

ภาคผนวก ง
เอกสารสอบเทียบเครื่องมือ



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)	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)	ของแข็งละลายน้ำทั้งหมด (TDS)	Mettler-Toledo	XSR205DU / C210685394	National Food Institute, Ministry of Industry, Thailand	2402283-002-01	2 Apr 24	1 Apr 25	-
6	Hot Air Oven	น้ำมันและไขมัน (Oil & Grease)	Memmert	UF55 / B212.0411	Technology Promotion Association (Thailand-Japan)	24TM589	1 Apr 24	31 Mar 25	-
7	Analytical Balance (Readability 0.1 mg)		Mettler-Toledo	XSR204 / C117635043	Technology Promotion Association (Thailand-Japan)	24MM293	11 May 24	10 May 25	-
8	BOD Incubator	บีโอดี (BOD)	Arco	UC4-1320 / (UAE.WAO.015/2551)	Technology Promotion Association (Thailand-Japan)	24TM303	10 Feb 24	8 Feb 25	-
9	BOD Incubator		Arco	UR-1320 / (UAE.WAO.018/2551)	Technology Promotion Association (Thailand-Japan)	24TM587	1 Apr 24	31 Mar 25	-
10	COD Reactor (Heating Block)	ซีโอดี (COD)	Hanna	HI839800-02 / H0185001	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 / 21E22-009	DOE Services Co.,Ltd.	SP25-001	3 Jan 25	2 Jan 26	-

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

Calibration Certificate

Certificate No.: 2401718-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhong, Bangkok 10260

Page 1 of 5

Equipment: pH Meter
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210
ID No.: UAE.WAT.010/2553
Order No.: 2401718
Operation No.: 2401718-001
Date of Receipt: 27 February 2024
Date of Calibration: 11 March 2024

Calibrated by Mr.Manas Somsak
Specialist
Date of issue: 12 March 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: 20-04-55

Calibration Report

Certificate No.: 2401718-001-01
Equipment: pH Meter
Manufacturer: METTLER TOLEDO
Serial No.: 1231155210
ID No.: UAE.WAT.010/2553
Resolution: 0.01 pH : 1 mV
Model: SevenEasy pH
Type: Bench top

Page 2 of 5

Date of Calibration: 11 March 2024
Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature: (23.4 ± 1.5) °C
Condition of Equipment: Good Condition
Condition of this Results of Calibration
1. Calibration Method: W-CC-002. In house method based on direct measurement by using standard voltage calibrator and certified reference material (CRM)
2. Reference Standards / Certified Reference Material

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2709007	Fluke	23E2003	14 June 2024
2.2 Digital Thermometer	2709007	Fluke	CC 660570-01	30 October 2024
2.3 Thermo-Hygro Meter	NFI.BTH.014/23	Iesto	CC 660353-01	3 April 2024
Certified Reference Material	Lot No.	Manufacturer	Ref. N	Expiry Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	888842	CPAchem	PH216.L5	13 April 2025
2.5 pH buffer 6.865 (Primary pH buffer Solution)	888843	CPAchem	PH217.L5	13 April 2025
2.6 pH buffer 10.01 (Primary pH buffer Solution)	888844	CPAchem	PH220.L5	13 April 2024
2.7 pH buffer 7.00 (Standard pH buffer Solution)	C03109	HACH LANGE GmbH	S11M004	16 October 2025

3. This certification is traceable to The International System of Unit (SI Unit)
3.1 Instruments No.2.1 through
3.2 Instruments No.2.2 and 2.3 traceable to
3.3 Certified Reference Material No.2.4 to 2.6 traceable to
3.4 Certified Reference Material No.2.7 traceable to
NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0008
NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0081
Primary measurement method- Handred cell using calibrated thermometer, barometer, and nanovoltmeter The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
PTB Certificate No. PTB-PhOA-5633050423 and Certificate No. PTB-PH05-5553062022 (PTB: Physikalisch-Technische Bundesanstalt, Braunschweig, Germany)

