

## ภาคผนวกที่ 5

เอกสารสอบเทียบความถูกต้องของเครื่องมือ

ตารางสรุปรายการเอกสารการสอบเทียบเครื่องมือตรวจวิเคราะห์

รายการตรวจวิเคราะห์	เครื่องมือตรวจวิเคราะห์
- Temperature	- Thermometer
- Turbidity	- Turbidity Meter
- pH	- pH Meter
- Conductivity	- Conductivity Meter
- Dissolved Oxygen (DO)	- DO Meter
- BOD <sub>5</sub>	- 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 :

<u>Instruments</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due date</u>
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

<u>Material</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Assay</u>
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





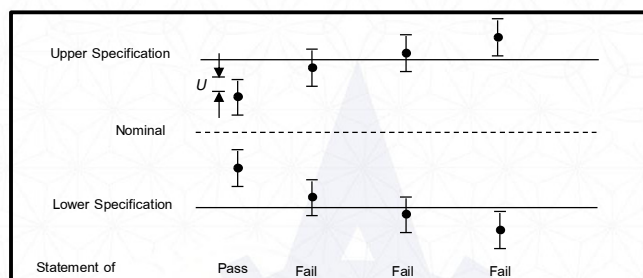
Cert.No. : 25CH217

Page. : 3 of 3

**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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QUALITY CALIBRATION CO., LTD.  
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160  
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584



CERTIFICATE No : 24E6416  
REFERENCE No : 73694-I

PAGE : 1 OF 3

## Certificate of Calibration

EQUIPMENT : pH METER  
MANUFACTURER : HANNA  
MODEL : HI 3512  
SERIAL No : TH118035  
ID No : pH 04/56  
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 : 27-Jun-24

APPROVED BY : PONGSAK J.

ISSUED DATE : 27-Jun-24

RECEIVED DATE : 24-Jun-24

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



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235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160  
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CERTIFICATE No : 24E6416

PAGE : 2 OF 3

## Calibration Report

EQUIPMENT : pH METER  
MANUFACTURER : HANNA  
ID No : pH 04/56  
RECEIVED DATE : 24-Jun-24  
AMBIENT TEMPERATURE : 23 °C ± 3 °C  
MODEL : HI 3512  
SERIAL NUMBER : TH118035  
CALIBRATION DATE : 27-Jun-24  
RELATIVE HUMIDITY : 50 % RH ± 10% RH

### CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT METHOD BASED ON WI-TQ-062 AND WI-TQ-063. THE DISPLAY UNIT WAS TESTED BY GENERATING STANDARD VOLTAGE TO THE UNIT AND READING THE VALUE COMPARED WITH THE CALCULATED VALUE. THE DISPLAY AND ELECTROD WAS CALIBRATED BY USING STANDARD pH BUFFER
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No/ LOT No	CERTIFICATE No	DUE DATE
1) pH STANDARD SOLUTION	00651-06	CC784945	4880-14413915	24-Aug-25
2) pH STANDARD SOLUTION	00651-08	CC785578	4881-14430633	31-Aug-25
3) pH STANDARD SOLUTION	00651-10	CC787086	4882-14483317	21-Sep-25
4) PROCESS CALIBRATOR	CA150	91S6079	24E1251	09-Apr-25
5) BATH	260014	1247 48074	23T9014	13-Sep-24
6) THERMOMETER WITH PROBE	421504	55000379	23T9623	13-Sep-24

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 SI UNIT MAINTAINED AT :-
  - NATIONAL INSTITUTE OF STANDARD AND TECHNOLOGY, USA.
  - NATIONAL INSTITUTE OF METROLOGY (THAILAND)

### RESULT OF CALIBRATION : ADJUSTMENT

#### 1. DISPLAY UNIT ONLY

SLOPE FACTOR k = 2.303 RT/F = 59 mV/pH

mV APPLIED	UUC READING (mV)	CORRECTION (mV)	UUC READING (pH)	UNCERTAINTY OF MEASUREMENT (± mV)	COVERAGE FACTOR k
414.11	414.8	-0.69	-0.115	0.15	2.00
354.95	355.5	-0.55	0.884	0.15	2.00
295.80	296.4	-0.60	1.885	0.15	2.00
236.64	237.1	-0.46	2.886	0.15	2.00
177.48	178.0	-0.52	3.887	0.15	2.00
118.32	118.8	-0.48	4.887	0.15	2.00
59.16	59.6	-0.44	5.887	0.15	2.00
0.00	0.4	-0.40	6.888	0.15	2.00
-59.16	-58.7	-0.46	8.101	0.15	2.00
-118.32	-117.9	-0.42	9.345	0.15	2.00
-177.48	-177.4	-0.08	10.589	0.15	2.00
-236.64	-236.4	-0.24	11.834	0.15	2.00
-295.80	-294.5	-1.30	13.077	0.15	2.00
-354.95	-354.7	-0.25	14.322	0.15	2.00
-414.11	-413.9	-0.21	15.565	0.15	2.00

