

## ภาคผนวก ค เอกสารสอบเทียบเครื่องมือ



รายการใบรับรองสอบเทียบ ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับคุณภาพน้ำเสีย น้ำทิ้ง

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์สำหรับคุณภาพน้ำ									
1	pH Meter	pH Meter	YSI	pH100A JC03345	Technology Promotion Association (Thailand-Japan)	22CH1000	26 Jul 22	25 Jul 23	-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL.: 0-2717-3000-27 FAX: 0-2719-9484



Cert.No.: 22CH1000  
Page.: 1 of 3

## Certificate of Calibration

Equipment : pH Meter  
Manufacturer : YSI  
Model : pH100A  
Serial No. : JC03345  
ID No. : UAE.EFM.058/2562(ENV.pH.07/61)  
Condition As-Received: Used Item  
Received Date : 25 July 2022  
Calibration Date : 26 July 2022  
Reference : 2207-0723WSC-2  
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 standard  
voltage calibrator and direct measurement with  
certified reference material (CRM)  
- CP-CH8 by comparison with standard thermometer

Calibrated by : Warakorn Lernagatrakul

Approved by :

Approved Signatory

(✓) Malee Bufruea  
( ) Sathip Meangmai  
( ) Warakorn Lernagatrakul

Issue Date : 29 July 2022

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.

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A 0043735



เอกสารไม่ควบคุม



Cert.No.: 22CH1000  
Page.: 2 of 3

### Condition of this calibration result

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Ref. Standard Thermometer	4982054	110RC044	21H1201	26 Oct 2022

This certification is traceable to the International System of Unit maintained at:-  
- Traceable to National Institute of Metrology (Thailand), NIMT

2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,  
ANSI-ASQ National Accreditation Board, Accredited No. AR-1635

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	823320	20 June 2024
pH 6.985	CPA chem	794122	14 Feb 2023
pH 10.008	CPA chem	823323	20 June 2023

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

### 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 (±)	Coverage factor k
pH Electrode S/N.: 21022SIA 605377	4.008	4.01	138	0.0079	2.00
	6.985	7.00	-35	0.0099	2.00
	6.985	7.00	-35	0.0093	2.00
	10.008	10.01	-209	0.0096	2.00

Remark : - Can not connect the BNC because the plug does not match with the socket.

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a 1119400



Cert.No.: 22CH1000  
Page.: 3 of 3

### Calibration Results

Function : Temperature Measurement

(\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model :  
- Serial No. : 210224SIA605377  
Dimension of probe;  
- Length : 110 mm.  
- Diameter : 12 mm.  
- Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
25.0	25.003	25.0	-0.003	0.13	2.00
30.0	30.003	30.0	-0.003	0.13	2.00
35.0	35.002	35.0	-0.002	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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เอกสารไม่ควบคุม  
a 1119399

รายการใบรับรองสอบเทียบ ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับคุณภาพน้ำเสีย น้ำทิ้ง

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์สำหรับคุณภาพน้ำ									
1	pH Meter	ความเป็นกรดและด่าง	Mettler-Toledo	Seven Easy S20 / 1231155210	National Food Institute, Ministry of Industry, Thailand	2301846-001-01	24 Feb 23	23 Feb 24	-
2	pH Meter		Mettler-Toledo	Seven Easy S20 / 1231155210	National Food Institute, Ministry of Industry, Thailand	2301846-001-01	24 Feb 23	23 Feb 24	-
3	Analytical Balance (Repeatability 0.01 mg)	สารแขวนลอย สารที่ละลายได้ทั้งหมด	Mettler-Toledo	XSR205DU / C009071872	Technology Promotion Association (Thailand-Japan)	23MM112	26 Apr 23	24 Apr 24	-
4	Hot Air Oven		Memmert	UF55 / B212.0411	Technology Promotion Association (Thailand-Japan)	23TM373	11 Apr 23	9 Apr 24	-
5	Digestor Unit	ไนโตรเจนในรูป ที่ เค เอ็น	FOSS TECATOR	2520auto / 91794469	National Food Institute, Ministry of Industry, Thailand	2302413-001-01	30 Mar 23	28 Mar 24	-
6	Distillation Unit (Kjeldahl Method)		FOSS TECATOR	KT8100 / 91889052	FOSS South East Asia	6623	25 Jul 22	24 Jul 23	-
7	Analytical Balance (Repeatability 0.1 mg)	น้ำมันและไขมัน	FOSS TECATOR	2520auto / 91794469	National Food Institute, Ministry of Industry, Thailand	2302413-001-01	30 Mar 23	28 Mar 24	
8	UV-VIS Spectrophotometer	ฟอสเฟต แอมโมเนียในหน่วยไนโตรเจน	Hitachi	U-1900 / 2021-064	DQE Services Co.,Ltd.	SP23-007	6 Jan 23	5 Jan 24	-
9	UV-VIS Spectrophotometer		Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP23-008	6 Jan 23	5 Jan 24	-
10	BOD Incubator	บีโอดี	Arco	UC4-1320 / (UAE.WAO.002/2550)	Technology Promotion Association (Thailand-Japan)	22TM1232	15 Aug 22	14 Aug 23	-
11	BOD Incubator		Arco	UR-1320 / (UAE.WAO.006/2553)	Technology Promotion Association (Thailand-Japan)	23TM372	11 Apr 23	9 Apr 24	-
12	BOD Incubator		Arco	UR-1320 / (UAE.WAO.018/2551)	Technology Promotion Association (Thailand-Japan)	23TM375	12 Apr 23	10 Apr 24	-



รายการใบรับรองสอบเทียบ ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับคุณภาพน้ำเสีย น้ำทิ้ง

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์สำหรับคุณภาพน้ำ									
13	Incubator (Cooled Incubator)	ฟิคอลโคลิฟอร์มแบคทีเรีย	Memmert	IPP 260 / V618.0033	Technology Promotion Association (Thailand-Japan)	23TM729	27 Apr 23	25 Apr 24	-
14	Incubator (Cooled Incubator)		Binder	BD 53 / 13-07343	Technology Promotion Association (Thailand-Japan)	23TM192	16 Feb 23	15 Feb 24	-
15	Water Bath		Memmert	WNE 14 / L416.0612	Technology Promotion Association (Thailand-Japan)	23TM194	15 Feb 23	14 Feb 24	-
16	Water Bath		Memmert	WB 14 / I401.0569	Technology Promotion Association (Thailand-Japan)	22TM1065	11 Jul 22	10 Jul 23	-
17	Analytical Balance		OHAUS	PX623 / C236754745	DKSH (Thailand) Ltd.	C01223732	9 Dec 22	8 Dec 23	-
18	Autoclave		ALP	CL-40L / 807298	Technology Promotion Association (Thailand-Japan)	22TM1121	11 Jul 22	10 Jul 23	-

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

## Calibration Certificate

**Certificate No.:** 2301846-001-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 5

**Equipment:** pH Meter  
**Manufacturer:** Mettler Toledo  
**Model:** SevenEasy TM S20 pH  
**Serial No.:** 1231155210  
**ID No.:** UAE.WAT.010/2553  
**Order No.:** 2301846  
**Operation No.:** 2301846-001  
**Date of Receipt:** 17 February 2023  
**Date of Calibration:** 24 February 2023

**Calibrated by:** Mr.Worapob Sooktong  
**Approved by:** (Mr.Nuttapol Niyomchart)  
Scientist Specialist, Division of Calibration Laboratory  
Responsible for the Technical Management Team  
**Date of Issue:** 24 February 2023

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 inability to recognize national standards and to the units of measurement related at the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-05



## Calibration Report

**Certificate No.:** 2301846-001-01  
**Equipment:** pH Meter  
**Resolution:** 0.01 pH ; 1 mV  
**Manufacturer:** Mettler Toledo  
**Model:** SevenEasy TM S20 pH  
**Serial No.:** 1231155210  
**Type:** Bench top  
**ID No.:** UAE.WAT.010/2053

Page 2 of 5

**Date of Calibration:** 24 February 2023  
**Location:** Chemical Calibration Laboratory, National Food Institute  
**Environment Condition:** Ambient Temperature:  $25.1 \pm 1.5$  °C  
**Relative Humidity:**  $(50 \pm 5)$  %  
**Condition of Equipment:** Good Condition  
**Condition of this Results of Calibration**

1. Calibration Method: In house method: W-CC-002 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	22E1959	17 June 2023	
2.2 Digital Thermometer	2709007	Fluke	GC 605677-01	30 October 2023	
2.3 Thermo-Hygro Meter	NPLBTH 007115	PCANPE 490	QR22-0886	26 April 2023	
Certified Reference Material		Lot No.	Manufacturer	Ref. No.	Expiry Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	832806	CPAchem	PH216.L5		8 August 2024
2.5 pH buffer 6.865 (Primary pH buffer Solution)	832607	CPAchem	PH217.L5		8 August 2024
2.6 pH buffer 10.01 (Primary pH buffer Solution)	832609	CPAchem	PH220.L5		8 August 2023
2.7 pH buffer 7.00 (Standard pH buffer Solution)	832610	CPAchem	PH107.L5		8 August 2023

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

- 3.1 Instruments No.2.1 through NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0008
- 3.2 Instruments No.2.2 through NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0061
- 3.3 Instruments No.2.3 through NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0292
- 3.4 Certified Reference Material No. 2.4 to 2.6 traceable to Primary measurement method: Homed cell using calibrated thermometer, barometer, and nanoscale: The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
- 3.5 Certified Reference Material No.2.7 traceable to SIM RefH H-27 LotN 04.06.2021; SIM RefH H-28 LotN 28.05.2021; SIM RefH H-27 LotN 04.06.2021; SIM RefH H-28 LotN 28.05.2021, the Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025

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.

F-CS-012 Revision: 01 Date: 20-04-05



## Calibration Report

**Certificate No.:** 2301846-001-01  
**Equipment:** pH Meter  
**Resolution:** 0.01 pH ; 1 mV  
**Manufacturer:** Mettler Toledo  
**Model:** SevenEasy TM S20 pH  
**Serial No.:** 1231155210  
**Type:** Bench top  
**ID No.:** UAE.WAT.010/2553

Page 3 of 5

**Date of Calibration:** 24 February 2023  
**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	414.120	414	0.00	0.58	2.00
2	295.814	296	2.00	0.58	2.00
4	177.464	178	4.00	0.58	2.00
6	59.190	59	6.00	0.58	2.00
7	0.000	0	7.00	0.58	2.00
8	-59.158	-59	8.00	0.58	2.00
10	-177.460	-177	10.00	0.58	2.00
12	-295.811	-296	12.00	0.58	2.00
14	-414.117	-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:** Mettler Toledo  
**Model:** InLab Solids  
**Serial No.:** 9016311  
**ID No.:** N/A

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

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (±pH)	Coverage Factor (k)
	pH	mV			
4.008	4.01	186	-	0.0071	2.00
6.985	6.99	19	97.98	0.0075	2.00
10.008	10.01	-180	97.29	0.0095	2.00
6.985	6.99	15	-	0.0092	2.00

F-CS-012 Revision: 01 Date: 20-04-05



## Calibration Report

**Certificate No.:** 2301846-001-01  
**Equipment:** Digital Thermometer with RTD  
**Resolution:** 0.1 °C  
**Model:** SevenEasy TM S20 pH  
**Serial No.:** 1231155210  
**ID No.:** UAE.WAT.010/2553  
**Manufacturer:** Mettler Toledo

Page 4 of 5

**Date of Calibration:** 24 February 2023  
**Location:** Chemical Calibration Laboratory, National Food Institute  
**Environment Condition:** Ambient Temperature:  $25$  °C  $\pm 1$  °C  
**Relative Humidity:**  $48$  %  $\pm 3$  %

**Condition of this results of Calibration:**

- 1. Calibration Method: - In house method: W-TE-025 by comparison with standard thermometer.
- The Calibration is determined by comparing with a known temperature from a standard resistance thermometer.
- The temperature scale in use at this laboratory is the International Temperature scale of 1990 (ITS-90).

2. Reference Standard Instrument:

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1523	2118154	PSL-T 0673/65	07-Jun-23	TISTR
Platinum Resistance Thermometer (PRT)	5627A	877332			

Support Equipment: - Low Temperature Bath (Micro Bath), Model: 7103, S/N: A39538,AN65 A85181.

- 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
- 7. Result of Calibration: ☒ Without adjustment ☐ After adjustment

F-CS-012 Revision: 01 Date: 20-04-05



Calibration Report

Certificate No.: 2301846-001-01  
Equipment: Digital Thermometer with RTD  
Resolution: 0.1 °C  
Model: SevenEasy TM 520 pH  
Serial No.: 1231155210 ID No.: UAE.WAT.010/2553  
Manufacturer: Mettler Toledo  
Date of Calibration: 24 February 2023

Calibration point: 15.0, 25.0 and 35.0 °C  
Calibration result:  
- The probe was immersed in liquid bath or dry bath to a minimum depth of 120 mm.  
- Description of probe, model: S/N: -  
Dimension of probe: Diameter 9 mm., Length 120 mm.,  
Sheath material: Stainless Steel

Table with 4 columns: UUC\* Reading (°C), Standard Temperature (°C), Correction Value (°C), and Uncertainty ± (°C). Rows show data for 15.1, 25.0, and 35.1 °C.

Note  
- UUC\* : Unit Under Calibration

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

Calibration Certificate

Certificate No.: 2301846-001-01  
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
Address: 3 Soi Udomsuk 41, Sukhumvit Road, Bangchack, Prakhonong, Bangkok 10260

Page 1 of 5

Equipment: pH Meter  
Manufacturer: Mettler Toledo  
Model: SevenEasy TM 520 pH  
Serial No.: 1231155210  
ID No.: UAE.WAT.010/2553  
Order No.: 2301846  
Operation No.: 2301846-001  
Date of Receipt: 17 February 2023  
Date of Calibration: 24 February 2023

Calibrated by: Mr.Worapob Sooktong Scientist  
Approved by: (Mr.Nuttapol Nymchart) Specialist, Division of Calibration Laboratory  
Date of Issue: 24 February 2023  
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 related 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-CS-009 Revision: 01 Date: 20-04-65

Calibration Report

Certificate No.: 2301846-001-01  
Equipment: pH Meter  
Resolution: 0.01 pH ; 1 mV  
Manufacturer: Mettler Toledo  
Model: SevenEasy TM 520 pH  
Serial No.: 1231155210 Type: Bench top  
ID No.: UAE.WAT.010/2553  
Date of Calibration: 24 February 2023

Location: Chemical Calibration Laboratory, National Food Institute  
Environment Condition: Ambient Temperature: ( 25.1 ± 1.5 ) °C Relative Humidity: ( 50 ± 5 ) %  
Condition of Equipment: Good Condition  
Condition of this Results of Calibration

1. Calibration Method In house method : W-CC-052 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)

2. Reference Standards / Certified Reference Material

Table with 5 columns: Instruments, Serial / ID No., Manufacturer, Certificate No., Due Date. Rows include DC Voltage Calibrator, Digital Thermometer, Thermo-Hygro Meter, and various pH buffer solutions.

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

- 3.1 Instruments No.2.1 through NSC-TIS-118 17025 Laboratory Accreditation of Calibration No.0008
- 3.2 Instruments No.2.2 through NSC-TIS-118 17025 Laboratory Accreditation of Calibration No.0061
- 3.3 Instruments No.2.3 through NSC-TIS-118 17025 Laboratory Accreditation of Calibration No.0292
- 3.4 Certified Reference Material No. 2.4 to 2.6 traceable to Primary measurement method- Formed 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
- 3.5 Certified Reference Material No.2.7 traceable to BSM RefH H-27 Lot#N 04.06.2021; BSM RefH H-28 Lot#N 28.05.2021; BSM RefH H-27 Lot#N 04.06.2021; BSM RefH H-28 Lot#N 28.05.2021, the Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025

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.

