

Certificate of Calibration

Certificate No. : 67-400515-1

Page : 1 of 2

Submitted by : Environmental & Resourec Development Co., Ltd.
115/35-36 Moo 3, Tambon Bang Duea, Amphoe Mueang Pathumthani, Pathumthani 12000

Equipment : Temperature controlled enclosure (Refrigerator)
Manufacturer : Sanden Model : SRR3-0687
Range : N/A °C Resolution : 0.1 °C
Serial No. : SRR30687I-22120021 ID No. : ERD-18

Environment : On site calibration was carried out at the Laboratory,
Environmental & Resourec Development Co., Ltd.
Ambient Temperature : (28.5 to 30.0) °C
Relative Humidity : (40 to 45) %
Line Voltage : (226.0 to 227.0) V

Date of Received : 05 September 2024

Date of Calibration : 05 September 2024

Date of Issue : 07 September 2024

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

ID No.	Cert. No.	Due Date	Traceability
400046 & 400042	67-400442-1	26 Jan 2025	National Institute of Metrology Thailand (NIMT)

Approved by : 
(Permpon Chanpu)
Supervisor

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the prior written approval of the Calibratech Co.,Ltd.



Certificate of Calibration

Certificate No. : 67-400515-1

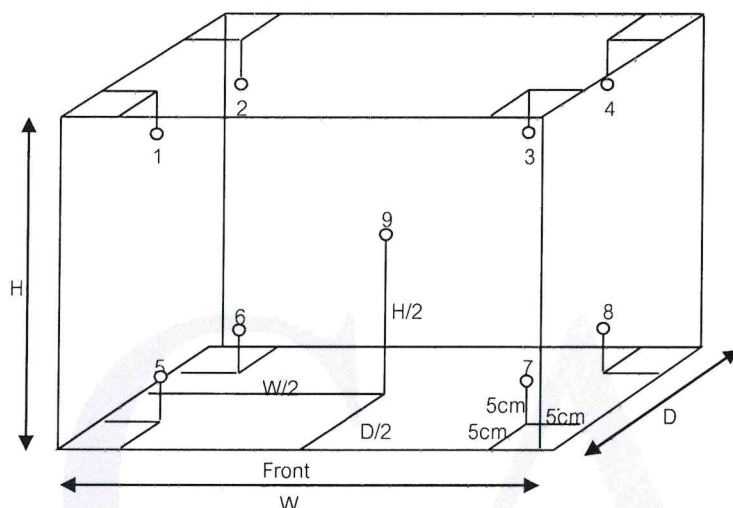
Page : 2 of 2

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 = 0.58 m

D = 0.56 m

H = 1.45 m

Capacity = 0.47 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	4.0	4.0	4.5	3.5	4.3	3.1	3.4	3.6	3.4	3.6	3.2	0.45

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
4.0	4.0	4.0	1.38	0.08	1.55

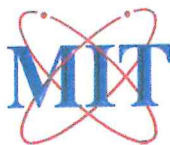
Remark The uncertainty is not combine uniformity of the air chamber

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 -





MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

214 Bangwack Rd. Bangpai Bangkac Bangkok 10160
Tel.: 0-2865-4647-8 Fax: 0-2865-4649 <http://www.mit.in.th>



CALIBRATION CERTIFICATE

Certificate No. : L202408121-0002

Date Issued : 21-Aug-24

Customer : Environmental & Resource Development Co., Ltd.
115/35-36 Moo 3 Tambon Bang Duea, Amphoe Mueang Pathumthani,
Pathumthani 12000

Equipment : Digital Thermo- Hygrometer

Manufacturer : ThermoPro

Model : -

Serial No. : A00333

ID No./Tag No. : ERD NO.08

Date Received : 15-Aug-24

Date Calibrated : 19-Aug-24

Calibrated by : Apiwat Peanrungroth

Calibration Method or Calibration Procedure Used

In-house method : CP-19 by comparing against Standard Digital Humidity / Temperature Meter

This certificate is traceable to national standards, which realize the units of measurement according to the International System of Units (SI).

Result of Calibration

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

This certificate may not be reproduced other than in full except with the prior written approval of the Miracle International Technology Company Limited.

Approved by:

Sarayuth T.

