

# ภาคผนวกที่ 4

เอกสารสอบเทียบความถูกต้องของเครื่องมือ

ตรวจวัดคุณภาพสิ่งแวดล้อม

ภาคผนวกที่ 4-1	คุณภาพอากาศในบรรยากาศ
ภาคผนวกที่ 4-2	คุณภาพอากาศจากปล่องระบาย
ภาคผนวกที่ 4-3	คุณภาพอากาศในสถานประกอบการ
ภาคผนวกที่ 4-4	ระดับเสียงในบรรยากาศ
ภาคผนวกที่ 4-5	ระดับเสียงในสถานประกอบการ
ภาคผนวกที่ 4-6	คุณภาพน้ำทิ้ง
ภาคผนวกที่ 4-7	ระดับความร้อนในสถานประกอบการ

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง  
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
<b>คุณภาพอากาศในบรรยากาศ</b>		
Total Suspended Particulate (TSP)	High Volume Air Sampler No. R05, R07, R17	Digital Balance
Particulate Matter less than 10 microns (PM-10)	High Volume PM-10 Air Sampler No. R12, R13, R17	Digital Balance
Nitrogen Dioxide (NO <sub>2</sub> )	NO <sub>2</sub> Analyzer No. R01, R10, R11	NO <sub>2</sub> Analyzer No. R01, R10, R11
<b>คุณภาพอากาศจากปล่องระบาย</b>		
Total Suspended Particulate	Console No. B03, R03 Pitot Tube No. B33, B35	Digital Balance
Oxides of Nitrogen	Vacuum Gauge	Spectrophotometer
Hydrogen Chloride	Personal Pump SKC No. R05 Rotameter No. H-R05	IC
Hydrogen Fluoride	Personal Pump SKC No. R05 Rotameter No. H-R05	IC
<b>คุณภาพอากาศในสถานประกอบการ</b>		
Total Dust	Personal Pump SKC No. B45, B77, R02, R03, R15, R21, R32, R34, R44 Rotameter No. H-R01, H-R02	Digital Balance
Respirable Dust	Personal Pump SKC No. B23, B31, B72, R21, R36, R38, R40, R42 Rotameter No. H-R01, H-R02	Digital Balance
Aluminum Fume	Personal Pump SKC No. R06, R19, R38 Rotameter No. H-R01, H-R02	ICP
Hydrogen Chloride	Personal Pump SKC No. B40 Rotameter No. L- R02	IC
Hydrogen Fluoride	Personal Pump SKC No. R03 Rotameter No. L- R02	IC
Ammonia	Personal Pump SKC No. R05 Rotameter No. L- R02	IC
<b>ระดับเสียงในบรรยากาศ</b>		
L <sub>eq</sub> 24 hr, L <sub>max</sub> , L <sub>90</sub> และเสียงรบกวน	Acoustic Calibrator Sound Level Meter : ACO-R22, R33, R47, R48 Sound Level Meter : CR-B04	-

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง  
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม (ต่อ)

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
ระดับเสียงในสถานประกอบการ $L_{eq}$ 8 hr และ $L_{max}$	Acoustic Calibrator Sound Level Meter : ACO-B18, B29, B33, B41, R51, R52	-
TWA	Sound Level Meter : NMD-B01, B02, B03, B12, B13	
คุณภาพน้ำทิ้ง		
pH	-	pH Meter
Total Dissolved Solids	-	Digital Balance
Total Suspended Solids	-	Digital Balance
BOD <sub>5</sub>	-	BOD Analyzer
COD	-	COD Reactor
Grease & Oil	-	Digital Balance
Total Aluminum	-	ICP
ระดับความร้อนในสถานประกอบการ WBGT	Digital Thermometer Heat Meter No. R08, R09, R12	-

ภาคผนวกที่ 4-1

คุณภาพอากาศในบรรยากาศ





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

## High Volume Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3611

### Calibration Data

High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft <sup>3</sup> /min)	R <sup>2</sup>
B35	B35	02/02/2024	y = 1.188x-3.435	0.996
B36	B36	01/02/2024	y = 1.201x-4.036	0.999
B37	B37	01/02/2024	y = 1.196x-2.671	0.998
B38	B38	02/02/2024	y = 1.232x-6.552	0.997
B39	B39	03/02/2024	y = 1.164x-0.902	0.997
B40	B40	01/02/2024	y = 1.225x-6.117	0.999
B41	B41	02/02/2024	y = 1.265x-6.140	0.999
B42	B42	02/02/2024	y = 1.187x-3.625	0.999
B43	B43	01/02/2024	y = 1.233x-2.707	0.997
B44	B44	01/02/2024	y = 1.202x-3.263	0.996
R01	R01	01/02/2024	y = 1.214x-4.512	0.999
R02	R02	02/02/2024	y = 1.222x-5.522	0.999
R03	R03	03/02/2024	y = 1.204x-5.785	0.999
R04	R04	01/02/2024	y = 1.220x-5.355	0.999
R05	R05	01/02/2024	y = 1.190x-5.262	0.997
R06	R06	02/02/2024	y = 1.223x-6.383	0.998
R07	R07	02/02/2024	y = 1.084x+0.577	0.999
R08	R08	01/02/2024	y = 1.157x-2.531	0.999
R09	R09	01/02/2024	y = 1.194x-3.227	0.998
R10	R10	02/02/2024	y = 1.198x-4.625	0.998
R11	R11	02/02/2024	y = 1.143x-2.176	1.000
R12	R12	02/02/2024	y = 1.165x-4.124	0.998
R13	R13	03/02/2024	y = 1.133x-1.833	0.997
R14	R14	01/02/2024	y = 1.216x-3.559	0.995
R15	R15	01/02/2024	y = 1.183x-5.143	0.999
R16	R16	01/02/2024	y = 1.227x-7.151	0.999
R17	R17	02/02/2024	y = 1.181x-3.964	0.996
R18	R18	02/02/2024	y = 1.195x-3.915	0.997
R19	R19	03/02/2024	y = 1.215x-6.609	1.000
R20	R20	03/02/2024	y = 1.208x-5.309	0.998





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7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900

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

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

### High Volume PM-10 Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3611

#### Calibration Data

High Volume PM-10 Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft <sup>3</sup> /min)	R <sup>2</sup>
R01	R01	02/02/2024	y = 1.206x-5.952	0.998
R02	R02	02/02/2024	y = 1.219x-3.961	0.997
R03	R03	01/02/2024	y = 1.203x-5.426	0.998
R04	R04	01/02/2024	y = 1.191x-6.027	0.997
R05	R05	01/02/2024	y = 1.199x-5.883	1.000
R06	R06	01/02/2024	y = 1.192x-3.038	0.998
R07	R07	02/02/2024	y = 1.169x-2.670	0.996
R08	R08	02/02/2024	y = 1.186x-4.195	0.997
R09	R09	03/02/2024	y = 1.184x-3.512	1.000
R10	R10	03/02/2024	y = 1.179x-3.695	0.999
R11	R11	03/02/2024	y = 1.202x-2.389	0.997
R12	R12	01/02/2024	y = 1.194x-5.194	0.998
R13	R13	01/02/2024	y = 1.173x-2.754	0.999
R14	R14	01/02/2024	y = 1.176x-2.231	0.997
R15	R15	02/02/2024	y = 1.188x-3.910	0.998
R16	R16	02/02/2024	y = 1.180x-3.568	0.998
R17	R17	02/02/2024	y = 1.195x-3.126	0.996
R18	R18	03/02/2024	y = 1.143x-2.749	1.000
R19	R19	01/02/2024	y = 1.154x-2.002	0.996
R20	R20	01/02/2024	y = 1.161x-4.362	0.998





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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

CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO <sub>2</sub> / NO <sub>x</sub> ANALYZER					
DATE :	03 April 2024	BRAND :	API	MODEL :	200E
NO.	NOX-R01	SERIAL NO.	769		
Calibrator (Dilution System)					
Brand	: API			Model	: 700
Last Cal. Date	: 08 August 2023			Serial No.	: 911
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)			Cylinder No.	: D636192
Certified Date	: 20 April 2022	Expired Date	: 20 April 2024	Cylinder Conc.	: 49.1 ppm
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
			% RH	49	
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.11	-	0	-
NO Span	400	399.9	-0.025	400.0	1.008
NO <sub>x</sub> Span	400	400.2	0.050	400.0	1.012
API Model 200E NO <sub>x</sub> Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	508	cc/min	500 ± 50		
OZONE FLOW	78	cc/min	80 ± 15		
PMT	103.0	mV	-20 - 150		
AZERO	93.7	mV	-20 - 150		
HVPS	673	V	420 - 900 constant		
RCELL TEMP	50.0	°C	50 ± 1		
BOX TEMP	29.1	°C	8 - 48		
PMT TEMP	7.3	°C	7 ± 2		
MOLY TEMP	315.2	°C	315 ± 5		
RCELL PRESS	8.3	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.5	IN-Hg-A	25 - 30 constant		
NO Span Conc	400	PPB	20 - 20,000		
NO <sub>x</sub> Span Conc	400	PPB	20 - 20,000		
NO Slope	1.008	-	1.0 ± 0.3		
NO <sub>x</sub> Slope	1.012	-	1.0 ± 0.3		
NO Offset	1.5	mV	-20 to +150		
NO <sub>x</sub> Offset	0.9	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		