4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only

F-CS-012 Revision: 01 Date: 20-04-55

Calibration Report

Certificate No.:

2401718-001-01

Equipment:

Digital Thermometer with RTD (pH Meter)

Resolution:

0.1 °C Model: SevenEasy pH

Serial No.:

123155210 ID No.: UAE.WAT.010/2553

Manufacturer:

METTLER TOLEDO

Date of Calibration:

11 March 2024

Page 5 of 5

Calibration point:

15.0, 25.0 and 35.0 °C

Calibration result:

- The probe was immersed in liquid bath or dry bath to a minimum depth of 100 mm.

- Description of probe, model:

N/A N/A SN: N/A

Dimension of probe Diameter 4 mm, Length 120 mm,

Sheath material: Stainless Steel

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.1	14.998	0.1	0.099
25.1	24.998	0.1	0.099
35.1	34.997	0.1	0.099

Note

- UUC*: Unit Under Calibration

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

***** End *****

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

Equipment:

pH METER

Model:

SevenEasy

Serial No. (or ID.):

1230525212 (UAE.WAS.003/2553)

Manufacturer:

METTLER TOLEDO

Electrode Serial No.:

1156883

Condition:

In Condition

Customer:

United Analyst and Engineering Consultant Company Limited

3 Soi Udomsuk 41 Sukhumvit Road,

Bangkok, 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, Bangkok,

Phrakhanong, Bangkok 10260 Thailand

Calibration By:

Miss.Orawan Khlaiphloi

Calibration Date:

9 April 2024

The Method used:

In house method, CAL-WI-58, base on ASTM E 70-07

Traceability:

This certificate is traceable to SI Units, Sample Test is assured through primary measurement method Harned cell, through CPASchem Ltd. (ISO/IEC 17034) Certificate No. 938377, 931985, 931984 And pH Scale traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through Industrial Foundation Electrical and Electronics Institute Certificate No. CA20230350EA

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.

Calibration Results:

pH Scale

Input	pH Meter Reading			Uncertainty of Measurement (mV)	Coverage Factor (k)
	(mV)	(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 9.987

-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. Nateekarn Mitjit
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



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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บริษัท ดีเคเอส อีที จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2539 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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



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

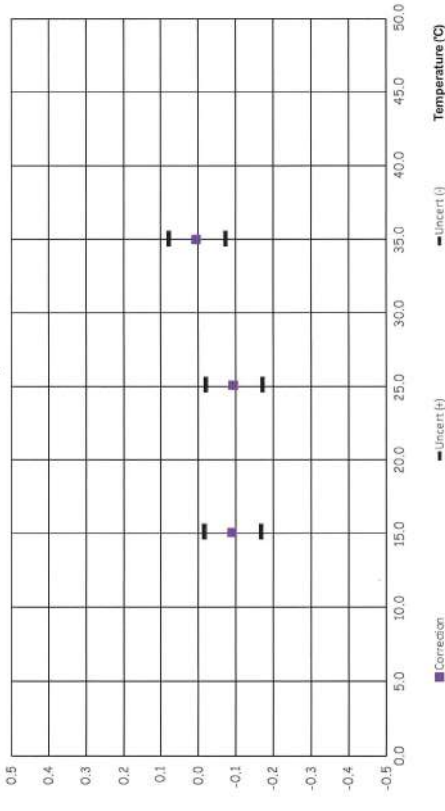
บริษัท ดีเคเอส อีที จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2539 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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



C15240373
Without Adjustment



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เอกสารไม่ควบคุม



Certificate of Calibration

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

Certificate No.: C24230059
Issued Date: 16 March 2023
Job No.: KSPR2304472
Page: 1 of 2
Model : LF413T
Brand : SI Analytics

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

Calibration By: Mr.Atachai Ngamchanat
Calibration Date: 16 March 2023
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. 838312, 838313, 838316