(Sarayuth Tochua)



Certificate No. : L202408121-0002

Environment : Ambient Temperature : $(25 \pm 2)^\circ\text{C}$
Relative Humidity : $(50 \pm 15)\%\text{RH}$

Function : Temperature Measurement Humidity Control : $(50 \pm 15)\%\text{RH}$

STD	UUC Reading	UUC Error	Measurement	MPE	Pass / Fail
Reading ($^\circ\text{C}$)	($^\circ\text{C}$)	($^\circ\text{C}$)	Uncertainty ($\pm^\circ\text{C}$)	$\pm^\circ\text{C}$	with Guard Band
19.99	19.9	-0.09	0.35	2	Pass
25.00	24.7	-0.30	0.35	2	Pass
30.00	29.7	-0.30	0.35	2	Pass

Function : Humidity Measurement Temperature Control : $(25 \pm 5)^\circ\text{C}$

STD	UUC Reading	UUC Error	Measurement	MPE	Pass / Fail
Reading ($\%\text{RH}$)	($\%\text{RH}$)	($\%\text{RH}$)	Uncertainty ($\pm\%\text{RH}$)	($\pm\%\text{RH}$)	with Guard Band
39.99	42	2.01	2.5	10	Pass
49.99	51	1.01	2.5	10	Pass
60.00	60	0.00	2.5	10	Pass

MPE = Maximum Permissible Error

Pass = $|\text{error}| + |\text{uncertainty}| \leq |\text{MPE}|$

STD = Standard

Fail = $|\text{error}| + |\text{uncertainty}| > |\text{MPE}|$

UUC = Unit Under Calibration

Description of UUC : Range $(-50) \text{ to } 70^\circ\text{C}$ Internal Sensor / 10 to 99 $\%\text{RH}$
Resolution 0.1°C / 1 $\%\text{RH}$

Condition As-Received : Used Item

The measurement results and statements of conformity with specification only relate to the item calibrated.

Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Certificate No. L202310317-0003 for Digital Thermometer with Probe (Fluke) Serial No. 5856603, Due 06-Nov-24

MIT Certificate No. L202310192-0001 for Digital Humidity Meter Serial No. F4260117, Due 06-Jan-25

End of Certificate

Certificate of Calibration

Certificate No. : 67-200310-1

Page : 1 of 2

Submitted by : Environmental & Resource Development Co., Ltd.
34/304-5 Moo 5, Soi Watpaikheaw, Srongprapa Rd., Sikan, Donmuang Bangkok 10210

Equipment : Electronic Balance

Manufacturer :	AND	Model :	HR-202i
Serial No. :	15201124	ID No. :	ERD 4
Capacity :	200 g	Resolution :	0.00001/51g, 0.0001/220g

Environment : On site calibration was carried out at the Laboratory, Environmental & Resource Development Co., Ltd.

Ambient Temperature :	(25.1 to 25.6)	° C
Relative Humidity :	(49.8 to 60.8)	%
Air Pressure :	1005.0	mbar

Date of Received : 05 September 2024

Date of Calibration : 05 September 2024

Date of Issue : 06 September 2024

Calibrated by : Satja Sangkhum

Calibration Method : In-house method CAL-M2001 based on UKAS Publication ref : LAB 14
Edition 7 - November 2022

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

Standard Weights

ID No.	Cert. No.	Due Date	Traceability
E261-E2624	C02232088	08 Nov 2024	National Institute of Metrology (Thailand), (NIMT)

Approved by :



(Satja Sangkhum)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the prior written approval of the Calibratech Co.,Ltd.



www.calibratech.co.th

Certificate of Calibration

Certificate No. : 67-200310-1

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 $\pm$ (g)
0.05	0.00000	0.000013
0.1	0.00000	0.000015
0.5	0.00001	0.000022
1	0.00000	0.000026
5	-0.00001	0.000043
10	0.00000	0.000053
20	-0.00003	0.000071
50	0.00003	0.00011
100	0.0001	0.00020
200	0.0002	0.00038

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

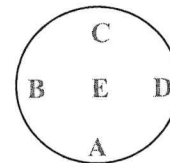
This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.00$, providing a level of confidence of approximately 95%

Eccentric error

Load test : 50 g

A B C D E

-0.00001 0.00001 0.00001 0.00000 0.00000 g



Repeatability

Load test : 200 g

Stdev. : 0.0000 g

- o0o -



Certificate of Calibration

Certificate No. : 67-420046-1

Page : 1 of 2

Submitted by : Environmental & Resource Development Co., Ltd.
115/35-36 Moo 3 Tambon Bang Duea, Amphoe Mueang Pathumthani, Pathumthani 12000

