

ภาคผนวก ฉ

เอกสารสอบเทียบเครื่องมือตรวจวัดและเครื่องมือวิเคราะห์

List of Instruments Certification for Water Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Water									
1	pH Meter	pH	Horiba	LAQUA-PH210 HA1G0008	Technology Promotion Association (Thailand-Japan)	22CH1441	21 Oct 22	20 Oct 23	-



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



Cert.No.: 22CH1441

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Certificate of Calibration

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HA1G0008
ID No. : UAE.EFM.201/2564(EFM.pH.09/64)
Condition As-Received: Used Item
Received Date : 20 October 2022
Calibration Date : 21 October 2022
Reference : 2210-0694WSC-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 : Walalak Sirithean

Approved by :

Approved Signatory

- (✓) Malee Butkruea
() Saithip Meangmai
() Warakorn Lernagtrakul

Issue Date : 26 October 2022

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

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Cert.No.: 22CH1441

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Condition of this calibration result

1. Reference Standard Instrument : -

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Document Process Calibrator	54030049	130RC116	22E2769	24 Aug 2023
2) Ref. Standard Thermometer	4982054	110RC044	21I1201	26 Oct 2022

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

- Traceable to National Institute of Metrology (Thailand), NIMT

2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

<u>Buffer Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
pH 4.008	CPA chem	788995	01 Jan 2024
pH 6.987	CPA chem	823322	20 June 2023
pH 10.008	CPA chem	823323	20 June 2023

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

Calibration Results

Function : 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 <i>k</i>
			mV	pH		
pH Meter S/N.: HA1G0008	4.00	177.48	177.5	4.01	0.058	2.00
	7.00	0.00	0.0	7.02	0.058	2.00
	7.00	0.00	0.0	7.02	0.058	2.00
	10.00	-177.48	-177.5	10.01	0.058	2.00

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Cert.No.: 22CH1441

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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 <i>k</i>
pH Electrode S/N.: 991F0169	4.008	4.01	144.6	0.0085	2.05
	6.987	6.99	-28.3	0.011	2.00
	6.987	7.00	-28.7	0.011	2.00
	10.008	10.01	-203.3	0.0085	2.00

Function : Temperature Measurement**(*) Without adjustment**

This equipment was connected with Temperature Probe;

- Model : 9652

- Serial No. : 991F0169

Dimension of probe;

- Length : 103 mm.

- Diameter : 16 mm.

- Immersion Depth : 90 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor <i>k</i>
25.0	25.000	24.9	-0.100	0.13	2.00
30.0	30.001	29.9	-0.101	0.13	2.00
35.0	34.999	34.9	-0.099	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

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รายการใบรับรองสอบเทียบ/ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์คุณภาพน้ำ									
1	pH Meter	pH	Mettler-Toledo	SevenCompact S220/ C113432421	National Food Institute, Ministry of Industry, Thailand	2203527-001-01	5 Jul 22	4 Jul 23	-
2	pH Meter		Mettler-Toledo	Seven Easy S20 / 1230525212	National Food Institute, Ministry of Industry, Thailand	2302181-001-01	24 Mar 23	22 Mar 24	-
3	Analytical Balance (Readability 0.01 mg)	Suspended Solid Settleable Solids	Mettler-Toledo	XSR205DU / C210685394	Technology Promotion Association (Thailand-Japan)	23MM113	26 Apr 23	24 Apr 24	-
4	Hot Air Oven	Total Dissolved Solids	Memmert	UF55 / B216.1666	Technology Promotion Association (Thailand-Japan)	22TM1490	19 Oct 22	18 Oct 23	-
5	Analytical Balance (Readability 0.1 mg)	Fat, Oil and Grease	Mettler-Toledo	XSR204 / C117635043	National Food Institute, Ministry of Industry, Thailand	2302827-001-01	10 May 23	8 May 24	-
6	BOD Incubator	Biochemical Oxygen Demand	Arco	UC4-1320 / (UAE.WAO.015/2561)	Technology Promotion Association (Thailand-Japan)	23TM249	15 Feb 23	14 Feb 24	-
7	BOD Incubator		Arco	UR-1320 / (UAE.WAO.018/2551)	Technology Promotion Association (Thailand-Japan)	23TM375	12 Apr 23	10 Apr 24	-
8	Digestor Unit	Total Kjeldahl Nitrogen	FOSS TECATOR	2520auto / 91794469	National Food Institute, Ministry of Industry, Thailand	2302413-001-01	30 Mar 23	28 Mar 24	-
9	Distillation Unit (Kjeldahl Method)		FOSS TECATOR	KT8100 / 91889052	FOSS South East Asia	6623	25 Jul 22	24 Jul 23	-
10	UV-VIS Spectrophotometer	Sulphide	Hitachi	U-1900 / 2021-064	DQE Services Co.,Ltd.	SP23-007	6 Jan 23	5 Jan 24	-
11	UV-VIS Spectrophotometer		Agilent Technologies	Cary60 G6860A / MY15410009	DQE Services Co.,Ltd.	SP23-021	20 May 23	18 May 24	-
12	Incubator	Total Coliform Bacteria Fecal Coliform Bacteria	Binder	KB400 / 20200000015535	Technology Promotion Association (Thailand-Japan)	23TM726	27 Apr 23	25 Apr 24	-
13	Incubator	Total Bacteria Legionella sp.	Memmert	IPP 260 / V616.0066	Technology Promotion Association (Thailand-Japan)	23TM728	27 Apr 23	25 Apr 24	-
14	Incubator		Memmert	IPP 260 / V615.0187	Technology Promotion Association (Thailand-Japan)	23TM378	12 Apr 23	10 Apr 24	
15	Water Bath		Memmert	WNE 14 / L414.1407	Technology Promotion Association (Thailand-Japan)	23TM374	11 Apr 23	9 Apr 24	-

รายการใบรับรองสอบเทียบ/ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์คุณภาพน้ำ									
16	Water Bath	Total Coliform Bacteria Fecal Coliform Bacteria	Memmert	WNE 14 / L414.1410	Technology Promotion Association (Thailand-Japan)	23TM377	12 Apr 23	10 Apr 24	-
17	Water Bath	Total Bacteria Legionella sp.	Memmert	WNE 14 / L416.0606	Technology Promotion Association (Thailand-Japan)	23TM193	15 Feb 23	14 Feb 24	
18	Auto Clave		ALP	CL-40L / 807298	Technology Promotion Association (Thailand-Japan)	22TM1121	11 Jul 22	10 Jul 23	-
19	Auto Clave		ALP	CL-40L / 808763	Technology Promotion Association (Thailand-Japan)	23TM763	27 Apr 23	25 Apr 24	-
20	Analytical Balance		OHAUS	PX623 / C236754745	DKSH (Thailand) Ltd.	C01223732	9 Dec 22	8 Dec 23	-

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

Calibration Certificate

Certificate No.: 2203527-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 5

Equipment: pH Meter
Manufacturer: METTLER TOLEDO
Model: Seven Compact S220
Serial No.: C113432421
ID No.: UAE.WAT.009/2564
Order No.: 2203527
Operation No.: 2203527-001
Date of Receipt: 30 June 2022
Date of Calibration: 5 July 2022

Calibrated by Mr.Worapob Soiktong **Approved by** (Mr.Pheraphat Tuanjit)
Scientist **Manager, Division of Calibration Laboratory**
Date of Issue: 5 July 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: 01 Date: 20-04-65

