

ภาคผนวกที่ 5
เอกสารสอบเทียบเครื่องมือตรวจวัด

Certificate of Calibration

Certificate No. : 66-420070-2

Page : 1 of 2

Submitted by : Pacific Laboratory Co.,Ltd.

14/5358 Moo 14, T. Bang Bua Thong, A. Bang Bua Thong, Nonthaburi 11110 Thailand

Equipment : pH Meter with electrode

pH meter

Manufacturer : Eutech

Model : pH 700

Range : N/A pH

Resolution : 0.01 pH

Serial No. : 2841305

ID No. : LAB-PH-002

Electrode

Model : N/A

Serial No. : 3052953

ID No. : LAB-PH-002

Environment : On site calibration was carried out at the Laboratory Pacific Laboratory Co.,Ltd.

Ambient Temperature : (25.0 to 25.6)° C

Relative Humidity : (45 to 47) %

Date of Received : 31 July 2023

Date of Calibration : 31 July 2023

Date of Issue : 05 August 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	915161	19 Jul 2025	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.985	61275614	898428	28 May 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
9.997	61281073	915163	19 Jul 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by :



The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-420070-2

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	-177.5	0.0	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
	6.985	7.00	-0.01	0.011
	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 measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%

- ๐(๐) -



Certificate of Calibration

Certificate No. : 66-400424-1

Page : 1 of 2

Submitted by : Pacific Laboratory Co., Ltd
14/5358 Moo 14, T. Bang Bua Thong, A. Bang Bua Thong, Nonthaburi 11110 Thailand

Equipment : Digital Thermometer with Thermistor probe
Temperature Indicator

Manufacturer :	Eutech	Model :	pH 700
Range :	N/A °C	Resolution :	0.1 °C
Serial No. :	2841305	ID No. :	LAB-PH-002
Thermistor probe			
Model :	N/A	Sheath Material :	Stainless
Diameter :	3 mm.	Length :	115 mm.
Serial No. :	PHSTEMB01P 049	ID No. :	LAB-PH-002

Environment : On site calibration was carried out at the Laboratory, Pacific Laboratory Co., Ltd

Ambient Temperature : (25.0 to 25.6) °C
Relative Humidity : (45 to 47) %
Line Voltage : (220.0 to 222.0) VAC

Date of Received : 31 July 2023

Date of Calibration : 31 July 2023

Date of Issue : 05 August 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 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	22E569	22 Feb 2024	National Institute of Metrology Thailand (NIMT)

Approved by



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Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech_cal@yahoo.com, calibratech_cal@hotmail.com

Certificate of Calibration

Certificate No. : 66-400424-1

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)
115	25.005	24.8	0.2	0.19

Remark

UUC : Unit Under Calibration

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Certificate of Calibration

Certificate No. : 66-420070-1

Page : 1 of 2

Submitted by : Pacific Laboratory Co.,Ltd.

14/5358 Moo 14, T. Bang Bua Thong, A. Bang Bua Thong, Nonthaburi 11110 Thailand

Equipment : pH Meter with electrode

pH meter

Manufacturer : Eutech

Model : pH 700

Range : N/A pH

Resolution : 0.01 pH

Serial No. : 2841305

ID No. : LAB-PH-002

Electrode

Model : N/A

Serial No. : 3093341

ID No. : LAB-PH-002

Environment : On site calibration was carried out at the Laboratory Pacific Laboratory Co.,Ltd.

Ambient Temperature : (25.0 to 25.6)° C

Relative Humidity : (45 to 47) %

Date of Received : 31 July 2023

Date of Calibration : 31 July 2023

Date of Issue : 05 August 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

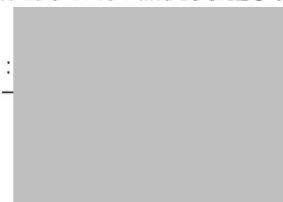
1. Multiproduct Calibrator

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	915161	19 Jul 2025	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.985	61275614	898428	28 May 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
9.997	61281073	915163	19 Jul 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

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Certificate of Calibration

Certificate No. : 66-420070-1

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	-177.5	0.0	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
	6.985	7.00	-0.01	0.011
	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 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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NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 66-200145-1

Page : 1 of 2

Submitted by : Special Lab Envi and Consultant Co., Ltd.
47/91 Moo 3, Tambol Tha-It, Pakkret, Nonthaburi 11120

Equipment : Electronic Balance
Manufacturer : AND **Model :** GR-200
Serial No. : 14245322 **ID No. :** LB-Eg-016
Capacity : 210 g **Resolution :** 0.0001 g

Environment : On site calibration was carried out at the Laboratory, Special Lab Envi and Consultant Co., Ltd.