Equipment : pH Meter with electrode
pH meter
Manufacturer : Hanna Model : HI 5221
Range : -2.00 pH to 20.00 pH Resolution : 0.01 pH
Serial No. : 06210023101 ID No. : ERD NO. 03
Electrode
Model : HI1131 Serial No. : 08180B0N

Environment : On site calibration was carried out at the Laboratory,
Environmental & Resource Development Co., Ltd.
Ambient Temperature : (25.0 to 25.5)° C
Relative Humidity : (45 to 50) %

Date of Received : 07 May 2024

Date of Calibration : 07 May 2024

Date of Issue : 11 May 2024

Calibrated by : Permpon Chanpu

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

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

1. Multiproduct Calibrator

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

2. Standard Buffer Solution

pH	Cert. No.	Lot No.	Exp. Date	Traceability
4.008	61293328	944535	27 Nov 2025	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.986	61281486	944537	17 Nov 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
9.997	61281073	944536	17 Nov 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by : 
(Surachai Promthong)
Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the prior written approval of the Calibratech Co.,Ltd.



Certificate of Calibration

Certificate No. : 67-420046-1

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	0.0097
	6.986	7.00	-0.01	0.012
	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 measurment was based on a standard uncertainty multiplied by a coverage factor $k = 2$,
providing a level of confidence of approximately 95%

- 000 -

P.B.I



Certificate of Calibration

Certificate No. : 67-400256-1

Page : 1 of 2

Submitted by : Environmental & Resource Development Co., Ltd.
115/35-36 Moo 3 Tambon Bang Duea, Amphoe Mueang Pathumthani, Pathumthani 12000

Equipment : Temperature Indicator with Thermistor Probe
Temperature Indicator

Manufacturer :	Hanna	Model :	HI 5221
Range :	N/A °C	Resolution :	0.1 °C
Serial No. :	06210023101	ID No. :	ERD NO. 03
Thermistor probe			
Model :	HI7662-W	Sheath Material :	Stainless
Diameter :	3.5 mm.	Length :	110 mm.
Serial No. :	0809023N	ID No. :	ERD NO. 03

Environment : On site calibration was carried out at the Laboratory,
Environmental & Resource Development Co., Ltd.

Ambient Temperature : (25.0 to 25.5) °C
Relative Humidity : (45 to 50) %
Line Voltage : (232.0 to 233.0) VAC

Date of Received : 07 May 2024

Date of Calibration : 07 May 2024

Date of Issue : 11 May 2024

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)

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
400002	TT-0074-22	20 Jun 2024	National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
400033	24E633	21 Feb 2026	National Institute of Metrology Thailand (NIMT)

Approved by :

(Surachai Promthong)
Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the prior written approval of the Calibratech Co.,Ltd.



Certificate of Calibration

Certificate No. : 67-400256-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Immersion Depth (mm.)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
110	20.005	20.0	0.0	0.19
110	25.002	25.0	0.0	0.19
110	30.004	30.1	-0.1	0.19

Remark

UUC : Unit Under Calibration

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

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

- ๐๐๐ -

Handwritten signature



Certificate of Calibration

Certificate No. : 68-420039-1

Page : 1 of 2

Submitted by : Environmental & Resource Development Co., Ltd.
115/35-36 Moo 3 Tambon Bang Duea, Amphoe Mueang Pathumthani, Pathumthani 12000

Equipment : pH Meter with electrode
pH meter
Manufacturer : Hanna Model : HI 5221
Range : -2.00 pH to 20.00 pH Resolution : 0.01 pH
Serial No. : 06210023101 ID No. : ERD NO. 03
Electrode
Model : HI1131 Serial No. : 08180B0N
ID No. : ERD NO. 03

Environment : On site calibration was carried out at the Laboratory,
Environmental & Resource Development Co., Ltd.
Ambient Temperature : (23.0 to 24.0) °C
Relative Humidity : (55 to 60) %

Date of Received : 06 May 2025

Date of Calibration : 06 May 2025

Date of Issue : 07 May 2025

Calibrated by : Permpon Chanpu

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

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

1. Multiproduct Calibrator

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

2. Standard Buffer Solution

pH	Cert. No.	Lot No.	Exp. Date	Traceability
4.008	61314276	1081108	28 Feb 2027	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.965	61318175	1081110	28 Feb 2026	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
10.010	61325043	1081109	28 Feb 2026	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by :
(Permpon Chanpu)
Supervisor

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the prior written approval of the Calibratech Co.,Ltd.



