

ภาคผนวก จ

สำเนาเอกสารรับรองเครื่องมือการตรวจวัด



Certificate of Calibration

Certificate No. : 66-420087-1

Page : 1 of 2

Submitted by : M Green Group Co.,Ltd.

188/46 Wisatesukhakhon 25, Pracha-Utd Rd., Thungkru Bangkok 10140 Thailand

Equipment : pH Meter with electrode

pH meter

Manufacturer : Eutech

Model : pH 700

pH

Resolution : 0.01

ID No. : N/A

Serial No. : 2884323

Electrode

Model : N/A

Serial No. : 01X099320

Environment : On site calibration was carried out at the Laboratory, M Green Group Co.,Ltd.

Ambient Temperature : (25.0 to 25.5) °C

Relative Humidity : (45 to 50) %

Date of Received : 20 September 2023

Date of Calibration : 20 September 2023

Date of Issue : 25 September 2023

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	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

(Signature Promoting)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-420087-1

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		Correction (pH)	Uncertainty (± pH)
		(pH)	(mV)		
4, 7, 10	4.008	4.01	0.00	0.00	0.010
	6.985	7.00	-0.01	-0.01	0.011
	9.997	10.01	-0.01	-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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Certificate of Calibration

Certificate No. : 66-400519-1

Page : 1 of 2

Submitted by :

M Green Group Co.,Ltd.

188/46 Wisatsunkhakhon 25, Pracha-Uttd Rd., Thungkru Bangkok 10140 Thailand

Equipment :

Digital Thermometer with Thermistor probe
Temperature Indicator

Manufacturer : Eutech

Model : pH 700

Range : N/A °C

Resolution : 0.1 °C

Serial No. : 2884323

ID No. : N/A

Thermistor probe

Model : N/A

Sheath Material : Stainless

Diameter : 3.2 mm.

Length : 100 mm.

Serial No. : PH5TEMB01P

ID No. : N/A

Environment :

On site calibration was carried out at the M Green Group Co.,Ltd.

Ambient Temperature : (25.0 to 26.0) °C

Relative Humidity : (56 to 60) %

Line Voltage : (224.0 to 225.2) VAC

Date of Received :

20 September 2023

Date of Calibration :

20 September 2023

Date of Issue :

25 September 2023

Calibrated by :

Permpoon 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 22E569 22 Feb 2024 National Institute of Metrology Thailand (NIMT)

Approved

(Surachai Pronthong)
Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-400519

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)
100	25.006	24.9	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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Certificate of Calibration

Certificate No. : 66-200300-1 Page : 1 of 2

Submitted by :

M Green Group Co., Ltd.

188/46 Wisutesuknakhon 25, Pracha-Utd Rd., Thungkru, Bangkok 10140 Thailand

Equipment :

Electronic Balance

Manufacturer : SHIMADZU

Model : AP225WD

Serial No. : D316300690

Capacity : 220 g Resolution : 0.00001g/102g, 0.0001g/220g

Environment :

On site calibration was carried out at the Laboratory, M Green Group Co., Ltd.

Ambient Temperature : (25.6 to 26.7) °C

Relative Humidity : (54.4 to 56.6) %

Air Pressure : 1010.0 mbar

Date of Received :

20 September 2023

Date of Calibration :

20 September 2023

Date of Issue :

22 September 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

ID No.

E261-E2624

Cert. No.
C02222345

Due Date

10 Nov 2023

Traceability

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. : 66-200300-1 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 ± (g)
0.001	0.00000	0.000012
0.01	0.00000	0.000013
0.1	0.00000	0.000015
1	0.00000	0.000026
10	0.00000	0.000053
20	-0.00003	0.000071
50	0.00004	0.00011
100	-0.00009	0.00020
150	0.0000	0.00038
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 $k = 2.15$, providing a level of confidence of approximately 95%

Eccentric error

Load test : 50 g

A	B	C	D	E
-0.00003	0.00000	0.00000	-0.00005	0.00000



Repeatability

Load test : 200 g

Sidev. : 0.000048 g

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Certificate of Calibration

Certificate No. : 66-400531-1

Page : 1 of 2

Submitted by :

M Green Group Co., Ltd.

188/46 Wisatesuknakhon 25, Pracha-Utd Rd., Thungkru, Bangkok 10140 Thailand

Equipment :

Liquid in Glass Thermometer

Manufacturer : N/A

Model : N/A

Range : 0 °C to 100 °C

Resolution : 1 °C

Serial No. : N/A

Immersion : Total

ID No. : 94-49747

Environment :

Ambient Temperature : (23 ± 2) °C

Relative Humidity : (50 ± 15) %

Line Voltage : (220 ± 22) VAC

Date of Received :

21 September 2023

Date of Calibration :

23 September to 26 September 2023

Date of Issue :

26 September 2022

Calibrated by :

Chortip Samchusri

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4001 based on ASTM E77-07 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

400001 TT-0016-22 07 Feb 2024

Traceability

National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No. Cert.No. Due Date

400003 23E1866 01 Jun 2025

Traceability

National Institute of Metrology Thailand (NIMT)

400004 23E1866 01 Jun 2025

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. : 66-400531-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Ice point check : UUC* reading 0 °C Standard reading 0.0352 °C

Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
39.7228	40	-0.3	0.31

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. : 66-400520-1

Page : 1 of 2

Submitted by : M Green Group Co., Ltd.

188/46 Wisatesukhakhon 25, Pracha-Utd Rd., Thungkru Bangkok 10140 Thailand

Equipment : Air Chamber (Refrigerator)

Manufacturer : Biobase

Model : BXC-V250M (II)

Range : N/A °C

Resolution : 0.1 °C

Serial No. : YC025025190108

ID No. : N/A

Environment : On site calibration was carried out at the Laboratory, M Green Group Co., Ltd.

Ambient Temperature : (25.0 to 26.0) °C

Relative Humidity : (40 to 50) %

Line Voltage : (226.0 to 230.0) V

Date of Received : 20 September 2023

Date of Calibration : 20 September 2023

Date of Issue : 25 September 2023

Calibrated by : Pempon 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. : 66-400520-1

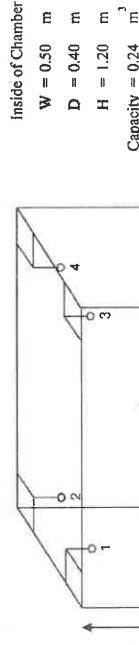
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



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	
4.0	2.0	2.0	4.05	4.04	4.27	4.89	4.10	4.05	4.92	4.37	4.43	0.46

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
4.0	2.0	2.0	0.60	0.21	1.2

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. : 66-400520-2 Page : 1 of 2

Submitted by : M Green Group Co., Ltd.
188/46 Wisutesukhakhon 25, Pracha-Utd Rd., Thungkru Bangkok 10140 ThailandEquipment : Air Chamber (Oven)
Manufacturer : Memmert
Range : N/A °C
Serial No. : B419.1092
Model : UF110
Resolution : 0.1 °C
ID No. : N/AEnvironment : On site calibration was carried out at the Laboratory, M Green Group Co., Ltd.
Ambient Temperature : (25.0 to 26.0) °C
Relative Humidity : (40 to 50) %
Line Voltage : (226.0 to 230.0) VDate of Received : 20 September 2023
Date of Calibration : 20 September 2023
Date of Issue : 25 September 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 probeID No. Cert. No. Due Date Traceability
400046 & 400028 66-400184-3 04 Oct 2023 National Institute of Metrology Thailand (NIMT)

Approved by :

(Surachai Promthong)
Laboratory Manager

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Certificate of Calibration

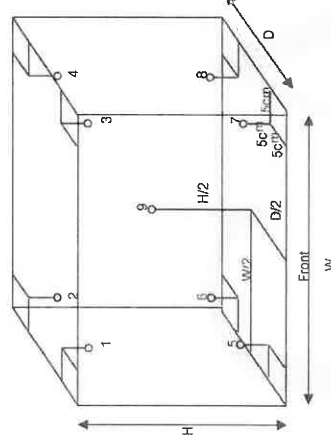
Certificate No. : 66-400520-2 Page : 2 of 2

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 = 0.56 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	
103.0	103.0	103.0	103.3	103.0	103.7	103.3	103.1	103.0	103.8	102.7	103.3	0.69
105.0	105.0	105.0	105.3	105.0	105.7	105.3	105.2	105.0	105.8	104.6	105.3	0.71
180.0	180.0	180.0	180.4	180.1	181.2	180.4	180.3	180.0	181.4	179.0	180.5	0.95

Test Point (° C.)	Setting Temperature (° C.)	Indicating Temperature (° C.)	Measured Uniformity (° C.)	Measured Stability (° C.)	Overall Variation (° C.)
103.0	103.0	103.0	0.8	0.1	1.3
105.0	105.0	105.0	0.9	0.1	1.4
180.0	180.0	180.0	1.7	0.2	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. : 66-400520-3

Page : 1 of 2

Submitted by :

M Green Group Co., Ltd.

188/46 Wisutesukhakhon 25, Pracha-Uttd Rd., Thungkru Bangkok 10140 Thailand

Equipment :

Water Bath

Manufacturer : Memmert

Model : WNB29

Range : N/A °C

Resolution : 0.1 °C

Serial No. : L619,0037

ID No. : N/A

Environment :

On site calibration was carried out at the Laboratory, M Green Group Co., Ltd.

Ambient Temperature : (25.0 to 26.0) °C

Relative Humidity : (40 to 50) %

Line Voltage : (226.0 to 230.0) V

Date of Received : 20 September 2023

Date of Calibration : 20 September 2023

Date of Issue : 25 September 2023

Calibrated by : Perngpon 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

400046 & 400024 66-400184-2 06 Oct 2023

National Institute of Metrology Thailand (NIMT)

Approve

(Sirachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

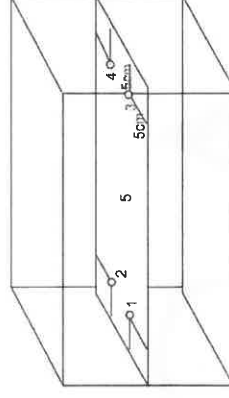
Certificate No. : 66-400520-3

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) @					Uncertainty (± °C)	Measured Uniformity (°C)	Measured Stability (°C)
			Sensor No.							
			1	2	3	4	5			
85.0	85.0	85.0	85.08	85.04	84.98	85.17	85.02	0.18	0.2	0.05

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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Certificate of Calibration

Certificate No. : 66-400520-4

Submitted by : M Green Group Co., Ltd.

188/46 Wisatsukhakhon 25, Pracha-Utd Rd., Thungru Bangkok 10140 Thailand

Equipment : Air Chamber (Incubator)

Manufacturer : Biobase

Range : 0 °C to 65 °C

Serial No. : KYP1502202003

ID No. : N/A

Environment : On site calibration was carried out at the Laboratory, M Green Group Co., Ltd.

Ambient Temperature : (25.0 to 25.5) °C

Relative Humidity : (45 to 50) %

Line Voltage : (226.0 to 230.0) V

Date of Received : 20 September 2023

Date of Calibration : 20 September 2023

Date of Issue : 25 September 2023

Calibrated by : Pernpon 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.

Traceability

400029 & 400043 66-400226-1

Due Date

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

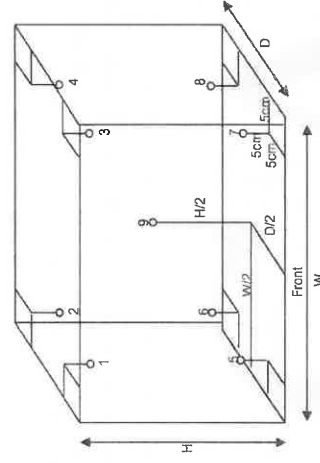
Certificate No. : 66-400520-4

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 = 0.45 m

D = 0.41 m

H = 0.85 m

Capacity = 0.16 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	20.14	20.04	19.91	19.97	20.03	19.96	19.91	19.96	19.92	0.70

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
20.0	20.0	20.0	0.28	0.37	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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Certificate of Calibration

Certificate No. : 66-300589-7 Page : 1 of 2

Submitted by : M Green Group Co., Ltd.

188/46 Wisatsuknakhon 25, Pracha-Utd Rd., Thungkru, Bangkok 10140 Thailand

Equipment : Burette

Manufacturer : GLASSCO Class : A

Capacity : 10 ml Graduation : 0.05 ml

ID No. : 2212-0344-1

Environment : Ambient Temperature : (20 ± 3) °C

Relative Humidity : (50 ± 10) %

Air Pressure : 1006.7 mbar.

