

ภาคผนวก ง
เอกสารสอบเทียบเครื่องมือ



List of Instruments Certification for Water Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Water									
1	pH Meter	pH	Horiba	LAQUA-PH210 HA1G0008	Technology Promotion Association (Thailand-Japan)	23CH1225	28 Sep 23	27 Sep 24	-
2	DO Meter	DO	YSI	Pro 20i 18F103884	Technology Promotion Association (Thailand-Japan)	23TW218/1	27 Sep 23	26 Sep 24	-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/44 PAITANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert.No.: 23CH1225
Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HA1G0008
ID No. : UAE.EFM.201/2564(EFM.pH.09/64)
Condition As-Received: Used Item
Received Date : 26 September 2023
Calibration Date : 28 September 2023
Reference : 2309-0881WSC-3
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phraekhanong, Bangkok 10260
(25 ± 2.5) °C
(50 ± 15) %
Ambient Temperature : In - house method :
Relative Humidity : - CP-CH5 by direct measurement with standard
Calibration Procedure : voltage calibrator and direct measurement with
certified reference material (CRM)
- CP-CH8 by comparison with standard thermometer

Calibrated by : Warakorn Lerngagrakul
Approved by :
Approved Signatory

(✓) Saithip Meangmai
() Warakorn Lerngagrakul
() Ponpan Paipim

Issue Date : 2 October 2023

The Uncertainties are for a confidence probability of approximately 95 %

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

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A 0053072



Cert.No.: 23CH1225
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument : -
Instrument **Serial No.** **ID No.** **Cert. No.** **Due Date**
1) Document Process Calibrator 54030049 130RC116 23E2802 27 Aug 2024
2) Ref. Standard Thermometer 4982054 110RC044 231908 26 Jul 2024
This certification is traceable to the International System of Unit maintained through:-
- Technology Promotion Association (Thailand-Japan)

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	913598	14 July 2025
pH 6.986	CPA chem	913599	14 July 2024
pH 9.997	CPA chem	913600	14 July 2024

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

Calibration Results

Function : mV Measurement

Performing standard curve by Fluke at pH (4.7)(7, 10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
			mV	pH		
pH Meter S/N.: HA1G0008	4.00	177.48	177.6	4.01	0.058	2.00
	7.00	0.00	0.0	7.02	0.058	2.00
	10.00	-177.48	-177.5	10.01	0.058	2.00

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a 1182402



Cert.No.: 23CH1225
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	4.008	4.01	173.7	0.0079	2.00
S/N.: -	6.986	6.99	4.6	0.011	2.00
	6.986	7.00	3.9	0.0093	2.00
	9.997	10.01	-165.0	0.0096	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652

- Serial No. : -

Dimension of probe;

- Length : 103 mm

- Diameter : 16 mm

- Immersion Depth : 90 mm

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (\pm °C)	Coverage factor k
25.0	25.002	24.9	-0.102	0.13	2.00
30.0	30.002	30.0	-0.002	0.13	2.00
35.0	35.004	35.0	-0.004	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

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a 1182779



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 FAX. 0-2719-9484

Cert.No.: 23TW2181
Page.: 1 of 2

Certificate of Testing

This Certificate was issued to replace to the Certificate No.23TW218
Equipment : DO Meter

Manufacturer : YSI

Model : Pro 20i

Serial No. : 18F103884

ID No. : UAE.EFM.199/2561 (ENV.DO. 03/61)

Received Date : 26 September 2023

Test Date : 27 September 2023

Reference : 2309-0884WSC-1

Submitted by : United Analyst and Engineering Consultant Co.,Ltd.

3 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Phrakhanong, Bangkok 10260

Laboratory Condition : Temperature (25 ± 5) °C

Humidity (50 ± 20) %

In - house method : GP-CH9

by Comparison Technique with Azide Modification Method

Tested by : Walalak Sirithean

Approved by :

Approved Signatory

(✓) Saithip Meangmai
() Warakorn Lemagtrakul
() Ponpan Palpim

Issue Date : 16 October 2023

เอกสารไม่ควบคุม
B 0326084



Cert.No.: 23TW218/1
Page.: 2 of 2

Condition of this result of calibration

- Reference Standard Instruments :
This certification is traceable to the International System of Unit through the reference standards laboratory of Industrial Calibration Center, Technology Promotion Association (Thailand-Japan).

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1) Burette	-	130BU10	23CG1172	22 Mar 2025
2) Balance	1124013382	140RC006	23MM18	20 Feb 2024
- Standard Material :-

Material	Manufacturer	Lot.No.	Assay
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %
Dissolved Oxygen Probe No.: 18F100252

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.16	8.16	0.0055

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency. The environmental impact control and present to organization it may concerned intend to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full, without written approval of the laboratory

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a 1184882



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484



NSC-TSL-71871025
CALIBRATION 0008

Cert. No.: 23LM167/1
Page.: 1 of 2

Certificate of Calibration

This Certificate was issued to replace to the Certificate No. 23LM167

Equipment : DO Meter with Sensor
Manufacturer : YSI
Model : Pro 20i
Serial No. : 18F103884
ID No. : UAE.EFM.199/2561(ENV.DO.03/61)

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

Location : TPA Chemistry Calibration Laboratory

Received Order : 25 September 2023
Calibrated Date : 29 September 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V

Calibrated by : Krisda Malee

Approved by : 
Approved Signatory

() Pornthippa Tameyakul
() Ponpan Paipim
(✓) Suwit Imjai

Issue Date : 16 October 2023

The Uncertainties are for a confidence probability of approximately 95 %

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

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A 0059489



Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2309-0884WSC-2

Cert. No.: 23LM167/1
Page: 2 of 2

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPT) into Temperature Bath.
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Digital Thermometer	2188080	2211285	TPA	21 Oct 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.

Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function :

Temperature measurement

This instrument was connected with temperature sensor, S/N.: 18F100252

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor <i>k</i>
25.0	100	25.002	24.9	-0.102	0.16	2.00
30.0	100	29.999	29.9	-0.099	0.16	2.00
35.0	100	35.000	34.8	-0.200	0.16	2.00

UUC* : Unit Under Calibration

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

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เอกสารแนบฉบับ

a 1184878

รายการใบรับรองสอบเทียบ/ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์คุณภาพน้ำ									
1	pH Meter	ความเป็นกรด-ด่าง (pH) อุณหภูมิ (Temperature)	Mettler-Toledo	Seven Easy S20 / 1231155210	National Food Institute, Ministry of Industry, Thailand	2401718-001-01	11 Mar 24	10 Mar 25	-
2	pH Meter		Mettler-Toledo	Seven Easy S20 / 1230525212	DKSH (Thailand) Ltd.	C07240167	9 Apr 24	8 Apr 25	-
3	Conductivity Meter	ความเค็ม (Salinity)	SI Analytics	Lab955 / 16300356	DKSH (Thailand) Ltd.	C24230059	11 Mar 24	10 Mar 25	-
4	Analytical Balance (Readability 0.01 mg)	ของแข็งแขวนลอย (SS) ของแข็งทั้งหมด (TS) ของแข็งละลายน้ำทั้งหมด (TDS)	Mettler-Toledo	XSR205DU / C09071872	National Food Institute, Ministry of Industry, Thailand	2402283-001-01	2 Apr 24	1 Apr 25	-
5	Analytical Balance (Readability 0.01 mg)		Mettler-Toledo	XSR205DU / C210685394	National Food Institute, Ministry of Industry, Thailand	2402283-002-01	2 Apr 24	1 Apr 25	-
6	Hot Air Oven		Memmert	UF55 / B212.0411	Technology Promotion Association (Thailand-Japan)	24TM589	1 Apr 24	31 Mar 25	-
7	Analytical Balance (Readability 0.1 mg)	น้ำมันและไขมัน (Oil & Grease)	Mettler-Toledo	XSR204 / C117635043	Technology Promotion Association (Thailand-Japan)	24MM293	11 May 24	10 May 25	-
8	BOD Incubator		Arco	UC4-1320 / (UAE.WAO.015/2551)	Technology Promotion Association (Thailand-Japan)	24TM303	10 Feb 24	8 Feb 25	-
9	BOD Incubator	ชีโอดี (COD)	Arco	UR-1320 / (UAE.WAO.018/2551)	Technology Promotion Association (Thailand-Japan)	24TM587	1 Apr 24	31 Mar 25	-
10	COD Reactor (Heating Block)		Hanna	HI839800-02 / H018500I	Hanna Instruments (Thailand) Ltd.	HIT-2412-0389	18 Mar 24	18 Mar 25	-
11	COD Reactor (Heating Block)		Hanna	HI839800-02 / 1147807	Hanna Instruments (Thailand) Ltd.	HIT-2417-0568	23 Apr 24	23 Apr 25	-

รายการใบรับรองสอบเทียบ/ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration *	Remark
12	UV-VIS Spectrophotometer	ไนโตรเจน-ไนโตรเจน (NO ₃ as N) ซีโอดี (COD)	Agilent Technologies	Cary60 G6860A / MY15410009	DOE Services Co.,Ltd.	SP24-018	7 May 24	6 May 25	-
13	UV-VIS Spectrophotometer		Hitachi	U-1900 / 2021-064	DOE Services Co.,Ltd.	SP24-008	16 Jan 24	14 Jan 25	-

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

Calibration Report

Certificate No.: 240718-001-01
Equipment: pH Meter
Resolution: 0.01 pH : 1 mV
Model: SevenEasy pH
Type: Bench top
Manufacturer: METTLER TOLEDO
Serial No.: 1231155210
ID No.: UAE.WAT.010/2553
Date of Calibration: 11 March 2024

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Calibration Results:

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

(offset value before adjust: -0.4 mV)

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (±mV)	Coverage Factor (k)
		mV	pH		
0	414.121	414	0.00	0.58	2.00
2	295.614	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	0.001	0	7.00	0.58	2.00
8	-59.159	-59	8.00	0.58	2.00
10	-177.461	-177	10.00	0.58	2.00
12	-295.611	-296	12.00	0.58	2.00
14	-414.118	-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.: 3065701
ID No.: N/A

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

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.01	188	-	0.0071	2.00
7.001	7.00	13	98.9	0.0086	2.00
10.010	10.01	-160	97.2	0.0085	2.00
6.865	6.87	21	-	0.0074	2.00

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

Calibration Report

Certificate No.: 240718-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C
Model: SevenEasy pH
Serial No.: 1231155210
ID No.: UAE.WAT.010/2553
Manufacturer: METTLER TOLEDO
Date of Calibration: 11 March 2024

Page 4 of 5

Location: Chemical Calibration Laboratory, National Food Institute

Environment Condition: Ambient Temperature 23 °C ± 1 °C
Relative Humidity 51 % ± 2 %

Condition of this results of Calibration:

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

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1523	2118154	PSL-T 0877166	06-Jun-24	TISTR
Platinum Resistance Thermometer (PRT)	5627A	877332			

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

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

6. Condition of Calibrated Item : Good

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

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

Calibration Results:

pH Scale

Input	pH Meter Reading			Uncertainty of Measurement (mV)	Coverage Factor (k)
	(mV)	(mV)	Error (mV)	(pH)	
414.12	414	-0.12	0.00	0.58	2.00
354.96	355	0.04	1.00	0.58	2.00
295.8	296	0.20	2.00	0.58	2.00
236.64	237	0.36	3.00	0.58	2.00
177.48	178	0.52	4.00	0.58	2.00
118.32	118	-0.32	5.00	0.58	2.00
59.16	59	-0.16	6.00	0.58	2.00
0	0	0.00	7.00	0.58	2.00
-59.16	-59	0.16	8.00	0.58	2.00
-118.32	-118	0.32	9.00	0.58	2.00
-177.48	-177	0.48	10.00	0.58	2.00
-236.64	-236	0.64	11.00	0.58	2.00
-295.8	-296	-0.20	12.00	0.58	2.00
-354.96	-355	-0.04	13.00	0.58	2.00
-414.12	-414	0.12	14.00	0.58	2.00

