

ภาคผนวก จ
เอกสารเทียบเครื่องมือที่ใช้ในการตรวจวิเคราะห์



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
เครื่องมือสำหรับวิเคราะห์คุณภาพน้ำ									
1	pH Meter	pH Temperature	Horiba	HI2211 / HA9M0047	Technology Promotion Association (Thailand-Japan)	22CH650	13 May 22	12 May 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 (Repeatability 0.01 mg)	Suspended Solid (SS)	Mettler-Toledo	XPE205 / B748058497	Technology Promotion Association (Thailand-Japan)	TH2065-067-092322-ACC-TH	23 Sep 22	22 Sep 23	-
4	Hot Air Oven		Memmert	UF55 / B216.1666	Technology Promotion Association (Thailand-Japan)	22TM1490	19 Oct 22	18 Oct 23	-
5	Analytical Balance (Readability 0.1 mg)	Oil & Grease	Mettler-Toledo	XSR205DU / C210685394	National Food Institute, Ministry of Industry, Thailand	TH2065-067-092322-ACC-TH	22 Sep 22	21 Sep 23	-
6	BOD Incubator	BOD	Arco	UC4-1320 / (UAE.WAO.018/2559)	Technology Promotion Association (Thailand-Japan)	22TM1233	15 Aug 22	14 Aug 23	-
7	BOD Incubator		Arco	UR-1320 / (UAE.WAO.006/2553)	Technology Promotion Association (Thailand-Japan)	22TM1232	15 Aug 22	14 Aug 23	-
8	BOD Incubator		Arco	UR-1320 / (UAE.WAO.006/2553)	Technology Promotion Association (Thailand-Japan)	22TM306	7 Apr 22	6 Apr 23	-
9	Incubator	Total Coliform Bacteria	Memmert	BE400 / e402.1032	Technology Promotion Association (Thailand-Japan)	22TM1064	11 Jul 22	10 Jul 23	-
10	Incubator		Memmert	INB 400 / E411.1325	Technology Promotion Association (Thailand-Japan)	22TM672	5 May 22	4 May 23	-
11	Water Bath		Memmert	WNE 14 / L416.0606	Technology Promotion Association (Thailand-Japan)	22TM1063	11 Jul 22	10 Jul 23	-

เครื่องมือสำหรับวิเคราะห์คุณภาพน้ำ									
12	Water Bath	Total Coliform Bacteria	Memmert	WNE 14 / L407.0756	Technology Promotion Association (Thailand-Japan)	22TM1066	11 Jul 22	10 Jul 23	-
13	Analytical Balance		Mettler-Toledo	AB204-S / 1129361010	Mettler-Toledo (Thailand) Ltd.	2203120-001-01	1 Jun 22	31 May 23	-
14	Auto Clave		ALP	CL-40L / 807298	Technology Promotion Association (Thailand-Japan)	22TM1121	11 Jul 22	10 Jul 23	-
15	Digestor Unit	TKN	VELP SCIENTIFICA	DKL20 / 213517	National Food Institute, Ministry of Industry, Thailand	2203368-001-01	22 Jun 22	21 Jun 23	-
16	Distillation Unit (Kjeldahl Method)		FOSS TECATOR	KT8100 / 91889052	FOSS South East Asia	6623	25 Jul 22	24 Jul 23	-

Calibration Certificate

Certificate No.: 2302181-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonng, 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.Pharnphat Tuanjit
Scientist
Approved by N. Nityapant
(Mr.Nittapol Nityomchart)
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
เอกสารไม่ควบคุม
เอกสารไม่ควบคุม

Calibration Report

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

Page 2 of 3

Date of Calibration: 24 March 2023

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

1. Calibration Method
In house method : W-CO-002 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)

2. Reference Standards / Certified Reference Material

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2709007	Fuke	22E1659	17 June 2023
2.2 Digital Thermometer	2709007	Fuke	CC-660557-01	30 October 2023
2.3 Thermo-Hygro Meter	NFLBT-H00347	PONPE	TE 690555-01	21 September 2023
Certified Reference Material		Lot. No.	Manufacturer	Expiry 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)	873608	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

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

3.1 Instruments No.2.1 through through NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0008

3.2 Instruments No.2.2 through through NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0081

3.3 Instruments No.2.3 through through NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0081

3.4 Certified Reference Material No. 2.4 to 2.6 traceable to Primary measurement method- Harned cell using calibrated thermometer, barometer, and mesowater. 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 ReN HH-13 LoN 25.05.2022; BIM ReN HH-16 LoN 02.06.2022;
BIM ReN HH-13 LoN 25.05.2022; BIM ReN HH-16 LoN 02.06.2022, the Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025

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

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

N. Nityapant

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



เอกสารไม่ควบคุม
เอกสารไม่ควบคุม
เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2302181-001-01

Equipment: pH Meter

Resolution: 0.01 pH ; 1 mV

Model: SevenEasy pH

Type: Bench top

Manufacturer: METTLER TOLEDO

Serial No.: 123052512

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	0.00	0.58	2.00
2	295.814	296	2.00	0.58	2.00
4	177.464	178	4.00	0.58	2.00
6	59.160	59	6.00	0.58	2.00
7	0.000	0	7.00	0.58	2.00
8	-59.156	-59	8.00	0.58	2.00
10	-177.460	-177	10.00	0.58	2.00
12	-295.811	-296	12.00	0.58	2.00
14	-414.117	-414	14.00	0.58	2.00

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

Equipment: pH Electrode Type: Combined Electrode

Manufacturer: METTLER TOLEDO Model: InLab Solids

Serial No.: 1158883 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
8.885	8.86	22	97.86	0.0075	2.00
10.010	10.01	-160	97.66	0.0086	2.00
6.985	6.99	14	-	0.0063	2.00

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

N. miphobol



เอกสารไม่ควบคุม
เอกสารนี้ไม่ใช่เอกสารควบคุมคุณภาพ
This document is not a quality control document
เอกสารนี้ไม่ใช่เอกสารควบคุมคุณภาพ

Calibration Report

Certificate No.: 2302181-001-01

Equipment: Digital Thermometer with RTD (pH Meter)

Resolution: 0.1 °C

Model: SevenEasy pH

Serial No.: 123052512 ID No.: UAE.WAS.003/2553

Manufacturer: METTLER TOLEDO

Date of Calibration: 24 March 2023

Page 4 of 5

Location:

Chemical Calibration Laboratory, National Food Institute

Environment Condition:

Ambient Temperature 25 °C ± 1 °C

Relative Humidity 55 % ± 5 %

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 660039-01 10-Dec-23 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

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

N. miphobol



เอกสารไม่ควบคุม
เอกสารนี้ไม่ใช่เอกสารควบคุมคุณภาพ
This document is not a quality control document
เอกสารนี้ไม่ใช่เอกสารควบคุมคุณภาพ

Calibration Report

Certificate No.:

2302181-001-01

Equipment:

Digital Thermometer with RTD (pH Meter)

Resolution: 0.1 °C

Model: SevenEasy pH

Serial No.: 1230525212

ID No.: UAE.WAS.003/2553

Manufacturer: METTLER TOLEDO

Date of Calibration: 24 March 2023

Page 5 of 5

Calibration point:

15.0, 25.0 and 30.0 °C

Calibration result:

- The probe was immersed in liquid bath or dry bath to a minimum depth of 120 mm.

- Description of probe, model: N/A S/N: N/A

Dimension of probe: Diameter 3 mm., Length 120 mm.,

Sheath material: N/A

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.2	14.999	- 0.2	0.12
25.2	24.999	- 0.2	0.12
30.2	29.999	- 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 %.

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

N. Nijmabul

End -----



เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10260
TEL. 0-2717-3000-27 FAX 0-2719-9484



NSC-TIS-17025
CALIBRATION 0088

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

Certificate of Calibration

Equipment : BOD Incubator

Manufacturer : ARCO

Model : UR-1320

Serial No. :

ID No. : UAE.WAQ.006/2553

Submitted by :

United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udonsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260

Location :

Lab Floor 2

Received Order :

7 April 2022

Calibration Date :

7 April 2022

Ambient Temperature :

(26 ± 10) °C

Relative Humidity :

(50 ± 30) %

Calibrated by :

Man Pattanapongpalboon

Approved by :

พณณ .

