

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)	21CH1136	30 Aug 21	31 Aug 22	-



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



Cert.No.: 21CH1136
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 : 30 August 2021
Calibration Date : 01 September 2021
Reference : 2108-0913WSC-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 Butkruea
() Saithip Meangmai
() Warakorn Lernagatrakul

Issue Date : 10 September 2021

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services & Equipment Calibration and Testing Services

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Cert.No.: 21CH1136
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Condition of this calibration result

1. Reference Standard Instrument : -
Instrument Serial No. ID No. Cert. No. Due Date
1) Document Process Calibrator 43160066 130RC092 21E1223/1 27 Apr 2022
2) Ref. Standard Thermometer 4982054 110RC044 2011233 15 Oct 2021
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-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	754028	28 June 2023
pH 6.985	CPA chem	725927	12 Jan 2022
pH 10.015	CPA chem	761018	02 Aug 2022

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

Calibration Results

Function : mV Measurement

Performing standard curve by Fluke at pH (4,7)(7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N.: JC03345	4.00	177.48	177	4.01	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-177	10.01	0.58	2.00

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Cert.No.: 21CH1136
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Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode S/N.: 210224SIA605377	4.008	4.01	164	0.0079	2.00
	6.985	7.00	-10	0.0099	2.00
	6.985	7.00	-10	0.0093	2.00
	10.015	10.01	-186	0.013	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model :
- Serial No. : 210224SIA605377
Dimension of probe:
- Length : 108 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	0.20	2.00
30.0	30.002	30.0	-0.002	0.20	2.00
35.0	30.000	30.0	0.000	0.20	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

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	Hanna Instrument	HI2020-02 / C0051107	National Food Institute, Ministry of Industry, Thailand	2203135-001-01	8 Jun 22	7 Jun 23	-
2	pH Meter		Mettler-Toledo	Seven Easy S20 / 1231155210	National Food Institute, Ministry of Industry, Thailand	2201793-001-01	1 Mar 22	28 Feb 23	-
3	Analytical Balance (Repeatability 0.01 mg)	สารแขวนลอย สารที่ละลายได้ทั้งหมด	Mettler-Toledo	AX105DR / 1122100406	National Food Institute, Ministry of Industry, Thailand	2200708-001-01	24 Nov 21	23 Nov 22	-
4	Hot Air Oven		Memmert	UF55 / B212.0411	Technology Promotion Association (Thailand-Japan)	22TM304	7 Apr 22	6 Apr 23	-
5	Digestor Unit	ไนโตรเจนในรูป ที่ เค เอ็น	FOSS TECATOR	2520auto / 91794469	National Food Institute, Ministry of Industry, Thailand	2202361-001-01	4 Apr 22	3 Apr 23	-
6	Distillation Unit (Kjeldahl Method)		FOSS TECATOR	KT200 / 91790524	FOSS South East Asia	5874	30 Nov 21	29 Nov 22	-
7	Analytical Balance (Repeatability 0.1 mg)	น้ำมันและไขมัน	Mettler-Toledo	AB-204S/FACT / 1129361010	National Food Institute, Ministry of Industry, Thailand	2203120-001-01	1 Jun 22	31 May 23	-
8	UV-VIS Spectrophotometer	ฟอสเฟต แอมโมเนียในหน่วยไนโตรเจน	Hitachi	U-1900 / 2021-064	DQE Services Co.,Ltd.	SP22-007	20 Jan 22	19 Jan 23	-
9	UV-VIS Spectrophotometer		Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP22-008	20 Jan 22	19 Jan 23	-
10	UV-VIS Spectrophotometer		Agilent Technologies	Cary60 G6860A / MY15410009	DQE Services Co.,Ltd.	SP22-016	31 May 22	30 May 23	-
11	BOD Incubator	บีโอดี	Arco	UC4-1320 / (UAE.LAB.015/2561)	Technology Promotion Association (Thailand-Japan)	22TM90	17 Feb 22	16 Feb 23	-
12	BOD Incubator		Arco	UC4-1320 (UAE.LAB.006/2553)	Technology Promotion Association (Thailand-Japan)	22TM306	7 Apr 22	6 Apr 23	-
13	BOD Incubator		Arco	UC4-1320 (UAE.LAB.018/2551)	Technology Promotion Association (Thailand-Japan)	22TM305	7 Apr 22	6 Apr 23	-

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									
14	Incubator (Cooled Incubator)	ฟิคอลโคลิฟอร์มแบคทีเรีย	Memmert	IPP260 / V618.0033_021_2561	Technology Promotion Association (Thailand-Japan)	21TM1875	28 Oct 21	27 Oct 22	-
15	Incubator (Cooled Incubator)		Binder	BD 53 / 13-07343	Technology Promotion Association (Thailand-Japan)	22TM335	17 Feb 22	16 Feb 23	-
16	Water Bath		Memmert	WNE 14 / L416.0614	Technology Promotion Association (Thailand-Japan)	22TM332	17 Feb 22	16 Feb 23	-
17	Water Bath		Memmert	WB14 / l401.0569	SPC RT CO., LTD.	C13200233	14 Jul 21	13 Jul 22	-
18	Analytical Balance		Mettler-Toledo	MS603S / B0070110311	Calibration Laboratory Mettler-Toledo (Thailand) Limited	2200705-001-01	24 Nov 21	23 Nov 22	-
19	Autoclave		ALP	CL-40L / 808763	Technology Promotion Association (Thailand-Japan)	22TM681	27 May 22	26 May 23	-

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

Calibration Certificate

Certificate No.: 2203135-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsak 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

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Equipment: pH Meter
Manufacturer: HANNA INSTRUMENTS
Model: HI2020-02
Serial No.: C0051107
ID No.: UAE.WAO.005/2557
Order No.: 2203135
Operation No.: 2203135-001
Date of Receipt: 7 June 2022
Date of Calibration: 8 June 2022

Calibrated by: Mr. Manas Somaak
Approved by: (Mr. Pheraphat Tuanjit)
Specialist
Manager, Division of Calibration Laboratory
Date of Issue: 13 June 2022
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-C5-009 Revision: 01 Date: 20-04-65

Calibration Report

Certificate No.: 2203135-001-01
Equipment: pH Meter
Resolution: 0.01 pH ; 0.1 mV
Manufacturer: HANNA INSTRUMENTS
Model: HI2020-02
Serial No.: C0051107
Type: Bench top
ID No.: UAE.WAO.005/2557

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Date of Calibration: 8 June 2022
Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature : 23.5 ± 1.5 °C
Condition of Equipment: Good Condition
Relative Humidity: (53 ± 5) %

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	2706007	Flyke	SCU-21F-6667	24 June 2022
2.2 Digital Thermometer	2706007	Flyke	CC-640599-01	30 October 2022
2.3 Thermo-Hygro-Meter	NPI.BT.H005/18	PONPE	QR22-0361	16 February 2023

Certified Reference Material	Lot No.	Manufacturer	Ref. N	Expiry Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	805203	CPAchem	PH4216.L5	21 April 2024
2.5 pH buffer 6.865 (Primary pH buffer Solution)	805204	CPAchem	PH4217.L5	21 April 2024
2.6 pH buffer 10.01 (Primary pH buffer Solution)	805205	CPAchem	PH4220.L5	21 April 2024
2.7 pH buffer 7.20 (Standard pH buffer Solution)	805206	CPAchem	PH4207.L5	21 April 2023
3. This calibration is traceable to The International System of Unit (SI Unit)

3.1 Instruments No.2.1	through	NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0075
3.2 Instruments No.2.2	through	NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0081
3.3 Instruments No.2.3	through	NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0092
3.4 Certified Reference Material No. 2.4 to 2.6	traceable to	Primary measurement method- Harmed 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	BM RefN H-27 LotN 04.06.2021; BM RefN H-28 LotN 28.05.2021; BM RefN H-27 LotN 04.06.2021; BM RefN 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-C5-012 Revision: 01 Date: 20-04-65

Calibration Report

Certificate No.: 2203135-001-01
Equipment: pH Meter
Resolution: 0.01 pH ; 0.1 mV
Manufacturer: HANNA INSTRUMENTS
Model: HI2020-02
Serial No.: C0051107
Type: Bench top
ID No.: UAE.WAO.005/2557

Page 3 of 5

Date of Calibration: 8 June 2022
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	614.117	415.9	9.00	0.063	2.00
2	295.911	297.5	2.00	0.063	2.00
4	177.462	179.1	4.00	0.063	2.00
6	59.159	60.6	6.00	0.063	2.00
7	-0.001	1.6	7.00	0.063	2.00
8	-59.159	-57.5	8.00	0.063	2.00
10	-177.463	-175.8	10.00	0.063	2.00
12	-295.912	-294.2	12.00	0.063	2.00
14	-414.119	-412.5	14.00	0.063	2.00

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

Equipment: pH Electrode
Type: Combined Electrode
Manufacturer: HANNA INSTRUMENTS
Model: HI11310
Serial No.: 076743
ID No.: N/A
Performance of Electrode system (Three-Point Calibration at pH4, pH7 and pH10)

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.01	169.8	96.7	0.0071	2.00
6.865	6.87	6.2	-	0.0075	2.00
10.008	10.01	-174.0	97.0	0.0087	2.00
6.985	6.99	-2.0	-	0.0093	2.00

F-C5-012 Revision: 01 Date: 20-04-65

Calibration Report

Certificate No.: 2203135-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C
Model: HI2020-02
Serial No.: C0051107
ID No.: UAE.WAO.005/2557
Manufacturer: HANNA INSTRUMENTS

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Date of Calibration: 8 June 2022
Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature : (23.5 ± 1.5) °C
Relative Humidity: (53 ± 3) %

Condition of this results of Calibration:

1. Calibration Method :
 - In house method : W-TB-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 0851/64	24-Jun-22	TISTR
Platinum Resistance Thermometer (PRT)	9527A	877332			

Support Equipment : - Low Temperature Bath (BOCAL-6), Model: Europa-6 Plus Basic, SN: 341982/2

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-C5-012 Revision: 01 Date: 20-04-65

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Calibration Report

Certificate No.: 2203135-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C **Model:** H2030-02
Serial No.: C0031107 **ID No.:** UAE.WAT.010/2557
Manufacturer: HANNA INSTRUMENTS
Date of Calibration: 8 June 2022 **Page 5 of 5**

Calibration point: 15.0, 20.0 and 25.0 °C
Calibration result:
- The probe was immersed in liquid bath or dry bath to a minimum depth of 120 mm.
- Description of probe, model: HI1310 S/N: 78743
Dimension of probe: Diameter 12 mm, Length 120 mm.
Sheath material: Glass

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.1	15.001	-0.1	0.099
20.1	20.002	-0.1	0.099
25.2	25.002	-0.2	0.099

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

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Calibration Certificate

Certificate No.: 2201793-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udumak 41, Sukhumvit Road, Bangchack, Prakanong, Bangkok 10260

Page 1 of 5

Equipment: pH Meter
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210
ID No.: UAE.WAT.010/2553
Order No.: 2201793
Operation No.: 2201793-001
Date of Receipt: 21 February 2022
Date of Calibration: 1 March 2022

Calibrated by: Mr.Pheraphat Tuanjit Scientist
Approved by: (Mr.Nuttapol Niyomchart) Specialist, Division of Calibration Laboratory
Date of Issue: 1 March 2022 **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: 00 Date: 14-12-61

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Calibration Report

Certificate No.: 2201793-001-01
Equipment: pH Meter
Resolution: 0.01 pH ; 1 mV
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210
Type: Bench top
ID No.: UAE.WAT.010/2553
Date of Calibration: 1 March 2022 **Page 2 of 5**

Location: Chemical Calibration Laboratory, NATIONAL FOOD INSTITUTE
Environment Condition: Ambient Temperature: (23.5 ± 1.5) °C Relative Humidity: (53 ± 5) %
Condition of Equipment: Good Condition

Condition of this Results of Calibration

1. Calibration Method
In house method : W-CO-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	2706007	Puke	BCI-21F-0667	24 June 2022
2.2 Digital Thermometer	2706007	Puke	CC-442569-01	30 October 2022
2.3 Thermo-Hygro Meter	NFLBTH5418	PONPE	GR22-0195	27 January 2023

Certified Reference Material	Lot No.	Manufacturer	Ref N	Expiry Date
2.4 pH buffer 4.003 (Primary pH buffer Solution)	741339	CPAchem	PH4216.L5	19 April 2023
2.5 pH buffer 6.863 (Primary pH buffer Solution)	741340	CPAchem	PH4217.L5	19 April 2023
2.6 pH buffer 10.01 (Primary pH buffer Solution)	741342	CPAchem	PH4220.L5	19 April 2022
2.7 pH buffer 7.00 (Standard pH buffer Solution)	732636	CPAchem	PH107.L5	16 March 2022

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.0075
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- Harned cell using calibrated thermometer, barometer, and nanocoulometer. 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 BM RefN H-7 LotN 30.04.2020; BM RefN H-8 LotN 28.05.2020; BM RefN H-8 LotN 30.04.2020; BM RefN H-10 LotN 28.05.2020. 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.