END OF CALIBRATION REPORT PAGE 2 OF 3





CERTIFICATE No : 24E6416

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## Calibration Report

### RESULT OF CALIBRATION (CONTINUE) :

#### 2. DISPLAY UNIT WITH pH ELECTRODE S/N: 09081C6M

STANDARD pH BUFFER SOLUTION (pH)	UUC READING (pH)	CORRECTION (pH)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT ( $\pm$ pH)	COVERAGE FACTOR k
4.015	4.011	0.004	3.905	0.012	2.00
7.003	7.003	0.000	6.972	0.012	2.00
10.009	10.014	-0.005	9.570	0.014	2.00

#### 3. DISPLAY UNIT WITH TEMPERATURE

STANDARD READING ( $^{\circ}$ C)	UUC READING ( $^{\circ}$ C)	CORRECTION ( $^{\circ}$ C)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT ( $\pm$ $^{\circ}$ C)	COVERAGE FACTOR k
25.004	25.0	0.004	---	0.0085	2.00

#### 4. PERCENT SLOPE 100%

UUC : UNIT UNDER CALIBRATION

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT



# 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 : 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

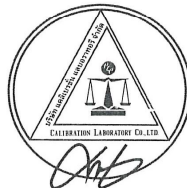
DATE OF RECEIVED : 04 February 2025

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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Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



## 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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@clccalibration



# 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



## 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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# 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



## 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

F3-011-05/12-23

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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  
MANUFACTURER : SARTORIUS  
ID No : BA09/61  
AIR PRESSURE : 1009mbar  $\pm$  1mbar  
AMBIENT TEMPERATURE : 24°C  $\pm$  1°C  
MODEL : BSA224S-CW  
S/N : 36591843  
RECEIVED DATE : 07-Mar-25  
CALIBRATION DATE : 07-Mar-25  
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.

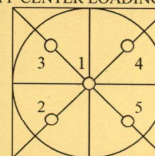
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND)

### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

- ZERO SETTING FUNCTION : NORMAL
- TARE FUNCTION : NORMAL
- REPEATABILITY OF READING AT 200 g WAS 0.000071 g
- 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



SITHIPORN ASSOCIATES CO., LTD.  
CALIBRATION LABORATORY

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



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 :   
( 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.

SITHIPORN ASSOCIATES CO., LTD.  
CALIBRATION LABORATORY

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



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

**SITHIPORN ASSOCIATES CO., LTD.**  
**CALIBRATION LABORATORY**

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



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  $\leq 1.0$  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

*T. Petch*



WO-02612424/2024

**MAINTENANCE AND TEST CERTIFICATE MODEL**  
**OPTIMA 5300DV**

<b>Customer :</b> <u>S.P.S.Consulting Service Co.,Ltd</u>	<b>Date Tested:</b> <u>January 6, 2025</u>
<b>Address :</b> <u>7 Soi Phaholyothin 24</u>	<b>Recommendation Recertification</b>
<u>Paholyothin Road</u>	<b>Period</b> <u>6</u> <b>Months</b>
<b>Jompoi Chatuchak, Bangkok 1090</b>	<b>Recertification Due:</b> <u>July 6, 2025</u>
<b>User Name:</b> <u>K.Phenpha Vipasthawatt</u>	<b>Date Last Certified:</b> <u>July 4, 2024</u>
<b>Phone:</b> <u>083-9269252</u>	<b>Visit Number:</b> <u>2 of 2</u>
<b>Fax:</b> <u>02-513-4221</u>	<b>PerkinElmer Phone:</b> <u>02-719-6420 ext 206</u>
	<b>PerkinElmer Fax:</b> <u>02-318-5597</u>

CONFIGURATION TESTED		ACCESSORIES/COMPONENT NOT INCLUDED
<b>MODEL</b>	<b>SERIAL NUMBER</b>	
<u>OPTIMA 5300DV</u>	<u>077C7042401</u>	
<b>TESTED EQUIPMENT</b>	<b>CALIBRATION NUMBER</b>	<b>EXPIRATION</b>
<u>IPV Methods</u>		
<b>TEST STANDARD USED</b>	<b>PART NUMBER</b>	<b>EXPIRATION DATE</b>
<u>Multielement Standard</u>	<u>N069-1579</u>	<u>December 30, 2025</u>
<u>Wavecal Solution</u>	<u>N058-2152</u>	<u>April 30, 2025</u>
<u>VIS Wavecal solution</u>	<u>N930-2946</u>	<u>December 30, 2025</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>August 30, 2025</u>
<b>CUSTOMER SUPPLIED</b>	<b>COMMENTS</b>	<b>CUSTOMER INITIALS</b>
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		

