

## ภาคผนวกที่ 4

เอกสารสอบเทียบเครื่องมือการตรวจวิเคราะห์คุณภาพน้ำ

ตารางสรุปการสอบเทียบเครื่องมือการตรวจวิเคราะห์

รายการตรวจวัด	เครื่องมือตรวจวิเคราะห์
คุณภาพน้ำผิวดิน	
- pH	- pH Meter
- Dissolved Oxygen (DO)	- Incubator
- Nitrate-Nitrogen	- Spectrophotometer



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert.No.: 21CH1216  
Page.: 1 of 2

## Certificate of Calibration

**Equipment :** pH Meter  
**Manufacturer :** HANNA  
**Model :** HI 3512  
**Serial No. :** 08685754  
**ID No. :** -  
**Condition As-Received:** Used Item  
**Received Date :** 14 September 2021  
**Calibration Date :** 16 September 2021  
**Reference :** 2109-0508WN-1  
**Submitted by :** S.P.S. Consulting Service Co.,Ltd.  
7 Phaholyothin 24, Phaholyothin Road,  
Jompol, Chatuchak, Bangkok10900  
**Ambient Temperature :** (25 ± 2.5) °C  
**Relative Humidity :** (50 ± 15) %  
**Calibration Procedure :** In - house method :  
- CP-CH5 by direct measurement with standard  
voltage calibrator and direct measurement  
with certified reference material (CRM)

**Calibrated by :** Walalak Sirithean

**Approved by :**   
Approved Signatory

(✓) Malee Butkruea  
( ) Salthip Meangmal  
( ) Warakorn Lernagtrakul

**Issue Date :** 22 September 2021

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.



Cert. No.: 21CH1216  
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### Condition of this calibration result

1. Reference Standard Instrument : -

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	46530031	130RC098	20E3666	14 Oct 2021

This certification is traceable to the International System of Unit maintained at:-  
- Traceable to National Institute of Metrology (Thailand), NIMT

2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,  
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	754028	28 June 2023
pH 6.985	CPA chem	725927	12 Jan 2022
pH 10.015	CPA chem	761018	02 Aug 2022

3. This certificate is valid only to the item calibrated on date and place of calibration.

### Calibration Results

**Function :** mV Measurement

**Performing standard curve by Fluke at pH (4,7,10)**

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement ( ±mV )	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N.: 08685754	4.000	177.48	177.9	4.000	0.058	2.00
	7.000	0.00	0.4	7.000	0.058	2.00
	10.000	-177.48	-177.2	10.000	0.058	2.00

**Function :** pH Measurement

**Performing three buffers standard curve by using buffer nominal pH (4,7,10)**

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading ( mV )	Uncertainty of pH measurement ( ± )	Coverage factor k
pH Electrode S/N.: 061416CM	4.008	4.008	169.2	0.0046	2.00
	6.985	6.985	-4.4	0.0075	2.00
	10.015	10.013	-178.9	0.013	2.05

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

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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.: 21TW101  
Page.: 1 of 2

## Certificate of Testing

Equipment : DO Meter  
Manufacturer : YSI  
Model : 5000-230V  
Serial No. : 15B100751  
ID No. : -  
Received Date : 28 April 2021  
Test Date : 30 April 2021  
Reference : 2104-0741WN-1  
Submitted by : S.P.S. Consulting Service Co.,Ltd.  
7 Soi Phaholyothin 24, Phaholyothin Rd.,  
Jompol, Chatuchak, Bangkok 10900  
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 : Walalak Sirithean  
Approved by :   
Approved Signatory  
( / ) Malee Butkruea  
( ) Saithip Meangmai  
( ) Warakorn Lerngagtrakul  
Issue Date : 7 May 2021

B 0259620



Cert.No.: 21TW101  
Page.: 2 of 2

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 14K100246

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.08	8.09	0.0071

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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MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

214 Bangwaek Rd. Bangpai Bangkae Bangkok 10160  
Tel.: 0-2865-4647-8 Fax: 0-2865-4649 http://www.mit.in.th



## CALIBRATION CERTIFICATE

Certificate No. : SS2110-013-0003

Date Issued : 04-Oct-21

**Customer & Calibrated Place** : S.P.S. CONSULTING SERVICE CO., LTD.  
7 Soi Phaholyothin 24 Phaholyothin Road., Jompol, Chatuchak, Bangkok 10900

