

ภาคผนวก ฉ

สำเนาเอกสารรับรองเครื่องมือการตรวจวัด



Certificate of Calibration

Certificate No. : 67-420106-1 Page : 1 of 2

Submitted by : M Green Group Co., Ltd.

188/46 Wisetueklakhon 25, Pracha-Ud Rd., Thungku Bangkok 10140 Thailand

Equipment : pH Meter with electrode

pH meter

Manufacturer : Eutech Model : pH 700
Range : N/A pH Resolution : 0.01 pH
Serial No. : 2884373 ID No. : N/A

Electrode

Model : ECF7252101B Serial No. : 01X099320

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

Ambient Temperature : (26.3 to 26.7) °C

Relative Humidity : (40 to 45) %

Date of Received : 20 September 2024

Date of Calibration : 20 September 2024

Date of Issue : 21 September 2024

Calibrated by : Permpon Chanpu

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

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

1. Multiproduct Calibrator

ID No.	Cert. No.	Due Date	Traceability
400005	SG-E-00307/66	23 Aug 2025	National Institute of Metrology Thailand (NIMT)
2. Standard Buffer Solution			
pH	Cert. No.	Lot No.	Exp. Date
4.008	61293328	1027612	15 Sep 2026
6.987	61297593	1027614	15 Sep 2025
10.010	61306165	1027613	15 Sep 2025

Traceability
CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
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Approved by :

(Permpon Chanpu)
Supervisor

Certificate of Calibration

Certificate No. : 67-420106-1 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	0.0	0.0	0.086
	-177.4800	10	10.00	-177.4	-0.1	0.12

Function : pH meter with electrode

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

Adjustment Curve at nominal pH	Standard Buffer (pH)	UUC Reading (pH)	Correction (pH)	Uncertainty (± pH)
4, 7, 10	4.008	4.01	0.00	0.0097
	6.987	7.00	-0.01	0.011
	10.010	10.01	0.00	0.014

Remark

UUC : Unit Under Calibration

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

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

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Certificate of Calibration

Certificate No. : 67-400547-1 Page : 1 of 2

Submitted by : M Green Group Co., Ltd.

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

Equipment : Temperature Indicator with Thermistor Probe
Temperature IndicatorManufacturer : Eutech Model : pH 700
Range : N/A °C Resolution : 0.1 °C
Serial No. : 2884323 ID No. : N/AThermistor probe
Model : N/A Sheath Material : Stainless
Diameter : 3 mm. Length : 115 mm.
Serial No. : PH5TEMB01P 279 ID No. : N/A

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

Ambient Temperature : (26.3 to 26.7) °C

Relative Humidity : (40 to 45) %

Line Voltage : (220.0 to 223.0) VAC

Date of Received : 20 September 2024

Date of Calibration : 20 September 2024

Date of Issue : 21 September 2024

Calibrated by : Permpon Champu

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-0095-24 01 Jul 2026

National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No. Cert. No. Due Date Traceability

400033 24E633 21 Feb 2026

National Institute of Metrology Thailand (NIMT)

Approved by :

(Permpon Champu)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-400547-1 Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Immersion Depth (mm.)	(°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
130	25.004	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. : 67-200334-1

Page : 1 of 2

Submitted by :

M Green Group Co., Ltd.

188/46 Wisatesuknakdon 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 : (24.9 to 26.3) °C

Relative Humidity : (40.8 to 55.4) %

Air Pressure : 1003.9 mbar

Date of Received :

20 September 2024

Date of Calibration :

20 September 2024

Date of Issue :

21 September 2024

Calibrated by :

Akaradath Thippichai

Calibration Method :

In-house method CAL-M2001 based on UKAS Publication ref : LAB 14

Edition 7 - November 2022

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

Standard Weights

ID.No.

Cert.No.

Due Date

Traceability

E261-E2624

C02232088

08 Nov 2024

National Institute of Metrology (Thailand), (NIMT)

Approved by :

(Sufja Sangkhum)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-200334-1

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	0.000015
0.01	0.00000	0.000016
0.1	0.00000	0.000018
1	0.00000	0.000026
10	0.00000	0.000053
20	-0.00003	0.000071
50	0.00006	0.00011
100	0.00004	0.00020
150	0.0001	0.00038
200	0.0000	0.00038

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.13$, providing a level of confidence of approximately 95%

Eccentric error

Load test : 50 g

A

B

C

D

E

-0.00005 0.00001 0.00002 0.00000 0.00000 0.00000 g



Repeatability

Load test

: 200 g

Stdev.

: 0.000000 g

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Certificate of Calibration

Certificate No. : 67-410112-1

Page : 1 of 2

Submitted by :

M Green Group Co., Ltd.

188/46 Wisetuknakhon 25, Pracha-Utd Rd., Thungkri, Bangkok 10140 Thailand

Equipment :

Digital Thermo-Hygrometer

Manufacturer : Digicon

Model : TH-02A

Range Temperature : 0 °C to 50 °C Resolution : 0.1 °C

Range Humidity : 20 %R.H. to 99 %R.H. Resolution : 1 %R.H.

Serial No. : 1819A0771796 ID No. : N/A

Environment :

Ambient Temperature : (23 ± 2) °C

Relative Humidity : (50 ± 15) %

Date of Received : 20 September 2024

Date of Calibration : 23 September to 24 September 2024

Date of Issue : 24 September 2024

Calibrated by : Chortip Samchusri

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4013 by compared with standard probe sensor humidity/temperature into humidity/temperature chamber.

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

Digital Indicator with Standard Probe Temp&Hum

ID.No. Cert. No. Due Date Traceability

400034 & 400035 SG-H-00611/67 04 Jan 2025 Success Gateway Co., Ltd., Accredited by TISI Calibration No.0268

Approved by :

(Permon Chanpu)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-410112-1

Page : 2 of 2

UUC Condition As-Received : Good

Result of Calibration : Without Adjustment

Function : Temperature measurement

Reference Humidity @ 50 %R.H.

Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
19.99	19.7	0.3	0.46
25.00	24.7	0.3	0.46
30.01	29.7	0.3	0.46

Result of Calibration : Without Adjustment

Function : Humidity measurement

Reference Temperature @ 25 °C

Standard Humidity (%R.H.)	UUC Reading (%R.H.)	Correction (%R.H.)	Uncertainty (± %R.H.)
40.01	38	2	2.2
60.00	56	4	2.3

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. : 67-400548-1 Page : 1 of 2

Submitted by : M Green Group Co., Ltd.

188/46 Wisetasukhakhon 25, Pracha-Uthit Rd., Thungturu Bangkok 10140 Thailand

Equipment : Temperature controlled enclosure (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 : (26.3 to 27.4) °C

Relative Humidity : (39 to 47) %

Line Voltage : (226.0 to 230.0) V

Date of Received : 20 September 2024

Date of Calibration : 20 September 2024

Date of Issue : 21 September 2024

Calibrated by : Permpoon Chianpu

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 67-400442-1 26 Jan 2025 National Institute of Metrology Thailand (NIMT)

Approved by :

(Permpoon Chianpu)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

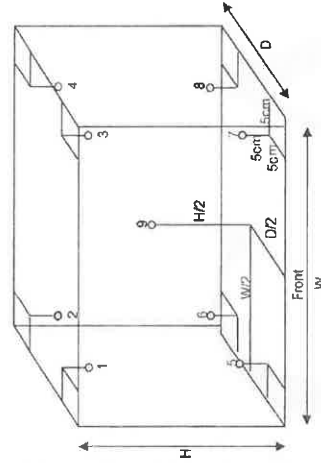
Certificate No. : 67-400548-1

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 = 0.50 m

D = 0.40 m

H = 1.20 m

Capacity = 0.24 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
4.0	2.0	2.0	4.70	4.42	5.04	4.99	4.52	4.22	4.74	4.67	3.89	0.45

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
4.0	2.0	2.00	1.23	0.13	1.40

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

Page : 1 of 2

Certificate No. : 67-400548-2

Submitted by : M Green Group Co., Ltd.

