

- 3.1 ผลตรวจวัดคุณภาพน้ำหลังบำบัดน้ำเสียแล้ว
จากบ่อบำบัดน้ำเสียทางทิศใต้ของโครงการ
และผลตรวจวัดคุณภาพน้ำจากสระว่ายน้ำของโครงการ
- 3.1.1 ผลตรวจวัดคุณภาพน้ำหลังบำบัดน้ำเสียแล้วจากบ่อบำบัด
น้ำเสียทางทิศใต้ของโครงการ เมื่อเดือน กรกฎาคม 2568
- 3.1.2 ผลตรวจวัดคุณภาพน้ำหลังบำบัดน้ำเสียแล้วจากบ่อบำบัด
น้ำเสียทางทิศใต้ของโครงการ เมื่อเดือน กันยายน 2568
- 3.1.3 ผลตรวจวัดคุณภาพน้ำหลังบำบัดน้ำเสียแล้วจากบ่อบำบัด
น้ำเสียทางทิศใต้ของโครงการ เมื่อเดือน พฤศจิกายน
2568
- 3.1.4 ผลตรวจวัดคุณภาพน้ำจากสระว่ายน้ำบริเวณอาคาร B
ในเดือนมิถุนายน 2568
- 3.1.5 ผลตรวจวัดคุณภาพน้ำจากสระว่ายน้ำบริเวณอาคาร A
ในเดือนกันยายน 2568
- 3.2 สำเนาต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการ
วิเคราะห์เอกชน
- 3.3 สำเนาของ Certificate of Calibrate ของเครื่องมือ

3.1 ผลตรวจวัดคุณภาพน้ำหลังบำบัดน้ำเสียแล้ว จากบ่อกักน้ำสุดท้ายทางทิศใต้ของโครงการ และผลตรวจวัดคุณภาพน้ำจากสระว่ายน้ำ ของโครงการ

3.1.1 ผลตรวจวัดคุณภาพน้ำหลังบำบัดน้ำเสีย
แล้วจากบ่อกักน้ำสุดท้ายทางทิศใต้ของ
โครงการ เมื่อเดือนกรกฎาคม 2568

3.1.2 ผลตรวจวัดคุณภาพน้ำหลังบำบัดน้ำเสีย
แล้วจากบ่อกักน้ำสุดท้ายทางทิศใต้ของ
โครงการ เมื่อเดือนกันยายน 2568

3.1.3 ผลตรวจวัดคุณภาพน้ำหลังบำบัดน้ำเสีย
แล้วจากบ่อกักน้ำสุดท้ายทางทิศใต้ของ
โครงการ เมื่อเดือนพฤศจิกายน 2568

3.1.4 ผลตรวจวัดคุณภาพน้ำจากสระว่ายน้ำ
บริเวณอาคาร B ในเดือนมิถุนายน 2568

3.1.5 ผลตรวจวัดคุณภาพน้ำจากสระว่ายน้ำ
บริเวณอาคาร A ในเดือนกันยายน 2568

No. 2088/68

WASTE WATER ANALYSIS REPORT

Date : 15/07/68

Analysis Date : 08/07/68-14/07/68

Customer :

Sampling Date : 07/07/68

Address :

Sampling Time : 11.30

Tel :

Received Date : 08/07/68

Reference Number	WP/PK 3795/68			
Parameter	Unit	น้ำเสียหลังบำบัด	มาตรฐาน อาคารประเภท ข.	Method of Analysis
Appearance		เหลืองขุ่นมีตะกอน เล็กน้อย		
pH		@ 26.1 °C = 6.4	5.5-9.0	Electrometric (SM 2023:4500-H ⁺ B.)
Biochemical Oxygen Demand	(mg/l)	340	≤ 30	5-Day BOD Test, Azide Modification (SM 2023:5210 B.)
Total Suspended Solids	(mg/l)	128	≤ 40	Dried at 103-105°C (SM 2023:2540 D.)
Total Dissolved Solids	(mg/l)	431	≤ 1000	Dried at 180°C (SM 2023:2540 C.)
Oil & Grease	(mg/l)	30.76	≤ 20	Soxhlet Extraction (SM 2023:5520 D.)
Total Kjeldahl Nitrogen	(mg/l)	47.24	≤ 35	Macro-Kjeldahl, Titrimetric (SM 2023:4500-N(org) B.)
Sulfide	(mg/l)	< 0.70	≤ 1.0	ZnS Precipitation, Iodometric (SM 2023:4500-S ²⁻ 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, 24th Edition, 2023.

