

เอกสารแนบ 6

เอกสารสอบเทียบ
เครื่องมือที่ใช้ในการวิเคราะห์



CALIBRATION LABORATORY CO., LTD.

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



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : BALANCE
MANUFACTURER : SHIMADZU
MODEL / TYPE : AP225WD
SERIAL NO. : D316300692[L/A-001]
CLID. NO. : 362100172
JOB CONTROL NO. : 220129009714

CUSTOMER : ENVIRONMENTAL MEASUREMENTS CO., LTD.
5/45 BAAN KIANG KRUNG BIZ TOWN, SOI SRINAGARINDRA 46/1 (PRAMOTE),
NONG BON SUB-DISTRICT, PRAWET DISTRICT, BANGKOK 10250

DATE OF RECEIVED : 29 January 2022

DATE OF ISSUED : 12 February 2022

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

Calibrated By :

Mangkomchai Lungkratok

Calibration Engineer



Approved By :

Authorized Signatory

12 February 2022

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

Certificate No. Q22009714

F3-011-04/01-12

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CALIBRATION LABORATORY CO., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
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REPORT OF CALIBRATION

FOR

NOMENCLATURE : BALANCE
MANUFACTURER : SHIMADZU
MODEL / TYPE : AP225WD
SERIAL NO. : D316300692[L/A-001]
LOCATION SITE : LABORATORY - BALANCE ROOM
DATE OF CALIBRATION : 07 February 2022

ENVIRONMENT CONDITIONS :

Temperature : 24 °C to 25 °C

Relative Humidity : 52 % to 55 %

PROCEDURE USED :

This instrument was calibrated under procedure No. WI-305-46 based on EURAMET/cg-18/Version 4.0 (11/2015).

The calibration was performed by using Weight Set which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Weight Set Phoenix Class E2 S/N. WBS-SET-E2-02.

TRACEABILITY :

The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand).

Certificate No. MM-0032-20, Due Date 19 May 2022.

UNCERTAINTY :

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

Certificate No. Q22009714

F3-011-04/01-12

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CALIBRATION LABORATORY CO., LTD.
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NSC-TIS-17025
CALIBRATION 0059
CLC

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. Error of indications

Nominal Test Value (g)	Conventional mass (g)	Display Value (g)	Error of Balance (g)	Uncertainty \pm (mg)	Coverage factor k
Unload	0.0000	0.0000	0.0000	0.09	2.09
5.0000	5.0000	5.0000	0.0000	0.12	2.00
10.0000	10.0000	10.0000	0.0000	0.12	2.00
20.0000	20.0000	20.0000	0.0000	0.13	2.00
40.0000	40.0000	40.0000	0.0000	0.14	2.00
60.0000	60.0000	60.0000	0.0000	0.15	2.00
80.0000	80.0000	80.0000	0.0000	0.17	2.00
100.0000	100.0000	99.9999	-0.0001	0.17	2.00
120.0000	120.0000	119.9999	-0.0001	0.22	2.00
140.0000	140.0000	139.9999	-0.0001	0.22	2.00
160.0000	160.0000	159.9998	-0.0002	0.24	2.00
180.0000	180.0000	179.9998	-0.0002	0.27	2.00
200.0000	200.0001	199.9998	-0.0003	0.27	2.00

2. Repeatability of indications

Nominal Test Value (g)	Standard Deviation of Reading (g)
200.0000	0.00010

3. Effect of eccentric application of a load on the indication

<div><div><div></div></div></div>	<div><div><div></div></div></div>					<div><div></div></div>	<div><div></div></div>
	Display Value (g)						
Nominal Test Value (g)	Position 1	Position 2	Position 3	Position 4	Position 5	Center Value (g)	Maximum Difference of
50.0000	50.0000	49.9999	49.9999	50.0000	50.0000	0.0001	

Note. The Scope of Accredited TISI Certificate No. 19C087/0655 Issue 1 Page 88 of 111

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

End of Certificate

Certificate No. Q22009714
F3-011-04/01-12



CALIBRATION LABORATORY CO., LTD.
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CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
MANUFACTURER : DIGICON
MODEL / TYPE : TH-02A
SERIAL NO. : 1919E0284991[DTH-01]
CLID. NO. : 232100200
JOB CONTROL NO. : 220127009145

CUSTOMER : ENVIRONMENTAL MEASUREMENTS CO., LTD.