188/46 Wisetaphachon 25, Pracha-Utd Rd., Thungku Bangkok 10140 Thailand

Equipment : Temperature controlled enclosure (Oven)

Manufacturer : Memmert

Range : N/A °C

Serial No. : B419.1092

Model : UF110

Resolution : 0.1 °C

ID No. : N/A

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

Ambient Temperature : (26.3 to 27.4) °C

Relative Humidity : (39 to 47) %

Line Voltage : (226.0 to 230.0) V

Date of Received : 20 September 2024

Date of Calibration : 20 September 2024

Date of Issue : 21 September 2024

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

Standard Digital Thermometer with Thermocouple probe

ID No. Cert. No. Due Date Traceability

400046 & 400023 67-400198-1 01 Oct 2024 National Institute of Metrology Thailand (NIMT)

Approved by :

(Permpon Chanpu)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Page : 2 of 2

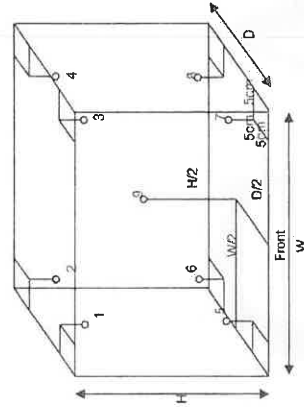
Certificate No. : 67-400548-2

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	102.3	102.9	103.7	103.7	102.3	102.3	103.8	102.2	102.7	0.82
104.0	104.0	104.0	103.3	103.9	104.8	104.6	103.2	103.3	104.8	103.2	103.7	0.84
105.0	105.0	105.0	104.3	104.9	105.8	105.7	104.3	104.3	105.8	104.3	104.7	0.83
150.0	150.0	150.0	149.3	149.9	151.3	151.2	149.1	149.2	151.2	149.3	149.5	1.1
180.0	180.0	180.0	179.0	179.8	181.4	181.1	178.8	179.0	181.1	178.8	179.3	1.1

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured		Overall Variation (°C)
			Uniformity (°C)	Stability (°C)	
103.0	103.0	103.0	1.3	0.3	2.0
104.0	104.0	104.0	1.5	0.3	2.1
105.0	105.0	105.0	1.4	0.3	2.0
150.0	150.0	150.0	2.3	0.5	2.7
180.0	180.0	180.0	2.5	0.5	3.3

Remark The uncertainty is not combine uniformity of the air chamber

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

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

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NSC-TIS-171709/5
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 67-400548-3 **Page : 1 of 2**

Submitted by : M Green Group Co., Ltd.
188/46 Wisatsukhakhon 25, Pracha-Utd 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 : (26.3 to 27.4) °C
Relative Humidity : (39 to 47) %
Line Voltage : (226.0 to 230.0)V

Date of Received : 20 September 2024
Date of Calibration : 20 September 2024
Date of Issue : 21 September 2024

Calibrated by : Pernpon 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. 400046
Cert. No. 67-400198-2
Due Date 30 Sep 2024
Traceability National Institute of Metrology Thailand (NIMT)

Approved by : 
(Pernpon Chanpu)
Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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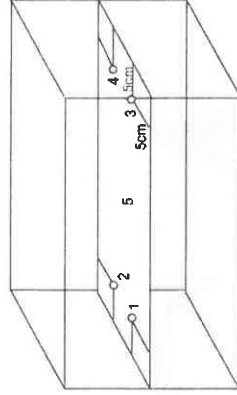
Certificate of Calibration

Certificate No. : 67-400548-3 **Page : 2 of 2**

Result of Callibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement



Front

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.					Uncertainty (± °C)	Measured Uniformity (°C)	Measured Stability (°C)
			1	2	3	4	5			
85.0	85.0	85.0	84.55	84.44	84.49	84.46	84.62	0.20	0.25	0.06

Remark The uncertainty is not combine uniformity of the water bath

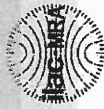
This result of calibration was found accurate as shown on date and place of calibration only.

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. : 67-400548-4

Page : 1 of 2

Submitted by : M Green Group Co., Ltd.

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

Equipment : Temperature controlled enclosure (Incubator)

Manufacturer : Biobase

Model : Biochemistry Incubator

Range : 0 °C to 65 °C

Resolution : 0.1 °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 : (31.0 to 32.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (226.0 to 230.0) V

Date of Received : 20 September 2024

Date of Calibration : 20 September 2024

Date of Issue : 21 September 2024

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.

Traceability

400029 & 400048

02 Feb 2025

National Institute of Metrology Thailand (NIMT)

Approved by :

(Pempon Chanpu)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-400548-4

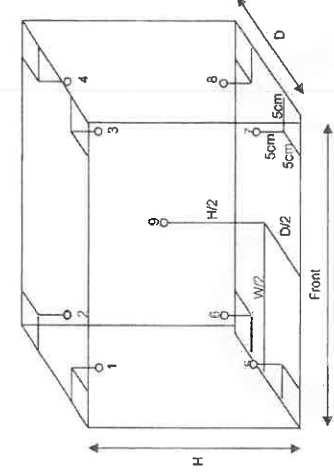
Page : 2 of 2

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 = 0.45 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	20.4	20.4	20.23	20.18	20.08	20.15	19.90	19.92	19.96	19.90	19.96	0.82

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
20.0	20.4	20.4	0.38	0.43	0.96

Remarks The uncertainty is not combine uniformity of the air chamber

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

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

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Certificate of Calibration

Certificate No. : 67-400560-1

Submitted by : M Green Group Co., Ltd.

188/46 Wisatsuknakhon 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 :

20 September 2024

Date of Calibration :

23 September 2024

Date of Issue :

23 September 2024

Calibrated by :

Chortip Sanchusri

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-0023-24 16 Feb 2026

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 :

(Pernpon Chanpu)
Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-400560-1

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Ice point check : UUC* reading 0 °C Standard reading -0.0321 °C

Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
39.8223	40	-0.2	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. : 67-300569-1

Page : 1 of 2

Submitted by

: M Green Group Co., Ltd.

188/46 Wisatsuknaknon 25, Pracha-Uttd 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 :

°C

(20 ± 3)

Relative Humidity :

%

(50 ± 10)

Air Pressure :

mbar.

1008.0

Date of Received : 20 September 2024

Date of Calibration : 23 September 2024

Date of Issue : 23 September 2024

Calibrated by : Areerat Sombun

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

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

Electronic Balance

ID.No.

Cert.No.

Due Date

Traceability

241005

67-200210-4

02 Dec 2024

National Institute of Metrology (Thailand) (NIMT)

Approved by :

(Wipa Towader)

Supervisor

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Certificate of Calibration

Certificate No. : 67-300569-1

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

Delivery Time : 19.92 sec.

Nominal Volume (ml)	Measuring Volume (ml)
2	2.0044
5	5.0024
10	9.9915

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. : 67-300569-2

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 : 25 ml

Graduation : 0.1 ml

ID No. : 2212-0344-2

Environment

: Ambient Temperature : (20 ± 3) °C

Relative Humidity : (50 ± 10) %

Air Pressure : 1008.0 mbar.

Date of Received : 20 September 2024

Date of Calibration : 23 September 2024

Date of Issue : 23 September 2024

Calibrated by : Areearat Sontbun

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

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

Electronic Balance

ID No. : 241005

Cert. No. : 67-200210-4

Due Date : 02 Dec 2024

Traceability

National Institute of Metrology (Thailand) (NIMT)

Approved by :

(Wipa Tovadee)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-300569-2

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 : 46.13 sec.

Nominal Volume (ml)	Measuring Volume (ml)
5	5.0039
15	14.9824
25	24.9757

Uncertainty of measurement with in ± 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%

- o o -





Certificate of Calibration

Certificate No. : 67-300569-3

Page : 1 of 2

Submitted by : M Green Group Co., Ltd.

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

Equipment : Measuring Pipette

Manufacturer : GLASSCO Class : A
Capacity : 10 ml Graduation : 0.1 ml
ID No. : MP1001/19

Environment : Ambient Temperature : (20 ± 3) °C
Relative Humidity : (50 ± 10) %
Air Pressure : 1000.8 mbar.

Date of Received : 20 September 2024

Date of Calibration : 23 September 2024

Date of Issue : 23 September 2024

Calibrated by : Areearat Sombun

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

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

Electronic Balance

ID.No.	Cert.No.	Due Date	Traceability
241005	67-200210-4	02 Dec 2024	National Institute of Metrology (Thailand) (NIMT)

Approved by :

(Wipa Tovadee)
Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-300569-3

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 : 12.20 sec.

Nominal Volume (ml)	Measuring Volume (ml)
2	1.9998
5	4.9871
10	9.9742

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%

-o0o-





Certificate of Calibration

Certificate No. : 67-300569-4 Page : 1 of 2

Submitted by : M Green Group Co., Ltd.

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

Equipment : Measuring Pipette
Manufacturer : GLASSCO Class : A
Capacity : 25 ml Graduation : 0.1 ml
ID No. : MP25/01/19

Environment : Ambient Temperature : (20 ± 3) °C
Relative Humidity : (50 ± 10) %
Air Pressure : 1000.8 mbar.

Date of Received : 20 September 2024
Date of Calibration : 23 September 2024
Date of Issue : 23 September 2024
Calibrated by : Arcerat Sombun

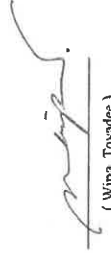
Calibration Method : In-house method CAL-M3001 based on ASTM E 542-22

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

Electronic Balance

ID No.	Cert. No.	Due Date	Traceability
241005	67-200210-4	02 Dec 2024	National Institute of Metrology (Thailand) (NIMT)

Approved by :


(Wipha Towadee)
Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-300569-4 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 : 15.20 sec.

Nominal Volume (ml)	Measuring Volume (ml)
5	5.0302
15	15.0832
25	25.0398

Uncertainty of measurement with in $\pm$ 0.0067 ml

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

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

-o0o-





Certificate of Calibration

Certificate No. : 67-300571-1

Page : 1 of 2

Submitted by

: M Green Group Co., Ltd.