Ambient Temperature : (29.4 to 29.7) °C

Relative Humidity : (50.9 to 51.5) %

Air Pressure : 1011.0 mbar

Date of Received : 24 April 2023

Date of Calibration : 24 April 2023

Date of Issue : 26 April 2023

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

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
E261-E2624	C02222345	10 Nov 2023	National Institute of Metrology (Thailand), (NIMT)

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CAL-F0031-03



Certificate of Calibration

Certificate No. : 66-200145-1

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)
0.001	0.0000	0.00010
0.01	0.0000	0.00011
0.1	0.0000	0.00011
0.5	0.0000	0.00010
2	0.0000	0.00011
5	-0.0001	0.00011
10	0.0000	0.00012
50	-0.0001	0.00014
100	-0.0001	0.00020
200	0.0000	0.00038

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

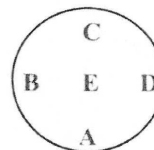
This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.06$, providing a level of confidence of approximately 95%

Eccentric error

Load test : 50 g

A	B	C	D	E
-0.0003	0.0001	0.0004	0.0000	0.0000

g



Repeatability

Load test : 200 g

Stdev. : 0.00005 g

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NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 66-400422-5

Page : 1 of 2

Submitted by : Pacific Laboratory Co.,Ltd
14/5358 Moo 14, T. Bang Bua Thong, A. Bang Bua Thong, Nonthaburi 11110 Thailand

Equipment : Air Chamber (Incubator)
Manufacturer : Aqua Lytic Model : TC 135S
Range : N/A °C Resolution : 0.1 °C
Serial No. : 0614/000033 ID No. : LAB-IB-001

Environment : On site calibration was carried out at the Laboratory, Pacific Laboratory Co., Ltd
Ambient Temperature : (23.5 to 24.2) °C
Relative Humidity : (40 to 45) %
Line Voltage : (220.0 to 222.0) V

Date of Received : 31 July 2023

Date of Calibration : 31 July 2023

Date of Issue : 05 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 RTD Probe

ID No.	Cert. No.	Due Date	Traceability
400029 & 400048	66-400067-1	04 Aug 2023	National Institute of Metrology Thailand (NIMT)

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Certificate of Calibration

Certificate No. : 66-400422-5

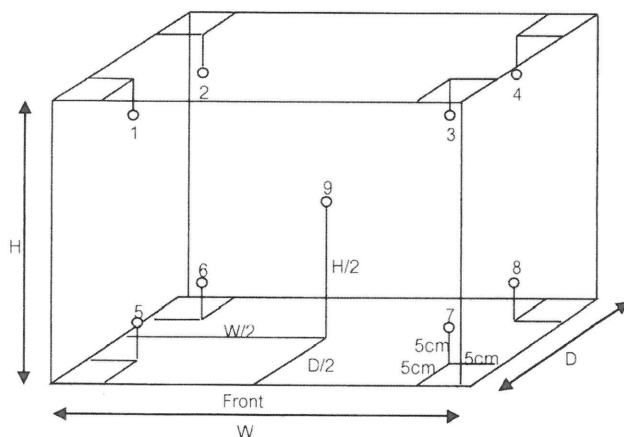
Page : 2 of 2

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 = 0.51 m

D = 0.04 m

H = 0.70 m

Capacity = 0.02 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	20.5	20.5	20.05	19.87	19.94	19.93	19.93	19.91	20.00	20.01	19.90	0.77

Test Point (° C)	Setting Temperature (° C)	Indicating Temperature (° C)	Measured Uniformity (° C)	Measured Stability (° C)	Overall Variation (° C)
20.0	20.5	20.5	0.33	0.39	0.8

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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NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 66-400422-4

Page : 1 of 2

Submitted by : Pacific Laboratory Co.,Ltd
14/5358 Moo 14, T. Bang Bua Thong, A. Bang Bua Thong, Nonthaburi 11110 Thailand

Equipment : Water Bath
Manufacturer : Memmert Model : WNB 22
Range : N/A °C Resolution : 0.1 °C
Serial No. : L514.0184 ID No. : LAB-WB-001

