

ภาคผนวก จ
เอกสารสอบเทียบเครื่องมือที่ใช้ในการตรวจวิเคราะห์

List of Instrument Certificates for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*
1	Auto Clave	TOTAL COLIFORM BACTERIA	ALP Co.,Ltd. (Japan)	CL-40L / 808763	National Food Institute, Ministry of Industry, Thailand	2602303-007-01	11/3/2026	11/3/2027
2	Cyanuric Acid Photometer	CYANURIC ACID	Hanna Instrument Inc., Romania	H197722C / 905060058111	Hanna Instruments (Thailand) Ltd.	C26030162	17/3/2026	16/3/2027
3	Cooled Incubator	ESCHERICHIA COLI FECAL COLIFORM BACTERIA TOTAL COLIFORM BACTERIA	Binder	K8400 / WTB2020000015535	National Food Institute, Ministry of Industry, Thailand	2602303-006-01	11/3/2026	10/3/2027
4	Incubator	FECAL COLIFORM BACTERIA TOTAL COLIFORM BACTERIA	Binder	K8400 / 20220000022479	National food institute ministry of Industry	2503682 004 01	1/7/2025	30/6/2026
5	Incubator	PSEUDOMONAS AERUGINOSA	MEMMERT	IN75 / D317.0307	National Food Institute Ministry of Industry	2602303-005-01	11/3/2026	10/3/2027
6	Incubator	STAPHYLOCOCCUS AUREUS	Memmert	IPP260 / V615.0187	National Food Institute, Ministry of Industry, Thailand	2602303 001 01	11/3/2026	10/3/2027
7	Incubator	LEGIONELLA SP.	Memmert	IPP260 / V616.0066	National Food Institute, Ministry of Industry, Thailand	2502229-002-01	19/3/2025	18/3/2026
8	pH Meter	pH	Horiba	LAQUA-PH210 / HA0A0005	National Food Institute, Ministry of Industry, Thailand	2602303-001-01	11/3/2026	10/3/2027
9	UV-VIS Spectrophotometer	NITRATE	Hitachi	U-2900 / 21E22-009	technology promotion association (thailand-japan) DQE Services Co.,Ltd.	25CH1433 SP25-021	11/12/2025 26/5/2025	10/12/2026 25/5/2026
10	UV-VIS Spectrophotometer	AMMONIA	Hitachi High-Tech Science Corporation Tokyo, Japan	U-5100 / 23A4-008	DQE Services Co.,Ltd.	SP25-024	17/6/2025	16/6/2026
11	Water Bath	FECAL COLIFORM BACTERIA	Memmert	WNE 14 / L416.0612	Technology Promotion Association (Thailand-Japan)	26TMM194	2/2/2026	1/2/2027

Due Date of Calibration* : Based on the annual calibration plan. At least 1 time per year.



QUALITY ASSURANCE & CONTROL SYSTEMS
QUALITY MANAGEMENT SYSTEMS
FUNDATION FOR INDUSTRIAL DEVELOPMENT National Food Institute
Food Industrial Laboratory Service Center



Calibration Certificate

Certificate No.: 202303-001-01
Page : 1 of 2

Equipment: Autoclave
Manufacturer: ALP
Model: CL-10L
Serial No.: 109182
ID No.: UAG-MD-050-280
Order No.: 202303-001
Operation No.: 202303-001
Date of Receipt: 12 March 2023
Date of Calibration: 13 March 2023

Customer Name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Ekkamai Rd, Sukhumvit Road,
Bangkok, Thailand, Bangkok 10110

Methodology for calibration:

1. Calibration Method:

- This instrument was calibrated by inserting 3 standard data loggers with RTD sensors into autoclave, in accordance with VITE 019, based on ISO 9001:2015, Autoclave for sterilization in accordance with Part 1: Design, construction, safety and performance - specification.
- The temperature scale used in this procedure is the International Temperature Scale of 1990 (ITS-90).
- All data shown are final values, and the final data may be obtained from the manufacturer.

2. Reference Standard Instrument:

Instrument	Model/Type	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with RTD Sensor Logger	HT TempLog 100	300390	202215-0001	22 March 2023	National Food Institute
	HT TempLog 100	300390	202303-001-01	12 January 2023	National Food Institute
	HT TempLog 100	300390	202303-001-01	12 January 2023	National Food Institute

- This certificate is valid only for the instrument shown in this report.
- This certificate is valid only for the instrument that was calibrated.
- The result of this calibration was found to be accurate only on the date and place of calibration shown.

Calibrated by: Mr. Nattapong Niyomchai
Specialist

Approved by:

(Mr. Phatthana Tienjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

Date of Issue: 13 March 2023

This Certificate is issued in accordance with the conditions of subscription granted by the High. Laboratory Accreditation scheme, which has assessed the measurement capability of the laboratory and its conformity in recognizing national standard and to certify of measurement results at the corresponding national standard laboratory. This certificate may not be reproduced other than in full, except with the prior written approval of the head of the National Food Institute.

FC-009 Revision: 02 Date: 01-10-16



QUALITY ASSURANCE & CONTROL SYSTEMS
QUALITY MANAGEMENT SYSTEMS
FUNDATION FOR INDUSTRIAL DEVELOPMENT National Food Institute
Food Industrial Laboratory Service Center



Calibration Certificate

Certificate No.: 202303-001-01
Page : 2 of 2

Calibration Conditions:

Equipment	Autoclave	Place of Calibration	Room 301
Resolution	0.1 °C	UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.	
Direction of the test	Normal 0 Good	Environment Conditions:	Ambient Temperature: (20.0 ± 1) °C Relative Humidity: (47.5 ± 3) % Line Voltage: (230 V ± 4) V
	Without adjustment / As Found		
	- Setting program: Autoclave Sterilization (STERILIZATION)		
	- Time of sterilization: 15 minutes at 115.0, 121.0 °C		

Calibration Results:

Table 1: Reporting of Temperature

Calibration Point (°C)	Std. A	Measured Temperature (°C) @ Sensor No.	Std. A ± (REF)	Std. A ±	Measurement Uncertainty (°C)
115.0	115.05	115.03	115.07	115.07	0.04
121.0	121.03	121.01	121.05	121.05	0.04

Table 2: Reporting of Characterization Results

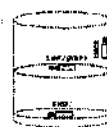
UUC Reading (°C)	Max	Min	Average	MPa	Stability	Uniformity	Overall Variation
115.0	115.1	114.9	115.0	0.05	0.03	0.02	0.01
121.0	121.1	120.9	121.0	0.12	0.03	0.02	0.01

Note:

- UUC: Unit Under Calibration
- The quoted uncertainty includes "Stability" and "Loading effect" (70% of Temp. Uncertainty).
- Repeatability: One-half of the greatest maximum difference of measured temperatures at any one sensor, for a fixed half an hour after reaching steady state.
- Uniformity: The maximum difference of measured temperatures at any sensor and the measured temperature at the volume load on which are observed at the same time.
- Overall Variation: The difference of the maximum and minimum measured temperatures throughout observation time.

For more information, details of the temperature calibration should be reported.

Standard Curve
The standard curve is used to convert the measured temperature into the actual temperature. The standard curve is used to convert the measured temperature into the actual temperature.



The quoted uncertainty of measurement was based on standard uncertainty evaluated by GUM (G1001-1) and is based on confidence of approximately 95%.

End of Report

FC-009 Revision: 02 Date: 01-10-16

Hanna Instruments (Thailand) Ltd.
410-6748 Soi Ratchadapisek 24, Ratchadapisek Rd., Samson-mit,
Huaykwang, Bangkok 10310 Tel: 0-2541-4199 Fax: 0-2541-4198

Certificate No.: C26030162
Page : 1 of 2

CERTIFICATE OF ANALYSIS

Equipment:	Cyanuric Acid Portable Photometer		
Meter Model:	H97722C	Serial No.:	905060058113
Manufacturer:	Hanna Instruments		
Made in:	Romania		
Condition As-Received:	Used Product		
Reference:	RE260497		
Customer name:	United Analyst and Engineering Consultant Co., Ltd. 3 Soi Udomsuk 41, Sukhumvit Rd., Bangkok Phrakhanong, Bangkok 10260		
Received date:	12 March 2023		
Calibrate date:	17 March 2023		
Issue date:	18 March 2023		
Ambient Temperature:	(25 ± 2) °C		
Relative Humidity:	(50 ± 3) %RH		
Calibrated Location:	Hanna Instruments (Thailand) Ltd.		

Calibrated by: Mr. Pichit Petchhong

Approved by:
(Mr. Anan Suanphaisitkul)
Authorized Signatory

This certificate was certified only in the instrument we calibrated. This result of calibration was found accurate on date and place of calibration only.
This certificate may not be reproduced other than in full, except with the prior written approval of the head of Hanna Instruments (Thailand) Ltd.

เอกสารไม่ควบคุม

Hanna Instruments

Certificate No.: C26030162
Page : 2 of 2

Condition of this result:

Product name:	Cyanuric Acid
Product code:	H97722-13
Lot number:	5CD221/25
Best used before:	May 2028

Standard Curves specifications @ 25°C:

Standard	Lot	Standard value	Lot standard
curve code	number	(mg/L)	deviation (mg/L)
A ZERO	9061	0	0.032
H97722B	9432	20	0.104

Specifications for validation procedure:

Standard curve	Lot	Validation standard	Lot acceptable
	number	value (mg/L)	reading (mg/L)
H97722B	9432	20 ± 1	19 to 21

Method: Adsorption of the turbidimetric method

Result:

Cyanuric Acid Standard (mg/L)	Reading (mg/L)	Error (mg/L)
0	0	0
20 ± 1	20	0

** End of certificate **

เอกสารไม่ควบคุม

Calibration Certificate

Certificate No.: 2503682-004-01
Page: 1 of 2

Equipment: CHAMBER (Incubator)
Manufacturer: BINDER
Model: KB 400
Serial No.: 2022000022479
ID No.: UAE.MIC.028/2556
Order No.: 2503682
Operation No.: 2503682-004
Date of Receipt: 11 March 2024
Date of Calibration: 11 March 2024

Customer Name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sakhumvit Road,
Bangchak, Prachinong, Bangkok 10260

Metrological Traceability:

1. Calibration Method:

- This instrument was calibrated by inserting Platinum thermometers into the chamber, in accordance with WTE-014.
- Based on TIAS G-20-1702-04 (E): Guidelines for Calibration and Checks of Temperature Controlled Enclosures.
- The temperature scale used in this laboratory is the International Temperature Scale of 1991 (ITS-90).
- All data shown below are final values and the final data may be obtained upon request.

2. Reference Standard Instrument:

Instrument	Model/Type	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	DA027 JA RTD	MY5000377 CHV120-102/1000-100	2502944-01-04	29 March 2021	NATIONAL FOOD INSTITUTE

- This certificate is traceable to the International System of Units (SI).
- This certificate is valid only for the instrument that was calibrated.
- The result of this calibration was found to be accurate only on the date and at the place of calibration shown.

Calibrated by: Mr. Phraphat Tuangit
Approved by: [Signature]
Date of Issue: 18 March 2024

Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

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 without the prior written approval of the National Food Institute.