Certificate of Calibration

Certificate No. : 68-420039-1

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Electrical measurement
pH meter

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

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

Function : pH meter with electrode

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

Adjustment Curve at nominal pH	Standard Buffer (pH)	UUC Reading (pH)	Correction (pH)	Uncertainty (± pH)
4, 7, 10	4.008	4.01	0.00	0.0097
	6.965	7.00	-0.03	0.011
	10.010	10.01	0.00	0.014

Remark

UUC : Unit Under Calibration

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

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

- o0o -



Certificate of Calibration

Certificate No. : 68-400256-1

Page : 1 of 2

Submitted by : Environmental & Resource Development Co., Ltd.
115/35-36 Moo 3 Tambon Bang Duea, Amphoe Mueang Pathumthani,
Pathumthani 12000

Equipment : Temperature Indicator with Thermistor Probe
Temperature Indicator
Manufacturer : Hanna Model : HI 5221
Range : N/A °C Resolution : 0.1 °C
Serial No. : D6210023101 ID No. : ERD NO. 03
Thermistor probe
Model : HI7662-W Sheath Material : Stainless
Diameter : 3.5 mm. Length : 110 mm.
Serial No. : 0809023N ID No. : ERD NO. 03

Environment : On site calibration was carried out at the Laboratory,
Environmental & Resource Development Co., Ltd.
Ambient Temperature : (23.0 to 24.0) °C
Relative Humidity : (55 to 60) %
Line Voltage : (232.0 to 233.0) VAC

Date of Received : 06 May 2025

Date of Calibration : 06 May 2025

Date of Issue : 07 May 2025

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-0095-24	01 Jul 2026	National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
400033	24E633	21 Feb 2026	National Institute of Metrology Thailand (NIMT)

Approved by : 
(Permpon Chanpu)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the prior written approval of the Calibratech Co.,Ltd.



Certificate of Calibration

Certificate No. : 68-400256-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Immersion Depth (mm.)	Standard Reading (° C)	UUC Reading (° C)	Correction (° C)	Uncertainty (± ° C)
110	20.003	20.1	-0.1	0.19
110	25.002	25.1	-0.1	0.19
110	30.004	30.1	-0.1	0.19

Remark

UUC : Unit Under Calibration

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

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

- ๐0๐ -



Certificate of Calibration

Certificate No. : 67-400515-3

Page : 1 of 2

Submitted by : Environmental & Resource Development Co., Ltd.
115/35-36 Moo 3 Tambon Bang Duea, Amphoe Mueang Pathumthani, Pathumthani 12000

Equipment : Water Bath
Manufacturer : Memmert Model : WB 14
Range : N/A °C Resolution : 0.1 °C
Serial No. : 1499.0536 ID No. : ERD-11

Environment : On site calibration was carried out at the Laboratory,
Environmental & Resource Development Co., Ltd.
Ambient Temperature : (28.5 to 30.0) °C
Relative Humidity : (40 to 45) %
Line Voltage : (226.0 to 227.0)V

Date of Received : 05 September 2024

Date of Calibration : 05 September 2024

Date of Issue : 07 September 2024

Calibrated by : Permpon Chanpu

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

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

ID No.	Cert. No.	Due Date	Traceability
400029 & 400031	67-400244-1	24 Oct 2024	National Institute of Metrology Thailand (NIMT)

Approved by :



(Permpon Chanpu)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the prior written approval of the Calibratech Co.,Ltd.



Certificate of Calibration

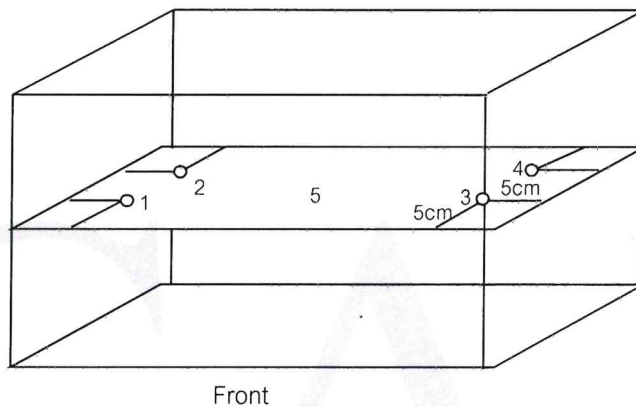
Certificate No. : 67-400515-3

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement



Test Point (° C)	Setting Temperature (° C)	Indicating Temperature (° C)	Measured Temperature (° C) @					Uncertainty (± ° C)	Measured Uniformity (° C)	Measured Stability (° C)
			Sensor No.							
			1	2	3	4	5			
80.0	80.0	80.0	79.9	80.1	80.0	80.0	80.0	0.18	0.16	0.04
85.0	85.0	85.0	84.9	85.1	85.0	85.0	85.0	0.19	0.16	0.06
90.0	90.0	90.0	90.0	90.2	90.0	90.1	90.1	0.20	0.20	0.08
95.0	95.0	95.0	95.0	95.2	95.0	95.0	95.1	0.20	0.22	0.07

