

ภาคผนวก จ

เอกสารรับรองเครื่องมือการตรวจวัด



Certificate of Calibration

Certificate No. : 66-420087-1

Page : 1 of 2

Submitted by :

M Green Group Co.,Ltd.

188/46 Wisetukhakhon 25, Pracha-Utd 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. : 01X099320

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

Ambient Temperature : (25.0 to 25.5) °C

Relative Humidity : (45 to 50) %

Date of Received : 20 September 2023

Date of Calibration : 20 September 2023

Date of Issue : 25 September 2023

Calibrated by : Permpon Chianpu

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

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

1. Multiproduct Calibrator

ID No.	Cert.No.	Due Date	Traceability
400005	SG-E-00307/66	23 Aug 2025	National Institute of Metrology Thailand (NIMT)

2. Standard Buffer Solution

pH	Cert.No.	Lot No.	Exp.Date	Traceability
4.008	61270213	915161	19 Jul 2025	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.985	61275614	898428	28 May 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
9.997	61281073	915163	19 Jul 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by :

(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-420087-1

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Electrical measurement

pH meter

Performing standard curve by Multiproduct Calibrator at pH (4,7,10)

Adjustment Curve at nominal pH	Applied Voltage (mV)	Nominal Value (pH)	UUC Reading		Correction (mV)	Uncertainty (± mV)
			(pH)	(mV)		
4, 7, 10	177.4800	4	4.00	177.5	0.0	0.12
	0.0000	7	7.00	0.1	-0.1	0.086
	-177.4800	10	10.00	-177.4	-0.1	0.12

Function : pH meter with electrode

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

Adjustment Curve at nominal pH	Standard Buffer (pH)	UUC Reading (pH)	Correction (pH)	Uncertainty (± pH)
4, 7, 10	4.008	4.01	0.00	0.010
	6.985	7.00	-0.01	0.011
	9.997	10.01	-0.01	0.014

Remark

UUC : Unit Under Calibration

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

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

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Certificate of Calibration

Certificate No. : 66-400519-1

Page : 1 of 2

Submitted by :

M Green Group Co.,Ltd.

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

Equipment :

Digital Thermometer with Thermistor probe
Temperature Indicator

Manufacturer : Eutech
Range : N/A °C
Resolution : 0.1 °C
Model : pH 700
ID No. : N/A
Serial No. : 2884323

Thermistor probe

Model : N/A
Diameter : 3.2 mm.
Serial No. : PH5TEMB01P
Sheath Material : Stainless
Length : 100 mm.
ID No. : N/A

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

Environment :

Ambient Temperature : (25.0 to 26.0) °C
Relative Humidity : (56 to 60) %
Line Voltage : (224.0 to 225.2) VAC

Date of Received :

20 September 2023

Date of Calibration :

20 September 2023

Date of Issue :

25 September 2023

Calibrated by :

Permpoon Charpu

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

400002 TT-0074-22 20 Jun 2024

Traceability
National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No. Cert.No. Due Date

400033 22E569 22 Feb 2024

Traceability
National Institute of Metrology Thailand (NIMT)

Approved by :

(Surachai Promthong)
Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-400519

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Immersion Depth (mm.)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
100	25.006	24.9	0.1	0.19

Remark

UUC : Unit Under Calibration

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

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

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Certificate of Calibration

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

Submitted by :

M Green Group Co., Ltd.

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

Equipment :

Electronic Balance

Manufacturer : SHIMADZU Model : AP225WD

Serial No. : D316300690

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

Environment :

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

Ambient Temperature : (25.6 to 26.7) °C

Relative Humidity : (54.4 to 56.6) %

Air Pressure : 1010.0 mbar

Date of Received :

20 September 2023

Date of Calibration :

20 September 2023

Date of Issue :

22 September 2023

Calibrated by :

Akaraduth 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

C02222345

10 Nov 2023

National Institute of Metrology (Thailand), (NIMT)

Approved by :

(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

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

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

Nominal Value (g)	Correction (g)	Uncertainty ± (g)
0.001	0.00000	0.000012
0.01	0.00000	0.000013
0.1	0.00000	0.000015
1	0.00000	0.000026
10	0.00000	0.000053
20	-0.00003	0.000071
50	0.00004	0.00011
100	-0.00009	0.00020
150	0.00000	0.00038
200	-0.0001	0.00038

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.15$, providing a level of confidence of approximately 95%

Eccentric error

Load test : 50 g

A

B

C

D

E

-0.00003 0.00000 0.00000 -0.00005 0.00000 g



Repeatability

Load test : 200 g

Sidev.

: 0.000048 g

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Certificate of Calibration

Certificate No. : 66-400531-1

Page : 1 of 2

Submitted by :

M Green Group Co., Ltd.

188/46 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 : 21 September 2023

Date of Calibration : 23 September to 26 September 2023

Date of Issue : 26 September 2022

Calibrated by : Chortip Sanchusi

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 23E1866 01 Jun 2025

National Institute of Metrology Thailand (NIMT)

400004 23E1866 01 Jun 2025

National Institute of Metrology Thailand (NIMT)

Approved by :

(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-400531-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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

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

Remark

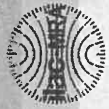
UUC : Unit Under Calibration

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

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

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Certificate of Calibration

Certificate No. : 66-400520-1 Page : 1 of 2

Submitted by : M Green Group Co., Ltd.

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

Equipment : Air Chamber (Refrigerator)

Manufacturer : Biobase

Model : BXC-V250M (II)

Range : N/A °C

Resolution : 0.1 °C

Serial No. : YC025025190108

ID No. : N/A

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

Ambient Temperature : (25.0 to 26.0) °C

Relative Humidity : (40 to 50) %

Line Voltage : (226.0 to 230.0) V

Date of Received : 20 September 2023

Date of Calibration : 20 September 2023

Date of Issue : 25 September 2023

Calibrated by : Pempon Chantu

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.

400046 & 400042 66-400453-1

Traceability

Due Date

31 Jan 2024 National Institute of Metrology Thailand (NIMT)

Approved by :

(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

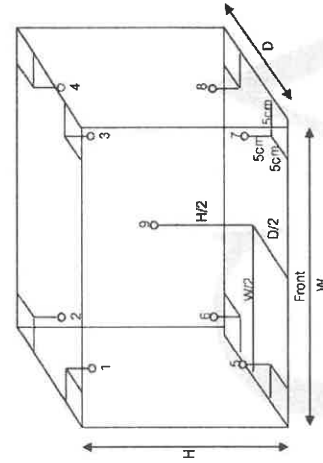
Certificate No. : 66-400520-1 Page : 2 of 2

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 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	4.05	4.04	4.27	4.89	4.10	4.05	4.92	4.37	4.43	0.46

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

Remark The uncertainty is not combine uniformity of the air chamber

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

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

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Certificate of Calibration

Certificate No. : 66-400520-2 Page : 1 of 2

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

Equipment : Air Chamber (Oven)
Manufacturer : Mommert
Range : N/A °C
Model : UF110
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 : (25.0 to 26.0) °C
Relative Humidity : (40 to 50) %
Line Voltage : (226.0 to 230.0) V

Date of Received : 20 September 2023

Date of Calibration : 20 September 2023

Date of Issue : 25 September 2023

Calibrated by : Permon 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 & 400028 66-400184-3 04 Oct 2023 National Institute of Metrology Thailand (NIMT)

Approved by :

(Surachai Promthong)
Laboratory Manager

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Certificate of Calibration

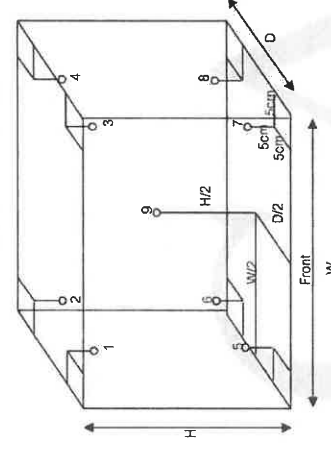
Certificate No. : 66-400520-2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



Inside of Chamber
W = 0.56 m
D = 0.40 m
H = 0.48 m
Capacity = 0.11 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
103.0	103.0	103.0	103.3	103.0	103.7	103.3	103.1	103.0	103.8	102.7	103.3	0.69
105.0	105.0	105.0	105.3	105.0	105.7	105.3	105.2	105.0	105.8	104.6	105.3	0.71
180.0	180.0	180.0	180.4	180.1	181.2	180.4	180.3	180.0	181.4	179.0	180.5	0.95

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured		Overall Variation (°C)
			Uniformity (°C)	Stability (°C)	
103.0	103.0	103.0	0.8	0.1	1.3
105.0	105.0	105.0	0.9	0.1	1.4
180.0	180.0	180.0	1.7	0.2	2.7

