ภาคผนวก 7-4

เอกสารสอบเทียบเครื่องมือวิเคราะห์

ENTECH
Difference For Greater Value

Calibration Certificate

NSC-TISI-TIS 17025
CALIBRATION 0157

Certificate No.: T/O 670240
Date of issue : 9-Oct-2024

Equipment Description	:	Refrigerator
Equipment Model	:	P1010
Equipment Serial No.	:	P1010-1020-0005
I.D. No. or Control No.	:	TNP.LAB.01
Manufacturer	:	Entech Industrial Solution Co.,Ltd.
Customer Name	:	TNP ENVIRONMENT CO.,LTD.
Customer Address	:	332/173 Moo. 3 Tambon Bang Rak Phatthana, Amphoe Bang Bua Thong, Nonthaburi 11110 Thailand
Total pages of certificate	:	2 pages
Instrument Receiving Date	:	7-Oct-2024
Receiving No.	:	O-240290
Environmental Conditions	:	All of the measurement were carried out in the working area Temperature : (25 ± 15) °C Humidity : (55 ± 30) % RH Voltage : (220 ± 22) VAC
Calibration Place	:	332/173 Moo. 3 Tambon Bang Rak Phatthana, Amphoe Bang Bua Thong, Nonthaburi 11110 Thailand
Calibration Procedure No.	:	This instrument was calibrated by comparison of indication with the Standard Resistance thermometer according to calibration TLAS G20, work instruction no WI-CL-18-C

The calibration certificate expended uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k, which for a normal distribution corresponds to a coverage probability of approximately 95%

The standard uncertainty of measurement has been determined in accordance with M 3003 The expression uncertainty and confidence in measurement.

This certificate is applied only to item under test environmental condition.

This calibration certificate may not be reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature and seal are not valid.

This calibration certificate documents are traceability to national standards, which realize the unit of measurement according to the International system of units (SI).

Date of Calibration : 7-Oct-2024

Mr. Kittipong Kaewsai
Calibration Engineer

Ms. Nongluck Wongsettee
Technical Manager

ENTECH INDUSTRIAL SOLUTION CO.,LTD.
17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210 THAILAND Tel. 0-2779-8888 Fax. 0-2779-8899 info@entech.co.th
Tax ID : 0105536035591 www.entech.co.th

Certificate No. : T/O 670240

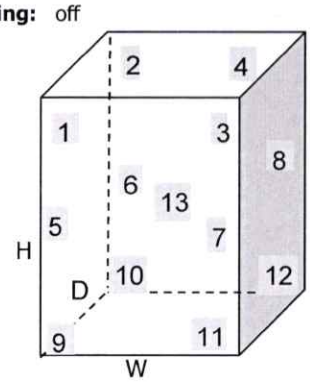
The Reference Standard Instrument :-

Instrument	Model	Serial No.	Cert No.	Due date
1) Data logger with RTD Probe	Agilent 34972A	MY41187730	PSL-T 0484-1/67	19-Feb-2025
		MY60008352	PSL-T 0484-3/67	19-Feb-2025

Measured room conditions

Temperature : Minimum: 24.1 °C Maximum: 25.8 °C
Humidity : Minimum: 43.5 %RH Maximum: 46.8 %RH
Voltage : Minimum: 219.8 VAC Maximum: 223.3 VAC
Fresh Air Setting: off

Sensor Position :



Working Space of chamber :

(Inside Dimensions) W x D x H : 1565 mm x 500 mm x 1450 mm

Sensor Installation Details :

- Sensor Number 1 to 12 installed approximately 50 mm From each wall.
- Sensor Number 13 installed approximately geometric of the chamber.

Results : The measurement results of the calibration were reported in the table below.
(*) Without adjustment ( ) After adjustment

UUC* Setting	UUC* Reading	Temperature Reading oF Standard Sensor												
		Sensor Position												
(°C)	(°C)	1	2	3	4	5	6	7	8	9	10	11	12	13
3.0	3.3	2.93	2.63	3.23	2.69	4.03	3.44	3.57	3.44	4.53	4.39	3.78	3.85	2.99

UUC* Setting	UUC* Reading	Temperature Uniformity	Temperature Stability	Overall Variation	Uncertainty of Measurement	Coverage Factor
(°C)	(°C)	(°C)	(± °C)	(°C)	(± °C)	K
3.0	3.3	2.65	1.99	4.75	2.5	2

UUC* = Unit Under Calibration

Remark :-

- Temperature reading of Standard Sensors shown in the table were taken from the average of Standard reading at each position.
- Temperature Uniformity was calculated from the difference between the maximum and minimum of actual temperature reading from all reference sensors at the same time.
- Temperature Stability was calculated from the maximum stability of nine positions, and formula of Stability is [(Maximum Temperature Value - Minimum Temperature Value) /2]
- Overall Variation was calculated from the difference between the maximum and minimum measured temperature throughout observation time.

End of Report

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NSC-TISI-TIS 17025
CALIBRATION 0260

CERTIFICATE OF CALIBRATION

Certificate No. : 24-1179-001

Issue Date : 7 September 2024

Work Order No. : 24/1179

Customer Name : TNP ENVIRONMENT CO.,LTD.
332/173 Moo 3 Bang Rak Phatthana,
Bang Bua Thong, Nonthaburi 11110

Date of Received : 6 September 2024

Date of Calibration : 6 September 2024

Instrument Details :

Description	:	pH meter
Manufacturer	:	HORIBA
Model	:	LAQUA-PH1100
Serial No.	:	B80A0042
ID No.	:	TNP.LAB.02
Resolution	:	0.01 pH
Location	:	Laboratory

Calibration Method : This instrument was calibrated by in-house calibration procedure no. CWI-C-02 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)

Environmental Condition

Temperature	:	Area Monitoring between 15°C to 40°C
Humidity	:	Area Monitoring between 30%RH to 85%RH

Traceability of Measurement

: This certificate of calibration documents the traceability to national standard, which realize the unit of measurement according to the International system of Units (SI)

Calibrated by : Mr. Kritsada Kaewwangpa
Calibration Engineer

Approved by : (Mr. Anuwat Yaklermjit)
Laboratory Manager

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NSC-TISI-TIS 17025
CALIBRATION 0260

CERTIFICATE OF CALIBRATION

Certificate No. : 24-1179-001

Issue Date : 7 September 2024

Work Order No. : 24/1179

Details of Calibration

1. Certified Reference Material / Certified of Instrument

Certified Reference Material	CRM Code	Lot no.	Expire Date
1.1 Buffer Solution pH 4.00	TRM-S-2027	150823	1 July 2025
1.2 Buffer Solution pH 7.00	TRM-S-2034	230524	1 July 2025
1.3 Buffer Solution pH 10.00	TRM-S-2031	160823	1 July 2025

Instrument	Certificate no.	Serial No. / ID No.	Due Date
1.4 DC Source Calibrator	23E3042	9791008	14 September 2024
1.5 Digital Thermometer with sensor	24-0002-013	316A14010055 / RTD-PH-02	8 January 2025

2. This certificate traceble to the international unit (SI)

Buffer solution no. 1.1 traceble to : Nation Institute of Metrology (Thailand)

Buffer solution no. 1.2 traceble to : Nation Institute of Metrology (Thailand)

Buffer solution no. 1.3 traceble to : Nation Institute of Metrology (Thailand)

Instrument no. 1.4 traceble to : Technology Promotion Association (Thailand-Japan) NAC Calibration No. 0008

Instrument no. 1.5 traceble to : Crystal Calibration slaes and service Co., Ltd., NAC Calibration No. 0260

3. Condition of item : Used

4. Calibration location : On-site

Result of Calibration

Measurement Function : mV Measurement

Performing : Standard curve by Voltage calibrator at pH (4, 7, 10)

Norminal value	Applied DC voltage	Average indicator reading		Uncertainty (±)	Coverage Factor
pH	mV	mV	pH	mV	*k*
0	414.1	414.0	0.03	0.083	2.00
2	295.8	295.8	2.02	0.083	2.00
4	177.5	177.5	4.01	0.083	2.00
7	0.0	-0.1	7.00	0.083	2.00
9	-118.3	-118.3	9.00	0.083	2.00
10	-177.5	-177.6	10.01	0.083	2.00
12	-295.8	-295.9	12.01	0.083	2.00
14	-414.1	-414.2	14.02	0.083	2.00

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NSC-TISI-TIS 17025
CALIBRATION 0260

CERTIFICATE OF CALIBRATION

Certificate No. : 24-1179-001

Issue Date : 7 September 2024

Work Order No. : 24/1179

Result of calibration

Measurement Function : pH Measurement with electrode

Performing : Three buffer standard curve using buffer nominal pH (4, 7, 10)

STD buffer solution	Average indicator reading			Uncertainty (±)	Coverage factor
pH @ 25 °C	pH	mV	pH correction	pH	*k*
4.01	3.99	155.6	0.02	0.012	2.00
7.00	6.99	-21.4	0.01	0.012	2.00
10.01	10.02	-197.0	-0.01	0.012	2.00

Descriptions of electrode :

Electrode Type : Glass electrode

Manufacturer : HORIBA Model : 9615S

Serial no. : 9XB0575 ID No. : N/A

Detail of % slope form calculation

pH range	% Slope value	% Slope recommend
4 pH to 7 pH	100.1	95% - 105%
7 pH to 10 pH	98.6	

Note : Calibrate items it good condition and this report customer request and accepted in certificate

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

The 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%.

--END--

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NSC-TISI-TIS 17025
CALIBRATION 0260

CERTIFICATE OF CALIBRATION

Certificate No. : 24-1179-002
Work Order No. : 24/1179

Issue Date : 7 September 2024

Customer Name : TNP ENVIRONMENT CO.,LTD.
332/173 Moo 3 Bang Rak Phatthana,
Bang Bua Thong, Nonthaburi 11110

Date of Received : 6 September 2024

Date of Calibration : 6 September 2024

Instrument Details :

Description	:	Digital Thermometer with probe
Manufacturer	:	HORIBA
Model	:	LAQUA-PH1100
Serial No.	:	B80A0042
ID No.	:	TNP.LAB.02
Resolution	:	0.1 °C
Location	:	Laboratory

Calibration Method : This instrument was calibrated by comparison of indication with Standard Thermometer into calibration bath temperature controller according to calibration procedure no. CWI-T-09

Environmental Condition

Temperature	:	Area Monitoring between 15°C to 40°C
Humidity	:	Area Monitoring between 30%RH to 85%RH

Traceability of Measurement

: This certificate of calibration documents the traceability to national standard, which realize the unit of measurement according to the International system of Units (SI) and The temperature scale in use at this laboratory is The International Temperature scale of 1990.

Calibrated by : Mr. Kritsada Kaewwangpa
Calibration Engineer

Approved by : _____
(Mr. Anuwat Yaklermjit)
Laboratory Manager

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NSC-TISI-TIS 17025
CALIBRATION 0260

CERTIFICATE OF CALIBRATION

Certificate No. : 24-1179-002

Issue Date : 7 September 2024

Work Order No. : 24/1179

Details of Calibration

1. Reference Standards Instrument

Instrument	Serial No. / ID No.	Certification	Due Date
Thermometer Readout	316A14010055	24-0002-001	5-Jan-2025
Standard Thermometers (RTD)	4706698-001	24-0002-001	5-Jan-2025

2. Certificate traceable : This certificate traceable to The International System of Unit (SI unit)

3. Condition of equipment : Used

4. Calibration site : On-Site

Result of Calibration

Calibration result : Without Adjustment

Calibration point (°C)	STD. Value (°C)	UUC Reading (°C)	Correction value (°C)	Uncertainty ± (°C)
25	25.00	25.0	+ 0.00	0.11

Note : Calibrate items it good condition and this report customer request and accepted in certificate

Electrode Type : Combination Electrode

Manufacturer : HORIBA Model : 9615S

Serial no. : 9XB0575 ID No. : N/A

UUC : Unit Under Calibration.

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

The 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%.

--END--

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Statements of conformity report

Refer to Certificate No. : 24-1179-002

Issue Date : 7 September 2024 Work Order No. : 24/1179

Detail of Equipment

Description : Digital Thermometer with probe

Manufacturer : HORIBA Serial no. : B80A0042

Model : LAQUA-PH1100 ID No. : TNP.LAB.02

Result of Calibration

This result of calibration : Without adustment

Tolerance	1	°C

Resolution : 0.1 °C

Calibration point	STD value	UUC reading	Correction	Uncertainty	Uncertainty + Absolute correc.	Evaluation
25	25.00	25.0	0.00	0.11	0.11	Pass

The conformity certificate documents validaty following ISO/IEC Giude 98-4 : Role of measurement uncertainty in conformity assessment based on statement with guard band refer to specification tolerance limit of customer consider expanded measurement uncertainty (k=95%)

The tolerance and decision rules ;

MPE of Customer = Measurement uncertainty + Absolute error ; ≤ MPE is pass , > MPE is Fail

Statements of conformity decision by :

(Mr. Anuwat Yaklermjit)

Laboratory Manager

-- END --

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NSC-TISI-TIS 17025
CALIBRATION 0260

CERTIFICATE OF CALIBRATION

Certificate No. : 24-1179-007

Issue Date : 11 September 2024

Work Order No. : 24/1179

Customer Name : TNP ENVIRONMENT CO.,LTD.
332/173 Moo 3 Bang Rak Phatthana,
Bang Bua Thong, Nonthaburi 11110

Date of Received : 5 September 2024

Date of Calibration : 10 September 2024

Instrument Details :

Description	:	Digital Thermo hygrometer
Manufacturer	:	EXTECH
Model	:	445814
Serial No.	:	PONPE5816745
ID No.	:	TNP.LAB.04
Location	:	Humidity and Temperature Laboratory

Calibration Method : This instrument was calibrated by comparison of indication with Standard Chilled Mirror Hygrometer and Standard Thermometer into Temperature and Humidity Chamber controller according to calibration procedure no. CWI-H-01

Environmental Condition

Temperature	:	Laboratory Control at 23°C ± 3°C
Humidity	:	Laboratory Control at 55%RH ± 20%RH

Traceability of Measurement

: This certificate of calibration documents the traceability to national standard, which realize the unit of measurement according to the International system of Units (SI) and The temperature scale in use at this laboratory is The International Temperature scale of 1990.