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

Calibration Report

Certificate No.: 2301846-001-01  
Equipment: pH Meter  
Resolution: 0.01 pH ; 1 mV  
Manufacturer: Mettler Toledo  
Model: SevenEasy TM 520 pH  
Serial No.: 1231155210 Type: Bench top  
ID No.: UAE.WAT.010/2553  
Date of Calibration: 24 February 2023

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

Table with 5 columns: Nominal pH, DC Voltage Standard (mV), Average Indicator Reading (mV and pH), Uncertainty (± mV), and Coverage Factor (K). Rows show data for pH values from 0 to 14.

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

Equipment: pH Electrode Type: Combined Electrode  
Manufacturer: Mettler Toledo Model: InLab Solids  
Serial No.: 9018311 ID.No. N/A  
Performance of Electrode system (Three-Point Calibration at pH 4, pH 7 and pH 10)

Table with 5 columns: Certified Value (25 °C (pH)), Average Indicator Reading (pH and mV), Relative Slope (%), Uncertainty (± pH), and Coverage Factor (K). Rows show data for pH values 4.058, 6.985, 10.008, and 6.985.

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



## Calibration Report

**Certificate No.:** 2301846-001-01  
**Equipment:** Digital Thermometer with RTD  
Resolution: 0.1 °C Model: SevenEasy TM 520 pH  
Serial No.: 1231155210 ID No.: UAE.WAT.010/2553  
Manufacturer: Mettler Toledo  
**Date of Calibration:** 24 February 2023 Page 4 of 5

**Location:** Chemical Calibration Laboratory, National Food Institute  
**Environment Condition:** Ambient Temperature 25 °C ± 1 °C  
Relative Humidity 48 % ± 3 %

### Condition of this results of Calibration:

1. Calibration Method : - In house method: W-TE-025 by comparison with standard thermometer.  
- The Calibration is determined by comparing with a known temperature from a standard resistance thermometer.  
- The temperature scale in use at this laboratory is the International Temperature scale of 1990 ( ITS-90 ).

### 2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1523	2118154	PSL-T 0673/65	07-Jun-23	TISTR
Platinum Resistance Thermometer (PRT)	5627A	877332			

Support Equipment : - Low Temperature Bath (Micro Bath), Model: 7103, S/N: A39538,AN65 A85181.

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

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

เอกสารไม่ควบคุม



## Calibration Report

**Certificate No.:** 2301846-001-01  
**Equipment:** Digital Thermometer with RTD  
Resolution: 0.1 °C Model: SevenEasy TM 520 pH  
Serial No.: 1231155210 ID No.: UAE.WAT.010/2553  
Manufacturer: Mettler Toledo  
**Date of Calibration:** 24 February 2023 Page 5 of 5

**Calibration point:** 15.0, 25.0 and 35.0 °C

### Calibration result:

- The probe was immersed in liquid bath or dry bath to a minimum depth of 120 mm.
- Description of probe, model : - S/N : -  
Dimension of probe : Diameter 9 mm., Length 120 mm.,  
Sheath material : Stainless Steel

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.1	15.015	- 0.1	0.11
25.0	25.014	0.0	0.11
35.1	35.016	- 0.1	0.11

### Note

- UUC\* : Unit Under Calibration

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

เอกสารไม่ควบคุม



**TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)**  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
53/44 PATTANAKARN ROAD SOI 14, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-29 FAX. 0-2719-9484



**Cert.No.:** 23MM112  
**Page.:** 1 of 3

## Certificate of Calibration

**Equipment :** Electronic Balance  
**Manufacturer :** Mettler Toledo  
**Model :** XSR205  
**Serial No. :** C009071872  
**ID No. :** UAE.WAO.012/2563  
**Submitted by :** United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phakhanong,  
Bangkok 10260  
**Location :** Balance Room  
**Received order :** 26 April 2023  
**Calibration Date :** 26 April 2023  
**Ambient Temperature :** 15 °C to 40 °C  
**Relative Humidity :** 30 % to 90 %  
**Calibrated by :** Man Pattanapongpaiboon  
**Approved by :**   
( ) Pornthippa Tameyakul  
( ) Malee Butkruea  
(✓) Suwit Imjai  
**Issue Date :** 2 May 2023

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.

เอกสารไม่ควบคุม

A 0053701



**Equipment :** Electronic Balance  
**Condition As-Received :** Used Item  
**Reference :** 2304-04590C-1  
**Procedure used :-**  
**Cert.No.:** 23MM112  
**Page:** 2 of 3

Calibration were conducted using in-house calibration procedure CP-OB01 according to direct measurement method against standard weight.

### Condition of this result of calibration

#### 1. Reference standard instruments:-

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	15884	24053	70RC007	MM-0010-22	20 Jan 2024

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This result of calibration was made on requested at the point specified by customer.
4. This certificate is not certified for any commercial transaction.
5. This certification is traceable to the International System of Unit.

### Result of calibration ( ) Without Adjustment ( \* ) After Adjustment by Internal Calibration

**Range capacity :** 0 g to 81 g Resolution 0.00001 g  
81 g to 220 g Resolution 0.0001 g

#### Before Adjustment :

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
80	80.00005	-0.00005	0.15	2.00
200	199.9999	+0.0001	0.29	2.00

#### After Adjustment :

#### 1. Determination of the standard deviation of weighing machine (n = 10)

Applied Weight (g)	Standard Deviation of Reading (g)
80	0.000007
200	0.00000

เอกสารไม่ควบคุม

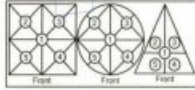
a 1159270





Equipment : Electronic Balance  
Condition As-Received : Used Item  
Reference : 2304-0459QC-1  
Result of calibration

Cert.No.: 23TM112  
Page: 3 of 3



Maximum difference between  
off-center and central loading  
(g)  
0.0001

Position 1 Position 2 Position 3 Position 4 Position 5  
(g) (g) (g) (g) (g)  
-0.0001 -0.0001 0.0000 -0.0001 -0.0001

### 3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
Unload	0.00000	0.00000	0.014	2.13
0.05	0.05001	-0.00001	0.015	2.09
0.1	0.10001	-0.00001	0.015	2.09
1	1.00001	-0.00001	0.018	2.04
5	5.00003	-0.00003	0.026	2.00
20	20.00006	-0.00006	0.045	2.00
50	50.00006	-0.00006	0.080	2.00
80	80.00004	-0.00004	0.15	2.00
100	100.00000	0.00000	0.16	2.00
150	150.00000	0.00000	0.29	2.00
200	200.00000	0.00000	0.29	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 %.

-000-

เอกสารไม่ควบคุม

a 1159269



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



Cert. No.: 23TM373  
Page : 1 of 3

## Certificate of Calibration

Equipment : Hot Air Oven  
Manufacturer : Memmert  
Model : UF 55  
Serial No. : B212.0411  
ID No. : UAE.WAO.005/2556  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : Lab Floor 2  
Received Order : 11 April 2023  
Calibration Date : 11 - 12 April 2023  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
Calibrated by : Krisda Malee

Approved by :

( / ) Pornthippa Tameyakul  
( / ) Malee Butkruea  
( / ) Suwit Imjai

Issue Date : 24 April 2023

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.

เอกสารไม่ควบคุม

A 0053359



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2304-0156OC-1  
Procedure Used :-

Cert. No.: 23TM373  
Page : 2 of 3

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD) and Thermocouple Type T.

The temperature scale used was based on ITS-90.

### Condition of this result of calibration

#### 1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1 ) Data Acquisition	34972A	MY59003411	22LM165	26 Nov 2023

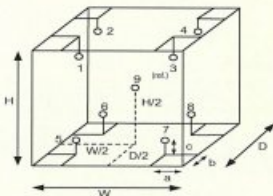
2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close



Probe Installation Details : Dimension of Chamber :  
a = 5.0 cm D = 0.50 m  
b = 5.0 cm W = 0.80 m  
c = 5.0 cm H = 0.75 m  
Capacity = 0.30 m<sup>3</sup>

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	27	28
REL.Humid. ( % )	45	44
AC Supply ( Volt )	221	220

Ref. Std. ID No.: @ Calibration Point		
Position :	( 120 to 180 ) °C	( 104 ) °C
1	18-20TC-01	20RTD-2/1
2	18-20TC-02	20RTD-2/2
3	18-20TC-03	20RTD-2/3
4	18-20TC-04	20RTD-2/4
5	18-20TC-05	20RTD-2/5
6	18-20TC-06	20RTD-2/6
7	18-20TC-07	20RTD-2/7
8	18-20TC-08	20RTD-2/8
9 (ref.)	18-20TC-09	20RTD-2/9

เอกสารไม่ควบคุม

a 1158261



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2304-0156OC-1  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 23TM373  
Page : 3 of 3

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Coverage Factor k
104.0	104.0	104.0	0.054	0.59	0.95	2
120.0	120.0	120.0	0.12	0.89	1.5	2
180.0	180.0	180.0	0.12	1.5	2.5	2

Calibration Point ( °C )	Measured Temperature ( °C )									Uncertainty ( ± °C )
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	104.512	104.016	104.542	104.407	103.704	103.729	104.167	104.158	104.001	0.42
120.0	120.317	119.768	120.524	120.232	119.363	119.209	119.888	119.797	119.735	1.1
180.0	180.878	179.819	181.357	180.871	179.303	179.139	180.230	180.055	179.960	1.1

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

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature 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.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

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 %.

-000-

เอกสารไม่ควบคุม

a 1158260

## Verification Certificate

**Certificate No.:** 2302413-001-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 4

**Equipment:** HEATING BLOCK DIGESTION  
**Manufacturer:** FOSS  
**Model:** 2520  
**Serial No.:** 91794469  
**ID No.:** UAE.WAS.011/2560  
**Order No.:** 2302413  
**Operation No.:** 2302413-001  
**Date of Receipt:** 28 March 2023  
**Date of Calibration:** 30-31 March 2023

**Calibrated by** Mr.Nuttapol Niyomchat **Approved by** (Mr.Pheraphat Tuanjit )  
Specialist Manager, Division of Calibration Laboratory  
**Date of Issue:** 10 April 2023 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.

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

2009 ซอยสุขุมวิท 41 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260 เอกสารไม่ควบคุม  
2009 Soi 41, Asoke Road, Bang Khun Subdistrict, Bang Khun District, Bangkok 10260, Thailand  
Tel +66(0) 2462 8569 Fax +66(0) 2462 8545 nfi.com

## Verification Report

**Certificate No.:** 2302413-001-01  
**Equipment:** HEATING BLOCK DIGESTION  
**Model:** 2520 **Serial No.:** 91794469  
**Resolution:** 1 °C **ID No.:** UAE.WAS.011/2560  
**Manufacturer:** FOSS  
**Date of Calibration:** 30-31 March 2023

Page 2 of 4

**Location:** Laboratory Room, NATIONAL FOOD INSTITUTE  
**Environment Condition:** Ambient Temperature ( 25 ± 3 ) °C  
Relative Humidity ( 55 ± 15 ) %  
Line Voltage ( 220 ± 10 ) Volt

### Condition of this results of Calibration:

1. This instrument was calibrated by Insert standard thermocouples type R into its heating block digestion and compared to temperature obtained from reference standards thermometer at calibrated point.  
- 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.	Certificate No.	Due Date	Through
Digital Thermometer with Thermocouple	34970A	MY44645526/MY41104452	TC22/0044	5-May-2023	N.M. Technical Center Laboratory
	Type R	TCF101-103 / CHF101-103			

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 - Hour 30 Minute At 380 °C

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

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

2009 ซอยสุขุมวิท 41 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260 เอกสารไม่ควบคุม  
2009 Soi 41, Asoke Road, Bang Khun Subdistrict, Bang Khun District, Bangkok 10260, Thailand  
Tel +66(0) 2462 8569 Fax +66(0) 2462 8545 nfi.com

## Verification Report

**Certificate No.:** 2302413-001-01  
**Equipment:** HEATING BLOCK DIGESTION  
**Model:** 2520 **Serial No.:** 91794469  
**Resolution:** 1 °C **ID No.:** UAE.WAS.011/2560  
**Manufacturer:** FOSS

**Date of Calibration:** 30-31 March 2023 **Page 3 of 4**

**Calibration point:** 380 °C

**Calibration result:**

### Reporting of Temperature

Block No.	UUC* Setting (°C)	UUC* Reading (°C)	Stability (±°C)	Standard Thermometer (°C)	Uncertainty (±°C)
1	380	380	0.96	377.74	2.1
2	380	380	0.40	377.28	2.1
3	380	380	1.18	377.82	2.1
4	380	380	0.44	377.19	1.6
5	380	380	0.11	377.30	1.6
6	380	380	0.14	377.90	1.6
7	380	380	1.17	373.85	2.1
8	380	380	0.33	376.96	2.1
9	380	380	0.14	374.18	2.1
10	380	380	0.96	378.56	2.0
11	380	380	1.04	378.34	2.0
12	380	380	0.35	378.06	2.0
13	380	380	0.48	377.05	1.6
14	380	380	0.38	379.19	1.6
15	380	380	0.50	377.48	1.6
16	380	380	0.48	378.33	1.7
17	380	380	0.71	377.60	1.7
18	380	380	0.35	376.77	1.7
19	380	380	0.84	377.06	1.8
20	380	380	0.41	378.58	1.8

Note:

- UUC\* = Unit Under Calibration
- Immersion depth of standard thermometer in tube level high of sand is equal heater plate of UUC.
- Stability = One-half of the greatest maximum difference of measured temperatures at one sensors, for at least half an hour after reaching steady state.

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

2009 ซอยสุขุมวิท 41 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260 เอกสารไม่ควบคุม  
2009 Soi 41, Asoke Road, Bang Khun Subdistrict, Bang Khun District, Bangkok 10260, Thailand  
Tel +66(0) 2462 8569 Fax +66(0) 2462 8545 nfi.com

## Verification Report

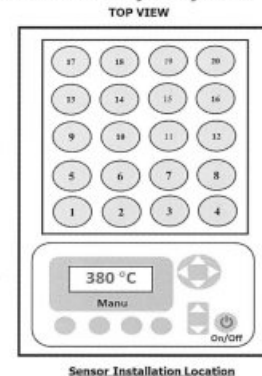
**Certificate No.:** 2302413-001-01  
**Equipment:** HEATING BLOCK DIGESTION  
**Model:** 2520 **Serial No.:** 91794469  
**Resolution:** 1 °C **ID No.:** UAE.WAS.011/2560  
**Manufacturer:** FOSS

**Date of Calibration:** 30-31 March 2023 **Page 4 of 4**

**Calibration point:** 380 °C

**Calibration result:** Continued

Figure 1. Location of Reference Standard and Block Diagram of Digestion Unit



Sensor Installation Location

Note:

- UUC\* = Unit Under Calibration
- Immersion depth of standard thermometer in tube level high of sand is equal heater plate of UUC.
- Stability = One-half of the greatest maximum difference of measured temperatures at one sensors, for at least half an hour after reaching steady state.

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

2009 ซอยสุขุมวิท 41 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260 เอกสารไม่ควบคุม  
2009 Soi 41, Asoke Road, Bang Khun Subdistrict, Bang Khun District, Bangkok 10260, Thailand  
Tel +66(0) 2462 8569 Fax +66(0) 2462 8545 nfi.com



## Customer Service Report

FOSS South East Asia  
3388 Sirinrat Building, 25th - 26th Floor, Unit No. 3388/90,  
Rama IV Road, Klongton - Klongtoey, Bangkok, Thailand 10110

Report No: 6623

Date: 25/7/2022

Customer: United Analyst and Engineering

Instrument: KT9100

Serial: 91899052

Hours  
Start 9:00  
Finish 9:50

Travel To Customer  
3.00  
30 min

Labour  
3.00 - 18.00  
18.00 - 16.00  
S + S  
1 hr.