Remark The uncertainty is not combine uniformity of the air chamber

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

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

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Certificate of Calibration

Certificate No. : 66-400520-3 Page : 1 of 2

Submitted by : M Green Group Co., Ltd.
188/46 Wisetasukhakhon 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 : (25.0 to 26.0) °C
Relative Humidity : (40 to 50) %
Line Voltage : (226.0 to 230.0) V

Date of Received : 20 September 2023

Date of Calibration : 20 September 2023

Date of Issue : 25 September 2023

Calibrated by : Permpon Chanpu

Calibration Method : This instrument was calibrated by In-house method CAL-M4006 based on ASTM E715-80
The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units
Standard Digital Thermometer with RTD probe

ID No. Cert.No. Due Date Traceability
400046 & 400024 66-400184-2 06 Oct 2023 National Institute of Metrology Thailand (NIMT)

Approved by :

(Surachai Promthong)
Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

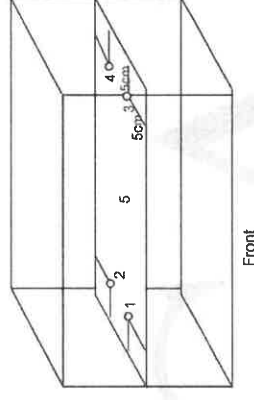
Certificate No. : 66-400520-3

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement



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

Remark The uncertainty is not combine uniformity of the water bath

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

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

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Certificate of Calibration

Page : 1 of 2

Certificate No. : 66-400520-4

Submitted by :

M Green Group Co., Ltd.

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

Equipment :

Air Chamber (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 : (25.0 to 25.5) °C

Relative Humidity : (45 to 50) %

Line Voltage : (226.0 to 230.0) V

Date of Received : 20 September 2023

Date of Calibration : 20 September 2023

Date of Issue : 25 September 2023

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

Standard Digital Thermometer with RTD Probe

ID No. Cert.No.

400029 & 400043 66-400226-1

Traceability

National Institute of Metrology Thailand (NIMT)

The Uncertainties are for a confidence probability of approximately 95%
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Certificate of Calibration

Page : 2 of 2

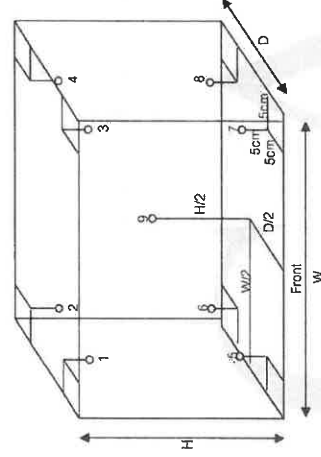
Certificate No. : 66-400520-4

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



Inside of Chamber
W = 0.45 m
D = 0.41 m
H = 0.85 m
Capacity = 0.16 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
20.0	20.0	20.0	20.14	20.04	19.91	19.97	20.03	19.96	19.91	19.96	19.92	0.70

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured		Overall Variation (°C)
			Uniformity (°C)	Stability (°C)	
20.0	20.0	20.0	0.28	0.37	0.8

Remark The uncertainty is not combine uniformity of the air chamber

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

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

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Approved by :

(Surachai Promthong)

Laboratory Manager





Certificate of Calibration

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

Submitted by : M Green Group Co., Ltd.
188/46 Wisatsuknakhon 25, Pracha-Utd Rd., Thungkru, Bangkok 10140 ThailandEquipment : Burette
Manufacturer : GLASSCO Class : A
Capacity : 10 ml Graduation : 0.05 ml
ID No. : 2212-0344-1Environment : Ambient Temperature : (20 ± 3) °C
Relative Humidity : (50 ± 10) %
Air Pressure : 1006.7 mbar.Date of Received : 20 September 2023
Date of Calibration : 27 September 2023
Date of Issue : 27 September 2023
Calibrated by : Wipa Tovadee

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

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

Electronic Balance

ID No.	Cert. No.	Due Date	Traceability
241003	66-200196-2	02 Dec 2023	National Institute of Metrology (Thailand) (NIMT)

Approved by
(Wipa Tovadee)
Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

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

Result of Calibration : This result of true Volume is referred to standard temperature at 20 °C

UUC Condition As-Received : Good

Delivery Time : 21.33 sec.

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

Uncertainty of measurement with in ± 0.0039 ml

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

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

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Certificate of Calibration

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

Submitted by : M Green Group Co., Ltd.

188/46 Wisatesnikhakon 25, Pracha-Ud 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 : 1006.7 mbar.

Date of Received : 20 September 2023

Date of Calibration : 27 September 2023

Date of Issue : 27 September 2023

Calibrated by : Wipa Tovadee

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

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

Electronic Balance

ID No.	Cert. No.	Due Date	Traceability
241003	66-200196-2	02 Dec 2023	National Institute of Metrology (Thailand) (NIMT)

Approved by :

(Wipa Tovadee)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

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

Result of Calibration : This result of true Volume is referred to standard temperature at 20 °C

UUC Condition As-Received : Good

Delivery Time : 46.01 sec.

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

Uncertainty of measurement with in $\pm$ 0.0066 ml

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

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

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Certificate of Calibration

Certificate No. : 66-300590-1

Page : 1 of 2

Submitted by : M Green Group Co., Ltd.

188/46 Wisatsukhachon 25, Pracha-Uth Rd., Thungkru, Bangkok 10140 Thailand

Equipment

: Imhoff Cone

Manufacturer : VITLAB

Capacity : 1000 ml **Graduation** : 50 ml

ID No. : CY1000/01/22

Environment

: **Ambient Temperature** : $(20 \pm 3) ^\circ\text{C}$

: **Relative Humidity** : $(50 \pm 10) \%$

: **Air Pressure** : 1005.4 mbar.

Date of Received : 20 September 2023

Date of Calibration : 26 September 2023

Date of Issue : 26 September 2023

Calibrated by : 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 66-200196-1 02 Dec 2023 National Institute of Metrology (Thailand) (NIMT)

Approved by :

(Wipa Tovadee)

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. : 66-300590-1

Page : 2 of 2

Result of Calibration :

This result of true Volume is referred to standard temperature at 20 °C

UUC Condition As-Received : Good

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

Uncertainty of measurement with in ± 0.17 ml

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.00$,

providing a level of confidence of approximately 95%

- o0o -



การดูแลบำรุงรักษาเชิงป้องกัน Preventive Maintenance



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

Type text here

เงื่อนไขการให้บริการ Preventive Maintenance

บริษัทฯ จะส่งวิศวกรผู้ชำนาญ เพื่อให้บริการตามขอบข่ายของการบริการ เฉพาะ ในวันและเวลา ราชการ หากมีความประสงค์ที่จะรับบริการนอกเหนือจากวัน เวลา ราชการ (วันหยุดเสาร์ – อาทิตย์ หรือวันสุด นักร์ดฤกษ์) บริษัทฯ จะคิดค่าบริการเพิ่มเติมตามอัตราที่กฎหมายแรงงานกำหนดไว้

ขอบข่ายการบริการ

- ตรวจสอบสภาพการทำงานต่าง ๆ ของเครื่องมือ
- ทดสอบประสิทธิภาพการทำงานของเครื่องมือ
- รายงานผลการตรวจสอบเครื่องมือ

หมายเหตุ

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



ช่องทางการติดต่อ

DKSH Technology Limited (บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด)
เลขที่ 2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260
เลขประจำตัวผู้เสียภาษี 010-555-001-4547 (สำนักงานใหญ่)



Call center 0 2 639 7000



DKSH Scientific



www.dksh.com/scientific-thailand



marketing.tec.th@dksh.com



@dkshscientific

Preventive Maintenance Contract

จำนวนในการทำสัญญาบริการ ...ครั้ง ต่อปี
ครั้งที่ 1, วันที่ 19/04/2024.....