Practical slope and zero point*

The three-point calibration using three standard buffer solutions; pH 4.008 , pH 6.985 and pH 9.997

-During calibration, display of pH meter reading; pH 4.00 , pH 7.00 and pH 10.01

The practical slope of the pH electrode; 57.01 (mV/pH), 96.37%

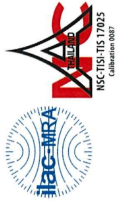
The zero point of the pH electrode; 6.88 (pH)

Sample Test Results

Standard Buffer Solution (pH)	Unit Under Calibration (pH)	Difference (pH)	Uncertainty of Measurement (pH)	Coverage Factor (k)
4.008	3.99	-0.018	0.0070	2.00
6.985	7.00	0.015	0.0091	2.00
9.997	10.02	0.023	0.0074	2.00

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

The End of Certificate



Certificate of Calibration

Equipment: Digital Thermometer with Probe
Model: SevenEasy pH
Serial No.: 1230525212
Manufacturer: METTLER TOLEDO
ID No.: UAE.WAS.003/2553

Customer: United Analyst and Engineering Consultant Company Limited
3 Soi Udomsuk 41 Sukhumvit Road,
Bangkok, Prakanong, Bangkok 10260 Thailand

Environment Condition: Temperature: 22 °C ± 3 °C
Humidity: 50 %RH ± 20 %RH
Voltage: 220 VAC ± 10 %

Calibration Place: Thermo-Hygro Laboratory, DKSH Technology Limited.
2533 Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260 Thailand

Calibration By: Mr. Nateekam Mitijit
Calibration Date: 09 April 2024
The Method used: In house method, CAL-WI-19, by comparison with standard thermometer
Traceability: This certificate is traceable to the International System of Unit maintained by
Quality Reborn Co.,Ltd. (QR) Certificate No. QR23-1073

(Mr. Nateekam Mitijit)
Person in charge

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled.
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DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตวัฒนา กรุงเทพมหานคร 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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Certificate No.: C15240373
Page: 2 of 2

Reference standard equipment:

Equipment	Certificate no	Cal. date	Next Cal. date
Digital Thermometer with Probe	QR23-1073	2 May 23	2 May 24

Calibration Results: Without Adjustment

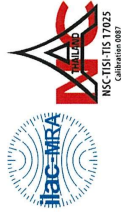
Sensor Type: RTD Channel: -

Diameter (mm) 4		Length (mm): 135		Immersion (mm): 110	
Calibrate Point.(°C)	STD. Reading (°C)	UUC. Reading (°C)	Correction of UUC (°C)	Uncertainty (± °C)	
15.0	15.010	15.1	-0.090	0.076	
25.0	25.006	25.1	-0.094	0.076	
35.0	35.004	35.0	0.004	0.076	

The End of Certificate

เอกสารนี้ควบคุม

CAL-FM-C-15-14: 06 Dec 2022



Certificate of Calibration

Equipment: CONDUCTIVITY METER
Model: Lab 955
Serial No. (or ID.): 16300356
Manufacturer: SI Analytic
Electrode Serial No. 16070067
Condition: In Condition

Customer: United Analyst and Engineering Consultant Company Limited
3 Soi Udomsuk 41 Sukhumvit Road,
Bangckak, Prakanong, Bangkok 10260 Thailand

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

Calibration Place: Environment Laboratory, DKSH Technology Limited.
2533 Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260 Thailand

Calibration By: Mr. Pongpisut Suebchantha
Calibration Date: 11 March 2024
The Method used: In house method, CAL-WI-49, base on ASTM D 1125-14 and D 5391-14
Traceability: This certificate is traceable to the SI Units maintained by CRM of NIST(SRM) through CPA chem Co., Ltd. (ISO/IEC 17034) Certificate No. 960753, 890591, 890593



(Mr.Pongpisut Suebchantha)

Person in charge

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

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
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เอกสารไม่ควบคุม

CAL-FM-C24-09: 12 Sep 2022



Certificate of Calibration

Standard	Unit Under Calibration	Correction	Coverage Factor (k)	Uncertainty (±)
Conductivity Solution	Reading			
25.000 µS/cm	26.7 µS/cm	-1.700 µS/cm	2.00	0.21 µS/cm
1413.0 µS/cm	1428 µS/cm	-15.0 µS/cm	2.00	9.0 µS/cm
111.3 mS/cm	108.4 mS/cm	2.9 mS/cm	2.00	0.67 mS/cm

After Adjustment ; at 1413 µS/cm

Standard	Unit Under Calibration	Correction	Coverage Factor (k)	Uncertainty (±)
Conductivity Solution	Reading			
25.000 µS/cm	25.9 µS/cm	-0.900 µS/cm	2.00	0.21 µS/cm
1413.0 µS/cm	1413 µS/cm	0.0 µS/cm	2.00	9.0 µS/cm
111.3 mS/cm	107.5 mS/cm	3.8 mS/cm	2.00	0.67 mS/cm

The End of Certificate



Certificate No.: C24240057

Page: 2 of 2

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
Phone : +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth – in Asia and Beyond.