Date of Received : 20 September 2023

Date of Calibration : 27 September 2023

Date of Issue : 27 September 2023

Calibrated by : Wipa Tovadee

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.

241003 66-200196-2

Due Date

02 Dec 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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Certificate of Calibration

Certificate No. : 66-300589-7 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 : 21.33 sec.

Nominal Volume (ml)	Measuring Volume (ml)
10	9.9913

Uncertainty of measurement with in ± 0.0039 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

Certificate No. : 66-300589-8 Page : 1 of 2

Submitted by : M Green Group Co., Ltd.

188/46 Wisetukulnakhon 25, Pracha-Utd Rd., Thungkru, Bangkok 10140 Thailand

Equipment : Burette

Manufacturer : GLASSCO Class : A

Capacity : 25 ml Graduation : 0.1 ml

ID No. : 2212-0344-2

Environment : Ambient Temperature : (20 ± 3) °CRelative Humidity : (50 ± 10) %

Air Pressure : 1006.7 mbar.

Date of Received : 20 September 2023

Date of Calibration : 27 September 2023

Date of Issue : 27 September 2023


Calibrated by : Wipa Tovadee

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
241003	66-200196-2	02 Dec 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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Certificate of Calibration

Certificate No. : 66-300589-8 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 : 46.01 sec.

Nominal Volume (ml)	Measuring Volume (ml)
25	24.9741

Uncertainty of measurement with in \pm 0.0066 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

Certificate No. : 66-300590-1

Page : 1 of 2

Submitted by

: M Green Group Co., Ltd.

188/46 Wisatesuknakhon 25, Pracha-Utd Rd., Thungkru, Bangkok 10140 Thailand

Equipment

: Imhoff Cone

Manufacturer : VITLAB

Capacity : 1000 ml

Graduation : 50 ml

ID No. : CY1000/01/22

Environment

: Ambient Temperature : (20 ± 3) °C

Relative Humidity : (50 ± 10) %

Air Pressure : 1005.4 mbar.

Date of Received : 20 September 2023

Date of Calibration : 26 September 2023

Date of Issue : 26 September 2023

Calibrated by : Areearat 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

241002

66-200196-1

02 Dec 2023

National Institute of Metrology (Thailand) (NIMT)

Approved by :

(Wipa Towadee)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-300590-1

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

Nominal Volume (ml)	Measuring Volume (ml)
500	501.19
1000	1010.67

Uncertainty of measurement with in ± 0.17 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%

- oOo -



ใบรับรองการทวนสอบ “เครื่องกลั่นไนโตรเจน”
(Calibration Certificate of Distillation Unit VAPODEST
VAP20, VAP30s)

การดูแลบำรุงรักษาเชิงป้องกัน
Preventive Maintenance



บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
ฝ่ายบริการหลังการขาย
โทร 0 2 639 7000 E-mail: service.asia@dksh.com
ฝ่ายขายและการตลาด
โทร 0 2 639 7000 E-Mail : marketing.asia@dksh.com
Website : www.dksh.co.th/technology/distillation

เงื่อนไขการให้บริการ Preventive Maintenance

บริษัทฯ จะส่งวิศวกรผู้ชำนาญ เพื่อให้บริการตรวจสอบค่าของบริการเฉพาะ ในวันและเวลา ราชการ หากมีความประสงค์ที่จะรับบริการนอกเหนือจากวัน เวลา ราชการ (วันหยุดเสาร์ – อาทิตย์ หรือวันหยุด นักชดถุภ) บริษัทฯ จะคิดค่าบริการเพิ่มเติมตามอัตราที่กำหนดบนหน้าหน้าใบ

ขอบข่ายการบริการ

- ตรวจสอบสภาพการทำงานต่าง ๆ ของเครื่องมือ
- ทดสอบประสิทธิภาพการทำงานของเครื่องมือ
- รายการผลการตรวจสอบเครื่องมือ

หมายเหตุ

- ราคาไม่รวมถึงค่าบริการซ่อม หรือ เปลี่ยนอะไหล่ที่ชำรุดเสียหาย หรือหมดสภาพการใช้งาน
- ในกรณีที่ผู้รับบริการอยู่นอกเขตพื้นที่ให้บริการ บริษัทฯ จำเป็นต้องคิดค่าใช้จ่ายเพิ่มเติม ได้แก่ ค่าเดินทาง เป็นต้น
- บริษัทฯ ขอสงวนสิทธิ์ในการเปลี่ยนแปลงราคา โดยไม่แจ้งให้ทราบล่วงหน้า

ช่องทางการติดต่อ



DKSH Technology Limited (บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด)
เลขที่ 2553 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260
เลขประจำตัวผู้เสียภาษี 010-555-001-4547 (สำนักงานใหญ่)



Call center 0 2 639 7000



DKSH Scientific



www.dksh.com/thailand



marketing.th@dksh.com



@dkshscientific

Preventive Maintenance Contract

จำนวนในการที่สัญญาบริการ 1 ครั้ง ต่อ ปี
 ครึ่งปี/วันที่ 28 Mar 2023

รายละเอียดผู้รับบริการ

หน่วยงาน	บริษัท เทคที เทค จำกัด		
ที่อยู่	30/32 ซอยพระรามที่ 2 ซอย 63 ถนนพระรามที่ 2 แขวงสามเสน แขวงจตุจักร กรุงเทพมหานคร 10150		
โทรศัพท์	0-2893-4211-7	แฟกซ์	0-2893-4218

ผู้ติดต่อ

ชื่อ - นามสกุล	คุณวิภา วิเศษสังข์		
ตำแหน่ง	หัวหน้าส่วน		
โทรศัพท์	0-2893-4211-7	เบอร์มือถือ	แฟกซ์ 0-2893-4218
E-mail	Lab_center@sestech.co.th		

รายละเอียดผู้ให้บริการ

บริษัท คีเคอสมท เทคโนโลยี จำกัด (ฝ่ายบริการเชิงการขยาย) (สำนักงานใหญ่) เลขที่ 2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260 โทรศัพท์ 0 2 693 7000 Email: siriporn.s@dkah.com Line ID : siriporn3007 เจ้าหน้าที่ประสานงาน : คุณศิริพร อู่ทองใจ โทรศัพท์ 090 678 6924 , 02 301 7467			
เจ้าหน้าที่ผู้ให้บริการ	นายชรินทร์ สมเอก		
ตำแหน่ง	Specialist, Technical Service.		
โทรศัพท์	0938138736	แฟกซ์	-
E-mail	Jirayut.j@dkah.com		

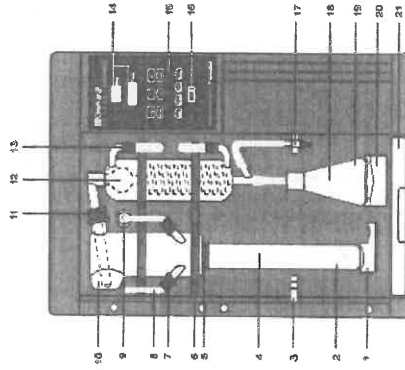
ลงนามผู้รับบริการ	ลงนามผู้ให้บริการ
ตำแหน่ง	ตำแหน่ง
ตำแหน่ง	ตำแหน่ง
วันที่ / ประทับตราบริษัท	วันที่ / ประทับตราบริษัท

JOB No: LAB2302591 MODEL: Vap30 S/N: 003718

Part : Operational Qualification (OQ)

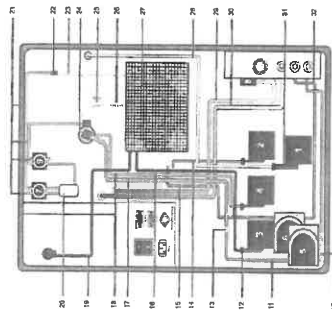
ตรวจสอบสภาพเครื่อง

FRONT



Pass	Fail	N/A	Remark
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1.Quick clamping device with wedge
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2. Kjeldatherm digestion tube
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	3. Holder for steam inlet tubing
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4. PTFE-Inlet tubing, steam
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5. Viton-cone
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6. Clamping for glassware
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	7. Screw cap GL18 with silicone seal
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8. PTFE-Inlet tubing, NaOH
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	9. PP-Distributor with PP-threaded joint
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	10. Distribution head, glass
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	11. Screw cap GL32 with silicone seal
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	12. Distillation condenser
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	13. Screw cap GL14 with plastic screw connection
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	14. Display
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	15. Keyboard, chemical-resistant
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	16. Main switch, green
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	17. Ventilation valve
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	18. Distillate outlet tubing
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	19. Erlenmeyer flask
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	20. Platform
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	21. Drip tray

REAR



	Pass	Fail	N/A	Remark
1. Diaphragm pump NaOH	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Diaphragm pump H ₃ BO ₃	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	vap 40 only
3. Diaphragm pump H ₂ O for steam generator	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Diaphragm pump H ₂ O for sample	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	vap 30,40 only
5. Peristaltic pump for suction sample	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	vap 30,40 only
6. Peristaltic pump for suction receiver	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	option
7. Pinch-solenoid valve, steam	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Magnetic valve with pressure control	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Pinch-solenoid valve, shut-off	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Verprene-tubing 4x8 mm.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Verprene-tubing 4x8 mm.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	vap 30,40 only
12. Non-return valve for diaphragm pumps	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Tubing reduction PP 51x10x5 mm.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	vap 30,40 only
14. Silicone tubing 4x7 mm.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	vap 40 only
15. Silicone tubing 4x7 mm.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	option
16. Silicone -tubing 4x7 mm.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Verprene-tubing 8x12 mm.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	vap 30,40 only
18. Verprene tubing 4x7 mm.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	vap 30,40 only
19. Silicone tubing 4x7 mm.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. Ventilation glass	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. Novoprene-tubing 4.8x8 mm.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. Tubing reduction	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23. Silicone tubing 6x10 mm.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. PP-distributor with PP-fitted	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. SKT-valve (built in with brass fitting)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26. Silicone tubing 8x16x80 mm.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27. Steam generator	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28. PTFE-inlet tubing NaOH	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29. Silicone tubing 8x16 for cooling water inlet	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30. Silicone tubing 8x16 for cooling water outlet	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31. Viton-tubing 6x12*50 mm.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32. Silicone tubing 4x7 mm.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	option

รายละเอียดการตรวจสอบ

ขั้นตอนการบริการ

ตรวจสอบระบบไฟฟ้า (Electrical Test)

- ความดันตามทางไฟฟ้าของเครื่องกับราคา
- กระแสไฟฟ้าที่ใช้งาน

ตรวจสอบสภาพเครื่อง (Optical Test)

- Main cable
- Electric wiring
- Pumps
- Distribution Head
- Condensor
- Steam generator
- Tubing
- Viton cone

ตรวจสอบ Function การทำงาน (The Function Test)

- ระบบสร้างและควบคุมความดันของ Steam
- ระบบการเติมน้ำเข้า Sample Tube
- ระบบการเติม Na OH
- ระบบการ Suction ค้าง Sample Tube และ Receiver

Part : ข้อมูลสนับสนุนด้านเทคนิค (General Technical Support)
การบำรุงรักษาทั่วไป (Basic maintenance)

Cleaning

Glass parts and suction pump should be cleaned before long periods of non-usage (i.e. holidays). This way blockages caused by crystalline deposits are avoided.

The following program should be run:

Addition H_2BO_3	0	s
Addition H_2O_2	13	s
Addition NaOH:	0	s
Reaction time:	0	s
Distillation time:	7	min.
Steam capacity:	100	%
Suction time:	20	s

Place an empty digestion tube and an Erlenmeyer flask into position, and start the program.
In case of extreme deposits in the glassware you can clean the system by putting about 10 ml of sulphuric acid into the digestion tube.

Error Code

The micro-processor continually surveys all the functions of the distillation system. As soon as an error arises it is shown on the display and accompanied by an acoustic signal.

