

คุณภาพน้ำผิวดิน

**QUALITY CALIBRATION CO., LTD.**

235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160

Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584



CERTIFICATE No : 24E6416

REFERENCE No : 73694-1

PAGE : 1 OF 3

Certificate of Calibration

EQUIPMENT : pH METER

MANUFACTURER : HANNA

MODEL : HI 3512

SERIAL No : TH118035

ID No : pH 04/56

CONDITION AS RECEIVED : USED ITEM

SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 27-Jun-24

APPROVED BY : PONGSAK J.

ISSUED DATE : 27-Jun-24

RECEIVED DATE : 24-Jun-24

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



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CERTIFICATE No : 24E6416

PAGE : 2 OF 3

Calibration Report

EQUIPMENT : pH METER
MANUFACTURER : HANNA
ID No : pH 04/56
RECEIVED DATE : 24-Jun-24
AMBIENT TEMPERATURE : 23 ° C ± 3 ° C
MODEL : HI 3512
SERIAL NUMBER : TH118035
CALIBRATION DATE : 27-Jun-24
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 READING THE VALUE COMPARED WITH THE CALCULATED VALUE. THE DISPLAY AND ELECTROD WAS CALIBRATED BY USING STANDARD pH BUFFER
2. REFERENCE STANDARD INSTRUMENTS :-

<u>INSTRUMENT</u>	<u>MODEL</u>	<u>SERIAL No/</u> <u>LOT No</u>	<u>CERTIFICATE No</u>	<u>DUE DATE</u>
1) pH STANDARD SOLUTION	00651-06	CC784945	4880-14413915	24-Aug-25
2) pH STANDARD SOLUTION	00651-08	CC785578	4881-14430633	31-Aug-25
3) pH STANDARD SOLUTION	00651-10	CC787086	4882-14483317	21-Sep-25
4) PROCESS CALIBRATOR	CA150	91S6079	24E1251	09-Apr-25
5) BATH	260014	1247 48074	23T9014	13-Sep-24
6) THERMOMETER WITH PROBE	421504	55000379	23T9623	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 INSTUTITE OF METROLOGY (THAILAND)

RESULT OF CALIBRATION : ADJUSTMENT

1. DISPLAY UNIT ONLY

SLOPE FACTOR $k = 2.303 RT/F = 59 \text{ mV/pH}$

mV APPLIED	UUC READING (mV)	CORRECTION (mV)	UUC READING (pH)	UNCERTAINTY OF MEASUREMENT (± mV)	COVERAGE FACTOR k
414.11	414.8	-0.69	-0.115	0.15	2.00
354.95	355.5	-0.55	0.884	0.15	2.00
295.80	296.4	-0.60	1.885	0.15	2.00
236.64	237.1	-0.46	2.886	0.15	2.00
177.48	178.0	-0.52	3.887	0.15	2.00
118.32	118.8	-0.48	4.887	0.15	2.00
59.16	59.6	-0.44	5.887	0.15	2.00
0.00	0.4	-0.40	6.888	0.15	2.00
-59.16	-58.7	-0.46	8.101	0.15	2.00
-118.32	-117.9	-0.42	9.345	0.15	2.00
-177.48	-177.4	-0.08	10.589	0.15	2.00
-236.64	-236.4	-0.24	11.834	0.15	2.00
-295.80	-294.5	-1.30	13.077	0.15	2.00
-354.95	-354.7	-0.25	14.322	0.15	2.00
-414.11	-413.9	-0.21	15.565	0.15	2.00

END OF CALIBRATION REPORT PAGE 2 OF 3



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CERTIFICATE No : 24E6416

PAGE : 3 OF 3

Calibration Report

RESULT OF CALIBRATION (CONTINUE):

2. DISPLAY UNIT WITH pH ELECTRODE S/N: 09081C6M

STANDARD pH BUFFER SOLUTION (pH)	UUC READING (pH)	CORRECTION (pH)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT (\pm pH)	COVERAGE FACTOR k
4.015	4.011	0.004	3.905	0.012	2.00
7.003	7.003	0.000	6.972	0.012	2.00
10.009	10.014	-0.005	9.570	0.014	2.00

3. DISPLAY UNIT WITH TEMPERATURE

STANDARD READING ($^{\circ}$ C)	UUC READING ($^{\circ}$ C)	CORRECTION ($^{\circ}$ C)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT (\pm $^{\circ}$ C)	COVERAGE FACTOR k
25.004	25.0	0.004	---	0.0085	2.00

4. PERCENT SLOPE 100%

UUC : UNIT UNDER CALIBRATION

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

Certificate of Calibration

Certificate No. : 67-400037-2

Page : 1 of 2

Submitted by : S. P. S Consulting Service Co.,Ltd.

7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900

Equipment : Liquid in Glass Thermometer

Manufacturer : SK

Model : N/A

Range : 0 °C to 100 °C

Resolution : 1 °C

Serial No. : N/A

Immersion : Total

ID No. : TM21/59

Environment : Ambient Temperature : (23 ± 2) °C

Relative Humidity : (50 ± 15) %

Line Voltage : (220 ± 22) VAC

Date of Received : 23 January 2024

Date of Calibration : 03 February 2024

Date of Issue : 03 February 2024

Calibrated by : Chortip Samchusri

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4001 based on ASTM E77-07 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-0016-22	07 Feb 2024	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)

Approved by :

(Surachai Promthong)

Laboratory Manager

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.



Certificate of Calibration

Certificate No. : 67-400037-2

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Ice point check : UUC* reading 0 °C Standard reading 0.4336 °C

Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
20.5609	20	0.6	0.31

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%

- oOo -





CERTIFICATE No : 24M2229
REFERENCE No : 72448-3

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : SARTORIUS

MODEL : BSA224S-CW

SERIAL No : 36591843

ID No : BA 09/61

CONDITION AS RECEIVED : USED ITEM

SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 08-Mar-24

APPROVED BY :  PONGSAK J.

