

ภาคผนวก ช

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## เอกสารสอบเทียบเครื่องมือที่ใช้ในการวิเคราะห์





CERTIFICATE No : 24E0681  
REFERENCE No : 71961-1

PAGE : 1 OF 2

### Certificate of Calibration

EQUIPMENT : pH METER  
MANUFACTURER : DKK TOA  
MODEL : HM-25R  
SERIAL No : 760205  
ID No : EQL-183  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : TEST TECH CO., LTD.  
30,32 RAMA II SOI 63, RAMA II RD., SAMAEADAM,  
BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY : PRASERT D.  
CALIBRATION DATE : 23-Jan-24

APPROVED BY : PONGSAK J.

ISSUED DATE : 24-Jan-24  
RECEIVED DATE : 23-Jan-24

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF QUALITY CALIBRATION CO., LTD.

F-G010 REV 03



CERTIFICATE No : 24T8053  
REFERENCE No : 74209-2

PAGE : 1 OF 3

### Certificate of Calibration

EQUIPMENT : BOD INCUBATOR  
MANUFACTURER : N/A  
MODEL : N/A  
SERIAL No : N/A  
ID No : EQL-166  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : TEST TECH CO., LTD.  
30,32 RAMA II SOI 63, RAMA II RD., SAMAEADAM,  
BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY : CHAICHARN CH.  
CALIBRATION DATE : 13-Aug-24

APPROVED BY : PONGSAK J.

ISSUED DATE : 19-Aug-24  
RECEIVED DATE : 13-Aug-24

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF QUALITY CALIBRATION CO., LTD.

F-G010 REV : 03

ภาคผนวก ข-1



CERTIFICATE No : 24E0681

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### Calibration Report

EQUIPMENT : pH METER  
MANUFACTURER : DKK TOA  
MODEL : HM-25R  
ID No : EQL-183  
SERIAL NUMBER : 760205  
RECEIVED DATE : 23-Jan-24  
CALIBRATION DATE : 23-Jan-24  
AMBIENT TEMPERATURE : 25° C ± 1° C  
RELATIVE HUMIDITY : 50 %RH ± 10 % RH

#### CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT METHOD BASED ON WI-TQ-062 AND WI-TQ-063. THE DISPLAY UNIT WAS TESTED BY GENERATING STANDARD VOLTAGE TO THE UNIT AND READ THE VALUE COMPARED WITH CALCULATED VALUE. THE DISPLAY AND ELECTRODE WAS CALIBRATED BY USING STANDARD pH BUFFER SOLUTION.

#### 2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No/ LOT No	CERTIFICATE No	DUE DATE
1) pH STANDARD SOLUTION	00651-06	CC767907	4880-13836406	29-Dec-24
2) pH STANDARD SOLUTION	00651-08	CC765602	4881-13757019	18-Nov-24
3) pH STANDARD SOLUTION	00651-10	CC767180	4882-13813369	14-Dec-24
4) PROCESS CALIBRATOR	CA150	91S6079	23E1312	19-Apr-24
5) BATH	260014	1247 48074	23T9014	13-Sep-24
6) THERMOMETER WITH PROBE	421504	55000379	23T9023	13-Sep-24

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.

4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.

5. THIS CERTIFICATE IS TRACEABLE TO SI UNIT MAINTAINED AT :-  
- NATIONAL INSTITUTE OF STANDARD AND TECHNOLOGY, USA.  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND)

#### RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

##### 1. DISPLAY UNIT ONLY

SLOPE FACTOR k = 2.303 RT/F = 59 mV/pH

mV APPLIED	UUC READING (mV)	CORRECTION (mV)	UNCERTAINTY OF MEASUREMENT (± mV)	COVERAGE FACTOR k
177.48	178	-0.52	0.59	2.0
0.00	1	-1.00	0.59	2.0
-177.48	-177	-0.48	0.59	2.0

##### 2. DISPLAY UNIT WITH pH ELECTRODE S/N: 202F0134MK

STANDARD pH BUFFER SOLUTION (pH)	UUC READING (pH)	CORRECTION (pH)	UNCERTAINTY OF MEASUREMENT (± pH)	COVERAGE FACTOR k
4.0061	4.01	-0.004	0.013	2.0
6.9994	7.00	-0.001	0.013	2.0
10.0070	10.01	-0.003	0.014	2.0

