

ภาคผนวกที่ 5

เอกสารสอบเทียบความถูกต้องของเครื่องมือ

ตารางสรุปรายการเอกสารการสอบเทียบเครื่องมือตรวจวิเคราะห์

รายการตรวจวิเคราะห์	เครื่องมือตรวจวิเคราะห์
- Temperature	- Thermometer
- Turbidity	- Turbidity Meter
- pH	- pH Meter
- Conductivity	- Conductivity Meter
- Dissolved Oxygen (DO)	- DO Meter
- BOD ₅	- DO Meter
- Total Suspended Solids (TSS)	- Digital Balance
- Total Dissolved Solids (TDS)	- Digital Balance
- Grease and Oil	- Digital Balance
- Total Phosphorus	- Spectrophotometer
- Total Nitrogen	- Spectrophotometer
- Lead	- ICP
- Mercury	- AAS
- Cadmium	- ICP

Certificate of Calibration

Certificate No. : 68-400046-2

Page : 1 of 2

Submitted by : S. P. S Consulting Service Co., Ltd.

7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900

Equipment : Liquid in Glass Thermometer

Manufacturer : SK

Model : N/A

Range : 0 °C to 100 °C

Resolution : 1 °C

Serial No. : N/A

Immersion : Total

ID No. : TM21/59

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

Relative Humidity : (50 ± 15) %

Line Voltage : (220 ± 22) VAC

Date of Received : 21 January 2025

Date of Calibration : 24 January 2025

Date of Issue : 24 January 2025

Calibrated by : Chortip Samchusri

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

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

ID No.	Cert. No.	Due Date
400001	TT-0023-24	16 Feb 2026

Traceability
National Institute of Metrology-Thailand (NIM1)

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date
400003	23E1866	01 Jun 2025
400004	23E1866	01 Jun 2025

Traceability
National Institute of Metrology Thailand (NIMT)
National Institute of Metrology Thailand (NIMT)

Approved by :

(Permpoon Chanpu)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 68-400046-2

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Ice point check : UUC* reading 0 °C Standard reading 0.4429 °C

Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
20.4801	20	0.5	0.31

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%


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Certificate of Calibration

Cert.No.: 25CH217
Page.: 1 of 3

Equipment : Turbidity Meter
Manufacturer : Eutech
Model : CyberScan WLTB1000
Serial No. : 201802206
ID. No. : TB 02/50
Condition As-Received: Used Item
Received Date : 17 February 2025
Calibration Date : 18 February 2025
Reference : 2502-0500WN-1
Submitted by : S.P.S. Consulting Service Co.,Ltd.
7 Phaholyothin 24, Phaholyothin Road.,
Jompol, Chatuchak, Bangkok 10900
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 20) %
Calibration Procedure : In - house method : CP-CH11
Direct measurement by
using Formazin standard solution
Calibrated by : Walalak Sirithean
Approved by : 
Approved Signatory
() Chakrit Waewwanjua
() Ponpan Paipim
(✓) Saithip Meangmai
Issue Date : 21 February 2025

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 Calibration and Testing Equipment Services.



Cert.No. : 25CH217
Page. : 2 of 3

Condition of this calibration result

1. Reference Standard Instruments :

Instruments	Serial No.	ID No.	Certificate No.	Due date
1) Thermo-Hygrograph	1103328	130EC010	24H1372	12 July 2025
2) Electronic Balance	14233821	110RC001	24MM131	04 July 2025

- This Certification is traceable to SI Through Technology Promotion Association (Thailand - Japan)

2. Standard Material : The Formazin suspension has been prepared gravimetric from

Material	Manufacturer	Lot No.	Assay
1) Hexamethylenetetramine	HIMEDIA	0000493947	99.65%
2) Hydrazinium Sulfate	HIMEDIA	0000522014	99.40%

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

Calibration result

Performing three - Formazin suspension standard curve by using 0,10,1000 NTU
Turbidity Meter Serial Number : 201802206

