

ภาคผนวก ข.

เอกสารรับรองเครื่องมือการตรวจวัด



## Certificate of Calibration

Certificate No. : 65-400499-1

Page : 1 of 2

Submitted by :

M Green Group Co., Ltd.

188/46 Wisatusukhakhon 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 : (30.0 to 31.0) °C

Relative Humidity : (45 to 50) %

Line Voltage : (229.0 to 232.0) V

Date of Received :

21 September 2022

Date of Calibration :

21 September 2022

Date of Issue :

23 September 2022

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 Thermocouple probe

ID No. Cert. No.

Traceability

400029 &amp; 400032 65-400274-1

Due Date

National Institute of Metrology Thailand (NIMT)

25 Nov 2022

Approved by

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

Certificate No. : 65-400499-1

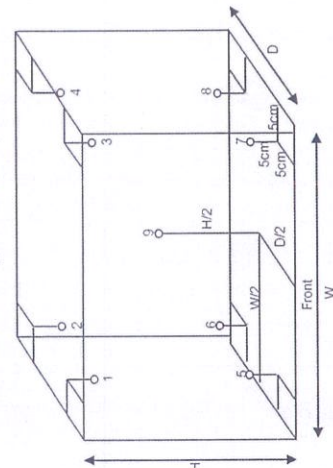
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



Inside of Chamber

W = 0.50 m

D = 0.40 m

H = 1.20 m

Capacity = 0.24 m<sup>3</sup>

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	3.9	4.8	5.2	5.0	5.2	4.7	5.2	4.1	5.1	0.75
			Indicating Temperature (°C)			Measured Uniformity (°C)			Measured Stability (°C)			Overall Variation (°C)
4.0	2.0	2.0	2.0			1.6			0.3			1.9

Remark: The uncertainty is not combine uniformity of the air chamber

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

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

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## Certificate of Calibration

Certificate No. : 65-400499-2

Page : 1 of 2

Submitted by : M Green Group Co., Ltd.

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

Equipment : Air Chamber (Oven)

Manufacturer : Memmert

Model : UF110

Range : N/A °C

Resolution : 0.1 °C

Serial No. : B419.1092

ID No. : N/A

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

Ambient Temperature : (30.0 to 31.0) °C

Relative Humidity : (45 to 50) %

Line Voltage : (229.0 to 232.0) V

Date of Received : 21 September 2022

Date of Calibration : 21 September 2022

Date of Issue : 23 September 2022

Calibrated by : Permpon Chamnu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

Standard Digital Thermometer with Thermocouple probe

ID No. Cert. No. Due Date Traceability

400029 &amp; 400030 65-400272-1 24 Nov 2022

National Institute of Metrology Thailand (NIMT)

Approved by

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

Certificate No. : 65-400499-2

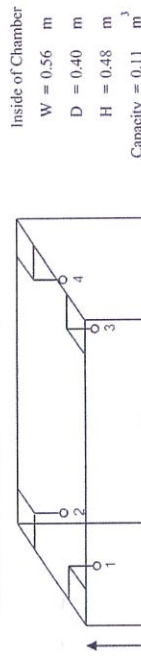
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
104.0	104.0	104.0	103.8	103.4	104.6	104.0	104.1	103.8	104.2	103.4	104.1	0.71
180.0	180.0	180.0	179.5	179.1	181.4	179.9	180.3	179.5	181.0	179.0	180.3	0.96

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured		Overall Variation (°C)
			Uniformity (°C)	Stability (°C)	
104.0	104.0	104.0	0.8	0.2	1.4
180.0	180.0	180.0	1.4	0.3	2.7

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

Page : 1 of 2

Certificate No. : 65-400499-3

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 : (30.0 to 31.0) °C

Relative Humidity : (45 to 50) %

Line Voltage : (229.0 to 232.0) V

Date of Received : 21 September 2022

Date of Calibration : 21 September 2022

Date of Issue : 23 September 2022

Calibrated by : Pempon Charpu

Calibration Method : This instrument was calibrated by In-house method CAL-M4006 based on ASTM E715-80

The temperature scale used was based on ITS-90

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

Standard Digital Thermometer with RTD probe

ID No. Cert. No. Due Date Traceability

400029 & 400031 65-400273-1 23 Nov 2022

National Institute of Metrology Thailand (NIMT)

Approved

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

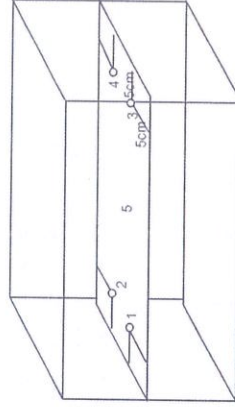
Page : 2 of 2

Certificate No. : 65-400499-3

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)
			1	2	3	4	5			
85.0	85.0	85.0	84.65	84.57	84.77	84.70	84.74	0.19	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. : 65-420076-1 Page : 1 of 2

Submitted by : M Green Group Co.,Ltd.

188/46 Wisatsukhakhon 25, Pracha-Uitd Rd., Thungkru 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. : 2884323

ID No. : N/A

Electrode

Model : N/A Serial No. : 40417

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

Ambient Temperature : (25.4 to 26.0)°C

Relative Humidity : (56 to 60) %

Date of Received : 21 September 2022

Date of Calibration : 21 September 2022

Date of Issue : 24 September 2022

Calibrated by : Bunjerd Masri

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

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

## 1. Multiproduct Calibrator

ID No.	Cert. No.	Due Date	Traceability
400005	SG-E-00473/64	27 Aug 2023	National Institute of Metrology Thailand (NIMT)

## 2. Standard Buffer Solution

pH	Cert.No.	Lot No.	Exp. Date	Traceability
4.008	61235182	795894	14 Feb 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.985	61243095	809356	21 Apr 2023	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
10.008	61244986	795895	25 Feb 2023	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

Certificate No. : 65-420076-1 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
	10.008	10.01	0.00	0.00	0.014

Remark

UUC : Unit Under Calibration

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

This reported uncertainty of 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. : 65-410112-1

Page : 1 of 2

Submitted by :

M Green Group Co., Ltd.

188/46 Wisatsuknakhon 25, Pracha-Utd Rd.,  
Thungkru, 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 : 21 September 2022

Date of Calibration : 22 September to 24 September 2022

Date of Issue : 24 September 2022

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&amp;Hum

ID No. Cert. No.

Traceability

400034 &amp; 400035 SG-H-00713/65 07 Jan 2023

Success Gateway Co., Ltd., Accredited by TISI Calibration No.0268

Approved by

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

Certificate No. : 65-410112-1

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)
20.04	19.8	0.2	0.46
24.99	24.7	0.3	0.46
30.03	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.)
40.00	39	1	2.2
60.01	58	2	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

Page : 1 of 2

Certificate No. : 65-200300-1

Submitted by : M Green Group Co., Ltd.

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

Equipment : Electronic Balance

Manufacturer : SHIMADZU

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 : (26.1 to 26.3) °C

Relative Humidity : (62.1 to 64.5) %

Air Pressure : 1007.0 mbar

Date of Received : 21 September 2022

Date of Calibration : 21 September 2022

Date of Issue : 24 September 2022

Calibrated by : Akaradath Thippichai

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

Edition 5, July 2015

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

Standard Weights

ID No. E261-E2624

Cert. No. C02213103

Due Date 18 Nov 2022

Traceability

National Institute of Metrology (Thailand), (NIMT)

Approved by :

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

Page : 2 of 2

Certificate No. : 65-200300-1

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	0.00001	0.000012
0.01	0.00000	0.000014
0.1	0.00001	0.000018
1	0.00000	0.000026
10	0.00000	0.000053
20	-0.00001	0.000071
50	0.00001	0.00011
100	-0.00008	0.00020
150	-0.0001	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
0.00001	0.00006	0.00004	-0.00006	0.00000
g				



Repeatability

Load test : 200 g

Sidev. : 0.000053 g

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## Certificate of Calibration

Certificate No. : 65-210457-1

Page : 1 of 2

Submitted by :

M Green Group Co., Ltd.

