-0.00002 g	0.051 mg	2
8	50.00000 g	50.00020 g	0.00020 g	0.13 mg	2
9	100.0000 g	100.0005 g	0.0005 g	0.23 mg	2
10	150.0000 g	150.0007 g	0.0007 g	0.35 mg	2
11	199.9998 g	200.0007 g	0.0009 g	0.42 mg	2

As Left

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.00000 g	0.00000 g	0.00000 g	0.030 mg	2
2	0.01000 g	0.00999 g	-0.00001 g	0.031 mg	2
3	0.05001 g	0.05000 g	-0.00001 g	0.032 mg	2
4	0.10001 g	0.10000 g	-0.00001 g	0.033 mg	2
5	0.50001 g	0.50002 g	0.00001 g	0.037 mg	2
6	1.00000 g	1.00000 g	0.00000 g	0.040 mg	2
7	5.00000 g	5.00000 g	0.00000 g	0.054 mg	2
8	50.00000 g	50.00000 g	0.00000 g	0.13 mg	2
9	100.0000 g	100.0000 g	0.0000 g	0.23 mg	2
10	150.0000 g	149.9999 g	-0.0001 g	0.36 mg	2
11	199.9998 g	200.0000 g	0.0002 g	0.42 mg	2



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.

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.:	WS53	Date of Issue:	10-Aug-2022
Certificate Number:	180948	Calibration Due Date:	09-Aug-2023

Thermo Hygrometer

Equipment No.:	IN284	Date of Issue:	17-Feb-2023
Certificate Number:	SG-G-00143/66	Calibration Due Date:	15-Feb-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: $2.0 \cdot 10^{-6} / K$

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

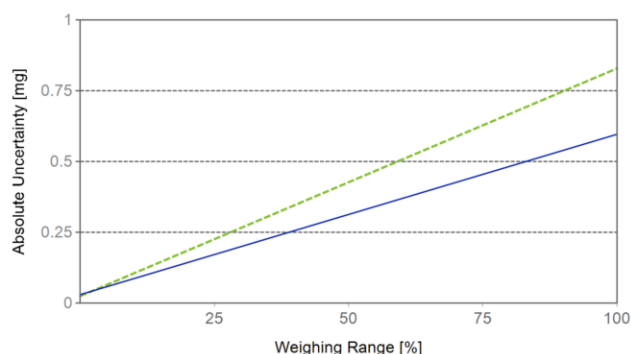
Linearization of Uncertainty Equation

Range			As Found	As Left
	d	Max		
1	0.00001 g	82 g	$U_1 = 0.025 \text{ mg} + 0.00981 \text{ mg/g} \cdot R$	$U_1 = 0.030 \text{ mg} + 0.00691 \text{ mg/g} \cdot R$
2	0.0001 g	220 g	$U_2 = 0.06 \text{ mg} + 0.00983 \text{ mg/g} \cdot R$	$U_2 = 0.06 \text{ mg} + 0.00698 \text{ mg/g} \cdot R$

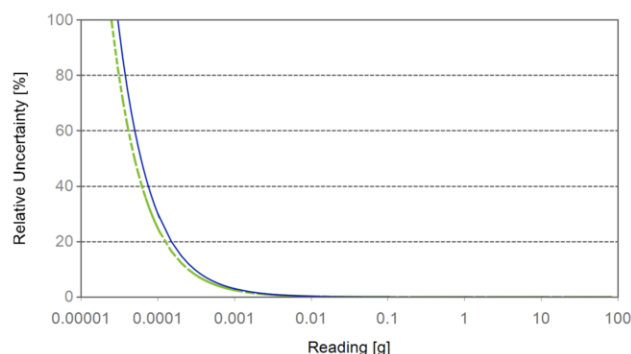
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

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

Net Indication	As Found		As Left	
0.00220 g	0.025 mg	1.1%	0.030 mg	1.4%
0.02200 g	0.025 mg	0.11%	0.030 mg	0.14%
0.22000 g	0.027 mg	0.012%	0.032 mg	0.014%
2.20000 g	0.047 mg	0.0021%	0.045 mg	0.0021%
220.0000 g	2.2 mg	0.0010%	1.6 mg	0.00073%



As Found



As Left

The weighing range shown in the absolute uncertainty graph refers to the first interval/range of the device.

GWP® Certificate



As
Found



As
Left



The weighing device meets the given process requirements.

The weighing device meets the given process requirements.

Tests Performed:



As Found



As Left

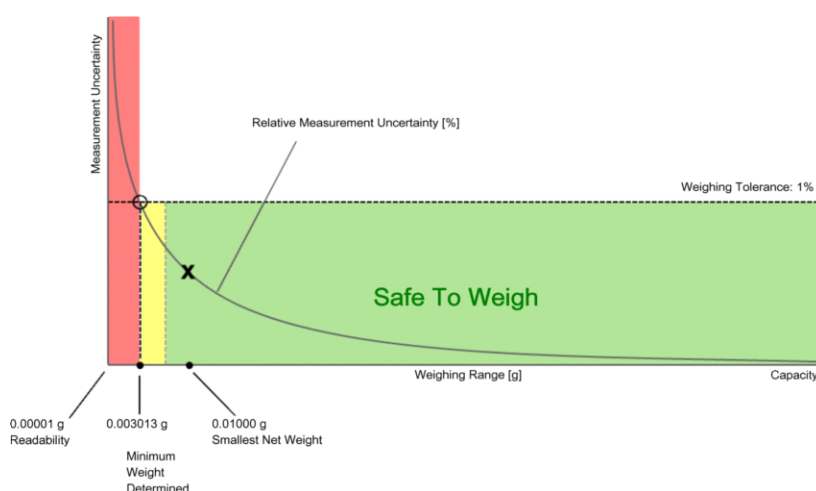
Process Requirements

Weighing Tolerance: 1%

Smallest Net Weight: 0.01000 g

Safety Factor: 2

Safe Weighing Range



While the values in this graph reflect the actual calibration results, the measurement uncertainty curves are simply a visual representation. This graph reflects As Left testing, unless only As Found was performed.

Minimum Weight

As Found Minimum Weight Table

Range 1

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.025101 g	0.050705 g	0.076827 g	0.130687 g	0.275593 g
0.2%	0.012489 g	0.025101 g	0.037840 g	0.063700 g	0.130687 g
0.5%	0.004981 g	0.009981 g	0.015001 g	0.025101 g	0.050705 g
1%	0.002488 g	0.004981 g	0.007479 g	0.012489 g	0.025101 g
2%	0.001243 g	0.002488 g	0.003734 g	0.006229 g	0.012489 g
5%	0.000497 g	0.000995 g	0.001492 g	0.002488 g	0.004981 g

The minimum weight table applies to the fine range of the weighing device.



Pass: The determined minimum weight meets the requirement for the smallest net weight.