P. Jengcharit
1 March 2022

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2201793-001-01
Equipment: pH Meter
Resolution: 0.01 pH ; 1 mV
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210
Type: Bench top
ID No.: UAE.WAT.010/2553
Date of Calibration: 1 March 2022 **Page 3 of 5**

Calibration Results:

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

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading mV	pH	Uncertainty (± mV)	Coverage Factor (K)
0.00	414.117	414	0.00	0.58	2.00
2.00	295.911	296	2.00	0.58	2.00
4.00	177.462	178	4.00	0.58	2.00
6.00	59.159	59	6.00	0.58	2.00
7.00	-0.001	0	7.00	0.58	2.00
8.00	-59.159	-59	8.00	0.58	2.00
10.00	-177.463	-177	10.00	0.58	2.00
12.00	-295.912	-296	12.00	0.58	2.00
14.00	-414.119	-414	14.00	0.58	2.00

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

Equipment: pH Electrode
Manufacturer: METTLER TOLEDO
Serial No.: 1156882
Type: Combined Electrode
Model: InLabSolids
ID No.: N/A

Performance of Electrode system (Three-Point Calibration at pH4, pH7 and pH10)

Certified Value @25 °C (pH)	Average Indicator Reading pH	mV	Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (K)
4.003	4.00	180	96.25	0.0076	2.00
6.865	6.88	19	-	0.0079	2.00
10.012	10.01	-162	98.13	0.0094	2.00
6.865	7.00	9	-	0.0097	2.00

P. Jengcharit
1 March 2022

F-CS-012 Revision: 00 Date: 14-12-61

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Calibration Report

Certificate No.: 2201793-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
 Resolution: 0.1 °C Model: SevenEasy pH
 Serial No.: 1231155210 ID No.: UAE.WAT.010/2553
 Manufacturer: METTLER TOLEDO
Date of Calibration: 1 March 2022 Page 4 of 5

Location: Chemical Calibration Laboratory, NATIONAL FOOD INSTITUTE
Environment Condition: Ambient Temperature 24 °C ± 1 °C
 Relative Humidity 53 % ± 2 %

Condition of this results of Calibration:

- 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 0851/64	03-Jun-22	TISTR.
Platinum Resistance Thermometer (PRT)	5627A	877332			

Support Equipment : Low Temperature Bath (ISOCAL-5), Model: Europa-5 Plus Basic, SN: 341592/2

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

6. Condition of Calibrated Item :

Good ☒ Without adjustment ☐ After adjustment

7. Result of Calibration :

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2201793-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
 Resolution: 0.1 °C Model: SevenEasy pH
 Serial No.: 1231155210 ID No.: UAE.WAT.010/2553
 Manufacturer: METTLER TOLEDO
Date of Calibration: 1 March 2022 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 100 mm.
- Description of probe, model : N/A SN : N/A
- Dimension of probe : Diameter 4 mm., Length 100 mm.,
- Sheath material : Stainless Steel

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.1	15.008	-0.1	0.099
25.1	25.004	-0.1	0.099
35.1	35.003	-0.1	0.099

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: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Certificate

Certificate No.: 2200708-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Sol Udomsuk 41, Sukhumvit Road,
 Bangchack, Prakhonong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: AX 105 DR

Serial No.: 1122100406

ID No.: UAE.WAO.004/2546


Order No.: 2200708

Operation No.: 2200708-001

Date of Receipt: 24 November 2021

Date of Calibration: 24 November 2021

Calibrated by Mr.Worapob Sooktong
 Scientist

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

Date of Issue: 30 November 2021

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-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2200708-001-01
Equipment: Electronic Balance
 Model: AX 105 DR
 Serial No.: 1122100406
 Capacity: 110 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.004/2546

Date of Calibration: 24 November 2021

Page 2 of 4

Environment Condition: Ambient Temperature: 22.0 ± 0.5 °C Relative Humidity: 39 ± 1 %

Place of Calibration: Balance Room, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

- Calibration Method: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	15880	TCS	M20111955	28 November 2021
Standard Weight Class E2	1-500g	15882	TCS	M20111965	28 November 2021
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	11A1	www.kit.BTH 003/55	Quality Reborn	QR21-0297	15 February 2022

3. This certification is traceable to SI UNIT

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.

Calibration Results:

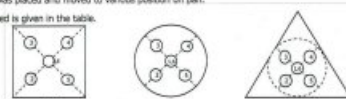
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
15	0.0000057
30	0.0000084
50	0.0000053
100	0.000048

2. Off-Center Error:

A mass of 50 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
50.0000	50.0000	49.9999	50.0000	49.9999	49.9999	0.0001

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2200708-001-01
Equipment: Electronic Balance
Model: AX 105 DR
Serial No.: 1122100406
Capacity: 110 g
Manufacturer: METTLER TOLEDO
Resolution: 0.0001 g / 0.0001 g
ID No.: UAE.WAO.004/2546

Date of Calibration: 24 November 2021 **Page 3 of 4**

Calibration Results: (Continued)
Calibration Range: 0-100 g
Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 0 - 30 g; Resolution: 0.0001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
Unload	0.00000	0.00000	0.00000	0.0000009	2.00
0.01	0.009998	0.01000	0.00000	0.000011	2.00
0.02	0.019997	0.02000	0.00000	0.000012	2.00
0.05	0.050001	0.05000	0.00000	0.000011	2.00
0.1	0.100002	0.10000	0.00000	0.000012	2.00
0.2	0.200004	0.20000	0.00000	0.000013	2.00
0.5	0.499994	0.50000	-0.00001	0.000014	2.00
1	0.999986	1.00000	-0.00001	0.000026	2.00
2	1.999989	1.99998	0.00001	0.000019	2.00
5	4.999979	4.99998	0.00000	0.000022	2.00
10	10.000026	9.99994	0.00009	0.000074	2.00
20	20.000037	19.99991	0.00013	0.000099	2.00
30	30.000063	30.00000	0.00006	0.00013	2.00

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2200708-001-01
Equipment: Electronic Balance
Model: AX 105 DR
Serial No.: 1122100406
Capacity: 110 g
Manufacturer: METTLER TOLEDO
Resolution: 0.0001 g / 0.0001 g
ID No.: UAE.WAO.004/2546

Date of Calibration: 24 November 2021 **Page 4 of 4**

Calibration Results: (Continued)
Calibration Range: 0-100 g
Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 31 - 100 g; Resolution: 0.0001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
40	40.00000	39.9999	0.0001	0.00014	2.00
45	44.99998	44.9999	0.0001	0.00015	2.00
50	49.99999	49.9999	0.0001	0.00016	2.00
55	54.99997	54.9998	0.0002	0.00016	2.00
60	60.00002	59.9999	0.0001	0.00018	2.00
65	65.00000	64.9999	0.0001	0.00018	2.00
70	70.00003	69.9999	0.0001	0.00019	2.00
75	75.00001	74.9999	0.0001	0.00020	2.00
80	80.00005	79.9998	0.0003	0.00021	2.00
85	85.00003	84.9998	0.0002	0.00022	2.00
90	89.99999	89.9998	0.0002	0.00021	2.00
100	99.99997	99.9998	0.0002	0.00020	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 %.

F-CS-012 Revision: 00 Date: 14-12-61

----- End -----

เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 38, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3000-27 FAX: 0-2719-9484



Cert. No.: 22TM304
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: 7 April 2022
Calibration Date: 7 April 2022
Ambient Temperature: (26 ± 10) °C
Relative Humidity: (50 ± 30) %
Calibrated by: Man Pattanapongpaiboon
Approved by:
() Pornthippa Tamayakul
(✓) Malee Butkrusa
() Suwit Imjai

Issue Date: 18 April 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 : Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม

A 0040245



Equipment: Hot Air Oven
Condition As-Received: Used Item
Reference: 2204-0015OC-1
Procedure Used :-

Cert. No.: 22TM304
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	34970A	MY41021843	22LM4	10 Jan 2023

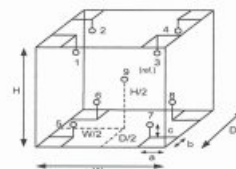
2. This certificate is valid only to the item calibrated on date and place of calibration.

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 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	28
REL.Humid. (%)	56	55
AC Supply (Volt)	221	224

Ref. Std. ID No.: @ Calibration Point (°C)		
Position :	(120 , 180)	(104)
1	21-04TC-01	18-04RTD-01
2	21-04TC-02	18-04RTD-02
3	21-04TC-03	18-04RTD-03
4	21-04TC-04	18-04RTD-04
5	21-04TC-05	18-04RTD-05
6	21-04TC-06	18-04RTD-06
7	21-04TC-07	18-04RTD-07
8	21-04TC-08	18-04RTD-08
9 (ref.)	21-04TC-09	18-04RTD-09

เอกสารไม่ควบคุม

a 1104316



Equipment : Hot Air Oven
 Condition As-Received : Used Item
 Reference : 2204-00150C-1
 Result of Calibration : (*) Without Adjustment
 Function of UUC* : Temperature Source
 Fresh air setting : Close

Cert. No.: 22TM304
 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
104.0	104.0	104.0	0.040	0.57	0.80	0.42	2
120.0	120.0	120.0	0.11	0.82	1.1	1.1	2
180.0	180.0	180.0	0.12	1.4	2.0	1.1	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
104.0	104.403	104.220	104.517	104.474	103.778	103.859	104.292	104.357	104.319
120.0	120.183	119.878	120.238	120.355	119.476	119.455	120.046	120.173	120.199
180.0	180.502	179.929	180.655	180.797	179.012	179.044	180.043	180.305	180.340

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
 1104315

Verification Certificate

Certificate No.: 2202361-001-01
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.: 2202361
Operation No.: 2202361-001
Date of Receipt: 4 April 2022
Date of Calibration: 4-6 April 2022

Calibrated by Mr.Nuttapol Niyomchat Specialist
Approved by (Mr.Pheraphat Tuanjit)
 Manager, Division of Calibration Laboratory
Date of Issue: 11 April 2022
 Responsible for the Technical Management Team

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

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

FCS-009 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

Verification Report

Certificate No.: 2202361-001-01
Equipment: HEATING BLOCK DIGESTION
 Model: 2520 Serial No.: 91794469
 Resolution: 1 °C ID No.: UAE.WAS.011/2560
 Manufacturer: FOSS
Date of Calibration: 4-6 April 2022

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:

- 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.
- Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with Thermocouple	34970A/34901A Type R	MY04043376 / MY01304033 TC181-103 / CH101-103	TC21/0041	24-Apr-2022	N.M. Technical Center Laboratory

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

UUC* Description
 Time of Record - Hour 30 Minute At 380 °C

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

เอกสารไม่ควบคุม

Verification Report

Certificate No.: 2202361-001-01
Equipment: HEATING BLOCK DIGESTION
 Model: 2520 Serial No.: 91794469
 Resolution: 1 °C ID No.: UAE.WAS.011/2560
 Manufacturer: FOSS
Date of Calibration: 4-6 April 2022

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	0.13	376.48	1.5
2	380	380	0.12	376.58	1.5
3	380	380	0.12	376.51	1.5
4	380	380	0.14	376.70	1.6
5	380	380	0.18	376.81	1.6
6	380	380	0.12	377.23	1.6
7	380	380	0.12	377.37	1.5
8	380	380	0.13	376.68	1.5
9	380	380	0.14	376.72	1.5
10	380	380	0.18	378.97	1.6
11	380	380	0.25	378.79	1.6
12	380	380	0.11	377.14	1.6
13	380	380	0.19	379.65	1.6
14	380	380	0.16	379.61	1.6
15	380	380	0.16	378.66	1.6
16	380	380	0.15	379.18	1.6
17	380	380	0.23	377.39	1.6
18	380	380	0.11	377.71	1.6
19	380	380	0.22	376.64	1.6
20	380	380	0.16	376.56	1.6

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.

เอกสารไม่ควบคุม

FCS-012 Revision: 00 Date: 14-12-61

Verification Report

Certificate No.: 2202361-001-01
Equipment: HEATING BLOCK DIGESTION
Model: 2520 Serial No.: 91794469
Resolution: 1 °C ID No.: UAE.WAS.011/2560
Manufacturer: FOSS
Date of Calibration: 4-6 April 2022 Page 4 of 4
Calibration point: 380 °C
Calibration result: Continued

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

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 *****

FCS-912 Revision: 00 Date: 14-12-61

เอกสารไม่ควบคุม

FOSS

Customer Service Report

Date: 30/4/21
Customer: UAE
Instrument: KT 200

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

Report No: 5874

Address: 91 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110
Serial: 91790529

Hours: Travel To Customer 1 Labour 19.00 Travel From Customer 19.00
Start 8.00 Finish 8.00

Application	Special	Standard
Normal	Courtesy Visit	Installation
Distributor	PMA Onboarding	Quote
Internal	Warranty	Repair
Digital Service	Sales Support	Remote
		Other

PO/Quote Number: If applicable

PMA Type: Foss Care - PM Contract No. If applicable

Details of Work / Test	Condition / Status
- Check Instrument	OK
- Check PM Kit for KT 200	Pass
- Check Safety Valve	Pass
- Check Rubber Gasket	Pass
- Check Seal	Pass
- Check Heating Element	Pass
- Check New Panel PCB	Pass
- Check Safety door	Pass
- Check Safety door complete	Pass
- Check Clean	Pass
- Check Leaked	Pass
- Check Volume 20ml set 30ml to 20ml	Pass
Instrument Ready for Use	OK / Not OK

Part No.	Batch	Description	Qty
10009945	11.23.2023	Foss PM Kit KT 200	1
15750824	29.07.21	Safety Valve	1
15940824	09.11.20	Rubber Gasket for Heating	2
10005172	02.05.21	Heating Element	1
10005762	16.11.20	Seal	1
10004273	16.07.20	KT 200 new panel PCB	1
10000385	22.04.21	Safety door complete	1

I confirm this report is accurate and complete
Signed FOSS: [Signature] Signed Customer: [Signature]
Name: [Name] Name: [Name]
Would you be willing to participate in a brief survey in order to tell us how we performed? []

เอกสารไม่ควบคุม

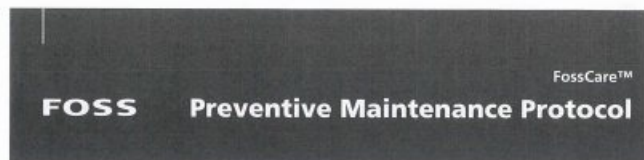
Maintenance Procedure

Exchange of Parts and Cleaning

Step	Action	Part	P/N	OK
1	Replace	Adapter for dig. tube 250 ml	1000 0056	<input type="checkbox"/>
2	Replace	Non return valve	1000 3538	<input type="checkbox"/>
3	Replace valves in alkali pump	Valve kit reagent/water pump	1575 0093	<input type="checkbox"/>
4	Replace steam tubing	Silicone tubing 8/12 mm	1582 0006	<input type="checkbox"/>
5	Replace alkali tubing	Tubing reinforced for alkali	1582 0011	<input type="checkbox"/>
6	Replace water tubing	Tubing PVC 8/11 mm	1582 0004	<input type="checkbox"/>
7	Cleaning	Steam generator		<input type="checkbox"/>
8	Cleaning	Splash head		<input type="checkbox"/>

Check and Adjustments

Step	Action	Module	Measured	Limits	OK
1	Check alkali volume, 10 ml/stroke	Alkali pump	98	At 50 ml -0/+3 ml	<input checked="" type="checkbox"/>
2	Check distillation volume		120ml	100 - 150 ml/4 min	<input checked="" type="checkbox"/>
3	Check front panel switches				<input checked="" type="checkbox"/>
4	Check cables and electrical connections				<input checked="" type="checkbox"/>
5	Check level pins in steam generator				<input checked="" type="checkbox"/>
6	Check safety door switch				<input checked="" type="checkbox"/>



Customer: UAE

Instrument	Kjeltec™ 2100 - Kjeltec 200
Recommended PM interval (whichever occurs first between interval and no. of samples analysed)	12 months No. of samples analysed (if applicable):
Preventive maintenance kit (P/N)	10009965 C/N 91790529

Introduction

A maintenance protocol provides systematic and functional means of maintaining a specific instrument type. The recommended PM interval depends on the operational conditions and is based on our extensive experience and knowledge of manufacturing and maintaining analytical instruments.