ISSUED DATE : 14-Mar-24

RECEIVED DATE : 08-Mar-24



CERTIFICATE No : 24M2229

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE **MODEL** : BSA224S-CW
MANUFACTURER : SARTORIUS **S/N** : 36591843
ID No : BA 09/61 **RECEIVED DATE** : 08-Mar-24
AIR PRESSURE : 1010mbar \pm 1mbar **CALIBRATION DATE** : 08-Mar-24
AMBIENT TEMPERATURE : 25° C \pm 1° C **RELATIVE HUMIDITY** : 55 %RH \pm 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.

2. REFERENCE STANDARD INSTRUMENTS :-

<u>INSTRUMENT</u>	<u>MODEL</u>	<u>SERIAL No</u>	<u>CERTIFICATE No</u>	<u>DUE DATE</u>
1) STANDARD WEIGHT SET	E2	QK-I-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) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

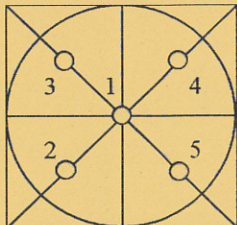
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.0	0.0000	0.0000	0.000082
0.1	0.1000	0.0000	0.000083
0.2	0.2000	0.0000	0.000083
0.5	0.5000	0.0000	0.000083
1.0	1.0000	0.0000	0.000084
2.0	2.0000	0.0000	0.000084
5.0	5.0000	0.0000	0.000086
10.0	10.0000	0.0000	0.000089
20.0	20.0001	-0.0001	0.000094
50.0	50.0000	0.0000	0.00012
100.0	100.0001	-0.0001	0.00019
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

CERT.No.: HS-V015C

Calibration Date : 20 Mar 24
 Submitted by : ASIA LAB @ CONSULTANT CO.,LTD
 184 Soi Phutthamonthon Sai 2 Soi 12,
 Bangphai, Bangkae, Bangkok 10160

Avg Room Temp : 20 °C
 Avg Water Temp : 20 °C
 Air Pressure : 760.00 mmHg
 Salinity : 0 ppt

Model : YSI 5000
 S/N : 15B100751
 Probe : YSI 5010
 S/N : 22D100097
 ID NO. : -
 Air Temp ref : S/N. F8065C26
 Barometric ref : S/N. F8065C26
 Water Temp ref : S/N. 11430
 Technician : Kittipong M.

Calibration Details

Calibration Point	100% air sat. (@20 °C, DO = 9.09 mg/l)	(status)	(status)
Measurement 1 (mg/l)	9.08	(PASS)	-
Measurement 2 (mg/l)	9.08	(PASS)	-
Measurement 3 (mg/l)	9.08	(PASS)	-
Measurement 4 (mg/l)	9.08	(PASS)	-
Measurement 5 (mg/l)	9.08	(PASS)	-
Measurement 6 (mg/l)	9.08	(PASS)	-
Measurement 7 (mg/l)	9.08	(PASS)	-
Measurement 8 (mg/l)	9.08	(PASS)	-
Measurement 9 (mg/l)	9.08	(PASS)	-
Measurement 10 (mg/l)	9.08	(PASS)	-
Mean Measurement	9.08	mg/l	-
Inaccuracy	0.01	mg/l	-

Overall Status (PASS)

Manufacturer Specification

Accuracy = +/- 0.02 mg/l

- 1) This certificate is issued based on the result that are found as shown on date and place of test only.
- 2) The calibration procedure followed in accordance with Harikul Science Co., Ltd.
- 3) This result shall not be used for advertising purpose.



Technician Signature
 (Kittipong Maekwong)



Laboratory Manager
 (Supreecha Sumaritam)



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www.qcalibration.com

CERTIFICATE No : 24T0774

REFERENCE No : 71986-2

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : COD REACTOR

MANUFACTURER : HACH

MODEL : DRB 200

SERIAL No : 15110C0235

ID No : CRB 05/59

SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : CHAICHARN CH.

CALIBRATION DATE : 5-Feb-24

APPROVED BY : 
PONGSAK J.

ISSUED DATE : 5-Feb-24

RECEIVED DATE : 5-Feb-24



CERTIFICATE No : 24T0774

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : COD REACTOR
MANUFACTURER : HACH
ID NUMBER : CRB 05/59
RECEIVED DATE : 5-Feb-24
AMBIENT TEMPERATURE : 23° C ± 1° C

MODEL : DRB 200
SERIAL NUMBER : 15110C0235
CALIBRATION DATE : 5-Feb-24
RELATIVE HUMIDITY : 52 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

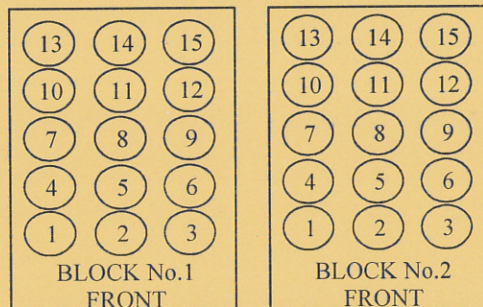
1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT TEMPERATURE RECORDER WITH THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON 15 POINTS AND LOCATED ONE THERMOCOUPLE IN EACH OF THE FOUR CORNERS OF THE REACTOR AND PLACED THE EIGHTH THERMOCOUPLE AT THE CENTER OF THE REACTOR.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH TC TYPE K	HYDRA 2635A	8009008	23T6640	14-Jul-24

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON 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



TEMPERATURE MEASUREMENT ACCURACY TEST

Block No.	1	2
Controller temperature (°C)	145	145
Indicating Temperature	145	145
Measured Temperature (°C) at Spread Locations	1	150.2
	2	150.2
	3	150.2
	4	149.9
	5	149.9
	6	150.1
	7	150.7
	8	149.9
	9	149.9
	10	150.8
	11	149.5
	12	150.2
	13	150.0
	14	149.5
	15	149.5
Uncertainty of Measurement(± °C)	0.86	0.86

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

NOTE 2 : 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

คุณภาพน้ำทิ้ง

**QUALITY CALIBRATION CO., LTD.**

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CERTIFICATE No : 24E6416

REFERENCE No : 73694-1

PAGE : 1 OF 3

Certificate of Calibration

EQUIPMENT : pH METER

MANUFACTURER : HANNA

MODEL : HI 3512

SERIAL No : TH118035

ID No : pH 04/56

CONDITION AS RECEIVED : USED ITEM

SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 27-Jun-24

APPROVED BY : 
PONGSAK J.