188/46 Wissunaknon25, Pracha-Utd 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 / m<sup>3</sup>

Assumed Air density : 1.2 kg / m<sup>3</sup>

Environment :

Ambient Temperature : (20 ± 2) °C

Relative Humidity : (50 ± 10) %

Air Pressure : 1001.1 mbar

Date of Received : 21 September 2022

Date of Calibration : 28 September 2022

Date of Issue : 28 September 2022

Calibrated by : Wuttichai 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.

E221-E2210

Cert. No.

MM-0042-22

Due Date

21 Mar 2025

Traceability

National Institute of Metrology (Thailand), (NIMT)

Approved by :

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

Certificate No. : 65-210457-1

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 -0.016 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%

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## Certificate of Calibration

Certificate No. : 65-210457-2

Page : 1 of 2

Submitted by :

M Green Group Co., Ltd.

188/46 Wisusuknakhon25, 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 / m<sup>3</sup>Assumed Air density : 1.2 kg / m<sup>3</sup>

Environment :

Ambient Temperature : ( 20 ± 2 ) °C

Relative Humidity : ( 50 ± 10 ) %

Air Pressure : 1001.8 mbar

Date of Received :

21 September 2022

Date of Calibration :

28 September 2022

Date of Issue :

28 September 2022

Calibrated by :

Wuttichai 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

Laboratory Manager

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## Certificate of Calibration

Certificate No. : 65-210457-2

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 -0.17 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. :** 65-210457-3 **Page : 1 of 2**

**Submitted by :** M Green Group Co., Ltd.  
188/46 Wisusuknakhon25, Pracha-Uttd 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 / m<sup>3</sup>

**Assumed Air density :** 1.2 kg / m<sup>3</sup>

**Environment :** Ambient Temperature : (20 ± 2) °C

Relative Humidity : (50 ± 10) %

Air Pressure : 1001.8 mbar

**Date of Received :** 21 September 2022

**Date of Calibration :** 28 September 2022

**Date of Issue :** 28 September 2022

**Calibrated by :** Wutichai Swaphong

**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

<b>ID No.</b>	<b>Cert. No.</b>	<b>Due Date</b>	<b>Traceability</b>
E221-E2210	MM-0042-22	21 Mar 2025	National Institute of Metrology (Thailand), (NIMT)

Approved by   
Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

**Certificate No. :** 65-210457-3 **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 +0.09 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%

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## Certificate of Calibration

Certificate No. : 65-400500-1

Page : 1 of 2

Submitted by :

M Green Group Co.,Ltd.

188/46 Wisutesukhakhon 25, Pracha-Utd 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 Laboratory, M Green Group Co.,Ltd.

Ambient Temperature : (25.4 to 26.0) °C

Relative Humidity : (56 to 60) %

Line Voltage : (224.0 to 225.2) VAC

Date of Received : 21 September 2022

Date of Calibration : 21 September 2022

Date of Issue : 24 September 2022

Calibrated by : Bunjerd Masri

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4003 by compared with PRT in the dry-well caloribrator 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

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

Certificate No. : 65-400500-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Immersion Depth ( mm.)	Standard Reading ( °C )	UUC Reading ( °C )	Correction ( °C )	Uncertainty ( ± °C )
100	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

Page : 1 of 2

Certificate No. : 65-400503-1

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

Equipment : Liquid in Glass Thermometer  
Manufacturer : N/A  
Range : 0 °C to 100 °C  
Serial No. : N/A  
ID No. : 94-49747  
Model : N/A  
Resolution : 1 °C  
Immersion : Total

Environment : Ambient Temperature : (23 ± 2) °C  
Relative Humidity : (50 ± 15) %  
Line Voltage : (220 ± 22) VAC

Date of Received : 21 September 2022  
Date of Calibration : 23 September to 26 September 2022  
Date of Issue : 26 September 2022  
Calibrated by : Chorrip 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	Traceability
400001	TT-0016-22	07 Feb 2024	National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
400003	21E1850	14 Jun 2023	National Institute of Metrology Thailand (NIMT)
400004	21E1850	14 Jun 2023	National Institute of Metrology Thailand (NIMT)

Approved by

Supervisor

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 Calibratech Co., Ltd.



Certificate No. : 65-400503-1

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Ice point check : UUC\* reading 0 °C Standard reading 0.0327 °C

Standard Reading ( °C )	UUC Reading ( °C )	Correction ( °C )	Uncertainty ( ± °C )
39.7131	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. : 65-300541-1

Page : 1 of 2

Submitted by :

M Green Group Co.,Ltd.

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

Equipment : Volumetric Flask

Manufacturer : GLASSCO

Class : A

Capacity : 100 ml

ID No. : VF100/01/19

Environment : Ambient Temperature :  $(23 \pm 2)$  °CRelative Humidity :  $(50 \pm 15)$  %

Air Pressure : 1007.5 mbar.

Date of Received : 21 September 2022

Date of Calibration : 26 September 2022

Date of Issue : 26 September 2022

Calibrated by : Arcerat 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

241005 65-200172-4

02 Dec 2022

National Institute of Metrology (Thailand) (NIMT)

Approved by :

Supervisor

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 Calibratech Co.,Ltd.



## Certificate of Calibration

Certificate No. : 65-300541-1

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 )
100	100.081

Uncertainty of measurement with in  $\pm$  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%

- oOo -



Certificate of Calibration

Certificate No. : 65-300541-2  
Submitted by : M Green Group Co.,Ltd.  
188/46 Wisatusuknakhon 25, Pracha-Utd Rd., Thungkru, Bangkok 10140 Thailand

Page : 1 of 2

Equipment : Volumetric Flask  
Manufacturer : GLASSCO  
Capacity : 250 ml  
Class : A  
ID No. : VF250/01/19

Environment : Ambient Temperature : ( 23 ± 2 ) °C  
Relative Humidity : ( 50 ± 15 ) %  
Air Pressure : 1007.4 mbar.

Date of Received : 21 September 2022  
Date of Calibration : 26 September 2022  
Date of Issue : 26 September 2022  
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 65-200172-1 02 Dec 2022 National Institute of Metrology (Thailand) (NIMT)

Approved by :

Supervisor

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 Calibratech Co.,Ltd.



Certificate No. : 65-300541-2

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	250.11

Uncertainty of measurement with in ± 0.049 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. :** 65-300541-3

**Page :** 1 of 2

**Submitted by :**

M Green Group Co.,Ltd.

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

**Equipment :**

Volumetric Flask

**Manufacturer :** GLASSCO

**Class :** A

**Capacity :** 1000 ml

**ID No. :** VF1000/01/19

**Environment :**

**Ambient Temperature :** (23 ± 2) °C

**Relative Humidity :** (50 ± 15) %

**Air Pressure :** 1007.4 mbar.

**Date of Received :** 21 September 2022

**Date of Calibration :** 26 September 2022

**Date of Issue :** 26 September 2022

**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.** 241002

**Cert.No.** 65-200172-1

**Due Date** 02 Dec 2022

**Traceability**

National Institute of Metrology (Thailand) (NIMT)

Approved by :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

**Certificate No. :** 65-300541-3

**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	1000.47

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. :** 65-300541-4 **Page : 1 of 2**

**Submitted by :** M Green Group Co.,Ltd.  
188/46 Wisatesuknakhon 25, Pracha-Uttd 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 : ( 23 ± 2 ) °C  
Relative Humidity : ( 50 ± 15 ) %  
Air Pressure : 1007.4 mbar.

**Date of Received :** 21 September 2022  
**Date of Calibration :** 26 September 2022  
**Date of Issue :** 26 September 2022  
**Calibrated by :** Arcerat 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	65-200172-1	02 Dec 2022	National Institute of Metrology (Thailand) (NIMT)



Approved by :

Supervisor



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 Calibratech Co.,Ltd.