Apart from sample throughput, the environmental conditions also need to be considered. A demanding environment, such as high ambient temperature, humidity, dirtiness etc can measurably shorten component lifetime and also the maintenance and component replacement intervals.

NOTE!

The content of this protocol is subject to change over time. In order to safeguard that you obtain the correct parts, please make sure to indicate serial no and date of installation when contacting your FOSS representative.

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Calibration Certificate

Certificate No.: 2203120-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 3

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: AB204-S/FACT

Serial No.: 1129361010

ID No.: UAE.WAS.002/2552

Order No.: 2203120

Operation No.: 2203120-001

Date of Receipt: 1 June 2022

Date of Calibration: 1 June 2022

Calibrated by Mr. Taveesak Seilee
Scientist

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

Date of Issue: 7 June 2022

The uncertainties are for a confidence probability of approximately 95%

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

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

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2203120-001-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: AB204-S/FACT
Serial No.: 1129361010
Capacity: 220 g
ID No.: UAE.WAS.002/2552

Date of Calibration: 1 June 2022 Page 3 of 3

Calibration Results: (Continued)

Calibration Range: 0 - 200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor k
Unloaded	0.00000	0.0000	0.0000	0.000088	2.00
0.01	0.01000	0.0100	0.0000	0.000088	2.00
0.05	0.05000	0.0499	0.0001	0.000088	2.00
0.1	0.10000	0.1000	0.0000	0.000088	2.00
0.2	0.20000	0.2000	0.0000	0.000088	2.00
0.5	0.50000	0.5000	0.0000	0.000088	2.00
1	1.00000	0.9999	0.0001	0.000088	2.00
2	2.00000	1.9999	0.0001	0.000088	2.00
5	5.00000	5.0000	0.0000	0.000088	2.00
10	9.99998	9.9999	0.0001	0.000088	2.00
20	19.99999	19.9999	0.0001	0.000088	2.00
50	49.99990	49.9999	0.0000	0.00012	2.00
70	69.99989	69.9998	0.0001	0.00014	2.00
100	100.00001	99.9999	0.0001	0.00017	2.00
150	149.99991	149.9997	0.0002	0.00022	2.00
200	200.00007	199.9998	0.0003	0.00030	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 %.

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

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2203120-001-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: AB204-S/FACT
Serial No.: 1129361010
Capacity: 220 g
Resolution: 0.0001 g
ID No.: UAE.WAS.002/2552

Date of Calibration: 1 June 2022 Page 2 of 3

Environment Condition: Ambient Temperature: 19.9 ± 0.3 °C Relative Humidity: 45 ± 1.5 %

Place of Calibration: 108, Balance Room, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	B308068554	TCS	H22010205	6 January 2023
Standard Weight Class E2	1-500g	B308068128	TCS	H22010215	6 January 2023
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	PONPE 490	NFLBTH 010/18	Quality Room	QR22-0350	18 February 2023

3. This certificate is traceable to SI UNIT

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.

Calibration Results:

1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
100	0.000046
200	0.000052

2. Off-Center Error:

A mass of 50 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
49.9999	49.9998	49.9998	49.9999	49.9998	49.9998	0.0001

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

เอกสารไม่ควบคุม

DQE Services Co., Ltd.
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.: SP22-007 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: 20 January 2022

Calibration Date: 20 January 2022

Issue Date: 24 January 2022

Condition Instrument: Good

Calibrated by: (Mr. Tanawat Rittidach)
Technical Manager

Approved by: (Ms. Chonticha Sengngern)
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.

PM-700-02 Rev 1/1/2021

เอกสารไม่ควบคุม


เอกสารไม่ควบคุม

DQE Services Co.,Ltd.

DQE Services

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ISO 15189:2013

LABORATORY

REPORT OF CALIBRATION

Certificate No. : SP22-007

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.

FM-708-02 R01 1/11/2021


เอกสารไม่ควบคุม

DQE Services Co.,Ltd.

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ISO 15189:2013

LABORATORY

REPORT OF CALIBRATION

Certificate No. : SP22-007

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	0.577	0.0017	0.0031	2.00
	1.0490	1.050	-0.0010	0.0029	2.00
	2.1900	2.183	0.0070	0.0080	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5607	0.560	0.0007	0.0034	2.00
	1.0247	1.023	0.0017	0.0035	2.00
	2.1229	2.118	0.0049	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5236	0.521	0.0026	0.0030	2.00
	0.9634	0.963	0.0004	0.0029	2.00
	1.9763	1.974	0.0023	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	1.996	0.0027	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	2.033	0.0061	0.0079	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5601	0.562	-0.0019	0.0031	2.00
	1.0512	1.052	-0.0008	0.0030	2.00
	1.9294	1.925	0.0044	0.0079	2.00

FM-708-02 R01 1/11/2021


เอกสารไม่ควบคุม

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ISO 15189:2013

LABORATORY

REPORT OF CALIBRATION

Certificate No. : SP22-007

Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7478	0.746	0.0018	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	0.638	0.0068	0.0055	2.00

FM-708-02 R01 1/11/2021


เอกสารไม่ควบคุม

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ISO 15189:2013

LABORATORY

REPORT OF CALIBRATION

Certificate No. : SP22-007

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	418.0	0.48	0.18	2.00
446.70	446.0	0.70	0.18	2.00
453.20	453.0	0.20	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	637.2	0.74	0.18	2.00
440.74	440.0	0.74	0.18	2.00
472.22	471.6	0.62	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	573.8	0.80	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	739.8	0.47	0.20	2.00
748.28	747.8	0.48	0.18	2.00
807.16	806.4	0.76	0.18	2.00
879.70	878.8	0.90	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

- The mesh 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 TSI accredited

- End of Certificate -

FM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม

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

CERTIFICATE OF CALIBRATION

Certificate No. : SP22-008 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 : 20 January 2022

Calibration Date : 20 January 2022

Issue Date : 24 January 2022

Condition Instrument : Good

Calibrated by :  Approved by : 
(Mr. Tanawut Rittidach) (Ms. Chonthicha 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 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.

PM-708-02 R01 1/11/2021

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REPORT OF CALIBRATION

Certificate No. : SP22-008 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 Sarna 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.

PM-708-02 R01 1/11/2021

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REPORT OF CALIBRATION

Certificate No. : SP22-008 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	0.576	0.0027	0.0031	2.00
	1.0490	1.046	0.0030	0.0029	2.00
	2.1900	2.182	0.0080	0.0075	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5607	0.559	0.0017	0.0034	2.00
	1.0247	1.023	0.0017	0.0035	2.00
	2.1229	2.116	0.0069	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5236	0.521	0.0026	0.0030	2.00
	0.9634	0.962	0.0014	0.0029	2.00
	1.9763	1.970	0.0063	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5191	0.519	0.0001	0.0031	2.00
	1.0003	0.999	0.0013	0.0033	2.00
	1.9987	1.992	0.0067	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	1.080	0.0009	0.0030	2.00
	2.0391	2.031	0.0081	0.0079	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5601	0.560	0.0001	0.0031	2.00
	1.0512	1.052	-0.0008	0.0030	2.00
	1.9294	1.922	0.0074	0.0079	2.00

PM-708-02 R01 1/11/2021

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REPORT OF CALIBRATION

Certificate No. : SP22-008 Page 4 of 5

Photometric Accuracy :


Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7478	0.747	0.0008	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8686	0.865	0.0036	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	0.640	0.0048	0.0055	2.00

PM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม

DQE Services

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ISO 9001:2015
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP22-008

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	241.0	0.72	0.18	2.00
279.45	279.0	0.45	0.18	2.00
287.81	287.0	0.81	0.18	2.00
334.06	333.5	0.56	0.18	2.00
360.93	360.0	0.93	0.18	2.00
418.59	418.0	0.59	0.18	2.00
445.94	445.5	0.44	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	536.0	0.59	0.18	2.00
637.98	637.5	0.48	0.18	2.00
431.38	431.0	0.38	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	573.0	0.17	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 -

FM-708-02 R01 1/11/2021

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DQE Services

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ISO 9001:2015
CALIBRATION DATA

CERTIFICATE OF CALIBRATION

Certificate No. : SP22-016

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 : Agilent Technologies

Model : Cary 60

Serial No. : MY15410009


ID No. : N/A

Received Date : 23 May 2022

Calibration Date : 23 May 2022


Issue Date : 26 May 2022

Condition Instrument : Good

Calibrated by : 

(Mr.Tanawat Rittidach)

Technical Manager

Approved by : 

(Ms. Chonthicha Sangnern)

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 task 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.

FM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม

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ISO 9001:2015
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP22-016

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 : 1.5 nm.

Scan Speed of UUC : 90 nm/min

Scan Interval of UUC : 0.15 nm.

Resolution of UUC : Photometric 0.0001 Abs.


Wavelength 0.1 nm.

FM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม

DQE Services

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ISO 9001:2015
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP22-016

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	0.0000	0.0000	0.0028	2.00
	0.5787	0.5755	0.0032	0.0031	2.00
	1.0490	1.0436	0.0054	0.0029	2.00
	2.1900	2.1847	0.0053	0.0075	2.00
440	0.0000	0.0000	0.0000	0.0028	2.00
	0.5607	0.5588	0.0019	0.0034	2.00
	1.0247	1.0232	0.0015	0.0035	2.00
	2.1229	2.1211	0.0018	0.0082	2.00
465	0.0000	0.0000	0.0000	0.0028	2.00
	0.5236	0.5197	0.0039	0.0029	2.00
	0.9634	0.9625	0.0009	0.0028	2.00
	1.9763	1.9752	0.0011	0.0070	2.00
546.1	0.0000	-0.0001	0.0001	0.0028	2.00
	0.5191	0.5171	0.0020	0.0031	2.00
	1.0003	0.9984	0.0019	0.0033	2.00
	1.9987	1.9946	0.0041	0.0084	2.00
590	0.0000	0.0000	0.0000	0.0028	2.00
	0.5523	0.5509	0.0014	0.0030	2.00
	1.0809	1.0799	0.0010	0.0029	2.00
	2.0391	2.0329	0.0062	0.0080	2.00
635	0.0000	0.0000	0.0000	0.0028	2.00
	0.5601	0.5584	0.0017	0.0031	2.00
	1.0512	1.0498	0.0014	0.0029	2.00
	1.9294	1.9265	0.0029	0.0082	2.00

FM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม



REPORT OF CALIBRATION

Certificate No. : SP22-016

Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000 0.7478	0.0001 0.7421	-0.0001 0.0057	0.0050 0.0056	2.00 2.00
257	0.0000 0.8686	0.0000 0.8619	0.0000 0.0067	0.0050 0.0059	2.00 2.00
313	0.0000 0.2912	0.0000 0.2896	0.0000 0.0016	0.0050 0.0051	2.00 2.00
350	0.0000 0.6448	0.0000 0.6403	0.0000 0.0045	0.0050 0.0055	2.00 2.00



REPORT OF CALIBRATION

Certificate No. : SP22-016

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	242.0	-0.28	0.18	2.00
279.45	279.5	-0.05	0.18	2.00
287.81	287.5	0.31	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	445.4	0.54	0.18	2.00
453.66	453.2	0.46	0.18	2.00
460.02	459.7	0.32	0.18	2.00
536.59	536.2	0.39	0.18	2.00
637.98	638.3	-0.32	0.18	2.00
431.38	431.0	0.38	0.18	2.00
472.50	472.5	0.00	0.18	2.00
513.47	513.5	-0.03	0.18	2.00
528.88	528.5	0.38	0.18	2.00
573.17	573.0	0.17	0.18	2.00
585.35	585.0	0.35	0.20	2.00
684.40	684.7	-0.30	0.18	2.00
740.72	740.8	-0.08	0.20	2.00
748.55	748.5	0.05	0.18	2.00
807.03	807.3	-0.27	0.18	2.00
879.28	879.0	0.28	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 TISI accredited

- End of Certificate -

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
55/48 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3000-27 FAX: 0-2719-9484



Cert. No.: 22TM90
Page.: 1 of 3

Certificate of Calibration

Equipment : BOD Incubator
Manufacturer : Arco
Model : UC4-1320
Serial No. : 13URC4S013201
ID No. : UAE.WAO.015/2561
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 : 17 February 2022
Calibration Date : 17 February 2022
Ambient Temperature : (28 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Kunchit Promprat

Approved by :
Approved Signatory

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

Issue Date : 22 February 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 Services.