ISSUED DATE : 27-Jun-24

RECEIVED DATE : 24-Jun-24

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CERTIFICATE No : 24E6416

PAGE : 2 OF 3

Calibration Report

EQUIPMENT : pH METER
MANUFACTURER : HANNA
ID No : pH 04/56
RECEIVED DATE : 24-Jun-24
AMBIENT TEMPERATURE : 23 ° C ± 3 ° C
MODEL : HI 3512
SERIAL NUMBER : TH118035
CALIBRATION DATE : 27-Jun-24
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 READING THE VALUE COMPARED WITH THE CALCULATED VALUE. THE DISPLAY AND ELECTROD WAS CALIBRATED BY USING STANDARD pH BUFFER
2. REFERENCE STANDARD INSTRUMENTS :-

<u>INSTRUMENT</u>	<u>MODEL</u>	<u>SERIAL No/</u> <u>LOT No</u>	<u>CERTIFICATE No</u>	<u>DUE DATE</u>
1) pH STANDARD SOLUTION	00651-06	CC784945	4880-14413915	24-Aug-25
2) pH STANDARD SOLUTION	00651-08	CC785578	4881-14430633	31-Aug-25
3) pH STANDARD SOLUTION	00651-10	CC787086	4882-14483317	21-Sep-25
4) PROCESS CALIBRATOR	CA150	91S6079	24E1251	09-Apr-25
5) BATH	260014	1247 48074	23T9014	13-Sep-24
6) THERMOMETER WITH PROBE	421504	55000379	23T9623	13-Sep-24

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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 INSTUTITE OF METROLOGY (THAILAND)

RESULT OF CALIBRATION : ADJUSTMENT

1. DISPLAY UNIT ONLY

SLOPE FACTOR $k = 2.303 RT/F = 59 \text{ mV/pH}$

mV APPLIED	UUC READING (mV)	CORRECTION (mV)	UUC READING (pH)	UNCERTAINTY OF MEASUREMENT (± mV)	COVERAGE FACTOR k
414.11	414.8	-0.69	-0.115	0.15	2.00
354.95	355.5	-0.55	0.884	0.15	2.00
295.80	296.4	-0.60	1.885	0.15	2.00
236.64	237.1	-0.46	2.886	0.15	2.00
177.48	178.0	-0.52	3.887	0.15	2.00
118.32	118.8	-0.48	4.887	0.15	2.00
59.16	59.6	-0.44	5.887	0.15	2.00
0.00	0.4	-0.40	6.888	0.15	2.00
-59.16	-58.7	-0.46	8.101	0.15	2.00
-118.32	-117.9	-0.42	9.345	0.15	2.00
-177.48	-177.4	-0.08	10.589	0.15	2.00
-236.64	-236.4	-0.24	11.834	0.15	2.00
-295.80	-294.5	-1.30	13.077	0.15	2.00
-354.95	-354.7	-0.25	14.322	0.15	2.00
-414.11	-413.9	-0.21	15.565	0.15	2.00

END OF CALIBRATION REPORT PAGE 2 OF 3



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CERTIFICATE No : 24E6416

PAGE : 3 OF 3

Calibration Report

RESULT OF CALIBRATION (CONTINUE):

2. DISPLAY UNIT WITH pH ELECTRODE S/N: 09081C6M

STANDARD pH BUFFER SOLUTION (pH)	UUC READING (pH)	CORRECTION (pH)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT (\pm pH)	COVERAGE FACTOR k
4.015	4.011	0.004	3.905	0.012	2.00
7.003	7.003	0.000	6.972	0.012	2.00
10.009	10.014	-0.005	9.570	0.014	2.00

3. DISPLAY UNIT WITH TEMPERATURE

STANDARD READING ($^{\circ}$ C)	UUC READING ($^{\circ}$ C)	CORRECTION ($^{\circ}$ C)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT (\pm $^{\circ}$ C)	COVERAGE FACTOR k
25.004	25.0	0.004	---	0.0085	2.00

4. PERCENT SLOPE 100%

UUC : UNIT UNDER CALIBRATION

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



CERTIFICATE No : 24M2229
REFERENCE No : 72448-3

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : SARTORIUS

MODEL : BSA224S-CW

SERIAL No : 36591843

ID No : BA 09/61

CONDITION AS RECEIVED : USED ITEM

SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 08-Mar-24

APPROVED BY :  PONGSAK J.

ISSUED DATE : 14-Mar-24

RECEIVED DATE : 08-Mar-24



CERTIFICATE No : 24M2229

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE **MODEL** : BSA224S-CW
MANUFACTURER : SARTORIUS **S/N** : 36591843
ID No : BA 09/61 **RECEIVED DATE** : 08-Mar-24
AIR PRESSURE : 1010mbar \pm 1mbar **CALIBRATION DATE** : 08-Mar-24
AMBIENT TEMPERATURE : 25° C \pm 1° C **RELATIVE HUMIDITY** : 55 %RH \pm 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.

2. REFERENCE STANDARD INSTRUMENTS :-

<u>INSTRUMENT</u>	<u>MODEL</u>	<u>SERIAL No</u>	<u>CERTIFICATE No</u>	<u>DUE DATE</u>
1) STANDARD WEIGHT SET	E2	QK-I-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) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

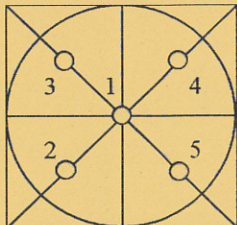
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.0	0.0000	0.0000	0.000082
0.1	0.1000	0.0000	0.000083
0.2	0.2000	0.0000	0.000083
0.5	0.5000	0.0000	0.000083
1.0	1.0000	0.0000	0.000084
2.0	2.0000	0.0000	0.000084
5.0	5.0000	0.0000	0.000086
10.0	10.0000	0.0000	0.000089
20.0	20.0001	-0.0001	0.000094
50.0	50.0000	0.0000	0.00012
100.0	100.0001	-0.0001	0.00019
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

CERT.No.: HS-V015C

Calibration Date : 20 Mar 24
 Submitted by : ASIA LAB @ CONSULTANT CO.,LTD
 184 Soi Phutthamonthon Sai 2 Soi 12,
 Bangphai, Bangkae, Bangkok 10160

Avg Room Temp : 20 °C
 Avg Water Temp : 20 °C
 Air Pressure : 760.00 mmHg
 Salinity : 0 ppt

Model : YSI 5000
 S/N : 15B100751
 Probe : YSI 5010
 S/N : 22D100097
 ID NO. : -
 Air Temp ref : S/N. F8065C26
 Barometric ref : S/N. F8065C26
 Water Temp ref : S/N. 11430
 Technician : Kittipong M.