## Certificate of Calibration

**Certificate No. :** 65-300541-4 **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

Nominal Volume ( ml )	Measuring Volume ( ml )
150	151.08
250	251.34

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%

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## Certificate of Calibration

Certificate No. : 65-300541-5

Page : 1 of 2

Submitted by :

M Green Group Co.,Ltd.

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

Equipment :

Measuring Pipette

Manufacturer : GLASSCO

Class : A

Capacity : 10 ml Graduation : 0.1 ml

ID No. : MP10/01/19

Environment :

Ambient Temperature :  $(23 \pm 2)$  °CRelative Humidity :  $(50 \pm 15)$  %

Air Pressure : 1002.7 mbar.

Date of Received : 21 September 2022

Date of Calibration : 26 September 2022

Date of Issue : 26 September 2022

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

241005

65-200172-4

02 Dec 2022

National Institute of Metrology (Thailand) (NIMT)

Approved by :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

Certificate No. : 65-300541-5

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 : 12.14 sec.

Nominal Volume ( ml )	Measuring Volume ( ml )
2	1.9942
5	4.9827
10	9.9888

Uncertainty of measurement with in  $\pm$  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. :** 65-300541-6

**Page :** 1 of 2

**Submitted by :** M Green Group Co.,Ltd.

188/46 Wisatsuknakhon 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 : ( 23 ± 2 ) °C

Relative Humidity : ( 50 ± 15 ) %

Air Pressure : 1002.7 mbar.

**Date of Received :** 21 September 2022

**Date of Calibration :** 26 September 2022

**Date of Issue :** 26 September 2022

**Calibrated by :** Atcerat 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**

241005 65-200172-4 02 Dec 2022 National Institute of Metrology (Thailand) (NIMT)

Approved by :

Supervisor

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 Calibratech Co.,Ltd.



## Certificate of Calibration

**Certificate No. :** 65-300541-6

**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 :** 12.14 sec.

Nominal Volume ( ml )	Measuring Volume ( ml )
5	5.0254
15	15.0847
25	25.0413

Uncertainty of measurement with in ± 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-







# MAINTENANCE REPORT

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

AAAnalyst 100&FIAS

Customer : บริษัท เทสท์ เทคโนโลยี จำกัด Date Tested: 18-ส.ค.-21

Address : 30,32 ซอยพระรามที่ 2 ซอย 63 Recommendation Recertification 12 Months

ถนนพระราม2, เขตบางขุนเทียน, Recertification Due: 17-ส.ค.-22

กรุงเทพฯ 10150 Date Last Certified: 26-ส.ค.-20

User Name: คุณ อ้อยใจ สรรจำนทร์ Visit Number: 1 OF 1

Phone: 02-8934211-7 Mobile Phone 081-7316733

E-mail: Aoyny\_999@hotmail.com E-Mail thonesource@gmail.com

## CONFIGURATION TESTED

MODEL	SERIAL NUMBER	SOFTWARE	TEST STANDARD USED	LOT NUMBER	EXPIRATION DATE
AAAnalyst 100	040S0020203	AA WinLab Version 3.2	MERCURY	S191106032	14-ก.ย.-21
FIAS 200 (EQL-052)	2671		ARSENIC	S190916002	16-ก.ย.-21
			SELENIUM	S200302006	14-ก.ย.-21
			FILTER 0.2 %	MGO-057	

Page 1 of 4



# MAINTENANCE REPORT

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

AAAnalyst 100&FIAS

SERIAL NUMBER 040S0020203 DATE TESTED 18-ส.ค.-21

1. OPTIC CHECKS

A. Optical alignment condition (if necessary) ☐ OK

B. Condition of Mirrors, Lenses etc. ☐ OK

## 2. ELECTRONICS CHECKS

A. Power Supplies

+ 5.00 Vdc $\pm$ 0.2 Vdc	+ 5.01 Vdc
+ 12.00 Vdc $\pm$ 1.0 Vdc	+ 11.3 Vdc
+ 15.00 Vdc $\pm$ 1.0 Vdc	+ 15.0 Vdc
- 15.00 Vdc $\pm$ 1.0 Vdc	- 15.0 Vdc
+ 35.00 Vdc $\pm$ 3.5 Vdc	+ 32.2 Vdc

B. High Voltage

1000 VAC $\pm$ 75 VAC	1003 VAC
-----------------------	----------

## 3. FIAS CHECKS

A. Output power supplies

+5 VDC $\pm$ 0.5 VDC.	+4.9 Vdc
+15 VDC. $\pm$ 1.0 VDC.	+14.80 Vdc
- 15.00 Vdc $\pm$ 1.0 Vdc	-14.90 Vdc

B. 5 Port Valve & Pump ☐ OK

C. Check Flow Meter ☐ OK

## 4. WAVELENGTH ACCURACY TEST

A. Ni Lamp wavelength 303.8 nm $\pm$ 0.3 nm.	303.86 nm.
B. Cu Lamp wavelength 324.8 nm $\pm$ 0.3 nm.	324.85 nm.
C. As Lamp wavelength 193.7 nm $\pm$ 0.3 nm.	193.58 nm.
D. K Lamp wavelength 766.5 nm $\pm$ 0.3 nm.	766.38 nm.
E. Zn Lamp wavelength 213.9 nm $\pm$ 0.3 nm.	213.80 nm.

Page 2 of 4



# MAINTENANCE REPORT

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

AAnalyst 100&FIAS

SERIAL NUMBER 040S0020203 DATE TESTED 18-ส.ค.-21

PARAMETER

SPECIFICATION

ACTUAL VALUE

## 5. PERFORMANCE TESTS

A. Neutral density filter checks with Copper (324.8 nm)

Neutral Density Filter 0.2

0.1713 ± 10%

0.182 Abs.

B. AA Baseline noise test with Copper (324.8 nm)

Integration time = 0.5 seconds

Replicates = 99 times

SD ≤ 0.005

Results 0.000

## C. PERFORMANCE TEST FOR FIAS

1. Characteristic mass for Mercury  
(500 ul of 10 ug/l for Hg and 3 replicates)

Characteristic Mass

% RSD

0.068 Abs.

349.2 pg/0.0044 Abs.

3.90 %

2. Characteristic mass for Arsenic

(500 ul of 10 ug/l for As and 3 replicates)

Characteristic Mass

% RSD

0.161 Abs.

136.6 pg/0.0044 Abs.

2.22 %

3. Characteristic mass for Selenium

(500 ul of 10 ug/l for Se and 3 replicates)

Characteristic Mass

% RSD

0.317 Abs.

71.0 pg/0.0044 Abs.

0.32 %



# MAINTENANCE REPORT

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

AAnalyst 100&FIAS

SERIAL NUMBER 040S0020203

DATE TESTED 18-ส.ค.-21

Remarks :

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 TH One Source Co., Ltd.