Travel From Customer  
16.50  
1 hr.

Job Type			
Application	Special	Standard	Training
Normal	<input type="checkbox"/>	Courtesy Visit	<input checked="" type="checkbox"/>
Distributor	<input checked="" type="checkbox"/>	PMA Onboarding	<input type="checkbox"/>
Internal	<input type="checkbox"/>	Warranty	<input type="checkbox"/>
Digital Service	<input type="checkbox"/>	Sales Support	<input type="checkbox"/>
		Repair	<input type="checkbox"/>
		Remote	<input type="checkbox"/>
		Other	<input type="checkbox"/>

PO/Quote Number: 18000000000000000000

PMA Type: ☐ PMA Onboarding ☐ Contract No. ☐

Details of Work / Test	Condition / Status
Unpack instrument and accessories	OK
Accessories kit	OK
Software installation	OK
Hardware installation	OK
Initial calibration	OK
Final calibration	OK
Instrument Ready for Use	<input checked="" type="checkbox"/> OK <input type="checkbox"/> Not OK

Part No.	Batch	Description	Qty

I confirm this report is accurate and complete

Signed FOSS: [Signature]  
Name: [Name]

Signed Customer: [Signature]  
Name: [Name]

Would you be willing to participate in a brief survey in order to tell us how we performed? ☐

เอกสารไม่ควบคุม

## Customer Service Report

FOSS South East Asia  
3388 Sirinrat Building, 25th - 26th Floor, Unit No. 3388/90,  
Rama IV Road, Klongton - Klongtoey, Bangkok, Thailand 10110

Report No: 6534

Date: 25/7/2022

Customer: United Analyst and Engineering

Instrument: KT9100

Serial: 91899052

Hours  
Start 9:00  
Finish 9:50

Travel To Customer  
3.00  
30 min

Labour  
3.00 - 18.00  
18.00 - 16.00  
S + S  
1 hr.

Travel From Customer  
16.50  
1 hr.

Job Type			
Application	Special	Standard	Training
Normal	<input type="checkbox"/>	Courtesy Visit	<input checked="" type="checkbox"/>
Distributor	<input checked="" type="checkbox"/>	PMA Onboarding	<input type="checkbox"/>
Internal	<input type="checkbox"/>	Warranty	<input type="checkbox"/>
Digital Service	<input type="checkbox"/>	Sales Support	<input type="checkbox"/>
		Repair	<input type="checkbox"/>
		Remote	<input type="checkbox"/>
		Other	<input type="checkbox"/>

PO/Quote Number: 18000000000000000000

PMA Type: ☐ PMA Onboarding ☐ Contract No. ☐

Details of Work / Test	Condition / Status
Unpack instrument and accessories	OK
Accessories kit	OK
Software installation	OK
Hardware installation	OK
Initial calibration	OK
Final calibration	OK
Instrument Ready for Use	<input checked="" type="checkbox"/> OK <input type="checkbox"/> Not OK

Part No.	Batch	Description	Qty

I confirm this report is accurate and complete

Signed FOSS: [Signature]  
Name: [Name]

Signed Customer: [Signature]  
Name: [Name]

Would you be willing to participate in a brief survey in order to tell us how we performed? ☐

เอกสารไม่ควบคุม

FOSS

## Installation Qualification

### Kjeltec™ 8100 Distillation Unit

This IQ applies to Kjeltec™ 8100 Distillation Unit manufactured by FOSS Analytical. The installation is performed by FOSS trained service personnel.

#### 1 Intended Use

Kjeltec 8100 is intended for laboratory use analyzing parameters as specified in FOSS Analytical AB's Application Notes.

#### 2 Purpose

This installation Qualification is designed to assure that:

- The Kjeltec instrument is received complete, with all required parts in good condition.
- The location of the instrument is environmentally and ergonomically suitable
- The instrument is assembled and configured correctly
- Suitable electricity and water are supplied to the instrument, see table 2 for requirements.

#### 3 Identification

Description	Serial Number
Kjeltec 8100 Distillation Unit	91899052

### 4 Control of Received Equipment

#### 4.1 Verify that the correct instrument type and accessory kit items are received and in proper condition

The packing list (shipped with the instrument) specifies all the items. The installer will verify that all items are received as shipped on the packing list. For each item listed, verify that the acceptance criteria are met. If so, write "Y" in the right column of the table immediately following.

Packing List Item	Acceptance Criteria	Pass/Y/N
Kjeltec 8100 Distillation Unit	No visible damage, received in undamaged FOSS Analytical's standard shipping container	Y
Accessory kit, according to packing list	Included. No visible damage, received in undamaged FOSS Analytical's standard shipping container	Y
Handling device for digestion tube	Included. No visible damage.	Y
Tanks with level sensors for Waste, Alkali and Water	Included. No visible damage.	Y
Receiver flask	Included. No visible damage.	Y
One digestion tube 250ml	Included. No visible damage.	Y
One digestion tube 100 ml	Included. No visible damage.	Y
Tube adapter	Included. No visible damage.	Y
User manual	Kjeltec 8100 Distillation Unit	Y
Owners guide	Kjeltec 8100 Distillation Unit	Y
Quick guide	Kjeltec 8100 Distillation Unit	Y
Spare parts manual	Kjeltec 8100 Distillation Unit	Y
Application notes	AN 300 included AN 303 included	Y

#### Dedicated Analytical Solutions

FOSS Analytical AS  
69 Slangerupgade  
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Web www.foss.dk

FOSS Analytical AB  
Box 70  
SE-263 21 Högabö  
Sweden

Tel +46 42 361500  
Fax +46 42 340349  
E-mail support@foss.se  
Web www.foss.se

## 5 Installation

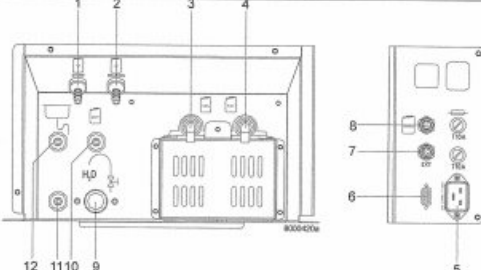
### 5.1 The equipment must be installed in a suitable location with power, water and draining available

Verify that the instrument installation site meets the acceptance criteria given in the table below. If so, write "Y" in the right column of the table immediately following.

Location Requirements	Acceptance Criteria	Pass (Y/N)
Adequate space for instrument	Dimensions 48x58x69 cm	Y
AC supply available for instrument	200-240 V 50/60Hz	Y
Current	10 A	Y
Cold water supply available	2 L/min at 30°C	Y
Drain	For cooling water and waste (depending on local waste disposal legislation)	Y
Ambient temperature	Max. 40°C	Y
Ambient humidity	Max. 80% relative	Y
Internal fuses	T10A AH	Y

### 5.2 The instrument must be assembled correctly

Verify that all tubes are correct connected. If so, write "Y" in the right column of the table immediately following.

Instrument Tubing Connections	Acceptance Criteria	Pass (Y/N)
 <ol style="list-style-type: none"> <li>Deionised water in (steam generator)</li> <li>Deionised water in (dilution water)</li> <li>*) Receiver solution in</li> <li>Alkali in</li> <li>Power</li> <li>Not used</li> <li>External titration module</li> <li>Level sensors</li> <li>Cooling water in (tap water)</li> <li>Waste water out (tube drain vessel)</li> <li>Drain</li> <li>Cooling water out (tap water)</li> </ol> <p>*) Only on Kjeltac 8200</p>	Visual verification by installer	Y

### 5.3 The instrument should be assembled and powered up

Connect the distilling unit to the power supply. Perform the start up procedure and check that the expected response is obtained. If so, write "Y" in the right column of the table immediately following.

Action	Expected Response	Pass (Y/N)
Switch on the power	The instruments start up and the self test will run. The sample counter shows the number of analysed samples since first power and the Software Version shows the version of the instruments software.	Y
	After start-up, Program 1 is loaded and the Analyse menu is displayed.	Y
Turn on the cold water tap	No visible reaction	Y
Press the "Manual" view	The Manual menu is opened	Y
Open the door with the handle, place the test tube and receiver flask in position. Close the door.		Y
Select <b>Dilution</b> and press <b>Start</b>	Water is added to the tube	Y
Select <b>Alkali</b> and press <b>Start</b>	Alkali is added to the tube	Y
Select <b>Steam</b> and press start	After heating up, steam is entering the tube	Y
Select <b>Drain</b> and press <b>Start</b>	The tube is drained	Y

## 6 Summary of Deviations/Comments

Deviations from above requirements are specified below and any corrective actions are noted.

Deviation	Action	Comment

## 7 IQ Documentation

Upon successful completion and recording of all instructions above, sign and date this sheet below. If required by customer, leave one signed copy with instrument.

If customer's internal procedures require further reporting or witnessing of results, execute those procedures as required.

Installed By: Pannipa Onnon  
 Company: Foss SEA  
 Customer Name: United Analyst and Engineering  
 Company: United Analyst and Engineering  
 Date completed: July 25, 2022



## Kjeltec™ 8100 Distillation Unit

This OQ applies to Kjeltec 8100 Distillation Unit manufactured by FOSS Analytical. The operation qualification is performed by FOSS trained service personnel.

## 1 Intended Use

Kjeltec 8100 is intended for laboratory use analyzing parameters as specified in FOSS Analytical Application Notes.

## 2 Purpose

This procedure is designed to test the function of the instrument according to factory test specifications:

- Alkali volume
- Distillation Accuracy
- Distillation Repeatability

## 3 Identification

Description	Serial Number
Kjeltec 8100 Distillation Unit, 200-240 V 50/60 Hz	91 99052

## Dedicated Analytical Solutions

FOSS Analytical AS  
65 Slangerupgade  
DK-3400 Hillerød  
Denmark

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## 4 Performance

## 4.1 Verify the dispensed volumes of reagents

**Note!** To verify the dispensed volumes of reagents a triple test should be done to be statistic correct. Then calculate a mean value.

- Choose "Manual" in the menu. (When starting up the instrument Program 1 is loaded)
- Open the safety door by pressing **Open** and place a tube in the instrument. Close the safety door.

## Water

- Press **Dilution** and then press **Start**. 80 ml of water will be filled into the tube.
- Measure the collected water in a graduated measuring glass and note the result in table 1 below.
- Check acceptance criteria in the table and make the judgment if passed or not.

**Note!** If the water volume needs to be calibrated, go to 4.8.5 Dilution Pump Calibration in the User Manual.

## Alkali

- Press **Alkali** and then press **Start**. 50 ml of alkali will be filled into the tube.
- Measure the collected alkali in a graduated measuring glass and note the result in table 1 below.
- Check acceptance criteria in the table and make the judgment if passed or not.

Table 1 Volume control

Test	Result	Expected result	Passed (Y/N)
Water volume	$\frac{75}{75}$ ml $\frac{75}{75}$ ml $\frac{75}{75}$ ml Mean $\frac{75.67}{75}$ ml	76- 84 ml	Y
Alkali volume	$\frac{47}{47}$ ml $\frac{47}{47}$ ml $\frac{47}{47}$ ml Mean $\frac{47.33}{47}$ ml	47- 54 ml	Y

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## 4.2 Verify the distillation procedure, accuracy and precision

The distillation principle is to convert ammonium ( $\text{NH}_4^+$ ) into ammonia ( $\text{NH}_3$ ) by using an alkali (NaOH) and thereafter steam distil it into a receiver flask containing boric acid and titrate with standard acid solution using colorimetric end-point detection. Ammonium sulphate, a substance with known ammonia content, can be used to check the accuracy of the distillation. The recovery is calculated from obtained result.

The way to perform this test will be described in the following.

## Chemical Check

Use ammonium sulphate ( $\text{NH}_4)_2\text{SO}_4$ , purity > 99.5 % \*)

Mol. weight = 132.14 g/mol, Nitrogen content in ammonium sulphate (99.5 %) = 21.09% \*)

## Analysis conditions according to AN 300

Water	80 ml
Alkali	50 ml NaOH (40%w/w)
Receiver solution	30 ml boric acid (4%)
Distillation time	5 minutes
SA/E	5 seconds
Titrant	0.2N HCl

## For reagent preparation see Appendix A

- Start the instrument and run two blanks without chemicals according to above analysis conditions, distil into a receiver flask containing boric acid. Titrate with a standard acid solution using colorimetric end-point detection. If the blanks are less than 0.2 ml continue with the recovery tests.
- Weight 0.15 g ammonium sulphate into a tube. Prepare 6 samples (tubes).
- Run the six samples according to above analysis conditions. Titrate with a standard acid solution using colorimetric end-point detection.
- Calculate the recovery according to below equations. Expected results of recovery should be 100%±1%.

Recovery test	Result	Expected result	Passed (Y/N)
Blank value (water blank)	1. 0.03 ml 2. 0.19 ml	0.05-0.20 ml	Y
Recovery	1. 100.38 % 2. 100.38 % 3. 100.45 % 4. 99.91 % 5. 99.92 % 6. 100.81 %		
Accuracy	Mean Value: 100.03	99-101%	Y
Precision	SD: 0.552	SD <1%	Y

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**\*) Note!** Please also note that the below calculations must be adjusted if other purity levels of ammonium salts are used. A certificate for the chemical supplier should be available

Purity	Nitrogen content
99,5%	21.09%
99,6%	21.12%
99,7%	21.14%
99,8%	21.16%
99,9%	21.18%

$$\% \text{ Nitrogen} = \frac{(ml_{\text{sample}} - ml_{\text{blank}}) \times N \times 14,007 \times 100}{mg_{\text{sample}}} \quad \begin{matrix} \nearrow 0.1095 \\ 21.72 \end{matrix}$$

N = Normality of titrant to 4 places of decimal.

$$\% \text{ Recovery} = \frac{\% \text{ Nitrogen}}{21.09} \times 100$$

$$mg_{\text{sample}} = 0.1598 \quad 21.56$$

- 1
- 2
- 3
- 4
- 5
- 6

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## 5 Summary of Deviations/Comments

Deviations from above requirements are specified below and any corrective actions are noted.

Deviation	Action	Comment

## 6 OQ Documentation

Upon successful completion of tests above, sign and date this sheet below. If required by customer, leave one signed copy with instrument.

If customer's internal procedures require further reporting or witnessing of results, execute those procedures as required.

Performed By: \_\_\_\_\_  
Company: \_\_\_\_\_  
Customer Name: \_\_\_\_\_  
Company: \_\_\_\_\_  
Date completed: \_\_\_\_\_

## 7 Appendix A

### 7.1 Preparation of Reagents

#### 7.1.1 Alkali

To convert ammonium into ammonia an excess of sodium hydroxide is necessary.

Use 400 g NaOH per litre of solution. Commercially available in concentrations up to 50 %. Do not use concentrations above 40 % as this will lead to crystal formation impairing the function of the pumps. If you can only buy concentrations > 40 %, dilute it before use.

#### 7.1.2 Titrant acid, determination of concentration

To be able to achieve accurate nitrogen / protein results, one must be quite sure that the HCl (hydrochloric acid) concentration is what it is supposed to be. A titration against a predetermined solution of sodium carbonate as described below is thus necessary. Incorrect HCl concentration can otherwise cause substantial errors.