เอกสารไม่ควบคุม

A 0038099



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2202-0446OC-1
Procedure Used :-

Cert. No.: 22TM90
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	34970A	MY44035217	21LM30	23 Dec 2022

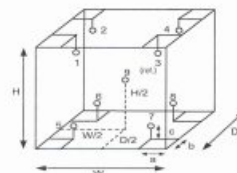
2. This certificate is valid only to the item calibrated on date and place of calibration.

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



Probe Installation Details : Dimension of Chamber :
a = 10 cm D = 0.62 m
b = 10 cm W = 1.2 m
c = 10 cm H = 1.2 m
Capacity = 0.89 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	28
REL.Humid. (%)	68	75
AC Supply (Volt)	226	226

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

เอกสารไม่ควบคุม

A 1096042



Equipment : BOD Incubator
 Condition As-Received : Used Item
 Reference : 2202-04480C-1
 Result of Calibration :- (*) Without Adjustment
 Function of UUC* : Temperature Source
 Fresh air setting : Not Available

Cert. No.: 22TM80
 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
20.0	19.6	19.4	0.30	0.58	1.0	0.55	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
20.0	20.154	20.013	20.356	19.939	19.834	19.761	19.817	19.824	19.922

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
 A 1096041



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
 CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
 534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
 TEL. 0-2717-3000-27 FAX. 0-2719-4484



Cert. No.: 22TM306
 Page.: 1 of 3

Certificate of Calibration

Equipment : BOD Incubator

Manufacturer : ARCO

Model : UR-1320

Serial No. : -

ID No. : UAE.WAO.006/2553

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 : 7 April 2022

Calibration Date : 7 April 2022

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Man Pattanapongpaiboon

Approved by :
 Approved Signatory

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

Issue Date : 18 April 2022

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 0040247



Equipment : BOD Incubator
 Condition As-Received : Used Item
 Reference : 2204-00150C-3
 Procedure Used :-

Cert. No.: 22TM306
 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	34970A	MY41021843	22LM4	10 Jan 2023

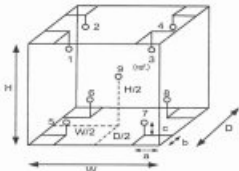
2. This certificate is valid only to the item calibrated on date and place of calibration.

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



Probe Installation Details : Dimension of Chamber :
 a = 10 cm D = 0.62 m
 b = 10 cm W = 1.2 m
 c = 10 cm H = 1.2 m
 Capacity = 0.89 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	27
REL.Humid. (%)	59	57
AC Supply (Volt)	221	220

Position :	Ref. Std. ID No.:
1	18-04RTD-01
2	18-04RTD-02
3	18-04RTD-03
4	18-04RTD-04
5	18-04RTD-05
6	18-04RTD-06
7	18-04RTD-07
8	18-04RTD-08
9 (ref.)	18-04RTD-09



Equipment : BOD Incubator
 Condition As-Received : Used Item
 Reference : 2204-00150C-3
 Result of Calibration :- (*) Without Adjustment
 Function of UUC* : Temperature Source
 Fresh air setting : Not Available

Cert. No.: 22TM306
 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
20.0	20.0	19.9	0.33	0.68	1.4	0.50	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
20.0	20.176	20.413	19.711	19.637	20.218	20.266	19.639	19.642	19.922

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
 A 1104312

เอกสารไม่ควบคุม
 A 1104311



Cert. No.: 22TM305
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 : 7 April 2022
Calibration Date : 7 April 2022
Ambient Temperature : $(26 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$
Calibrated by : Man Pattansongpaiboon
Approved by :
() Ponthippa Tameyakul
(✓) Malee Butkruea
() Suwit Imjai

Issue Date : 18 April 2022

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 0040246



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2204-0015OC-2
Procedure Used :-

Cert. No.: 22TM305
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	34970A	MY41021843	22LM4	10 Jan 2023

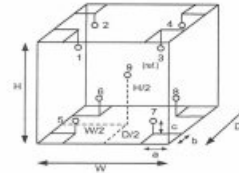
2. This certificate is valid only to the item calibrated on date and place of calibration.

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



Probe Installation Details :		Dimension of Chamber :	
a = 10 cm	D = 0.62 m		
b = 10 cm	W = 1.2 m		
c = 10 cm	H = 1.2 m		
	Capacity = 0.89 m ³		

Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	27
REL Humid. (%)	56	59
AC Supply (Volt)	222	221

Position :	Ref. Std. ID No.:
1	18-04RTD-01
2	18-04RTD-02
3	18-04RTD-03
4	18-04RTD-04
5	18-04RTD-05
6	18-04RTD-06
7	18-04RTD-07
8	18-04RTD-08
9 (ref.)	18-04RTD-09

เอกสารไม่ควบคุม

a 1104314



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2204-0015OC-2
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 22TM305
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
20.0	20.0	20.0	0.50	0.44	1.1	0.64	2

Measured Temperature (°C)									
Calibration Point (°C)	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
20.0	20.080	20.056	19.866	19.826	19.855	19.656	19.819	19.979	19.899

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

a 1104313



Cert. No.: 21TM1875
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 : 28 October 2021
Calibration Date : 28 - 29 October 2021
Ambient Temperature : $(26 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$
Calibrated by : Kunchit Promprat
Approved by :
() Ponthippa Tameyakul
(✓) Malee Butkruea
() Suwit Imjai

Issue Date : 4 November 2021

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 : 2110-0698OC-2

Cert. No.: 21TM1875
Page.: 2 of 3

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	34970A	MY44067817	21LM10	20 Jul 2022

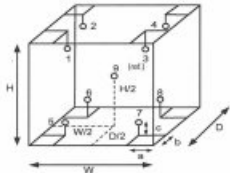
2. This certificate is valid only to the item calibrated on date and place of calibration.

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)	22	22
REL.Humid. (%)	59	60
AC Supply (Volt)	226	226

Position :	Ref. Std. ID No.:
1	19-15RTD-01
2	19-15RTD-02
3	19-15RTD-03
4	19-15RTD-04
5	19-15RTD-05
6	21-15RTD-06
7	19-15RTD-07
8	19-15RTD-08
9 (ref.)	19-15RTD-09

Probe Installation Details :

Dimension of Chamber :

a = 5.0 cm D = 0.50 m
b = 5.0 cm W = 0.64 m
c = 5.0 cm H = 0.80 m
Capacity = 0.26 m³

Male

เอกสารไม่ควบคุม



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2110-0698OC-2

Cert. No.: 21TM1875
Page.: 3 of 3

Result of Calibration :-

(*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
22.0	22.0	21.5	0.022	0.11	0.13	0.30	2
35.0	35.0	35.0	0.062	0.56	1.0	0.30	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
22.0	21.872	21.877	21.800	21.770	21.813	21.786	21.832	21.824	21.778
35.0	35.468	35.405	35.216	35.202	34.621	34.763	34.525	34.730	35.049

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-

Male

เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
554/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 22TM335
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 : 17 February 2022
Calibration Date : 17 February 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Suwit Imjai

Approved by :
Approved Signatory

() Ponthippa Tameyskul
(✓) Malee Bulkrues

Issue Date : 22 February 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 Services.



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2202-0444OC-2

Cert. No.: 22TM335
Page.: 2 of 3

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	34970A	MY44067817	21LM10	20 Jul 2022

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

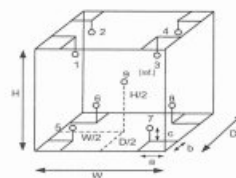
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	21	22
REL.Humid. (%)	65	62
AC Supply (Volt)	229	230



Probe Installation Details :

Dimension of Chamber :

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 m³

Position :	Ref. Std. ID No.:
1	15RTD2/11
2	15RTD2/12
3	15RTD2/13
4	15RTD2/14
5	15RTD2/15
6	15RTD2/16
7	15RTD2/17
8	15RTD2/18
9 (ref.)	15RTD2/19

Male

เอกสารไม่ควบคุม



Equipment : Incubator
 Condition As-Received : Used Item
 Reference : 2202-0444OC-2
 Result of Calibration :- (*) Without Adjustment
 Function of UUC* : Temperature Source
 Fresh air setting : Close

Cert. No.: 22TM335
 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	34.9	34.9	0.024	0.47	0.70	0.30	2

Calibration Point (°C)	Measured Temperature (°C)								9 (ref.)
	1	2	3	4	5	6	7	8	
35.0	35.184	35.333	35.121	35.141	34.725	34.969	34.665	34.726	34.897

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

a 1096058

กำหนดจุดห้ามใช้งาน

References Certificate Number. : 22TM335

Equipment : Incubator

Model : BD 53

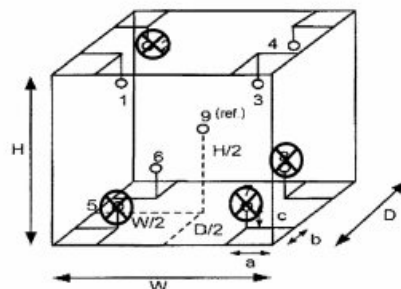
Serial No. : 13-07343

ID No. : UAE.MIC.005/2558

Manufacturer : Binder

Calibration Point : 35 °C

Unit Under Calibration Setting : 34.9 °C



รูปภาพเครื่องมือ แสดงจุดที่ได้รับการสอบเทียบ และสัญลักษณ์ ⊗ แสดงจุดห้ามใช้งาน

กำหนดจุดห้ามใช้งานตำแหน่งที่.....2,5,7,8.....

หมายเหตุ เก็บใบนี้เพิ่ม.....

\\uae-netapp\Netapp_LAB\Lab-EQUIPMENT\11-2016-4-Certificate\กำหนดห้ามใช้งาน\เครื่องวัดอุณหภูมิ 2558\กำหนดจุดห้ามใช้งาน Incubator_UAE.MIC.005_2558\22TM335.doc

เอกสารไม่ควบคุม



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.: 22TM332
 Page.: 1 of 3

Certificate of Calibration

Equipment : Water Bath
 Manufacturer : Memmert
 Model : WNE 14
 Serial No. : L416.0614
 ID No. : UAE.MIC.020/2561
 Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
 3 Soi Udomsuk 41, Sukhumvit Road,
 Bangchak, Phrakhanong,
 Bangkok 10260
 Location : Microbiology Laboratory
 Received Order : 17 February 2022
 Calibration Date : 17 February 2022
 Ambient Temperature : (26 ± 10) °C
 Relative Humidity : (50 ± 30) %
 Calibrated by : Suwit Imjai

Approved by :
 () Ponthippa Tamayakul
 (✓) Malee Butkruea

Issue Date : 22 February 2022

The Uncertainties are for a confidence probability of approximately 95 %

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เอกสารไม่ควบคุม

A 0038096



Equipment : Water Bath
 Condition As-Received : Used Item
 Reference : 2202-0444OC-6
 Procedure Used :-

Cert. No.: 22TM332
 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	34970A	MY44067817	21LM10	20 Jul 2022

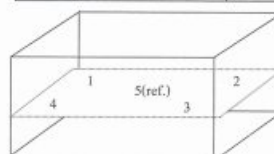
2. This certificate is valid only to the item calibrated on date and place of calibration.

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	21	65	229
Finished of Calibration	22	66	230



Position :	Ref. Std. ID No.:
1	70RC143
2	70RC144
3	70RC145
4	70RC146
5(ref.)	70RC147

เอกสารไม่ควบคุม

a 1096053



Equipment : Water Bath
 Condition As-Received : Used Item
 Reference : 2202-0444OC-5
 Result of Calibration :- (*) Without Adjustment
 Function of UUC* : Temperature Source

Cert. No.: 22TM332
 Page.: 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)				
			Position				
			1	2	3	4	5 (ref.)
44.5	44.5	44.5	44.546	44.517	44.513	44.537	44.578
50.0	50.0	50.0	50.089	50.051	50.036	50.061	50.092

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor k
44.5	0.10	0.043	0.15	2
50.0	0.11	0.042	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 %.

-o0o-

เอกสารไม่ควบคุม

a 1096052



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
 CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
 554/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
 TEL. 0-2717-3000-27 FAX. 0-2719-9488



Cert. No.: 21TM1355/1
 Page.: 1 of 3

Certificate of Calibration

This Certificate was issued to replace to the Certificate No. 21TM1355

Equipment : Water Bath

Manufacturer : Memmert

Model : WB 14

Serial No. : I401.0569

ID No. : UAE.MIC.004/2544

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

Location : Microbiology Laboratory

Received Order : 14 July 2021

Calibration Date : 14 July 2021

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Preecha Hiahb

Approved by :
 Approved Signatory

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

Issue Date : 30 July 2021

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 0030834



Equipment : Water Bath
 Condition As-Received : Used Item
 Reference : 2107-0318OC-5
 Procedure Used :-

Cert. No.: 21TM1355/1
 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	21LM3	26 Feb 2022

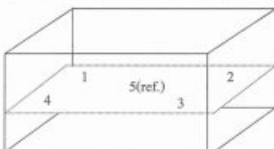
2. This certificate is valid only to the item calibrated on date and place of calibration.

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	54	220
Finished of Calibration	25	57	222



Front

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



Equipment : Water Bath
 Condition As-Received : Used Item
 Reference : 2107-0318OC-5
 Result of Calibration :- (*) Without Adjustment
 Function of UUC* : Temperature Source

Cert. No.: 21TM1355/1
 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	41.418	41.379	41.374	41.447	41.420

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor k
41.5	0.084	0.043	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

a 1065656

เอกสารไม่ควบคุม

a 1065656



Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2205-0764OC-2
Cert. No.: 22TM561
Page.: 2 of 3

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-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	MY44060450	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.