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
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CAL-FW-C24-08: 12 Sep 2022



Certificate No.: C24230059

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Calibration Results:

Before Adjustment

Standard	Unit Under Calibration	Correction	Coverage Factor	Uncertainty (±)
Conductivity Solution	Reading			
25.000 µS/cm	24.5 µS/cm	0.500 µS/cm	2.00	0.21 µS/cm
1413.0 µS/cm	1403 µS/cm	10.0 µS/cm	2.00	9.0 µS/cm
111.3 mS/cm	108.5 mS/cm	2.80 mS/cm	2.00	0.67 mS/cm

After Adjustment ; at 1413 µS/cm

Standard	Unit Under Calibration	Correction	Coverage Factor	Uncertainty (±)
Conductivity Solution	Reading			
25.000 µS/cm	24.8 µS/cm	0.200 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	108.8 mS/cm	2.50 mS/cm	2.00	0.67 mS/cm

The End of Certificate

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2333 Sukhumvit Road, Bangkok, Phrahanon, Bangkok 10260
Phone: +66 2039 7000 Email: info.calibration@dksh.com Website: www.dksh.com/identify-thailand

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CAL-FW-C24-08: 12 Sep 2022



ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: KSPR2304472

ชนิดเครื่องมือ: CONDUCTIVITY METER รุ่น: Lab 955

หมายเลขเครื่อง: 16300356

ตรวจสอบ (รับ)	รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
		16 Mar 2023	16 Mar 2023	
ปกติ	ปกติ	ปกติ	ปกติ	
General				
<input checked="" type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	3. สวิตช์ ปิด - เปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Spectrophotometer				
<input checked="" type="checkbox"/>	6. แรงดันไฟฟ้า (Battery Backup) ≥ 2.5 VDC	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	7. ความแม่นยำความยาวคลื่น (Wavelength Control)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	9. แหล่งกำเนิดแสง (UV $< 3,000$ hour)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible $< 5,000$ hour)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	11. ช่องวัดหลายตัวอย่าง (Carousel Module)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
pH Meter and Conductivity Meter				
<input checked="" type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	14. ฟังก์ชันป้องกัน Electrode (Dust Protection Hood)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	15. ขาจับอิเล็กโทรด (Stand)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Turbidimeter				
<input checked="" type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	17. ระดับการส่องสว่างของแสง (≥ 2.5 ไม่นเกิน 3.0)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Automatic titrator				
<input checked="" type="checkbox"/>	18. สภาพ Piston Burettes	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	19. Function Rinsing and Dosing	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	

ข้อแนะนำ : Electrode วัดอุณหภูมิได้ 25.1°C โดย Control Waterbath ที่ 25.0 \pm 0.1°C

Mr.Atachai Ngamchanat

Service Engineer

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
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Phone: +66 2039 7000 Email: info.calibration@dksh.com Website: www.dksh.com/identify-thailand

เอกสารไม่ควบคุม

CAL-FW-R31-03: 20 Jul 2022

Delivering Growth - In Asia and Beyond.

Calibration Certificate

Certificate No.: 2402283-002-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 SOI UDOMSUK 41, SUKHUMVIT ROAD,
 Bangchack, Prakanong, 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. Jerawat Papawuttipong**
Scientist
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



36008 โทรสาร ๐๖-๒๖๖๖๖๖๖ 36 นวนครนิคมสงขลา กรุงเทพมหานคร
36008 โซ 36, Arun Annam Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand.
(๖610) 2๕22 8688 Fax (๖610) 2๕22 8545

Calibration Report

Certificate No.: 2402283-002-01

Equipment: Electronic Balance

Model: XSR20SDU

Serial No.: C21068539

Capacity: 220 g

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 %

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	BS05567572	TCS	M23040535	8 April 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hanna Meter	506-H	NET RTH 0166/23	QualiVet Reborn	OR24-0343	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	0.000052
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.