Calibrated by : Miss Phiraya Prawabut
Calibration Engineer

Approved by :
(Mr. Anuwat Yaklermjit)
Laboratory Manager

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NSC-TISI-TIS 17025
CALIBRATION 0260

CERTIFICATE OF CALIBRATION

Certificate No. : 24-1179-007

Issue Date : 11 September 2024

Work Order No. : 24/1179

Details of Calibration

1. Reference Standards Instrument

Instrument	Serial No.	Certification	Due Date
1.1 Chilled Mirror Hygrometer	157151 / 157152	TH-0069-23	24 February 2025
1.2 Digital Thermometer with RTD	15000016 / RTD-11	23-1415-003	16 October 2024

2. Certificate traceable : This certificate traceable to The International System of Unit refer to
No. 1.1 National Institute of Metrology (Thailand), NAC Calibration No. 0144
No. 1.2 Crystal Calibration Sales and Service Co., Ltd. , NAC Calibration No. 0260

3. Condition of item : Used

4. Calibration location : Permanent

Result of Calibration

1. Temperature Measurement : Without Adjustment Resolution of UUC : 0.1 °C

Calibration Point (°C)	Average Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty ± (°C)
17	17.066	17.0	+ 0.066	0.30
23	23.050	23.3	- 0.250	0.30
30	30.050	30.5	- 0.450	0.30

2. Humidity Measurement : Without Adjustment Resolution of UUC : 1 %RH

Calibration Point (%RH)	Calculated Standard Reading (%RH)	UUC Reading (%RH)	Correction (%RH)	Uncertainty ± (%RH)
40	40.46	36	+ 4.46	1.6
50	50.05	45	+ 5.05	1.6
65	65.63	59	+ 6.63	1.7

Note : 1. Process calibration humidity measurement Reference temperature control at 25°C

2. Calculated STD humidity refer to dew-point temperature and convert to humidity by magnus's Equation

3. Calibrate items it good condition and this report customer request and accepted in certificate

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

The 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%.

--END--

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Statements of conformity report

Refer to Certificate No. : 24-1179-007

Issue Date : 11 September 2024 Work Order No. : 24/1179

Detail of Equipment

Description : Digital Thermo hygrometer

Manufacturer : EXTECH Serial no. : PONPE5816745

Model : 445814 ID No. : TNP.LAB.04

Result of Calibration

This result of calibration : Without adustment

MPE part Temp.	3	°C

Resolution : 0.1 °C

Calibration point	STD value	UUC reading	Correction	Uncertainty	Uncertainty + Absolute correc.	Evaluation
17	17.066	17.0	0.066	0.30	0.366	Pass
23	23.050	23.3	-0.250	0.30	0.550	Pass
30	30.050	30.5	-0.450	0.30	0.750	Pass

MPE part Humid	15	%RH

Resolution : 1 %RH

Calibration point	STD value	UUC reading	Correction	Uncertainty	Uncertainty + Absolute correc.	Evaluation
40	40.46	36	4.46	1.6	6.06	Pass
50	50.05	45	5.05	1.6	6.65	Pass
65	65.63	59	6.63	1.7	8.33	Pass

The conformity certificate documents validaty following ISO/IEC Giude 98-4 : Role of measurement uncertainty in conformity assessment based on statement with guard band refer to specification tolerance limit of customer consider expanded measurement uncertainty (k=95%)

The tolerance and decision rules ;

MPE of Customer = Measurement uncertainty + Absolute error ; ≤ MPE is pass , > MPE is Fail

Statements of conformity decision by :

(Mr. Anuwat Yaklermjit)

Laboratory Manager

-- END --

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CLC Accredited ISO/IEC 17025

ilac-MRA

ANAB ANSI National Accreditation Board ACCREDITED ISO/IEC 17025 CALIBRATION AND DIMENSIONAL MEASUREMENT ACDM-2814

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE	:	HOT AIR OVEN
MANUFACTURER	:	MEMMERT
MODEL / TYPE	:	UF75
SERIAL NO.	:	B320.0251
CLID. NO.	:	332402706
JOB CONTROL NO.	:	241212132142
CALIBRATION SERVICE	:	☐ IN-LABORATORY ☑ ON-SITE

CUSTOMER : TNP ENVIRONMENT CO., LTD.
332/173 MOO 3 TAMBON BANG RAK PHATTANA,
AMPHOE BANG BUA THONG, NONTHABURI 11110

DATE OF RECEIVED : 12 December 2024 DATE OF ISSUED : 23 December 2024

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

Calibrated By : Wenick Inchaisri
Calibration Engineer

Approved By : Mongkol Yotsoontorn
Authorized Signatory
23 December 2024

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. Q24132142

@clccalibration

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CALIBRATION AND DIMENSIONAL MEASUREMENT
ACDM-2814

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	**HOT AIR OVEN**
MANUFACTURER	:	**MEMMERT**
MODEL / TYPE	:	**UF75**
SERIAL NO.	:	**B320.0251**
LOCATION SITE	:	**LABORATORY ROOM 2 FLOOR 3**
DATE OF CALIBRATION	:	**17 December 2024**

ENVIRONMENT CONDITIONS :

Temperature : 25 °C to 26 °C **Relative Humidity : 52% to 54 %**

PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPTH-07** based on **TLAS G-20** as calibration guidelines.

The calibration was performed by using Hydra Data Logger which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Hydra Data Logger, Fluke Model 2635A S/N. 5499551.

TRACEABILITY :

The measurements are traceable to International System of Units (SI) , through Calibration Laboratory Co., Ltd.

Certificate No. Q24099493, Due Date 25 September 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)"

@clccalibration

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 the measuring hot air oven.

CALIBRATION DATA

1. HOT AIR OVEN PERFORMANCE

DUC		Measured Uniformity	Measured Stability	Measured Overall
Setting (°C)	Indicating (°C)	(°C)	(°C)	Variation (°C)
85.0	85.0	0.33	0.07	0.53
104.0	104.0	0.38	0.10	0.62
180.0	180.0	0.58	0.17	0.98

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CLC Accredited ISO/IEC 17025

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ANAB ANSI National Accreditation Board ACCREDITED ISO/IEC 17025 CALIBRATION AND DIMENSIONAL MEASUREMENT ACDM-2814

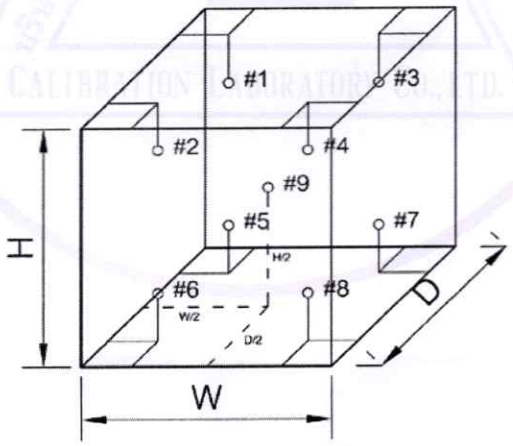
CALIBRATION DATA

2. TEMPERATURE DISTRIBUTION

DUC		Measured Temperature (°C)@Probe No.9 is Ref.									Uncertainty ±(°C)	Coverage factor *k*
Setting (° C)	Indicating (° C)	1	2	3	4	5	6	7	8	9		
85.0	85.0	84.77	85.05	84.96	84.74	84.81	84.84	85.04	84.64	84.77	0.25	2,00
104.0	104.0	103.64	104.00	103.85	103.60	103.77	103.83	104.05	103.61	103.72	0.43	2,00
180.0	180.0	179.20	179.83	179.33	179.09	179.56	179.67	179.93	179.41	179.45	0.47	2,00

Technical Note : W = 40 cm, D = 33 cm, H = 56 cm.

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 58 of 67



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

End of Certificate

@clccalibration

ENTECH
Difference For Greater Value

Calibration Certificate

NSC-TISI-TIS 17025
CALIBRATION 0157

Certificate No. T/O 670239
Date of issue : 9-Oct-2024

Equipment Description	:	Incubator
Equipment Model	:	Smart i250-DS
Equipment Serial No.	:	0410-0121-0003
I.D. No. or Control No.	:	TNP.LAB.08
Manufacturer	:	Entech Industrial Solution Co.,Ltd.
Customer Name	:	TNP ENVIRONMENT CO.,LTD.
Customer Address		332/173 Moo. 3 Tambon Bang Rak Phatthana, Amphoe Bang Bua Thong, Nonthaburi 11110
Total pages of certificate	:	2 pages
Instrument Receiving Date	:	7-Oct-2024
Receiving No.	:	O-240289
Environmental Conditions	:	All of the measurement were carried out in the working area Temperature : (25 ± 15) °C Humidity : (55 ± 30) % RH Voltage : (220 ± 22) VAC
Calibration Place	:	332/173 Moo. 3 Tambon Bang Rak Phatthana, Amphoe Bang Bua Thong, Nonthaburi 11110
Calibration Procedure No.	:	This instrument was calibrated by comparison of indication with the Standard Resistance thermometer according to calibration TLAS G20, work instruction no WI-CL-18-C

The calibration certificate expended uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k, which for a normal distribution corresponds to a coverage probability of approximately 95%

The standard uncertainty of measurement has been determined in accordance with M 3003
The expression uncertainty and confidence in measurement.

This certificate is applied only to item under test environmental condition.

This calibration certificate may not be reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature and seal are not valid and The results relate only to the items tested/calibrated.

This calibration certificate documents are traceability to national standards, which realize the unit of measurement according to the International system of units (SI).

Date of Calibration : 7-Oct-2024

Mr. Kittipong Kaewsai
Calibration Engineer

Ms. Nongluck Wongsettee
Technical Manager

ENTECH INDUSTRIAL SOLUTION CO.,LTD.
17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210 THAILAND Tel. 0-2779-8888 Fax. 0-2779-8899 info@entech.co.th
Tax ID : 0105536035591 www.entech.co.th

Certificate No. : T/O 670239

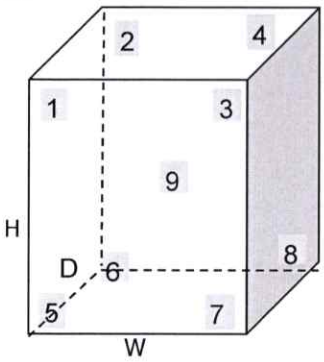
The Reference Standard Instrument :-

Instrument	Model	Serial No.	Cert No.	Due date
1) Data logger with RTD Probe	Agilent 34972A	MY60008352	PSL-T 0484-3/67	19-Feb-2025

Measured room conditions

Temperature :	Minimum:	22.1 °C	Maximum:	23.2 °C
Humidity :	Minimum:	45.8 %RH	Maximum:	56.5 %RH
Voltage :	Minimum:	219.9 VAC	Maximum:	223.1 VAC
Fresh Air Setting:	off			

Sensor Position :



Working Space of chamber :

(Inside Dimensions) W x D x H : 500 mm x 480 mm x 1100 mm

Sensor Installation Details :

- Sensor Number 1 to 8 installed approximately 50 mm From each wall.
- Sensor Number 9 installed approximately geometric of the chamber.

Results : The measurement results of the calibration were reported in the table below.

(*) Without adjustment ( ) After adjustment

UUC* Setting	UUC* Reading	Temperature Reading oF Standard Sensor Sensor Position								
(°C)	(°C)	1	2	3	4	5	6	7	8	9
20.0	20.0	20.34	20.28	20.09	20.13	20.04	20.04	19.84	19.95	19.90

UUC* Setting	UUC* Reading	Temperature Uniformity	Temperature Stability	Overall Variation	Uncertainty of Measurement	Coverage Factor
(°C)	(°C)	(°C)	(± °C)	(°C)	(± °C)	K
20.0	20.0	0.53	0.48	1.26	0.70	2

UUC* = Unit Under Calibration

Remark :-

- Temperature reading of Standard Sensors shown in the table were taken from the average of Standard reading at each position.
- Temperature Uniformity was calculated from the difference between the maximum and minimum of actual temperature reading from all reference sensors at the same time.
- Temperature Stability was calculated from the maximum stability of nine positions, and formula of Stability is [(Maximum Temperature Value - Minimum Temperature Value) /2]
- Overall Variation was calculated from the difference between the maximum and minimum measured temperature throughout observation time.