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

Equipment

: Cylinder

Manufacturer : GLASSCO

Class : A

Capacity : 100 ml

Graduation : 1 ml

ID No. : CY100/01/24

Environment

: Ambient Temperature : (20 ± 3) °C

Relative Humidity : (50 ± 10) %

Air Pressure : 1003.9 mbar.

Date of Received : 20 September 2024

Date of Calibration : 24 September 2024

Date of Issue : 24 September 2024

Calibrated by : Atsarat Sombun

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

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

Electronic Balance

ID No. Cert. No.

Due Date

Traceability

241002

67-200210-1

02 Dec 2024

National Institute of Metrology (Thailand) (NIMT)

Approved by :

(Wipa Tovadee)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-300571-1

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)
50	50.45
100	100.52

Uncertainty of measurement with in ± 0.063 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-





Certificate of Calibration

Certificate No. : 67-300571-2

Page : 1 of 2

Submitted by

: M Green Group Co., Ltd.

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

Equipment

: Cylinder

Manufacturer : GLASSCO

Class : A

Capacity : 250 ml

Graduation : 2 ml

ID No. : CY250/01/19

Environment

: Ambient Temperature : (20 ± 3) °C

Relative Humidity : (50 ± 10) %

Air Pressure : 1004.1 mbar.

Date of Received : 20 September 2024

Date of Calibration : 24 September 2024

Date of Issue : 24 September 2024

Calibrated by : Arcerat Sombun

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

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

Electronic Balance

ID No. 241002

Cert. No. 67-200210-1

Due Date 02 Dec 2024

Traceability National Institute of Metrology (Thailand) (NIMT)

Approved by :

(Wipha Tovattee)
Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-300571-2

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)
150	151.02
250	251.16

Uncertainty of measurement with in ± 0.087 ml

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

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

- o0o -





Certificate of Calibration

Certificate No. : 67-300571-3

Page : 1 of 2

Submitted by : M Green Group Co., Ltd.

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

Equipment : Cylinder
Manufacturer : GLASSCO
Capacity : 1000 ml
Class : A
Graduation : 10 ml
ID No. : CY1000/01/24

Environment : Ambient Temperature : (20 ± 3) °C
Relative Humidity : (50 ± 10) %
Air Pressure : 1001.7 mbar.

Date of Received : 20 September 2024

Date of Calibration : 24 September 2024

Date of Issue : 24 September 2024

Calibrated by : Areerat Sombun

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

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

Electronic Balance

ID No.	Cert. No.	Due Date	Traceability
241002	67-200210-1	02 Dec 2024	National Institute of Metrology (Thailand) (NIMT)

Approved by : 
(Wipa Tovadee)
Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-300571-3

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	500.74
1000	1003.10

Uncertainty of measurement with in $\pm$ 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 -





Certificate of Calibration

Page : 1 of 2

Certificate No. : 67-300572-1

Submitted by

: M Green Group Co., Ltd.

188/46 Wisatsukhakhont 25, Pracha-Uthit Rd., Thungkru, Bangkok 10140 Thailand

Equipment

: Imhoff Cone

Manufacturer : VITLAB

Capacity : 1000 ml

Graduation : 0.1, 50 ml

ID No. : CY1000/01/22

Environment

: Ambient Temperature : (20 ± 3) °C

Relative Humidity : (50 ± 10) %

Air Pressure : 1001.5 mbar.

Date of Received

: 20 September 2024

Date of Calibration

: 23 September 2024

Date of Issue

: 23 September 2024

Calibrated by

: Areerat Sombun

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

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

Electronic Balance

ID No. Cert.No. Due Date

Traceability

241002 67-200210-1 02 Dec 2024

National Institute of Metrology (Thailand) (NIMT)

Approved by :

(Wipa Te'adec)

Supervisor

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Certificate of Calibration

Page : 2 of 2

Certificate No. : 67-300572-1

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	500.74
1000	1009.16

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%

- o0o -





Certificate of Calibration

Certificate No. : 67-300570-1 **Page : 1 of 2**

Submitted by : M Green Group Co., Ltd.
188/46 Wisutesuknakhon 25, Pracha-Uitd Rd., Thungkru, Bangkok 10140 Thailand

Equipment : Volumetric Flask
Manufacturer : GLASSCO **Class :** A
Capacity : 100 ml
ID No. : VF100/01/19

Environment : Ambient Temperature : $(20 \pm 3) ^\circ\text{C}$
Relative Humidity : $(50 \pm 10) \%$
Air Pressure : 1003.9 mbar.

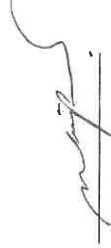
Date of Received : 20 September 2024
Date of Calibration : 24 September 2024
Date of Issue : 24 September 2024
Calibrated by : Areearat Sombun

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

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

Electronic Balance

ID No.	Cert. No.	Due Date	Traceability
241005	67-200210-4	02 Dec 2024	National Institute of Metrology (Thailand) (NIMT)

Approved by : 
(Wipa Tovadee)
Supervisor

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Certificate of Calibration

Certificate No. : 67-300570-1 **Page : 2 of 2**

Result of Calibration : This result of true Volume is referred to standard temperature at $20 ^\circ\text{C}$

UUC Condition As-Received : Good

Nominal Volume (ml)	Measuring Volume (ml)
100	100.063

Uncertainty of measurement with in ± 0.018 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%

- o O o -







Certificate of Calibration

Certificate No. : 67-300570-2 Page : 1 of 2

Submitted by : M Green Group Co., Ltd.

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

Equipment : Volumetric Flask

Manufacturer : GLASSCO Class : A

Capacity : 250 ml

ID No. : VF250/01/19

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

Relative Humidity : (50 ± 10) %

Air Pressure : 1003.8 mbar.

Date of Received : 20 September 2024

Date of Calibration : 24 September 2024

Date of Issue : 24 September 2024

Calibrated by : Areearat Sombun

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

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

Electronic Balance

ID No. Cert. No. Date Date

241002 67-200210-1 02 Dec 2024

Traceability

National Institute of Metrology (Thailand) (NIMT)

Approved by :

(Wipa Tovadee)

Supervisor

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Certificate of Calibration

Certificate No. : 67-300570-2 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)
250	250.04

Uncertainty of measurement with in ± 0.051 ml

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

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

-o0o-





Certificate of Calibration

Certificate No. : 67-300570-3

Page : 1 of 2

Submitted by

: M Green Group Co., Ltd.

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

Equipment

: Volumetric Flask

Manufacturer : GLASSCO

Class : A

Capacity : 1000 ml

ID No. : VF1000/01/19

Environment

: Ambient Temperature : (20 ± 3) °C

Relative Humidity : (50 ± 10) %

Air Pressure : 1003.3 mbar.

Date of Received

: 20 September 2024

Date of Calibration

: 24 September 2024

Date of Issue

: 24 September 2024

Calibrated by

: Arcerat Sombun

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

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

Electronic Balance

ID No.

Cert. No.

Due Date

Traceability

241002

67-200210-1

02 Dec 2024

National Institute of Metrology (Thailand) (NIMT)

Approved by:

(Wipa Towadee)

Supervisor

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Certificate of Calibration

Certificate No. : 67-300570-3

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)
1000	1000.25

Uncertainty of measurement with in ± 0.14 ml

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

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

-o0o-





Certificate of Calibration

Certificate No. : 67-210362-1

Page : 1 of 2

Submitted by :

M Green Group Co., Ltd.

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

Equipment :

Weight

Manufacturer : N/A

Material : Stainless Steel

Weight size : 1 g

ID No. : 63-210391-1

Assumed density of weight : 7950 kg / m³Assumed Air density : 1.2 kg / m³

Environment :

Ambient Temperature : (20 ± 2) °C

Relative Humidity : (50 ± 10) %

Air Pressure : 1005.7 mbar

Date of Received :

20 September 2024

Date of Calibration :

23 September 2024

Date of Issue :

23 September 2024

Calibrated by :

Wutichai Swatphong

Calibration Method : In-house method CAL-M2101 based on OIML R 111-1 : 2004(E)

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

Standard Weights

ID.No.

Cert.No.

Due Date

Traceability

E221-E2210

MM-0042-22

21 Mar 2025

National Institute of Metrology (Thailand), (NIMT)

Approved by :

(Satja Sangkhum)

Supervisor

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Certificate of Calibration

Certificate No. : 67-210362-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

No.	Nominal Value	Id.Mark	Conventional mass Value	Measuring Uncertainty
1	1 g	none	1 g +0.003 mg	± 0.023 mg

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

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

-oOo-





Certificate of Calibration

Certificate No. : 67-210362-2

Page : 1 of 2

Submitted by :

M Green Group Co., Ltd.