Standard Formazine suspension (NTU)	UUC* Reading (NTU)	Error (NTU)	Uncertainty of Measurement (± NTU)	Coverage Factor k	Tolerance Limit (± NTU)	Judgement
20	19.4	-0.6	0.38	2.00	2.0	Pass
40	39.9	-0.1	0.40	2.00	2.0	Pass
100	98.9	-1.1	0.70	2.00	2.0	Pass
400	391	-9	1.5	2.05	20.0	Pass

Remark - UUC* = Unit Under Calibration
- NTU = Nephelometric Turbidity Units



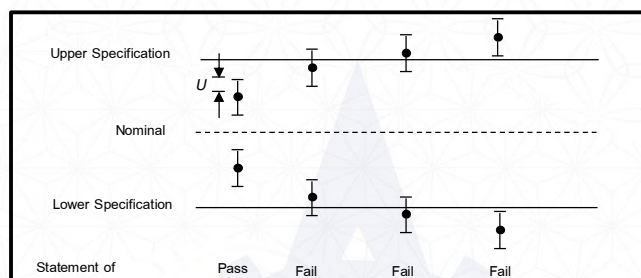
Cert.No. : 25CH217

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Decision Rule : The decision rule is prescribed by customer (Error \pm Uncertainty < Specification)

Statement of conformity are reported as :

- o Pass - the measured value included the measurement uncertainty is below the acceptance limit.
- o Fail - the measured value included the measurement uncertainty is above the acceptance limit.



$U=95\%$ expanded measurement uncertainty

Tolerance Limit (Specification Limit) provided by customer

Tolerance Limit (TL) (Specification Limit) : specified upper or lower bound of permissible values of property.

Acceptance Limit (AL) : specified upper or lower bound of permissible measured quantity values.

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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CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : pH METER
MANUFACTURER : HANNA
MODEL / TYPE : HI3512/HI1332/HI7662-T
SERIAL NO. : 08685754/11250B7M/092806BN[PH04/56]
CLID. NO. : 272501562
JOB CONTROL NO. : 250617070523
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

CUSTOMER : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24 ROAD, JOMPOL,
CHATUCHAK, BANGKOK 10900

DATE OF RECEIVED : 17 June 2025

DATE OF ISSUED : 20 June 2025

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Sukgasem Sechanart
Wenick Inchaisri
Calibration Engineer

Approved By : Mongkol Yotsoontorn
Authorized Signatory
20 June 2025



This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q25070523

F3-011-05/12-23

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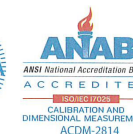


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REPORT OF CALIBRATION

FOR

NOMENCLATURE : pH METER
MANUFACTURER : HANNA
MODEL / TYPE : HI3512/HI1332/HI7662-T
SERIAL NO. : 08685754/11250B7M/092806BN[PH04/56]
DATE OF CALIBRATION : 18 June 2025

ENVIRONMENT CONDITIONS :

Temperature : $(25 \pm 2.5) ^\circ\text{C}$ Relative Humidity : $(50 \pm 15) \% \text{ RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPCH-01 [pH Meter]. The calibration was performed by direct measurement with Certified Reference Material (CRM).

This instrument was calibrated under procedure No. CLC-CPH-04 [Temperature] based on ASTM E 644-04 as calibration guidelines. The calibration was performed by using Calibration Bath, Precision Thermometer and IPRT which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. pH Standard Solution, NIMT TRM CODE TRM-S-2003, TRM CODE TRM-S-2007.
2. pH Standard Solution, Control Company Catalog Number 06664260,11754256, Lot Number CC787362.
3. Calibration Bath, Kambic Model OB-22/2 ULT S/N. 17115653.
4. Precision Thermometer, ASL Model F250 S/N. 1334023800.
5. IPRT, Wika Model CTP5000-250-D S/N. PO00043543-1-10-1.

