

CAL

Calibratech Co.,Ltd.

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

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



Certificate of Calibration

Certificate No. : 66-420087-1

Page : 1 of 2

Submitted by : M Green Group Co.,Ltd.

188/46 Wisatesukhakhon 25, Pracha-Uttd 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 : Permpoon Chanpu

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

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

1. Multiproduct Calibrator

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

2. Standard Buffer Solution

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

Approved by :

(Surachai Promthong)

Laboratory Manager

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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%

- o()o -

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

CAL-F0031-03



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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 Wisatesukhakhon 25, Pracha-Uttd Rd., Thungkru Bangkok 10140 Thailand

Equipment : Digital Thermometer with Thermistor probe

Temperature Indicator

Manufacturer : Eutech

Model : pH 700

Range : N/A °C

Resolution : 0.1 °C

Serial No. : 2884323

ID No. : N/A

Thermistor probe

Model : N/A

Sheath Material : Stainless

Diameter : 3.2 mm.

Length : 100 mm.

Serial No. : PH5TEMB01P

ID No. : N/A

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

Ambient Temperature : (25.0 to 26.0) °C

Relative Humidity : (56 to 60) %

Line Voltage : (224.0 to 225.2) VAC

Date of Received : 20 September 2023

Date of Calibration : 20 September 2023

Date of Issue : 25 September 2023

Calibrated by : Permpon Chanpu

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4003 by compared with PRT in the liquid bath at the constant controlled temperature.

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

ID No. Cert. No. Due Date Traceability

400002 TT-0074-22 20 Jun 2024 National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No. Cert. No. Due Date Traceability

400033 22E569 22 Feb 2024 National Institute of Metrology Thailand (NIMT)

Approved by :

(Surachai Promthong)

Laboratory Manager

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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.

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- o0o -

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CAL-F0031-03



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NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 66-200300-1

Page : 1 of 2

Submitted by : M Green Group Co., Ltd.

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

Equipment : Electronic Balance

Manufacturer : SHIMADZU Model : AP225WD

Serial No. : D316300690

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

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

Ambient Temperature : (25.6 to 26.7) °C

Relative Humidity : (54.4 to 56.6) %

Air Pressure : 1010.0 mbar

Date of Received : 20 September 2023

Date of Calibration : 20 September 2023

Date of Issue : 22 September 2023

Calibrated by : Akaradath Thippichai

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

Edition 7 - November 2022

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

Standard Weights

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

Approved by : 

(Surachai Promthong)

Laboratory Manager

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Certificate of Calibration

Certificate No. : 66-200300-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

| Nominal Value (g) | Correction (g) | Uncertainty ± (g) |
|----------------------|-------------------|----------------------|
| 0.001 | 0.00000 | 0.000012 |
| 0.01 | 0.00000 | 0.000013 |
| 0.1 | 0.00000 | 0.000015 |
| 1 | 0.00000 | 0.000026 |
| 10 | 0.00000 | 0.000053 |
| 20 | -0.00003 | 0.000071 |
| 50 | 0.00004 | 0.00011 |
| 100 | -0.00009 | 0.00020 |
| 150 | 0.0000 | 0.00038 |
| 200 | -0.0001 | 0.00038 |

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

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

Eccentric error Load test : 50 g
A B C D E
-0.00003 0.00000 0.00000 -0.00005 0.00000 g



Repeatability Load test : 200 g
Stddev. : 0.000048 g

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NSC-TISI-TIS 17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 66-400531-1

Page : 1 of 2

Submitted by : M Green Group Co., Ltd.

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

Equipment : Liquid in Glass Thermometer

Manufacturer : N/A

Model : N/A

Range : 0 °C to 100 °C

Resolution : 1 °C

Serial No. : N/A

Immersion : Total

ID No. : 94-49747

Environment : Ambient Temperature : (23 ± 2) °C

Relative Humidity : (50 ± 15) %

Line Voltage : (220 ± 22) VAC

Date of Received : 21 September 2023

Date of Calibration : 23 September to 26 September 2023

Date of Issue : 26 September 2022

Calibrated by : Chortip Samchusri

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4001 based on ASTM E77-07 by compared with PRT in the liquid bath at the constant controlled temperature.

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

| ID No. | Cert. No. | Due Date | 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

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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

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- o0o -

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CAL-F0031-03



CAL-F0031-03

Certificate of Calibration

Certificate No. : 66-400520-1

Page : 1 of 2

Submitted by :

M Green Group Co., Ltd.

188/46 Wisatesukhakhon 25, Pracha-Utid 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 :

Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

Standard Digital Thermometer with RTD Probe

ID No. Cert. No. Due Date Traceability

400046 & 400042 66-400453-1 31 Jan 2024 National Institute of Metrology Thailand (NIMT)

Approved by :

(Surachai Promthong)

Laboratory Manager

Certificate of Calibration

Certificate No. : 66-400520-1

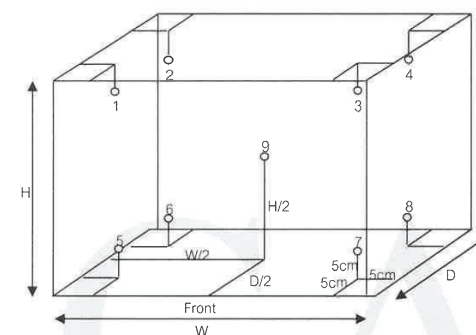
Page : 2 of 2

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%

- oOo -



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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 Wisatesukhakhon 25, Pracha-Utid 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 : (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 : Permpoon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

Standard Digital Thermometer with 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

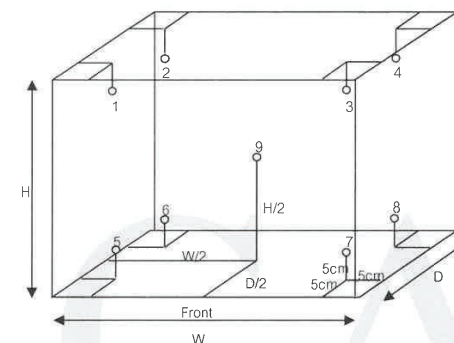
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



