

## ภาคผนวก ข

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เอกสารสอบเทียบเครื่องมือที่ใช้ในการวิเคราะห์

# CAL

Calibratech Co.,Ltd.

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

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



NSC-TISI-TIS 17025  
CALIBRATION 0030

## Certificate of Calibration

Certificate No. : 66-200125-1

Page : 1 of 2

Submitted by : HVE Co., Ltd.

603 Soi Jarunsanitwong 46, Jarunsanitwong Road, Bangyeekun, Bangplad, Bangkok 10700

Equipment : Electronic Balance

Manufacturer : SHIMADZU Model : AX200

Serial No. : D432620040 ID No. : 114

Capacity : 200 g Resolution : 0.0001 g

Environment : On site calibration was carried out at the Laboratory, HVE Co., Ltd.

Ambient Temperature : (29.3 to 29.9) °C

Relative Humidity : (56.1 to 60) %

Air Pressure : 1007.0 mbar

Date of Received : 19 April 2023

Date of Calibration : 19 April 2023

Date of Issue : 22 April 2023

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	C02222345	10 Nov 2023	National Institute of Metrology (Thailand), (NIMT)

Approved by :

( Surachai Promthong )

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

Certificate No. : 66-200125-1

Page : 2 of 2

Result of Calibration : Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

Nominal Value (g)	Correction (g)	Uncertainty $\pm$ (g)	Error before Adjustment (g)
0.01	0.0000	0.000085	0.0000
0.1	0.0000	0.000085	0.0000
0.5	0.0001	0.000086	0.0001
1	0.0000	0.00011	0.0001
10	0.0000	0.00012	0.0000
20	-0.0001	0.00011	0.0003
50	0.0000	0.00014	0.0005
100	0.0000	0.00020	0.0005
150	0.0000	0.00038	0.0000
200	0.0004	0.00038	-0.0002

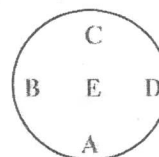
This result of calibration was found accurate as shown on date and place of calibration only.

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	
0.0000	0.0000	0.0000	0.0001	0.0000	g



Repeatability

Load test : 200 g

Stdev. : 0.00005 g

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*Handwritten signature*



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NSC-TISI-TIS17025  
CALIBRATION 0030

## Certificate of Calibration

**Certificate No. :** 66-400195-5

**Page : 1 of 2**

**Submitted by :** HVE Co., Ltd.

603 Soi Jarunsanitwong 46, Jarunsanitwong Road, Bangyeekun, Bangplad, Bangkok 10700

**Equipment :** Air Chamber (Oven)

Manufacturer : Memmert

Model : UNB 500

Range : N/A °C

Resolution : 0.5 °C

Serial No. : C507.1007

ID No. : 012

**Environment :** On site calibration was carried out at the Laboratory, HVE Co., Ltd.

Ambient Temperature : (25.0 to 26.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (229.0 to 230.0) V

**Date of Received :** 19 April 2023

**Date of Calibration :** 19 April 2023

**Date of Issue :** 22 April 2023

**Calibrated by :** Bunjerd Masri

**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 & 400023

66-400184-1

03 Oct 2023

National Institute of Metrology Thailand (NIMT)

Approved by :

( Bunjerd Masri )