5/45 BAAN KLANG KRUNG BIZ TOWN, SOI SRINAGARINDRA 46/1 (PRAMOTE),
NONG BON SUB-DISTRICT, PRAWET DISTRICT, BANGKOK 10250

DATE OF RECEIVED : 27 January 2022

DATE OF ISSUED : 31 January 2022

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

Calibrated By :

Oranut Kamchatphai

Calibration Engineer

Approved By :

Authorized Signatory

31 January 2022

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

Certificate No. Q22009145

F3-011-04/01-12





CALIBRATION LABORATORY CO., LTD.

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



REPORT OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
MANUFACTURER : DIGICON
MODEL / TYPE : TH-02A
SERIAL NO. : 1919E0284991[DTH-01]
DATE OF CALIBRATION : 29 January 2022

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$ Relative Humidity : $(55 \pm 10) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. WI-305-74. The calibration was performed by using Chilled Mirror Hygrometer and Temperature & Humidity Chamber which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Chilled Mirror Hygrometer, Edgetech Model Dew Master S/N. 36151.
Temperature & Humidity Chamber, PGC Model 9141-5114 S/N. 0802282.

TRACEABILITY :

The measurements are traceable to International System of Units (SI), through Thunder Scientific Corporation.
Certificate No. 19317, Due Date 09 July 2022.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2013)"

Certificate No. Q22009145

F3-011-04/01-12



@cclcalibration



CALIBRATION LABORATORY CO., LTD.

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CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The table in the following gives the calibration results and associated measurement uncertainties of the measuring digital thermohygro meter.

CALIBRATION DATA

1. CORRECTION OF TEMPERATURE

Test point ($^\circ\text{C}$)	Actual Temperature ($^\circ\text{C}$)	DUC Reading ($^\circ\text{C}$)	Correction ($^\circ\text{C}$)	Uncertainty $\pm (^\circ\text{C})$
20.0	19.99	19.4	+0.59	0.40
25.0	24.99	24.4	+0.59	
30.0	30.00	29.4	+0.60	

2. CORRECTION OF HUMIDITY

STD Temperature ($^\circ\text{C}$)	STD Reading (%RH)	DUC Reading (%RH)	Correction (%RH)	Uncertainty $\pm (\% \text{RH})$
25	40.0	35	+5.0	1.3
25	60.0	55	+5.0	1.5

Note. The Scope of Accredited TISI Certificate No. 19C087/0655 Issue 1 Page 36 of 111

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

End of Certificate

Certificate No. Q22009145

F3-011-04/01-12



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CALIBRATION LABORATORY CO., LTD.

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NSC-TIS-TIS 17025
CALIBRATION 0659
CLC

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
MANUFACTURER : DIGICON
MODEL / TYPE : TH-02A
SERIAL NO. : 1919E0284980[DTH-02]
CLID. NO. : 232100201
JOB CONTROL NO. : 220127009146

CUSTOMER : ENVIRONMENTAL MEASUREMENTS CO., LTD.

5/45 BAAN KLANG KRUNG BIZ TOWN, SOI SRINAGARINDRA 46/1 (PRAMOTE),

NONG BON SUB-DISTRICT, PRAWET DISTRICT, BANGKOK 10250

DATE OF RECEIVED : 27 January 2022

DATE OF ISSUED : 31 January 2022

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

Calibrated By :

Oranut Kamchatphai

Calibration Engineer



Approved By :

Authorized Signatory

31 January 2022

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

Certificate No. Q22009146

F3-011-04/01-12

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NSC-TIS-TIS 17025
CALIBRATION 0659
CLC

REPORT OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
MANUFACTURER : DIGICON
MODEL / TYPE : TH-02A
SERIAL NO. : 1919E0284980[DTH-02]
DATE OF CALIBRATION : 29 January 2022

ENVIRONMENT CONDITIONS :

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

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

PROCEDURE USED :

This instrument was calibrated under procedure No. WI-305-74. The calibration was performed by using

Chilled Mirror Hygrometer and Temperature & Humidity Chamber which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

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

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

TRACEABILITY :

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

Certificate No. 19317, Due Date 09 July 2022.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied

by the coverage factor $k = 2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.