As Left Minimum Weight Table

Range 1

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.030320 g	0.061066 g	0.092245 g	0.155942 g	0.323460 g
0.2%	0.015108 g	0.030320 g	0.045639 g	0.076601 g	0.155942 g
0.5%	0.006031 g	0.012078 g	0.018142 g	0.030320 g	0.061066 g
1%	0.003013 g	0.006031 g	0.009052 g	0.015108 g	0.030320 g
2%	0.001506 g	0.003013 g	0.004521 g	0.007541 g	0.015108 g
5%	0.000602 g	0.001205 g	0.001807 g	0.003013 g	0.006031 g

The minimum weight table applies to the fine range of the weighing device.



Pass: The determined minimum weight meets the requirement for the smallest net weight.

At these net minimum weight values, the measurement uncertainty of the weighing device is equal to or less than 1/1 (no safety factor), 1/2, 1/3, 1/5, or 1/10 of the required tolerance. The values are calculated with $k = 2$ and based on the linear formula of the measurement uncertainty of the weighing device in use.

The safety factor for As Found is always 1. This implies no safety factor. As Found testing looks at the behavior of the instrument from the past until test occurred. For the past, it is necessary to know that the tolerance was met, but not the safety factor. The safety factor is a proactive measure to apply for future measurements.

Notes on minimum weight values in above table:

1. If "N/A" is shown above, no appropriate value could be calculated.
2. METTLER TOLEDO is not responsible for the definition of the process requirements.

Measurement Results

Results Summary

	Repeatability	Eccentricity	Error of Indication
As Found	✓	✓	✓
As Left	✓	✓	✓

✓ = Passed

✗ = Failed

⚠ = Safety Factor not met

Repeatability

Test Load: 70 g

Tolerance	Control Limit	As Found		As Left	
		Std. Deviation	Result	Std. Deviation	Result
0.1%	0.000005 g	0.000012 g	✗	0.000014 g	✗
0.2%	0.000010 g		✗		✗
0.5%	0.000025 g		✓		⚠
1%	0.000050 g		✓		✓
2%	0.000100 g		✓		✓
5%	0.000250 g		✓		✓

The weighing tolerance is met if the standard deviation is less than or equal to the corresponding control limit.

Eccentricity

Test Load: 100 g

Tolerance	Control Limit	As Found		As Left	
		Deviation	Result	Deviation	Result
0.1%	0.0500 g	0.0002 g	✓	0.0002 g	✓
0.2%	0.1000 g		✓		✓
0.5%	0.2500 g		✓		✓
1%	0.5000 g		✓		✓
2%	1.0000 g		✓		✓
5%	2.5000 g		✓		✓

The weighing tolerance is met if the deviation is less than or equal to the corresponding control limit.

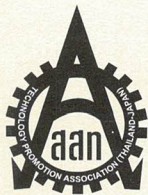
Error of Indication**As Found**

		Control limits for various weighing tolerances					
Reference Value	Error	0.1%	0.2%	0.5%	1%	2%	5%
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A	N/A
50.00000 g	0.00020 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	0.50000 g	1.25000 g
100.0000 g	0.0005 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g
150.0000 g	0.0007 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
199.9998 g	0.0009 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓	✓

As Left

		Control limits for various weighing tolerances					
Reference Value	Error	0.1%	0.2%	0.5%	1%	2%	5%
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A	N/A
50.00000 g	0.00000 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	0.50000 g	1.25000 g
100.0000 g	0.0000 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g
150.0000 g	-0.0001 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
199.9998 g	0.0002 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓	✓

The weighing tolerance is met if the error (of indication) for each test point is less than or equal to the corresponding control limit for that particular weighing tolerance. Results at or close to the zero point cannot be assessed.



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



Cert. No.: 23TM1101

Page : 1 of 3

Certificate of Calibration

Equipment : Incubator

Manufacturer : Songserm Intercool

Model : -

Serial No. : -

ID No. : CHI-001

Submitted by : Environment & Laboratory Co.,Ltd.
40 Soi Liangmueangnonthaburi 13,
Talad Kwan, Mueang,
Nonthaburi 11000

Location : Room No. 301

Received Order : 12 July 2023

Calibration Date : 13 July 2023

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Preecha Hlahib

Approved by :

Malee

Approved Signatory

- () Pornthippa Tameyakul
(☒) Malee Butkruea
() Suwit Imjai

Issue Date : 24 July 2023

The Uncertainties are for a confidence probability of approximately 95%

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

A 0056479



Equipment : Incubator
 Condition As-Received : Used Item
 Reference : 2307-0094OC-5

Cert. No.: 23TM1101
 Page : 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
 The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY41021843	22LM172	TPA	27 Dec 2023

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

3. This certification is traceable to the International System of Unit.

Remark : TPA : Technology Promotion Association (Thailand - Japan)

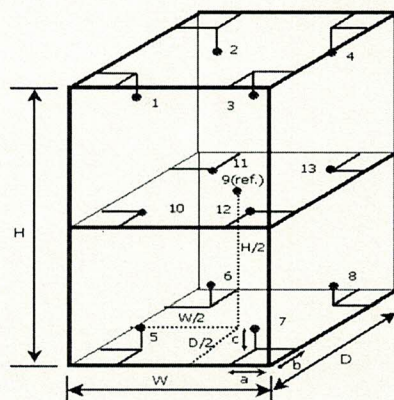
Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	32	33
REL.Humi. (%)	50	53
AC Supply (Volt)	221	221

Position :	Ref. Std. ID No.:
1	18-04RTD-01
2	18-04RTD-02
3	18-04RTD-03
4	18-04RTD-04
5	18-04RTD-05
6	18-04RTD-06
7	18-04RTD-07
8	18-04RTD-08
9 (ref.)	18-04RTD-09
10	18-04RTD-10
11	21-04RTD-11
12	21-04RTD-12
13	21-04RTD-13



Dimension of Chamber :

D = 0.60 m
 W = 0.60 m
 H = 1.2 m
 Capacity = 0.43 m³

Probe Installation Details :

a = 10 cm
 b = 10 cm
 c = 10 cm

Malu.



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2307-0094OC-5
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 23TM1101

Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor <i>k</i>
20.0	20.0	20.0	0.12	0.56	0.92	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
20.0	1	2	3	4	5	6	7	8	9 (ref.)	0.30
	19.805	19.696	20.297	20.050	19.622	20.160	19.570	19.567	19.762	
	10	11	12	13						
	19.646	19.865	19.923	19.820						

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

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

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity.

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

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Malu.