Approved Signatory

(/) Ponthippa Tameyakul

(/) Malee Bulkruea

(/) Suwit Imjai

Issue Date :

18 April 2022

The Uncertainties are for a confidence probability of approximately 95 %

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

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

เอกสารไม่ควบคุม

A 0040247



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

Cert. No.: 22TM306
Page.: 2 of 3

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY41021843	22LM4	10 Jan 2023

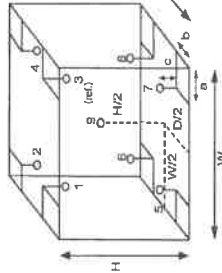
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



Probe Installation Details :

	a	b	c
Dimension of Chamber :	10 cm	10 cm	10 cm
D =	0.62 m		
W =	1.2 m		
H =	1.2 m		
Capacity =	0.69 m ³		

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

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



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

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

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
20.0	20.0	19.9	0.33	0.68	1.4	0.50	2
Measured Temperature (°C)							
Position							
1	2	3	4	5	6	7	8
20.176	20.413	19.711	19.637	20.218	20.286	19.639	19.642
20.0							9 (ref.)
							19.922

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

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

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

UUC* : Unit Under Calibration

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

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

-o0o-

เอกสารไมควบคุม
a 1104312

เอกสารไมควบคุม
a 1104311

2008 บริษัทประกันภัย 35 บริษัทประกันภัย แขวงถนนสีสุราษฎร์ธานี กรุงเทพมหานคร 10700, Thailand
Tel: +66(0) 2122 8668 Fax: +66(0) 2122 8545

Calibration Report

Certificate No.: 2203120-001-01
Equipment: Electronic Balance
Model: AB204-S/FAC
Serial No.: 11293610
Capacity: 220 g

Manufacturer: METTLER TOLEDO
Resolution: 0.0001 g
ID No.: UAE.WAS.002/2552

Date of Calibration: 1 June 2022

Date of Calibration: 1 June 2022

Calibration Results: (Continued)

Calibration Range:

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
Unused	0.00000	0.0000	0.0000	0.000088	2.00
0.01	0.01000	0.0100	0.0000	0.000088	2.00
0.05	0.05000	0.0499	0.0001	0.000088	2.00
0.1	0.10000	0.1000	0.0000	0.000088	2.00
0.2	0.20000	0.2000	0.0000	0.000088	2.00
0.5	0.50000	0.5000	0.0000	0.000088	2.00
1	1.00000	0.9999	0.0001	0.000088	2.00
2	2.00000	1.9999	0.0001	0.000089	2.00
5	5.00000	5.0000	0.0000	0.000089	2.00
10	9.99998	9.9999	0.0001	0.000092	2.00
20	19.99999	19.9999	0.0001	0.000094	2.00
50	49.99999	49.9999	0.0000	0.00012	2.00
70	69.99989	69.9998	0.0001	0.00014	2.00
100	100.00001	99.9999	0.0001	0.00017	2.00
150	149.99991	149.9997	0.0002	0.00022	2.00
200	200.00007	199.9998	0.0003	0.00030	2.00

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

End -

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


เอกสารไม่ควบคุม
 220808 ขายรถจักรยาน 36 คันและจักรยาน 1 คันบนถนนหลวงเมืองนนทบุรี
 220808 36, Anu Ananin Road, Bang Yi Khan Subdistrict, Bang Phlat District, Bangkok 10700, Thailand
 โทร. +66(0) 2142 8688 Fax. +66(0) 2422 8545

Total	+56(1)	2122	8698	Eax +56(1)	2122	8698	5475
-------	--------	------	------	------------	------	------	------



Verification Certificate

Certificate No.: 2203368-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
 Bangsack, Prakanong, Bangkok 10260

Page 1 of 4

Equipment:	Digestor Unit
Manufacturer:	VELP SCIENTIFICA
Model:	DKL20
Serial No.:	213517
UID No.:	UAE.WAS.005/2555
Order No.:	2203368
Operation No.:	2203368-001
Date of Receipt:	22 June 2022
Date of Calibration:	23-24 June 2022

Calibrated by Mr.Nuttapol Niyomchat
Specialist

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

Date of Issue: 30 June 2022

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

This certificate is not a guarantee of conformity with the Thai Laboratory Accreditation scheme which is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme. 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.

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

2008 ขอเชิญสมัคร 36 นายสุภาวรัตน์ นวกวรัตน์ เขตบางพลี กรุงเทพมหานคร
2009 Soi 36, Avun Anarin Road, Bang Yi Khan Subdistrict, Bang Phlat District, Bangkok 10700, Thailand
Tel : +66(0) 2422 8588 Fax : +66(0) 2422 8545

Tel: +86 22 2422 8888 Fax: +86 22 2422 8555



4000

Verification Report

Certificate No.: 2203368-001-01
Equipment: Digestor Unit
Model: DKL20 **Serial No.:** 213517
Resolution: 1 °C **ID No.:** UAE.WAS.005/2555
Manufacturer: VEP SCIENTIFICA
Date of Calibration: 23-24 June 2022

Page 2 of 4

Location: Laboratory Room, NATIONAL FOOD INSTITUTE

Environment Condition:
Ambient Temperature (25 ± 1) °C
Relative Humidity (58 ± 8) %
Line Voltage (224 ± 2) Volt

Condition of this results of Calibration:

1. This instrument was calibrated by insert: standard thermocouples type S/R into its chamber and Calibration according to NFI Method W-TE-026 based on BS 4309 : 1968 : LABORATORY ELECTRIC RESISTANCE FURNACE.

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

2. 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 Type R	MY4465576/MY41194453 R/CH1 to R/CH3	TC22/0044	5-May-2023	N.M. Technical Center Laboratory

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

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

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

6. Condition of Calibrated item : Good

UUC* Description

Time of Record 1 Hour 6 Minute At 380 °C

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

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

Verification Report

Certificate No.: 2203368-001-01
Equipment: Digestor Unit
Model: DKL20 **Serial No.:** 213517
Resolution: 1 °C **ID No.:** UAE.WAS.005/2555
Manufacturer: VEP SCIENTIFICA
Date of Calibration: 23-24 June 2022

Page 3 of 4

Calibration point: 380 °C

Calibration result:

Table1 : Reporting of Temperature

Block No.	UUC* Setting (°C)	UUC* Reading (°C)	Stability (±°C)	Standard Thermometer (°C)	Uncertainty (±°C)
1	380	378 - 380	0.23	381.88	2.4
2	380	378 - 380	0.64	382.15	2.4
3	380	378 - 380	0.21	382.38	2.4
4	380	378 - 380	0.40	380.44	2.4
5	380	378 - 380	0.34	378.52	2.4
6	380	378 - 380	0.25	379.64	2.4
7	380	378 - 380	0.31	382.46	2.4
8	380	378 - 380	0.29	381.13	2.4
9	380	378 - 380	0.36	382.25	2.4
10	380	378 - 380	0.17	382.23	2.4
11	380	378 - 380	0.24	382.47	2.4
12	380	378 - 380	0.39	381.63	2.4
13	380	378 - 380	0.63	382.02	2.5
14	380	378 - 380	0.46	382.39	2.5
15	380	378 - 380	0.38	381.69	2.5
16	380	378 - 380	0.38	377.97	2.4
17	380	378 - 380	0.50	379.87	2.4
18	380	378 - 380	0.33	380.73	2.4
19	380	378 - 380	0.56	378.47	2.4
20	380	378 - 380	0.41	378.77	2.4

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 %.

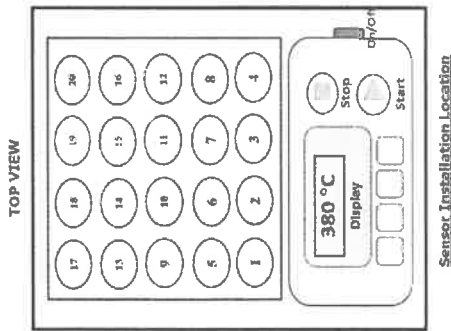
FCS-012 Revision: 01 Date: 20-04-65

Verification Report

Certificate No.: 2203368-001-01
Equipment: Digester Unit
Model: DKL20
Resolution: 1 °C
Manufacturer: VLP SCIENTIFICA
Date of Calibration: 23-24 June 2022
Calibration point: 380 °C
Calibration result: Continued

Page 4 of 4

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 %.

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



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



NCC-TB1-1017023
CALIBRATION 0098

Cert. No.: 22TM1064
Page.: 1 of 3

Certificate of Calibration

Equipment : Incubator
Manufacturer : Memmert
Model : BE 400
Serial No. : e402.1032
ID No. : UAE.MIC.001/2546
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory
Received Order : 11 July 2022
Calibration Date : 11 July 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Man Pattanapongpaiboon
Approved by : Approved Signatory
() Pornthippa Tameyakul
(✓) Malee Bukruea
() 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

เอกสารไม่ควบคุม



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2207-0245OC-2
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	MY57013823	22LM24	26 Feb 2023

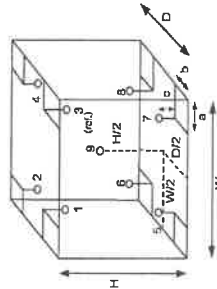
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Probe Installation Details :

a =	5.0	cm
b =	5.0	cm
c =	5.0	cm
Dimension of Chamber :		
D =	0.40	m
W =	0.33	m
H =	0.40	m
Capacity =	0.053	m ³

Position :	Ref. Std. ID No.:
1	21-17RTD-01
2	21-17RTD-02
3	17RTD-03
4	17RTD-04
5	17RTD-05
6	17RTD-06
7	17RTD-07
8	17RTD-08
9 (ref.)	17RTD-09

Environment during calibration		
	Beginning	Finished
Temp. (°C)	25	25
REL Humid. (%)	62	63
AC Supply (Volt)	222	223



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2207-0245OC-2
Result of Calibration :- (*) Without Adjustment
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
37.0	38.0	38.0	0.092	0.62	0.94	0.30	2
56.0	57.5	57.5	0.083	0.87	1.3	0.42	2
Measured Temperature (°C)							
Position							
1	2	3	4	5	6	7	8
37.0	37.823	37.576	37.476	37.577	36.834	36.997	37.038
56.0	56.489	56.520	56.445	56.485	55.291	55.589	55.591
9 (ref.)							
37.387							
56.097							

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 %.