รายละเอียดผู้รับบริการ

หน่วยงาน	บริษัท เทคที เพค จำกัด
ที่อยู่	30,32 ซอยพระรามที่ 2 ซอย 63 ถนนพระรามที่ 2 แขวงสามตำบลบางขุนเทียน กรุงเทพมหานคร 10150
โทรศัพท์	0-2893-4211-7 แฟกซ์ 0-2893-4218

ผู้ติดต่อ

ชื่อ - นามสกุล	คุณกรรณก พนพิทักษ์
ตำแหน่ง	หัวหน้าส่วน
โทรศัพท์	087 398 9274 เบอร์ติดต่อ - แฟกซ์ -
E-mail	lab_center@testtech.co.th

รายละเอียดผู้ให้บริการ

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด (ฝ่ายบริการหลังการขาย) (สำนักงานใหญ่)
เลขที่ 2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260
โทรศัพท์ 0 2 693 7000 Email: marketing.th@dksh.com
เจ้าหน้าที่ประสานงาน : คุณสุภาวรัตน์ ศิริรัตน์ โทรศัพท์ 090 678 6925

เจ้าหน้าที่ผู้ให้บริการ	นางศิริภาณุ พลธาดา	
ตำแหน่ง	Specialist, Technical Service.	
โทรศัพท์	0938138736	แฟกซ์ -
E-mail	Jirayut.jir@dksh.com	

ลงนามผู้รับบริการ	ทศพล ขุนสังข์	ลงนามผู้ให้บริการ
ตัวจริง	(ลงลายมือชื่อ.....)	ตัวจริง
ตำแหน่ง	ผู้อำนวยการห้องปฏิบัติการ	ตำแหน่ง
วันที่ / ประทับตราบริษัท	19/04/2024	วันที่ / ประทับตราบริษัท

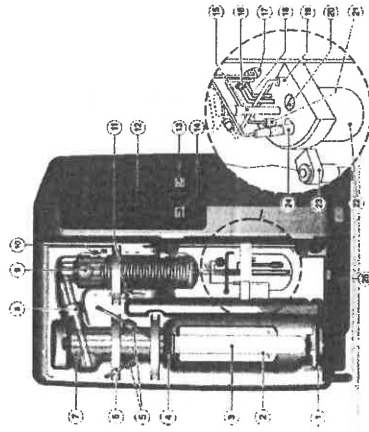
(นายจิรายุส พลธาดา)
Specialist, Technical Service.
19/04/2024

JOB No: I.SPR2402440.....MODEL:YAP300.....S/N: GER5300210095

Operational Qualification (OQ)

ตรวจสอบสภาพเครื่อง

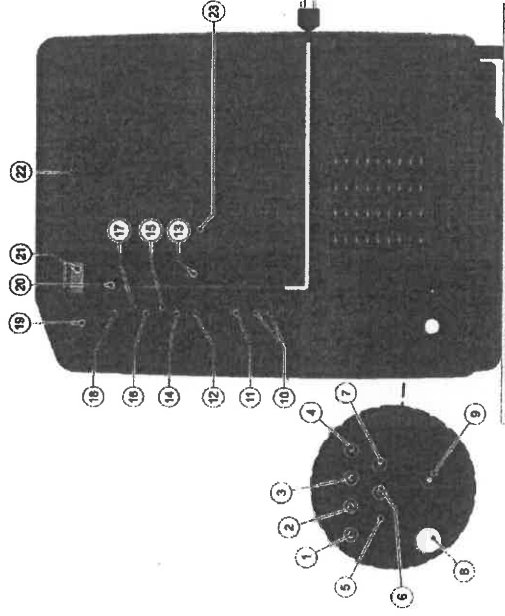
FRONT



No		PASS	FAIL	N/A
1	Quick clamping device with clamping block	☒	☐	☐
2	Digestion tube 250/300 ml	☒	☐	☐
3	PTFE steam inlet tubing	☒	☐	☐
4	Connection stopper, Viton	☒	☐	☐
5	Screw cap GL18	☒	☐	☐
6	PTFE-inlet tubing NaOH	☒	☐	☐
7	Distribution head made of glass	☒	☐	☐
8	Screw cap GL32	☒	☐	☐
9	Distillation condenser made of glass	☒	☐	☐
10	Screw cap GL14	☒	☐	☐
11	Ventilation valve	☒	☐	☐
12	Control panel	☒	☐	☐
13	Operating Button	☒	☐	☐
14	USB interface (with protective cap)	☒	☐	☐
15	Silicone tubing 8/10 for distillate discharge **	☐	☐	☒
16	Verprene tubing 4/8, receiver suction **	☐	☐	☒
17	Cable duct for electrode cable + titration tube**	☐	☐	☒
18	Silicone tubing 4/7, boric acid inlet**	☐	☐	☒
19	Sensor for level monitoring including connector**	☐	☐	☒
20	Agitator motor with propeller**	☐	☐	☒
21	Titration acid inlet tube **	☐	☐	☒
22	Receiver glass**	☐	☐	☒
23	Holder for pH electrode, removable**	☐	☐	☒
24	pH electrode (combined electrode)**	☐	☐	☒
25	Drip tray PP	☒	☐	☐

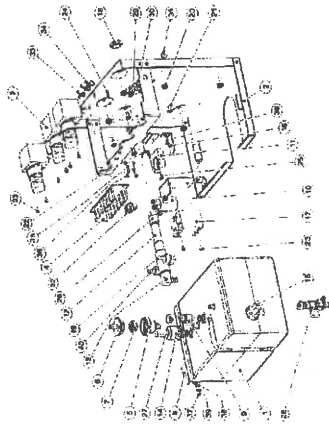
** only VAP 450

REAR



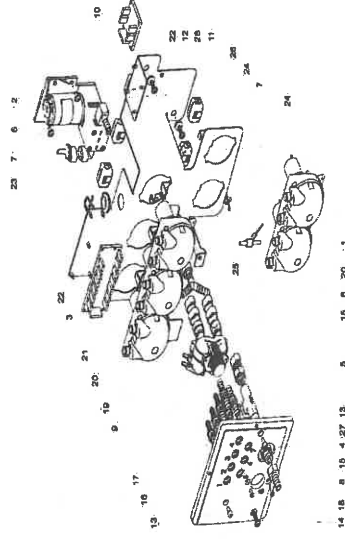
No		PASS	FAIL	N/A
1	Tube connection for sample H3BO3 supply	☐	☐	☒
2	Tube connection for sample H2O supply	☒	☐	☐
3	Tube connection for steam generator H2O supply	☒	☐	☐
4	Tube connection for NaOH supply	☒	☐	☐
5	Tube connection for receiver glass extraction	☒	☐	☐
6	Tube connection for sample waste extraction	☒	☐	☐
7	Tube connection, overpressure steam outlet	☒	☐	☐
8	Connection for cooling water supply (with cleaning sleeve)	☒	☐	☐
9	Tube connection for cooling water outlet	☒	☐	☐
10	4 X USB interface	☒	☐	☐
11	1 X RS-232 Interface	☒	☐	☐
12	LAN Interface	☒	☐	☐
13	Screw cap for Perspex cover	☒	☐	☐
14	Connection socket for sample waste tank level monitoring	☒	☐	☐
15	Connection (not used)	☐	☐	☒
16	Connection socket for H2O tank level monitoring	☒	☐	☐
17	Connection socket for H3BO3 tank level monitoring	☒	☐	☐
18	Connection socket for NaOH tank level monitoring	☒	☐	☐
19	Overcurrent circuit breaker	☒	☐	☐
20	Apparatus socket (mains cable connection)	☒	☐	☐
21	Rating plate with serial number	☒	☐	☐
22	Exhaust air fan	☒	☐	☐
23	Excess temperature switch	☒	☐	☐

Inside Steam generator



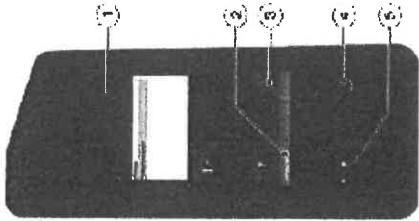
No		PASS	FAIL	N/A
1	Steam generator	☒	☐	N/A
2	Steam generator traverse	☒	☐	☐
3	Pinch valve	☒	☐	☐
4	Circuit board distributor	☒	☐	☐
5	Valve tubing connection	☒	☐	☐
6	Housing safety valve	☒	☐	☐
7	Safety valve SKT	☒	☐	☐
8	Excess temperature protection, steam generator	☒	☐	☐
9	Safety valve G 1/8 0.5 bar	☒	☐	☐
10	Ventilation glass pinch valve VAPODEST	☒	☐	☐
11	Hose clamp for ventilation clamp	☒	☐	☐
12	Distributor PP	☒	☐	☐
13	Angle connection PP	☒	☐	☐
14	Pressure transmitter	☒	☐	☐
15	Level switch	☒	☐	☐
16	Fixing bracket steam generator	☒	☐	☐
17	Relay HT+	☒	☐	☐
18	VA Hexagon nut 1/4"	☒	☐	☐
19	Angle connection 1/8"	☒	☐	☐
20	Bushing nipple 6-10-14	☒	☐	☐
21	VA Lens head screw M5 X 10	☒	☐	☐
22	Grounding connection, 2-pole	☒	☐	☐
23	VA Lens head screw M4 X 6	☒	☐	☐
24	Spacer belt 5 mm	☒	☐	☐
25	VA Lens head screw M4 X 10	☒	☐	☐
26	Tubing connection	☒	☐	☐
27	Hose clamp 14.5 mm	☒	☐	☐
28	Module ball valve with nozzles	☒	☐	☐
29	Cross manifold with spout	☒	☐	☐
30	Seal copper G 1/8	☒	☐	☐
31	Locking screw 1/8"	☒	☐	☐
32	Pin strip	☒	☐	☐
33	Bundle clamp 12 H 4500	☒	☐	☐
34	Bundle clamp 12 H 4502	☒	☐	☐
35	Temperature switch 80°C	☒	☐	☐
36	VA Lens head screw M3 X 6	☒	☐	☐
37	VA Hexagon nut M4	☒	☐	☐
38	Lins head screw M4 X 8	☒	☐	☐
39	VA Spirtux washer	☒	☐	☐
40	Angle connection, reduced, 1/8" PP	☒	☐	☐