( )

Customer Support Engineer





บริษัท ไทยยูนิค จำกัด THAI UNIQUE CO., LTD.  
80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200  
80-82 Prachathipatai Rd., Bangkokkhunphrom, Pranakorn, Bangkok 10200  
Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawati@thaiunique.com, Website : www.thaiunique.com

ATOMIC ABSORPTION SPECTROMETER TEST CERTIFICATE

Certificate No : SV2101/19153  
Instrument Type : Atomic Absorption Spectrophotometers  
Model : AA240FS  
Serial Number : EL08043418  
Organization : Test Tech Co., Ltd.  
Address : 30,32 Rama II Soi 63 Rd. Sammaedam Bangkokkhunien, Bangkok 10150  
Date : 06 Jan 2021

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 (EHT)			
Cu at 324.8 nm	≤ 64 % or 380 V	32 %	Pass
As at 193.7 nm	≤ 80 % or 540 V	56 %	Pass
K at 766.5 nm*	≤ 84 % or 540 V	63 %	Pass
Fe at 248.3 nm	≤ 80 % or 540 V	65 %	Pass
Mn at 279.5 nm	≤ 64 % or 380 V	48 %	Pass
Photometric noise Cu BGC off			
STDV @ 0 Abs	≤ 0.0005	0.0000	Pass



บริษัท ไทยยูนิค จำกัด THAI UNIQUE CO., LTD.  
80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200  
80-82 Prachathipatai Rd., Bangkokkhunphrom, Pranakorn, Bangkok 10200  
Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawati@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	766.5 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	7.5 ml/min	Pass
Max Abs	≥ 0.75 Abs	0.83 Abs	Pass
Precision(%RSD)	≤ 0.5 %	0.5 %	Pass

Zeeman Background Correction Accuracy (%)\*\*\*

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

Zeeman Magnetic Sensitivity Ratio (%)\*\*\*

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

Date : 6 / Jan / 2021



APPROVED  
Signature: \_\_\_\_\_  
Service Manager

Date : 06 / Jan / 2021



PerkinElmer

# MAINTENANCE AND IPV TEST CERTIFICATE MODEL

## OPTIMA 8000

Customer : บริษัท เทคโนโลยี จำกัด	Date Tested: May 21, 2021
Address : 30,32 ถนนพหลโยธิน 2 ซอย 63 ถนนพหลโยธิน 2 แขวงจตุจักร เขตจตุจักร กรุงเทพมหานคร 10150	Recommendation Recertification Period 12 Months Recertification Due: May 20, 2022 Date Last Certified: November 24, 2020 Visit Number: 1 of 1
User Name: คุณอภัยสิทธิ์	PerkinElmer Phone: 02-719-6420 ext 206
Phone: 02-893-4211-17	PerkinElmer Fax: 02-318-5597
Email: aoyntv_999@hotmail.com	

CONFIGURATION TESTED		ACCESSORIES/COMPONENT NOT INCLUDED	
MODEL	SERIAL NUMBER	WinLab32 Version 5.5.0.0714	
OPTIMA 8000	078S1411171C	PN:5150T21E4Q1E	
N0772045	2F1441085		
EQL-180			
TESTED EQUIPMENT	CALIBRATION NUMBER	EXPIRATION	
IPV Methods			
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE	
Mixed standard 1/10	N069-1579	NOV 30, 2021	
Mixed standard 1/100	N930-0221	JUN 30, 2021	
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS	
2 % HNO3			
10 % HNO3			



PerkinElmer

# MAINTENANCE AND IPV TEST CERTIFICATE MODEL

## OPTIMA 8000

SERIAL NUMBER : 078S1411171C	DATE TESTED : May 21, 2021
<b>1. MECHANICAL CHECKS</b>	
A. Inspect and clean all fans and filters.	<input type="checkbox"/> OK
B. Inspect and replace as necessary, all torch components including the RF coil.	<input type="checkbox"/> OK
C. Inspect all tubing for sign of clacking or leaking.	<input type="checkbox"/> OK
D. Adjust water and gas pressure regulator settings.	<input type="checkbox"/> OK
E. Inspect and leak check pneumatics drawers.	<input type="checkbox"/> OK
F. Clean the exterior of the instrument.	<input type="checkbox"/> OK
<b>2. OPTICAL CHECKS</b>	
A. Inspect and clean all optical components.	<input type="checkbox"/> OK
B. As required, check and replace all purgefilters.	<input type="checkbox"/> OK
C. Recheck optical alignment.	<input type="checkbox"/> OK
<b>3. COOLING SYSTEM CHECKS</b>	
A. Perform preventive maintenance on chiller.	<input type="checkbox"/> OK
B. Flush out the chiller every six months.	<input type="checkbox"/> OK
<b>4. PERFORMANCE CHECKS</b>	
A. Torch View Alignment.	<input type="checkbox"/> OK
B. Wavelength Calibration.	<input type="checkbox"/> OK





**MAINTENANCE AND IPV TEST CERTIFICATE MODEL**  
**OPTIMA 8000**

SERIAL NUMBER : 078S1411171C	DATE TESTED : May 21, 2021		
PARAMETER	SPECIFICATION	FINAL VALUE	
Spectral Resolution : UV			
As	193.696 nm	≤ 0.009	0.00702 nm
Ni	231.604 nm	≤ 0.011	0.00855 nm
Ni	341.476 nm	≤ 0.015	0.01304 nm
Ba	455.403 nm	≤ 0.020	0.01682 nm
Spectral Resolution : VIS			
Precision			
Zn	206.200 nm	% RSD ≤ 1.0	0.21 %
Mg	280.271 nm	% RSD ≤ 1.0	0.16 %
Mg	285.213 nm	% RSD ≤ 1.0	0.39 %
Ba	455.403 nm	% RSD ≤ 1.0	0.17 %
Detection Limits : Axial			
As	193.696 nm	3(SD) ppb ≤ 10.0 ppb	2.81 ppb
Se	196.026 nm	3(SD) ppb ≤ 5.0 ppb	2.58 ppb
Tl	190.801 nm	3(SD) ppb ≤ 10.0 ppb	0.75 ppb
Pb	220.353 nm	3(SD) ppb ≤ 3.0 ppb	1.26 ppb
Detection Limits : Radial			
As	193.696 nm	3(SD) ppb ≤ 60.0 ppb	7.86 ppb
Zn	213.857 nm	3(SD) ppb ≤ 2.0 ppb	0.40 ppb
Mn	257.610 nm	3(SD) ppb ≤ 1.0 ppb	0.17 ppb
La	379.478 nm	3(SD) ppb ≤ 3.0 ppb	0.17 ppb
Ba	455.403 nm	3(SD) ppb ≤ 0.3 ppb	0.14 ppb
Ba	493.408 nm	3(SD) ppb ≤ 0.6 ppb	0.11 ppb
BEC : Axial (IB X 1000)/(IS-IB)			
Mn	257.610 nm	≤ 30 ppb	7.47 ppb
BEC : Radial (IB X 1000)/(IS-IB)			
Mn	257.610 nm	≤ 30 ppb	15.47 ppb



**MAINTENANCE REPORT AND IPV TEST CERTIFICATE**  
**OPTIMA 8000**

SERIAL NUMBER : 078S1411171C DATE TESTED : May 21, 2021

Remarks : \_\_\_\_\_  
Commissioning follow as commissioning performance sheets.  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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

v	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 : \_\_\_\_\_  
Senior Customer Support Engineer



# MAINTENANCE AND IPV TEST CERTIFICATE MODEL OPTIMA 8000

Customer : บริษัท เทคโนโลยี จำกัด	Date Tested: May 21, 2021
Address : 30/32 ซอยพหลโยธิน 2 ซอย 63 ถนนพหลโยธิน 2 แขวงสามเ่า เขตบางซื่อ กรุงเทพมหานคร 10150	Recommendation Recertification Period 12 Months
User Name: คุณอรรณพ สรรค์จันทร์	Recertification Due: May 20, 2022
Phone: 02-893-4211-17	Date Last Certified: November 24, 2020
Email: aovny_999@hotmail.com	Visit Number: 1 of 1
	PerkinElmer Phone: 02-719-6420 ext 206
	PerkinElmer Fax: 02-318-5597

CONFIGURATION TESTED		ACCESSORIES/COMPONENT NOT INCLUDED	
MODEL	SERIAL NUMBER	WinLab32 Version 5.5.0.0714	
OPTIMA 8000	078S1411171C	PN:6150T21E4Q1E	
N0772045	2F1441085		
EQL-180			
TESTED EQUIPMENT		EXPIRATION	
IPV Methods	CALIBRATION NUMBER		
TEST STANDARD USED		EXPIRATION DATE	
Mixed standard 1/10	PART NUMBER	NOV 30, 2021	
Mixed standard 1/100	N069-1579	JUN 30, 2021	
	N930-0221		
CUSTOMER SUPPLIED		CUSTOMER INITIALS	
2 % HNO3	COMMENTS		
10 % HNO3			