End of Report

ENTECH INDUSTRIAL SOLUTION CO.,LTD.
17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210 THAILAND Tel. 0-2779-8888 Fax. 0-2779-8899 info@entech.co.th
Tax ID : 0105536035591 www.entech.co.th

CRYSTAL CALIBRATION SALES AND SERVICE CO., LTD.
45/48 Soi Salathammasop31, Salathammasop Rd.,
Salathammasop, Thawewatthana, Bangkok 10170 Thailand
Tel : 0-2408-8474-5 Fax : 0-2408-8477 Email : info@crystalcal.com www.crystalcal.com

NSC-TISI-TIS 17025
CALIBRATION 0260

CERTIFICATE OF CALIBRATION

Certificate No. : 25-0753-025

Issue Date : 12 June 2025

Work Order No. : 25/0753

Customer Name : TNP ENVIRONMENT CO.,LTD.
332/173 Moo 3 Bang Rak Phatthana,
Bang Bua Thong, Nonthaburi 11110

Date of Received : 12 June 2025

Date of Calibration : 12 June 2025

Instrument Details :

Description	:	Electronic Balance
Manufacturer	:	SHIMADZU
Model	:	AP225WD
Serial No.	:	D316301848
ID No.	:	TNP.LAB.30
Resolution	:	0.00001 g / 0.0001 g
Capacity	:	102 g / 220 g
Location	:	ห้องปฏิบัติการ 2 ชั้น 3

Calibration Method : This calibration was conducted by using in-house method according to calibration procedure no. CWI-B-01 based on UKAS LAB14 edition 6, October 2019

Environmental Condition

Temperature	:	Maximum 25.5°C / Minimum 25.2°C
Humidity	:	Maximum 48%R.H. / Minimum 45%R.H.
Air Pressure	:	Maximum 999.2hPa / Minimum 999.1hPa

Traceability of Measurement

: This certificate of calibration documents the traceability to national standard, which realize the unit of measurement according to the International system of Units (SI)

Calibrated by : Mr. Itsara Sawanbancha
Calibration Engineer

Approved by : _____
(Mr. Thichakorn Srisupob)
Asst. Laboratory Manager

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NSC-TISI-TIS 17025
CALIBRATION 0260

CERTIFICATE OF CALIBRATION

Certificate No. : 25-0753-025

Issue Date : 12 June 2025

Work Order No. : 25/0753

Details of Calibration

1. Reference Standards Instrument

Instrument	Capacity of Weight	Serial No. / ID No.	Certificate No.	Due date
Weight Set E2	1mg to 200g	B744909236	22-130801	6 December 2025

2. Certificate traceable : This certificate traceable to The International System of Unit refer to Asia Medical and Agricultural Laboratory and Research center Co., Ltd. , NSC-ONSC Calibration No. 0152

3. Condition of item : Used

4. Calibration site : On-site

Result of Calibration

1. Calibration result : Check performance before calibration

Applied Weight g	Balance Reading g	Correction Value g	Uncertainty (±) g	Coverage Factor (k)
50.00005	50.00009	-0.00004	0.000080	2.00
99.99996	100.00004	-0.00008	0.00016	2.00
200.0000	200.0007	-0.0007	0.00032	2.00

2. The result of check performance in frist step has to Reset span

3. Calibration result : After set span by External Reset span by weight 100 g ID No. WE2-02

3.1 Repeatability number of repeatability is 10 times

Norminal Value (g)	Standard Deviation of Reading (g)
50	0.00000480
100	0.00000480
200	0.0000422

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

The 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-TIS 17025
CALIBRATION 0260

CERTIFICATE OF CALIBRATION

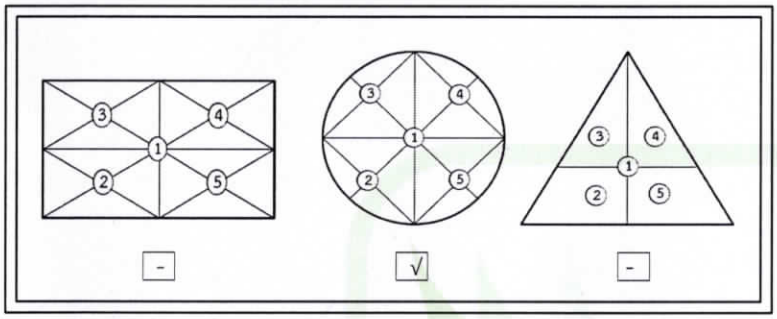
Certificate No. : 25-0753-025

Issue Date : 12 June 2025

Work Order No. : 25/0753

3. Calibration result : After set span by External Reset span by weight 100 g ID No. WE2-02 (continued)

3.2 Eccentric or Off-center Error A mass of 100 g was placed and moved to various position on pan.



Result of Eccentric Error		
Position 1	99.99997	g
Position 2	100.00001	g
Position 3	100.00002	g
Position 4	99.99999	g
Position 5	99.99998	g
(Maximum Difference)	0.00005	g

3.3 Departure of indication from nominal value

Applied Weight g	Balance Reading g	Correction Value g	Uncertainty (±) g	Coverage Factor *(k)*
Unload	0.00000	0.00000	0.000020	2.00
0.10001	0.10001	0.00000	0.000020	2.00
0.50001	0.50003	-0.00002	0.000020	2.00
1.00001	1.00000	0.00001	0.000020	2.00
5.00002	5.00001	0.00001	0.000020	2.00
10.00001	10.00001	0.00000	0.000040	2.00
19.99999	19.99997	0.00002	0.000050	2.00
50.00005	50.00005	0.00000	0.000080	2.00
99.99996	99.99997	-0.00001	0.00016	2.00
200.0000	200.0000	0.0000	0.00032	2.00

Note

Calibrate items it good condition and this report customer request and accepted in certificate

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

The 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%.

--END--

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Tel : 0-2408-8474-5 Fax : 0-2408-8477 Email : info@crystalcal.com www.crystalcal.com

Statements of conformity report

Refer to Certificate No. : 25-0753-025

Issue Date : 12 June 2025

Work Order No. : 25/0753

Detail of Equipment

Description : Electronic Balance

Manufacturer : SHIMADZU

ID No. : TNP.LAB.30

Model : AP225WD

Resolution : 0.00001 g / 0.0001 g

Serial no. : D316301848

Capacity : 102 g / 220 g

Result of Calibration

This result of calibration : Adjustment

Unit : g

Applied Weight	Balance Reading	Correction Value	Uncertainty	Uncertainty + Correction	Limit of performance	Evaluation
0.10001	0.10001	0.00000	0.000020	0.000020	0.000051	Pass
0.50001	0.50003	-0.00002	0.000020	0.000040	0.000051	Pass
1.00001	1.00000	0.00001	0.000020	0.000030	0.000051	Pass
5.00002	5.00001	0.00001	0.000020	0.000030	0.000051	Pass
10.00001	10.00001	0.00000	0.000040	0.000040	0.000071	Pass
19.99999	19.99997	0.00002	0.000050	0.000070	0.000081	Pass
50.00005	50.00005	0.00000	0.000080	0.000080	0.00011	Pass
99.99996	99.99997	-0.00001	0.00016	0.00017	0.00019	Pass
200.0000	200.0000	0.0000	0.00032	0.00032	0.00035	Pass

The conformity certificate documents validaty following ISO/IEC Giude 98-4 : Role of measurement uncertainty in conformity assessment based on statement with guard band refer to NATA User checks and maintenance of laboratory balances consider expanded measurement uncertainty (k=95%)

The tolerance and decision rules ;

Limit of performance (LoP) = 2.26 sw + |Corr| + U(Cal)

Evaluation of decision = Measurement uncertainty + Absolute correction ; ≤ LoP is pass , > LoP is Fail

Statements of conformity decision by :

(Mr. Thichakorn Srisupob)

Asst. Laboratory Manager

-- END --

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NSC-TISI-TIS 17025
CALIBRATION 0260

CERTIFICATE OF CALIBRATION

Certificate No. : 25-0753-026

Issue Date : 12 June 2025

Work Order No. : 25/0753

Customer Name : TNP ENVIRONMENT CO.,LTD.
332/173 Moo 3 Bang Rak Phatthana,
Bang Bua Thong, Nonthaburi 11110

Date of Received : 12 June 2025

Date of Calibration : 12 June 2025

Instrument Details :

Description	:	Electronic Balance
Manufacturer	:	sartorius
Model	:	SECURA224-1S
Serial No.	:	0041305301
ID No.	:	TNP.LAB.31
Resolution	:	0.0001 g
Capacity	:	220 g
Location	:	ห้องปฏิบัติการ 2 ชั้น 3

Calibration Method : This calibration was conducted by using in-house method according to calibration procedure no. CWI-B-01 based on UKAS LAB14 edition 6, October 2019

Environmental Condition

Temperature	:	Maximum 25.6°C / Minimum 25.2°C
Humidity	:	Maximum 48%R.H. / Minimum 44%R.H.
Air Pressure	:	Maximum 999.3hPa / Minimum 999.2hPa

Traceability of Measurement

: This certificate of calibration documents the traceability to national standard, which realize the unit of measurement according to the International system of Units (SI)

Calibrated by : Mr. Itsara Sawanbancha
Calibration Engineer

Approved by : _____
(Mr. Thichakorn Srisupob)
Asst. Laboratory Manager

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NSC-TISI-TIS 17025
CALIBRATION 0260

CERTIFICATE OF CALIBRATION

Certificate No. : 25-0753-026

Issue Date : 12 June 2025

Work Order No. : 25/0753

Details of Calibration

1. Reference Standards Instrument

Instrument	Capacity of Weight	Serial No. / ID No.	Certificate No.	Due date
Weight Set E2	1mg to 200g	B744909236	22-130801	6 December 2025

2. Certificate traceable : This certificate traceable to The International System of Unit refer to Asia Medical and Agricultural Laboratory and Research center Co., Ltd. , NSC-ONSC Calibration No. 0152

3. Condition of item : Used

4. Calibration site : On-site

Result of Calibration

1. Calibration result : Check performance before calibration

Applied Weight g	Balance Reading g	Correction Value g	Uncertainty (±) g	Coverage Factor *(k)*
100.0000	100.0000	0.0000	0.00019	2.00
200.0000	200.0000	0.0000	0.00032	2.00

2. The result of check performance in frist step has to Reset span

3. Calibration result : After set span by Internal Calibration

3.1 Repeatability number of repeatability is 10 times

Norminal Value (g)	Standard Deviation of Reading (g)
100	0.0000316
200	0.0000316

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

The 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-TIS 17025
CALIBRATION 0260

CERTIFICATE OF CALIBRATION

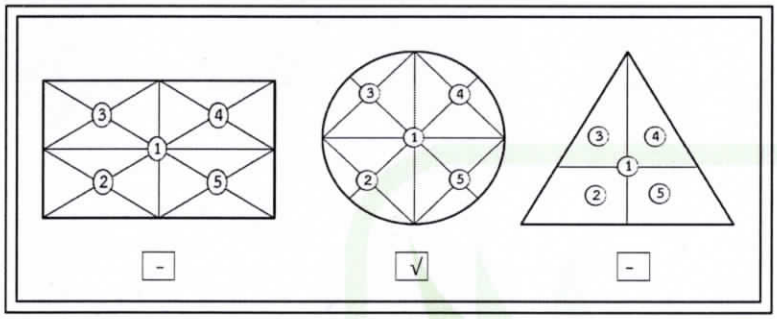
Certificate No. : 25-0753-026

Issue Date : 12 June 2025

Work Order No. : 25/0753

3. Calibration result : After set span by Internal Calibration (continued)

3.2 Eccentric or Off-center Error A mass of 100 g was placed and moved to various position on pan.



Result of Eccentric Error		
Position 1	100.0000	g
Position 2	100.0000	g
Position 3	100.0000	g
Position 4	99.9999	g
Position 5	100.0000	g
(Maximum Difference)	0.0001	g

3.3 Departure of indication from nominal value

Applied Weight g	Balance Reading g	Correction Value g	Uncertainty (±) g	Coverage Factor *(k)*
Unload	0.0000	0.0000	0.000090	2.00
0.1000	0.1000	0.0000	0.000090	2.00
0.5000	0.5000	0.0000	0.000090	2.00
1.0000	1.0000	0.0000	0.000090	2.00
5.0000	5.0000	0.0000	0.000090	2.00
10.0000	10.0000	0.0000	0.00010	2.00
20.0000	20.0000	0.0000	0.00010	2.00
50.0000	50.0000	0.0000	0.00012	2.00
100.0000	100.0000	0.0000	0.00019	2.00
200.0000	200.0000	0.0000	0.00032	2.00

Note

Calibrate items it good condition and this report customer request and accepted in certificate

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

The 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%.