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%

- o0o -

[Handwritten signature]



Certificate of Calibration

Certificate No. : 67-400515-4

Page : 1 of 2

Submitted by : Environmental & Resource Development Co., Ltd.
115/35-36 Moo 3 Tambon Bang Duea, Amphoe Mueang Pathumthani, Pathumthani 12000

Equipment : Temperature controlled enclosure (Oven)
Manufacturer : Memmert Model : UF 55
Range : N/A °C Resolution : 0.1 °C
Serial No. : B214.0248 ID No. : ERD-06

Environment : On site calibration was carried out at the Laboratory,
Environmental & Resource Development Co., Ltd.
Ambient Temperature : (28.5 to 30.0) °C
Relative Humidity : (40 to 45) %
Line Voltage : (226.0 to 227.0) V

Date of Received : 05 September 2024

Date of Calibration : 05 September 2024

Date of Issue : 07 September 2024

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

ID No.	Cert. No.	Due Date	Traceability
400029 & 400030	67-400246-1	25 Oct 2024	National Institute of Metrology Thailand (NIMT)

Approved by :



(Permpon Chanpu)

Supervisor



Certificate of Calibration

Certificate No. : 67-400515-4

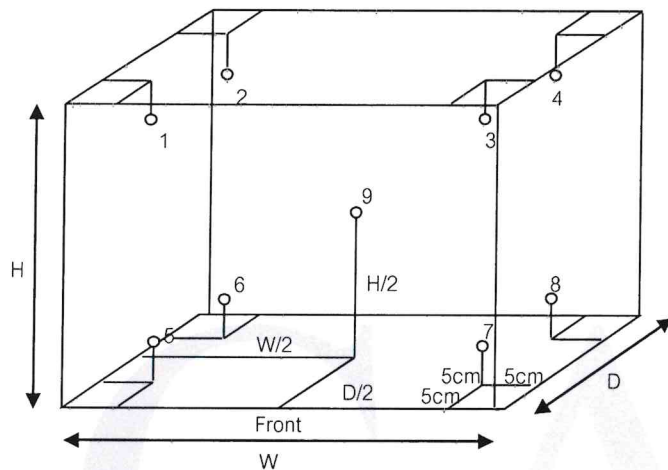
Page : 2 of 2

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 = 0.40 m

D = 0.33 m

H = 0.40 m

Capacity = 0.05 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	
104.0	104.0	104.0	104.3	104.2	104.3	104.3	104.2	103.9	103.7	104.0	104.1	0.69
150.0	150.0	150.0	151.1	150.6	151.1	151.1	150.9	150.2	149.3	150.3	150.6	0.84
180.0	180.0	180.0	181.0	180.4	181.0	180.9	180.9	180.0	179.0	180.0	180.6	0.95

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
104.0	104.0	104.0	0.38	0.08	0.74
150.0	150.0	150.0	1.46	0.09	1.99
180.0	180.0	180.0	1.67	0.11	2.18

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 -

(Handwritten signature)



Certificate of Calibration

Certificate No. : 67-400515-2

Page : 1 of 2

Submitted by : Environmental & Resource Development Co., Ltd.
115/35-36 Moo 3 Tambon Bang Duea, Amphoe Mueang Pathumthani, Pathumthani 12000

Equipment : Temperature controlled enclosure (Incubator)
Manufacturer : M-LAB Model : BIC-140
Range : N/A °C Resolution : 0.1 °C
Serial No. : 1020 ID No. : ERD-1

Environment : On site calibration was carried out at the Laboratory,
Environmental & Resource Development Co., Ltd.
Ambient Temperature : (28.5 to 30.0) °C
Relative Humidity : (40 to 45) %
Line Voltage : (226.0 to 227.0) V

Date of Received : 05 September 2024

Date of Calibration : 05 September 2024

Date of Issue : 07 September 2024

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

ID No.	Cert. No.	Due Date	Traceability
400046 & 400047	67-400442-2	27 Jan 2025	National Institute of Metrology Thailand (NIMT)

Approved by : 
(Permpon Chanpu)
Supervisor

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the prior written approval of the Calibratech Co.,Ltd.