F-05-009 Revision: 05 Date: 05-06-16

Calibration Certificate

Certificate No.: 2503682-004-01
Page: 2 of 2

Calibration Condition:

Equipment: CHAMBER (Incubator)
UUC Resolution: 0.1 °C
Condition of the item: Normal & Good
Without adjustment / As Found
Time of record: 1 hour 9 minutes point

Place of Calibration: Microbiology Laboratory
Unit/Analyst and Engineering Consultant Co., Ltd.
Environmental Conditions: Ambient Temperature (23 ± 1) °C
Relative Humidity: (55 ± 5) %
Line Voltage: (230 ± 5) V

Calibration Results:

Table 1: Reporting of Temperature

Calibration Point (°C)	Std. A	Std. B	Measured Temperature (°C) @ Sensor No. (Sensor No. 3 is REF)	Measurement Uncertainty U=1.0
35.0	34.78	34.68	34.81 34.83 35.22 35.21 35.27 35.12 35.61	0.26

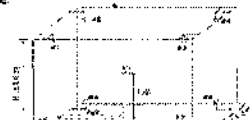
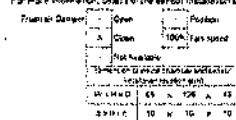
Table 2: Reporting of Characterization Results

UUC Setting (°C)	Min	Max	Average	Stability 1 (°C)	Uniformity (°C)	Overall Variation (°C)
35.0	35.0	35.0	35.0	0.034	0.29	0.32

Note:

- UUC: Unit Under Calibration
- The quoted uncertainty includes contributions from "Biology and Handling Effect" (20% of Temperature Uniformity)
- Stability: A measure of the greatest maximum difference of the measured values at any one sensor, for at least half an hour after reaching steady state
- Uniformity: A measure of the difference of measured temperatures at any sensor and the measured temperature at the reference location which is observed at the same time
- Overall Variation: The difference of the maximum and minimum measured temperature throughout calibration time

For more information, details of the record, calibration should be recorded.



The measurement results are based on a certified uncertainty of 0.1 °C by the reference instrument, resulting in a total uncertainty of approximately 0.3 °C.

F-04-009 Revision: 05 Date: 05-10-16

Calibration Certificate

Certificate No.: 2503682-004-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sakhumvit Road,
Bangchak, Prachinong, Bangkok 10260

Page 1 of 3

Equipment: CHAMBER (Incubator)
Manufacturer: BINDER
Model: KB 400
Serial No.: 2022000022479
ID No.: UAE.MIC.028/2556
Order No.: 2503682
Operation No.: 2503682-004
Date of Receipt: 1 July 2025
Date of Calibration: 1 July 2025

Calibrated by: Mr. Phraphat Tuangit
Approved by: [Signature]
Date of Issue: 3 July 2025

Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

The uncertainty is 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 without the prior written approval of the National Food Institute.

F-05-009 Revision: 05 Date: 20-04-15

Calibration Report

Certificate No.: 2503682-004-01
Equipment: CHAMBER (Incubator)
Model: KB 400
Resolution: 0.1 °C
Manufacturer: BINDER
Date of Calibration: 1 July 2025

Serial No.: 2022000022479
ID No.: UAE.MIC.028/2556

Page 2 of 3

Location: Microbiology Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Environment Condition: Ambient Temperature (23 ± 1) °C
Relative Humidity (55 ± 5) %
Line Voltage (230 ± 5) V

Condition of this results of Calibration:

- This instrument was calibrated by inserting 13 standard thermometer into its chamber and calibration according to WTE-014 Based on TIAS G-20-1702-04 (E): Guidelines for Calibration and Checks of Temperature Controlled Enclosures.
- The temperature scale used was based on ITS - 90.
- All data shown below are final values and the final 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	31922A RTD	MY5000377 CHV120-102/1000-100	250168-001-01	13 January 2026	NATIONAL FOOD INSTITUTE

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

UUC Description:
Time of Record: 1 Hour 9 Minutes At 25.0 °C
Fresh air Damper: Open Position
X Close
- Not Available

7. Result of Calibration: X Without adjustment ☐ After adjustment

F-04-012 Revision: 05 Date: 20-04-15

Calibration Report

Certificate No.: 2503687-004-01
 Equipment: CHAMBER (Incubator)
 Model: K8 400 Serial No.: 202300002429
 Resolution: 0.1 °C ID No.: UKLPHC 02/02/066
 Manufacturer: BINDER

Date of Calibration: 1 July 2025 Page 3 of 3

Calibration point: 35.0 °C

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (V)
Min	20.1	45	225.0
Max	22.0	55	235.0

Table 1: Reporting of Temperature

Calibration point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No. 13 is REF)													Uncertainty ± (°C)
	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	
35.0	35.19	35.08	34.80	35.21	34.96	34.94	34.84	34.84	35.06	34.94	35.35	34.79	34.92	0.27

Table 2: Reporting of Characterization Result

UUC ¹ Setting (°C)	UUC ¹ Reading (°C)			Temperature Stability ± (°C)	Temperature Uniformity (°C)	Overall Variation (°C)
	MIN	MAX	Average			
34.8	34.8	34.8	34.8	0.040	0.29	0.50

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

UUC¹ = Unit Under Calibration

Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors, for at least 1 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 throughout observation time.

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

FC-002 Revision: 01 Date: 20-04-05

Calibration Certificate

Certificate No.: 2602307-005-01
 Page: 1 of 2

Equipment: CHAMBER (Incubator)
 Manufacturer: MEILBERT
 Model: RTD
 Serial No.: 0317 3367
 ID No.: UKLPHC 02/02/061
 Order No.: 2602303
 Operation No.: 2602303-005
 Date of Receipt: 11 March 2025
 Date of Calibration: 11 March 2025

Customer Name: UNITED ANALYST AND ENGINEERING CONSULTANT CO. LTD.
 Address: 25 Sukhumvit 41, Sukhumvit Road,
 Bangkok, Pathumwan Bangkok 10600

Metrological traceability:

1. Calibration Method:

- This instrument was calibrated by measuring 9 standard thermometers and its chamber, in accordance with WTE 01.1, based on TLAS 0-25-100-08 (E) Guidelines for Calibration and Check of Temperature Controlled Enclosures.
- The temperature scale used in this laboratory is the International Temperature Scale of 1990 (ITS-90).
- All data shown below are final values and the initial data may be obtained upon request.