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

CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO <sub>2</sub> / NO <sub>x</sub> ANALYZER					
DATE :	03 April 2024	BRAND :	API	MODEL :	200E
NO.	NOX-R10	SERIAL NO.	1991		
Calibrator (Dilution System)					
Brand : API			Model : 700		
Last Cal. Date : 08 August 2023			Serial No. : 911		
Reference Standard Gas					
Standard Gas : Nitric Oxide (NO)			Cylinder No. : D636192		
Certified Date : 20 April 2022		Expired Date : 20 April 2024		Cylinder Conc. : 49.1 ppm	
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
% RH 49					
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	399.6	-0.100	400.0	1.005
NO <sub>x</sub> Span	400	399.9	-0.025	400.0	1.009
API Model 200E NO <sub>x</sub> Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	511	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	103.1	mV	-20 - 150		
AZERO	93.9	mV	-20 - 150		
HVPS	670	V	420 - 900 constant		
RCELL TEMP	50.1	°C	50 ± 1		
BOX TEMP	29.3	°C	8 - 48		
PMT TEMP	7.4	°C	7 ± 2		
MOLY TEMP	314.8	°C	315 ± 5		
RCELL PRESS	8.2	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.4	IN-Hg-A	25 - 30 constant		
NO Span Conc	400	PPB	20 - 20,000		
NO <sub>x</sub> Span Conc	400	PPB	20 - 20,000		
NO Slope	1.005	-	1.0 ± 0.3		
NO <sub>x</sub> Slope	1.009	-	1.0 ± 0.3		
NO Offset	1.3	mV	-20 to +150		
NO <sub>x</sub> Offset	0.8	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		





บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด

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## CALIBRATION REPORT

### CHEMILUMINESCENT NO / NO<sub>2</sub> / NO<sub>x</sub> ANALYZER

DATE : 03 April 2024

BRAND : API

MODEL : 200E

NO. NOX-R11

SERIAL NO. 2621

#### Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 08 August 2023

Serial No. : 911

#### Reference Standard Gas

Standard Gas : Nitric Oxide (NO)

Cylinder No. : D636192

Certified Date : 20 April 2022

Expired Date : 20 April 2024

Cylinder Conc. : 49.1 ppm

#### CALIBRATING CONDITION

Pressure 1011 mmbar

Temp. 24.5 °C

% RH 49

#### CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
NO Span	400	400.1	0.025	400.0	1.009
NO <sub>x</sub> Span	400	400.3	0.075	400.0	1.014

#### API Model 200E NO<sub>x</sub> Analyzer Check List

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	500 standard
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air
SAMPLE FLOW	505	cc/min	500 ± 50
OZONE FLOW	78	cc/min	80 ± 15
PMT	103.3	mV	-20 - 150
AZERO	94.1	mV	-20 - 150
HVPS	674	V	420 - 900 constant
RCELL TEMP	50.2	°C	50 ± 1
BOX TEMP	29.4	°C	8 - 48
PMT TEMP	7.1	°C	7 ± 2
MOLY TEMP	314.9	°C	315 ± 5
RCELL PRESS	8.5	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.7	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO <sub>x</sub> Span Conc	400	PPB	20 - 20,000
NO Slope	1.009	-	1.0 ± 0.3
NO <sub>x</sub> Slope	1.014	-	1.0 ± 0.3
NO Offset	1.7	mV	-20 to +150
NO <sub>x</sub> Offset	1.0	mV	-20 to 150
Stability at Zero	0.1	PPB	< 0.2
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas



**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](http://www.qcalibration.com)

CERTIFICATE No : 24M2227

REFERENCE No : 72448-1

PAGE : 1 OF 2

**Certificate of Calibration**

**EQUIPMENT** : DIGITAL BALANCE

**MANUFACTURER** : METTLER TOLEDO

**MODEL** : XS105DU

**SERIAL No** : 1126422905

**ID No** : BA05/50

**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

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





CERTIFICATE No : 24M2227

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU  
MANUFACTURER : METTLER TOLEDO S/N : 1126422905  
ID No : BA05/50 RECEIVED DATE : 08-Mar-24  
AIR PRESSURE : 1010mbar  $\pm$  1mbar CALIBRATION DATE : 08-Mar-24  
AMBIENT TEMPERATURE : 25° C  $\pm$  1° C RELATIVE HUMIDITY : 53 %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 :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
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

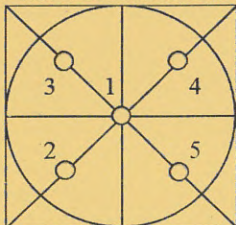
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000055 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY ( $\pm$ g)
0.00	0.00000	0.00000	0.000065
0.02	0.02001	-0.00001	0.000065
0.10	0.10002	-0.00002	0.000066
0.20	0.20001	-0.00001	0.000066
0.50	0.50001	-0.00001	0.000065
1.00	1.00003	-0.00003	0.000066
2.00	2.00001	-0.00001	0.000067
5.00	5.00001	-0.00001	0.000068
10.00	9.99994	0.00006	0.000070
20.00	20.00008	-0.00008	0.000078
50.00	50.0000	0.0000	0.00013
100.00	100.0001	-0.0001	0.00019
120.00	120.0001	-0.0001	0.00022

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	50.0000
2	50.0000
3	50.0000
4	50.0000
5	50.0000
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

ภาคผนวกที่ 4-2

คุณภาพอากาศจากปล่องระบาย





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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

## Console Calibration Report

Calibration Method

Critical Orifices

### Calibration Data

Console Data		Calibration Data		
No.	Serial No.	Date	y	$\Delta H_{\text{g}}$ (mmH <sub>2</sub> O)
B01	1563	01/03/2024	1.003	50.38
B02	8002514	04/03/2024	1.002	49.73
B03	1503016	02/03/2024	0.997	50.45
B04	00006659	01/03/2024	1.004	49.97
B05	00007428	02/03/2024	0.996	49.65
R01	1561	02/03/2024	0.999	50.18
R02	8002513	01/03/2024	1.005	50.04
R03	1570	03/03/2024	0.998	49.82
R04	8002519	02/03/2024	1.004	49.58
R05	1503015	03/03/2024	1.002	50.33

Remark : Accept Value of y (test) is  $0.97 < y < 1.03$

Accept Value of  $\Delta H_{\text{g}}$  (test) is  $46.7 \pm 6.4$  (mmH<sub>2</sub>O)



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## Pitot Tube Calibration Report

Calibration Method

Standard Pitot Tube

### Calibration Data

Pitot Tube Data			Calibration Data		
No.	Type of Pitot	Coefficient of Standard Pitot	Date	Avg. of Cp (test)	
				Side A	Side B
B03	S	0.99	01/02/2024	0.84	0.83
B04	S	0.99	02/02/2024	0.85	0.84
B05	S	0.99	02/02/2024	0.84	0.84
B07	S	0.99	01/02/2024	0.84	0.85
B08	S	0.99	01/02/2024	0.83	0.84
B09	S	0.99	03/02/2024	0.84	0.85
B11	S	0.99	03/02/2024	0.84	0.84
B16	S	0.99	01/02/2024	0.83	0.84
B18	S	0.99	02/02/2024	0.84	0.84
B19	S	0.99	02/02/2024	0.84	0.83
B21	S	0.99	01/02/2024	0.84	0.85
B24	S	0.99	02/02/2024	0.85	0.84
B27	S	0.99	01/02/2024	0.84	0.84
B30	S	0.99	02/02/2024	0.84	0.83
B31	S	0.99	02/02/2024	0.84	0.85
B33	S	0.99	01/02/2024	0.84	0.84
B35	S	0.99	01/02/2024	0.85	0.84

Remark : Accept value of Cp (test) is  $0.84 \pm 0.01$



## CERTIFICATE OF CALIBRATION FOR

NOMENCLATURE : VACUUM GAUGE  
MANUFACTURER : HI-LIGHT  
MODEL / TYPE : N/A  
SERIAL NO. : N/A[64-220088-1]  
CLID. NO. : 212301419  
JOB CONTROL NO. : 230725081570

CUSTOMER : S.P.S. CONSULTING SERVICE CO., LTD.  
7 SOI PHAHOLYOTHIN 24 ROAD., JOMPOL,  
CHATUCHAK, BANGKOK 10900

DATE OF RECEIVED : 25 July 2023

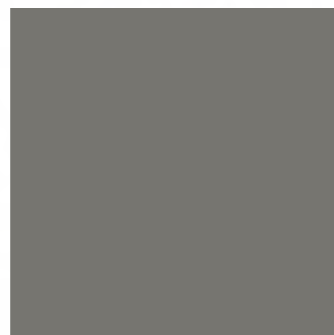
DATE OF ISSUED : 31 July 2023

Report of calibration screening must not be taken in part. Except complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Sittipong Pimdee  
Calibration Engineer



Approved By : Mongkol Yotsoontorn  
Authorized Signatory  
31 July 2023



This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units ( SI )

Certificate No. Q23081570

F3-011-04/01-12

page 1 of 3



@clccalibration

## REPORT OF CALIBRATION

### FOR

NOMENCLATURE	:	VACUUM GAUGE
MANUFACTURER	:	HI-LIGHT
MODEL / TYPE	:	N/A
SERIAL NO.	:	N/A[64-220088-1]
DATE OF CALIBRATION	:	26 July 2023
DUE DATE OF CALIBRATION	:	26 July 2024

---

#### ENVIRONMENT CONDITIONS :

Temperature :  $(23 \pm 2) ^\circ\text{C}$

Relative Humidity :  $(55 \pm 10) \% \text{RH}$

#### PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPPP-05** according to **DKD-R 6-1** as calibration guidelines.

The calibration was performed by direct measurement with Document Process Calibrator and Pressure Module which maintained by the Calibration Laboratory Co., Ltd.

#### REFERENCE STANDARD USED :

Document Process Calibrator, Fluke Model 741B S/N. 8295020 with Pressure Module Model 700PD5 S/N. 89404505.

#### TRACEABILITY :

The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand).  
Certificate No. MP-0035-23, Due Date 02 February 2024.

#### UNCERTAINTY :

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor of  $k = 2$ . It has been evaluated according to the "Calibration of Pressure Gauges (DKD-R 6-1)" which provides a level of confidence approximately 95%.

Certificate No. Q23081570

F3-011-04/01-12

page 2 of 3



@clccalibration



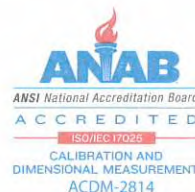


**CLC**  
Accredited  
ISO/IEC 17025

# CALIBRATION LABORATORY Co., LTD.

2/10-11,14, 55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230

Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



**CONDITION OF CALIBRATION ITEM : GOOD**

**MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment**

The DUC was exercised by applying a known pressure from its zero to full scale 1 times. Then 2 series of known gauge pressure were applied. The STD reading were recorded and the means value were reported in the table below.