จุดเก็บ : Resort Side

- ❖ 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. 2705/68

WASTE WATER ANALYSIS REPORT

Date 16/9/68

Customer

Address

Tel

Analysis Date : 9/9/68-15/9/68

Sampling Date : 8/9/68

Sampling Time : 11.10

Received Date : 9/9/68

Reference Number	WP/PK 4950/68			
Parameter	Unit	น้ำเสียหลังบำบัด	มาตรฐาน อาคารประเภท ข.	Method of Analysis
Appearance		ขุ่นมีตะกอน		
pH		@ 23.3 °C = 6.9	5.5-9.0	Electrometric (SM 2023:4500-H ⁺ B.)
Biochemical Oxygen Demand	(mg/l)	147	≤ 30	5-Day BOD Test, Azide Modification (SM 2023:5210 B.)
Total Suspended Solids	(mg/l)	76	≤ 40	Dried at 103-105 °C (SM 2023:2540 D.)
Total Dissolved Solids	(mg/l)	316	≤ 1000	Dried at 180 °C (SM 2023:2540 C.)
Oil & Grease	(mg/l)	21.45	≤ 20	Soxhlet Extraction (SM 2023:5520 D.)
Total Kjeldahl Nitrogen	(mg/l)	40.02	≤ 35	Macro-Kjeldahl, Titrimetric (SM 2023:4500-N(org) B.)
Sulfide	(mg/l)	1.01	≤ 1.0	ZnS Precipitation, Iodometric (SM 2023:4500-S ²⁻ F.)
Settleable Solids	(ml/l)	0.8	-	Imhoff Cone, Volumetric (SM 2023:2540 F.)

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

จุดเก็บ : Resort

- ❖ 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. 3324/68

WASTE WATER ANALYSIS REPORT

Date : 11/11/68

Analysis Date : 4/11/68-10/11/68

Customer :

Sampling Date : 3/11/68

Address :

Sampling Time : 13.00

Tel :

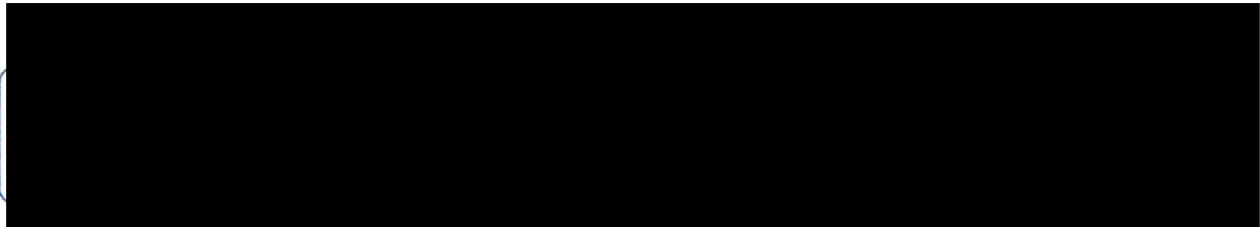
Received Date : 4/11/68

Reference Number	WP/PK 6079/68			
Parameter	Unit	น้ำเสียหลังบำบัด	มาตรฐาน อาคารประเภท ข.	Method of Analysis
Appearance		ขุ่นมีตะกอน		
pH		@ 24.8 °C = 7.0	5.5-9.0	Electrometric (SM 2023:4500-H ⁺ B.)
Biochemical Oxygen Demand	(mg/l)	154	≤ 30	5-Day BOD Test, Azide Modification (SM 2023:5210 B.)
Total Suspended Solids	(mg/l)	122	≤ 40	Dried at 103-105 °C (SM 2023:2540 D.)
Total Dissolved Solids	(mg/l)	334	≤ 1000	Dried at 180 °C (SM 2023:2540 C.)
Oil & Grease	(mg/l)	25.08	≤ 20	Soxhlet Extraction (SM 2023:5520 D.)
Total Kjeldahl Nitrogen	(mg/l)	10.07	≤ 35	Macro-Kjeldahl, Titrimetric (SM 2023:4500-N(org) B.)
Sulfide	(mg/l)	< 0.70	≤ 1.0	ZnS Precipitation, Iodometric (SM 2023:4500-S ²⁻ 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, 24th Edition, 2023.