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

Certificate No. : 66-400195-5

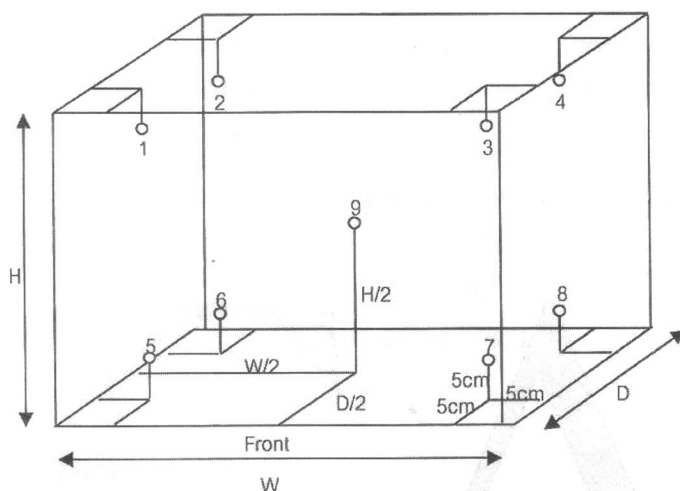
Page : 2 of 2

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 m<sup>3</sup>

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (±°C)
			1	2	3	4	5	6	7	8	9	
104.0	105.5	105.5	105.2	105.4	105.1	105.3	101.9	103.9	100.6	103.5	103.3	1.0

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
104.0	105.5	105.5	3.0	0.3	5.0

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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NSC-TISI-TIS17025  
CALIBRATION 0030

## Certificate of Calibration

**Certificate No. :** 66-400196-1

**Page : 1 of 2**

**Submitted by :** HVE Co., Ltd.

603 Soi Jarunsanitwong 46, Jarunsanitwong Road, Bangyeekun, Bangplad, Bangkok 10700

**Equipment :** Air Chamber (Incubator)

Manufacturer : Lovibond

Model : ET636-6

Range : N/A °C

Resolution : 0.1 °C

Serial No. : 9982523-03

ID No. : 011

**Environment :** On site calibration was carried out at the Laboratory, HVE Co., Ltd.

Ambient Temperature : (24.0 to 25.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (229.0 to 230.0) V

**Date of Received :** 19 April 2023

**Date of Calibration :** 19 April 2023

**Date of Issue :** 22 April 2023

**Calibrated by :** Bunjerd Masri

**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 66-400066-2

03 Aug 2023

National Institute of Metrology Thailand (NIMT)

Approved by :

( Bunjerd Masri )

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

Certificate No. : 66-400196-1

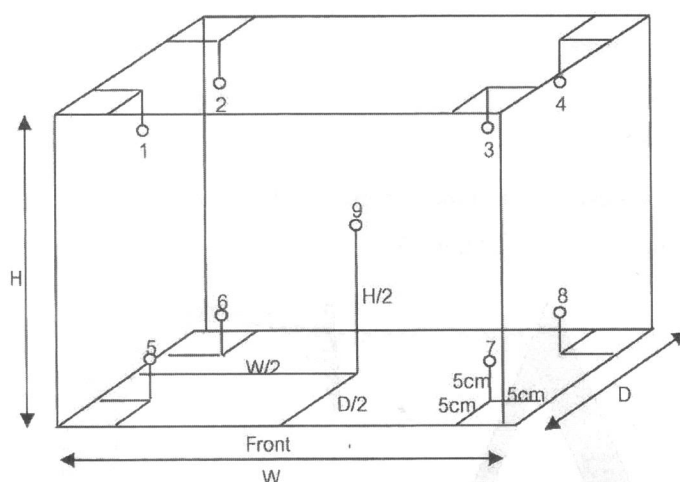
Page : 2 of 2

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 = 0.53 m

D = 0.43 m

H = 1.40 m

Capacity = 0.32 m<sup>3</sup>

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
20.0	21.0	21.0	20.12	20.18	20.29	20.29	20.16	20.03	19.93	19.87	20.01	0.42

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
20.0	21.0	21.0	0.32	0.19	0.6

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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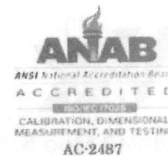




WK Electric Co., Ltd.