# MAINTENANCE AND IPV TEST CERTIFICATE MODEL OPTIMA 8000

SERIAL NUMBER : 078S1411171C	DATE TESTED : May 21, 2021
<b>1. MECHANICAL CHECKS</b>	
A. Inspect and clean all fans and filters.	<input type="checkbox"/> OK
B. Inspect and replace as necessary, all torch components including the RF coil.	<input type="checkbox"/> OK
C. Inspect all tubing for sign of clacking or leaking.	<input type="checkbox"/> OK
D. Adjust water and gas pressure regulator settings.	<input type="checkbox"/> OK
E. Inspect and leak check pneumatics drawers.	<input type="checkbox"/> OK
F. Clean the exterior of the instrument.	<input type="checkbox"/> OK
<b>2. OPTICAL CHECKS</b>	
A. Inspect and clean all optical components.	<input type="checkbox"/> OK
B. As required, check and replace all purge filters.	<input type="checkbox"/> OK
C. Recheck optical alignment.	<input type="checkbox"/> OK
<b>3. COOLING SYSTEM CHECKS</b>	
A. Perform preventive maintenance on chiller.	<input type="checkbox"/> OK
B. Flush out the chiller every six months.	<input type="checkbox"/> OK
<b>4. PERFORMANCE CHECKS</b>	
A. Torch View Alignment.	<input type="checkbox"/> OK
B. Wavelength Calibration.	<input type="checkbox"/> OK





PerkinElmer

# MAINTENANCE AND IPV TEST CERTIFICATE MODEL OPTIMA 8000

SERIAL NUMBER : 078S1411171C DATE TESTED : May 21, 2021

PARAMETER	SPECIFICATION	FINAL VALUE
Spectral Resolution : UV	As 193.696 nm	0.00702 nm
	Ni 231.604 nm	0.00855 nm
	Ni 341.476 nm	0.01304 nm
	Ba 455.403 nm	0.01682 nm
Spectral Resolution : VIS		
Precision	Zn 206.200 nm	0.21 %
	Mg 280.271 nm	0.16 %
	Mg 285.213 nm	0.39 %
	Ba 455.403 nm	0.17 %
Detection Limits : Axial	As 193.696 nm	2.81 ppb
	Se 196.026 nm	2.58 ppb
	Tl 190.801 nm	0.75 ppb
	Pb 220.353 nm	1.26 ppb
Detection Limits : Radial	As 193.696 nm	7.86 ppb
	Zn 213.857 nm	0.40 ppb
	Mn 257.610 nm	0.17 ppb
	La 379.478 nm	0.17 ppb
BEC : Axial (IB X 1000)/(IS-IB)	Ba 455.403 nm	0.14 ppb
	Ba 493.408 nm	0.11 ppb
	Mn 257.610 nm	7.47 ppb
	Mn 257.610 nm	15.47 ppb
BEC : Radial (IB X 1000)/(S-IB)		



# MAINTENANCE REPORT AND IPV TEST CERTIFICATE OPTIMA 8000

SERIAL NUMBER : 078S1411171C DATE TESTED : May 21, 2021

Remarks :

Commissioning follow as commissioning performance sheets.


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

<input checked="" type="checkbox"/>	<input type="checkbox"/>
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 :



Senior Customer Support Engineer






CERTIFICATE No : 22TI730  
REFERENCE No : 64109-6

PAGE : 1 OF 2

## Certificate of Calibration

EQUIPMENT : AUTOCLAVE  
MANUFACTURER : HIRAYAMA  
MODEL : HVE-50  
SERIAL No : 30612085166  
D No : EQL-155  
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 : 21-Feb-22

APPROVED BY :   
ISSUED DATE : 22-Feb-22  
RECEIVED DATE : 21-Feb-22

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



CERTIFICATE No : 22TI730

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : AUTOCLAVE  
MANUFACTURER : HIRAYAMA  
ID NUMBER : EQL-155  
RECEIVED DATE : 21-Feb-22  
AMBIENT TEMPERATURE : 30° C ± 1° C  
MODEL : HVE-50  
SERIAL NUMBER : 30612085166  
CALIBRATION DATE : 21-Feb-22  
RELATIVE HUMIDITY : 50 %RH ± 10 % RH

### CONDITION OF THIS RESULTS OF CALIBRATION

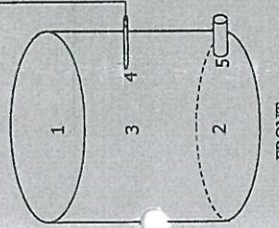
1. THIS INSTRUMENT WAS CALIBRATED BASED ON BS 2646 : Part 5 : 1993 BY COMPARISON WITH CALIBRATED THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON FIVE LOCATIONS AS SHOWN IN THE PICTURE. TWO PROBES WERE PLACES NEAR TOP AND BOTTOM WALL AND EACH PROBE WAS AWAY FROM THE EACH 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.

### REFERENCE STANDARD INSTRUMENTS :-

- 1) DATA LOGGER  
VALPROBE S350, DV35, DN94  
SERIAL No 22T0541  
DUE DATE 31-Jan-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

xxx.x °C



### 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	Average All	Temperature	Stability	Temperature	Uniformity	Overall	Pressure	Holding	Operating
Temperature	Locations	(°C)	(±°C)	(°C)	(°C)	Variation	(MPa)	time (min)	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	116.45	116.50	116.53	116.45	116.45	0.59	
122	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 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, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-27 FAX. 0-2719-9484



NSC-TS17817025  
CALIBRATION 0008

Cert.No.: 22CH120

Page.: 1 of 3

## Certificate of Calibration

Equipment : Conductivity Meter

Manufacturer : TOA DKK

Model : CM-41X

Serial No. : 842572

ID No. : EQL-211

Condition As-Received : Used Item

Received Date : 24 January 2022

Calibration Date : 26 January 2022

Reference : 2201-0646DN-1

Submitted by : TEST TECH CO.,LTD (HEAD Office)  
30,32 Rama II Soi 63, Rama II Rd.,  
Samaedam, Bangkokthian, Bangkok 10150

Ambient Temperature :  $(25 \pm 2.5) ^\circ\text{C}$

Relative Humidity :  $(50 \pm 15) \%$

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 Lengagtrakul

Approved by :

(✓) Malee Bulkrua  
( ) Saithip Meangmai  
( ) Warakorn Lengagtrakul

Issue Date :

3 February 2022

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 0037370



Cert.No.: 22CH120

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	130RC095	21977	17 Sep 2022
2) Ref. Std. Thermometer	4982054	110RC044	211201	26 Oct 2022

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	761020	02 Aug 2022
1.413 $\text{mS/cm}$	CPA Chem	761021	02 Aug 2022
12.8806 $\text{mS/cm}$	CPA Chem	754037	28 June 2022

- Control Conductivity calibration solution temperature by Water bath  $(25 \pm 0.1) ^\circ\text{C}$
- 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, 12880.6  $\mu\text{S/cm}$

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 $\mu\text{S/cm}$	149.1 $\mu\text{S/cm}$	146.9 $\mu\text{S/cm}$	0.99 $\mu\text{S/cm}$	2.00
1.413 $\text{mS/cm}$	1.424 $\text{mS/cm}$	1.413 $\text{mS/cm}$	0.0092 $\text{mS/cm}$	2.00
12.8806 $\text{mS/cm}$	12.81 $\text{mS/cm}$	12.88 $\text{mS/cm}$	0.086 $\text{mS/cm}$	2.00

Remark - UUC\* = Unit Under Calibration

- 147.0  $\mu\text{S/cm}$  Adjustment Cell constant =  $98.4 \text{m}^{-1}$
- 1.413  $\text{mS/cm}$  Adjustment Cell constant =  $99.2 \text{m}^{-1}$
- 12.8806  $\text{mS/cm}$  Adjustment Cell constant =  $100.7 \text{m}^{-1}$

a 1092322



Cert.No.: 22CH120  
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 (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement ( $\pm$ °C)	Coverage factor k
25.0	25.003	25.1	0.097	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 %.