##### 3. PERCENT SLOPE 97%

##### 4. DISPLAY UNIT MEASUREMENT TEMPERATURE WITH PROBE

STANDARD READING (°C)	UUC* READING (°C)	IMMERSION DEPTH (mm)	CORRECTION (°C)	UNCERTAINTY OF MEASUREMENT (± °C)
24.999	25.0	80	-0.001	0.21

UUC : UNIT UNDER CALIBRATION

THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

F-G010 REV 03



CERTIFICATE No : 24T8053

PAGE : 2 OF 3

### Calibration Report

EQUIPMENT : BOD INCUBATOR  
MANUFACTURER : N/A  
MODEL : N/A  
ID NUMBER : EQL-166  
SERIAL NUMBER : N/A  
RECEIVED DATE : 13-Aug-24  
CALIBRATION DATE : 13-Aug-24  
AMBIENT TEMPERATURE : 25° C ± 1° C  
RELATIVE HUMIDITY : 54 %RH ± 10 % RH

#### CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TIAS G-20 BY COMPARISON WITH CALIBRATED THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON 19 POINTS AND LOCATED AS THE PICTURE BELOW AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND PLACED THE TENTH THERMOCOUPLE WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE CHAMBER. THE UNIFORMITY WAS MEASURED BETWEEN REFERENCE PROBE AND OTHER PROBES AT THE SAME TIME.

#### 2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH TC TYPE K	HYDRA 2635A	7286308	24T6471	24-Jun-25

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.

4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO., LTD.

#### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

##### GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 0

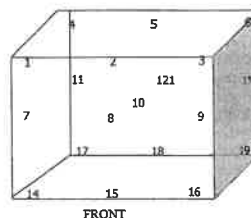
Overall Line Voltage (V) variation : 11

Instrument Condition : Normal

Chamber Size (W\*L\*H): 190\*70\*174 cm

##### CHAMBER PERFORMANCE

Calibrat Point (°C)	Average all Located Temp. (°C)	Temperature Stability (± °C)	Temperature Uniformity (°C)	Overall Variation (°C)
20.0	20.09	0.41	0.47	1.0



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END OF CALIBRATION REPORT PAGE 2 OF 3

F-G010 REV : 03



CERTIFICATE No : 24T8053

PAGE : 3 OF 3

### Calibration Report

#### RESULT OF CALIBRATION (CONTINUE):-

##### TEMPERATURE MEASUREMENT ACCURACY TEST

Controller temperature (°C)	20.0
Indicating Temperature	20.0
Measured Temperature (°C) at Spread Locations	
1	20.00
2	20.15
3	20.16
4	20.17
5	20.18
6	20.12
7	20.21
8	20.10
9	20.09
10 Ref.	19.92
11	19.97
12	20.22
13	20.16
14	20.11
15	20.16
16	20.06
17	20.01
18	19.94
19	20.04
Uncertainty of Measurement (± °C)	0.62

NOTE 1: THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.

NOTE 2: LOCATION 10 WAS REFERENCE LOCATION.

NOTE 3: THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

F-0010 REV: 03



CERTIFICATE No : 24M6589

PAGE : 2 OF 2

### Calibration Report

EQUIPMENT : DIGITAL BALANCE  
MANUFACTURER : SARTORIUS  
ID No : EQL-268  
AIR PRESSURE : 1006mbar ± 1mbar  
AMBIENT TEMPERATURE : 25° C ± 1° C  
MODEL : BCA224i-1S  
S/N : 15843  
RECEIVED DATE : 01-Jul-24  
CALIBRATION DATE : 01-Jul-24  
RELATIVE HUMIDITY : 59 %RH ± 10 % RH

#### CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 6:2019 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS NOT ADJUSTED BEFORE CALIBRATION. THE BALANCE HAS NO ZERO TRACKING FUNCTION. REPEATABILITY WAS MEASURED BY USING 10 REPEATED MEASUREMENTS. LINEARITY WAS MEASURED COVERING 10 POINTS, EVENLY SPREAD OVER THE RANGE. THE INSTRUMENT WAS SET ZERO BEFORE PERFORMING THE LINEARITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN.

#### REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-1-151	M2302013S	02-Feb-25
2) STANDARD WEIGHT	E2	15843	M2302014S	02-Feb-25

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.

4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-

- NATIONAL INSTITUTE OF METROLOGY (THAILAND)

#### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000042 g

4. DEPARTURE FROM NOMINAL VALUE/LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (± g)
0.0	0.0000	0.0000	0.000093
0.1	0.1000	0.0000	0.000093
0.5	0.5000	0.0000	0.000093
1.0	1.0000	0.0000	0.000093
2.0	2.0000	0.0000	0.000093
20.0	20.0001	-0.0001	0.00010
40.0	40.0001	-0.0001	0.00011
50.0	50.0000	0.0000	0.00012
80.0	80.0001	-0.0001	0.00018
100.0	100.0000	0.0000	0.00019
120.0	120.0000	0.0000	0.00022
140.0	140.0001	-0.0001	0.00025
160.0	160.0000	0.0000	0.00027
180.0	180.0000	0.0000	0.00030
200.0	200.0000	0.0000	0.00032

#### 5. OFF CENTER LOADING ERROR

POINT	READING (g)
1	100.0000
2	100.0000
3	100.0000
4	100.0000
5	100.0000
OFF-CENTER LOADING	0.0000

NOTE: THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA. THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

F-0010 REV 03

ภาพผนวก 0-2



CERTIFICATE No : 24M6589  
REFERENCE No : 73767-8

PAGE : 1 OF 2

### Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE  
MANUFACTURER : SARTORIUS  
MODEL : BCA224i-1S  
SERIAL No : 43402017  
ID No : EQL-268  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : TEST TECH CO., LTD.  
30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM,  
BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY : ATSAWIN Y.  
CALIBRATION DATE : 01-Jul-24

APPROVED BY :   
ISSUED DATE : 02-Jul-24  
RECEIVED DATE : 01-Jul-24

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF QUALITY CALIBRATION CO., LTD.

F-0010 REV 03

# CAL

Calibratech Co., Ltd.

719/7 Moo 2, Subphanchang 3 Rd., Bangpoo, Pathum Thani, Thailand 11120  
Tel (02) 964-6211 Fax (02) 964-5155, e-mail : calibratech.co@yahoocom, calibratech.co@gmail.com



### Certificate of Calibration

Certificate No. : 67-300495-1  
Page : 1 of 2  
Submitted by : Test Tech Co., Ltd. (Head Office)  
30, 32 Rama II Soi 63, Rama II Rd., Samedam, Bangkhunthian, Bangkok 10150

Equipment : Auto Burette  
Manufacturer : EM  
Capacity : 25 ml  
Graduation : 0.05 ml  
ID No. : 6310BU25/01

Environment : Ambient Temperature : (20 ± 3) °C  
Relative Humidity : (50 ± 10) %  
Air Pressure : 1003.0 mbar

Date of Received : 28 August 2024

Date of Calibration : 30 August 2024

Date of Issue : 30 August 2024

Calibrated by : Areerat Sombun

Calibration Method : In-house method CAL-M3001 based on ASTM E 542-22

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

Electronic Balance

ID No.	Cert. No.	Due Date	Traceability
241005	67-200210-4	02 Dec 2024	National Institute of Metrology (Thailand) (NIMT)

Approved by :   
( Wipa Towadee )  
Supervisor

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the prior written approval of the Calibratech Co., Ltd.



# CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhaphrasit 3 Rd., Banggood, Pathum, Nonthaburi 11120

Tel:(02) 964-0211 Fax:(02) 964-9155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com

## Certificate of Calibration

Certificate No. : 67-300495-1

Page : 2 of 2

Result of Calibration : This result of true Volume is referred to standard temperature at 20 °C

UUC Condition As-Received : Good

Delivery Time : 34.20 sec.

Nominal Volume ( ml )	Measuring Volume ( ml )
5	4.9776
15	14.9768
25	24.9767

Uncertainty of measurement with in  $\pm$  0.0056 ml

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  $k = 2.00$  ,  
providing a level of confidence of approximately 95%

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CAL-F0021-03