68/242 Moo 5, Sawaipracharaj Rd., Tumbol Ladsawai, Amphur Lamlukka, Pathumthani 12150

Tel. +66 2993 4773, +66 2153 7132-3 Fax. +66 2994 5509 E-mail : wk.calibrations@gmail.com www.wk-etc.com



## Certificate of Calibration

Certificate No.: WK2304-173-14

Page 1 of 2

Customer : HVE COMPANY LIMITED  
603 Soi Charansanitwong 46 Charansanitwong Road,  
Bang Phlat, Bangkok 10700

Instrument	: pH Meter	Ambient Temperature	: (25 ± 2) °C
Manufacturer	: HANNA	Humidity	: (50 ± 15) %RH
Model	: HI 221	Received Date	: 26-Apr-23
Serial No.	: 08376721	Calibrated Date	: 2-May-23
Identity No.	: N/A	Issued Date	: 3-May-23
Range	: See to Data	Calibrated Location	: In Lab
Resolution	: See to Data		
Calibration Method	: CP-WK-C01 and CP-WK-T06		

### Reference standard instruments :

Instrument	Serial No.	Certificate No.	Due Date	Traceability to
pH Buffer # 4	PH216.L5	880819	13-Mar-24	CPAchem Ltd.
pH Buffer # 7	PH107.L5	880818	13-Mar-24	CPAchem Ltd.
pH Buffer # 10	PH220.L5	880822	13-Mar-24	CPAchem Ltd.
Digital Thermometer	382081948	WK2210-140-5	24-Oct-23	WK Electric Co., Ltd.
Temperature Indicator with PRT Standard	4507	PSL-T 0292/65	11-Feb-24	TISTR

TISTR : Thailand Institute of Scientific and Technological Research.

This result calibrate was found accurate as shown on date place of calibrate only

This certificate is traceability to the International System of Unit (SI)

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%

Calibrated by : Ms. Usa Phuangphiphat

Approved by :

Ms. Budsagorn Patcha

Authorized Signatory

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## Calibration Results

Certificate No.: WK2304-173-14

Page 2 of 2

### Calibration Result of the Accuracy

Function : pH Measurement

Range : 4 pH to 10 pH

Resolution : 0.01 pH

Unit : pH

STD Solution	UUC Reading	Error	Uncertainty ( ± pH )
4.00	4.02	0.02	0.0080
7.00	7.02	0.02	0.010
10.00	9.98	-0.02	0.010

Function : Temperature Measurement

Range : 25 °C

Resolution : 0.1 °C

Unit : °C

Temperature Setting	STD Reading	UUC Reading	Error	Uncertainty ( ± °C )
25	25.069	25.2	0.131	0.032

( X ) Without Adjustment ( ) After Adjustment

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\*\*\*\* End of Certificate\*\*\*\*



**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.: 23TW93

Page.: 1 of 2

## Certificate of Testing

**Equipment :** DO Meter  
**Manufacturer :** Digicon  
**Model :** DO-552SD  
**Serial No. :** AG.35318  
**ID No. :** -  
**Received Date :** 31 March 2023  
**Test Date :** 03 April 2023  
**Reference :** 2303-1117DN-1  
**Submitted by :** HVE Co.,Ltd  
603 Soi Jarransanitwong 46, Jarransanitwong Road,  
Bang Yi Khan, Bang Phlat, Bangkok 10700  
**Laboratory Condition :** Temperature (  $25 \pm 5$  ) °C  
Humidity (  $50 \pm 20$  ) %  
**Test Procedure :** In - house method : CP-CH9  
by Comparison Technique with Azide Modification Method  
**Tested by :** Walalak Sirithean  
**Approved by :** Malee  
Approved Signatory  
( ☒ ) Malee Butkruea  
( ☐ ) Saithip Meangmai  
( ☐ ) Warakorn Lernagatrakul  
**Issue Date :** 5 April 2023

B 0311635



Cert.No.: 23TW93

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	1126143764	140RC004	22MM50	20 Sep 2023

**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.: 07-07

<b>Titration Method (Azide Modification Method) (mg/L)</b>	<b>DO Meter Reading (mg/L)</b>	<b>Standard Deviation (mg/L)</b>
8.16	8.0	0.055