- Standard substance**  
Weigh approx. 10 g of anhydrous sodium carbonate ( $\text{Na}_2\text{CO}_3$ ). Use a mortar to make a fine powder. Dry it for 1 h at 265 °C or 2 h at 200 °C. After cooling in a desiccator, transfer the sodium carbonate to a beaker with a tight lid. Store it in a desiccator.
- Indicator solutions**  
Dissolve 0.1 g methyl red in 100 ml methanol. Dissolve 0.1 g bromocresol green in 100 ml methanol.
- Procedure**  
Weigh approx. 0.4 g of the standard substance, using an analytical balance, note the weight ( $W_1$ ). Transfer the sodium carbonate to a receiver flask and add 40 ml of  $\text{H}_2\text{O}$  (distilled or deionized). Add 8 drops from each of the indicator solutions. Titrate to pink. Note the amount in ml used ( $A_1$ ). Boil this solution for a few minutes. The solution will turn green. Cool rapidly to room temperature under running water. Continue the titration until the next pink colour change occurs. Note also this volume ( $A_2$ ). Boil the solution for a few minutes. Cool rapidly to room temperature under running water. Continue the titration until the next pink colour occurs. Note also this volume ( $A_3$ ).  
**Note!** Temperature changes will influence the volume and the concentration of the titrant solution. The working temperature of the titrant should approximate that of its temperature during standardization. If temperature corrections are necessary, sufficient accuracy may be obtained by use of a correction table. (AOAC 942.25)

### 7.2 Calculation

$$\text{Molarity (M)} = \frac{18,870 \times W_1}{(A_1 + A_2 + A_3)}$$

**Note!** Concentration must be accurate to four digits, i.e. 0.2000 M.

**Note!** The colour change of this official procedure (AOAC 936.15) may be difficult to see, therefore a pH meter or a mixed indicator (e.g. 0.1 g Methyl red and 0.1 g Bromocresol green in 100 ml methanol) will make it much easier to perform.

### 7.3 Receiver Solution

Boric acid 4 % with bromocresol green / methyl red indicator solution

In order to obtain accurate results the receiver solution is adjusted so that a small (0.05-0.20 ml) positive blank is obtained when running a blank sample. The 4 % boric acid receiver solution is prepared by dissolving 400 g of boric acid in about 5-6 l very hot deionized water. Mix and add more hot deionized water to a volume of about 9 l. Cool the solution to room temperature and add 100 ml of bromocresol green solution (100 mg in 100 ml methanol) and 70 ml of methyl red solution (100 mg in 100 ml of methanol). Dilute to 10 l with deionized water and mix carefully.

**Note!** The addition of alkali is to achieve a positive blank value. This should, however, be kept between 0.05 - 0.20 ml titrant, to obtain good repeatability when testing blanks.

Adjustment of the boric acid is made by the following procedure:

- Transfer 25 ml boric acid solution to a receiver flask and add 100 ml of distilled water. If the solution in the flask is still red, titrate with 0.1 M sodium hydroxide solution until a neutral grey colour is obtained. Calculate the amount of sodium hydroxide solution necessary to adjust the boric acid solution in the 10 l flask with the formula: ml 1.0 M alkali = ml titrant x 40
- Add the calculated amount of 1.0 M alkali solution to the boric acid solution. Mix.
- To check proceed as follows using 25 ml of the boric acid solution. Run a blank. If the value of this blank is high (0.5 ml of 0.2 M HCl) the boric acid is incorrectly adjusted. This might create irregular blanks. For correction add HCl directly into the boric acid tank, mix it carefully and repeat until a reading of 0.05 - 0.20 ml HCl is obtained. If a positive blank is not achieved, add further small quantities of 1 M NaOH and repeat the check until a satisfactory value is achieved.

## FOSS Performance Qualification

### Kjeltec™ 8100 Distillation Unit Tecator™ 2508/2520 Digestor

#### 1 Scope

This PQ applies to the Digestion system 2508/2520 (including exhaust and scrubber unit) and Kjeltec 8100 Distillation Unit manufactured by FOSS Analytical. The user of the instrument performs the PQ.

#### 2 Intended Use

The Digestion system (including exhaust and scrubber) and Kjeltec 8100 Distillation Unit are intended for laboratory use analyzing parameters as specified in FOSS Application Notes.

#### 3 Purpose

The guidelines are intended to assist the user in successfully developing Performance Qualifications for the specific application(s) to which the instrument is applied.

The Performance Qualification (PQ) includes the process of demonstrating that the Digestion system 2508/2520 (including exhaust and scrubber unit) and the Kjeltec 8100 Distillation unit consistently perform according to a specification appropriate for its routine use. Main activities in the PQ phase are:

- Preventive maintenance
- On-going verification tests

This document suggests routines to fulfill the requirements for an acceptable PQ but the final procedure should be adapted to local routines for similar equipment.

#### 4 Definition of Test Procedures

##### 4.1 Preventive Maintenance

Maintenance of the Kjeltec 8100 should be performed according to the instructions in manual, see User Manual Kjeltec 8100/8200 Distillation Unit, chapter 5. Maintenance. A yearly service is recommended (service agreement).

Maintenance of the Digestion block (including exhaust and scrubber) should be performed according to instruction in the user manual, see User Manual Tecator Digestor, chapter 5. Maintenance.

##### Dedicated Analytical Solutions

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### 6.2.3 Every 1-3 Months Maintenance

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## 6.2 FossCare™ Customer Log

### 6.2.1 Daily Maintenance

Date																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						</
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#### 6.2.4 Additional Maintenance

[illegible]

## เอกสารไม่ควบคุม

### 6.2.2 Weekly Maintenance

[illegible]

## เอกสารไม่ควบคุม



## Verification Report

**Certificate No.:** 2302413-001-01  
**Equipment:** HEATING BLOCK DIGESTION  
Model: 2520 Serial No.: 91794469  
Resolution: 1 °C ID No.: UAE.WAS.011/2560  
Manufacturer: FOSS

**Date of Calibration:** 30-31 March 2023 **Page 3 of 4**  
**Calibration point:** 380 °C  
**Calibration result:** 380 °C

### Reporting of Temperature

Block No.	UUC* Setting (°C)	UUC* Reading (°C)	Stability (±°C)	Standard Thermometer (°C)	Uncertainty (±°C)
1	380	380	0.96	377.74	2.1
2	380	380	0.40	377.28	2.1
3	380	380	1.18	377.82	2.1
4	380	380	0.44	377.19	1.6
5	380	380	0.11	377.30	1.6
6	380	380	0.14	377.90	1.6
7	380	380	1.17	373.85	2.1
8	380	380	0.33	376.96	2.1
9	380	380	0.14	374.18	2.1
10	380	380	0.96	378.56	2.0
11	380	380	1.04	378.34	2.0
12	380	380	0.35	378.06	2.0
13	380	380	0.48	377.05	1.6
14	380	380	0.38	379.19	1.6
15	380	380	0.50	377.48	1.6
16	380	380	0.48	378.33	1.7
17	380	380	0.71	377.60	1.7
18	380	380	0.35	376.77	1.7
19	380	380	0.84	377.06	1.8
20	380	380	0.41	378.58	1.8

### Note:

- UUC\* = Unit Under Calibration
- Immersion depth of standard thermometer in tube level high of sand is equal heater plate of UUC.
- Stability = One-half of the greatest maximum difference of measured temperatures at one sensors, for at least half an hour after reaching steady state.

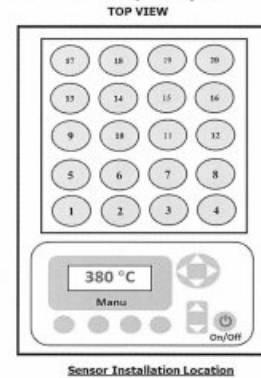
F-CS-009 Revision: 01 Date: 20-04-65

## Verification Report

**Certificate No.:** 2302413-001-01  
**Equipment:** HEATING BLOCK DIGESTION  
Model: 2520 Serial No.: 91794469  
Resolution: 1 °C ID No.: UAE.WAS.011/2560  
Manufacturer: FOSS

**Date of Calibration:** 30-31 March 2023 **Page 4 of 4**  
**Calibration point:** 380 °C  
**Calibration result:** Continued

Figure 1. Location of Reference Standard and Block Diagram of Digestion Unit



Sensor Installation Location

### Note:

- UUC\* = Unit Under Calibration
- Immersion depth of standard thermometer in tube level high of sand is equal heater plate of UUC.
- Stability = One-half of the greatest maximum difference of measured temperatures at one sensors, for at least half an hour after reaching steady state.

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

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

**CERTIFICATE OF CALIBRATION**

**Certificate No.:** SP23-007 **Page 1 of 5**  
**Customer:** United Analyst and Engineering Consultant Co., Ltd. (Head Office)  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260  
**Location of calibration:** Laboratory 315  
**Equipment:** UV-Vis Spectrophotometer  
**Manufacturer:** Hitachi  
**Model:** U-1900  
**Serial No.:** 2021-064  
**ID No.:** UAE.WAS.006/2552  
**Received Date:** 6 January 2023  
**Calibration Date:** 6 January 2023  
**Issue Date:** 10 January 2023  
**Condition Instrument:** Used

**Calibrated by:** (Mr. Tanawat Ritidach) **Approved by:** (Ms. Chonchicha Sangngern)  
Technical Manager Quality Manager

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

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 DQE Services Co., Ltd.

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

**REPORT OF CALIBRATION**

**Certificate No.:** SP23-007 **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	95935	22 October 2023
Absorbance Standard set	25757	95929	22 October 2023
Wavelength Standard set	25806	95916	22 October 2023
Wavelength Standard set	25758	95915	22 October 2023

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

**Spectral Band Width of UUC:** 4.0 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.





## REPORT OF CALIBRATION

Certificate No. : SP23-007

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
	0.5787	0.575	0.0037	0.0031	2.00
	1.0490	1.044	0.0050	0.0029	2.00
	2.1900	2.181	0.0090	0.0080	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5607	0.558	0.0027	0.0034	2.00
	1.0247	1.021	0.0037	0.0035	2.00
	2.1229	2.115	0.0079	0.0081	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5236	0.520	0.0036	0.0030	2.00
	0.9634	0.961	0.0024	0.0029	2.00
	1.9763	1.968	0.0083	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5191	0.518	0.0011	0.0031	2.00
	1.0003	1.000	0.0003	0.0033	2.00
	1.9987	1.993	0.0057	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5523	0.552	0.0003	0.0030	2.00
	1.0809	1.082	-0.0011	0.0030	2.00
	2.0391	2.031	0.0081	0.0080	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5601	0.562	-0.0019	0.0032	2.00
	1.0512	1.052	-0.0008	0.0030	2.00
	1.9294	1.923	0.0064	0.0079	2.00

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FM-708-02 R01 1/11/2021



## REPORT OF CALIBRATION

Certificate No. : SP23-007

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## Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7478	0.743	0.0048	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8686	0.861	0.0076	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2912	0.291	0.0002	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6448	0.639	0.0058	0.0055	2.00

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FM-708-02 R01 1/11/2021



## REPORT OF CALIBRATION

Certificate No. : SP23-007

Page 5 of 5

## Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.54	240.8	0.74	0.18	2.00
279.40	278.5	0.90	0.18	2.00
288.70	288.0	0.70	0.18	2.00
334.22	333.5	0.72	0.18	2.00
361.26	360.5	0.76	0.18	2.00
418.48	417.8	0.68	0.21	2.00
446.70	445.9	0.80	0.18	2.00
453.20	452.5	0.70	0.18	2.00
460.06	459.5	0.56	0.18	2.00
536.90	536.0	0.90	0.18	2.00
637.94	637.1	0.84	0.18	2.00
440.74	440.0	0.74	0.18	2.00
472.22	471.5	0.72	0.18	2.00
513.70	513.0	0.70	0.18	2.00
528.72	528.0	0.72	0.18	2.00
574.60	574.0	0.60	0.18	2.00
585.48	584.6	0.88	0.20	2.00
684.63	684.0	0.63	0.18	2.00
740.27	740.0	0.27	0.20	2.00
748.28	747.5	0.78	0.18	2.00
807.16	806.5	0.66	0.18	2.00
879.70	879.0	0.70	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

- The result expanded uncertainty of measurement U 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%

- \* Indicates not TIS accredited

- End of Certificate -

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FM-708-02 R01 1/11/2021



## CERTIFICATE OF CALIBRATION

Certificate No. : SP23-008

Page 1 of 5

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

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

Location of calibration : Laboratory 213

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-2900

Serial No. : 21E22-009

ID No. : UAE.WAT.051/2564

Received Date : 6 January 2023

Calibration Date : 6 January 2023

Issue Date : 10 January 2023

Condition Instrument : Used

Calibrated by :

Approved by :

( Mr.Tanawat Ritidach )

( Ms. Chonthicha Sangngem )

Technical Manager

Quality Manager

The calibration result is applied only to the above calibrated item and was found accurate as 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 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 DQE Services Co., Ltd.

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FM-708-02 R01 1/11/2021



## REPORT OF CALIBRATION

Certificate No. : SP23-008

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Environment Condition : Ambient Temperature  $25 \pm 5$  °CRelative humidity  $55 \pm 20$  %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	95935	22 October 2023
Absorbance Standard set	25757	95929	22 October 2023
Wavelength Standard set	25806	95916	22 October 2023
Wavelength Standard set	25758	95915	22 October 2023

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

Institute of Standards and Technology (NIST) through Starna 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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## REPORT OF CALIBRATION

Certificate No. : SP23-008

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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
	0.5787	0.574	0.0047	0.0031	2.00
	1.0490	1.044	0.0050	0.0029	2.00
	2.1900	2.182	0.0080	0.0080	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5607	0.558	0.0027	0.0034	2.00
	1.0247	1.021	0.0037	0.0035	2.00
	2.1229	2.114	0.0089	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5236	0.520	0.0036	0.0030	2.00
	0.9634	0.960	0.0034	0.0029	2.00
	1.9763	1.969	0.0073	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5191	0.516	0.0031	0.0031	2.00
	1.0003	0.997	0.0033	0.0033	2.00
	1.9987	1.991	0.0077	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5523	0.550	0.0023	0.0030	2.00
	1.0809	1.078	0.0029	0.0030	2.00
	2.0391	2.032	0.0071	0.0080	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5601	0.558	0.0021	0.0031	2.00
	1.0512	1.049	0.0022	0.0030	2.00
	1.9294	1.922	0.0074	0.0079	2.00

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## REPORT OF CALIBRATION

Certificate No. : SP23-008

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## Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7478	0.744	0.0038	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8686	0.863	0.0056	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2912	0.290	0.0012	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6448	0.639	0.0058	0.0055	2.00

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FM-708-02 R01 1/11/2021



## REPORT OF CALIBRATION

Certificate No. : SP23-008

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## 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	287.9	-0.09	0.18	2.00
334.06	333.5	0.56	0.18	2.00
360.93	360.5	0.43	0.18	2.00
418.59	418.0	0.59	0.18	2.00
445.94	445.8	0.14	0.18	2.00
453.66	453.0	0.66	0.18	2.00
460.02	459.5	0.52	0.18	2.00
536.59	536.5	0.09	0.18	2.00
637.98	638.0	-0.02	0.18	2.00
431.38	430.6	0.78	0.18	2.00
472.50	472.0	0.50	0.18	2.00
513.47	513.0	0.47	0.18	2.00
528.88	528.5	0.38	0.18	2.00
573.17	573.7	-0.53	0.18	2.00
585.35	585.0	0.35	0.20	2.00
684.40	684.0	0.40	0.18	2.00
740.72	740.5	0.22	0.20	2.00
748.55	748.5	0.05	0.18	2.00
807.03	807.0	0.03	0.18	2.00
879.28	879.5	-0.22	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

- The result expanded uncertainty of measurement U 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%

- \* Indicates non TISI accredited

- End of Certificate -

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FM-708-02 R01 1/11/2021







Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2304-0156OC-3  
Procedure Used :-

Cert. No.: 23TM372  
Page : 2 of 3

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).  
The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

##### 1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34972A	MY59003411	22LM165	26 Nov 2023

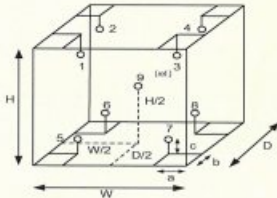
2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Not Available