2. Reference Standard Instrument:

Instrument	Model/Type	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	74912A	UKLPHC 02/02/061	2601006-001-01	18 January 2025	NATIONAL FOOD INSTITUTE

3. This certificate is traceable to the International System of Units (SI).

4. This certificate is valid only for the instrument(s) was calibrated.

5. The result of this calibration was found to be accurate only on the date and at the place of calibration shown.

Calibrated by: Mr. Manas Somrak
 Specialist

Approved by: (Mr. Phraphat Tomya)
 Manager, Division of Calibration Laboratory
 Responsible for the Technical Management Team

Date of issue: 18 March 2025

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 this laboratory and its compliance to international standards and to the units of measurement required for the corresponding national standard hierarchy. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

FC-002 Revision: 02 Date: 01-10-05

Calibration Certificate

Certificate No.: 2602307-005-01
 Page: 2 of 2

Calibration Condition:
 Equipment: CHAMBER (Incubator)
 UUC¹ Resolution: 0.1 °C
 Condition of the unit: Normal & Good
 Working parameters: As follows
 - Time of record: 1 hour @ 10 minutes/point

Place of Calibration: Pathumwan Laboratory (PLN)

UNITED ANALYST AND ENGINEERING CONSULTANT CO. LTD.

Environment Condition: Ambient Temperature: (22.6 ± 1.1) °C

Relative Humidity: (59.1 ± 3.7) %

Line Voltage: (229 ± 3.1) V

Calibration Results:

Table 1: Reporting of Temperature

Calibration Point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No. 9 is REF)										Measurement Uncertainty (°C)
	Sld#1	Sld#2	Sld#3	Sld#4	Sld#5	Sld#6	Sld#7	Sld#8	Sld#9		
41.5	41.81	41.65	41.40	41.76	41.56	41.78	41.42	41.22	41.33	0.29	

Table 2: Reporting of Characterization Results

UUC ¹ Setting (°C)	UUC ¹ Reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	Max	Min	Average			
41.5	41.5	41.5	41.5	0.06	0.52	0.96

Note:

1. UUC¹ = Unit Under Calibration

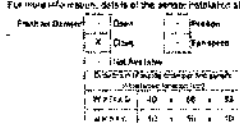
2. The quoted uncertainty includes contributions from "Stability" and "Loading Effect (20% of Temperature Uniformity)".

3. Stability = One-half of the greatest maximum difference of measured temperatures at any one location, for at least 1 hour after reaching steady state.

4. 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.

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

For more information, details of the sensor installation should be requested.



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

End of Report

FC-002 Revision: 02 Date: 01-10-05

Calibration Certificate

Certificate No.: 2602307-005-01
 Page: 1 of 2

Equipment: CHAMBER (Incubator)
 Manufacturer: MEILBERT
 Model: PPE26
 Serial No.: V516 1167
 ID No.: UKLPHC 02/02/058
 Order No.: 2602303
 Operation No.: 2602303-001
 Date of Receipt: 11 March 2025
 Date of Calibration: 11 March 2025

Customer Name: UNITED ANALYST AND ENGINEERING CONSULTANT CO. LTD.
 Address: 25 Sukhumvit 41, Sukhumvit Road,
 Bangkok, Pathumwan Bangkok 10600

Metrological traceability:

1. Calibration Method:

- This instrument was calibrated by measuring 2 standard thermometers and its chamber, in accordance with WTE 01.1, based on TLAS 0-25-100-08 (E) Guidelines for Calibration and Check of Temperature Controlled Enclosures.
- The temperature scale used in this laboratory is the International Temperature Scale of 1990 (ITS-90).
- All data shown below are final values and the initial data may be obtained upon request.

2. Reference Standard Instrument:

Instrument	Model/Type	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	DAC371A	UKLPHC 02/02/061	2602304-001-01	29 March 2025	NATIONAL FOOD INSTITUTE

3. This certificate is traceable to the International System of Units (SI).

4. This certificate is valid only for the instrument(s) was calibrated.

5. The result of this calibration was found to be accurate only on the date and at the place of calibration shown.

Calibrated by: Mr. Nopon Myemhat
 Specialist

Approved by: (Mr. Phraphat Tomya)
 Manager, Division of Calibration Laboratory
 Responsible for the Technical Management Team

Date of issue: 19 March 2025

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 this laboratory and its compliance to international standards and to the units of measurement required for the corresponding national standard hierarchy. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

FC-002 Revision: 02 Date: 01-10-05

Calibration Certificate

Certificate No.: 2502229-002-01
Page: 2 of 2

Calibration Condition:

Equipment: CHAMBER (Incubator) Place of Calibration: Microbiology Laboratory
UUC* Result: 0.1 °C UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Condition of the item: Normal & Good Environment Conditions: Ambient Temperature (23.7 ± 1.1 °C
Relative Humidity (59 ± 1.1 %
Voltage Adjustment: As Found Relative Humidity (51.5 ± 1.1 %
Line Voltage (229 ± 3 V

Calibration Results:

Table 1. Reporting of Temperature

Calibration Point (°C)	Std. 81	Std. 82	Std. 83	Std. 84	Std. 85	Std. 86	Std. 87	Std. 88	Std. 89	Std. 90	Measurement Uncertainty (°C)
25.0	25.01	25.04	25.00	25.15	25.00	24.69	24.79	24.85	25.02		0.23

Table 2. Reporting of Characterization Results

UUC* Setting (°C)	Min	UUC* Reading (°C)	Average	Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
25.0	25.0	25.0	25.0	0.008	0.24	0.25

Note:

* UUC* = Unit Under Calibration

The quoted uncertainty include "Stability" and "Loading Effect" (20% of Temperature Uniformity).

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 throughout observation time.

For more information, details of the sensor installation should be reviewed.