เอกสารไม่ควบคุม



Calibration Report

Certificate No.: 2203527-001-01
Equipment: pH Meter
Resolution: 0.01 pH ; 1 mV
Manufacturer: METTLER TOLEDO
Model: Seven Compact S220
Serial No.: C113432421
Type: Bench top
ID No.: UAE.WAT.009/2564

Page 2 of 5

Date of Calibration: 5 July 2022
Location: 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-CC-002 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)

2. Reference Standards / Certified Reference Material

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2709007	Fluke	22E1959	17 June 2023
2.2 Digital Thermometer	2709007	Fluke	CC-640599-01	30 October 2022
2.3 Thermo-Hygro Meter	NPLBTH005/18	PONPE	QR22-0351	18 February 2023
Certified Reference Material	Lot No.	Manufacturer	Ref. N	Expiry Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	805203	CPAchem	PHQ16.L5	21 April 2024
2.5 pH buffer 6.860 (Primary pH buffer Solution)	805204	CPAchem	PHQ17.L5	21 April 2024
2.6 pH buffer 10.01 (Primary pH buffer Solution)	805205	CPAchem	PHQ20.L5	21 April 2023
2.7 pH buffer 7.00 (Standard pH buffer Solution)	805206	CPAchem	PH107.L5	21 April 2023

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

- 3.1 Instruments No.2.1 through NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.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.0232
- 3.4 Certified Reference Material No. 2.4 to 2.6 traceable to Primary measurement method: Harrod 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 BIM RefN H-27 LotN 04.06.2021; BIM RefN H-28 LotN 28.05.2021; BIM RefN H-29 LotN 04.06.2021; BIM RefN H-30 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 was calibrated.

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

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

เอกสารไม่ควบคุม



Calibration Report

Certificate No.: 2203527-001-01
Equipment: pH Meter
Resolution: 0.01 pH ; 1 mV
Manufacturer: METTLER TOLEDO
Model: Seven Compact S220
Serial No.: C113432421
Type: Bench top
ID No.: UAE.WAT.009/2564

Date of Calibration: 5 July 2022 **Page 3 of 5**

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

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (±mV)	Coverage Factor (k)
		mV	pH		
0	414.117	414	0.00	0.58	2.00
2	295.811	296	2.00	0.58	2.00
4	177.462	177	4.00	0.58	2.00
6	59.159	59	6.00	0.58	2.00
7	-0.001	0	7.00	0.58	2.00
8	-59.159	-59	8.00	0.58	2.00
10	-177.463	-177	10.00	0.58	2.00
12	-295.812	-296	12.00	0.58	2.00
14	-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
Type: Combined Electrode
Manufacturer: METTLER TOLEDO
Model: InLab Expert Pro-ISM
Serial No.: 2210418
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	4.019	162	-	0.0071	2.00
6.860	6.850	14	100.0	0.0075	2.00
10.008	10.010	-169	97.9	0.0093	2.00
6.985	6.990	6	-	0.0087	2.00

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

เอกสารไม่ควบคุม



Calibration Report

Certificate No.: 2203527-001-01
Equipment: Digital Thermometer with RTD
Resolution: 0.1 °C
Model: Seven Compact S220
Serial No.: C113432421
ID No.: UAE.WAT.009/2564
Manufacturer: METTLER TOLEDO

Date of Calibration: 5 July 2022 **Page 4 of 5**

Location: Calibration Laboratory, National Food Institute

Environment Condition: Ambient Temperature 25 °C ± 1 °C
Relative Humidity 48 % ± 3 %

Condition of this results of Calibration:

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

2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1521	A85997	TE 650057-01	10-Dec-22	NATIONAL FOOD INSTITUTE
Platinum Resistance Thermometer (PRT)	385	509201			

Support Equipment : - Low Temperature Bath (ISOCAL-6), Model: Europa-6 Plus Basic, S/N: 341592/2

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

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

เอกสารไม่ควบคุม



Calibration Report

Certificate No.: 2203527-001-01
Equipment: Digital Thermometer with RTD
Resolution: 0.1 °C Model: Seven Compact S220
Serial No.: C113432421 ID No.: UAE.WAT.009/2564
Manufacturer: METTLER TOLEDO
Date of Calibration: 5 July 2022

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Calibration point: 15.0, 25.0 and 35.0 °C

Calibration result:

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

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.1	15.038	- 0.1	0.12
25.1	25.038	- 0.1	0.12
35.2	35.024	- 0.2	0.12

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 Report

Certificate No.: 2302181-001-01
Equipment: pH Meter
Resolution: 0.01 pH : 1 mV
Manufacturer: METTLER TOLEDO Model: SevenEasy pH
Serial No.: 1230525212 Type: Bench top
ID No.: UAE.WAS.003/2553

Date of Calibration: 24 March 2023 Page 2 of 5

Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature: (23.4 ± 1.5) °C Relative Humidity: (52 ± 3) %
Condition of Equipment: Good Condition

Condition of this Results of Calibration

- Calibration Method
In house method : W-CC-002 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)
- Reference Standards / Certified Reference Material

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2709007	Fuke	22E1959	17 June 2023
2.2 Digital Thermometer	2709007	Fuke	CC-650557-01	30 October 2023
2.3 Thermo-Hygro Meter	NFLBTH003/17	PONPE	TE 650555-01	21 September 2023
Certified Reference Material				
	Lot No.	Manufacturer	Ref No.	Expires Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	873608	CPAchem	PH216.L5	16 February 2025
2.5 pH buffer 6.865 (Primary pH buffer Solution)	873609	CPAchem	PH217.L5	16 February 2025
2.6 pH buffer 10.01 (Primary pH buffer Solution)	873611	CPAchem	PH220.L5	16 February 2024
2.7 pH buffer 7.00 (Standard pH buffer Solution)	873612	CPAchem	PH107.L5	16 February 2024
- This certificate is traceable to The International System of Unit (SI Unit)
 - Instruments No.2.1 through NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0008
 - Instruments No.2.2 through NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0061
 - Instruments No.2.3 through NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0061
 - Certified Reference Material No. 2.4 to 2.6 traceable to Primary measurement method- Harned cell using calibrated thermometer, barometer, and nanovoltmeter. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025.
 - Certified Reference Material No.2.7 traceable to BIM RefN Hi-13 LotN 25 05 2022; BIM RefN Hi-16 LotN 02 06 2022; BIM RefN Hi-13 LotN 25 05 2022; BIM RefN Hi-16 LotN 02 06 2022, the Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
- 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.