--END--

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Salathammasop, Thawewatthana, Bangkok 10170 Thailand
Tel : 0-2408-8474-5 Fax : 0-2408-8477 Email : info@crystalcal.com www.crystalcal.com

Statements of conformity report

Refer to Certificate No. : 25-0753-026

Issue Date : 12 June 2025

Work Order No. : 25/0753

Detail of Equipment

Description : Electronic Balance

Manufacturer : sartorius

ID No. : TNP.LAB.31

Model : SECURA224-1S

Resolution : 0.0001 g

Serial no. : 0041305301

Capacity : 220 g

Result of Calibration

This result of calibration : Adjustment

Unit : g

Applied Weight	Balance Reading	Correction Value	Uncertainty	Uncertainty + Correction	Limit of performance	Evaluation
0.1000	0.1000	0.0000	0.000090	0.000090	0.00016	Pass
0.5000	0.5000	0.0000	0.000090	0.000090	0.00016	Pass
1.0000	1.0000	0.0000	0.000090	0.000090	0.00016	Pass
5.0000	5.0000	0.0000	0.000090	0.000090	0.00016	Pass
10.0000	10.0000	0.0000	0.00010	0.00010	0.00017	Pass
20.0000	20.0000	0.0000	0.00010	0.00010	0.00017	Pass
50.0000	50.0000	0.0000	0.00012	0.00012	0.00019	Pass
100.0000	100.0000	0.0000	0.00019	0.00019	0.00026	Pass
200.0000	200.0000	0.0000	0.00032	0.00032	0.00039	Pass

The conformity certificate documents validaty following ISO/IEC Giude 98-4 : Role of measurement uncertainty in conformity assessment based on statement with guard band refer to NATA User checks and maintenance of laboratory balances consider expanded measurement uncertainty (k=95%)

The tolerance and decision rules ;

Limit of performance (LoP) = 2.26 sw + |Corr| + U(Cal)

Evaluation of decision = Measurement uncertainty + Absolute correction ; ≤ LoP is pass , > LoP is Fail

Statements of conformity decision by :

(Mr. Thichakorn Srisupob)

Asst. Laboratory Manager

-- END --

Harikul Science Co.,Ltd.
694 Soi Ratchadanivet 24, Pracharatbamphen,
Samsaennok, Huaikhwang, Bangkok 10310
Tel: 0-2274-2456 Fax: 0-2274-2443
Email: info@harikul.com www.harikul.com

CERT.No.: HS-V050G

Certificate of Calibration

Calibration Date : 17 Jul 25

Submitted by : TNP ENVIRONMENT COMPANY LIMITED
332/173 Moo.3, Tambon Bang Rak Phatthana,
Amphoe Bang Bua Thong, Nonthaburi 11110

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

Model : HI 5421
S/N : 07210004101
Probe : HI 76408W
S/N : KC1N32W9P
ID NO. :
Air Temp ref : S/N. F8065C26
Barometric ref : S/N. F8065C26
Water Temp ref : -
HS001
Technician : Kittipong M.

Calibration Details

Calibration Point	100% air sat. (@20 °C, DO = 9.08 mg/l)	(status)		(status)
Measurement 1 (mg/l)	9.05	(PASS)	-	-
Measurement 2 (mg/l)	9.04	(PASS)	-	-
Measurement 3 (mg/l)	9.04	(PASS)	-	-
Measurement 4 (mg/l)	9.05	(PASS)	-	-
Measurement 5 (mg/l)	9.06	(PASS)	-	-
Measurement 6 (mg/l)	9.05	(PASS)	-	-
Measurement 7 (mg/l)	9.06	(PASS)	-	-
Measurement 8 (mg/l)	9.07	(PASS)	-	-
Measurement 9 (mg/l)	9.05	(PASS)		-
Measurement 10 (mg/l)	9.05	(PASS)	-	-
Mean Measurement	9.05	mg/l	-	-
Inaccuracy	0.03	mg/l	-	-
Overall Status	(PASS)			

Manufacturer Specification

Accuracy = +/- 0.15 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)

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

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ANSI National Accreditation Board
ACCREDITED
ISO/IEC 17025
CALIBRATION AND DIMENSIONAL MEASUREMENT
ACDM-2814

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE	:	WATER QUALITY METER
MANUFACTURER	:	DIGICON
MODEL / TYPE	:	WA-48SD
SERIAL NO.	:	T.075714/TF43846/T.075695/11-05[TNP.LAB.46]
CLID. NO.	:	272500210
JOB CONTROL NO.	:	250127009952
CALIBRATION SERVICE	:	☑ IN-LABORATORY ☐ ON-SITE

CUSTOMER : TNP ENVIRONMENT CO., LTD.
332/173 MOO 3 TAMBON BANG RAK PHATTANA,
AMPHOE BANG BUA THONG, NONTHABURI 11110

DATE OF RECEIVED : 27 January 2025 DATE OF ISSUED : 01 March 2025

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

Calibrated By : Sukgasem Seehanart
Calibration Engineer

Approved By : Mongkol Yotsoontorn
Authorized Signatory
01 March 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. Q25009952

@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

CLC
Accredited
ISO/IEC 17025

ANAB
ANSI National Accreditation Board
ACCREDITED
ISO/IEC 17025
CALIBRATION AND DIMENSIONAL MEASUREMENT
ACDM-2814

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	**WATER QUALITY METER**
MANUFACTURER	:	**DIGICON**
MODEL / TYPE	:	**WA-48SD**
SERIAL NO.	:	**T.075714/TF43846/T.075695/11-05[TNP.LAB.46]**
DATE OF CALIBRATION	:	**29 January 2025**

ENVIRONMENT CONDITIONS :

Temperature : (25 ± 2.5) °C **Relative Humidity :** (50 ± 15) % 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-CPCH-02** [Conductivity Meter].

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

This instrument [Sodium chloride] was calibrated by direct measurement with Sodium chloride which maintained by the Calibration Laboratory Co., Ltd.

This instrument was calibrated under procedure No. **CLC-CPCH-06** [Oxygen Meter].

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

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 06664263,11784256, Lot Number CC788789.
3. Potassium Chloride Solution (nominal 0.147 mS/cm , nominal 1.41 mS/cm , nominal 12.8 mS/cm)
4. Sodium chloride, Code 82089719 Lot Number 948692.
5. Dissolved Oxygen, Sigma-Alorich Product ID QC3077-500ML .

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI) , through National Institute of Metrology (Thailand).

Lot Number. 040822 , 120124. Due Date 04 March 2025.

2. The measurements are traceable to International System of Units (SI) , through Control Company.

Certificate No. 4288-14548619 , Due Date 17 October 2025.

3. The measurements are traceable to International System of Units (SI) , through Sigma-Aldrich Canada Co.

Certificate No. HC31089557, HC30595403, HC20111554. Due Date 31 January 2026 , 31 January 2026, 30 September 2025.

4. The measurements are traceable to International System of Units (SI), through CPA chem Ltd.

Ref. No. PSNACLC.50G, Due Date 12 January 2027.

5. The measurements are traceable to International System of Units (SI) , through Merck Co., Ltd.

Lot LRAD8571 , Due Date April 2026.

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)"

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 water quality 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 (± pH)	*k* Factor
4.003	4.00	-	+0.003	0.013	2,15
7.005	7.00	-	+0.005	0.015	2,06
10.015	10.02	-	-0.005	0.016	2,05

Technical Note. Setting function CAL 1 point (4).

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 014 Page 4 of 68

2. CONDUCTIVITY SOLUTION TEST @ 25 °C

Standard Conductivity Solution	DUC Reading	Uncertainty of Measurement	*k* Factor
146.00 µS/cm	146.1 µS/cm	± 2.10 µS/cm	2,00
1.414 mS/cm	1.415 mS/cm	± 0.021 mS/cm	2,00
12.83 mS/cm	12.84 mS/cm	± 0.19 mS/cm	2,00

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 014 Page 4 of 68

*3. SODIUM CHLORIDE RESULT

STD Applied (%NaCl)	Nominal Value (Pcnt)	DUC Reading (Pcnt)	Correction (Pcnt)	Uncertainty ± (Pcnt)	Coverage factor *k*
5.00	5.00	5.01	-0.01	0.010	2,05

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

4. OXYGEN SOLUTION RESULT @ 25°C

Nominal Value (mg/L)	DUC Reading (mg/L)	Correction (mg/L)	Uncertainty (mg/L)	Coverage factor *k*
8.18	8.20	-0.02	± 0.38	2,00

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 014 Page 5 of 68

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

End of Certificate

Certificate No. Q25009952

F3-011-05/12-23

@clccalibration

SCIMET Co., Ltd.
818/124 Udomsuk Rd., Bangna-Nuea,
Bangna, Bangkok 10260 Thailand
Email:scimet2022@gmail.com, Tel: 02 460 9239
https://www.scimet.co.th

NSC-TISI-TIS 17025
CALIBRATION 0454

Certificate No. C07250018

Calibration Certificate

Equipment:	SPECTROPHOTOMETER		
Model:	T6U	Job No.:	KSMT2500582
Serial No.(or ID):	31-1654-01-1055 (TNP.LAB.48)	Received Date:	17 February 2025
Manufacturer:	PG Instrument	Issued Date:	17 February 2025
Condition:	In Condition	Page:	1 of 3

Customer

TNP ENVIRONMENT CO., LTD.

332/173 Village No. 3, Bangrak Phatthana Subdistrict,
Bang Bua Thong District, Nonthaburi Province 11110

Calibration Place

TNP ENVIRONMENT CO., LTD. (ห้องปฏิบัติการ 2)

332/173 Village No. 3, Bangrak Phatthana Subdistrict,
Bang Bua Thong District, Nonthaburi Province 11110

Calibration Date

17 February 2025

Environment Condition

Temperature:	27.1 °C	±	0.3	°C
Humidity:	50.3 %RH	±	2.9	%RH

The Method used

In-house method, WI07, based on ASTM E 275-08 and ASTM E 387-04

Traceability

This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Starna Scientific Limited.

The standard for Wavelength Certificate No. 125472 and 125471

The standard for Photometric Certificate No. 125567 and 125517

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of SCIMET Co., Ltd.

(Mr. Hattapong Pumnil)
Person in charge

SCIMET CO.,LTD

(Mr. Thalerngkeat Poungngam)
Authorized signatory

Condition of reference standards Instruments / CRM:

Instruments	Set No.	Certificate No.	Due date
Didymium Oxide Glass Reference	131033	125472	16-Sep-26
Holmium Oxide Glass Reference	136650	125471	16-Sep-26
Neutral Density Filter Reference	45329	125567	17-Sep-26
Potassium Dichromate Solution References	45328	125517	17-Sep-26

Calibration Results:

Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 2 nm and UUC at 2 nm

Standard Wavelength (nm)	Unit Under Calibration (nm)	Correction (nm)	Uncertainty of Measurement (± nm)
219.30	219.8	-0.50	0.14
241.29	241.8	-0.51	0.14
287.62	287.8	-0.18	0.14
360.43	360.4	0.03	0.14
417.72	418.4	-0.68	0.14
431.57	431.0	0.57	0.14
472.47	473.0	-0.53	0.14
513.41	513.8	-0.39	0.14
528.83	528.6	0.23	0.14
537.13	537.2	-0.07	0.14
573.33	573.6	-0.27	0.14
585.29	585.6	-0.31	0.14
640.94	641.0	-0.06	0.14
684.49	684.8	-0.31	0.14
740.18	739.8	0.38	0.14
748.48	748.8	-0.32	0.14
807.03	806.6	0.43	0.14
879.27	879.4	-0.13	0.14

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance (Abs)	Unit Under Calibration (Abs)	Correction (Abs)	Uncertainty of Measurement(± Abs)
235 nm	0.0000	0.000	0.0000	0.0080
	0.7328	0.733	-0.0002	0.0080
257 nm	0.0000	0.000	0.0000	0.0080
	0.8537	0.852	0.0017	0.0080
313 nm	0.0000	0.000	0.0000	0.0080
	0.2855	0.287	-0.0015	0.0080
350 nm	0.0000	0.000	0.0000	0.0080
	0.6338	0.633	0.0008	0.0080

Calibration Results:

Without Adjustment

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance (Abs)	Unit Under Calibration (Abs)	Correction (Abs)	Uncertainty of Measurement(± Abs)
420 nm	0.0000	0.000	0.0000	0.0045
	0.2352	0.236	-0.0008	0.0045
	0.5716	0.573	-0.0014	0.0045
	0.7146	0.716	-0.0014	0.0045
	1.0179	1.020	-0.0021	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.2314	0.232	-0.0006	0.0045
	0.5566	0.558	-0.0014	0.0045
	0.7028	0.703	-0.0002	0.0045
	1.0016	1.003	-0.0014	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.2107	0.212	-0.0013	0.0045
	0.5192	0.521	-0.0018	0.0045
	0.6638	0.664	-0.0002	0.0045
	0.9447	0.944	0.0007	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.2187	0.220	-0.0013	0.0045
	0.5207	0.522	-0.0013	0.0045
	0.7002	0.700	0.0002	0.0045
	1.0001	1.000	0.0001	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.2430	0.243	0.0000	0.0045
	0.5546	0.555	-0.0004	0.0045
	0.7756	0.775	0.0006	0.0045
	1.1117	1.112	-0.0003	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.2635	0.264	-0.0005	0.0045
	0.5622	0.563	-0.0008	0.0045
	0.7651	0.765	0.0001	0.0045
	1.0974	1.097	0.0004	0.0045

The End of Certificate

บริษัท ซายน์เมท จำกัด (SCIMET CO., LTD.)
818/124 Udomsuk rd., Bangna-Nuea, Bangna, Bangkok 10260 Thailand
Email: scimet2022@gmail.com, Tel: 02 460 9239

Statements of conformity:

This conformity certificate documents the validity of the following statements of conformity based on the measurement results of corresponding calibration certificate:

The error of temperature determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, ASTM E 275-08 and ASTM E 387-04. Therefore, those parameters have not been assessed separately.

Tolerance and Decision rules:

Assessment of the conformity of the measurement device are done based on direct comparison of the relevant measurement results with the tolerances and decision rule are prescribed by the customer.

Decision rule :

- ☐ Choice A — Binary Statement for Simple Acceptance Rule (w = 0), Specific Risk < 50% PFA.
- ☑ Choice B — Non-binary statement with guard band (w = 1 U), Pass or Fail Specific Risk < 2.5% PFA and Condition Pass or Condition Fail Specific Risk < 50% PFA.
- ☐ Choice C — Customer defined, Customers may define arbitrary multiple of r to have applied as guard band (w = r U) .