## CALIBRATION DATA

### CORRECTION OF PRESSURE

DUC Test point ( inHg )	STD Reading ( kPa )		Conversion to inHg		Correction ( inHg )	
	Up	Down	Up	Down	Up	Down
0	0.00	0.00	0.0	0.0	0.0	0.0
-5	-15.07	-15.10	-4.5	-4.5	+0.5	+0.5
-10	-32.10	-32.13	-9.5	-9.5	+0.5	+0.5
-15	-49.20	-49.23	-14.5	-14.5	+0.5	+0.5
-20	-66.26	-66.26	-19.6	-19.6	+0.4	+0.4
-25	-83.30	-83.33	-24.6	-24.6	+0.4	+0.4
-30	-100.39	-100.39	-29.6	-29.6	+0.4	+0.4

Uncertainty of measurement  $\pm 0.2$  inHg

Transmitting fluid : Air.

Technical Note. Conversion factor 1 kPa ; 0.2953003 inHg

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 008 Page 36 of 54

**This report is valid for the above stated instrument/s only.**

### End of Certificate ###

Certificate No. Q23081570

F3-011-04/01-12

page 3 of 3



@clccalibration





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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  $^{\circ}\text{C}$   
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 <sup>2</sup>
R01	SKC	224-PCXR4	602467	04/04/2024	1,000	1,500	2,000	994	1,506	2,006	1.009x – 15.012	1.000
R02	SKC	224-PCXR4	626450	04/04/2024	1,000	2,000	3,000	999	1,497	1,989	0.988x + 13.944	1.000
R03	SKC	224-PCXR4	691592	09/04/2024	1,000	1,500	2,000	1,006	1,498	2,005	1.011x – 20.963	0.999
R04	SKC	224-PCXR4	691672	02/04/2024	1,000	1,500	2,000	998	1,491	1,995	0.996x + 0.630	1.000
R05	SKC	224-PCXR4	798470	04/04/2024	1,000	1,500	2,000	995	1,508	1,998	1.010x – 23.496	0.999
R06	SKC	224-PCXR4	798456	05/04/2024	1,000	1,500	2,000	998	1,500	1,997	1.001x – 5.085	1.000
R07	SKC	224-PCXR4	798480	02/04/2024	1,000	1,500	2,000	996	1,491	2,002	1.009x – 17.230	1.000
R08	SKC	224-PCXR4	883215	04/04/2024	1,000	1,500	2,000	1,010	1,502	2,007	1.001x + 0.255	1.000
R09	SKC	224-PCXR4	034650	05/04/2024	1,000	1,500	2,000	994	1,503	2,003	1.017x – 34.105	0.999
R10	SKC	224-PCXR4	091765	05/04/2024	1,000	1,500	2,000	998	1,497	1,996	1.001x - 3.929	1.000
R11	SKC	224-PCXR4	091763	05/04/2024	1,000	1,500	2,000	1,001	1,501	2,001	1.010x – 21.251	0.999
R12	SKC	224-PCXR4	091568	04/04/2024	1,000	1,500	2,000	997	1,500	2,002	1.004x – 9.014	1.000
R13	SKC	224-PCXR4	091638	08/04/2024	1,000	1,500	2,000	1,003	1,503	1,993	0.990x + 13.944	1.000
R14	SKC	224-PCXR4	091764	09/04/2024	1,000	1,500	2,000	995	1,501	1,998	1.013x – 27.899	0.999
R15	SKC	224-PCXR8	529457	04/04/2024	1,000	1,500	2,000	1,002	1,501	2,003	1.005x – 8.870	1.000
R16	SKC	224-PCXR8	529643	08/04/2024	1,000	1,500	2,000	999	1,497	1,995	1.000x – 4.367	1.000
R17	SKC	224-PCXR8	529645	04/04/2024	1,000	1,500	2,000	997	1,507	2,003	1.012x – 23.233	0.999
R18	SKC	224-PCXR8	566756	08/04/2024	1,000	1,500	2,000	992	1,499	1,999	1.002x – 7.159	1.000
R19	SKC	224-PCXR8	566802	04/04/2024	1,000	1,500	2,000	1,002	1,497	2,002	1.011x – 21.211	0.999
R20	SKC	224-PCXR8	529089	08/04/2024	1,000	1,500	2,000	994	1,501	2,004	1.013x – 24.274	1.000
R21	SKC	224-PCXR8	665728	04/04/2024	1,000	1,500	2,000	1,000	1,496	1,998	0.999x – 1.264	1.000
R22	SKC	224-PCXR8	707444	04/04/2024	1,000	1,500	2,000	1,001	1,501	2,004	1.006x – 10.948	1.000
R23	SKC	224-PCXR8	761067	04/04/2024	1,000	1,500	2,000	997	1,493	1,992	0.994x + 2.840	1.000
R24	SKC	224-PCXR8	707893	02/04/2024	1,000	1,500	2,000	997	1,507	1,998	1.006x – 14.466	0.999
R25	SKC	224-PCXR8	761052	09/04/2024	1,000	1,500	2,000	1,009	1,494	1,996	0.987x + 17.592	1.000
R26	SKC	224-PCXR8	707956	08/04/2024	1,000	1,500	2,000	1,003	1,500	2,004	1.009x – 15.934	0.999
R27	SKC	224-PCXR8	707398	09/04/2024	1,000	1,500	2,000	995	1,502	2,003	1.008x – 17.956	1.000
R28	SKC	224-PCXR8	707481	09/04/2024	1,000	1,500	2,000	1,003	1,500	2,003	1.012x – 22.471	0.999
R29	SKC	224-PCXR8	707402	08/04/2024	1,000	1,500	2,000	1,005	1,495	1,992	0.987x + 16.057	1.000
R30	SKC	224-PCXR8	093811	09/04/2024	1,000	1,500	2,000	999	1,494	1,995	0.997x + 0.921	1.000
R31	SKC	224-PCXR8	093183	04/04/2024	1,000	1,500	2,000	1,002	1,504	2,001	1.001x – 1.723	1.000
R32	SKC	224-PCXR8	671950	09/04/2024	1,000	1,500	2,000	999	1,502	1,996	0.997x + 3.418	1.000
R33	SKC	224-PCXR4	626254	04/04/2024	1,000	1,500	2,000	996	1,499	2,001	1.010x – 22.367	0.999
R34	SKC	224-PCXR4	626131	04/04/2024	1,000	1,500	2,000	1,000	1,501	2,005	1.008x – 14.071	1.000
R35	SKC	224-PCXR8	707460	08/04/2024	1,000	1,500	2,000	996	1,496	1,996	0.997x + 1.671	1.000
R36	SKC	224-PCXR8	707446	02/04/2024	1,000	1,500	2,000	1,002	1,499	2,000	1.010x – 20.385	0.999
R37	SKC	224-PCXR8	707432	04/04/2024	1,000	1,500	2,000	998	1,497	1,999	0.997x + 1.683	1.000
R38	SKC	224-PCXR8	707349	04/04/2024	1,000	1,500	2,000	999	1,499	2,000	1.000x – 3.701	1.000
R39	SKC	224-PCXR8	761095	09/04/2024	1,000	1,500	2,000	1,002	1,496	1,993	0.996x + 2.987	1.000



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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 <sup>2</sup>
H-R01	Dwyer	VFB-65	03/01/2024	500	1,000	2,000	501.7	994.0	1980.7	1.000x – 3.859	0.999
H-R02	Dwyer	VFB-65	04/01/2024	500	1,000	2,000	500.8	999.1	1988.7	1.001x – 2.909	1.000
H-R03	Dwyer	VFB-65	03/01/2024	500	1,000	2,000	501.7	990.3	1997.7	0.993x + 3.830	1.000
H-R04	Dwyer	VFB-65	03/01/2024	500	1,000	2,000	496.8	992.2	2016.5	1.007x – 11.486	1.000
H-R05	Dwyer	VFB-65	04/01/2024	500	1,000	2,000	499.6	992.9	1990.7	1.002x – 4.797	1.000
H-R06	Dwyer	VFB-65	05/01/2024	500	1,000	2,000	505.2	995.4	1982.6	0.999x – 1.343	0.999



**QUALITY CALIBRATION CO.,LTD.**

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

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

[www.qcalibration.com](http://www.qcalibration.com)

CERTIFICATE No : 24M2227

REFERENCE No : 72448-1

PAGE : 1 OF 2

**Certificate of Calibration**

**EQUIPMENT** : DIGITAL BALANCE

**MANUFACTURER** : METTLER TOLEDO

**MODEL** : XS105DU

**SERIAL No** : 1126422905

**ID No** : BA05/50

**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

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





CERTIFICATE No : 24M2227

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU  
MANUFACTURER : METTLER TOLEDO S/N : 1126422905  
ID No : BA05/50 RECEIVED DATE : 08-Mar-24  
AIR PRESSURE : 1010mbar  $\pm$  1mbar CALIBRATION DATE : 08-Mar-24  
AMBIENT TEMPERATURE : 25°C  $\pm$  1°C RELATIVE HUMIDITY : 53 %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 :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
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

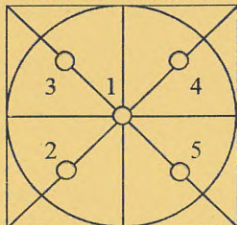
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000055 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY ( $\pm$ g)
0.00	0.00000	0.00000	0.000065
0.02	0.02001	-0.00001	0.000065
0.10	0.10002	-0.00002	0.000066
0.20	0.20001	-0.00001	0.000066
0.50	0.50001	-0.00001	0.000065
1.00	1.00003	-0.00003	0.000066
2.00	2.00001	-0.00001	0.000067
5.00	5.00001	-0.00001	0.000068
10.00	9.99994	0.00006	0.000070
20.00	20.00008	-0.00008	0.000078
50.00	50.0000	0.0000	0.00013
100.00	100.0001	-0.0001	0.00019
120.00	120.0001	-0.0001	0.00022

