

# ภาคผนวกที่ 4

## ผลการวิเคราะห์คุณภาพน้ำ

### 4.1 ผลตรวจวัดคุณภาพน้ำหลังบำบัดน้ำเสียแล้ว

#### จากบ่อบำบัดน้ำสุดท้ายของโครงการ

- ผลตรวจวัดคุณภาพน้ำหลังบำบัดน้ำเสียแล้วจากบ่อบำบัดน้ำสุดท้ายของโครงการ เมื่อเดือนสิงหาคม 2568
- ผลตรวจวัดคุณภาพน้ำหลังบำบัดน้ำเสียแล้วจากบ่อบำบัดน้ำสุดท้ายของโครงการ เมื่อเดือนตุลาคม 2568
- ผลตรวจวัดคุณภาพน้ำหลังบำบัดน้ำเสียแล้วจากบ่อบำบัดน้ำสุดท้ายของโครงการ เมื่อเดือนธันวาคม 2568

### 4.2 สำเนาต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการ

#### วิเคราะห์เอกชน

### 4.3 สำเนาของ Certificate of Calibrate ของเครื่องมือ

#### 4.1 ผลตรวจวัดคุณภาพน้ำหลังบำบัดน้ำเสียแล้ว

จากบ่อกักน้ำสุดท้ายของโครงการ

- ผลตรวจวัดคุณภาพน้ำหลังบำบัดน้ำเสียแล้วจาก

บ่อกักน้ำสุดท้ายของโครงการ เมื่อเดือนสิงหาคม 2568

- ผลตรวจวัดคุณภาพน้ำหลังบำบัดน้ำเสียแล้วจาก

บ่อกักน้ำสุดท้ายของโครงการ เมื่อเดือนตุลาคม 2568

- ผลตรวจวัดคุณภาพน้ำหลังบำบัดน้ำเสียแล้วจาก

บ่อกักน้ำสุดท้ายของโครงการ เมื่อเดือนธันวาคม 2568

No. 2312/68

## WASTE WATER ANALYSIS REPORT

Date : 13/8/68

Analysis Date : 5/8/68-11/8/68

Customer :

Sampling Date : 4/8/68

Address :

Sampling Time : 15.20

Received Date : 5/8/68

Tel : 032-531-470

Reference Number	WP/PK 4218/68			
Parameter	Unit	น้ำเสียนหลังบำบัด	มาตรฐาน อาคารประเภท ข.	Method of Analysis
Appearance		ขุ่นมีตะกอน		
pH		@ 25.7 °C = 6.9	5.5-9.0	Electrometric (SM 2023:4500-H <sup>+</sup> B.)
Biochemical Oxygen Demand	(mg/l)	97	≤ 30	5-Day BOD Test, Azide Modification (SM 2023:5210 B.)
Total Suspended Solids	(mg/l)	57	≤ 40	Dried at 103-105°C (SM 2023:2540 D.)
Total Dissolved Solids	(mg/l)	348	≤ 1000	Dried at 180°C (SM 2023:2540 C.)
Oil & Grease	(mg/l)	< 5.00	≤ 20	Soxhlet Extraction (SM 2023:5520 D.)
Total Kjeldahl Nitrogen	(mg/l)	34.46	≤ 35	Macro-Kjeldahl, Titrimetric (SM 2023:4500-N(org) B.)
Sulfide	(mg/l)	< 0.70	≤ 1.0	ZnS Precipitation, Iodometric (SM 2023:4500-S <sup>2-</sup> F.)
Settleable Solids	(ml/l)	< 0.5	-	Imhoff Cone, Volumetric (SM 2023:2540 F.)

SM : Standard Methods for the Examination of Water and Wastewater, APHA, AWWA, WEF, 24<sup>th</sup> Edition, 2023.

จุดเก็บ Ocean

- ❖ The results relate only to the samples tested and apply to customer's self-drawn samples only.
- ❖ This analysis report may not be reproduced other than in full, except with the prior written approval of the technical manager.

No. 3027/68

## WASTE WATER ANALYSIS REPORT

Date : 16/10/68

Analysis Date : 7/10/68-14/10/68

Customer :

Sampling Date : 6/10/68

Address :

Sampling Time : 11.50

Tel :

Received Date : 7/10/68

Reference Number	WP/PK 5535/68			
Parameter	Unit	น้ำเสียหลังบำบัด	มาตรฐาน อาคารประเภท ข.	Method of Analysis
Appearance		ขุ่น		
pH		@ 23.1 °C = 7.1	5.5-9.0	Electrometric (SM 2023.4500-H <sup>+</sup> B.)
Biochemical Oxygen Demand	(mg/l)	89	≤ 30	5-Day BOD Test, Azide Modification (SM 2023.5210 B.)
Total Suspended Solids	(mg/l)	28	≤ 40	Dried at 103-105°C (SM 2023.2540 D.)
Total Dissolved Solids	(mg/l)	300	≤ 1000	Dried at 180°C (SM 2023.2540 C.)
Oil & Grease	(mg/l)	< 5.00	≤ 20	Soxhlet Extraction (SM 2023.5520 D.)
Total Kjeldahl Nitrogen	(mg/l)	8.10	≤ 35	Macro-Kjeldahl, Titrimetric (SM 2023.4500-N(org) B.)
Sulfide	(mg/l)	< 0.70	≤ 1.0	ZnS Precipitation, Iodometric (SM 2023.4500-S <sup>2-</sup> F.)
Settleable Solids	(ml/l)	< 0.5	-	Imhoff Cone, Volumetric (SM 2023.2540 F.)

SM : Standard Methods for the Examination of Water and Wastewater, APHA, AWWA, WEF, 24<sup>th</sup> Edition, 2023.

