

ภาคผนวกที่ 4

ใบรับรองการสอบเทียบเครื่องมือ

Certificate of Calibration

Certificate No. : 68-200092-1

Page : 1 of 2

Submitted by : M E T Company Limited
36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Electronic Balance
Manufacturer : METTLER TOLEDO Model : AG285
Serial No. : 1122140126 ID No. : MET-EB01/46
Capacity : 210 g Resolution : 0.00001g/81g, 0.0001g/210g

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited
Ambient Temperature : (25.4 to 26.4) °C
Relative Humidity : (47.8 to 56.8) %
Air Pressure : 1012.0 mbar

Date of Received : 10 March 2025

Date of Calibration : 10 March 2025

Date of Issue : 11 March 2025

Calibrated by : Akaradath Thippichai

Calibration Method : In-house method CAL-M2001 based on UKAS Publication ref : LAB 14
Edition 7 - November 2022

Reference Standard Instruments : This certification is traceable to the International System of Units

Standard Weights

ID No.	Cert. No.	Due Date	Traceability
E261-E2624	C02242009	07 Nov 2025	National Institute of Metrology (Thailand), (NIMT)

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The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 68-200092-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

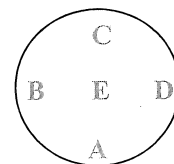
Nominal Value (g)	Correction (g)	Uncertainty $\pm$ (g)
0.01	0.00000	0.000017
0.1	0.00001	0.000019
1	0.00000	0.000027
5	-0.00001	0.000043
10	0.00000	0.000053
20	-0.00016	0.000071
50	-0.00019	0.00011
100	-0.0006	0.00021
150	-0.0008	0.00038
200	-0.0008	0.00038

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.15$, providing a level of confidence of approximately 95%

Eccentric error Load test : 50 g

A	B	C	D	E	
0.00029	0.00024	-0.00038	-0.00039	0.00000	g



Repeatability Load test : 200 g

Stdev. : 0.000053 g

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Certificate of Calibration

Certificate No. : 68-400122-1

Page : 1 of 2

Submitted by : M E T Company Limited
36/659 Moo 6, T. Bangrakpattana, A. Bangbuatong, Nonthaburi 11110

Equipment : Temperature Indicator with TC Probe Type K (Temp pH)

Temperature Indicator

Manufacturer : Digicon

Model : PH-235SD

Range : 0 °C to 60 °C

Resolution : 0.1 °C

Serial No. : AL.58204

ID No. : MET-PH11/67

TC Probe Type K

Model : TP-07

Sheath Material : Stainless

Diameter : 3 mm.

Length : 109 mm.

Serial No. : N/A

ID No. : MET-PH11/67

Environment : Ambient Temperature : (23 ± 2) °C
Relative Humidity : (50 ± 15) %
Line Voltage : (220 ± 22) VAC

Date of Received : 20 February 2025

Date of Calibration : 28 February 2025

Date of Issue : 28 February 2025

Calibrated by : Chortip Samchusri

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4003
by compared with PRT in the liquid bath at the constant controlled temperature.

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units

1. Platinum Resistance Thermometer (PRT)

ID No.	Cert. No.	Due Date	Traceability
400001	TT-0023-24	16 Feb 2026	National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
400003	23E1866	01 Jun 2025	National Institute of Metrology Thailand (NIMT)
400004	23E1866	01 Jun 2025	National Institute of Metrology Thailand (NIMT)

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 68-400122-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Immersion Depth (mm.)	Standard Reading (° C)	UUC Reading (° C)	Correction (° C)	Uncertainty (± ° C)
130	10.0022	10.1	-0.1	0.18
130	25.0017	25.0	0.0	0.22
130	50.0022	50.0	0.0	0.27

Remark

UUC : Unit Under Calibration

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

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

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Certificate of Calibration

Certificate No. : 68-420022-1

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T. Bangrakpattana, A. Bangbuatong, Nonthaburi 11110

Equipment : pH Meter with electrode

pH meter

Manufacturer : Digicon

Model : PH-235SD

Range : N/A pH

Resolution : 0.01 pH

Serial No. : AL.58204

ID No. : MET-PH11/67

Electrode

Model : TF 54074

Serial No. : 435029183

ID No. : MET-PH11/67

Environment : Ambient Temperature : $(25 \pm 2) ^\circ \text{C}$ Relative Humidity : $(50 \pm 15) \%$

