

ภาคผนวกที่ 4

ใบรับรองการสอบเทียบเครื่องมือ

Certificate of Calibration

Certificate No. : 66-400619-1

Page : 1 of 2

Submitted by : MET Company Limited

36/659 Moo 6, T. Bangrakpattana, A. Bangbuatong, Nonthaburi 11110

Equipment : Air Chamber (Refrigerator)

Manufacturer : Sanden Intercool

Model : SRC-680SRTM

Range : N/A °C

Resolution : 1 °C

Serial No. : SRC680201-1107-00165

ID No. : MET-RE 01/54

Environment : On site calibration was carried out at the Laboratory, MET Company Limited

Ambient Temperature : (29.0 to 30.0) °C

Relative Humidity : (55 to 60) %

Line Voltage : (226.5 to 228.2) V

Date of Received : 07 November 2023

Date of Calibration : 07 November 2023

Date of Issue : 11 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 :

(

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The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-400619-1

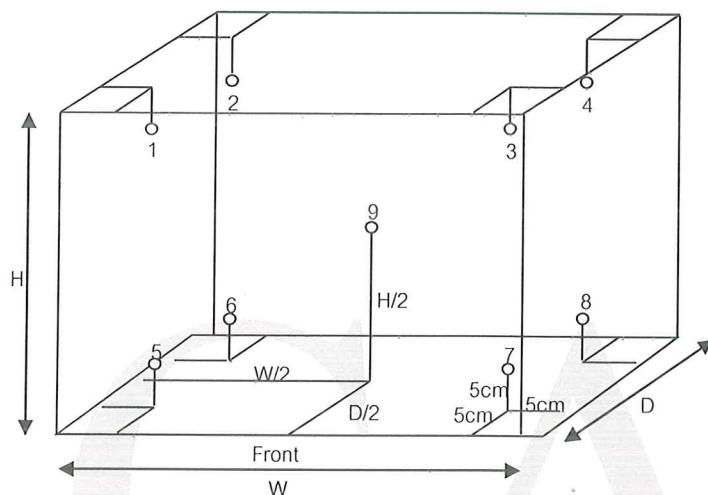
Page : 2 of 2

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 = 0.60 m

H = 1.35 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	
3	2	2	3.84	3.95	3.07	3.10	3.47	3.74	3.67	3.90	2.93	0.75

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
3	2	2	1.09	0.17	1.31

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. : 67-400505-3 **Page : 1 of 2**

Submitted by : M E T Company Limited
36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Temperature controlled enclosure (Refrigerator)
Manufacturer : Sanden Intercool Model : YPR-068S
Range : N/A °C Resolution : 1 °C
Serial No. : YPR0659S-141200060R ID No. : MET-RE03/59

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited
Ambient Temperature : (29.0 to 30.0) °C
Relative Humidity : (55 to 60) %
Line Voltage : (210.0 to 210.8) V

Date of Received : 20 August 2024

Date of Calibration : 20 August 2024

Date of Issue : 21 August 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
400046 & 400023	67-400198-1	01 Oct 2024	National Institute of Metrology Thailand (NIMT)

Approved by

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-400505-3

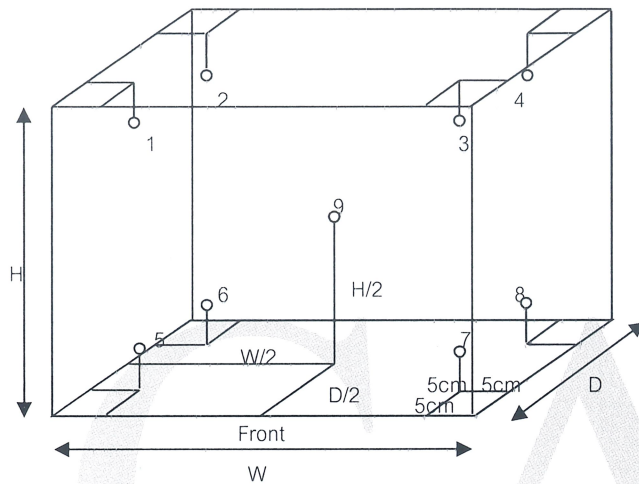
Page : 2 of 2

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 = 0.58 m

D = 0.60 m

H = 1.45 m

Capacity = 0.50 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	
3	2	2	3.9	4.2	4.0	4.5	3.2	3.9	3.6	2.9	3.0	0.9

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
3	2	2	1.6	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%

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Certificate of Calibration

Certificate No. : 67-420045-1

Page : 1 of 2

Submitted by : M E T Company Limited
36/659 Moo 6, T. Bangrakpattana, A. Bangbuatong, Nonthaburi 11110

Equipment : pH Meter with electrode
pH meter
Manufacturer : Digicon Model : PH-235SD
Range : 0 to 14 pH pH Resolution : 0.01 pH
Serial No. : AL.58184 ID No. : MET-PH12/67
Electrode
Model : N/A Serial No. : TF 55306

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

Date of Received : 25 April 2024

Date of Calibration : 30 April 2024

Date of Issue : 30 April 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
440001	23E1240	24 Mar 2025	National Institute of Metrology Thailand (NIMT)