Environment : On site calibration was carried out at the Laboratory, Pacific Laboratory Co., Ltd
Ambient Temperature : (30.0 to 32.0) °C
Relative Humidity : (50 to 55) %
Line Voltage : (220.0 to 222.0) V

Date of Received : 31 July 2023

Date of Calibration : 31 July 2023

Date of Issue : 05 August 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

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CAL-F0031-03



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Certificate of Calibration

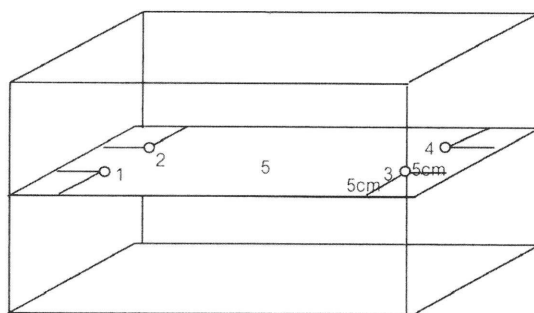
Certificate No. : 66-400422-4

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement



Front

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			
95.0	95.0	95.0	94.46	94.37	94.38	94.38	94.41	0.18	0.08	0.04

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%

- o0o -



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NSC-TISI-TIS 17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 66-400422-3

Page : 1 of 2

Submitted by : Pacific Laboratory Co.,Ltd
14/5358 Moo 14, T. Bang Bua Thong, A. Bang Bua Thong, Nonthaburi 11110 Thailand

Equipment : Air Chamber (Oven)
Manufacturer : Memmert Model : UN 55
Range : N/A °C Resolution : 0.1 °C
Serial No. : B214.1879 ID No. : LAB-OV-001

Environment : On site calibration was carried out at the Laboratory, Pacific Laboratory Co., Ltd
Ambient Temperature : (30.0 to 32.0) °C
Relative Humidity : (50 to 55) %
Line Voltage : (220.0 to 222.0) V

Date of Received : 31 July 2023

Date of Calibration : 31 July 2023

Date of Issue : 05 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 :

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CAL-F0031-03



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Certificate of Calibration

Certificate No. : 66-400422-3

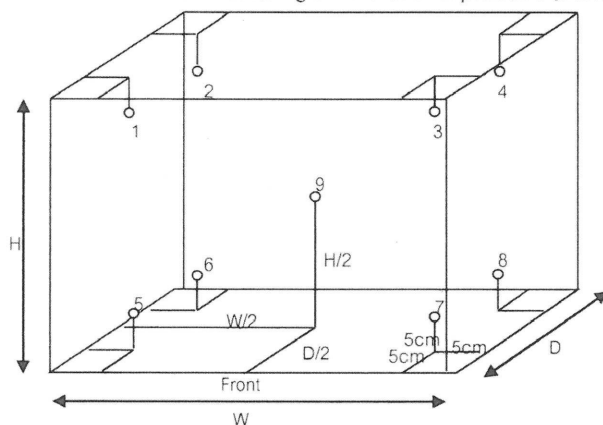
Page : 2 of 2

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 = 0.33 m

H = 0.40 m

Capacity = 0.05 m³

Test Point (° C)	Setting Temperature (° C)	Indicating Temperature (° C)	Measured Temperature (° C) @ Sensor No.									Uncertainty
			1	2	3	4	5	6	7	8	9	(± ° C)
104.0	107.0	107.0	104.9	104.7	104.2	104.7	103.1	103.2	102.9	104.2	103.5	0.83
180.0	184.0	184.0	180.5	180.3	179.7	180.3	176.9	176.8	177.0	180.3	179.4	1.1

Test Point (° C)	Setting Temperature (° C)	Indicating Temperature (° C)	Measured Uniformity (° C)	Measured Stability (° C)	Overall Variation (° C)
104.0	107.0	107.0	1.5	0.3	2.3
180.0	184.0	184.0	2.8	0.4	4.3

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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Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhprachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120

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NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 66-200247-2

Page : 1 of 2

Submitted by : Pacific Laboratory Co., Ltd.
14/5358 Moo 14, T.Bang Bua Thong, A.Bang Bua Thong, Nonthaburi 11110 Thailand