A diagram of a triangular cell. Inside the triangle is a dashed circle. Within this dashed circle are five smaller circles, each containing a letter: 'a' at the top, 'b' in the center, 'c' at the bottom left, 'd' at the bottom right, and 'e' at the top right.

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

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



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2008 Sol 36, Anun Amarin Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel: +66(0) 2423 8688 Fax: +66(0) 2422 8545

Calibration Report

Certificate No.: 2402283-002-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR205DU

Resolution: 0.00001 g / 0.0001 g

Serial No.: C210685394

ID No.: UAE.WAO.010/2565

Capacity: 220 g

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
Unload	0.00000	0.00000	0.00000	0.0000086	2.00
0.001	0.001003	0.00101	-0.00001	0.0000089	2.00
0.005	0.005003	0.00500	0.00000	0.0000092	2.00
0.01	0.010003	0.01000	0.00000	0.0000089	2.00
0.05	0.049996	0.05000	0.00000	0.0000096	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	1.000033	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	20.00000	0.00003	0.000037	2.00
30	30.000040	30.00001	0.00003	0.000050	2.00
50	50.000028	50.00002	0.00001	0.000068	2.00
80	80.000068	80.00002	0.00005	0.00011	2.00

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

Calibration Report

Certificate No.: 2402283-002-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR205DU

Resolution: 0.00001 g / 0.0001 g

Serial No.: C210685394

ID No.: UAE.WAO.010/2565

Capacity: 220 g

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	90.0001	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
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TEL. 0-2717-3000-29 FAX. 0-2719-9484



Metro-MRA
CALIBRATION 0008
MSC-78175817028

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
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.

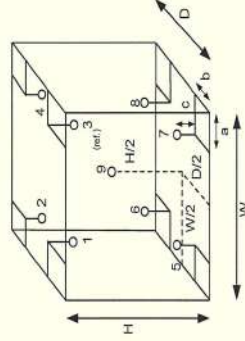
Remark : TPA : Technology Promotion Association (Thailand - Japan)

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



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

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

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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TEL.0-2717-3000-29 FAX.0-2719-9484



NSC-TS8-T817025
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 : Khitt Ruttanaprapachai

Approved by :

() 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

Cert.No.: 24MM293
Page: 2 of 3

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

After Adjustment :

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

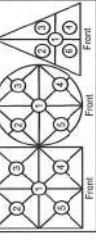
(n = 10)

1. Determination of the standard deviation of weighing machine



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

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



**Maximum difference between
off-center and central loading
(g)**
0.0003

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 Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
Unload	0.0000	0.0000	0.15	2.13
1	1.0000	0.0000	0.15	2.13
5	5.0000	0.0000	0.15	2.13
10	10.0000	0.0000	0.15	2.11
20	20.0000	-0.0000	0.19	2.03
50	50.0001	-0.0001	0.19	2.06
60	60.0001	-0.0001	0.19	2.04
80	80.0001	-0.0001	0.27	2
100	100.0002	-0.0002	0.27	2.03
120	120.0001	-0.0001	0.29	2
200	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 (THAILAND-JAPAN)
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TEL. 0-2717-3000-29 FAX. 0-2719-9484



NSC-TB-0787025
CALIBRATION 0048

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 :

() Pornthippa Tameyakul
(✓) Unnophol Harachai
() Suwit Injai

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 & 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	Uncertainty	
							9 (ref.)	(± °C)
20.0	20.1	19.9	0.37	0.72	1.4	2	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 %.

