

# ภาคผนวกที่ 4

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## ผลการวิเคราะห์คุณภาพน้ำ

### 4.1 ผลตรวจวัดคุณภาพน้ำหลังบำบัดน้ำเสียแล้ว

#### จากบ่อบำบัดน้ำสุดท้ายของโครงการ

- ผลตรวจวัดคุณภาพน้ำหลังบำบัดน้ำเสียแล้วจากบ่อบำบัดน้ำสุดท้ายของโครงการ เมื่อเดือนมกราคม 2567
- ผลตรวจวัดคุณภาพน้ำหลังบำบัดน้ำเสียแล้วจากบ่อบำบัดน้ำสุดท้ายของโครงการ เมื่อเดือนพฤษภาคม 2567

### 4.2 สำเนาต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการ

#### วิเคราะห์เอกชน

### 4.3 สำเนาของ Certificate of Calibrate ของเครื่องมือ

#### 4.1 ผลตรวจวัดคุณภาพน้ำหลังบำบัดน้ำเสียแล้ว

จากบ่อกักน้ำสุดท้ายของโครงการ

- ผลตรวจวัดคุณภาพน้ำหลังบำบัดน้ำเสียแล้วจาก

บ่อกักน้ำสุดท้ายของโครงการ เมื่อเดือนมกราคม 2567

- ผลตรวจวัดคุณภาพน้ำหลังบำบัดน้ำเสียแล้วจาก

บ่อกักน้ำสุดท้ายของโครงการ เมื่อเดือนพฤษภาคม 2567



บริษัท วิศวกรรมเคมี จำกัด

THAI CHEMICAL & ENGINEERING CO., LTD.

1048/2 ซ.สุขุมวิท 66/1 อ.สุขุมวิท แขวงพระโขนงใต้ เขตพระโขนง กรุงเทพฯ 10260 โทร. 0-2744-9911 แฟกซ์ 0-2393-0165

1048/2 Soi Sukhumvit 66/1, Sukhumvit Rd., Prakanong Tai, Prakanong, Bangkok 10260 TEL. 0-2744-9911 FAX 0-2393-0165

No. 0181/67

### WASTE WATER ANALYSIS REPORT

Date : 30/01/67

Analysis Date : 23/01/67-29/01/67

Customer : โรงแรมพุทธรักษา หัวหิน

Sampling Date : 22/01/67

Address : เลขที่ 22/65 ถนนแนบเคหาสน์ ตำบลหัวหิน อำเภอหัวหิน จังหวัดประจวบคีรีขันธ์ 77110

Sampling Time : 14.00

Received Date : 23/01/67

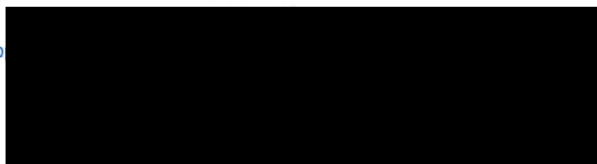
Tel : 032-531-470

Reference Number	WP/PK 0381/67			
Parameter	Unit	น้ำเสียหลังบำบัด	มาตรฐาน อาคารประเภท จ.	Method of Analysis
Appearance		เหลืองขุ่น		
pH		@ 24.4 °C = 6.7	5-9	Electrometric (SM 2017:4500-H <sup>+</sup> B.)
Biochemical Oxygen Demand	(mg/l)	224	≤ 200	5-Day BOD Test, Azide Modification (SM 2017:5210 B.)
Total Suspended Solids	(mg/l)	89	≤ 60	Dried at 103-105°C (SM 2017:2540 D.)
Total Dissolved Solids	(mg/l)	448	-	Dried at 180°C (SM 2017:2540 C.)
Oil & Grease	(mg/l)	22.03	≤ 100	Soxhlet Extraction (SM 2017:5520 D.)
Total Kjeldahl Nitrogen	(mg/l)	40.46	-	Macro-Kjeldahl, Titrimetric (SM 2017:4500-N(org) B.)
Sulfide	(mg/l)	0.81	-	ZnS Precipitation, Iodometric (SM 2017:4500-S <sup>2-</sup> F.)
Settleable Solids	(ml/l)	< 0.5	-	Imhoff Cone, Volumetric (SM 2017:2540 F.)