Certificate of Calibration

Certificate No. : 67-400515-2

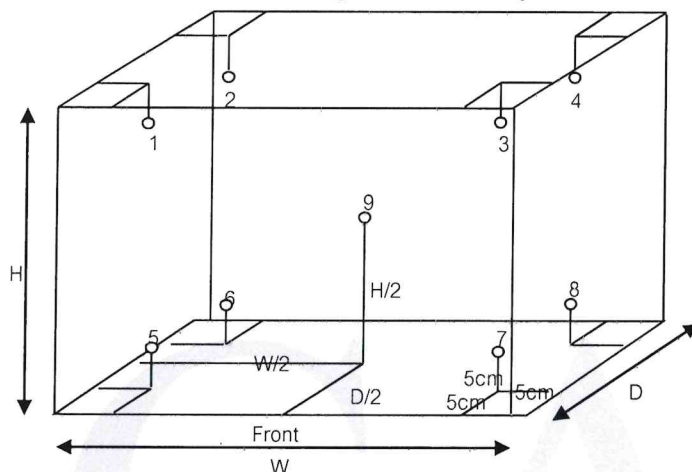
Page : 2 of 2

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 = 0.38 m

D = 0.35 m

H = 1.15 m

Capacity = 0.15 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	19.8	19.9	19.6	19.6	20.3	20.5	20.5	20.5	19.5	0.39

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
20.0	20.0	20.0	1.02	0.08	1.11

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 -

[Handwritten signature]



Certificate of Calibration

Certificate No. : 67-400515-5

Page : 1 of 2

Submitted by : Environmental & Resource Development Co., Ltd.
115/35-36 Moo 3 Tambon Bang Duea, Amphoe Mueang Pathumthani, Pathumthani 12000

Equipment : Temperature controlled enclosure (Incubator)
Manufacturer : Memmert Model : BE 500
Range : N/A °C Resolution : 0.1 °C
Serial No. : e500.0202 ID No. : ERD-14

Environment : On site calibration was carried out at the Laboratory,
Environmental & Resource Development Co., Ltd.
Ambient Temperature : (28.5 to 30.0) °C
Relative Humidity : (40 to 45) %
Line Voltage : (226.0 to 227.0) V

Date of Received : 05 September 2024

Date of Calibration : 05 September 2024

Date of Issue : 07 September 2024

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

ID No.	Cert. No.	Due Date	Traceability
400029 & 400048	67-400444-1	02 Feb 2025	National Institute of Metrology Thailand (NIMT)

Approved by : 
(Permpon Chanpu)
Supervisor

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the prior written approval of the Calibratech Co.,Ltd.



Certificate of Calibration

Certificate No. : 67-400515-5

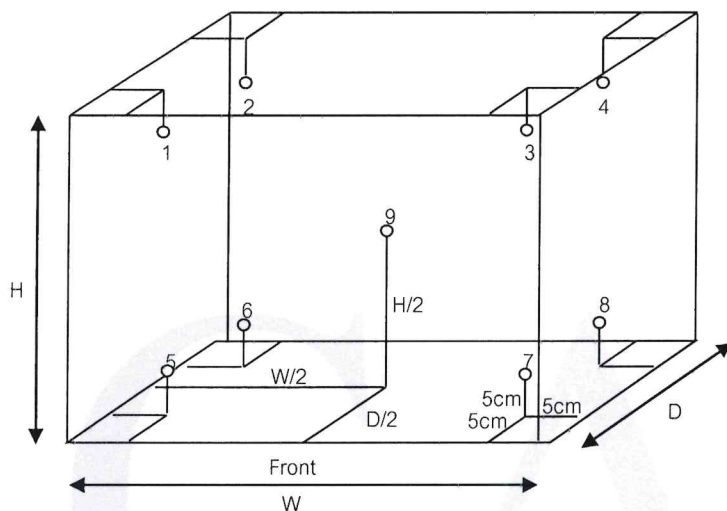
Page : 2 of 2

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	
30.0	32.0	32.0	30.1	30.1	30.2	30.2	29.9	30.1	29.9	29.9	29.8	0.34
35.0	37.0	37.0	35.0	35.0	35.0	35.1	34.7	34.9	34.7	34.7	34.7	0.31
40.0	44.8	44.8	40.4	40.3	40.4	40.5	39.8	40.1	39.8	39.9	39.7	0.36
45.0	51.5	51.5	45.2	45.1	45.2	45.3	44.5	44.8	44.5	44.5	44.5	0.37