**Equipment** : Incubator  
**Manufacturer** : BINDER  
**Model** : BD 115  
**Serial No.** : 12-16967  
**ID No./Tag No.** : IN 05/56  
**Date Received** : 01-Oct-21  
**Date Calibrated** : 01-Oct-21  
**Calibrated by** : Mr. Jame Khaothong

### Calibration Method or Calibration Procedure Used

Standard method : CP-05 TLAS G-20.

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 :

*K. Nathapong*

(Mr. Nathapong Krudaum)



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Certificate No. : SS2110-013-0003

**Environment** : Ambient Temperature : Start record 26.0 °C, Stop record 25.7 °C  
Relative Humidity : Start record 56.5 %RH, Stop record 55.7 %RH

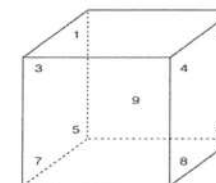
Calibration Temperature (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Stability <sup>1</sup> (°C)	Measured Uniformity <sup>2</sup> (°C)	Overall Variation <sup>3</sup> (°C)
35	35.0	35.0	0.12	0.40	0.45
41.5	41.5	41.5	0.11	0.39	0.51

Without adjustment

Calibration Temperature (°C)	STD No. 1 (°C)	STD No. 2 (°C)	STD No. 3 (°C)	STD No. 4 (°C)	STD No. 5 (°C)	STD No. 6 (°C)	STD No. 7 (°C)	STD No. 8 (°C)	STD No. 9 (°C)	Uncertainty <sup>4</sup> ±°C
35	35.01	35.11	34.95	35.00	34.99	34.95	35.07	35.07	35.23	0.23
41.5	41.47	41.47	41.40	41.49	41.37	41.33	41.43	41.51	41.62	0.22

Note : Probe No. 9 is Reference Probe

Setting Air Fresh No. 0



### Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Certificate No. AD2107-034-0001 for Digital Thermometer with Probe (Agilent) Module 1 (245) Serial No. US37005130, Due 04-Feb-22

Notes : 1. The temperature stability is the one-half of greatest maximum difference of measured temperatures at any one probe.

2. The temperature uniformity is the maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time.

3. Overall variation is the difference of maximum and minimum measured temperatures throughout observation time.

4. The uncertainty of measurement is included temperature stability.

5. The temperature uniformity, stability, overall variation and indicating temperature is applicable to all air or gas filled temperature controlled enclosures at atmospheric pressure.

End of Certificate

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# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd.,Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : SP21012  
Pages 1 of 3

## Calibration Certificate

**Equipment :** UV-VIS SPECTROPHOTOMETER  
**Manufacturer :** PERKINELMER  
**Model :** LAMBDA 365  
**Serial No.:** 365K7060203  
**ID No.:** SP04/60  
**Calibration Mode :** WAVELENGTH ACCURACY  
PHOTOMETRIC ACCURACY  
**Condition As Found :** GOOD  
**Customer :** S.P.S. CONSULTING SERVICE CO., LTD.  
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN ROAD,  
CHOMPHON, CHATUCHAK,  
BANGKOK 10900, THAILAND.  
**Location :** ORGANIC LABORATORY IV  
**Ambient Temperature :** ( 24.5 ± 5 ) °C  
**Relative Humidity :** ( 68.0 ± 25 ) %  
**Received Date :** 30 AUGUST 2021  
**Calibration Date :** 30 AUGUST 2021  
**Date of Issue :** 31 AUGUST 2021

Calibrated by : Nathakorn Pisutpaisan

Approved by :

*T. Petchurai*  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

Cert. No. : SP21012  
Job No. : VC64SP0012  
Pages : 2 of 3

### Calibration Method :

This instrument was calibrated by using on-site calibration procedure In-house method : CP-SP-01  
The calibration procedure to direct measurement wavelength accuracy by using wavelength standard solution, Photometric accuracy by using absorbance standard filter and absorbance standard solution  
The calibration procedure used was based on ASTM E275-01,ASTM E925-02