Calibration Details

Calibration Point	100% air sat. (@20 °C, DO = 9.09 mg/l)	(status)	(status)
Measurement 1 (mg/l)	9.08	(PASS)	-
Measurement 2 (mg/l)	9.08	(PASS)	-
Measurement 3 (mg/l)	9.08	(PASS)	-
Measurement 4 (mg/l)	9.08	(PASS)	-
Measurement 5 (mg/l)	9.08	(PASS)	-
Measurement 6 (mg/l)	9.08	(PASS)	-
Measurement 7 (mg/l)	9.08	(PASS)	-
Measurement 8 (mg/l)	9.08	(PASS)	-
Measurement 9 (mg/l)	9.08	(PASS)	-
Measurement 10 (mg/l)	9.08	(PASS)	-
Mean Measurement	9.08	mg/l	-
Inaccuracy	0.01	mg/l	-

Overall Status (PASS)

Manufacturer Specification

Accuracy = +/- 0.02 mg/l

- 1) This certificate is issued based on the result that are found as shown on date and place of test only.
- 2) The calibration procedure followed in accordance with Harikul Science Co., Ltd.
- 3) This result shall not be used for advertising purpose.



Technician Signature
 (Kittipong Maekwong)



Laboratory Manager
 (Supreecha Sumaritam)



QUALITY CALIBRATION CO.,LTD.

235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160

Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

www.qcalibration.com

CERTIFICATE No : 24T0774

REFERENCE No : 71986-2

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : COD REACTOR

MANUFACTURER : HACH

MODEL : DRB 200

SERIAL No : 15110C0235

ID No : CRB 05/59

SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : CHAICHARN CH.

CALIBRATION DATE : 5-Feb-24

APPROVED BY : 
PONGSAK J.

ISSUED DATE : 5-Feb-24

RECEIVED DATE : 5-Feb-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 : 02



CERTIFICATE No : 24T0774

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : COD REACTOR
MANUFACTURER : HACH
ID NUMBER : CRB 05/59
RECEIVED DATE : 5-Feb-24
AMBIENT TEMPERATURE : 23° C ± 1° C

MODEL : DRB 200
SERIAL NUMBER : 15110C0235
CALIBRATION DATE : 5-Feb-24
RELATIVE HUMIDITY : 52 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

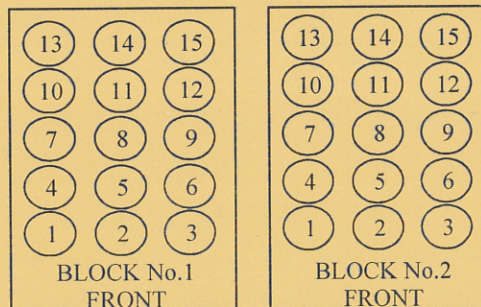
1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT TEMPERATURE RECORDER WITH THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON 15 POINTS AND LOCATED ONE THERMOCOUPLE IN EACH OF THE FOUR CORNERS OF THE REACTOR AND PLACED THE EIGHTH THERMOCOUPLE AT THE CENTER OF THE REACTOR.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH TC TYPE K	HYDRA 2635A	8009008	23T6640	14-Jul-24

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON 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



TEMPERATURE MEASUREMENT ACCURACY TEST

Block No.	1	2
Controller temperature (°C)	145	145
Indicating Temperature	145	145
Measured Temperature (°C) at Spread Locations	1	150.2
	2	150.2
	3	150.2
	4	149.9
	5	149.9
	6	150.1
	7	150.7
	8	149.9
	9	149.9
	10	150.8
	11	149.5
	12	150.2
	13	150.0
	14	149.5
	15	149.5
Uncertainty of Measurement(± °C)	0.86	0.86