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

เอกสารไม่ควบคุม



Calibration Certificate

Certificate No.: 2302181-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhnong, Bangkok 10260

Page 1 of 5

Equipment: pH Meter

Manufacturer: METTLER TOLEDO

Model: SevenEasy pH

Serial No.: 1230525212

ID No.: UAE.WAS.003/2553

Order No.: 2302181

Operation No.: 2302181-001

Date of Receipt: 14 March 2023

Date of Calibration: 24 March 2023

Calibrated by Mr.Pheraphat Tuanjit
Scientist

Approved by (Mr.Nuttapol Niyomchart)
Specialist, Division of Calibration Laboratory
Responsible for the Technical Management Team

Date of Issue: 24 March 2023

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

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

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

เอกสารไม่ควบคุม



Calibration Report

Certificate No.: 2302181-001-01
Equipment: pH Meter
Resolution: 0.01 pH : 1 mV
Manufacturer: METTLER TOLEDO Model: SevenEasy pH
Serial No.: 1230525212 Type: Bench top
ID No.: UAE.WAS.003/2553

Date of Calibration: 24 March 2023 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		Uncertainty (±mV)	Coverage Factor (k)
		mV	pH		
0	414.120	414	9.00	0.58	2.00
2	296.814	296	2.00	0.58	2.00
4	177.464	178	4.00	0.58	2.00
6	59.160	59	6.00	0.58	2.00
7	0.000	0	7.00	0.58	2.00
8	-59.158	-59	8.00	0.58	2.00
10	-177.460	-177	10.00	0.58	2.00
12	-296.811	-296	12.00	0.58	2.00
14	-414.117	-414	14.00	0.58	2.00

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

Equipment: pH Electrode **Type:** Combined Electrode
Manufacturer: METTLER TOLEDO **Model:** InLab Solids
Serial No.: 1156883 **ID No.:** N/A
Performance of Electrode system (Three-Point Calibration at pH 4, pH 7 and pH 10)

Certified Value (25 °C pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.01	187	-	0.0071	2.00
6.865	6.86	22	97.86	0.0075	2.00
10.010	10.01	-180	97.86	0.0066	2.00
6.985	6.99	14	-	0.0093	2.00

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

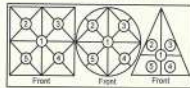
เอกสารไม่ควบคุม





Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0459OC-2

Cert.No.: 23MM113
Page: 3 of 3



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

2. Effect of off center loading

A mass of 100 g was placed to various position on the pan.
The weighing machine reading error obtained is given in the table

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

3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
Unload	0.00000	0.00000	0.014	2.11
0.05	0.04999	+0.00001	0.015	2.09
0.1	0.09999	+0.00001	0.015	2.07
1	1.00000	0.00000	0.018	2.04
5	5.00000	0.00000	0.026	2.00
20	20.00002	-0.00002	0.045	2.00
50	50.00002	-0.00002	0.080	2.00
80	80.00002	-0.00002	0.15	2.00
100	100.00000	0.00000	0.17	2.00
150	150.00000	0.00000	0.29	2.00
200	199.99999	+0.00001	0.29	2.00

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

-00-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10230
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 22TM1490
Page: 1 of 3

Certificate of Calibration

Equipment : Hot Air Oven
Manufacturer : Memmert
Model : UF 55
Serial No. : B216.1666
ID No. : UAE.WAO.027/2559
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 : 19 October 2022
Calibration Date : 19 October 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Preecha Hlahib
Approved by :
() Pornthippa Tameyakul
() Malee Butkruea
(✓) Suwit Imjai

Issue Date : 31 October 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 0046800



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2210-0575OC-1

Cert. No.: 22TM1490
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) 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

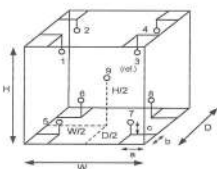
2. This certificate is valid only to the item calibrated on date and place of calibration.

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 :
a = 5.0 cm
b = 5.0 cm
c = 5.0 cm
Dimension of Chamber :
D = 0.33 m
W = 0.40 m
H = 0.40 m
Capacity = 0.053 m³

Environment during calibration	
	Beginning Finished
Temp. (°C)	29 30
REL.Humid. (%)	47 40
AC Supply (Volt)	221 220

Ref. Std. ID No.: @ Calibration Point	
Position :	(104) °C (140,180) °C
1	18-04RTD-01 21-04TC-01
2	18-04RTD-02 21-04TC-02
3	18-04RTD-03 21-04TC-03
4	18-04RTD-04 21-04TC-04
5	18-04RTD-05 21-04TC-05
6	18-04RTD-06 21-04TC-06
7	18-04RTD-07 21-04TC-07
8	18-04RTD-08 21-04TC-08
9 (ref.)	18-04RTD-09 21-04TC-09



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2210-0575OC-1

Cert. No.: 22TM1490
Page: 3 of 3

Result of Calibration :-

Function of UUC* : Temperature Source

Fresh air setting : Close

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	0.061	1.3	1.7	0.42	2
140.0	140.0	140.0	0.14	2.3	2.4	1.1	2
180.0	180.0	180.0	0.21	3.5	3.6	1.3	2

Calibration Point (°C)	Measured Temperature (°C)								
	1	2	3	4	5	6	7	8	9 (ref.)
104.0	103.076	103.876	103.777	104.124	104.667	104.426	104.012	103.928	104.370
140.0	138.199	139.189	138.808	139.550	140.266	139.622	139.293	139.385	140.369
180.0	177.930	179.267	178.643	179.753	181.011	180.093	179.496	179.743	181.278

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 %.

-00-

เอกสารไม่ควบคุม

a 1133252

เอกสารไม่ควบคุม

a 1133251

Calibration Certificate

Certificate No.: 2302827-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR204
Serial No.: C117635043
ID No.: UAE.WAS.012/2564
Order No.: 2302827
Operation No.: 2302827-001
Date of Receipt: 10 May 2023
Date of Calibration: 10 May 2023

Calibrated by Mr. Manas Somsak Specialist
Approved by (Mr. Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team
Date of Issue: 18 May 2023

The uncertainties are for a confidence probability of approximately 95%

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

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

Calibration Report

Certificate No.: 2302827-001-01
Equipment: Electronic Balance
Model: XSR204
Serial No.: C117635043
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.0001 g
ID No.: UAE.WAS.012/2564

Page 2 of 4

Date of Calibration: 10 May 2023
Environment Condition: Ambient Temperature: 21.4 ± 0.2 °C Relative Humidity: 43.4 ± 0.9 %
Place of Calibration: Balance room (Water Analysis Unit), 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	1mg to 200g	B505567572	TCS	M23040535	8 April 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH 016/23	Quality Reborn	QR23-0489	21 February 2024

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.

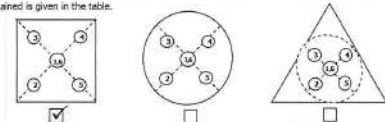
Calibration Results:

1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
100	0.000032
200	0.000032

2. Off-Center Error:

A mass of 100 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)
100.0002	100.0002	100.0002	100.0002	100.0003	100.0002	0.0001

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

Calibration Report

Certificate No.: 2302827-001-01
Equipment: Electronic Balance
Model: XSR204
Serial No.: C117635043
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.0001 g
ID No.: UAE.WAS.012/2564

Page 3 of 4

Date of Calibration: 10 May 2023
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
Unread	0.00000	0.0000	0.0000	0.000085	2.00
0.01	0.01000	0.0100	0.0000	0.000085	2.00
0.02	0.02001	0.0200	0.0000	0.000085	2.00
0.05	0.05000	0.0500	0.0000	0.000085	2.00
0.1	0.10001	0.1000	0.0000	0.000085	2.00
0.2	0.20001	0.2000	0.0000	0.000085	2.00
0.5	0.50002	0.5000	0.0000	0.000085	2.00
1	1.00000	1.0000	0.0000	0.000086	2.00
2	2.00002	2.0000	0.0000	0.000086	2.00
3	3.00003	3.0000	0.0000	0.000087	2.00
5	5.00002	5.0000	0.0000	0.000087	2.00
10	10.00001	10.0000	0.0000	0.000088	2.00
20	20.00003	20.0000	0.0000	0.000092	2.00
30	30.00004	30.0000	0.0000	0.000098	2.00
40	40.00007	40.0000	0.0000	0.00011	2.00
45	45.00009	45.0001	0.0000	0.00013	2.00