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency, The environmental impact control and present to organization it may concerned 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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Malu.

a 1156571





บริษัท กิตติสิทธ์ เอ็นเตอร์ไพรส์ จำกัด (สำนักงานใหญ่)

KITTISIT ENTERPRISE CO.,LTD

38/76, 38/77 หมู่ 3 ตำบลตุ้มตุ้ย อำเภอสามโก้ จังหวัดปทุมธานี 12130

โทร : 02-991-0963 แฟกซ์ : 02-991-0986 มือถือ : 089-455-1486

E-mail sale@ktssci.com , www.ktssci.com



## CERTIFICATE OF CALIBRATION

Certificate No : 22-072

Page : 1 of 5

**Customer** : HVE CO ., LTD .  
**Address** : 603 Soi Jarunsanitwong 46 , Jarunsanitwong Road , Bangyeekun  
Bangplad , Bangkok 10700  
**Instrument** : UV/Vis Spectrophotometer  
**Manufacturer** : Thermo Scientific  
**Model** : G10S UV-VIS  
**Serial Number** : 2L9Q310003  
**Environment** : Temperature ( Before 26.7 °C , After 27.0 °C )  
: Humidity ( Before 55.6 %RH , After 56.7 %RH )  
**Received Date** : 2/11/2022  
**Calibration Date** : 8/11/2022  
**Issue Date** : 10/11/2022  
**Calibration Status** : No Adjustment  
**Calibration Area** : Onsite Laboratory Room

**Calibrated By** : Apichit Puttachart  
( Mr. Apichit Puttachart )

**Approved By** : [Signature]  
( Mr. Puttipong Busayakitisit )

F-2401-01/26-07-60





บริษัท กิตติสิทธิ์ เอ็นเตอร์ไพรส์ จำกัด (สำนักงานใหญ่)

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Certificate No : 22-072

## 1. Wavelength Accuracy

Page : 2 of 5

Spectral slit width: 2.00 nm

### 1.1 CRMs : Holmium Glass Filter

Traceability : Traceable to the International System of Unit through Starna Certificat 94650

Filter STDs(nm) Certificate	Average Measuring Value(nm)	Correction (nm)	Uncertainty ±(nm)
241.74	241.40	0.34	0.12
279.44	279.30	0.14	0.12
287.98	287.89	0.09	0.13
334.10	334.10	0.00	0.12
361.00	360.80	0.20	0.12
418.61	418.60	0.01	0.12
453.63	453.60	0.03	0.12
460.05	460.00	0.05	0.12
536.66	536.80	-0.14	0.12
637.98	638.56	-0.58	0.14

### 1.2 CRMs : Didymium Glass Filter

Traceability : Traceable to the International System of Unit through Starna Certificat 94647

Filter STDs(nm) Certificate	Average Measuring Value(nm)	Correction (nm)	Uncertainty ±(nm)
585.29	585.70	-0.41	0.12
684.49	685.10	-0.61	0.12
740.18	741.00	-0.82	0.12
748.48	749.20	-0.72	0.12
807.03	807.80	-0.77	0.12

F-2401-01/26-07-60



บริษัท กิตติสิริ เอ็นเตอร์ไพรส์ จำกัด (สำนักงานใหญ่)

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## 2. Photometric Accuracy

Certificate No : 22-072

CRMs : Neutral Density Glass Filters

Page : 3 of 5

Traceability: Traceable to the International System of Unit through Starna Certificate 94683

Spectral slit width: 2.00 nm

### 2.1 Reading scale at 420.0 nm. (\* Not Accredited )

Filter STDs (Abs.) Certificate	Average Measuring Value (A)	Correction (A)	Uncertainty $\pm(A)$
0.0000	0.0000	0.0000	0.0028
0.5732	0.5720	0.0012	0.0056
0.7135	0.7130	0.0005	0.0050
1.0269	1.0280	-0.0011	0.0034