### Condition of this result of calibration :

#### 1. Certified reference materials

Material	Ref. type	Cell serial No.	Cert. No.	Due Date
Holmium liquid	RM-HL	29706	87569	13/10/2022
Didymium liquid	RM-DL	28912	87588	15/10/2022
Neutral density filter	RM-1N2N3N	13877	87600	15/10/2022
Potassium dichromate solutions	RM-0204060810	14204	87614	16/10/2022
Potassium Iodide solution	-	KI-0701-001	CI-0030-20	13/02/2022

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

3. This certificate is traceable to the international system of unit maintained at :

- 3.1 The UK National Physical Laboratory (NPL)
- 3.2 The National Institute of Standards and Technology, NIST.

### Result of calibration : Wavelength Accuracy

(Without adjustment)

Material	Certified Values of Reference Material (nm)	UUC* Reading (nm)	Error (nm)	Uncertainty ± (nm)	k Factor
RM-HL	278.13	278.2	0.07	0.16	2.00
	361.25	361.4	0.15	0.16	2.00
	467.82	468.1	0.28	0.16	2.00
	536.56	536.7	0.14	0.16	2.00
	640.50	640.7	0.20	0.16	2.00
RM-DL	740.09	739.2	-0.89	0.16	2.00
	864.94	863.8	-1.14	0.16	2.00

UUC\* = Unit Under Calibration

*T. Petchurai*



## Continuation of Calibration Certificate

Cert. No. : SP21012  
Job No. : VC64SP0012  
Pages : 3 of 3

## Result of calibration : Photometric Accuracy

(Without adjustment)

Material	Wavelength (nm)	Filter S/N	Nominal Absorbance (A)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor
Neutral Density glass filter	440.0	29360	1.0	1.0524	1.0507	-0.0017	0.0028	2.00
		29914	0.7	0.7454	0.7441	-0.0013	0.0030	2.00
		29381	0.5	0.5426	0.5414	-0.0012	0.0028	2.00
	546.1	29360	1.0	0.9822	0.9801	-0.0021	0.0028	2.00
		29914	0.7	0.6962	0.6947	-0.0015	0.0028	2.00
		29381	0.5	0.5076	0.5064	-0.0012	0.0028	2.00
	590.0	29360	1.0	1.0221	1.0199	-0.0022	0.0028	2.00
		29914	0.7	0.7238	0.7222	-0.0016	0.0029	2.00
		29381	0.5	0.5364	0.5342	-0.0022	0.0031	2.00
	635.0	29360	1.0	0.9751	0.9737	-0.0015	0.0028	2.00
		29914	0.7	0.6912	0.6899	-0.0013	0.0028	2.00
		29381	0.5	0.5214	0.5197	-0.0017	0.0032	2.00
Material	Wavelength (nm)	Solution (mg/l)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor	
RM-0204060810	235.0	20	0.2436	0.2421	-0.0015	0.0101	2.00	
		40	0.4905	0.4865	-0.0040	0.0115	2.00	
		60	0.7453	0.7403	-0.0050	0.0067	2.00	
		80	0.9920	0.9919	-0.0001	0.0071	2.00	
		100	1.2487	1.2614	0.0127	0.0073	2.00	

UUC\* = Unit Under Calibration

## Condition of this result of calibration : Spectrophotometer PERKINELMER Model LAMBDA 365 S/N 365K7060203

Resolution of Wavelength Mode 0.1 nm  
Resolution of Photometric Mode 0.0001 A

Parameter Setting

Measurement Mode Wavelength, Absorbance

Wavelength Scan 1100 nm-190 nm

Scanning Speed 600 nm/min

Data Pitch 0.1 nm

Band width(Wavelength) 1.0 nm

Band width(Vis) 1.0 nm

Band width(Uv) 1.0 nm

## Stray Light\*\* UUC\* Reading at 220 nm

Transmission T(%)	Absorbance(A)
0.0002	6.3546

\*\*Specific Acceptance :

Transmission  $\leq 1.0$  T(%), Absorbance  $\geq 2.0$  A

\*\*Stray light not TISI Accredited

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

End of Calibration Certificate