Certificate No. Q25070523

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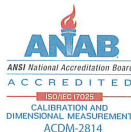


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2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



TRACEABILITY :

1. The measurements are traceable to International System of Units (SI) , through National Institute of Metrology (Thailand).
Lot Number. 080124 , 120124. Due Date 23 January 2026.
2. The measurements are traceable to International System of Units (SI) , through Control Company.
Certificate No. 4281-14495731 , Due Date 27 September 2025.
3. The measurements are traceable to International System of Units (SI) , through Calibration Laboratory Co., Ltd.
Certificate No. Q24120999, Due Date 26 November 2025.
4. The measurements are traceable to International System of Units (SI) , through Thailand Institute of Scientific and Technological Research (TISTR). Certificate No. PSL-T 1042/67, Due Date 16 October 2025.
5. The measurements are traceable to International System of Units (SI) , through National Institute of Metrology (Thailand).
Certificate No. TT-0146-24, Due Date 28 October 2025.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor complies with the table which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q25070523

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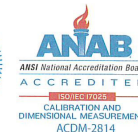


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CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The table in the following gives the calibration results and associated measurement uncertainties of pH meter.

CALIBRATION DATA

1. pH METER RESULT @ 25 °C

Standard pH Buffer Solution (pH)	pH Meter Reading (pH)	pH Meter Reading (mV)	Correction (pH)	Uncertainty of pH Measurement (\pm pH)	k Factor
4.003	4.005	168.2	-0.002	0.010	2,00
7.005	7.010	-8.1	-0.005	0.013	2,00
10.015	10.010	-177.7	+0.005	0.014	2,00

Technical Note. Setting function CAL 3 point (4,7,10).

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 015 Page 4 of 68

2. TEMPERATURE RESULT

Immersion depth (mm)	Actual Temperature (°C)	DUC Reading (°C)	Correction (°C)	Uncertainty \pm (°C)
100	25.00	25.0	0.00	0.07

Technical Note. Type of sensor : Thermistor

Probe \varnothing 3 mm

Materials : Metal Sheath.

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor of $k = 2,00$.

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 015 Page 56 of 68

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q25070523

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CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : CONDUCTIVITY METER
MANUFACTURER : METTLER TOLEDO
MODEL / TYPE : SEVEN COMPACT S230
SERIAL NO. : C141708983/5821320179[CD 05/65]
CLID. NO. : 272300452
JOB CONTROL NO. : 250204013412
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

CUSTOMER : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24 ROAD, JOMPOL,
CHATUCHAK, BANGKOK 10900

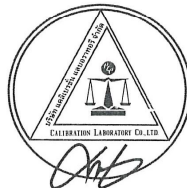
DATE OF RECEIVED : 04 February 2025

DATE OF ISSUED : 06 February 2025

The report of calibration shall not be reproduced except in full without approval of the calibration Laboratory Co., Ltd.

Calibrated By : Sukgasem Seechanart
Wenick Inchaistri
Calibration Engineer

Approved By : Mongkol Yotsoontorn
Authorized Signatory
06 February 2025



This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q25013412

F3-011-05/12-23

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@clccalibration



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REPORT OF CALIBRATION

FOR

NOMENCLATURE : CONDUCTIVITY METER
MANUFACTURER : METTLER TOLEDO
MODEL / TYPE : SEVEN COMPACT S230
SERIAL NO. : C141708983/5821320179[CD 05/65]
DATE OF CALIBRATION : 05 February 2025

ENVIRONMENT CONDITIONS :

Temperature : $(25 \pm 2.5) ^\circ\text{C}$

Relative Humidity : $(50 \pm 15) \% \text{ RH}$

PROCEDURE USED :

This instrument [Conductivity Meter] was calibrated under procedure No. WI-305-130.

The calibration was performed by direct measurement with Certified Reference Material (CRM) and Reference Material (RM) .