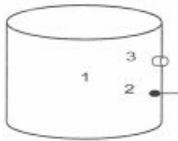
4. This result of calibration covers laboratory autoclaves for the sterilization of goods and material which could be infected with organisms categorized as Hazard Group 1, 2 and 3**

(** = 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

Function of UUC* : Temperature Source



	Environmental		
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	27	56	220
Finished of Calibration	27	59	221

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

เอกสารไม่ควบคุม



Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2205-0764OC-2
Cert. No.: 22TM561
Page.: 3 of 3

Result of Calibration :- (*) Without Adjustment

Operating parameter Set : Temperature = 115.0 °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 k
115.0	115.0	1	115.553	0.4	0.08	0.82	2
		2	115.562				
		3	115.325				

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 k
121.0	121.0	1	121.484	0.21	1.1	0.75	2
		2	121.581				
		3	121.311				

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

Equipment: Balance Certificate No.: C01212658
 Model: BSA3202S-CW Issued Date: 13 September 2021
 Serial No. (or ID.): 31892173 (INS/LB-122) Job No.: KSPR2112115
 Manufacturer: Sartorius Page: 1 of 2
 Condition: In condition

Customer: THAI CHEMICAL & ENGINEERING CO., LTD.
 1048/2 Soi Sukhumvit 66/1, Sukhumvit Road,
 Bangchak, Phraknong, Bangkok 10260 Thailand

Environment Condition: Temperature 28 °C ± 0.5 °C
 Humidity 52 %RH ± 2.8 %RH

Calibration Place: THAI CHEMICAL & ENGINEERING CO., LTD. (Laboratory)
 1048/2 Soi Sukhumvit 66/1, Sukhumvit Road,
 Bangchak, Phraknong, Bangkok 10260 Thailand

Calibration By: Mr. Adinan Ninivboon

Calibration Date: 13 September 2021

The Method used: In house method, SPCC-WI-47, base on UKAS Lab 14

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through SPC RT Co., Ltd. Certificate No. C02211362


 (Mr. Adinan Ninivboon)
 Person in charge


 บริษัท เอสพีซี อาร์ที จำกัด
 SPC RT Co., Ltd.


 (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.

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 Branch 00003 1194 Soi Sukhumvit 66/1 Road, Bangkok, Phraknong, Bangkok 10260 Thailand
 Tel: 0 2855 4333 Ext. 3300-3308 Fax: 0 2855 4424 E-mail: info@spc-rt.com Website: www.spc-rt.com

SPCC-FM-C01-10; 23 Nov 2020




Certificate No.: C01212658

Page: 2 of 2

Calibration Results:

Without Adjustment

Eccentric Error: Weight to be 1/4 or 1/3 of Maximum capacity, taken from the center of the pan as a zero reference.

			Nominal Test Value	1000	(g)
Reference Points (g)					
A	B	C	D	E	
-	0.00	-0.01	-0.01	0.00	

Repeatability: Determination of the standard deviation of weighing balance., Readability 0.01 (g)

Nominal test value (g)	Standard Deviation
200	0.003
2000	0.004

Departure of indication from nominal value., Readability 0.01 (g)

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Correction of Balance (g)	Uncertainty (g)	k
1	1.000	1.00	0.00	0.0096	2.02
10	10.000	10.00	0.00	0.0096	2.02
50	50.000	50.00	0.00	0.0096	2.02
100	100.000	100.00	0.00	0.0096	2.02
200	200.000	200.00	0.00	0.0096	2.02
500	500.000	500.00	0.00	0.0097	2.02
1000	1000.003	1000.00	0.00	0.010	2.02
1500	1500.003	1500.00	0.00	0.010	2.01
2000	2000.003	2000.00	0.00	0.011	2.01
2500	2500.003	2500.00	0.00	0.012	2.01
3000	3000.006	3000.00	0.01	0.012	2.01

The End of Certificate

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 Branch 00003 1194 Soi Sukhumvit 66/1 Road, Bangkok, Phraknong, Bangkok 10260 Thailand
 Tel: 0 2855 4333 Ext. 3300-3308 Fax: 0 2855 4424 E-mail: info@spc-rt.com Website: www.spc-rt.com

SPCC-FM-C01-10; 23 Nov 2020

Certificate No.: C01212658

Page: 1 of 1

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 correction 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). Specific Risk < 2.5% 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

Without Adjustment

Readability: 0.01 g

Tolerances : 0.04 g

Nominal Value (g)	Correction of Balance (g)	Guard band (w) (g)	Tolerance (±) (g)	Conformity
1	0.00	0.0096	0.04	Pass
10	0.00	0.0096	0.04	Pass
50	0.00	0.0096	0.04	Pass
100	0.00	0.0096	0.04	Pass
200	0.00	0.0096	0.04	Pass
500	0.00	0.0097	0.04	Pass
1000	0.00	0.010	0.04	Pass
1500	0.00	0.010	0.04	Pass
2000	0.00	0.011	0.04	Pass
2500	0.00	0.012	0.04	Pass
3000	0.01	0.012	0.04	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 Certificate

บริษัท เอสพีซี อาร์ที จำกัด
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 Branch 00003 1194 Soi Sukhumvit 66/1 Road, Bangkok, Phraknong, Bangkok 10260 Thailand
 Tel: 0 2855 4333 Ext. 3300-3308 Fax: 0 2855 4424 E-mail: info@spc-rt.com Website: www.spc-rt.com

SPCC-FM-C01-10; 23 Nov 2020



Certificate of Calibration

Equipment: Balance Certificate No.: C01212660
 Model: BSA224S-CW Issued Date: 13 September 2021
 Serial No. (or ID.): 3137910058 (INS/LB-144) Job No.: KSPR2112117
 Manufacturer: Sartorius Page: 1 of 2
 Condition: In condition

Customer: THAI CHEMICAL & ENGINEERING CO., LTD.
 1048/2 Soi Sukhumvit 66/1, Sukhumvit Road,
 Bangchak, Phraknong, Bangkok 10260 Thailand

Environment Condition: Temperature 28 °C ± 0.4 °C
 Humidity 52 %RH ± 2 %RH

Calibration Place: THAI CHEMICAL & ENGINEERING CO., LTD. (Laboratory)
 1048/2 Soi Sukhumvit 66/1, Sukhumvit Road,
 Bangchak, Phraknong, Bangkok 10260 Thailand

Calibration By: Mr. Adinan Ninivboon

Calibration Date: 13 September 2021

The Method used: In house method, SPCC-WI-47, base on UKAS Lab 14

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through SPC RT Co., Ltd. Certificate No. C02210017


 (Mr. Adinan Ninivboon)
 Person in charge


 บริษัท เอสพีซี อาร์ที จำกัด
 SPC RT Co., Ltd.


 (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.

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 Branch 00003 1194 Soi Sukhumvit 66/1 Road, Bangkok, Phraknong, Bangkok 10260 Thailand
 Tel: 0 2855 4333 Ext. 3300-3308 Fax: 0 2855 4424 E-mail: info@spc-rt.com Website: www.spc-rt.com

SPCC-FM-C01-10; 23 Nov 2020

SPCC-FM-C01-10; 23 Nov 2020

Calibration Results:

Without Adjustment

Eccentric Error: Weight to be 1/4 or 1/3 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
20		0.0001	0.0000	0.0000	0.0000	
200						

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

Nominal test value (g)	Standard Deviation
20	0.00004
200	0.00006

Departure of indication from nominal value., Readability 0.0001 (g)

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Correction of Balance (g)	Uncertainty (g)	k
1	1.00001	1.0000	0.0000	0.00011	2.04
2	2.00002	2.0000	0.0000	0.00011	2.04
5	4.99999	5.0000	0.0000	0.00011	2.04
10	10.00000	10.0000	0.0000	0.00011	2.04
20	19.99999	20.0000	0.0000	0.00012	2.03
50	49.99997	50.0000	0.0000	0.00013	2.02
100	100.00000	100.0000	0.0000	0.00017	2.01
120	119.99999	120.0000	0.0000	0.00021	2.00
150	149.99997	150.0000	0.0000	0.00024	2.00
200	199.99990	199.9999	0.0000	0.00030	2.00

The End of Certificate

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 correction 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), Specific Risk < 2.5% 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

Without Adjustment

Readability: 0.0001 g

Tolerances : 0.0005 g

Nominal Value g	Correction of Balance g	Guard band (w) g	Tolerance (±) g	Conformity
1	0.0000	0.00011	0.0005	Pass
2	0.0000	0.00011	0.0005	Pass
5	0.0000	0.00011	0.0005	Pass
10	0.0000	0.00011	0.0005	Pass
20	0.0000	0.00012	0.0005	Pass
50	0.0000	0.00013	0.0005	Pass
100	0.0000	0.00017	0.0005	Pass
120	0.0000	0.00021	0.0005	Pass
150	0.0000	0.00024	0.0005	Pass
200	0.0000	0.00030	0.0005	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 Certificate



Certificate of Calibration

Equipment: CONDUCTIVITY METER
Model: CM-41X
Serial No. (or ID.): 886312
Manufacturer: TOA-DKK
Electrode Serial No. 011F0010
Condition: In Condition

Certificate No.: C24220061
Issued Date: 8 March 2022
Job No.: KSPR2203035
Page: 1 of 2
Model: CT-58101B **Brand:** TOA-DKK

Customer: THAI CHEMICAL & ENGINEERING CO., LTD.
1048/2 Soi Sukhumvit 66/1, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260 Thailand

Environment Condition: Temperature 23 °C ± 2 °C
Humidity 50 %RH ± 15 %RH

Calibration Place: Environment Laboratory, SPC RT Co., Ltd.
1194 Soi Wachirathamsathit 57, Sukhumvit 101/1 Rd.,
Bangchak, Phrakhanong, Bangkok 10260 Thailand

Calibration By: Mr. Nattapat Rungrueang
Calibration Date: 8 March 2022
The Method used: In house method, SPCC-WI-49, base on ASTM D 1125-14 and D 5391-14

Traceability: This certificate is traceable to the SI Units maintained by CRM of NIST(SRM) through CPA chem Co., Ltd. (ISO/IEC 17034) Certificate No. 772621, 772622, 772623

(Mr. Nattapat Rungrueang)

Person in charge

(Mr. Dumrong Boonsopon)

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.

Calibration Results:

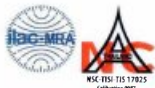
Before Adjustment

Standard Conductivity Solution	Unit Under Calibration Reading	Correction	Coverage Factor (k)	Uncertainty (±)
25.000 μS/cm	36.7 μS/cm	-11.700 μS/cm	2.00	0.22 μS/cm
1413.0 μS/cm	1475 μS/cm	-62.0 μS/cm	2.00	8.9 μS/cm
12.880 mS/cm	13.24 mS/cm	-0.3600 mS/cm	2.00	0.082 mS/cm

After Adjustment ; at 1413 μS/cm

Standard Conductivity Solution	Unit Under Calibration Reading	Correction	Coverage Factor (k)	Uncertainty (±)
25.000 μS/cm	26.0 μS/cm	-1.000 μS/cm	2.00	0.22 μS/cm
1413.0 μS/cm	1413 μS/cm	0.0 μS/cm	2.00	8.9 μS/cm
12.880 mS/cm	12.67 mS/cm	0.2100 mS/cm	2.00	0.081 mS/cm

The End of Certificate



Certificate of Calibration

Equipment: Cooled Incubator
Model: IPP750eco
Serial No.(or ID): V821.0094 (INS/LB-158)
Manufacturer: Memmert
Condition: In Condition
Shelves(pc.): 3

Certificate No.: C31220504
Issued Date: 11 March 2022
Job No.: KSPR2203034
Page: 1 of 3
Ventilation Valve: None

Customer: THAI CHEMICAL & ENGINEERING CO., LTD.
1048/2 Soi Sukhumvit 66/1, Sukhumvit Road,
Bangchak, Phrakonong, Bangkok 10260 Thailand

Environment Condition: Temperature: 25 °C ± 0.4 °C
Humidity: 63 %RH ± 2.9 %RH
Voltage: 230 VAC ± 0.3 VAC

Calibration Place: THAI CHEMICAL & ENGINEERING CO., LTD. (Laboratory)
1048/2 Soi Sukhumvit 66/1, Sukhumvit Road,
Bangchak, Phrakonong, Bangkok 10260 Thailand

Calibration By: Mr. Piyapong Somkaew
Calibration Date: 07 March 2022
The Method used: In house method, SPCC-WI-16, base on TLAS-G20
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through SPC RT Co., Ltd. Certificate No. C10220002

(Mr. Piyapong Somkaew)
Person in charge

(Mr. Udon Srichana)
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.