Error message	Measures
No tap water	Check cooling water inlet for blockages. Ensure the tap is turned on
No sample tube	Insert tube
Check chemicals	Check set of tanks
Low water Press Enter	Check the water inlet distilled H_2O
Filling Steam generator	This message disappears as soon as steam generator is filled
After the above mentioned errors are corrected, the following message is displayed.	
Error message	Measures
Stop Prog. No. x continue=Enter	Enter = continue of interrupted program Reset = Standby-mode
Other error messages	
Error message	Measures
Wait for steam	Message disappears as soon as stand-by is reached
Add sol. > 1min Continue=Enter	Check programming Enter=continue of interrupted program Reset=Standby-mode
Program undefined	Check programming
Excess steam pressure	Switch the system off and call service
Sensor error	Switch the system off and call service



CERTIFICATE No : 23T1387
REFERENCE No : 68174-5

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : INCUBATOR
MANUFACTURER : MEMMERT
MODEL : IF 110
SERIAL No : D415.0802
ID No : EQL-190
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : TEST TECH CO., LTD.
30,32 RAMA II SOI 63, RAMA II RD., SAMAEADAM,
BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY : PRASERT P.
CALIBRATION DATE : 13-Feb-23

APPROVED BY :
ISSUED DATE : 14-Feb-23
RECEIVED DATE : 13-Feb-23

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF
QUALITY CALIBRATION CO., LTD.

F-G010 REV : 02



CERTIFICATE No : 23T1387

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : INCUBATOR
MANUFACTURER : MEMMERT
MODEL : IF 110
ID No : EQL-190
RECEIVED DATE : 13-Feb-23
AMBIENT TEMPERATURE : 24 °C ± 1 °C
SN : D415.0802
CALIBRATION DATE : 13-Feb-23
RELATIVE HUMIDITY : 50 %RH ± 10 %RH

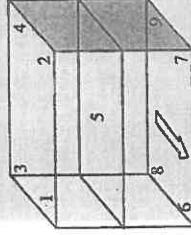
CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TLAS G-20 BY COMPARISON WITH CALIBRATED RTD Pt100 UNDER NO LOAD CONDITION. THE TEMPERATURE PROBES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOMETER PROBE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND PLACED THE NINTH THERMOMETER PROBE WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE CHAMBER. THE UNIFORMITY WAS MEASURED BETWEEN REFERENCE PROBE AND OTHER PROBES AT THE SAME TIME.

2. REFERENCE STANDARD INSTRUMENTS :-

- 1) DATA LOGGER WITH RTD HYDRA 2635A 22T7509
3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 5
Overall Line Voltage (V) variation : 8
Instrument Condition : Normal
Chamber Size (W*L*H): 56*40*48 cm

CHAMBER PERFORMANCE

Calibration Point (°C)	Controller Temperature (°C)	Indicating Temperature (°C)	Average All Locations (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
37.0	37.0	37.0	36.93	0.07	0.16	0.26
44.0	44.0	44.0	44.17	0.07	0.22	0.27

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (± °C)
	#1	#2	#3	#4	#5	#6	#7	#8	#9	
37.0	36.97	36.95	36.94	36.96	36.91	36.90	36.84	36.84	36.84	0.25
44.0	44.21	44.23	44.09	44.23	44.23	44.13	44.21	44.15	44.07	0.36

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.

NOTE 2 : LOCATION 5 WAS REFERENCE LOCATION.

NOTE 3 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

F-G010 REV : 02



QUALITY CALIBRATION CO.,LTD.

235 Petchkasem 63/2 Road, Laksoeng, Bangkok, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qualitycalibration.com

CERTIFICATE No : 23T1386
REFERENCE No : 68174-4

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : INCUBATOR
MANUFACTURER : MEMBERT
MODEL : IF 160
SERIAL No : D518.0082
No : EQL-205
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : TEST TECH CO., LTD.
30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM,
BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY : PRASERT P.
CALIBRATION DATE : 13-Feb-23

APPROVED BY :
ISSUED DATE : 14-Feb-23
RECEIVED DATE : 13-Feb-23

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF
QUALITY CALIBRATION CO., LTD.

F-G010 REV : 02



QUALITY CALIBRATION CO.,LTD.

235 Petchkasem 63/2 Road, Laksoeng, Bangkok, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 23T1386

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : INCUBATOR
MANUFACTURER : MEMBERT
MODEL : IF 160
ID No : EQL-205
RECEIVED DATE : 13-Feb-23
AMBIENT TEMPERATURE : 24 °C ± 1 °C
SERIAL No : D518.0082
CALIBRATION DATE : 13-Feb-23
RELATIVE HUMIDITY : 50 %RH ± 10 %RH

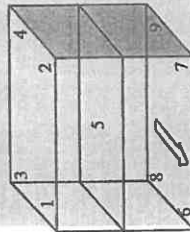
CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TIAS G-20 BY COMPARISON WITH CALIBRATED RTD Pt100 UNDER NO LOAD CONDITION. THE TEMPERATURE PROBES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOMETER PROBE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 3 cm TO 10 cm. AND PLACED THE NINTH THERMOMETER PROBE WITHIN 2.3 cm. OF THE GEOMETRIC CENTER OF THE CHAMBER. THE UNIFORMITY WAS MEASURED BETWEEN REFERENCE PROBE AND OTHER PROBES AT THE SAME TIME.

2. REFERENCE STANDARD INSTRUMENTS :-

- 1) DATA LOGGER WITH RTD
2) HYDRA 2635A
3) THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 2
Overall Line Voltage (V) variation : 9
Instrument Condition : Normal
Chamber Size (W*L*H): 56*40*72 cm

CHAMBER PERFORMANCE

Calibration Point (°C)	Controller Temperature (°C)	Indicating Temperature (°C)	Average All Locations (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation
35.0	35.0	35.0	34.99	0.02	0.14	0.20
36.0	36.0	36.0	36.00	0.03	0.14	0.22
41.5	41.5	41.5	41.46	0.05	0.10	0.19

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (± °C)
	#1	#2	#3	#4	#5	#6	#7	#8	#9	
35.0	34.91	34.94	34.93	34.93	34.98	35.03	35.08	35.01	35.08	0.25
36.0	35.93	35.95	35.95	35.94	36.00	36.05	36.10	36.01	36.10	0.25
41.5	41.46	41.47	41.41	41.47	41.50	41.47	41.45	41.43	41.49	0.36

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.

NOTE 2 : LOCATION 5 WAS REFERENCE LOCATION.

NOTE 3 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY K COVERAGE FACTOR K=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%
END OF CALIBRATION REPORT



QUALITY CALIBRATION CO.,LTD.

233 Petchkasem 63/2 Road, Laksong, Bangkoe, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com



CERTIFICATE No : 23T1385
REFERENCE No : 68174-3

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : INCUBATOR
MANUFACTURER : MEMMERT
MODEL : IF 160
SERIAL No : D518.0240
No : EQL-218
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : TEST TECH CO., LTD.
30,32 RAMA II SOI 63, RAMA II RD., SAMAEADAM,
BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY : PRASERT P.
CALIBRATION DATE : 13-Feb-23

APPROVED BY :
ISSUED DATE : 14-Feb-23
RECEIVED DATE : 13-Feb-23

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF
QUALITY CALIBRATION CO., LTD.

F-G010 REV : 02



QUALITY CALIBRATION CO.,LTD.

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CERTIFICATE No : 23T1385

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : INCUBATOR
MANUFACTURER : MEMMERT
MODEL : IF 160
ID No : EQL-218
RECEIVED DATE : 13-Feb-23
AMBIENT TEMPERATURE : 24 °C ± 1 °C
S/N : D518.0240
CALIBRATION DATE : 13-Feb-23
RELATIVE HUMIDITY : 50 %RH ± 10 %RH

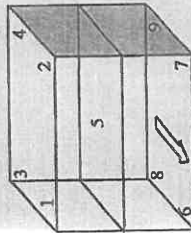
CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TIAS G-20 BY COMPARISON WITH CALIBRATED RTD PH100 UNDER NO LOAD CONDITION. THE TEMPERATURE PROBES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOMETER PROBE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND PLACED THE NINTH THERMOMETER PROBE WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE CHAMBER. THE UNIFORMITY WAS MEASURED BETWEEN REFERENCE PROBE AND OTHER PROBES AT THE SAME TIME.

REFERENCE STANDARD INSTRUMENTS :-

- INSTRUMENT MODEL SERIAL No CERTIFICATE No DUE DATE
1) DATA LOGGER WITH RTD HYDRA 2635A 6635300 22T7309 10-Jul-23
3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



FRONT

GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 2
Overall Line Voltage (V) variation : 12
Instrument Condition : Normal
Chamber Size (W*H*D): 56*40*72 cm

CHAMBER PERFORMANCE

Calibration Point (°C)	Controller Temperature (°C)	Indicating Temperature (°C)	Average All Locations (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
35.0	35.0	35.0	35.00	0.05	0.15	0.26
36.0	36.0	36.0	36.00	0.04	0.16	0.26

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (± °C)
	#1	#2	#3	#4	Ref. 5	#6	#7	#8	#9	
35.0	34.94	34.98	34.93	34.97	35.10	34.94	35.04	35.05	35.05	0.25
36.0	35.94	35.97	35.92	35.96	36.07	36.11	35.95	36.05	36.05	0.25

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.

NOTE 2 : LOCATION 5 WAS REFERENCE LOCATION.

NOTE 3 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.
END OF CALIBRATION REPORT



QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksoeng, Bangkok, Bangkok 10160
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www.qcalibration.com



CERTIFICATE No : 23TI1384
REFERENCE No : 68174-2

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : INCUBATOR
MANUFACTURER : MEMMERT
MODEL : IF 160
SERIAL No : D519.0140
ID No : EQL-231
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : TEST TECH CO., LTD.
30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM,
BANGKOKHUNTHIAN, BANGKOK 10150

CALIBRATED BY : PRASERT P.
CALIBRATION DATE : 13-Feb-23

APPROVED BY :
ISSUED DATE : 14-Feb-23
RECEIVED DATE : 13-Feb-23

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF
QUALITY CALIBRATION CO., LTD.

F-C010 REV : 02



QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksoeng, Bangkok, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 23TI1384

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : INCUBATOR
MANUFACTURER : MEMMERT
MODEL : IF 160
ID No : EQL-231
RECEIVED DATE : 13-Feb-23
AMBIENT TEMPERATURE : 24 °C ± 1 °C
SN : D519.0140
CALIBRATION DATE : 13-Feb-23
RELATIVE HUMIDITY : 50 %RH ± 10 %RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO IAS G-20 BY COMPARISON WITH CALIBRATED RTD Pt100 UNDER NO LOAD CONDITION. THE TEMPERATURE PROBES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOMETER PROBE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND PLACED THE NINTH THERMOMETER PROBE WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE CHAMBER. THE UNIFORMITY WAS MEASURED BETWEEN REFERENCE PROBE AND OTHER PROBES AT THE SAME TIME.

2. REFERENCE STANDARD INSTRUMENTS :-

1) DATA LOGGER WITH RTD
MODEL : HYDRA 2635A
SERIAL No : 6633300
CERTIFICATION No : 22/17509
DUE DATE : 10-Jul-23

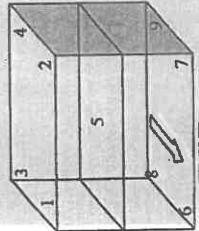
3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.

4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-

- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 2

Overall Line Voltage (V) variation : 8

Instrument Condition : Normal

Chamber Size (W*H): 36*40*72 cm

CHAMBER PERFORMANCE

Calibration Point (°C)	Controller Temperature (°C)	Indicating Temperature (°C)	Average All Locations (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
35.0	35.0	35.0	35.03	0.08	0.17	0.32
37.0	37.0	37.0	37.02	0.08	0.22	0.32
41.5	41.5	41.5	41.54	0.04	0.13	0.20

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)		Measured Temperature (°C) at 9 read Locations									Uncertainty (± °C)
		#1	#2	#3	#4	#5	#6	#7	#8	#9	
35.0	35.0	34.92	35.02	34.99	35.01	35.04	35.03	35.06	35.09	35.10	0.25
37.0	37.0	37.00	36.99	36.95	36.95	37.00	37.02	37.09	37.07	37.11	0.25
41.5	41.5	41.52	41.51	41.47	41.49	41.54	41.53	41.62	41.58	41.56	0.36

NOTE 1 :- THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.

NOTE 2: LOCATION 5 WAS REFERENCE LOCATION

NOTE 3 :- THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A

COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT



QUALITY CALIBRATION CO.,LTD.