SM : Standard Methods for the Examination of Water and Wastewater, APHA, AWWA, WEF, 23 rd Edition, 2017.

- ❖ 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.

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บริษัท วิศวกรรมเคมี จำกัด

THAI CHEMICAL & ENGINEERING CO., LTD.

1048/2 ซ.สุขุมวิท 66/1 ถ.สุขุมวิท แขวงพระโขนงใต้ เขตพระโขนง กรุงเทพฯ 10260 โทร. 0-2744-9911 แฟกซ์ 0-2393-0165

1048/2 Soi Sukhumvit 66/1, Sukhumvit Rd., Prakanong Tai, Prakanong, Bangkok 10260 TEL. 0-2744-9911 FAX 0-2393-0165

No. 1117/67

# WASTE WATER ANALYSIS REPORT

Date : 14/05/67  
Customer : โรงแรมพุทธรักษา ห้วยหิน  
Address : เลขที่ 22/65 ถนนแนบเคหาสน์ ตำบลห้วยหิน อำเภอห้วยหิน จังหวัดประจวบคีรีขันธ์ 77110  
Tel : 032-531-470

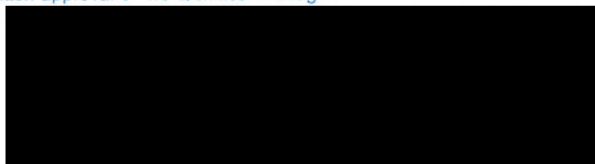
Analysis Date : 08/05/67-13/05/67  
Sampling Date : 07/05/67  
Sampling Time : 11.00  
Received Date : 08/05/67

Reference Number	WP/PK 2086/67			
Parameter	Unit	น้ำเสียหลังบำบัด	มาตรฐาน อาคารประเภท จ.	Method of Analysis
Appearance		เหลืองขุ่นมีตะกอน		
pH		@ 24.0 °C = 6.7	5-9	Electrometric (SM 2023:4500-H <sup>+</sup> B.)
Biochemical Oxygen Demand	(mg/l)	254	≤ 200	5-Day BOD Test, Azide Modification (SM 2023:5210 B.)
Total Suspended Solids	(mg/l)	107	≤ 60	Dried at 103-105°C (SM 2023:2540 D.)
Total Dissolved Solids	(mg/l)	264	-	Dried at 180°C (SM 2023:2540 C.)
Oil & Grease	(mg/l)	35.59	≤ 100	Soxhlet Extraction (SM 2023:5520 D.)
Total Kjeldahl Nitrogen	(mg/l)	22.08	-	Macro-Kjeldahl, Titrimetric (SM 2023:4500-N(org) B.)
Sulfide	(mg/l)	0.96	-	ZnS Precipitation, Iodometric (SM 2023:4500-S <sup>2-</sup> F.)
Settleable Solids	(ml/l)	3.4	-	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 : โอเซียน

- ❖ 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.





## 4.2 สำเนาต่ออายุหนังสือรับขึ้นทะเบียน

ห้องปฏิบัติการวิเคราะห์เอกชน



ที่ อก ๐๓๑๐(๑)/ ๕๔๓ ๓

กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๙ พฤษภาคม ๒๕๖๕

เรื่อง ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท วิศวกรรมเคมี จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๒ มีนาคม ๒๕๖๕

สิ่งที่ส่งมาด้วย เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
บริษัท วิศวกรรมเคมี จำกัด จำนวน ๑ แผ่น

ตามหนังสือที่อ้างถึง บริษัท วิศวกรรมเคมี จำกัด ขอต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการ  
วิเคราะห์เอกชน เลขทะเบียน ว-๐๐๑ สถานที่ตั้งเลขที่ ๑๐๔๘/๒ ซอยสุขุมวิท ๖๖/๑ ถนนสุขุมวิท แขวงพระโขนงใต้  
เขตพระโขนง กรุงเทพมหานคร ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท วิศวกรรมเคมี จำกัด ต่ออายุหนังสือรับขึ้นทะเบียน  
ห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์