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

Certificate No. Q22009146

F3-011-04/01-12

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NSC-TIS-TIS 17025
CALIBRATION 0059
CLC

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The table in the following gives the calibration results and associated measurement uncertainties of the measuring digital thermohygro meter.

CALIBRATION DATA

1. CORRECTION OF TEMPERATURE

Test point (°C)	Actual Temperature (°C)	DUC Reading (°C)	Correction (°C)	Uncertainty ± (°C)
20.0	19.99	19.6	+0.39	0.40
25.0	24.99	24.5	+0.49	
30.0	30.00	29.5	+0.50	

2. CORRECTION OF HUMIDITY

STD Temperature (°C)	STD Reading (%RH)	DUC Reading (%RH)	Correction (%RH)	Uncertainty ± (%RH)
25	40.0	36	+4.0	1.3
25	60.0	56	+4.0	1.5

Note. The Scope of Accredited TIS Certificate No. 19C087/0655 Issue 1 Page 36 of 111

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

Certificate No. Q22009146
F3-011-04/01-12

End of Certificate

page 3 of 3



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



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : DO METER
MANUFACTURER : YSI
MODEL / TYPE : 5000-230V/5010
SERIAL NO. : 16D101626/19D100367[DOM-01]
CLID. NO. : 272100329
JOB CONTROL NO. : 220127009144

CUSTOMER : ENVIRONMENTAL MEASUREMENTS CO., LTD.

5/45 BAAN KLANG KRUNG BIZ TOWN, SOI SRINAGARINDRA 46/1 (PRAMOTE),
NONG BON SUB-DISTRICT, PRAWET DISTRICT, BANGKOK 10250

DATE OF RECEIVED : 27 January 2022

DATE OF ISSUED : 29 January 2022

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

Calibrated By :

Prapaporn Khanchalee

Calibration Engineer



Approved By :

Authorized Signatory

29 January 2022

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

Certificate No. Q22009144
F3-011-04/01-12

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@ccalibration



CALIBRATION LABORATORY Co., LTD.

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ISO/IEC 17025
CALIBRATION AND
DIMENSIONAL MEASUREMENT
ACDM-2814

REPORT OF CALIBRATION

FOR

NOMENCLATURE : DO METER
MANUFACTURER : YSI
MODEL / TYPE : 5000-230V/5010
SERIAL NO. : 16D101626/19D100367[DOM-01]
DATE OF CALIBRATION : 28 January 2022

ENVIRONMENT CONDITIONS :

Temperature : $(25 \pm 2.5) ^\circ\text{C}$ Relative Humidity : $(50 \pm 15) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPCH-06. The calibration was performed by direct measurement with Certified Reference Material (CRM).

REFERENCE STANDARD USED :

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

TRACEABILITY :

The measurements are traceable to International System of Units (SI), through Sigma-Aldrich, Lot LRAC4478, Due Date January 2022.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %. It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2013)"

Certificate No. Q22009144

F3-011-04/01-12

page 2 of 3



CALIBRATION LABORATORY Co., LTD.

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ISO/IEC 17025
CALIBRATION AND
DIMENSIONAL MEASUREMENT
ACDM-2814

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

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

CALIBRATION DATA

Nominal Value (mg/L)	DUC Reading (mg/L)	Correction (mg/L)	Uncertainty (mg/L)
8.49	8.60	-0.11	± 0.31

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 008 Page 4 of 54

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

End of Certificate

Certificate No. Q22009144

F3-011-04/01-12

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CALIBRATION LABORATORY Co., LTD.