-o0o-

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2713-3000-27 FAX. 0-2719-9384



Cert. No.: 22TM1063
Page.: 1 of 3

Certificate of Calibration

Equipment : Incubator
Manufacturer : Memmert
Model : INB 400
Serial No. : E411.1325
ID No. : UAE.MIC.003/2555

Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok 10260
Location : Microbiology Laboratory

Received Order : 11 July 2022
Calibration Date : 11 July 2022
Ambient Temperature : $(26 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$
Calibrated by : Man Pattanapongpaiboon

Approved by : 
Approved Signatory

() Ponthippa Tameyakul
() Malee Butruea
() 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 : Incubator
Condition As-Received : Used Item
Reference : 2207-02450C-3
Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument **Model** **Serial No.** **Cert. No.** **Due Date**
1) Data Acquisition 34972A MY57013823 22LM24 26 Feb 2023

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

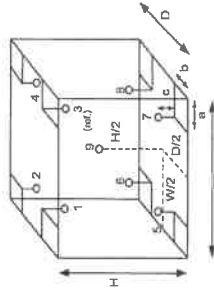
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration	
Temp. (°C)	Beginning 25 Finished 25
REL.Humid. (%)	56 62
AC Supply (Volt)	219 223



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

Position :	Ref. Std. ID No.:
1	21-17RTD-01
2	21-17RTD-02
3	17RTD-03
4	17RTD-04
5	17RTD-05
6	17RTD-06
7	17RTD-07
8	17RTD-08
9 (ref.)	17RTD-09

เอกสารไม่ควบคุม



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2207-0245OC-3
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 22TM1063
Page.: 3 of 3

Calibration Point (°C)	UUC*		Temperature stability (± °C)		Temperature uniformity (°C)		Overall Variation (°C)		Uncertainty (± °C)		Coverage Factor k
	Setting (°C)	Reading (°C)	± °C	± °C	°C	°C	°C	°C	± °C	± °C	
36.0	35.5	35.5	0.10	0.10	0.63	0.63	0.86	0.86	0.30	0.30	2
Measured Temperature (°C)											
Position											
1	2	3	4	5	6	7	8	9 (ref.)			
36.0	35.896	35.803	35.846	35.766	36.272	35.561	36.212	35.519	35.687		

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 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 %.

-o0o-




TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 22TM1066
Page.: 1 of 3

Certificate of Calibration

Equipment : Water Bath
Manufacturer : Memmert
Model : WNB 14
Serial No. : L407.0756
ID No. : UAE.MIC.024/2550
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10280
Location : Microbiology Laboratory
Received Order : 11 July 2022
Calibration Date : 11 July 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Man Pattanapongpalboon

Approved by : 
() Ponthippa Tameyakul
() Malee Buikrua
() Suwit Injai
Approved Signatory

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 : Water Bath
Condition As-Received : Used Item
Reference : 2207-0245OC-6
Cert. No.: 22TM1066
Page.: 2 of 3

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument Model Serial No. Cert. No. Due Date
1) Data Acquisition 34972A MY57013823 22LM24 26 Feb 2023

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

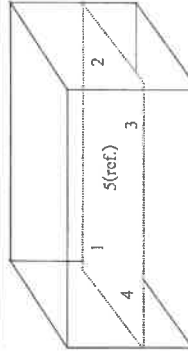
3. This certification is traceable to the International System of Unit.

Result of Calibration :-

(*) Without Adjustment

Function of UUC* : Temperature Source

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



Front

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

เอกสารไม่ควบคุม



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2207-0245OC-6
Cert. No.: 22TM1066
Page.: 3 of 3
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)				
			1	2	3	4	5 (ref.)
44.5	45.0	45.0	44.559	44.526	44.528	44.528	44.537

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor k
44.5	0.12	0.032	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 %.

-000-

เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG BANGKOK 10250
TEL. 0-2717-3800-27 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
301 Room

Received Order: 11 July 2022
Calibration Date: 11 July 2022
Ambient Temperature: (26 ± 10) °C
Relative Humidity: (50 ± 30) %

Calibrated by: Preecha Hahib

Approved by: 
Approved Signatory

(/) 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

เอกสารไม่ควบคุม



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

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

Condition of this result of calibration

1. Reference standard instrument:-

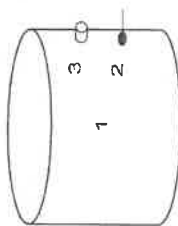
Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44060450	22LM46	28 Mar 2023
2. This certificate is valid only to the item calibrated on date and place of calibration.				
3. This certification is traceable to the International System of Unit.				
4. This result of calibration covers laboratory autoclaves for the sterilization of goods and material which could be infected with organisms categorized as Hazard Group 1, 2 and 3**				

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

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

Result of Calibration :- (*) Without Adjustment

Function of UUC*: Temperature Source



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

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

เอกสารไม่ควบคุม

FOSS

Customer Service Report

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

Report No: **6534**

Date: 25/7/2022
Customer: บริษัท อานิล และ ดึง เจริญ
Instrument: KT8100
Address: 100/114
Serial: 91829052

Hours Start: 9.00
Finish: 12.00
Travel To Customer: 0.5
Travel From Customer: 1.0
Labour: 6 hr
Serial: 91829052

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

PO/Quote Number: 3388/90
PMA Type: If applicable
Contract No. If applicable

Details of Work / Test	Condition / Status
Kjetec 8100 - Software Editor - Program Editor - MP Editing - Manual Run - 1320 manual service - Run Blank - Run Recovery	Done
Instrument Ready for Use	OK / Not OK

Part No:	Batch	Description	Qty

I confirm this report is accurate and complete

Signed FOSS: [Signature]
Name: Tina Aue
Signed Customer: [Signature]
Name: Klongtoey, Bangkok

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

เอกสารไม่ควบคุม

FOSS

Installation Qualification

Kjetec™ 8100 Distillation Unit

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

1 Intended Use

Kjetec 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 Kjetec 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
Kjetec 8100 Distillation Unit	91829052

Dedicated Analytical Solutions

FOSS Analytical AS
69 Skovvejsvej
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-265 21 Höganäs
Sweden
Tel: +46 42 361500
Fax: +46 42 340349
E-mail: support@foss.dk
Web: www.foss.dk

เอกสารไม่ควบคุม

Customer Support, 8003 7242 / Rev. 1

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

5 Installation

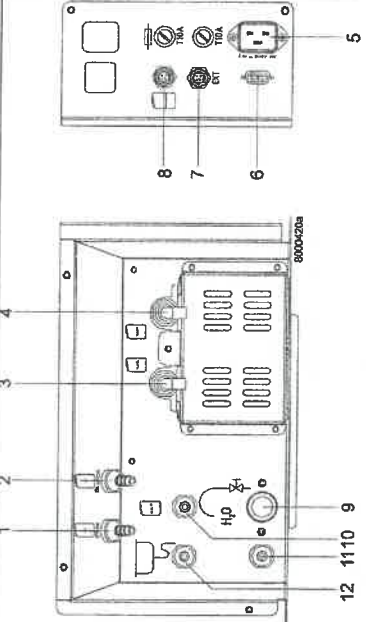
5.1 The equipment must be installed in a suitable location with power, water and draining available

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

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

5.2 The instrument must be assembled correctly

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

Instrument Tubing Connections		Acceptance Criteria	Pass (Y/N)
		Visual verification by installer	Y

5.3 The instrument should be assembled and powered up

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

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

Company: Foss SEA

Customer Name: United Analyst and Engineering

Company: United Analyst and Engineering

Date completed: July 25, 2022

FOSS

Operation Qualification

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	๑1 8๖๗52

Dedicated Analytical Solutions

FOSS Analytical AS
89 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

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.