; PFA – Probability of False Accept

SCIMET CO .,LTD
บริษัท ซายน์เมท จำกัด

(Mr. Thalerngkeat Poungngam)

Authorized signatory

Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 2 nm and UUC at 2 nm

Unit Under Calibration	Correction	Guard Band (w)	Tolerance (±)	Conformity
219.8	-0.50	0.14	1.5	Pass
241.8	-0.51	0.14	1.5	Pass
287.8	-0.18	0.14	1.5	Pass
360.4	0.03	0.14	1.5	Pass
418.4	-0.68	0.14	1.5	Pass
431.0	0.57	0.14	1.5	Pass
473.0	-0.53	0.14	1.5	Pass
513.8	-0.39	0.14	1.5	Pass
528.6	0.23	0.14	1.5	Pass
537.2	-0.07	0.14	1.5	Pass
573.6	-0.27	0.14	1.5	Pass
585.6	-0.31	0.14	1.5	Pass
641.0	-0.06	0.14	1.5	Pass
684.8	-0.31	0.14	1.5	Pass
739.8	0.38	0.14	1.5	Pass
748.8	-0.32	0.14	1.5	Pass
806.6	0.43	0.14	1.5	Pass
879.4	-0.13	0.14	1.5	Pass

Photometric Accuracy (Absorbance)

Wavelength	Unit Under Calibration	Correction	Guard Band (w)	Tolerance (±)	Conformity
235 nm	0.000	0.0000	0.0080	0.02	Pass
	0.733	-0.0002	0.0080	0.02	Pass
257 nm	0.000	0.0000	0.0080	0.02	Pass
	0.852	0.0017	0.0080	0.02	Pass
313 nm	0.000	0.0000	0.0080	0.02	Pass
	0.287	-0.0015	0.0080	0.02	Pass
350 nm	0.000	0.0000	0.0080	0.02	Pass
	0.633	0.0008	0.0080	0.02	Pass

Without Adjustment

Photometric Accuracy (Absorbance)

Wavelength	Unit Under Calibration	Correction	Guard Band (w)	Tolerance (±)	Conformity
420 nm	0.000	0.0000	0.0045	0.015	Pass
	0.236	-0.0008	0.0045	0.015	Pass
	0.573	-0.0014	0.0045	0.015	Pass
	0.716	-0.0014	0.0045	0.015	Pass
	1.020	-0.0021	0.0045	0.02	Pass
440 nm	0.000	0.0000	0.0045	0.015	Pass
	0.232	-0.0006	0.0045	0.015	Pass
	0.558	-0.0014	0.0045	0.015	Pass
	0.703	-0.0002	0.0045	0.015	Pass
	1.003	-0.0014	0.0045	0.015	Pass
465 nm	0.000	0.0000	0.0045	0.015	Pass
	0.212	-0.0013	0.0045	0.015	Pass
	0.521	-0.0018	0.0045	0.015	Pass
	0.664	-0.0002	0.0045	0.015	Pass
	0.944	0.0007	0.0045	0.015	Pass
546.1 nm	0.000	0.0000	0.0045	0.015	Pass
	0.220	-0.0013	0.0045	0.015	Pass
	0.522	-0.0013	0.0045	0.015	Pass
	0.700	0.0002	0.0045	0.015	Pass
	1.000	0.0001	0.0045	0.015	Pass
590 nm	0.000	0.0000	0.0045	0.015	Pass
	0.243	0.0000	0.0045	0.015	Pass
	0.555	-0.0004	0.0045	0.015	Pass
	0.775	0.0006	0.0045	0.015	Pass
	1.112	-0.0003	0.0045	0.015	Pass
635 nm	0.000	0.0000	0.0045	0.015	Pass
	0.264	-0.0005	0.0045	0.015	Pass
	0.563	-0.0008	0.0045	0.015	Pass
	0.765	0.0001	0.0045	0.015	Pass
	1.097	0.0004	0.0045	0.015	Pass

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

The End of Statements of Conformity

ใบตรวจสอบสภาพเครื่อง Spectrophotometer

เลขที่ใบงาน: KSMT2500582

ชนิดเครื่องมือ: SPECTROPHOTOMETER รุ่น: T6U หมายเลขเครื่อง: 31-1654-01-1055

ตรวจสอบ (รับ) 17 Feb 2025		รายการตรวจเช็ค	ตรวจสอบ (ส่ง) 17 Feb 2025		หมายเหตุ
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
☑	☐	1. ความสมบูรณ์เครื่อง	☑	☐	
☑	☐	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	☑	☐	
☑	☐	3. สวิทช์ ปิด – เปิด เครื่อง (On-Off Swicth)	☑	☐	
☑	☐	4. ปุ่มกด (Keypad)	☑	☐	
☑	☐	5. หน้าจอ (Display, Screen Contrast)	☑	☐	
☑	☐	6. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	☑	☐	
☑	☐	7. ความยาวคลื่น (Wavelength Check)	☑	☐	
☑	☐	8. แหล่งกำเนิดแสง (UV < 3,000 hour)	☑	☐	
☑	☐	9. แหล่งกำเนิดแสง (Visible < 5,000 hour)	☑	☐	
☑	☐	10. ช่องวัดหลายตัวอย่าง (Carousel Module)	☑	☐	

เพิ่มเติม/ข้อแนะนำ :

Mr. Hattapong Pumnil

Service Engineer

บริษัท ชายน์เมท จำกัด (SCIMET CO., LTD.)
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national food institute
ministry of industry
อุตสาหกรรมพัฒนามูลนิธิเพื่อสถาบันอาหาร
ศูนย์บริการห้องปฏิบัติการอุตสาหกรรมอาหาร
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center

NSC-TISI-TIS 17025
CALIBRATION 0061

Calibration Certificate

Certificate No.: 2502859-003-01
Client name: TNP ENVIRONMENT CO., LTD.
Address: 332/173 Moo 3 Tambon Bang Rak Phatthana,
Amphone Bang Bua Thong, Nonthaburi 11110

Equipment: pH Meter
Manufacturer: EUTECH INSTRUMENTS
Model: pH 700
Serial No.: 3178920
ID No.: TNP.LAB.57
Order No.: 2502859
Operation No.: 2502859-003
Date of Receipt: 8 May 2025
Date of Calibration: 8 May 2025

Calibrated by Mr.Manas Somsak
Specialist

Approved by
(Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

Date of Issue: 13 May 2025

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

2008 ซอยอรุณอมรินทร์ 36 ถนนอรุณอมรินทร์ แขวงบางยี่ขัน เขตบางพลัด กรุงเทพมหานคร 10700
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อุตสาหกรรมพัฒนามูลนิธิเพื่อสถาบันอาหาร
ศูนย์บริการห้องปฏิบัติการอุตสาหกรรมอาหาร
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center

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THAILAND
NSC-TISI-TIS 17025
CALIBRATION 0061

Calibration Report

Certificate No.: 2502859-003-01

Equipment: pH Meter — **Resolution:** 0.01 pH ; 0.1 mV

Manufacturer: EUTECH INSTRUMENTS — **Model:** pH 700

Serial No.: 3178920 — **Type:** Bench top

ID No.: TNP.LAB.57

Date of Calibration: 8 May 2025

Location: Laboratory 1, TNP ENVIRONMENT CO., LTD.

Environment Condition: **Ambient Temperature:** (23.4 ± 1.5) °C **Relative Humidity:** (55 ± 3) %

Condition of Equipment: Good Condition

Condition of this Results of Calibration

1.Calibration Method: W-CC-002 : In house method based on direct measurement by using standard voltage calibrator and certified reference material (CRM)

2. Reference Standards / Certified Reference Material

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2709007	Fluke	24E1752	30 May 2025
2.2 Digital Thermometer	2709007	Fluke	2500376-002-01	29 October 2025
2.3 Thermo-Hygro Meter	NFI.BTH 013/23	testo	CC 670420-01	21 May 2025
Certified Reference Material	**Lot. No.**	**Manufacturer**	**Ref N**	**Expire Date**
2.4 pH buffer 4.008 (Primary pH buffer Solution)	1016435	CPAchem	PH216.L5	25 July 2026
2.5 pH buffer 6.865 (Primary pH buffer Solution)	949186	CPAchem	PH217.L5	30 November 2025
2.6 pH buffer 10.01 (Primary pH buffer Solution)	1016437	CPAchem	PH220.L5	25 July 2025
2.7 pH buffer 7.00 (Standard pH buffer Solution)	C03109	HACH LANGE GmbH	S11M004	16 October 2025

3. This certification is traceable to The International System of Unit (SI Unit)

3.1 Instruments No.2.1	through	NSC-TISI-TIS 17025 Laboratory Accredition of Calibration No.0008
3.2 Instruments No.2.2 to 2.3	through	NSC-TISI-TIS 17025 Laboratory Accredition of Calibration No.0061
3.3 Certified Reference Material No.2.4 to 2.6	traceable to	Primary measurement method- Harned cell using calibrated thermometer, barometer, and nanovoltmeter.The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
3.4 Certified Reference Material No.2.7	traceable to	PTB Certificate Nr. PTB-PHOA-563/30504/23 and Certificate Nr. PTB-PHOB-555/30620/22 (PTB: Physikalish-Thechnische Bundesanstalt, Braunschweig, Germany)

4. This certificate was certified only for the instrument we calibrated.

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

2008 ซอยอรุณอมรินทร์ 36 ถนนอรุณอมรินทร์ แขวงบางยี่ขัน เขตบางพลัด กรุงเทพมหานคร 10700
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THAILAND
NSC-TISI-TIS 17025
CALIBRATION 0061

Calibration Report

Certificate No.: 2502859-003-01

Equipment: pH Meter — **Resolution:** 0.01 pH ; 0.1 mV

Manufacturer: EUTECH INSTRUMENTS — **Model:** pH 700

Serial No.: 3178920 — **Type:** Bench top

ID No.: TNP.LAB.57

Date of Calibration: 8 May 2025

Calibration Results:

1. Calibration of pH Meter (Manual Temperature Compensation at 25 °C)

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (±mV)	Coverage Factor (*k*)
		mV	pH		
0	414.122	414	0.00	0.58	2.00
2	295.815	296	2.00	0.58	2.00
4	177.463	177.6	4.00	0.063	2.00
6	59.160	59.3	6.00	0.063	2.00
7	0.001	0.2	7.00	0.063	2.00
8	-59.159	-59.0	8.00	0.063	2.00
10	-177.462	-177.3	10.00	0.063	2.00
12	-295.813	-296	12.00	0.58	2.00
14	-414.121	-414	14.00	0.58	2.00

2. Calibration of pH Meter with Electrode (Manual Temperature Compensation at 25 °C)

Equipment: pH Electrode — **Type:** Combined Electrode

Manufacturer: EUTECH INSTRUMENTS — **Model:** 93X218814

Serial No.: 3231404 (ECFG7350401B) — **ID.No.** N/A

Performance of Electrode system (Three-Point Calibration at pH 4, 7 and 10)

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (*k*)
	pH	mV			
4.008	4.01	176.2	-	0.0071	2.00
7.001	7.00	0.0	99.6	0.0086	2.00
10.010	10.01	-172.4	96.8	0.0086	2.00
6.876	6.88	8.0	-	0.0074	2.00

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 %.

---------- End ----------

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Food Industrial Laboratory Service Center

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THAILAND
NSC-TISI-TIS 17025
CALIBRATION 0061

Calibration Certificate

Certificate No.: 2502859-004-01
Client name: TNP ENVIRONMENT CO., LTD.
Address: 332/173 Moo 3 Tambon Bang Rak Phatthana,
Amphone Bang Bua Thong, Nonthaburi 11110

Equipment: Water Bath
Manufacturer: MEMMERT
Model: WTB24
Serial No.: LD23.0297
ID No.: TNP.LAB.58
Order No.: 2502859
Operation No.: 2502859-004
Date of Receipt: 8 May 2025
Date of Calibration: 8 May 2025

Calibrated by Mr.Worapob Sookthong
Scientist

Approved by
(Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

Date of Issue: 13 May 2025

The uncertainties are for a confidence probability of approximately 95 %.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

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NSC-TISI-TIS 17025
CALIBRATION 0061

Calibration Report

Certificate No.: 2502859-004-01

Equipment: Water Bath

Model: WTB24 Serial No.: LD23.0297

Resolution: 0.1 °C ID No.: TNP.LAB.58

Manufacturer: MEMMERT

Date of Calibration: 8 May 2025

Location: Floor 3, Laboratory, TNP ENVIRONMENT CO., LTD.

Environment Condition:

Ambient Temperature (23 ± 1) °C

Relative Humidity (40 ± 2) %

Line Voltage (230 ± 1) Volt

Condition of this results of Calibration:

1. This instrument was calibrated by insert 5 standard thermometer into its liquid bath and calibration according to W-TE-011 based on ASTM E715-80 (Re-approved-2016): Standard Specification for Gravity-Convection and Forced-Circulation Water Baths.
   - The temperature scale used is ITS - 90.
   - All data show below were final values and the initial data may be obtained upon request.
2. Reference Standard Instrument :

Instrument	Model	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	34972A	MY49016894	2502528-001-01	19-Apr-26	NATIONAL FOOD INSTITUTE
	RTD	RTD#201-205 / CH#201-205			

3. This certificate is traceable to International System of Units (SI Units).
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.
6. Condition of Calibrated item : Good

   UUC Description:

   Time of Record 1 Hour 9 Minute At 44.5 °C
7. Result of Calibration :
   - [X] Without adjustment
   - [ ] After adjustment

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NSC-TISI-TIS 17025
CALIBRATION 0061

Calibration Report

Certificate No.: 2502859-004-01

Equipment: Water Bath

Model: WTB24 Serial No.: LD23.0297

Resolution: 0.1 °C ID No.: TNP.LAB.58

Manufacturer: MEMMERT

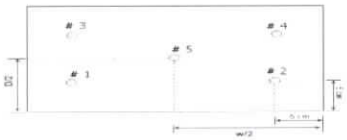
Date of Calibration: 8 May 2025

Calibration point: 44.5 °C

Calibration result:

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
Min	23.0	38.5	229.3
Max	23.5	41.6	231.4

TOP VIEW



SIDE VIEW

Table1 : Reporting of Temperature

Sensor Installation Location

Calibration Point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.5 is REF)					Uncertainty ± (°C)
	# 1	# 2	# 3	# 4	# 5	
44.5	44.49	44.52	44.49	44.53	44.51	0.17

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* Reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	MIN	MAX	Average			
44.5	44.5	44.5	44.5	0.050	0.022	0.15

Note The quoted uncertainty include " Stability " and " Loading effect (20% of Temp Uniformity)"

UUC* = Unit Under Calibration

Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors, for at least half an hour after reaching steady state.