Certificate of Calibration

Certificate No. : 66-400274-2

Page : 1 of 2

Submitted by : Environmental & Resource Development Co., Ltd.
115/35-36 Moo 3 Tambon Bang Duea, Amphoe Mueang Pathumthani, Pathumthani 12000

Equipment : Water Bath
Manufacturer : M-LAB Model : WNB 15
Range : N/A °C Resolution : 0.1 °C
Serial No. : 0341 ID No. : ERD NO. 05

Environment : On site calibration was carried out at the Laboratory,
Environmental & Resource Development Co., Ltd.
Ambient Temperature : (28.0 to 29.0) °C
Relative Humidity : (40 to 45) %
Line Voltage : (232.0 to 233.0) V

Date of Received : 19 May 2023

Date of Calibration : 19 May 2023

Date of Issue : 27 May 2023

Calibrated by : Permpon Chanpu

Calibration Method : This instrument was calibrated by In-house method CAL-M4006 based on ASTM E715-80
The temperature scale used was based on ITS-90

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

ID No.	Cert. No.	Due Date	Traceability
400029 & 400031	66-400225-1	28 Oct 2023	National Institute of Metrology Thailand (NIMT)

Approved by :



(Bunjerd Masri)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

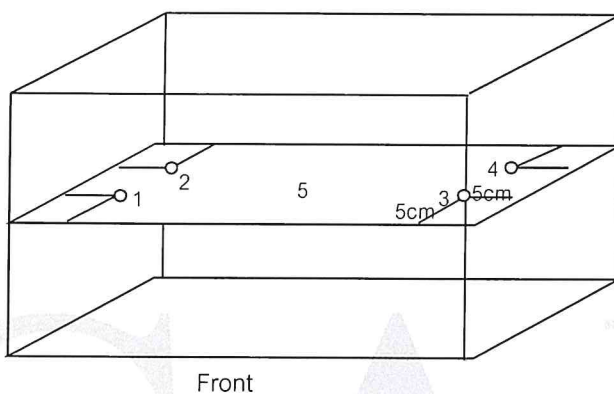
Certificate No. : 66-400274-2

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement



Test Point (° C)	Setting Temperature (° C)	Indicating Temperature (° C)	Measured Temperature (° C) @ Sensor					Uncertainty (± ° C)	Measured Uniformity (° C)	Measured Stability (° C)
			No.							
			1	2	3	4	5			
80.0	80.0	80.0	79.94	79.96	79.97	80.04	80.16	0.24	0.36	0.13
85.0	85.0	85.0	85.13	85.21	85.18	85.28	85.38	0.24	0.42	0.13
90.0	90.0	90.0	90.03	90.18	90.11	90.22	90.27	0.25	0.40	0.13
95.0	95.0	95.0	95.14	95.10	95.26	95.26	95.36	0.24	0.41	0.11

Remark The uncertainty is not combine uniformity of the water bath

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%

- oOo -

(Signature)



Certificate of Calibration

Certificate No. : 66-400274-3 **Page : 1 of 2**

Submitted by : Environmental & Resource Development Co., Ltd.
115/35-36 Moo 3 Tambon Bang Duea, Amphoe Mueang Pathumthani, Pathumthani 12000

Equipment : Air Chamber (Oven)
 Manufacturer : Memmert Model : UF 30
 Range : N/A °C Resolution : 0.1 °C
 Serial No. : B121.1551 ID No. : ERD NO. 04

Environment : On site calibration was carried out at the Laboratory,
 Environmental & Resource Development Co., Ltd.
 Ambient Temperature : (28.0 to 29.0) °C
 Relative Humidity : (40 to 45) %
 Line Voltage : (232.0 to 233.0) V

Date of Received : 19 May 2023
Date of Calibration : 19 May 2023
Date of Issue : 27 May 2023
Calibrated by : Permpoon Chanpu
Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
400029 & 400030	66-400227-1	24 Oct 2023	National Institute of Metrology Thailand (NIMT)

Approved by :



(Bunjerd Masri)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-400274-3

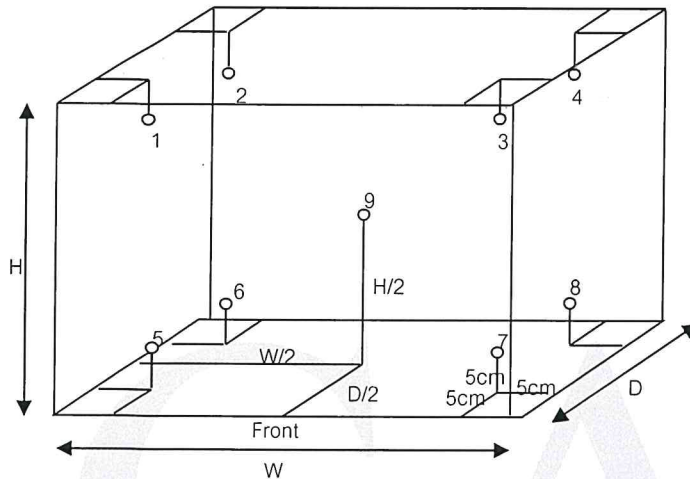
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



Inside of Chamber

W = 0.40 m

D = 0.25 m

H = 0.32 m

Capacity = 0.03 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
104.0	104.0	104.0	103.7	103.7	103.7	103.9	103.8	103.8	103.7	104.2	103.9	0.69
150.0	150.0	150.0	149.7	150.0	149.5	150.0	150.0	150.1	149.2	150.9	150.1	0.84
180.0	180.0	180.0	180.0	180.6	179.7	180.3	180.5	180.6	179.5	181.0	180.4	0.95

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
104.0	104.0	104.0	0.4	0.1	0.8
150.0	150.0	150.0	1.0	0.2	1.9
180.0	180.0	180.0	1.1	0.2	1.9

Remark The uncertainty is not combine uniformity of the air chamber

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k = 2 , providing a level of confidence of approximately 95%

- o0o -



Certificate of Calibration

Certificate No. : 66-300323-8

Page : 1 of 2

Submitted by : Environmental & Resource Development Co.,Ltd.
115/35-36 Moo 3 Tambon Bang Duea, Amphoe Mueang Pathumthani, Pathumthani 12000

Equipment : Burette
Manufacturer : EM Class : A
Capacity : 50 ml Graduation : 0.1 ml
ID No. : BU50/01/23

Environment : Ambient Temperature : (20 ± 3) °C
Relative Humidity : (50 ± 10) %
Air Pressure : 1006.0 mbar.

Date of Received : 19 May 2023

Date of Calibration : 26 May 2023

Date of Issue : 26 May 2023

Calibrated by : Areerat Sombun

Calibration Method : In-house method CAL-M3001 based on ASTM E 542-01

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

Electronic Balance

ID No.	Cert. No.	Due Date	Traceability
241005	65-200370-4	02 Jun 2023	National Institute of Metrology (Thailand) (NIMT)

Approved by :



(Wipa Tovadee)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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www.calibratech.co.th

Certificate of Calibration

Certificate No. : 66-300323-8

Page : 2 of 2

Result of Calibration : This result of true Volume is referred to standard temperature at 20 °C

UUC Condition As-Received : Good

Delivery Time : 41.70 sec.

Nominal Volume (ml)	Measuring Volume (ml)
10	9.9998
25	25.0032
50	49.9788

Uncertainty of measurement with in $\pm$ 0.011 ml

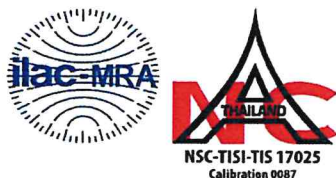
This result of calibration was found accurate as shown on date and place of calibration only.

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.00$,
providing a level of confidence of approximately 95%

- o0o -

D.