SPC RT CO., LTD.
Branch 00003 1194 Soi Wachirathamwong 57, Sukhumvit 101/1 Road, Bangkok, Phrakonong, Bangkok 10260 Thailand
Tel: 0 2185 4333 Ext. 3300-3308 Fax: 0 2185 4424 E-mail: info@spc-rt.com Website: www.spc-rt.com

SPCC-FM-C31-07, 23 Nov 2020

Calibration Results:

Before adjustment

Setting: Indicating: #1: #2: #3: #4: #5: #6: #7: #8: #9:

20.0 20.0 20.58 20.41 20.32 20.26 20.10 20.15 20.00 19.96 19.77

After adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 20.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	20.27	0.27	0.23
#2	20.15	0.15	0.23
#3	20.18	0.18	0.23
#4	20.10	0.10	0.23
#5	20.01	0.01	0.23
#6	20.03	0.03	0.23
#7	19.93	-0.07	0.23
#8	19.92	-0.08	0.23
#9	19.87	-0.13	0.23

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
20.0	20.0	20.0	20.27	20.15	20.18	20.10	20.01	20.03	19.93	19.92	19.87	0.23

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
20.0	0.47	0.04	0.47

Note: * Maximum uncertainty of the each position

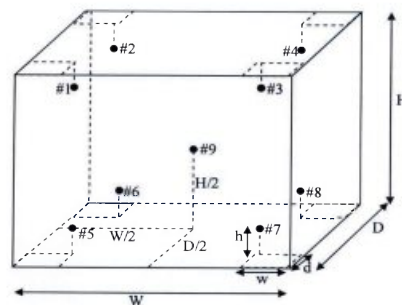
The End of Certificate

SPC RT CO., LTD.
Branch 00003 1194 Soi Wachirathamwong 57, Sukhumvit 101/1 Road, Bangkok, Phrakonong, Bangkok 10260 Thailand
Tel: 0 2185 4333 Ext. 3300-3308 Fax: 0 2185 4424 E-mail: info@spc-rt.com Website: www.spc-rt.com

SPCC-FM-C31-07, 23 Nov 2020

Certificate No.: C31220504

Page: 2 of 3



Standard Installation Locations

Volume (Calibration Zone)= 369 (Liters)

Inside chamber: W = 100 (cm) D = 60 (cm) H = 120 (cm)

Standard Locations (#1, #2, #3, #4): w = 10 (cm) d = 6 (cm) h = 12 (cm)

Standard Locations (#5, #6, #7, #8): w = 10 (cm) d = 6 (cm) h = 12 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	1	2	3	4	5	6	7	8	9

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.**Measured Temperature:** The average reading of standards at any positions or location.**Measured Uniformity:** The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.**Measured Stability:** The one-half of greatest maximum difference of measured temperatures at any one probe.**Overall Variation:** The difference of maximum and minimum measured temperatures throughout observation time.

SPC RT CO., LTD.
Branch 00003 1194 Soi Wachirathamwong 57, Sukhumvit 101/1 Road, Bangkok, Phrakonong, Bangkok 10260 Thailand
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SPCC-FM-C31-07, 23 Nov 2020

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 correction 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, TLAS-G20. 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 ($w = 1 U$), Specific Risk < 2.5% 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

After adjustment

Desired Temperature : 20.0 °C Tolerances : 1.0 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 20.0 °C

Locations	Measured (°C)	Correction of UUC. (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	20.27	0.27	0.23	1.0	Pass
#2	20.15	0.15	0.23	1.0	Pass
#3	20.18	0.18	0.23	1.0	Pass
#4	20.10	0.10	0.23	1.0	Pass
#5	20.01	0.01	0.23	1.0	Pass
#6	20.03	0.03	0.23	1.0	Pass
#7	19.93	-0.07	0.23	1.0	Pass
#8	19.92	-0.08	0.23	1.0	Pass
#9	19.87	-0.13	0.23	1.0	Pass

Correction of UUC.* = Measured Temperature - Desired Temperature

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

SPC RT CO., LTD.
Branch 00003 1194 Soi Wachirathamwong 57, Sukhumvit 101/1 Road, Bangkok, Phrakonong, Bangkok 10260 Thailand
Tel: 0 2185 4333 Ext. 3300-3308 Fax: 0 2185 4424 E-mail: info@spc-rt.com Website: www.spc-rt.com

SPCC-FM-C31-07, 23 Nov 2020



Certificate of Calibration

Equipment: Hot Air Oven
Model: UF 55
Serial No.(or ID): B218.3817 (IN-LB-134)
Manufacturer: Memmert
Condition: In Condition
Shelves(pc.): 2

Certificate No.: C31211853
Issued Date: 16 September 2021
Job No.: KSPR2112118
Page: 1 of 4
Ventilation Valve: Closed

Customer: THAI CHEMICAL & ENGINEERING CO., LTD.
1048/2 Soi Sukhumvit 66/1, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260 Thailand

Environment Condition: Temperature: 26 °C ± 0.3 °C
Humidity: 54 %RH ± 2.2 %RH
Voltage: 225 VAC ± 1.9 VAC

Calibration Place: THAI CHEMICAL & ENGINEERING CO., LTD. (Laboratory)
1048/2 Soi Sukhumvit 66/1, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260 Thailand

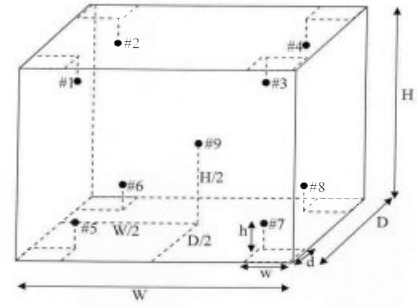
Calibration By: Mr. Tharanid Fasawang
Calibration Date: 13 September 2021
The Method used: In house method, SPCC-WI-16, base on TLAS-G20
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through SPC RT Co., Ltd. Certificate No. C10210008

(Mr. Tharanid Fasawang)
Person in charge

S**P****C****R****T**
บริษัท เอสพีซีอาร์ที จำกัด
SPC RT Co., Ltd.

(Mr. Udon Srichana)
Authorized signatory

This certificate is issued by 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 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.



Standard Installation Locations

Volume (Calibration Zone)= 16 (Liters)

Inside chamber: W = 40 (cm) D = 33 (cm) H = 40 (cm)

Standard Locations (#1, #2, #3, #4): w = 5 (cm) d = 5 (cm) h = 5 (cm)

Standard Locations (#5, #6, #7, #8): w = 5 (cm) d = 5 (cm) h = 12 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	1	2	3	4	5	6	7	8	9

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.

Measured Temperature: The average reading of standards at any positions or location.

Measured Uniformity: The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

Overall Variation: The difference of maximum and minimum measured temperatures throughout observation time.

บริษัท เอสพีซีอาร์ที จำกัด
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Tel: 0 2185 4333 Ext. 3300-3308 Fax: 0 2185 4424 E-mail: info@spc-rt.com Website: www.spc-rt.com

SPCC-FM-C31-07: 23 Nov 2020

SPCC-FM-C31-07: 23 Nov 2020

Calibration Results: Without adjustment

Certificate No.: C31211853 Page: 3 of 4

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 104.0 °C

Locations	Measured Temperature (°C)	Correction of UUC: (°C)	Uncertainty (± °C)
#1	104.06	0.06	0.40
#2	103.89	-0.11	0.40
#3	103.99	-0.01	0.40
#4	103.87	-0.13	0.40
#5	104.23	0.23	0.41
#6	104.26	0.26	0.40
#7	105.03	1.03	0.40
#8	104.06	0.06	0.40
#9	104.07	0.07	0.40

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
104.0	104.0	104.0	104.06	103.89	103.99	103.87	104.23	104.26	105.03	104.06	104.07	0.41

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
104.0	1.03	0.11	1.33

Note: * Maximum uncertainty of the each position

Without adjustment (Cont.)

Certificate No.: C31211853 Page: 4 of 4

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 180.0 °C

Locations	Measured Temperature (°C)	Correction of UUC: (°C)	Uncertainty (± °C)
#1	179.55	-0.45	0.50
#2	179.36	-0.64	0.50
#3	179.45	-0.55	0.50
#4	179.04	-0.96	0.50
#5	180.27	0.27	0.52
#6	180.38	0.38	0.50
#7	181.33	1.33	0.52
#8	179.69	-0.31	0.50
#9	179.77	-0.23	0.50

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
180.0	180.0	180.0	179.55	179.36	179.45	179.04	180.27	180.38	181.33	179.69	179.77	0.52

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
180.0	1.68	0.13	2.50

Note: * Maximum uncertainty of the each position

The End of Certificate

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 correction 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, TLAS-G20. 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 Single Acceptance Rule ($w = 0$), Specific Risk < 50% PFA
 - ☒ Choice B Non-binary statement with guard band ($w = 1$ U), Specific Risk < 2.5% 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

Without adjustment

Desired Temperature : 104.0 °C Tolerances : 1.0 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 104.0 °C

Locations	Measured (°C)	Correction of UUC, (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	104.06	0.06	0.40	1.0	Pass
#2	103.89	-0.11	0.40	1.0	Pass
#3	103.99	-0.01	0.40	1.0	Pass
#4	103.87	-0.13	0.40	1.0	Pass
#5	104.23	0.23	0.41	1.0	Pass
#6	104.26	0.26	0.40	1.0	Pass
#7	105.03	1.03	0.40	1.0	Condition Fail
#8	104.06	0.06	0.40	1.0	Pass
#9	104.07	0.07	0.40	1.0	Pass

Correction of UUC = Measured Temperature - Desired Temperature

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

Statements of conformity:(Cont.)

Without adjustment (Cont.)

Desired Temperature : 180.0 °C Tolerances : 2.0 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 180.0 °C

Locations	Measured (°C)	Correction of UUC, (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	179.55	-0.45	0.50	2.0	Pass
#2	179.36	-0.64	0.50	2.0	Pass
#3	179.45	-0.55	0.50	2.0	Pass
#4	179.04	-0.96	0.50	2.0	Pass
#5	180.27	0.27	0.52	2.0	Pass
#6	180.38	0.38	0.50	2.0	Pass
#7	181.33	1.33	0.52	2.0	Pass
#8	179.69	-0.31	0.50	2.0	Pass
#9	179.77	-0.23	0.50	2.0	Pass

Correction of UUC = Measured Temperature - Desired Temperature

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



Certificate of Calibration

Equipment: Hot Air Oven
Model: UF 55
Serial No.(or ID): B219.1995 (INS/LB-149)
Manufacturer: Memmert
Condition: In Condition
Shelves(pc.): 2

Certificate No.: C31212315
Issued Date: 10 November 2021
Job No.: KSPR2113805
Page: 1 of 4
Ventilation Valve: Closed

Customer: THAI CHEMICAL & ENGINEERING CO., LTD.
 1048/2 Soi Sukhumvit 66/1, Sukhumvit Road,
 Bangchak, Phrakhanong, Bangkok 10260 Thailand

Environment Condition: Temperature: 27 °C ± 0.4 °C
 Humidity: 58 %RH ± 4.4 %RH
 Voltage: 224 VAC ± 1.9 VAC

Calibration Place: THAI CHEMICAL & ENGINEERING CO., LTD. (Laboratory)
 1048/2 Soi Sukhumvit 66/1, Sukhumvit Road,
 Bangchak, Phrakhanong, Bangkok 10260 Thailand

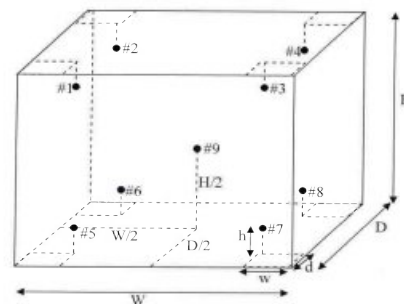
Calibration By: Mr. Chanachol Moohammudrosol
Calibration Date: 08 November 2021
The Method used: In house method, SPCC-WI-16, base on TLAS-G20
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through SPC RT Co., Ltd. Certificate No.C10210006

(Mr. Chanachol Moohammudrosol)

SPC RT Co., Ltd.

(Mr. Udon Srichana)
 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.



Standard Installation Locations

Volume (Calibration Zone)= 21 (Liters)

Inside chamber: W = 40 (cm) D = 33 (cm) H = 40 (cm)
 Standard Locations (#1, #2, #3, #4): w = 5 (cm) d = 5 (cm) h = 5 (cm)
 Standard Locations (#5, #6, #7, #8): w = 5 (cm) d = 5 (cm) h = 5 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	1	2	3	4	5	6	7	8	9

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.

Measured Temperature: The average reading of standards at any positions or location.

Measured Uniformity: The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

Overall Variation: The difference of maximum and minimum measured temperatures throughout observation time.

Certificate No.: C31212315Page: 3 of 4

Calibration Results:

Before adjustment

Setting: 104.0Indicating: 104.19 104.09 104.81 104.53 104.83 104.37 103.66 104.66 104.76

After adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 104.0 °C

Locations	Measured Temperature (°C)	Correction of UUC, (°C)	Uncertainty (± °C)
#1	103.68	-0.32	0.39
#2	103.59	-0.41	0.39
#3	104.30	0.30	0.39
#4	103.99	-0.01	0.39
#5	104.33	0.33	0.39
#6	103.87	-0.13	0.39
#7	104.17	0.17	0.39
#8	104.17	0.17	0.39
#9	104.24	0.24	0.39

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
104.0	104.0	104.0	103.68	103.59	104.30	103.99	104.33	103.87	104.17	104.17	104.24	0.39

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
104.0	0.70	0.05	0.84

Note: * Maximum uncertainty of the each position

After adjustment (Cont.)

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 180.0 °C

Locations	Measured Temperature (°C)	Correction of UUC, (°C)	Uncertainty (± °C)
#1	179.82	-0.18	0.51
#2	179.15	-0.85	0.50
#3	180.75	0.75	0.49
#4	179.99	-0.01	0.49
#5	179.82	-0.18	0.50
#6	179.51	-0.49	0.50
#7	178.63	-1.37	0.55
#8	180.13	0.13	0.50
#9	180.08	0.08	0.50

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
180.0	180.0	180.0	179.82	179.15	180.75	179.99	179.82	179.51	178.63	180.13	180.08	0.55

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
180.0	1.66	0.21	2.39

Note: * Maximum uncertainty of the each position

The End of Certificate

Certificate No.: C31212315Page: 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 correction 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, TLAS-G20. 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), Specific Risk < 2.5% PFA
☐ Choice C Customer defined, Customers may define arbitrary multiple of t to have applied as guard band (w = r U)
: PFA – Probability of False Accept

After adjustment

Desired Temperature : 104.0°C Tolerances : 1.0 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 104.0 °C

Locations	Measured (°C)	Correction of UUC, (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	103.68	-0.32	0.39	1.0	Pass
#2	103.59	-0.41	0.39	1.0	Pass
#3	104.30	0.30	0.39	1.0	Pass
#4	103.99	-0.01	0.39	1.0	Pass
#5	104.33	0.33	0.39	1.0	Pass
#6	103.87	-0.13	0.39	1.0	Pass
#7	104.17	0.17	0.39	1.0	Pass
#8	104.17	0.17	0.39	1.0	Pass
#9	104.24	0.24	0.39	1.0	Pass

Correction of UUC.* = Measured Temperature - Desired Temperature

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

Statements of conformity:(Cont.)