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CERTIFICATE No : 23T1391
REFERENCE No : 68175-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : AUTOCLAVE
MANUFACTURER : HIRAYAMA
MODEL : HVE-50
SERIAL No : 30612085166
No : EQL-155
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : TEST TECH CO., LTD.
3032 RAMA II SOI 63, RAMA II RD,
SAMAEDAM, BANGKHUNTHIAN, BANGKOK,
10130

CALIBRATED BY : PRASERT P.
CALIBRATION DATE : 13-Feb-23

APPROVED BY :
ISSUED DATE : 14-Feb-23
RECEIVED DATE : 13-Feb-23

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF
QUALITY CALIBRATION CO., LTD.

F-C010 REV : 02



QUALITY CALIBRATION CO.,LTD.

235 Petchkasem 63/2 Road, Laksong, Bangkok, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com

CERTIFICATE No : 23T1391

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : AUTOCLAVE
MANUFACTURER : HIRAYAMA
ID NUMBER : EQL-155
RECEIVED DATE : 13-Feb-23
AMBIENT TEMPERATURE : 30° C ± 1° C
MODEL : HVE-50
SERIAL NUMBER : 30612085166
CALIBRATION DATE : 13-Feb-23
RELATIVE HUMIDITY : 50 %RH ± 10 % RH

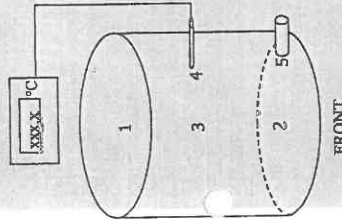
CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BASED ON BS 2646 : Part 5 : 1993 BY COMPARISON WITH CALIBRATED THERMOCOUPLE
1. TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON FIVE LOCATIONS AS SHOWN IN THE
PICTURE. TWO PROBES WERE PLACES NEAR TOP AND BOTTOM WALL AND EACH PROBE WAS AWAY FROM THE EACH WALL
OF 5 cm TO 10 cm. AND PLACED THE THIRD PROBE WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE INSTRUMENT
CHAMBER. PROBE NUMBER 4 WAS ATTACHED TO THE LOAD TEMPERATURE PROBE, IF FITTED, WITHIN 20 mm OF ITS TIP.
PROBE NUMBER 5 WAS PLACED IN THE CHAMBER DRAIN OR VENT WITHIN 100 mm OF ITS CONNECTION TO THE CHAMBER.

2. REFERENCE STANDARD INSTRUMENTS :-

- 1) DATA LOGGER
VAL PROBE
MODEL S350, DV35, DN94
SERIAL No 23TU885
CERTIFICATE No 27-Jan-24
3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



GENERAL INFORMATION

Overall Ambient Temperature around the Chamber variation : 1.2 °C

Autoclave Condition : Normal

Chamber Size (Diameter*H): 30 ± 71 cm

CHAMBER PERFORMANCE

Controller Temperature (°C)	Average All Locations Temperature (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)	Pressure (MPa)	Holding time (min)	Operating Cycle time (min)
116	116.48	0.09	0.10	0.27	0.090	15	60
122	122.43	0.09	0.13	0.27	0.130	15	60

TEMPERATURE MEASUREMENT ACCURACY TEST(°C)

Cont Temp	Measured Temperature (°C) at Spread Locations					Uncertainty (± °C)
	#1	#2	#3	#4	#5	
116	116.45	116.50	116.53	116.45	116.45	0.59
122	122.40	122.46	122.50	122.39	122.39	0.59

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT OF TEMPERATURE MEASUREMENT ACCURACY TEST EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.

NOTE 2 : THE STABILITY TERM IN THE UNCERTAINTY BUDGET WAS REPLACED BY THE STANDARD REPEATABILITY.

NOTE 3 : LOCATION 3 WAS REFERENCE LOCATION.

NOTE 4 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SIUANLUANG, SIUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2715-9484



Certificate of Calibration

Certificate No.: 23M259
Page: 1 of 2

Equipment: Standard Weight
Manufacturer: LS
Model:
Serial No.:
ID No.: EQL-121
Condition As-Received: Used Item
Received Date: 02 February 2023
Calibration Date: 07 February 2023
Reference: 2302-0080DN
Submitted by: TEST TECH CO.,LTD. (HEAD Office)
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: 1008.9 mbar

30, 32 Rama II Soi 63, Rama II Rd.,
Samaedarn, Bangkokhuthian, Bangkok 10150

Procedure used: Calibration were conducted using in-house calibration procedure CP-M01 according to comparison method against standard weights on the basis of weightings at an average air density of 1.2 kg/m³ and a temperature of 23.4 °C material density of weight is 8000 kg/m³.

Condition of this result of calibration

1.Reference standards Instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard weight Set (E2)	YCS31-712-00	50202965	MM-0109-22	11 Jul 2024

2.This certificate is not certified for any commercial transaction.

3.The certificate is valid only to the item calibrated on date and place of calibration.

4.This Certification is traceable to the International System of Unit maintained at-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Chaowalit Ritirak
Issue Date : 08 February 2023

Approved Signatory :

[] Phailinee Prabpaipal
[x] Sura Suwanasri
[] Chaowalit Ritirak



Cert No.: 23M259
Page: 2 of 2

Result of calibration

Nominal Value	Conventional mass	Uncertainty of Measurement (±)	Maximum Permissible error (±)
50 g	50.00015	0.10 mg	0.30 mg

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

-o0o-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484



NSC-TBL-11617023
CALIBRATION 0008

Certificate of Calibration

Certificate No. : 23M260
Page : 1 of 2

Equipment : Standard Weight
Manufacturer :
Model :
Serial No. :
ID No. : EQL-258
Condition As-Received: Used Item
Received Date: 02 February 2023
Calibration Date: 07 February 2023
References: 2302-0080DN
Submitted by: TEST TECH CO.,LTD. (HEAD Office)
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: 1012 mbar

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.

Procedure used: Calibration were conducted using in-house calibration procedure CP-M01 according to comparison method
against standard weights on the basis of weighings at an average air density of 1.2 kg/m³ and a temperature
of 23.6 °C material density of weight is 8000 kg/m³.

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard weight Set (E2)	YCS31-712-00	50202965	MM-0109-22	11 Jul 2024

2.This certificate is not certified for any commercial transaction.

3.The certificate is valid only to the item calibrated on date and place of calibration.

4.This Certification is traceable to the International System of Unit maintained at:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Chaowalit Rittrak
Issue Date : 08 February 2023

Approved Signatory :

[] Phallinee Prabpaipal
[x] Sura Suwamserf
[] Chaowalit Rittrak



Cert No.: 23M260
Page: 2 of 2

Result of calibration Without adjustment

Nominal Value	Conventional mass	Uncertainty of Measurement (±)	Maximum Permissible error (±)
2 kg	2.00000034 kg	3.0 mg	10 mg

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

-o0o-

B 0307756

a 1146232



PerkinElmer

ICP02329207

MAINTENANCE AND TEST CERTIFICATE MODEL OPTIMA 8000

Customer : บริษัท เทคโนโลยี จำกัด
Address : 30, 32 ถนนพระรามที่ 2 ซอย 63
ถนนพระรามที่ 2 แขวงสามลำ
ยอดบางขุนเทียน กรุงเทพฯ 10150
User Name: คุณอานใจ สระจันทร์
Phone: 02-893-4211-17
Fax: lab_center@testtech.co.th

Date Tested: May 18, 2023
Recommendation Recertification
Period 12
Recertification Due: May 17, 2024
Date Last Certified: May 19, 2022
Visit Number: 1 of 1
PerkinElmer Phone: 02-719-6420 ext 206
PerkinElmer Fax: 02-318-5597

CONFIGURATION TESTED

MODEL SERIAL NUMBER
OPTIMA 8000 078S1411171C
N0772045 2F1441085
EQL-180

TESTED EQUIPMENT

IPV Methods

TEST STANDARD USED

Mixed standard 1/10
Mixed standard 1/100

CUSTOMER SUPPLIED

2 % HNO3
10 % HNO3

ACCESSORIES/COMPONENT NOT INCLUDED

WinLab32 Version 5.5.0.0714
PN:6150T21E4Q1E

EXPIRATION

EXPIRATION DATE

NOV 30, 2023
NOV 30, 2023

CUSTOMER INITIALS

Page 1 of 4

PerkinElmer Ltd. 290 Soi 17, Rama 9 Road, Khwang Bangkokpi, Khet Huay Kwang, Bangkok 10310, Thailand



PerkinElmer

ICP02329207

MAINTENANCE AND TEST CERTIFICATE MODEL OPTIMA 8000

SERIAL NUMBER : 078S1411171C

DATE TESTED : May 18, 2023

1. MECHANICAL CHECKS

- A. Inspect and clean all fans and filters. ☐ OK
- B. Inspect and replace as necessary, all torch components including the RF coil. ☐ OK
- C. Inspect all tubing for sign of clacking or leaking. ☐ OK
- D. Adjust water and gas pressure regulator settings. ☐ OK
- E. Inspect and leak check pneumatics drawers. ☐ OK
- F. Clean the exterior of the instrument. ☐ OK

2. OPTICAL CHECKS

- A. Inspect and clean all optical components. ☐ OK
- B. As required, check and replace all purge filters. ☐ OK
- C. Recheck optical alignment. ☐ OK

3. COOLING SYSTEM CHECKS

- A. Perform preventive maintenance on chiller. ☐ OK
- B. Flush out the chiller every six months. ☐ OK

4. PERFORMANCE CHECKS

- A. Torch View Alignment. ☐ OK
- B. Wavelength Calibration. ☐ OK

Page 2 of 4

PerkinElmer Ltd. 290 Soi 17, Rama 9 Road, Khwang Bangkokpi, Khet Huay Kwang, Bangkok 10310, Thailand

MAINTENANCE REPORT AND IPV TEST CERTIFICATE
OPTIMA 8000

SERIAL NUMBER : 078S1411171C DATE TESTED : May 18, 2023

Remarks :

Commissioning follow as commissioning performance sheets.

This is to certify that the above tests have been performed and the configuration tested



meets



does not meet

the PerkinElmer Specifications listed on this certificate.

This certificate does not modify PerkinElmer's standard terms and condition of sale, including warranty terms.

Service Department PerkinElmer Ltd.

Authorized Representative :

(Khwanchai Siangwong)

Customer Support Engineer

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 8000

SERIAL NUMBER : 078S1411171C DATE TESTED : May 18, 2023

PARAMETER	SPECIFICATION	FINAL VALUE
Spectral Resolution : UV	As 193.696 nm	0.00720 nm
	Ni 231.604 nm	0.00892 nm
	Ni 341.476 nm	0.01343 nm
Spectral Resolution : VIS	Ba 455.403 nm	0.01726 nm
Precision	Zn 206.200 nm	% RSD ≤ 1.0 %
	Mg 280.271 nm	% RSD ≤ 1.0 %
	Mg 285.213 nm	% RSD ≤ 1.0 %
	Ba 455.403 nm	% RSD ≤ 1.0 %
Detection Limits : Axial	Tl 190.801 nm	3(SD) ppb ≤ 10 ppb
	As 193.696 nm	3(SD) ppb ≤ 10 ppb
	Se 196.026 nm	3(SD) ppb ≤ 5.0 ppb
	Pb 220.353 nm	3(SD) ppb ≤ 3.0 ppb
Detection Limits : Radial	As 193.696 nm	3(SD) ppb ≤ 60 ppb
	Zn 213.857 nm	3(SD) ppb ≤ 2.0 ppb
	Mn 257.610 nm	3(SD) ppb ≤ 1.0 ppb
	La 379.478 nm	3(SD) ppb ≤ 3.0 ppb
BEC : Axial (IB X 1000)/(IS-IB)	Ba 455.403 nm	3(SD) ppb ≤ 0.3 ppb
	Ba 493.408 nm	3(SD) ppb ≤ 0.6 ppb
BEC : Radial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 30 ppb
	Mn 257.610 nm	≤ 30 ppb



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.

Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6851, +669 8247 2360

Website : www.scieco.co.th E-Mail : calibrate@scg.com



NSC-TIS-TIS 17025
CALIBRATION 0244

Certificate No. T230022

Page 1 of 4

Certificate of Calibration

Equipment : Chamber (Cooling Room)

Manufacturer : -

Model : -

Serial No. : -

Customer Code : EQL-167

ID No. : T1447A1

Customer : Test Tech Co.,Ltd

30, 32 Rama II Sol 63, Rama II Rd., Samaedam,

Bangkhunthian Bangkok 10150

Customer Location : LABORATORY FLOOR 3

Date of Receipt : 13 January 2023

Calibrated By : Sujjar Naknakred (Site Calibration Manager)

Approved By : [Redacted] / Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 24 JAN 2023

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

FM-L1418/31-08-64



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.