This instrument [Temperature] was calibrated by comparison with Calibration Bath, Precision Thermometer and IPRT which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Conductivity Solution , Hanna Product Code HI 7033L Lot Number 7830.
2. Potassium Chloride Solution (nominal 1.41 mS/cm)
3. Potassium Chloride Solution (nominal 12.8 mS/cm)
4. Calibration Bath, Kambic Model OB-22/2 ULT S/N. 17115653.
5. Precision Thermometer, ASL Model F201 S/N. 016168/09.
6. IPRT, ASL Model T100-250-1D S/N. PO106346-1-13.

Certificate No. Q25013412

F3-011-05/12-23

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TRACEABILITY :

1. The measurements are traceable to International System of Units (SI) , through Hanna instruments.
Certificate No. 20F21 , Due Date June 2025 .
2. The measurements are traceable to International System of Units (SI) , through Sigma-Aldrich Canada Co.
Certificate No. HC30595403 , Due Date 31 January 2026 .
3. The measurements are traceable to International System of Units (SI) , through Sigma-Aldrich Canada Co.
Certificate No. HC20111554 , Due Date 30 September 2025.
4. The measurements are traceable to International System of Units (SI) , through Calibration Laboratory Co , Ltd.
Certificate No. Q24120999, Due Date 26 November 2025.
5. The measurements are traceable to International System of Units (SI) , through Thailand Institute of Scientific and Technological Research (TISTR). Certificate No. PSL-T 0424/67, Due Date 21 February 2025.
6. The measurements are traceable to International System of Units (SI) , through National Institute of Metrology (Thailand).
Certificate No. TT-0035-24, Due Date 01 March 2025.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor complies with the table which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q25013412

F3-011-05/12-23

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CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The table in the following gives the calibration results and associated measurement uncertainties of Conductivity Meter.

CALIBRATION DATA

1. Conductivity Solution Test @ 25°C

Standard Conductivity Solution	DUC Reading	Uncertainty of Measurement	k Factor
*84.00 µS/cm	84.02 µS/cm [Cell Constant 0.548589]	± 1.00 µS/cm	2,00
1414.0 µS/cm	1414 µS/cm [Cell Constant 0.548589]	± 21.0 µS/cm	2,00
12.83 mS/cm	12.84 mS/cm [Cell Constant 0.548589]	± 0.19 mS/cm	2,00

Note. The Scope of Accredited TISI Certificate No. 23-LB0092 Issue 02 Page 91 of 138

* means Calibrations marked "Not TISI Accredited" in this Certificate have been included for completeness.

*2. TEMPERATURE RESULT

Immersion depth (mm)	Actual Temperature (°C)	DUC Reading (°C)	Correction (°C)	Uncertainty ± (°C)
100	25.01	24.9	+0.11	0.07

Technical Note. Type of sensor : Conductivity Probe

Probe Ø 12 mm

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor of $k = 2,00$.

Note. * means Calibrations marked "Not TISI Accredited" in this Certificate have been included for completeness.

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q25013412

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CERT.No.: HS-W015C

Calibration Date : 18 Mar 25
 Submitted by : S.P.S CONSULTING SERVICE CO.,LTD
 7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol,
 Chatuchak, Bangkok, Thailand 10900

Avg Room Temp : 20 °C
 Avg Water Temp : 20 °C
 Air Pressure : 760.00 mmHg
 Salinity : 0 ppt

Model : YSI 5000
 S/N : 15B100751
 Probe : YSI 5010
 S/N : 22D100097
 ID NO. : -
 Air Temp ref : S/N. F8065C26
 Barometric ref : S/N. F8065C26
 Water Temp ref : -
 ID NO. HS001
 Technician : Kittipong M.