Certificate of Calibration

Equipment:	SPECTROPHOTOMETER	Certificate No.:	C06230549
Model:	DR3900	Issued Date:	14 November 2023
Serial No. (or ID.):	1920252	Job No.:	WO-00009615
Manufacturer:	HACH	Page:	1 of 3
Condition:	In Condition		

Customer: ENVIRONMENTAL & RESOURCE DEVELOPMENT CO.,LTD.
115/35-36 Moo 3, Tambol Bang Duea
Amphur Muang, Pathumthanee 12000 Thailand.

Environment Condition:

Temperature	26.8	°C	±	0.5	°C
Humidity	55.9	%RH	±	2.2	%RH

Calibration Place: ENVIRONMENTAL & RESOURCE DEVELOPMENT CO.,LTD.
115/35-36 Moo 3, Tambol Bang Duea
Amphur Muang, Pathumthanee 12000 Thailand.

Calibration By: Mr.Siwapan Srijan

Calibration Date: 14 November 2023

The Method used: In house method, CAL-WI-24, base on ASTM E 275-08 and ASTM E 387-04

Traceability: This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Starna Scientific Limited.

The standard for Wavelength Certificate No. 105931 and 105898

The standard for Photometric Certificate No. 105940

The standard for Stray light Certificate No. 101040



(Mr. Siwapan Srijan)

Person in charge



(Mr. Nitinun Srihawan)

Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด

DKSH Technology Limited

2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260

2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Calibration Results:

Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 5 nm and UUC at 5 nm

Standard Wavelength	Unit Under Calibration	Correction	Uncertainty
334.50	334	0.50	0.59
361.40	361	0.40	0.59
418.40	418	0.40	0.59
638.00	638	0.00	0.59
441.29	441	0.29	0.59
479.88	480	-0.12	0.59
513.75	513	0.75	0.59
585.56	585	0.56	0.59
879.68	880	-0.32	0.59

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.5890	0.588	0.0010	0.0045
	0.7604	0.758	0.0024	0.0045
	1.0241	1.024	0.0001	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.5782	0.577	0.0012	0.0045
	0.7430	0.741	0.0020	0.0045
	1.0016	1.001	0.0006	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.5283	0.529	-0.0007	0.0045
	0.6854	0.685	0.0004	0.0045
	0.9509	0.952	-0.0011	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.5457	0.544	0.0017	0.0045
	0.6944	0.692	0.0024	0.0045
	0.9965	0.995	0.0015	0.0045

Calibration Results:
Without Adjustment
Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
590 nm	0.0000	0.000	0.0000	0.0045
	0.5837	0.581	0.0027	0.0045
	0.7223	0.719	0.0033	0.0045
	1.0935	1.089	0.0045	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.5675	0.565	0.0025	0.0045
	0.6900	0.687	0.0030	0.0045
	1.0862	1.083	0.0032	0.0045

Stray light *

Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%T)	Absorbance (A)
391.94 +/- 0.11 nm	392	3.5	1.456

* Calibration Marked " Not TISI Accredited " in this Certificate have been included for completeness.

The End of Certificate

Statements of conformity:

This conformity certificate documents the validity of the following statements of conformity based on the measurement results of corresponding calibration certificate:

The error of temperature determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, ASTM E 275-08 and ASTM E 387-04. Therefore, those parameters have not been assessed separately.

Tolerance and Decision rules:

Assessment of the conformity of the measurement device are done based on direct comparison of the relevant measurement results with the tolerances and decision rule are prescribed by the customer.

- Decision rule :** ☐ Choice A Binary Statement for Simple Acceptance Rule ($w = 0$), Specific Risk < 50% PFA.
- ☒ Choice B Non-binary statement with guard band ($w = 1 U$), Pass or Fail Specific Risk < 2.5% PFA and Condition Pass or Condition Fail Specific Risk < 50% PFA.
- ☐ Choice C Customer defined, Customers may define arbitrary multiple of r to have applied as guard band ($w = r U$).
- ; PFA – Probability of False Accept



(Nitinun Srihawan)

Authorized signatory

Without Adjustment**Wavelength Accuracy (nm), The spectral bandwidth of Std at 5 nm and UUC at 5 nm**

Unit Under Calibration	Correction	Guard Band (w)	Tolerance ($\pm$)	Conformity
334	0.50	0.59	3	Pass
361	0.40	0.59	3	Pass
418	0.40	0.59	3	Pass
638	0.00	0.59	3	Pass
441	0.29	0.59	3	Pass
480	-0.12	0.59	3	Pass
513	0.75	0.59	3	Pass
585	0.56	0.59	3	Pass
880	-0.32	0.59	3	Pass

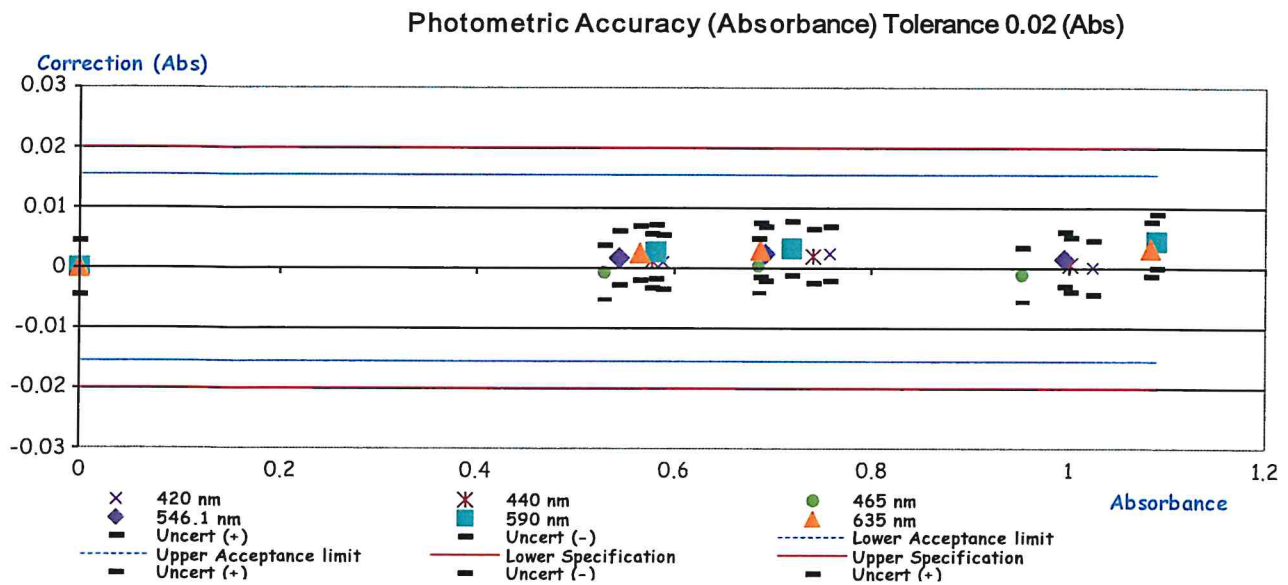
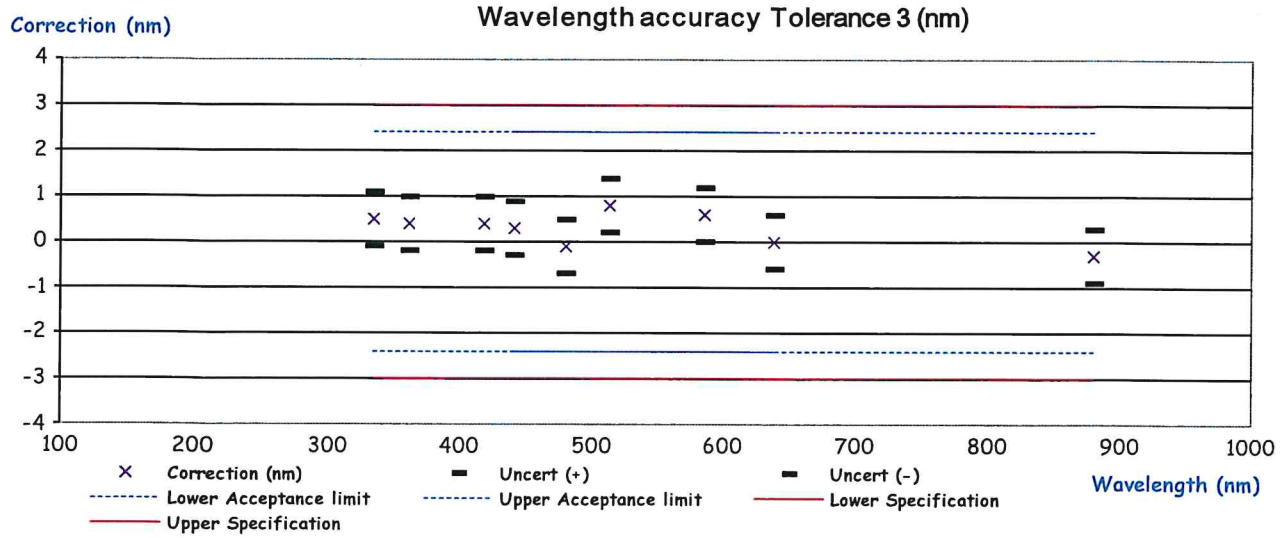
The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