18846 Wisatesulnakhon 25, Pracha-Utd Rd., Thungkru, Bangkok 10140 Thailand

Equipment :

Weight

Manufacturer : N/A

Material : Stainless Steel

Weight size : 100 g

ID No. : 63-210391-2

Assumed density of weight : 7950 kg / m³Assumed Air density : 1.2 kg / m³

Ambient Temperature : (20 ± 2) °C

Relative Humidity : (50 ± 10) %

Air Pressure : 1005.7 mbar

Date of Received : 20 September 2024

Date of Calibration : 23 September 2024

Date of Issue : 23 September 2024

Calibrated by : Wuttichai Swarphong

Calibration Method : In-house method CAL-M2101 based on OIML R 111-1 : 2004(E)

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

Standard Weights

ID No. Cert. No.

MM-0042-22 Due Date

Traceability

21 Mar 2025 National Institute of Metrology (Thailand), (NIMT)

Approved by :

(Sanja Sangkhum)

Supervisor

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Certificate of Calibration

Certificate No. : 67-210362-2

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

No.	Nominal Value	Id.Mark	Conventional mass Value	Measuring Uncertainty
1	100 g	none	100 g -0.06 mg	± 0.11 mg

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

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

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Certificate of Calibration

Certificate No. : 67-210362-3 Page : 1 of 2

Submitted by :

M Green Group Co., Ltd.

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

Equipment :

Weight

Manufacturer : N/A

Material : Stainless Steel

Weight size : 200 g

ID No. : 63-210391-3

Assumed density of weight : 7950 kg / m³Assumed Air density : 1.2 kg / m³

Environment :

Ambient Temperature : (20 ± 2) °C

Relative Humidity : (50 ± 10) %

Air Pressure : 1005.7 mbar

Date of Received : 20 September 2024

Date of Calibration : 23 September 2024

Date of Issue : 23 September 2024

Calibrated by : Wutichai Swatphong

Calibration Method : In-house method CAL-M2101 based on OIML R 111-1 : 2004(E)

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

Standard Weights

ID No.

Cert. No.

Traceability

E221-E2210

MM4-0042-22

Due Date

21 Mar 2025

National Institute of Metrology (Thailand), (NIMT)

Approved by :

(Sirja Sangkhum)

Supervisor

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Certificate of Calibration

Certificate No. : 67-210362-3 Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

No.	Nominal Value	Id. Mark	Conventional mass Value	Measuring Uncertainty
1	200 g	none	200 g +0.06 mg	± 0.17 mg

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%

- oOb -





บริษัท ไทยยูนิค จำกัด THAI UNIQUE CO., LTD.

80-82 ถนนประชาวิทย์ แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200
80-82 Prachathipatani Rd., Bangkokhuprom, Pranakorn, Bangkok 10200
Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawan@thaiunique.com, Website : www.thaiunique.com

ATOMIC ABSORPTION SPECTROMETER TEST CERTIFICATE

Certificate No : SV2410/22223
Instrument Type : Atomic Absorption Spectrophotometers
Model : AA240FS
Serial Number : EL08043418
Organization : Test Tech Co., Ltd.
Address : 30.32 Soi 63 Rama II Rd. Samadarn Bangkokhuprom, Bangkok 10150
Date : 17 Oct 2024

Hollow cathode lamps used

Element	Lamp number	Comments
Arsenic	56-101003-00	
Copper	56-101014-00	
Potassium	56-101042-00	
Iron	56-101027-00	
Manganese	56-101337-00	

Test description	Specification	Result	Comments
Light throughput (%Gain) or (BHT)			
Cu at 324.8 nm	≤ 64 % or 380 V	32 %	Pass
As at 193.7 nm	≤ 80 % or 540 V	54 %	Pass
K at 766.5 nm*	≤ 84 % or 540 V	64 %	Pass
Fe at 248.3 nm	≤ 80 % or 540 V	63 %	Pass
Mn at 279.5 nm	≤ 64 % or 380 V	53 %	Pass
Photometric noise Cu BGC off			
STDV @ 0 Abs	≤ 0.0005	0.0001	Pass



บริษัท ไทยยูนิค จำกัด THAI UNIQUE CO., LTD.

80-82 ถนนประชาวิทย์ แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200
80-82 Prachathipatani Rd., Bangkokhuprom, Pranakorn, Bangkok 10200
Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawan@thaiunique.com, Website : www.thaiunique.com

Wavelength accuracy

Cu at 324.8 nm	323.0 nm - 326.0 nm	324.7 nm	Pass
As 193.7 nm	192.0 nm - 195.0 nm	193.7 nm	Pass
K at 766.5 nm*	765.0 nm - 768.0 nm	766.4 nm	Pass
Fe at 248.3 nm	246.8 nm - 249.8 nm	248.2 nm	Pass
Mn at 279.5 nm	278.0 nm - 281.0 nm	279.5 nm	Pass

High solids nebulizer setting**

Uptake rate	7.2 - 10.6 ml / min	7.8 ml/min	Pass
Max Abs	≥ 0.75 Abs	0.79 Abs	Pass
Precision(%RSD)	≤ 0.5 %	0.4 %	Pass

Zeeman Background Correction Accuracy (%)*

BCA @ Au 242.8 nm	< 3.7 %	***	***
-------------------	---------	-----	-----

Zeeman Magnetic Sensitivity Ratio (%)**

MSR @ Cu 324.7 nm	> 70 %	***	***
-------------------	--------	-----	-----

Characteristic mass and sensitivity ****

Sensitivity	≥ 0.21 Abs	****	****
Precision (%RSD)	≤ 4.0 %	****	****

* for Wideband PMT (Wavelength 190nm - 900nm)

** for Flame system

*** for Zeeman system

**** for Graphite furnace system



CALIBRATED BY:

Signature:
Engineer : Suriya Neachoon
Date : 17 / Oct / 2024

APPROVED BY:

Signature:
Service Manager : Suchai Sangantkajitjai
Date : 17 / Oct / 2024



PinAAcle 900F Preventive Maintenance Report

Company Name: TEST TECH CO., LTD.
Instrument Location: 30,32 RAMA2 SOI 63, RAMA 2 RD.,
SAMMAEDAM, BANGKHUNTEN, BANGKOK 10150
Instrument Serial No.: PFBS21091601
Date: 22-Feb-2024

PinAAcle 900F Preventive Maintenance (PM)				
Company Name:		TEST TECH CO., LTD.		
Address (Instrument Location):		30,32 RAMA2 SOI 63, RAMA 2 RD., BANGKHUNTEN, BANGKOK 10150		
Serial Number:	PFBS21091601	PM Number:	1 of 1	
Customer Name (If applicable):	Juralrat Jongprabokkitt	Telephone Number:	087-5199005	
Customer Support Engineer Name:	Chainarong	Service Order Number:	WO-02710284	
Date PM Performed: (DD-MMM-YYYY)	22-Feb-2024	Next PM Due Date: (DD-MMM-YYYY)	22-Feb-2025	
Standard Labor Hours to Complete PM :			5 hours	

Part Number	Release	Publication Date
09370145 Rev.9	A	January 2018

Scope
The purpose of this PM is to ensure the continued functionality of the PinAAcle 900F by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer.
The customer should save their method before the PM begins.

General Instructions:
The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM.
Always check with the customer before making any changes that may affect the customer's analysis or calibration, including a current back-up of system software and/or data files.
The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer.
Update the PM sticker and instrument logbook as required.

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Component List

Component / Specific Model	Serial #	Configuration Notes
FIAS 400	400521100101	Syngistix version 4.0

Parts Lists

Parts Included with the PM		
Part Number (If applicable)	Description	Quantity
B05Q1696	Fan Filters	2
N3160156	O-Ring Kits for Sampling Introduction (Stainless Steels Nebulizer)	N/A
N3160157	O-Ring Kits for Sampling Introduction (Plastic Nebulizer)	1
N3001714	Replacement Acetylene Filter Cartridge	1
TH001022	Replacement Air Filter Cartridge	2

Additional Reagents and Standards Required for PM			
Part Number (If applicable)	Description	Quantity	Batch/Lot # Expired Date (mm/yy)
N9300183	1000 mg/L Copper Standard	AR	27-39CJY1 APR-2025

Additional Reagents and Standards Required for PM (Customer Support Solution)			
Part Number (If applicable)	Description	Quantity	Batch/Lot # Expiration Date (mm/yy)
N/A	DI Water	250 mL	AR AR
N/A	0.5% HNO ₃	250 mL	AR AR

Additional Tools Required for PM			
Part Number (If applicable)	Description	Quantity	Serial #
N1013000	0.2A Neutral density filter	1	MG0-141
N1013002	1.0A Neutral density filter	1	MG2-045
09030997	System 2 EDL Driver	1	839936
N3050605	As System 2 EDL	1	06261
N3050121	Cu Lumina HCL	1	101615-010080
N3050109	Ba Lumina HCL	1	838ADB
N3050139	K Lumina HCL	1	011604-41713
N3050152	Ni Lumina HCL	1	050914-010060

Procedure Checklist

Use (✓) to check off those steps in the checklist that have been completed.

1. General:

- ☒ Review the instrument performance with the customer and document any recent problems.
- ☒ Inspect the customer log book and make any appropriate PM entries.
- ☒ Perform general inspection of system for cleanliness.

