

เอกสารแนบ 6

เอกสารสอบเทียบเครื่องมือที่ใช้ในการวิเคราะห์

Certificate of Calibration

Certificate No. : 67-400217-3

Page : 1 of 2

Submitted by : Special Lab Envi and Consultant Co., Ltd.
47/91 Moo 3 Thambol Tha-it, Pakkret, Nonthaburi 11120

Equipment : Water Bath
Manufacturer : Memmert Model : WNB22
Range : N/A °C Resolution : 0.1 °C
Serial No. : L520.0201 ID No. : LB-Eq-041

Environment : On site calibration was carried out at the Laboratory, Special Lab Envi and Consultant Co., Ltd.
Ambient Temperature : (34.0 to 35.0) °C
Relative Humidity : (35 to 40) %
Line Voltage : (226.0 to 226.5) V

Date of Received : 20 April 2024

Date of Calibration : 20 April 2024

Date of Issue : 26 April 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	66-400592-1	24 Apr 2024	National Institute of Metrology Thailand (NIMT)

Approved by

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

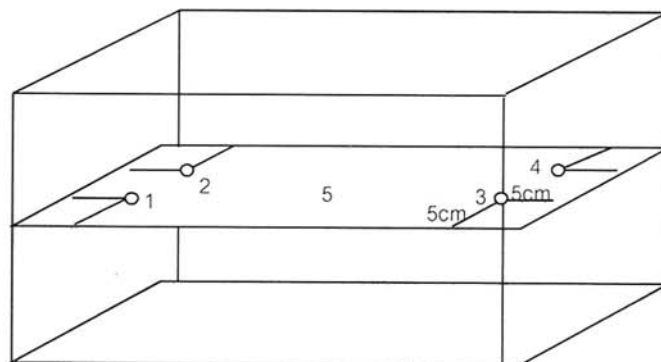
Certificate No. : 67-400217-3

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement



Front

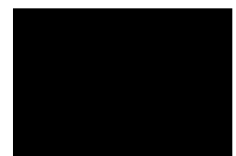
Test Point (° C)	Setting Temperature (° C)	Indicating Temperature (° C)	Measured Temperature (° C) @ Sensor					Uncertainty (± ° C)	Measured Uniformity (° C)	Measured Stability (° C)
			No.							
			1	2	3	4	5			
62.0	62.0	62.0	62.04	62.05	62.03	62.05	62.02	0.18	0.09	0.04
85.0	85.0	85.0	85.05	85.05	85.04	85.06	85.02	0.18	0.09	0.05
95.0	95.0	95.0	94.92	94.82	94.81	94.78	94.80	0.21	0.21	0.10
100.0	CCC	100.6	100.44	100.47	100.55	100.50	100.36	0.21	0.28	0.09

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 -



Certificate of Calibration

Certificate No. : 67-400217-4

Page : 1 of 2

Submitted by : Special Lab Envi and Consultant Co., Ltd.
47/91-93 Moo 3, Tambol Tha-It, Pakkret, Nonthaburi 11120

Equipment : Temperature controlled enclosure (Refrigerator)
Manufacturer : Frozen Model : CC-2288F
Range : N/A °C Resolution : 1 °C
Serial No. : CC-2288F-1163-003 ID No. : LB-Eq-046

Environment : On site calibration was carried out at the Laboratory, Special Lab Envi and Consultant Co., Ltd.
Ambient Temperature : (32.0 to 33.0) °C
Relative Humidity : (40 to 45) %
Line Voltage : (226.0 to 226.5) V

Date of Received : 20 April 2024

Date of Calibration : 20 April 2024

Date of Issue : 26 April 2024

Calibrated by : Permpon Chanpu

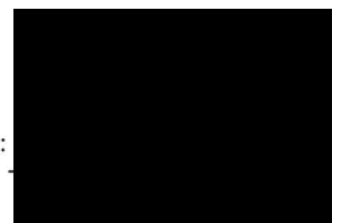
Calibration Method : CAL-M4004, TLAS G-20

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	66-400595-1	26 Apr 2024	National Institute of Metrology Thailand (NIMT)

Approved by :



Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-400217-4

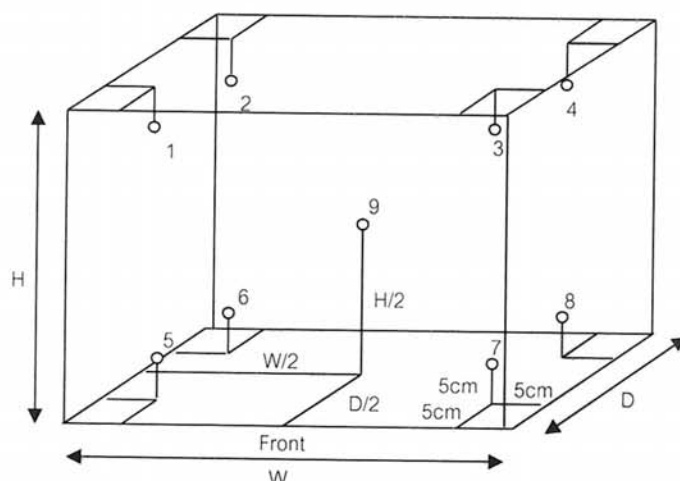
Page : 2 of 2

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 = 1.02 m

D = 0.47 m

H = 1.48 m

Capacity = 0.71 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	
3	3	3	4.0	3.0	2.6	2.5	4.0	4.1	2.1	2.1	3.1	0.85

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
3	3	3	1.2	0.2	2.3

Remark The uncertainty is not combine uniformity of the air chamber

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

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

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Certificate of Calibration

Certificate No. : 67-400217-1

Page : 1 of 2

Submitted by : Special Lab Envi and Consultant Co., Ltd.
47/91 Moo 3 Thambol Tha-it, Pakkret, Nonthaburi 11120

Equipment : Temperature controlled enclosure(Incubator)
 Manufacturer : Lovibond Model : FKU 1800
 Range : N/A °C Resolution : 0.1 °C
 Serial No. : 0925481-19 ID No. : LB-Eq-005

Environment : On site calibration was carried out at the Laboratory, Special Lab Envi and Consultant Co., Ltd.
 Ambient Temperature : (24.0 to 25.0) °C
 Relative Humidity : (50 to 55) %
 Line Voltage : (226.0 to 226.5) V

Date of Received : 20 April 2024

Date of Calibration : 20 April 2024

Date of Issue : 26 April 2024

Calibrated by : Kittisak Kokaco

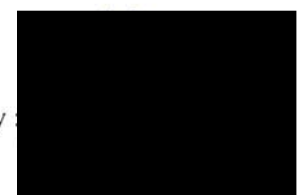
Calibration Method : CAL-M4004, TLAS G-20

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	67-400047-2	26 Jul 2024	National Institute of Metrology Thailand (NIMT)

Approved by



Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-400217-1

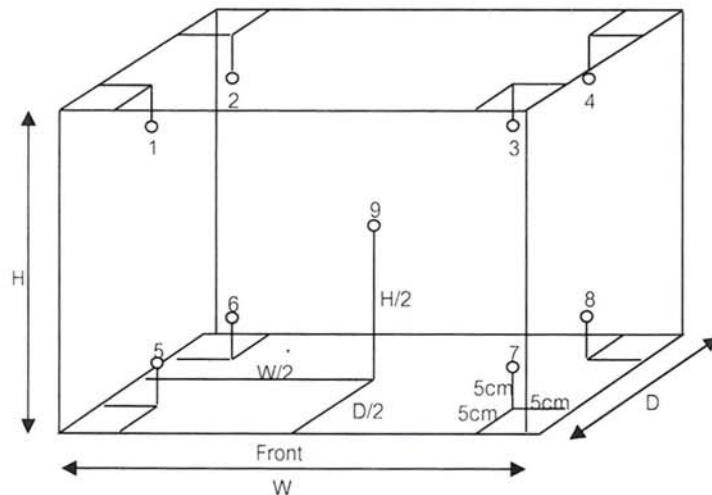
Page : 2 of 2

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 = 0.55 m

D = 0.73 m

H = 0.50 m

Capacity = 0.20 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	30.0	30.0	30.09	30.21	30.18	30.17	30.52	30.49	30.13	30.32	30.13	0.31
35.0	35.0	35.0	34.95	35.17	35.13	35.14	35.62	35.67	35.04	35.40	35.19	0.32
37.0	37.0	37.0	36.94	37.16	37.13	37.11	37.60	37.64	37.02	37.37	37.16	0.33