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

Water

1. Press **Dilution** and then press **Start**. 80 ml of water will be filled into the tube.
2. Measure the collected water in a graduated measuring glass and note the result in table 1 below.
3. 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

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

Table 1 Volume control

Test	Result	Expected result	Passed (Y/N)
Water volume	$\frac{82}{83}$ ml $\frac{82}{83}$ ml Mean $\frac{82.67}{82.67}$ ml	76- 84 ml	Y
Alkali volume	$\frac{42}{52}$ ml $\frac{52}{53}$ ml Mean $\frac{52.32}{52.32}$ ml	47- 54 ml	Y

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 distill 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
Titrant	0.2N HCl

For reagent preparation see Appendix A

1. 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.
2. Weigh 0.15 g ammonium sulphate into a tube. Prepare 6 samples (tubes).
3. Run the six samples according to above analysis conditions. Titrate with a standard acid solution using colorimetric end-point detection.
4. 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. $\frac{0.08}{0.14}$ ml 2. $\frac{0.14}{0.14}$ ml	0.05-0.20 ml	Y
Recovery	1. $\frac{100.30}{100.30}$ % 2. $\frac{100.30}{100.30}$ % 3. $\frac{100.30}{100.30}$ % 4. $\frac{99.01}{99.01}$ % 5. $\frac{99.97}{99.97}$ % 6. $\frac{100.01}{100.01}$ %		
Accuracy	Mean Value: $\frac{100.07}{100.07}$	99-101%	Y
Precision	SD: $\frac{0.52}{0.52}$	SD <1%	Y

*) 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%

$$\% \text{ Nitrogen} = \frac{(m_{\text{sample}} - m_{\text{blank}}) \times N \times 14,007 \times 100}{mg_{\text{sample}}} \quad \begin{matrix} 0.1035 \\ 21.72 \end{matrix}$$

N = Normality of titrant to 4 places of decimal.

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

mg sample

0.1598 23.56

- ①
- ②
- ③
- ④
- ⑤
- ⑥

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)

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:

1. 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: $\text{ml } 1.0 \text{ M alkali} = \text{ml titrant} \times 40$
2. Add the calculated amount of 1.0 M alkali solution to the boric acid solution. Mix.
3. 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.

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
69 Skjervevej
DK-5860 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 Håganäs
Sweden
Tel +46 42 361500
Fax +46 42 340349
E-mail support@foss.se
Web www.foss.se

Customer Support, 6903 7363 / Rev. 2

เอกสารไม่ควบคุม 1(11)

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 (Kjeltec, 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 $0.10 - 0.15 g \pm 0.0001 g$ 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)

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

$$w_n = \frac{14.007(V_s - V_b)N \times 100\%}{778}$$

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

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.

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

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

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.

เอกสารประกอบคำอธิบาย

[illegible]

Customer Support, 6003 7363 / Rev. 2

6.2	FossCare™ Customer Log
6.2.1	Daily Maintenance

6.2.1 Daily Maintenance

[illegible]

²⁷Applicable for FOSS sales and service companies.

[illegible]

เอกสารไม่ควบคุม

Customer Support, 6003 7363 / Rev. 2

(11)8

[illegible]

เอกสารไม่ควบคุม

Customer Support, 6003 7363 / Rev. 2

(11)Z

[illegible]



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
53/43 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 22TM1232
Page.: 1 of 3

Certificate of Calibration

Equipment : BOD Incubator

Manufacturer : Arco

Model : UC4-1320

Serial No. :

ID No. : UAE.WAO.002/2550

Submitted by :

United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Lab Floor 2

Location :

Received Order : 15 August 2022

Calibration Date : 15 August 2022

Ambient Temperature : $(26 \pm 10) ^\circ\text{C}$

Relative Humidity : $(50 \pm 30) \%$

Calibrated by : Kunchit Promprat

Approved by :

Approved Signatory

() Ponthippa Tameyakul

() Malee Butkruea

() Suwit Imjai

Issue Date :

16 August 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

A 0044201

6.2.6 Exchange of Parts and Reagents Maintenance

Signature

Exchange of Parts and Reagents

Date

เอกสารไม่ควบคุม

Customer Support, 6003 7363 / Rev. 2

11(11)



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2208-0186OC-1
Procedure Used :-

Calibration were conducted using calibration procedure CP-QT02 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. Due Date
1) Data Acquisition 34970A MY44035217 23 Dec 2022

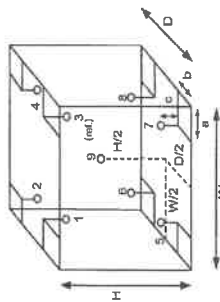
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



Probe Installation Details : Dimension of Chamber :
a = 10 cm D = 0.53 m
b = 10 cm W = 1.2 m
c = 10 cm H = 1.2 m
Capacity = 0.76 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	28
REL-Humid. (%)	61	63
AC Supply (Volt)	227	227

Position :	Ref. Std. ID No.:
1	18-10RTD-01
2	18-10RTD-02
3	18-10RTD-03
4	18-10RTD-04
5	18-10RTD-05
6	18-10RTD-06
7	18-10RTD-07
8	18-10RTD-08
9 (ref.)	18-10RTD-09



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2208-0186OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
20.0	19.6	19.5	0.38	0.39	1.1	0.70	2
Measured Temperature (°C)							
Position							
1	2	3	4	5	6	7	8
20.050	20.264	19.851	19.771	19.928	20.169	19.886	19.829
						9 (ref.)	20.001

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 %.

-o0o-

เอกสารไม่ควบคุม
a 1121247

เอกสารไม่ควบคุม
a 1121246



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484



NIST-715-7628
CALIBRATION 0018

Cert. No.: 22TM1233
Page.: 1 of 3

Certificate of Calibration

Equipment : BOD Incubator
Manufacturer : Arco
Model : UC4-1320
Serial No. : -
ID No. : UAE.WAO.018/2559
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 : 15 August 2022
Calibration Date : 15 August 2022
Ambient Temperature : $(26 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$
Calibrated by : Kunchit Promprat
Approved by :
() Ponthippa Tameyakul
() Malee Bulkruea
() Suwit Injai

Issue Date : 16 August 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.

เอกสารไมควบคุม
A 0044202



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2208-0186OC-2

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument **Model** **Serial No.** **Cert. No.** **Due Date**
1) Data Acquisition 34970A MY4035217 21LM30 23 Dec 2022

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

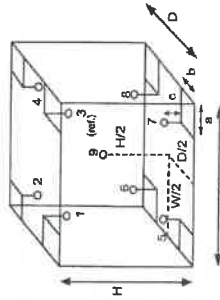
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Environment during calibration	
Beginning	Finished
Temp. (°C)	28
REL Humid. (%)	65
AC Supply (Volt)	227



Probe Installation Details :

a = 10 cm
b = 10 cm
c = 10 cm
D = 0.53 m
W = 1.2 m
H = 1.2 m
Capacity = 0.76 m³

Dimension of Chamber :

Position :	Ref. Std. ID No.:
1	18-10RTD-01
2	18-10RTD-02
3	18-10RTD-03
4	18-10RTD-04
5	18-10RTD-05
6	18-10RTD-06
7	18-10RTD-07
8	18-10RTD-08
9 (ref.)	18-10RTD-09

เอกสารไมควบคุม
a 1121245



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2208-01860C-2
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 22TM1233
Page.: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
20.0	19.8	19.7	0.31	0.29	0.77	0.61	2
Measured Temperature (°C)							
Position							
1	2	3	4	5	6	7	8
19.956	19.783	19.988	19.842	19.843	19.908	19.770	19.910
20.0	19.956	19.783	19.842	19.843	19.908	19.770	19.910
20.0	19.956	19.783	19.842	19.843	19.908	19.770	19.910

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 %.

-o-o-

เอกสารไมควบคุม
a 1121244

Calibration Certificate ID
TH-2065-087-092322-ACC-TH

Mettler-Toledo (Thailand) Ltd.
84/4 - 84/5 Lasalle Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10780
+66 2723 0382
MT-TH-ServiceSupport@mt.com

METTLER TOLEDO



Accuracy Calibration Certificate

Customer

Company: United Analyst and Engineering Consultant Co., Ltd.
Address: 3 Soi Udom Suk 41, Sukhumvit Rd., Bang Chak
City: Phra Khanong
Zip / Postal: 10280
State / Province: Bangkok
Order Number:
Contact: Suwit Chonok



Weighing Device

Manufacturer: Mettler Toledo
Model: XP205
Serial No.: B74B058497
Building: N/A
Floor: 4
Room: Laboratory Calibrate Glassware
Instrument Type: Weighing Instrument
Asset Number: UAE.CAL.004/2561
Terminal Model: PEAT
Terminal Serial No.: B74B058497
Terminal Asset No.: N/A

Range	Max. Capacity	Repeatability (g)
1	220 g	0.00001 g

Procedure

Calibration Guideline:
METTLER TOLEDO Work Instruction:
EURAMET cg-18 v. 4.0 (11/2015)
CPW002/20

This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.
The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.
In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

Temperature		Humidity	
As Found	Start: 22.8 °C	End: 22.5 °C	Start: 62.2 %
			End: 58.8 %

As Found Calibration Date: 23-Sep-2022
As Left Calibration Date: N/A
Issue Date: 26-Sep-2022
Calibrator: Suwicha C
Approved Signatory: Suwicha Choykamchu
Technical Manager / Head of Calibration Center

Software Version: 1.23.0.314
Report Version: 2.16.25
Form Number: F103C

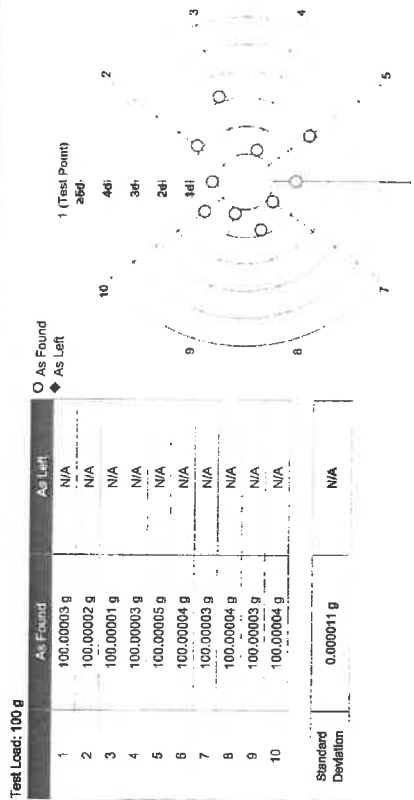
Page 1 of 5

This is an original document and may not be partially reproduced without the written permission of the issuing calibration laboratory.