2/10-11, 14, 55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
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NSC-TIS-TIS 17025
CALIBRATION 0659
CLC

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : HOT AIR OVEN
MANUFACTURER : MEMMERT
MODEL / TYPE : UF30
SERIAL NO. : B119.1030[LA-005]
CLID. NO. : 332100152
JOB CONTROL NO. : 220129009715

CUSTOMER : ENVIRONMENTAL MEASUREMENTS CO., LTD.

5/45 BAAN KLANG KRUNG BIZ TOWN, SOI SRINAGARINDRA 46/1 (PRAMOTE),
NONG BON SUB-DISTRICT, PRAWET DISTRICT, BANGKOK 10250

DATE OF RECEIVED : 29 January 2022 DATE OF ISSUED : 11 February 2022

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

Calibrated By :

Wenick Inchaisri
Calibration Engineer

Approved By :

Authorized Signatory

11 February 2022

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

Certificate No. Q22009715

F3-011-04/01-12

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CALIBRATION LABORATORY Co., LTD.

2/10-11, 14, 55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
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NSC-TIS-TIS 17025
CALIBRATION 0659
CLC

REPORT OF CALIBRATION

FOR

NOMENCLATURE : HOT AIR OVEN
MANUFACTURER : MEMMERT
MODEL / TYPE : UF30
SERIAL NO. : B119.1030[LA-005]
LOCATION SITE : LABORATORY -HOT ZONE
DATE OF CALIBRATION : 07 February 2022

ENVIRONMENT CONDITIONS :

Temperature : 24 °C to 25 °C

Relative Humidity : 37 % to 40 %

PROCEDURE USED :

This instrument was calibrated under procedure No. WI-305-165 based on TLAS G-20 as calibration guidelines.

The calibration was performed by using Hydra Data Bucket which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Hydra Data Bucket, Fluke Model 2635A S/N. 6496317.

TRACEABILITY :

The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd.

Certificate No. Q21093324, Due Date 04 October 2022.

UNCERTAINTY :

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

Certificate No. Q22009715

F3-011-04/01-12

page 2 of 4



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The table in the following gives the calibration results and associated measurement uncertainties of the measuring hot air oven.

CALIBRATION DATA

1. HOT AIR OVEN PERFORMANCE

Setting (°C)	DUC		Measured Uniformity (°C)	Measured Stability (°C)	Measured Overall Variation (°C)
	Indicating (°C)				
104.0	104.0		2.37	0.33	2.72
180.0	180.0		3.70	0.38	4.33

Certificate No. Q22009715

F3-011-04/01-12

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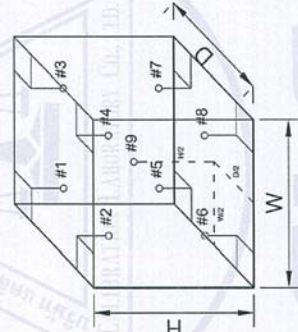
CALIBRATION DATA

2. TEMPERATURE DISTRIBUTION

DUC		Measured Temperature (°C) @Probe No.9 is Ref.									Uncertainty ± (°C)	Coverage factor k	
		Setting (°C)	Indicating (°C)	1	2	3	4	5	6	7			8
104.0	104.0	104.0	106.72	106.96	106.02	105.45	106.12	107.05	107.75	106.08	105.69	1.50	2.00
180.0	180.0	180.0	185.05	185.85	183.65	182.33	183.54	185.48	186.06	183.14	182.81	1.50	2.00

Technical Note : W = 40 cm, D = 25 cm, H = 32 cm.