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	50.0000
2	50.0000
3	50.0000
4	50.0000
5	50.0000
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



# SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY



451-451/1 Sirinthorn Rd.,Bangbumru, Bangplud Bangkok 10700 THAILAND.  
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiphorn.com <http://www.sithiphorn.com>

NSC-TISI-TIS 17025  
CALIBRATION 0394

Cert. No. : SP23016

Pages : 1 of 3

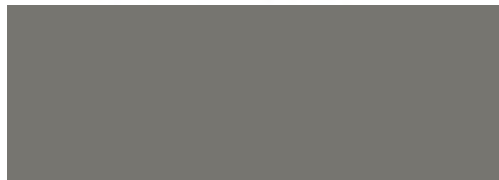
## Calibration Certificate

**Equipment :** UV-VIS SPECTROPHOTOMETER  
**Manufacturer :** PERKINELMER  
**Model :** LAMBDA 25  
**Serial No.:** 501S14123010  
**ID No.:** SP03/58  
**Calibration Mode :** WAVELENGTH ACCURACY  
PHOTOMETRIC ACCURACY  
**Condition As Found :** GOOD  
**Customer :** S.P.S. CONSULTING SERVICE CO., LTD.  
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN ROAD,  
CHOMPHON, CHATUCHAK,  
BANGKOK 10900, THAILAND.  
**Location :** ORGANIC LABORATORY IV  
**Ambient Temperature :** ( 25.0 ± 5 ) °C  
**Relative Humidity :** ( 48.4 ± 25 ) %  
**Received Date :** 30 AUGUST 2023  
**Calibration Date :** 30 AUGUST 2023  
**Date of Issue :** 31 AUGUST 2023

**Calibrated by :**

Nathakorn Pisutpaisan

**Approved by :**



This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.



## Continuation of Calibration Certificate

Cert. No. : SP23016

Job No. : VC66SP0014

Pages : 2 of 3

**Calibration Method :**

This instrument was calibrated by using on-site calibration procedure In-house method : CP-SP-01

The calibration procedure to direct measurement wavelength accuracy by using wavelength standard solution, Photometric accuracy by using absorbance standard filter and absorbance standard solution

The calibration procedure used was based on ASTM E275-01,ASTM E925-02

**Condition of this result of calibration :**

## 1. Certified reference materials

Material	Ref. type	Cell serial No.	Cert. No.	Due Date
Holmium liquid	RM-HL	29706	106864	01/11/2024
Didymium liquid	RM-DL	28912	106905	02/11/2024
Neutral density filter	RM-1N2N3N	13877	106918	03/11/2024
Potassium dichromate solutions	RM-0204060810	14204	106902	02/11/2024
Potassium Iodide solution	-	KI-0701-001	CI-0090-22	08/04/2024

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

3. This certificate is traceable to the international system of unit maintained at :

3.1 The UK National Physical Laboratory (NPL)

3.2 The National Institute of Standards and Technology, NIST.

**Result of calibration : Wavelength Accuracy**

(Without adjustment)

Material	Certified Values of Reference Material (nm)	UUC* Reading (nm)	Error (nm)	Uncertainty ± (nm)	k Factor
RM-HL	278.13	278.3	0.17	0.16	2.00
	361.25	361.3	0.05	0.16	2.00
	467.82	468.0	0.18	0.16	2.00
	536.56	536.6	0.04	0.16	2.00
	640.50	640.4	-0.10	0.16	2.00
RM-DL	740.09	740.0	-0.09	0.16	2.00
	864.94	865.0	0.06	0.16	2.00

UUC\* = Unit Under Calibration



Continuation of Calibration Certificate

Cert. No. : SP23016  
Job No. : VC66SP0014  
Pages : 3 of 3

**Result of calibration : Photometric Accuracy**

(Without adjustment)

Material	Wavelength (nm)	Filter S/N	Nominal Absorbance (A)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor
Neutral Density glass filter	440.0	29360	1.0	1.0517	1.0564	0.0047	0.0031	2.00
		29914	0.7	0.7445	0.7460	0.0015	0.0032	2.00
		29381	0.5	0.5416	0.5429	0.0013	0.0032	2.00
	546.1	29360	1.0	0.9821	0.9849	0.0028	0.0030	2.00
		29914	0.7	0.6961	0.6961	0.0000	0.0030	2.00
		29381	0.5	0.5073	0.5073	0.0000	0.0030	2.00
	590.0	29360	1.0	1.0222	1.0244	0.0022	0.0030	2.00
		29914	0.7	0.7237	0.7234	-0.0003	0.0030	2.00
		29381	0.5	0.5361	0.5360	-0.0001	0.0031	2.00
	635.0	29360	1.0	0.9753	0.9775	0.0022	0.0030	2.00
		29914	0.7	0.6910	0.6910	0.0000	0.0030	2.00
		29381	0.5	0.5211	0.5210	-0.0001	0.0032	2.00
Material	Wavelength (nm)	Solution (mg/l)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor	
RM-0204060810	235.0	20	0.2422	0.2462	0.0040	0.0101	2.00	
		40	0.4866	0.4900	0.0034	0.0115	2.00	
		60	0.7414	0.7390	-0.0024	0.0068	2.00	
		80	0.9858	0.9871	0.0013	0.0093	2.00	
		100	1.2442	1.2480	0.0038	0.0087	2.00	

UUC\* = Unit Under Calibration

**Condition of this result of calibration : Spectrophotometer PERKINELMER Model Lambda 25 S/N 501S141230**

Resolution of Wavelength Mode 0.1 nm  
Resolution of Photometric Mode 0.0001 A  
Parameter Setting  
Measurement Mode Wavelength, Absorbance  
Wavelength Scan 1100 nm-190 nm  
Scanning Speed 7.5 nm/min  
Data Pitch 0.1 nm  
Band width(Wavelength) 1.0 nm  
Band width(Vis) 1.0 nm  
Band width(Uv) 1.0 nm

Stray Light** UUC* Reading at 220 nm	
Transimission T(%)	Absorbance(A)
0.0111	3.9564

\*\*Specific Acceptance :

Transmission  $\leq$  1.0 T(%), Absorbance  $\geq$  2.0 A

\*\*Stray light not TISI Accredited

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k$ , providing a level of confidence of approximately 95%

End of Calibration Certificate





## Certificate of Calibration

**Aquion : Anion (ID#894)**

This certificate is to verify that instrument below are calibrated

by Archemica Lab Co.,Ltd.

AQUION S/N : 190840059

AS-DV S/N : 190915235

for

**S.P.S. Consulting Service Co., Ltd.**

ARCHEMICA LAB  
บริษัท อาร์เคมีกา แล็บ จำกัด  
ARCHEMICA LAB CO.,LTD

Operator Signature : \_\_\_\_\_

Date : Jul 3, 2023

(Mr.Nutdanai Laekhwan)