๑) นางสาวธัญญารัตน์ พลอยกระจำจ

ทะเบียนเลขที่ ว-๐๐๑-ค-๐๐๐๑

๒) นางสาวกรรณตนา สว่างรุ่งรัตนะ

ทะเบียนเลขที่ ว-๐๐๑-ค-๐๐๐๒

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์

๑) นางสาวรัชนิษฐ์ วนิชกุลวิริยะ

ทะเบียนเลขที่ ว-๐๐๑-จ-๐๐๐๑

๒) นางสาวกมลชนก วงศ์พนาไกร

ทะเบียนเลขที่ ว-๐๐๑-จ-๐๐๐๒

๓) นางสาววรลักษณ์ เทียนกระจำจ

ทะเบียนเลขที่ ว-๐๐๑-จ-๐๐๐๓

๔) นางสาวเกวรินทร์ ศิริวัฒนสกุล

ทะเบียนเลขที่ ว-๐๐๑-จ-๐๐๐๔

๕) นางสาวจิราพร เบญจริยาภรณ์

ทะเบียนเลขที่ ว-๐๐๑-จ-๐๐๐๕

๖) นางสาวจารุวรรณ ต้นสกุล

ทะเบียนเลขที่ ว-๐๐๑-จ-๐๐๐๖

๗) นางสาวกาญจนา ลาชุมเหล็ก

ทะเบียนเลขที่ ว-๐๐๑-จ-๐๐๐๗

๘) นางสาวกิตติยา นารี

ทะเบียนเลขที่ ว-๐๐๑-จ-๐๐๐๘

ค. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำเสีย ตามสิ่งที่ส่งมาด้วย

หนังสือฉบับนี้...

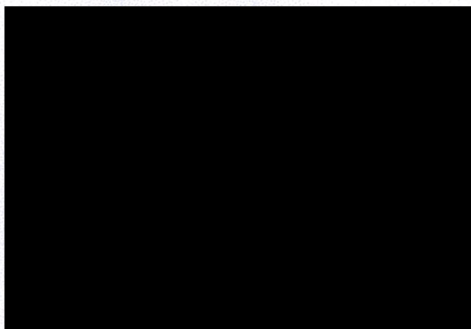




หนังสือฉบับนี้จะหมดอายุในวันที่ ๘ เมษายน ๒๕๖๘ หากประสงค์จะต่ออายุหนังสือ  
รับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอ  
ต่อกรมโรงงานอุตสาหกรรม ภายใน ๓๐ วัน ก่อนวันสิ้นอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์  
เอกชน ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code  
ท้ายหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ



กองวิจัยและเตือนภัยมลพิษโรงงาน  
กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ  
โทร. ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕  
โทรสาร ๐ ๒๔๓๐ ๖๓๑๒ ต่อ ๒๑๙๙  
ไปรษณีย์อิเล็กทรอนิกส์ saraban@diw.mail.go.th

ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์





เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท วิศวกรรมเคมี จำกัด

เลขทะเบียน ว-๐๐๑

ที่ อก ๐๓๑๐(๑)/ ๕๔๓ ๓

ลงวันที่ ๙ พฤษภาคม ๒๕๖๕

ขอขยายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๒๐ รายการ

น้ำเสีย จำนวน 20 รายการ

ลำดับที่	สารมลพิษ	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 at 103-105 °C <sup>[2]</sup>
20	Zinc	Digestion, Inductively Coupled Plasma Method <sup>[2]</sup>

#### เอกสารอ้างอิง

1. สมาคมวิศวกรรมสิ่งแวดล้อมแห่งประเทศไทย. คู่มือวิเคราะห์น้ำเสีย. พิมพ์ครั้งที่ 4. กรุงเทพฯ: เรือนแก้วการพิมพ์, 2547.

2. APHA, AWWA, WEF. Standard Methods for the Examination of Water and Wastewater. 23<sup>rd</sup> ed. Washington, DC: APHA, 2017.