The Scope of Accredited TISI Certificate No. 19C087/0655 Issue 1 Page 105 of 111



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

Certificate No. Q22009715

F3-011-04/01-12

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End of Certificate





Certificate of Calibration

Certificate Number

: SPR22020045-2

Page : 1 of 3

Customer

: ENVIRONMENTAL MEASUREMENTS CO.,LTD

5/45 BAAN KLANG KRUNG BIZ TOWN, SOI SRINAGARINDRA 46/1
(PRAMOTE), NONG BON SUB-DISTRICT, PRAWET DIST, BANGKOK
10250

Equipment Name

: Hydrometer

Manufacturer

: Precision

Model

: N/A

Serial Number

: 503

ID. Number

: N/A

Environmental Conditions

Ambient Temperature

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

Received Date

: 03 Feb 2022

Relative Humidity

: $50\% \pm 15\%$

Calibration Date

: 03 Feb 2022

Location of Calibration

: In-Lab

Recommend Due Date

: N/A

Calibration Procedure

: In-House Method

Date of Issue

: 04 Feb 2022

Method of Calibration

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

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

Calibrated by : Mr.Prayoon Topart

Approved by

Calibration Officer

Authorized Signatory

SP-FM-04-15 rev.0



Calibration Report

Certificate Number : SPR22020045-2

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Electronic Balance	ME235S	22314692	SPR21070480-1	03 Aug 2022

Traceability

This certification is traceable to the International System of Unit maintained at :
SP Metrology - SP Metrology system (Thailand) Co.Ltd.



Result of Calibration

Certificate No. : SPR22020045-2

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Specific Gravity Measurement @ 20 °C

Unit : g/cm³

STD Reading	UUC Reading	Error	Uncertainty (±)
1.200	1.200	0.000	0.00058
1.250	1.250	0.000	0.00058
1.300	1.300	0.000	0.00058

Note:

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

Measurement Uncertainty

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

- End of Certificate -



Certificate of Calibration

Certificate Number : SPR22020045-1

Page : 1 of 3

Customer : ENVIRONMENTAL MEASUREMENTS CO.,LTD

5/45 BAAAN KLANG KRUNG BIZ TOWN, SOI SRINAGARINDRA 46/1
(PRAMOTE), NONG BON SUB-DISTRICT, PRAWET DIST, BANGKOK
10250

Equipment Name : Hydrometer
Manufacturer : Precision
Model : N/A
Serial Number : 3363
ID. Number : N/A

Environmental Conditions

Ambient Temperature : $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ Received Date : 03 Feb 2022
Relative Humidity : $50\% \pm 15\%$ Calibration Date : 03 Feb 2022
Location of Calibration : In-Lab Recommend Due Date : N/A
Calibration Procedure : In-House Method Date of Issue : 04 Feb 2022

Method of Calibration

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

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

Calibrated by : Mr.Prayoon Topart

Calibration Officer

Approved by

Authorized Signatory



Calibration Report

Certificate Number : SPR22020045-1

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Electronic Balance	ME235S	22314692	SPR21070480-1	03 Aug 2022

Traceability

This certification is traceable to the International System of Unit maintained at :
SP Metrology - SP Metrology system (Thailand) Co.Ltd.



Result of Calibration

Certificate No. : SPR22020045-1

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Specific Gravity Measurement @ 20 °C Unit : g/ml

STD Reading	UUC Reading	Error	Uncertainty (±)
1.600	1.600	0.00	0.00058
1.650	1.650	0.00	0.00058
1.700	1.700	0.00	0.00058

Note:

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

Measurement Uncertainty

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



CALIBRATION LABORATORY CO., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
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CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : INCUBATOR
MANUFACTURER : ACCUPLUS
MODEL / TYPE : SMART i250
SERIAL NO. : 2059-0718-0010[LA-002]
CLID. NO. : 332100155
JOB CONTROL NO. : 220129009716

CUSTOMER : ENVIRONMENTAL MEASUREMENTS CO., LTD.

5/45 BAAN KLANG KRUNG BIZ TOWN, SOI SRINAGARINDRA 46/1 (PRAMOTE),
NONG BON SUB-DISTRICT, PRAWET DISTRICT, BANGKOK 10250

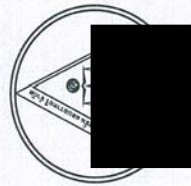
DATE OF RECEIVED : 29 January 2022 DATE OF ISSUED : 11 February 2022

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

Calibrated By :

Wenick Inchaisri

Calibration Engineer



Approved By :

Authorized Signatory

11 February 2022

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

Certificate No. Q22009716

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CALIBRATION LABORATORY CO., LTD.