เอกสารไมควบคุม

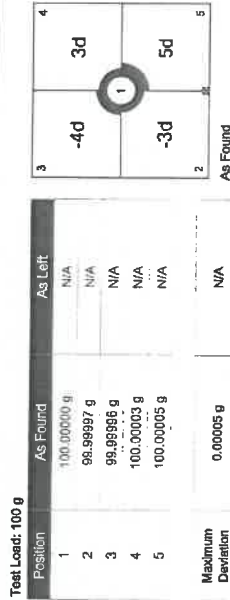
Measurement Results

Repeatability



The "3d" in the graph represents the readability of the range/interval in which the test was performed.
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

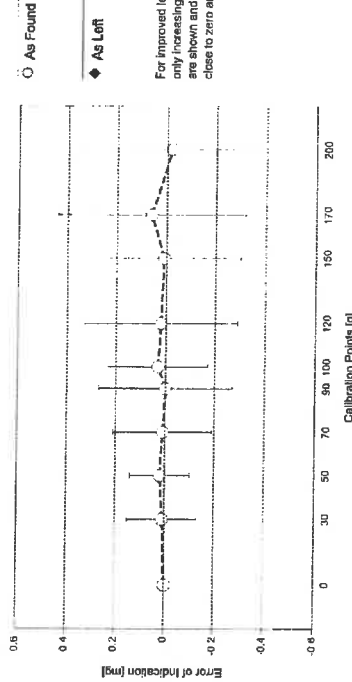


The "4d" in the graph represents the readability of the range/interval in which the test was performed.

Error of Indication

As Found				
Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1 0.00000 g	0.00000 g	0.00000 g	0.023 mg	2
2 9.99997 g	9.99997 g	0.00000 g	0.063 mg	2
3 29.99998 g	29.99995 g	0.00001 g	0.14 mg	2
4 49.99998 g	50.00000 g	0.00002 g	0.12 mg	2
5 69.99998 g	70.00000 g	0.00001 g	0.20 mg	2
6 90.00002 g	90.00002 g	0.00000 g	0.27 mg	2
7 100.00002 g	100.00005 g	0.00003 g	0.20 mg	2
8 120.00003 g	120.00005 g	0.00002 g	0.31 mg	2
9 150.00001 g	150.00002 g	0.00001 g	0.31 mg	2
10 170.00001 g	170.00007 g	0.00006 g	0.38 mg	2
11 200.00002 g	200.00000 g	-0.00002 g	0.35 mg	2

*The calculated uncertainty was replaced by the CMC (Calibration and Measurement Capabilities) value because the calculated uncertainty was smaller than the CMC value.



For improved legibility of the graphics only increasing measurement points are shown and measurement points close to zero are not displayed.

The uncertainty stated is the expanded uncertainty obtained by multiplying the standard combined uncertainty by the coverage factor k - which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML E2

Weight Set No.: WS03
Certificate Number: 175498
Date of Issue: 21-Sep-2021
Calibration Due Date: 14-Mar-2023

Weight Set 2: OIML E2

Weight Set No.: WS66
Certificate Number: C142784709
Date of Issue: 21-Oct-2021
Calibration Due Date: 17-Apr-2023

Weight Set 3: OIML E2

Weight Set No.: WS70
Certificate Number: C142784702
Date of Issue: 21-Oct-2021
Calibration Due Date: 19-Mar-2023

Thermo Hygrometer

Equipment No.: IN281
Certificate Number: 22-H1057
Date of Issue: 23-May-2022
Calibration Due Date: 15-May-2023

Remarks

FACT adjustment functionality activated

Equipment condition: Good

Next calibration according to customer's procedure

Calibration data not decide by calibration laboratory.

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration

Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with $k=2$ in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: $1.0 \cdot 10^{-6} / K$

Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

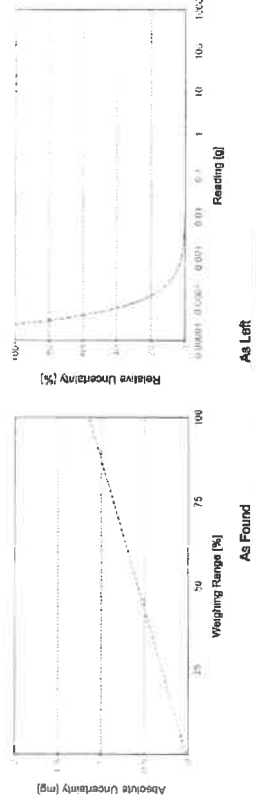
Linearization of Uncertainty Equation

Range	As Found	As Left
d	Max	
1 0.00001 g	220 g	N/A

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found	As Left
0.00220 g	0.024 mg	N/A
0.02200 g	0.024 mg	N/A
0.22000 g	0.025 mg	N/A
2.20000 g	0.035 mg	N/A
220.00000 g	1.1 mg	N/A



GWP® Certificate



As
Found



As
Left



The weighing device meets the given
process requirements.

The weighing device meets the given
process requirements.

Tests Performed:

☒ As Found

☐ As Left

☒ No adjustments/modifications made. As Left results
correspond to As Found.

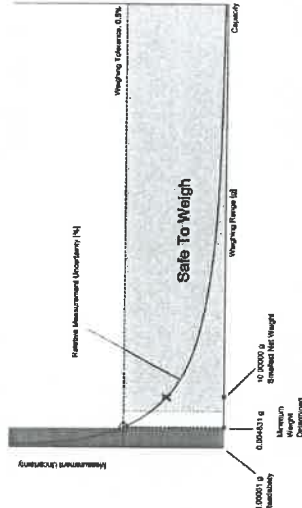
Process Requirements

Weighing Tolerance: 0.5%

Smallest Net Weight: 10.00000 g

Safety Factor: 2

Safe Weighing Range



While the values in this graph reflect the actual calibration results, the measurement uncertainty curves are simply a visual representation. This graph reflects As Left testing, unless only As Found was performed.

Minimum Weight As Found Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Tolerance	1	2	3	5	10
0.1%	0.024253 g	0.048754 g	0.073509 g	0.123795 g	0.254223 g
0.2%	0.012095 g	0.024253 g	0.036472 g	0.061100 g	0.123795 g
0.5%	0.004831 g	0.009671 g	0.014522 g	0.024253 g	0.048754 g
1%	0.002414 g	0.004831 g	0.007250 g	0.012095 g	0.024253 g
2%	0.001207 g	0.002414 g	0.003622 g	0.006040 g	0.012095 g
5%	0.000483 g	0.000965 g	0.001448 g	0.002414 g	0.004831 g

Pass: The determined minimum weight meets the requirement for the smallest net weight.

As Left Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Tolerance	1	2	3	5	10
0.1%	0.024253 g	0.048754 g	0.073509 g	0.123795 g	0.254223 g
0.2%	0.012095 g	0.024253 g	0.036472 g	0.061100 g	0.123795 g
0.5%	0.004831 g	0.009671 g	0.014522 g	0.024253 g	0.048754 g
1%	0.002414 g	0.004831 g	0.007250 g	0.012095 g	0.024253 g
2%	0.001207 g	0.002414 g	0.003622 g	0.006040 g	0.012095 g
5%	0.000483 g	0.000965 g	0.001448 g	0.002414 g	0.004831 g

Pass: The determined minimum weight meets the requirement for the smallest net weight.

At these net minimum weight values, the measurement uncertainty of the weighing device is equal to or less than 1/1 (no safety factor), 1/2, 1/3, 1/5, or 1/10 of the required tolerance. The values are calculated with $k = 2$ and based on the linear formula of the measurement uncertainty of the weighing device in use.

The safety factor for As Found is always 1. This implies no safety factor. As Found testing looks at the behavior of the instrument from the past until test occurred. For the past, it is necessary to know that the tolerance was met, but not the safety factor. The safety factor is a proactive measure to apply for future measurements.