## 4.3 สำเนาของ Certificate of Calibrate ของเครื่องมือ



# Certificate of Calibration

## Equipment:

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

## Customer:

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

## Environment Condition:

Temperature 23 °C ± 2 °C  
Humidity 50 %RH ± 15 %RH

## Calibration Place:

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

## Calibration By:

Miss.Orawan Khaiphloi

## Calibration Date:

16 February 2024

## The Method used:

### Traceability:

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

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. 931983, 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. CA20230264EA



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, Bangchak, Phrakhanong, Bangkok 10260  
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth - in Asia and Beyond.

14.3-1

CAL-FM-C07-13: 12 Sep 2022

Certificate No.: C07240086

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## Electrode Test Results\*

The three-point calibration using three standard buffer solutions; pH 4.008 , pH 6.985 and pH 9.997  
- During calibration, display of pH meter can be adjust to reading; pH 4.008 , pH 6.985 and pH 9.997  
The practical slope of the pH electrode; 58.81 (mV/pH), 99.41%  
The zero point of the pH electrode; 7.10 (pH)

## Sample Test Results

Standard Buffer Solution (pH)	Unit Under Calibration (pH)	Difference (pH)	Uncertainty of Measurement (pH)	Coverage Factor (k)
4.008	4.008	0.000	0.0070	2.00
6.985	6.988	0.003	0.0075	2.00
9.997	9.999	0.002	0.0070	2.00

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

## The End of Certificate

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

Delivering Growth - in Asia and Beyond.

14.3-2

CAL-FM-C07-13: 12 Sep 2022

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	0.001		0.065	2.00
354.96	354.9	-0.06	1.001		0.065	2.00
295.8	295.8	0.00	2.001		0.065	2.00
236.64	236.6	-0.04	3.001		0.065	2.00
177.48	177.5	0.02	4.001		0.065	2.00
118.32	118.4	0.08	5.000		0.065	2.00
59.16	59.2	0.04	6.000		0.065	2.00
0	0.1	0.10	7.000		0.065	2.00
-59.16	-59.1	0.06	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	11.001		0.065	2.00
-295.8	-295.6	0.20	12.000		0.065	2.00
-354.96	-354.8	0.16	12.000		0.065	2.00
-414.12	-413.9	0.22	14.000		0.065	2.00



Certificate of Calibration

**Equipment:** Digital Thermometer with Probe  
**Model:** Seven Compact S220  
**Serial No.:** B914466655  
**Manufacturer:** Mettler Toledo  
**Condition:** In Condition

**Certificate No.:** C15240250  
**Issued Date:** 16 February 2024  
**Job No.:** WO-00017105  
**ID No.:** -  
**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: 22 °C ± 3 °C  
Humidity: 50 %RH ± 20 %RH  
Voltage: 220 VAC ± 10 %

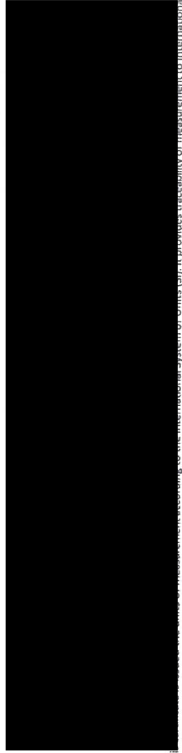
**Calibration Place:** Thermo-Hygro Laboratory, DKSH Technology Limited.  
2533 Sukhumvit Road, Bangchak,  
Phrakanong, Bangkok 10260 Thailand

**Calibration By:** Mr. Tweewong Thaitiang

**Calibration Date:** 16 February 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 in accordance with the requirements of ISO 17025:2017, in providing traceability of measurement to international or national standard or other recognized national standard laboratory.  
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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Certificate No.: C15240250

Page: 2 of 2

### Calibration Results: Without Adjustment

Sensor Type: RTD

Diameter (mm): 12		Length (mm): 120		Channel: -	
Calibrate Point (°C)		UUC Reading (°C)		Immersion (mm): 110	
20.0	20.077	20.0	0.077	Uncertainty (± °C)	
25.0	25.073	25.0	0.073	0.076	
30.0	30.076	30.0	0.076	0.076	