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

Calibration Report

Certificate No.: 2302827-001-01
Equipment: Electronic Balance
Model: XSR204
Serial No.: C117635043
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.0001 g
ID No.: UAE.WAS.012/2564

Page 4 of 4

Date of Calibration: 10 May 2023
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
50	50.00003	50.0000	0.0000	0.00011	2.00
55	55.00005	55.0000	0.0000	0.00012	2.00
60	60.00004	60.0000	0.0000	0.00012	2.00
65	65.00005	65.0000	0.0000	0.00013	2.00
70	70.00006	70.0001	-0.0001	0.00013	2.00
75	75.00008	75.0002	-0.0001	0.00013	2.00
80	80.00007	80.0002	-0.0001	0.00014	2.00
85	85.00009	85.0002	-0.0001	0.00014	2.00
90	90.00010	90.0002	-0.0001	0.00015	2.00
100	100.00006	100.0002	-0.0001	0.00016	2.00
120	120.00009	120.0002	-0.0001	0.00018	2.00
150	150.00009	150.0002	-0.0001	0.00021	2.00
200	200.00016	200.0003	-0.0001	0.00028	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: 01 Date: 20-04-65



Cert. No.: 23TM249
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 : 15 February 2023
Calibration Date : 15 February 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Preecha Hiahib

Approved by :
Approved Signatory
() Pornthippa Tameyakul
(✓) Malee Butkruea
() Suwit Imjai

Issue Date : 24 February 2023

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม

A 0051476



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2302-0297OC-1
Procedure Used :-

Cert. No.: 23TM249
Page : 2 of 3

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

Condition of this result of calibration

1. Reference standard instrument:-

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

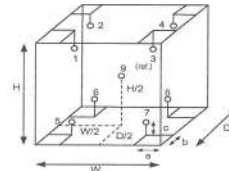
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



Probe Installation Details :

a = 10 cm
b = 10 cm
c = 10 cm

Dimension of Chamber :

D = 0.62 m
W = 1.2 m
H = 1.2 m
Capacity = 0.89 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	29	31
REL.Humid. (%)	63	67
AC Supply (Volt)	220	220

Position :	Ref. Std. ID No.:
1	22-18RTD-2/1
2	18RTD-2/2
3	18RTD-2/3
4	18RTD-2/4
5	18RTD-2/5
6	18RTD-2/6
7	18RTD-2/7
8	18RTD-2/8
9 (ref.)	18RTD-2/9

เอกสารไม่ควบคุม

A 0051476



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2302-0297OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 23TM249
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	19.3	0.32	0.57	1.0	0.60	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
20.0	20.086	19.916	20.386	19.976	19.973	19.838	19.837	19.821	19.949

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 1149512



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

Certificate of Calibration

Equipment : BOD Incubator
Manufacturer : ARCO
Model : UR-1320
Serial No. : -
ID No. : UAE.WAO.018/2551
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Lab Floor 2
Received Order : 11 April 2023
Calibration Date : 12 April 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Krisda Malee
Approved by :
Approved Signatory
() Pornthippa Tameyakul
(✓) Malee Butkruea
() Suwit Imjai
Issue Date : 24 April 2023

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม

A 0053360



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

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

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

Condition of this result of calibration

1. Reference standard instrument:-

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

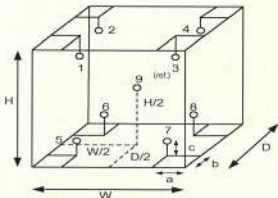
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



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

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

Probe Installation Details :

Dimension of Chamber :

a = 10 cm
b = 10 cm
c = 10 cm
D = 0.62 m
W = 1.2 m
H = 1.2 m
Capacity = 0.89 m³

เอกสารไม่ควบคุม

a 1158259



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

Cert. No.: 23TM375
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)	Coverage Factor k
20.0	20.0	20.0	0.48	0.42	1.2	2

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

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

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

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

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

UUC* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม

a 1158258



มูลนิธิสถาบันพัฒนาอุตสาหกรรมอาหาร
ศูนย์บริการห้องปฏิบัติการอุตสาหกรรมอาหาร
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center

Verification Certificate

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

Page 1 of 4

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

Calibrated by Mr.Nuttapol Niyomchat Specialist
Approved by (Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team
Date of Issue: 10 April 2023

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

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

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

เอกสารไม่ควบคุม



มูลนิธิสถาบันพัฒนาอุตสาหกรรมอาหาร
ศูนย์บริการห้องปฏิบัติการอุตสาหกรรมอาหาร
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center

Verification Report

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

Date of Calibration: 30-31 March 2023 Page 2 of 4

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

Condition of this results of Calibration:

1. This instrument was calibrated by insert standard thermocouples type R into its heating block digestion and compared to temperature obtained from reference standards thermometer at calibrated point.

- The temperature scale used was based on ITS - 90 .

- All data show below were final values and the initial data may be obtained upon request.

2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with Thermocouple	34970A	MY44045376 / MY41394453	TC22/0044	5-May-2023	N.M. Technical Center Laboratory
	Type R	7C4185-183 / CH4185-183			

3. This certificate is traceable to international system of units (SI Units).

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

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

6. Condition of Calibrated item : Good

UUC* Description

Time of Record : Hour 30 Minute At 380 °C

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

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

เอกสารไม่ควบคุม



Verification Report

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

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

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

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

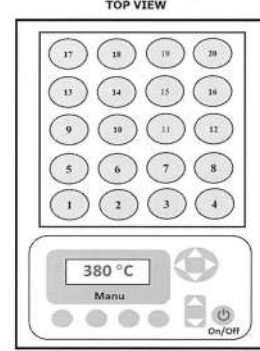
FC-S-009 Revision: 01 Date: 20-04-65

Verification Report

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

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

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



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 %.

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

FOSS (ประเทศไทย) จำกัด 35 หมู่ 5 ต.บางพลีใหญ่ อ.บางพลี จ.สมุทรปราการ 10710
2008 So. 36, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phli District, Bangkok 10710, Thailand
Tel: +66(0) 2452 8588 Fax: +66(0) 2452 8545

เอกสารไม่ควบคุม

FOSS (ประเทศไทย) จำกัด 35 หมู่ 5 ต.บางพลีใหญ่ อ.บางพลี จ.สมุทรปราการ 10710
2008 So. 36, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phli District, Bangkok 10710, Thailand
Tel: +66(0) 2452 8588 Fax: +66(0) 2452 8545

เอกสารไม่ควบคุม

FOSS
Customer Service Report

Date: 25/2/2022
Customer: United Analyst and Engineering
Instrument: KT9100
Serial: 31983052

Report No.: 6623

Hours:
Start: 9:00
Finish: 9:50
30 mins

Travel To Customer: 9:00 - 12:00
Labour: 3 + 5
16:00 - 16:00 x 5 hrs.
Travel From Customer: 16:30 - 17:30
1 hrs.