Notes on minimum weight values in above table:

1. If "N/A" is shown above, no appropriate value could be calculated.
2. METTLER TOLEDO is not responsible for the definition of the process requirements.

Measurement Results

Results Summary

Repeatability		Eccentricity		Error of Indication	
As Found	✓	As Found	✓	As Found	✓
As Left	✓	As Left	✓	As Left	✓

✓ = Passed

✗ = Failed

N = Safety Factor not met

Repeatability

Test Load: 100 g

Tolerance	As Found			As Left		
	Control Limit	Std. Deviation	Result	Std. Deviation	Result	Result
0.1%	0.005000 g		✓		✓	✓
0.2%	0.010000 g		✓		✓	✓
0.5%	0.025000 g		✓		✓	✓
1%	0.050000 g	0.000011 g	✓	0.000011 g	✓	✓
2%	0.100000 g		✓		✓	✓
5%	0.250000 g		✓		✓	✓

The weighing tolerance is met, if the standard deviation is less than or equal to the corresponding control limit.

Eccentricity

Test Load: 100 g

Tolerance	As Found			As Left		
	Control Limit	Deviation	Result	Deviation	Result	Result
0.1%	0.005000 g		✓		✓	✓
0.2%	0.010000 g		✓		✓	✓
0.5%	0.025000 g		✓		✓	✓
1%	0.050000 g	0.000005 g	✓	0.000005 g	✓	✓
2%	0.100000 g		✓		✓	✓
5%	0.250000 g		✓		✓	✓

The weighing tolerance is met, if the deviation is less than or equal to the corresponding control limit.

Error of Indication

As Found

Reference Value	Error	Control limits for various weighing tolerances					
		0.1%	0.2%	0.5%	1%	2%	5%
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A	N/A
29.99998 g	0.00001 g	0.01500 g	0.03000 g	0.07500 g	0.15000 g	0.30000 g	0.75000 g
49.99998 g	0.00002 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	0.50000 g	1.25000 g
69.99999 g	0.00001 g	0.03500 g	0.07000 g	0.17500 g	0.35000 g	0.70000 g	1.75000 g
90.00002 g	0.00000 g	0.04500 g	0.09000 g	0.22500 g	0.45000 g	0.90000 g	2.25000 g
100.00002 g	0.00003 g	0.05000 g	0.10000 g	0.25000 g	0.50000 g	1.00000 g	2.50000 g
120.00003 g	0.00002 g	0.06000 g	0.12000 g	0.30000 g	0.60000 g	1.20000 g	3.00000 g
150.00001 g	0.00001 g	0.07500 g	0.15000 g	0.37500 g	0.75000 g	1.50000 g	3.75000 g
170.00001 g	0.00006 g	0.08500 g	0.17000 g	0.42500 g	0.85000 g	1.70000 g	4.25000 g
200.00002 g	-0.00002 g	0.10000 g	0.20000 g	0.50000 g	1.00000 g	2.00000 g	5.00000 g
Result		✓	✓	✓	✓	✓	✓

As Left

Reference Value	Error	Control limits for various weighing tolerances					
		0.1%	0.2%	0.5%	1%	2%	5%
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A	N/A
29.99998 g	0.00001 g	0.01500 g	0.03000 g	0.07500 g	0.15000 g	0.30000 g	0.75000 g
49.99998 g	0.00002 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	0.50000 g	1.25000 g
69.99999 g	0.00001 g	0.03500 g	0.07000 g	0.17500 g	0.35000 g	0.70000 g	1.75000 g
90.00002 g	0.00000 g	0.04500 g	0.09000 g	0.22500 g	0.45000 g	0.90000 g	2.25000 g
100.00002 g	0.00003 g	0.05000 g	0.10000 g	0.25000 g	0.50000 g	1.00000 g	2.50000 g
120.00003 g	0.00002 g	0.06000 g	0.12000 g	0.30000 g	0.60000 g	1.20000 g	3.00000 g
150.00001 g	0.00001 g	0.07500 g	0.15000 g	0.37500 g	0.75000 g	1.50000 g	3.75000 g
170.00001 g	0.00006 g	0.08500 g	0.17000 g	0.42500 g	0.85000 g	1.70000 g	4.25000 g
200.00002 g	-0.00002 g	0.10000 g	0.20000 g	0.50000 g	1.00000 g	2.00000 g	5.00000 g
Result		✓	✓	✓	✓	✓	✓

The weighing tolerance is met, if the error (of indication) for each test point is less than or equal to the corresponding control limit for that particular weighing tolerance. Results at or close to the zero point cannot be assessed.

Mettler-Toledo (Thailand) Ltd.
84/64 - 84/65 Lasaile Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+66 2723 0382
MT-TH.ServicesSupport@mt.com



Accuracy Calibration Certificate

Customer

Company: United Analyst and Engineering Consultant Co., Ltd.
Address: 9 Soi Udon Suk 41, Sukhumvit Rd., Bang Chak
City: Phra Khanong
Zip / Postal: 10260
State / Province: Bangkok
Order Number: 0333333333

Contact: Suwit Chetnok

Weighing Device

Manufacturer: Mettler Toledo
Model: XPE205
Serial No.: B748058497
Building: N/A
Floor: 4
Room: Laboratory Calibrate Glassware

Weighing Instrument
UAE.CAL.004/2561
PEAT
B748058497
N/A

Range	Max Capacity	Readability (g)
1	220 g	0.0001 g

Procedure

Calibration Guideline:
METTLER TOLEDO Work Instruction:
CPW002/20

This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.
The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.
In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

As Found	Start: 22.8 °C	End: 22.5 °C	Humidity	Start: 62.2 %	End: 58.6 %
----------	----------------	--------------	----------	---------------	-------------

As Found Calibration Date: 23-Sep-2022
As Left Calibration Date: N/A
Issue Date: 26-Sep-2022

Calibrator: Suwicha C
Suwicha Choykamchu

Approved Signatory:

Technical Manager / Head of Calibration Center



Calibration Certificate ID:
TH2085-067-092322-ACC-TH
Balance
Mettler Toledo
Model: XPE205
S/N: B748 058497
ID. No.: UAE.CAL.004/2561

29 Sep 2022

CHW
asa 94p. 92

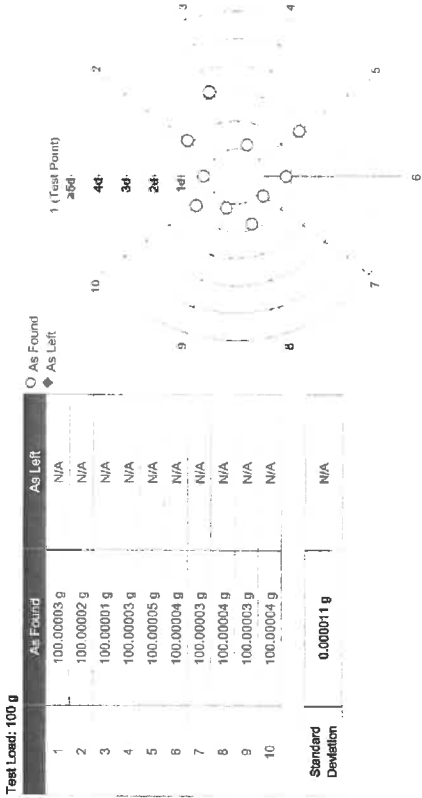
Equipment: Electronic Balance									
Model: XPE205									
ID No.: UAE.CAL.004/2561									
Serial No.: B748058497									
Nominal Value	Standard Value	Average Reading	Error	Correction	Uncertainty (U)	U + Error	Judgement	(Total Error < Judgement) Result	
(g)	(g)	(g)	(g)	(g)	(g)	(g)	(g)	(g)	(Pass / Fail)
0	0.0000	0.0000	0.0000	0.0000	0.00023	0.00023	0.02	0.00023	Pass
10	9.9997	9.9997	0.0000	0.0000	0.00063	0.00063	0.02	0.00063	Pass
30	29.9998	29.9998	0.0001	-0.0001	0.0014	0.0015	0.02	0.0015	Pass
50	49.9998	50.0000	0.0002	0.0002	0.0012	0.0014	0.02	0.0014	Pass
70	69.9999	70.0000	0.0001	-0.0001	0.0010	0.0011	0.02	0.0011	Pass
90	90.0002	90.0002	0.0000	0.0000	0.0027	0.0027	0.02	0.0027	Pass
100	100.0002	100.0005	0.0003	-0.0003	0.002	0.0025	0.02	0.0025	Pass
120	120.0003	120.0005	0.0002	-0.0002	0.0031	0.0033	0.02	0.0033	Pass
150	150.0003	150.0002	0.0001	-0.0001	0.0031	0.0032	0.02	0.0032	Pass
170	170.0001	170.0007	0.0006	-0.0006	0.0038	0.0044	0.02	0.0044	Pass
200	200.0002	200.0000	-0.0002	0.0002	0.0035	0.0037	0.02	0.0037	Pass