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

NOTE 2 : 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

คุณภาพอากาศในสถานประกอบการ



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com, www.spscon.com

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

Temperature : 25 \pm 3 $^{\circ}$ C
Pressure : 1010 \pm 15 mmbar

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (mL/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
B01	SKC	224-PCXR4	262101	03/10/2024	1,000	1,500	2,000	1,006	1,505	2,012	1.013x - 17.267	0.999
B02	SKC	224-PCXR4	626166	03/10/2024	1,000	1,500	2,000	998	1,500	1,995	1.000x - 2.067	1.000
B03	SKC	224-PCXR4	612968	02/10/2024	1,000	1,500	2,000	1,005	1,494	2,006	0.998x + 4.721	0.999
B04	SKC	224-PCXR4	602804	03/10/2024	1,000	1,500	2,000	996	1,511	2,007	1.012x - 19.485	0.999
B05	SKC	224-PCXR4	612693	02/10/2024	1,000	1,500	2,000	1,005	1,504	2,008	1.004x - 4.306	1.000
B06	SKC	224-PCXR4	262188	02/10/2024	1,000	1,500	2,000	1,013	1,505	2,008	0.996x + 6.748	0.999
B07	SKC	224-PCXR4	626262	02/10/2024	1,000	1,500	2,000	1,005	1,506	2,010	1.011x - 12.753	1.000
B08	SKC	224-PCXR4	626100	03/10/2024	1,000	1,500	2,000	1,000	1,498	1,993	0.995x + 5.105	1.000
B09	SKC	224-PCXR4	626479	02/10/2024	1,000	1,500	2,000	1,005	1,494	2,002	0.996x + 5.969	1.000
B10	SKC	224-PCXR4	091950	02/10/2024	1,000	1,500	2,000	1,004	1,504	2,008	1.011x - 15.436	1.000
B11	SKC	224-PCXR8	564315	03/10/2024	1,000	1,500	2,000	1,010	1,497	2,001	0.993x + 10.007	1.000
B12	SKC	224-PCXR4	034656	04/10/2024	1,000	1,500	2,000	998	1,507	2,005	1.013x - 22.552	0.999
B13	SKC	224-PCXR4	602073	03/10/2024	1,000	1,500	2,000	1,001	1,494	2,000	0.998x + 1.307	1.000
B14	SKC	224-PCXR4	626313	03/10/2024	1,000	1,500	2,000	1,014	1,504	2,013	0.999x + 8.699	1.000
B15	SKC	224-PCXR4	626474	03/10/2024	1,000	1,500	2,000	1,006	1,513	2,008	1.002x - 0.788	0.999
B16	SKC	224-PCXR4	626477	03/10/2024	1,000	1,500	2,000	1,001	1,514	2,009	1.009x - 11.678	1.000
B17	SKC	224-PCXR4	626860	02/10/2024	1,000	1,500	2,000	1,018	1,513	2,013	0.997x + 11.094	0.999
B18	SKC	224-PCXR4	691484	02/10/2024	1,000	1,500	2,000	999	1,498	1,999	1.000x + 0.668	1.000
B19	SKC	224-PCXR4	691599	03/10/2024	1,000	1,500	2,000	1,000	1,508	2,007	1.004x - 5.189	1.000
B20	SKC	224-PCXR4	691587	03/10/2024	1,000	1,500	2,000	997	1,514	2,005	1.010x - 12.129	1.000
B21	SKC	224-PCXR4	691531	04/10/2024	1,000	1,500	2,000	996	1,499	2,000	1.001x - 1.875	1.000
B22	SKC	224-PCXR4	691654	03/10/2024	1,000	1,500	2,000	999	1,508	2,006	1.008x - 13.641	1.000
B23	SKC	224-PCXR4	798393	03/10/2024	1,000	1,500	2,000	1,001	1,494	1,995	0.996x + 3.954	1.000
B24	SKC	224-PCXR4	626363	02/10/2024	1,000	1,500	2,000	999	1,492	2,003	1.001x - 3.994	1.000
B25	SKC	224-PCXR4	798489	03/10/2024	1,000	1,500	2,000	1,001	1,501	1,995	0.993x + 10.846	1.000
B26	SKC	224-PCXR4	798479	03/10/2024	1,000	1,500	2,000	996	1,507	2,004	1.007x - 13.888	1.000
B27	SKC	224-PCXR4	691673	03/10/2024	1,000	1,500	2,000	1,006	1,505	2,009	1.010x - 14.064	0.999
B28	SKC	224-PCXR4	691570	03/10/2024	1,000	1,500	2,000	996	1,510	2,008	1.012x - 19.941	0.999
B29	SKC	224-PCXR4	626472	03/10/2024	1,000	1,500	2,000	1,005	1,502	2,005	1.006x - 9.763	1.000
B30	SKC	224-PCXR4	691489	03/10/2024	1,000	1,500	2,000	1,004	1,501	2,008	1.009x - 13.737	1.000
B31	SKC	224-PCXR4	691509	03/10/2024	1,000	1,500	2,000	1,012	1,497	1,997	0.990x + 14.932	1.000
B32	SKC	224-PCXR4	091567	03/10/2024	1,000	1,500	2,000	1,010	1,510	2,008	1.003x - 3.978	0.999
B33	SKC	224-PCXR4	091756	02/10/2024	1,000	1,500	2,000	998	1,512	2,005	1.007x - 10.478	1.000
B34	SKC	224-PCXR4	612962	02/10/2024	1,000	1,500	2,000	999	1,504	2,000	1.001x - 0.963	1.000
B35	SKC	224-PCXR4	602682	02/10/2024	1,000	1,500	2,000	1,004	1,498	2,002	0.996x + 5.501	1.000
B36	SKC	224-PCXR4	626164	02/10/2024	1,000	1,500	2,000	1,008	1,507	2,004	1.000x + 2.331	1.000
B37	SKC	224-PCXR4	626256	04/10/2024	1,000	1,500	2,000	1,008	1,505	2,008	1.002x - 2.423	1.000
B38	SKC	224-PCXR4	626167	04/10/2024	1,000	1,500	2,000	997	1,499	1,998	1.001x - 2.994	1.000
B39	SKC	224-PCXR4	034637	04/10/2024	1,000	1,500	2,000	998	1,504	1,999	1.004x - 8.599	1.000
B40	SKC	224-PCXR4	798349	04/10/2024	1,000	1,500	2,000	1,001	1,500	1,994	0.999x - 2.619	1.000