Inside of Chamber

W = 0.56 m

D = 0.40 m

H = 0.48 m

Capacity = 0.11 m³

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

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

Remark The uncertainty is not combine uniformity of the air chamber

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

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

- o0o -

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

CAL-F0031-03



Certificate of Calibration

Certificate No. : 66-400520-3

Page : 1 of 2

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

Equipment : Water Bath
Manufacturer : Memmert Model : WNB29
Range : N/A °C Resolution : 0.1 °C
Serial No. : L619.0037 ID No. : N/A

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

Ambient Temperature : (25.0 to 26.0) °C

Relative Humidity : (40 to 50) %

Line Voltage : (226.0 to 230.0) V

Date of Received : 20 September 2023

Date of Calibration : 20 September 2023

Date of Issue : 25 September 2023

Calibrated by : Permpoon 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

Certificate of Calibration

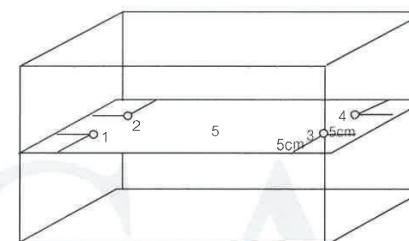
Certificate No. : 66-400520-3

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement



Front

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

Remark The uncertainty is not combine uniformity of the water bath

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

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

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Certificate of Calibration

Certificate No. : 66-400520-4

Page : 1 of 2

Submitted by : M Green Group Co., Ltd.

188/46 Wisatesukhakhon 25, Pracha-Utid 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. | Due Date | Traceability |
|-----------------|-------------|-------------|---|
| 400029 & 400043 | 66-400226-1 | 27 Oct 2023 | National Institute of Metrology Thailand (NIMT) |

Approved by :
(Surachai Promthong)
Laboratory Manager

Certificate of Calibration

Certificate No. : 66-400520-4

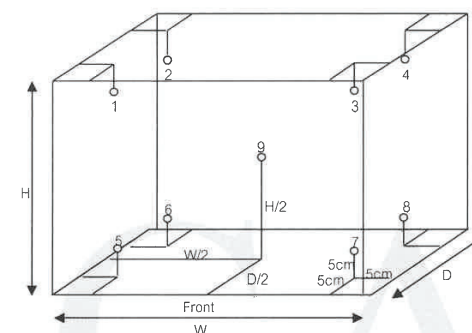
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



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

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

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

Remark The uncertainty is not combine uniformity of the air chamber

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Certificate of Calibration

Certificate No. : 66-300589-7

Page : 1 of 2

Submitted by : M Green Group Co., Ltd.

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

Equipment : Burette

Manufacturer : GLASSCO

Class : A

Capacity : 10 ml

Graduation : 0.05 ml

ID No. : 2212-0344-1

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

Relative Humidity : (50 ± 10) %

Air Pressure : 1006.7 mbar.

Date of Received : 20 September 2023

Date of Calibration : 27 September 2023

Date of Issue : 27 September 2023

Calibrated by : Wipa Tovadee

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

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

Electronic Balance

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

Approved by :

(Wipa Tovadee)

Supervisor

CAL

Calibratech Co.,Ltd.

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

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

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 \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 -

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03



CAL-F0031-03

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



Certificate of Calibration

Certificate No. : 66-300589-8

Page : 1 of 2

Submitted by : M Green Group Co., Ltd.

188/46 Wisatesuknakhon 25, Pracha-Utid 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

CAL

Calibratech Co.,Ltd.

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

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

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%

-o0o-

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03



CAL-F0031-03

CAL

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

Certificate of Calibration

Certificate No. : 66-300590-1

Page : 1 of 2

Submitted by : M Green Group Co., Ltd.

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

Equipment : Imhoff Cone

Manufacturer : VITLAB

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

ID No. : CY1000/01/22

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

Relative Humidity : (50 ± 10) %

Air Pressure : 1005.4 mbar.

Date of Received : 20 September 2023

Date of Calibration : 26 September 2023

Date of Issue : 26 September 2023

Calibrated by : 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 Tovadec)

Supervisor

CAL

Calibratech Co.,Ltd.

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

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

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 \pm 0.17 ml

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

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

- o0o -

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03



CAL-F0031-03



การดูแลบำรุงรักษาเชิงป้องกัน

Preventive Maintenance



บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด

ฝ่ายบริการหลังการขาย

โทร 0 2 639 7000 E-mail: service.tec.th@dksh.com

ฝ่ายขายและการตลาด

โทร 0 2 639 7000 E-Mail : marketing.tec.th@dksh.com

Website : www.dksh.co.th/technology/scientific-thailand

เงื่อนไขการให้บริการ Preventive Maintenance

Type text here

บริษัทฯ จะส่งวิศวกรผู้ชำนาญ เพื่อให้บริการตามขอบข่ายของการบริการ เฉพาะ ในวันและเวลา ราชการ หากมีความประสงค์ที่จะรับบริการนอกเหนือจากวัน เวลา ราชการ (วันหยุดเสาร์ – อาทิตย์ หรือวันหยุด นักชดถุกษ์) บริษัทฯ จะคิดค่าบริการเพิ่มเติมตามอัตราที่กฎหมายแรงงานกำหนดไว้

ขอบข่ายการบริการ

- ตรวจสอบสภาพการทำงานต่าง ๆ ของเครื่องมือ
- ทดสอบประสิทธิภาพการทำงานของเครื่องมือ
- รายการผลการตรวจสอบเครื่องมือ

หมายเหตุ

- ราคานี้ไม่รวมถึงค่าบริการซ่อม 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 ...1...ครั้ง ต่อปี
ครั้งที่ 1 วันที่ 19/04/2024.....