2. PC Instrument Software:

- ☒ Instrument Software user files/databases archived, packed, and/or deleted as needed.

3. Mechanical:

- ☒ Inspect and clean all fans and filters. Replace filters if necessary
- ☒ Inspect all gas lines for leaks and/or wear. Replace if needed.
- ☒ Clean exterior of the instrument.
- ☒ Inspect the burner head, burner chamber, and nebulizer. Clean if needed as stated in the Hardware Guide.
- ☒ Check burner head dimensions with the feeler gauge as stated in the Hardware Guide in the Maintenance chapter section on cleaning the burner head and checking slot width. Replace if out of specification
- ☒ Check the condition of the end cap, burner head, and nebulizer O-rings. Replace if necessary.
- ☒ Check the drain system for signs of wear. Replace worn or damaged parts.
- ☒ Visually check for proper flame conditions when lighting the Air-C2H2 and N2O-C2H2 flames (if applicable).

4. Electrical:

- ☒ Inspect PC boards. Clean if necessary.
- ☒ Carefully check all internal and external cable connections.
- ☒ Check instrument firmware revisions upgrade to current levels (if necessary)
- ☒ Run Diagnostics Test within the Advanced function of the Spectrometer page. Check the results in the service log folder in the Spectrometer BM Log Viewer.

5. Optics:

- ☒ Inspect and clean the sample compartment windows, if needed.
- ☒ Inspect optics. Clean or replace if necessary.

6. Gases:

- ☒ Verify that the Gases supplied to the instrument are within the pressure and purity specifications found in the PinaAcle 900 Series Pre-Installation Checklist SDB.
- ☒ Verify that the acetylene filter and air filter element is dry. Replace if necessary.

7. Flame Interlock Check:

Description: Check to ensure that all safety interlocks are closed.

Parameter	Specification	Test Results	Pass/Fail
Flame Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Drain Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Nebulizer Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
C ₂ H ₂ Pressure Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Air Pressure Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Burner Head Sensor	Choosing Nitrous Oxide as the oxidant should trigger an interlock shut down	Active	Passed

8. After PM Performance tests:

8.1 Detector Linearity with Barium

Description: Ensures that the detector is linear in the Visible Range.

Parameter	Specification	Certificate Value at 553.8 nm (Abs.)	Test Results	Pass/Fail
1.0 A ND Filter	± 5% from Cert.	1.0547	1.0432	Passed
0.2 A ND Filter	± 5% from Cert.	0.1903	0.1832	Passed

8.2 Baseline Noise at 1.0 Absorbance with Barium

Description: Ensures that a high absorbance will not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0038	Passed

8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.001	0.0001	Passed

8.4 D₂ Background Compensation with Copper

Description: Verifies the Instruments ability to compensate for Background absorption.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0090	Passed

8.5 AA-BG Baseline Noise with Copper

Description: Ensures that background correction does not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0001	Passed

8.6 AA-BG Baseline Noise with Arsenic

Description: Ensures that background correction does not produce excessive noise at a low wavelength.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0002	Passed

8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

Standard Copper Sensitivity	Specification	Results (Abs.)	Pass/Fail
5 mg/L Sensitivity SS Neb (if applicable)	> 0.250 Abs.	N/A	Not Applicable
2 mg/L Sensitivity HS Neb (if applicable)	> 0.250 Abs.	0.3366	Passed

10. Review:

- ☒ Review with the customer PM work performed.
- ☒ Review with the customer routine maintenance procedures.
- ☒ Discuss recommended customer supplied materials to have on hand.
- ☒ Attach PM sticker.

Additional Comments

Additional Comments Regarding the PM	
PERFORMANCE TEST FOR FIAS	
1. Characteristics mass for Mercury, (500ul of 10ug/L Hg and 5 replicates) Characteristics mass %RSD	307.3 pg/0.0044 A 2.09 %
2. Characteristics mass for Arsenic, (500ul of 10ug/L As and 5 replicates) Characteristics mass %RSD	134.7 pg/0.0044 A 1.63 %
2. Characteristics mass for Selenium, (500ul of 10ug/L Se and 5 replicates) Characteristics mass %RSD	80.4 pg/0.0044 A 1.02 %
Wavelength Accuracy Check	
As 193.700 nm +/- 0.3nm	193.700 nm
Cu 324.750 nm +/- 0.3nm	324.700 nm
Ba 553.550 nm +/- 0.3nm	553.650 nm
K 766.490 nm +/- 0.3nm	766.490 nm

Review

The preventive maintenance checks and if applicable performance tests for PinaAcle 900F have been completed.

This PinaAcle 900F ☒ Passes ☐ Fails ☐ the preventive maintenance.

Review of Preventive Maintenance:	Date: 22-Feb-2024 (DD-MMM-YYYY)
Authorized PerkinElmer Representative:	Chaiwang
Authorized Customer Representative:	Swiret
	Date: 22-Feb-2024 (DD-MMM-YYYY)

MAINTENANCE AND IPV TEST CERTIFICATE MODEL
OPTIMA 8000

SERIAL NUMBER: 078S1411171C	DATE TESTED: May 14, 2024	
PARAMETER	SPECIFICATION	FINAL VALUE
Spectral Resolution : UV		
As 193.696 nm	≤ 0.009 nm	0.00735 nm
Ni 231.604 nm	≤ 0.011 nm	0.00813 nm
Ni 341.476 nm	≤ 0.015 nm	0.01386 nm
Spectral Resolution : VIS		
Ba 455.403 nm	≤ 0.020 nm	0.01721 nm
Precision		
Zn 206.200 nm	% RSD ≤ 1.0 %	0.35 %
Mg 280.271 nm	% RSD ≤ 1.0 %	0.27 %
Mg 285.213 nm	% RSD ≤ 1.0 %	0.46 %
Ba 455.403 nm	% RSD ≤ 1.0 %	0.48 %
Detection Limits : Axial		
Tl 190.801 nm	3(sd) ≤ 10.0 ppb	1.00 ppb
As 193.696 nm	3(sd) ≤ 10.0 ppb	3.32 ppb
Se 196.026 nm	3(sd) ≤ 5.0 ppb	3.88 ppb
Pb 220.353 nm	3(sd) ≤ 3.0 ppb	1.45 ppb
Detection Limits : Radial		
As 193.696 nm	3(sd) ≤ 60.0 ppb	3.41 ppb
Zn 213.857 nm	3(sd) ≤ 2.0 ppb	0.30 ppb
Mn 257.610 nm	3(sd) ≤ 1.0 ppb	0.03 ppb
La 379.478 nm	3(sd) ≤ 3.0 ppb	0.27 ppb
Ba 455.403 nm	3(sd) ≤ 0.3 ppb	0.05 ppb
Ba 493.408 nm	3(sd) ≤ 0.6 ppb	0.06 ppb
BEC : Axial (IB X 1000)/(IS-IB)		
Mn 257.610 nm	≤ 30 ppb	10.70 ppb
BEC : Radial (IB X 1000)/(IS-IB)		
Mn 257.610 nm	≤ 30 ppb	21.54 ppb

MAINTENANCE AND IPV TEST CERTIFICATE MODEL
OPTIMA 8000

SERIAL NUMBER: 078S1411171C

DATE TESTED: May 14, 2024

Remarks :
Commissioning follow as commissioning performance sheets.

☒

☐

meets
does not meet

This is to certify that the above tests have been performed and the configuration tested 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 Scientific (Thailand) Co., Ltd.

Customer Service Engineer: (Narong Wajankit)
Service Engineer



CERTIFICATE No : 25T0970
REFERENCE No : 76012-2

PAGE : 1 OF 2

Certificate of Calibration

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

CALIBRATED BY : CHAICHARN CH.
CALIBRATION DATE : 04-Feb-25
APPROVED BY :
ISSUED DATE : 12-Feb-25
RECEIVED DATE : 04-Feb-25

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 : 25T0970

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : INCUBATOR
MANUFACTURER : MEMMERT
MODEL : IF 160
ID No : EQL-205
RECEIVED DATE : 04-Feb-25
AMBIENT TEMPERATURE : 25 °C ± 1 °C
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 :-

- INSTRUMENT : MODEL : SERIAL No : CERTIFICATE No : DUE DATE :
1) DATA LOGGER WITH RTD : HYDRA 2635A : 7301307 : 24T6467 : 26-Jun-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 QUALITY CALIBRATION CO., LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

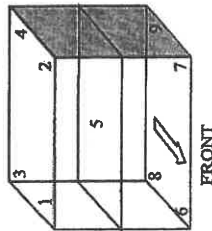
GENERAL INFORMATION

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

Overall Line Voltage (V) variation : 11

Instrument Condition : Normal

Chamber Size (W*L*H): 56*40*72 cm



CHAMBER PERFORMANCE

Point	Calibration	Temperature	Average	Stability	Temperature	Overall
(°C)	(°C)	(°C)	(°C)	(°C)	Uniformity	Variation
35.0	35.0	35.0	34.98	0.03	0.08	0.12
36.0	36.0	36.0	35.99	0.02	0.16	0.16
41.5	41.6	41.6	41.51	0.03	0.19	0.23

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller		Measured Temperature (°C) at Spread Locations										Uncertainty
Temp (°C)	Indicating Temp (°C)	#1	#2	#3	#4	Ref. 5	#6	#7	#8	#9	(± °C)	
35.0	35.0	34.96	35.01	34.94	35.00	35.01	34.99	34.98	34.97	35.01	0.25	
36.0	36.0	35.98	36.03	35.95	36.01	36.04	36.01	35.91	35.99	36.04	0.25	
41.6	41.6	41.49	41.53	41.43	41.52	41.59	41.53	41.42	41.53	41.58	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-C010 REV : 03



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



CERTIFICATE No : 24E11174
REFERENCE No : 75187-2

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : pH METER
MANUFACTURER : TOA DKK
MODEL : HM-41X
SERIAL No : 858942
ID No : EQL-225
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : TEST TECH CO., LTD.
3032 RAMA II SOI 63, RAMA II RD., SAMAEADAM,
BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY

PRASERT D.