2. Certified Reference Material (CRM)

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


Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-420045-1

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) and (7,10)

Adjustment Curve at nominal pH	Applied Voltage (mV)	Nominal Value (pH)	UUC Reading		Correction (mV)	Uncertainty (± mV)
			(pH)	(mV)		
4, 7	177.4800	4	4.00	177	0	0.58
	0.0000	7	7.00	0	0	0.58
7,10	0.0000	7	7.00	0	0	0.58
	-177.4800	10	10.00	-177	0	0.58

Function : pH meter with electrode

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

Adjustment Curve at nominal pH	Standard Buffer (pH)	UUC Reading (pH)	Correction (pH)	Uncertainty (± pH)
4, 7	4.008	4.00	0.01	0.0097
	6.986	7.00	-0.01	0.011
7, 10	6.986	7.00	-0.01	0.012
	9.997	10.00	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 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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Certificate of Calibration

Certificate No. : 66-400476-2

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Air Chamber (Oven)

Manufacturer : Binder

Model : ED53

Range : N/A °C

Resolution : 1 °C

Serial No. : 13-07419

ID No. : MET-OV02/57

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited

Ambient Temperature : (31.0 to 32.0) °C

Relative Humidity : (55 to 60) %

Line Voltage : (210.0 to 210.8) V

Date of Received : 23 August 2023

Date of Calibration : 23 August 2023

Date of Issue : 23 August 2023

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

Standard Digital Thermometer with Thermocouple probe

ID No.

Cert. No.

Due Date

Traceability

400029 & 400030 66-400227-1

24 Oct 2023

National Institute of Metrology Thailand (NIMT)

Approved by

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-400476-2

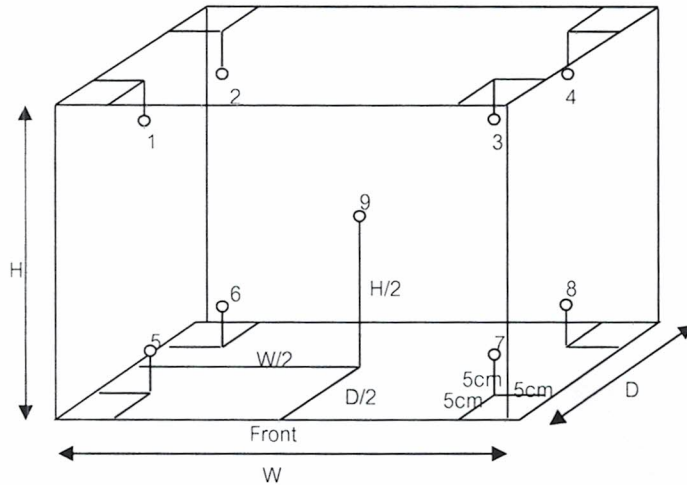
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



Inside of Chamber

W = 0.40 m

D = 0.33 m

H = 0.40 m

Capacity = 0.05 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	110	110	105.0	105.0	105.0	104.9	103.9	103.9	104.2	104.2	104.2	0.94
180	184	184	180.1	181.9	180.8	179.7	180.2	180.8	180.7	180.8	180.2	1.2

Test Point (° C)	Setting Temperature (° C)	Indicating Temperature (° C)	Measured Uniformity (° C)	Measured Stability (° C)	Overall Variation (° C)
104	110	110	1.0	0.2	1.3
180	184	184	1.9	0.3	2.7

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. : 67-400505-2

Page : 1 of 2

Submitted by : M E T Company Limited
36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Temperature controlled enclosure (Oven)
Manufacturer : Binder Model : ED53
Range : N/A °C Resolution : 1 °C
Serial No. : 13-07419 ID No. : MET-OV02/57

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited
Ambient Temperature : (30.0 to 31.0) °C
Relative Humidity : (50 to 55) %
Line Voltage : (210.0 to 210.8) V

Date of Received : 20 August 2024

Date of Calibration : 20 August 2024

Date of Issue : 21 August 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

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-400505-2

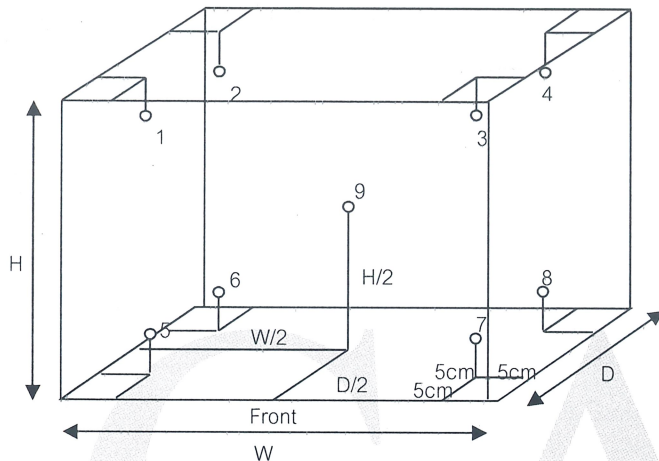
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