Page 1 of 4



WO-02612424/2024

**MAINTENANCE AND TEST CERTIFICATE MODEL**  
**OPTIMA 5300DV**

<b>SERIAL NUMBER</b> <u>077C7042401</u>	<b>DATE TESTED</b> <u>January 6, 2025</u>
<b>1. MECHANICAL CHECKS</b>	
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
<b>2. OPTICAL CHECKS</b>	
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
<b>3. COOLING SYSTEM CHECKS</b>	
A. Perform preventive maintenance on chiller.	<input type="checkbox"/> OK
B. Flush out the chiller every year.	<input type="checkbox"/> N/A
<b>4. PERFORMANCE CHECKS</b>	
A. Torch View Alignment.	<input type="checkbox"/> OK
B. Wavelength Calibration.	<input type="checkbox"/> OK

Page 2 of 4





## MAINTENANCE AND TEST CERTIFICATE MODEL

### OPTIMA 5300DV

SERIAL NUMBER : <u>077C7042401</u>		DATE TESTED : <u>January 6, 2025</u>	
PARAMETER	SPECIFICATION		FINAL VALUE
Spectral Resolution : UV	As 193.696 nm	≤ 0.007	0.00519
	Ni 231.604 nm	≤ 0.008	0.00667
	Ni 341.476 nm	≤ 0.012	0.00757
Spectral Resolution : VIS	La 408.672 nm	≤ 0.020	0.01621
	Ba 455.403 nm	≤ 0.025	0.02183
Precision	As 193.656 nm	% RSD < 1.0	0.51 %
	Zn 213.856 nm	% RSD < 1.0	0.48 %
	Mn 257.610 nm	% RSD < 1.0	0.03 %
	La 379.478 nm	% RSD < 1.0	0.05 %
	Ba 455.403 nm	% RSD < 1.0	0.07 %
	Ba 493.408 nm	% RSD < 1.0	0.04 %
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)	12.41 ppb
	Zn 213.856 nm	3(sd)	0.91 ppb
	Mn 257.610 nm	3(sd)	0.13 ppb
	La 379.478 nm	3(sd)	4.74 ppb
	Ba 455.403 nm	3(sd)	0.10 ppb
	Ba 493.408 nm	3(sd)	0.18 ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd 226.502 nm	≤ 150 ppb	14.22
BEC : Radial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 45 ppb	6.14



## MAINTENANCE AND TEST CERTIFICATE MODEL

### OPTIMA 5300DV

SERIAL NUMBER	<u>077C7042401</u>	DATE TESTED	<u>January 6, 2025</u>
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Remarks :

Commissioning follow as commissioning performance sheets.

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This is to certify that the above tests have been performed and the configuration tested

☒ meets  
☐ 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

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

<b>Customer :</b> S.P.S.Consulting Service Co.,Ltd	<b>Date Tested:</b> January 6, 2025
	<b>Recommendation</b> Recertification
<b>Address :</b> 7 Soi Phaholyothin 24	<b>Period</b> 6 Months
Paholyothin Road	<b>Recertification Due:</b> July 6, 2025
Jompol Chatuchak, Bangkok 10900	<b>Date Last Certified:</b> July 4, 2024
<b>User Name:</b> K.Phenpha Vipasthawatt	<b>Visit Number:</b> 1 OF 2
<b>Phone:</b> 083-9269252	<b>PerkinElmer Phone:</b> 02-719-6420 ext 204
<b>Email:</b>	<b>PerkinElmer Fax:</b> 02-318-5597

### CONFIGURATION TESTED

MODEL	SERIAL NUMBER	SOFTWARE
PinAAcle 900T	PTCS14111103	Wiblab V5.1
AS 900		
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
Copper	N9300183	APR 30 2025
GFAAS Mixed standard	N9300244	FEB 28 2025
MG0-042	N101-3000	
MG2-045	N101-3002	

## MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

<b>SERIAL NUMBER</b> PTCS14111103	<b>DATE TESTED</b> January 6, 2025
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- INSTRUMENT CHECKS**
  - A. The Mirror and Lenses Condition ☐ OK
  - B. Grating Condition ☐ OK
  - C. Replace or Clean Dust Filter ☐ OK
  - D. Cleaning the Contact Cylinders ☐ OK
  - E. Cleaning the Furnace Windows ☐ OK
  - F. Cleaning the Burner Head ☐ OK
  - G. Cleaning the Nebulizer ☐ OK
  - H. Cleaning the Drain System ☐ OK
- AUTOSAMPLE CHECK**
  - A. Sampling and Arm ☐ OK
  - B. Sampling & Rinse Pump ☐ OK
  - C. Sample Position & Clean ☐ OK
- COOLING SYSTEM CHECKS**
  - A. Clean and Change Distill water ☐ OK
  - B. Themensor ☐ OK
- FIAS CHECKS**
  - A. Pump and 5 Port Valve ☐ N/A
  - B. Chemifold and Tubing ☐ N/A
  - C. Power Supply ☐ N/A
  - D. Flow meter and Gas system ☐ N/A

## MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

### ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER	PTCS14111103	DATE TESTED	January 6, 2025
PARAMETER		SPECIFICATION	ACTUAL VAULE
<b>A. Flame Mode Tests</b>			
1. Detector-Linearity with Barium (553.55 nm)			
Neutral Density Filter 0.2 :	0.2042	Abs. + 5%	0.2029 Abs.
Neutral Density Filter 1.0 :	0.9798	Abs. + 5%	1.0137 Abs.
2. Baseline Noise at 1 Abs with Barium (553.55 nm) (at an integration time of 0.5 seconds and 99 replicates)			
	SD $\leq$ 0.010 Abs.		0.0016 Abs.
3. AA Baseline with Copper (Cu 324.75 nm) (at an integration time of 0.5 seconds and 99 replicates)			
	SD $\leq$ 0.001 Abs.		0.0002 Abs.
4. D <sub>2</sub> Background Compensation (Copper 324.75 nm) with Neutral Density Filter 1.0	Absorbance $\leq$ 0.010 Abs		0.0020 Abs.
5. AA-BG Baseline Noise with Copper (324.75 nm) (at an integration time of 2.0 seconds and 99 replicates)			
	SD $\leq$ 0.005 Abs.		0.0002 Abs.
6. AA-BG Baseline Noise with Arsenic (193.70 nm) (at an integration time of 2.0 seconds and 99 replicates)			
	SD $\leq$ 0.005 Abs.		0.0007 Abs.

## MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

### ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER	PTCS14111103	DATE TESTED	January 6, 2025
PARAMETER		SPECIFICATION	ACTUAL VAULE
7. Flame Interlock Shutdown			
	Shutdown correct?		<input checked="" type="checkbox"/> OK
8. Flame Sensitivity with Copper (324.75 nm) (5 mg/L Cu Standard a read time of 10 seconds 10 replicates, standard burner and Stainless stell nebulizer)			
	Sensitivity $\geq$ 0.250 Abs.		0.3115 Abs.
(2 mg/L Cu Standard a read time of 10 seconds 10 replicates, standard burner and High sensitivity nebulizer)			
	Sensitivity $\geq$ 0.250 Abs.		N/A Abs.

## MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

### ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

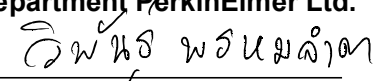
PinAAcle 900T

SERIAL NUMBER	PTCS14111103		DATE TESTED	January 6, 2025
PARAMETER	SPECIFICATION		ACTUAL VAULE	
<b>B. THGA Tests</b>				
1. Furnace Gas Flows				
Internal Flow	250 ± 25 mL/min	250	mL/min	
External Flow	100 ± 10 mL/min	100	mL/min	
2. Chromium Baseline Noise (357.87 nm) (mesure 5 furnace dry firings without any sample)				
	Baseline ≤ 0.005 Int.Abs	0.0012		
	SD ≤ 0.005 Int.Abs	0.0002	Int.Abs.	
3. Chromium Characteristic Mass(m <sub>0</sub> ) and Precition (357.87 nm) (measure 5 furnace firing using 20 ul sample injections of 10 ug/L Cr standard)				
	m0 Results ≤ 7.0 pg/0.0044A-s	5.4	pg/0.0044A-s	
	Precision ≤ 2.0%	1.15	%	
4. Copper Characteristic Mass(m <sub>0</sub> ) and Zeeman Ratio (324.75 nm) (measure 5 furnace firing using 20 ul sample injections of 25 ug/L Cu standard)				
	m0 Results ≤ 16.5 pg/0.0044A-s	14.4	pg/0.0044A-s	
	Zeeman Ratio 0.52 ± 0.04	0.542		

## MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

### ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER	PTCS14111103		DATE TESTED	January 6, 2025
Remarks :				
- Neutral Density Filter refer to data sheet				
- Zeeman Ratio = $\frac{\text{Atomic Signal(peak area)}}{\text{Atomic Signal(peak area)+Background Signal(peak area)}}$				
= 0.1635/0.1635+0.1378				
0.542				
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 standrd terms and condition of sale, including warranty terms.				
<b>Service Department PerkinElmer Ltd.</b>  ( Wiphan Promlumda ) Service Engineer				
Customer Service Engineer:				