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REPORT OF CALIBRATION

FOR

NOMENCLATURE : INCUBATOR
MANUFACTURER : ACCUPLUS
MODEL / TYPE : SMART i250
SERIAL NO. : 2059-0718-0010[LA-002]
LOCATION SITE : LABORATORY
DATE OF CALIBRATION : 07 February 2022

ENVIRONMENT CONDITIONS :

Temperature : 24 °C to 25 °C

Relative Humidity : 37 % to 40 %

PROCEDURE USED :

This instrument was calibrated under procedure No. WI-305-165 based on TLAS G-20 as calibration guidelines.

The calibration was performed by using Hydra Data Logger which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Hydra Data Logger, Fluke Model 2620 S/N. 5592550.

TRACEABILITY :

The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd.

Certificate No. Q21068655, Due Date 27 July 2022.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty multiplied by the coverage factor complies with the table which for a normal distribution corresponds to a coverage probability of approximately 95 %.

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

Certificate No. Q22009716

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CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The table in the following gives the calibration results and associated measurement uncertainties of the measuring incubator.

CALIBRATION DATA

1. INCUBATOR PERFORMANCE

Setting (°C)	DUC	Measured Uniformity (°C)		Measured Stability (°C)	Measured Overall Variation (°C)
		Indicating (°C)			
20.0		20.0	0.37	0.57	1.33



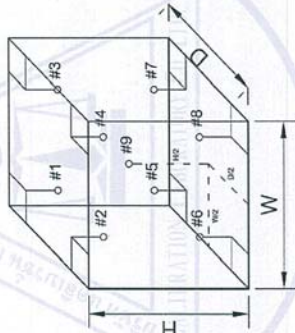
CALIBRATION DATA

2. TEMPERATURE DISTRIBUTION

DUC		Measured Temperature (°C)@Probe No.9 is Ref.									Uncertainty ± (°C)	Coverage factor k
Setting (°C)	Indicating (°C)	1	2	3	4	5	6	7	8	9		
20.0	20.0	20.63	20.60	20.58	20.61	20.53	20.47	20.40	20.39	20.52	0.79	2.00

Technical Note : W = 50 cm, D = 48 cm, H = 110 cm.

The Scope of Accredited TISI Certificate No. 19C087/0655 Issue 1 Page 105 of 111



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

End of Certificate





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CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : pH METER
MANUFACTURER : APERA
MODEL / TYPE : PH700/201T-F
SERIAL NO. : PH700X1019061009/N/A[PHM-01/PH-01]
CLID. NO. : 272100152
JOB CONTROL NO. : 220127009147

CUSTOMER : ENVIRONMENTAL MEASUREMENTS CO., LTD.

5/45 BAAN KLANG KRUNG BIZ TOWN, SOI SRINAGARINDRA 46/1 (PRAMOTE),
NONG BON SUB-DISTRICT, PRAWET DISTRICT, BANGKOK 10250

DATE OF RECEIVED : 27 January 2022

DATE OF ISSUED : 02 February 2022

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

Calibrated By :

Prapaporn Khanchalee

Tanawan Seenam-Ngoen

Calibration Engineer

Approved By :

Authorized Signatory

02 February 2022

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

Certificate No. Q22009147

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calibration



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REPORT OF CALIBRATION

FOR

NOMENCLATURE : pH METER
MANUFACTURER : APERA
MODEL / TYPE : PH700/201T-F
SERIAL NO. : PH700X1019061009/N/A[PHM-01/PH-01]
DATE OF CALIBRATION : 28 January 2022

ENVIRONMENT CONDITIONS :

Temperature : $(25 \pm 2.5) ^\circ\text{C}$ Relative Humidity : $(50 \pm 15) \% \text{ RH}$

PROCEDURE USED :

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

REFERENCE STANDARD USED :

1. pH Standard Solution, TRM CODE TRM-S-2003, TRM CODE TRM-S-2007.
2. pH Standard Solution, Catalog Number 06-664-260, 11754256, Lot Number CC728484.
3. Buffer Solution, Hanna Product Code HI 5013, Lot Number 4982.
4. Calibration Bath, Kambie Model OB-22/2 ULT S/N. 17115653.
5. Precision Thermometer, ASL Model F200-A-8 S/N. 014433/03.
6. IPRT, ASL Model T100-250-1D S/N. PO106346-1-13.