จุดเก็บ : Resort

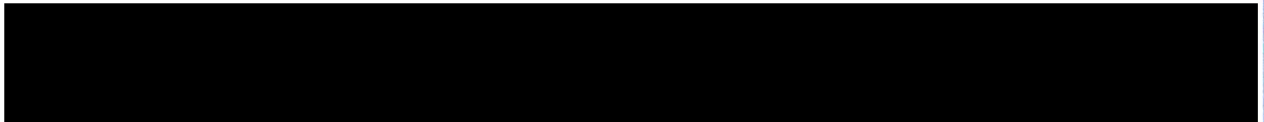
- ❖ The results relate only to the samples tested and apply to customer's self-drawn samples only.
- ❖ This analysis report may not be reproduced other than in full, except with the prior written approval of the technical manager.



ANALYSIS REPORT

REF. NO. WP/PK 3000/68

June 09, 2025



COMMODITY : Swimming Pool

SAMPLING DATE : June 02, 2025

Received Date : June 02, 2025

ANALYSIS RESULT (S) :

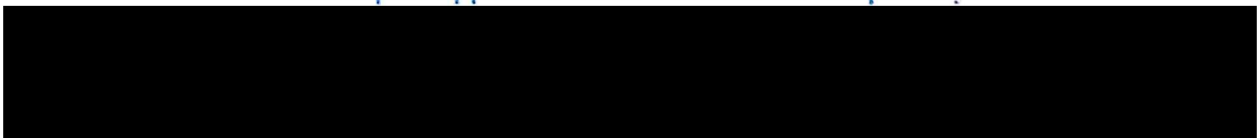
Items	Unit	Result	Standard	Analysis Method
Total Coliform	MPN/100 ml	< 2	< 10	Multiple tube technique
E.Coli	MPN/100 ml	Negative	Negative	Multiple tube technique

Remark :

คุณภาพน้ำอยู่ในเกณฑ์มาตรฐาน

TR/lc

This report applies to client's self-drawn sample only.



ANALYSIS REPORT

REF. NO. WP/PK 4951/68

September 11, 2025

COMMODITY : น้ำสระว่ายน้ำ (Swimming Pool) (Silksand Pool)

SAMPLING DATE : September 08, 2025

Received Date : September 09, 2025

ANALYSIS RESULT (S) :

Items	Unit	Result	Standard	Analysis Method
Total Coliform	MPN/100 ml	< 2	< 10	Multiple tube technique
E.Coli	MPN/100 ml	Negative	Negative	Multiple tube technique

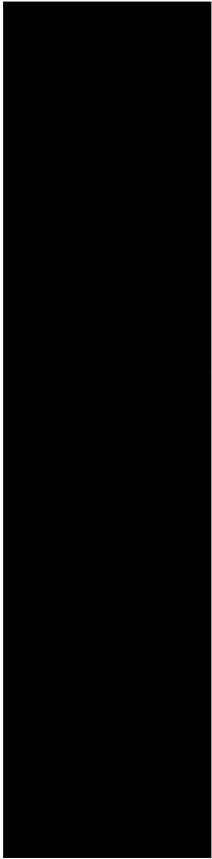
Remark :

คุณภาพน้ำอยู่ในเกณฑ์มาตรฐาน

TR/lc

This report applies to client's self-drawn sample only.

3.2 สำเนาต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการ วิเคราะห์เอกชน



๑๖ พฤษภาคม ๒๕๖๕

เรื่อง ข้ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
เรียน กรรมการผู้จัดการ บริษัท วิศวกรรมเคมี จำกัด
อ้างถึง คำขอขึ้นทะเบียน/ขออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารเคมีของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๑๑ มีนาคม ๒๕๖๕

สิ่งที่ส่งมาด้วย เอกสารแนบท้ายหนังสือขออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
บริษัท วิศวกรรมเคมี จำกัด จำนวน ๑ แผ่น
ตามคำขอที่อ้างถึง บริษัท วิศวกรรมเคมี จำกัด ขอต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการ
วิเคราะห์เอกชน เลขทะเบียน ๖-๐๐๑ สลนที่ดังเลขที่ ๑๐๔๘/๒ ขอขสขณวท ๖๖/๑ ถนนสุขุมวิท แขวงพระโขนงใต้
เขตพระโขนง กรุงเทพมหานคร ต้องการมีโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท วิศวกรรมเคมี จำกัด ต่ออายุหนังสือรับขึ้นทะเบียน
ห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้