รายละเอียดผู้รับบริการ

| | | | |
|----------|---|-------|-------------|
| หน่วยงาน | บริษัท เทสท์ เทค จำกัด | | |
| ที่อยู่ | 30,32 ซอยพระรามที่ 2 ซอย 63 ถนนพระรามที่ 2 แขวงสามค่าเขตบางขุนเทียน กรุงเทพมหานคร 10150 | | |
| โทรศัพท์ | 0-2893-4211-7 | แฟกซ์ | 0-2893-4218 |

ผู้ติดต่อ

| | | | | |
|----------------|---------------------------|----------|---|---------|
| ชื่อ - นามสกุล | คุณกรรณก ขุนพิทักษ์ | | | |
| ตำแหน่ง | หัวหน้าส่วน | | | |
| โทรศัพท์ | 087 398 9274 | เบอร์ต่อ | - | 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: sudarat.sk@dksh.com | |
| เจ้าหน้าที่ประสานงาน : คุณสุดาร์ตนี ศิริรัตน์ โทรศัพท์ 090 678 6925 | |
| เจ้าหน้าที่ผู้ให้บริการ | นายจิรายุส สเลอาด |
| ตำแหน่ง | Specialist, Technical Service. |
| โทรศัพท์ | 0938138736 แฟกซ์ - |
| E-mail | Jirayut.js@dksh.com |

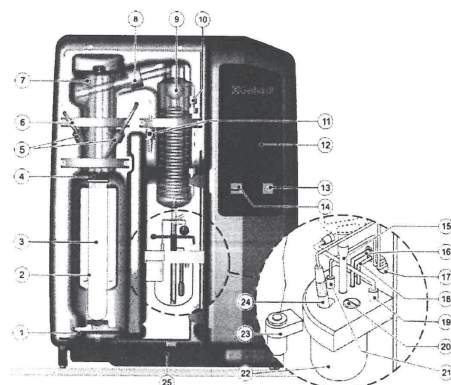
| | | | |
|--------------------------|-------------------------------|--------------------------|--------------------------------|
| ลงนามผู้รับบริการ | กรรณก ขุนพิทักษ์ | ลงนามผู้ให้บริการ | |
| ตัวบรรจง | (นางสาวกรรณก ขุนพิทักษ์.....) | ตัวบรรจง | (นายจิรายุส สเลอาด) |
| ตำแหน่ง | หัวหน้าส่วนทดสอบ | ตำแหน่ง | Specialist, Technical Service. |
| วันที่ / ประทับตราบริษัท | 19/04/2024 | วันที่ / ประทับตราบริษัท | 19/04/2024 |

JOB No: LSPR2402440.....MODEL:VAP300.....S/N: GER5300210095

Operational Qualification (OQ)

ตรวจสอบสภาพเครื่อง

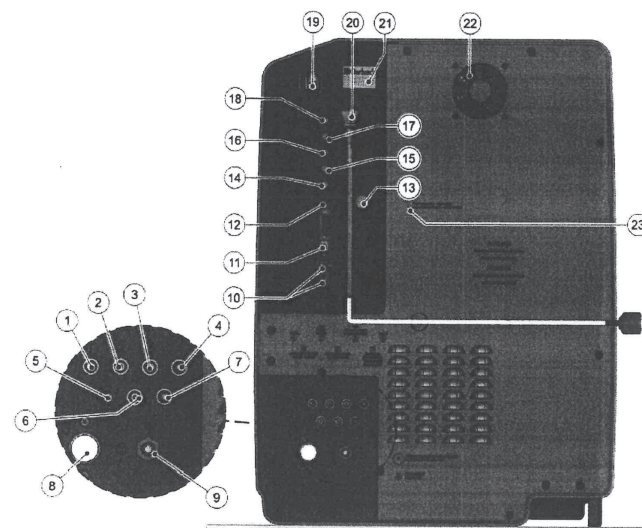
FRONT



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

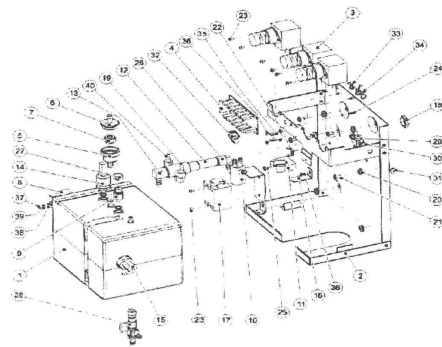
** only VAP 450

REAR



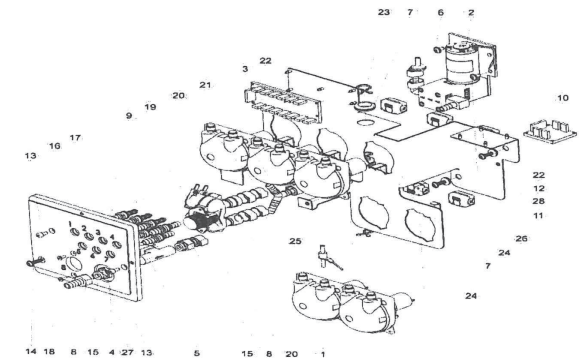
| No | | PASS | FAIL | N/A |
|----|---|-------------------------------------|--------------------------|-------------------------------------|
| 1 | Tube connection for sample H3BO3 supply | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2 | Tube connection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