Date of Received : 20 February 2025

Date of Calibration : 28 February 2025

Date of Issue : 28 February 2025

Calibrated by : Permpon Chanpu

Calibration Method : In-house method CAL-M4201 direct measurement by using standard voltage calibrator and using certified reference material (CRM)

Reference Standard Instruments : This certification is traceable to the International System of Units

1. Multiproduct Calibrator

ID No.	Cert. No.	Due Date	Traceability
440001	23E1240	24 Mar 2025	National Institute of Metrology Thailand (NIMT)

2. Standard Buffer Solution

pH	Cert. No.	Lot No.	Exp. Date	Traceability
4.008	61293328	1027612	15 Sep 2026	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.987	61297593	1027614	15 Sep 2025	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
10.010	61306165	1027613	15 Sep 2025	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 68-420022-1

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Electrical measurement

pH meter

Performing standard curve by Multiproduct Calibrator at pH (4,7,10)

Adjustment Curve at nominal pH	Applied Voltage (mV)	Nominal Value (pH)	UUC Reading		Correction (mV)	Uncertainty (± mV)
			(pH)	(mV)		
4, 7, 10	177.4800	4	4.00	177	0	0.58
	0.0000	7	7.00	0	0	0.58
	-177.4800	10	10.00	-177	0	0.58

Function : pH meter with electrode

Performing a three - buffer standard curve using buffer nominal pH (4,7,10)

Adjustment Curve at nominal pH	Standard Buffer (pH)	UUC Reading (pH)	Correction (pH)	Uncertainty (± pH)
4, 7, 10	4.008	4.00	-0.01	0.0097
	6.987	7.00	-0.01	0.011
	10.010	10.00	0.01	0.014

Remark

UUC : Unit Under Calibration

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

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

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Certificate of Calibration

Certificate No. : 68-400468-5

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Temperature controlled enclosure (Incubator)

Manufacturer : M-LAB

Model : BIC-140

Range : N/A °C

Resolution : 0.1 °C

Serial No. : 240412

ID No. : MET-BI01/55

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited

Ambient Temperature : (22.6 to 23.9) °C

Relative Humidity : (40 to 50) %

Line Voltage : (210.0 to 210.8) V

Date of Received : 19 August 2025

Date of Calibration : 19 August 2025

Date of Issue : 19 August 2025

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units

Standard Digital Thermometer with RTD Probe

ID No.

Cert. No.

Due Date

Traceability

400029 & 400043 68-400215-1

26 Oct 2025

National Institute of Metrology Thailand (NIMT)

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 68-400468-5

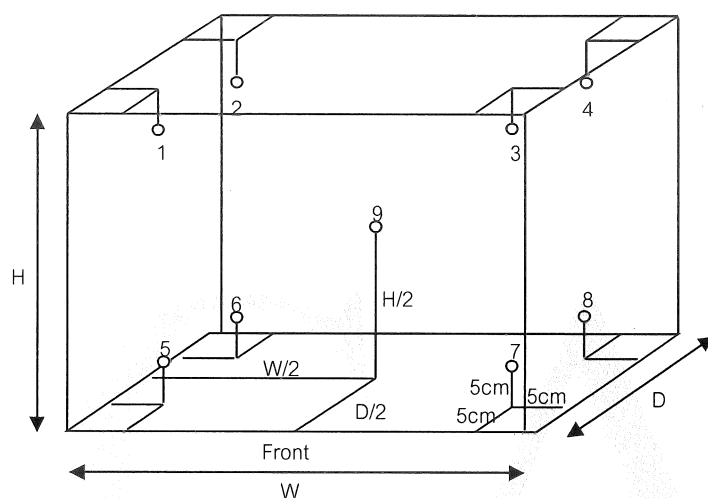
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.37 m

D = 0.33 m

H = 1.14 m

Capacity = 0.14 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
20.0	20.0	20.0	19.66	19.59	19.42	19.35	20.65	20.29	20.26	20.28	20.00	0.33

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
20.0	20.0	20.0	0.68	0.03	1.33

Remark The uncertainty is not combine uniformity of the air chamber

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

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

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Certificate of Calibration

Certificate No. : 68-400468-6

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Temperature controlled enclosure (Refrigerator)

Manufacturer : Sanden Intercool

Model : SRR3-0687 AR

Range : N/A °C

Resolution : 1 °C

Serial No. : SRR3675A-201200111 R

ID No. : MET-RE05/64

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited

Ambient Temperature : (26.8 to 28.4) °C

Relative Humidity : (55 to 60) %

Line Voltage : (210.0 to 210.8) V

Date of Received : 19 August 2025

Date of Calibration : 19 August 2025

Date of Issue : 19 August 2025

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units

Standard Digital Thermometer with RTD Probe

ID No.