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

Temperature : 25 \pm 3 $^{\circ}$ C
Pressure : 1010 \pm 15 mmbar

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (mL/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
B41	SKC	224-PCXR4	612669	02/10/2024	1,000	1,500	2,000	1,010	1,497	2,001	0.994x + 9.527	1.000
B42	SKC	224-PCXR4	626041	04/10/2024	1,000	1,500	2,000	998	1,507	2,005	1.009x - 14.416	0.999
B43	SKC	224-PCXR4	034636	03/10/2024	1,000	1,500	2,000	1,005	1,494	2,001	0.995x + 6.369	1.000
B44	SKC	224-PCXR8	529341	03/10/2024	1,000	1,500	2,000	1,010	1,494	2,000	0.990x + 14.704	1.000
B45	SKC	224-PCXR8	529594	02/10/2024	1,000	1,500	2,000	1,014	1,504	2,010	0.997x + 11.890	1.000
B46	SKC	224-PCXR8	566743	04/10/2024	1,000	1,500	2,000	1,006	1,514	2,009	1.002x - 1.391	0.999
B47	SKC	224-PCXR8	566747	02/10/2024	1,000	1,500	2,000	1,000	1,513	2,009	1.009x - 11.714	1.000
B48	SKC	224-PCXR8	566753	04/10/2024	1,000	1,500	2,000	1,020	1,513	2,012	0.995x + 15.140	0.999
B49	SKC	224-PCXR8	566780	04/10/2024	1,000	1,500	2,000	999	1,498	2,000	1.000x + 0.144	1.000
B50	SKC	224-PCXR8	500400	04/10/2024	1,000	1,500	2,000	1,000	1,508	2,006	1.004x - 5.541	1.000
B51	SKC	224-PCXR8	500363	04/10/2024	1,000	1,500	2,000	996	1,506	2,005	1.007x - 10.582	1.000
B52	SKC	224-PCXR8	093186	03/10/2024	1,000	1,500	2,000	998	1,509	2,003	1.006x - 10.386	1.000
B53	SKC	224-PCXR8	707670	03/10/2024	1,000	1,500	2,000	1,000	1,493	1,996	0.994x + 4.977	0.999
B54	SKC	224-PCXR3	509821	02/10/2024	1,000	1,500	2,000	1,001	1,493	2,008	1.006x - 9.295	1.000
B55	SKC	224-PCXR3	510710	04/10/2024	1,000	1,500	2,000	999	1,508	2,004	1.005x - 8.519	1.000
B56	SKC	224-PCXR3	511450	03/10/2024	1,000	1,500	2,000	1,003	1,502	2,012	1.008x - 10.418	1.000
B57	SKC	224-PCXR3	510798	02/10/2024	1,000	1,500	2,000	997	1,503	2,005	1.009x - 15.639	1.000
B58	SKC	224-PCXR3	509852	02/10/2024	1,000	1,500	2,000	1,016	1,517	2,008	0.994x + 13.453	0.999
B59	SKC	224-PCXR3	509862	04/10/2024	1,000	1,500	2,000	999	1,511	2,010	1.010x - 14.912	0.999
B60	SKC	224-PCXR3	512655	02/10/2024	1,000	1,500	2,000	1,009	1,514	1,996	0.992x + 12.737	0.999
B61	SKC	224-PCXR3	503915	04/10/2024	1,000	1,500	2,000	1,005	1,503	2,006	1.011x - 15.735	0.999
B62	SKC	224-PCXR3	505975	03/10/2024	1,000	1,500	2,000	1,006	1,513	2,008	1.002x - 0.788	0.999
B63	SKC	224-PCXR3	511432	02/10/2024	1,000	1,500	2,000	1,020	1,513	2,013	0.995x + 14.152	0.999
B64	SKC	224-PCXR3	508302	04/10/2024	1,000	1,500	2,000	1,000	1,508	2,007	1.004x - 5.189	1.000
B65	SKC	224-PCXR3	508310	02/10/2024	1,000	1,500	2,000	997	1,514	2,005	1.006x - 7.652	1.000
B66	SKC	224-PCXR3	509861	04/10/2024	1,000	1,500	2,000	996	1,499	2,003	1.009x - 13.421	1.000
B67	SKC	224-PCXR3	506295	03/10/2024	1,000	1,500	2,000	998	1,510	2,004	1.010x - 17.666	0.999
B68	SKC	224-PCXR3	505872	03/10/2024	1,000	1,500	2,000	998	1,494	1,997	0.996x + 2.043	1.000
B69	SKC	224-PCXR3	508375	04/10/2024	1,000	1,500	2,000	996	1,499	2,003	1.004x - 4.961	1.000
B70	SKC	224-PCXR3	510623	03/10/2024	1,000	1,500	2,000	1,002	1,504	2,000	1.002x - 1.959	1.000
B71	SKC	224-PCXR3	508367	03/10/2024	1,000	1,500	2,000	996	1,503	1,999	1.003x - 5.913	1.000
B72	SKC	224-PCXR3	505977	04/10/2024	1,000	1,500	2,000	997	1,499	1,996	0.998x - 0.140	1.000
B73	SKC	224-PCXR3	512606	02/10/2024	1,000	1,500	2,000	1,005	1,504	2,007	1.008x - 11.262	1.000
B74	SKC	224-PCXR3	505993	03/10/2024	1,000	1,500	2,000	998	1,504	2,002	1.005x - 10.110	1.000
B75	SKC	224-PCXR3	509820	02/10/2024	1,000	1,500	2,000	1,004	1,503	2,007	1.009x - 12.679	1.000
B76	SKC	224-PCXR3	509811	04/10/2024	1,000	1,500	2,000	1,005	1,493	2,003	0.997x + 5.309	1.000
B77	SKC	224-PCXR3	508301	02/10/2024	1,000	1,500	2,000	998	1,495	2,002	1.002x - 3.498	1.000
B78	SKC	224-PCXR3	510677	03/10/2024	1,000	1,500	2,000	1,015	1,505	2,010	1.003x - 0.420	0.999
B79	SKC	224-PCXR3	510920	04/10/2024	1,000	1,500	2,000	999	1,493	2,004	1.008x - 14.332	1.000

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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S.P.S. CONSULTING SERVICE CO., LTD.
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7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com, www.spscon.com

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

Temperature : 25 \pm 3 $^{\circ}$ C
Pressure : 1010 \pm 15 mmbar

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (mL/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
B80	SKC	224-PCXR3	504569	03/10/2024	1,000	1,500	2,000	998	1,507	2,003	1.007x - 12.517	1.000
B81	SKC	224-PCXR3	503480	03/10/2024	1,000	1,500	2,000	997	1,496	1,997	1.001x - 3.994	1.000
B82	SKC	224-PCXR3	505673	03/10/2024	1,000	1,500	2,000	1,005	1,503	2,006	1.001x - 1.851	0.999
B83	SKC	224-PCXR3	510785	02/10/2024	1,000	1,500	2,000	1,001	1,505	2,000	0.999x + 0.108	1.000
B84	SKC	224-PCXR3	508333	02/10/2024	1,000	1,500	2,000	1,003	1,504	1,999	1.001x - 1.315	1.000
B85	SKC	224-PCXR3	505757	02/10/2024	1,000	1,500	2,000	1,003	1,506	2,001	1.003x - 1.855	1.000
B86	SKC	224-PCXR3	512625	04/10/2024	1,000	1,500	2,000	1,000	1,501	1,998	1.000x - 1.111	1.000
B87	SKC	224-PCXR3	504324	04/10/2024	1,000	1,500	2,000	999	1,509	2,007	1.009x - 15.683	0.999
B88	SKC	224-PCXR3	508307	04/10/2024	1,000	1,500	2,000	999	1,500	1,996	0.996x + 4.825	1.000
B89	SKC	224-PCXR3	509860	04/10/2024	1,000	1,500	2,000	1,002	1,503	2,006	1.008x - 10.170	1.000
B90	SKC	224-PCXR3	508366	02/10/2024	1,000	1,500	2,000	999	1,506	2,003	1.000x - 0.612	1.000
B91	SKC	224-PCXR3	510919	02/10/2024	1,000	1,500	2,000	1,011	1,504	2,001	0.991x + 17.894	1.000
B92	SKC	224-PCXR3	510987	03/10/2024	1,000	1,500	2,000	1,004	1,505	2,008	1.008x - 10.210	1.000
B93	SKC	224-PCXR3	509845	03/10/2024	1,000	1,500	2,000	1,005	1,505	2,005	1.005x - 5.793	1.000
B94	SKC	224-PCXR8	A127871	03/10/2024	1,000	1,500	2,000	1,003	1,503	2,001	1.003x - 3.458	1.000
B95	SKC	224-PCXR8	A127921	01/10/2024	1,000	1,500	2,000	998	1,506	2,006	1.008x - 11.706	1.000
B96	SKC	224-PCXR8	A127942	01/10/2024	1,000	1,500	2,000	1,003	1,502	2,000	0.999x + 2.679	1.000
B97	SKC	224-PCXR8	A127955	01/10/2024	1,000	1,500	2,000	1,004	1,505	2,008	1.010x - 12.557	1.000
B98	SKC	224-PCXR8	A127956	01/10/2024	1,000	1,500	2,000	998	1,497	2,001	1.004x - 8.311	1.000