-o0o-

*Malu*

a 1092321



## 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](http://www.scieco.co.th) E-Mail : [calibrate@scg.co.th](mailto:calibrate@scg.co.th)

Certificate No. T220242

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 : 3 February 2022

Calibrated By : Watcharasak Puttarat (Technician)

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

Date of Issue : 7 FEB 2022

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-L14 117/01-02-64



## Calibration Report

Equipment : Chamber (Cooling Room)

Date of Calibration : 7 February 2022

Environment : Temperature : 16.4-17.9 °C

Line Voltage : 221.4-230.2 V

Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

1. This equipment was calibrated by insert 15 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).
2. 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	T210743	21 April 2022
TC	TYPE T	TN151-TN160	T210743	21 April 2022
DATA LOGGER	34970A	T150	T210743	21 April 2022

### 3. This certificate is traceable to :

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

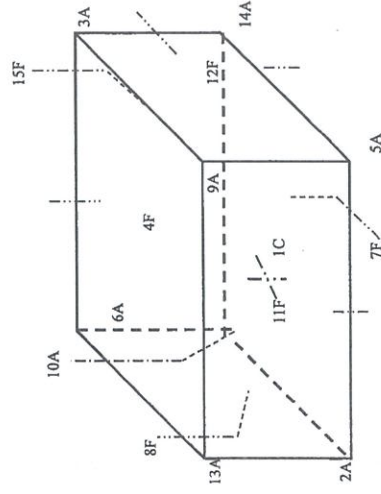
### 4. Condition of calibrated item : good

#### Equipment Description :

Time Constant : 2 Hour  
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available

### 5. Adjustment :

( X ) without adjustment ( ) after adjustment



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

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

1C	=	TN141
2A	=	TN142
3A	=	TN143
4F	=	TN144
5A	=	TN145
6A	=	TN146
7F	=	TN147
8F	=	TN148
9A	=	TN149
10A	=	TN150
11F	=	TN151

Approved

## Calibration Report

Equipment : Chamber (Cooling Room)

Date of Calibration : 7 February 2022

Environment : Temperature : 16.4-17.9 °C

Line Voltage : 221.4-230.2 V

Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

1. This equipment was calibrated by insert 15 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).
2. 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	T210743	21 April 2022
TC	TYPE T	TN151-TN160	T210743	21 April 2022
DATA LOGGER	34970A	T150	T210743	21 April 2022

### 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 : 2 Hour  
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available

### 5. Adjustment :

( X ) without adjustment ( ) after adjustment

Approved



# Metrological Center

SCI ECO Services Company Limited

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



NSC-TIS-TIS 17025  
CALIBRATION 0244

Certificate No. T220242

Page 4 of 4

## Calibration Report

### Measurement Results

Calibration Point	Average Standard Reading at each position (°C)									
	TN141	TN142	TN143	TN144	TN145	TN146	TN147	TN148	TN149	TN150
3.0	3.03	2.89	2.89	3.39	2.90	3.05	3.02	3.00	2.89	3.13
	TN151	TN152	TN153	TN154	TN155					
	3.23	3.20	3.25	2.93	3.17					

Chamber (Cooling Room)			Temperature Distribution				Coverage Factor <i>k</i>
Setting (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	
	Min, Max	Average					
3.0	2.7, 3.3	3.0	3.07	1.09	1.30	1.50	2.00

\* The Acquired 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



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-TIS-TIS 17025  
CALIBRATION 0244

## Certificate of Calibration

Certificate No. : 22H2197

Page : 1 of 2

Equipment : Dial Thermo-Hygrometer

Manufacturer : Barigo

Model : -

Serial No. : -

ID No. : EQL-064

Condition As-Received: Used Item

Received Date: 17 October 2022

Calibration Date: 25 October 2022

Reference: 2210-0461DN

Ambient Temperature: ( 25 ± 3 ) °C

Relative Humidity: ( 50 ± 20 ) %

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

30, 32 Rama II Soi 63, Rama II Rd.,

Samaedam, Bangkokthian, Bangkok 10150

Procedure used: Calibration were conducted using in-house calibration procedure CP-HQ2 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) Chilled-Mirror Hygrometer	Dew Master	41292	19848	03 Nov 2022
2) Handheld Thermometer With Sensor	1523	3240076	221249	02 Mar 2023

2. The 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 at:-

-National Institute of Standards and Technology (NIST), The United States of America

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Surasit Phansudnoi

Issue Date : 01 November 2022

Approved Signatory :

[✓] J Chakrit Weewanjua

[ ] J Pornthippa Tameyakul

[ ] J Viporn Tantiyawutti






CERTIFICATE No : 22M9915  
REFERENCE No : 66549-2

## 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 P.  
CALIBRATION DATE : 15-Sep-22  
APPROVED BY :   
ISSUED DATE : 21-Sep-22  
RECEIVED DATE : 15-Sep-22

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

Cert. No.: 22H2197  
Page.: 2 of 2

### Result of Calibration:- Function: Humidity measurement.

Reference Temperature (°C)	Standard Humidity (%R.H.)	Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	30.1	29.0	-1.1	1.5
25.0	40.1	39.0	-1.1	1.5
25.0	50.1	50.0	-0.1	1.7
25.0	60.0	61.0	1.0	1.7
25.0	75.2	76.5	1.3	1.7

### Result of Calibration:- Function: Temperature measurement.

Standard Temperature (°C)	Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
15.013	15.0	-0.013	0.72
20.023	20.0	-0.023	0.72
25.019	25.0	-0.019	0.72
30.009	30.0	-0.009	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%.

-o0o-



# Calibration Report

EQUIPMENT	:	DIGITAL BALANCE	:	MODEL	:	BP210S
MANUFACTURER	:	SARTORIUS	:	SN	:	S0736477
ID No	:	EQL-008	:	RECEIVED DATE	:	15-Sep-22
AIR PRESSURE	:	1011mbar $\pm$ 1mbar	:	CALIBRATION DATE	:	15-Sep-22
AMBIENT TEMPERATURE	:	21° C $\pm$ 1° C	:	RELATIVE HUMIDITY	:	51 %RH $\pm$ 10 % RH

### CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 6:2019 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	QK-I-151	C02210415	09-Feb-23
2)	STANDARD WEIGHT	E2	15843	C02210419	10-Feb-23
3)	STANDARD WEIGHT	E2	QK-I-349	N2103234S	26-Mar-23

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

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

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

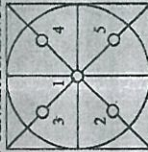
3. THIS CERTIFICATE IS GRANTED TO THE INTERNATIONAL SYSTEM OF UNITS MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS & MEASURES

#### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION ; NORMAL
2. TARE FUNCTION ; NORMAL
3. REPEATABILITY OF READING AT 200 g WAS 0.000063 g
4. DEPARTURE FROM NOMINAL VALUE/LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY ( $\pm g$ )
0.00	0.0000	0.0000	0.000090
0.10	0.1000	0.0000	0.000090
0.20	0.2000	0.0000	0.000090
0.50	0.5000	0.0000	0.000091
1.00	1.0000	0.0000	0.000091
2.00	2.0000	0.0000	0.000092
5.00	5.0000	0.0000	0.000093
10.00	10.0000	0.0000	0.000095
20.00	19.9999	0.0001	0.00010
50.00	49.9998	0.0002	0.00012
100.00	99.9998	0.0002	0.00019
200.00	199.9993	0.0007	0.00032

### 5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	99.9997
2	99.9996
3	99.9995
4	99.9997
5	99.9998
OFF-CENTER LOADING	0.0002