Calibration Details

Calibration Point	100% air sat. (@20 °C, DO = 9.09 mg/l)	(status)	(status)
Measurement 1 (mg/l)	9.08	(PASS)	-
Measurement 2 (mg/l)	9.08	(PASS)	-
Measurement 3 (mg/l)	9.08	(PASS)	-
Measurement 4 (mg/l)	9.07	(PASS)	-
Measurement 5 (mg/l)	9.07	(PASS)	-
Measurement 6 (mg/l)	9.07	(PASS)	-
Measurement 7 (mg/l)	9.07	(PASS)	-
Measurement 8 (mg/l)	9.07	(PASS)	-
Measurement 9 (mg/l)	9.07	(PASS)	-
Measurement 10 (mg/l)	9.07	(PASS)	-

Mean Measurement	9.07	mg/l	-	-
Inaccuracy	0.02	mg/l	-	-

Overall Status (PASS)

Manufacturer Specification

Accuracy = +/- 0.02 mg/l

- 1) This certificate is issued based on the result that are found as shown on date and place of test only.
- 2) The calibration procedure followed in accordance with Harikul Science Co., Ltd.
- 3) This result shall not be used for advertising purpose.



Technician Signature
 (Kittipong Maekwong)



Laboratory Manager
 (Natenapha Pisatkunchon)



CERTIFICATE No : 25M2256
REFERENCE No : 76365-3

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : SARTORIUS
MODEL : BSA224S-CW
SERIAL No : 36591843
ID No : BA09/61
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : ATSAWIN Y.
CALIBRATION DATE : 07-Mar-25

APPROVED BY : PONGSAK J.
ISSUED DATE : 13-Mar-25
RECEIVED DATE : 07-Mar-25

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



F-G010 REV 03



CERTIFICATE No : 25M2256

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : BSA224S-CW
MANUFACTURER : SARTORIUS S/N : 36591843
ID No : BA09/61 RECEIVED DATE : 07-Mar-25
AIR PRESSURE : 1009mbar \pm 1mbar CALIBRATION DATE : 07-Mar-25
AMBIENT TEMPERATURE : 24°C \pm 1°C RELATIVE HUMIDITY : 52 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 6:2019 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS NOT ADJUSTED BEFORE CALIBRATION. THE BALANCE HAS NO ZERO TRACKING FUNCTION. REPEATABILITY WAS MEASURED BY USING 10 REPEATED MEASUREMENTS. LINEARITY WAS MEASURED COVERING 10 POINTS, EVENLY SPREAD OVER THE RANGE. THE INSTRUMENT WAS SET ZERO BEFORE PERFORMING THE LINEARITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-I-151	C02250116	28-Jan-27
2) STANDARD WEIGHT	E2	15843	C02250117	29-Jan-27

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

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

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND)

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

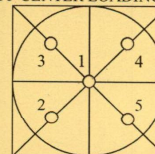
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000071 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.0000	0.0000	0.00012
0.10	0.1000	0.0000	0.00012
0.20	0.2000	0.0000	0.00012
0.50	0.5000	0.0000	0.00012
1.00	1.0000	0.0000	0.00012
2.00	2.0000	0.0000	0.00012
5.00	5.0000	0.0000	0.00012
10.00	10.0000	0.0000	0.00012
20.00	20.0001	-0.0001	0.00012
50.00	50.0000	0.0000	0.00014
100.00	100.0001	-0.0001	0.00019
200.00	200.0001	-0.0001	0.00032

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	100.0000
2	100.0000
3	100.0000
4	100.0000
5	100.0000
OFF-CENTER LOADING	0.0000

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

END OF CALIBRATION REPORT



F-G010 REV 03

Cert. No. : SP24020
Pages 1 of 3

Calibration Certificate

Equipment : UV-VIS SPECTROPHOTOMETER
Manufacturer : PERKINELMER
Model : LAMBDA 25
Serial No.: 501S14123010
ID No.: SP03/58
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 : WET CHEMISTRY LABORATORY IV

Ambient Temperature : (28.1 ± 5) °C
Relative Humidity : (47.2 ± 25) %

Received Date : 27 AUGUST 2024
Calibration Date : 27 AUGUST 2024
Date of Issue : 27 AUGUST 2024