Environment during calibration		
	Beginning	Finished
Temp. ( °C )	27	28
REL.Humid. ( % )	44	41
AC Supply ( Volt )	221	220

Position :	Ref. Std. ID No.:
1	20RTD-2/1
2	20RTD-2/2
3	20RTD-2/3
4	20RTD-2/4
5	20RTD-2/5
6	20RTD-2/6
7	20RTD-2/7
8	20RTD-2/8
9 (ref.)	20RTD-2/9

#### Probe Installation Details :

#### Dimension of Chamber :

a = 10 cm  
b = 10 cm  
c = 10 cm  
D = 0.62 m  
W = 1.2 m  
H = 1.2 m  
Capacity = 0.89 m<sup>3</sup>

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a 1158257



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2304-0156OC-3  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Not Available

Cert. No.: 23TM372  
Page : 3 of 3

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Coverage Factor k
20.0	20.0	19.9	0.40	0.72	0.97	2

Calibration Point ( °C )	Measured Temperature ( °C )									Uncertainty ( ± °C )
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	20.236	20.278	19.949	19.981	20.313	20.369	19.887	19.828	19.755	0.59

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

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature 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.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.  
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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a 1151821



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3090-29 FAX. 0-2719-9484



Cert. No.: 23TM375  
Page : 1 of 3

## Certificate of Calibration

Equipment : BOD Incubator

Manufacturer : ARCO

Model : UR-1320

Serial No. : -

ID No. : UAE.WAO.018/2551

Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260

Location : Lab Floor 2

Received Order : 11 April 2023

Calibration Date : 12 April 2023

Ambient Temperature : ( 26 ± 10 ) °C

Relative Humidity : ( 50 ± 30 ) %

Calibrated by : Krisda Malee

Approved by :

( ) Ponthippa Tameyakul

(✓) Malee Butkruea

( ) Suwit Imjai

Issue Date : 24 April 2023

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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A 0053360



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2304-0156OC-2  
Procedure Used :-

Cert. No.: 23TM375  
Page : 2 of 3

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).  
The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

##### 1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34972A	MY59003411	22LM165	26 Nov 2023

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

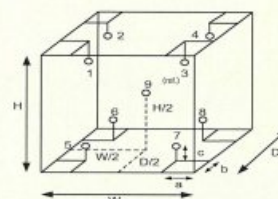
3. This certification is traceable to the International System of Unit.

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	28	27
REL.Humid. ( % )	42	45
AC Supply ( Volt )	219	220



#### Probe Installation Details :

#### Dimension of Chamber :

a = 10 cm  
b = 10 cm  
c = 10 cm  
D = 0.62 m  
W = 1.2 m  
H = 1.2 m  
Capacity = 0.89 m<sup>3</sup>

Position :	Ref. Std. ID No.:
1	20RTD-2/1
2	20RTD-2/2
3	20RTD-2/3
4	20RTD-2/4
5	20RTD-2/5
6	20RTD-2/6
7	20RTD-2/7
8	20RTD-2/8
9 (ref.)	20RTD-2/9

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a 1158259





Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2304-0156OC-2  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Not Available

Cert. No.: 23TM375  
Page : 3 of 3

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Coverage Factor k
20.0	20.0	20.0	0.48	0.42	1.2	2

Calibration Point ( °C )	Measured Temperature ( °C )									Uncertainty ( ± °C )
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	20.040	20.170	20.263	20.093	19.749	19.704	19.920	20.191	20.020	0.66

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

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature 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.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

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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1158258



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



Cert. No.: 23TM729  
Page : 1 of 3

## Certificate of Calibration

Equipment : Incubator  
Manufacturer : Memmert  
Model : IPP 260  
Serial No. : V618.0033  
ID No. : UAE.MIC.021/2561  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : Microbiology Laboratory (302)  
Received Order : 27 April 2023  
Calibration Date : 27 April 2023  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
Calibrated by : Tawatchai Pama

Approved by :   
Approved Signatory

( / ) Ponthipha Tameyakul  
( / ) Mailee Buikruea  
( / ) Suwit Imjai

Issue Date : 11 May 2023

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

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Approval of the head of Corporate Services & Equipment Calibration and Testing Services.

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Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2304-0461OC-7  
Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector ( RTD ).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1 ) Data Acquisition	34972A	MY57013711	22LM93	02 Jul 2023

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

3. This certification is traceable to the International System of Unit.

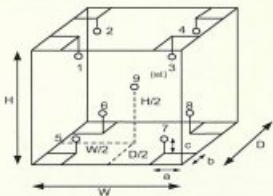
Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	20	21
REL.Humid. ( % )	72	77
AC Supply ( Volt )	230	231

Position :	Ref. Std. ID No.
1	18-18RTD-01
2	18-18RTD-02
3	18-18RTD-03
4	18-18RTD-04
5	18-18RTD-05
6	18-18RTD-10
7	18-18RTD-07
8	22-18RTD-08
9 (ref.)	18-18RTD-09



Probe Installation Details :

Dimension of Chamber :

a = 10 cm	D = 0.50 m
b = 10 cm	W = 0.64 m
c = 10 cm	H = 0.80 m
	Capacity = 0.26 m³

เอกสารไม่ควบคุม



Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2304-0461OC-7  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 23TM729  
Page : 3 of 3

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Coverage Factor k
22.0	22.0	22.0	0.058	0.11	0.19	2
44.0	44.0	44.0	0.066	0.50	0.87	2

Calibration Point ( °C )	Measured Temperature ( °C )									Uncertainty ( ± °C )
	1	2	3	4	5	6	7	8	9 (ref.)	
22.0	22.009	22.038	21.971	22.005	22.004	22.009	21.941	21.959	22.022	0.30
44.0	44.393	44.447	44.029	44.204	43.899	43.895	43.637	43.923	44.085	0.30

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

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature 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.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

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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Cert. No.: 23TM192  
Page : 1 of 3

## Certificate of Calibration

Equipment : Incubator  
Manufacturer : Binder  
Model : BD 53 E2  
Serial No. : 13-07343  
ID No. : UAE.MIC.005/2558  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : Microbiology Laboratory  
Received Order : 15 February 2023  
Calibration Date : 15 February 2023  
Ambient Temperature :  $(26 \pm 10) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 30) \%$   
Calibrated by : Suwit Imjai  
Approved by :   
( ) Ponnthippa Tameyakul  
( ) Malee Butkruea  
Issue Date : 24 February 2023

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

เอกสารไม่ควบคุม



Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2302-0295OC-1  
Procedure Used :-

Cert. No.: 23TM192  
Page : 2 of 3

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).  
The temperature scale used was based on ITS-90.

### Condition of this result of calibration

#### 1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34972A	MY58003411	22LM165	26 Nov 2023

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

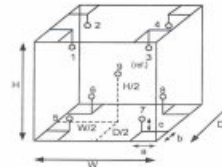
3. This certification is traceable to the International System of Unit.

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	22	23
REL.Humid. ( % )	65	61
AC Supply ( Volt )	231	231



#### Probe Installation Details :

Dimension	Value
a = 5.0 cm	D = 0.33 m
b = 5.0 cm	W = 0.40 m
c = 5.0 cm	H = 0.40 m
	Capacity = 0.053 m <sup>3</sup>

Position :	Ref. Std. ID No.:
1	20RTD-2/1
2	20RTD-2/2
3	20RTD-2/3
4	20RTD-2/4
5	20RTD-2/5
6	20RTD-2/6
7	20RTD-2/7
8	20RTD-2/8
9 (ref.)	20RTD-2/9

เอกสารไม่ควบคุม



Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2302-0295OC-1  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 23TM192  
Page : 3 of 3

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Uncertainty ( ± °C )	Coverage Factor k
35.0	35.4	35.4	0.037	0.56	0.86	0.30	2

Calibration Point ( °C )	Measured Temperature ( °C )								
	Position								
35.0	1	2	3	4	5	6	7	8	9 (ref.)
	35.256	35.308	35.116	35.453	34.700	34.798	34.718	34.657	34.938

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

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature 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.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

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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เอกสารไม่ควบคุม



Cert. No.: 23TM194  
Page : 1 of 3

## Certificate of Calibration

Equipment : Water Bath  
Manufacturer : Memmert  
Model : WNE 14  
Serial No. : L416.0612  
ID No. : UAE.MIC.003/2580  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : Microbiology Laboratory  
Received Order : 15 February 2023  
Calibration Date : 15 February 2023  
Ambient Temperature :  $(26 \pm 10) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 30) \%$   
Calibrated by : Suwit Imjai  
Approved by :   
( ) Ponnthippa Tameyakul  
( ) Malee Butkruea  
Issue Date : 24 February 2023

The Uncertainties are for a confidence probability of approximately 95%

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เอกสารไม่ควบคุม





Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2302-0295OC-3  
Procedure Used :-

Cert. No.: 23TM194  
Page : 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT04 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 Model Serial No. Cert. No. Due Date  
1) Data Acquisition 34972A MY59003411 22LM165 26 Nov 2023

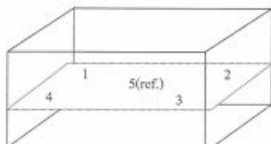
2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

	Environmental		AC Voltage Supply
	( °C )	( %R.H. )	( Volt )
Beginning of Calibration	22	65	231
Finished of Calibration	22	63	230



Front

Position :	Ref. Std. ID No.:
1	4804539-001
2	4804539-002
3	4804539-003
4	4804539-004
5(ref.)	4804539-005

เอกสารไม่ควบคุม



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2302-0295OC-3  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source

Cert. No.: 23TM194  
Page : 3 of 3

Calibration point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Average* Standard Reading ( °C )				
			Position				
44.5	44.5	44.6	1	2	3	4	5 (ref.)
			44.520	44.509	44.498	44.552	44.530

Calibration point ( °C )	Uniformity ( °C )	Stability ( ± °C )	Uncertainty ( ± °C )	Coverage Factor k
44.5	0.077	0.037	0.15	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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เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG BANGKOK 10250  
TEL: 0-2717-3000-27 FAX: 0-2719-9484



Cert. No.: 22TM1065  
Page.: 1 of 3

## Certificate of Calibration

Equipment : Water Bath  
Manufacturer : Memmert  
Model : WB 14  
Serial No. : M01.0569  
ID No. : UAE.MIC.004/2544  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : Microbiology Laboratory  
Received Order : 11 July 2022  
Calibration Date : 11 - 12 July 2022  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 10 ) %  
Calibrated by : Man Pattanapongpaiboon  
Approved by :  
( ) Pornthippa Tameyakul  
( ✓ ) Malee Butkruea  
( ) Suwit Imjai  
Issue Date : 18 July 2022

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2207-0245OC-5  
Procedure Used :-

Cert. No.: 22TM1065  
Page.: 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT04 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 Model Serial No. Cert. No. Due Date  
1) Data Acquisition 34972A MY57013823 22LM24 26 Feb 2023

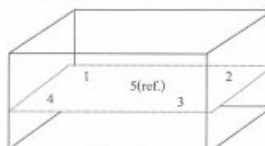
2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

	Environmental		AC Voltage Supply
	( °C )	( %R.H. )	( Volt )
Beginning of Calibration	25	59	223
Finished of Calibration	25	63	224



Front

Position :	Ref. Std. S/N.:
1	4804539-006
2	4804539-007
3	4804539-008
4	4804539-009
5(ref.)	4804539-010

เอกสารไม่ควบคุม



Equipment : Water Bath  
 Condition As-Received : Used Item  
 Reference : 2207-02450C-5  
 Result of Calibration : ( ° ) Without Adjustment  
 Function of UUC\* : Temperature Source

Cert. No.: 22TM1085  
 Page.: 3 of 3

Calibration point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Average* Standard Reading ( °C )				
			Position				
			1	2	3	4	5 (ref.)
41.5	41.2	41.2	41.475	41.459	41.427	41.485	41.493

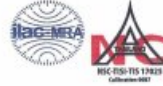
  

Calibration point ( °C )	Uniformity ( °C )	Stability ( ± °C )	Uncertainty ( ± °C )	Coverage Factor k
41.5	0.097	0.065	0.15	2

**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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## Certificate of Calibration

Equipment: Balance  
 Model: PX823  
 Serial No. (or ID.): C236754745  
 Manufacturer: Ohaus  
 Condition: New

Certificate No.: C01223732  
 Issued Date: 09 December 2022  
 Job No.: KSPR2215576  
 Page: 1 of 2

**Customer:** United Analyst and Engineering Consultant Co., Ltd.  
 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak Sub-District,  
 Phrakhanong District, Bangkok, THAILAND 10260

**Environment Condition:** Temperature 26 °C ± 0.5 °C  
 Humidity 53 %RH ± 3.9 %RH

**Calibration Place:** United Analyst and Engineering Consultant Co., Ltd. (301 Microbiology Room)  
 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak Sub-District,  
 Phrakhanong District, Bangkok, THAILAND 10260

**Calibration By:** Mr. Adisai Maknoi  
**Calibration Date:** 09 December 2022  
**The Method used:** In-house method, CAL-WI-47, based on UKAS Lab 14  
**Traceability:** This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Co., Ltd. Certificate No. C02221765

(Mr. Adisai Maknoi)  
 Person in charge

(Mr. Rungrod Jenkitrakulchai)  
 Authorized signatory

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 DKSH Technology Limited.

บริษัท เทคโนโลยี จำกัด  
 DKSH Technology Limited  
 2533 สุขุมวิท 41 แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260  
 2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260  
 Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/en/office-thailand

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CAL-FM-C01-14: 12 Sep 2022

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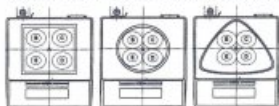


Certificate No.: C01223732 Page: 2 of 2

### Calibration Results:

Without Adjustment

**Eccentric Error:** Weight to be 1/3 or 1/2 of Maximum capacity, taken from the center of the pan as a zero reference.



Nominal Test Value 200 (g)					
Reference Points (g)					
A	B	C	D	E	
-	0.000	0.000	0.000	0.000	

**Repeatability:** Determination of the standard deviation of weighing balance., Readability 0.001 (g)

Nominal test value (g)	Standard Deviation
50	0.0004
500	0.0005

**Error of Indication from nominal or conventional mass value., Readability 0.001 (g)**

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Error of Indication (g)	Uncertainty (g)	k
1	1.0000	1.000	0.000	0.0010	2.03
5	5.0001	5.000	0.000	0.0010	2.03
10	10.0001	10.000	0.000	0.0010	2.03
20	20.0001	20.000	0.000	0.0010	2.03
50	50.0001	50.000	0.000	0.0010	2.03
100	100.0001	100.000	0.000	0.0011	2.03
200	200.0004	200.000	0.000	0.0011	2.02
300	300.0005	300.000	-0.001	0.0013	2.01
400	400.0008	400.001	0.000	0.0014	2.01
500	500.0003	500.000	0.000	0.0017	2.00
600	600.0004	600.000	0.000	0.0019	2.00

The End of Certificate

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Refer to Certificate No.: C01223732 Page: 1 of 2

### 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 indication 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, UKAS Lab14. 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

(Mr. Rungrod Jenkitrakulchai)  
 Authorized signatory

บริษัท เทคโนโลยี จำกัด  
 DKSH Technology Limited  
 2533 สุขุมวิท 41 แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260  
 2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260  
 Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/en/office-thailand

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CAL-FM-C01-14: 12 Sep 2022

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 DKSH Technology Limited  
 2533 สุขุมวิท 41 แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260  
 2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260  
 Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/en/office-thailand