Uniformity = The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.

Overall Variation = The difference of the maximum and minimum measured temperatures througout observation time.

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

--------- **End** ---------

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THAILAND
NSC-TISI-TIS 17025
CALIBRATION 0061

Calibration Certificate

Certificate No.: 2502859-005-01
Client name: TNP ENVIRONMENT CO., LTD.
Address: 332/173 Moo 3 Tambon Bang Rak Phatthana,
Amphone Bang Bua Thong, Nonthaburi 11110

Equipment: CHAMBER (Incubator)
Manufacturer: BIOBASE
Model: BJPX-M100B
Serial No.: BJPXM1002301016
ID No.: TNP.LAB.59
Order No.: 2502859
Operation No.: 2502859-005
Date of Receipt: 8 May 2025
Date of Calibration: 8 May 2025

Calibrated by Mr.Worapob Sookthong
Scientist

Approved by
(Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

Date of Issue: 13 May 2025

The uncertainties are for a confidence probability of approximately 95 %.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

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NSC-TISI-TIS 17025
CALIBRATION 0061

Calibration Report

Certificate No.: 2502859-005-01

Equipment: CHAMBER (Incubator)

Model: BJPX-M100B Serial No.: BJPXM1002301016

Resolution: 0.1 °C ID No.: TNP.LAB.59

Manufacturer: BIOBASE

Date of Calibration: 8 May 2025

Location: Floor 3, Laboratory, TNP ENVIRONMENT CO., LTD.

Environment Condition:

Ambient Temperature (22.4 ± 1) °C

Relative Humidity (41 ± 1) %

Line Voltage (232 ± 2) Volt

Condition of this results of Calibration:

1. This instrument was calibrated by insert 9 standard thermometer into its chamber and calibration according to W-TE-014 Based on TLAS G-20-1/02-08 (E): Guidelines for Calibration and Checks of Temperature Controlled Enclosures.
   - The temperature scale used was based on ITS - 90.
   - All data show below were final values and the initial data may be obtained upon request.
2. Reference Standard Instrument :

Instrument	Model	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	34972A	MY49016894	2502528-001-01	19 April 2026	NATIONAL FOOD INSTITUTE
	RTD	CH#101-109/ RTD#101-109			

3. This certificate is traceable to International System of Units (SI Units).
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.
6. Condition of Calibrated item : Good

   UUC Description :

   Time of Record 1 Hour 9 Minute At 35.0, 37.0, 41.5 and 42.0 °C

   Fresh air Damper [-] Open Position [-]

   [X] Close Fan [100%]

   [-] Not Available
7. Result of Calibration : [X] Without adjustment [ ] After adjustment

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CALIBRATION 0061

Calibration Report

Certificate No.: 2502859-005-01

Equipment: CHAMBER (Incubator)

Model: BJPX-M100B Serial No.: BJPXM1002301016

Resolution: 0.1 °C ID No.: TNP.LAB.59

Manufacturer: BIOBASE

Date of Calibration: 8 May 2025

Calibration point: 35.0, 37.0, 41.5 and 42.0 °C

Calibration result:

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
MIN	21.8	40.3	230.5
MAX	22.7	42.5	233.9

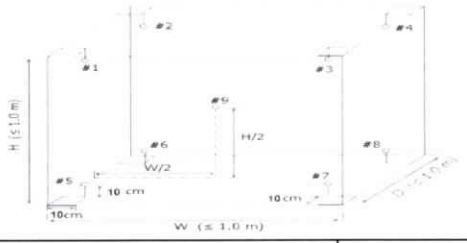

Table1 : Reporting of Temperature

Calibration point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.9 is REF)									Uncertainty ± (°C)
	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	
35.0	36.49	35.70	34.90	35.13	36.07	35.87	35.35	35.35	35.04	0.56
37.0	38.61	37.85	36.83	37.08	38.15	37.90	37.39	37.38	36.96	0.60
41.5	42.98	42.31	41.31	41.49	42.76	42.42	41.83	41.79	41.40	0.62
42.0	43.74	42.85	41.66	42.02	43.26	42.94	42.35	42.33	41.91	0.65

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* Reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	MIN	MAX	Average			
35.0	35.0	35.0	35.0	0.31	1.45	2.08
37.0	37.0	37.0	37.0	0.33	1.65	2.41
41.2	41.2	41.2	41.2	0.36	1.58	2.34
41.7	41.7	41.7	41.7	0.36	1.83	2.64

Note The quoted uncertainty include " Stability " and " Loading effect (20% of Temp Uniformity) "

UUC* = Unit Under Calibration

Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors, for at least half an hour after reaching steady state.

Uniformity = The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.

Overall Variation = The difference of the maximum and minimum measured temperatures througout observation time.

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

--------- End ---------

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45/48 Soi Salathammasop31, Salathammasop Rd.,
Salathammasop, Thawewatthana, Bangkok 10170 Thailand
Tel : 0-2408-8474-5 Fax : 0-2408-8477 Email : info@crystalcal.com www.crystalcal.com

NSC-TISI-TIS 17025
CALIBRATION 0260

CERTIFICATE OF CALIBRATION

Certificate No. : 25-0753-006

Issue Date : 16 June 2025

Work Order No. : 25/0753

Customer Name : TNP ENVIRONMENT CO.,LTD.
332/173 Moo 3 Bang Rak Phatthana,
Bang Bua Thong, Nonthaburi 11110

Date of Received : 12 June 2025

Date of Calibration : 16 June 2025

Instrument Details :

Description	:	Volumetric flask
Manufacturer	:	DARAN
Model	:	N/A
Serial No.	:	N/A
ID No.	:	TNP-LAB-G.39
Capacity	:	25 ml
Class	:	A
Location	:	Volumetric and Mass Calibration Laboratory, CCS

Calibration Method : This instrument was calibrated by Gravimetric methods for the determination of measurement error according to calibration procedure no. CWI-V-02 follow up to ASTM E542-01 (2012) Standard Practice for Calibration of Laboratory Volumetric Apparatus

Environmental Condition

Ambient Temperature	:	Control at 20 °C ± 2.5 °C
Relative humidity	:	Control at 50 %RH ± 10 %RH
Atmospheric pressure	:	Monitoring at 1013 hPa ± 8 hPa

Traceability of Measurement

: This certificate of calibration documents the traceability to national standard, which realize the unit of measurement according to the International system of Units (SI)

Calibrated by : Miss Lalitphat Thiankaew
Calibration Engineer

Approved by :
(Mr. Thichakorn Srisupob)
Asst. Laboratory Manager

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NSC-TISI-TIS 17025
CALIBRATION 0260

CERTIFICATE OF CALIBRATION

Certificate No. : 25-0753-006

Issue Date : 16 June 2025

Work Order No. : 25/0753

Details of Calibration

1. Reference Standards Instrument

Instrument	ID No.	Certification	Due Date
1.1 Electronic Balance	BAL-11	25--0164-008	14 March 2026
1.2 Digital thermometer with sensor	RTD-10	25-0164-010	28 February 2026
1.3 Thermo-Hygrometer	TH-07	25-01644-016	28 February 2026
1.4 Barometer	BM-05	L202410225-0001	18 October 2025

2. Certificate traceable : This certificate traceable to The International System of Unit refer to
1.1 Crystal Calibration Sales and Service Co., Ltd.,NSC-ONSC Calibration No. 0260
1.2-1.3 Crystal Calibration Sales and Service Co., Ltd., NSC-ONSC Calibration No. 0260
1.4 Miracle international Technology Co., Ltd., NSC-ONSC Calibration No. 0052

3. Condition of item : Used

4. Calibration site : Permanent

Other detail of volumetric ware

Type of calibration : To Contain Designation of standard : N/A

Tolerance : ± 0.04 ml

Result of Calibration

Caibration result without adjustment

Norminal value (ml)	Mean Volume (ml)	Error (ml)	Standard deviation (ml)	Uncertainty (± ml)	Coverage factor (*k*)
25	25.00714	-0.00714	0.000065	0.0065	2.00

Note :

1. The result of repeat the test 10 measurements
2. The standard uncertainty of measurement has been determined in accordance with ISO/TR 20461:2000 and UKAS M3003
3. This report customer request and accepted in detail and data in certificate
4. Calibrate items it good condition and this report customer request and accepted in certificate

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

The 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%.

--END--

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45/48 Soi Salathammasop31, Salathammasop Rd.,
Salathammasop, Thawewatthana, Bangkok 10170 Thailand
Tel : 0-2408-8474-5 Fax : 0-2408-8477 Email : info@crystalcal.com www.crystalcal.com

Statements of conformity report

Refer to Certificate No. : 25-0753-006

Issue Date : 16 June 2025

Work Order No. : 25/0753

Detail of Equipment

Description : Volumetric flask

Manufacturer : DARAN

ID No. : TNP-LAB-G.39

Model : N/A

Capacity : 25 ml

Serial no. : N/A

Sub Deviation : 1 ml

Type of calibration : To Contain

Designation of standard : N/A

Tolerance : ± 0.04 ml

Result of Calibration

This result of calibration : Without adustment

Tolerance	0.0400	ml

Volumetric glassware class : A

Norminal volume	Mean volume	Absolute Volume Error	Uncertainty	Uncertainty + volume error	Evaluation
25	25.00714	0.0071	0.0065	0.014	Pass

The conformity certificate documents validaty following ISO/IEC Giude 98-4 : Role of measurement uncertainty in conformity assessment based on statement with guard band refer to specification tolerance limit mark on glassware consider expanded measurement uncertainty (k=95%)

The tolerance and decision rules ;

MPE of Glassware = Measurement uncertainty + Absolute error ; ≤ MPE is pass , > MPE is Fail

Statements of conformity decision by :

(Mr. Thichakorn Srisupob)

Asst. Laboratory Manager

-- END --

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL.0-2717-3000-29 FAX.0-2719-9484

NSC-TISI-TIS17025
CALIBRATION 0008

Certificate of Calibration

Cert.No.: 25CHO337

Equipment :	Spectrophotometer
Manufacturer :	Hach
Model :	DR3900
Serial No. :	1988383
ID No. :	SPE-002
Condition As-Received:	Used Item
Received Date :	08 July 2025
Calibration Date :	09 July 2025
Reference :	2507-0148OC-9
Submitted by :	Environment & Laboratory Co.,Ltd 40 Soi Liangmueangnonthaburi 13 Talad Kwan, Mueang, Nonthaburi 11000
Calibration Place :	Room No.304
Ambient Temperature :	(25.4 to 24.8) °C (On-Site)
Relative Humidity :	(62 to 61) % (On-Site)
Calibration Procedure :	In - house method : CP-OCH4 based on ASTM E 275-08
Calibrated by :	Uthen Kankawi

Approved by :

Approved Signatory

( ) Chakrit Waewwanjua
( ) Ponpan Paipim
(✓) Saithip Meangmai

Issue Date : 14 July 2025

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

Condition of calibration result

1. Reference Standard Material :

Material	Serial No.	Certificate No.	Due date
1. Absorbance Standard set	43532	119613	22 Feb 2026
2. Absorbance Standard set	44487	122584	31 May 2026
3. Wavelength Standard set	29829	114509	11 Sep 2025
4. Wavelength Standard set	29829	114510	11 Sep 2025

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certificate is traceable to the International System of Unit maintained through :
   - Starna Scientific Ltd.
4. Spectral BandWidth : 5 nm
   Scan Speed : - nm/min

Calibration Results : without adjustment

Wavelength Accuracy

Certified Values of Reference Material (nm)	UUC Reading (nm)	Uncertainty of Measurement (± nm)	Coverage Factor *k*
361.40	361	0.59	2.00
447.20	447	0.59	2.00
537.00	536	0.59	2.00
638.00	638	0.59	2.00
740.51	741	0.59	2.00
807.04	807	0.59	2.00

Calibration Results : without adjustment

Photometric Accuracy

Wavelength (nm)	Certified Values of Reference Material (Abs)	UUC Reading (Abs)	Uncertainty of Measurement (±Abs)	Coverage Factor *k*
350.0	Zero	0.000	0.0046	2.00
	0.4271	0.425	0.0046	2.00
	0.6391	0.635	0.0050	2.00
440.0	Zero	0.000	0.0028	2.00
	0.5598	0.556	0.0028	2.00
	0.7037	0.700	0.0028	2.00
	1.0013	0.997	0.0028	2.00
546.1	Zero	0.000	0.0028	2.00
	0.5234	0.522	0.0028	2.00
	0.7007	0.699	0.0028	2.00
	0.9992	0.998	0.0028	2.00
635.0	Zero	0.000	0.0028	2.00
	0.5648	0.563	0.0028	2.00
	0.7654	0.763	0.0028	2.00
	1.0961	1.094	0.0028	2.00

Remark

- Each individual filter is measured against the empty filter holder (blank) used to zero the spectrophotometer
- The Potassium Dichromate filled cells are measured against a Perchloric acid blank.
- 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 of approximately 95 %.