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No. 3645/68

## WASTE WATER ANALYSIS REPORT

Date : 9/12/68

Customer :

Address :

Tel :

Analysis Date : 2/12/68-8/12/68

Sampling Date : 1/12/68

Sampling Time : 11.00

Received Date : 2/12/68

Reference Number	WP/PK 6677/68			
Parameter	Unit	น้ำเสียน้ำบ้าน	มาตรฐาน อาคารประเภท ข.	Method of Analysis
Appearance		ค่อนข้างขุ่น มีตะกอน		
pH		@ 23.4 °C = 6.8	5.5-9.0	Electrometric (SM 2023:4500-H <sup>+</sup> B.)
Biochemical Oxygen Demand	(mg/l)	145	≤ 30	5-Day BOD Test, Azide Modification (SM 2023:5210 B.)
Total Suspended Solids	(mg/l)	73	≤ 40	Dried at 103-105°C (SM 2023:2540 D.)
Total Dissolved Solids	(mg/l)	274	≤ 1000	Dried at 180°C (SM 2023:2540 C.)
Oil & Grease	(mg/l)	< 5.00	≤ 20	Soxhlet Extraction (SM 2023:5520 D.)
Total Kjeldahl Nitrogen	(mg/l)	18.94	≤ 35	Macro-Kjeldahl, Titrimetric (SM 2023:4500-N(org) B.)
Sulfide	(mg/l)	1.09	≤ 1.0	ZnS Precipitation, Iodometric (SM 2023:4500-S <sup>2-</sup> F.)
Settleable Solids	(ml/l)	< 0.5	-	Imhoff Cone, Volumetric (SM 2023:2540 F.)

SM : Standard Methods for the Examination of Water and Wastewater, APHA, AWWA, WEF, 24<sup>th</sup> Edition, 2023.

จุดเก็บ : โอเชียน

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## 4.2 สำเนาต่ออายุหนังสือรับขึ้นทะเบียน

ห้องปฏิบัติการวิเคราะห์เอกชน



ที่อก ๐๓๑๐(๑)/๔๑๑๒

๑๖ พฤษภาคม ๒๕๖๕

เรื่อง ขอดำเนินการขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
เรียน กรรมการผู้จัดการ บริษัท วิศวกรรมเคมี จำกัด  
อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารเคมีของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๑๑ มีนาคม ๒๕๖๕  
สิ่งที่ส่งมาด้วย เอกสารแนบท้ายหนังสือขอขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
บริษัท วิศวกรรมเคมี จำกัดจำนวน ๑ แผ่น

ตามคำขอที่อ้างถึง บริษัท วิศวกรรมเคมี จำกัด ขอดำเนินการขึ้นทะเบียนห้องปฏิบัติการ  
วิเคราะห์เอกชน เลขทะเบียน ๖-๐๐๑ สถานที่ตั้งเลขที่ ๑๐๔๔/๒ ซอยสุขุมวิท ๖๒/๑ ถนนสุขุมวิท แขวงพระโขนงใต้  
เขตพระโขนง กรุงเทพมหานคร ต่อกรมโรงงานอุตสาหกรรม นั้น  
กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้อำนาจวิศวกรรมการขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยไม่ต้องประกอบดังนี้

ห้องปฏิบัติการวิเคราะห์เอกชน โดยไม่ต้องประกอบดังนี้

ค. ขอบข่ายชนิดสารเคมีที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำ/น้ำเสีย ตามสิ่งที่ส่งมาด้วย  
หนังสือฉบับนี้จะสิ้นสุดในวันที่ ๘ เมษายน ๒๕๖๖ หากประสงค์จะต่ออายุหนังสือขึ้น  
ทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอต่อกรมโรงงานอุตสาหกรรม  
ภายใน ๖๐ วัน ก่อนวันสิ้นสุดของหนังสือขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

เอกสารแนบท้ายหนังสือขอขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
บริษัท วิศวกรรมเคมี จำกัด เลขทะเบียน ๖-๐๐๑  
ที่อก ๐๓๑๐(๑)/๔๑๑๒ ลงวันที่ ๑๖ พฤษภาคม ๒๕๖๕

ขอช่วยสามารถพิมพ์ที่ขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๒๐ รายการ  
น้ำ/น้ำเสีย จำนวน ๒๐ รายการ

ลำดับที่	สารเคมี	วิธีวิเคราะห์
1	Arsenic	Digestion, Inductively Coupled Plasma Method <sup>[2]</sup>
2	Barium	Digestion, Inductively Coupled Plasma Method <sup>[2]</sup>
3	Biochemical Oxygen Demand	5-Day BOD Test, Azide Modification Method <sup>[2]</sup>
4	Cadmium	Digestion, Inductively Coupled Plasma Method <sup>[2]</sup>
5	Chemical Oxygen Demand	1) Closed Reflux, Colorimetric Method <sup>[2]</sup> 2) Closed Reflux, Titrimetric Method <sup>[2]</sup>
6	Chromium	Digestion, Inductively Coupled Plasma Method <sup>[2]</sup>
7	Color	ADMI Weighted-Ordinate Spectrophotometric Method <sup>[2]</sup>
8	Copper	Digestion, Inductively Coupled Plasma Method <sup>[2]</sup>
9	Formaldehyde	Distillation, Colorimetric Method <sup>[1]</sup>
10	Lead	Digestion, Inductively Coupled Plasma Method <sup>[2]</sup>
11	Manganese	Digestion, Inductively Coupled Plasma Method <sup>[2]</sup>
12	Nickel	Digestion, Inductively Coupled Plasma Method <sup>[2]</sup>
13	Oil & Grease	Soxhlet Extraction Method <sup>[2]</sup>
14	pH	Electrometric Method <sup>[2]</sup>
15	Selenium	Digestion, Inductively Coupled Plasma Method <sup>[2]</sup>
16	Sulfide	Iodometric Method <sup>[2]</sup>
17	Total Dissolved Solids	Dried at 180 °C <sup>[2]</sup>
18	Total Kjeldahl Nitrogen	Macro Kjeldahl Method <sup>[2]</sup>
19	Total Suspended Solids	Dried form 103 to 105 °C <sup>[2]</sup>
20	Zinc	Digestion, Inductively Coupled Plasma Method <sup>[2]</sup>

เอกสารอ้างอิง

- สมาคมวิศวกรรมสิ่งแวดล้อมแห่งประเทศไทย. คู่มือวิเคราะห์น้ำเสีย. พิมพ์ครั้งที่ 4. กรุงเทพฯ: เรือนแก้วการพิมพ์, 2547.
- APHA, AWWA, WEF. Standard Methods for the Examination of Water and Wastewater. 24<sup>th</sup> ed. Washington, DC: APHA, 2023.