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. : SP24020
Job No. : VC67SP0013
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	106864	01/11/2024
Didymium liquid	RM-DL	28912	106905	02/11/2024
Neutral density filter	RM-1N2N3N	13877	106918	03/11/2024
Potassium dichromate solutions	RM-0204060810	14204	106902	02/11/2024
Potassium Iodide solution	-	KI-0701-001	CI-0185-24	14/05/2026

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	278.3	0.17	0.16	2.00
	361.25	361.4	0.15	0.16	2.00
	467.82	467.7	-0.12	0.16	2.00
	536.56	536.5	-0.06	0.16	2.00
	640.50	640.4	-0.10	0.16	2.00
RM-DL	740.09	739.9	-0.19	0.16	2.00
	864.94	865.2	0.26	0.16	2.00

UUC* = Unit Under Calibration

T. Petchurai

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Sirinthorn Road, Bangbunru, Bangplud, Bangkok, 10700 Thailand
 Tel. +66 2433 8331 Email : calibration@sithiporn.com

SITHIPORN
 associates



Cert. No. : SP24020
 Job No. : VC67SP0013
 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	1.0517	1.0550	0.0033	0.0029	2.00
		29914	0.7	0.7445	0.7460	0.0015	0.0029	2.00
		29381	0.5	0.5416	0.5431	0.0015	0.0030	2.00
	546.1	29360	1.0	0.9821	0.9820	-0.0001	0.0028	2.00
		29914	0.7	0.6961	0.6958	-0.0003	0.0028	2.00
		29381	0.5	0.5073	0.5080	0.0007	0.0029	2.00
	590.0	29360	1.0	1.0222	1.0210	-0.0012	0.0028	2.00
		29914	0.7	0.7237	0.7221	-0.0016	0.0029	2.00
		29381	0.5	0.5361	0.5361	0.0000	0.0031	2.00
	635.0	29360	1.0	0.9753	0.9745	-0.0008	0.0028	2.00
		29914	0.7	0.6910	0.6900	-0.0010	0.0029	2.00
		29381	0.5	0.5211	0.5210	-0.0001	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	0.2422	0.2418	-0.0004	0.0101	2.00
		40	0.4866	0.4852	-0.0014	0.0115	2.00
		60	0.7414	0.7389	-0.0025	0.0067	2.00
		80	0.9858	0.9842	-0.0016	0.0093	2.00
		100	1.2442	1.2414	-0.0028	0.0086	2.00

UUC* = Unit Under Calibration

Condition of this result of calibration : Spectrophotometer PERKINELMER Model Lambda 25 S/N 501S14123010

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 7.5 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)
0.0117	3.8659

**Specific Acceptance :

Transmission ≤ 1.0 T(%), Absorbance ≥ 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

T. Petch



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

Customer :	S.P.S.Consulting Service Co.,Ltd	Date Tested:	July 1, 2025
		Recommendation Recertification	
Address :	7 Soi Phaholyothin 24	Period	6 Months
	Paholyothin Road	Recertification Due:	January 1, 2026
	Jompoi Chatuchak, Bangkok 1090	Date Last Certified:	January 6, 2025
User Name:	K.Phenpha Viphashtawat	Visit Number:	1of 2
Phone:	083-9269252	PerkinElmer Phone:	02-719-6420 ext 206
Fax:	02-513-4221	PerkinElmer Fax:	02-318-5597

CONFIGURATION TESTED	ACCESSORIES/COMPONENT NOT INCLUDED	
MODEL	SERIAL NUMBER	
OPTIMA 5300DV	077C7042401	
TESTED EQUIPMENT	CALIBRATION NUMBER	EXPIRATION
IPV Methods		
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
Multielement Standard	N069-1579	December 30, 2024
Wavecal Solution	N058-2152	March 30, 2024
VIS Wavecal solution	N930-2946	February 28, 2024
Instrument Cal. STD4	N930-0221	November 30, 2024
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
2 % HNO3		
10 % HNO3		