**6. INTERNAL WEIGHT ERROR:** -0.0006666666666666667

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

END OF CALIBRATION REPORT

## 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	:	15-Sep-22

APPROVED BY	:	[REDACTED]
ISSUED DATE	:	21-Sep-22
RECEIVED DATE	:	15-Sep-22

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





CERTIFICATE No : 22T9917

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : HOT AIR OVEN  
MANUFACTURER : MEMMERT  
MODEL : UFE 500  
ID No : EQL-128  
RECEIVED DATE : 15-Sep-22  
AMBIENT TEMPERATURE : 25 °C ± 1 °C  
SN : G508.0791  
CALIBRATION DATE : 15-Sep-22  
RELATIVE HUMIDITY : 51 %RH ± 10 %RH

### CONDITION OF THIS RESULTS OF CALIBRATION

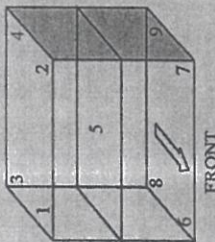
1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TIAS G-20 BY COMPARISON WITH CALIBRATED RTD Pt100 UNDER NO LOAD CONDITION. THE TEMPERATURE PROBES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOMETER PROBE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND 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  
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 : 1  
Overall Line Voltage (V) variation : 3  
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	104.32	0.15	0.62	1.02
180.0	180.09	0.29	1.23	1.86

### TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (± °C)
		#1	#2	#3	#4	#5	#6	#7	#8	#9	
104.0	104.0	104.23	103.89	104.54	104.02	104.33	104.63	104.42	104.48	104.39	0.38
180.0	180.0	180.16	179.13	180.46	179.35	179.79	180.66	180.36	180.29	180.61	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 : 22T1726  
REFERENCE No : 64109-2

## 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 SOI 63, RAMA II RD., SAMAEADAM,  
BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY : CHAICHARN CH.  
CALIBRATION DATE : 21-Feb-22

APPROVED BY :  
ISSUED DATE : 22-Feb-22  
RECEIVED DATE : 21-Feb-22





# 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 : 22T1726

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : INCUBATOR  
MANUFACTURER : MEMMERT  
MODEL : IF 160  
ID No : SN : D518.0082  
RECEIVED DATE : 21-Feb-22  
RELATIVE HUMIDITY : 50 %RH ± 10 %RH  
AMBIENT TEMPERATURE : 24 °C ± 1 °C

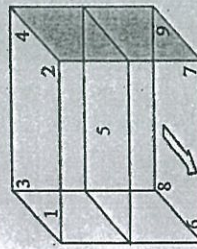
### CONDITION OF THIS RESULTS OF CALIBRATION

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.

### REFERENCE STANDARD INSTRUMENTS :-

- 1) DATA LOGGER WITH RTD HYDRA 2635A  
2) TIT6765  
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 : 9

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	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)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (± °C)
		#1	#2	#3	#4	#5	#6	#7	#8	#9	
35.0	35.0	34.91	34.94	34.93	34.93	34.98	35.03	35.08	35.01	35.08	0.25
36.0	36.0	35.93	35.95	35.95	35.94	36.00	36.05	36.10	36.01	36.10	0.25
41.5	41.5	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 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  
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 22E0980

REFERENCE No : 63904-1

PAGE : 1 OF 2

## Certificate of Calibration

EQUIPMENT : PH METER  
MANUFACTURER : DKK-TOA  
MODEL : HM-25R  
SERIAL No : 760205  
ID No : EQJ-183  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : TEST TECH CO., LTD.  
30.32 RAMA II SOI 63, RAMA IIRD., SAMAEADAM,  
BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY :

PRASERT P.

CALIBRATION DATE :

02-Feb-22

APPROVED BY :

ISSUED DATE :

02-Feb-22

RECEIVED DATE :

02-Feb-22

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





## QUALITY CALIBRATION CO., LTD.

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

CERTIFICATE No. : 22B0980

PAGE : 2 OF 2

### Calibration Report

EQUIPMENT : pH METER  
MANUFACTURER : DKK-TOA  
ID No : EQL-183  
RECEIVED DATE : 02-Feb-22  
AMBIENT TEMPERATURE : 25° C ± 1° C  
MODEL : HM-23R  
SERIAL NUMBER : 760205  
CALIBRATION DATE : 02-Feb-22  
RELATIVE HUMIDITY : 57 %RH ± 10 % RH

#### CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT METHOD BASED ON WI-TQ-062. 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	MODEL	SERIAL No./ LOT No	CERTIFICATE No	DUE DATE
1) pH STANDARD SOLUTION	00651-06	CC719181	4880-12119147	05-Apr-23
2) pH STANDARD SOLUTION	00651-08	CC718727	4881-12110709	31-Mar-23
3) pH STANDARD SOLUTION	00651-10	CC717045	4882-12063386	17-Mar-23
4) PROCESS CALIBRATOR	744	7514008	21E1392	29-Apr-22
5) BATH	260014	1247 48074	21T9121	10-Sep-22
6) THERMOMETER WITH PROBE	421504	53000379	21T9129	14-Sep-22
7) STANDARD THERMOMETER	2560	A14546	PSL-T0049/64	23-Nov-22

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 SI UNIT MAINTAINED AT :

- NATIONAL INSTITUTE OF STANDARD AND TECHNOLOGY, USA.  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND)

#### RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

1. DISPLAY UNIT WITH pH ELECTRODE S/N: 002F0035MK				
STANDARD pH BUFFER SOLUTION (pH)	UUC READING (pH)	CORRECTION (pH)	ACTUAL READING (mV)	COVERAGE FACTOR k
4.007	4.01	-0.003	174	2.0
7.003	7.00	0.003	0.0	2.0
10.014	10.01	0.004	-172	2.0

#### 2. DISPLAY UNIT MEASUREMENT TEMPERATURE WITH PROBE

STANDARD READING (°C)	UUC* READING (°C)	IMMERSION DEPTH (mm)	CORRECTION (°C)	UNCERTAINTY OF MEASUREMENT (±°C)
25.003	25.1	80	-0.097	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

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 except in full, without written approval of the Bara Scientific Co., Ltd.



Bara Scientific  
Solutions of Science

Bara Scientific Co., Ltd.  
988 U Chu Liang Building Floor7 Ramada Road  
Sliom Bangkok Bangkok Thailand 10500  
Tel : 02-6324300 Fax : 02-6375496-7  
www.barascientific.com



## Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-17322  
Equipment UV/Vis Spectrophotometer  
Model UV-1900i  
Manufacturer Shimadzu  
Serial No. A12535780311 ML  
ID No. EQL-233  
Date of receipt 19 May 2022  
Date of calibration 19 May 2022  
Date of issue 26 May 2022  
Customer name Test Tech Co., Ltd.  
Address 30, 32 Rama II Soi 83, Rama II RD., Samaedam, Bangkhunthian, Bangkok 10150.

Temperature (23.7-24.3) °C (On site)  
Humidity (47.5-48.3) %RH (On site)

Equipment condition Good Operation

Calibration Location Water Room

Calibration Procedure In-house method WI-UV-702-01 based on ASTM E275-01

Traceability Wavelength Accuracy is traceable to certificate No. 96367 and 96366  
Photometric Accuracy is traceable to certificate No. 99925 and 100147  
Stray Light is traceable to certificate No. 99385  
The above certificate are traceable to SI unit through Slama Scientific Ltd.  
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr.Kanchit Choothep

Approved by

Technical Manager





Bara Scientific Co., Ltd.  
968 U Chu Liang Building Floor 7 Rama4 Road  
Silom Bangkok Bangkok Thailand 10500  
Tel : 02-6324300 Fax : 02-6375496-7  
www.barascientific.com



## Certificate of Calibration

Certificate No.