### 2.2 Reading scale at 440.0 nm.

Filter STDs (Abs.) Certificate	Average Measuring Value (A)	Correction (A)	Uncertainty $\pm(A)$
0.0000	0.0000	0.0000	0.0028
0.5582	0.5570	0.0012	0.0056
0.7019	0.7010	0.0009	0.0050
1.0099	1.0100	-0.0001	0.0034

### 2.3 Reading scale at 465.0 nm.

Filter STDs (Abs.) Certificate	Average Measuring Value (A)	Correction (A)	Uncertainty $\pm(A)$
0.0000	0.0000	0.0000	0.0028
0.5209	0.5190	0.0019	0.0053
0.6631	0.6620	0.0011	0.0049
0.9531	0.9530	0.0001	0.0032

F-2401-01/26-07-60



Certificate No : 22-072

Page : 4 of 5

**2.4 Reading scale at 546.1 nm.**

Filter STDs (Abs.) Certificate	Average Measuring Value (A)	Correction (A)	Uncertainty $\pm(A)$
0.0000	0.0000	0.0000	0.0028
0.5224	0.5200	0.0024	0.0043
0.6997	0.6970	0.0027	0.0041
1.0066	1.0040	0.0026	0.0028

**2.5 Reading scale at 590.0 nm.**

Filter STDs (Abs.) Certificate	Average Measuring Value (A)	Correction (A)	Uncertainty $\pm(A)$
0.0000	0.0000	0.0000	0.0028
0.5564	0.5530	0.0034	0.0038
0.7750	0.7710	0.0040	0.0037
1.1171	1.1130	0.0041	0.0029

**2.6 Reading scale at 635.0 nm.**

Filter STDs (Abs.) Certificate	Average Measuring Value (A)	Correction (A)	Uncertainty $\pm(A)$
0.0000	0.0000	0.0000	0.0028
0.5638	0.5610	0.0028	0.0035
0.7644	0.7610	0.0034	0.0035
1.1014	1.0990	0.0024	0.0029



บริษัท กิตติสิทธิ์ เอ็นเตอร์ไพรส์ จำกัด (สำนักงานใหญ่)

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Certificate No : 22-072

Page : 5 of 5

### 3. Photometric Accuracy

CRMs : Potassium Dichromate 60 mg/l CRMs Serial Number : 35553

Blank Serial Number : 105079

Traceability : Traceable to NIST through Sarna Certificate

94662

Spectral slit width : 2.00 nm

	Certificate (Abs.)	Average Measuring Value (A)	Correct (A)	Uncertainty $\pm(A)$
Blank	0.0000	0.0000	0.0000	0.0049
235 nm	0.7454	0.7413	0.0041	0.0062
Blank	0.0000	0.0000	0.0000	0.0049
257 nm	0.8651	0.8590	0.0061	0.0058
Blank	0.0000	0.0000	0.0000	0.0049
313 nm	0.2895	0.2900	-0.0005	0.0052
Blank	0.0000	0.0000	0.0000	0.0049
350 nm	0.6415	0.6370	0.0045	0.0052

### 4. Stray Light (\*Not Accredited)

CRMs : Potassium Iodide aqueous solution

CRM Serial Number : 35557

Traceability : Traceable to NIST through Sarna Certificate

94670

Spectral slit width: 2.00 nm

Wavelength (nm)	Certificate	Average Measuring
260.3	>2A	2.3741
260.3	<1%T	0.42

#### Note

#### 1. Calibration Method

1.1 Wavelength Accuracy : Measuring Wavelength by CRMs base on ASTM E925/ASTM E275-08

1.2 Photometric Accuracy : Measuring Absorbance by CRMs based on ASTM E925/ASTM E275-08

1.3 Stray light : Measuring Absorbance and Transmittance by CRMs base on ASTM E387

2. Uncertainty of Measurement : The report uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor  $k=2$ , providing a level of confidence of approximately 95%

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

4. This certificate was certificate only for the our calibrated instrument.

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