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

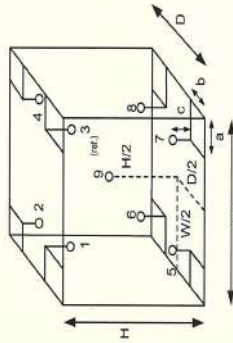
Remark : TPA : Technology Promotion Association (Thailand - Japan)

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 :

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

เอกสาร



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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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 :
() Ponpan Paipim
(✓) Suwit Injail
() 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 0065063

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,
Phraekhanong, Bangkok 10260

Serial No. : H018500I
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 **Approved by :** 
☐ Mr. Channarong Soimak

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



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



Certificate No. : HIT-2417-0568

Page : 1 of 2

CERTIFICATE OF CALIBRATION

Equipment : COD Test Tube Heater
Meter Model : HI839800-02 **Serial No. :** 1147807
Tube Heater : 25 Vial Capacity **Resolution :** 0.1 °C
Temperature Range : (-10 to 160) °C **Temperature of Reaction :** 150 °C
Manufacturer : Hanna Instruments **Made in :** Romania
Condition As-Received : Used Product **Reference :** RE240681
Ambient Temperature : (25 ± 2) °C **Relative Humidity :** (50 ± 15)%RH
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 Petthong

☐ Mr. Chamarong Soinak

Approved by :



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).

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Certificate No. : HIT-2417-0568
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	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)
149.350	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 **

เอกสารไม่ควบคุม



CERTIFICATE OF CALIBRATION

Certificate No. : SP24-018 **Page 1 of 5**

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

Address : 3 Soi Udomsuk 41, Sukhumvit Road, Banchak, 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

Approved by

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 recognised 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 2021

DQE Services Co.,Ltd.



32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230

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



REPORT OF CALIBRATION

Certificate No. : SP24-018 **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 Siama 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

Wavelength Accuracy :

Page 5 of 5

CRMs Values	UUC Reading	Correction	Uncertainty	Coverage factor
(nm.)	(nm.)	(nm.)	(nm.)	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 1/1/2021

CERTIFICATE OF CALIBRATION

Certificate No. : SP25-001

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

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

Location of calibration : Laboratory 213

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-2900

Serial No. : 21E22-009

ID No. : UAE.WAT.051/2564

Received Date : 3 January 2025

Calibration Date : 3 January 2025

Issue Date : 8 January 2025

Condition Instrument : Good

Calibrated by : [Redacted]

Approved by : [Redacted]

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 DQE Services Co., Ltd.

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FM-708-02 R01 1/1/2021

REPORT OF CALIBRATION

Certificate No. : SP25-001

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 : 1.5 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

REPORT OF CALIBRATION

Certificate No. : SP25-001

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	0.578	0.0000	0.0031	2.00
	1.0484	1.045	0.0034	0.0029	2.00
	2.1876	2.192	-0.0044	0.0075	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.560	-0.0005	0.0034	2.00
	1.0239	1.023	0.0009	0.0035	2.00
	2.1230	2.125	-0.0020	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5230	0.521	0.0020	0.0030	2.00
	0.9633	0.961	0.0023	0.0029	2.00
	1.9753	1.977	-0.0017	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.518	0.0001	0.0031	2.00
	1.0002	0.998	0.0022	0.0033	2.00
	1.9973	1.993	0.0043	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.552	-0.0003	0.0030	2.00
	1.0803	1.079	0.0013	0.0030	2.00
	2.0373	2.032	0.0053	0.0079	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.559	0.0001	0.0031	2.00
	1.0518	1.050	0.0018	0.0030	2.00
	1.9274	1.923	0.0044	0.0079	2.00

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

REPORT OF CALIBRATION

Certificate No. : SP25-001

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 0.7469	0.000 0.744	0.0000 0.0029	0.0050 0.0057	2.00 2.00
257	0.0000 0.8674	0.000 0.863	0.0000 0.0044	0.0050 0.0059	2.00 2.00
313	0.0000 0.2919	0.000 0.290	0.0000 0.0019	0.0050 0.0051	2.00 2.00
350	0.0000 0.6430	0.000 0.640	0.0000 0.0030	0.0050 0.0055	2.00 2.00