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
30.0	32.0	32.0	0.43	0.09	0.50
35.0	37.0	37.0	0.39	0.04	0.44
40.0	44.8	44.8	0.76	0.08	0.80
45.0	51.5	51.5	0.87	0.06	0.93

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 -



Certificate of Calibration

Certificate No. : 67-300264-7

Page : 1 of 2

Submitted by : Environmental & Resource Development Co., Ltd.
115/35-36 Moo 3, Tambon Bang Duea, Amphoe Mueang Pathumthani, Pathumthani 12000

Equipment : Burette
Manufacturer : Witeg Class : B
Capacity : 50 ml Graduation : 0.1 ml
ID No. : BU50/01

Environment : Ambient Temperature : (20 ± 3) °C
Relative Humidity : (50 ± 10) %
Air Pressure : 1010.1 mbar.

Date of Received : 07 May 2024

Date of Calibration : 13 May 2024

Date of Issue : 13 May 2024

Calibrated by : Areerat Sombun

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

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

Electronic Balance

ID No.	Cert. No.	Due Date	Traceability
241005	66-200388-4	02 Jun 2024	National Institute of Metrology (Thailand) (NIMT)

Approved by :

(Wipa Tovadee)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the prior written approval of the Calibratech Co.,Ltd.



www.calibratech.co.th

Certificate of Calibration

Certificate No. : 67-300264-7

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 : 29.99 sec.

Nominal Volume (ml)	Measuring Volume (ml)
10	9.9855
25	24.9237
50	49.9339

Uncertainty of measurement with in $\pm$ 0.011 ml

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

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

- o0o -



Certificate of Calibration

Certificate No. : 67-300264-4

Page : 1 of 2

Submitted by : Environmental & Resource Development Co., Ltd.
115/35-36 Moo 3, Tambon Bang Duea, Amphoe Mueang Pathumthani, Pathumthani 12000

Equipment : Cylinder
Manufacturer : EM Class : A
Capacity : 50 ml Graduation : 1 ml
ID No. : CY50/01/23

Environment : Ambient Temperature : (20 ± 3) °C
Relative Humidity : (50 ± 10) %
Air Pressure : 1010.3 mbar.

Date of Received : 07 May 2024

Date of Calibration : 13 May 2024

Date of Issue : 13 May 2024

Calibrated by : Areerat Sombun

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

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

Electronic Balance

ID No.	Cert. No.	Due Date	Traceability
241002	66-200388-1	02 Jun 2024	National Institute of Metrology (Thailand) (NIMT)

Approved by :

(Wipa Tovadee)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the prior written approval of the Calibratech Co.,Ltd.



Certificate of Calibration

Certificate No. : 67-300264-4

Page : 2 of 2

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

UUC Condition As-Received : Good

Nominal Volume (ml)	Measuring Volume (ml)
30	29.83
50	49.88

Uncertainty of measurement with in $\pm$ 0.054 ml

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

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

- o0o -



Certificate of Calibration

Certificate No. : 67-300264-6

Page : 1 of 2

Submitted by : Environmental & Resource Development Co., Ltd.
115/35-36 Moo 3, Tambon Bang Duea, Amphoe Mueang Pathumthani, Pathumthani 12000

Equipment : Cylinder
Manufacturer : Witeg Class : A
Capacity : 250 ml Graduation : 2 ml
ID No. : CY250/01

Environment : Ambient Temperature : (20 ± 3) °C
Relative Humidity : (50 ± 10) %
Air Pressure : 1010.4 mbar.

Date of Received : 07 May 2024

Date of Calibration : 13 May 2024

Date of Issue : 13 May 2024

Calibrated by : Areerat Sombun

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

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

Electronic Balance

ID No.	Cert. No.	Due Date	Traceability
241002	66-200388-1	02 Jun 2024	National Institute of Metrology (Thailand) (NIMT)

Approved by :

(Wipa Tovadee)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the prior written approval of the Calibratech Co.,Ltd.



www.calibratech.co.th

Certificate of Calibration

Certificate No. : 67-300264-6

Page : 2 of 2

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

UUC Condition As-Received : Good

Nominal Volume (ml)	Measuring Volume (ml)
160	160.02
250	249.91

Uncertainty of measurement with in $\pm$ 0.087 ml

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

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

- o0o -



Certificate of Calibration

Certificate No. : 67-300264-3

Page : 1 of 2

Submitted by : Environmental & Resource Development Co., Ltd.
115/35-36 Moo 3, Tambon Bang Duea, Amphoe Mueang Pathumthani, Pathumthani 12000

Equipment : Volumetric Flask
Manufacturer : ISOLAB Class : A
Capacity : 1000 ml
ID No. : VF1000/01/23

Environment : Ambient Temperature : (20 ± 3) °C
Relative Humidity : (50 ± 10) %
Air Pressure : 1010.3 mbar.