Without Adjustment
Photometric Accuracy (Absorbance)

Wavelength	Unit Under Calibration	Correction	Guard Band (w)	Tolerance ($\pm$)	Conformity
420 nm	0.000	0.0000	0.0045	0.020	Pass
	0.588	0.0010	0.0045	0.020	Pass
	0.758	0.0024	0.0045	0.020	Pass
	1.024	0.0001	0.0045	0.020	Pass
440 nm	0.000	0.0000	0.0045	0.020	Pass
	0.577	0.0012	0.0045	0.020	Pass
	0.741	0.0020	0.0045	0.020	Pass
	1.001	0.0006	0.0045	0.020	Pass
465 nm	0.000	0.0000	0.0045	0.020	Pass
	0.529	-0.0007	0.0045	0.020	Pass
	0.685	0.0004	0.0045	0.020	Pass
	0.952	-0.0011	0.0045	0.020	Pass
546.1 nm	0.000	0.0000	0.0045	0.020	Pass
	0.544	0.0017	0.0045	0.020	Pass
	0.692	0.0024	0.0045	0.020	Pass
	0.995	0.0015	0.0045	0.020	Pass
590 nm	0.000	0.0000	0.0045	0.020	Pass
	0.581	0.0027	0.0045	0.020	Pass
	0.719	0.0033	0.0045	0.020	Pass
	1.089	0.0045	0.0045	0.020	Pass
635 nm	0.000	0.0000	0.0045	0.020	Pass
	0.565	0.0025	0.0045	0.020	Pass
	0.687	0.0030	0.0045	0.020	Pass
	1.083	0.0032	0.0045	0.020	Pass

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

The End of Statements of Conformity



ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00009615

ชนิดเครื่องมือ: SPECTROPHOTOMETER

รุ่น: DR3900

หมายเลขเครื่อง: 1920252

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
14 Nov 2023			14 Nov 2023		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
☒	☐	1. ความสมบูรณ์เครื่อง	☒	☐	
☒	☐	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	☒	☐	
☒	☐	3. สวิทช์ ปิด – เปิด เครื่อง (On-Off Swicth)	☒	☐	
☒	☐	4. ปุ่มกด (Keypad)	☒	☐	
☒	☐	5. หน้าจอ (Display, Screen Contrast)	☒	☐	
		Spectrophotometer			
☐	☐	6. แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC	☐	☐	
☒	☐	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	☒	☐	807 = 807.0 nm
☐	☐	8. ความยาวคลื่น (Wavelength Check)	☐	☐	
☐	☐	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	☐	☐	
☒	☐	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	☒	☐	
☐	☐	11. ช่องวัดหลายตัวอย่าง (Carousel Module)	☐	☐	
		pH Meter and Conductivity Meter			
☐	☐	12. อิเล็กโทรด (Electrode and Connection Cable)	☐	☐	
☐	☐	13. ระดับสารละลายใน Electrode (Level KCl)	☐	☐	
☐	☐	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)	☐	☐	
☐	☐	15. ขาจับอิเล็กโทรด (Stand)	☐	☐	
		Turbidimeter			
☐	☐	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	☐	☐	
☐	☐	17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่เกิน 3.0)	☐	☐	
		Automatic titrator			
☐	☐	18. สภาพ Piston Burettes	☐	☐	
☐	☐	19. Function Rinsing and Dosing	☐	☐	
☐	☐	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	☐	☐	

เพิ่มเติม/ข้อแนะนำ :

Mr.Siwapan Srijan

Service Engineer

Certificate of Calibration

Certificate No. : 67-400257-1

Page : 1 of 2

Submitted by : Environmental & Resource Development Co., Ltd.
115/35-36 Moo 3 Tambon Bang Duea, Amphoe Mueang Pathumthani, Pathumthani 12000

Equipment : Temperature controlled enclosure (Refrigerator)
Manufacturer : Sanden Intercool Model : SRR3-0687 AR
Range : N/A °C Resolution : 1 °C
Serial No. : SRR3675A-221100298 R ID No. : ERD NO. 01

Environment : On site calibration was carried out at the Laboratory,
Environmental & Resource Development Co., Ltd.
Ambient Temperature : (25.5 to 26.0) °C
Relative Humidity : (40 to 45) %
Line Voltage : (232.0 to 233.0) V

Date of Received : 07 July 2024

Date of Calibration : 07 May 2024

Date of Issue : 10 May 2024

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

ID No.	Cert. No.	Due Date	Traceability
400029 & 400030	67-400246-1	25 Oct 2024	National Institute of Metrology Thailand (NIMT)

Approved by :