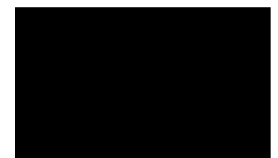
Test Point (° C)	Setting Temperature (° C)	Indicating Temperature (° C)	Measured Uniformity (° C)	Measured Stability (° C)	Overall Variation (° C)
30.0	30.0	30.0	0.42	0.03	0.46
35.0	35.0	35.0	0.50	0.04	0.77
37.0	37.0	37.0	0.51	0.06	0.79

Remark The uncertainty is not combine uniformity of the air chamber

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

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

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Certificate of Calibration

Certificate No. : 67-400217-2

Page : 1 of 2

Submitted by : Special Lab Envi and Consultant Co., Ltd.
47/91 Moo 3 Thambol Tha-it, Pakkret, Nonthaburi 11120

Equipment : Temperature controlled enclosure(Incubator)
Manufacturer : Lovibond Model : FKU 1800
Range : N/A °C Resolution : 0.1 °C
Serial No. : 0914643-01 ID No. : LB-Eq-004

Environment : On site calibration was carried out at the Laboratory, Special Lab Envi and Consultant Co., Ltd.
Ambient Temperature : (26.0 to 27.0) °C
Relative Humidity : (45 to 50) %
Line Voltage : (226.0 to 226.5) V

Date of Received : 20 April 2024

Date of Calibration : 20 April 2024

Date of Issue : 26 April 2024

Calibrated by : Kittisak Kokaco

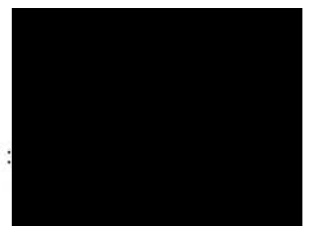
Calibration Method : CAL-M4004, TLAS G-20

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	67-400047-1	25 Jul 2024	National Institute of Metrology Thailand (NIMT)

Approved by :



Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-400217-2

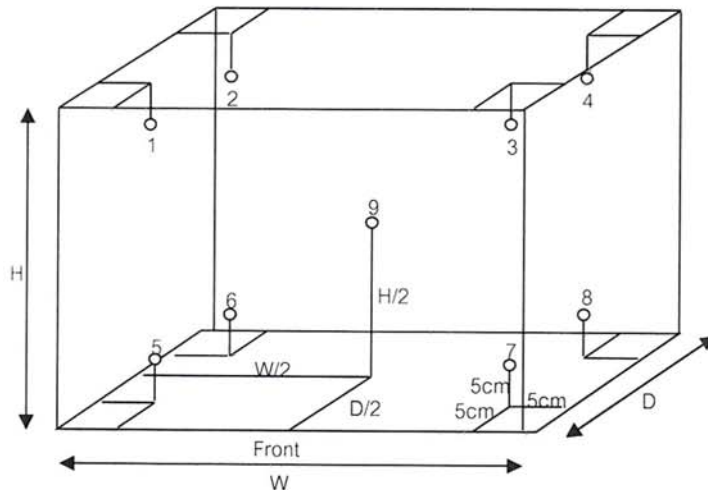
Page : 2 of 2

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 = 0.55 m

D = 0.73 m

H = 0.50 m

Capacity = 0.20 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	19.9	19.9	20.27	20.24	20.07	20.06	20.15	20.14	20.21	20.03	20.12	0.44

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
20.0	19.9	19.9	0.24	0.20	0.54

Remark The uncertainty is not combine uniformity of the air chamber

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

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

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Certificate of Calibration

Certificate No. : 67-200136-1

Page : 1 of 2

Submitted by : Special Lab Envi and Consultant Co., Ltd.
47/91-93 Moo 3, Tambol Tha-It, Pakkret, Nonthaburi 11120