Cert. No.

Due Date

Traceability

400046 & 400042 68-400410-1

25 Jan 2026

National Institute of Metrology Thailand (NIMT)

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 68-400468-6

Page : 1 of 2

Submitted by : M E T Company Limited
36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Temperature controlled enclosure (Refrigerator)
Manufacturer : Sanden Intercool Model : SRR3-0687 AR
Range : N/A °C Resolution : 1 °C
Serial No. : SRR3675A-201200111 R ID No. : MET-RE05/64

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited
Ambient Temperature : (26.8 to 28.4) °C
Relative Humidity : (55 to 60) %
Line Voltage : (210.0 to 210.8) V

Date of Received : 19 August 2025

Date of Calibration : 19 August 2025

Date of Issue : 19 August 2025

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units
Standard Digital Thermometer with RTD Probe

ID No.	Cert. No.	Due Date	Traceability
400046 & 400042	68-400410-1	25 Jan 2026	National Institute of Metrology Thailand (NIMT)

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 68-400468-6

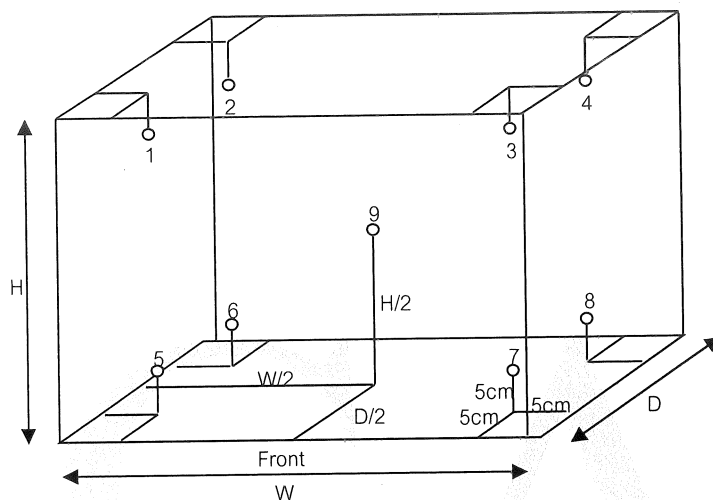
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.58 m

D = 0.60 m

H = 1.45 m

Capacity = 0.50 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
3	3	3	4.17	3.08	3.25	2.83	2.84	2.80	2.63	2.70	2.72	1.2

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
3	3	3	1.58	0.50	2.10

Remark The uncertainty is not combine uniformity of the air chamber

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

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

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Certificate of Calibration

Certificate No. : 68-400468-2

Page : 1 of 2

Submitted by : M E T Company Limited
36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Temperature controlled enclosure (Oven)
Manufacturer : Binder Model : ED53
Range : N/A °C Resolution : 1 °C
Serial No. : 13-07419 ID No. : MET-OV02/57

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited
Ambient Temperature : (32.5 to 33.5) °C
Relative Humidity : (45 to 50) %
Line Voltage : (210.0 to 210.8) V

Date of Received : 19 August 2025

Date of Calibration : 19 August 2025

Date of Issue : 19 August 2025

Calibrated by : Permpoon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units
Standard Digital Thermometer with Thermocouple probe

ID No.	Cert. No.	Due Date	Traceability
400029 & 400032	68-400217-1	28 Oct 2025	National Institute of Metrology Thailand (NIMT)