### 4.3 สำเนาของ Certificate of Calibrate ของเครื่องมือ





## Certificate of Calibration

**Equipment:** Balance  
**Model:** BSA224S-CW  
**Serial No. (or ID.):** 3137910058 (INS/LB-144)  
**Manufacturer:** Sartorius  
**Condition:** In condition

**Certificate No.:** C01242840  
**Issued Date:** 06 September 2024  
**Job No.:** WO-00040768  
**Page:** 1 of 2

**Customer:** THAI CHEMICAL & ENGINEERING CO., LTD.  
1048/2 Sukhumvit 66/1 Rd., Prakanong Tai,  
Prakanong, Bangkok 10260 Thailand

**Environment Condition:** Temperature 25 °C ± 0.5 °C  
Humidity 54 %RH ± 1.7 %RH

**Calibration Place:** THAI CHEMICAL & ENGINEERING CO., LTD. ( Laboratory )  
1048/2 Sukhumvit 66/1 Rd., Prakanong Tai,  
Prakanong, Bangkok 10260 Thailand

**Calibration By:** Mr. Chananyu Kongtiralphop  
**Calibration Date:** 04 September 2024  
**The Method used:** In-house method, CAL-WI-47, based on UKAS Lab 14  
**Traceability:** This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Co., Ltd. Certificate No. C02232254

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.

DKSH Technology Limited  
2533 Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260  
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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W.4.3-1

CAL-FM-C01-14: 12 Sep 2022



Certificate No.: C01242840

Page: 2 of 2

### Calibration Results: Without Adjustment

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

Nominal Test Value	Reference Points (g)				
	A	B	C	D	E
-	0.0001	-0.0001	0.0001	0.0001	-0.0001

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

Nominal test value (g)	Standard Deviation
20	0.00005
200	0.00007

**Error of Indication from nominal or conventional mass value., Readability** 0.0001 (g)

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Error of Indication (g)	Uncertainty (g)	k
0.05	0.05000	0.0500	0.0000	0.00012	2.07
1	1.00000	1.0000	0.0000	0.00012	2.07
2	2.00002	2.0000	0.0000	0.00012	2.07
5	4.99998	5.0000	0.0000	0.00012	2.06
10	10.00000	10.0000	0.0000	0.00012	2.06
20	19.99997	20.0000	0.0000	0.00013	2.05
50	49.99995	49.9999	0.0000	0.00014	2.03
100	99.99995	99.9999	-0.0001	0.00018	2.01
120	119.99992	119.9999	0.0000	0.00021	2.01
150	149.99990	149.9998	-0.0001	0.00024	2.00
200	199.99994	199.9999	0.0000	0.00030	2.00

The End of Certificate

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W.4.3-2

CAL-FM-C01-14: 12 Sep 2022



Refer to Certificate No.: C01242840

Page: 1 of 2

## Statements of conformity:

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

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

### Tolerance and Decision rules:

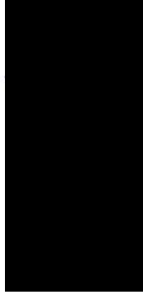
Assessment of the conformity of the measurement device are done based on direct comparison of the relevant measurement results with the tolerances and decision rule are prescribed by the customer.

Decision rule : ☐ Choice A Binary Statement for Simple Acceptance Rule ( $w = 0$ ), Specific Risk < 50% PFA.

☒ Choice B Non-binary statement with guard band ( $w = 1$  U), Pass or Fail Specific Risk < 2.5% PFA and Condition Pass or Condition Fail Specific Risk < 50% PFA.

☐ Choice C Customer defined, Customers may define arbitrary multiple of  $r$  to have applied as guard band ( $w = r$  U).

; PFA – Probability of False Accept



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

## The End of Statements of conformity



Refer to Certificate No.: C01242840

Page: 2 of 2

## Statements of conformity:

### Without Adjustment

Readability; 0.0001 g

Tolerances : 0.0005 g

Nominal Value g	Error of Indication g	Guard band (w) g	Tolerance (±) g	Conformity
0.05	0.0000	0.00012	0.0005	Pass
1	0.0000	0.00012	0.0005	Pass
2	0.0000	0.00012	0.0005	Pass
5	0.0000	0.00012	0.0005	Pass
10	0.0000	0.00012	0.0005	Pass
20	0.0000	0.00013	0.0005	Pass
50	0.0000	0.00014	0.0005	Pass
100	-0.0001	0.00018	0.0005	Pass
120	0.0000	0.00021	0.0005	Pass
150	-0.0001	0.00024	0.0005	Pass
200	0.0000	0.00030	0.0005	Pass





# Certificate of Calibration

**Equipment:** pH METER  
**Model:** SevenCompact S220  
**Serial No. (or ID.):** B914466655  
**Manufacturer:** Mettler Toledo  
**Electrode Serial No.:** 3021943  
**Condition:** In Condition

**Customer:** THAI CHEMICAL & ENGINEERING CO., LTD.  
1048/2 Sukhumvit 66/1 Rd., Prakanong Tai,  
Phrakhanong, 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. Pongpisut Suebchantha  
**Calibration Date:** 13 February 2025  
**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 CPAchem Ltd. (ISO/IEC 17034) Certificate No. 1034229, 1034230, 1034231 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. CA20240267EA



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

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W.4.3-5

CAL-FM-C07-14; 9 Apr 2024

## Calibration Results:

### pH Scale

Input	pH Meter Reading			Uncertainty of Measurement (mV)	Coverage Factor (k)
	(mV)	(mV)	Error (mV)	(pH)	
414.12	414.1	-0.02	0.003	0.065	2.00
354.96	354.9	-0.06	1.003	0.065	2.00
295.8	295.8	0.00	2.003	0.065	2.00
236.64	236.7	0.06	3.002	0.065	2.00
177.48	177.5	0.02	4.000	0.065	2.00
118.32	118.4	0.08	5.000	0.065	2.00
59.16	59.3	0.14	6.000	0.065	2.00
0	0.1	0.10	7.000	0.065	2.00
-59.16	-59.0	0.16	8.000	0.065	2.00
-118.32	-118.2	0.12	9.000	0.065	2.00
-177.48	-177.3	0.18	10.000	0.065	2.00
-236.64	-236.5	0.14	11.000	0.065	2.00
-295.8	-295.6	0.20	12.000	0.065	2.00
-354.96	-354.8	0.16	13.000	0.065	2.00
-414.12	-413.9	0.22	14.000	0.065	2.00

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W.4.3-6

CAL-FM-C07-14; 9 Apr 2024



Practical slope and zero point\*

The three-point calibration using three standard buffer solutions: pH 4.007 , pH 6.976 and pH 10.010  
- During calibration, display of pH meter can be adjust to reading: pH 4.007 , pH 6.976 and pH 10.010  
The practical slope of the pH electrode;  
57.04 (mV/pH), 96.42%  
The zero point of the pH electrode;  
6.98 (pH)