Certificate No. Q22009147

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calibration

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand), Lot Number. 160221, 180121, Due Date 14 June 2022.
2. The measurements are traceable to International System of Units (SI), through Control Company, Certificate No. 4281-12405788, Due Date 30 June 2023.
3. The measurements are traceable to International System of Units (SI), through Hanna instruments, Certificate No. 19B02, Due Date January 2025.
4. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd., Certificate No. Q22007520, Due Date 22 January 2023.
5. The measurements are traceable to International System of Units (SI), through Thailand Institute of Scientific and Technological Research (TISTR), Certificate No. PSL-T 0717/64, Due Date 14 June 2022.
6. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand), Certificate No. TT-0014-21, Due Date 10 February 2022.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor complies with the table which for a normal distribution corresponds to a coverage probability of approximately 95 %.

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

Certificate No. Q22009147

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etccalibration

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

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

CALIBRATION DATA

1. pH METER RESULT @ 25 °C

Standard pH Buffer Solution (pH)	pH Meter Reading (pH)	pH Meter Reading (mV)	Correction (pH)	Uncertainty of pH Measurement (\pm pH)	k Factor
0.000	0.00	0	0.000	-	-
4.000	3.99	161	+0.010	0.014	2,20
6.996	7.00	-14	-0.004	0.014	2,00
10.007	10.00	-187	+0.007	0.100	2,00
*13.000	12.50	-330	+0.500	0.019	2,37

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

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*2. TEMPERATURE RESULT

Immersion depth (mm)	Actual Temperature (°C)	DUC Reading (°C)	Correction (°C)	Uncertainty \pm (°C)
40	24.98	25.0	-0.02	0.07

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

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor of $k = 2.00$.

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

End of Certificate

Certificate No. Q22009147

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etccalibration



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CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : REFRIGERATOR
MANUFACTURER : MEDICOOL
MODEL / TYPE : BB-117
SERIAL NO. : BB117-190725001[LA-003]
CLID. NO. : 332100156
JOB CONTROL NO. : 220129009717

CUSTOMER : ENVIRONMENTAL MEASUREMENTS CO., LTD.
5/45 BAAN KLANG KRUNG BIZ TOWN, SOI SRINAGARINDRA 46/1 (PRAMOTE),
NONG BON SUB-DISTRICT, PRAWET DISTRICT, BANGKOK 10250
DATE OF RECEIVED : 29 January 2022 DATE OF ISSUED : 11 February 2022

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

Calibrated By : Wenick Inchaisri
Calibration Engineer



Approved By :
Authorized Signatory
11 February 2022

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

Certificate No. Q22009717
F3-011-04/01-12

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getcalibration



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REPORT OF CALIBRATION

FOR

NOMENCLATURE : REFRIGERATOR
MANUFACTURER : MEDICOOL
MODEL / TYPE : BB-117
SERIAL NO. : BB117-190725001[LA-003]
LOCATION SITE : LABORATORY
DATE OF CALIBRATION : 07 February 2022

ENVIRONMENT CONDITIONS :
Temperature : 24 °C to 25 °C
Relative Humidity : 37 % to 40 %

PROCEDURE USED :
This instrument was calibrated under procedure No. WI-305-165 based on TLAS G-20 as calibration guidelines.
The calibration was performed by using Hydra Data Logger which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :
Hydra Data Logger, Fluke Model 2620 S/N: 5592550.

TRACEABILITY :
The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd.
Certificate No. Q21068655, Due Date 27 July 2022.

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

Certificate No. Q22009717
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getcalibration

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The table in the following gives the calibration results and associated measurement uncertainties of the measuring refrigerator.