Inside of Chamber

W = 0.40 m

D = 0.33 m

H = 0.40 m

Capacity = 0.05 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	110	110	103.4	105.0	104.8	105.0	104.1	103.8	104.2	104.4	104.2	0.96
180	184	184	179.3	182.0	180.1	180.6	180.1	180.4	180.0	180.7	179.9	1.3

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
104	110	110	1.1	0.3	2.0
180	184	184	2.5	0.4	3.3

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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Certificate of Calibration

Certificate No. : 67-200064-2

Page : 1 of 2

Submitted by : M E T Company Limited
36/659 Moo 6, T. Bangrakpattana, A. Bangbuatong, Nonthaburi 11110

Equipment : Electronic Balance
Manufacturer : AND Model : FX-2000i
Serial No. : 15639789 ID No. : MET-EB03/61
Capacity : 2200 g Resolution : 0.01 g

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited
Ambient Temperature : (25.8 to 26.0) °C
Relative Humidity : (60.8 to 61.2) %
Air Pressure : 1012.0 mbar

Date of Received : 22 February 2024

Date of Calibration : 22 February 2024

Date of Issue : 23 February 2024

Calibrated by : Satja Sangkhum

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
F181-F1821	67-210021-1	29 Jul 2024	National Institute of Metrology (Thailand), (NIMT)

Approved by

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-200064-2

Page : 2 of 2

Result of Calibration : After Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

Nominal Value (g)	Correction (g)	Uncertainty $\pm$ (g)	Error before Adjustment (g)
200	0.00	0.010	0.00
500	0.00	0.011	0.01
600	0.00	0.011	0.01
700	0.00	0.011	0.02
800	0.00	0.011	0.02
1000	0.00	0.011	0.03
1200	0.00	0.012	0.04
1500	0.00	0.012	0.05
2000	-0.01	0.014	0.08
2200	-0.01	0.023	0.09

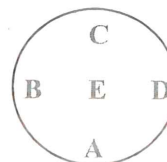
This result of calibration was found accurate as shown on date and place of calibration only.

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.06$, providing a level of confidence of approximately 95%

Eccentric error

Load test : 500 g

A	B	C	D	E	
0.00	-0.01	-0.02	-0.01	0.00	g

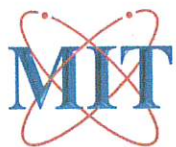


Repeatability

Load test : 2000 g
Stdev. : 0.004 g

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MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

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



CALIBRATION CERTIFICATE

Certificate No. : S2024090374-0002

Date Issued : 23-Sep-24

Customer : S.P.S. CONSULTING SERVICE CO., LTD.
7 Soi Phaholyothin 24 Phaholyothin Road., Jompol, Chatuchak, Bangkok 10900

Equipment : Incubator

Manufacturer : BINDER

Model : BD 240

Serial No. : 12-17739

ID No./Tag No. : IN 04/56

Date Received : 16-Sep-24

Date Calibrated : 16-Sep-24

Calibrated by : Anusak Songliam

Calibration Method or Calibration Procedure Used

Standard method : CP-05 TLAS G-20.

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



Certificate No. : S2024090374-0002

Environment : Ambient Temperature : Start record 23.9 °C, Stop record 23.6 °C
Relative Humidity : Start record 54.8 %RH, Stop record 54.5 %RH

Calibration Temperature (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Stability ¹ (°C)	Measured Uniformity ² (°C)	Overall Variation ³ (°C)
35	35.0	35.0	0.04	0.14	0.22

Without adjustment

Calibration Temperature (°C)	STD No. 1 (°C)	STD No. 2 (°C)	STD No. 3 (°C)	STD No. 4 (°C)	STD No. 5 (°C)	STD No. 6 (°C)	STD No. 7 (°C)	STD No. 8 (°C)	STD No. 9 (°C)	Uncertainty ⁴ (±°C)
35	34.83	34.90	34.80	34.87	34.84	34.75	34.90	34.80	34.77	0.23

Decision Rule with Guard Band

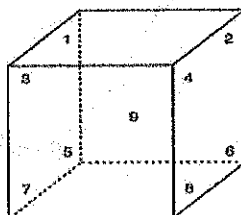
Calibration Temperature (°C)	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	MPE (±°C)
35	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	0.5

Pass = |error| + |uncertainty| ≤ |MPE| **MPE =** Maximum Permissible Error

Fail = |error| + |uncertainty| > |MPE|

Note : Probe No. 9 is Reference Probe

Setting Air Fresh No. 0



Condition As-Received : Used 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. L202407373-0005 for Temperature Indicator with Sensor Serial No. US37020317, Due 31-Jan-25

Notes : 1. The temperature stability is the one-half of greatest maximum difference of measured temperatures at any one probe.

2. The temperature uniformity is the maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time.

3. Overall variation is the difference of maximum and minimum measured temperatures throughout observation time.

4. The uncertainty of measurement is included temperature stability.

5. The temperature uniformity, stability, overall variation and indicating temperature is applicable to all air or gas filled temperature controlled enclosures at atmospheric pressure.

End of Certificate