Inside Steam generator



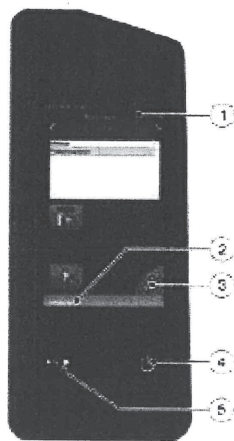
| No | | PASS | FAIL | N/A |
|----|---|-------------------------------------|--------------------------|--------------------------|
| 1 | Steam generator | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2 | Steam generator traverse | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3 | Pinch valve | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4 | Circuit board distributor | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5 | Valve tubing connection | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6 | Housing safety valve | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 7 | Safety valve SKT | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8 | Excess temperature protection , steam generator | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9 | Safety valve G 1/8 0,5 bar | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10 | Ventilation glass pinch valve VAPODEST | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 11 | Hose clamp for ventilation clamp | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 12 | Distributor PP | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 13 | Angle connection PP | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 14 | Pressure transmitter | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 15 | Level switch | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 16 | Fixing bracket steam generator | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 17 | Relay HT+ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 18 | VA Hexagon nut 1/2" | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 19 | Angle connection 1/8" | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 20 | Bushing nipple 6-10-14 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 21 | VA Lens head screw M5 X 10 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 22 | Grounding connection , 2-pole | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 23 | VA Lens head screw M4 X 6 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 24 | Spacer bolt 5 mm | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 25 | VA Lens head screw M4 X 10 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 26 | Tubing connection | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 27 | Hose clamp 14.5 mm | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 28 | Module ball valve with nozzles | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 29 | Cross manifold with spout | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 30 | Seal copper G 1/8 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 31 | Locking screw 1/8" | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 32 | Pin strip | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 33 | Bundle clamp 12 H 4500 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 34 | Bundle clamp 12 H 4502 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 35 | Temperature switch 80°C | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 36 | VA Lens head screw M3 X 6 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 37 | VA Hexagon nut M4 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 38 | Lins head screw M4 X 8 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 39 | VA Spring washer | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 40 | Angle connection , reduced , 1/8" PP | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Module Pump holder VAP200 - 450 V3



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

Control panel



| No | | PASS | FAIL |
|----|--------------------------------------|-------------------------------------|--------------------------|
| 1 | Title bar | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 2 | Status bar | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 3 | Navigation button | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 4 | Smart switch with multiple functions | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 5 | USB interface | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

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)

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

รายงานผลการให้บริการ

1. TECHNICAL DATA

| | Pass | Fail | N/A | Remark |
|--|-------------------------------------|--------------------------|--------------------------|--------------|
| Main Supply 220 volt + 10% 50 Hz with ground | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Norminal current | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |8a..... |

1.1 COOLING WATER BATH

| | Pass | Fail | N/A | Remark |
|----------------------|-------------------------------------|--------------------------|--------------------------|--------|
| Temperature 15-20 °C | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Cooling Water Outlet | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Control Temperature | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |

1.2 OPTICAL TEST

| | Pass | Fail | N/A | Remark |
|------------------------------|-------------------------------------|--------------------------|-------------------------------------|--------|
| Screw cap GL14 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Screw cap GL18 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Screw cap GL32 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Distillation Head | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Condensor | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Viton Cone | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Ventilation Valve BV | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Micro Switch Sample | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Agitator motor for propeller | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |

2. SYSTEM COOLING WATER INLET

| | Pass | Fail | N/A | Remark |
|----------------------|-------------------------------------|--------------------------|--------------------------|--------|
| Cooling Water Inlet | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Cooling Water Outlet | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Flow control valve | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |

3.SYSTEM CONTROL

| | Pass | Fail | N/A | Remark |
|------------------|-------------------------------------|--------------------------|-------------------------------------|--------|
| Display | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Program | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Adding NaOH | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Adding H2O | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Adding H3BO3 | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| Suction Sample | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Suction Receiver | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |

4.SYSTEM DISTILLATION

| | Pass | Fail | N/A | Remark |
|----------------------------|-------------------------------------|--------------------------|--------------------------|--------|
| Boiler | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Level Sensor | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Novopren | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Solenoid Valve Shut-Off | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Solenoid Valve Steam | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Solenoid Valve soft steam | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Ventilation Valve Premount | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Excess Pressure Detector | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Heating Element | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |

5. PUMP

| | Pass | Fail | N/A | Remark |
|------------------------------|-------------------------------------|--------------------------|-------------------------------------|--------|
| Pump H ₂ O Steam | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| - Non-Return Valve | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Pump H ₂ O Sample | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| - Non-Return Valve | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Pump NaOH | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| - Non-Return Valve | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Pump H3BO3 | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| - Non-Return Valve | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| Pump suction | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Pump suction receiver | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |

6. The Following Program Run :

| | Pass | Fail | N/A | Remark |
|-----------------------------|-------------------------------------|--------------------------|-------------------------------------|--------|
| Addition H2O 0-999 ml. | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Addition NaOH 0-999 ml. | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Addition H3BO3 0-999 ml. | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| Reaction Time 0-108 min | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Distillation Time 0-108 min | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Steam Capacity 10%-100% | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Suction Sampe | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Suction Receiver | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |

7. Measured pumps

| | | |
|------------|----------------------------|-------|
| Pump NaOH | Volume :20.40.....ml | |
| Pump H2O | Volume :10.00.....ml | |
| Pump H3BO3 | Volume :ml | |

Remark :

ข้อมูลสนับสนุนด้านเทคนิค (General Technical Support)

การบำรุงรักษาทั่วไป (Basic maintenance)

Cleaning program

Glass parts and tubes must be rinsed daily before starting analysis in order to prevent clogging by crystallising chemicals.
The following settings are recommended for this:

| parameters | Value |
|---------------------------|--------|
| H ₂ O addition | 150 ml |
| NaOH addition | 0 ml |
| Distillation time | 7 min |
| Steam power | 100 % |
| Reaction time | 0 s |
| Suction sample | 30 s |

→ Insert a digestion tube (without sample) and start the program.

→ All liquid carrying parts are cleaned. In the case of strong soiling, approx. 10 ml of sulphuric acid can also be added to the digestion tube.