- ก. ผู้ควบคุมห้องปฏิบัติการวิเคราะห์เอกชน
- ๑) นางสาวอัญญารัตน์ พลอยกระจำจาง ทะเบียนเลขที่ ๖-๐๐๑-ค-๐๐๐๑๑
 - ๒) นางสาวกรรณธนา สว่างรุ่งธนะ ทะเบียนเลขที่ ๖-๐๐๑-ค-๐๐๐๑๒
- ข. เจ้าหน้าที่ห้องปฏิบัติการวิเคราะห์เอกชน
- ๑) นางสาวรัชนิชา วนิชกุลวิริยะ ทะเบียนเลขที่ ๖-๐๐๑-จ-๐๐๐๑๑
 - ๒) นางสาวจิราพร บุญจริยกรรณ์ ทะเบียนเลขที่ ๖-๐๐๑-จ-๐๐๐๑๕
 - ๓) นางสาวกาญจนา ลาขุนเหล็ก ทะเบียนเลขที่ ๖-๐๐๑-จ-๐๐๐๑๗
- ค. ขอบข่ายชนิดสารเคมีที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำ/น้ำเสีย ตามสิ่งที่ส่งมาด้วย
หนังสือฉบับนี้ส่งภายในวันที่ ๘ เมษายน ๒๕๖๕ หากประสงค์จะต่ออายุหนังสือรับขึ้น
ทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำต่อกรมโรงงานอุตสาหกรรม
ภายใน ๖๐ วัน ก่อนวันสิ้นอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ



กองวิจัยและพัฒนายุทธศาสตร์
กลุ่มมาตรฐานวิธีการวิเคราะห์ที่
โทร. ๐ ๒๕๓๐ ๖๓๑๒ ต่อ ๒๑๓๕-๕
โทรสาร ๐ ๒๕๓๐ ๖๓๑๒ ต่อ ๒๑๔๙
ไปรษณีย์อิเล็กทรอนิกส์ saraban@dlw.mail.go.th

3.2-1
"อุตสาหกรรมกาวไทย" ร่วมกันพัฒนา อุตสาหกรรมสีเขียว
Green Industry
Thailand



เอกสารแนบท้ายหนังสือขออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
บริษัท วิศวกรรมเคมี จำกัด เลขทะเบียน ๖-๐๐๑
ที่ อก ๐๓๑๐(๑)/ ๕๑๑๒ ลงวันที่ ๑๖ พฤษภาคม ๒๕๖๕

ขอขยสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๒๐ รายการ
น้ำ/น้ำเสีย จำนวน 20 รายการ

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

เอกสารอ้างอิง

1. สมาคมวิศวกรรมสิ่งแวดล้อมแห่งประเทศไทย. คู่มือวิเคราะห์น้ำเสีย. พิมพ์ครั้งที่ 4. กรุงเทพมหานคร: การพิมพ์, 2547.
2. APHA, AWWA, WEF. Standard Methods for the Examination of Water and Wastewater. 24th ed. Washington, DC: APHA, 2023.

3.3 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 Kongraiphop
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

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

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

Delivering Growth - in Asia and Beyond.

หน้า 3.3-1

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
-	-	0.0001	-0.0001	0.0001

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

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

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

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

Delivering Growth - in Asia and Beyond.

หน้า 3.3-2

CAL-FM-C01-14: 12 Sep 2022



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:

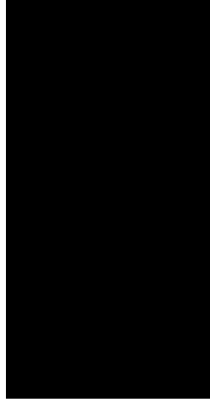
Assessment of the conformity of the measurement device are done based on direct comparison of the relevant measurement results with the tolerances and decision rule are prescribed by the customer.

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

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

: PFA – Probability of False Accept



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 (\pm) 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

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: 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, Bangchak,
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.