CALIBRATION DATE

04-Nov-24

APPROVED BY

PONGSAK J.

ISSUED DATE

05-Nov-24

RECEIVED DATE

04-Nov-24

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



QUALITY CALIBRATION CO., LTD.

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

CERTIFICATE No : 24E11174

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : pH METER
MANUFACTURER : TOA DKK
ID No : EQL-225
RECEIVED DATE : 04-Nov-24
AMBIENT TEMPERATURE : 25° C ± 1° C
MODEL : HM-41X
SERIAL NUMBER : 858942
CALIBRATION DATE : 04-Nov-24
RELATIVE HUMIDITY : 49 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT METHOD BASED ON WI-TQ-062 AND WI-TQ-063. THE DISPLAY UNIT WAS TESTED BY GENERATING STANDARD VOLTAGE TO THE UNIT AND READ THE VALUE COMPARED WITH CALCULATED VALUE. THE DISPLAY AND ELECTRODE WAS CALIBRATED BY USING STANDARD pH BUFFER SOLUTION.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT

- 1) pH STANDARD SOLUTION
- 2) pH STANDARD SOLUTION
- 3) pH STANDARD SOLUTION
- 4) PROCESS CALIBRATOR
- 5) BATH
- 6) THERMOMETER WITH PROBE

MODEL

- 00651-06
00651-08
00651-10
CA150
260014
421504

SERIAL No/

- CC801395
CC801899
CC803826
91S6079
124748074
5500379

CERTIFICATE No

- 4880-15044130
4881-15078560
4882-15161223
24E1251
24T9693
24T9694

DUE DATE

- 18-Apr-26
01-May-26
31-May-26
09-Apr-25
12-Sep-25
12-Sep-25

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 SI UNIT MAINTAINED AT :-

- NATIONAL INSTITUTE OF STANDARD AND TECHNOLOGY, USA.

- NATIONAL INSTITUTE OF METROLOGY (THAILAND)

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

1. DISPLAY UNIT ONLY

SLOPE FACTOR $k = 2.303 \text{ RT/F} = 59 \text{ mV/pH}$

mV APPLIED	UUC READING (mV)	CORRECTION (mV)	UNCERTAINTY OF MEASUREMENT ($\pm \text{mV}$)	COVERAGE FACTOR k
177.48	177	0.48	0.59	2.0
0.00	0	0.00	0.59	2.0
-177.48	-178	0.52	0.59	2.0

2. DISPLAY UNIT WITH pH ELECTRODE SN: 903F0088AK

STANDARD pH BUFFER SOLUTION (pH)	UUC READING (pH)	CORRECTION (pH)	UNCERTAINTY OF MEASUREMENT ($\pm \text{pH}$)	COVERAGE FACTOR k
4.0060	4.01	-0.004	0.013	2.0
7.0000	7.00	0.000	0.013	2.0
10.0070	10.01	-0.003	0.014	2.0

3. DISPLAY UNIT MEASUREMENT TEMPERATURE WITH PROBE

STANDARD READING (°C)	UUC* READING (°C)	IMMERSION DEPTH (mm)	CORRECTION (°C)	UNCERTAINTY OF MEASUREMENT ($\pm ^\circ \text{C}$)
25.004	25.1	80	-0.096	0.21

UUC : UNIT UNDER CALIBRATION

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 , PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

[Signature]

F-G010 REV 03



BECTHAI BANGKOK EQUIPMENT & CHEMICAL CO., LTD.
CALIBRATION LABORATORY

99/9 Moo 2, Maha Sawet, Phuthamonthon, Nakhon Pathom, 73100, Thailand. Tel: +66 3424 5299 Fax: +66 3424 5250
E-mail: bkk@becthai.com Website: www.becthai.com



REC-TB1-TB1 17625
CALIBRATION #131

Certificate No. : CAL-24-196

Page : 1 of 3

CERTIFICATE OF CALIBRATION

Equipment : Spectrophotometer
Manufacturer : Thermo Scientific
Model : Genesys 30
Serial No. : 9A1Z098145
ID No. : EQL-251
Customer : TEST TECH CO., LTD.
: 30,32 Rama II Soi 63, Rama II Rd.,
: Samaedam, Bangkhunthian,
: Bangkok 10150
Location : Wastewater Room 3
Date of Receipt : 10 June 2024
Date of Calibration : 10 June 2024
Date of Issue : 13 June 2024
Ambient Temperature : (25±10) °C
Relative Humidity : (60±20) %
Condition As-Received : Used Item

Calibrated by

Mr. Palawat Luchak

Calibration Engineer

Approved by

(Ms. Jintana Sangthajaroenlap)

Calibration Manager

The reported expanded uncertainty of measurement was based on a combined standard uncertainty multiplied by a coverage factor *k* providing a level of confidence of approximately 95%.
This certificate may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.
Indicated values are valid for the state of the Spectrophotometer at the time of calibration only.

ISSUE: 6 REV:5

FM-CAL-33/2

2002/24



BECTHAI BANGKOK EQUIPMENT & CHEMICAL CO., LTD.
CALIBRATION LABORATORY

99/9 Moo 2, Maha Sawet, Phuthamonthon, Nakhon Pathom, 73100, Thailand. Tel: +66 3424 5299 Fax: +66 3424 5250
E-mail: bkk@becthai.com Website: www.becthai.com



REC-TB1-TB1 17625
CALIBRATION #131

Certificate No. : CAL-24-196

Page : 2 of 3

CALIBRATION REPORT

Conditions of this result of calibration

1. Reference Standard Material :

Material	Model	Serial No.	Cert. No.	Due date
Holmium Glass Filter	RM-HG	12705	117342	13 December 2025
Dilutonium Glass Filter	RM-DG	13498	117323	13 December 2025
Neutral Density Filter	RM-1N2N3N	8323	117341	13 December 2025

2. Traceability : This certification is traceable to the International System of Unit maintained at:

The Starna Scientific Ltd. Accredited Calibration Laboratory No. 0659.

3. Method of calibration :

The calibration procedure was carried out according to ASTM E275-08 (2022) and ASTM E925-09 (2014).

4. Result of calibration :

(✓) without adjustment () after adjustment

5. Equipment Specifications:

Spectral Bandwidth :	5	nm
Data Interval :	1	nm
Scan Speed :	1200	nm/min

ISSUE: 6 REV:5

FM-CAL-33/2

2002/24



BECTHAI BANGKOK EQUIPMENT & CHEMICAL CO., LTD.
CALIBRATION LABORATORY

99/9 Moo 2, Nakhon Sawan, Phuthumwanthorn, Nakhon Pathom, 7370, Thailand. Tel: +66 3404 5299 Fax: +66 3404 5250
E-mail: bkk@becthai.com Website: www.becthai.com



Certificate No. : CAL-24-196

Page : 3 of 3

CALIBRATION REPORT

Wavelength Calibration

Certified Values of Reference Material	Nominal Value (nm)	UUC* Reading (nm)	Error (nm)	Uncertainty of Measurement ($\pm$ nm)	k Factor
361.40	361.40	361	-0.40	0.59	2.00
537.00	537.00	537	0.00	0.59	2.00
879.68	879.68	879	-0.68	0.59	2.00

Photometric Calibration for Visible

Wavelength (nm)	Certified Values of Reference Material (A)	UUC* Reading (A)	Error (A)	Uncertainty of Measurement ($\pm$ A)	k Factor
420.0	Zero	0.000	0.0000	0.0028	2.00
	0.5703	0.569	-0.0013	0.0045	2.00
	0.7336	0.733	-0.0006	0.0045	2.00
	1.0709	1.070	-0.0009	0.0045	2.00
440.0	Zero	0.000	0.0000	0.0028	2.00
	0.5592	0.559	-0.0002	0.0045	2.00
	0.716	0.718	0.0020	0.0045	2.00
	1.0454	1.045	-0.0004	0.0045	2.00
485.0	Zero	0.000	0.0000	0.0028	2.00
	0.5094	0.511	0.0016	0.0045	2.00
	0.6601	0.663	0.0029	0.0045	2.00
	0.963	0.966	0.0030	0.0045	2.00
546.1 (546.0)	Zero	0.000	0.0000	0.0028	2.00
	0.5206	0.522	0.0014	0.0045	2.00
	0.6677	0.670	0.0023	0.0045	2.00
	0.9763	0.977	0.0007	0.0045	2.00
590.0	Zero	0.000	0.0000	0.0028	2.00
	0.5522	0.553	0.0008	0.0045	2.00
	0.6966	0.698	0.0014	0.0045	2.00
	1.0201	1.021	0.0009	0.0045	2.00
635.0	Zero	0.000	0.0000	0.0028	2.00
	0.5377	0.540	0.0023	0.0045	2.00
	0.6649	0.667	0.0021	0.0045	2.00
	0.9736	0.974	0.0004	0.0045	2.00

Remark : Each individual filter is measured against the empty filter holder (blank) used to zero the Spectrophotometer.