Module Pump holder VAP200 - 450 V3



No		PASS	FAIL	N/A
1	Peristaltic pump	☒	☐	N/A
2	Diaphragm pump NaOH, with non return valve	☒	☐	☐
3	Circuit board	☒	☐	☐
4	Tubing connection module	☒	☐	☐
5	Flow controller	☒	☐	☐
6	Lens head screw M5 x 10	☒	☐	☐
7	Bushing nozzle	☒	☐	☐
8	Screw in socket	☒	☐	☐
9	Magnetic valve 2/2 way	☒	☐	☐
10	Circuit board distributor	☒	☐	☐
11	Bushing nozzle	☒	☐	☐
12	Screw 5 x 25	☒	☐	☐
13	Cylinder screw	☒	☐	☐
14	Screw 5 x 20	☒	☐	☐
15	Seal EPDM 15 x 4	☒	☐	☐
16	Tubing connection piece 51x10x6,5	☒	☐	☐
17	Tubing connection piece 51x10x10	☒	☐	☐
18	Screw M4x10	☒	☐	☐
19	Clamp	☒	☐	☐
20	Clamp	☒	☐	☐
21	Y-tube connector	☒	☐	☐
22	Spacer bolt 5 mm	☒	☐	☐
23	Bundle clamp	☒	☐	☐
24	Bundle clamp	☒	☐	☐
25	Retrofit earthing pumpv	☒	☐	☐
26	Snap ferrite	☒	☐	☐
27	Nut G 3/8"	☒	☐	☐
28	Pump holder plate	☒	☐	☐

Control panel



No		PASS	FAIL
1	Title bar	☒	☐
2	Status bar	☒	☐
3	Navigation button	☒	☐
4	Smart switch with multiple functions	☒	☐
5	USB interface	☒	☐

รายละเอียดการตรวจสอบ

ขั้นตอนการบริการ

ตรวจสอบระบบไฟฟ้า (Electrical Test)

- ความต้านทานทางไฟฟ้าของเครื่องกับกราวด์
- กระแสไฟฟ้าที่ใช้งาน

ตรวจสอบสภาพเครื่อง (Optical Test)

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

ตรวจสอบ Function การทำงาน (The Function Test)

- ระบบสร้างและควบคุมอุณหภูมิของ Steam
- ระบบการเติมน้ำเข้า Sample Tube
- ระบบการเติม Na OH
- ระบบการเติม H3BO3

รายงานผลการให้บริการ

1. TECHNICAL DATA

Main Supply 220 volt + 10% 50 Hz with ground
Nominal current

Pass ☒ ☒ Remark
N/A ☐ ☐ ..8a.....

1.1 COOLING WATER BATH

Temperature 15-20 °C
Cooling Water Outlet
Control Temperature

Pass ☒ ☒ ☒ Remark
N/A ☐ ☐ ☐ ..

1.2 OPTICAL TEST/AP300

Screw cap GL14
Screw cap GL18
Screw cap GL32
Distillation Head
Condensor
Viton Cone
Ventilation Valve BV
Micro Switch Sample
Agitator motor for propeller

Pass ☒ ☒ ☒ ☒ ☒ ☒ ☒ ☒ ☒ ☒ ☒ Remark
N/A ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☒ ..

2. SYSTEM COOLING WATER INLET

Cooling Water Inlet
Cooling Water Outlet
Flow control valve

Pass ☒ ☒ ☒ Remark
N/A ☐ ☐ ☐ ..

3.SYSTEM CONTROL

Display
Program
Adding NaOH
Adding H2O
Adding H3BO3
Suction Sample
Suction Receiver

Pass ☒ ☒ ☒ ☒ ☐ ☒ ☒ Remark
N/A ☐ ☐ ☐ ☐ ☒ ☒ ..

4.SYSTEM DISTILLATION

Boiler
Level Sensor
Novopren
Solenoid Valve Shut-Off
Solenoid Valve Steam
Solenoid Valve soft steam
Ventilation Valve Premount
Excess Pressure Detector
Heating Element

Pass ☒ ☒ ☒ ☒ ☒ ☒ ☒ ☒ ☒ Remark
N/A ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ..

5. PUMP

Pump H₂O Steam
- Non-Return Valve
Pump H₂O Sample
- Non-Return Valve
Pump NaOH
- Non-Return Valve
Pump H3BO3
- Non-Return Valve
Pump suction
Pump suction receiver

Pass ☒ ☒ ☒ ☒ ☒ ☐ ☐ ☒ ☐ Fail ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ N/A ☐ ☐ ☐ ☐ ☐ ☒ ☒ ☒ Remark
.....
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6. The Following Program Run :

Addition H2O 0-999 ml
Addition NaOH 0-999 ml
Addition H3BO3 0-999 ml
Reaction Time 0-108 min
Distillation Time 0-108 min
Steam Capacity 10%-100%
Suction Sample
Suction Receiver

Pass ☒ ☒ ☐ ☒ ☒ ☒ ☒ ☒ ☐ Fail ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ N/A ☐ ☐ ☒ ☐ ☐ ☐ ☐ ☒ Remark
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7. Measured pumps

Pump NaOH
Pump H2O
Pump H3BO3

Volume : 20.40.....ml
Volume : 19.00.....ml
Volume : ml
Remark
.....
.....
.....

Remark :

การบำรุงรักษาทั่วไป (Basic maintenance)

Glass parts and tubes must be heated only before starting analysis in order to prevent clogging by crystallizing chemicals.

The following sections are recommended for this:

Parameter	Value
H ₂ O solution	100 ml
NaOH solution	0 ml
Chlorination time	7 min
Chlorine power	500 %
Preheating time	0 s
Reaction sample	20 s

↑ Invert a reaction time (without sample) and start the process.

- At fixed carrying rate, observed in the case of strong oxidizing agents, 90 ml of sulphuric acid must be added in the reaction tank.

[illegible]



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



CERTIFICATE No : 23T8796
REFERENCE No : 70515-4

PAGE : 1 OF 2

Certificate of Calibration

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

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

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

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

F-G010 REV : 03



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

CERTIFICATE No : 23T8796

PAGE : 2 OF 2

Calibration Report

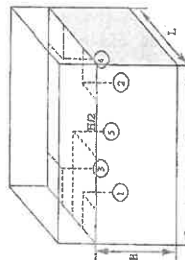
EQUIPMENT : WATER BATH
MANUFACTURER : MEMMERT
ID NUMBER : EQL-241
RECEIVED DATE : 16-Aug-23
AMBIENT TEMPERATURE : 25 °C ± 1 °C
RELATIVE HUMIDITY : 50 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO 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) MODEL 2625A
- 3) THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO., LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



GENERAL INFORMATION

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

BATH PERFORMANCE

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

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations					Uncertainty (± °C)
		#1	#2	#3	#4	Ref. 5	
83.0	83.0	83.08	83.09	83.06	83.11	83.12	0.15
92.0	92.0	92.11	92.13	92.10	92.16	92.16	0.19

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

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

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

END OF CALIBRATION REPORT

F-G010 REV : 03



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



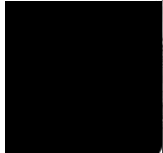
CERTIFICATE No : 24T1185
REFERENCE No : 72116-3

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 SOI 63, RAMA II RD., SAMAEDAM,
BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY : CHAICHARN CH
CALIBRATION DATE : 09-Feb-24

APPROVED BY : 
PONGSAK J.
ISSUED DATE : 12-Feb-24
RECEIVED DATE : 09-Feb-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 Petchbessam 63/2 Road, Laksoeng, Bangkok, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 24T1185

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : INCUBATOR
MANUFACTURER : MEMMERT
MODEL : IF 160
ID No : EQL-205
RECEIVED DATE : 09-Feb-24
AMBIENT TEMPERATURE : 25 °C ± 1 °C
SN : D518.0082
CALIBRATION DATE : 09-Feb-24
RELATIVE HUMIDITY : 53 %RH ± 10 %RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