The End of Certificate



## Certificate of Calibration

**Equipment:** Balance  
**Model:** BSA224S-CW  
**Serial No. (or ID.):** 28092544 (INS/LB-109)  
**Manufacturer:** Sartorius  
**Condition:** In condition

**Certificate No.:** C01233119  
**Issued Date:** 04 September 2023  
**Job No.:** WO-00004422  
**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 ± 0.3 °C  
Humidity 52 %RH ± 4.2 %RH

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

**Calibration By:** Mr. Polawad Ruamrurup  
**Calibration Date:** 04 September 2023  
**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. C02222418

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 2839 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C15-14, 06 Dec 2022

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CAL-FM-C01-14: 12 Sep 2022



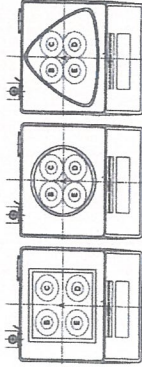


Certificate No.: C01233119

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
-		0.0000	0.0000	0.0001	0.0000	-0.0001

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

Nominal test value (g)	Standard Deviation
20	0.00004
200	0.00006

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
1	1.00000	1.0000	0.0000	0.00011	2.04
2	2.00001	2.0000	0.0000	0.00011	2.04
5	4.99999	5.0000	0.0000	0.00011	2.04
10	10.00001	10.0000	0.0000	0.00011	2.04
20	19.99998	20.0000	0.0000	0.00012	2.03
50	49.99994	49.9999	0.0000	0.00013	2.02
100	99.99997	100.0000	0.0000	0.00017	2.01
120	119.99995	119.9999	-0.0001	0.00021	2.00
150	149.99991	149.9999	0.0000	0.00024	2.00
200	199.99993	200.0000	0.0001	0.00030	2.00

### The End of Certificate

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pg4.3-7

CAL-FM-C01-14: 12 Sep 2022



## Certificate of Calibration

Represent to Certificate of Calibration No. C31232310

Equipment: Hot Air Oven Certificate No.: C31240750  
Model: UF 55 Issued Date: 02 April 2024  
Serial No.(or ID): B219.1995 ( INS/LB 149 ) Job No.: WO-00009089  
Manufacturer: Memmert Page: 1 of 4  
Condition: In Condition Ventilation Valve: Closed  
Shelves(pc.): 2

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

Environment Condition: Temperature: 22 °C ± 1.0 °C  
Humidity: 54 %RH ± 4.7 %RH  
Voltage: 224 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. Bovon Jannantha

Calibration Date: 07 November 2023

The Method used: In house method, CAL-WJ-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. C10230015

international or national standard or other recognized national 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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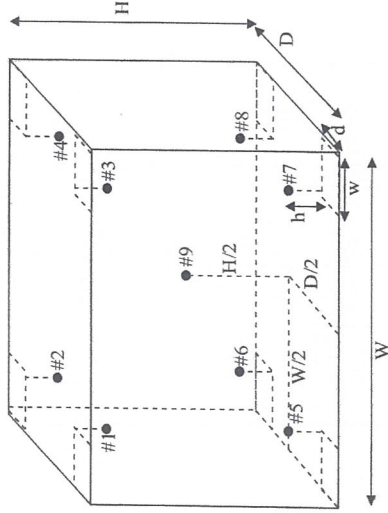
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CAL-FM-C31-10: 12 Sep 2022





#### Standard Installation Locations

Volume (Calibration Zone) = 21 (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 = 5 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	201	202	203	204	205	206	207	208	209

#### 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.



#### Calibration Results:

##### Before adjustment

Setting: 104.0  
Indicating: #1: #2: #3: #4: #5: #6: #7: #8: #9:  
103.69 103.78 104.05 103.78 103.51 103.33 103.23 103.90 103.68

##### After 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	104.14	0.14	0.39
#2	104.17	0.17	0.39
#3	104.46	0.46	0.39
#4	104.21	0.21	0.39
#5	103.92	-0.08	0.39
#6	103.77	-0.23	0.39
#7	103.66	-0.34	0.39
#8	104.31	0.31	0.39
#9	103.91	-0.09	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	104.14	104.17	104.46	104.21	103.92	103.77	103.66	104.31	103.91	0.39

#### Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
104.0	0.59	0.13	0.99

Note: \* Maximum uncertainty of the each position



Certificate No.: C31240750 Page: 4 of 4

After 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	180.29	0.29	0.42
#2	180.37	0.37	0.42
#3	180.81	0.81	0.42
#4	180.21	0.21	0.42
#5	179.87	-0.13	0.42
#6	179.55	-0.45	0.42
#7	179.69	-0.31	0.42
#8	180.17	0.17	0.42
#9	180.18	0.18	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	180.29	180.37	180.81	180.21	179.87	179.55	179.69	180.17	180.18	0.42	

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
180.0	0.67	0.12	1.37

Note: \* Maximum uncertainty of the each position

The End of Certificate

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หน้า 3-11

CAL-FM-C31-10: 12 Sep 2022



Certificate of Calibration

Equipment:

Liquid Bath

Certificate No.: C13240087

Model:

WNE 14

Issued Date: 01 March 2024

Serial No. (or ID.):

L418.0212 (INS/LB-154)

Job No.: WO-00019023

Manufacturer:

Memmert

Page: 1 of 4

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

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

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.

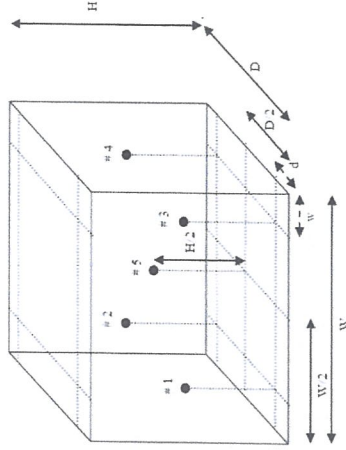
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CAL-FM-C13-13: 12 Sep 2022





#### 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.

#### 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



## 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



## Certificate of Calibration

**Equipment:** Cooled Incubator  
**Model:** IPP750 eco  
**Serial No.(or ID):** V821.0094 (INS/LB-158)  
**Manufacturer:** Memmert  
**Condition:** In Condition  
**Shelves(pc.):** 3  
**Certificate No.:** C31240527  
**Issued Date:** 06 March 2024  
**Job No.:** WO-00019023  
**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: 19 °C ± 1.2 °C  
Humidity: 46 %RH ± 5.8 %RH  
Voltage: 224 VAC ± 1.8 VAC

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

**Calibration By:** Mr. Sittiphong Lekfu

**Calibration Date:** 01 March 2024

**The Method used:** In house method, CAL-VI-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. C10230022

This is

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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Certificate No.: C31240527

Page: 2 of 3



Certificate No.: C31240527

Page: 3 of 3

### Calibration Results: Before adjustment

Setting:	Indicating:	#1:	#2:	#3:	#4:	#5:	#6:	#7:	#8:	#9:
20.0	20.0	20.07	20.00	20.28	20.07	20.37	20.39	20.65	20.41	20.21

### After 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	20.03	0.03	0.23
#2	19.74	-0.26	0.23
#3	20.04	0.04	0.23
#4	19.83	-0.17	0.23
#5	20.04	0.04	0.23
#6	20.05	0.05	0.23
#7	20.33	0.33	0.23
#8	20.12	0.12	0.23
#9	19.90	-0.10	0.23

### 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	20.03	19.74	20.04	19.83	20.04	20.05	20.33	20.12	19.90	0.23

### Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
20.0	0.46	0.04	0.67

Note: \* Maximum uncertainty of the each position

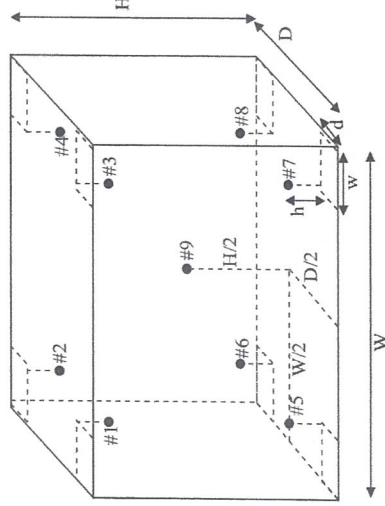
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หน้า 3-18