General error message

| Fault description | Cause | Remedy |
|--|-------------------------------------|---|
| 'Cooling water flow volume too low' | Cooling water pressure under 1 bar | <ul style="list-style-type: none"> Open water tap. Check coolant pressure. Check coolant tube. <p>Program continues automatically once error has been fixed.</p> |
| 'Sample tube missing' | Sample tube missing. | <ul style="list-style-type: none"> Insert sample tube. <p>Continue program or restart.</p> |
| 'Distillation room protective door open' | Protection door not closed | <ul style="list-style-type: none"> Close protection door. <p>Program continues automatically once error has been fixed.</p> |
| 'Reagent storage/waste' | One or more storage tanks are empty | <ul style="list-style-type: none"> Fill storage tank. Check correct seating of the universal sensors. <p>The running program can be continued after rectification of the error.</p> |
| | The sample waste tank is full. | <ul style="list-style-type: none"> Empty sample waste tank. Check correct seating of the universal sensors. <p>The running program can be continued after rectification of the error.</p> |

Analytical errors

| Fault description | Cause | Remedy |
|--------------------------------------|--|--|
| Analysis results too high | <p>The chemicals used are contaminated with nitrogen compounds.</p> <p>Violent reaction in the digestion tube, sodium hydroxide drops get into the receiver.</p> <p>Glass bridge of the condenser is broken or worn out, sodium hydroxide drops get into the receiver.</p> <p>Glass cleaning agents in the digestion tube.</p> <p>Entrainment of ammonia from the previous sample.</p> | <ul style="list-style-type: none"> Defatted checking of the chemicals. Determination of a blank value. Replace the chemicals if necessary. Increase of the water addition amount. Replacement of the glass condenser. Clean digestion tube in advance with distilled water. Increase distillation time. Check whether the sample was previously sufficiently alkalised. |
| Analysis result too low or no result | <p>Incomplete distillation; distillation time too short.</p> <p>Ammonia escapes at leaking places.</p> | <ul style="list-style-type: none"> No quantitative expulsion of the ammonia content. The distillation amount should be 100 ml. Sealed or defective Viton plugs; clean or replace. Check seals (GL screw connections) on the distribution head; replace if necessary. Check valve at the condenser is gummed up; clean or replace. Digestion tube is damaged at the neck extension. Distribution head glass leaks; replace. Check the constant flow rate of the NaOH pump (see Technical Data). |
| | <p>Addition amount of the sodium hydroxide too little; no ammonia development.</p> <p>Too low boric acid amount in the receiver; escaping ammonia is not completely bonded.</p> <p>Tube not completely immersed in the acid receiver.</p> <p>Formation of stable ammonia compounds which are not destroyed with sodium hydroxide.</p> | <ul style="list-style-type: none"> Increase of the boric acid amount. Increase of the acid amount. This problem only occurs with catalysts containing mercury. Sodium sulphate solution destroys these compounds. |



CERTIFICATE No : 23T8796
REFERENCE No : 70515-4

PAGE : 1 OF 2

Certificate of Calibration

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

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

APPROVED BY :
PONGSAK J.
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



CERTIFICATE No : 23T8796

PAGE : 2 OF 2

Calibration Report

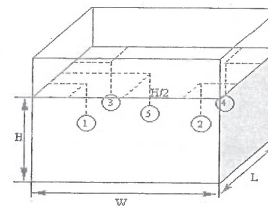
EQUIPMENT : WATER BATH
MANUFACTURER : MEMMERT
ID NUMBER : EQL-241
RECEIVED DATE : 16-Aug-23
AMBIENT TEMPERATURE : 25 °C ± 1 °C
MODEL : WNE 45
SERIAL NUMBER : L720.0266
CALIBRATION DATE : 16-Aug-23
RELATIVE HUMIDITY : 50 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

- 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.
- REFERENCE STANDARD INSTRUMENTS :-

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



PROBE INSTALLATION
POSITION IN THE BATH

GENERAL INFORMATION

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

BATH PERFORMANCE

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

TEMPERATURE MEASUREMENT ACCURACY TEST

| Controller Temp (°C) | Indicating Temp (°C) | Measured Temperature (°C) at Spread Locations | | | | | Uncertainty (± °C) |
|----------------------|----------------------|---|-------|-------|-------|--------|--------------------|
| | | #1 | #2 | #3 | #4 | 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 Petchkasem 63/2 Road, Laksong, Bangkae, 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 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 24T1185

PAGE : 2 OF 2

Calibration Report

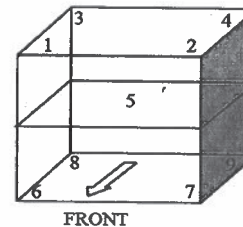
EQUIPMENT : INCUBATOR
MANUFACTURER : MEMMERT
MODEL : IF 160
ID No : EQL-205
RECEIVED DATE : 09-Feb-24
AMBIENT TEMPERATURE : 25 °C ± 1 °C
S/N : D518.0082
CALIBRATION DATE : 09-Feb-24
RELATIVE HUMIDITY : 53 %RH ± 10 %RH

CONDITION OF THIS RESULTS OF CALIBRATION

- 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 :-

| INSTRUMENT | MODEL | SERIAL No | CERTIFICATE No | DUE DATE |
|---|-------------|-----------|----------------|-----------|
| 1) DATA LOGGER WITH RTD | HYDRA 2635A | 7301307 | 23T6636 | 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



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Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com



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 : 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 : 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



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Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com

CERTIFICATE No : 24T1189

PAGE : 2 OF 2

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

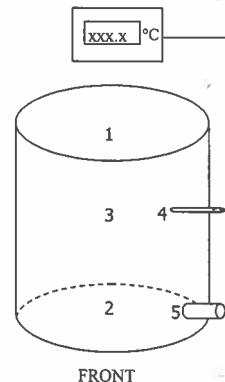
1. THIS INSTRUMENT WAS CALIBRATED BASED ON BS 2646-1:2021 BY COMPARISON WITH CALIBRATED RTD DATA LOGGERS UNDER NO LOAD CONDITION. THE SENSORS WERE PLACED ON FIVE LOCATIONS AS SHOWN IN THE PICTURE. THE SENSOR ON LOCATION 1 AND 2 WERE PLACED IN THE UPPER HALF AND LOWER HALF OF CHAMBER FREE SPACE RESPECTIVELY. 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 :-

| INSTRUMENT | MODEL | SERIAL No | CERTIFICATE No | DUE DATE |
|----------------|----------|---------------------|----------------|-----------|
| 1) DATA LOGGER | VALPROBE | S350,S367,DV35,DN94 | 24T0890 | 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 |

TEMPERATURE MEASUREMENT ACCURACY TEST (° C)

| Cont Temp | Ind 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

F-G010 REV : 03



Bara Scientific Co., Ltd.
968 U Chu Liang Building Floor7 Rama4 Road
Silom Bangrak 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-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 Sarna Scientific Ltd.
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr.Wanchana Janloey