Sample Test Results

Standard Buffer Solution (pH)	Unit Under Calibration (pH)	Difference (pH)	Uncertainty of Measurement (pH)	Coverage Factor (k)
4.007	4.011	0.004	0.0070	2.00
6.976	6.980	0.004	0.0075	2.00
10.010	10.015	0.005	0.0070	2.00

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

The End of Certificate



ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

ชนิดเครื่องมือ: pH METER

เลขที่ใบงาน: WO-00061162

รุ่น: SevenCompact S22C หมายเลขเครื่อง: B914466655

ตรวจสอบ (วัน)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
13 Feb 2025			13 Feb 2025		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิตช์ ปิด – เปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		Spectrophotometer			
<input type="checkbox"/>	<input type="checkbox"/>	6. แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	11. ช่องวัดหลายตัวอย่าง (Carousel Module)	<input type="checkbox"/>	<input type="checkbox"/>	
		pH Meter and Conductivity Meter			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด ( Electrode and Connection Cable )	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl )	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	15. ขาจับอิเล็กโทรด (Stand)	<input type="checkbox"/>	<input type="checkbox"/>	
		Turbidimeter			
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่นเกิน 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
		Automatic titrator			
<input type="checkbox"/>	<input type="checkbox"/>	18. สภาพ Piston Burettes	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>	

เห็นด้วย/ข้อแนะนำ :





# Certificate of Calibration

Equipment : Digital Thermometer with Probe  
Model : SevenCompact S220  
Serial No. : B914466655  
Manufacturer : METTLER TOLEDO  
ID No. : -  
Certificate No. : C15250267  
Issued Date : 16 February 2025  
Job No. : WO-00061162  
Page : 1 of 2  
Condition : In Condition

Customer : THAI CHEMICAL & ENGINEERING CO., LTD.  
1048/2 Sukhumvit 66/1 Rd., Prakanong Tai,  
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, Bangkok,  
Phrakhanong, Bangkok 10260 Thailand

Calibration By : Mr. Anat Karapilak  
Calibration Date : 13 February 2025  
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)

TK



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

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CAL-FM-C15-14: 06 Dec 2022



Certificate No.: C15250267  
Page: 2 of 2

Reference standard equipment:

Equipment	Certificate no	Cal. date	Next Cal. date
Digital Thermometer with Probe	QR24-0956	02 May 2024	02 May 2025

Calibration Results:  
Without Adjustment  
Sensor Type: RTD

Diameter (mm): 12 Length (mm): 130 Immersion (mm): 130 Channel: -

Calibrate Point (°C)	STD. Reading (°C)	UUC. Reading (°C)	Correction of UUC (°C)	Uncertainty (± °C)
20.0	20.004	19.9	0.104	0.076
25.0	25.002	25.0	0.002	0.076
30.0	30.008	30.0	0.008	0.076

The End of Certificate

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W.4.3-10

CAL-FM-C15-14: 06 Dec 2022



## Certificate of Calibration

**Equipment:** Hot Air Oven  
**Model:** UF55  
**Serial No.(or ID):** B218.3817 (INS/LB-134)  
**Manufacturer:** Memmert  
**Condition:** In Condition  
**Shelves(pc.):** 2

**Certificate No.:** C31241805  
**Issued Date:** 09 September 2024  
**Job No.:** WO-00040768  
**Page:** 1 of 4  
**Ventilation Valve:** Closed

**Customer:** THAI CHEMICAL & ENGINEERING CO., LTD.  
1048/2 Sukhumvit 66/1 Rd., Prakanong Tai,  
Prakanong, Bangkok 10260 Thailand

**Environment Condition:** Temperature: 20 °C ± 1.2 °C  
Humidity: 63 %RH ± 5.2 %RH  
Voltage: 226 VAC ± 2.4 VAC

**Calibration Place:** THAI CHEMICAL & ENGINEERING CO., LTD. ( Laboratory )  
1048/2 Sukhumvit 66/1 Rd., Prakanong Tai,  
Prakanong, Bangkok 10260 Thailand

**Calibration By:** Mr. Suphanimit Khamnonphoem  
**Calibration Date:** 04 September 2024  
**The Method used:** In house method, CAL-WI-16, base on TLAS-G20  
**Traceability:** This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.  
Certificate No. C10240005



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).  
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Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

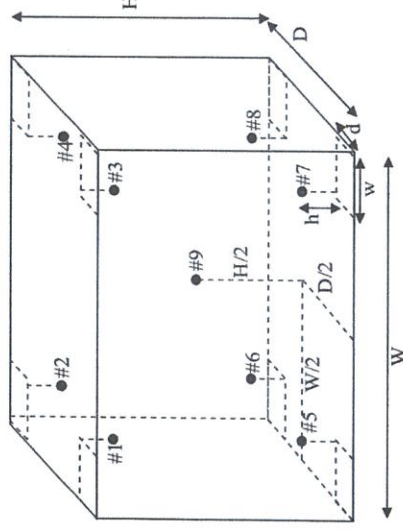
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W.4.3-11

CAL-FM-C31-10: 12 Sep 2022



Certificate No.: C31241805 Page: 2 of 4



### Standard Installation Locations

Volume (Calibration Zone)= 16 (Liters)

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

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

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

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	101	102	103	104	105	106	107	108	109

### Definitions

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

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

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

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

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

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W.4.3-12

CAL-FM-C31-10: 12 Sep 2022



Calibration Results:  
Without adjustment

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

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	103.82	-0.18	0.39
#2	103.63	-0.37	0.39
#3	103.92	-0.08	0.39
#4	104.03	0.03	0.39
#5	104.07	0.07	0.39
#6	103.57	-0.43	0.39
#7	104.22	0.22	0.39
#8	103.57	-0.43	0.39
#9	103.67	-0.33	0.39

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
104.0	104.0	104.0	103.82	103.63	103.92	104.03	104.07	103.57	104.22	103.57	103.67	0.39

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
104.0	0.61	0.08	0.80

Note: \* Maximum uncertainty of the each position



Without adjustment (Cont.)