REPORT OF CALIBRATION

Certificate No. : SP25-001

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor <i>k</i>
241.72 279.45 287.81 334.06 360.93 418.59 445.94 453.66 460.02 536.59 637.98	241.1 279.0 287.3 333.8 360.6 418.2 445.5 453.4 459.8 536.6 637.7	0.62 0.45 0.51 0.26 0.33 0.39 0.44 0.26 0.22 -0.01 0.28	0.18 0.18 0.18 0.18 0.18 0.18 0.18 0.18 0.18 0.18 0.18	2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00
431.38 472.50 513.47 528.88 573.17 585.35 684.40 740.72 748.55 807.03 879.28	431.1 472.3 513.4 528.9 573.3 585.1 684.5 741.0 748.8 807.3 879.6	0.28 0.20 0.07 -0.02 -0.13 0.25 -0.10 -0.28 -0.25 -0.27 -0.32	0.18 0.18 0.18 0.18 0.18 0.20 0.18 0.20 0.18 0.18 0.18	2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00 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%

- End of Certificate -

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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 HA9M0047	Technology Promotion Association (Thailand-Japan)	24CH400	2 Apr 24	1 Apr 25	-
2	DO Meter	DO	Horiba	LAQUA-DO210 HE9M0048	Technology Promotion Association (Thailand-Japan)	24TW72	2 Apr 24	1 Apr 25	-
3	Salinity Meter	Salinity	YSI	Pro 30 26A104804	Technology Promotion Association (Thailand-Japan)	24CH822	10 Jul 24	9 Jul 25	-



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NSC-TIS-TIS7025
CALIBRATION 0008

Cert.No.: 24CH400
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 : 01 April 2024
Calibration Date : 02 April 2024
Reference : 2404-0037WSC-2
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260

Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with DC voltage standard and direct measurement with certified reference material (CRM)
- CP-CH8 by comparison with temperature standard

Calibrated by : Warakorn Lermagtrakul
Approved by : 

() Pornthippa Tameyakul
() Unnopphol Harachai
(✓) Salthip Meangmai
Issue Date : 06 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

A 0062140



Cert.No.: 24CH400
Page: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

Instrument

Serial No.	ID No.	Cert. No.	Due Date
54030049	130RC116	23E2802	27 Aug 2024
4982054	110RC044	23I908	26 July 2024

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

- Technology Promotion Association (Thailand-Japan)
- 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	940102	27 Nov 2025
pH 6.986	CPA chem	940104	02 Nov 2024
pH 9.997	CPA chem	940106	02 Nov 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 Document Process Calibrator 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.: HA9M0047	pH 4.00	177.48	177.3	4.01	0.058	2.00
	7.00	0.00	0.0	7.01	0.058	2.00
	10.00	-177.48	-177.4	10.01	0.058	2.00

a 1209883



Cert.No.: 24CH400
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	171.6	0.0079	2.00
S/N: -	6.986	6.99	-8.4	0.0099	2.00
	6.986	7.00	-9.6	0.011	2.00
	9.997	10.02	-173.8	0.0096	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : -
- Serial No. : -

Dimension of probe

- Length : 103 mm.

- Diameter : 16 mm.

- Immersion Depth : 90 mm.

Calibration Point ($^{\circ}\text{C}$)	Standard Temperature ($^{\circ}\text{C}$)	UUC* Reading ($^{\circ}\text{C}$)	Error ($^{\circ}\text{C}$)	Uncertainty of measurement (\pm $^{\circ}\text{C}$)	Coverage factor k
25.0	25.002	25.0	-0.002	0.13	2.00
30.0	30.002	30.0	-0.002	0.13	2.00
35.0	35.003	35.0	-0.003	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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Cert.No.: 24TW72
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : Horiba
Model : LAQUA-DO210
Serial No. : HE9M0048
ID No. : UAE.EFM.118/2563 (ENV.DO.07/63)
Received Date : 01 April 2024
Test Date : 02 April 2024
Reference : 2404-0035WSC-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) $^{\circ}\text{C}$