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CAL-FM-C24-09: 12 Sep 2022

Calibration Report

Certificate No.: 2402283-001-01

Equipment:

Electronic Balance

Model: XSR20SDU

Serial No.: C009071872

Capacity: 220 g

Manufacturer: METTLER TOLEDO

Resolution: 0.00001 g / 0.0001 g

ID No.: UAE.WAO.012/2563

Date of Calibration: 2 April 2024

Page 3 of 4

Calibration Results: (Continued)

Calibration Range: 0 - 80 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 0 - 80 g ; Resolution: 0.00001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
Unbead	0.000000	0.00000	0.00000	0.0000088	2.00
0.001	0.001003	0.00101	-0.00001	0.0000091	2.00
0.005	0.005003	0.00499	0.00001	0.0000094	2.00
0.01	0.010003	0.01000	0.00000	0.0000091	2.00
0.05	0.049996	0.05000	0.00000	0.0000098	2.00
0.1	0.100011	0.10000	0.00001	0.000011	2.00
0.5	0.500016	0.50001	0.00001	0.000014	2.00
1	1.000003	1.00002	-0.00002	0.000016	2.00
2	2.000023	2.00001	0.00001	0.000017	2.00
5	5.000017	5.00002	0.00000	0.000020	2.00
10	10.000009	10.00000	0.00001	0.000026	2.00
20	20.000031	20.00002	0.00001	0.000037	2.00
30	30.000040	30.00003	0.00001	0.000052	2.00
50	50.000028	50.00004	-0.00001	0.000068	2.00
80	80.000068	80.00005	0.00002	0.00011	2.00

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



nfi.earth

Calibration Report

Certificate No.: 2402283-001-01

Equipment:

Electronic Balance

Model: XSR20SDU

Serial No.: C009071872

Capacity: 220 g

Manufacturer: METTLER TOLEDO

Resolution: 0.00001 g / 0.0001 g

ID No.: UAE.WAO.012/2563

Date of Calibration: 2 April 2024

Page 4 of 4

Calibration Results: (Continued)

Calibration Range: 81 - 200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 81 - 200 g ; Resolution: 0.0001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
90	90.00010	90.0000	0.0001	0.00015	2.00
100	100.00006	100.0000	0.0001	0.00015	2.00
110	110.00007	110.0001	0.0000	0.00017	2.00
120	120.00009	120.0000	0.0001	0.00018	2.00
130	130.00010	130.0000	0.0001	0.00019	2.00
140	140.00014	140.0000	0.0001	0.00020	2.00
150	150.00009	150.0001	0.0000	0.00020	2.00
160	160.00010	160.0001	0.0000	0.00022	2.00
170	170.00012	170.0001	0.0000	0.00023	2.00
200	200.00016	200.0000	0.0002	0.00028	2.00

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

----- End -----

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



nfi.earth

Calibration Certificate

Certificate No.: 2402283-002-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 SOI UDOMSUK 41, SUKHUMVIT ROAD,
 Bangchack, Prakanond, Bangkok 10260

Page 1 of 4

Equipment:	Electronic Balance
Manufacturer:	METTLER TOLEDO
Model:	XSR205DU
Serial No.:	C210685394
ID No.:	UAE.WAO.010/2565
Order No.:	2402283
Operation No.:	2402283-002
Date of Receipt:	2 April 2024
Date of Calibration:	2 April 2024

Calibrated by Mr.Jerawut Papawuttipong
Approved by

Scientist
(Mr.Pheraphat Tuanjit)

Date of Issue: 9 April 2024

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



2008 บะอูนถนอมสินธุ์ 36 บะอูนถนอมสินธุ์ แขวงบางยี่สิบ เขตบางคอแหลม กรุงเทพมหานคร 10700, Thailand
Tel: +66(0) 21422 8688 Fax: +66(0) 21422 8545

Calibration Report

Certificate No.: 2402283-002-01
Equipment: Electronic Balance
Model: XSR20SDU
Serial No.: C210685394
Capacity: 220 g
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE:WAO.010/2585
Manufacturer: METTLER TOLEDO

Page 2 of 4

Date of Calibration: 2 April 2024

Environment Condition:	Ambient Temperature:	24.5 ± 0.5 °C	Relative Humidity:	47.5 ± 2.5 %
------------------------	----------------------	---------------	--------------------	--------------

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

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	B505567572	TCS	M23040535	8 April 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFLBTH-016/23	Quality Reborn	QR24-0343	9 February 2025

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

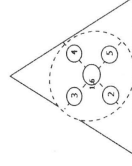
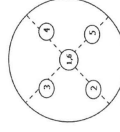
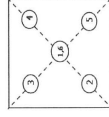
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.000042
80	0.0000052
100	0.000048
200	0.000048

2. Off-Center Error:

A mass of 100 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



1 (g)	2 (g)	3 (g)	4 (g)	5 (g)	6 (g)	(Maximum Difference) (g)
100.0000	100.0001	99.9999	99.9999	100.0001	100.0000	0.0001

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

[illegible]

Calibration Report

Certificate No.: 2402283-002-01

Equipment:

Electronic Balance

Model: XSR20SDU

Serial No.: C210685394

Capacity: 220 g

Manufacturer: METTLER TOLEDO

Resolution: 0.00001 g / 0.0001 g

ID No.: UAE.WAO.010/2565

Date of Calibration: 2 April 2024

Calibration Results: (Continued)

Calibration Range: 0 - 80 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 0 - 80 g ; Resolution: 0.00001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
Unlead	0.000000	0.000000	0.000000	0.0000086	2.00
0.001	0.001003	0.00101	-0.000001	0.0000089	2.00
0.005	0.005003	0.00500	0.000000	0.0000092	2.00
0.01	0.010003	0.01000	0.000000	0.0000089	2.00
0.05	0.049996	0.05000	0.000000	0.0000096	2.00
0.1	0.100011	0.10000	0.000001	0.000011	2.00
0.5	0.500016	0.50001	0.000001	0.000014	2.00
1	1.000033	1.00002	-0.000002	0.000016	2.00
2	2.000023	2.00001	0.000001	0.000017	2.00
5	5.000017	5.00002	0.000000	0.000020	2.00
10	10.000009	10.00000	0.000001	0.000026	2.00
20	20.000031	20.00000	0.000003	0.000037	2.00
30	30.000040	30.00001	0.000003	0.000050	2.00
50	50.000028	50.00002	0.000001	0.000068	2.00
80	80.000068	80.00002	0.000005	0.00011	2.00

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

Calibration Report

Certificate No.: 2402283-002-01

Equipment:

Electronic Balance

Model: XSR20SDU

Serial No.: C210685394

Capacity: 220 g

Manufacturer: METTLER TOLEDO

Resolution: 0.00001 g / 0.0001 g

ID No.: UAE.WAO.010/2565

Date of Calibration: 2 April 2024

Calibration Results: (Continued)

Calibration Range: 81 - 200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 81 - 200 g ; Resolution: 0.0001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
90	90.00010	90.0001	0.0000	0.00015	2.00
100	100.00006	100.0001	0.0000	0.00015	2.00
110	110.00007	110.0001	0.0000	0.00016	2.00
120	120.00009	120.0000	0.0001	0.00017	2.00
130	130.00010	130.0000	0.0001	0.00019	2.00
140	140.00014	140.0000	0.0001	0.00020	2.00
150	150.00009	150.0001	0.0000	0.00020	2.00
160	160.00010	160.0001	0.0000	0.00022	2.00
170	170.00012	170.0001	0.0000	0.00023	2.00
200	200.00016	200.0002	0.0000	0.00028	2.00

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

----- End -----

F-CS-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. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 24TM589
Page : 1 of 3

Certificate of Calibration

Equipment : Hot Air Oven
Manufacturer : Memmert
Model : UF 55
Serial No. : B212.0411
ID No. : UAE.WAO.005/2556
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Lab Floor 2
Received Order : 01 April 2024
Calibration Date : 01 - 02 April 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Krisda Malee

Approved by : 
() Ponpan Paipim
(✓) Suwit Imjai
() Kunchit Promprat

Issue Date : 5 April 2024

The Uncertainties are for a confidence probability of approximately 95 %

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

เอกสารนี้ควบคุม
A 0065065



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2404-0004OC-3

Cert. No.: 24TM589
Page : 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 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	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024

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

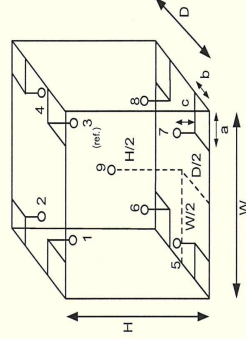
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	26
REL.Humid. (%)	47	48
AC Supply (Volt)	221	220



Ref. Std. ID No.: @ Calibration Point	
Position :	(120 to 180) °C (104) °C
1	21-18TC-01 22-18RTD-2/1
2	21-18TC-02 18RTD-2/2
3	21-18TC-03 18RTD-2/3
4	21-18TC-04 18RTD-2/4
5	21-18TC-05 18RTD-2/5
6	21-18TC-06 18RTD-2/6
7	21-18TC-07 18RTD-2/7
8	21-18TC-08 18RTD-2/8
9 (ref.)	21-18TC-09 18RTD-2/9

Probe Installation Details : Dimension of Chamber :
a = 5.0 cm D = 0.50 m
b = 5.0 cm W = 0.80 m
c = 5.0 cm H = 0.75 m
Capacity = 0.30 m³

เอกสารนี้ควบคุม
a 1209739



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2404-0004OC-3
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 24TM589
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
104.0	104.0	104.0	0.032	0.47	0.84	2
120.0	120.0	120.0	0.12	0.72	1.3	2
180.0	180.0	180.0	0.13	1.2	1.5	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	104.464	103.847	104.226	104.232	104.106	103.691	104.275	104.127	104.013	0.42
120.0	120.486	120.089	120.635	120.596	119.531	119.644	120.364	120.144	120.158	1.1
180.0	180.574	179.769	180.285	180.870	179.594	179.790	180.287	179.961	179.802	1.1

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

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

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

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

UUC* : Unit Under Calibration

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

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

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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TEL.0-2717-3000-29 FAX.0-2719-9484



NSC-TS17817025
CALIBRATION 0008

Certificate of Calibration

Cert.No.: 24MM293
Page.: 1 of 3

Equipment : Electronic Balance

Manufacturer : Mettler Toledo

Model : XSR204

Serial No. : C117635043

ID No. : UAE.WAS.012/2564

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

Location : Balance Room (108)

Received order : 11 May 2024

Calibration Date : 11 May 2024

Ambient Temperature : 15 °C to 40 °C

Relative Humidity : 30 % to 90 %

Calibrated by : Khit Ruttanaprapachai

Approved by :

Approved Signatory

() Ponpan Paipim

() Suwit Imjai

(✓) Kunchit Promprat

Issue Date :

15 May 2024

The Uncertainties are for a confidence probability of approximately 95%

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เอกสารไม่ควบคุม
a 1209738

เอกสารไม่ควบคุม



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2405-0166OC-2
Procedure used :-

Calibration were conducted using in-house calibration procedure CP-OB01 based on UKAS LAB 14 according to direct measurement method against standard weight.

Condition of this result of calibration

1. Reference standard instruments:-

- | Instruments | Model | Serial No. | ID No. | Test report No. | Due date |
|-----------------------------|-------|------------|---------|-----------------|-------------|
| 1) Standard Weight Set (E2) | 15884 | 24053 | 70RC007 | MM-0013-24 | 25 Jan 2026 |
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This result of calibration was made on requested at the point specified by customer.
4. This certificate is not certified for any commercial transaction.
5. This certification is traceable to the International System of Unit.