NSC-TIS-TIS 17025
CALIBRATION 0244

Certificate No. T230022

Page 2 of 4

Calibration Report

Equipment : Chamber (Cooling Room)

Date of Calibration : 18 January 2023

Environment : Temperature : 25.0-27.2 °C

Line Voltage : 221.9-227.3 V

Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert nine standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986) .

All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN141-TN150	T222123	5 October 2023
TC	TYPE T	TN151-TN160	T222123	5 October 2023
DATA LOGGER	34970A	T150	T222123	5 October 2023

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TIS-TIS 17025 CALIBRATION 0244.)

4. Condition of calibrated item : good

Equipment Description :

Time Constant 2 Hour 8 Minute At 3 °C

Fresh Air Damper

☐ Open ☐ Min ☐ Medium ☐ Max

☐ Close

☒ Not Available

5. Adjustment :

() without adjustment

(X) after adjustment

Approved By

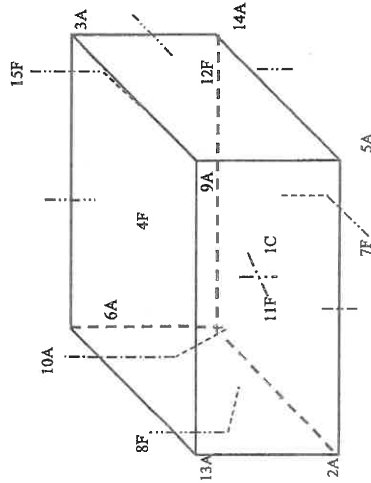
FM-L15 11/715-05-63



Certificate No. T230022

Page 3 of 4

Calibration Report



C = Centre, F = Centre of Face, A = Corner, E = Centre of Edge

1C	=	TN141
2A	=	TN142
3A	=	TN143
4F	=	TN144
5A	=	TN145
6A	=	TN146
7F	=	TN147
8F	=	TN148
9A	=	TN149
10A	=	TN150

11F	=	TN151
12F	=	TN152
13A	=	TN153
14A	=	TN154
15F	=	TN155

Approved By



Certificate No. T230022

Page 4 of 4

Calibration Report

Measurement Results:

Average Standard Reading at each position (°C)										
Calibration Point	TN141	TN142	TN143	TN144	TN145	TN146	TN147	TN148	TN149	TN150
3	2.93	2.77	2.79	2.26	3.04	3.39	2.91	3.05	3.54	2.95
	TN151	TN152	TN153	TN154	TN155					
	3.32	3.28	3.00	2.96	2.90					

Chamber (Cooling Room)			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor k
	Min, Max	Average					
3.0	2.9, 3.1	3.0	3.01	0.47	1.04	0.98	2.00

* The quoted uncertainty exclude " uniformity "

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t -distribution, providing a level of confidence of approximately 95 % .

Approved By





Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.

Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6851 , +669 8247 2360

Website : www.scieco.co.th E-Mail : callbrate@scg.com



NSC-TISI-TIS 17025
CALIBRATION 0244

Certificate No. T230121

Page 1 of 4

Certificate of Calibration

Equipment : Chamber (Cooling Room)
Manufacturer : -
Model : -
Serial No. : -
Customer Code : EQL-181
ID No. : T0399A5
Customer : Test Tech Co.,Ltd
30, 32 Rama II Soi 63, Rama II Rd., Samaedam,
Bangkhunthian Bangkok 10150
Customer Location : LABORATORY FLOOR 4
Date of Receipt : 26 January 2023
Calibrated By : Sujjar Naknakred (Site Calibration Manager)
Approved By : Boonchai Suriyawong (Site Calibration Manager)
Date of Issue : 01 FEB 2023

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

FM-L14118/31-08-64



Metrological Center SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.

Certificate No. T230121

Page 2 of 4

Calibration Report

Equipment : Chamber (Cooling Room)
Date of Calibration : 30 January 2023
Environment : Temperature : 25.0-27.2 °C
Line Voltage : 221.9-227.3 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert nine standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986).

All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN141-TN150	T222123	5 October 2023
TC	TYPE T	TN151-TN160	T222123	5 October 2023
DATA LOGGER	34970A	T150	T222123	5 October 2023

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244.)

4. Condition of calibrated item : good

Equipment Description :

Time Constant 1 Hour 30 Minute At 3 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close ☒ Not Available

5. Adjustment :

() without adjustment (X) after adjustment

Approved By

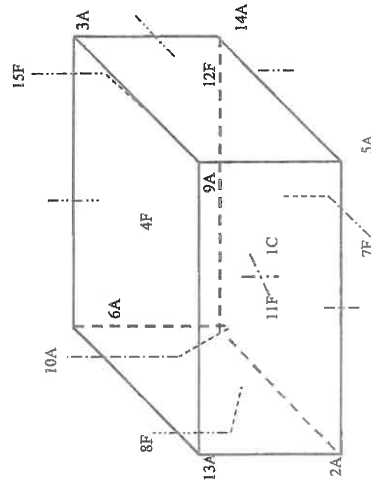
FM-L15117/15-05-63



Certificate No. T230121

Page 3 of 4

Calibration Report



C = Centre, F = Centre of Face, A = Corner, E = Centre of Edge

1C	=	TN141
2A	=	TN142
3A	=	TN143
4F	=	TN144
5A	=	TN145
6A	=	TN146
7F	=	TN147
8F	=	TN148
9A	=	TN149
10A	=	TN150

11F	=	TN151
12F	=	TN152
13A	=	TN153
14A	=	TN154
15F	=	TN155

Approved By _____



Certificate No. T230121

Page 4 of 4

Calibration Report

Measurement Results:

Average Standard Reading at each position (°C)											
Calibration Point	TN141	TN142	TN143	TN144	TN145	TN146	TN147	TN148	TN149	TN150	
	3	2.84	2.89	3.01	3.07	3.13	3.19	3.04	2.99	3.15	2.94
	TN151	TN152	TN153	TN154	TN155						
	2.99	2.99	3.14	2.85	2.88						

Chamber (Cooling Room)			Temperature Distribution				
S (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor k
	Min, Max	Average					
3.0	2.8, 3.1	3.0	3.01	0.48	0.93	0.99	2.00

* The quoted uncertainty exclude " uniformity "
The calibration result apply only the above calibrated item.
The result of test was found accurate as shown on date and place of test only.
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing level of confidence of approximately 95 % .

Approved By _____



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No. : 23H2216
Page : 1 of 2

Equipment : Dial Thermo-Hygrometer
Manufacturer: Barigo
Model :
Serial No.:
ID No.: EQL-664
Condition As-Received: Used Item
Received Date: 12 October 2023
Calibration Date: 17 October 2023
Reference: 2310-0447DN
Ambient Temperature: (25 ± 3) °C
Relative Humidity: (50 ± 20) %

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.

Submitted by: TEST TECH CO.,LTD. (HEAD Office)

30, 32 Rama II Soi 63, Rama II Rd.,
Samaedam, Bangkhunthian, Bangkok 10150

Procedure used: Calibration were conducted using in-house calibration procedure CP-H02 according to comparison
with standard chilled mirror sensor for humidity measurement function and comparison with standard
temperature probe for temperature measurement function into humidity / temperature chamber.

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Handheld Thermometer With Sensor	1523	3240078	23305	15 Mar 2024
2) Dew Point Hygrometer	Optidew 401	164756	TH-0158-22	13 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 maintained through:-

-Technology Promotion Association (Thailand-Japan), NSC-ONSC Accredited No. Calibration 0008
-National Institute of Metrology Thailand (NIMT)

Calibrated by : Sunat Phansudnoi
Issue Date : 26 October 2023

Approved Signatory :

[] Chakrit Waewwanjua
[] Pornthipha Tameyatkul
[✓] Viporn Tantiyawutti

B 0327545



Cert No.: 23H2216
Page.: 2 of 2

Result of Calibration:-
Function: Humidity Measurement

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	30.1	30.0	-0.1	1.5
25.0	40.1	39.0	-1.1	1.5
25.0	50.1	48.0	-1.1	1.7
25.0	60.0	59.0	-1.0	1.7
25.0	75.2	75.5	0.3	1.8

Result of Calibration:-
Function: Temperature Measurement

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
15.046	15.0	-0.046	0.72
19.975	20.0	0.025	0.72
25.022	25.0	-0.022	0.72
30.000	30.0	0.000	0.72

UUC* : Unit Under Calibration

The reported uncertainty of measurement was base on standard uncertainty multiplied
by coverage factor k = 2.00, providing confidence level approximately 95%.

-000-

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CERTIFICATE No : 23M6754
REFERENCE No : 69854-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : SARTORIUS
MODEL : BP210S
SERIAL No : S0736477
ID No : EQL-008
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : TEST TECH CO., LTD.
30,32 RAMA II SOI 63, RAMA II RD.,
SAMAEDAM, BANGKHUNTHIAN, BANGKOK
10150

CALIBRATED BY : PRASERT D.
CALIBRATION DATE : 13-Jul-23

APPROVED BY :
ISSUED DATE : 17-Jul-23
RECEIVED DATE : 13-Jul-23

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF
QUALITY CALIBRATION CO., LTD.

F-G010 REV 03



CERTIFICATE No : 23M6754

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : SARTORIUS
ID No : EQL-008
AIR PRESSURE : 1011mbar ± 1mbar
AMBIENT TEMPERATURE : 23° C ± 1° C
MODEL : BP210S
S/N : S0736477
RECEIVED DATE : 13-Jul-23
CALIBRATION DATE : 13-Jul-23
RELATIVE HUMIDITY : 50 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 62019 BY USING KNOWN WEIGHT
STANDARD WEIGHT. THE BALANCE WAS ADJUSTED USING INTERNAL WEIGHT TO ADJUST. THE BALANCE HAS NO
ZERO TRACKING FUNCTION. REPEATABILITY WAS MEASURED BY USING 10 REPEATED MEASUREMENTS. LINEARITY
WAS MEASURED COVERING 10 POINTS, EVENLY SPREAD OVER THE RANGE. THE INSTRUMENT WAS SET ZERO BEFORE
PERFORMING THE LINEARITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED
ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN. THE INTERNAL WEIGHT WAS CHECKED BY USING
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT : MODEL : SERIAL No : CERTIFICATE No : DUE DATE :
1) STANDARD WEIGHT SET E2 M2302013S 02-Feb-25
2) STANDARD WEIGHT E2 15843 M2302014S 02-Feb-25

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.

4. THIS CERTIFICATE EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-

- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

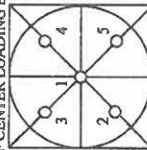
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0 g

4. DEPARTURE FROM NOMINAL VALUE/LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (± g)
0.0	0.0000	0.0000	0.000082
0.1	0.1000	0.0000	0.000083
0.2	0.2000	0.0000	0.000083
0.5	0.5000	0.0000	0.000083
1.0	1.0000	0.0000	0.000084
2.0	2.0000	0.0000	0.000084
5.0	5.0000	0.0000	0.000086
10.0	10.0000	0.0000	0.000089
20.0	20.0001	-0.0001	0.000094
50.0	49.9999	0.0001	0.00012
100.0	99.9999	0.0001	0.00019
200.0	199.9997	0.0003	0.00032

5. OFF-CENTER LOADING ERROR



POINT	READING (g)
1	99.9998
2	99.9997
3	99.9998
4	99.9998
5	99.9998
OFF-CENTER LOADING	0.0001

6. INTERNAL WEIGHT ERROR -0.000499999999988177 g

NOTE: THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A
COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT



QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkok, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com



CERTIFICATE No : 23T8798
REFERENCE No : 70515-6

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : HOT AIR OVEN
MANUFACTURER : MEMMERT
MODEL : UFE 500
SERIAL No : G508.0791
ID No : EQL-128
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : TEST TECH CO., LTD.
30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM,
BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY : CHAICHARN CH.
CALIBRATION DATE : 11-Sep-23

APPROVED BY :
ISSUED DATE : 15-Sep-23
RECEIVED DATE : 11-Sep-23

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF
QUALITY CALIBRATION CO., LTD.