Equipment : Electronic Balance
Manufacturer : AND Model : GR-200
Serial No. : 14245322 ID No. : LB-Eq-016
Capacity : 210 g Resolution : 0.0001 g

Environment : On site calibration was carried out at the Laboratory,
Special Lab Envi and Consultant Co., Ltd.
Ambient Temperature : (27.3 to 27.7) °C
Relative Humidity : (42.5 to 44.0) %
Air Pressure : 1006.0 mbar

Date of Received : 20 April 2024

Date of Calibration : 20 April 2024

Date of Issue : 24 April 2024

Calibrated by : Akaradath Thippichai

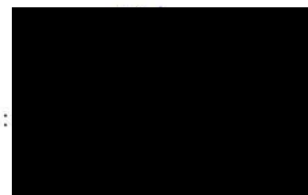
Calibration Method : In-house method CAL-M2001 based on UKAS Publication ref : LAB 14
Edition 7 - November 2022

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

Standard Weights

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

Approved by :



Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-200136-1

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)
0.001	0.0000	0.00012
0.01	0.0000	0.00012
0.1	0.0000	0.00012
0.5	0.0000	0.00013
2	0.0000	0.00013
5	-0.0001	0.00013
10	0.0000	0.00013
50	0.0000	0.00015
100	0.0000	0.00020
200	0.0001	0.00038

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

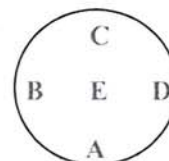
This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.06$, providing a level of confidence of approximately 95%

Eccentric error

Load test : 50 g

A	B	C	D	E
-0.0003	0.0000	0.0006	-0.0001	0.0000

g

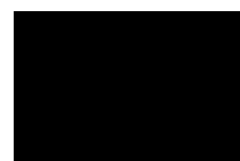


Repeatability

Load test : 200 g

Stdev. : 0.00005 g

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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 FAX. 0-2719-9484

Cert.No.: 24TW29

Page.: 1 of 2

Certificate of Testing

Equipment :	DO Meter
Manufacturer :	Hanna
Model :	HI98193
Serial No. :	03030056991
ID No. :	LB-Eq-014
Received Date :	05 February 2024
Test Date :	06 February 2024
Reference :	2402-0129WN-1
Submitted by :	Special Lab Envi And Consultant Co.,Ltd 47/91-93, 96 Moo 3 Thambon Tha-it, Pakkret, Nonthaburi 11120
Laboratory Condition :	Temperature (25 ± 5) °C Humidity (50 ± 20) %
Test Procedure :	In - house method : CP-CH9 by Comparison Technique with Azide Modification Method
Tested by :	
Approved by :	
(<input checked="" type="checkbox"/>) Saithip Meangmai (<input type="checkbox"/>) Warakorn Lerngagtrakul (<input type="checkbox"/>) Ponpan Paipim	
Issue Date :	7 February 2024

B 0333618



Cert.No.: 24TW29

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

This certification is traceable to the International System of Unit through the reference standards laboratory of Industrial Calibration Center, Technology Promotion Association (Thailand-Japan).

<u>Instruments</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1. Burette	-	130BU10	23CG1172	22 Mar 2025
2. Balance	1124013382	140RC006	23MM18	20 Feb 2024

2. Standard Material :-

<u>Material</u>	<u>Manufacturer</u>	<u>Lot.No.</u>	<u>Assay</u>
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

Result : **Dissolved Oxygen Meter Adjustment With Air 100 %**

Dissolved Oxygen Probe No.: KC1N20CDJ

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.18	8.18	0.0084

This report was certified only for the instrument we tested. It is allowable to use for study
Intend to use for advertising and referral purpose is prohibited. This report may not be reproduced
other in full, without written approval of the laboratory

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

99/9 Moo 2, Maha Sawat, Phutthamonthon, Nakhon Pathom 73170, Thailand. Tel: +66 3424 5299 Fax: +66 3424 5250
E-mail: bkk@becthai.com Website: www.becthai.com