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

PO/Quote Number: 1600-1600

PMA Type: 1600-1600 **Contract No.:** 1600-1600

Details of Work / Test	Condition / Status
- Unpack อุปกรณ์และชุดเครื่องมือ	OK
- ตรวจสอบ Accessory kit	OK
- ตรวจสอบโปรแกรมและไฟล์ Alkali	OK
- ตรวจสอบและติดตั้ง ไฟ, สาย, PA	OK

Instrument Ready for Use: ☒ OK ☐ Not OK

Part No.	Batch	Description	Qty

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? ☐ Yes ☐ No

เอกสารไม่ควบคุม

FOSS
Customer Service Report

Date: 25/2/2022
Customer: United Analyst and Engineering
Instrument: KT9100
Serial: 31983052

Report No.: 6534

Hours:
Start: 9:00
Finish: 9:50
30 mins

Travel To Customer: 9:00 - 12:00
Labour: 3 + 5
16:00 - 16:00 x 5 hrs.
Travel From Customer: 16:30 - 17:30
1 hrs.

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

PO/Quote Number: 1600-1600

PMA Type: 1600-1600 **Contract No.:** 1600-1600

Details of Work / Test	Condition / Status
- Unpack อุปกรณ์และชุดเครื่องมือ	OK
- ตรวจสอบ Accessory kit	OK
- ตรวจสอบโปรแกรมและไฟล์ Alkali	OK
- ตรวจสอบและติดตั้ง ไฟ, สาย, PA	OK

Instrument Ready for Use: ☒ OK ☐ Not OK

Part No.	Batch	Description	Qty

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? ☐ Yes ☐ No

เอกสารไม่ควบคุม

Kjeltec™ 8100 Distillation Unit

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

1 Intended Use

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

2 Purpose

This installation Qualification is designed to assure that:

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

3 Identification

Description	Serial Number
Kjeltec 8100 Distillation Unit	918 89052

Dedicated Analytical Solutions

FOSS Analytical AIS
69 Slangerupgade
DK-3400 Hillerød
Denmark

Tel +45 7010 3370
Fax +45 7010 3371
E-mail support@foss.dk
Web www.foss.dk

FOSS Analytical AB
Box 70
SE-263 21 Höganäs
Sweden

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

Customer Support, 6003 7242 / Rev. 1

เอกสารไม่ควบคุม 1(6)

4 Control of Received Equipment

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

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

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

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เอกสารไม่ควบคุม 2(6)

5 Installation

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

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

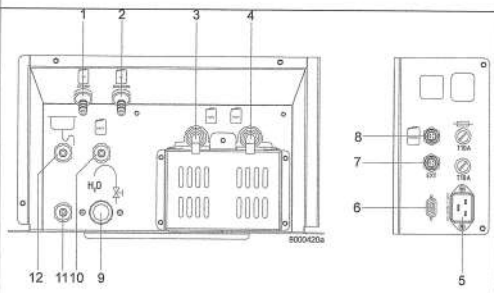
Location Requirements	Acceptance Criteria	Pass (Y/N)
Adequate space for instrument	Dimensions 48x58x69 cm	Y
AC supply available for instrument	200-240 V 50/60Hz	Y
Current	10 A	Y
Cold water supply available	2 L/min at 30°C	Y
Drain	For cooling water and waste (depending on local waste disposal legislation)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

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เอกสารไม่ควบคุม 3(6)

5.2 The instrument must be assembled correctly

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

Instrument Tubing Connections	Acceptance Criteria	Pass (Y/N)
 <p>1. Deionised water in (steam generator) 2. Deionised water in (dilution water) 3. *) Reiser solution in 4. Alkali in 5. Power 6. Not used 7. External titration module 8. Level sensors 9. Cooling water in (tap water) 10. Waste water out (tube drain vessel) 11. Drain 12. Cooling water out (tap water) *) Only on Kjeltec 8200</p>	Visual verification by installer	Y

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เอกสารไม่ควบคุม 4(6)

5.3 The instrument should be assembled and powered up

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

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

6 Summary of Deviations/Comments

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

Deviation	Action	Comment

7 IQ Documentation

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

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

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



Kjeltec™ 8100 Distillation Unit

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

1 Intended Use

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

2 Purpose

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

- Alkali volume
- Distillation Accuracy
- Distillation Repeatability

3 Identification

Description	Serial Number
Kjeltec 8100 Distillation Unit, 200-240 V 50/60 Hz	91 869052

4 Performance

4.1 Verify the dispensed volumes of reagents

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

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

Water

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

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

Alkali

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

Table 1 Volume control

Test	Result	Expected result	Passed (Y/N)
Water volume	<div>85 ml</div> <div>85 ml</div> <div>81 ml</div> <div>Mean 83.67 ml</div>	76- 84 ml	Y
Alkali volume	<div>42 ml</div> <div>52 ml</div> <div>53 ml</div> <div>Mean 49.33 ml</div>	47- 54 ml	Y

Dedicated Analytical Solutions

FOSS Analytical AS
69 Slangerupgade
DK-3400 Hillerød
Denmark

Tel +45 7010 3370
Fax +45 7010 3371
E-mail support@foss.dk
Web www.foss.dk

FOSS Analytical AB
Box 70
SE-263 21 Högabås
Sweden

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

4.2 Verify the distillation procedure, accuracy and precision

The distillation principle is to convert ammonium (NH_4^+) into ammonia (NH_3) by using an alkali (NaOH) and thereafter steam distil it into a receiver flask containing boric acid and titrate with standard acid solution using colorimetric end-point detection. Ammonium sulphate, a substance with known ammonia content, can be used to check the accuracy of the distillation. The recovery is calculated from obtained result.

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

Chemical Check

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

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

Analysis conditions according to AN 300

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

For reagent preparation see Appendix A

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

Recovery test	Result	Expected result	Passed (Y/N)
Blank value (water blank)	1. 0.05 ml 2. 0.14 ml	0.05-0.20 ml	Y
Recovery	1. 100.50 % 2. 100.30 % 3. 100.65 % 4. 99.81 % 5. 99.92 % 6. 100.01 %		
Accuracy	Mean Value: 100.03	99-101%	Y
Precision	SD: 0.552	SD <1%	Y

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

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

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

N = Normality of titrant to 4 places of decimal.

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

mg sample

1. 0.15 g 23.56
- 2.
- 3.
- 4.
- 5.
- 6.

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5 Summary of Deviations/Comments

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

Deviation	Action	Comment

6 OQ Documentation

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

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

Performed By: _____
 Company: _____
 Customer Name: _____
 Company: _____
 Date completed: _____

7 Appendix A

7.1 Preparation of Reagents

7.1.1 Alkali

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

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

7.1.2 Titrant acid, determination of concentration

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

- Standard substance**
Weigh approx. 10 g of anhydrous sodium carbonate (Na_2CO_3). Use a mortar to make a fine powder. Dry it for 1 h at 265 °C or 2 h at 200 °C. After cooling in a desiccator, transfer the sodium carbonate to a beaker with a tight lid. Store it in a desiccator.
- Indicator solutions**
Dissolve 0.1 g methyl red in 100 ml methanol. Dissolve 0.1 g bromocresol green in 100 ml methanol.
- Procedure**
Weigh approx. 0.4 g of the standard substance, using an analytical balance, note the weight (W_1). Transfer the sodium carbonate to a receiver flask and add 40 ml of H_2O (distilled or deionized). Add 8 drops from each of the indicator solutions. Titrate to pink. Note the amount in ml used (A_1). Boil this solution for a few minutes. The solution will turn green. Cool rapidly to room temperature under running water. Continue the titration until the next pink colour change occurs. Note also this volume (A_2). Boil the solution for a few minutes. Cool rapidly to room temperature under running water. Continue the titration until the next pink colour occurs. Note also this volume (A_3).
Note! Temperature changes will influence the volume and the concentration of the titrant solution. The working temperature of the titrant should approximate that of its temperature during standardization. If temperature corrections are necessary, sufficient accuracy may be obtained by use of a correction table. (AOAC 942.25)

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7.2 Calculation

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

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

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

7.3 Receiver Solution

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

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

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

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

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

4.2 Ongoing Qualification Tests

Block Temperature

The temperature for the digestion is limited by the boiling point for the sulphuric acid, this can be increased by adding a salt (K_2SO_4) to the digestion mixture. It's important that the optimal ratio between acid and salt is kept; please follow recommendation in AN 300 or suggested procedures for a specific kind of sample material.