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	201	202	203	204	205	206	207	208	209

### 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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หน้า 3-17



## Certificate of Calibration

Represent to Certificate of Calibration No. C31232311

**Equipment:** Incubator  
**Model:** IN 55  
**Serial No.(or ID):** D219.0767 (INS/LB 145)  
**Manufacturer:** Memmert  
**Condition:** In Condition  
**Shelves(pc.):** 1

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

**Environment Condition:** Temperature: 25 °C ± 0.7 °C  
Humidity: 57 %RH ± 4.9 %RH  
Voltage: 226 VAC ± 3.3 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:** 07 November 2023  
**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. C40220004

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

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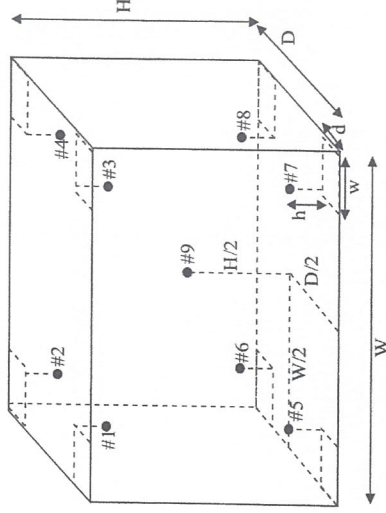
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CAL-FM-C31-10: 12 Sep 2022



Certificate No.: C31240764

Page: 2 of 3



### Standard Installation Locations

Volume (Calibration Zone) = 21 (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 = 5 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	301	302	303	304	305	306	307	308	309

### 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 Variator:** The difference of maximum and minimum measured temperatures throughout observation time.

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pg.3-20

CAL-FM-C31-10: 12 Sep 2022





Certificate No.: C31240764 Page: 3 of 3

Calibration Results:  
Without adjustment

Measurement: Temperature at Spread Locations, Indicating of Unit Under Calibration: 35.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	35.15	0.15	0.23
#2	35.21	0.21	0.23
#3	35.23	0.23	0.23
#4	35.15	0.15	0.23
#5	34.93	-0.07	0.23
#6	34.96	-0.04	0.23
#7	34.95	-0.05	0.23
#8	35.34	0.34	0.24
#9	35.23	0.23	0.23

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	
35.0	35.0	35.0	35.15	35.21	35.23	35.15	34.93	34.96	34.95	35.34	35.23	0.24

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
35.0	0.36	0.10	0.55

Note: \* Maximum uncertainty of the each position

The End of Certificate

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หน้า 3-21

CAL-FM-C31-10: 12 Sep 2022



Certificate of Calibration

Equipment: Incubator Certificate No.: C31231887  
Model: IN55 Issued Date: 04 September 2023  
Serial No.(or ID): D215.1344 (INS/LB-022) Job No.: WO-00004422  
Manufacturer: Memmert Page: 1 of 3  
Condition: In Condition Ventilation Valve: Closed  
Shelves(pc.): 1

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

Environment Condition: Temperature: 27 °C ± 1.5 °C  
Humidity: 53 %RH ± 6.6 %RH  
Voltage: 228 VAC ± 1.7 VAC

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

Calibration By: Mr. Nakarin Ruenros

Calibration Date: 04 September 2023

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.

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 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).

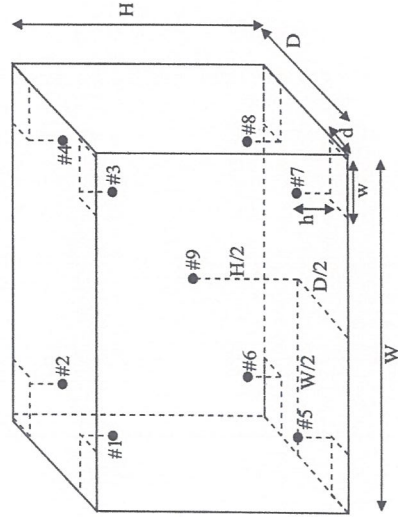
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

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CAL-FM-C31-10: 12 Sep 2022





#### Standard Installation Locations

Volume (Calibration Zone) = 21 (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 = 5 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	201	202	203	204	205	206	207	208	209