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

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	179.77	-0.23	0.42
#2	179.40	-0.60	0.42
#3	180.04	0.04	0.42
#4	180.39	0.39	0.42
#5	180.28	0.28	0.42
#6	179.47	-0.53	0.42
#7	180.77	0.77	0.42
#8	179.34	-0.66	0.42
#9	179.74	-0.26	0.42

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
180.0	180.0	180.0	179.77	179.40	180.04	180.39	180.28	179.47	180.77	179.34	179.74	0.42

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
180.0	1.11	0.11	1.59

Note: \* Maximum uncertainty of the each position

The End of Certificate





### Statements of conformity:

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

The correction of indication determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, TLAS-G20. Therefore, those parameters have not been assessed separately.

#### Tolerance and Decision rules:

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

**Decision rule:** ☐ Choice A Binary Statement for Simple Acceptance Rule ( $w = 0$ ), Specific Risk < 50% PFA.

☒ Choice B Non-binary statement with guard band ( $w = 1$  U), Pass or Fail Specific Risk < 2.5% PFA and Condition Pass or Condition Fail Specific Risk < 50% PFA.

☐ Choice C Customer defined, Customers may define arbitrary multiple of  $r$  to have applied as guard band ( $w = r$  U).  
; PFA – Probability of False Accept



### Without adjustment

Desired Temperature : 104.0°C Tolerances : 1.0 °C

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

Locations	Measured (°C)	Correction* (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	103.82	-0.18	0.39	1.0	Pass
#2	103.63	-0.37	0.39	1.0	Pass
#3	103.92	-0.08	0.39	1.0	Pass
#4	104.03	0.03	0.39	1.0	Pass
#5	104.07	0.07	0.39	1.0	Pass
#6	103.57	-0.43	0.39	1.0	Pass
#7	104.22	0.22	0.39	1.0	Pass
#8	103.57	-0.43	0.39	1.0	Pass
#9	103.67	-0.33	0.39	1.0	Pass

Correction\* = Measured Temperature - Desired Temperature

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



### Statements of conformity:(Cont.)

#### Without adjustment (Cont.)

Desired Temperature : 180.0°C Tolerances : 2.0 °C

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

Locations	Measured (°C)	Correction* (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	179.77	-0.23	0.42	2.0	Pass
#2	179.40	-0.60	0.42	2.0	Pass
#3	180.04	0.04	0.42	2.0	Pass
#4	180.39	0.39	0.42	2.0	Pass
#5	180.28	0.28	0.42	2.0	Pass
#6	179.47	-0.53	0.42	2.0	Pass
#7	180.77	0.77	0.42	2.0	Pass
#8	179.34	-0.66	0.42	2.0	Pass
#9	179.74	-0.26	0.42	2.0	Pass

Correction\* = Measured Temperature - Desired Temperature

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

### The End of Statements of Conformity





## Certificate of Calibration

**Equipment:** Liquid Bath  
**Model:** WNE 14  
**Serial No. (or ID.):** L418.0212 (INS/LB-154)  
**Manufacturer:** Memmert  
**Condition:** In Condition  
**Forced Circulation:** None

**Customer:** THAI CHEMICAL & ENGINEERING CO., LTD.  
1048/2 Sukhumvit 66/1 Rd., Prakanong Tai, Prakanong,  
Bangkok 10260 Thailand

**Environment Condition:** Temperature: 25 °C ± 0.6 °C  
Humidity: 49 %RH ± 5.8 %RH  
Voltage: 225 VAC ± 1.6 VAC

**Calibration Place:** THAI CHEMICAL & ENGINEERING CO., LTD. ( Laboratory )  
1048/2 Sukhumvit 66/1 Rd., Prakanong Tai, Prakanong,  
Bangkok 10260 Thailand

**Calibration By:** Mr. Preecha Phooarsai  
**Calibration Date:** 01 March 2024  
**The Method used:** In house method, CAL-WI-17, base on ASTM E715-80  
**Traceability:** This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited. Certificate No. C10230010



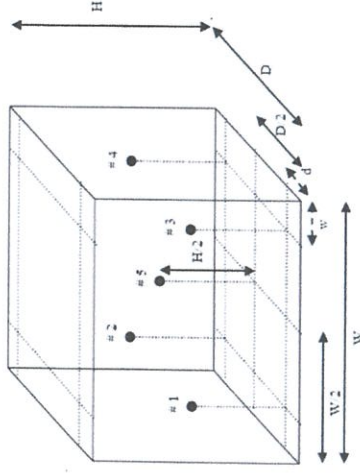
This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.  
The measurement uncertainty stated is the expanded uncertainty which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

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W.4.3-17

CAL-FM-C13-13: 12 Sep 2022



### Standard Installation Locations

Midway between the diffuser plate and the water surface

Inside bath: W = 36 (cm) D = 32 (cm) H = 16 (cm) Volume = 18 (Liters)

Standard Locations #1: w = 5 (cm) d = 5 (cm)

Standard Locations #2: w = 5 (cm) d = 5 (cm)

Standard Locations #3: w = 5 (cm) d = 5 (cm)

Standard Locations #4: w = 5 (cm) d = 5 (cm)

Standard Locations #5: Center of any probes. (#1 - #4)

Position of Std	#1	#2	#3	#4	#5
Channel of Logger	101	102	103	104	109

### Definitions

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

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

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

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

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

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W.4.3-18

CAL-FM-C13-13: 12 Sep 2022



Certificate No.: C13240087

Page: 3 of 4

**Calibration Results:**  
**Without adjustment**

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 60.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	59.92	-0.08	0.17
#2	60.01	0.01	0.21
#3	59.92	-0.08	0.18
#4	59.99	-0.01	0.19
#5	60.01	0.01	0.21

**Temperature Distribution**

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)					Uncertainty (± °C)*
			#1	#2	#3	#4	#5	
60.0	60.0	60.0	59.92	60.01	59.92	59.99	60.01	0.21

**Bath Characterization**

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
60.0	0.20	0.07	0.24

Note: \* Maximum uncertainty of the each position



Certificate No.: C13240087

Page: 4 of 4

**Without adjustment (Cont.)**

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 85.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	84.86	-0.14	0.21
#2	84.98	-0.02	0.24
#3	84.82	-0.18	0.23
#4	84.91	-0.09	0.22
#5	84.93	-0.07	0.20

**Temperature Distribution**

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)					Uncertainty (± °C)*
			#1	#2	#3	#4	#5	
85.0	85.0	85.0	84.86	84.98	84.82	84.91	84.93	0.24

**Bath Characterization**

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
85.0	0.21	0.09	0.36

Note: \* Maximum uncertainty of the each position

**The End of Certificate**



### Statements of conformity:

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

The correction of indication determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, ASTM E715-80. Therefore, those parameters have not been assessed separately.