The block temperature itself can be controlled external by inserting a temperature probe in the intended hole in the aluminium block (front row of holes).

Use the reagents and method procedure specified in AN 300. Use only reagents of recognized analytical grade, unless otherwise specified and distilled or demineralised water or water of equivalent purity.

Suggested standard material for internal quality control:

Ammonium sulphate $[(NH_4)_2SO_4]$, min. 99.5 % (mass fraction), with certified purity.

Note: The above chemical is usually readily available with a certificate specifying the purity.

Alternatively ammonium iron(II) sulphate, $(NH_4)_2 Fe(SO_4)_2 \times 6 H_2O$, with certified purity may be used.

Tryptophan ($C_{11}H_{12}N_2O_2$), minimum assay 99 % (mass fraction). Nitrogen content 137.2 g/kg. Do not dry in an oven before use.

Acetanilide (C_8H_9NO), minimum assay 99 % (mass fraction). Nitrogen content 103.6 g/kg. Do not dry in an oven before use.

Sucrose, ($C_{12}H_{22}O_{11}$), with a nitrogen content of not more than 0.002 % (mass fraction). Do not dry in an oven before use.

Blank Tests

Carry out a blank test following the currently used procedure for digestion, distillation and titration taking 2 ml of water and about 0.7 g of sucrose instead of the test portion. Keep a record of blank values. If blank values change, identify the cause.

Note: The amount of titrant used in the blank test should always be greater than 0.0 ml. Blanks within the same laboratory should be consistent across time.

4.3 Recovery Tests

Regularly run recovery studies to check the accuracy of procedure and equipment:

- Nitrogen loss.** - Use 0.12 g ammonium sulphate and 0.67 g sucrose per flask weighted to the nearest 0.1 mg. Add all other reagents as stated in the method currently used (Kjeltabs, H_2SO_4 , etc). Digest and distil under same conditions as for sample. Recoveries shall be >99 %.
- Digestion efficiency.** - Use a test portion of minimum 0.15 g of tryptophan or acetanilide and 0.67 g sucrose per flask weighted to the nearest 0.1 mg. Determine the nitrogen content according to the current procedure in use. The recoveries of tryptophan shall be >98.5 %; the recoveries of acetanilide shall be >99.5 %.
- Distillation and titration efficiency.** - Distil 0.10 - 0.15 g ± 0.0001 g ammonium sulphate, omitting the digestion step. The recoveries should be >99.5 %.

Note: Results less than 98.5 % or more than 101.0 % in either of the recovery tests indicate failures in the procedure and/or inaccurate concentration of the standard volumetric hydrochloric acid solution (should be adjusted to four decimals accuracy according to procedure in AN 300)

Kjeltec™ 8100 Distillation Unit Tecator™ 2508/2520 Digestor

1 Scope

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

2 Intended Use

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

3 Purpose

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

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

- Preventive maintenance
- On-going verification tests

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

4 Definition of Test Procedures

4.1 Preventive Maintenance

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

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

Dedicated Analytical Solutions

FOSS Analytical AS
65 Slangerupgade
DK-3400 Hillerød
Denmark

Tel +45 7010 3370
Fax +45 7010 3371
E-mail support@foss.dk
Web www.foss.dk

FOSS Analytical AB
Box 70
SE-263 21 Höganäs
Sweden

Tel +46 42 361500
Fax +46 42 360549
E-mail support@foss.dk
Web www.foss.dk

External Quality Control Program

It is recommended to participate in an external quality control program, such a proficiency program or ring test, with equivalent sample material as analysed within the laboratory.

Calculation and Expression of Results

$$w_N = \frac{14.007(V_s - V_b)N \times 100\%}{m}$$

Where:

w_N is the nitrogen content of the sample, expressed as a percentage by mass.

V_s is the numerical value of the volume of the hydrochloric acid standard volumetric solution used in the sample test, in milliliters, expressed to the nearest 0.05 ml.

V_b is the numerical value of the volume of the hydrochloric acid standard volumetric solution used in the blank test, in milliliters, expressed to the nearest 0.05 ml.

N is the numerical value of the exact normality of the hydrochloric acid standard volumetric solution, expressed to four decimal places.

m is the numerical value of the mass of the test portion, in milligrams, expressed to the nearest 1 mg for sample weights >1 g or to the nearest 0.1 mg for sample weights <1 g.

5 Maintenance

5.1 Maintenance Kjeltec™ 8100

See instructions in User Manual - Kjeltec 8100/8200, chapter 5 Maintenance.

5.2 Maintenance Tecator™ Digestor

See instructions in User Manual - Tecator Digestor, chapter 5 Maintenance.

6 The Maintenance Record Charts

This record charts are provided to assist you in keeping your system in good working order. Please make copies and use them regularly as they can often help us to help you in the unlikely event a system malfunction.

6.2.5 Yearly Maintenance

[illegible]

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6.2.3 Every 1-3 Months Maintenance

[illegible]

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6.2.6 Exchange of Parts and Reagents Maintenance

[illegible]

เอกสารไม่ควบคุม


6.2.4 Additional Maintenance

[illegible]

เอกสารไม่ควบคุม

DQEServices

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


ISO 9001:2015
CALIBRATION 0454

CERTIFICATE OF CALIBRATION

Certificate No. : SP23-007Page 1 of 5

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

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

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-1900

Serial No. : 2021-064

ID No. : UAE.WAS.006/2552

Received Date : 6 January 2023

Calibration Date : 6 January 2023

Issue Date : 10 January 2023

Condition Instrument : Used

Calibrated by : (Mr.Tanawat Ritidach)
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 unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the DQE Services Co., Ltd.

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FM-708-02 R01 1/11/2021

DQEServices

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


ISO 9001:2015
CALIBRATION 0454

REPORT OF CALIBRATION

Certificate No. : SP23-007Page 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 : 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.