UUC*: Unit Under Calibration

Remarks:

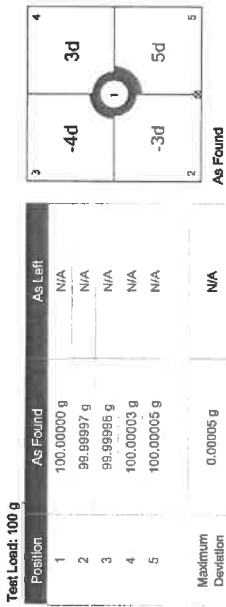
Measurement Results

Repeatability



The "1" in the graph represents the readability of the range interval in which the test was performed.
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

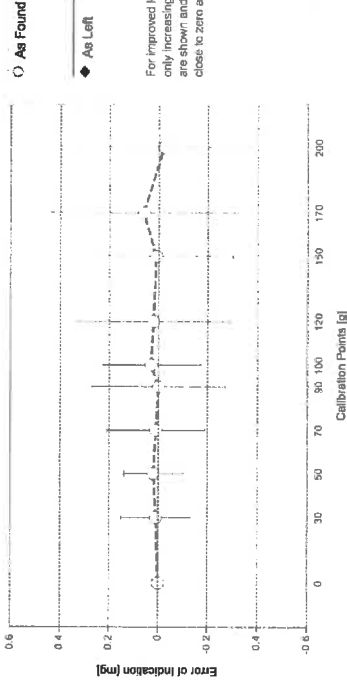


The "3" in the graph represents the readability of the range interval in which the test was performed.

Error of Indication

As Found	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.00000 g	0.00000 g	0.00000 g	0.023 mg	2
2	9.99997 g	9.99997 g	0.00000 g	0.063 mg	2
3	29.99998 g	29.99999 g	0.00001 g	0.14 mg	2
4	49.99998 g	50.00000 g	0.00002 g	0.12 mg	2
5	69.99999 g	70.00000 g	0.00001 g	0.20 mg	2
6	90.00002 g	90.00002 g	0.00000 g	0.27 mg	2
7	100.00002 g	100.00005 g	0.00003 g	0.20 mg	2
8	120.00003 g	120.00005 g	0.00002 g	0.31 mg	2
9	150.00001 g	150.00002 g	0.00001 g	0.31 mg	2
10	170.00001 g	170.00007 g	0.00006 g	0.36 mg	2
11	200.00002 g	200.00000 g	-0.00002 g	0.35 mg	2

The calculated uncertainty was replaced by the CMC (Calibration and Measurement Capabilities) value because the calculated uncertainty was smaller than the CMC value.



For improved legibility of the graphics only increasing measurement points are shown and measurement points close to zero are not displayed.

The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k - which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML E2

Weight Set No.: WS03
Certificate Number: 175498
Date of Issue: 21-Sep-2021
Calibration Due Date: 14-Mar-2023

Weight Set 2: OIML E2

Weight Set No.: WS66
Certificate Number: C142764709
Date of Issue: 21-Oct-2021
Calibration Due Date: 17-Apr-2023

Weight Set 3: OIML E2

Weight Set No.: WS70
Certificate Number: C142764702
Date of Issue: 21-Oct-2021
Calibration Due Date: 19-Mar-2023

Thermo Hygrometer

Equipment No.: IN281
Certificate Number: 221-1057
Date of Issue: 23-May-2022
Calibration Due Date: 15-May-2023

Remarks

FACT adjustment functionality activated
Equipment condition: Good
Next calibration according to customer's procedure
Calibration data not decide by calibration laboratory.

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with $k=2$ in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: $1.0 \cdot 10^{-5} / K$

Temperature range on site for the evaluation of the measurement uncertainty in use: $3 K$

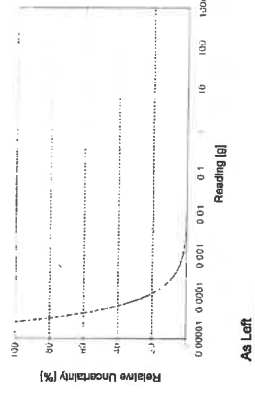
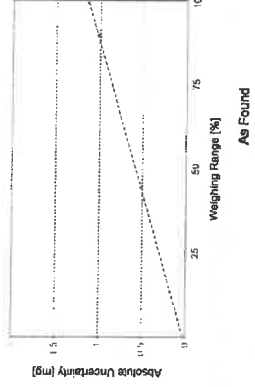
Linearization of Uncertainty Equation

Range	Max	As Found	As Left
1	0.00001 g	220 g	$U_1 = 0.024 \text{ mg} + 0.00509 \text{ mg/g} \cdot R$
			N/A

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found	As Left
0.00220 g	0.024 mg	1.1%
0.02200 g	0.024 mg	0.11%
0.22000 g	0.025 mg	0.011%
2.20000 g	0.035 mg	0.0016%
22.00000 g	1.1 mg	0.00052%
		N/A
		N/A
		N/A
		N/A
		N/A



GWP® Certificate



As
Found



As
Left



The weighing device meets the given process requirements.

The weighing device meets the given process requirements.

Tests Performed:

☒ As Found

☐ As Left

☒ No adjustments/modifications made. As Left results correspond to As Found.

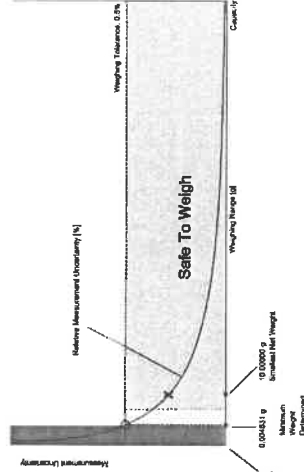
Process Requirements

Weighing Tolerance: 0.5%

Smallest Net Weight: 10.00000 g

Safety Factor: 2

Safe Weighing Range



While the values in this graph reflect the actual calibration results, the measurement uncertainty curves are simply a visual representation. This graph reflects As Left testing, unless only As Found was performed.

Minimum Weight As Found Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.024253 g	0.048754 g	0.073509 g	0.123795 g	0.254223 g
0.2%	0.012095 g	0.024253 g	0.036472 g	0.061100 g	0.123795 g
0.5%	0.004831 g	0.009671 g	0.014522 g	0.024253 g	0.048754 g
1%	0.002414 g	0.004831 g	0.007250 g	0.012095 g	0.024253 g
2%	0.001207 g	0.002414 g	0.003622 g	0.006040 g	0.012095 g
5%	0.000483 g	0.000965 g	0.001448 g	0.002414 g	0.004831 g

✓ Pass: The determined minimum weight meets the requirement for the smallest net weight.

As Left Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.024253 g	0.048754 g	0.073509 g	0.123795 g	0.254223 g
0.2%	0.012095 g	0.024253 g	0.036472 g	0.061100 g	0.123795 g
0.5%	0.004831 g	0.009671 g	0.014522 g	0.024253 g	0.048754 g
1%	0.002414 g	0.004831 g	0.007250 g	0.012095 g	0.024253 g
2%	0.001207 g	0.002414 g	0.003622 g	0.006040 g	0.012095 g
5%	0.000483 g	0.000965 g	0.001448 g	0.002414 g	0.004831 g

✓ Pass: The determined minimum weight meets the requirement for the smallest net weight.

At these net minimum weight values, the measurement uncertainty of the weighing device is equal to or less than 1/1 (no safety factor), 1/2, 1/3, 1/5, or 1/10 of the required tolerance. The values are calculated with $k = 2$ and based on the linear formula of the measurement uncertainty of the weighing device in use.

The safety factor for As Found is always 1. This implies no safety factor. As Found testing looks at the behavior of the instrument from the past until test occurred. For the past, it is necessary to know that the tolerance was met, but not the safety factor. The safety factor is a proactive measure to apply for future measurements.

Notes on minimum weight values in above table:

1. If "N/A" is shown above, no appropriate value could be calculated.
2. METTLER TOLEDO is not responsible for the definition of the process requirements.

Measurement Results

Results Summary

		Repeatability	Eccentricity	Error of Indication	
As Found	✓	✓	✓	✓	✓
As Left	✓	✓	✓	✓	✓

✓ = Passed
✗ = Failed
N = Safety Factor not met

Repeatability

Test Load: 100 g

Tolerance	As Found			As Left		
	Control Limit	Std. Deviation	Result	Std. Deviation	Result	Result
0.1%	0.005000 g		✓		✓	✓
0.2%	0.010000 g		✓		✓	✓
0.5%	0.025000 g		✓		✓	✓
1%	0.050000 g	0.000011 g	✓	0.000011 g	✓	✓
2%	0.100000 g		✓		✓	✓
5%	0.250000 g		✓		✓	✓

The weighing tolerance is met if the standard deviation is less than or equal to the corresponding control limit.