#### Tolerance and Decision rules:

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

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



### Without adjustment

Desired Temperature : 60.0 °C Tolerances : 1.0 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 60.0 °C

Locations	Measured (°C)	Correction of UUC, (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	59.92	-0.08	0.17	1.0	Pass
#2	60.01	0.01	0.21	1.0	Pass
#3	59.92	-0.08	0.18	1.0	Pass
#4	59.99	-0.01	0.19	1.0	Pass
#5	60.01	0.01	0.21	1.0	Pass

Correction of UUC\* = Measured Temperature - Desired Temperature

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



### Without adjustment (Cont.)

Desired Temperature : 85.0 °C Tolerances : 1.0 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 85.0 °C

Locations	Measured (°C)	Correction of UUC* (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	84.86	-0.14	0.21	1.0	Pass
#2	84.98	-0.02	0.24	1.0	Pass
#3	84.82	-0.18	0.23	1.0	Pass
#4	84.91	-0.09	0.22	1.0	Pass
#5	84.93	-0.07	0.20	1.0	Pass

Correction of UUC\* = Measured Temperature - Desired Temperature

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

### The End of Statements of Conformity





## Certificate of Calibration

Certificate No.: C31250586

Page: 2 of 3

**Equipment:** Cooled Incubator  
**Model:** IP750eco  
**Serial No.(or ID):** V821.0094 (INSILB-158)  
**Manufacturer:** Memmert  
**Condition:** In Condition  
**Shelves(pc.):** 3

**Certificate No.:** C31250586  
**Issued Date:** 02 March 2025  
**Job No.:** WO-00061166  
**Page:** 1 of 3  
**Ventilation Valve:** None

**Customer:** THAI CHEMICAL & ENGINEERING CO., LTD.  
1048/2 Sukhumvit 66/1 Rd., Prakanong Tai,  
Prakanong, Bangkok 10260 Thailand

**Environment Condition:** Temperature: 20 °C ± 0.9 °C  
Humidity: 55 %RH ± 4.7 %RH  
Voltage: 230 VAC ± 1.9 VAC

**Calibration Place:** THAI CHEMICAL & ENGINEERING CO., LTD. ( Laboratory )  
1048/2 Sukhumvit 66/1 Rd., Prakanong Tai,  
Prakanong, Bangkok 10260 Thailand

**Calibration By:** Mr. Suphanimit Khamnonphoem  
**Calibration Date:** 28 February 2025  
**The Method used:** In house method, CAL-WI-16, base on TLAS-G20  
**Traceability:** This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.  
Certificate No. C10250004

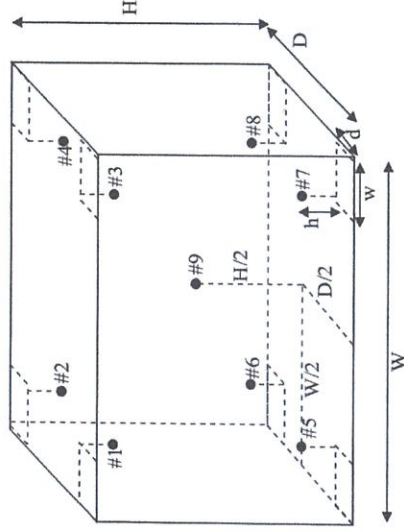
This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.  
The measurement uncertainty stated is the expanded uncertainty which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

DKSH Technology Limited  
2533 Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260  
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth - in Asia and Beyond.

PL4.3-23

CAL-FM-C31-10: 12 Sep 2022



### Standard Installation Locations

Volume (Calibration Zone) = 369 (Liters)

Inside chamber:

W = 100 (cm)

D = 60 (cm)

H = 120 (cm)

Standard Locations (#1, #2, #3, #4):

w = 10 (cm)

d = 6 (cm)

h = 12 (cm)

Standard Locations (#5, #6, #7, #8):

w = 10 (cm)

d = 6 (cm)

h = 12 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	101	102	103	104	105	106	107	108	109

### Definitions

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

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

**Measured Uniformity:** The maximum difference of measured temperatures between of any probes and the

measured temperature at the reference location which are observed at same time or at close observation time as

possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference

probe is preferably located in the geometric center of the chamber.

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

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

DKSH Technology Limited  
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Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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PL4.3-24

CAL-FM-C31-10: 12 Sep 2022





Calibration Results:  
Without adjustment

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

Locations	Measured Temperature (°C)	Correction of UUC, (°C)	Uncertainty (± °C)
#1	19.71	-0.29	0.23
#2	19.67	-0.33	0.23
#3	19.82	-0.18	0.23
#4	19.97	-0.03	0.23
#5	20.34	0.34	0.23
#6	20.32	0.32	0.23
#7	20.31	0.31	0.24
#8	20.32	0.32	0.23
#9	20.15	0.15	0.24

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
20.0	20.0	20.0	19.71	19.67	19.82	19.97	20.34	20.32	20.31	20.32	20.15	0.24

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
20.0	0.52	0.03	0.73

Note: \* Maximum uncertainty of the each position

The End of Certificate



Statements of conformity:

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

The correction of indication determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, TLAS-G20. Therefore, those parameters have not been assessed separately.

Tolerance and Decision rules:

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

Decision rule : ☐ Choice A Binary Statement for Simple Acceptance Rule (w = 0), Specific Risk < 50% PFA,

☒ Choice B Non-binary statement with guard band (w = 1 U), Pass or Fail Specific Risk < 2.5% PFA and Condition Pass or Condition Fail Specific Risk < 50% PFA.