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

DQEServices

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ISO 9001:2015
CALIBRATION 0454

REPORT OF CALIBRATION

Certificate No. : SP23-007Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :


Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5787	0.575	0.0037	0.0031	2.00
	1.0490	1.044	0.0050	0.0029	2.00
	2.1900	2.181	0.0090	0.0080	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5607	0.558	0.0027	0.0034	2.00
	1.0247	1.021	0.0037	0.0035	2.00
	2.1229	2.115	0.0079	0.0081	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5236	0.520	0.0036	0.0030	2.00
	0.9634	0.961	0.0024	0.0029	2.00
	1.9763	1.968	0.0083	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5191	0.518	0.0011	0.0031	2.00
	1.0003	1.000	0.0003	0.0033	2.00
	1.9987	1.993	0.0057	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5523	0.552	0.0003	0.0030	2.00
	1.0809	1.082	-0.0011	0.0030	2.00
	2.0391	2.031	0.0081	0.0080	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5601	0.562	-0.0019	0.0032	2.00
	1.0512	1.052	-0.0008	0.0030	2.00
	1.9294	1.923	0.0064	0.0079	2.00

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FM-708-02 R01 1/11/2021

DQEServices

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ISO 9001:2015
CALIBRATION 0454

REPORT OF CALIBRATION

Certificate No. : SP23-007Page 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	0.743	0.0048	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8686	0.861	0.0076	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2912	0.291	0.0002	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6448	0.639	0.0058	0.0055	2.00

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FM-708-02 R01 1/11/2021

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

REPORT OF CALIBRATION

Certificate No. : SP23-021 Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000 0.7478	0.0000 0.7436	0.0000 0.0042	0.0050 0.0058	2.00 2.00
257	0.0000 0.8686	0.0000 0.8648	0.0000 0.0038	0.0050 0.0064	2.00 2.00
313	0.0000 0.2912	0.0000 0.2908	0.0000 0.0004	0.0050 0.0052	2.00 2.00
350	0.0000 0.6448	0.0000 0.6398	0.0000 0.0050	0.0050 0.0058	2.00 2.00

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

REPORT OF CALIBRATION

Certificate No. : SP23-021 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	360.3	0.63	0.18	2.00
418.59	418.0	0.59	0.18	2.00
445.94	445.3	0.64	0.18	2.00
453.66	453.0	0.66	0.18	2.00
460.02	459.6	0.42	0.18	2.00
536.59	536.4	0.19	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	529.0	-0.12	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	684.5	-0.10	0.18	2.00
740.72	741.0	-0.28	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 1/1/2021

FM-708-02 R01 1/1/2021

เอกสารไม่ควบคุม

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: 0-2717-3000-29 FAX: 0-2719-9484

Certificate of Calibration

Cert. No.: 23TM726 Page : 1 of 3

Equipment : Cooled Incubator

Manufacturer : Binder

Model : KB 400 E6

Serial No. : 2020000015535

ID No. : UAE.MIC.018/2564

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

Location : Microbiology Laboratory (302)

Received Order : 27 April 2023
Calibration Date : 27 April 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Tawatchai Pama

Approved by : 
Approved Signatory

() Pomthippa Tameyakul
() Malee Butkruea
() Suwit Imjai

Issue Date : 12 May 2023

The Uncertainties are for a confidence probability of approximately 95%

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เอกสารไม่ควบคุม

Certificate of Calibration

Equipment : Cooled Incubator
Condition As-Received : Used Item
Reference : 2304-0461OC-1
Procedure Used :- Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
The temperature scale used was based on ITS-90.
Condition of this result of calibration

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

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Environment during calibration

	Beginning	Finished
Temp. (°C)	20	19
REL.Humid. (%)	72	82
AC Supply (Volt)	230	231

Probe Installation Details : Dimension of Chamber :

Position :	Ref. Std. ID No.:
1	22-18RTD-2/1
2	18RTD-2/2
3	18RTD-2/3
4	18RTD-2/4
5	18RTD-2/5
6	18RTD-2/6
7	18RTD-2/7
8	18RTD-2/8
9 (ref.)	18RTD-2/9

a = 10 cm D = 0.48 m
b = 10 cm W = 0.65 m
c = 10 cm H = 1.2 m
Capacity = 0.37 m³

เอกสารไม่ควบคุม



Equipment : Cooled Incubator
Condition As-Received : Used Item
Reference : 2304-0461OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 23TM726
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
35.0	35.0	35.0	0.0090	0.16	0.21	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	34.913	34.997	34.834	34.893	35.034	35.027	35.025	35.035	34.980	0.30

Average* : The average of 30 values in each position.
Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.
Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.
UUC* : Unit Under Calibration
Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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

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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. 0-2717-3000-29 FAX. 0-2719-4484



Cert. No.: 23TM728
Page : 1 of 3

Certificate of Calibration

Equipment : Incubator
Manufacturer : Memmert
Model : IPP 260
Serial No. : V616.0066
ID No. : UAE.MIC.032/2559
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory (302)
Received Order : 27 April 2023
Calibration Date : 27 - 28 April 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Tawatchai Pama
Approved by :
() Pornthippa Tameyakul
(✓) Malee Butkruea
() Suwit Imjai
Issue Date : 11 May 2023

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2304-0461OC-6
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 23TM728
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
25.0	25.0	25.0	0.020	0.81	1.2	2
36.0	36.0	36.0	0.15	1.1	1.6	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
25.0	25.541	25.354	25.388	25.278	24.341	24.349	24.379	24.455	24.747	0.30
36.0	35.275	35.351	35.768	35.941	36.543	36.590	36.653	36.728	36.232	0.39

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



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2304-0461OC-6
Procedure Used :-

Cert. No.: 23TM728
Page : 2 of 3

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

Condition of this result of calibration

1. Reference standard instrument:-

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

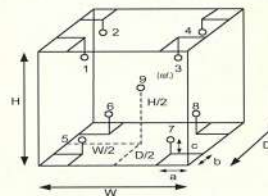
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	25	22
REL.Humid. (%)	76	83
AC Supply (Volt)	231	231



Probe Installation Details :

a =	10	cm
b =	10	cm
c =	10	cm

Dimension of Chamber :

D =	0.50	m
W =	0.64	m
H =	0.80	m
Capacity =	0.26	m ³

Position :	Ref. Std. ID No.:
1	22-18RTD-2/1
2	18RTD-2/2
3	18RTD-2/3
4	18RTD-2/4
5	18RTD-2/5
6	18RTD-2/6
7	18RTD-2/7
8	18RTD-2/8
9 (ref.)	18RTD-2/9

เอกสารไม่ควบคุม



Cert. No.: 23TM378
Page : 1 of 3

Certificate of Calibration

Equipment : Incubator
Manufacturer : Memmert
Model : IPP 260
Serial No. : V615.0187
ID No. : UAE.MIC.003/2559
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory
Received Order : 11 April 2023
Calibration Date : 12 April 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Preecha Hlahib
Approved by : [Signature]
() Pornthippa Tameyakul
(/) Malee Butkrusa
() Suwit Imjai
Issue Date : 24 April 2023

The Uncertainties are for a confidence probability of approximately 95%

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

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Equipment : Incubator
Condition As-Received : Used Item
Reference : 2304-0155OC-1
Procedure Used :-

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

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34972A	MY49001451	23LM27	25 Feb 2024

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

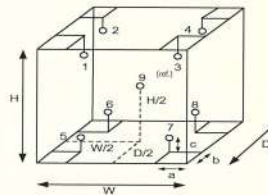
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	25	26
REL.Humid. (%)	57	61
AC Supply (Volt)	220	220



Probe Installation Details :

a = 5.0 cm
b = 5.0 cm
c = 5.0 cm

Dimension of Chamber :

D = 0.50 m
W = 0.64 m
H = 0.80 m
Capacity = 0.26 m³

Position :	Ref. Std. ID No.:
1	19RTD-2/1
2	19RTD-2/2
3	19RTD-2/3
4	19RTD-2/4
5	19RTD-2/5
6	19RTD-2/6
7	19RTD-2/7
8	19RTD-2/8
9 (ref.)	19RTD-2/9

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Equipment : Incubator
Condition As-Received : Used Item
Reference : 2304-0155OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 23TM378
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
35.0	35.0	35.0	0.052	0.53	0.60	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	35.092	35.148	34.817	35.149	34.894	35.323	34.773	35.058	34.802	0.30