Note:

UUC* : Unit Under Calibration

- End of Report -
FM-CAL-33/2

ISSUE: 6 REV:5

Signature
20/02/24



Bara Scientific
SOLUTION OF SUCCESS

Bara Scientific Co., Ltd.
998 U Chu Liang Building Floor7 Rama4 Road
Siam Bangkok Bangkok Thailand 10500
Tel : 02-6324300 Fax : 02-6375486-7
www.barscientific.com



Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSOC-UV-168/24
Equipment UV/Vis Spectrophotometer
Model UV-1900U
Manufacturer Shimadzu
Serial No. A12535780311 ML
ID No. EQL-233
Date of receipt 26 April 2024
Date of calibration 26 April 2024
Date of issue 30 April 2024

Customer name Test Tech Co., Ltd.

Address 30,32 Rama II Soi 83, Rama II Road, Samsae Dam, Bang Khun Thian, Bangkok 10150

Temperature (24.9 - 25.4) °C (On site)
Humidity (49.4 - 51.1) %RH (On site)

Equipment condition Good Operation

Calibration Location Water Room

Calibration Procedure In-house method W-LUV-702-01 based on ASTM E275-01

Traceability Wavelength Accuracy is traceable to certificate No. 106372 and 106371
Photometric Accuracy is traceable to certificate No. 106364 and 111388
Stray Light is traceable to certificate No. 106377
The above certificate are traceable to SI unit through Stama Scientific Ltd.
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr. Wanchana Janloy

Approved by

Signature

Mr. Sorinth Tamboonsakdi
Service Manager

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.
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988 U Chu Liang Building Floor 7 Ramas Road
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Certificate of Calibration

Certificate No.

BSCC-UV-166/24

Number of Page(s)

2 of 3

Calibration Results:

1. Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (±nm)
279.44	279.18	-0.26	0.18
418.53	418.46	-0.07	0.18
536.52	536.54	0.02	0.18
684.50	684.63	0.13	0.18
879.41	878.43	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	0.0000	0.0000	0.0000	0.0075
350	0.8354	0.8333	-0.0021	0.0075
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	0.0000	-0.0001	-0.0001	0.0075
	0.8199	0.8190	-0.0009	0.0075

*CNR = Customer not request

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Certificate of Calibration

Certificate No.

BSCC-UV-166/24

Number of Page(s)

3 of 3

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
	0.5761	0.5791	0.0030	0.0042
	0.7119	0.7132	0.0013	0.0042
	1.0189	1.0221	0.0032	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5610	0.5636	0.0026	0.0042
	0.7001	0.7012	0.0011	0.0042
	1.0026	1.0062	0.0036	0.0042
465.0	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
546.1	0.0000	0.0000	0.0000	0.0042
	0.5249	0.5260	0.0011	0.0042
	0.6875	0.6871	-0.0004	0.0042
	1.0009	1.0012	0.0003	0.0042
590.0	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
635.0	0.0000	0.0000	0.0000	0.0042
	0.5886	0.5973	0.0087	0.0042
	0.7620	0.7611	-0.0009	0.0042
	1.0982	1.0976	-0.0006	0.0042

*CNR = Customer not request

4. Stray Light*

Standard cut-off wavelength (nm)	Wavelength (nm)	Transmission (%)	Absorbance (A)
200.85±0.11nm	200.78	0.9795	2.0091

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

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บริษัท ซีจี ไซแอนติฟิค จำกัด
CG SCIENTIFIC CO., LTD.

การดูแลบำรุงรักษาเชิงป้องกัน

Preventive Maintenance

Customer Name : บริษัท เทสท์ โพลี จำกัด
Product : Distillation Unit
Brand : GERHARDT
Model : Vapodest 30
Serial number : GER003718



บริษัท ซีจี ไซแอนติฟิค จำกัด
CG SCIENTIFIC CO., LTD.

- Part 1: สัญญาการให้บริการ (Service Contact)
Part 2: ข้อมูลพื้นฐานของเครื่องมือ (Details of Instrument)
Part 3: ตรวจสอบประสิทธิภาพเครื่อง
Part 4: รายละเอียดและรายงานผลการให้บริการ Preventive Maintenance
4.1 ขั้นตอนการบริการ
4.2 รายงานผลการให้บริการ
Part 5: ข้อมูลสนับสนุนด้านเทคนิค (General Technical Support)
5.1 Care and Maintenance
5.1.1 การบำรุงรักษาทั่วไป (Basic maintenance)
5.1.2 General error message



บริษัท ซีจี ไซแอนติฟิค จำกัด
CG SCIENTIFIC CO., LTD.

1. ข้อมูลการให้บริการ (Service Contact)

หน่วยงานลูกค้า :	บริษัท เทสท์ เทค จำกัด
ที่อยู่ :	30.32 ซอยพราหมณ์ 2 ซอย 63 แขวงสามเสนใน เขตพญาไท กรุงเทพมหานคร 10150
โทรศัพท์ :	
อีเมล :	
บุคคลติดต่อ :	
ชื่อ-นามสกุล :	คุณ กรรณก จุฬพิทักษ์
ตำแหน่ง :	
โทรศัพท์ :	02-893-4211-17
อีเมล :	lab_center@testtech.co.th

สัญญาการบริการจำนวน 1 ครั้ง ต่อ ปี

ครั้งที่ 1 วันที่ :	19 มีนาคม 2568
ครั้งที่ 2 วันที่ :	
ครั้งที่ 3 วันที่ :	

2. ข้อมูลพื้นฐานของเครื่องมือ (Details of Instrument)

2.1 รายละเอียดเครื่องมือ (Instrument Description)

ประเภทเครื่องมือ :	Distillation Unit
ผลิตภัณฑ์ :	GERHARDT
รุ่น :	Vapodest 30
หมายเลขเครื่อง :	GER003718
หมายเลขชุดภัณฑ์ :	EQL-062

2.2 ผู้ดำเนินการ

ดำเนินการทำ PM โดย

ชื่อ-นามสกุล :	คุณเอกฤทธิ์ อดชนวรัตน์
ตำแหน่ง :	วิศวกร
แผนก :	บริการหลังการขาย
ฝ่าย :	บริการหลังการขาย

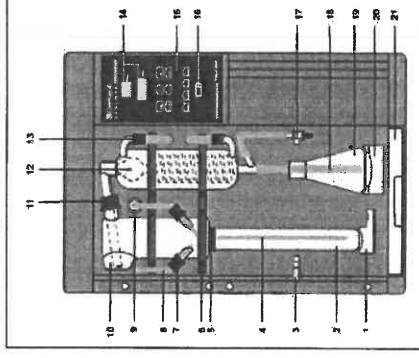


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CG SCIENTIFIC CO., LTD.