Approved by

Mr.Sonthi 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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www.barascientific.com



Certificate of Calibration

Certificate No. BSCC-UV-166/24

Number of Page(s) 2 of 3

Calibration Results:

1.Wavelength Accuracy

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

*CNR = Customer not request

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www.barascientific.com



Certificate of Calibration

Certificate No. **BSCC-UV-166/24** Number of Page(s) **3 of 3**

Calibration Results:

3. Photometric Accuracy (Visible)

| Wavelength (nm) | Certified Absorbance (A) | UUC (A) | Error (A) | Uncertainty ($\pm A$) |
|-----------------|--------------------------|---------|-----------|-------------------------|
| 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) | Unit Under Calibration(UUC) | | |
|----------------------------------|-----------------------------|-------------------|----------------|
| | Wavelength (nm) | Transmission (%T) | Absorbance (A) |
| 200.85 \pm 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 base on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

End of Certificate

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

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

Certificate No.: C06240153
Issued Date: 18 April 2024
Job No.: WO-00024683
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 \pm 0.1 °C
Humidity 45.7 %RH \pm 6.9 %RH

Calibration Place: TEST TECH CO., LTD. (แผนกน้ำดี)
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

(Miss Kaewkan Suradech)

Person in charge

(Mr. Nitinun Srihawan)
Authorized signatory

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

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

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

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DKSH Technology Limited
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2533 Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth - in Asia and Beyond.

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 |
| | 0.7062 | 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 |

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
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Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C06-16: 11 Mar 2024

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 | SBW |
|----------------------------------|--------|--------|-------|------|
| Standard Wavelength (nm) | 268.74 | 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 TISI Accredited " in this Certificate have been included for completeness.

The End of Certificate

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CAL-FM-C06-16: 11 Mar 2024



บริษัท ไทยยูนิค จำกัด

THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200
80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200

Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@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., Samaedam Bangkhuntien, 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 |



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80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200

Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@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 Nacharoen

Date : 25 / Oct / 2023



APPROVED BY :

Signature:

Engineer : Suchai Sanguanklattichai

Date : 25 / Oct / 2023



ICP02329207

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 8000

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

CONFIGURATION TESTED

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

TESTED EQUIPMENT CALIBRATION NUMBER
IPV Methods

TEST STANDARD USED PART NUMBER
Mixed standard 1/10 N069-1579
Mixed standard 1/100 N930-0221

CUSTOMER SUPPLIED COMMENTS
2 % HNO3
10 % HNO3

ACCESSORIES/COMPONENT
NOT INCLUDED

WinLab32 Version 5.5.0.0714
PN:6150T21E4Q1E

EXPIRATION

EXPIRATION DATE
NOV 30, 2023
NOV 30, 2023

CUSTOMER INITIALS

Page 1 of 4



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

2. OPTICAL CHECKS

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

3. COOLING SYSTEM CHECKS

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

4. PERFORMANCE CHECKS

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

Page 2 of 4



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 |
| Spectral Resolution : VIS | Ba 455.403 nm | ≤ 0.020 nm | | 0.01726 | nm |
| Precision | 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 |
| | 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 |
| BEC : Axial (IB X 1000)/(IS-IB) | Mn 257.610 nm | ≤ 30 ppb | | 6.83 | ppb |
| BEC : Radial (IB X 1000)/(IS-IB) | 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. | |
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| <hr/> | |
| This is to certify that the above tests have been performed and the configuration tested | |
| <input checked="" type="checkbox"/> | meets |
| <input type="checkbox"/> | 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 : <u>KL S.</u> | |
| (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: Barigo

Model : -

Serial No.: -

ID No.: EQL-064

Condition As-Received: Used Item

Received Date: 12 October 2023

Calibration Date: 17 October 2023
to 20 October 2023

Reference: 2310-0447DN

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

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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

This certificate may not be reproduced other than in full,
except with the prior written approval of the head of
Corporate Services 3: Equipment Calibration and Testing Services.

Procedure used: Calibration were conducted using in-house calibration procedure CP-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 | 23I305 | 15 Mar 2024 |
| 2) Dew Point Hygrometer | Optidew 401 | 164756 | TH-0158-22 | 13 Dec 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 through:-

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

Calibrated by : Surasit Phansudnoi
Issue Date : 26 October 2023

Approved Signatory :

- Viporn*
- [] Chakrit Waewwanjua
[] Pornthippa Tameyakul
[✓] Viporn Tantiyawutti

B 0327545



Cert. No.: 23H2216

Page.: 2 of 2

Result of Calibration:- Without Adjustment

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 | 49.0 | -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:- Without Adjustment

Function: Temperature Measurement

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

UUC* : Unit Under Calibration

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

-o-o-

Viporn
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 :
PONGSAK J.

ISSUED DATE : 17-Jul-23

RECEIVED DATE : 13-Jul-23

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

F-G010 REV 03



CERTIFICATE No : 23M6754

PAGE : 2 OF 2

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

- 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
- REFERENCE STANDARD INSTRUMENTS :-

| INSTRUMENT | MODEL | SERIAL No | CERTIFICATE No | DUE DATE |
|------------------------|-------|-----------|----------------|-----------|
| 1) STANDARD WEIGHT SET | E2 | QK-I-151 | M2302013S | 02-Feb-25 |
| 2) STANDARD WEIGHT | E2 | I5843 | M2302014S | 02-Feb-25 |

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

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

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

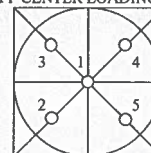
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

- ZERO SETTING FUNCTION : NORMAL
- TARE FUNCTION : NORMAL
- REPEATABILITY OF READING AT 200 g WAS 0 g
- 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 |