Humidity (50 ± 20) %

In - house method : CP-CH9

by Comparison Technique with Azide Modification Method

Test Procedure :

Tested by : Walalak Sirithean

Approved by :

() Unnophol Harachai

() Ponpan Papim

() Saithip Meangmai

Issue Date : 6 April 2024

เอกสารไม่ควบคุม

a 1209884

B 0338790



Cert.No.: 24TW72
Page.: 2 of 2

Condition of this result of calibration

1. 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	14233821	110RC001	23MM405	18 July 2024

2. 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.: 9K2B0030

Titration Method (Azide Modification Method)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.22	8.22	0.0045

This report was certified only for the instrument we tested. It is allowable to use for study. 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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NEC-TS-1517025
CALIBRATION 0008

Cert. No.: 24LM63
Page.: 1 of 2

Certificate of Calibration

Equipment : DO Meter with Sensor
Manufacturer : Horiba
Model : LAQUA-DO210
Serial No. : HE9M0048
ID No. : UAE.EFM.118/2563 (ENV.DO.0763)

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

Location : TPA On Site Calibration Laboratory

Received Order : 01 April 2024
Calibrated Date : 03 April 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V

Calibrated by : Warakorn Lernagatrakul

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

Issue Date : 7 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.

เอกสารไม่ควบคุม

a 1209895

A 0065095



Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2404-0035WSC-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	A52847	2311222	TPA	10 Oct 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 : Temperature measurement.

This instrument was connected with temperature sensor, S/N : 9K2B0030

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
25.0	80	25.004	25.0	-0.004	0.16	2.00
30.0	80	30.004	30.0	-0.004	0.16	2.00
35.0	80	35.003	35.0	-0.003	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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a 1209897



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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Certificate of Calibration

Cert.No.: 24CH822
Page.: 1 of 2

Equipment :	Salinity Meter
Manufacturer :	YSI
Model :	Pro 30
Serial No. :	26A104804
ID No. :	UAE.EFM.070/2566 (EFM.SCT.06/66)
Condition As-Received:	Used Item
Received Date :	09 July 2024
Calibration Date :	10 July 2024
Reference :	2407-0331WSC-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 :	(65 ± 15) %
Calibration Procedure:	In - house method : Direct measurement by using Sodium Chloride Solution
Calibrated by :	Walalak Sirinthean
Approved by :	Approved Signatory

() Unnoppol Harachai
() Ponpan Paipim
(✓) Sathip Meangmai

Issue Date : 16 July 2024

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Calibration and Testing Equipment Services.

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Cert.No.: 24CH822
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) Thermometer	9549224	130RC003	24I426	24 Apr 2025
2) Thermo-Hygrograph	1102794	130EC009	23H2522	07 Dec 2024
- Reference Standard Material :
 - Sodium chloride solution, solution, Eutech Instruments Pte Ltd., The measurement results are traceable to SI through ThermoFisher Scientific Water and Lab Products.
 - Calibrated Total Dissolved Solids solution temperature controlled by Water bath at $(25 \pm 0.1) ^\circ\text{C}$
 - Sodium chloride solution has been prepared dilution from

Material	Manufacturer	Lot No.	Exp. Date
25 ppt	Eutech	133/01	31 Mar 2026
- This certificate is valid only to the item calibrated on date and place of calibration.

Calibration results (*) Without Adjustment

Probe Serial No. : 23D100303

Standard NaCl Solution	UUC* Reading	Uncertainty of Measurement (\pm)
2.50 ppt	2.6 ppt	0.063 ppt
5.00 ppt	5.1 ppt	0.077 ppt
10.00 ppt	10.2 ppt	0.12 ppt

Remark: - UUC* = Unit Under Calibration
- ppt = ppt of NaCl
- ppt = Parts per Thousand

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

-o0o-

เอกสารไม่ควบคุม