Calibration Results:

pH Scale

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

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 (รับ)	ผลการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
		13 Feb 2025	ปกติ	
ปกติ	ไม่ปกติ	ปกติ	ไม่ปกติ	
General				
<input checked="" type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	2. ความสะอาด (ของใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	3. สวิตช์ ปิด – เปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Spectrophotometer				
<input type="checkbox"/>	6. แรงดัน ไฟฟ้า (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<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"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	14. ฝาปิดกั้นลابل Electrode (Dust Protection Hood)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	15. ขาจับอิเล็กโทรด (Stand)	<input type="checkbox"/>	<input type="checkbox"/>	
Turbidimeter				
<input type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	<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"/>	18. สลัฟ Piston Burettes	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>	

เพิ่มเติม/ข้อแนะนำ :

Mr.Pongpisut Suebchantha
 Service Engineer



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, Bangchak,
Phra Khanong, Bangkok 10260 Thailand

Calibration By : Mr. Anat Karapitak
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)



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

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 สุขุมวิท กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Phra Khanong, Bangkok 10260
Phone : +66 2639 7000 Email : info.calibration@dksh.com Website : www.dksh.com/scientific-thailand

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W.3.3-9

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

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 สุขุมวิท กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Phra Khanong, Bangkok 10260
Phone : +66 2639 7000 Email : info.calibration@dksh.com Website : www.dksh.com/scientific-thailand

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W.3.3-10

CAL-FM-C15-14: 06 Dec 2022



Certificate of Calibration

Certificate No.: C31241805

Page: 2 of 4

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 Khamnonphoom

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

Person in charge

Authorized Signatory

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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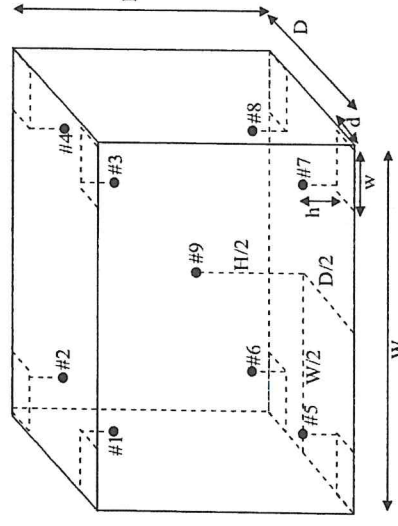
DKSH Technology Limited

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

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W.3.3-11

CAL-FM-C31-10: 12 Sep 2022



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

DKSH Technology Limited

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

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W.3.3-12

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

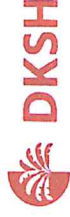
Desired Temperature : 104.0°C Tolerances : 1.0 °C

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

Certificate No.: C13240087

Page: 2 of 4

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

Certificate No.: C13240087
Issued Date: 01 March 2024
Job No.: WO-00019023
Page: 1 of 4

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

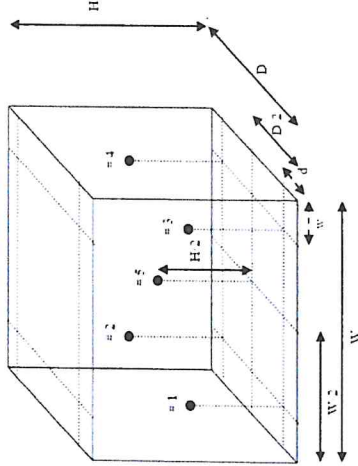
Environment Condition: Temperature: 25 °C ± 0.6 °C
Humidity: 49 %RH ± 5.8 %RH
Voltage: 225 VAC ± 1.6 VAC

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.



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



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



Certificate of Calibration

Equipment: Cooled Incubator
Model: IPP750eco
Serial No.(or ID): V821.0094 (INS/LB-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 Khamnonphoom
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.

บริษัท ดีเคเอส อีซี จำกัด
DKSH Technology Limited
2533 สุขุมวิท ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangna, Prakanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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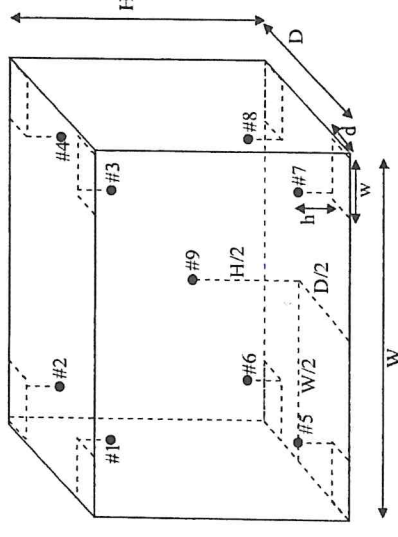
W.3.3-23

CAL-FM-C31-10: 12 Sep 2022



Certificate No.: C31250586

Page: 2 of 3



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.