(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-400257-1

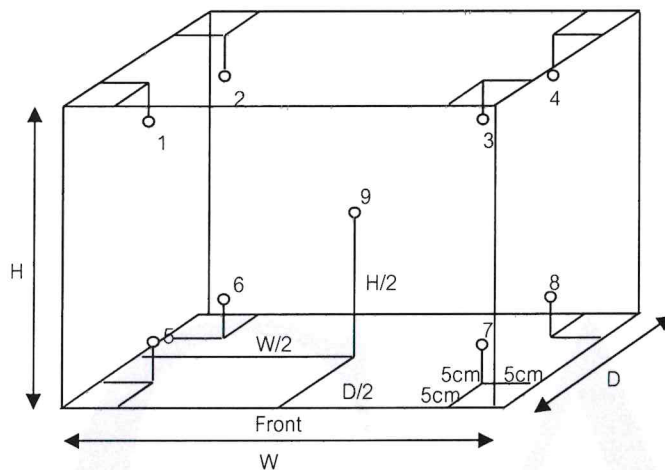
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



Inside of Chamber

W = 0.58 m

D = 0.56 m

H = 1.45 m

Capacity = 0.47 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
4	4	4	4.7	4.2	4.5	4.1	4.1	4.0	4.1	4.2	4.0	0.93

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
4	4	4	0.7	0.4	1.3

Remark The uncertainty is not combine uniformity of the air chamber

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k = 2 , providing a level of confidence of approximately 95%

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Signature



Certificate of Calibration

Certificate No. : 67-200100-1

Page : 1 of 2

Submitted by : Environmental & Resource Development Co., Ltd.
115/35-36 Moo 3, Tambon Bang Duea, Amphoe Mueang Pathumthani, Pathumthani 12000

Equipment : Electronic Balance
Manufacturer : METTLER TOLEDO Model : MS205DU
Serial No. : C217935519 ID No. : ERD 2
Capacity : 220 g Resolution : 0.00001g/ 82g, 0.0001g/ 220g

Environment : On site calibration was carried out at the Laboratory,
Environmental & Resource Development Co., Ltd.
Ambient Temperature : (21.8 to 22.5) °C
Relative Humidity : (50.8 to 52.1) %
Air Pressure : 1010.0 mbar

Date of Received : 19 March 2024

Date of Calibration : 19 March 2024

Date of Issue : 20 March 2024

Calibrated by : Akaradath Thippichai

Calibration Method : In-house method CAL-M2001 based on UKAS Publication ref : LAB 14
Edition 7 - November 2022

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

Standard Weights

ID No.	Cert. No.	Due Date	Traceability
E261-E2624	C02232088	08 Nov 2024	National Institute of Metrology (Thailand), (NIMT)

Approved by :



(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-200100-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

Nominal Value (g)	Correction (g)	Uncertainty $\pm$ (g)
0.05	-0.00001	0.000018
0.1	0.00000	0.000022
0.5	0.00000	0.000026
1	-0.00001	0.000031
5	-0.00002	0.000043
10	0.00000	0.000053
20	-0.00004	0.000071
50	0.00001	0.00011
100	0.0000	0.00022
200	0.0001	0.00038

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

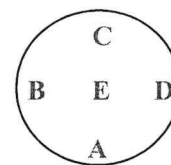
This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.20$, providing a level of confidence of approximately 95%

Eccentric error

Load test : 50 g

A	B	C	D	E
-0.00008	-0.00007	-0.00003	-0.00001	0.00000

g



Repeatability

Load test : 200 g

Stdev. : 0.000053 g

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Certificate of Calibration

Certificate No. : 67-420046-1

Page : 1 of 2

Submitted by : Environmental & Resource Development Co., Ltd.
115/35-36 Moo 3 Tambon Bang Duea, Amphoe Mueang Pathumthani, Pathumthani 12000

Equipment : pH Meter with electrode
pH meter
Manufacturer : Hanna Model : HI 5221
Range : -2.00 pH to 20.00 pH Resolution : 0.01 pH
Serial No. : 06210023101 ID No. : ERD NO. 03
Electrode
Model : HI1131 Serial No. : 08180B0N

Environment : On site calibration was carried out at the Laboratory,
Environmental & Resource Development Co., Ltd.
Ambient Temperature : (25.0 to 25.5)° C
Relative Humidity : (45 to 50) %

Date of Received : 07 May 2024

Date of Calibration : 07 May 2024

Date of Issue : 11 May 2024

Calibrated by : Permpon Chanpu

Calibration Method : In-house method CAL-M4201 direct measurement by using standard voltage calibrator and using certified reference material (CRM)

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

1. Multiproduct Calibrator

ID No.	Cert. No.	Due Date	Traceability
400005	SG-E-00307/66	23 Aug 2025	National Institute of Metrology Thailand (NIMT)

2. Standard Buffer Solution

pH	Cert. No.	Lot No.	Exp. Date	Traceability
4.008	61293328	944535	27 Nov 2025	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.986	61281486	944537	17 Nov 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
9.997	61281073	944536	17 Nov 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by : 
(Surachai Promthong)
Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-420046-1

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Electrical measurement

pH meter

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

Adjustment Curve at nominal pH	Applied Voltage (mV)	Nominal Value (pH)	UUC Reading		Correction (mV)	Uncertainty (± mV)
			(pH)	(mV)		
4, 7, 10	177.4800	4	4.00	177.5	0.0	0.12
	0.0000	7	7.00	0.1	-0.1	0.086
	-177.4800	10	10.00	-177.4	-0.1	0.12

Function : pH meter with electrode

Performing a three - buffer standard curve using buffer nominal pH (4,7,10)

Adjustment Curve at nominal pH	Standard Buffer (pH)	UUC Reading (pH)	Correction (pH)	Uncertainty (± pH)
4, 7, 10	4.008	4.01	0.00	0.0097
	6.986	7.00	-0.01	0.012
	9.997	10.01	-0.01	0.014

Remark

UUC : Unit Under Calibration

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

This reported uncertainty of measurment was based on a standard uncertainty multiplied by a coverage factor $k = 2$,
providing a level of confidence of approximately 95%

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P.B.I



Certificate of Calibration

Certificate No. : 67-400256-1

Page : 1 of 2

Submitted by : Environmental & Resource Development Co., Ltd.
115/35-36 Moo 3 Tambon Bang Duea, Amphoe Mueang Pathumthani, Pathumthani 12000

Equipment : Temperature Indicator with Thermistor Probe

Temperature Indicator

Manufacturer : Hanna

Model : HI 5221

Range : N/A °C

Resolution : 0.1 °C

Serial No. : 06210023101

ID No. : ERD NO. 03

Thermistor probe

Model : HI7662-W

Sheath Material : Stainless

Diameter : 3.5 mm.

Length : 110 mm.

Serial No. : 0809023N

ID No. : ERD NO. 03

Environment : On site calibration was carried out at the Laboratory,
Environmental & Resource Development Co., Ltd.

Ambient Temperature : (25.0 to 25.5) °C

Relative Humidity : (45 to 50) %

Line Voltage : (232.0 to 233.0) VAC

Date of Received : 07 May 2024

Date of Calibration : 07 May 2024

Date of Issue : 11 May 2024

Calibrated by : Permpon Chanpu

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4003
by compared with PRT in the liquid bath at the constant controlled temperature.