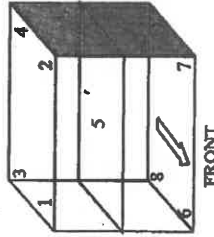
- 1) DATA LOGGER WITH RTD : MODEL : HYDRA 2635A : SERIAL No : 7301307 : CERTIFICATE No : 23T6636 : DUE DATE : 10-Jul-24
3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 1
Overall Line Voltage (V) variation : 3
Instrument Condition : Normal
Chamber Size (W*L*H): 56*40*72 cm



CHAMBER PERFORMANCE

Calibrate Point (°C)	Average All Position Temp. (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
35.0	35.03	0.05	0.09	0.16
36.0	36.05	0.07	0.08	0.19
41.5	41.45	0.08	0.13	0.20

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (± °C)
		#1	#2	#3	#4	Ref. 5	#6	#7	#8	#9	
35.0	35.0	34.98	35.01	35.00	35.00	35.02	35.08	35.07	35.04	35.10	0.25
36.0	36.0	36.00	36.03	36.03	36.02	36.04	36.09	36.10	36.04	36.12	0.25
41.5	41.5	41.45	41.45	41.39	41.46	41.46	41.47	41.43	41.44	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

F-G010 REV : 03



CERTIFICATE No : 24T1189
REFERENCE No : 72116-7

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : AUTOCLAVE
MANUFACTURER : HIRAYAMA
MODEL : HVE-50
SERIAL No : 30612085166
ID No : BQL-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 : 09-Feb-24

APPROVED BY :
ISSUED DATE : 12-Feb-24
RECEIVED DATE : 09-Feb-24

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



CERTIFICATE No : 24T1189

PAGE : 2 OF 2

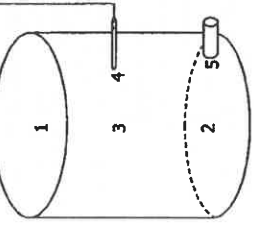
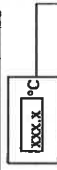
Calibration Report

EQUIPMENT : AUTOCLAVE
MANUFACTURER : HIRAYAMA
MODEL : HVE-50
ID NUMBER : BQL-155
SERIAL NUMBER : 30612085166
RECEIVED DATE : 09-Feb-24
CALIBRATION DATE : 09-Feb-24
AMBIENT TEMPERATURE : 30° C ± 1° C
RELATIVE HUMIDITY : 53 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BASED ON BS 2646-1:2021 BY COMPARISON WITH CALIBRATED RTD DATA LOGGERS UNDER NO LOAD CONDITION. THE SENSORS WERE PLACED ON FIVE LOCATIONS AS SHOWN IN THE PICTURE. THE SENSOR ON LOCATION 1 AND 2 WERE PLACED IN THE UPPER HALF AND LOWER HALF OF CHAMBER FREE SPACE RESPECTIVELY. THE THIRD SENSOR WAS PLACED WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE INSTRUMENT CHAMBER. SENSOR NUMBER 4 WAS ATTACHED TO THE LOAD TEMPERATURE PROBE, IF FITTED, WITHIN 15 mm OF ITS TIP. SENSOR NUMBER 5 WAS PLACED IN THE CHAMBER DRAIN OR VENT WITHIN 100 mm OF ITS CONNECTION TO THE CHAMBER.
2. REFERENCE STANDARD INSTRUMENTS :-
- 1) DATA LOGGER : MODEL : S350, S367 DV31 DN94
INSTRUMENT : VALPROBE
SERIAL No : 24T0890
CERTIFICATE No : 26-Jan-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 THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



GENERAL INFORMATION

Overall Ambient Temperature around the Chamber variation : 0.5 °C
Autoclave Condition : Normal
Chamber Size (Diameter*H): 30 * 71 cm

CHAMBER PERFORMANCE

Calibrate Point (°C)	Average all Position (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)	Pressure (MPa)	Holding time (min)	Operating Cycle time (min)
115	115.74	0.09	0.11	0.25	0.090	20	60
121	121.59	0.06	0.21	0.28	0.125	20	60

FRONT

TEMPERATURE MEASUREMENT ACCURACY TEST(°C)

Cont Temp		Measured Temperature (°C) at Spread Locations					Uncertainty (± °C)
		#1	#2	#3	#4	#5	
115	115	115.72	115.74	115.79	115.71	115.71	0.59
121	121	121.59	121.62	121.56	121.58	121.59	0.59

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

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

NOTE 3 : LOCATION 3 WAS REFERENCE LOCATION.

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

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

END OF CALIBRATION REPORT



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



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Siam Bangkok Bangkok Thailand 10500
Tel : 02-6324300 Fax : 02-6375486-7
www.barascientific.com

Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-166/24
Equipment UV/Vis Spectrophotometer
Model UV-1900I
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 63, Rama II Road, Samae 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 WI-UV-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 111398
Stray Light is traceable to certificate No. 106377
The above certificate are traceable to SI unit through Siam Scientific Ltd.
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr.Wanchana Janioey

Approved by



Mr.Sorithi Temboonsakdi
Service Manager

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.
Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced
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Certificate of Calibration

Number of Page(s) 2 of 3

Certificate No. BSCC-UV-166/24

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	879.43	0.02	0.18

2.Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
235	CNR	CNR	CNR	CNR
257	CNR	CNR	CNR	CNR
257	0.0000	0.0000	0.0000	0.0075
313	0.8354	0.8333	-0.0021	0.0075
313	CNR	CNR	CNR	CNR
350	CNR	CNR	CNR	CNR
350	0.0000	-0.0001	-0.0001	0.0075
350	0.6199	0.6190	-0.0009	0.0075

*CNR = Customer not request

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.
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www.barascientific.com



Bara Scientific Co., Ltd.
NSC-ONSC Calibration

Certificate of Calibration

Certificate No. BSCC-UV-16824 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	1.0052	0.0026	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
	0.6975	0.6971	-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
	0.5666	0.5673	0.0007	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)	Transmittance (%T)	Absorbance (A)
200.85±0.11nm	200.76	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 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 mentioned 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.



Certificate of Calibration



Equipment: SPECTROPHOTOMETER
Model: DR6000
Serial No. (or ID.): 1693421 (EQL-197)
Manufacturer: HACH
Condition: In Condition

Certificate No.: C06240163
Issued Date: 18 April 2024
Job No.: WO-00024883
Page: 1 of 3

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

Environment Condition:
Temperature 29.8 °C ± 0.1 °C
Humidity 45.7 %RH ± 6.9 %RH

Calibration Place: TEST TECH CO., LTD. (เลขที่ ๓๒)
30,32 Rama II Soi 63, Rama II Rd.,
Samaedam, Bangkhuntien Bangkok 10150 Thailand

Calibration By: Miss.Kaewkan Suradech
Calibration Date: 18 April 2024

The Method used: In house method, CAL-WI-24, base on ASTM E 275-08 and ASTM E 387-04
Traceability: This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Starna Scientific Limited.

The standard for Wavelength Certificate No. 118106 and 118118
The standard for Photometric Certificate No. 118123 and 118113
The standard for Stray light Certificate No. 118110 and 118112
The standard for Spectral resolution Certificate No. 118104

Person in charge
(Miss Kaewkan Suradech)
Authorized signatory
(Mr. Nitinun Srihawan)

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

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

Unit: Bara Scientific Co., Ltd.
2533 Sukhumvit Road, Bangkok, Phrahanong, Bangkok 10260
Phone: +66 2639 1000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth - in Asia and Beyond.