NSC-TISI-TIS 17025
CALIBRATION 0131

Page : 1 of 3

Certificate No. : CAL-24-099

CERTIFICATE OF CALIBRATION

Equipment	:	Spectrophotometer
Manufacturer	:	Thermo Scientific
Model	:	Genesys 20
Serial No.	:	3SGT041007
ID No.	:	LB-Eq-029
Customer	:	Special Lab Envi And Consultant Co.,Ltd.
	:	47/91-93 Moo 3, Tambol Tait, Amphur Pakrad,
	:	Nonthaburi, 11120
Location	:	Becthai Laboratory
Date of Receipt	:	30 April 2024
Date of Calibration	:	2 May 2024
Date of Issue	:	2 May 2024
Ambient Temperature	:	(25±10) °C
Relative Humidity	:	(60±20) %
Condition As-Received	:	Used Item

Calibrated by

Ms. Bussayamas Noppakhun

Calibration Engineer

Approved by

Calibration Manager

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

This certificate may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

Indicated values are valid for the state of the Spectrophotometer at the time of calibration only.



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

99/9 Moo 2, Maha Sawat, Phutthamonthon, Nakhon Pathom. 73170. Thailand. Tel: +66 3424 5299 Fax: +66 3424 5250
E-mail: bkk@becthai.com Website: www.becthai.com



Certificate No. : CAL-24-099

Page : 2 of 3

CALIBRATION REPORT

Conditions of this result of calibration

1. Reference Standard Material :

<u>Material</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert.No.</u>	<u>Due date</u>
Holmium Glass Filter	RM-HG	12705	117342	13 December 2025
Neutral Density Filter	RM-1N2N3N	8323	117341	13 December 2025

2. **Traceability** : This certification is traceable to the International System of Unit maintained at;
The Starna Scientific Ltd. Accredited Calibration Laboratory No. 0659.

3. Method of calibration :

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

4. Result of calibration :

(☒) without adjustment (☐) after adjustment

5. Equipment Specifications:

Spectral Bandwidth :	8	nm
Data Interval :	1	nm
Scan Speed :	N/A	nm/min



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

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E-mail: bkk@becthai.com Website: www.becthai.com



Certificate No. : CAL-24-099

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CALIBRATION REPORT

Wavelength Calibration

Certified Values of Reference Material	Nominal Value (nm)	UUC* Reading (nm)	Error (nm)	Uncertainty of Measurement (\pm nm)	k Factor
418.40	418	418	-0.40	0.59	2.00
537.00	537	537	0.00	0.59	2.00
638.00	638	639	1.00	0.59	2.00

Photometric Calibration for Visible

Wavelength (nm)	Certified Values of Reference Material (A)	UUC* Reading (A)	Error (A)	Uncertainty of Measurement (\pm A)	k Factor
420.0	Zero	0.000	0.0000	0.0028	2.00
	0.5703	0.573	0.0027	0.0045	2.00
	0.7336	0.734	0.0004	0.0045	2.00
	1.0709	1.075	0.0041	0.0045	2.00
440.0	Zero	0.000	0.0000	0.0028	2.00
	0.5592	0.557	-0.0022	0.0045	2.00
	0.716	0.717	0.0010	0.0045	2.00
	1.0454	1.044	-0.0014	0.0045	2.00
465.0	Zero	0.000	0.0000	0.0028	2.00
	0.5094	0.511	0.0016	0.0045	2.00
	0.6601	0.664	0.0039	0.0045	2.00
	0.963	0.966	0.0030	0.0045	2.00
546.1 (546.0)	Zero	0.000	0.0000	0.0028	2.00
	0.5206	0.523	0.0024	0.0045	2.00
	0.6677	0.665	-0.0027	0.0045	2.00
	0.9763	0.979	0.0027	0.0045	2.00
590.0	Zero	0.000	0.0000	0.0028	2.00
	0.5522	0.555	0.0028	0.0045	2.00
	0.6966	0.699	0.0024	0.0045	2.00
	1.0201	1.022	0.0019	0.0045	2.00
635.0	Zero	0.000	0.0000	0.0028	2.00
	0.5377	0.538	0.0003	0.0045	2.00
	0.6649	0.667	0.0021	0.0045	2.00
	0.9736	0.977	0.0034	0.0045	2.00

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

Note:

UUC* : Unit Under Calibration

- End of Report -