-o0o-

Business Unit
Technology

DKSH

Performance Verification Certificate

Job No. WO-00043742

Equipment :	AA SPECTROMETER	**Serial No. :**	A8631
Manufacturer :	GBC Scientific	**Verification Date :**	7-Oct-2024
Model Type :	SavantAA		
Customer :	Environment & Laboratory Co.,Ltd.		
	40 Soi Liangmueangnonthaburi 13 Talad Kwan,Mueang, Nonthaburi 11000, Thailand		

Result of Verification

Test Description	Criteria	Reading	Result
1. EHT	< 350 V	318 V	**PASS**
Photometric Noise (if >350 V)	Std. Dev <0.0002	-	
2. Wavelength Accuracy , Cu 324.75 nm	± 0.20 nm	324.83 nm	**PASS**
3. Wavelength Accuracy , Cs 852.10 nm	± 0.20 nm	852.04 nm	**PASS**
4. Slit Width 0.2 nm	± 0.02 nm	0.21 nm	**PASS**
5. Slit Width 0.5 nm	± 0.05 nm	0.53 nm	**PASS**
6. Slit Width 1.0 nm	± 0.10 nm	1.04 nm	**PASS**
7. Standard Gauze Screen 0.49 Abs*	± 0.02 Abs.	0.4909 Abs.	**PASS**
BC mode with gauze		-0.0000 Abs.	
BC mode without gauze		0.0002 Abs.	
Difference between With gauze and without gauze	< 0.004 Abs.	0.0002 Abs.	**PASS**
8. ABS Reading 5ppm,Cu	> 0.7 Abs.	0.842 Abs.	**PASS**
9. %RSD	< 0.5 %	0.39 %	**PASS**

** Write in the criteria column the Abs reading on the gauze screen calibration label*

We hereby certify that instrument complies with GBC factory speccifications

***Your satisfaction is our promise* @ DKSH Technology Limited**

Verification By : Mr. NIWAT SUPATANIT

Issued Date : 7-Oct-2024

Signatory : _____

DKSH Technology Limited
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone +662 639 7000, www.dksh.com

ศูนย์บริการลูกค้าหลังการขาย - Technology service call center
02 639 7000

Delivering growth – in Asia and beyond

Job No. WO-00043742
☑ Service contract Basic Plan
☐ Service contract Performance Plan

DKSH
บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด

PREVENTIVE MAINTENANCE AND PERFORMANCE VERIFICATION REPORT

ATOMIC ABSORPTION SPECTROPHOTOMETER (AAS)

Issued Date: 7/10/24

Customer :	บริษัท เอ็นไวรอนเม้นท์ แอนด์ แลบอราตอรี่ จำกัด	**Manufacturer :**	GBC Scientific Equipment Pty Ltd.
Address :	40 ซอย เลี่ยงเมืองนนทบุรี 13 ตำบลตลาดขวัญ อำเภอเมือง จังหวัดนนทบุรี 11000	**Model :**	SavantAA
		Serial No :	A8631
Contract :	คุณ อลิสา ทรงสวัสดิ์	**Location :**	Laboratory

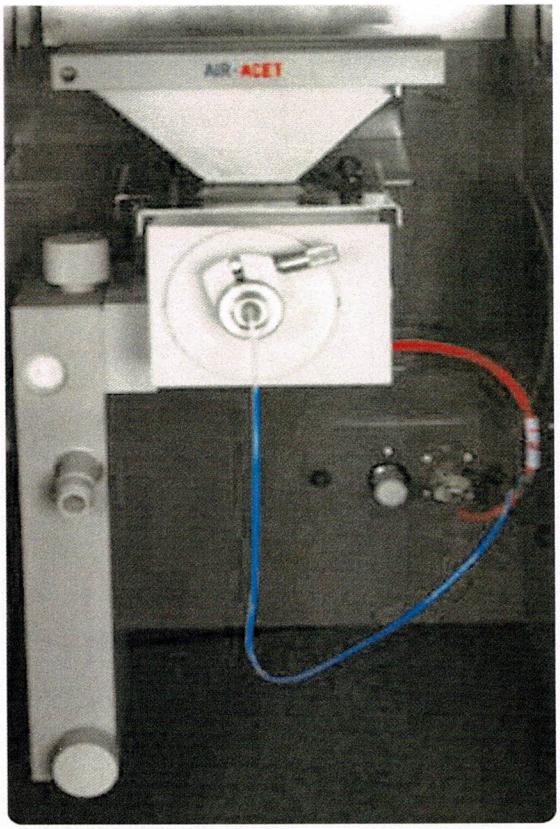
Power on switch and initial status

Instrument Ready สถานะเครื่องพร้อมใช้งาน

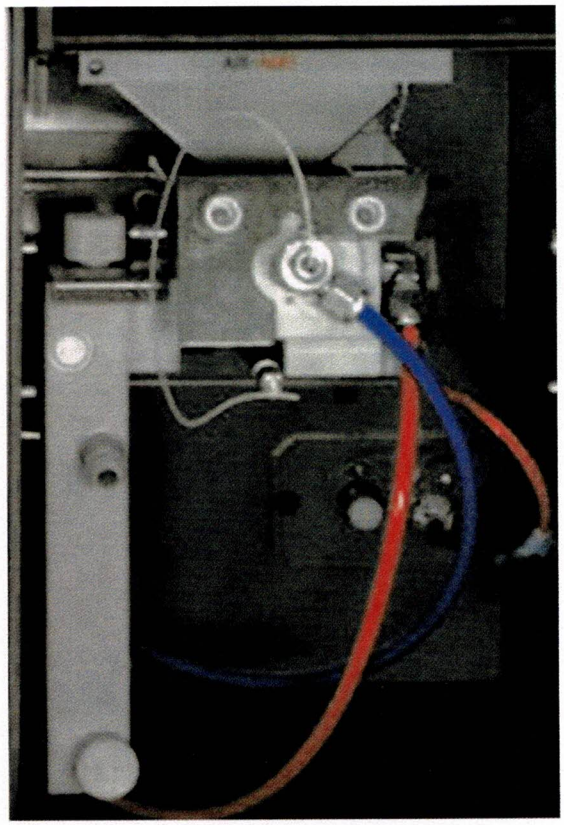
Preventive Maintenance	Pass	Fail	Remarks
Electrical Voltage			
- **Main voltage** (power supply check 220V ±10V).	☑	☐	218.9 VAC
- **Power indicator light** (Replace if faulty).	☑	☐	N/A
- **Power core** (Clean or replace as appropriate).	☑	☐	N/A
- **Fan** (Clean or replace filter element as appropriate).	☑	☐	N/A
Environment			
- **Temperature** (10 to 35 deg.C)	☑	☐	22.5 C
- **Humidity** (8 to 80%).	☑	☐	57 %
- **Air Quality (No Dust)**	☑	☐	N/A
- No corrosive vapours present from laboratory sample preparation or external sources.	☑	☐	N/A
Optics			
- **Windows lens** (Clean or replace as appropriate).	☑	☐	Clean
- **Light Source** (Check operation. Replace if required).	☑	☐	Ready
- **D2 Lamp** (Check operation. Replace if required).	☑	☐	Ready
Gas system			
- **General** (Tube and Fitting /Check for leaks).	☑	☐	Ready
- **Air Zero** (Inlet pressure range 300-400 kPa).	☑	☐	4 Bar
- **Acetylene** (Inlet pressure range 55-96 kPa).	☑	☐	0.9 Bar
- **Nitrous oxide** (Inlet pressure range 300-400 kPa).	☐	☑	-
Computer			
- **Operating system**	☑	☐	Windows 10
- **Software Version**	☑	☐	SavantAA3.11
- **Verify that all computer links and installed software operate correctly**	☑	☐	Ready

Spray Chamber Type

☐ ABR Spray Chamber



☑ Standard Spray Chamber



Preventive Maintenance	Pass	Fail	Remark
Flame system			
- **Burner head** (Clean the jaws using GBC Burner Cleaning Card).	☑	☐	Ready
- **Burner mount** (Check for wear. Replace the burner retaining plate if required).	☑	☐	Ready
- **Spray chamber** (Visually inspect the bead for cracks, pitting or solid deposits. Check or replace O-ring kit).	☑	☐	Ready
- **Safety interlocks**			
➢ Burner (Check for Interlocks connector)	☑	☐	Ready
➢ Spray chamber (Check for Interlocks connector)	☑	☐	Ready
- **Pressure relief bung.** (Check or replace O-ring)	☑	☐	Ready
- **Nebulizer** (Clean and check operation / Replace the O-ring)	☑	☐	Ready
- **Gas connections** (Check for leaks).	☑	☐	Ready
- **Capillary tube** (Check bends and clog).	☑	☐	Ready
- **Liquid trap** (Drain / clean and replace O-ring).	☑	☐	Ready

Gas Flow Optimisation	Pass	Fail	Remark
- **Bleed gas lines** (Relieve pressure in the spray chamber).	☑	☐	Ready
- **Ignitor** (Ignite the flame several times to check ignition reliability. Replace the glow plug if required).	☑	☐	Ready
- **Extinguish** (Check operation).	☑	☐	Ready
- **Horizontal movement** (Check operation for STD. Spray Chamber).	☑	☐	Ready
- **Vertical movement** (Check operation for STD. Spray Chamber).	☑	☐	Ready
- **Burner Adjuster** (Check operation for ABR Spray Chamber)			
➢ Burner Angle (° C)	☐	☐	
➢ Angle Zero (mm)	☐	☐	
➢ Work head Height (mm)	☐	☐	
➢ Work head Centre (mm)	☐	☐	

Note:

Signature	
Customer : ..... (Alisa Songsanwasd)	**Date :** 7/10/24
Service Engineer : Niwat S. ..... (**Mr. NIWAT SUPATANIT**)	**Maintenance Date :** 7/Oct/2024

Performance Verification	Specification	Actual Value	Pass	Fail	Remarks
1. Wavelength accuracy (optic calibration check).	Cu 324.75 nm ±0.2 nm	324.83 nm	☑	☐	N/A
	Cs 852.10 nm ±0.2 nm	852.04 nm	☑	☐	N/A
2. Slit width accuracy (0.2 nm ,0.5 nm,1.0 nm)	0.2 nm ±0.02 nm	324.752,46 / 324.960,46	☑	☐	0.208 nm
	0.5 nm ±0.05 nm	324.60,50 / 325.13,50	☑	☐	0.53 nm
	1.0 nm ±0.10 nm	324.38,46 / 325.42,46	☑	☐	1.04 nm
3. EHT	<350V	318 V	☑	☐	N/A
4. Absorbance accuracy (absorbance calibration check). ➢ Gauze 0.49 A.U.	Reading ±10% of calibrated value.	0.4909 Abs	☑	☐	N/A
5. Background correction (optics alignment check). difference between measurement with and without 0.49 A.U. gauze for 10 samples.	SavantAA <1% SensAA/XplorAA <2%	BC on with gauze: -0.0000 Abs BC on without gauze: 0.0002 Abs	☑	☐	N/A
6. Sensitivity /noise flame test (aqueous Cu solution test under air-acetylene flame).	Cu 5 ppm >0.7 A.U.	0.8421 Abs	☑	☐	N/A
	<0.5% RSD	0.39 %RSD	☑	☐	N/A

Note:

Signature	
Customer : ..... (Alisa Songsawasd)	**Date :** 7/10/24
Service Engineer : Niwat S. (**Mr. NIWAT SUPATANIT**)	**Maintenance Date :** 7/Oct/2024

DKSH
บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด

This is to certify that

Niwat Supatanit

From

DKSH Technology Limited Thailand

has successfully completed GBC Service Training including hardware and software training, installation and repair on the following instruments:

AAS Instruments and Accessories

UV-Vis Instruments and Accessories

ICP-OES Quantima and Accessories

Introduction to:

ICP-TOFMS OptiMass

High Performance Liquid Chromatography

X-ray Equipment Emma

Training conducted in Penang, Malaysia

From 22 July to 2 August 2019

Geoff Condick
CEO

GBC

GBC Scientific Equipment Pty Ltd

Certificate of Conformance

This is to certify that the gauze membrane serial number: F104

Reads a value of: 0.49 A.U. at a wavelength of **440 nm**, using a GBC Cintra serial number V 4331 referenced to a NIST neutral density filter: 8661/SRM 930D (1210).

Valid for 12 months from date of issue.