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CAL-FM-C01-14: 12 Sep 2022



## Statements of conformity:

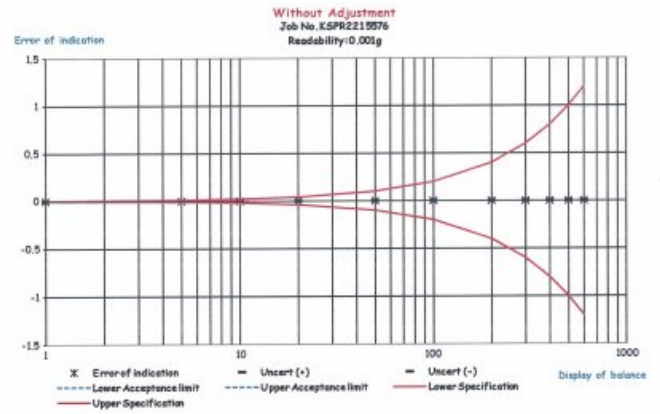
Without Adjustment

Readability: 0.001 g

Nominal Value g	Error of indication g	Guard band (w) g	Tolerance (±) g	Conformity
1	0.000	0.0010	0.002	Pass
5	0.000	0.0010	0.010	Pass
10	0.000	0.0010	0.020	Pass
20	0.000	0.0010	0.040	Pass
50	0.000	0.0010	0.100	Pass
100	0.000	0.0011	0.200	Pass
200	0.000	0.0011	0.400	Pass
300	-0.001	0.0013	0.600	Pass
400	0.000	0.0014	0.800	Pass
500	0.000	0.0017	1.000	Pass
600	0.000	0.0019	1.200	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



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL: 0-2717-3000-27 FAX: 0-2719-0484



Cert. No.: 22TM1121  
Page.: 1 of 3

## Certificate of Calibration

Equipment : Autoclave  
Manufacturer : ALP  
Model : CL-40L  
Serial No. : 807298  
ID No. : UAE.MIC.019/2560  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : 301 Room  
Received Order : 11 July 2022  
Calibration Date : 11 July 2022  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %

Calibrated by : Preecha Hiahib

Approved by :   
Approved Signatory

( ) Pornthippa Tameyakul  
( ) Malee Butkrues  
( ) Suwit Imjai

Issue Date : 18 July 2022

The Uncertainties are for a confidence probability of approximately 95%

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



Equipment : Autoclave  
Condition As-Received : Used Item  
Reference : 2207-02450C-7  
Procedure Used :-

Cert. No.: 22TM1121  
Page.: 2 of 3

Calibration were conducted using in-house calibration procedure GP-OT03 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T  
The temperature scale used was based on ITS-90.

### Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1 ) Data Acquisition	34970A	MY44080450	22LM46	28 Mar 2023

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

3. This certification is traceable to the International System of Unit.

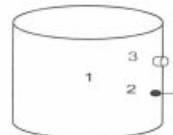
4. This result of calibration covers laboratory autoclaves for the sterilization of goods and material which could be infected with organisms categorized as Hazard Group 1, 2 and 3\*\*

(\*\* = Categorization of pathogens according to hazard and categories of containment, second edition, 1990 )  
It does not cover autoclaves for use with material infect with organisms in Hazard Group 4, for which complete containment and sterilization of infected condensate is considered to be essential.

This result of calibration does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical or veterinary purposes which are directly concerned with patient care, or those used for fabrics subjected to sterilization which are required to be dry at the end of cycle.

Result of Calibration :- ( \* ) Without Adjustment

Result of UUC\* : Temperature Source



	Environmental		
	( °C )	( %R.H. )	( Volt )
Beginning of Calibration	29	49	220
Finished of Calibration	32	48	220

Position	Description	Ref. Std. ID No.:
1 =	Center of chamber	22-14TC-01
2 =	Temperature sensor	22-14TC-02
3 =	Exhaust port	22-14TC-03



Equipment : Autoclave  
Condition As-Received : Used Item  
Reference : 2207-02450C-7  
Result of Calibration : ( ° ) Without Adjustment

Cert. No.: 22TM1121  
Page.: 3 of 3

Operating parameter Set : Temperature = 115 °C  
Sterilization period = 15 minute

UUC* Setting ( °C )	UUC* Reading ( °C )	Position	Average* Standard Reading ( °C )	Stability ( ± °C )	Pressure Reading ( MPa )	Uncertainty ( ± °C )	Coverage Factor <i>k</i>
116	116	1	116.523	0.14	0.08	0.90	2
		2	116.566				
		3	116.440				

Operating parameter Set : Temperature = 121 °C  
Sterilization period = 30 minute

UUC* Setting ( °C )	UUC* Reading ( °C )	Position	Average* Standard Reading ( °C )	Stability ( ± °C )	Pressure Reading ( MPa )	Uncertainty ( ± °C )	Coverage Factor <i>k</i>
122	122	1	122.503	0.19	0.12	0.91	2
		2	122.637				
		3	122.558				

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

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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เอกสารไม่ควบคุม



## CERTIFICATE OF CALIBRATION

Certificate No.: C0-1908005/22 Page 1 of total 4 pages

**Customer** WATER ANALYSIS CENTER CO., LTD.  
30/5 Soi Viphavadee 60, Viphavadee Rangsit Road,  
Kwaeng Taladbangkhen, Khet Laksi, Bangkok 10210

**Equipment** pH Meter  
**Manufacturer** METTLER TOLEDO **Model** SevenCompact S220  
**Serial No.** B327527211 **ID No.** WWL 0068  
**Description** Range : 0 - 14 pH, Resolution : 0.01 pH

**Environmental Conditions** Ambient Temperature: (20 ± 2) °C  
Relative Humidity: (50 ± 10) %  
Atmospheric Pressure: -

**Calibration Location** Jayhawks Laboratory (CL&GL)  
**Received Date** 19 August 2022  
**Calibration Date** 19 August 2022

**Date of Issue** 22 August 2022

**Checked by** [Signature] **Approved by** [Signature]  
Act as Technical Manager Representative of Managing Director

( ) ( Krisyosol K. ) ( ) ( Sakda Y. )  
( ) ( Patiphan K. ) ( ) ( Onnappa P. )  
( ) ( Pongsak H. ) ( ) ( Nitiphong K. )  
( ) ( Kanung C. ) ( ) ( Nonthachai K. )  
( ) ( Pramong P. ) ( ) ( Noppol P. )

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FE-169 REV.02 02/24/21

Certificate No.: C0-1908005/22 Page 3 of total 4 pages

Measurement Results (Cont.):

2. Calibration of pH Electrode (Serial No.: 3322791)

pH Standard Solution (pH)	Measured Value		Uncertainty (± pH)
	(pH)	(mV)	
4.01	4.01	185.9	0.013
7.01	7.01	9.3	0.013
10.00	10.01	-164.9	0.013

Note : Adjust Curve to Buffer Solution pH (4,7,10)  
Temperature stability of micro bath : 25 ± 0.2°C

The above reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor  $k = 2.00$ , providing a level of confidence approximately 95%.

Certificate No.: C0-1908005/22 Page 2 of total 4 pages

Reference Method:

- The calibration method used was CP-178 based on an in-house method.
- This certificate can be traceable to the national standards, which is realized the shown measurement units according to the International System of Units (SI Units).

Reference Standard:

Type	pH Value	Lot No.	Due Date	Traceability
pH Standard Solution	4.01	081020	Jan. 22, 2023	NIMT
	7.01	020221	Jan. 18, 2023	
	10.00	091020	Feb. 7, 2023	

Type	Model	Serial No.	Certificate No.	Due Date	Traceability
Documenting Process Calibrator	753	3101007	10-0804001/22	Apr. 7, 2023	THC
Digital Thermometer with Sensor	1523 / 5622	1709138 / 4605984-005	10-1006004/22	Jun. 9, 2023	

Remark: This certificate is traceable to the International System of Unit (SI Unit) through:

- NIMT, National Institute of Metrology (Thailand).
- THC, Thai Heart Calibration Co., Ltd.

Measurement Results:

1. Function Simulated pH Meter

Standard Applied (mV)	Nominal Value (pH)	UUC Reading		Uncertainty (± mV)
		pH	mV	
177.48	4.00	4.01	177.4	0.060
0.00	7.00	7.00	0.0	0.060
-177.48	10.00	10.01	-177.4	0.060

UUC : Unit Under Calibration

Note : Adjust Curve to simulate pH (4,7,10)

FE-169 Calibrated by Kittipong REV.02 02/24/21

Certificate No.: C0-1908005/22 Page 4 of total 4 pages

Reference Method:

- The calibration method used was CP-096 based on an in-house method.
- The temperature scale used was an ITS-90.
- This certificate can be traceable to the national standards, which is realized the shown measurement units according to the International System of Units (SI Units).

Reference Standard Instruments:

Type	Model	Serial No.	Cert. No.	Due Date	Traceability
Thermometer Readout	1529-R	B7C853	10-1011001/21	Nov. 10, 2022	THC
Platinum Resistance Thermometer	5626	4854	C0A30047	Oct. 22, 2023	FLUKE
Liquid Bath	XORTS-40A	XO111019	10-0306002/21	Jun. 3, 2023	THC

Remark: This certificate is traceable to the International System of Unit (SI Unit) through:

- THC, Thai Heart Calibration Co., Ltd.
- FLUKE, Fluke Corporation, U.S.A.

Measurement Results:

(X) Without Adjustment

Dimension of probe : Diameter 4 mm.		Sensor Type : RTD (PT100)		
Immersion Depth (mm.)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
120	22.00	22.0	0.00	0.060
120	25.00	25.0	0.00	0.060
120	28.00	28.0	0.00	0.060

UUC : Unit Under Calibration

The above reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor  $k = 2.00$ , providing a level of confidence approximately 95%.

- End of Certificate -

## CERTIFICATE OF CALIBRATION

Certificate No.: C0-2007006/22 Page 1 of total 2 pages

**Customer** WATER ANALYSIS CENTER CO., LTD.  
30/5 Soi Viphavadee 60, Viphavadee Rangsit Road,  
Kwaeng Taladbangkhen, Khet Laksi, Bangkok 10210

**Equipment** Conductivity Meter  
**Manufacturer** EUTECH **Model** CON 2700  
**Serial No.** 2657889 **ID No.** WWL 0136  
**Description** -

**Environmental Conditions** Ambient Temperature: (20 ± 2) °C  
Relative Humidity: (50 ± 10) %  
Atmospheric Pressure: -

**Calibration Location** Jayhawks Laboratory (CL&GL)  
**Received Date** 20 July 2022  
**Calibration Date** 20 July 2022

**Date of Issue** 21 July 2022

**Checked by**

Act as Technical Manager

**Approved by**

Representative of Managing Director

( ) ( Krisyosl K. ) ( ) ( Sakda Y. )  
( ) ( Patiphan K. ) ( ) ( Onnappa P. )  
( ) ( Pongsak H. ) ( ) ( Nitiphong K. )  
( ) ( Kanung C. ) ( ) ( Nonthachai K. )  
( ) ( Pramong P. ) ( ) ( Noppol P. )

( Dr. Ekachai Puttittwong )

This calibration certificate shall not be reproduced other than in full except with the prior written approval of the Thai Heart Calibration Co., Ltd.  
FE-169 REV.02.02/24/21

Certificate No.: C0-2007006/22

Page 2 of total 2 pages

Reference Method:

- The calibration method used was CP-177 based on an in-house method.  
- This certificate can be traceable to the national standards, which is realized the shown measurement units according to the International System of Units (SI Units).

Reference Standard :

Material	Batch Value	Lot Number	Due Date	Traceability
Conductivity Standard Solution	151.1 µS/cm	S211008031	Jan. 18, 2023	SCP Science
	1.421 mS/cm	S220112015	May 16, 2023	

Remark: This certificate is traceable to the International System of Unit (SI Unit) through:  
- SCP Science.

Measurement Results:

Conductivity Standard Solution	Measured Value	Correction	Uncertainty ( ± )
151.1 µS/cm	150.9 µS/cm	0.2 µS/cm	1.5 µS/cm
1.421 mS/cm	1.423 mS/cm	-0.002 mS/cm	0.0052 mS/cm

Note : Adjustment points: 151.1µS/cm 1.421mS/cm

The above reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor  $k = 2.00$ , providing a level of confidence approximately 95%.

- End of Certificate -

Calibrated by Kittipong  
REV.02.02/24/21



**AUTOMATION SERVICE CO.,LTD.**  
CALIBRATION LABORATORY

SV 201003/2023

Cert. No. WAC-065  
Page 1 of 2

## CERTIFICATE OF CALIBRATION

**Instrument :** DO Meter **Machine :** -  
**Model :** DO-31P **Location :** -  
**Serial No. :** 780065  
**Manufacturer :** TOA-DKK  
**Measuring Range :** 0.00 ~ 20.00 mg/l

**Customer :** Water Analysis Center Co.,Ltd.  
1/94 Moo.5 T.Kanham, A.U.-Thai  
Ayutthaya 13210 Thailand

**Date Of Received :** 05 / 01 / 2023  
**Date Of Calibration :** 05 / 01 / 2023

**Ambient Condition :** Temperature 25 °C  
Humidity 50 % RH

**Calibrated By :**

( Ms. Phancee Yooyen )  
Technician

**Approved By :**

( Mr. Nipon Phungsomsak )  
Technical Manager

**Date Of Issue :** 09 / 01 / 2023

This Certificate may not be reproduced other than in full, except with the prior written approval of the head of the industrial instruments calibration center.



**AUTOMATION SERVICE CO.,LTD.**  
CALIBRATION LABORATORY

**Instrument :** DO Meter  
**Model :** DO-31P  
**Serial No. :** 780065

Cert. No. WAC-065  
Page 2 of 2

**Calibrate Procedure**

- ☐ This instrument was calibrated by comparison with standard solution (PH/ORP)  
☐ This instrument was calibrated by comparison with scattering plate value (Turbidity)  
☐ This instrument was calibrated by comparison with conductivity (Conductivity)  
☒ This instrument was calibrated by comparison with Sodium sulfite anhydrous (DO)

**Condition of this result of calibration**

1). Reference Standard Solution

Standard	Lot No	Batch	Cert. No.	Due Date
Sodium Sulfite Power	1.06657.0500	K54224057	-	30 Sep 2023

2). Traceability This certification is traceable to  
☒ Merck KGaA 64271 Darmstadt  
☐ DKK Corporation

**Result Of Calibration**

Standard Solution (mg/l) at 24.1°C	Before Adjust		After Adjust	
	Indicator	Error	Indicator	Error
Zero	0.00	0.05	0.00	-
Span	8.25	7.13	8.25	-

DO Electrode No. OE270AA(5) S/N 111F0029

**Calibrated By**

( Ms. Phancee Yooyen )  
Technician

# Certificate of Calibration

## TEMPERATURE CONTROLLER ENCLOSURES



Certificate No.: MC 2207678

Page 1 of 3

Customer : Water Analysis Center Co., Ltd.  
1/94 Moo 5, T.Kantham, A.U.-Thai, Ayutthaya 13210.

Reference Job No. : 22-1601 Received Date : 12 July 2022  
Description : Refrigerator  
Manufacturer : SANDENINTERCOOL Model : SEC-1500SBD  
Serial No. : SEC1500201A-0708-00304 ID. No. : WWL0038  
Marking : Additionally for the purpose of identification by this laboratory a label marked with this certificate number ( MC 2207678 ) has been attached to the case.  
Method : In-House calibration procedure MWI-T-033 this method is reference to TLAS G-20 "Temperature Controlled Enclosures".  
Location of Calibration : Water Analysis Center Co., Ltd. ; Laboratory.  
Environmental Conditions : Ambient Temperature : ( 25.8 to 27.5 ) °C  
Relative Humidity : ( 48.8 to 52.2 ) %  
Date of Calibration : 12 July 2022 Date of Issue : 19 July 2022

Checked by :   
Thanagorn Limchaicharoen  
(Calibration Supervisor)

Approved by :   
Aittipong Kanjanawasit  
( Technical Manager )

The uncertainties are for a confidence probability of approximately 95%

This certificate is issued in accordance with the conditions of accreditation granted by the National Standardization Council of Thailand-Office of the National Standardization Council that 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 Master Calibration Co.,Ltd.