F-0010 REV : 03



QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkok, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 23T8798

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : HOT AIR OVEN
MANUFACTURER : MEMMERT
MODEL : UFE 500
ID No : EQL-128
RECEIVED DATE : 11-Sep-23
AMBIENT TEMPERATURE : 24 °C ± 1 °C
S/N : G508.0791
CALIBRATION DATE : 11-Sep-23
RELATIVE HUMIDITY : 51 %RH ± 10 %RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TLA5 G-20 BY COMPARISON WITH CALIBRATED RTD Pt100 UNDER NO LOAD CONDITION. THE TEMPERATURE PROBES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOMETER PROBE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm AND PLACED THE NINTH THERMOMETER PROBE WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE CHAMBER. THE UNIFORMITY WAS MEASURED BETWEEN REFERENCE PROBE AND OTHER PROBES AT THE SAME TIME.

2 REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT

1) DATA LOGGER WITH RTD HYDRA 2635A

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.

4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-

- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

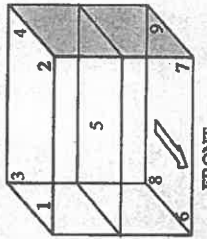
GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 1

Overall Line Voltage (V) variation : 10

Instrument Condition : Normal

Chamber Size (W*L*H): 56*40*48 cm



CHAMBER PERFORMANCE

Calibrate Point (°C)	Average All Position Temp. (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
104.0	104.49	0.28	0.66	0.93
180.0	180.25	0.32	0.62	1.11

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (± °C)
		#1	#2	#3	#4	Ref. 5	#6	#7	#8	#9	
104.0	104.0	104.46	104.13	104.45	104.28	104.57	104.67	104.60	104.58	104.67	0.38
180.0	180.0	180.27	179.85	180.41	179.93	180.19	180.54	180.41	180.51	180.13	1.1

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.

NOTE 2 : LOCATION 5 WAS REFERENCE LOCATION.

NOTE 3 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.
END OF CALIBRATION REPORT



CERTIFICATE No : 23T8799
REFERENCE No : 70515-7

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : HOT AIR OVEN
MANUFACTURER : MEMMERT
MODEL : UFE 500
SERIAL No : G512.2005
ID No : EQL-161
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : TEST TECH CO., LTD.
30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM,
BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY : CHAICHARN CH.
CALIBRATION DATE : 11-Sep-23

APPROVED BY :
ISSUED DATE : 15-Sep-23
RECEIVED DATE : 11-Sep-23

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF
QUALITY CALIBRATION CO., LTD.

F-C010 REV : 03



CERTIFICATE No : 23T8799

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : HOT AIR OVEN
MANUFACTURER : MEMMERT
MODEL : UFE 500
ID No : EQL-161
RECEIVED DATE : 11-Sep-23
AMBIENT TEMPERATURE : 24 °C ± 1 °C
SN : G512.2005
CALIBRATION DATE : 11-Sep-23
RELATIVE HUMIDITY : 51 %RH ± 10 %RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TLAS G-20 BY COMPARISON WITH CALIBRATED RTD Pt100 UNDER NO LOAD CONDITION. THE TEMPERATURE PROBES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOMETER PROBE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND PLACED THE NINTH THERMOMETER PROBE WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE CHAMBER. THE UNIFORMITY WAS MEASURED BETWEEN REFERENCE PROBE AND OTHER PROBES AT THE SAME TIME.

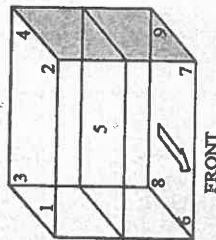
2. REFERENCE STANDARD INSTRUMENTS :-

- 1) DATA LOGGER WITH RTD
MODEL : HYDRA 2635A
SERIAL No : 7001307
CERTIFICATE No : 23T6636
DUE DATE : 10-Jul-24
3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO., LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 1
Overall Line Voltage (V) variation : 10
Instrument Condition : Normal
Chamber Size (W*L*H): 56*40*48 cm



CHAMBER PERFORMANCE

Calibrate Point (°C)	Average All Position Temp. (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
104.0	103.96	0.14	0.58	0.73
180.0	179.55	0.22	0.93	1.47

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (± °C)
		#1	#2	#3	#4	Ref. 5	#6	#7	#8	#9	
104.0	104.0	104.13	104.16	104.20	103.98	103.76	104.06	103.71	103.93	103.93	0.38
180.0	180.0	179.73	179.89	180.04	179.54	179.30	178.98	179.75	178.97	179.77	1.1

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.

NOTE 2 : LOCATION 5 WAS REFERENCE LOCATION.

NOTE 3 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.
END OF CALIBRATION REPORT



Certificate of Calibration

Equipment: TURBIDIMETER
Model: 2100N
Serial No. (or ID.): 970400003415 (EQL-024)
Manufacturer: HACH
Condition: In Condition
Customer: TEST TECH CO., LTD.
30,32 Rama II Soi 63, Rama II Rd.,
Samaedam, Bangkokhunting Bangkok 10150 Thailand

Environment Condition: Temperature 23 °C ± 2 °C
Humidity 50 %RH ± 15 %RH

Calibration Place: Environment Laboratory, DKSH Technology Limited,
2533 Sukhumvit Road, Bangkok,
Phrakhanong, Bangkok 10260 Thailand

Calibration By: Miss.Orawan Khaiphioi
Calibration Date: 14 September 2023
The Method used: In house method, CAL-WI-23, base on Hach Manufacturer Method 8195
Traceability: This certificate is traceable to Primary standard Fromazin and StabCal accepted by United States Environmental Protection Agency (EPA) through Hach Company Certificate No. A1075 , A1074 , A1091 , A1074 , A1074

Person in charge
(Miss Orawan Khaiphioi)
(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.

100% Recalibration warranty
DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Thailand 10260
Phone: +66 2688 7000 Email: info.calibration@dksh.com Website: www.dksh.com/calibration-thailand

Delivering Growth – In Asia and Beyond.

CAL-FM-C08-08: 20 Jul 2022



Certificate No.: C08230153
Page 2 of 2

Calibration Results:

Before Adjustment

Std Turbidity (NTU)	UUC Reading	Correction	Deviation	Uncertainty
0.050	0.088	-0.038	0.0	0.070
20.40	19.1	1.30	0.0	1.0
205.0	195	10.0	0.5	10
1028.0	952	76.0	0.9	50
4068.0	3942	126.0	0.9	200

After Adjustment

Std Turbidity (NTU)	UUC Reading	Correction	Deviation	Uncertainty
0.050	0.084	-0.034	0.0	0.070
20.40	20.4	0.00	0.0	1.0
205.0	205	0.0	0.5	10
1028.0	1026	2.0	0.5	50
4068.0	4063	5.0	0.5	200

The End of Certificate

100% Recalibration warranty
DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Thailand 10260
Phone: +66 2688 7000 Email: info.calibration@dksh.com Website: www.dksh.com/calibration-thailand

Delivering Growth – In Asia and Beyond.

CAL-FM-C08-08: 20 Jul 2022

ใบรับรองการทวนสอบ “เครื่อง Spectrophotometer”
(Calibration Certificate of Spectrophotometer)



Bara Scientific Co., Ltd.
988 U Chu Liang Building Floor 7 Rama 9 Road
Silom Bangkok Bangkok Thailand 10500
Tel : 02-6374300 Fax : 02-6375498-7
www.barascientific.com



Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No.	BSCC-UV-163/23
Equipment	UV/Vis Spectrophotometer
Model	UV-1900i
Manufacturer	Shimadzu
Serial No.	A12535780311ML
ID No.	EQL-233
Date of receipt	27 April 2023
Date of calibration	27 April 2023
Date of issue	8 May 2023
Customer name	Test Tech Co., Ltd.
Address	30, 32 Rama II Soi 83, Rama II RD., Samaedam, Bangkokhuthien, Bangkok 10150
Temperature	(23.5-24.4) °C (On site)
Humidity	(50.8-48.2) %RH (On site)
Equipment condition	Good Operation
Calibration Location	Clean Room Ciroubond
Calibration Procedure	In-house method WI-UV-702-01 based on ASTM E275-01
Traceability	Wavelength Accuracy is traceable to certificate No. 96387 and 96388 Photometric Accuracy is traceable to certificate No. 99925 and 96363 Stray Light is traceable to certificate No. 96346 The above certificate are traceable to SI unit through Stama Scientific Ltd. (UKAS accredited calibration laboratory NO. 0659)
Calibrated by	Mr.Poomjai Korsawatvorakul



Mr.Kanchit Choothep
Technical Manager

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.
Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced
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Bara Scientific Co., Ltd.
988 U Chu Liang Building Floor7 Rama4 Road
Silom Bangkok Bangkok Thailand 10500
Tel : 02-6324300 Fax : 02-6375496-7
www.barascientific.com



Certificate of Calibration

Certificate No.

BSCC-UV-163/23

Number of Page(s)

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Calibration Results:

1.Wavelength Accuracy

Wavelength (nm)	Certified Absorbance (A)	UUC (nm)	Error (nm)	Uncertainty (±nm)
279.44	0.0000	279.17	-0.27	0.18
418.53	0.0000	418.45	-0.08	0.18
538.52	0.0000	538.58	0.06	0.18
684.50	0.0000	684.82	0.12	0.18
879.41	0.0000	879.43	0.02	0.18

2.Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
235	CNR	CNR	CNR	CNR
257	CNR	CNR	CNR	CNR
313	CNR	CNR	CNR	CNR
350	CNR	CNR	CNR	CNR

*CNR = Customer not request

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Tel : 02-6324300 Fax : 02-6375496-7
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Certificate of Calibration

Certificate No.

BSCC-UV-163/23

Number of Page(s)

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Calibration Results:

3.Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
420.0	0.0000	0.0000	0.0000	0.0042
	0.5472	0.5485	0.0013	0.0042
	0.7637	0.7637	0.0000	0.0042
	1.0480	1.0484	0.0004	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5371	0.5384	0.0013	0.0042
	0.7457	0.7457	0.0000	0.0042
	1.0233	1.0247	0.0014	0.0042
465.0	CNR	CNR	CNR	0.0042
	CNR	CNR	CNR	0.0042
	CNR	CNR	CNR	0.0042
546.1	0.0000	0.0000	0.0000	0.0042
	0.5006	0.5017	0.0011	0.0042
	0.6961	0.6954	-0.0007	0.0042
	0.9563	0.9565	0.0002	0.0042
590.0	CNR	CNR	CNR	0.0042
	CNR	CNR	CNR	0.0042
	CNR	CNR	CNR	0.0042
635.0	0.0000	0.0000	0.0000	0.0042
	0.5137	0.5147	0.0010	0.0042
	0.6907	0.6900	-0.0007	0.0042
	0.9533	0.9536	0.0003	0.0042

*CNR = Customer not request

4.Stray Light*

Standard cut-off wavelength (nm)	Wavelength (nm)	Transmission (%T)	Absorbance (A)
200.91±0.11nm	200.55	0.9870	2.0147

The Stray light transmission reference is less than 1.0%T and Stray light absorbance reference is greater than 2.00A
*Stray Light not NSC-ONSC Accredited.

The measurement uncertainty is base on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.
*** End of Certificate ***

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.
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Certificate of Calibration

Equipment: SPECTROPHOTOMETER
Model: DR6000
Serial No. (or ID.): 1693421 (EQL-197)
Manufacturer: HACH
Condition: In Condition
Certificate No.: C06230165
Issued Date: 24 April 2023
Job No.: KSPR2306121
Page: 1 of 3

Customer: TEST TECH CO., LTD.
30,32 Rama II Soi 63, Rama II Rd.,
Samaedam, Bangkokthient Bangkok 10150 Thailand

Environment Condition: Temperature 25.3 °C ± 0.2 °C
Humidity 48.9 %RH ± 1.7 %RH

Calibration Place: TEST TECH CO., LTD. (แบบวัด)
30,32 Rama II Soi 63, Rama II Rd.,
Samaedam, Bangkokthient Bangkok 10150 Thailand

Calibration By: Mr. Atchai Ngamchanat
Calibration Date: 21 April 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 Stama Scientific Limited.

The standard for Wavelength Certificate No. 93907 and 93914
The standard for Photometric Certificate No. 94010 and 93900
The standard for Stray light Certificate No. 93903 and 93902
The standard for Spectral resolution Certificate No. 103140

Person in charge (Mr. Atchai Ngamchanat)
Authorized signatory (Mr. Nitinun Sirhawana)
This certificate is issued in 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.