BSCC-UV-173/22

Number of Page(s)

2 of 3

Calibration Results:

### 1. Wavelength Accuracy

Wavelength (nm)	Certified Absorbance (A)	UUC (nm)	Error (nm)	Uncertainty (±nm)
279.44	0.0000	279.06	-0.38	0.18
418.53	0.0000	418.35	-0.18	0.18
536.52	0.0000	536.47	-0.06	0.18
684.50	0.0000	684.50	0.00	0.18
879.41	0.0000	879.24	-0.17	0.18

### 2. Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
235	CNR	CNR	CNR	CNR
257	0.0000	0.0000	0.0000	0.0075
313	0.8499	0.8490	-0.0010	0.0075
350	0.0000	0.0000	0.0000	0.0075

\*CNR = Customer not request

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Silom Bangkok Bangkok Thailand 10500  
Tel : 02-6324300 Fax : 02-6375496-7  
www.barascientific.com



## Certificate of Calibration

Certificate No.

BSCC-UV-173/22

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
	0.5472	0.5481	0.0009	0.0042
	0.7637	0.7626	-0.0011	0.0042
	1.0480	1.0484	0.0004	0.0042
	0.0000	0.0000	0.0000	0.0042
	0.5371	0.5381	0.0010	0.0042
	0.7457	0.7450	-0.0008	0.0042
	1.0233	1.0243	0.0010	0.0042
465.0	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	0.0000	0.0000	0.0000	0.0042
	0.5006	0.5012	0.0006	0.0042
	0.6961	0.6946	-0.0015	0.0042
	0.9563	0.9558	-0.0005	0.0042
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	0.0000	0.0000	0.0000	0.0042
	0.5137	0.5143	0.0006	0.0042
	0.6907	0.6892	-0.0015	0.0042
	0.9533	0.9527	-0.0006	0.0042

\*CNR = Customer not request

### 4. Stray Light\*

Standard	Wavelength (nm)	Transmission (%)	Absorbance (A)
200.98±0.11nm	200.85	0.9120	2.0401

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 based 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.  
Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced except in full, without written approval of the Bara Scientific Co., Ltd.





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



## Certificate of Calibration

Certificate No.: 22M196  
Page: 1 of 2

Equipment: Standard Weight  
Manufacturer: LS  
Model: -  
Serial No.: -  
ID No.: EQL-121  
Condition As-Received: Used Item  
Received Date: 03 February 2022  
Calibration Date: 08 February 2022  
Reference: 2202-0110DN  
Ambient Temperature: ( 23 ± 2 ) °C  
Relative Humidity: ( 50 ± 15 ) %  
Atmospheric Pressure: 1011 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.

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-M01 according to comparison method  
against standard weights on the basis of weightings at an average air density of 1.2 kg/m<sup>3</sup> and a temperature  
of 23 °C material density of weight is 8000 kg/m<sup>3</sup>.

### Condition of this result of calibration

1.Reference standards instruments:

Instrument

Model Serial No. Certificate No. Due Date  
YCS31-712-00 50202965 MM-0102-20 13 Jul 2022

1) Standard weight Set (E2)

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: Suwat Wuthicharnmongkol  
Issue Date: 08 February 2022

Approved Signatory  
[ ] Phalinee Prabpai  
[x] Sura Suwanasri  
[ ] Chaowalit Ritirak

B 0280632

a 1092727



Cert No.: 22M196  
Page: 2 of 2

### Result of calibration

Without adjustment

Nominal Value	Conventional mass	Uncertainty of Measurement ( ± )	Maximum Permissible error ( ± )
50 g	50.00008 g	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 %.

-o-o-



## Certificate of Calibration

Equipment: TURBIDIMETER  
Model: 2100N  
Serial No. (or ID.): 970400034415 (EQL-024)  
Manufacturer: HACH  
Condition: In Condition  
Customer: TEST TECH CO., LTD.  
30,32 Rama II Soi 63, Rama II Rd.,  
Samaedam, Bangkokthien Bangkok 10150 Thailand

Certificate No.: C08220157  
Issued Date: 21 September 2022  
Job No.: KSPR2211615  
Page: 1 of 2

Environment Condition: Temperature 23 °C ± 2 °C  
Humidity 50 %RH ± 15 %RH  
Calibration Place: Environment Laboratory, DKSH Technology Limited.  
1194 Soi Wachirathamsathit 57, Sukhumvit 101/1 Rd.,  
Bangchak, Prakhonong, Bangkok 10260 Thailand

Calibration By: Mr. Wasan Nuchnabee  
Calibration Date: 21 September 2022  
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 SiabCal accepted by United States Environmental Protection Agency (EPA) through Hach Company  
Certificate No. A1075, A1074, A1091, A1074, A1074

### Person in charge

### Authorized signatory

This certificate is issued to the unit of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national 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.

within business hours 4-6 PM  
DKSH Technology Limited  
2533 Sukhumvit Road, Bangkok, Thailand 10260  
Phone: +66 2839 7000 Email: info@dksh.com Website: www.dksh.com/thailand

Delivering Growth - In Asia and Beyond.

CAL-FM-C08-06: 20 Jul 2022



Certificate No.: C08220157

Page 2 of 2

### Calibration Results:

#### Before Adjustment

Std Turbidity (NTU)	UUC Reading	Correction	Deviation	Uncertainty
0.060	0.048	0.012	0.0004	0.070
20.40	20.1	0.30	0.05	1.0
206.0	204	2.0	0.5	10
1020.0	1013	7.0	1.2	50
4065.0	3875	190.0	1.8	200

#### After Adjustment

Std Turbidity (NTU)	UUC Reading	Correction	Deviation	Uncertainty
0.060	0.057	0.003	0.0015	0.070
20.40	20.5	-0.10	0.04	1.0
206.0	206	0.0	0.5	10
1020.0	1018	2.0	0.5	50
4065.0	4064	1.0	0.5	200

The End of Certificate

within business hours 4-6 PM  
DKSH Technology Limited  
2533 Sukhumvit Road, Bangkok, Thailand 10260  
Phone: +66 2839 7000 Email: info@dksh.com Website: www.dksh.com/thailand

Delivering Growth - In Asia and Beyond.

CAL-FM-C08-06: 20 Jul 2022





CERTIFICATE No : 22T7648  
REFERENCE No : 65843-2

PAGE : 1 OF 2

## Certificate of Calibration

EQUIPMENT : WATER BATH  
MANUFACTURER : MEMMERT  
MODEL : WPE 45  
SERIAL No : L711.0024  
ID No : EQL-147  
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 : 14-Jul-22

APPROVED BY :   
ISSUED DATE : 15-Jul-22  
RECEIVED DATE : 14-Jul-22

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



CERTIFICATE No : 22T7648

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : WATER BATH  
MANUFACTURER : MEMMERT  
ID NUMBER : EQL-147  
RECEIVED DATE : 14-Jul-22  
AMBIENT TEMPERATURE : 24 °C ± 1 °C  
MODEL : WPE 45  
SERIAL NUMBER : L711.0024  
CALIBRATION DATE : 14-Jul-22  
RELATIVE HUMIDITY : 50 %RH ± 10 % RH

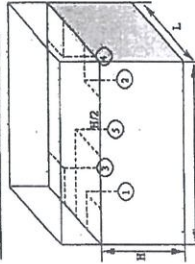
### CONDITION OF THIS RESULTS OF CALIBRATION

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 :-

- 1) DATA LOGGER WITH RTD  
2) REFERENCE TEMPERATURE : 2625A  
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



PROBE INSTALLATION  
POSITION IN THE BATH

### GENERAL INFORMATION

Overall Variation of Ambient Temperature around the Bath (°C) : 0.9
Overall Variation of Line Voltage (V) : 3
Instrument Condition : Normal
Bath Inner Size (W*L*H) : 60*42*24 cm

### BATH PERFORMANCE

Calibration Point (°C)	Controller Temperature (°C)	Indicating Temperature (°C)	Average All Locations (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
41.5	41.5	41.5	41.54	0.05	0.03	0.12
44.5	44.5	44.5	44.50	0.07	0.02	0.15

### TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Measured Temperature (°C) at Spread Locations					Uncertainty (± °C)
	#1	#2	#3	#4	Ref. 5	
41.5	41.54	41.55	41.52	41.55	41.55	0.14
44.5	44.48	44.51	44.50	44.50	44.51	0.15

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 QC 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