Date of Received : 07 May 2024

Date of Calibration : 13 May 2024

Date of Issue : 13 May 2024

Calibrated by : Areerat Sombun

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

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

Electronic Balance

ID No.	Cert. No.	Due Date	Traceability
241002	66-200388-1	02 Jun 2024	National Institute of Metrology (Thailand) (NIMT)

Approved by :

(Wipa Tovadee)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the prior written approval of the Calibratech Co.,Ltd.



www.calibratech.co.th

Certificate of Calibration

Certificate No. : 67-300264-3

Page : 2 of 2

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

UUC Condition As-Received : Good

Nominal Volume (ml)	Measuring Volume (ml)
1000	1000.20

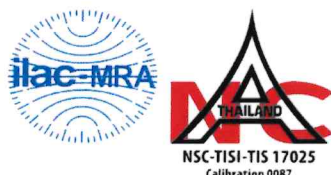
Uncertainty of measurement with in $\pm$ 0.14 ml

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

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

- o0o -





Certificate of Calibration

Equipment:	SPECTROPHOTOMETER	Certificate No.:	C06240481
Model:	DR3900	Issued Date:	01 November 2024
Serial No. (or ID.):	1920252 (ERD-09)	Job No.:	WO-00048097
Manufacturer:	HACH	Page:	1 of 3
Condition:	In Condition		

Customer: ENVIRONMENTAL & RESOURCE DEVELOPMENT CO.,LTD.
115/35-36 Moo 3, Tambol Bang Duea
Amphur Muang, Pathumthanee 12000 Thailand.

Environment Condition:

Temperature	24.8	°C	±	0.3	°C
Humidity	51.1	%RH	±	1.3	%RH

Calibration Place: ENVIRONMENTAL & RESOURCE DEVELOPMENT CO.,LTD. (Lab ชั้น 3)
115/35-36 Moo 3, Tambol Bang Duea
Amphur Muang, Pathumthanee 12000 Thailand.

Calibration By: Mr. Atachai Ngamchanat

Calibration Date: 31 October 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. 113620 and 113619

The standard for Photometric Certificate No. 113650

The standard for Stray light Certificate No. 113614



(Mr. Atachai Ngamchanat)

Person in charge



(Miss Kaewkan Suradech)

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 แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260

2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Calibration Results:**Without Adjustment**

Wavelength Accuracy (nm), The spectral bandwidth of Std at 5 nm and UUC at 5 nm

Standard Wavelength	Unit Under Calibration	Correction	Uncertainty
334.50	334	0.50	0.59
361.40	361	0.40	0.59
418.40	418	0.40	0.59
447.20	447	0.20	0.59
459.30	459	0.30	0.59
537.00	537	0.00	0.59
638.00	638	0.00	0.59
441.29	441	0.29	0.59
479.88	480	-0.12	0.59
513.75	513	0.75	0.59
528.59	528	0.59	0.59
575.10	575	0.10	0.59
585.56	585	0.56	0.59
684.70	685	-0.30	0.59
740.51	741	-0.49	0.59
747.61	748	-0.39	0.59
807.04	807	0.04	0.59
879.68	880	-0.32	0.59

Calibration Results:
Without Adjustment
Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.5797	0.577	0.0027	0.0045
	0.7119	0.709	0.0029	0.0045
	1.0124	1.009	0.0034	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.5634	0.560	0.0034	0.0045
	0.7001	0.697	0.0031	0.0045
	0.9955	0.992	0.0035	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.5239	0.522	0.0019	0.0045
	0.6613	0.660	0.0013	0.0045
	0.9395	0.939	0.0005	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.5212	0.519	0.0022	0.0045
	0.6977	0.696	0.0017	0.0045
	0.9927	0.991	0.0017	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.5548	0.552	0.0028	0.0045
	0.7732	0.770	0.0032	0.0045
	1.1021	1.098	0.0041	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.5621	0.560	0.0021	0.0045
	0.7629	0.760	0.0029	0.0045
	1.0873	1.084	0.0033	0.0045

Stray light *

Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%T)	Absorbance (A)
391.83 +/- 0.11 nm	392	3.4	1.469

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

The End of Certificate