Applications Chemist

ภาคผนวกที่ 4-3

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 ± 3 °C  
Pressure : 1010 ± 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 <sup>2</sup>
B01	SKC	224-PCXR4	262101	03/01/2024	1,000	1,500	2,000	993	1,497	1,998	1.002x – 4.467	1.000
B02	SKC	224-PCXR4	626166	03/01/2024	1,000	1,500	2,000	1,003	1,505	2,001	1.009x – 19.803	0.999
B03	SKC	224-PCXR4	612968	03/01/2024	1,000	1,500	2,000	996	1,494	2,001	1.006x – 12.799	1.000
B04	SKC	224-PCXR4	602804	04/01/2024	1,000	1,500	2,000	1,000	1,502	1,994	0.999x + 0.239	1.000
B05	SKC	224-PCXR4	612693	04/01/2024	1,000	1,500	2,000	1,003	1,500	2,002	1.011x – 21.266	0.999
B06	SKC	224-PCXR4	262188	05/01/2024	1,000	1,500	2,000	1,002	1,508	2,006	1.007x – 12.077	0.999
B07	SKC	224-PCXR4	626262	05/01/2024	1,000	1,500	2,000	998	1,492	1,997	0.994x + 4.810	1.000
B08	SKC	224-PCXR4	626100	04/01/2024	1,000	1,500	2,000	1,002	1,500	2,003	1.013x – 24.585	0.999
B09	SKC	224-PCXR4	626479	05/01/2024	1,000	1,500	2,000	998	1,490	1,994	0.993x + 3.837	1.000
B10	SKC	224-PCXR4	091950	04/01/2024	1,000	1,500	2,000	993	1,502	2,001	1.017x – 34.867	0.999
B11	SKC	224-PCXR8	564315	05/01/2024	1,000	1,500	2,000	996	1,492	1,999	1.004x – 7.965	1.000
B12	SKC	224-PCXR4	034656	05/01/2024	1,000	1,500	2,000	1,003	1,502	2,003	1.010x – 19.683	0.999
B13	SKC	224-PCXR4	602073	04/01/2024	1,000	1,500	2,000	997	1,500	1,998	1.000x – 0.862	1.000
B14	SKC	224-PCXR4	626313	03/01/2024	1,000	1,500	2,000	999	1,492	1,989	0.991x + 8.479	1.000
B15	SKC	224-PCXR4	626474	03/01/2024	1,000	1,500	2,000	1,002	1,502	2,005	1.012x – 21.697	0.999
B16	SKC	224-PCXR4	626477	04/01/2024	1,000	1,500	2,000	995	1,504	2,001	1.007x – 16.807	1.000
B17	SKC	224-PCXR4	626860	04/01/2024	1,000	1,500	2,000	997	1,494	1,991	0.997x + 0.331	1.000
B18	SKC	224-PCXR4	691484	05/01/2024	1,000	1,500	2,000	1,003	1,500	2,002	1.009x – 17.214	0.999
B19	SKC	224-PCXR4	691599	05/01/2024	1,000	1,500	2,000	993	1,503	1,999	1.005x – 8.906	1.000
B20	SKC	224-PCXR4	691587	05/01/2024	1,000	1,500	2,000	991	1,504	2,000	1.016x – 33.407	0.999
B21	SKC	224-PCXR4	691531	04/01/2024	1,000	1,500	2,000	993	1,499	1,995	1.001x – 5.540	1.000
B22	SKC	224-PCXR4	691654	03/01/2024	1,000	1,500	2,000	1,003	1,501	2,004	1.011x – 19.966	0.999
B23	SKC	224-PCXR4	798393	03/01/2024	1,000	1,500	2,000	993	1,507	2,002	1.017x – 33.276	0.999
B24	SKC	224-PCXR4	626363	03/01/2024	1,000	1,500	2,000	1,000	1,502	2,001	1.012x – 23.859	0.999
B25	SKC	224-PCXR4	798489	03/01/2024	1,000	1,500	2,000	1,001	1,492	2,001	0.998x + 0.694	1.000
B26	SKC	224-PCXR4	798479	04/01/2024	1,000	1,500	2,000	1,000	1,500	1,993	0.996x + 4.204	1.000
B27	SKC	224-PCXR4	691673	04/01/2024	1,000	1,500	2,000	994	1,503	2,002	1.016x – 30.902	0.999
B28	SKC	224-PCXR4	691570	05/01/2024	1,000	1,500	2,000	1,003	1,500	2,001	1.009x – 18.263	0.999
B29	SKC	224-PCXR4	626472	04/01/2024	1,000	1,500	2,000	1,002	1,498	2,000	1.002x – 3.909	1.000
B30	SKC	224-PCXR4	691489	04/01/2024	1,000	1,500	2,000	1,003	1,509	2,006	1.008x – 11.399	1.000
B31	SKC	224-PCXR4	691509	03/01/2024	1,000	1,500	2,000	993	1,496	1,997	1.005x – 11.275	1.000
B32	SKC	224-PCXR4	091567	03/01/2024	1,000	1,500	2,000	991	1,503	2,000	1.015x – 30.886	0.999
B33	SKC	224-PCXR4	091756	05/01/2024	1,000	1,500	2,000	993	1,498	1,992	0.999x – 2.317	1.000
B34	SKC	224-PCXR4	612962	05/01/2024	1,000	1,500	2,000	1,002	1,501	2,002	1.007x – 13.995	1.000
B35	SKC	224-PCXR4	602682	05/01/2024	1,000	1,500	2,000	996	1,498	1,996	1.000x – 5.285	1.000
B36	SKC	224-PCXR4	626164	04/01/2024	1,000	1,500	2,000	999	1,510	1,999	1.004x – 10.131	0.999
B37	SKC	224-PCXR4	626256	05/01/2024	1,000	1,500	2,000	994	1,506	1,999	1.013x – 28.454	0.999
B38	SKC	224-PCXR4	626167	03/01/2024	1,000	1,500	2,000	997	1,498	1,998	1.003x – 5.983	1.000
B39	SKC	224-PCXR4	034637	03/01/2024	1,000	1,500	2,000	1,005	1,501	2,001	1.006x – 15.188	0.999
B40	SKC	224-PCXR4	798349	05/01/2024	1,000	1,500	2,000	994	1,505	2,000	1.014x – 29.004	0.999





บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด  
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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 ± 3 °C  
Pressure : 1010 ± 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 <sup>2</sup>
B41	SKC	224-PCXR4	612669	05/01/2024	1,000	1,500	2,000	999	1,496	1,991	0.996x + 1.914	1.000
B42	SKC	224-PCXR4	626041	03/01/2024	1,000	1,500	2,000	1,004	1,498	1,991	0.986x + 19.248	1.000
B43	SKC	224-PCXR4	034636	03/01/2024	1,000	1,500	2,000	1,000	1,501	1,992	0.991x + 11.682	1.000
B44	SKC	224-PCXR8	529341	03/01/2024	1,000	1,500	2,000	1,002	1,502	2,002	1.004x – 6.860	1.000
B45	SKC	224-PCXR8	529594	03/01/2024	1,000	1,500	2,000	1,001	1,501	1,987	0.987x + 16.026	1.000
B46	SKC	224-PCXR8	566743	04/01/2024	1,000	1,500	2,000	995	1,506	2,002	1.013x – 27.915	0.999
B47	SKC	224-PCXR8	566747	04/01/2024	1,000	1,500	2,000	1,002	1,502	2,004	1.010x – 21.769	0.999
B48	SKC	224-PCXR8	566753	04/01/2024	1,000	1,500	2,000	1,000	1,493	1,998	0.997x + 0.239	1.000
B49	SKC	224-PCXR8	566780	04/01/2024	1,000	1,500	2,000	1,003	1,502	2,006	1.011x – 21.550	0.999
B50	SKC	224-PCXR8	500400	03/01/2024	1,000	1,500	2,000	1,001	1,496	2,002	1.001x – 2.900	1.000
B51	SKC	224-PCXR8	500363	03/01/2024	1,000	1,500	2,000	996	1,502	2,000	1.011x – 25.709	0.999
B52	SKC	224-PCXR8	093186	03/01/2024	1,000	1,500	2,000	994	1,496	1,992	0.995x + 1.751	1.000
B53	SKC	224-PCXR8	707670	05/01/2024	1,000	1,500	2,000	1,002	1,501	2,002	1.008x – 16.042	0.999
B54	SKC	224-PCXR3	509821	05/01/2024	1,000	1,500	2,000	995	1,501	2,002	1.016x – 32.282	0.999
B55	SKC	224-PCXR3	510710	05/01/2024	1,000	1,500	2,000	1,004	1,495	1,992	0.991x + 7.666	1.000
B56	SKC	224-PCXR3	511450	05/01/2024	1,000	1,500	2,000	1,002	1,500	2,001	1.005x – 8.559	1.000
B57	SKC	224-PCXR3	510798	03/01/2024	1,000	1,500	2,000	997	1,492	1,999	0.999x – 2.122	1.000
B58	SKC	224-PCXR3	509852	03/01/2024	1,000	1,500	2,000	1,000	1,500	1,999	1.007x – 19.073	0.999
B59	SKC	224-PCXR3	509862	04/01/2024	1,000	1,500	2,000	995	1,503	1,995	0.998x + 2.118	1.000
B60	SKC	224-PCXR3	512655	04/01/2024	1,000	1,500	2,000	1,004	1,510	2,004	1.005x – 6.421	0.999
B61	SKC	224-PCXR3	503915	04/01/2024	1,000	1,500	2,000	993	1,492	1,999	1.003x – 11.706	1.000
B62	SKC	224-PCXR3	505975	03/01/2024	1,000	1,500	2,000	999	1,494	1,996	0.996x + 0.822	1.000
B63	SKC	224-PCXR3	511432	03/01/2024	1,000	1,500	2,000	990	1,501	2,000	1.017x – 36.259	0.999
B64	SKC	224-PCXR3	508302	03/01/2024	1,000	1,500	2,000	998	1,492	1,989	0.990x + 10.175	1.000
B65	SKC	224-PCXR3	508310	03/01/2024	1,000	1,500	2,000	1,002	1,501	2,002	1.007x – 13.537	1.000
B66	SKC	224-PCXR3	509861	04/01/2024	1,000	1,500	2,000	1,002	1,491	1,992	0.988x + 13.744	1.000
B67	SKC	224-PCXR3	506295	04/01/2024	1,000	1,500	2,000	995	1,508	2,004	1.007x – 12.843	1.000
B68	SKC	224-PCXR3	505872	04/01/2024	1,000	1,500	2,000	1,002	1,491	1,998	0.995x + 4.040	1.000
B69	SKC	224-PCXR3	508375	04/01/2024	1,000	1,500	2,000	1,003	1,499	2,000	1.009x – 18.977	0.999
B70	SKC	224-PCXR3	510623	05/01/2024	1,000	1,500	2,000	992	1,493	1,996	1.002x – 7.730	1.000
B71	SKC	224-PCXR3	508367	05/01/2024	1,000	1,500	2,000	994	1,506	2,002	1.015x – 31.561	0.999
B72	SKC	224-PCXR3	505977	03/01/2024	1,000	1,500	2,000	1,003	1,499	1,994	0.991x + 9.042	1.000
B73	SKC	224-PCXR3	512606	04/01/2024	1,000	1,500	2,000	1,001	1,501	2,004	1.008x – 14.346	1.000
B74	SKC	224-PCXR3	505993	04/01/2024	1,000	1,500	2,000	996	1,497	1,995	1.001x – 7.036	1.000
B75	SKC	224-PCXR3	509820	05/01/2024	1,000	1,500	2,000	996	1,496	1,991	0.996x + 1.432	1.000
B76	SKC	224-PCXR3	509811	05/01/2024	1,000	1,500	2,000	993	1,499	1,999	1.006x – 14.283	1.000
B77	SKC	224-PCXR3	508301	05/01/2024	1,000	1,500	2,000	1,001	1,501	2,003	1.013x – 25.406	0.999
B78	SKC	224-PCXR3	510677	05/01/2024	1,000	1,500	2,000	995	1,503	1,999	1.012x – 27.520	0.999
B79	SKC	224-PCXR3	510920	05/01/2024	1,000	1,500	2,000	994	1,494	1,994	1.001x – 6.178	1.000