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

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

Before Adjustment :

Applied Weight (g)	Balance		Measurement Uncertainty (± mg)	Coverage Factor (k)
	Reading (g)	Correction (g)		
100	100.0000	0.0000	0.27	2.03
200	200.0001	-0.0001	0.31	2

After Adjustment :

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

Applied Weight (g)	Standard Deviation of Reading (g)
100	0.00007
200	0.00007



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2405-0166OC-2

Result of calibration

2. Effect of off center loading

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

Position 1 (g)	Position 2 (g)	Position 3 (g)	Position 4 (g)	Position 5 (g)
+0.0002	-0.0001	0.0000	+0.0002	0.0000

3. Departure from nominal value

Applied Weight (g)	Balance		Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
	Reading (g)	Balance Reading (g)			
Unload	0.0000	0.0000	0.0000	0.15	2.13
1	1.0000	1.0000	0.0000	0.15	2.13
5	5.0000	5.0000	0.0000	0.15	2.13
10	10.0000	10.0000	0.0000	0.15	2.11
20	20.0000	20.0000	-0.0000	0.19	2.03
50	50.0001	50.0001	-0.0001	0.19	2.06
60	60.0001	60.0001	-0.0001	0.19	2.04
80	80.0001	80.0001	-0.0001	0.27	2
100	100.0002	100.0002	-0.0002	0.27	2.03
120	120.0001	120.0001	-0.0001	0.29	2
200	200.0001	200.0001	-0.0001	0.31	2

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 (THAI AND JAPAN)
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TEL. 0-2717-3000-29 FAX. 0-2719-9484



NSCT-B18-7187025
CALIBRATION 0008

Cert. No.: 24TM303
Page : 1 of 3

Certificate of Calibration

Equipment : BOD Incubator
Manufacturer : Arco
Model : UC4-1320
Serial No. : 13URC4S013201
ID No. : UAE.WAO.015/2561
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Lab Floor 2
Received Order : 10 February 2024
Calibration Date : 10 February 2024
Ambient Temperature : (28 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Tawatchai Pama

Approved by :  Approved Signatory

() Porphippa Tameyakul
(✓) Unnophol Harachai
() Suwit Inrijai

Issue Date : 19 February 2024

The Uncertainties are for a confidence probability of approximately 95 %

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

เอกสารไม่ควบคุม



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2402-0234OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 24TM303

Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k	Measured Temperature (°C)									Uncertainty (± °C)
							Position									
							1	2	3	4	5	6	7	8	9 (ref.)	
20.0	19.873	19.803	20.322	19.690	19.615	19.585	19.612	19.558	19.645	0.58						

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



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2402-0234OC-1
Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 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

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY59003411	23LM208	TPA	27 Dec 2024

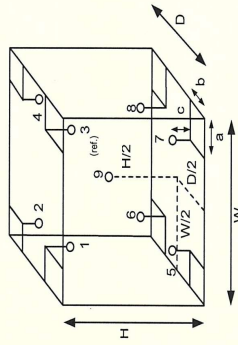
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source
Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	31
REL.Humid. (%)	70	65
AC Supply (Volt)	233	234



Probe Installation Details :

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

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



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 24TM587
Page : 1 of 3

Certificate of Calibration

Equipment : BOD Incubator
Manufacturer : ARCO
Model : UR-1320
Serial No. : -
ID No. : UAE.WAO.018/2551
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Lab Floor 2
Received Order : 01 April 2024
Calibration Date : 01 April 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Krisda Malee
Approved by : [Signature]
Approved Signatory

Issue Date : 5 April 2024

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

เอกสารไม่ควบคุม
A 0065063



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2404-0004OC-1

Cert. No.: 24TM587
Page : 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 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 **Serial No.** **Cert. No.** **Traceable** **Due Date**
1) Data Acquisition MY57013711 23LM115 TPA 11 Jul 2024

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

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

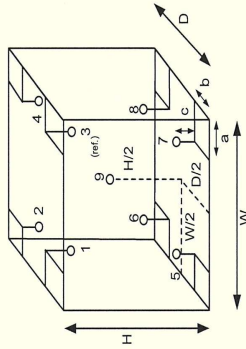
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Environment during calibration	
Temp. (°C)	Beginning Finished
REL Humid. (%)	27 26
AC Supply (Volt)	48 49
	221 220



Probe Installation Details :

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

Dimension of Chamber :

D =	0.62	m
W =	1.2	m
H =	1.2	m

Capacity = 0.89 m³

Position :	Ref. Std. ID No.:
1	18-18RTD-01
2	18-18RTD-02
3	18-18RTD-03
4	18-18RTD-04
5	18-18RTD-05
6	23-18RTD-06
7	18-18RTD-07
8	22-18RTD-08
9 (ref.)	18-18RTD-09



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2404-0004OC-1

Cert. No.: 24TM587
Page : 3 of 3

Result of Calibration :-

Function of UUC* : Temperature Source
Not Available

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
20.0	20.0	20.0	0.45	0.55	1.3	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	19.954	20.183	20.235	19.707	19.706	19.739	19.785	19.821	19.828	0.66

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

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

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

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

UUC* : Unit Under Calibration

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

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

-000-

เอกสารแนบควบคุม
a 1209743

เอกสารแนบควบคุม
a 1209742



Hanna Instruments (Thailand) Ltd.
410/67-68 Soi Ratchadapisek 24, Ratchadapisek Rd., Samsen-nok,
Huykwang, Bangkok 10310 Tel: 0-2541-4199 Fax: 0-2541-4198



AC-3061

Certificate No. : HIT-2412-0389

Page : 1 of 2

CERTIFICATE OF CALIBRATION

Equipment : COD Test Tube Heater
Meter Model : HI839800-02
Tube Heater : 25 Vial Capacity
Temperature Range : (-10 to 160) °C
Manufacturer : Hanna Instruments
Condition As-Received : Used Product
Ambient Temperature : (25 ± 2) °C
Customer name : United Analyst and Engineering Consultant Co., Ltd.
Serial No. : H0185001
Resolution : 0.1 °C
Temperature of Reaction : 150 °C
Made in : Romania
Reference : RE240478
Relative Humidity : (50 ± 15)%RH

Received date : 18 March 2024
Calibrate date : 18 March 2024
Issue date : 20 March 2024
Calibrated Location : Hanna Instruments (Thailand) Ltd.
Calibration Procedure : This calibrator was conducted by using in-house: calibration procedure CP-04 by using certified reference standard instruments.