CAL-FM-C06-16:11 Mar 2024



Calibration Results:
Without Adjustment

Wavelength Accuracy (nm). The spectral bandwidth of Std at 2 nm and UUC at 2 nm				
Standard Wavelength	Unit Under Calibration	Correction	Uncertainty	
418.61	418.5	0.11	0.13	
536.66	536.7	-0.04	0.13	
637.98	637.9	0.08	0.13	
748.48	748.6	-0.12	0.13	
807.03	807.4	-0.37	0.13	
Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.5772	0.576	0.0012	0.0045
	0.7198	0.719	0.0008	0.0045
	1.0394	1.039	0.0004	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.5608	0.560	0.0008	0.0045
	0.7052	0.705	0.0012	0.0045
	1.0189	1.018	0.0009	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.5214	0.521	0.0004	0.0045
	0.6652	0.664	0.0012	0.0045
	0.9577	0.957	0.0007	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.5192	0.518	0.0012	0.0045
	0.6907	0.689	0.0017	0.0045
	0.9949	0.993	0.0019	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.5530	0.551	0.0020	0.0045
	0.7555	0.753	0.0025	0.0045
	1.0761	1.073	0.0031	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.5604	0.559	0.0014	0.0045
	0.7418	0.739	0.0028	0.0045
	1.0467	1.044	0.0027	0.0045



Calibration Results:
Without Adjustment

Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
235 nm	0.0000	0.000	0.0000	0.0080
	0.7533	0.748	0.0053	0.0080
257 nm	0.0000	0.000	0.0000	0.0080
	0.8745	0.869	0.0055	0.0080
313 nm	0.0000	0.000	0.0000	0.0080
	0.2926	0.293	-0.0004	0.0080
350 nm	0.0000	0.000	0.0000	0.0080
	0.6486	0.644	0.0046	0.0080
Stray light *				
Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%T)	Absorbance (A)	
260.95 +/- 0.11 nm	261.0	0.9		2.046
392.04 +/- 0.11 nm	392.0	1.3		1.886
Spectral Resolution *				
Nominal Concentration 0.02 % v/v	Peak	Trough	Ratio	SRW
Standard Wavelength (nm)	266.74	266.81	1.29	2.00
UUC: Wavelength (nm)	268.6	266.6		
Std Absorbance (A)	0.5137	0.3473		
UUC: Absorbance (A)	0.463	0.359		

* Calibration Marked "Not TSI Accredited" in this Certificate have been included for completeness.

The End of Certificate



บริษัท ไทยยูนิค จำกัด THAI UNIQUE CO., LTD.

80-82 ถนนประจักษ์ศิลปาคม แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200
80-82 Prachathipsai Rd., Bangkokphrom, Pranakorn, Bangkok 10200
Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawat@thaiunique.com, Website : www.thaiunique.com

ATOMIC ABSORPTION SPECTROMETER TEST CERTIFICATE

Certificate No : SV2310/21414
Instrument Type : Atomic Absorption Spectrometer
Model : AA240FS
Serial Number : EL08043418
Organization : Test Tech Co., Ltd.
Address : 30.32 Soi 66 Rama II Rd., Samadarn Bangkokhutin, Bangkok 10150
Date : 25 Oct 2023

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	55 %	Pass
K at 766.5 nm*	≤ 84 % or 540 V	64 %	Pass
Fe at 248.3 nm	≤ 80 % or 540 V	59 %	Pass
Mn at 279.5 nm	≤ 64 % or 380 V	46 %	Pass
Photometric noise Cu BGC off			
STDV @ 0 Abs	≤ 0.0001	0.0001	Pass



บริษัท ไทยยูนิค จำกัด THAI UNIQUE CO., LTD.

80-82 ถนนประจักษ์ศิลปาคม แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200
80-82 Prachathipsai Rd., Bangkokphrom, Pranakorn, Bangkok 10200
Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawat@thaiunique.com, Website : www.thaiunique.com

Wavelength accuracy			
Cu at 324.8 nm	323.0 nm - 326.0 nm	324.8 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	766.6 nm	Pass
Fe at 248.3 nm	246.8 nm - 249.8 nm	248.3 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	9.8 ml/min	Pass
Max Abs	≥ 0.75 Abs	0.81 Abs	Pass
Precision(%RSD)	≤ 0.5 %	0.2 %	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 Nachatuen
Date : 25 / Oct / 2023

APPROVED BY:

Signature: 
Engineer : Suchai Sangunkiatichai
Date : 25 / Oct / 2023



ICP02329207

PerkinElmer

MAINTENANCE AND TEST CERTIFICATE MODEL OPTIMA 8000

Customer : บริษัท เทคโนโลยี เทรด จำกัด
Address : 30, 32 ซอยพระรามที่ 2 ซอย 63
ถนนพระรามที่ 2 แขวงสามยุค
เขตบางขุนเทียน กรุงเทพมหานคร 10150
User Name: คุณลลิตา ศรีจันทร์
Phone: 02-893-4211-17
Fax: lab_center@testtech.co.th
Date Tested: May 18, 2023
Recommendation Recertification Period 12
Recertification Due: May 17, 2024
Date Last Certified: May 19, 2022
Visit Number: 1 of 1
PerkinElmer Phone: 02-719-6420 ext 206
PerkinElmer Fax: 02-318-5597

CONFIGURATION TESTED

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

TESTED EQUIPMENT

IPV Methods

TEST STANDARD USED

Mixed standard 1/10
Mixed standard 1/100

CUSTOMER SUPPLIED

2 % HNO3
10 % HNO3

ACCESSORIES/COMPONENT NOT INCLUDED

WinLab32 Version 5.5.0.0714
PN:6150T21E4Q1E

CALIBRATION NUMBER

EXPIRATION

EXPIRATION DATE

NOV 30, 2023
NOV 30, 2023

CUSTOMER INITIALS

Page 1 of 4

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



ICP02329207

MAINTENANCE AND TEST CERTIFICATE MODEL OPTIMA 8000

SERIAL NUMBER : 078S1411171C

DATE TESTED : May 18, 2023

1. MECHANICAL CHECKS

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

2. OPTICAL CHECKS

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

3. COOLING SYSTEM CHECKS

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

4. PERFORMANCE CHECKS

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

Page 2 of 4

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



ICP02329207

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 8000

SERIAL NUMBER : 078S1411171C		DATE TESTED : May 18, 2023	
PARAMETER	SPECIFICATION	FINAL VALUE	
Spectral Resolution : UV	As 193.696 nm	≤ 0.009 nm	0.00720 nm
	Ni 231.604 nm	≤ 0.011 nm	0.00892 nm
	Ni 341.476 nm	≤ 0.015 nm	0.01343 nm
	Ba 455.403 nm	≤ 0.020 nm	0.01726 nm
Precision			
Spectral Resolution : VIS	Zn 206.200 nm	% RSD ≤ 1.0 %	0.35 %
	Mg 280.271 nm	% RSD ≤ 1.0 %	0.19 %
	Mg 285.213 nm	% RSD ≤ 1.0 %	0.19 %
	Ba 455.403 nm	% RSD ≤ 1.0 %	0.13 %
Detection Limits : Axial	Tl 190.801 nm	3(SD) ppb ≤ 10 ppb	1.54 ppb
	As 193.696 nm	3(SD) ppb ≤ 10 ppb	2.10 ppb
	Se 196.026 nm	3(SD) ppb ≤ 5.0 ppb	2.43 ppb
	Pb 220.353 nm	3(SD) ppb ≤ 3.0 ppb	1.40 ppb
Detection Limits : Radial	As 193.696 nm	3(SD) ppb ≤ 60 ppb	4.44 ppb
	Zn 213.857 nm	3(SD) ppb ≤ 2.0 ppb	0.12 ppb
	Mn 257.610 nm	3(SD) ppb ≤ 1.0 ppb	0.05 ppb
	La 379.478 nm	3(SD) ppb ≤ 3.0 ppb	0.21 ppb
BEC : Axial (IB X 1000)/(S-IB)	Ba 455.403 nm	3(SD) ppb ≤ 0.3 ppb	0.01 ppb
	Ba 493.408 nm	3(SD) ppb ≤ 0.6 ppb	0.01 ppb
	Mn 257.610 nm	≤ 30 ppb	6.83 ppb
	Mn 257.610 nm	≤ 30 ppb	9.29 ppb

Page 3 of 4



ICP02329207

MAINTENANCE REPORT AND IPV TEST CERTIFICATE
OPTIMA 8000

SERIAL NUMBER : 078S1411171C

DATE TESTED : May 18, 2023

Remarks :

Commissioning follow as commissioning performance sheets.

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

☒ meets

☐ does not meet

the PerkinElmer Specifications listed on this certificate.

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

Service Department PerkinElmer Ltd.