Part 3: Operational Qualification (OQ)

3.1 ตรวจสอบสภาพเครื่อง

FRONT



No Description

1.	Quick clamping device with wedge	☒	☐	☐
2.	Kjeldatherm digestion tube	☒	☐	☐
3.	Holder for steam inlet tubing	☒	☐	☐
4.	PTFP-Inlet tubing, steam	☒	☐	☐
5.	Viton-cone	☒	☐	☐
6.	Clamping for glassware	☒	☐	☐
7.	Screw cap GL18 with silicone seal	☒	☐	☐
8.	PTFP-Inlet tubing, NaOH	☒	☐	☐
9.	PP-Distributor with PP-threaded joint	☒	☐	☐
10.	Distribution head, PP	☒	☐	☐
11.	Screw cap GL32 with silicone seal	☒	☐	☐
12.	Distillation condenser	☒	☐	☐
13.	Screw cap GL14 with plastic screw connection	☒	☐	☐
14.	Display	☒	☐	☐
15.	Keypad, chemical-resistant	☒	☐	☐
16.	Main switch, green	☒	☐	☐
17.	Ventilation valve	☒	☐	☐
18.	Distillate outlet tubing	☒	☐	☐
19.	Erlenmeyer flask	☒	☐	☐
20.	Platform	☒	☐	☐
21.	Drip tray	☒	☐	☐

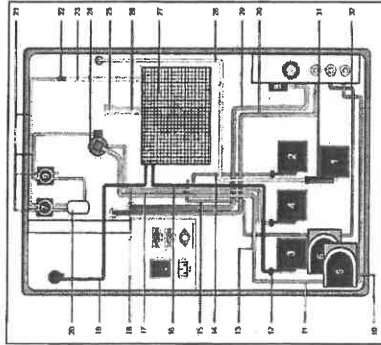
N/A

FAIL

PASS



REAR



No	Description	Pass	Fail	Remark
1.	Diaphragm pump NaOH	☒	☐	
2.	Diaphragm pump H ₂ O ₂	☒	☐	
3.	Diaphragm pump H ₂ O for steam generator	☒	☐	
4.	Diaphragm pump H ₂ O for sample	☒	☐	
5.	Peristaltic pump for suction sample	☒	☐	
6.	Peristaltic pump for suction receiver	☒	☐	
7.	Pinch-solenoid valve, steam	☒	☐	
8.	Magnetic valve with pressure control	☒	☐	
9.	Pinch-solenoid valve, shut-off	☒	☐	
10.	Verprene-tubing 4x8 mm.	☒	☐	
11.	Verprene-tubing 4x8 mm.	☒	☐	
12.	Non-return valve for diaphragm pumps	☒	☐	
13.	Tubing reduction PP 51x10x6 mm.	☒	☐	
14.	Silicone tubing 4x7 mm.	☒	☐	
15.	Silicone tubing 4x7 mm.	☒	☐	
16.	Silicone -tubing 4x7 mm.	☒	☐	
17.	Verprene-tubing 8x12 mm.	☒	☐	
18.	Verprene tubing 4x7 mm.	☒	☐	
19.	Silicone tubing 4x7 mm.	☒	☐	
20.	Ventilation glass	☒	☐	
21.	Novoprene-tubing 4.8x8 mm.	☒	☐	
22.	Tubing reduction	☒	☐	
23.	Silicone tubing 6x10 mm.	☒	☐	
24.	PP-distributor with PP-thread	☒	☐	
25.	SKT-valve (built in with brass fitting)	☒	☐	
26.	Silicone tubing 8x16x80 mm.	☒	☐	
27.	Steam generator	☒	☐	
28.	PTFE-inlet tubing NaOH	☒	☐	
29.	Silicone tubing 8x16 for cooling water inlet	☒	☐	
30.	Silicone tubing 8x16 for cooling water outlet	☒	☐	
31.	Viton-tubing 8x12*50 mm.	☒	☐	
32.	Silicone tubing 4x7 mm.	☒	☐	



Part 4: รายละเอียดการตรวจสอบ

4.1 ขั้นตอนการบริการ

ตรวจสอบระบบไฟฟ้า (Electrical Test)

- ความต้านทานลัดไฟฟ้าของเครื่องทำความร้อน
- กระแสไฟฟ้าใช้งาน

PASS	FAIL	Remark
☒	☐	
☒	☐	

ตรวจสอบสภาพเครื่อง (Optical Test)

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

PASS	FAIL	Remark
☒	☐	
☒	☐	
☒	☐	
☒	☐	
☒	☐	
☒	☐	
☒	☐	
☒	☐	

ตรวจสอบ Function การทำงาน (The Function Test)

- ระบบเครื่องทำความร้อนของ Steam
- ระบบการฉีดน้ำเข้า Sample Tube
- ระบบการเติม NaOH
- ระบบการ Suction คัด Sample Tube และ Receiver

PASS	FAIL	Remark
☒	☐	
☒	☐	
☒	☐	
☒	☐	

4.2 รายละเอียดการให้บริการ

1. TECHNICAL DATA

- Main Supply 220 volt + 10% 50 Hz
- Nominal current

PASS	FAIL	Remark
☒	☐	
☒	☐	

1.1 COOLING WATER BATH

- Temperature 15-20 °C
- Cooling Water Outlet
- Control Temperature

PASS	FAIL	Remark
☒	☐	
☒	☐	
☒	☐	

1.2 OPTICAL TEST VAP

- Screw cap GL14
- Screw cap GL18
- Screw cap GL32
- Distillation Head
- Condensor
- Viton Cone
- Ventilation Valve
- Micro Switch Sample

PASS	FAIL	Remark
☒	☐	
☒	☐	
☒	☐	
☒	☐	
☒	☐	
☒	☐	
☒	☐	

2. SYSTEM COOLING WATER INLET

- Cooling Water Inlet
- Cooling Water Outlet
- Flow control valve

PASS	FAIL	Remark
☒	☐	
☒	☐	
☒	☐	

3. SYSTEM CONTROL

	PASS	FAIL	Remark
Key Board	☒	☐	
Display	☒	☐	
ProgramID	☒	☐	
Adding H ₂ O	☒	☐	*Vap30.40
Adding NaOH	☒	☐	
Adding H ₃ BO ₃	☐	☐	*Vap40
Suction Sample	☒	☐	*Vap30.40

4. SYSTEM DISTILLATION

	PASS	FAIL	Remark
Boiler	☒	☐	
Level Sensor	☒	☐	
Neoprene-Tubing	☒	☐	
Solenoid Valve Shut-Off	☒	☐	
Solenoid Valve Steam	☒	☐	
Excess Pressure Detector	☒	☐	
Ventilation Valve	☒	☐	
Heater	☒	☐	

5. PUMPS

	PASS	FAIL	Remark
Pump H ₂ O Steam	☒	☐	
- Non-Return Valve	☒	☐	
Pump H ₂ O Sample	☒	☐	
- Non-Return Valve	☒	☐	
Pump NaOH	☒	☐	
- Non-Return Valve	☒	☐	
Pump H ₃ BO ₃	☐	☐	N/A
- Non-Return Valve	☒	☐	
Pump suction	☒	☐	

6. THE FOLLOWING PROGRAM RUN

	PASS	FAIL	Remark
Addition H ₂ O	☒	☐	0-99 sec.
Addition NaOH	☒	☐	0-99 sec.
Addition H ₃ BO ₃	☒	☐	0-99 sec.
Reaction Time	☒	☐	0-99 min
Distillation Time	☒	☐	0-99 min
Steam Capacity	☒	☐	30%-100%
Suction Time	☒	☐	0-99 sec.

The Instrument is in perfect technical shape

Remark :

4.2 Error Code

The micro-processor continuously 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.

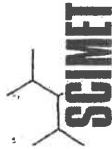
Error message	Measures
No tap water	Check cooling water inlet for blockages. Ensure the tap is turned on
No sample tube	Insert tube
Check chemicals	Check set of tanks
Low water Press Enter	Check the water inlet distilled H ₂ O
Filling Steam generator	This message disappears as soon as steam generator 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



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Phrakhanong, Bangkok 10260 Thailand
Email: scimet2022@gmail.com, Tel: 02 460 9239
https://www.scimet.co.th

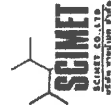
Certificate No. C06240053

Calibration Certificate

Equipment: TURBIDIMETER
Model: 2100N
Job No.: KSMIT2402432
Serial No.(or ID): 970400003415 (EQL-024)
Received Date: 12 September 2024
Manufacturer: HACH
Issued Date: 12 September 2024
Condition: In Condition
Page: 1 of 2
Customer: TEST TECH CO., LTD.
30,32 Rama II Soi 63, Rama II Rd.,Samaedam, Bangkokunten Bangkok 10150 Thailand

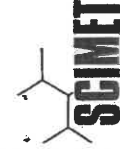
Calibration Place
TEST TECH CO., LTD.(503 ซอยเทศบาลใต้)
30,32 Rama II Soi 63, Rama II Rd.,Samaedam, Bangkokunten Bangkok 10150 Thailand

Calibration Date
12 September 2024
Environment Condition
Temperature: 24.4 °C ± 0.2 °C
Humidity: 58.4 %RH ± 1.1 %RH
The Method used
In-house method, W106, based 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. A3304, A3312, A3305, A3304, A3305
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 SCIMET Co., Ltd.



(Mr. Dumrong Boonsopon)
Person in charge

(Mr. Thalemgkeat Pongngam)
Authorized signatory



Certificate No.: C06240053

Page 2 of 2

Calibration Results:

Before Adjustment

Std Turbidity (NTU)	UUC Reading	Correction	Deviation	Uncertainty
0.040	0.121	-0.081	0.002	0.070
20.40	20.0	0.40	0.0	1.0
205.0	198	7.0	0.3	10
1026.0	995	31.0	0.0	50
4114.0	4017	97.0	5.0	200

After Adjustment

Std Turbidity (NTU)	UUC Reading	Correction	Deviation	Uncertainty
0.040	0.122	-0.082	0.003	0.070
20.40	20.5	-0.10	0.0	1.0
205.0	205	0.0	0.3	10
1026.0	1027	-1.0	0.3	50
4114.0	4113	1.0	1.1	200

The End of Certificate