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com, www.spscon.com

Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (mL/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
H-B01	Dwyer	VFB-65	02/10/2024	500	1,000	2,000	502.4	998.3	1992.4	0.996x + 5.889	1.000
H-B02	Dwyer	VFB-65	04/10/2024	500	1,000	2,000	498.5	1001.9	2009.0	0.997x + 5.707	1.000
H-B03	Dwyer	VFB-65	04/10/2024	500	1,000	2,000	499.2	996.1	2011.4	1.004x - 11.451	0.999
H-B04	Dwyer	VFB-65	04/10/2024	500	1,000	2,000	504.0	999.2	1995.1	0.995x + 7.219	1.000
H-B05	Dwyer	VFB-65	03/10/2024	500	1,000	2,000	498.7	1001.8	2007.6	0.997x + 4.568	1.000
H-B06	Dwyer	VFB-65	03/10/2024	500	1,000	2,000	497.3	999.1	2012.1	1.005x - 11.101	0.999
H-B07	Dwyer	VFB-65	01/10/2024	500	1,000	2,000	503.0	1004.1	1992.6	0.998x + 6.074	1.000
H-B08	Dwyer	VFB-65	02/10/2024	500	1,000	2,000	503.7	1000.4	1994.6	0.992x + 12.996	1.000
H-B09	Dwyer	VFB-65	01/10/2024	500	1,000	2,000	501.3	1001.6	1990.3	0.999x + 4.046	0.999
H-B10	Dwyer	VFB-65	01/10/2024	500	1,000	2,000	500.3	1002.0	1992.6	0.995x + 8.990	1.000

Calibrated by :

Adul Dangklom
(Mr.Adul Dangklom)

Approved by :

Peera Detudorn
(Mr. Peera Detudorn)



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Rotameter Calibration Report (For Personal Pump Low Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
L-B01	Dwyer	VFA-21	02/10/2024	50	100	200	50.8	99.7	201.2	0.990x + 1.455	1.000
L-B02	Dwyer	VFA-21	04/10/2024	50	100	200	50.3	98.8	199.5	1.003x - 0.022	0.999
L-B03	Dwyer	VFA-21	04/10/2024	50	100	200	50.6	100.7	200.1	1.002x + 0.030	1.000
L-B04	Dwyer	VFA-21	04/10/2024	50	100	200	50.9	101.3	201.6	0.993x + 2.147	1.000
L-B05	Dwyer	VFA-21	03/10/2024	50	100	200	49.9	102.0	200.2	1.001x + 0.423	1.000
L-B06	Dwyer	VFA-21	03/10/2024	50	100	200	50.2	100.7	200.9	0.999x + 0.931	1.000
L-B07	Dwyer	VFA-21	01/10/2024	50	100	200	50.1	100.5	200.9	0.999x + 1.192	0.999
L-B08	Dwyer	VFA-21	02/10/2024	50	100	200	50.1	101.2	199.0	1.001x - 0.298	1.000
L-B09	Dwyer	VFA-21	01/10/2024	50	100	200	50.2	99.0	202.1	1.001x + 0.711	0.999
L-B10	Dwyer	VFA-21	01/10/2024	50	100	200	50.3	100.2	201.7	1.003x + 0.455	1.000

Calibrated by :

Adul Dangklom
(Mr.Adul Dangklom)

Approved by :

(Mr. Peera Detudorn)



GAS CHROMATOGRAPH TEST CERTIFICATION

Certificate No. : SV0824/22063

Instrument Type : Gas Chromatography

Model : CP-3800

Serial Number : 00734

Organization : S.P.S. Consulting Service Co., Ltd.

Address : 7 Phahonyothin Soi 24 Phahonyothin Rd. Ladyao Chatuchak Bangkok 10900

Date : 05/08/2024

ELECTRONIC TEST

CPU	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
LCD TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
VENT TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
KEY ECHO TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
DESTRUCTION RAM TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL

RUN CHROMATOGRAM TEST

DETECTOR : Flame Ionization Detector (FID Channel Front)

INJECTOR : Capillary Injector Model 1079

GC CONDITION:

Column	80 °C hold 1 min., rate 20 °C/min. to 200 °C hold 1min.
Injector	220 °C
Detector	300 °C
Column flow	5 mL/min
Makeup flow	25 mL/min
Air flow	300 mL/min
Hydrogen flow	30 mL/min

Column: Capillary Column CP sil 5 CB 0.25 ID x 15 M

Sample: 1 µL Injection FID Test Sample 0.218 g/L C14, C15, C16 in hexane

SENSITIVITY TEST: C15. (Area count) = 156,955 Counts.