☐ Choice C Customer defined, Customers may define arbitrary multiple of t to have applied as guard band (w = t U) .  
: PFA – Probability of False Accept

Without adjustment

Desired Temperature : 20.0 °C Tolerances : 1.0 °C

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

Locations	Measured (°C)	Correction* (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	19.71	-0.29	0.23	1.0	Pass
#2	19.67	-0.33	0.23	1.0	Pass
#3	19.82	-0.18	0.23	1.0	Pass
#4	19.97	-0.03	0.23	1.0	Pass
#5	20.34	0.34	0.23	1.0	Pass
#6	20.32	0.32	0.23	1.0	Pass
#7	20.31	0.31	0.24	1.0	Pass
#8	20.32	0.32	0.23	1.0	Pass
#9	20.15	0.15	0.24	1.0	Pass

Correction\* = Measured Temperature - Desired Temperature

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

The End of Statements of Conformity

## Preventive Maintenance Kjeldahl

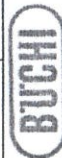
Service No. PM25-508-046

### 1. Customer Information

Customer Name	Instrument	Serial Number	Service Date
บริษัท วิศกรรมเคมี จำกัด 1048/2 ซอย สุขุมวิท 66/1 แขวงพระโขนงใต้ เขตพระโขนง กรุงเทพมหานคร 10260	K-350	0700000546	27 Feb 2025 PM 1/2
คุณเชษฐารัตน์ Tel: 084-463-8741 Fax:			

### 2. Instrument

2.1 Cooling water (if it connected)	OK	NOT OK	Remark
- Temperature 15 – 20 °C	/		
- Cooling water inlet	/		
- Cooling water outlet	/		
- Control Temperature	/		
2.2 Cleaning	DONE	NOT DONE	Remark
- Outside Instrument	/		
- Inside Instrument	/		
- Splash protector	/		
- Condenser	/		



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ว.4.3-27

## Preventive Maintenance Kjeldahl

2.3 Visual Test	OK	NOT OK	Remark
- Screw Coupling (between splash protector and condenser)	/		
- Condenser	/		
- Splash protector	/		
- Hypalon connection (connection tube)	/		
- Rubber bung	/		
- Ventilation valve	/		
- PTFE tube	/		
- Cooling water inlet	/		
- Cooling water outlet	/		
- Magnetic valve	/		

2.4 System control	OK	NOT OK	Remark
- Key board	/		
- Display	/		
- Program	/		
- Adding H <sub>2</sub> O	-		
- Adding NaOH	/		
- Adding H <sub>3</sub> BO <sub>3</sub>	-		
- Aspiration	-		



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ว.4.3-28

## Preventive Maintenance Kjeldahl

2.5 System Distillation	OK	NOT OK	Remark
- Boiler	/		
- Water level sensor	/		
- One way valve	/		
- Pressure switch	/		
- Thermostat	/		
- Steam valve1 (Y4)	/		
- Steam valve2 (Y5)	/		
- Drain valve (Y3)	-		
- Water 3/2 way valve (Y1)	-		

2.6 Hose	OK	NOT OK	Remark
- Unisil hose	/		
- Hypalon hose	/		
- Drain hose	-		
- Viton hose	/		
- Silicone hose	/		

2.7 Diaphragm pump	OK	NOT OK	Remark
- Diaphragm pump for H <sub>2</sub> O	-		
- Diaphragm pump for NaOH	/		
- Diaphragm pump for H <sub>3</sub> BO <sub>3</sub>	-		

2.8 Program test	OK	NOT OK	Remark
- Distillation	/		
- Aspiration	-		
- Preheating	/		
- Cleaning	/		



## Preventive Maintenance Kjeldahl

3. Function Test	0 ml	0 ml	0 min
Addition H <sub>2</sub> O	0 ml	0 ml	0 min
Addition NaOH	0 ml	0 ml	5 min
Addition H <sub>3</sub> BO <sub>3</sub>	0 ml	0 ml	100%
Aspiration			SAM

Result: Water in receiving vessel now approximately 172 ml 174 ml

## 4. Summary



All specifications OK	Specification not OK
OK	

## Comments

PM 1/2  
เครื่องใช้งานได้ปกติ

## Signature BUCHI

- Services by

Date 27 Feb 2025

- Approve by

Date 28 Feb 2025





## Preventive Maintenance Scrubber

Service No. PM25-S08-046

### 1. Customer Information

Customer Name	Instrument	Serial Number	Service Date
บริษัท วิศวกรรมเคมี จำกัด 1048/2 ซอย สุขุมวิท 66/1 แขวงพระโขนงใต้ เขตพระโขนง กรุงเทพมหานคร 10260	B-414	0700002972	27 Feb 2025 PM 1/2
คุณณัฐภาวรัตน์ Tel: 084-463-8741 Fax:			

### 2. Instrument

2.1 Cooling water (if it connected)	OK	NOT OK	Remark
- Temperature 10 – 20 °C	/		
- Cooling water inlet	/		
- Cooling water outlet	/		
2.2 Cleaning	DONE	NOT DONE	Remark
- Housing	/		
- Condenser	/		
- Swirl disc	/		

## Preventive Maintenance Scrubber

2.3 Visual Check	OK	NOT OK	Remark
- Hose connection to suction	/		
- Glassware	/		
- Lip gasket	/		
- GL-14 connector	/		
- Activated charcoal	/		

### 2.4 Flush Pump

Make sure, the bypass valve is closed completely (for maximum suction power).

- Disconnect the silencer, move it down (or take it away from the instrument), and flush out the pump with at least 500 mL of distilled water through the pump inlet, until the collected washing water is clean.
- Switch on the instrument and collect the waste water from the pump output in a suitable vessel.

Flush pump

☒ OK ☐ NOT OK

### 2.5 Washing Solution

- Sodium hydroxide 8-10 %, max. 20 %
- Sodium carbonate
  - dissolve 600 g Na<sub>2</sub>CO<sub>3</sub> in 3 L distilled warm water, or
  - dissolve 1.7 Kg Na<sub>2</sub>CO<sub>3</sub> in 10 H<sub>2</sub>O in 3 L distilled warm water

Washing solution

☒ OK ☐ NOT OK



## Preventive Maintenance Scrubber

### 3. Summary

All specifications OK	Specification not OK
OK	

#### Comments

PM 1/2  
เครื่องใช้งานได้ปกติ



#### Signature BUCHI

- Service by -

Date 27 Feb 2025

- Approve by

Date 28 Feb 2025



BUCHI (Thailand) Limited

## Preventive Maintenance Scrubber

Service No. PM25-S08-046

### 1. Customer Information

Customer Name	Instrument	Serial Number	Service Date
บริษัท วิศวกรรมเคมี จำกัด 1048/2 ซอย สุขุมวิท 66/1 แขวงพระโขนงใต้ เขตพระโขนง กรุงเทพมหานคร 10260	K-415	1000122494	27 Feb 2025 PM 1/2
คุณชัยวัฒน์			
Tel: 084-463-8741			
Fax:			



### 2. Instrument

2.1 Cooling water (if it connected)	OK	NOT OK	Remark
- Temperature 10 – 20 °C	/		
- Cooling water inlet	/		
- Cooling water outlet	/		
2.2 Cleaning	DONE	NOT DONE	Remark
- Housing	/		
- Condenser	/		
- Swirl disc	/		



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## Preventive Maintenance Scrubber

2.3 Visual Check	OK	NOT OK	Remark
- Hose connection to suction	/		
- Glassware	/		
- Lip gasket	/		
- GL-14 connector	/		
- Activated charcoal	/		

### 2.4 Flush Pump

Make sure, the bypass valve is closed completely (for maximum suction power).