ผู้ให้บริการการสอบเทียบ
DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Thailand 10260
Phone: +66 2638 7000 Email: info@calibration@dksh.com Website: www.dksh.com/calibration-thailand

Delivering Growth - In Asia and Beyond.

CAL-FIM-C06-15: 12 Sep 2022



Certificate No.: C06230165

Page 2 of 3

Calibration Results: Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 2 nm and UUC at 2 nm

Standard Wavelength	Unit Under Calibration	Correction	Uncertainty
418.61	418.5	0.11	0.13
536.66	536.7	-0.04	0.13
637.98	637.9	0.08	0.13
748.48	748.7	-0.22	0.13
807.03	807.5	-0.47	0.13

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
	0.0000	0.000	0.0000	0.0045
420 nm	0.5816	0.580	0.0016	0.0045
	0.7130	0.712	0.0010	0.0045
	1.0151	1.013	0.0021	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.5649	0.563	0.0019	0.0045
	0.7012	0.699	0.0022	0.0045
	0.9982	0.996	0.0022	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.5249	0.524	0.0009	0.0045
	0.6621	0.661	0.0011	0.0045
	0.9420	0.939	0.0030	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.5214	0.520	0.0014	0.0045
	0.8982	0.897	0.0012	0.0045
	0.9947	0.992	0.0027	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.5549	0.553	0.0018	0.0045
	0.7736	0.771	0.0026	0.0045
	1.1041	1.101	0.0031	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.5621	0.561	0.0011	0.0045
	0.7630	0.761	0.0020	0.0045
	1.0890	1.086	0.0030	0.0045

ผู้ให้บริการการสอบเทียบ
DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Thailand 10260
Phone: +66 2638 7000 Email: info@calibration@dksh.com Website: www.dksh.com/calibration-thailand

Delivering Growth - In Asia and Beyond.

CAL-FIM-C06-15: 12 Sep 2022



Certificate No.: C08230165

Page 3 of 3

Calibration Results: Without Adjustment

Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
235 nm	0.0000	0.000	0.0000	0.0080
	0.7440	0.737	0.0070	0.0080
257 nm	0.0000	0.000	0.0000	0.0080
	0.8635	0.855	0.0085	0.0080
313 nm	0.0000	0.000	0.0000	0.0080
	0.2902	0.288	0.0022	0.0080
350 nm	0.0000	0.000	0.0000	0.0080
	0.6409	0.634	0.0069	0.0080
Stray light *				
Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%)	Absorbance (A)	
260.51 +/- 0.11 nm	260.5	0.7	2.155	
391.84 +/- 0.11 nm	391.8	1.2	1.921	

Spectral Resolution *				
Nominal Concentration 0.02 % v/v	Peak	Trough	Ratio	SBW
Standard Wavelength (nm)	268.73	266.77	1.35	2.00
UUC: Wavelength (nm)	268.6	266.6		
Std Absorbance (A)	0.4237	0.2591		
Absorbance (A)	0.385	0.285		

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

The End of Certificate

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 หมู่ที่ 9 ตำบลบางนาใหม่ กรุงเทพมหานคร 10260
โทรศัพท์: 02-2859 7000 Email: info@dksh.com Website: www.dksh.com/thailand
Phone: +66 2859 7000 Email: info@dksh.com Website: www.dksh.com/thailand

Delivering Growth - In Asia and Beyond.

CAL-FM-C08-15: 12 Sep 2022



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484



NEC-TEL-TST7825
CALIBRATION 0008

Cert.No.: 23CH82
Page.: 1 of 3

Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : TOA
Model : CM-41X
Serial No. : 842572
ID No. : EQL-211
Condition As-Received: Used Item
Received Date : 19 January 2023
Calibration Date : 20 January 2023
Reference : 2301-0614DN-1
Submitted by : TEST TECH CO.,LTD. (HEAD Office)
30, 32 Rama II Soi 63, Rama II Rd.,
Samaedam, Bangkokthian, Bangkok 10150
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In -house method :
- CP-CH6 by direct measurement
with certified reference material (CRM)
- CP-CH8 by comparison with standard thermometer
Calibrated by : Warakorn Lemgagtrakul

Approved by :

(/) Malee Bulkuea
(/) Sathip Meangmai
(/) Warakorn Lemgagtrakul

Approved Signatory

Issue Date :

24 January 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 0049391



Cert.No.: 23CH92

Page.: 2 of 3

Condition of this result of calibration

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	1963878	130RC085	2211140	12 Sep 2023
2) Ref. Std. Thermometer	4982054	110RC044	2211306	27 Oct 2023

This certification is traceable to the International System of Unit maintained at:-

- Traceable to National Institute of Metrology (Thailand), NIMT

2. Certified Reference Materials :-

- Conductivity calibration solution, CPA chem Ltd., The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Conductivity Solution	Manufacturer	Lot No.	Exp. date
147.0 $\mu\text{S/cm}$	CPA Chem	823327	20 June 2023
1.413 mS/cm	CPA Chem	823328	20 June 2023
12.880 mS/cm	CPA Chem	823329	20 June 2023

- Control Conductivity calibration solution temperature by Water bath (25 ± 0.1) $^{\circ}\text{C}$

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

Calibration results

Function : Conductivity Measurement

(*) After Adjustment at 147.0, 1413.0, 12880 $\mu\text{S/cm}$

Conductivity Electrode Serial No.: 806F0005

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (\pm)	Coverage factor k
147.0 $\mu\text{S/cm}$	150.3 $\mu\text{S/cm}$	147.0 $\mu\text{S/cm}$	0.99 $\mu\text{S/cm}$	2.00
1.413 mS/cm	1.428 mS/cm	1.413 mS/cm	0.0092 mS/cm	2.00
12.880 mS/cm	12.71 mS/cm	12.98 mS/cm	0.086 mS/cm	2.00

Remark

- UUC* = Unit Under Calibration
- 147.0 $\mu\text{S/cm}$ Adjustment Cell constant = 98.5m^{-1}
- 1.413 mS/cm Adjustment Cell constant = 99.5m^{-1}
- 12.880 mS/cm Adjustment Cell constant = 101.8m^{-1}



a 1144880



Cert.No.: 23CH92

Page.: 3 of 3

Calibration Results

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : CT-58101B
- Serial No. : 806F0005

Dimension of probe;

- Length : 114 mm.
- Diameter : 12 mm.
- Immersion Depth : 100 mm.

Calibration Point ($^{\circ}\text{C}$)	Standard Temperature ($^{\circ}\text{C}$)	UUC* Reading ($^{\circ}\text{C}$)	Error ($^{\circ}\text{C}$)	Uncertainty of Measurement (\pm $^{\circ}\text{C}$)	Coverage factor k
25.0	25.003	25.0	-0.003	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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 %.

-000-



a 1144879



QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com



CERTIFICATE No : 23T8796
REFERENCE No : 70515-4

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : WATER BATH
MANUFACTURER : MEMMERT
MODEL : WNE 45
SERIAL No : L720.0266
ID No : EQL-241
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : TEST TECH CO., LTD.
30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM,
BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY : CHAICHARN CH.
CALIBRATION DATE : 16-Aug-23

APPROVED BY :
ISSUED DATE : 16-Aug-23
RECEIVED DATE : 16-Aug-23

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF
QUALITY CALIBRATION CO., LTD.

F-C010 REV : 03



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CERTIFICATE No : 23T8796

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : WATER BATH
MANUFACTURER : MEMMERT
ID NUMBER : EQL-241
RECEIVED DATE : 16-Aug-23
AMBIENT TEMPERATURE : 23 °C ± 1 °C
MODEL : WNE 45
SERIAL NUMBER : L720.0266
CALIBRATION DATE : 16-Aug-23
RELATIVE HUMIDITY : 50 %RH ± 10 % RH

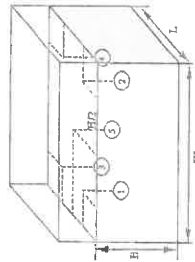
CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO ASTM E715-80 (REAPPROVED 2001) BY COMPARISON WITH CALIBRATED RTD. THE PROBES WERE PLACED ON FIVE POINTS AND LOCATED ONE PROBE IN EACH OF THE FOUR CORNERS OF THE BATH AND PLACED THE FIFTH RTD WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE WATER VOLUME (REFERENCE LOCATION) UNDER NO LOAD CONDITION.

2. REFERENCE STANDARD INSTRUMENTS :-

- INSTRUMENT MODEL SERIAL No CERTIFICATE No DUE DATE
- 1) DATA LOGGER WITH RTD 2625A 6603614 23T6642 19-Jul-24
3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



PROBE INSTALLATION
POSITION IN THE BATH

GENERAL INFORMATION

Overall Variation of Ambient Temperature around the Bath (°C) : 0.6
Overall Variation of Line Voltage (V) : 3
Instrument Condition : Normal
Bath Inner Size (W*L*H) : 59*35*20 cm

BATH PERFORMANCE

Calibrate Point (°C)	Average All Position Temp. (±°C)	Temperature Stability (±°C)	Radius Uniformity (°C)	Axial Uniformity (°C)	Overall Variation (°C)
83.0	83.09	0.05	0.07	0.05	0.16
92.0	92.13	0.11	0.06	0.06	0.28

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations				Uncertainty (± °C)
		#1	#2	#3	#4	
83.0	83.0	83.08	83.09	83.06	83.11	0.15
92.0	92.0	92.11	92.13	92.10	92.16	0.19

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE BATH.

NOTE 2 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

F-C

ภาคผนวก ฉ

กฎหมายที่เกี่ยวข้อง

ประกาศกระทรวงทรัพยากรธรรมชาติและสิ่งแวดล้อม

เรื่อง กำหนดมาตรฐานควบคุมการระบายน้ำทิ้ง

จากอาคารบางประเภทและบางขนาด

โดยที่ ได้มีการปฏิบัติงานบริหาร โดยให้มีการจัดตั้งกระทรวงทรัพยากรธรรมชาติและสิ่งแวดล้อมขึ้นมา เพื่อให้โอนภารกิจของกระทรวงวิทยาศาสตร์ เทคโนโลยีและสิ่งแวดล้อม ในส่วนที่เกี่ยวข้องกับพระราชบัญญัติส่งเสริมและรักษาคุณภาพสิ่งแวดล้อมแห่งชาติ พ.ศ. ๒๕๓๕ ไปเป็นของกระทรวงทรัพยากรธรรมชาติและสิ่งแวดล้อม ประกอบกับการสมควรให้คณะกรรมการควบคุมมลพิษ เป็นผู้พิจารณาเห็นชอบกับวิธีการตรวจหาค่ามาตรฐานการระบายน้ำทิ้ง นอกเหนือจากวิธีการที่กำหนดไว้ในแผนภูมิควบคุมมลพิษ จึงสมควรแก้ไขปรับปรุงประกาศกระทรวงวิทยาศาสตร์ เทคโนโลยีและสิ่งแวดล้อม เรื่อง กำหนดมาตรฐานควบคุมการระบายน้ำทิ้งจากอาคารบางประเภทและบางขนาด

อาศัยอำนาจตามความในมาตรา ๕๕ แห่งพระราชบัญญัติส่งเสริมและรักษาคุณภาพสิ่งแวดล้อมแห่งชาติ พ.ศ. ๒๕๓๕ แก้ไข โดยมาตรา ๑๑๔ แห่งพระราชกฤษฎีกาแก้ไขบทบัญญัติให้สอดคล้องกับการโอนอำนาจหน้าที่ของส่วนราชการ ให้เป็นไปตามพระราชบัญญัติปรับปรุงกระทรวง ทบวง กรม พ.ศ. ๒๕๔๕ พ.ศ. ๒๕๔๕ อันเป็นพระราชบัญญัติที่มีบทบัญญัติบางประการเกี่ยวกับการจำกัดสิทธิและเสรีภาพของบุคคล ซึ่งมาตรา ๒๕ ประกอบกับมาตรา ๓๕ มาตรา ๔๘ มาตรา ๕๐ และมาตรา ๕๑ ของรัฐธรรมนูญแห่งราชอาณาจักรไทยบัญญัติให้กระทำได้ โดยอาศัยอำนาจตามบทบัญญัติแห่งกฎหมาย รัฐมนตรีว่าการกระทรวงทรัพยากรธรรมชาติและสิ่งแวดล้อม โดยคำแนะนำของคณะกรรมการควบคุมมลพิษ และโดยความเห็นชอบของคณะกรรมการสิ่งแวดล้อมแห่งชาติ จึงออกประกาศไว้ ดังต่อไปนี้