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 of Report -----

F-CE-012 Revision 01 Date: 20-04-65

Calibration Certificate

Page 2 of 3

Certificate No.:

2502229-002-01

Client name:

UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Address:

33 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhong, Bangkok 10250

Equipment:

CHAMBER (Incubator)

Manufacturer:

HEMERT

Model:

1PP260

Serial No.:

V616.0066

ID No.:

UAE.MIC.032/2559

Order No.:

2502229

Operation No.:

2502229-002

Date of Receipt:

19 March 2025

Date of Calibration:

19 March 2025

Calibrated by

Mr. Yuthin Charoensuk
Scientist

Approved by

(Mr. Phetphat Yuen) (Signature)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

Date of Issue:

25 March 2025

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Foundation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement maintained 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.

F-CE-009 Revision 01 Date: 20-04-65

Calibration Report

Certificate No.:

2502229-002-01

Equipment:

CHAMBER (Incubator)

Model:

Serial No.: V616.0066

Resolution:

0.1 °C

Manufacturer:

HEMERT

Date of Calibration:

19 March 2025

Page 2 of 3

Location:

302, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Environment Condition:

Ambient Temperature (23.7 ± 1.1 °C
Relative Humidity (59 ± 1.1 %
Line Voltage (223 ± 3 Volt

Condition of this results of Calibration:

- This instrument was calibrated by insert 9 standard thermometer into its chamber and calibration according to W-TE-014 Based on TIAS 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 shown 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	MYS7003188	TE 670485-01	8 June 2025	NATIONAL FOOD INSTITUTE
	RTD	CH201-119/RTD 201-209			

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: 25.0 and 36.0 °C
Fresh Air Damper: Open Position: X
Close: X
Fan: X

7. Result of Calibration:

☒ Without adjustment ☐ After adjustment

F-CE-012 Revision 01 Date: 20-04-65

Calibration Report

Certificate No.:

2502229-002-01

Equipment:

CHAMBER (Incubator)

Model:

Serial No.: V616.0066

Resolution:

0.1 °C

Manufacturer:

HEMERT

Date of Calibration:

19 March 2025

Page 3 of 3

Calibration point:

25.0 and 36.0 °C

Calibration result:

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (V)
MIN	23.3	59	220.0
MAX	22.0	60	225.0

Table 1. Reporting of Temperature

Calibration point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No. 9 is REF)									Uncertainty ± (°C)
25.0	#1	#2	#3	#4	#5	#6	#7	#8	#9	
25.0	25.19	25.16	25.22	25.17	24.85	24.93	24.78	24.85	24.97	0.29
36.0	34.57	34.74	35.13	35.29	36.32	36.16	36.20	36.34	35.73	0.63

Table 2. Reporting of Characterization Result

UUC* Setting (°C)	UUC* Reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	MIN	MAX	Average			
25.0	24.9	25.0	25.0	0.008	0.25	0.61
36.0	35.9	36.0	36.0	0.44	1.2	2.3

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 throughout 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 -----

F-CE-013 Revision 01 Date: 20-04-65



มูลนิธิส่งเสริมการค้าไทย-ญี่ปุ่น
Foundation for Industrial Development (Thailand-Japan)
Food Industrial Laboratory Service Center



Calibration Certificate

Certificate No.: 202203-002-01
Page: 1 of 2

Equipment: CHAMBER (Insulator)
Manufacturer: NEUMET
Model: 17P250
Serial No.: V516-0365
ID No.: UAE-MG-022-2022
Order No.: 26220301
Operation No.: 20220301-002
Date of Receipt: 11 March 2022
Date of Calibration: 11 March 2022

Customer Name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangna, Bangkok, Thailand 10260

Metrology (traceability):

1. Calibration Method:

- This instrument was calibrated by comparing 8 standard thermometers and 10 chambers in accordance with BIPM-5M based on IEC 607-152-08 (JCL Guideline for Calibration and Checks of Temperature Controlled Chambers).
- The temperature scale used in this laboratory is the International Temperature Scale of 1990 (ITS-90).
- All data shown below are final values, and the initial data may be obtained upon request.

2. Reference Standard Instrument:

Instrument	Model/Type	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	540724	UAE000000000	2021095-001-01	10 January 2022	INDUSTRIAL FOOD INSTITUTE

2. The certificate is acceptable to the International System of Units (SI).

4. This certificate is valid only for the instrument that was calibrated.

5. The result of this calibration shall be accurate only on the date and at the place of calibration shown.

Calibrated by: Mr. Manos, Special Specialist

Approved by:

(Signature)
Manager, Division of Calibration Laboratory

Date of Issue: 18 March 2022

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Association scheme which has adopted the measurement capability of the laboratory and an uncertainty to integrate relevant standards and to the units of measurement indicated in the corresponding national standards laboratory. This certificate may not be reproduced other than in full without the prior written approval of the National Food Institute.

F-05184 Revision 02 Date: 01-10-08



มูลนิธิส่งเสริมการค้าไทย-ญี่ปุ่น
Foundation for Industrial Development (Thailand-Japan)
Food Industrial Laboratory Service Center



Calibration Certificate

Certificate No.: 202203-002-01
Page: 2 of 2

Calibration Condition:

Equipment: CHAMBER (Insulator)
UNIT: Resolution: 0.1 °C
Correction of the Unit: Journal & Book
Method Adjustment: As Found
Time of Record: 1 hour, 5 minutes, 00 sec
Place of Calibration: Metrology Laboratory (JCL)
UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Environment Conditions: Ambient Temperature: 20.4 ± 0.3 °C
Relative Humidity: 59.1 ± 0.1 %
Air Flow: 120 ± 0.5 L/min

Calibration Results:

Table 1: Reporting of Temperature

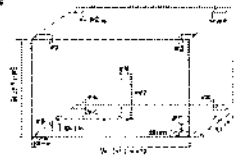
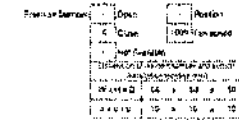
Calibration Point (°C)	Std. 1	Std. 2	Std. 3	Std. 4	Std. 5	Std. 6	Std. 7	Std. 8	Std. 9	Std. 10	Measured Temperature (°C) @ Serial No. (Chamber No. is 0007)	Uncertainty (°C)
20.0	20.05	20.07	20.07	20.08	20.08	20.09	20.10	20.10	20.11	20.11	20.08	± 0.03

Table 2: Reporting of Characterization Results

UUT: Reading (°C)	Max	UUT: Reading (°C) Min	Average	Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
20.0	20.0	20.0	20.0	0.14	0.00	± 0.10

Note:

- UUT: Unit Under Calibration
- The stated uncertainty includes contributions from "Stability" and "Loading Effect" (20% of Temperature Uniformity).
- Stability: One-half of the greatest maximum difference of measured temperatures at any one point for at least half an hour after reaching steady state uniformity. The maximum difference of measured temperatures at any point and the mean of measured temperatures at the reference location which is repeated at the same time.
- Overall Variation: The difference of the maximum and minimum measured temperatures throughout observation time.
- For more information, details of the process calibration method be reported.



The reported uncertainty of measurement has been evaluated uncertainty and shall be reported together with the measurement result. It is provided a formal certificate of approval of 15%.

— End of Report —

F-05184 Revision 02 Date: 01-10-08

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
534/14 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 2717-3000-28 FAX: 2718-9484



Cert. No.: 25CH1493
Page: 2 of 3

Certificate of Calibration

Cert. No.: 25CH1493
Page: 1 of 3

Equipment: pH Meter
Manufacturer: Horiba
Model: LAQUA-PH210
Serial No.: HA0A0005
ID No.: UAE-EFM-004/2563 (EFM pH 04/03)
Condition As-Received: Used Item
Received Date: 09 December 2022
Calibration Date: 11 December 2022
Reference: 2512-0243WSC-2
Submitted by: United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangna,
Phraekhong, Bangkok 10260

Ambient Temperature: (25 ± 2.5) °C
Relative Humidity: (50 ± 16) %
Calibration Procedure:
In-house method:
- CP-CH5 by direct measurement with DC voltage standard and direct measurement with certified reference material (CRM)
- CP-CH8 by comparison with temperature standard

Calibrated by: Watsorn Lertongratkul

Approved by:

(Signature)
Approved Signatory

(✓) Chalot Wawwanjan
() Porpan Palpm
() Seethip Meangmal

Issue Date:

12 December 2022

Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC118	25E2743	25 Aug 2026
2) Ref. Standard Thermometer	4082054	110RC044	25F706	03 July 2026

- This measurement result is traceable to SI through Technology Promotion Association (Thailand - Japan)

2. Certified Reference Materials

The measurement results are traceable to SI through Hach Lange GmbH Ltd.,
Deutsch-Akkradierungsgesellschaft, Accredited No. D-RUK-16194-01-00
The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AP-1635

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.007	CPA chem	1114384	12 June 2027
pH 6.999	Hach Lange GmbH	C03273	13 May 2027
pH 10.010	CPA chem	1114365	08 June 2026

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

Calibration Results

Function: mV Measurement

Performing standard curve by Document Process Calibrator at pH (4.7, 7, 10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter SN: HA0A0005	4.00	177.48	177.4	4.01	0.058	2.00
	7.00	0.00	0.1	7.00	0.058	2.00
	7.00	0.00	0.1	7.00	0.058	2.00
	10.00	-177.48	-177.2	10.01	0.058	2.00

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 & Equipment Calibration and Testing Services.

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Cert.No.: 25QH1433
Page.: 3 of 3

Calibration Results

Function: pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4.7)(7.1)(9)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (±)	Coverage factor k
pH Electrode S/N.: -	4.007	4.01	175.4	0.0085	2.05
	6.859	7.00	-0.3	0.0085	2.00
	8.999	7.01	-0.5	0.0088	2.00
	10.010	10.01	-170.5	0.0092	2.00

Function: Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe:

- Model: -

- Serial No.: -

Dimension of probe

- Length: 112 mm.

- Diameter: 10 mm.

- Immersion Depth: 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
15.0	15.002	15.0	-0.002	0.13	2.00
30.0	30.002	30.0	-0.002	0.13	2.00
45.0	45.003	45.0	-0.003	0.13	2.00

Remark: - 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 %.

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DQE Services

DQE Services Co., Ltd.

32 Soi Ladprao-Wangthong 55, Ladprao-Wangthong Rd., Ladprao, Ladprao, Bangkok 10230

Phone: +66 (0)2 534 2054, Email: dqeserviceinfo@gmail.com



CERTIFICATE OF CALIBRATION

Certificate No.: SP25-021

Page 1 of 5

Customer: United Analyst and Engineering Consultant Co., Ltd. (Head Office)

Address: 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phraekhanong, Bangkok 10260

Location of calibration: Instrument room (207)

Equipment: UV-Vis Spectrophotometer

Manufacturer: HITACHI

Model: U-2900

Serial No.: 21E22-009

ID No.: UAE.WAT.051/2564

Received Date: 26 May 2025

Calibration Date: 26 May 2025

Issue Date: 29 May 2025

Condition Instrument: Good

Calibrated by:

(Mr. Tanawat Kintach)

Approved by:

(Ms. Chantida Saengern)

Technical Manager

Quality Manager

The calibration result is applied only to the above calibrated item and was found accurate to shown on date and place of calibration only.

The measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement exist at the corresponding national standards laboratory. This certificate may not be reproduced either alone or in full except with the prior written approval of the DQE Services Co., Ltd.

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174-704 02 TH 1/1/2021

DQE Services

DQE Services Co., Ltd.