Eccentricity

Test Load: 100 g

Tolerance	As Found			As Left		
	Control Limit	Deviation	Result	Deviation	Result	Result
0.1%	0.05000 g		✓		✓	✓
0.2%	0.10000 g		✓		✓	✓
0.5%	0.25000 g		✓		✓	✓
1%	0.50000 g	0.00005 g	✓	0.00005 g	✓	✓
2%	1.00000 g		✓		✓	✓
5%	2.50000 g		✓		✓	✓

The weighing tolerance is met if the deviation is less than or equal to the corresponding control limit.

Error of Indication

As Found

Reference Value	Error	Control limits for various weighing tolerances				
		0.1%	0.2%	0.5%	1%	5%
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A
29.99999 g	0.00001 g	0.01500 g	0.03000 g	0.07500 g	0.15000 g	0.75000 g
49.99998 g	0.00002 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	1.25000 g
69.99999 g	0.00001 g	0.03500 g	0.07000 g	0.17500 g	0.35000 g	1.75000 g
90.00002 g	0.00000 g	0.04500 g	0.09000 g	0.22500 g	0.45000 g	2.25000 g
100.00002 g	0.00003 g	0.05000 g	0.10000 g	0.25000 g	0.50000 g	2.50000 g
120.00003 g	0.00002 g	0.06000 g	0.12000 g	0.30000 g	0.60000 g	3.00000 g
150.00001 g	0.00001 g	0.07500 g	0.15000 g	0.37500 g	0.75000 g	3.75000 g
170.00004 g	0.00006 g	0.08500 g	0.17000 g	0.42500 g	0.85000 g	4.25000 g
200.00002 g	-0.00002 g	0.10000 g	0.20000 g	0.50000 g	1.00000 g	5.00000 g
Result	✓	✓	✓	✓	✓	✓

As Left

Reference Value	Error	Control limits for various weighing tolerances				
		0.1%	0.2%	0.5%	1%	5%
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A
29.99998 g	0.00001 g	0.01500 g	0.03000 g	0.07500 g	0.15000 g	0.75000 g
49.99998 g	0.00002 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	1.25000 g
69.99999 g	0.00001 g	0.03500 g	0.07000 g	0.17500 g	0.35000 g	1.75000 g
90.00002 g	0.00000 g	0.04500 g	0.09000 g	0.22500 g	0.45000 g	2.25000 g
100.00002 g	0.00003 g	0.05000 g	0.10000 g	0.25000 g	0.50000 g	2.50000 g
120.00003 g	0.00002 g	0.06000 g	0.12000 g	0.30000 g	0.60000 g	3.00000 g
150.00001 g	0.00001 g	0.07500 g	0.15000 g	0.37500 g	0.75000 g	3.75000 g
170.00004 g	0.00006 g	0.08500 g	0.17000 g	0.42500 g	0.85000 g	4.25000 g
200.00002 g	-0.00002 g	0.10000 g	0.20000 g	0.50000 g	1.00000 g	5.00000 g
Result	✓	✓	✓	✓	✓	✓

The weighing tolerance is met if the error (of indication) for each test point is less than or equal to the corresponding control limit for that particular weighing tolerances. Results at or close to the zero point cannot be assessed.



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/44 PATTANAKARN ROAD SOI 19, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3060-27 FAX. 0-2719-9484



NSC-TSI-TS17025
CALIBRATION 0008

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 : $(26 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$

Calibrated by : Preecha Hlanib

Approved by :
Approved Signatory

() Ponthippa Tameyakul
() Malee Butkruee
(✓) 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 3: Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม

A 0046800



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2210-05750C-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) 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.

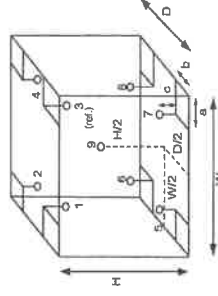
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

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



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

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

เอกสารไม่ควบคุม

a 1133252



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2210-0575OC-1
Result of Calibration : (°) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

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

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
104.0	104.0	104.0	0.061	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)								
	Position								
	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 %.

-000-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert.No.: 22CH650
Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HA9M0047
ID No. : UAE.EFM.005/2563(EFM.pH.05/63)
Condition As-Received : Used Item
Received Date : 29 April 2022
Calibration Date : 13 May 2022
Reference : 2204-0781WSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangkok,
Phrakhanong, Bangkok 10260
(25 ± 2.5) °C
(50 ± 15) %
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 : Uthen Kankawi

Approved by : 
Approved Signatory

(/) Malee Bulkruea
(/) Sathip Meangmai
(/) Warakorn Lenggaetrakul

Issue Date : 19 May 2022

The Uncertainties are for a confidence probability of approximately 95 %

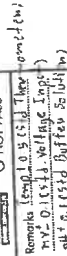
This certificate may not be reproduced other than in full, except with the prior written approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม

a 1133251

เอกสารไม่ควบคุม

A 0041259



NOT PASS

NOT PASS

Remarks	Date	Time	Temp	Wind	Bar	Humidity	Clouds	Direction	Speed	Altitude	Latitude	Longitude	Notes
	10-5-54	1700	68	10	30.0	75	100	N	10	1000	34° 15' N	122° 15' W	

HY-0105+5. voltage 200V
all + 0.105d Buffer 5.000V

[illegible][illegible]

Verify	Approve
--------	---------

1. **Introduction**



Page: 2 of 3

1. Reference Standard Instrument :-

1) Document Process Calibrator

This certification is traceable to
NIST Ref. Standard Thermometer

* Accessible to National Institute of Metrology (Thailand), NIMT

2. **CONFORM TO OTHER MATERIALS**
: THE MEASUREMENT TOOLS ARE SUBJECTED TO AN INSIGHT OF A CERTAIN LEVEL
ANSI-ASQ National Accreditation Board Accredited No. AB-1835

[illegible]

pH 6.983

2251

Calibration Results

Performing standard curve

[illegible]

Unit Under Calibration	Value	Voltage Input mV	Actual reading		Measurement (\pm mV)	factor <i>k</i>
			pH	mV		
pH Meter S/N.: HA9M0047	4.00	177.48	177.7	4.00	0.058	2.00
	7.00	0.00	0.3	7.01	0.058	2.00
	10.00	0.00	0.3	7.01	0.058	2.00
			-177.48	10.00	0.058	2.00

เอกสารไม่ควบคุม

Malu

เอกสารไม่ควบคุม

a 1108698



Cert.No.: 22CH650
Page.: 3 of 3

Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (\pm)	Coverage factor k
pH Electrode S/N.: 990C0199	4.008	4.01	131.3	0.011	2.13
	6.983	6.98	-43.3	0.012	2.07
	6.983	6.99	-43.7	0.011	2.00
	10.015	10.02	-215.3	0.013	2.13

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652

- Serial No. : 990C0199

Dimension of probe:

- Length : 95 mm.

- Diameter : 12 mm.

- Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (\pm °C)	Coverage factor k
25.0	25.004	25.0	-0.004	0.13	2.00
30.0	30.005	30.0	-0.005	0.13	2.00
35.0	35.012	35.0	-0.012	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 %.

-๐๐๐-

เอกสารไมศวกคม
a 1108697

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	YSI	pH100A JC03340	Technology Promotion Association (Thailand-Japan)	22CH1001	26 Jul 22	25 Jul 23	-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

Tel. 0-2717-3000-27 FAX. 0-2719-9184



Cert.No.: 22CH1001
Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : YSI
Model : pH100A
Serial No. : JC03340
ID No. : UAE.EFM.059/2562(ENV.pH.08/61)
Condition As-Received :
Received Date : 25 July 2022
Calibration Date : 26 July 2022
Reference : 2207-0723WSC-3
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-GH8 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)
- CP-GH8 by comparison with standard thermometer

Calibrated by : Warakorn Lerngagrakul

Approved by : 
Approved Signatory

() Maiee Bulkuea
() Saithip Meangmal
() Warakorn Lerngagrakul

Issue Date : 29 July 2022

The Uncertainties are for a confidence probability of approximately 95 %

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

เอกสารไม่ควบคุม
A 0043736



Cert.No.: 22CH1001
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument :
Instrument : Serial No. ID No. Cert. No. Due Date
1) Ref. Standard Thermometer 4982054 110RC044 2111201 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

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

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

Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4.7)(7.10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode S/N.: 220202SIA 605377	4.008	4.01	172	0.0071	2.00
	6.985	7.00	-1	0.0093	2.00
	10.008	7.00	-1	0.0093	2.00

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

เอกสารไม่ควบคุม
a 1119398



Cert.No.: 22CH1001
Page.: 3 of 3

Calibration Results

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : _____
- Serial No. : 220202SIA605377
- Dimension of probe;
- Length : 110 mm.
- Diameter : 12 mm.
- Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor <i>k</i>
25.0	25.002	25.1	0.098	0.13	2.00
30.0	30.003	30.1	0.097	0.13	2.00
35.0	35.004	35.1	0.096	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 %.

-๐๐๐-

๑๑๒๒ -
เอกสารไม่ควบคุม
a 1119397