ข้อ ๑ ให้ยกเลิกประกาศกระทรวงวิทยาศาสตร์ เทคโนโลยีและสิ่งแวดล้อม เรื่อง กำหนดมาตรฐานควบคุมการระบายน้ำทิ้งจากอาคารบางประเภทและบางขนาด ลงวันที่ ๑๐ มกราคม พ.ศ. ๒๕๓๖

ข้อ ๒ ในประกาศนี้

“อาคาร” หมายความว่า อาคารที่ก่อตัวขึ้น ไม่ว่าจะมียกฐานะเป็นอาคารหลังเดียว หรือเป็นกลุ่มของอาคารซึ่งตั้งอยู่ภายในพื้นที่ซึ่งเป็นบริเวณเดียวกัน และไม่จำเป็นต้องมีท่อน้ำทิ้งเดียว หรือมีหลายท่อที่เชื่อมติดต่อกันระหว่างอาคารหรือไม่ก็ตาม ซึ่งได้แก่

(๑) อาคารชุด ตามกฎหมายว่าด้วยอาคารชุด

(๒) โรงแรม ตามกฎหมายว่าด้วยโรงแรม

(๓) หอพัก ตามกฎหมายว่าด้วยหอพัก

(๔) สถานบริการประเภทสถานอาบน้ำ นวดหรืออบตัว ซึ่งมีผู้ให้บริการแก่ลูกค้า ตามกฎหมายว่าด้วยสถานบริการ

(๕) โรงพยาบาลของทางราชการหรือสถานพยาบาล ตามกฎหมายว่าด้วยสถานพยาบาล

(๖) อาคารโรงเรียนเอกชน ตามกฎหมายว่าด้วยโรงเรียนเอกชน โรงเรียนของทางราชการ อาคารสถาบันอุดมศึกษาของเอกชน ตามกฎหมายว่าด้วยสถาบันอุดมศึกษาของเอกชนและสถาบันอุดมศึกษาของทางราชการ

(๗) อาคารที่ทำการของทางราชการ รัฐวิสาหกิจ หรือองค์การระหว่างประเทศและของเอกชน

(๘) อาคารของศูนย์การค้าหรือห้างสรรพสินค้า

(๙) ตลาด ตามกฎหมายว่าด้วยการค้าสารพัดสุข แต่ไม่รวมถึง ท่าเทียบเรือประมง สะพานปลา หรือกิจการแปปลา

(๑๐) กัดอาคารหรือร้านอาหาร

“น้ำทิ้ง” หมายความว่า น้ำเสียที่ผ่านระบบบำบัดมาแล้วแล้วจนเป็นไปตามมาตรฐานควบคุมการระบายน้ำทิ้งตามที่กำหนดไว้ในประกาศนี้

ข้อ ๓ ให้แบ่งประเภทของอาคารตามข้อ ๒ ออกเป็น ๕ ประเภท คือ

(๑) อาคารประเภท ก.

(๒) อาคารประเภท ข.

(๓) อาคารประเภท ค.

(๔) อาคารประเภท ง.

(๕) อาคารประเภท จ.

ข้อ ๔ อาคารประเภท ก. หมายความว่า อาคารดังต่อไปนี้

(๑) อาคารชุดที่มีจำนวนห้องสำหรับใช้เป็นที่อยู่อาศัยรวมกันทุกชั้นของอาคาร หรือกลุ่มของอาคารตั้งแต่ ๕๐๐ ห้องขึ้นไป

(๒) โรงแรมที่มีจำนวนห้องสำหรับใช้เป็นห้องพักรวมกันทุกชั้นของอาคาร หรือกลุ่มของอาคารตั้งแต่ ๒๐๐ ห้องขึ้นไป

(๓) โรงพยาบาลของทางราชการ รัฐวิสาหกิจหรือสถานพยาบาล ตามกฎหมายว่าด้วยสถานพยาบาล ที่มีเตียงสำหรับผู้ป่วยไว้ค้างคืนรวมกันทุกชั้นของอาคารหรือกลุ่มของอาคารตั้งแต่ ๓๐ เตียงขึ้นไป

(๑) หอพักที่มีจำนวนห้องสำหรับใช้เป็นที่อยู่ชั่วคราวร่วมกันทุกชั้นของอาคาร หรือกลุ่มของอาคาร ตั้งแต่ ๑๐ ห้อง แต่ไม่ถึง ๕๐ ห้อง

(๒) ตลาดที่มีพื้นที่ใช้สอยรวมกันทุกชั้นของอาคาร หรือกลุ่มของอาคารตั้งแต่ ๕๐๐ ตารางเมตร แต่ไม่ถึง ๑,๐๐๐ ตารางเมตร

(๓) กภัตตาคารหรือร้านอาหารที่มีพื้นที่ให้บริการรวมกันทุกชั้นของอาคาร หรือกลุ่มของอาคาร ตั้งแต่ ๑๐๐ ตารางเมตร แต่ไม่ถึง ๒๕๐ ตารางเมตร

ข้อ ๘ อาคารประเภท ก. หมายความว่า กภัตตาคารหรือร้านอาหารที่มีพื้นที่ให้บริการรวมกันทุกชั้นไม่ถึง ๑๐๐ ตารางเมตร

ข้อ ๙ มาตรฐานควบคุมการระบายน้ำทิ้งจากอาคาร ประเภท ก. ต้องมีค่าดังต่อไปนี้

- (๑) ความเป็นกรดและด่าง (PH) ต้องมีค่าระหว่าง ๕-๙
- (๒) บีโอดี (BOD) ต้องมีค่าไม่เกิน ๒๐ มิลลิกรัมต่อลิตร
- (๓) สารแขวนลอย (Suspended Solids) ต้องมีค่าไม่เกิน ๓๐ มิลลิกรัมต่อลิตร
- (๔) ชัลไฟด์ (Sulfide) ต้องมีค่าไม่เกิน ๑.๐ มิลลิกรัมต่อลิตร
- (๕) สารที่ละลายได้ทั้งหมด (Total Dissolved Solids) ต้องมีค่าเพิ่มขึ้นจากปริมาณสารละลายในน้ำใช้ตามปกติไม่เกิน ๕๐๐ มิลลิกรัมต่อลิตร

- (๖) ตะกอนหนัก (Settleable Solids) ต้องมีค่าไม่เกิน ๐.๕ มิลลิกรัมต่อลิตร
- (๗) น้ำมันและไขมัน (Fat Oil and Grease) ต้องมีค่าไม่เกิน ๒๐ มิลลิกรัมต่อลิตร
- (๘) ทีเคเอ็น (TKN) ต้องมีค่าไม่เกิน ๓๕ มิลลิกรัมต่อลิตร

ข้อ ๑๐ มาตรฐานควบคุมการระบายน้ำทิ้งจากอาคาร ประเภท ข. ต้องเป็นไปตามข้อ ๘ เว้นแต่

- (๑) บีโอดี ต้องมีค่าไม่เกิน ๓๐ มิลลิกรัมต่อลิตร
 - (๒) สารแขวนลอย ต้องมีค่าไม่เกิน ๔๐ มิลลิกรัมต่อลิตร
- ข้อ ๑๑ มาตรฐานควบคุมการระบายน้ำทิ้งจากอาคาร ประเภท ค. ต้องเป็นไปตามข้อ ๘ เว้นแต่

- (๑) บีโอดี ต้องมีค่าไม่เกิน ๔๐ มิลลิกรัมต่อลิตร
- (๒) สารแขวนลอย ต้องมีค่าไม่เกิน ๕๐ มิลลิกรัมต่อลิตร

- (๓) ชัลไฟด์ ต้องมีค่าไม่เกิน ๓.๐ มิลลิกรัมต่อลิตร
- (๔) ค่าทีเคเอ็น ต้องมีค่าไม่เกิน ๔๐ มิลลิกรัมต่อลิตร

ข้อ ๑๒ มาตรฐานควบคุมการระบายน้ำทิ้งจากอาคาร ประเภท ง. ต้องเป็นไปตามข้อ ๘ เว้นแต่

- (๑) บีโอดี ต้องมีค่าไม่เกิน ๕๐ มิลลิกรัมต่อลิตร
 - (๒) สารแขวนลอย ต้องมีค่าไม่เกิน ๕๐ มิลลิกรัมต่อลิตร
 - (๓) ชัลไฟด์ ต้องมีค่าไม่เกิน ๔.๐ มิลลิกรัมต่อลิตร
 - (๔) ค่าทีเคเอ็น ต้องมีค่าไม่เกิน ๔๐ มิลลิกรัมต่อลิตร
- ข้อ ๑๓ มาตรฐานควบคุมการระบายน้ำทิ้งจากอาคาร ประเภท จ. ต้องมีค่าดังต่อไปนี้

- (๑) ความเป็นกรดและด่างต้องมีค่าระหว่าง ๕-๙
 - (๒) บีโอดี ต้องมีค่าไม่เกิน ๒๐๐ มิลลิกรัมต่อลิตร
 - (๓) สารแขวนลอย ต้องมีค่าไม่เกิน ๖๐ มิลลิกรัมต่อลิตร
 - (๔) น้ำมันและไขมัน ต้องมีค่าไม่เกิน ๑๐๐ มิลลิกรัมต่อลิตร
- ข้อ ๑๔ การตรวจสอบมาตรฐานการระบายน้ำทิ้งจากอาคาร ให้ใช้วิธีการดังต่อไปนี้
- (๑) การตรวจสอบค่าความเป็นกรดและด่างให้กระทำโดยใช้เครื่องวัดความเป็นกรดและด่างของน้ำ (PH Meter)

(๒) การตรวจสอบค่าบีโอดีให้กระทำโดยใช้วิธีการอะไซด์โมดิฟิเคชัน (Azide Modification) ที่อุณหภูมิ ๒๐ องศาเซลเซียส เป็นเวลา ๕ วัน คัดลอกหรือวิธีการอื่นที่คณะกรรมการควบคุมมลพิษให้ความเห็นชอบ

(๓) การตรวจสอบค่าสารแขวนลอยให้กระทำโดยใช้วิธีการกรองผ่านกระดาษกรองใยแก้ว (Glass Fibre Filter Disc)

- (๔) การตรวจสอบค่าชัลไฟด์ให้กระทำโดยใช้วิธีการไตเตรท (Titrate)
- (๕) การตรวจสอบค่าสารที่ละลายได้ทั้งหมดให้กระทำโดยใช้วิธีการแพร่แห้งระหว่างอุณหภูมิ ๑๐๓ องศาเซลเซียส ถึงอุณหภูมิ ๑๐๕ องศาเซลเซียส ในเวลา ๑ ชั่วโมง

(๖) การตรวจสอบค่าตะกอนหนักให้กระทำโดยใช้วิธีการกรวยอิมฮอฟฟ์ (Imhoff cone) ขนาดบรรจุ ๑,๐๐๐ ลูกบาศก์เซนติเมตร ในเวลา ๑ ชั่วโมง

(๓) การตรวจสอบค่านิยมและ^๙เงินใน^๙การ^๙ทำ^๙โดย^๙ใช้^๙การ^๙สั^๙กั^๙ต^๙ว^๙ที่^๙ละ^๙ลาย^๙ แ^๙ล^๙ว^๙แยก^๙ท^๙า

น^๙า^๙ห^๙น^๙ก^๙จ^๙อ^๙น^๙า^๙น^๙แ^๙ล^๙ว^๙เ^๙ิ^๙ง^๙เ^๙ิ^๙ง^๙

(๘) การตรวจสอบค่าที่เคเอ็นให้กระทำได้ใช้วิธีการเจดาคัท (Kjeldahl)

ข้อ ๑๕ การคิดคำนวณพื้นที่ใช้สอย จำนวนอาคารและจำนวนห้องของอาคาร หรือกลุ่มของอาคาร

ข้อ ๑๖ วิธีการเก็บตัวอย่างน้ำ ความถี่ และระยะเวลาในการเก็บตัวอย่างน้ำ ให้เป็นไปตามที่ คณะกรรมการควบคุมมลพิษกำหนด โดยประกาศในราชกิจจานุเบกษา

ข้อ ๑๓ ประกาศให้ใช้บังคับตั้งแต่บัดนี้เป็นต้นไป

ประกาศ ณ วันที่ ๗ พฤศจิกายน พ.ศ. ๒๕๔๘

ยงยุทธ์ ตริยะไพรัช

รู้มันตรว่า การกระหว่งทรพยากรรรมชาติและสิ่งแวดลอม