After adjustment (Cont.)

Desired Temperature : 180.0°C Tolerances : 2.0 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 180.0 °C

Locations	Measured (°C)	Correction of UUC.* (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	179.82	-0.18	0.51	2.0	Pass
#2	179.15	-0.85	0.50	2.0	Pass
#3	180.75	0.75	0.49	2.0	Pass
#4	179.99	-0.01	0.49	2.0	Pass
#5	179.82	-0.18	0.50	2.0	Pass
#6	179.51	-0.49	0.50	2.0	Pass
#7	178.63	-1.37	0.55	2.0	Pass
#8	180.13	0.13	0.50	2.0	Pass
#9	180.08	0.08	0.50	2.0	Pass

Correction of UUC.* = Measured Temperature - Desired Temperature

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



Certificate of Calibration

Equipment: Incubator
Model: IN 55
Serial No.(or ID): D212.0259 (INS/LB-017)
Manufacturer: Memmert
Condition: In Condition
Shelves(pc.): 1

Certificate No.: C31211844
Issued Date: 14 September 2021
Job No.: KSPR2112120
Page: 1 of 3
Ventilation Valve: Closed

Customer: THAI CHEMICAL & ENGINEERING CO., LTD.
1048/2 Soi Sukhumvit 66/1, Sukhumvit Road,
Bangchak, Phraknong, Bangkok 10260 Thailand

Environment Condition: Temperature: 25 °C ± 0.8 °C
Humidity: 60 %RH ± 3.5 %RH
Voltage: 225 VAC ± 1.6 VAC

Calibration Place: THAI CHEMICAL & ENGINEERING CO., LTD. (Laboratory)
1048/2 Soi Sukhumvit 66/1, Sukhumvit Road,
Bangchak, Phraknong, Bangkok 10260 Thailand

Calibration By: Mr. Chanachol Moohammudrosol
Calibration Date: 13 September 2021
The Method used: In house method, SPCC-WI-16, base on TLAS-G20
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through SPC RT Co., Ltd. Certificate No. C10210006

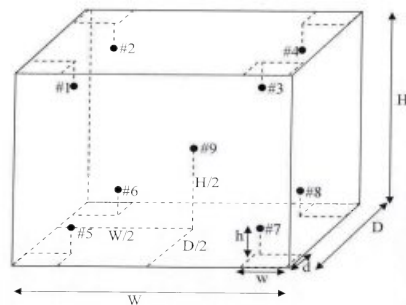
(Mr. Chanachol Moohammudrosol)
Person in charge

(Mr. Udon Srichana)
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.



Standard Installation Locations

Volume (Calibration Zone)= 21 (Liters)

Inside chamber: W = 40 (cm) D = 33 (cm) H = 40 (cm)

Standard Locations (#1, #2, #3, #4): w = 5 (cm) d = 5 (cm) h = 5 (cm)

Standard Locations (#5, #6, #7, #8): w = 5 (cm) d = 5 (cm) h = 5 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	1	2	3	4	5	6	7	8	9

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.

Measured Temperature: The average reading of standards at any positions or location.

Measured Uniformity: The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

Overall Variation: The difference of maximum and minimum measured temperatures throughout observation time.

SPC RT CO., LTD.
Branch 00003 1194 Soi Wachirathamwong 57, Sukhumvit 101/1 Road, Bangkok, Phraknong, Bangkok 10260 Thailand
Tel: 0 2185 4333 Ext. 3300-3308 Fax: 0 2185 4424 E-mail: info@spcrt.com Website: www.spcrt.com

SPCC-FM-C31-07: 23 Nov 2020

Calibration Results:

Before adjustment

Setting: 35.0
Indicating: 35.0
#1: 35.52 #2: 35.54 #3: 35.48 #4: 35.52 #5: 35.30 #6: 35.35 #7: 35.25 #8: 35.41 #9: 35.51

After adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 35.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	35.17	0.17	0.23
#2	35.17	0.17	0.23
#3	35.13	0.13	0.23
#4	35.19	0.19	0.23
#5	34.96	-0.04	0.23
#6	34.95	-0.05	0.24
#7	34.92	-0.08	0.23
#8	35.07	0.07	0.24
#9	35.17	0.17	0.23

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
35.0	35.0	35.0	35.17	35.17	35.13	35.19	34.96	34.95	34.92	35.07	35.17	0.24

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
35.0	0.32	0.11	0.38

Note: * Maximum uncertainty of the each position

Certificate No.: C31211844 Page: 3 of 3

The End of Certificate

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 correction 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, TLAS-G20. 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), Specific Risk < 2.5% 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

After adjustment

Desired Temperature : 35.0°C Tolerances : 1.0 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 35.0 °C

Locations	Measured (°C)	Correction of UUC. (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	35.17	0.17	0.23	1.0	Pass
#2	35.17	0.17	0.23	1.0	Pass
#3	35.13	0.13	0.23	1.0	Pass
#4	35.19	0.19	0.23	1.0	Pass
#5	34.96	-0.04	0.23	1.0	Pass
#6	34.95	-0.05	0.24	1.0	Pass
#7	34.92	-0.08	0.23	1.0	Pass
#8	35.07	0.07	0.24	1.0	Pass
#9	35.17	0.17	0.23	1.0	Pass

Correction of UUC.* = Measured Temperature - Desired Temperature

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

SPC RT CO., LTD.
Branch 00003 1194 Soi Wachirathamwong 57, Sukhumvit 101/1 Road, Bangkok, Phraknong, Bangkok 10260 Thailand
Tel: 0 2185 4333 Ext. 3300-3308 Fax: 0 2185 4424 E-mail: info@spcrt.com Website: www.spcrt.com

SPCC-FM-C31-07: 23 Nov 2020



Certificate of Calibration

Certificate No.: C31211846

Page: 2 of 3

Equipment: Incubator
Model: IN 55
Serial No. (or ID): D215.1344 (INS/LB-022)
Manufacturer: Memmert
Condition: In Condition
Shelves(pc.): 2

Certificate No.: C31211846
Issued Date: 14 September 2021
Job No.: KSPR2112123
Page: 1 of 3
Ventilation Valve: Closed

Customer: THAI CHEMICAL & ENGINEERING CO., LTD.
 1048/2 Soi Sukhumvit 66/1, Sukhumvit Road,
 Bangchak, Phrakhanong, Bangkok 10260 Thailand

Environment Condition: Temperature: 25 °C ± 0.8 °C
 Humidity: 60 %RH ± 3.5 %RH
 Voltage: 225 VAC ± 1.6 VAC

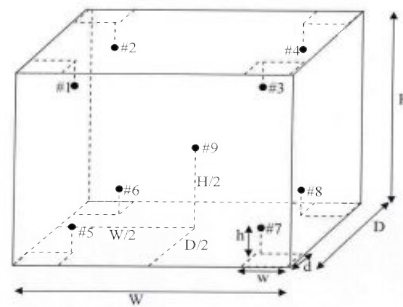
Calibration Place: THAI CHEMICAL & ENGINEERING CO., LTD. (Laboratory)
 1048/2 Soi Sukhumvit 66/1, Sukhumvit Road,
 Bangchak, Phrakhanong, Bangkok 10260 Thailand

Calibration By: Mr. Chanachol Moohammudrosol
Calibration Date: 13 September 2021
The Method used: In house method, SPCC-WI-16, base on TLAS-G20
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through SPC RT Co., Ltd. Certificate No. C10210006

(Mr. Chanachol Moohammudrosol)
 Person in charge

(Mr. Udon Srichana)
 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.



Standard Installation Locations

Volume (Calibration Zone)= 21 (Liters)

Inside chamber: W = 40 (cm) D = 33 (cm) H = 40 (cm)

Standard Locations (#1, #2, #3, #4): w = 5 (cm) d = 5 (cm) h = 5 (cm)

Standard Locations (#5, #6, #7, #8): w = 5 (cm) d = 5 (cm) h = 5 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	1	2	3	4	5	6	7	8	9

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.

Measured Temperature: The average reading of standards at any positions or location.

Measured Uniformity: The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

Overall Variation: The difference of maximum and minimum measured temperatures throughout observation time.

Business Unit
SPC Calibration Center

SPC RT CO., LTD.
 Branch 00003 1194 Soi Wachirathamsothi 57, Sukhumvit 101/1 Road, Bangkok, Phrakhanong, Bangkok 10260 Thailand
 Tel: 0 2185 4333 Ext. 3300-3308 Fax: 0 2185 4424 E-mail: info@spcrt.com Website: www.spcrt.com

SPCC-FM-C31-07: 23 Nov 2020

Certificate No.: C31211846

Page: 3 of 3

Calibration Results:

Before adjustment

Setting: Indicating: #1: #2: #3: #4: #5: #6: #7: #8: #9:
 45.0 45.0 44.93 44.85 45.03 44.97 44.48 44.41 44.57 44.80 44.85

After adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 45.0 °C

Locations	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
#1	45.33	0.33	0.23
#2	45.21	0.21	0.23
#3	45.41	0.41	0.23
#4	45.31	0.31	0.23
#5	44.90	-0.10	0.23
#6	44.76	-0.24	0.23
#7	44.99	-0.01	0.23
#8	45.18	0.18	0.23
#9	45.23	0.23	0.24

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
45.0	45.0	45.0	45.33	45.21	45.41	45.31	44.90	44.76	44.99	45.18	45.23	0.24

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
45.0	0.53	0.06	0.72

Note: * Maximum uncertainty of the each position

The End of Certificate

Certificate No.: C31211846

Page: 1 of 1

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 correction 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, TLAS-G20. 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), Specific Risk < 2.5% 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

After adjustment

Desired Temperature : 45.0 °C

Tolerances : 1.0 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 45.0 °C

Locations	Measured (°C)	Correction of UUC (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	45.33	0.33	0.23	1.0	Pass
#2	45.21	0.21	0.23	1.0	Pass
#3	45.41	0.41	0.23	1.0	Pass
#4	45.31	0.31	0.23	1.0	Pass
#5	44.90	-0.10	0.23	1.0	Pass
#6	44.76	-0.24	0.23	1.0	Pass
#7	44.99	-0.01	0.23	1.0	Pass
#8	45.18	0.18	0.23	1.0	Pass
#9	45.23	0.23	0.24	1.0	Pass

Correction of UUC* = Measured Temperature - Desired Temperature

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

Business Unit
SPC Calibration Center

SPC RT CO., LTD.
 Branch 00003 1194 Soi Wachirathamsothi 57, Sukhumvit 101/1 Road, Bangkok, Phrakhanong, Bangkok 10260 Thailand
 Tel: 0 2185 4333 Ext. 3300-3308 Fax: 0 2185 4424 E-mail: info@spcrt.com Website: www.spcrt.com

SPCC-FM-C31-07: 23 Nov 2020

SPCC-FM-C31-07: 23 Nov 2020

Business Unit
SPC Calibration Center

SPC RT CO., LTD.
 Branch 00003 1194 Soi Wachirathamsothi 57, Sukhumvit 101/1 Road, Bangkok, Phrakhanong, Bangkok 10260 Thailand
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Certificate of Calibration

Certificate No.: C13220086

Page: 2 of 3

Equipment: Liquid Bath
Model: WB 14
Serial No. (or ID.): 1403.0322 (INS/LB-050)
Manufacturer: Memmert
Condition: In Condition
Forced Circulation: None

Certificate No.: C13220086
Issued Date: 07 March 2022
Job No.: KSPR2203030
Page: 1 of 3

Customer: THAI CHEMICAL & ENGINEERING CO., LTD.
1048/2 Soi Sukhumvit 66/1, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260 Thailand

Environment Condition: Temperature: 27 °C ± 0.4 °C
Humidity: 59 %RH ± 5.3 %RH
Voltage: 224 VAC ± 2.5 VAC

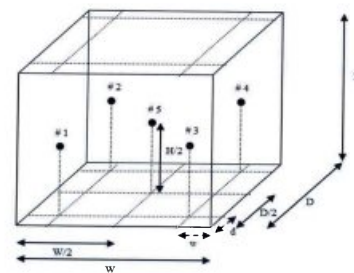
Calibration Place: THAI CHEMICAL & ENGINEERING CO., LTD. (Laboratory)
1048/2 Soi Sukhumvit 66/1, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260 Thailand

Calibration By: Mr. Mongkolwat Hasanon
Calibration Date: 07 March 2022
The Method used: In house method, SPCC-WI-17, base on ASTM E715-80
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through SPC RT Co., Ltd. Certificate No. C10210019

(Mr. Mongkolwat Hasanon)
Person in charge

(Mr. Udon Srichana)
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.



Standard Installation Locations

Midway between the diffuser plate and the water surface

Inside bath: W = 37 (cm) D = 33 (cm) H = 15 (cm) Volume = 18 (Liters)
Standard Locations #1: w = 5 (cm) d = 5 (cm)
Standard Locations #2: w = 5 (cm) d = 5 (cm)
Standard Locations #3: w = 5 (cm) d = 5 (cm)
Standard Locations #4: w = 5 (cm) d = 5 (cm)
Standard Locations #5: Center of any probes. (#1 - #4)

Position of Std	#1	#2	#3	#4	#5
Channel of Logger	1	2	3	4	5

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the bath.

Measured Temperature: The average reading of standards at any positions or location.