[MCF-Q-077 ; Rev.6 ; Date : 22/04/2021]

Certificate No.: MC 2207678

Page 2 of 3

### The Reference Standard :

Description	Certificate No.	Serial No.	Due date
Data Acquisition/Switch Unit	MC 2114432	MY44096104	20 December 2022

With Thermocouple Type " T " ID. No.2/1 to 2/9

This certificate is traceable to the international system of units maintained at:

- Master Calibration Co., Ltd.

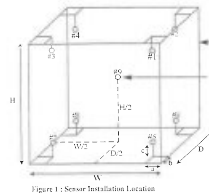
### I. Calibration Procedure:

This Instrument was calibration according to TLAS G-20 by comparison with calibrated thermocouple type T under no load condition. The thermocouples were placed on nine points and located one thermocouple in each of the eight corners of the chamber and was away from the each wall of 5 cm to 10 cm. And placed the ninth thermocouple within 2.5 cm of the geometric center of the chamber.

*Temperature 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. The reference sensor should preferably be located at the geometric center of the chamber.

*Temperature Stability* - one-half of the greatest maximum difference of measured temperatures at any one sensor.

*Overall Variation* - The Difference of the maximum and minimum measured temperatures throughout observation.



Overall Ambient Temperature around the Chamber variation : 3.4 °C  
Overall Line Voltage variation : 0.1 V  
Chamber Size (W\*H\*D) : 171 cm x 157 cm x 60 cm

Checked by :

[MCF-Q-077 ; Rev.6 ; Date : 22/04/2021]

Certificate No.: MC 2207678

Page 3 of 3

### 2. Result of calibration :

#### Temperature Measurement Accuracy Test

Indicating Temperature (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (±°C)
	#1	#2	#3	#4	#5	#6	#7	#8	Ref. #9	
2.5	3.5	3.6	3.7	3.5	3.6	3.4	3.4	3.3	3.4	1.1

#### Chamber Characterization Result

Controller Temperature (°C)	Indicating Temperature (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
2.0	2.5	1.5	0.6	3.1

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 %.

This report will certify of the calibrated equipment only.

End of Certificate

Checked by :

[MCF-Q-077 ; Rev.6 ; Date : 22/04/2021]

Certificate No.: MC 2203933

Page 1 of 3

Customer : Water Analysis Center Co., Ltd.  
1/94 Moo 5, T.Kantham, A.U.-Thai, Ayutthaya 13210.

Reference Job No. : 22-0740 Received Date : 24 March 2022  
Description : Oven  
Manufacturer : Memmert Model : UF260  
Serial No. : B620.0814 ID. No. : WWL0212  
Marking : Additionally for the purpose of identification by this laboratory a label marked with this certificate number ( MC 2203933 ) has been attached to the case.  
Method : In-House calibration procedure MWI-T-033 this method is reference to TLAS G-20 "Temperature Controlled Enclosures".  
Location of Calibration : Water Analysis Center Co., Ltd. ; Laboratory.  
Environmental Conditions : Ambient Temperature : ( 30.5 to 32.6 ) °C  
Relative Humidity : ( 56.2 to 61.2 ) %  
Date of Calibration : 24 March 2022 Date of Issue : 28 March 2022

Checked by :   
Thanagorn Limchaicharoen  
(Calibration Supervisor)

Approved by :   
Aittipong Kanjanawasit  
( Technical Manager )

The uncertainties are for a confidence probability of approximately 95%

This certificate is issued in accordance with the conditions of accreditation granted by the National Standardization Council of Thailand-Office of the National Standardization Council that 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 Master Calibration Co.,Ltd.

[MCF-Q-077 ; Rev.6 ; Date : 22/04/2021]

Certificate No.: MC 2203933

Page 2 of 3

**The Reference Standard :**

Description	Certificate No.	Serial No.	Due date
Data Acquisition/Switch Unit	MC 2106035	93000641	8 August 2022
With Thermocouple Type "T" ID. No.30/1 to 30/9			

This certificate is traceable to the international system of units maintained at:

- Master Calibration Co., Ltd.

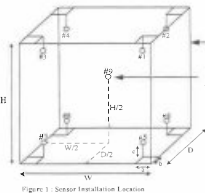
**1. Calibration Procedure:**

This Instrument was calibration according to TLAS G-20 by comparison with calibrated thermocouple type T under no load condition. The Thermocouples were placed on nine points and located one thermocouple in each of the eight corners of the chamber and was away from the each wall of 5 cm to 10 cm. And placed the ninth thermocouple within 2.5 cm of the geometric center of the chamber.

**Temperature 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. The reference sensor should preferably be located at the geometric center of the chamber.

**Temperature Stability** - one-half of the greatest maximum difference of measured temperatures at any one sensor.

**Overall Variation** - The Difference of the maximum and minimum measured temperatures throughout observation.



Overall Ambient Temperature around the Chamber variation : 1.1 °C

Overall Line Voltage variation : 0.2 V

Chamber Size (W\*H\*D) : 65 cm x 80 cm x 50 cm

Checked by : [Signature]

[MCF-Q-077 ; Rev 6 ; Date : 22/04/2021]

Certificate No.: MC 2203933

Page 3 of 3

**2. Result of calibration :**

**Temperature Measurement Accuracy Test**

Indicating Temperature (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (±°C)
	#1	#2	#3	#4	#5	#6	#7	#8	Ref. #9	
104.0	103.9	103.9	103.9	104.1	104.3	104.2	104.2	104.1	104.0	0.67
180.0	179.3	179.3	179.3	179.5	180.1	180.3	180.5	180.4	180.1	0.99

**Chamber Characterization Result**

Controller Temperature (°C)	Indicating Temperature (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
104.0	104.0	0.27	0.45	0.92
180.0	180.0	0.29	1.00	1.65

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 %.

This report will certify of the calibrated equipment only.

End of Certificate

Checked by : [Signature]

[MCF-Q-077 ; Rev 6 ; Date : 22/04/2021]

Business Unit  
SPC Calibration Center



**Certificate of Calibration**

<b>Equipment:</b>	Balance	<b>Certificate No.:</b>	C01221685
<b>Model:</b>	BL210S	<b>Issued Date:</b>	08 June 2022
<b>Serial No. (or ID.):</b>	15808131 (WWL 0022)	<b>Job No.:</b>	KSPR2206906
<b>Manufacturer:</b>	Sartorius	<b>Page:</b>	1 of 2
<b>Condition:</b>	In condition		
<b>Customer:</b>	Water Analysis Center Co., Ltd. 1/94 Moo 5, Rojana Industrial Park, Rojana Road, Tambol Kanham, Amphur U-Thai, Ayutthaya 13210 Thailand		
<b>Environment Condition:</b>	Temperature 27 °C ± 0.5 °C Humidity 42 %RH ± 4.7 %RH		
<b>Calibration Place:</b>	Water Analysis Center Co., Ltd. ( หอเครื่องชั่ง ) 1/94 Moo 5, Rojana Industrial Park, Rojana Road, Tambol Kanham, Amphur U-Thai, Ayutthaya 13210 Thailand		
<b>Calibration By:</b>	Mr. Preecha Phoosai		
<b>Calibration Date:</b>	08 June 2022		
<b>The Method used:</b>	In-house method, SPCC-WI-47, based on UKAS Lab 14		
<b>Traceability:</b>	This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through SPC RT Co., Ltd. Certificate No. C02220794		

(Mr. Preecha Phoosai)  
Person in charge



(Mr. Rungrod Jenkitrakulchai)  
Authorized signatory

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 SPC RT Co., Ltd.

Business Unit  
SPC Calibration Center



Certificate No.: C01221685

Page: 2 of 2

**Calibration Results:**

**Without Adjustment**

**Eccentric Error:** Weight to be 1/3 or 1/2 of Maximum capacity, taken from the center of the pan as a zero reference.

Nominal Test Value		Reference Points (g)				
		A	B	C	D	E
100 (g)		-	0.0001	0.0001	-0.0002	-0.0002

**Repeatability:** Determination of the standard deviation of weighing balance., Readability 0.0001 (g)

Nominal test value (g)	Standard Deviation
20	0.00004
200	0.00004

**Error of Indication from nominal or conventional mass value., Readability 0.0001 (g)**

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Error of Indication (g)	Uncertainty (g)	k
1	0.99998	1.0000	0.0000	0.000097	2.02
2	1.99999	2.0000	0.0000	0.000098	2.02
5	5.00000	5.0000	0.0000	0.000099	2.02
10	10.00002	10.0000	0.0000	0.00010	2.02
20	19.99995	20.0000	0.0000	0.00011	2.01
50	50.00002	50.0000	0.0000	0.00012	2.01
70	69.99997	70.0000	0.0000	0.00015	2.00
100	100.00007	100.0001	0.0000	0.00017	2.00
120	120.00002	120.0000	0.0000	0.00020	2.00
150	150.00009	150.0002	0.0001	0.00023	2.00
200	199.99993	200.0003	0.0004	0.00029	2.00

The End of Certificate



# Certificate of Calibration

Certificate No. BSCC-UV-149/22 Number of Page(s) 1 of 3  
Equipment UV/Vis Spectrophotometer  
Model UV-1800  
Manufacturer Shimadzu  
Serial No. A11635405598CD  
ID No. WWL0082  
Date of receipt 29 April 2022  
Date of calibration 29 April 2022  
Date of issue 6 May 2022  
Customer name Water Analysis Center Co., Ltd.  
Address 1/94 Moo 5, T.Kantham, A.Uthai, Ayutthaya 13210  
Temperature (29.9-31.8) °C (On site)  
Humidity (48.7-52.6) %RH (On site)  
Equipment condition Good Operation  
Calibration Location Laboratory Room Water Analysis Center  
Calibration Procedure In-house method WI-UV-702-01 based on ASTM E275-01  
Traceability Wavelength Accuracy is traceable to certificate No. 95917 and 95918  
Photometric Accuracy is traceable to certificate No. 95924 and 95937  
Stray Light is traceable to certificate No. 95908  
The above certificate are traceable to SI unit through Starna Scientific Ltd.  
(UKAS accredited calibration laboratory NO. 0659)  
Calibrated by Mr.Waruth Janphung

Approved by

Mr.Kanchit Choothep  
Technical Manager

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.  
Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced  
except in full, without written approval of the Bara Scientific Co., Ltd.

FM-UV-708-02 Rev 01 (23/01/63)

# Certificate of Calibration

Certificate No. BSCC-UV-149/22 Number of Page(s) 2 of 3

## Calibration Results: 1.Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (±nm)
360.89	360.86	-0.03	0.18
418.53	418.72	0.19	0.18
445.82	446.51	0.69	0.18
453.67	453.56	-0.11	0.18
459.99	459.81	-0.18	0.18
638.00	638.17	0.17	0.18
431.22	431.52	0.30	0.18
513.39	513.60	0.21	0.18
528.90	528.80	-0.10	0.18
572.99	576.13	3.14	0.18
585.25	585.30	0.04	0.18
684.50	684.68	0.18	0.18
741.02	741.22	0.20	0.18
879.41	879.30	-0.11	0.18

## 2.Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
235	CNR	CNR	CNR	CNR
257	CNR	CNR	CNR	CNR
313	CNR	CNR	CNR	CNR
350	0.0000	0.0000	0.0000	0.0075
	0.6429	0.6404	-0.0025	0.0075

\*CNR = Customer not request.

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.  
Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced  
except in full, without written approval of the Bara Scientific Co., Ltd.

FM-UV-708-02 Rev 01 (23/01/63)

# Certificate of Calibration

Certificate No. BSCC-UV-149/22 Number of Page(s) 3 of 3

## Calibration Results:

### 3.Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
420.0	0.0000	0.0000	0.0000	0.0042
	0.5783	0.5806	0.0023	0.0042
	0.7628	0.7650	0.0022	0.0042
	1.0206	1.0245	0.0039	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5621	0.5635	0.0014	0.0042
	0.7455	0.7466	0.0011	0.0042
	0.9985	1.0007	0.0022	0.0042
465.0	0.0000	0.0000	0.0000	0.0042
	0.5227	0.5240	0.0013	0.0042
	0.6880	0.6895	0.0015	0.0042
	0.9487	0.9508	0.0021	0.0042
546.1	0.0000	0.0000	0.0000	0.0042
	0.5207	0.5205	-0.0002	0.0042
	0.6973	0.6966	-0.0007	0.0042
	0.9959	0.9955	-0.0004	0.0042
590.0	0.0000	0.0000	0.0000	0.0042
	0.5544	0.5536	-0.0008	0.0042
	0.7253	0.7240	-0.0013	0.0042
	1.0942	1.0924	-0.0018	0.0042
635.0	0.0000	0.0000	0.0000	0.0042
	0.5616	0.5609	-0.0007	0.0042
	0.6927	0.6915	-0.0012	0.0042
	1.0881	1.0869	-0.0012	0.0042

\*CNR = Customer not request

### 4.Stray Light\*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC) Wavelength (nm)	Transmission (%T)	Absorbance (A)
200.96±0.11nm	199.31	0.9668	2.0147

The Stray light transmission reference is less than 1.0%T and Stray light absorbance reference is greater than 2.00A  
\*Stray Light not NSC-ONSC Accredited.

The measurement uncertainty is base on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%  
\*\*\*End of Certificate\*\*\*

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.  
Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced  
except in full, without written approval of the Bara Scientific Co., Ltd.

FM-UV-708-02 Rev 01 (23/01/63)

## PREVENTATIVE MAINTENANCE (PM) CHECK LIST

### FOR ATOMIC ABSORPTION SPECTROMETER

Model & Serial Number: AA 240FS x AA 09110073

Customer : จ. อนุจิตรวาทกิจ

Date: 10 ก.พ. 22

### Safety

- ☒ Flame, Inspect/replace o-ring nebulizer, spray chamber and burner
- ☒ Flame, Clean nebulizer, spray chamber and burner
- ☒ Flame, Check liquid trap interlock, burner interlock, pressure relief pump interlock and shield interlock
- ☐ Furnace, Clean work head, electrode and shroud N/A
- ☐ Furnace, Clean PSD and PSD tray N/A
- ☐ Furnace, Check water pressure N/A
- ☒ Check drain tube
- ☒ Check exhaust system
- ☒ Check gas pressure sensor interlock
- ☒ Check and all gas hoses for SpectrAA
- ☒ Clean computer control

### Optics

- ☒ Inspect/Replace that external optics surfaces
- ☒ Check Wavelength Accuracy the copper line at 323.0-326.0 nm = 324.8 nm
- ☒ Check that PMT % Gain the copper at 324.8 nm, 4 mA, 0.5 nm slit width, Gain = 96% (should be ≤ 64% or ≤ 380V)
- ☒ Flame, Check D2 lamp is work



บริษัท ไทยยูนิค จำกัด

THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200  
80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200

Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@thaiunique.com, Website : www.thaiunique.com

## SVD Results Report

VARIAN

Report ID:1 Diagnostic Start Time:10/2/2022 11:56:32 Diagnostic End Time:10/2/2022 12:36:59

Customer: Water Analysis Center Co., Ltd.