- Disconnect the silencer, move it down (or take it away from the instrument), and flush out the pump with at least 500 mL of distilled water through the pump inlet, until the collected washing water is clean.
- Switch on the instrument and collect the waste water from the pump output in a suitable vessel.

### Flush pump

☒ OK

☐ NOT OK

### 2.5 Washing Solution

- Sodium hydroxide 8-10 %, max. 20 %
- Sodium carbonate
  - dissolve 600 g Na<sub>2</sub>CO<sub>3</sub> in 3 L distilled warm water, or
  - dissolve 1.7 kg Na<sub>2</sub>CO<sub>3</sub> in 10 H<sub>2</sub>O in 3 L distilled warm water

### Washing solution

☒ OK

☐ NOT OK



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## Preventive Maintenance Scrubber

### 3. Summary

All specifications OK	Specification not OK
OK	

### Comments

PM 1/2  
เครื่องใช้งานได้ปกติ

### Signature BUCHI

Date 27 Feb 2025

- Service by

Date 28 Feb 2025

- Approve by



BUCHI (Thailand) Limited

## Preventive Maintenance IR Digestion

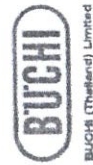
Service No. PM25-S08-046

### 1. Customer Information

Customer Name	Instrument	Serial Number	Service Date
บริษัท วิศวกรรมเคมี จำกัด 1048/2 ซอย สุขุมวิท 66/1 แขวงพระโขนงใต้ เขตพระโขนง กรุงเทพมหานคร 10260	K-436	1000122502	27 Feb 2025 PM 1/2
คุณณัฐวัฒน์ Tel: 084-463-8741 Fax:			

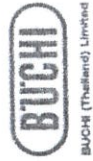
### 2. Instrument

2.1 Housing	OK	NOT OK	Remark
- Clean the housing	/		
- Visual check	/		
- Check for defects (e.g. cracks)	/		
2.2 Heating	OK	NOT OK	Remark
- Clean insulation plate	/		
- Visual check	/		
- Check heating element	/		



## Preventive Maintenance IR Digestion

2.3 Visual Check	OK	NOT OK	Remark
- Connection to suction	/		
- PTFE seal	/		
- O-ring	/		
- Glass holder set	/		
- Suction module	/		
2.4 System control (for K-439 only)	OK	NOT OK	Remark
- Keyboard	/		
- Display	/		
- Program	/		





## Preventive Maintenance IR Digestion

### 3. Summary

All specifications OK	Specification not OK
OK	

#### Comments

PM 1/2  
เครื่องใช้งานได้ปกติ

#### Signature BUCHI

- Service by -

Date 27 Feb 2025

- Approve by

Date 28 Feb 2025



## Preventive Maintenance Kjeldahl

Service No. PM25-S08-046

### 1. Customer Information

Customer Name	Instrument	Serial Number	Service Date
บริษัท วิศวกรรมเคมี จำกัด 1048/2 ซอย สุขุมวิท 66/1 แขวงพระโขนงใต้ เขตพระโขนง กรุงเทพมหานคร 10260  คุณณัฏฐารัตน์ Tel: 084-463-8741 Fax:	K-350	1000117313	27 Feb 2025 PM 1/2

### 2. Instrument

2.1 Cooling water (if it connected)	OK	NOT OK	Remark
- Temperature 15 - 20 °C	/		
- Cooling water inlet	/		
- Cooling water outlet	/		
- Control Temperature	/		
2.2 Cleaning	DONE	NOT DONE	Remark
- Outside Instrument	/		
- Inside Instrument	/		
- Splash protector	/		
- Condenser	/		



## Preventive Maintenance Kjeldahl

2.5 System Distillation	OK	NOT OK	Remark
- Boiler	/		
- Water level sensor	/		
- One way valve	/		
- Pressure switch	/		
- Thermostat	/		
- Steam valve1 (Y4)	/		
- Steam valve2 (Y5)	/		
- Drain valve (Y3)	-		
- Water 3/2 way valve (Y1)	-		

2.6 Hose	OK	NOT OK	Remark
- Unisil hose	/		
- Hypalon hose	/		
- Drain hose	-		
- Viton hose	/		
- Silicone hose	/		

2.7 Diaphragm pump	OK	NOT OK	Remark
- Diaphragm pump for H <sub>2</sub> O	-		
- Diaphragm pump for NaOH	/		
- Diaphragm pump for H <sub>3</sub> BO <sub>3</sub>	-		

2.8 Program test	OK	NOT OK	Remark
- Distillation	/		
- Aspiration	-		
- Preheating	/		
- Cleaning	/		



## Preventive Maintenance Kjeldahl

3. Function Test	0 ml	0 min
Addition H <sub>2</sub> O	0 ml	0 min
Addition NaOH	0 ml	5 min
Addition H <sub>3</sub> BO <sub>3</sub>	0 ml	100%
Aspiration		SAM
Result: Water in receiving vessel now approximately	173 ml	172 ml

## 4. Summary



All specifications OK	Specification not OK
OK	

Comments PM 1/2 เครื่องใช้งานปกติ	
Signature BUCHI	
- Service by	Date 27 Feb 2025
- Approved	Date 28 Feb 2025



## Preventive Maintenance Kjeldahl

2.3 Visual Test	OK	NOT OK	Remark
- Screw Coupling (between splash protector and condenser)	/		
- Condenser	/		
- Splash protector	/		
- Hypalon connection (connection tube)	/		
- Rubber bung	/		
- Ventilation valve	/		
- PTFE tube	/		
- Cooling water inlet	/		
- Cooling water outlet	/		
- Magnetic valve	/		

2.4 System control	OK	NOT OK	Remark
- Key board	/		
- Display	/		
- Program	/		
- Adding H <sub>2</sub> O	-		
- Adding NaOH	/		
- Adding H <sub>3</sub> BO <sub>3</sub>	-		
- Aspiration	-		