Equipment : Electronic Balance
Manufacturer : SHIMADZU Model : AP225WD
Serial No. : D316301828 ID No. : LAB-BL-003
Capacity : 220 g Resolution : 0.00001g/102g, 0.0001g/220g

Environment : On site calibration was carried out at the Laboratory, Pacific Laboratory Co., Ltd.
Ambient Temperature : (25.1 to 25.4) °C
Relative Humidity : (62.3 to 64.8) %
Air Pressure : 1007.0 mbar

Date of Received : 31 July 2023

Date of Calibration : 31 July 2023

Date of Issue : 02 August 2023

Calibrated by : Akaradath Thippichai

Calibration Method : In-house method CAL-M2001 based on UKAS Publication ref : LAB 14
Edition 5, July 2015

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

Standard Weights

ID No.	Cert. No.	Due Date	Traceability
E261-E2624	C02222345	10 Nov 2023	National Institute of Metrology (Thailand), (NIMT)

Approved by :



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Certificate of Calibration

Certificate No. : 66-200247-2

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)
0.001	0.00001	0.000020
0.01	0.00001	0.000021
0.05	0.00001	0.000019
0.1	0.00001	0.000024
1	-0.00001	0.000030
2	0.00000	0.000036
5	-0.00001	0.000046
20	-0.00002	0.000073
50	-0.00004	0.00011
100	-0.00005	0.00020
150	-0.0001	0.00038
200	-0.0001	0.00040

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

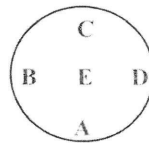
This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.52$, providing a level of confidence of approximately 95%

Eccentric error

Load test : 50 g

A B C D E

0.00002 0.00003 0.00001 0.00004 0.00000 g



Repeatability

Load test : 200 g

Stdev. : 0.000048 g

- oOo -



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NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 66-400220-1

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Submitted by : Special Lab Envi and Consultant Co., Ltd.
47/91 Moo 3 Thambol Tha-it, Pakkret, Nonthaburi 11120

Equipment : Air Chamber (Incubator)

Manufacturer : Lovibond

Model : FKU 1800

Range : N/A °C

Resolution : 0.1 °C

Serial No. : 0925481-19

ID No. : LB-Eq-005

Environment : On site calibration was carried out at the Laboratory, Special Lab Envi and Consultant Co., Ltd.

Ambient Temperature : (31.0 to 32.0) °C

Relative Humidity : (40 to 45) %

Line Voltage : (226.0 to 226.5) V

Date of Received : 24 April 2023

Date of Calibration : 24 April 2023

Date of Issue : 26 April 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

400046 & 400047 66-400066-2

03 Aug 2023

National Institute of Metrology Thailand (NIMT)

Approved by



The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

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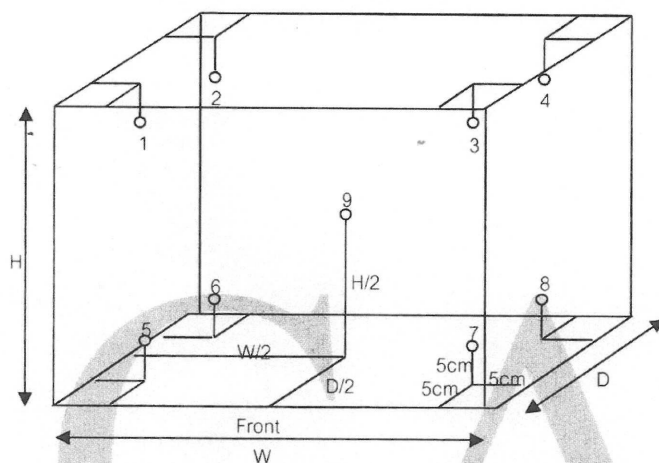
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Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



Inside of Chamber

W = 0.55 m

D = 0.73 m

H = 0.50 m

Capacity = 0.20 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	30.0	30.0	30.30	30.42	30.25	30.34	30.43	30.48	30.30	30.44	30.01	0.31
35.0	35.0	35.0	35.06	35.48	34.86	35.50	35.46	35.52	35.04	35.51	35.06	0.32
37.0	37.0	37.0	37.08	37.47	36.92	37.48	37.45	37.56	37.06	37.56	37.05	0.33

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
30.0	30.0	30.0	0.48	0.04	0.5
35.0	35.0	35.0	0.49	0.05	0.7
37.0	37.0	37.0	0.57	0.06	0.7

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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