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

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

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

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

UUC* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม



Cert. No.: 23TM374
Page : 1 of 3

Certificate of Calibration

Equipment : Water Bath
Manufacturer : Memmert
Model : WNE 14
Serial No. : L414.1407
ID No. : UAE.MIC.006/2558
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok. 10260
Location : Microbiology Laboratory
Received Order : 11 April 2023
Calibration Date : 11 April 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Krisda Malee
Approved by : [Signature]
() Pornthippa Tameyakul
(/) Malee Butkrusa
() Suwit Imjai
Issue Date : 24 April 2023

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2304-0155OC-3
Result of Calibration : (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 23TM374
Page : 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)					Uncertainty (± °C)
			Position					
			1	2	3	4	5 (ref.)	
44.5	44.5	44.5	44.508	44.466	44.456	44.478	44.483	0.15

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Coverage Factor k
44.5	0.065	0.031	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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Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2304-0155OC-3
Procedure Used :-

Cert. No.: 23TM374
Page : 2 of 3

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

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

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

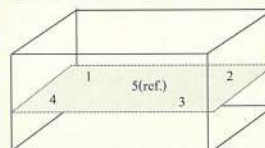
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

	Environmental		AC Voltage Supply (Volt)
	(°C)	(%R.H.)	
Beginning of Calibration	26	55	220
Finished of Calibration	25	56	221



Front

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

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
334/4 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 23TM377
Page : 1 of 3

Certificate of Calibration

Equipment : Water Bath
Manufacturer : Memmert
Model : WNE 14
Serial No. : L414.1410
ID No. : UAE.MIC.007/2558
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 : 11 April 2023
Calibration Date : 12 April 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Preecha Hlahib

Approved by :
Approved Signatory

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

Issue Date : 24 April 2023

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 0053356



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2304-0155OC-4
Result of Calibration : (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 23TM377
Page : 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)					Uncertainty (± °C)
			Position					
			1	2	3	4	5 (ref.)	
44.5	44.5	44.5	44.494	44.459	44.477	44.507	44.498	0.15

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Coverage Factor k
44.5	0.13	0.056	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 1158266



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2304-0155OC-4
Procedure Used :-

Cert. No.: 23TM377
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	MY49001451	23LM27	25 Feb 2024

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

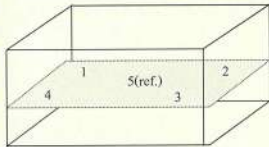
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	27	65	220
Finished of Calibration	30	70	221



Front

Position :	Ref. Std. ID No.:
1	N37P301419
2	N37P300732
3	N37P301420
4	N37P301421
5(ref.)	N37P301425

เอกสารไม่ควบคุม

a 1158267



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
334/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 - FAX. 0-2719-9484



Cert. No.: 23TM193
Page : 1 of 3

Certificate of Calibration

Equipment : Water Bath

Manufacturer : Memmert

Model : WNE 14

Serial No. : L416.0606

ID No. : UAE.MIC.002/2560

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

Location : Microbiology Laboratory

Received Order : 15 February 2023

Calibration Date : 15 February 2023

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Suwit Imjai

Approved by : 
Approved Signatory

() Pornthipha Tameyakul
(/) Malee Bulkruea

Issue Date : 24 February 2023

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

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

เอกสารไม่ควบคุม



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2302-0295OC-2
Procedure Used :-

Cert. No.: 23TM193
Page : 2 of 3

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

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

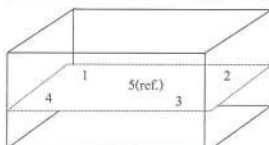
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	22	65	231
Finished of Calibration	23	61	231



Front

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

เอกสาร



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2302-0295OC-2
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 23TM193
Page : 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)				
			Position				
44.5	44.5	44.5	1	2	3	4	5 (ref.)
			44.453	44.437	44.428	44.477	44.459

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor k
44.5	0.079	0.038	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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เอกสาร



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.: 22TM1121
Page.: 1 of 3

Certificate of Calibration

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

Issue Date : 18 July 2022

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written

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

เอกสารไม่ควบคุม



Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2207-0245OC-7
Procedure Used :-

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

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.

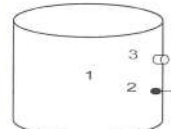
This result of calibration does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical

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	29	49	220
Finished of Calibration	32	48	220

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

เอกสาร



Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2207-0245OC-7
Result of Calibration :- (*) Without Adjustment

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

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

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

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

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

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

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

UUC* : Unit Under Calibration

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

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

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เอกสาร



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



Cert. No.: 23TM763
Page : 1 of 3

Certificate of Calibration

Equipment : Autoclave
Manufacturer : ALP
Model : CL-40L
Serial No. : 808763
ID No. : UAE.MIC.026/2563
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory (301)
Received Order : 27 April 2023
Calibration Date : 27 April 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Preecha Hlahib
Approved by :
() Pornthippa Tameyakul
(/) Malee Butkruea
() Suwit Imjai
Issue Date : 11 May 2023

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม

A 0053944



Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2304-0461OC-2

Cert. No.: 23TM763
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.

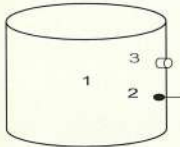
Condition of this result of calibration

1. Reference standard instrument:-

- | Instrument | Model | Serial No. | Cert. No. | Due Date |
|---------------------|--------|------------|-----------|-------------|
| 1) Data Acquisition | 34972A | MY59003411 | 22LM165 | 26 Nov 2023 |
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.
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	60	220
Finished of Calibration	27	58	220

Position	Description	Ref. Std. ID No.:
1 =	Center of chamber	18-20TC-04
2 =	Temperature sensor	18-20TC-05
3 =	Exhaust port	18-20TC-06

เอกสารไมควบคุม

a 1159968



Certificate of Calibration

Equipment: Balance
Model: PX623
Serial No. (or ID.): C236754745
Manufacturer: Ohaus
Condition: New

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

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

Environment Condition: Temperature 25 °C ± 0.5 °C
Humidity 53 %RH ± 3.9 %RH

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

Calibration By: Mr. Adisai Maknoi
Calibration Date: 09 December 2022

The Method used: In-house method, CAL-WI-47, based on UKAS Lab 14

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Co., Ltd. Certificate No. C02221765

(Mr. Adisai Maknoi)
Person in charge

(Mr. Rungroj Jenkitrakulchai)
Authorized signatory

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

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

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DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Phrakhanong District, Bangkok 10260
Phone: +66 2639 1000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

เอกสารไมควบคุม



Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2304-0461OC-2
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 23TM763
Page : 3 of 3

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	115.213	0.22	0.08	0.75	2
		2	115.166				
		3	115.260				

Operating parameter Set : Temperature = 121.0 °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	121.260	0.29	1.1	0.75	2
		2	121.224				
		3	121.284				

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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เอกสารไมควบคุม

a 1159967



Certificate No.: C01223732

Page: 2 of 2

Calibration Results:

Without Adjustment

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

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

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

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

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

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

The End of Certificate

บริษัท ดเคช เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Phrakhanong District, Bangkok 10260
Phone: +66 2639 1000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

เอกสารไมควบคุม

Statements of conformity:

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

The error of indication determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, UKAS Lab14. Therefore, those parameters have not been assessed separately.

Tolerance and Decision rules:

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

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



(Mr. Rungrod Jenkitrakulchai)
Authorized signatory

Statements of conformity:

Without Adjustment

Readability; 0.001 g

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

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

The End of Statements of conformity