32 Soi Ladprao-Wangthong 55, Ladprao-Wangthong Rd., Ladprao, Ladprao, Bangkok 10230

Phone: +66 (0)2 534 2054, Email: dqeserviceinfo@gmail.com



REPORT OF CALIBRATION

Certificate No.: SP25-021

Page 2 of 5

Environment Condition: Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 20 %RH

Calibration method: In-house method CP-01 Based on ASTM E275-08

Certified Reference Materials:

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	115663	25 October 2025
Absorbance Standard set	25757	115638	25 October 2025
Wavelength Standard set	25806	115657	25 October 2025
Wavelength Standard set	25758	115665	25 October 2025

Traceability: This certification is traceable to the International System of Unit maintained at National-

Institute of Standards and Technology (NIST) through Sigma Scientific Limited

Spectral Band Width of UUC: 1.5 nm.

Scan Speed of UUC: 200 nm/min

Scan Interval of UUC: 0.1 nm.

Resolution of UUC: Photometric 0.001 Abs.

Wavelength 0.1 nm.

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174-704 02 TH 1/1/2021

DQE Services

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Phone: +66 (0)2 534 2054, Email: dqeserviceinfo@gmail.com



REPORT OF CALIBRATION

Certificate No.: SP25-021

Page 3 of 5

Calibration Results: Without adjustment

Photometric Accuracy:

Wavelength (nm)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5780	0.574	0.0040	0.0031	2.00
	1.0484	1.043	0.0054	0.0029	2.00
	2.1876	2.185	0.0026	0.0075	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.558	0.0015	0.0034	2.00
	1.0239	1.022	0.0019	0.0035	2.00
	2.1230	2.121	0.0020	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5230	0.519	0.0040	0.0030	2.00
	0.9633	0.960	0.0033	0.0029	2.00
	1.9753	1.973	0.0023	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.516	0.0021	0.0031	2.00
	1.0002	0.998	0.0022	0.0033	2.00
	1.9973	1.995	0.0023	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.550	0.0017	0.0030	2.00
	1.0803	1.080	0.0003	0.0030	2.00
	2.0373	2.036	0.0013	0.0079	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.558	0.0011	0.0031	2.00
	1.0518	1.051	0.0008	0.0030	2.00
	1.9274	1.926	0.0014	0.0079	2.00

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174-704 02 TH 1/1/2021

DQE Services Co., Ltd.
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REPORT OF CALIBRATION

Certificate No. : SP25-021 Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000 0.7469	0.0000 0.748	0.0000 -0.0011	0.0050 0.0057	2.00 2.00
257	0.0000 0.8674	0.0000 0.866	0.0000 0.0014	0.0050 0.0059	2.00 2.00
313	0.0000 0.2919	0.0000 0.291	0.0000 0.0009	0.0050 0.0051	2.00 2.00
350	0.0000 0.6430	0.0000 0.640	0.0000 0.0030	0.0050 0.0055	2.00 2.00

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REPORT OF CALIBRATION

Certificate No. : SP25-021 Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	241.0	0.72	0.18	2.00
279.45	278.8	0.65	0.18	2.00
287.81	287.2	0.61	0.18	2.00
334.06	333.6	0.46	0.18	2.00
360.93	360.6	0.33	0.18	2.00
418.59	418.2	0.39	0.18	2.00
445.94	445.6	0.34	0.18	2.00
460.02	459.8	0.22	0.18	2.00
536.59	536.6	-0.01	0.18	2.00
617.08	618.0	-0.92	0.18	2.00
431.38	431.2	0.18	0.18	2.00
472.50	472.4	0.10	0.18	2.00
513.47	513.4	0.07	0.18	2.00
528.88	528.8	0.08	0.18	2.00
573.17	573.2	-0.03	0.18	2.00
585.35	585.0	0.35	0.20	2.00
684.40	684.4	0.00	0.18	2.00
740.72	741.0	-0.28	0.20	2.00
748.55	748.8	-0.25	0.18	2.00
807.03	807.2	-0.17	0.18	2.00
879.28	879.6	-0.32	0.18	2.00

Remark : - UUC = Unit Under Calibration
- N/A = Not Available
- The stated expanded uncertainty of measurement U is stated in the standard uncertainty of measurement multiplied by the coverage factor k, which for a normal distribution corresponds to a coverage probability of approximately 95%
- End of Certificate -

เอกสารไม่ควบคุม

FM-708-Q2-R01 1/11/2021

เอกสารไม่ควบคุม

FM-708-Q2-R01 1/11/2021

DQE Services Co., Ltd.
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Phone : +66 (0)2 538 2054, Email : dqservicethai@gmail.com

CERTIFICATE OF CALIBRATION

Certificate No. : SP25-024 Page 1 of 5

Customer : United Analyst and Engineering Consultant Co., Ltd. (Head Office)

Address : 3 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Phrahasong, Bangkok 10260

Location of calibration : Instrument room (207)

Equipment : UV-Vis Spectrophotometer

Manufacturer : HITACHI

Model : U-5100

Serial No. : 23A4-005

ID No. : UAE.WAS.010/2567

Received Date : 17 June 2025

Calibration Date : 17 June 2025

Issue Date : 20 June 2025

Condition instrument : Good

Calibrated by :  Approved by : 
(Mr. Tanawat Rittidach) (Ms. Chonlaha Saengphet)
Technical Manager Quality Manager

The calibration result is applied only to the above calibrated item and was found accurate as shown on draw and place of calibration only.
The measurement capability of the laboratory and its suitability to recognized national standards used in the test of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced otherwise in full except with the prior written approval of the DQE Services Co., Ltd.

DQE Services Co., Ltd.
32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230
Phone : +66 (0)2 538 2054, Email : dqservicethai@gmail.com

REPORT OF CALIBRATION

Certificate No. : SP25-024 Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C
Relative humidity 55 ± 20 %RH

Calibration method : In-house method CP-01 Based on ASTM E275-08

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	115663	25 October 2025
Absorbance Standard set	25757	115638	25 October 2025
Wavelength Standard set	25806	115657	25 October 2025
Wavelength Standard set	25758	115665	25 October 2025

Traceability : This certification is traceable to the International System of Unit maintained at National Institute of Standards and Technology (NIST) through Sarna Scientific Limited

Spectral Band Width of UUC : 5.0 nm.