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

ID No.	Cert. No.	Due Date	Traceability
400002	TT-0074-22	20 Jun 2024	National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
400033	24E633	21 Feb 2026	National Institute of Metrology Thailand (NIMT)

Approved by :

(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-400256-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Immersion Depth (mm.)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
110	20.005	20.0	0.0	0.19
110	25.002	25.0	0.0	0.19
110	30.004	30.1	-0.1	0.19

Remark

UUC : Unit Under Calibration

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%

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Handwritten signature



Certificate of Calibration

Certificate No. : 66-400658-1

Page : 1 of 2

Submitted by : Environmental & Resource Development Co., Ltd.
115/35-36 Moo 3 Tambon Bang Duea, Amphoe Mueang Pathumthani, Pathumthani 12000

Equipment : Air Chamber (BOD Chamber)
Manufacturer : M-LAB Model : BIC-140
Range : N/A °C Resolution : 0.1 °C
Serial No. : 1020 ID No. : ERD 1

Environment : On site calibration was carried out at the Laboratory,
Environmental & Resource Development Co., Ltd.
Ambient Temperature : (24.0 to 25.0) °C
Relative Humidity : (45 to 50) %
Line Voltage : (226.0 to 227.0) V

Date of Received : 22 November 2023

Date of Calibration : 22 November 2023

Date of Issue : 23 November 2023

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

ID No.	Cert. No.	Due Date	Traceability
400046 & 400042	66-400453-1	31 Jan 2024	National Institute of Metrology Thailand (NIMT)

Approved by :

(Surachai Promthong)

Laboratory Manager

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Certificate of Calibration

Certificate No. : 66-400658-1

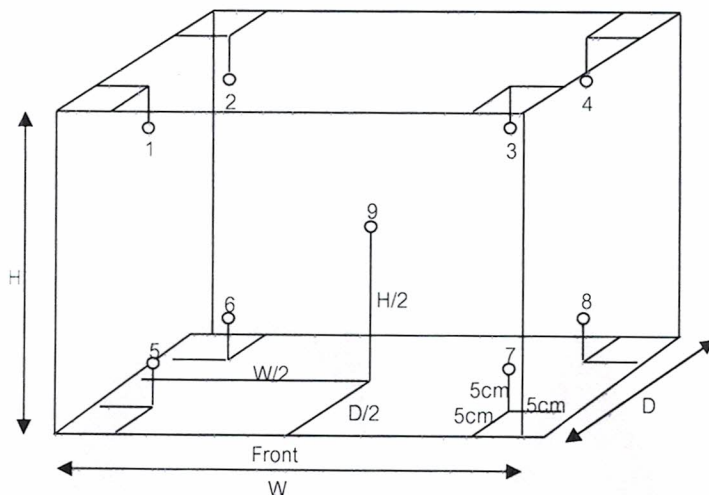
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



Inside of Chamber

W = 0.38 m

D = 0.35 m

H = 1.15 m

Capacity = 0.15 m³

Test Point (° C)	Setting Temperature (° C)	Indicating Temperature (° C)	Measured Temperature (° C) @ Sensor No.									Uncertainty (± ° C)
			1	2	3	4	5	6	7	8	9	
20.0	20.0	20.0	20.19	20.06	20.12	19.84	20.29	20.24	20.21	20.22	20.21	0.30

Test Point (° C)	Setting Temperature (° C)	Indicating Temperature (° C)	Measured Uniformity (° C)	Measured Stability (° C)	Overall Variation (° C)
20.0	20.0	20.0	0.39	0.02	0.48

Remark The uncertainty is not combine uniformity of the air chamber

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k = 2 , providing a level of confidence of approximately 95%

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Certificate of Calibration

Certificate No. : 67-400257-2

Page : 1 of 2

Submitted by : Environmental & Resource Development Co., Ltd.
115/35-36 Moo 3 Tambon Bang Duea, Amphoe Mueang Pathumthani, Pathumthani 12000

Equipment : Water Bath
Manufacturer : M-LAB Model : WNB 15
Range : N/A °C Resolution : 0.1 °C
Serial No. : 0341 ID No. : ERD NO. 05

Environment : On site calibration was carried out at the Laboratory,
Environmental & Resource Development Co., Ltd.

Ambient Temperature : (26.0 to 27.0) °C

Relative Humidity : (55 to 60) %

Line Voltage : (232.0 to 233.0)V

Date of Received : 07 May 2024

Date of Calibration : 07 May 2024

Date of Issue : 13 May 2024

Calibrated by : Kittisak Kokaeo

Calibration Method : This instrument was calibrated by In-house method CAL-M4006 based on ASTM E715-80
The temperature scale used was based on ITS-90

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

ID No.	Cert. No.	Due Date	Traceability
400046 & 400024	67-400198-2	30 Sep 2024	National Institute of Metrology Thailand (NIMT)

Approved by :

(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

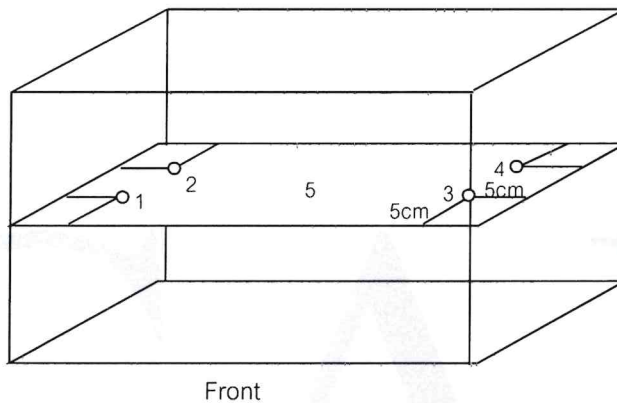
Certificate No. : 67-400257-2

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement



Test Point (° C)	Setting Temperature (° C)	Indicating Temperature (° C)	Measured Temperature (° C) @ Sensor					Uncertainty (± ° C)	Measured Uniformity (° C)	Measured Stability (° C)
			No.							
			1	2	3	4	5			
80.0	80.0	80.0	80.00	79.94	80.02	80.04	80.06	0.22	0.22	0.10
85.0	85.0	85.0	84.99	84.96	85.00	85.02	85.01	0.24	0.16	0.13
90.0	90.0	90.0	90.11	90.09	90.20	90.20	90.16	0.24	0.24	0.13
95.0	95.0	95.0	95.17	95.13	95.31	95.42	95.24	0.26	0.34	0.15

Remark The uncertainty is not combine uniformity of the water bath

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%

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AD



Certificate of Calibration

Certificate No. : 67-400257-3

Page : 1 of 2

Submitted by : Environmental & Resource Development Co., Ltd.
115/35-36 Moo 3 Tambon Bang Duea, Amphoe Mueang Pathumthani, Pathumthani 12000

Equipment : Temperature controlled enclosure (Oven)
Manufacturer : Memmert Model : UF 30
Range : N/A °C Resolution : 0.1 °C
Serial No. : B121.1551 ID No. : ERD NO. 04