Service Engineer: Suriya Nacharoen

Address: Ayuthaya

Contact Details: Kanitsaya

## Instrument Configuration

## Configuration:

Serial Number: AAC911M073 Turret Type: Automatic  
Instrument Model: Varian AA140/240/280 Number Of Lamps: 4  
Flame Instrument: True Mono Type: Automatic  
Furnace Instrument: True Gasbox Type: 'Y' Gas Box  
Zeeman Present: False Auto Burner Adjuster: False  
Internal Zeeman: False Mains Frequency: 50  
Internal UltraAA: False Firmware Version: 2.12  
Optics Type: Double Beam Photomultiplier Type: Normal(900nm)  
D2 BG Correction Fitted: True PWB Version: 181  
Boot Block Version: 2.02

## EEPROM Data:

Instrument Run Hours: 29533.551 D2 Run Hours: 4026.533  
Zero Wavelength Offset: -18.735 D2 Serial Number: not set !  
Mono Correction: -0.360 D2 Install Date: 1/1/1970  
Flame Hours: 7417.833 D2 Original Intensity: 1.000  
D2 Last Intensity: 678.000

## Frequency:

Averaging Period: 30.0  
Datapoint Count: 20

Upper Limit: 51.00 Highest Measured Frequency: 50.00  
Average Frequency: 50.00  
Lower Limit: 49.00 Lowest Measured Frequency: 50.00

Result: **Passed**

## Electronics

- ☒ Check power supply voltage  
☒ Check cables and connectors  
☒ Check/Clean all boards in the instrument  
☐ Furnace, Check camera and align\*\* N/A

\*\*Option for Graphite Zeeman only

## Mechanisms

- ☒ Flame, Check the burner adjuster  
☐ Furnace, Check PSD accessories N/A

## Analytical performance

- ☒ Clear the sample compartment  
☒ Flame, Check uptake rate form 7.2-10.6 mL per minute = 9.5 mL/min  
☒ Test Photometric noise, STDV = 0.0003 Abs (should be  $\leq 0.00050$  Abs)  
☒ Flame, Test high solids nebulizer setting use

-Air/acet Cu 5 ppm = 0.77 Abs, and Precision  
(%RSD)= 0.4 % (should be  $> 0.55$  Abs and  $< 0.5\%$  RSD)

or

-N20/Acet Cu 5 ppm = Abs, and Precision  
(%RSD)= % (should be  $> 0.3$  Abs and  $< 0.5\%$  RSD)

- ☐ Furnace, Characteristic mass and sensitivity Cu 25 ppb = Abs, and N/A  
Precision (%RSD)= % (should be  $\geq 0.15$  Abs and  $< 4.0\%$  RSD)

## SIGN :

Engineer : [Signature] Customer : [Signature]

2/2

Report Generated At: 10/2/2022 12:39:54

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SVD Results Report SVD

## Power Supply:

Averaging Period: 30.0  
Datapoint Count: 20

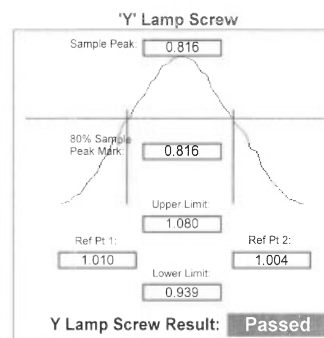
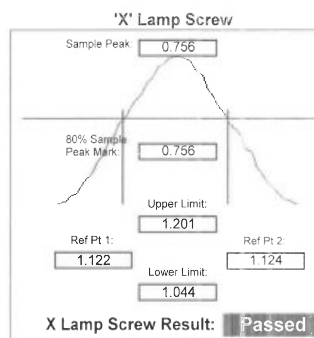
	Lower Limit (V)	Actual (V)	Upper Limit (V)	Result:
12.00 V Rail	10.80	12.20	13.20	<b>Passed</b>
-12.00 V Rail	-13.20	-12.00	-10.80	<b>Passed</b>
5.00 V Rail	4.50	5.10	5.50	<b>Passed</b>
310.00 V Rail	279.00	318.00	341.00	<b>Passed</b>

## Optics

## Beam Balance:

Lamp Type: Copper  
Lamp Socket Used: 3

Peak Selected: 324.80  
Lamp Alignment: **Performed**



## Grating Squareness:

Lamp Element(s): Copper  
Lamp Turret Position: 3  
Lamp Current(mA): 4.00  
Slit Width(nm): 0.5  
1st Order Wavelength(nm): 324.80  
Lamp Alignment: **Performed**

	Lower Limit (nm)	Actual (nm)	Upper Limit (nm)	Result:
Zero Order	-0.10	0.00	0.10	<b>Passed</b>
First Order	324.45	324.74	325.15	<b>Passed</b>
Second Order	649.23	649.56	649.97	<b>Passed</b>

## Wavelength Repeatability:

Lamp Used: Copper  
 Peak Used(nm): 324.750  
 Connected to Socket: 3  
 Lamp Current(mA): 4  
 Slit Width(nm): 0.2  
 Slit Height: Normal  
 Lamp Alignment: **Performed**  
 Lower Limit(nm) 324.759 324.879 Upper Limit(nm)  
 (Approach from Zero Order) (Approach from end)  
 Sample 1: 324.819 Sample 2: 324.811  
 Sample 3: 324.819 Sample 4: 324.811  
 Sample 5: 324.815 Sample 6: 324.811  
 Sample 7: 324.819 Sample 8: 324.815  
 Sample 9: 324.819 Sample 10: 324.819  
 Mean: 324.816 Standard Deviation: 0.004  
 Result: **Passed**

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SVD Results Report

## Auto Lamp Recognition:

Lamp 1: Uncoded Lamp/Not Connected  
 Lamp 2: Uncoded Lamp/Not Connected  
 Lamp 3: 14 - Copper (Cu)  
 Lamp 4: Uncoded Lamp/Not Connected  
 Lamp 5: Not Supported  
 Lamp 6: Not Supported  
 Lamp 7: Not Supported  
 Lamp 8: Not Supported

Result: **Passed**

## GTA Temperature Monitoring:

**Not Performed**

## Notes:

C2202SU09\_1  
 PM 10 Feb 2022

## Signatures:

Water Analysis Center Co., Ltd. Date  
 Suriya Nacharoen Date  
 10 Feb 2022

Report Generated At: 10/2/2022 12:39:55

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SVD Results Report

## Mechanical

### Wavelength Drive:

**Passed**

### Slit Drive:

**Passed**

### Turret Drive:

**Passed**

### Auto Burner Adjuster Drive:

**Untested**

## Miscellaneous

### Signal Processing Linearity:

Calculate Mode: New Calc Mode

	Lower Limit	Actual	Upper Limit	Result:
S0	114	248	297	<b>Passed</b>
S1	156	165	191	<b>Passed</b>
S2	271	293	332	<b>Passed</b>
S3	474	504	579	<b>Passed</b>
S4	825	904	1008	<b>Passed</b>
S5	1435	1510	1754	<b>Passed</b>
S6	2498	2711	3053	<b>Passed</b>
S7	4347	4658	5313	<b>Passed</b>

### Interlocks:

Burner Fitted: **Working**  
 N2O Burner Fitted: **Working**  
 Flame Shield Closed: **Working**  
 Gas Control Fitted: **Untested**  
 Pressure Release Bung Fitted: **Working**  
 Liquid Trap Fitted: **Working**  
 Flame Detect: **Working**  
 GCU Active: **Working**  
 Oxidant Pressure: **Working**  
 Oxidant Changeover: **Working**  
 Ignition: **Working**

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SVD Results Report



บริษัท ไทยยูนิค จำกัด THAI UNIQUE CO., LTD.

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## PREVENTATIVE MAINTENANCE (PM) CHECK LIST

### FOR ATOMIC ABSORPTION SPECTROMETER

Model & Serial Number: 2402 AA 18 M918250004

Customer: คุณวิจิตร นิลรัตน์

Date: 29 Jan. 22

### Safety

- ☐ Flame, Inspect/replace o-ring nebulizer, spray chamber and burner N/A
- ☐ Flame, Clean nebulizer, spray chamber and burner N/A
- ☐ Flame, Check liquid trap interlock, burner interlock, pressure relief bung interlock and shield interlock N/A
- ☒ Furnace, Clean work head, electrode and shroud
- ☒ Furnace, Clean PSD and PSD tray
- ☒ Furnace, Check water pressure N/A
- ☒ Check drain tube
- ☒ Check exhaust system
- ☒ Check gas pressure sensor interlock
- ☒ Check and all gas hoses for SpectraAA
- ☒ Clean computer control

### Optics

- ☒ Inspect/Replace that external optics surfaces
- ☒ Check Wavelength Accuracy the copper line at 323.0-326.0 nm = 324.7
- ☒ Check that PMT % Gain the copper at 324.8 nm, 4 mA, 0.5 nm slit width, Gain = 49% (should be  $\leq 64\%$  or  $\leq 380V$ )
- ☐ Flame, Check D2 lamp is work N/A

Report Generated At: 10/2/2022 12:39:55

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SVD Results Report



## Electronics

- ☒ Check power supply voltage  
☒ Check cables and connectors  
☒ Check/Clean all boards in the instrument  
☒ Furnace, Check camera and align\*\*

\*\*Option for Graphite Zeeman only

## Mechanisms

- ☒ Flame, Check the burner adjuster  
☒ Furnace, Check PSD accessories

## Analytical performance

- ☒ Clear the sample compartment  
☒ Flame, Check uptake rate from 7.2-10.6 mL per minute =        mL/min  
☒ Test Photometric noise, STDV = 0.0001 Abs (should be  $\leq 0.00050$  Abs)  
☒ Flame, Test high solids nebulizer setting use  
-Air/acet Cu 5 ppm =        Abs, and Precision  
(%RSD) =        % (should be  $> 0.55$  Abs and  $< 0.5\%$  RSD)  
or  
-N20/Acet Cu 5 ppm =        Abs, and Precision  
(%RSD) =        % (should be  $> 0.3$  Abs and  $< 0.5\%$  RSD)  
☒ Furnace, Characteristic mass and sensitivity Cu 25 ppb = 0.22 Abs, and  
Precision (%RSD) = 2.4 % (should be  $\geq 0.15$  Abs and  $\leq 4.0\%$  RSD)

SIGN :

Engineer

Customer

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FR-5-453 Rev 05



## BSC Certification Test Report

Page 1 of 6

Certificate No. : M01075/22

Customer Name : LABORATORY WATER ANALYSIS CENTER COMPANY LIMITED

Customer Address : 1/94 Moo 5 T.Kanharm, A.U-Thai,  
Phra Nakhon Si Ayutthaya 13210

Equipment : Biological Safety Cabinet Class II Type A2

Manufacturer : Microtech

Model : V6-T

Serial No : 0972

ID No. : WWL0084

Were in accordance with ☒ EN 12469 ☐ NSF 49 ☐ Manufacturer's specification

Test Date : 23/09/2022

Due Date : 23/09/2023 or after HEPA filters are replaced or unit is moved

Test by : Mr. Piyaopong Pusua

Approved by :

(Mr.Krudsada Thinhuafoei)  
Authorized Signatory

Issued Date : 26/09/2022

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

This certificate may not be reproduced other than in full except with the prior written approval of the Megafil Company Limited.

Megafil Co.,Ltd.

MG-FM-7.8-001, R00 (01/07/19)



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Certificate No. : M01075/22

Procedure Used : European Standard EN12469 : 2000 has the status of British Standard,  
Biotechnology Performance criteria for microbiological safety cabinets.  
: NSF International Standard / American National Standard NSF / ANSI 49-2008  
Biosafety Cabinet : Design, Construction, Performance and Field Certification.  
: Australian Standard : AS 1807.23-2000 Determination of intensity of radiation  
from germicidal ultraviolet lamps.  
: Manufacturer's specification.

## 1. Downflow velocity test.

## Measurement Information

No. of Rows	No. of Readings	Grid Spacing Front-Back	Grid Spacing Side-Side	Probe height Above sash
2	8	1/4,3/4	1/8,3/8	100mm

## Measurement Data.

0.36	0.42	0.43	0.41
0.40	0.34	0.34	0.33

Average velocity 0.38 m/s ( 75 FPM.) Velocity range 0.25-0.50 m/s ( 49-98 FPM.)Uniformity( EN: +/-20%avg.) 0.30 - 0.46 m/s ( 60 - 90 FPM.)Supply filter dimension 24 x 72 (inch x inch) Supply filter area 10.69 SQ.FTDownflow volume (Q) 802 CFM.Result Summary ☒ Pass ☐ Fail

Equipment used : Thermo Anemometer Model 425 S/N : 02623979 Calibration date : 14/07/2022



Page 3 of 6

Certificate No. : M01075/22

## 2. Inflow velocity test.

Select method. : ☐ DIM ☒ Exhaust velocity. ☐ MFG's Specifications

0.53	0.47	0.48	0.50	0.51
0.57	0.46	0.52	0.53	0.50
0.54	0.57	0.55	0.52	0.53
0.53	0.51	0.57	0.54	0.51
0.51	0.48	0.53	0.55	0.56

Average Inflow velocity 0.44 m/s (86 FPM.) Velocity range ≥0.40 m/s ( ≥79 FPM.)Inflow dimension 8 x 72 (inch x inch) Inflow area 4.00 SQ.FTInflow volume(Q) 344 CFMResult Summary ☒ Pass ☐ FailAdjustments Required ☐ Fan Speed ☐ Damper

Equipment used : Thermo Anemometer Model 425 S/N : 02623979 Calibration date : 14/07/2022

## 3. HEPA filter leak test.

## Measurement Data

HEPA Filter	PAO Upstream Conc.(calculated)	Specification	Measured leak penetration
Supply HEPA Filter	18 $\mu$ g/l.	<0.003%	<0.003%
Exhaust HEPA Filter	18 $\mu$ g/l.	<0.003%	<0.003%



Certificate No. : M01075/22

**Leak location**

Supply HEPA Filter

Back



Exhaust HEPA Filter

Back



Result Summary

☒ Pass

☐ Fail

Equipment used : Aerosol Photometer Model 2I S/N : 26468 Calibration date 14/07/2022

Equipment used : Smoke Generator Model TDA-6D S/N : 26530

**4. Airflow smoke patterns test**
**Measurement Information**

1. Downflow Pattern test : Smoke shall be passed from one end of the cabinet to the other, along the centerline of the work surface, at a height of 4 inch (10 cm) above the top of the access opening
2. View screen retention test : Smoke shall be passed from one end of the cabinet to the other, 1.0 in (2.5 cm) behind the view screen, at a height 6.0 inch (15 cm) above the top of the access opening.
3. Work opening edge retention test : Smoke shall be passed along the entire perimeter of the work opening. Particular attention should be paid to corners and vertical edges.
4. Sash/window seal test : Smoke shall be passed up the inside of the window 2 in (5 cm) from the sides and along the top of the work area.

Certificate No. : M01075/22

**Result Summary**

Downflow Pattern test

☒ Accept

☐ Non-Conforming

View screen retention test

☒ Accept

☐ Non-Conforming

Work opening edge retention test

☒ Accept

☐ Non-Conforming

Sash/window seal test

☒ Accept

☐ Non-Conforming

**5. Site installation**

Sash Alarm.

☐ Pass

☐ Fail

☒ N/A

Interlock System.

☐ Pass

☐ Fail

☒ N/A

Exhaust System Performance

☐ Pass

☐ Fail

☒ N/A

**Remark / Recommendation**

หมายเหตุ Site installation ไม่มีการตรวจพบข้อบกพร่องใดๆ

**6. Illumination Test (Lighting) : Option**

Lighting should be adequate for safe working within the cabinet. Illumination measured at the work surface.

Lux

620	965	938	561
867	1446	1492	768

Remark :

Certificate No. : M01075/22

**7. Ultraviolet Lamp Test (UV) : Option**

 Ultraviolet radiation where UV Lamp are fitted, the intensity of radiation at a wavelength of 254 nm. Shall be not less than 400 mW/m<sup>2</sup> when measures at work floor surface.

 mW/m<sup>2</sup>

720	1510	1540	760
470	980	990	450

Remark :