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 ± 3 °C  
Pressure : 1010 ± 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 <sup>2</sup>
R01	SKC	224-PCXR4	602467	03/01/2024	1,000	1,500	2,000	992	1,508	2,005	1.008x – 15.012	1.000
R02	SKC	224-PCXR4	626450	04/01/2024	1,000	2,000	3,000	998	1,499	1,990	0.989x + 12.189	1.000
R03	SKC	224-PCXR4	691592	03/01/2024	1,000	1,500	2,000	1,004	1,500	2,004	1.012x – 22.718	0.999
R04	SKC	224-PCXR4	691672	04/01/2024	1,000	1,500	2,000	996	1,493	1,996	0.998x – 2.002	1.000
R05	SKC	224-PCXR4	798470	03/01/2024	1,000	1,500	2,000	993	1,507	1,999	1.013x – 29.199	0.999
R06	SKC	224-PCXR4	798456	04/01/2024	1,000	1,500	2,000	997	1,498	1,996	1.002x – 6.760	1.000
R07	SKC	224-PCXR4	798480	05/01/2024	1,000	1,500	2,000	994	1,492	1,999	1.008x – 16.153	1.000
R08	SKC	224-PCXR4	883215	05/01/2024	1,000	1,500	2,000	1,012	1,500	2,005	0.999x + 3.725	1.000
R09	SKC	224-PCXR4	034650	05/01/2024	1,000	1,500	2,000	991	1,504	2,001	1.018x – 36.179	0.999
R10	SKC	224-PCXR4	091765	03/01/2024	1,000	1,500	2,000	997	1,511	1,994	1.000x + 0.499	1.000
R11	SKC	224-PCXR4	091763	04/01/2024	1,000	1,500	2,000	1,000	1,499	2,002	1.012x – 24.042	0.999
R12	SKC	224-PCXR4	091568	03/01/2024	1,000	1,500	2,000	996	1,500	2,000	1.003x – 7.698	1.000
R13	SKC	224-PCXR4	091638	04/01/2024	1,000	1,500	2,000	1,002	1,501	1,991	0.989x + 14.781	1.000
R14	SKC	224-PCXR4	091764	03/01/2024	1,000	1,500	2,000	994	1,503	1,999	1.014x – 30.292	0.999
R15	SKC	224-PCXR8	529457	03/01/2024	1,000	1,500	2,000	1,001	1,500	2,004	1.006x – 11.543	1.000
R16	SKC	224-PCXR8	529643	05/01/2024	1,000	1,500	2,000	998	1,495	1,994	0.999x – 3.450	1.000
R17	SKC	224-PCXR8	529645	04/01/2024	1,000	1,500	2,000	995	1,509	2,001	1.015x – 30.890	0.999
R18	SKC	224-PCXR8	566756	04/01/2024	1,000	1,500	2,000	991	1,498	1,998	1.001x – 6.800	1.000
R19	SKC	224-PCXR8	566802	04/01/2024	1,000	1,500	2,000	1,002	1,499	2,000	1.010x – 20.772	0.999
R20	SKC	224-PCXR8	529089	05/01/2024	1,000	1,500	2,000	991	1,500	2,003	1.020x – 39.390	0.999
R21	SKC	224-PCXR8	665728	03/01/2024	1,000	1,500	2,000	998	1,495	1,999	1.000x – 3.937	1.000
R22	SKC	224-PCXR8	707444	03/01/2024	1,000	1,500	2,000	1,003	1,500	2,003	1.005x – 8.595	1.000
R23	SKC	224-PCXR8	761067	03/01/2024	1,000	1,500	2,000	998	1,491	1,991	0.993x + 3.358	1.000
R24	SKC	224-PCXR8	707893	04/01/2024	1,000	1,500	2,000	996	1,508	2,000	1.008x – 16.660	0.999
R25	SKC	224-PCXR8	761052	04/01/2024	1,000	1,500	2,000	1,010	1,496	1,995	0.985x + 21.199	1.000
R26	SKC	224-PCXR8	707956	04/01/2024	1,000	1,500	2,000	1,002	1,500	2,005	1.010x – 16.732	1.000
R27	SKC	224-PCXR8	707398	03/01/2024	1,000	1,500	2,000	996	1,500	2,002	1.007x – 16.201	1.000
R28	SKC	224-PCXR8	707481	05/01/2024	1,000	1,500	2,000	1,004	1,501	2,002	1.010x – 19.878	0.999
R29	SKC	224-PCXR8	707402	05/01/2024	1,000	1,500	2,000	1,003	1,494	1,989	0.986x + 16.137	1.000
R30	SKC	224-PCXR8	093811	05/01/2024	1,000	1,500	2,000	1,000	1,493	1,993	0.995x + 4.371	1.000
R31	SKC	224-PCXR8	093183	05/01/2024	1,000	1,500	2,000	1,001	1,501	2,000	1.002x – 2.800	1.000
R32	SKC	224-PCXR8	671950	05/01/2024	1,000	1,500	2,000	998	1,501	1,993	0.996x + 4.136	1.000
R33	SKC	224-PCXR4	626254	03/01/2024	1,000	1,500	2,000	994	1,502	2,000	1.015x – 32.298	0.999
R34	SKC	224-PCXR4	626131	03/01/2024	1,000	1,500	2,000	1,002	1,499	2,004	1.007x – 12.157	1.000
R35	SKC	224-PCXR8	707460	04/01/2024	1,000	1,500	2,000	999	1,498	1,995	0.994x + 6.098	1.000
R36	SKC	224-PCXR8	707446	04/01/2024	1,000	1,500	2,000	1,004	1,498	2,001	1.009x – 18.630	0.999
R37	SKC	224-PCXR8	707432	04/01/2024	1,000	1,500	2,000	996	1,499	2,000	1.000x – 1.827	1.000
R38	SKC	224-PCXR8	707349	03/01/2024	1,000	1,500	2,000	997	1,500	2,002	1.003x – 7.889	1.000
R39	SKC	224-PCXR8	761095	03/01/2024	1,000	1,500	2,000	1,001	1,497	1,994	0.998x + 1.193	1.000



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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 <sup>2</sup>
R40	SKC	224-PCXR4	612753	05/01/2024	1,000	1,500	2,000	1,001	1,502	2,003	1.013x – 23.923	0.999
R41	SKC	224-PCXR4	626140	05/01/2024	1,000	1,500	2,000	992	1,509	2,001	1.016x – 31.995	0.999
R42	SKC	224-PCXR4	626463	03/01/2024	1,000	1,500	2,000	998	1,494	1,999	1.000x – 2.397	1.000
R43	SKC	224-PCXR4	626129	03/01/2024	1,000	1,500	2,000	1,003	1,501	2,005	1.012x – 20.899	0.999
R44	SKC	224-PCXR4	602753	05/01/2024	1,000	1,500	2,000	1,002	1,496	1,993	0.995x + 3.007	1.000
R45	SKC	224-PCXR4	626137	03/01/2024	1,000	1,500	2,000	992	1,505	2,002	1.019x – 37.144	0.999





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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 <sup>2</sup>
H-R01	Dwyer	VFB-65	03/01/2024	500	1,000	2,000	501.7	994.0	1980.7	1.000x – 3.859	0.999
H-R02	Dwyer	VFB-65	04/01/2024	500	1,000	2,000	500.8	999.1	1988.7	1.001x – 2.909	1.000
H-R03	Dwyer	VFB-65	03/01/2024	500	1,000	2,000	501.7	990.3	1997.7	0.993x + 3.830	1.000
H-R04	Dwyer	VFB-65	03/01/2024	500	1,000	2,000	496.8	992.2	2016.5	1.007x – 11.486	1.000
H-R05	Dwyer	VFB-65	04/01/2024	500	1,000	2,000	499.6	992.9	1990.7	1.002x – 4.797	1.000
H-R06	Dwyer	VFB-65	05/01/2024	500	1,000	2,000	505.2	995.4	1982.6	0.999x – 1.343	0.999



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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

Rotameter Calibration Report (For Personal Pump Low 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 <sup>2</sup>
L-R01	Dwyer	VFA-21	03/01/2024	50	100	200	50.8	101.0	204.3	0.982x + 3.092	0.999
L-R02	Dwyer	VFA-21	04/01/2024	50	100	200	50.1	102.0	201.4	1.006x – 0.301	0.999
L-R03	Dwyer	VFA-21	03/01/2024	50	100	200	50.1	100.2	202.3	1.013x – 0.675	1.000
L-R04	Dwyer	VFA-21	03/01/2024	50	100	200	50.2	100.9	201.2	1.007x – 0.709	0.999
L-R05	Dwyer	VFA-21	04/01/2024	50	100	200	50.2	101.0	201.4	0.993x + 1.253	1.000
L-R06	Dwyer	VFA-21	05/01/2024	50	100	200	51.0	100.2	202.3	1.001x + 0.832	1.000





CERTIFICATE No : 23M2441

REFERENCE No : 68471-1

PAGE : 1 OF 2

## Certificate of Calibration

**EQUIPMENT** : DIGITAL BALANCE

**MANUFACTURER** : METTLER TOLEDO

**MODEL** : XS105DU

**SERIAL No** : 1126422905

**ID No** : BA 05/50

**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** : 10-Mar-23

**APPROVED BY** : 

**ISSUED DATE** : 16-Mar-23

**RECEIVED DATE** : 10-Mar-23





CERTIFICATE No : 23M2441

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU  
MANUFACTURER : METTLER TOLEDO S/N : 1126422905  
ID No : BA 05/50 RECEIVED DATE : 10-Mar-23  
AIR PRESSURE : 1010mbar  $\pm$  1mbar CALIBRATION DATE : 10-Mar-23  
AMBIENT TEMPERATURE : 23°C  $\pm$  1°C RELATIVE HUMIDITY : 49 %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 :-

#### INSTRUMENT

#### MODEL

#### SERIAL No

#### CERTIFICATE No

#### DUE DATE

1) STANDARD WEIGHT SET

E2

QK-I-151

M2302013S

02-Feb-25

2) STANDARD WEIGHT

E2

15843

M2302014S

02-Feb-25

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 CENTRAL BUREAU OF WEIGHTS&MEASURES

### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

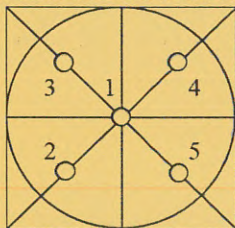
2. TARE FUNCTION : NORMAL

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)
0.00	0.00000	0.00000	0.000039
0.02	0.02000	0.00000	0.000039
0.10	0.10000	0.00000	0.000039
0.20	0.20001	-0.00001	0.000040
0.50	0.50001	-0.00001	0.000040
1.00	1.00000	0.00000	0.000041
2.00	2.00003	-0.00003	0.000042
5.00	5.00001	-0.00001	0.000046
10.00	10.00003	-0.00003	0.000053
20.00	20.00005	-0.00005	0.000067
50.00	50.00001	-0.00001	0.00011
100.00	100.00001	-0.00001	0.00019
200.00	200.00001	-0.00001	0.00032