CALIBRATION DATA

1. REFRIGERATOR PERFORMANCE

Setting (°C)	DUC		Measured Uniformity (°C)	Measured Stability (°C)	Measured Overall Variation (°C)
	4.0	Indicating (°C)			
		4.0	0.65	0.98	2.25

Certificate No. Q22009717

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@cclcalibration

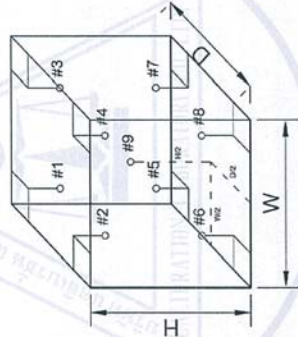
CALIBRATION DATA

2. TEMPERATURE DISTRIBUTION

DUC		Measured Temperature (°C) @ Probe No.9 is Ref.									Uncertainty ± (°C)	Coverage factor k
Setting (°C)	Indicating (°C)	1	2	3	4	5	6	7	8	9		
4.0	4.0	3.29	3.79	3.14	3.56	3.58	3.31	3.11	3.15	3.46	1.22	2.00

Technical Note : W = 50 cm, D = 50 cm, H = 120 cm.

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

End of Certificate

Certificate No. Q22009717

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@cclcalibration



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CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : WATER BATH
MANUFACTURER : MEMMERT
MODEL / TYPE : WNB14
SERIAL NO. : L418.0758[LA-004]
CLID. NO. : 332100157
JOB CONTROL NO. : 220129009718

CUSTOMER : ENVIRONMENTAL MEASUREMENTS CO., LTD.

5/45 BAAN KLANG KRUNG BIZ TOWN, SOI SRINAGARINDRA 46/1 (PRAMOTE),
NONG BON SUB-DISTRICT, PRAWET DISTRICT, BANGKOK 10250

DATE OF RECEIVED : 29 January 2022 DATE OF ISSUED : 11 February 2022

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

Calibrated By :

Wenick Inchaisri

Calibration Engineer



Approved By :

Authorized Signatory

11 February 2022

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

Certificate No. Q22009718

F3-011-04/01-12

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REPORT OF CALIBRATION

FOR

NOMENCLATURE : WATER BATH
MANUFACTURER : MEMMERT
MODEL / TYPE : WNB14
SERIAL NO. : L418.0758[LA-004]
LOCATION SITE : LABORATORY - HOT ZONE
DATE OF CALIBRATION : 07 February 2022

ENVIRONMENT CONDITIONS :

Temperature : 24 °C to 25 °C

Relative Humidity : 37% to 40%

PROCEDURE USED :

This instrument was calibrated under procedure No. WI-305-135 based on ASTM E 715-80 as calibration guidelines.

The calibration was performed by using Hydra Data Logger which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Hydra Data Logger, Fluke Model 2620 S/N. 5592550.

TRACEABILITY :

The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd.

Certificate No. Q21100192, Due Date 18 April 2022.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %. It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2013)"

Certificate No. Q22009718

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CALIBRATION LABORATORY Co., LTD.

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CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The table in the following gives the calibration results and associated measurement uncertainties of the measuring water bath.

CALIBRATION DATA

1. WATER BATH PERFORMANCE

Test Point (°C)	DUC Reading (°C)	Uniformity (°C)	Stability (°C)
95.0	95.0	0.53	0.17

Certificate No. Q22009718

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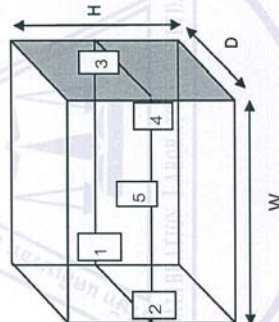
CALIBRATION DATA

2. TEMPERATURE DISTRIBUTION

Test Point (°C)	DUC Reading (°C)	STD Reading (°C)					Uncertainty ± (°C)
		Probe No. 1	Probe No. 2	Probe No. 3	Probe No. 4	Probe No. 5	
95.0	95.0	95.91	95.79	95.61	95.89	96.01	0.66

Technical Note : W = 35 cm, D = 29 cm, H = 14 cm.

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

End of Certificate

Certificate No. Q22009718

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