Authorized Representative :

(Khwanchai Siangwong)
Customer Support Engineer

Page 4 of 4



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



Certificate of Calibration

Certificate No. : 23H2216
Page : 1 of 2

Equipment : Dial Thermo-Hygrometer
Manufacturer: Berigo
Model :
Serial No.: EQL-064
ID No.:
Condition As-Received: Used Item
Received Date: 12 October 2023
Calibration Date: 17 October 2023
Reference: to 20 October 2023
2310-0447DN
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, Bangkokhuthlan, Bangkok 10150

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

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Handheld Thermometer With Sensor	1523	3240076	231305	15 Mar 2024
2) Dew Point Hygrometer	Opildew 401	164756	TH-0156-22	13 Dec 2023

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

3.This Certificate is traceable to the International System of Unit maintained through:-

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

Calibrated by : Sunait Phansuindul
Issue Date : 28 October 2023

Approved Signatory :

[] Chakrit Waswanijula
[] Ponnthippa Tanwatsukul
[x] Viporn Tantiyawutti

B 0327545



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

Result of Calibration:-
Function: Humidity Measurement

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

Result of Calibration:-
Function: Temperature Measurement

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

UUC*: Unit Under Calibration

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

-o-o-

a 1185882



CERTIFICATE No : 23M6754
REFERENCE No : 69854-1

PAGE : 1 OF 2

Certificate of Calibration

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

CALIBRATED BY : PRASERT D.
CALIBRATION DATE : 13-Jul-23
APPROVED BY : 
ISSUED DATE : 17-Jul-23
RECEIVED DATE : 13-Jul-23

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



CERTIFICATE No : 23M6754

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : SARTORIUS
MODEL : BP210S
ID No : S0736477
AIR PRESSURE : 1011mbar $\pm$ 1mbar
AMBIENT TEMPERATURE : 23°C $\pm$ 1°C
CALIBRATION DATE : 13-Jul-23
RELATIVE HUMIDITY : 50 %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 :-

1) STANDARD WEIGHT SET : MODEL : SERIAL No : CERTIFICATE No : DUE DATE :
2) STANDARD WEIGHT : E2 : QK-1-151 : M2302013S : 02-Feb-25
15843 : M2302014S : 02-Feb-25

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

4. THIS 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 CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

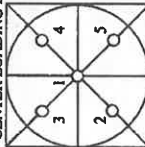
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

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

5. OFF CENTER LOADING ERROR



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

6. INTERNAL WEIGHT ERROR :0.0004959999999998177 g

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

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

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

END OF CALIBRATION REPORT





CERTIFICATE No : 23T8798
REFERENCE No : 70515-6

PAGE : 1 OF 2

Certificate of Calibration

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

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

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

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

F-G010 REV : 03



CERTIFICATE No : 23T8798

PAGE : 2 OF 2

Calibration Report

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

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.

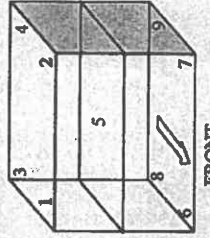
2. REFERENCE STANDARD INSTRUMENTS :-

- INSTRUMENT : DATA LOGGER WITH RTD
MODEL : HYDRA 2635A
SERIAL No : 7301307
CERTIFICATE No : 2376636
DUE DATE : 10-Jul-24
3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 1
Overall Line Voltage (V) variation : 10
Instrument Condition : Normal
Chamber Size (W*L*H): 36°40°48 cm



CHAMBER PERFORMANCE

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

TEMPERATURE MEASUREMENT ACCURACY TEST

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

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

NOTE 2: LOCATION 5 WAS REFERENCE LOCATION.

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



F-G010 REV : 03



CERTIFICATE No : 23T8799
REFERENCE No : 70515-7

PAGE : 1 OF 2

Certificate of Calibration

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

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

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

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

F-G010 REV : 03



CERTIFICATE No : 23T8799

PAGE : 2 OF 2

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TLAS G-20 BY COMPARISON WITH CALIBRATED RTD P100 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 :-

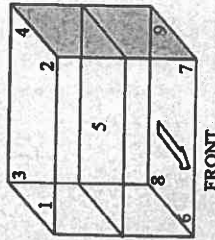
INSTRUMENT : MODEL : SERIAL No : CERTIFICATE No : DUE DATE :
1) DATA LOGGER WITH RTD : HYDRA 2635A : 7301307 : 23T6656 : 10-Jul-24
3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

GENERAL INFORMATION

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



CHAMBER PERFORMANCE

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

TEMPERATURE MEASUREMENT ACCURACY TEST

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

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

NOTE 2 : LOCATION 5 WAS REFERENCE LOCATION.

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

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

F-G010 REV : 03



Certificate of Calibration

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

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

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

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

Person in charge
(Miss Orawan Khlaiphloi)

Authorized signatory
(Mr. Nitnun Srihawan)

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Thailand 10260
Phone: +66 2353 7000 Email: info.calibration@dksh.com Website: www.dksh.com/certificate-thailand

Delivering Growth – In Asia and Beyond.

CAL-FM-C08-08: 20 Jul 2022



Certificate No.: C08230153

Page 2 of 2

Calibration Results:

Before Adjustment

Std Turbidity (NTU)	UUC Reading	Correction	Deviation	Uncertainty
0.050	0.088	-0.038	0.0	0.070
20.40	19.1	1.30	0.0	1.0
205.0	195	10.0	0.5	10
1028.0	952	78.0	0.9	50
4068.0	3942	126.0	0.9	200

After Adjustment

Std Turbidity (NTU)	UUC Reading	Correction	Deviation	Uncertainty
0.050	0.084	-0.034	0.0	0.070
20.40	20.4	0.00	0.0	1.0
205.0	205	0.0	0.5	10
1028.0	1028	2.0	0.5	50
4068.0	4063	5.0	0.5	200

The End of Certificate

DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Thailand 10260
Phone: +66 2353 7000 Email: info.calibration@dksh.com Website: www.dksh.com/certificate-thailand

Delivering Growth – In Asia and Beyond.

CAL-FM-C08-08: 20 Jul 2022

ใบรับรองการสอบเทียบ “เครื่องวัดความนำไฟฟ้า”
(Calibration Certificate of Conductivity Meter)

๗2



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert.No.: 24CH59
Page.: 1 of 3

Certificate of Calibration

Equipment :	Conductivity Meter
Manufacturer :	TOA
Model :	CM-41X
Serial No. :	842572
ID No. :	EQL-211
Condition As-Received:	Used Item
Received Date :	11 January 2024
Calibration Date :	15 January 2024
Reference :	2401-0300DN-1
Submitted by :	TEST TECH CO.,LTD. (HEAD Office) 30, 32 Rama II Soi 63, Rama II Rd., Samaedam, Bangkhunthian, Bangkok 10150
Ambient Temperature :	(25 ± 2.5) °C
Relative Humidity :	(50 ± 15) %
Calibration Procedure:	In-house method : - CP-CH6 by direct measurement with certified reference material (CRM) - CP-CH8 by comparison with standard thermometer

Calibrated by : Warakorn Lengagtrakul

Approved by :  Approved Signatory

(☒) Sathip Meangmai
() Warakorn Lengagtrakul
() Ponpan Paipim

Issue Date : 17 January 2024

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.



Condition of this result of calibration

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	1963878	130RC095	231051	05 Sep 2024
2) Ref. Std.Thermometer	4982054	110RC044	231908	26 Jul 2024

- This Certification is traceable to SI Through Technology Promotion Association (Thailand - Japan)

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

Conductivity Solution	Manufacturer	Lot No.	Exp. date
147.0 µS/cm	CPA Chem	913595	14 July 2024
1.413 mS/cm	CPA Chem	931955	30 Sep 2024
12.880 mS/cm	CPA Chem	913597	14 July 2024

- Control Conductivity calibration solution temperature by Water bath (25±0.1) °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 µS/cm

Conductivity Electrode Serial No.: 806F0005

Standard Conductivity Solution	After Adjustment UUC* Reading	Uncertainty of Measurement (±)	Coverage factor k
147.0 µS/cm	147.1 µS/cm	0.99 µS/cm	2.00
1.413 mS/cm	1.413 mS/cm	0.0092 mS/cm	2.00
12.880 mS/cm	12.88 mS/cm	0.086 mS/cm	2.00

Remark - UUC* = Unit Under Calibration

- Adjustment Cell constant = 147.0 µS/cm 96.8 m⁻¹, 1.413 mS/cm = 98.0 m⁻¹, 12.880 mS/cm = 99.4 m⁻¹



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 (± °C)	Coverage factor k
25.0	25.003	25.0	-0.003	0.13	2.00

Remark :- UUC* = Unit Under Calibration

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

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Metrology

SCI ECO Services Company Limited

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

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

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



Certificate No. T240070

Page 1 of 4

Certificate of Calibration

Equipment : Chamber (Cooling Room)
Manufacturer : -
Model : -
Serial No. : -
Customer Code : EQL-167
ID No. : T1447A1
Customer : Test Tech Co.,Ltd
30, 32 Rama II Soi 63, Rama II Rd., Samaedam,
Bangkhunthian Bangkok 10150

Customer Location : LABORATORY FLOOR 3

Date of Receipt : 12 January 2024

Calibrated By : Sujjar Naknakred (Site Calibration Manager)

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

Date of Issue : 24 JAN 2024

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 Metrology

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ใบรับรองการสอบเทียบ "ห้องเย็น"
(Calibration Certificate of Cool Room)



Metrology

SCI ECO Services Company Limited

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Certificate No. T240070

Page 2 of 4

Calibration Report

Equipment : Chamber (Cooling Room)
Date of Calibration : 16 January 2024
Environment : Temperature : 19.4-24.1 °C
Line Voltage : 221.3-226.1 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