บริษัท ดีเคเอส อีซี จำกัด
DKSH Technology Limited
2533 สุขุมวิท ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangna, Prakanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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W.3.3-24

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

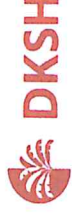
Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
20.0	20.0	20.0	19.71	19.67	19.82	19.97	20.34	20.32	20.31	20.32	20.15	0.24

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 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 : 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-S08-046

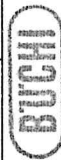
1. Customer Information

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
คุณณัฐญารัตน์ 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.3.3-27

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 ₂ O	-		
- Adding NaOH	/		
- Adding H ₃ BO ₃	-		
- Aspiration	-		



BUCHI (Thailand) Limited

ว.3.3-28

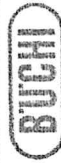
Preventive Maintenance Kjeldahl

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 ₂ O	-		
- Diaphragm pump for NaOH	/		
- Diaphragm pump for H ₃ BO ₃	-		

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



Preventive Maintenance Kjeldahl

3. Function Test			
Addition H ₂ O	0 ml	Reaction time	0 min
Addition NaOH	0 ml	Distillation time	5 min
Addition H ₃ BO ₃	0 ml	Steam capacity	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 เครื่องใช้งานได้น่าดี	
Signature BUCHI	
- Service by	Date 27 Feb 2025
- Approve by	Date 28 Feb 2025



Preventive Maintenance Scrubber

Service No. PM25-S08-046

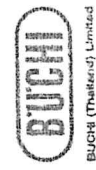
1. Customer Information

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
คุณธัญญารัตน์ 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

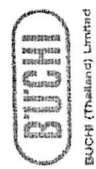
☒ OK ☐ NOT OK

2.5 Washing Solution

- Sodium hydroxide 8-10 %, max. 20 %
- Sodium carbonate
 - dissolve 600 g Na₂CO₃ in 3 L distilled warm water, or
 - dissolve 1.7 kg Na₂CO₃ in 10 H₂O in 3 L distilled warm water

Washing solution


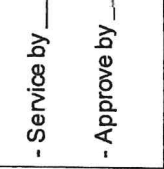
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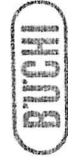


Preventive Maintenance Scrubber

3. Summary

All specifications OK	Specification not OK
OK	

Comments PM 1/2 เครื่องใช้งานได้ปกติ	
Signature BUCHI	
- Service by 	Date <u>27 Feb 2025</u>
- Approve by 	Date <u>28 Feb 2025</u>



BUCHI (Thailand) Limited

Preventive Maintenance Scrubber

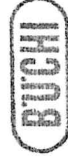
Service No. PM25-S08-046

1. Customer Information

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



BUCHI (Thailand) Limited

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

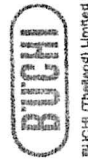
☒ OK ☐ NOT OK

2.5 Washing Solution

- Sodium hydroxide 8-10 %, max. 20 %
- Sodium carbonate
 - dissolve 600 g Na_2CO_3 in 3 L distilled warm water, or
 - dissolve 1.7 kg Na_2CO_3 in 10 H_2O in 3 L distilled warm water

Washing solution

☒ OK ☐ NOT OK



BUCHI (Thailand) Limited

Preventive Maintenance Scrubber

3. Summary

All specifications OK	Specification not OK
OK	

Comments

PM 1/2
เครื่องใช้งานได้ดี

Signature BUCHI

- Service by

Date 27 Feb 2025

- Approve by

Date 28 Feb 2025



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
คุณณัฐกรรัตน์ 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	/		



BUCHI (Thailand) Limited

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	/		




BUCHI (Thailand) Limited

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 วิจิตรกรรมเคมี จำกัด 1048/2 ซอย สุขุมวิท 66/1 แขวงพระโขนงใต้ เขตพระโขนง กรุงเทพมหานคร 10260	K-350	1000117313	27 Feb 2025 PM 1/2
คุณณัฐยาวิรัตน์ 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	/		



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 ₂ O	-		
- Diaphragm pump for NaOH	/		
- Diaphragm pump for H ₃ BO ₃	-		

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



Preventive Maintenance Kjeldahl

3. Function Test			
Addition H ₂ O	0 ml	Reaction time	0 min
Addition NaOH	0 ml	Distillation time	5 min
Addition H ₃ BO ₃	0 ml	Steam capacity	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
- Approve by	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 ₂ O	-		
- Adding NaOH	/		
- Adding H ₃ BO ₃	-		
- Aspiration	-		