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER	077C7042401	DATE TESTED	July 1, 2025
1. MECHANICAL CHECKS			
A. Inspect and clean all fans and filters.			<input type="checkbox"/> OK
B. Inspect and replace as necessary, all torch components including the RF coil.			<input type="checkbox"/> OK
C. Inspect all tubing for sign of clacking or leaking.			<input type="checkbox"/> OK
D. Adjust water and gas pressure regulator settings.			<input type="checkbox"/> OK
E. Inspect and leak check pneumatics drawers.			<input type="checkbox"/> OK
F. Clean the exterior of the instrument.			<input type="checkbox"/> OK
2. OPTICAL CHECKS			
A. Inspect and clean all optical components.			<input type="checkbox"/> OK
B. As required, check and replace all purgefilters.			<input type="checkbox"/> OK
C. Recheck optical alignment.			<input type="checkbox"/> OK
3. COOLING SYSTEM CHECKS			
A. Perform preventive maintenance on chiller.			<input type="checkbox"/> OK
B. Flush out the chiller every year.			<input type="checkbox"/> N/A
4. PERFORMANCE CHECKS			
A. Torch View Alignment.			<input type="checkbox"/> OK
B. Wavelength Calibration.			<input type="checkbox"/> OK



MAINTENANCE AND TEST CERTIFICATE MODEL

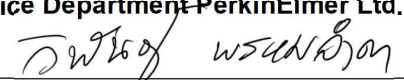
OPTIMA 5300DV

SERIAL NUMBER : 077C7042401		DATE TESTED : July 1, 2025	
PARAMETER	SPECIFICATION	FINAL VALUE	
Spectral Resolution : UV	As 193.696 nm	≤ 0.007	0.00570
	Ni 231.604 nm	≤ 0.008	0.00734
	Ni 341.476 nm	≤ 0.012	0.00763
Spectral Resolution : VIS	La 408.672 nm	≤ 0.020	0.01627
	Ba 455.403 nm	≤ 0.025	0.02428
Precision	As 193.656 nm	% RSD < 1.0	0.82 %
	Zn 213.856 nm	% RSD < 1.0	0.83 %
	Mn 257.610 nm	% RSD < 1.0	0.20 %
	La 379.478 nm	% RSD < 1.0	0.89 %
	Ba 455.403 nm	% RSD < 1.0	0.92 %
	Ba 493.408 nm	% RSD < 1.0	0.75 %
Detection Limits : Axial	Tl 190.080 nm	3(sd)	10.65 ppb
	As 193.696 nm	3(sd)	2.48 ppb
	Pb 220.353 nm	3(sd)	3.09 ppb
Detection Limits : Radial	As 193.696 nm	3(sd)	331.50 ppb
	Zn 213.856 nm	3(sd)	0.98 ppb
	Mn 257.610 nm	3(sd)	0.34 ppb
	La 379.478 nm	3(sd)	2.54 ppb
	Ba 455.403 nm	3(sd)	2.19 ppb
	Ba 493.408 nm	3(sd)	4.32 ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd 226.502 nm	≤ 150 ppb	140.03
BEC : Radial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 45 ppb	24.17



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER	077C7042401	DATE TESTED	July 1, 2025
Remarks :			
Commissioning follow as commissioning performance sheets.			
This is to certify that the above tests have been performed and the configuration tested			
<input checked="" type="checkbox"/> meets			
<input type="checkbox"/> does not meet			
the PerkinElmer Specifications listed on this certificate.			
This certificate does not modify PerkinElmer's standard terms and condition of sale, including warranty terms.			
Service Department PerkinElmer Ltd.			
Authorized Representative: 			
(Wiphan Promlumda)			
Service Engineer			