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

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

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN161-TN170	T230773	10 April 2024
TC	TYPE T	TN161-TN170	T230773	10 April 2024
DATA LOGGER	34970A	T149	T230773	10 April 2024

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 - Hour 37 Minute At 3 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

() without adjustment

(X) after adjustment

Approved By



Approved By



Metrology

SCI ECO Services Company Limited

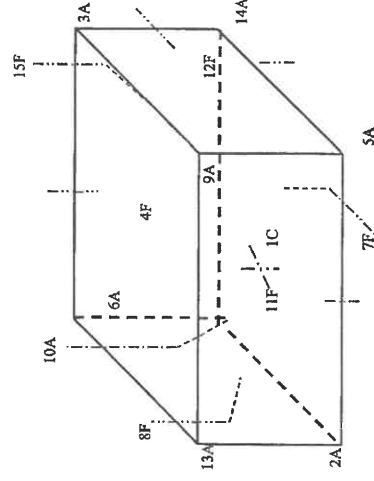
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Certificate No. T240070

Page 3 of 4

Calibration Report



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

1C =	TN161
2A =	TN162
3A =	TN163
4F =	TN164
5A =	TN165
6A =	TN166
7F =	TN167
8F =	TN168
9A =	TN169
10A =	TN170

11F =	TN161
12F =	TN162
13A =	TN163
14A =	TN164
15F =	TN165



Metrology

SCI ECO Services Company Limited

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NSC-TIS-TIS 17025
CALIBRATION 0244

Certificate No. T240070

Page 4 of 4

Calibration Report

Measurement Results:

Calibration Point	Average Standard Reading at each position (°C)									
	TN161	TN162	TN163	TN164	TN165	TN166	TN167	TN168	TN169	TN170
	3.17	3.11	3.11	3.33	2.94	3.06	2.95	3.17	2.86	2.59
3	TN161	TN162	TN163	TN164	TN165					
	2.74	2.95	2.75	2.95	2.85					

Chamber (Cooling Room)		Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)		Stability (± °C)	
	Min , Max	Average	Stability (± °C)		Uniformity (°C)	
3.0	2.9 , 3.1	3.0	2.97	0.29	0.64	0.80
					Coverage Factor k	2.00

* The quoted uncertainty exclude " uniformity "

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and piece 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. _____

FM-L15 118/18-08-66



Metrology

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

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

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

Certificate No. T240161

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 : 24 January 2024

Calibrated By : Preecha Phisassutthikul (Temperature Calibration Manager)

Approved By : _____ / Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 31 JAN 2024

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 Metrology.

FM-L14 119/18-08-66



Metrology

SCI ECO Services Company Limited

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



Certificate No. T240161

Page 2 of 4

Calibration Report

Equipment : Chamber (Cooling Room)
Date of Calibration : 29 January 2024
Environment : Temperature : 25.4-27.9 °C
Line Voltage : 223.4-227.1 V
Relative Humidity : 45 - 49 %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).
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	TN161-TN170	T230773	10 April 2024
TC	TYPE T	TN171-TN180	T230773	10 April 2024
DATA LOGGER	34970A	T149	T230773	10 April 2024

3. This certificate is traceable to :

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

4. Condition of calibrated item : good

Equipment Description :

Time Constant : 1 Hour
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

(X) without adjustment () after adjustment

Approved By

FM-L15 I18/18-08-66



Metrology

SCI ECO Services Company Limited

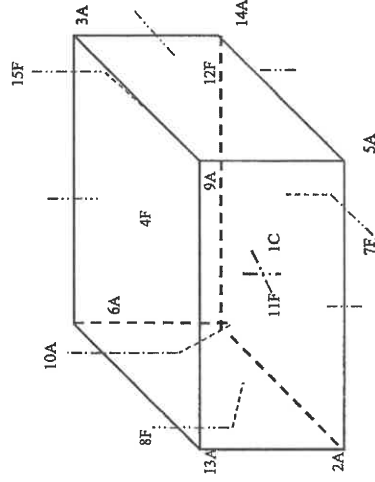
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Certificate No. T240161

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Calibration Report



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

1C =	TN161
2A =	TN162
3A =	TN163
4F =	TN164
5A =	TN165
6A =	TN166
7F =	TN167
8F =	TN168
9A =	TN169
10A =	TN170
11F =	TN171

12F =	TN172
13A =	TN173
14A =	TN174
15F =	TN175

Approved By

FM-L15 I18/18-08-66



Metrology
SCECO Services Company Limited

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



Certificate No. T240161

Page 4 of 4

Calibration Report

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)									
	TN161	TN162	TN163	TN164	TN165	TN166	TN167	TN168	TN169	TN170
3.0	2.81	3.01	2.99	2.87	2.92	3.08	3.04	2.93	3.31	3.10
	TN171	TN172	TN173	TN174	TN175					
	3.08	3.10	3.40	3.00	3.24					

Chamber (Cooling Room)		Temperature Distribution			
		Reading (°C)	Average (°C)	Stability (±°C)	Uniformity (°C)
Setting (°C)	Min, Max	Average			Uncertainty (±°C)
3.0	2.8, 3.1	3.0	3.06	0.40	0.92
					1.07
					2.00

* The Annotated 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. _____



MAINTENANCE AND IPV TEST CERTIFICATE MODEL
OPTIMA 8000

Customer : บริษัท เทคโนโลยี อวกาศ จำกัด.	Date Tested: May 14, 2024
Address : 30/32 ซอยพหลโยธิน 2 แขวง 63 ถนนพหลโยธิน เขตจตุจักร กรุงเทพฯ 10110	Recommendation Recertification
User Name : คุณสุวิทย์ อธิปสรกุล	Period 12 Months
Phone: 02-893-4211-17	Recertification Due: May 14, 2025
Fax: lab_center@iastech.co.th	Date Last Certified: May 18, 2023
	Visit Number: 1 of 1
	PerkinElmer Phone: 02-719-6420 ext 206
	PerkinElmer Fax: 02-318-5597

CONFIGURATION TESTED	
MODEL	SERIAL NUMBER
OPTIMA 8000 (EQL-180)	078S1411171C
TESTED EQUIPMENT IPV Methods	SOFTWARE ICP WinLab32 version 5
	EXPIRATION
TEST STANDARD USED Multiement Standard Instrument Cal. STD4	EXPIRATION DATE Dec 30, 2024 Nov 30, 2024
CUSTOMER SUPPLIED 2 % HNO3 10 % HNO3	CUSTOMER INITIALS



MAINTENANCE AND IPV TEST CERTIFICATE MODEL
OPTIMA 8000

SERIAL NUMBER: 078S1411171C	DATE TESTED: May 14, 2024
1. MECHANICAL CHECKS	
A. Inspect and clean all fans and filters.	OK
B. Inspect and replace as necessary, all torch components including the RF coil.	OK
C. Inspect all tubing for sign of clacking or leaking.	OK
D. Adjust water and gas pressure regulator settings.	OK
E. Inspect and leak check pneumatics drawers.	OK
F. Clean the exterior of the instrument.	OK
2. OPTICAL CHECKS	
A. Inspect and clean all optical components.	OK
B. As required, check and replace all purge filters.	OK
C. Recheck optical alignment.	OK
3. COOLING SYSTEM CHECKS	
A. Perform preventive maintenance on chiller.	OK
B. Flush out the chiller every six months.	OK
4. PERFORMANCE CHECKS	
A. Torch View Alignment.	OK
B. Wavelength Calibration.	OK

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	0.00913 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(scd) ≤ 10.0 ppb	1.00 ppb
As 193.696 nm	3(scd) ≤ 10.0 ppb	3.32 ppb
Se 196.026 nm	3(scd) ≤ 5.0 ppb	3.88 ppb
Pb 220.353 nm	3(scd) ≤ 3.0 ppb	1.45 ppb
Detection Limits : Radial		
As 193.696 nm	3(scd) ≤ 60.0 ppb	3.41 ppb
Zn 213.857 nm	3(scd) ≤ 2.0 ppb	0.30 ppb
Mn 257.610 nm	3(scd) ≤ 1.0 ppb	0.03 ppb
La 379.478 nm	3(scd) ≤ 3.0 ppb	0.27 ppb
Ba 455.403 nm	3(scd) ≤ 0.3 ppb	0.05 ppb
Ba 493.408 nm	3(scd) ≤ 0.6 ppb	0.06 ppb
BEC : Axial (IB X 1000)/(S-IB)		
Mn 257.610 nm	≤ 30 ppb	10.70 ppb
BEC : Radial (IB X 1000)/(S-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 :

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

☒ meets

does not meet

the PerkinElmer Specifications listed on this certificate.

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

Service Department PerkinElmer Scientific (Thailand) Co., Ltd.

Customer Service Engineer:

(~~Narong Watanakit~~)
Service Engineer