Environment : On site calibration was carried out at the Laboratory,
Environmental & Resource Development Co., Ltd.
Ambient Temperature : (26.0 to 27.0) °C
Relative Humidity : (55 to 60) %
Line Voltage : (232.0 to 233.0) V

Date of Received : 07 May 2024

Date of Calibration : 07 May 2024

Date of Issue : 13 May 2024

Calibrated by : Kittisak Kokaeo

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

ID No.	Cert. No.	Due Date	Traceability
400046 & 400023	67-400198-1	01 Oct 2024	National Institute of Metrology Thailand (NIMT)

Approved by :



(Surachai Promthong)

Laboratory Manager

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Certificate of Calibration

Certificate No. : 67-400257-3

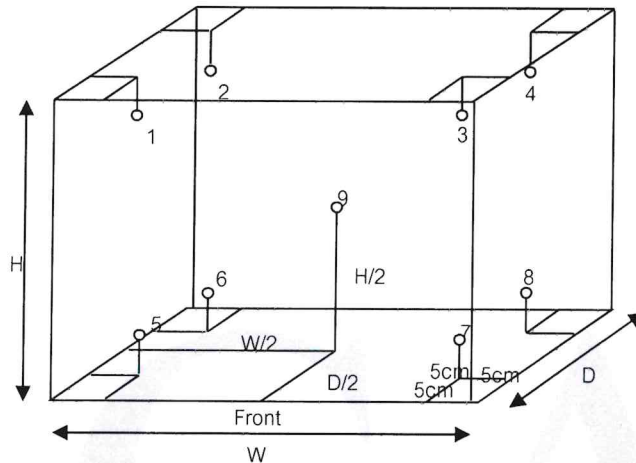
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



Inside of Chamber

W = 0.40 m

D = 0.25 m

H = 0.32 m

Capacity = 0.03 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
104.0	104.0	104.0	104.3	104.1	103.8	103.9	103.8	103.8	103.7	103.9	103.9	0.69
150.0	150.0	150.0	150.8	150.8	149.8	149.9	150.0	150.1	149.5	150.8	150.1	0.84
180.0	180.0	180.0	180.6	180.6	179.8	180.0	180.3	180.3	179.6	181.0	180.4	0.95

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
104.0	104.0	104.0	0.5	0.2	0.9
150.0	150.0	150.0	0.9	0.2	1.6
180.0	180.0	180.0	0.9	0.2	1.7

Remark The uncertainty is not combine uniformity of the air chamber

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%

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Certificate of Calibration

Certificate No. : 67-300264-7

Page : 1 of 2

Submitted by : Environmental & Resource Development Co., Ltd.
115/35-36 Moo 3, Tambon Bang Duea, Amphoe Mueang Pathumthani, Pathumthani 12000

Equipment : Burette
Manufacturer : Witeg Class : B
Capacity : 50 ml Graduation : 0.1 ml
ID No. : BU50/01

Environment : Ambient Temperature : (20 ± 3) °C
Relative Humidity : (50 ± 10) %
Air Pressure : 1010.1 mbar.

Date of Received : 07 May 2024

Date of Calibration : 13 May 2024

Date of Issue : 13 May 2024

Calibrated by : Areerat Sombun

Calibration Method : In-house method CAL-M3001 based on ASTM E 542-22

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

Electronic Balance

ID No.	Cert. No.	Due Date	Traceability
241005	66-200388-4	02 Jun 2024	National Institute of Metrology (Thailand) (NIMT)

Approved by :

(Wipa Tovadee)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-300264-7

Page : 2 of 2

Result of Calibration : This result of true Volume is referred to standard temperature at 20 °C

UUC Condition As-Received : Good

Delivery Time : 29.99 sec.

Nominal Volume (ml)	Measuring Volume (ml)
10	9.9855
25	24.9237
50	49.9339

Uncertainty of measurement with in $\pm$ 0.011 ml

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.00$,
providing a level of confidence of approximately 95%

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Certificate of Calibration

Page : 1 of 2

Certificate No. : 66-400493-5

Submitted by : Environmental & Resource Development Co.,Ltd.
34/304-5 Moo 5 Soi Watpaikheaw Srongprapa Rd.Srikan, Donmuang Bangkok 10210

Equipment : Air Chamber (Incubator)
Manufacturer : Memmert
Range : N/A °C
Serial No. : e500.0202
Model : BE 500
Resolution : 0.1 °C
ID No. : ERD 6

Environment : On site calibration was carried out at the Laboratory,
Environmental & Resource Development Co., Ltd.
Ambient Temperature : (28.0 to 30.0) °C
Relative Humidity : (44 to 48) %
Line Voltage : (227.0 to 228.2) V

Date of Received : 07 September 2023
Date of Calibration : 07 September 2023
Date of Issue : 09 September 2023
Calibrated by : Permpoon Chanpu
Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

ID No.	Cert. No.	Due Date	Traceability
400029 & 400043	66-400226-1	27 Oct 2023	National Institute of Metrology Thailand (NIMT)

Approved by :



(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-400493-5

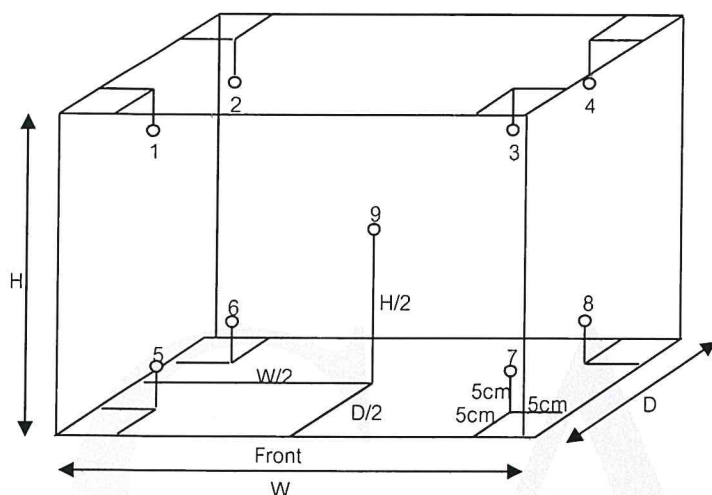
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



Inside of Chamber

W = 0.56 m

D = 0.40 m

H = 0.48 m

Capacity = 0.11 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
30.0	32.2	32.2	30.14	30.18	30.18	30.14	30.10	30.13	30.06	30.17	30.00	0.30
35.0	37.2	37.2	35.15	35.25	35.18	35.13	35.16	35.18	35.12	35.21	35.01	0.30
40.0	44.8	44.8	40.33	40.37	40.32	40.25	40.21	40.24	40.11	40.25	40.01	0.33
45.0	51.4	51.4	45.09	45.15	45.11	44.97	44.94	44.95	44.89	45.06	44.88	0.32

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
30.0	32.2	32.2	0.22	0.03	0.2
35.0	37.2	37.2	0.29	0.03	0.3
40.0	44.8	44.8	0.49	0.06	0.5
45.0	51.4	51.4	0.31	0.07	0.4

Remark The uncertainty is not combine uniformity of the air chamber

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%

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