Date: 22/03/2024

Operator: NIWAT SUPATANIT

GBC Scientific Equipment Pty Ltd
A.C.N. 005 472 686
A.B.N. 30 005 472 686

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Visionary Technology
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gbc@gbcsci.com

GBC

01-1065-00

Supelco®

www.sigmaaldrich.com

Certified Reference Material
Reference material certificate

Copper Standard for AAS

TraceCERT®

Product no.:	38996
Lot no.:	BCCH9264
Description of CRM:	Copper metal (pure material) in 2% HNO_3 (prepared with HNO_3 suitable for trace analysis and high-purity water, 18.2 MΩ·cm, 0.22 µm filtered).
Expiry date:	JUN 2025
Storage:	Store at 5°C-25°C
Density (certified) at 20°C:	1011.3 kg m^{-3} ± 0.5 kg m^{-3}

Constituent	Certified values at 20°C and expanded uncertainties, $U = k \cdot u$ ($k = 2$) [1][2]	
Copper	**989 mg kg^{-1} ± 4 mg kg^{-1}**	**1000 mg L^{-1} ± 4 mg L^{-1}**

Metrological traceability:	Certified values are traceable to the International System of units (SI) through a metrologically valid weighing process. Details see "Details on metrological traceability".[3]
Measurement method:	The certified value is determined by high-precision weighing of thoroughly characterized starting materials and verified by measurement against NIST SRMs or similar CRMs in accordance with ISO/IEC 17025.[4]
Intended use:	Calibration of AAS, ICP, spectrophotometry or any other analytical technique.
Instructions for handling and correct use:	The bottle's temperature must be 20°C. Shake well before every use. If storage of a partially used bottle is necessary (at the user`s risk), the cap should be tightly sealed and the bottle should be stored at reduced temperature (e.g. refrigerator) to minimize transpiration rate.
Health and safety information:	Please refer to the Safety Data Sheet for detailed information about the nature of any hazard and appropriate precautions to be taken.
Packaging:	250 mL HDPE bottle
Accreditation:	Sigma-Aldrich Production GmbH is accredited by the Swiss Accreditation Service SAS as reference material producer under no. SRMS 0001 in accordance with international standard ISO 17034[5]
Certificate issue date:	29 JUL 2022

ISO 17034
SRMS 0001

S. Matt – CRM Operations

Dr. P. Zell – Approving Officer

Sigma-Aldrich Production GmbH, Industriestrasse 25, 9471 Buchs, Switzerland;
Tel +41-81-755-2511; Fax +41-81-756-5449; www.sigmaaldrich.com
Sigma-Aldrich Production GmbH is a subsidiary of Merck KGaA, Darmstadt, Germany.

Certification process details:

To guarantee top reliability of the values for this *Trace***CERT®** certified reference material, three independent procedures were followed. The values have to agree in the range of their uncertainties, but the value from the gravimetric preparation has been chosen as certified value [3]:

1. Gravimetric preparation using pure materials is a practical realization of concentration units, through conversion of mass to amount of substance [3]. If the purity of the materials is demonstrated and if contamination and loss of material is strictly prevented this approach allows highest accuracy and small uncertainties. The certified value of this *Trace***CERT®** reference material is based on this approach and directly traceable to the SI unit kilogram. Therefore comprehensively characterized materials of high purity are used. All balances are calibrated annually by an ISO/IEC 17025 accredited laboratory and certified according to DKD guidelines. Calibration is checked daily with OIML Class E2 or F2 weights.
2. The starting material is measured against a certified reference material (i.e. NIST or BAM) followed by gravimetric preparation using balances calibrated with SI-traceable weights. Consequently the value calculated by this unbroken chain of comparisons is traceable to the reference to which the starting material is compared.
3. Whenever applicable the bottled *Trace***CERT®** calibration solution is compared to a second reference which is independent from the first reference.

Details on metrological traceability:

Only internationally accepted reference materials e.g. from NIST (USA) or BAM (Germany) have been carefully selected to provide the basis for traceability to the SI unit mole. When no such reference is available, an elemental metal or an adequate salt of highest available purity is used to confirm traceability to this pure material (and therefore to the SI unit kg).

To underpin the certified gravimetric value all traceability measurements are performed with the most accurate and precise analytical technique available. Therefore titrimetry measurement series are applied whenever possible (corrected for trace impurities). When no titrimetric technique is available, the traceability measurements are performed with another analytical technique, e.g. ICP-OES or AAS.

Reference and applied technique used for traceability measurements of the

starting material: NIST SRM 728 / complexometric titration

bottled solution: BAM 365 / complexometric titration

Details on starting materials:

For high purity materials (P >99.9%) the most appropriate way of purity determination is to quantify the impurities (w_i) and to subtract the sum from 100%. Impurities below the detection limit are considered with a contribution of half of the detection limit (DL_j).

$$P = 100\% - \sum_i w_i - \sum_j \left(\frac{DL_j}{2}\right)$$

Water containing materials were dried to absolute dryness by individual drying conditions (up to 600°C). When drying is impossible due to decomposition water was determined by high-precision KF-titration.

Homogeneity assessment:

Due to the production process, a homogeneous solution derives. Nevertheless a small homogeneity contribution is included into the calculation of content uncertainty of this CRM.

Density Measurement:

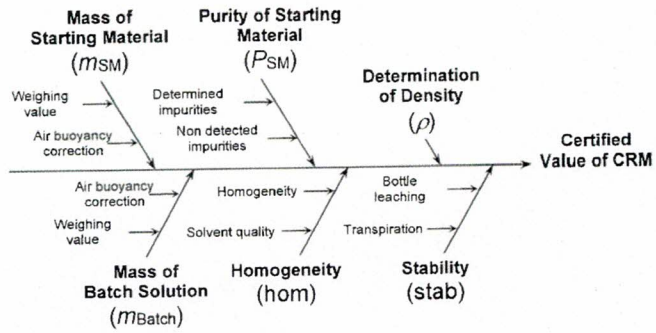
The density measurement is carried out in accordance with ISO/IEC 17025[4] and ISO 15212-1 [6] using the digital density meter DMA 4500M from Anton Paar with an oscillating U-tube installed. The measurement uncertainty is calculated according to Eurachem/CITAC Guide and reported as combined expanded uncertainty at the 95% confidence level, using a coverage factor of k = 2.

Uncertainty evaluation:

The uncertainty contributions are illustrated by the following cause-effect diagram [7]:

Typical relative contributions are:

$u(m_{SM})$	< 0.01 %
$u(m_{Batch})$	< 0.01 %
$u(P_{SM})$	< 0.05 %
u_{hom}	< 0.03 %
u_{stab}	< 0.17 %
$u(\rho)$	< 0.05 %



The combined standard uncertainty is calculated by combination of the standard uncertainties of the input estimates according to Eurachem/CITAC Guide "Quantifying Uncertainty in Analytical Measurement" and ISO 17034.[2][5]

Expanded uncertainty is then calculated to a confidence level of 95%, typically by multiplying with a confidence level factor of k=2.

References:

[1] ISO Guide 35:2017, "Reference materials - Guidance for characterization and assessment of homogeneity and stability"
[2] Eurachem/CITAC Guide, 3rd Ed. (2012), "Quantifying uncertainty in analytical measurement"
[3] Eurachem/CITAC Guide, 2nd Ed. (2019), "Metrological Traceability in chemical measurement"
[4] The accredited testing laboratory STS 0490 performs the measurements and weighing steps for the certification of this CRM under ISO/IEC 17025:2017, "General requirements for the competence of testing and calibration laboratories"
[5] ISO 17034:2016, "General requirements for the competence of reference material producers"
[6] DIN EN ISO 15212-1:1998, Oscillation-type density meters - Part 1: Laboratory instruments
[7] Reichmuth, A., Wunderli, S., Weber, M., Meyer, V. R. (2004), "The uncertainty of weighing data obtained with electronic analytical balances", Microchimica Acta 148: 133-141.

Certificate of analysis revision history:

Certificate version	Certificate issue date	Reason for version
01	29 JUL 2022	Initial version

Disclaimer:

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The life science business of Merck KGaA, Darmstadt, Germany
operates as MilliporeSigma in the US and Canada.

PREVENTIVE MAINTENANCE REPORT

Avio200

Customer :	Environment & Laboratory Co.,Ltd	**Date Tested:**	October 16, 2024
		Recommendation Recertification	
Address :	40 Soi Liangmueangnonthaburi 13	**Period**	12
	Talad Kwan Mueang,	**Recertification Due**	October 16, 2025
	Nonthaburi 11000	**Date Last Certified:**	October 16, 2023
User Name:	Alisa	**Visit Number:**	1 of 1
Phone:		**PerkinElmer Phone**	02-719-6420 ext 206
Fax:		**PerkinElmer Fax:**	02-318-5597

CONFIGURATION TESTED

ACCESSORIES/COMPONENT NOT INCLUDED

MODEL	SERIAL NUMBER	
Avio200	**079S16062402**	**Syngistix 2.0.0.2236**

TESTED EQUIPMENT	CALIBRATION NUMBER	EXPIRATION
IPV Methods		

TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
Mixed standard 1/10	N069-1579	JUN 30, 2025
Mixed standard 1/100	N930-0221	NOV 30, 2024

CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
2 % HNO3		
10 % HNO3		

PerkinElmer

PREVENTIVE MAINTENANCE REPORT

Avio200

SERIAL NUMBER : 079S16062402 **DATE TESTED :** October 16, 2024

1. MECHANICAL CHECKS

A. Inspect and clean all fans and filters.	OK
B. Inspect and replace as necessary, all torch components including the RF coil.	OK
C. Inspect all tubing for sign of clacking or leaking.	OK
D. Adjust water and gas pressure regulator settings.	OK
E. Inspect and leak check pneumatics drawers.	OK
F. Clean the exterior of the instrument.	OK

2. OPTICAL CHECKS

A. Inspect and clean all optical components.	OK
B. As reqiured, check and replace all purgebfilters.	OK
C. Recheck optical alignment.	OK

3. COOLING SYSTEM CHECKS

A. Perform preventive maintenance on chiller.	OK
B. Flush out the chiller every six months.	OK

4. PERFORMANCE CHECKS

A. Torch View Alignment.	OK
B. Wavelength Calibration.	OK

PerkinElmer

PREVENTIVE MAINTENANCE REPORT
Avio200

SERIAL NUMBER : 079S16062402 **DATE TESTED :** October 16, 2024

PARAMETER			SPECIFICATION		FINAL VALUE
Spectral Resolution : UV	**As**	**193.696 nm**	≤ 0.009		0.00726
	Ni	**231.604 nm**	≤ 0.011		0.00923
	Ni	**341.476 nm**	≤ 0.015		0.01321
Spectral Resolution : VIS	**Ba**	**455.403 nm**	≤ 0.020		0.01693
Precision					
	Zn	**206.200 nm**	% RSD	≤ 1.0	0.34
	Mg	**280.271 nm**	% RSD	≤ 1.0	0.32
	Mg	**285.213 nm**	% RSD	≤ 1.0	0.36
	Ba	**455.403 nm**	% RSD	≤ 1.0	0.39
Detection Limits : Axial	**As**	**193.696 nm**	3(SD) ppb		63.71
	Se	**196.026 nm**	3(SD) ppb		8.95
	Tl	**190.801 nm**	3(SD) ppb		3.13
	Pb	**220.353 nm**	3(SD) ppb		0.63
Detection Limits : Radial	**As**	**193.696 nm**	3(SD) ppb		10.24
	Zn	**213.857 nm**	3(SD) ppb		9.08
	Mn	**257.610 nm**	3(SD) ppb		4.98
	La	**379.478 nm**	3(SD) ppb		3.50
	Ba	**455.403 nm**	3(SD) ppb		0.70
	Ba	**493.408 nm**	3(SD) ppb		5.16
BEC : Axial (IB X 1000)/(IS-IB)	**Mn**	**257.610 nm**	≤ 30 ppb		0.88
BEC : Radial (IB X 1000)/(IS-IB)	**Mn**	**257.610 nm**	≤ 30 ppb		2.08

PerkinElmer

PREVENTIVE MAINTENANCE REPORT
Avio200

SERIAL NUMBER : 079S16062402 **DATE TESTED :** October 16, 2024

Remarks :

Commissioning follow as commissioning performance sheets.

Found As, Ba, Mn, Zn, blank has high intensity with analysis air - need to replace new Injector and torch

This is to certify that the above tests have been perfomed 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 : _____

(Khwanchai Siangwong)

Customer Support Engineer

PerkinEler Ltd. 290 Soi 17, Rama 9 Road, Khwang Bangkapi, Khet Huay Kwang, Bangkok 10310, Thailand

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL.0-2717-3000-29 FAX.0-2719-9484

NSC-TISI-TIS17025
CALIBRATION 0008

Certificate of Calibration

Cert.No.: 25CG465
Page.: 1 of 2

Equipment :	Burette
Capacity :	50 mL
Serial No. :	-
ID. No. :	BUR-001
Manufacturer :	Witeg
Made in :	Germany
Submitted by :	Environment & Laboratory Co.,Ltd. 40 Soi Liangmueangnonthaburi 13 Talad Kwan, Mueang, Nonthaburi 11000
Ambient Temperature :	(20 ± 2.5) °C
Relative Humidity :	(50 ± 10) %
Barometric Pressure :	756 mmHg
Calibration Procedure :	ASTM E 542 - 01
Calibrated by :	Natcha Chayyingcheiw

Approved by :

Approved Signatory

(✓) Srisuda Khamtha
( ) Ponpan Paipim

Issue Date : 6 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 Corporate Services 3 : Equipment Calibration and Testing Services.

Equipment : Burette
Received Date : 4 February 2025
Condition As-Received : Used Item
Calibration Date : 6 February 2025
Reference : 2502-0076DC-6

Cert.No.: 25CG465

Condition of this result of calibration

1. Reference Standard Instruments :

Instruments	Model	Serial No.	ID. No.	Certificate No.	Traceability	Due date
1) Balance	XP205DR	1126143764	140RC004	24MM602/1	TPA	17 Sep 2025
2) Thermo-Hygrograph	THDX-CE	00016540	140EC001	24H1153	TPA	10 June 2025
3) Thermometer	-	1594592	140EC010	24I175	TPA	20 Feb 2025

This certification is traceable to SI Unit

2. The certificate is valid only to the item calibrated on date and place of calibration.
3. True value is converted to true volume at the standard temperature of 20 $^{\circ}$C

Calibration result :

Nominal capacity (mL)	Reading (mL)	Uncertainty (± mL)	*k* Factor
50	49.9874	0.010	2.00

Remark mL = cm^3

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 %.

-o0o-