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 68-400468-2

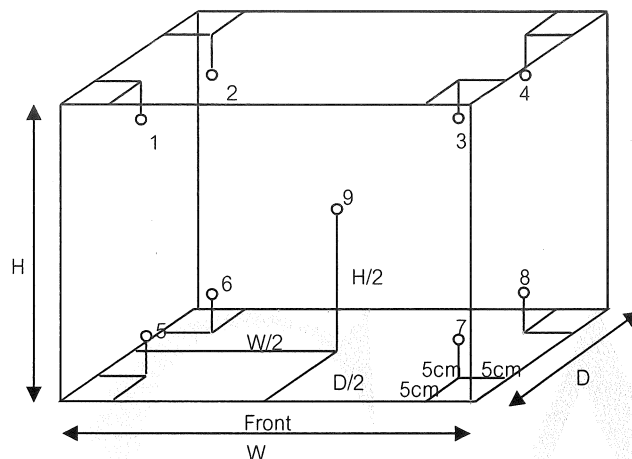
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.40 m

D = 0.33 m

H = 0.40 m

Capacity = 0.05 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
104	110	110	105.6	105.8	105.4	105.7	104.1	104.1	103.6	103.8	104.3	1.0
180	184	184	179.9	182.1	179.9	181.0	179.8	181.1	179.4	180.8	179.5	1.3

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
104	110	110	1.8	0.2	2.4
180	184	184	2.9	0.3	3.2

Remark The uncertainty is not combine uniformity of the air chamber

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

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

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Certificate of Calibration

Certificate No. : 68-400468-1

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Temperature controlled enclosure (Oven)

Manufacturer : Memmert

Model : UF 55

Range : N/A °C

Resolution : 0.1 °C

Serial No. : B223.1049

ID No. : MET-OV03/67

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited

Ambient Temperature : (27.0 to 27.5) °C

Relative Humidity : (55 to 58) %

Line Voltage : (210.0 to 210.8) V

Date of Received : 19 August 2025

Date of Calibration : 19 August 2025

Date of Issue : 19 August 2025

Calibrated by : Permon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units

Standard Digital Thermometer with Thermocouple probe

ID No.

Cert. No.

Due Date

Traceability

400029 & 400030

68-400216-1

28 Oct 2025

National Institute of Metrology Thailand (NIMT)

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 68-400468-1

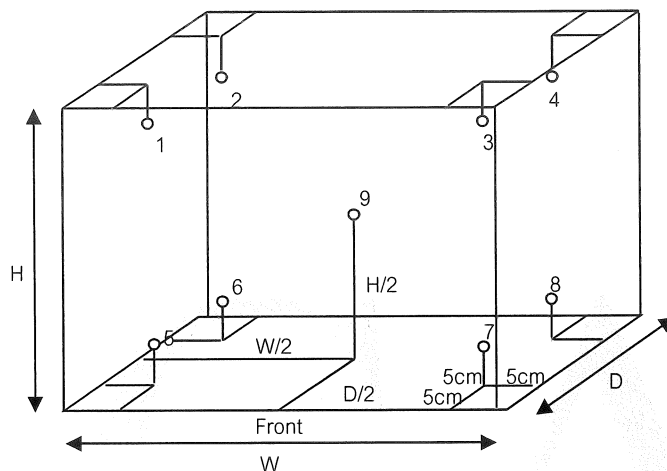
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.40 m

D = 0.33 m

H = 0.40 m

Capacity = 0.05 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
180.0	180.0	180.0	180.4	179.9	180.2	179.4	180.3	180.1	179.1	179.0	180.5	0.95

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
180.0	180.0	180.0	1.6	0.1	1.7

Remark The uncertainty is not combine uniformity of the air chamber

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

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

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Preventive Maintenance Kjeldahl

Service No. PM25-S08-106

1. Customer Information

Customer Name	Instrument	Serial Number	Service Date
บริษัท เอ็ม อี ที จำกัด 36/659 หมู่ที่ 6 ถนนดลิ่งชัน-สุ พรรณฯ ตำบลบางรักพัฒนา อำเภอ บางบัวทอง นนทบุรี 11110 ติดต่อคุณ ศศิธร Tel: 087 4985239 Fax:	K-360	1000281014	30 Apr 2025 PM 2/2

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 ₂ O	/		
- Adding NaOH	/		
- Adding H ₃ BO ₃	/		
- 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 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 Test Steam

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 <u>163</u> ml, <u>171</u> ml			

4. Summary



All specifications OK	Specification not OK
OK	

Comments

- เครื่องทำงานปกติ
- PM 2/2561
- M 1/2561
- 2/2561
- 3/2561
- 4/2561

Signature BUCHI

30 Apr 2025

02 May 2025