#### 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.

#### Calibration Results:

##### Before adjustment

Setting:	Indicating:	#1:	#2:	#3:	#4:	#5:	#6:	#7:	#8:	#9:
45.0	45.0	44.74	44.67	44.70	44.78	44.51	44.55	44.49	44.80	44.75

##### After adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 45.0 °C

Locations	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
#1	45.22	0.22	0.23
#2	45.14	0.14	0.23
#3	45.25	0.25	0.23
#4	45.32	0.32	0.23
#5	45.01	0.01	0.23
#6	45.15	0.15	0.23
#7	45.02	0.02	0.23
#8	45.28	0.28	0.23
#9	45.32	0.32	0.23

#### 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	
45.0	45.0	45.0	45.22	45.14	45.25	45.32	45.01	45.15	45.02	45.28	45.32	0.23

#### Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
45.0	0.36	0.06	0.39

Note: \* Maximum uncertainty of the each position

#### The End of Certificate

## Preventive Maintenance Scrubber

Service No. PM24-S08-041

### 1. Customer Information

Customer Name	Instrument	Serial Number	Service Date
บริษัท สวรรคต จำกัด 1048/2 ซ.สุขุมวิท 66/1 ถ.สุขุมวิท แขวงพระโขนงใต้ เขตพระโขนง กรุงเทพมหานคร 10260 คุณณัฏฐารัตน์ Tel: 084-463-8741 Fax:	K-415	1000122494	28 Feb 2024 PM 1/2

### 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
PASS	

Comments
PM1-2 - เครื่องใช้งานได้นิ่งดี

Signature BUCHI
<div></div>
Date 28 Feb 2024
Date 7 Mar 2024



## Preventive Maintenance Kjeldahl

Service No. PM24-S08-041

### 1. Customer Information

Customer Name	Instrument	Serial Number	Service Date
บริษัท รศวรรณเคมี จำกัด 1048/2 ซ.สุขุมวิท 66/1 ถ.สุขุมวิท แขวงพระโขนงใต้ เขตพระโขนง กรุงเทพมหานคร 10260  คุณชัยยุทธรัตน์ Tel: 084-463-8741 Fax:	K-350	1000117313	28 Feb 2024 PM 1/2



### 2. Instrument

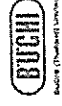
2.1 Cooling water (if it connected)	OK	NOT OK	Remark
- Temperature 15 – 20 °C	/		
- Cooling water inlet	/		
- Cooling water outlet	/		
- Control Temperature	/		
2.2 Cleaning	DONE	NOT DONE	Remark
- Outside Instrument	/		
- Inside Instrument	/		
- Splash protector	/		
- Condenser	/		



## Preventive Maintenance Kjeldahl

2.3 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	-		



## 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

Addition H<sub>2</sub>O 0 ml      Reaction time 0 min  
Addition NaOH 0 ml      Distillation time 5 min  
Addition H<sub>3</sub>BO<sub>3</sub> 0 ml      Steam capacity 100%  
Aspiration SAM  
Result: Water in receiving vessel now approximately 164 ml, 165 ml

### 4. Summary

All specifications OK	Specification not OK
Pass	

### Comments

PM1-2  
- เครื่องใช้งานปกติ

### Signature BUCHI

Date 28 Feb 2024

Date 7 Mar 2024



## Preventive Maintenance IR Digestion

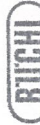
Service No. PM24-S08-041

### 1. Customer Information

Customer Name	Instrument	Serial Number	Service Date
บริษัท วิศกรรมเคมี จำกัด 1048/2 ซ.สุขุมวิท 66/1 ถ.สุขุมวิท แขวงพระโขนงใต้ เขตพระโขนง กรุงเทพมหานคร 10260  คุณชัยวัฒน์ Tel: 084-463-8741 Fax:	K-436	1000122502	28 Feb 2024 PM 1/2

### 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
PASS	

Comments
PM1-2 - เครื่องใช้งานปกติ

Signature BUCHI	
Date 28 Feb 2024	
Date 7 Mar 2024	