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	50.0000
2	50.0001
3	50.0000
4	50.0000
5	49.9999
OFF-CENTER LOADING	0.0001

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  
COVERAGE FACTOR  $k=2$ , PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT



**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](http://www.qcalibration.com)

CERTIFICATE No : 24M2227

REFERENCE No : 72448-1

PAGE : 1 OF 2

**Certificate of Calibration**

**EQUIPMENT** : DIGITAL BALANCE

**MANUFACTURER** : METTLER TOLEDO

**MODEL** : XS105DU

**SERIAL No** : 1126422905

**ID No** : BA05/50

**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** : 

**ISSUED DATE** : 14-Mar-24

**RECEIVED DATE** : 08-Mar-24

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





CERTIFICATE No : 24M2227

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU  
MANUFACTURER : METTLER TOLEDO S/N : 1126422905  
ID No : BA05/50 RECEIVED DATE : 08-Mar-24  
AIR PRESSURE : 1010mbar  $\pm$  1mbar CALIBRATION DATE : 08-Mar-24  
AMBIENT TEMPERATURE : 25° C  $\pm$  1° C RELATIVE HUMIDITY : 53 %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 :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
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

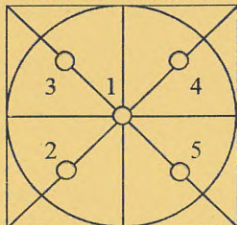
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000055 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY ( $\pm$ g)
0.00	0.00000	0.00000	0.000065
0.02	0.02001	-0.00001	0.000065
0.10	0.10002	-0.00002	0.000066
0.20	0.20001	-0.00001	0.000066
0.50	0.50001	-0.00001	0.000065
1.00	1.00003	-0.00003	0.000066
2.00	2.00001	-0.00001	0.000067
5.00	5.00001	-0.00001	0.000068
10.00	9.99994	0.00006	0.000070
20.00	20.00008	-0.00008	0.000078
50.00	50.0000	0.0000	0.00013
100.00	100.0001	-0.0001	0.00019
120.00	120.0001	-0.0001	0.00022

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	50.0000
2	50.0000
3	50.0000
4	50.0000
5	50.0000
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





## MAINTENANCE AND TEST CERTIFICATE MODEL

### OPTIMA 5300DV

<b>Customer :</b> <u>S.P.S.Consulting Service Co.,Ltd</u>	<b>Date Tested:</b> <u>January 4, 2024</u>	
	<b>Recommendation Recertification</b>	
<b>Address :</b> <u>7 Soi Phaholyothin 24</u>	<b>Period</b> <u>6</u> <b>Months</b>	
<u>Paholyothin Road</u>	<b>Recertification Due:</b> <u>July 4, 2024</u>	
<u>Jompol Chatuchak, Bangkok 1090</u>	<b>Date Last Certified:</b> <u>July 6, 2023</u>	
<b>User Name:</b> <u>K.Phenpha Vipasthawatt</u>	<b>Visit Number:</b> <u>2 of 2</u>	
<b>Phone:</b> <u>083-9269252</u>	<b>PerkinElmer Phone:</b> <u>02-719-6420 ext 206</u>	
<b>Fax:</b> <u>02-513-4221</u>	<b>PerkinElmer Fax:</b> <u>02-318-5597</u>	

CONFIGURATION TESTED		ACCESSORIES/COMPONENT NOT INCLUDED
<b>MODEL</b>	<b>SERIAL NUMBER</b>	
<u>OPTIMA 5300DV</u>	<u>077C7042401</u>	
<b>TESTED EQUIPMENT</b>	<b>CALIBRATION NUMBER</b>	<b>EXPIRATION</b>
<u>IPV Methods</u>		
<b>TEST STANDARD USED</b>	<b>PART NUMBER</b>	<b>EXPIRATION DATE</b>
<u>Multielement Standard</u>	<u>N069-1579</u>	<u>December 30, 2024</u>
<u>Wavecal Solution</u>	<u>N058-2152</u>	<u>March 30, 2024</u>
<u>VIS Wavecal solution</u>	<u>N930-2946</u>	<u>February 28, 2024</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>November 30, 2024</u>
<b>CUSTOMER SUPPLIED</b>	<b>COMMENTS</b>	<b>CUSTOMER INITIALS</b>
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		



## MAINTENANCE AND TEST CERTIFICATE MODEL

### OPTIMA 5300DV

**SERIAL NUMBER** 077C7042401**DATE TESTED** January 4, 2024**1. MECHANICAL CHECKS**

A. Inspect and clean all fans and filters.

☐ OK

B. Inspect and replace as necessary, all torch components including the RF coil.

☐ OK

C. Inspect all tubing for sign of clacking or leaking.

☐ OK

D. Adjust water and gas pressure regulator settings.

☐ OK

E. Inspect and leak check pneumatics drawers.

☐ OK

F. Clean the exterior of the instrument.

☐ OK**2. OPTICAL CHECKS**

A. Inspect and clean all optical components.

☐ OK

B. As required, check and replace all purgefilters.

☐ OK

C. Recheck optical alignment.

☐ OK**3. COOLING SYSTEM CHECKS**

A. Perform preventive maintenance on chiller.

☐ OK

B. Flush out the chiller every year.

☐ N/A**4. PERFORMANCE CHECKS**

A. Torch View Alignment.

☐ OK

B. Wavelength Calibration.

☐ OK





## MAINTENANCE AND TEST CERTIFICATE MODEL

### OPTIMA 5300DV

**SERIAL NUMBER :** 077C7042401
**DATE TESTED :** January 4, 2024

PARAMETER		SPECIFICATION		FINAL VALUE	
<b>Spectral Resolution : UV</b>	<b>As</b>	<b>193.696 nm</b>	$\leq 0.007$	<u>0.00529</u>	
	<b>Ni</b>	<b>231.604 nm</b>	$\leq 0.008$	<u>0.00672</u>	
	<b>Ni</b>	<b>341.476 nm</b>	$\leq 0.012$	<u>0.00793</u>	
<b>Spectral Resolution : VIS</b>	<b>La</b>	<b>408.672 nm</b>	$\leq 0.020$	<u>0.01588</u>	
	<b>Ba</b>	<b>455.403 nm</b>	$\leq 0.025$	<u>0.02280</u>	
<b>Precision</b>					
	<b>As</b>	<b>193.656 nm</b>	% RSD < 1.0	<u>0.92</u>	%
	<b>Zn</b>	<b>213.856 nm</b>	% RSD < 1.0	<u>0.95</u>	%
	<b>Mn</b>	<b>257.610 nm</b>	% RSD < 1.0	<u>0.75</u>	%
	<b>La</b>	<b>379.478 nm</b>	% RSD < 1.0	<u>0.44</u>	%
	<b>Ba</b>	<b>455.403 nm</b>	% RSD < 1.0	<u>0.46</u>	%
	<b>Ba</b>	<b>493.408 nm</b>	% RSD < 1.0	<u>0.37</u>	%
<b>Detection Limits : Axial</b>	<b>Tl</b>	<b>190.080 nm</b>	3(sd)	<u>19.99</u>	ppb
	<b>As</b>	<b>193.696 nm</b>	3(sd)	<u>26.66</u>	ppb
	<b>Pb</b>	<b>220.353 nm</b>	3(sd)	<u>1.81</u>	ppb
<b>Detection Limits : Radial</b>	<b>As</b>	<b>193.696 nm</b>	3(sd)	<u>38.21</u>	ppb
	<b>Zn</b>	<b>213.856 nm</b>	3(sd)	<u>2.48</u>	ppb
	<b>Mn</b>	<b>257.610 nm</b>	3(sd)	<u>0.59</u>	ppb
	<b>La</b>	<b>379.478 nm</b>	3(sd)	<u>5.52</u>	ppb
	<b>Ba</b>	<b>455.403 nm</b>	3(sd)	<u>0.13</u>	ppb
	<b>Ba</b>	<b>493.408 nm</b>	3(sd)	<u>1.08</u>	ppb
<b>BEC : Axial (IB X 500)/(IS-IB)</b>	<b>Cd</b>	<b>226.502 nm</b>	$\leq 150$ ppb	<u>141.47</u>	
<b>BEC : Radial (IB X 1000)/(IS-IB)</b>	<b>Mn</b>	<b>257.610 nm</b>	$\leq 45$ ppb	<u>29.04</u>	



## MAINTENANCE AND TEST CERTIFICATE MODEL

### OPTIMA 5300DV

**SERIAL NUMBER** 077C7042401**DATE TESTED** January 4, 2024**Remarks :**

Commissioning follow as commissioning performance sheets.

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This is to certify that the above tests have been performed and the configuration tested



meets



does not meet

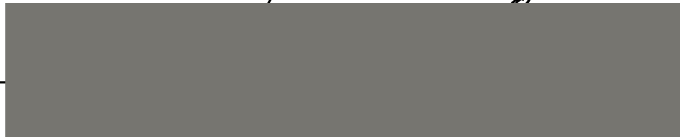
the PerkinElmer Specifications listed on this certificate.

This certificate does not modify PerkinElmer's standard terms and condition of sale, including warranty terms.

**Service Department PerkinElmer Ltd.**

**Authorized Representative:**

(



Service Engineer





## Certificate of Calibration

**Aquion : Anion (ID#894)**

This certificate is to verify that instrument below are calibrated  
by Archemica Lab Co.,Ltd.

AQUION S/N : 190840059

AS-DV S/N : 190915235

for

**S.P.S. Consulting Service Co., Ltd.**



Operator Signature : \_\_\_\_\_

Date : Jul 3, 2023

(Mr.Nutdanai Laekhwan)

Applications Chemist

ภาคผนวกที่ 4-4  
ระดับเสียงในบรรยากาศ





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 ✓

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FM.BL.MTC.002 Rev.4

#### Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand

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 $\mu$ Pa at 1000 Hz

Acoustic Output in dB re 20 $\mu$ 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	$\pm 0.10$	$\pm 0.75$ 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	$\pm 1.5$	$\pm 2.0\%$

3. Total Distortion

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

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.