Scan Speed of UUC : 40

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.
Wavelength 0.1 nm.

เอกสารไม่ควบคุม

FM-708-Q2-R01 1/11/2021

เอกสารไม่ควบคุม

FM-708-Q2-R01 1/11/2021

DQE Services Co., Ltd.
32 Soi Ladprao-Wangkhao 55, Ladprao-Wangkhao Rd., Ladprao, Bangkok 10230
Phone : +66 (0)2 538 2054, Email : dqservicethailand@gmail.com

REPORT OF CALIBRATION

Certificate No. : SP25-024 Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5780	0.574	0.0040	0.0031	2.00
	1.0484	1.044	0.0044	0.0029	2.00
	2.1876	2.185	0.0026	0.0075	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.558	0.0015	0.0035	2.00
	1.0239	1.021	0.0029	0.0035	2.00
	2.1230	2.122	0.0010	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5230	0.519	0.0040	0.0030	2.00
	0.9633	0.961	0.0023	0.0029	2.00
	1.9753	1.975	0.0003	0.0071	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.515	0.0031	0.0031	2.00
	1.0002	0.996	0.0042	0.0033	2.00
	1.9973	1.994	0.0033	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.549	0.0027	0.0030	2.00
	1.0803	1.078	0.0023	0.0030	2.00
	2.0373	2.031	0.0063	0.0082	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.557	0.0021	0.0031	2.00
	1.0518	1.049	0.0028	0.0030	2.00
	1.9274	1.924	0.0034	0.0081	2.00

เอกสารไม่ควบคุม
FSA-018-02 R01 11/12/2021

DQE Services Co., Ltd.
32 Soi Ladprao-Wangkhao 55, Ladprao-Wangkhao Rd., Ladprao, Bangkok 10230
Phone : +66 (0)2 538 2054, Email : dqservicethailand@gmail.com

REPORT OF CALIBRATION

Certificate No. : SP25-024 Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0030	2.00
	0.7469	0.747	-0.0001	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8574	0.854	0.0034	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2919	0.293	-0.0011	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6430	0.639	0.0040	0.0055	2.00

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Certificate No. : SP25-024 Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.00	240.4	0.60	0.18	2.00
279.30	278.8	0.50	0.18	2.00
288.90	288.3	0.60	0.18	2.00
324.50	323.9	0.60	0.18	2.00
361.40	360.8	0.60	0.18	2.00
418.40	417.9	0.50	0.18	2.00
447.20	446.6	0.60	0.18	2.00
459.30	459.1	0.20	0.18	2.00
537.00	536.4	0.60	0.18	2.00
638.00	637.5	0.50	0.18	2.00
441.29	440.7	0.59	0.18	2.00
479.38	479.4	0.48	0.18	2.00
513.75	513.3	0.45	0.18	2.00
528.59	528.2	0.39	0.18	2.00
575.10	574.5	0.60	0.18	2.00
585.56	585.4	0.16	0.20	2.00
684.70	684.1	0.60	0.18	2.00
740.51	740.2	0.31	0.20	2.00
747.61	747.0	0.61	0.18	2.00
807.04	806.4	0.64	0.18	2.00
879.68	879.1	0.58	0.18	2.00

Remark : - UUC = Unit Under Calibration
- N/A = Not Available
- The maximum expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor, which for a normal distribution corresponds to a coverage probability of approximately 95%.

• End of Certificate •

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FSA-018-02 R01 11/12/2021

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES S. EQUIPMENT CALIBRATION AND TESTING SERVICES
52/44 PATTANAKARN ROAD SOI 18, SUKHUMVIT, SUKHUMVIT BANGKOK 10250
TEL 0-2717-3000-25 FAX 0-2719-9484

Certificate of Calibration Cert. No.: 28TM194
Page : 1 of 3

Equipment : Water Bath
Manufacturer : Memmert
Model : WNE 14
Serial No. : L410.0612
ID No. : MIC.0032560
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsak 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10250
Location : Microbiology Laboratory (802)
Received Order : 02 February 2025
Calibration Date : 02 February 2025
Ambient Temperature : (28 ± 0) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V
Calibrated by : Kietda Malee
Approved by : Approved Signatory
() Chaisit Wawongwaja
() Suwit Imjai
(✓) Kietda Promprai
Issue Date : 17 February 2025

The Uncertainties are for a confidence probability of approximately 95%
This certificate may not be reproduced other than in full, along with the prior written Approval of the head of Corporate Services S. Equipment Calibration and Testing Services.

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Equipment : Water Bath
 Condition As-Received : Used Item
 Reference : 2602-0004OC-2
 Procedure Used :-

Cert. No.: 26TM194
 Page: 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT04 Based on ASTM E715 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1.) Data Acquisition	MYS7013711	25LM117	TPA	17 Jul 2020

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

3. This measurement result is traceable to the International System of Unit maintained through:

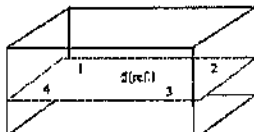
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	25	52	221
Finished of Calibration	24	51	220



Front

Position :	Ref. Std. ID No.:
1	4803988-001
2	4803988-002
3	4803988-003
4	4803988-004
5(ref.)	4803988-005

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Equipment : Water Bath
 Condition As-Received : Used Item
 Reference : 2602-0004OC-2
 Result of Calibration :- (*) Without Adjustment
 Function of UUC* : Temperature Source

Cert. No.: 26TM194
 Page: 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)					Uncertainty (± °C)
			Position					
			1	2	3	4	5 (ref.)	
44.5	44.5	44.6	44.518	44.483	44.472	44.508	44.521	0.15

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Coverage Factor k
44.5	0.11	0.044	2

Average* : The average of 30 values in each position.

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 or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity.

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

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