- 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 |

- INTERNAL WEIGHT ERROR : -0.000499999999988177 g

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

END OF CALIBRATION REPORT

F-G010 REV 03



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



CERTIFICATE No : 23T8798
REFERENCE No : 70515-6

PAGE : 1 OF 2

Certificate of Calibration

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

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

APPROVED BY :
PONGKAJ J.
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



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

CERTIFICATE No : 23T8798

PAGE : 2 OF 2

Calibration Report

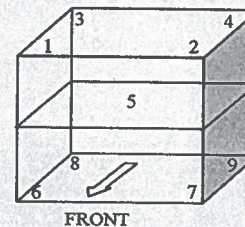
EQUIPMENT : HOT AIR OVEN
MANUFACTURER : MEMMERT
MODEL : UFE 500
ID No : EQL-128
RECEIVED DATE : 11-Sep-23
AMBIENT TEMPERATURE : 24 °C ± 1 °C
S/N : G508.0791
CALIBRATION DATE : 11-Sep-23
RELATIVE HUMIDITY : 51 %RH ± 10 %RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

| INSTRUMENT | MODEL | SERIAL No | CERTIFICATE No | DUE DATE |
|---|-------------|-----------|----------------|-----------|
| 1) DATA LOGGER WITH RTD | HYDRA 2635A | 7301307 | 23T6636 | 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 Piont (°C) | Average All Position Temp. (°C) | Temperature Stability (±°C) | Temperature Uniformity (°C) | Overall Variation (°C) |
|----------------------|---------------------------------|-----------------------------|-----------------------------|------------------------|
| 104.0 | 104.49 | 0.28 | 0.66 | 0.93 |
| 180.0 | 180.25 | 0.32 | 0.62 | 1.11 |

TEMPERATURE MEASUREMENT ACCURACY TEST

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

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.
NOTE 2 : LOCATION 5 WAS REFERENCE LOCATION.

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

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 :
PONGSAK J.
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
S/N : G512.2005
CALIBRATION DATE : 11-Sep-23
RELATIVE HUMIDITY : 51 %RH ± 10 %RH

CONDITION OF THIS RESULTS OF CALIBRATION

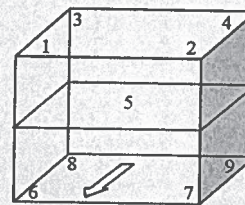
1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TLAS G-20 BY COMPARISON WITH CALIBRATED RTD Pt100 UNDER NO LOAD CONDITION. THE TEMPERATURE PROBES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOMETER PROBE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND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

2. REFERENCE STANDARD INSTRUMENTS :-

| INSTRUMENT | MODEL | SERIAL No | CERTIFICATE No | DUE DATE |
|-------------------------|-------------|-----------|----------------|-----------|
| 1) DATA LOGGER WITH RTD | HYDRA 2635A | 7301307 | 23T6636 | 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



FRONT

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 Piont (°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
Certificate No.: C08230153
Issued Date: 15 September 2023
Job No.: WO-00005226
Page: 1 of 2

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



(Miss Orawan Khlaiphloi)

Person in charge



(Mr. Nitinun Srihawan)

Authorized signatory

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

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

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

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
 DKSH Technology Limited
 2533 ถนนสุขุมวิท แขวงคลองตันใต้ เขตวัฒนา กรุงเทพมหานคร 10260
 2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
 Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth – in Asia and Beyond.

CAL-FM-C08-08: 20 Jul 2022

Certificate No.: C08230153

Page 2 of 2

Calibration Results:

Before Adjustment

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

After Adjustment

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

The End of Certificate

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
 DKSH Technology Limited
 2533 ถนนสุขุมวิท แขวงคลองตันใต้ เขตวัฒนา กรุงเทพมหานคร 10260
 2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
 Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth – in Asia and Beyond.

CAL-FM-C08-08: 20 Jul 2022

๕๒

ใบรับรองการสอบเทียบ “เครื่องวัดความนำไฟฟ้า”
(Calibration Certificate of Conductivity Meter)



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 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 Lerngagtrakul

Approved by :

Saithip

Approved Signatory

(☒) Saithip Meangmai
() Warakorn Lerngagtrakul
() 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.

A 0062587



Cert.No.: 24CH59

Page.: 2 of 3

Condition of this result of calibration**1. Reference Standard Instrument :-**

| <u>Instrument</u> | <u>Serial No.</u> | <u>ID No.</u> | <u>Certificate No.</u> | <u>Due date</u> |
|--------------------------|-------------------|---------------|------------------------|-----------------|
| 1) Thermometer | 1963878 | 130RC095 | 23I1051 | 05 Sep 2024 |
| 2) Ref. Std. Thermometer | 4982054 | 110RC044 | 23I908 | 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

| <u>Conductivity Solution</u> | <u>Manufacturer</u> | <u>Lot No.</u> | <u>Exp. date</u> |
|------------------------------|---------------------|----------------|------------------|
| 147.0 $\mu\text{S/cm}$ | 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 \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 $\mu\text{S/cm}$

Conductivity Electrode Serial No.: 806F0005

| Standard Conductivity Solution | After Adjustment UUC* Reading | Uncertainty of Measurement (\pm) | Coverage factor k |
|--------------------------------|-------------------------------|--------------------------------------|-------------------|
| 147.0 $\mu\text{S/cm}$ | 147.1 $\mu\text{S/cm}$ | 0.99 $\mu\text{S/cm}$ | 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 $\mu\text{S/cm}$ 96.8 m^{-1} , 1.413 mS/cm = 98.0 m^{-1} , 12.880 mS/cm = 99.4 m^{-1}

Sathip

a 1197672



Cert.No.: 24CH59

Page.: 3 of 3

Calibration Results**Function : Temperature Measurement****(*) Without adjustment**

This equipment was connected with Temperature Probe;

- Model : CT-58101B

- Serial No. : 806F0005

Dimension of probe;

- Length : 114 mm

- Diameter : 12 mm

- Immersion Depth : 100 mm

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

Remark : - UUC* = Unit Under Calibration

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

-o0o-

Sathip

a 1197671

ใบรับรองการสอบเทียบ “ห้องเย็น”
(Calibration Certificate of Cool Room)

๗๙



Metrology

SCI ECO Services Company Limited

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

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

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

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



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 :  / 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