**Detector Sensitivity (FID)**

Detector Response	Result	Specification
Baseline Noise (μ V)	2.85	≤ 50
Baseline Drift (%)	0.09	≤ 1
Sensitivity (S/N for C15)	16,400	$\geq 1,024$

Temperature Specification

Temperature	Set	Result	Specification
Column Oven ($^{\circ}$ C)	80	80	± 5
Injector ($^{\circ}$ C)	220	220	± 5
Detector ($^{\circ}$ C)	300	300	± 5
Incubator ($^{\circ}$ C)	60	N/A	± 5

Relative Standard Deviation % (% RSD)

Checkout Procedure	Result	Specification
Area C15 (%)	1.71	≤ 5
Retention Time C15(%)	0	≤ 0.5

APPROVAL :

Signature: Suwarot.Engineer : Suwarot TrikainutDate : 05/08/2024



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THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200

80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200

Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@thaiunique.com, Website : www.thaiunique.com

Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 Area 1	157,309
C15 Area 2	159,359
C15 Area 3	157,349
C15 Area 4	152,379
C15 Area 5	158,379
C15 Area Average	156,955
* % RSD (< 5 %)	1.71

* The precision specification should be less than 2.0 % RSD ** (Relative Standard Deviation) for an Auto sampler injection and less than 5 % for Manual injections. To calculate the %RSD, select the C15 peak area for each of the five (5) samples.

** (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)

$$\% \text{ RSD} = (\text{std.dev} / \text{avg}) * 100$$

Compliance	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Performance by	Samarot.	
Date	05/08/2567	



Comments	-		
Reviewed by	Samar P.	Date	05/08/2024



VARIAN



บริษัท ไทยยูนิค จำกัด

THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200

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Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@thaiunique.com, Website : www.thaiunique.com

Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 RT 1	4.128
C15 RT 2	4.128
C15 RT 3	4.128
C15 RT 4	4.128
C15 RT 5	4.128
C15 RT Average	4.128
* % RSD (< 0.5 %)	0

* The precision specification should be less than 0.5 % RSD ** (Relative Standard Deviation) for an Auto sampler injection and less than 0.5 % for Manual injections. To calculate the %RSD, select the RT C15 peak for each of the five (5) samples.

** (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)

$$\% \text{ RSD} = (\text{std.dev} / \text{avg}) * 100$$

Compliance	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Performance by	Sumrat.	
Date	05/08/2024	



Comments	-		
Reviewed by	Sudat P.		Date 05/08/2024



VARIAN

ระดับเสียงในสถานประกอบการ



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304

MTC No. EEL. BP. 109/0267

CALIBRATION CERTIFICATE

Submitted by : S.P.S.Consulting Service Co.,Ltd.

Address : 7 Soi Phaholyothin 24, Phaholyothin Road, Jompol, Chatuchak, Bangkok 10900.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

Serial No. : 130006

Ambient Environment

Temperature : $(23 + 3) ^\circ\text{C}$

Relative Humidity : $(50 \pm 15) \%$

Ambient Pressure : $(101.325 \pm 1.500) \text{ kPa}$

Standards used :

1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
4. Digital Multimeter Agilent 34401A S/N MY44005560.
5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
6. Audio Analyzer Keithley 2015-P S/N4106495.
7. Condenser Microphone B&K 4180 S/N 2889871.

Calibration Procedure: CP-102-04 based on IEC 60942-2003; The sound pressure level generated by sound calibrator under test shall be measured by standard microphone using an insert voltage technique.

This instrument has been calibrated against standards maintained at Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

Date of Receipt : 22 Feb. 2024

Date of Calibration : 4 Mar. 2024

1 / 2

The results relate only to the items tested/calibrated or value assigned.

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BL.MTC.002 Rev.4

Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
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Tel. (66) 0 2577 9000

Fax. (66) 0 2577 9009

E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand

Tel. (66) 0 2323 1672-80 ext. 115, 116

Fax. (66) 0 2323 9165

E-mail : mtc@tistr.or.th

Office

196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand

Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217

Fax. (66) 0 2579 8592

E-mail : sumalee@tistr.or.th

Request No. 21-67/0304

MTC No. EEL. BP. 109/0267

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%.

Nominal Output of Unit Under Test = 94 dB re 20 μ Pa at 1000 Hz

Acoustic Output in dB re 20 μ Pa, Corrected to Reference Conditions: 101.325 kPa, 23.0 °C and 50 %RH.

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	93.85	-0.15	± 0.10	± 0.75 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	999.9	-0.1	± 1.5	$\pm 2.0\%$

3. Total Distortion


Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	1.65	± 0.50	$\pm 4.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :


.....
(Mr. Weerachai Deechaiyae)

Approved by :


.....
(Mr. Prawate Kluaypa)
Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 4 Mar. 2024

Date of Issue : 5 Mar. 2024

Ref : 2011267022200795001

End of Certificate

2 / 2

The results relate only to the items tested/calibrated or value assigned.

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

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Office/Laboratory

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Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
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Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com., www.spscon.com

Noise B_381/24

Sound Level Meter Calibration Report

Acoustic Calibrator Data

Brand	ACO	Number	AC 03/56
Model	2127	Serial No.	130006
Calibration Range	94 dB, 1000 Hz	Last Calibration	04 March 2024
		Due Date	04 March 2025

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B33	ACO	6236	00182015	03 October 2024	93.9	93.9
ACO-B36	ACO	6236	00192027	03 October 2024	94.1	93.9
ACO-B41	ACO	6236	00192032	03 October 2024	93.9	93.9
ACO-B43	ACO	6236	00192034	03 October 2024	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	

Calibrated by :

Adul Dangklom
(Mr.Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com., www.spscon.com

Noise B_503/24

Sound Level Meter Calibration Report

Acoustic Calibrator Data

Brand	ACO	Number	AC 03/56
Model	2127	Serial No.	130006
Calibration Range	94 dB, 1000 Hz	Last Calibration	04 March 2024
		Due Date	04 March 2025

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-R40	ACO	6236	00192052	17 December 2024	94.1	93.9
ACO-R41	ACO	6236	00192053	17 December 2024	94.1	93.9
ACO-R50	ACO	6236	00192062	17 December 2024	93.9	93.9
ACO-R51	ACO	6236	00192063	17 December 2024	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	

Calibrated by :

Adul Dangklom

(Mr. Adul Dangklom)

Approved by :

(Mr. Peera Detudom)