Calibrated by : ☒ Mr. Pichit Pethong
☐ Mr. Channarong Soimak
Approved by : 
Mr. Anan Suwanchaisakul
Authorized Signatory



This certificate was certified only for the instrument we calibrated.
This result of calibration was found accurate on date and place of calibration only.
** This certificate may not be reproduced other than in full, except with the prior written **
approval of the head of Hanna Instrument (Thailand) **เอกสารไม่ควบคุม**



Certificate No. : HIT-2412-0389
Page : 2 of 2

Condition of this calibration result:

Reference Standard Instruments : This certification is traceable to the international unit of unit maintained through:

Instruments	Model	Serial No.	Certificate No.	Traceable
Data Acquisition Switch Unit	34970A	MY44065265	WK2307-164-1	WK Electric Co., Ltd.
Digital Thermo-Hygrometer	HT-771SD	AL07155	24H41	Technology Promotion Association (Thailand-Japan).

Calibration Result:

Measurement Temperature Source Accuracy for COD Reactor.

Capacity (Vial)	Nominal Value (°C)	Average Value (°C)	Uncertainty of Measurement (± °C)
25 Vial	150.0	150.0	0.50

Unit : °C

(1A) 150.308	(2A) 150.221	(3A) 150.101	(4A) 150.121	(5A) 149.738
(1B) 150.011	(2B) 149.395	(3B) 150.792	(4B) 149.934	(5B) 150.178
(1C) 150.071	(2C) 150.052	(3C) 150.477	(4C) 150.400	(5C) 150.451
(1D) 149.235	(2D) 149.601	(3D) 149.411	(4D) 150.014	(5D) 149.708
(1E) 150.096	(2E) 149.107	(3E) 150.024	(4E) 150.002	(5E) 149.342

Figure: Shows the location of the temperature source.


The report uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%

** End of certificate **

เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

Equipment : COD Test Tube Heater
Meter Model : HI839800-02
Tube Heater : 25 Vial Capacity
Temperature Range : (-10 to 160) °C
Manufacturer : Hanna Instruments
Condition As-Received : Used Product
Ambient Temperature : (25 ± 2) °C
Customer name : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Rd., Bangchak,
Phrakhanong, Bangkok 10260
Received date : 22 April 2024
Calibrate date : 23 April 2024
Issue date : 25 April 2024
Calibrated Location : Hanna Instruments (Thailand) Ltd.
Calibration Procedure : This calibrator was conducted by using in-house: calibration procedure CP-04 by using certified reference standard instruments.

Calibrated by : ☒ Mr. Pichit Peithong
☐ Mr. Channarong Soinak
Approved by : 
Mr. Anan Suwanchaisakul
Authorized Signatory



This certificate was certified only for the instrument we calibrated.

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

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

approval of the head of Hanna Instrument (Thailand).

เอกสารนี้ควบคุม

Condition of this calibration result:

Reference Standard Instruments : This certification is traceable to the international unit of unit maintained through:

Instruments	Model	Serial No.	Certificate No.	Traceable
Data Acquisition Switch Unit	34970A	MY44065265	WK2307-164-1	WK Electric Co., Ltd.
Digital Thermo-Hygrometer	HT-771SD	AI07155	24H41	Technology Promotion Association (Thailand-Japan).

Calibration Result:

Measurement Temperature Source Accuracy for COD Reactor.

Capacity (Vial)	Nominal Value (°C)	Average Value (°C)	Uncertainty of Measurement (± °C)
25 Vial	150.0	149.8	0.49

Unit : °C

(1A)	(2A)	(3A)	(4A)	(5A)
148.901	149.249	149.950	150.042	149.186
(1B)	(2B)	(3B)	(4B)	(5B)
149.724	149.578	149.852	150.100	150.117
(1C)	(2C)	(3C)	(4C)	(5C)
149.863	149.799	150.233	149.847	149.977
(1D)	(2D)	(3D)	(4D)	(5D)
149.550	149.666	149.958	149.744	149.819
(1E)	(2E)	(3E)	(4E)	(5E)
150.044	149.869	149.361	149.973	149.654

Figure: Shows the location of the temperature source.

The report uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%

** End of certificate **

เอกสารนี้ควบคุม

CERTIFICATE OF CALIBRATION

Certificate No. : SP24-018

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

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

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Agilent Technologies

Model : Cary 60

Serial No. : MY15410009

ID No. : UAE.WAT.020/2558

Received Date : 7 May 2024

Calibration Date : 7 May 2024

Issue Date : 9 May 2024

Condition Instrument : Good

Calibrated by :

(Mr.Tanawut Ritfidach)
Technical Manager

Approved by :

(Ms. Chonthicha Sangnern)
Quality Manager

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

The measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the DQE Services Co., Ltd.

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. : SP24-018

Environment Condition : Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 20 %RH

Calibration method : In-house method CP-01 Based on ASTM E275-08

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	115663	25 October 2025
Absorbance Standard set	25757	115638	25 October 2025
Wavelength Standard set	25806	115657	25 October 2025
Wavelength Standard set	25758	115665	25 October 2025

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

Institute of Standards and Technology (NIST) through Starna Scientific Limited

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 60 nm/min

Scan Interval of UUC : 0.15 nm.

Resolution of UUC : Photometric 0.0001 Abs.

Wavelength 0.1 nm.

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. : SP24-018

Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>
420	0.0000	0.0000	0.0000	0.0028	2.00
	0.5780	0.5747	0.0033	0.0031	2.00
	1.0484	1.0438	0.0046	0.0029	2.00
440	2.1876	2.1832	0.0044	0.0080	2.00
	0.0000	0.0000	0.0000	0.0028	2.00
	0.5595	0.5581	0.0014	0.0034	2.00
465	1.0239	1.0231	0.0008	0.0035	2.00
	2.1230	2.1219	0.0011	0.0080	2.00
	0.0000	0.0000	0.0000	0.0028	2.00
546.1	0.5230	0.5184	0.0046	0.0030	2.00
	0.9633	0.9614	0.0019	0.0029	2.00
	1.9753	1.9731	0.0022	0.0070	2.00
590	0.0000	0.0000	0.0000	0.0028	2.00
	0.5181	0.5150	0.0031	0.0031	2.00
	1.0002	0.9964	0.0038	0.0033	2.00
635	1.9973	1.9914	0.0059	0.0088	2.00
	0.0000	0.0000	0.0000	0.0028	2.00
	0.5517	0.5485	0.0032	0.0030	2.00
635	1.0803	1.0772	0.0031	0.0030	2.00
	2.0373	2.0293	0.0080	0.0080	2.00
	0.0000	0.0000	0.0000	0.0028	2.00
635	0.5591	0.5565	0.0026	0.0031	2.00
	1.0518	1.0482	0.0036	0.0030	2.00
	1.9274	1.9202	0.0072	0.0079	2.00