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

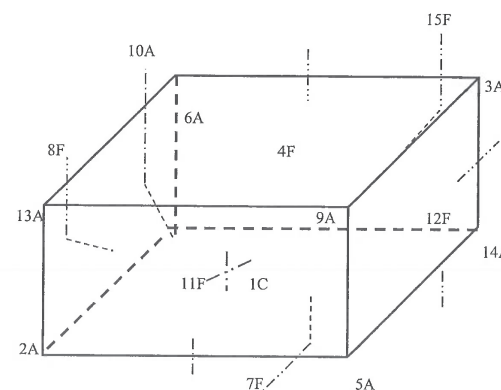
Approved By



Certificate No. T240070

Page 3 of 4

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

Approved By



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 | 3.17 | 3.11 | 3.11 | 3.33 | 2.94 | 3.06 | 2.95 | 3.17 | 2.86 | 2.59 |
| | 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) | Uniformity (°C) | Uncertainty (± °C) | Coverage |
| | Min , Max | Average | | | | | Factor <i>k</i> |
| 3.0 | 2.9 , 3.1 | 3.0 | 2.97 | 0.29 | 0.64 | 0.80 | 2.00 |

* The quoted uncertainty exclude " uniformity "

The calibration result apply only the above calibrated item.

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

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

Approved By. 



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.



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

5. Adjustment :

(X) without adjustment () after adjustment

Approved By.

FM-L15 118/18-08-66



Metrology

SCI ECO Services Company Limited

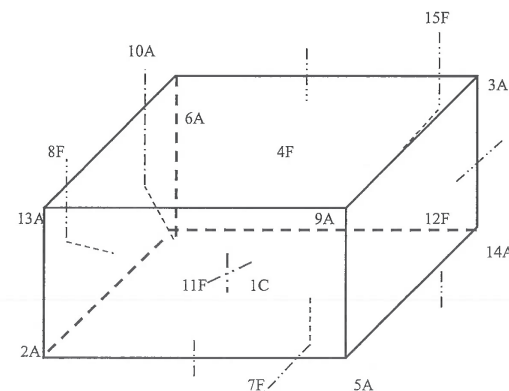
33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.



Certificate No. T240161

Page 3 of 4

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 118/18-08-66



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 | | | | |
|--------------------------|--------------|---------|--------------------------|------------------|-----------------|--------------------|-----------------------------|
| Setting (°C) | Reading (°C) | | Average (°C) | Stability (± °C) | Uniformity (°C) | Uncertainty (± °C) | Coverage Factor <i>k</i> |
| | Min , Max | Average | | | | | |
| 3.0 | 2.8 , 3.1 | 3.0 | 3.06 | 0.40 | 0.92 | 1.07 | 2.00 |

* The Acuoted 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 เทสท์ เทคโนโลยี จำกัด.
Address : 30,32 ซอยพระรามที่ 2 ซอย 63
ถนนพระรามที่ 2 แขวงสมเด็จเจ้าพระยา กรุงเทพมหานคร 10150
User Name: คุณจตุรนต์ ใจประกอบกิจ
Phone: 02-893-4211-17
Fax: lab_center@testtech.co.th

Date Tested: May 14, 2024
Recommendation Recertification
Period 12 Months
Recertification Due: May 14, 2025
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 | SOFTWARE |
|---|---------------------------------------|---|
| OPTIMA 8000 (EQL-180) | 078S1411171C | ICP WinLab32 version 5 |
| TESTED EQUIPMENT IPV Methods | CALIBRATION NUMBER | EXPIRATION |
| TEST STANDARD USED MultiElement Standard Instrument Cal. STD4 | PART NUMBER N069-1579 N930-0221 | EXPIRATION DATE Dec 30, 2024 Nov 30, 2024 |
| CUSTOMER SUPPLIED 2 % HNO3 10 % HNO3 | COMMENTS | 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. ☐
- B. Inspect and replace as necessary, all torch components including the RF coil. ☐
- C. Inspect all tubing for sign of clacking or leaking. ☐
- D. Adjust water and gas pressure regulator settings. ☐
- E. Inspect and leak check pneumatics drawers. ☐
- F. Clean the exterior of the instrument. ☐

2. OPTICAL CHECKS

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

3. COOLING SYSTEM CHECKS

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


4. PERFORMANCE CHECKS

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

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(sd) ≤ 10.0 ppb | 1.00 ppb |
| As 193.696 nm | 3(sd) ≤ 10.0 ppb | 3.32 ppb |
| Se 196.026 nm | 3(sd) ≤ 5.0 ppb | 3.88 ppb |
| Pb 220.353 nm | 3(sd) ≤ 3.0 ppb | 1.45 ppb |
| Detection Limits : Radial | | |
| As 193.696 nm | 3(sd) ≤ 60.0 ppb | 3.41 ppb |
| Zn 213.857 nm | 3(sd) ≤ 2.0 ppb | 0.30 ppb |
| Mn 257.610 nm | 3(sd) ≤ 1.0 ppb | 0.03 ppb |
| La 379.478 nm | 3(sd) ≤ 3.0 ppb | 0.27 ppb |
| Ba 455.403 nm | 3(sd) ≤ 0.3 ppb | 0.05 ppb |
| Ba 493.408 nm | 3(sd) ≤ 0.6 ppb | 0.06 ppb |
| BEC : Axial (IB X 1000)/(IS-IB) | | |
| Mn 257.610 nm | ≤ 30 ppb | 10.70 ppb |
| BEC : Radial (IB X 1000)/(IS-IB) | | |
| Mn 257.610 nm | ≤ 30 ppb | 21.54 ppb |

MAINTENANCE AND IPV TEST CERTIFICATE MODEL
OPTIMA 8000

| SERIAL NUMBER: 078S1411171C | DATE TESTED: May 14, 2024 |
|--|---|
| Remarks : | |
| Commissioning follow as commissioning performance sheets. | |
| <div> <input checked="" type="checkbox"/> meets <input type="checkbox"/> does not meet </div> | |
| 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 |