

ภาคผนวก จ

เอกสารสอบเทียบเครื่องมือที่ใช้ในการตรวจวิเคราะห์

List of Instruments Certification for Water Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Water									
1	pH Meter	pH	Ecosence	pH100A 24H005157JEN	Technology Promotion Association (Thailand-Japan)	25CH1230	28 Oct 25	27 Oct 26	-



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



Certificate of Calibration

Cert.No.: 25CH1230

Page.: 1 of 3

Equipment : pH Meter
Manufacturer : EcoSence
Model : pH 100A
Serial No. : 24H005157JEN
ID No. : UAE.EFM.039/2567(EFM.pH.02/67)
Condition As-Received: Used Item
Received Date : 27 October 2025
Calibration Date : 28 October 2025
Reference : 2510-0739WSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260

Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
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 : Warakorn Lerngagtrakul

Approved by : 
Approved Signatory

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

Issue Date : 29 October 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.

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Cert.No.: 25CH1230

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Condition of this calibration result

1. Reference Standard Instrument

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Document Process Calibrator	54030049	130RC116	25E2743	25 Aug 2026
2) Ref. Standard Thermometer	4982054	110RC044	25I708	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 Lenge GmbH Ltd.,
Deutsche Akkreditierungsstelle, Accredited No.D-RM-15184-01-00
: The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

<u>Buffer Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
pH 4.007	CPA chem	1114384	12 June 2027
pH 6.999	Hach Lenge GmbH	C03273	13 May 2027
pH 10.010	CPA chem	1135355	16 Aug 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 <i>k</i>
	pH	mV	mV	pH		
pH Meter S/N.: 24H005157JEN	4.00	177.48	177	4.00	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-177	10.01	0.58	2.00

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Cert.No.: 25CH1230

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Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement ($\pm$)	Coverage factor k
pH Electrode S/N.: 240821SIA605377	4.007	4.01	153	0.0080	2.00
	6.999	6.99	-18	0.0085	2.00
	6.999	7.00	-19	0.0085	2.00
	10.010	10.00	-189	0.0095	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : -

- Serial No. : 240821SIA605377

Dimension of probe

- Length : - mm.

- Diameter : 12 mm.

- Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement ($\pm$ °C)	Coverage factor k
15.0	15.002	15.1	0.098	0.13	2.00
30.0	30.002	30.0	-0.002	0.13	2.00
45.0	45.005	45.0	-0.005	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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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	Incubator	TOTAL BACTERIA	Binder	KB400 / 20220000022479	National food institute ministry of Industry	2503682 004 01	1/7/2025	30/6/2026
2	Incubator	LEGIONELLA SP.	Memmert	IPP260 / V616.0066	National Food Institute, Ministry of Industry, Thailand	2502229-002-01	19/3/2025	18/3/2026
3	pH Meter	pH	Horiba	LAQUA-PH210 / HA0A0006	technology promotion association (thailand-japan	25CH606	27/5/2025	25/5/2026

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

Calibration Certificate

Certificate No.: 2502229-002-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

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Equipment: CHAMBER (Incubator)
Manufacturer: MEMMERT
Model: IPP260
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.Yothin Charoensuk **Approved** [Signature]
Scientist Manager, Division of Calibration Laboratory
Date of Issue: 25 March 2025 **Responsible for the Technical Management Team**

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.

FCS-009 Revision: 01 Date: 20-04-65

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0006 หมู่ 3 ถนนสุขุมวิท แขวงคลองตัน เขตคลองเตย กรุงเทพมหานคร 10110
0006 หมู่ 36 Anu Aham Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel : +66(0) 2462 8549 Fax : +66(0) 2462 8545

Calibration Report

Certificate No.: 2502229-002-01
Equipment: CHAMBER (Incubator)
Model: IPP260 **Serial No.:** V616.0066
Resolution: 0.1 °C **ID No.:** UAE.MIC.032/2559
Manufacturer: MEMMERT

Date of Calibration: 19 March 2025

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Location: 302, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Environment Condition: Ambient Temperature (21.7 ± 1) °C
Relative Humidity (59 ± 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-20-1/02-06 (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.
- Reference Standard Instrument :

Instrument	Model	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	34972A	MY57003188	TE 670486-01	8 June 2025	NATIONAL FOOD INSTITUTE
RTD	CH201-209	RTD#201-209			

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This 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 Minute At 25.0 and 36.0 °C
Fresh air Damper - Open Position -
X Close Fan -
Not Available

- Result of Calibration : X Without adjustment

FCS-012 Revision: 01 Date: 20-04-65

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0006 หมู่ 36 Anu Aham Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel : +66(0) 2462 8549 Fax : +66(0) 2462 8545

Calibration Report

Certificate No.: 2502229-002-01
Equipment: CHAMBER (Incubator)
Model: IPP260 **Serial No.:** V616.0066
Resolution: 0.1 °C **ID No.:** UAE.MIC.032/2559
Manufacturer: MEMMERT

Date of Calibration: 19 March 2025

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Calibration point: 25.0 and 36.0 °C

Calibration result:

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
MIN	21.3	58	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)
	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	
25.0	25.19	25.16	25.22	25.17	24.85	24.91	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
	MIN	MAX	Average			
25.0	24.9	25.0	25.0	0.088	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 multiple level of confidence of approximately 95 %