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. : SP24-018

Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>
235	0.0000	0.0000	0.0000	0.0050	2.00
	0.7469	0.7435	0.0034	0.0057	2.00
257	0.0000	0.0000	0.0000	0.0050	2.00
	0.8674	0.8639	0.0035	0.0060	2.00
313	0.0000	0.0000	0.0000	0.0050	2.00
	0.2919	0.2907	0.0012	0.0051	2.00
350	0.0000	0.0000	0.0000	0.0050	2.00
	0.6430	0.6402	0.0028	0.0055	2.00

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. : SP24-018

Wavelength Accuracy :

Page 5 of 5

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	242.0	-0.28	0.18	2.00
279.45	279.5	-0.05	0.18	2.00
287.81	287.9	-0.09	0.18	2.00
334.06	333.9	0.16	0.18	2.00
360.93	360.5	0.43	0.18	2.00
418.59	418.1	0.49	0.18	2.00
445.94	445.6	0.34	0.18	2.00
453.66	453.3	0.36	0.18	2.00
460.02	459.8	0.22	0.18	2.00
536.59	536.0	0.59	0.18	2.00
637.98	638.7	-0.72	0.18	2.00
431.38	430.8	0.58	0.18	2.00
472.50	472.4	0.10	0.18	2.00
513.47	513.7	-0.23	0.18	2.00
528.88	529.1	-0.22	0.18	2.00
573.17	573.5	-0.33	0.18	2.00
585.35	585.2	0.15	0.20	2.00
684.40	685.1	-0.70	0.18	2.00
740.72	741.4	-0.68	0.20	2.00
748.55	749.1	-0.55	0.18	2.00
807.03	807.3	-0.27	0.18	2.00
879.28	879.3	-0.02	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available
- The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k, which for a normal distribution corresponds to a coverage probability of approximately 95%
- * Indicates non TISI accredited

- End of Certificate -

เอกสารไม่ควบคุม
FM-708-02 R01 1/11/2021

CERTIFICATE OF CALIBRATION

Certificate No. : SP24-008

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

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

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-1900

Serial No. : 2021-064

ID No. : UAE.WAS.006/2552

Received Date : 16 January 2024

Calibration Date : 16 January 2024

Issue Date : 19 January 2024

Condition Instrument : Good

Calibrated by :

(Mr.TanaWut Ritfidach)
Technical Manager

Approved by :

(Ms. Chonthicha Sangngern)
Quality Manager

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

The measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the DQE Services Co., Ltd.

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

REPORT OF CALIBRATION

Certificate No. : SP24-008

Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 20 %RH

Calibration method : In-house method CP-01 Based on ASTM E275-08

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	115663	25 October 2025
Absorbance Standard set	25757	115638	25 October 2025
Wavelength Standard set	25806	115657	25 October 2025
Wavelength Standard set	25758	115665	25 October 2025

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

Institute of Standards and Technology (NIST) through Starna Scientific Limited

Spectral Band Width of UUC : 4.0 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. : SP24-008

Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5780	0.575	0.0030	0.0031	2.00
	1.0484	1.046	0.0024	0.0029	2.00
	2.1876	2.186	0.0016	0.0080	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.558	0.0015	0.0034	2.00
	1.0239	1.024	-0.0001	0.0035	2.00
	2.1230	2.121	0.0020	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5230	0.520	0.0030	0.0030	2.00
	0.9633	0.961	0.0023	0.0029	2.00
	1.9753	1.975	0.0003	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.516	0.0021	0.0031	2.00
	1.0002	0.999	0.0012	0.0033	2.00
	1.9973	1.994	0.0033	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.550	0.0017	0.0030	2.00
	1.0803	1.080	0.0003	0.0030	2.00
	2.0373	2.032	0.0053	0.0080	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.558	0.0011	0.0031	2.00
	1.0518	1.051	0.0008	0.0030	2.00
	1.9274	1.923	0.0044	0.0079	2.00

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. : SP24-008

Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7469	0.748	-0.0011	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8674	0.865	0.0024	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2919	0.293	-0.0011	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6430	0.641	0.0020	0.0055	2.00

REPORT OF CALIBRATION

Certificate No. : SP24-008

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.54	241.1	0.44	0.18	2.00
279.40	278.9	0.50	0.18	2.00
288.70	288.0	0.70	0.18	2.00
334.22	333.8	0.42	0.18	2.00
361.26	360.8	0.46	0.18	2.00
418.48	418.2	0.28	0.18	2.00
446.70	446.0	0.70	0.18	2.00
453.20	453.1	0.10	0.18	2.00
460.06	459.6	0.46	0.18	2.00
536.90	536.4	0.50	0.18	2.00
637.94	637.6	0.34	0.18	2.00
440.74	440.1	0.64	0.18	2.00
472.22	472.0	0.22	0.18	2.00
513.70	513.5	0.20	0.18	2.00
528.72	528.2	0.52	0.18	2.00
574.60	574.3	0.30	0.18	2.00
585.48	585.0	0.48	0.20	2.00
684.63	684.2	0.43	0.18	2.00
740.27	740.0	0.27	0.20	2.00
748.28	747.8	0.48	0.18	2.00
807.16	806.8	0.36	0.18	2.00
879.70	879.2	0.50	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

- The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k .

which for a normal distribution corresponds to a coverage probability of approximately 95%

- * Indicates non TISI accredited

- End of Certificate -

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021