Measured Uniformity: The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the bath at steady-state. The reference probe is preferably located in the geometric center of the bath.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

Overall Variation: The difference of maximum and minimum measured temperatures throughout observation time.

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Tel: 0 2185 4333 Ext. 3300-3308 Fax: 0 2185 4424 E-mail: info.spc@spc-rt.com Website: www.spc-rt.com

SPCC-FM-C13-10: 23 Nov 2020

SPC RT CO., LTD.
Branch 00003 1194 Soi Wachirathammasri 57, Sukhumvit 10/1 Road, Bangkok, Phrakhanong, Bangkok 10260 Thailand
Tel: 0 2185 4333 Ext. 3300-3308 Fax: 0 2185 4424 E-mail: info.spc@spc-rt.com Website: www.spc-rt.com

SPCC-FM-C13-10: 23 Nov 2020

Certificate No.: C13220086

Page: 3 of 3

Calibration Results:

Pre-Calibration

Setting:	Indicating:	#1:	#2:	#3:	#4:	#5:
85.0	85.0	83.49	83.38	83.37	83.31	83.39

Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 86.6 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	85.07	-1.53	0.27
#2	84.91	-1.69	0.26
#3	84.94	-1.66	0.28
#4	84.82	-1.78	0.28
#5	84.99	-1.61	0.28

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)					Uncertainty (± °C)*
85.0	86.6	86.6	85.07	84.91	84.94	84.82	84.99	0.28

Bath Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
86.6	0.28	0.10	0.44

Note: * Maximum uncertainty of the each position

The End of Certificate

Certificate No.: C13220086 Page: 1 of 1

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 correction 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, ASTM E715-80. 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), Specific Risk < 2.5% 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

Without adjustment

Desired Temperature : 85.0 °C Tolerances : 1.0 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 86.6 °C

Locations	Measured (°C)	Correction of UUC. (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	85.07	0.07	0.27	1.0	Pass
#2	84.91	-0.09	0.26	1.0	Pass
#3	84.94	-0.06	0.28	1.0	Pass
#4	84.82	-0.18	0.28	1.0	Pass
#5	84.99	-0.01	0.28	1.0	Pass

Correction of UUC.* = Measured Temperature - Desired Temperature

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



Certificate of Calibration

Certificate No.: C07220176 Page 2 of 3

Equipment: pH METER
Model: HM-41X
Serial No. (or ID.): 887863
Manufacturer: TOA DKK
Electrode Serial No.: 111F0030MK
Condition: In Condition

Certificate No.: C07220176
Issued Date: 29 March 2022
Job No.: KSPR2203804
Page: 1 of 3
Model: GST-5821C Brand: TOA DKK

Customer: THAI CHEMICAL & ENGINEERING CO., LTD.
1048/2 Soi Sukhumvit 66/1, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260 Thailand

Environment Condition: Temperature 23 °C ± 2 °C
Humidity 50 %RH ± 15 %RH

Calibration Place: Environment Laboratory, SPC RT Co., Ltd.
1194 Soi Wachirathamsathit 57, Sukhumvit 101/1 Rd.,
Bangchak, Phrakhanong, Bangkok 10260 Thailand

Calibration By: Miss. Kaewkan Suradech
Calibration Date: 29 March 2022

The Method used: In house method, SPCC-WI-58, base on ASTM E 70-07

Traceability: This certificate is traceable to SI Units, Sample Test is assured through primary measurement method Hamed cell, through CPAchem Ltd. (ISO/IEC 17034) Certificate No. 794132, 776046, 776045 And pH Scale traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through Industrial Foundation Electrical and Electronics Institute Certificate No. CA20220100EA

Calibration Results:

pH Scale

Input (mV)	pH Meter Reading			Uncertainty of Measurement (mV)	Coverage Factor (k)
	(mV)	Error (mV)	(pH)		
414.12	414	-0.12	-0.001	0.58	2.00
354.96	355	0.04	1.000	0.58	2.00
295.8	296	0.20	2.000	0.58	2.00
236.64	237	0.36	3.000	0.58	2.00
177.48	177	-0.48	4.000	0.58	2.00
118.32	118	-0.32	5.000	0.58	2.00
59.16	59	-0.16	6.000	0.58	2.00
0	0	0.00	7.000	0.58	2.00
-59.16	-59	0.16	8.000	0.58	2.00
-118.32	-118	0.32	9.000	0.58	2.00
-177.48	-177	0.48	10.000	0.58	2.00
-236.64	-237	-0.36	11.001	0.58	2.00
-295.8	-296	-0.20	12.002	0.58	2.00
-354.96	-355	-0.04	13.002	0.58	2.00
-414.12	-414	0.12	14.002	0.58	2.00

(Miss Kaewkan Suradech)
Person in charge

บริษัท เอสพีซี อาร์ที จำกัด
SPC RT Co., Ltd.

(Mr. Dumrong Boonsopon)
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.

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SPCC-FM-C07-10: 23 Nov 2020

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SPCC-FM-C07-10: 23 Nov 2020

Certificate No.: C07220176 Page 3 of 3

Electrode Test Results*

The three-point calibration using three standard buffer solutions; pH 4.008 , pH 6.983 and pH 10.015
The practical slope of the pH electrode; 58.59 (mV/pH), 99.04%
The zero point of the pH electrode; 7.10 (pH)

Sample Test Results

Standard Buffer Solution (pH)	Unit Under Calibration (pH)	Difference (pH)	Uncertainty of Measurement (pH)	Coverage Factor (k)
4.008	4.008	0.000	0.0070	2.00
6.983	6.997	0.014	0.0075	2.00
10.015	10.016	0.001	0.0070	2.00

* Calibration Marked "Not TISI Accredited" in this Certificate have been included for completeness.

The End of Certificate



Certificate of Calibration

Equipment: Digital Thermometer
Model: HM-41X
Serial No. (or ID): 887863
Manufacturer: TOA
Condition: In Condition

Certificate No.: C15220155
Issued Date: 30 March 2022
Job No.: KSPR2203803
Page: 1 of 2

Customer: THAI CHEMICAL & ENGINEERING CO., LTD.
1048/2 Soi Sukhumvit 66/1, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260 Thailand

Environment Condition: Temperature: 22 °C ± 3.0 °C
Humidity: 50 %RH ± 15.0 %RH
Voltage: 230 VAC ± 11.0 VAC

Calibration Place: Sensor Laboratory, SPC RT Co., Ltd.
1194 Soi Wachirathamsathit 57, Sukhumvit 101/1 Rd.,
Bangchak, Phrakhanong, Bangkok 10260 Thailand

Calibration By: Mr. Tweewong Thaihiang
Calibration Date: 25 March 2022

The Method used: In house method, SPCC-WI-19, by comparison with standard thermometer
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through Quality Reborn Co., Ltd. (QR) Certificate No. QR22-0366

(Mr. Tweewong Thaihiang)
Person in charge

บริษัท เอสพีซี อาร์ที จำกัด
SPC RT Co., Ltd.

(Mr. Udon Srichana)
Authorized signatory

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Tel: 0 2185 4333 Ext. 3300-3308 Fax: 0 2185 4424 E-mail: info.spc@spc-rt.com Website: www.spc-rt.com

SPCC-FM-C15-10: 23 Nov 2020

Calibration Results:

Without Adjustment

Sensor Type: Thermistor

Channel: -

Diameter (mm) 12

Length (mm): 120

Immersion (mm): 110

Desired Temp.(°C)	STD. Reading (°C)	UUC. Reading (°C)	Correction of UUC (°C)	Uncertainty (± °C)
20.0	19.994	19.8	0.194	0.083
25.0	24.988	24.8	0.188	0.083
30.0	29.994	29.7	0.294	0.083

The End of Certificate



CERTIFICATE OF CALIBRATION

Equipment	⚡	Spectrophotometer
Manufacturer	⚡	Thermo Scientific
Model	⚡	Genesys 20
Serial No.	⚡	3SGQ305005
ID No.	⚡	INS/LB-111
Customer	⚡	Thai Chemical & Engineering Co., Ltd.
	⚡	1048/2 Sukhmvit 66/1 Rd., Phra Khanong Tai,
	⚡	Prakanong, Bangkok 10260
Location	⚡	Customer Laboratory
Date of Receipt	⚡	26 August 2021
Date of Calibration	⚡	26 August 2021
Date of Issue	⚡	31 August 2021
Ambient Temperature	⚡	(25±10) °C
Relative Humidity	⚡	(60±20) %
Condition As-Received	⚡	Used Item

Calibrated by

(Mr.Somphop Duangnuan)

Calibration Engineer

Approved by

(Ms. Jintana Sangthaijaroenlap)

Calibration Manager

The reported expanded uncertainty of measurement was based on a combined standard uncertainty multiplied by a coverage factor k=2.00, providing a level of confidence of approximately 95%.

This certificate may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

Indicated values are valid for the state of the Spectrophotometer at the time of calibration only.

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FM-CAL-33/2

15/05/61



CALIBRATION REPORT

Conditions of this result of calibration

1. Reference Standard Material:

Material	Model	Serial No.	Cert.No.	Due date
Holmium Glass Filter	RM-HG	24563	90313	2 Mar 23
Didymium Glass Filter	RM-DG	24562	90311	2 Mar 23
Neutral Density Filter	RM-1N2N3N	24568	90324	3 Mar 23

2. Traceability: This certification is traceable to the International System of Unit maintained at:

The Starna Scientific Ltd. Accredited Calibration Laboratory No. 0659.

3. Method of calibration:

The calibration procedure was carried out according to the Guide to CPM-CAL-02 based on ASTM E275-08 (2013) and ASTM E925-09 (2014).

4. Result of calibration:

(✓) without adjustment

() after adjustment

5. Equipment Specifications:

Spectral Bandwidth	8	nm
Data Interval	1	nm
Scan Speed	N/A	nm/min



CALIBRATION REPORT

Wavelength Calibration

Certified Values of Reference Material (nm)	Nominal Value (nm)	UUC*Reading (nm)	Error (nm)	Uncertainty of Measurement (± nm)
418.40	418	418	-0.40	0.59
513.75	514	514	0.25	0.59
537.00	537	537	0.00	0.59
585.56	586	586	0.44	0.59
879.68	880	879	-0.68	0.59

Photometric Calibration for Visible

Wavelength (nm)	Certified Values of Reference Material (A)	UUC* Reading (A)	Error (A)	Uncertainty of Measurement (± A)
420.0	Zero	0.000	0.0000	0.0028
	0.5824	0.584	0.0016	0.0044
	0.7266	0.727	0.0004	0.0040
	1.0377	1.038	0.0003	0.0040
440.0	Zero	0.000	0.0000	0.0028
	0.5659	0.567	0.0011	0.0042
	0.7126	0.712	-0.0006	0.0037
	1.0172	1.016	-0.0012	0.0037
465.0	Zero	0.000	0.0000	0.0028
	0.5256	0.532	0.0064	0.0044
	0.6705	0.674	0.0035	0.0035
	0.9562	0.961	0.0048	0.0034
546.1 (546.0)	Zero	0.000	0.0000	0.0028
	0.5236	0.529	0.0054	0.0036
	0.6962	0.699	0.0028	0.0031
	0.9933	0.996	0.0027	0.0032
590.0	Zero	0.000	0.0000	0.0028
	0.5578	0.563	0.0052	0.0036
	0.7523	0.754	0.0017	0.0031
	1.0747	1.076	0.0013	0.0032
635.0	Zero	0.000	0.0000	0.0028
	0.5655	0.567	0.0015	0.0035
	0.7321	0.733	0.0009	0.0031
	1.0454	1.046	0.0006	0.0031

Remark: Each individual filter is measured against the empty filter holder (blank) used to zero the Spectrophotometer.

Note:

UUC*: Unit Under Calibration

- End of Report -

Certificate of Calibration

Equipment: TURBIDIMETER Certificate No.: C08210171
Model: 2100P Issued Date: 07 September 2021
Serial No. (or ID.): 010300028236 (INS/LB-049) Job No.: KSPR2112125
Manufacturer: HACH Page: 1 of 2
Condition: In Condition

Customer: THAI CHEMICAL & ENGINEERING CO., LTD.
1048/2 Soi Sukhumvit 66/1, Sukhumvit Road,
Bangchak, Phraknong, Bangkok 10260 Thailand

Environment Condition: Temperature 23 °C ± 2 °C
Humidity 50 %RH ± 15 %RH

Calibration Place: Environment Laboratory, SPC RT Co., Ltd.
1194 Soi Wachirathamsathit 57, Sukhumvit 101/1 Rd.,
Bangchak, Phraknong, Bangkok 10260 Thailand

Calibration By: Mr. Imron Ama
Calibration Date: 07 September 2021
The Method used: In house method, SPCC-WI-23, base on Hach Manufacturer Method 8195
Traceability: This certificate is traceable to Primary standard Fromazin and StablCal accepted by
United States Environmental Protection Agency (EPA) through Hach Company
Certificate No. A1090 , A1064 , A1062 , A1050

Imron Ama

(Mr. Imron Ama)
Person in charge

SERT
บริษัท เอสพีซี แอร์ที จำกัด
SPC RT Co., Ltd.

Dumrong Boonsopon

(Mr. Dumrong Boonsopon)
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.
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Calibration Results:

Before Adjustment

Std Turbidity (NTU)	UUC Reading	Correction	Deviation	Uncertainty
0.080	0.14	-0.060	0.000	0.070
20.40	18.6	1.80	0.07	1.0
103.0	94.6	8.4	0.2	7.0
820.0	789	31.0	0.7	45

After Adjustment

Std Turbidity (NTU)	UUC Reading	Correction	Deviation	Uncertainty
0.080	0.09	-0.010	0.000	0.070
20.40	20.5	-0.10	0.05	1.0
103.0	102	1.0	0.4	7.0
820.0	819	1.0	0.5	45

The End of Certificate