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FCS-012 Revision: 01 Date: 20-04-65

2025

0006 หมู่ 3 ถนนสุขุมวิท แขวงคลองตัน เขตคลองเตย กรุงเทพมหานคร 10110
0006 หมู่ 36 Anu Aham Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel : +66(0) 2462 8549 Fax : +66(0) 2462 8545

Certificate of Calibration

Cert.No.: 25CH606
Page: 1 of 3

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HAA0A0006
ID No. : UAE.EFM.006/2563(EFM.pH.06/03)
Condition As-Received: Used Item
Received Date : 26 May 2025
Calibration Date : 27 May 2025
Reference : 2505-0796WSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Phrakhanong, Bangkok 10260

Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
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 :

Approved by :

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

Issue Date : 28 May 2025

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 25CH606
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Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	24E2759	25 Aug 2025
2) Ref. Standard Thermometer	4982054	110RC044	24I757	14 July 2025

- 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 Lenge GmbH Ltd., Deutsche Akkreditierungsstelle, Accredited No.D-RM-15184-01-00

: The measurement results are traceable to SI through CPA chem Ltd., Deutsche Akkreditierungsstelle, Accredited No.D-RM-15184-01-00

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.007	CPA chem	1066665	18 Jan 2027
pH 7.000	Hach Lenge GmbH	C03232	02 Dec 2026
pH 10.010	CPA chem	1066669	18 Jan 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 ($\pm$ mV)	Coverage factor k
	pH	mV	mV	pH	mV	pH		
pH Meter S/N: HA0A0006	4.00	177.48	177.5	4.01	0.058	2.00	0.058	2.00
	7.00	0.00	0.0	7.00	0.058	2.00		
	7.00	0.00	0.0	7.00	0.058	2.00		
	10.00	-177.48	-177.4	10.01	0.058	2.00		



Cert.No.: 25CH606
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Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement ($\pm$)	Coverage factor k
pH Electrode S/N: Q92M0159	4.007	4.01	181.7	0.0071	2.00
	7.000	7.00	5.4	0.0085	2.00
	7.000	7.00	6.5	0.0092	2.00
	10.010	10.00	-188.7	0.0095	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652-10D

- Serial No. : Q92M0159

Dimension of probe

- Length : 103 mm.

- Diameter : 16 mm.

- Immersion Depth : 80 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement ($\pm$ °C)	Coverage factor k
15.0	15.002	15.0	-0.002	0.13	2.00
30.0	30.003	30.0	-0.003	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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สถาบันการวิจัยและพัฒนาอาหาร
ศูนย์บริการห้องปฏิบัติการอาหาร
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center



Calibration Certificate

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

Page 1 of 2

Equipment: CHAMBER (Incubator)
Manufacturer: BINDER
Model: KB 400
Serial No.: 20220000022479
ID No.: UAE.MIC.028/2566
Order No.: 2503682
Operation No.: 2503682-004
Date of Receipt: 1 July 2025
Date of Calibration: 1 July 2025

Calibrated by Mr.Pheraphat Tuanjit
Scientist

Date of Issue: 3 July 2025

Responsible for the Technical Management Team

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.

FC-009 Revision: 01 Date: 20-04-65



สถาบันการวิจัยและพัฒนาอาหาร
ศูนย์บริการห้องปฏิบัติการอาหาร
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center



Calibration Report

Certificate No.: 2503682-004-01
Equipment: CHAMBER (Incubator)
Model: KB 400 Serial No.: 20220000022479
Resolution: 0.1 °C ID No. UAE.MIC.028/2566
Manufacturer: BINDER

Date of Calibration: 1 July 2025

Page 2 of 3

Location: Microbiology Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Environment Condition: Ambient Temperature (21 $\pm$ 1) °C
Relative Humidity (55 $\pm$ 10) %
Line Voltage (230 $\pm$ 5) Volt

Condition of this results of Calibration:

- This instrument was calibrated by insert 13 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	MY9003377	2501168-001-01	13 January 2026	NATIONAL FOOD INSTITUTE
	RTD	CH-01 / 02 / R104 / 01 / 202			

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This 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 : Hour 9 Minute At 35.0 °C

Fresh air Damper : Open Position -

X Close Fan 100%

- Not Available

7. Result of Calibration : X Without adjustment After adjustment

FC-012 Revision: 01 Date: 20-04-65



Calibration Report

Certificate No.:	2503582-004-01		
Equipment:	CHAMBER (Incubator)		
	Model:	KB 400	Serial No.: 2022000022479
	Resolution:	0.1 °C	ID No.: UAE.MIC.028/2566
	Manufacturer:	BINDER	

Date of Calibration: 1 July 2025

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Calibration point: 35.0 °C

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
MIN	20.1	45	225.0
MAX	22.0	65	235.0

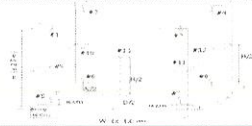


Table1 : Reporting of Temperature

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	35.03	34.83	35.21	34.96	34.94	34.84	34.84	35.06	34.94	35.15	34.79	34.92	0.27

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* 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)"

UUC^a = 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-CS-012 Revision: 01 Date: 20-04-65