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

FLOW INJECTION MERCURY SYSTEMS MODEL

FIAS 100

Customer : S.P.S.Consulting Service Co.,Ltd	Date Tested: July 1, 2025
Address : 7 Soi Phaholyothin 24	Recommendation Recertification
Paholyothin Road	Period 6 Months
Jompol Chatuchak, Bangkok 10900	Recertification Due: January 1, 2026
User Name: K.Phenpha Vipasthawat	Date Last Certified: January 6, 2025
Phone: 083-9269252	Visit Number: 1 of 2
Fax: 02-513-4221	PerkinElmer Phone: 02-719-6420 ext 8
	PerkinElmer Fax: 02-318-5597

CONFIGURATION TESTED		
MODEL	SERIAL NUMBER	SOFTWARE
FIAS 100	100S14090404	Syngistix version 7.3
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
Mercury (Hg) Std	N9300174	JUN 30, 2026

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

FLOW INJECTION MERCURY SYSTEMS MODEL

FIAS 100

SERIAL NUMBER 100S14090404	DATE TESTED July 1, 2025
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- INSTRUMENT CHECKS**
 - A. The light part, quartz windows and detector. Clean if necessary. ☐
 - B. Inspect the mercury lamp. Alignment if necessary. ☐
 - C. Inspect the mercury filter. Replace if necessary. ☐
 - D. Inspect and clean or replace the dust filter. ☐
 - E. Inspect peristaltic pump tubes. Replace if necessary. ☐
- ELECTRONICS CHECKS**
 - A. Electronic power supplies

+ 5 Volts (± 0.3)	+ 4.98	Volts
+ 15 Volts (± 1.0)	+ 15.03	Volts
- 15 Volts (± 1.0)	- 15.07	Volts
+ 40 Volts (± 1.0)	+ 40.02	Volts
- GAS SYSTEM CHECK**
 - A. Leak test all internal and external gas box joints. ☐
 - B. Inspect solenoid valve and pressure switch. ☐
 - C. Inspect non return valve. Replace sleeve if necessary. ☐
 - D. Inspect flow meter and needle valve. Clean if necessary. ☐
- MECHANICAL CHECKS**
 - A. Inspect pump motor and pump roller. ☐
 - B. Inspect and clean switching valve. ☐
 - C. Inspect, clean and lubricant autosample. ☐

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

FLOW INJECTION MERCURY SYSTEMS MODEL

FIAS 100

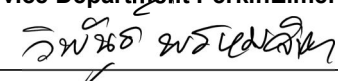
SERIAL NUMBER	100S14090404		DATE TESTED	July 1, 2025	
PARAMETER			SPECIFICATION	ACTUAL VALUE	
5. PERFORMANCE TEST					
A. Baseline Noise Test					
(measure peak area at 10 replicates without any sample)					
	SD		≤ 0.0015 A*s		0.0025 A*s
B. Sensitivity Check					
(10 ppb Hg Standard at 11 replicates)					
	Mean Absorbance		≥ 0.0800 Abs.		0.1201 Abs.
C. Characteristic mass(m_0)					
(10 ppb Hg Standard at 11 replicates)					
	m_0		≤ 314 pg		183.2 pg/0.0044A
D. Precision Check (%RSD)					
(10 ppb Hg Standard at 11 replicates)					
	%RSD		≤ 2.5 %		1.65 %

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

FLOW INJECTION MERCURY SYSTEMS MODEL

FIAS 100

SERIAL NUMBER	100S14090404		DATE TESTED	July 1, 2025	
Remarks :					

This is to certify that the above tests have been performed and the configuration tested					
<input checked="" type="checkbox"/> meets					
<input type="checkbox"/> does not meet					
the PerkinElmer Specifications listed on this certificate.					
This certificate does not modify PerkinElmer's standard terms and condition of sale, including warranty terms.					
Service Department PerkinElmer Ltd.					
Customer Service Engineer: 					
(Wiphan Promlumda)					
Service Engineer					