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Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand  
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





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

Noise R\_191/24

## 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-R22	ACO	6236	00182010	03 April 2024	93.9	93.9
ACO-R33	ACO	6236	00192045	03 April 2024	93.9	93.9
ACO-R47	ACO	6236	00192059	03 April 2024	93.9	93.9
ACO-R48	ACO	6236	00192060	03 April 2024	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	

Request No. 21-67/0304

MTC No. EEL. BP. 110/0267

## 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 : Acoustic Calibrator

Manufacturer : Cirrus

Model : CR:515

Serial No. : 92002

### Ambient Environment

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

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/N 4106495.

7. Condenser Microphone Bruel&Kjaer 4180 S/N 2889871.

**Calibration Procedure:** CP-102-04 based on IEC 60942-2003. The sound pressure level of instrument was 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 : 5 Mar. 2024

1 / 2

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

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FM.BL.MTC.002 Rev.4

### Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand

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



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304

MTC No. EEL. BP. 110/0267

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 $\mu$ Pa at 1000 Hz

Acoustic Output in dB re 20 $\mu$ 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 1
1/2 inch Bruel&Kjaer 4180	94.04	0.04	$\pm 0.10$	$\pm 0.40$ dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1000.3	0.3	$\pm 1.5$	$\pm 1.0\%$

3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.70	$\pm 0.50$	$\pm 3.0\%$

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)

TISTR  
Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 5 Mar. 2024

Date of Issue : 6 Mar. 2024

Ref : 2011267022200795002

End of Certificate

2 / 2

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

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FM.BL.MTC.002 Rev.4

Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand  
Tel. (66) 0 2577 9000  
Fax. (66) 0 2577 9009  
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Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,  
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Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
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E-mail : sumalee@tistr.or.th



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด  
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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

Noise R\_191-1/24

## Sound Level Meter Calibration Report

### Acoustic Calibrator Data

Brand	CIRRUS	Number	AC-CR01/63
Model	CR515	Serial No.	92002
Calibration Range	94 dB, 1000 Hz	Last Calibration	05 March 2024
		Due Date	05 March 2025

### Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
CR-B04	Cirrus	CR161B	G301404	03 April 2024	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					94.04 ± 0.10 dB	





ภาคผนวกที่ 4-5  
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.

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FM.BL.MTC.002 Rev.4

#### Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand

Tel. (66) 0 2577 9000

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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 $\mu$ Pa at 1000 Hz

Acoustic Output in dB re 20 $\mu$ 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	$\pm 0.10$	$\pm 0.75$ 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	$\pm 1.5$	$\pm 2.0\%$

3. Total Distortion

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

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

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Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand

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



Noise R\_187/24

## 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-B18	ACO	6236	00172048	04 April 2024	93.9	93.9
ACO-B29	ACO	6236	00182011	04 April 2024	93.9	93.9
ACO-B33	ACO	6236	00182015	04 April 2024	93.8	93.9
ACO-B41	ACO	6236	00192032	04 April 2024	93.9	93.9
ACO-R51	ACO	6236	00192063	04 April 2024	93.9	93.9
ACO-R52	ACO	6236	00192064	04 April 2024	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	



Request No. 21-66/0639

MTC No. EEL. BP. 39/0866

## CALIBRATION CERTIFICATE

Submitted by : S.P.S Consulting Services 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 : SVANTEK

Model : SV34

Serial No. : 33137

### Ambient Environment

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

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 Panasonic VP-7722A S/N 041477D122.
  7. Condenser Microphone Bruel&Kjaer 4180 S/N 2633526.

**Calibration Procedure:** CP-102-04 based on IEC 60942-2003. The sound pressure level of instrument was 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 : 11 Aug. 2023

Date of Calibration : 22 Aug. 2023

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,  
Changwat Pathumthani 12120, Thailand  
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

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0639

MTC No. EEL. BP. 39/0866

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 = 114 dB re 20 $\mu$ Pa at 1000 Hz

Acoustic Output in dB re 20 $\mu$ 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	113.53	-0.47	$\pm 0.10$	$\pm 0.75$ 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	1000.0	0.0	$\pm 1.5$	$\pm 2.0\%$

3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	0.39	$\pm 0.50$	$\pm 4.0\%$

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 Kluyap)

Director

Electrical and Electronic Standards Laboratory  
Industrial Metrology and Testing Service Centre

Date of Calibration : 22 Aug. 2023

Date of Issue : 24 Aug. 2023

Ref : 2011266081103146002

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.

FM.BL.MTC.002 Rev.4

Head Office

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Fax. (66) 0 2579 8592  
E-mail : sumalee@tistr.or.th





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

Noise Dose R\_282/24

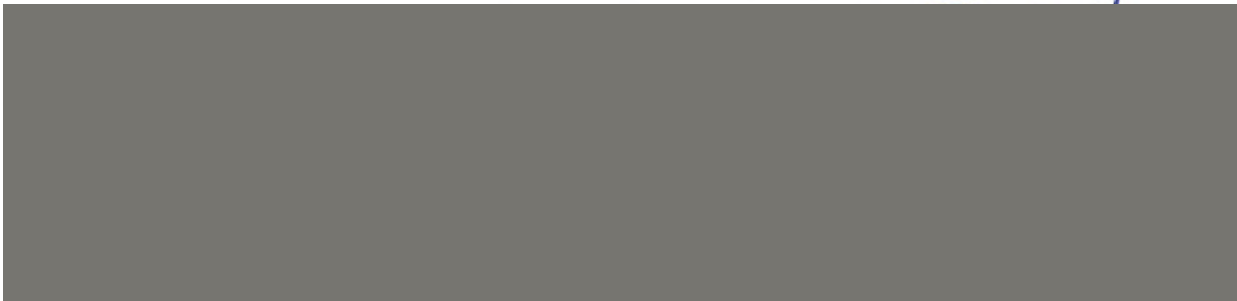
## Noise Dose Meter Calibration Report

### Acoustic Calibrator Data

Brand	SVANTEK	Number	SV 01/60
Model	SV34	Serial No.	33137
Calibration Range	114 dB, 1000 Hz	Last Calibration	22 August 2023
		Due Date	22 August 2024

### Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NMD-B01	SVANTEK	SV-104IS	80840	13 May 2024	113.5	113.5
NMD-B02	SVANTEK	SV-104IS	80842	13 May 2024	113.5	113.5
NMD-B03	SVANTEK	SV-104IS	80852	13 May 2024	113.5	113.5
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					113.53± 0.10 dB	





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

Noise Dose R\_188/24

## Noise Dose Meter Calibration Report

### Acoustic Calibrator Data

Brand	SVANTEK	Number	SV 01/60
Model	SV34	Serial No.	33137
Calibration Range	114 dB, 1000 Hz	Last Calibration	22 August 2023
		Due Date	22 August 2024

### Calibration Data

#### Sound Level Meter Data

#### Calibration Data

SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NMD-B12	SVANTEK	SV-104IS	80832	04 April 2024	113.6	113.5
NMD-B13	SVANTEK	SV-104IS	80834	04 April 2024	113.5	113.5
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					113.53± 0.10 dB	



ภาคผนวกที่ 4-6  
คุณภาพน้ำทิ้ง



# 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 : 23E8494  
REFERENCE No : 70413-1

PAGE : 1 OF 3

## Certificate of Calibration

**EQUIPMENT** : pH METER  
**MANUFACTURER** : HANNA  
**MODEL** : HI 3512  
**SERIAL No** : TH118035  
**ID No** : pH04/56  
**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** : 06-Sep-23

**APPROVED BY** : 

**ISSUED DATE** : 06-Sep-23

**RECEIVED DATE** : 31-Aug-23

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





CERTIFICATE No : 23E8494

PAGE : 2 OF 3

## Calibration Report

EQUIPMENT : pH METER  
MANUFACTURER : HANNA  
ID No : pH04/56  
RECEIVED DATE : 31-Aug-23  
AMBIENT TEMPERATURE : 23 ° C ± 3 ° C

MODEL : HI 3512  
SERIAL NUMBER : TH118035  
CALIBRATION DATE : 06-Sep-23  
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
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	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	22T9870	13-Sep-23
6) THERMOMETER WITH PROBE	421504	55000379	22T9904	13-Sep-23

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 : ADJUSTMENT

#### 1. DISPLAY UNIT ONLY

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

mV APPLIED	UUC READING (mV)	CORRECTION (mV)	UUC READING (pH)	UNCERTAINTY OF MEASUREMENT (± mV)	COVERAGE FACTOR k
414.11	414.6	-0.49	-0.290	0.15	2.00
354.95	355.4	-0.45	0.741	0.15	2.00
295.80	296.3	-0.50	1.773	0.15	2.00
236.64	237.1	-0.46	2.804	0.15	2.00
177.48	177.9	-0.42	3.835	0.15	2.00
118.32	118.7	-0.38	4.867	0.15	2.00
59.16	59.6	-0.44	5.898	0.15	2.00
0.00	0.4	-0.40	6.930	0.15	2.00
-59.16	-58.8	-0.36	7.961	0.15	2.00
-118.32	-117.9	-0.42	8.992	0.15	2.00
-177.48	-177.1	-0.38	10.024	0.15	2.00
-236.64	-236.3	-0.34	11.055	0.15	2.00
-295.80	-295.5	-0.30	12.087	0.15	2.00
-354.95	-354.6	-0.35	13.118	0.15	2.00
-414.11	-413.8	-0.31	14.149	0.15	2.00





# 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 : 23E8494

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
4.006	4.006	0.000	4.015	0.012	2.00
7.000	7.000	0.000	6.914	0.012	2.00
10.008	10.010	-0.002	9.996	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
25.005	25.0	0.005	---	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 : 23M2442

REFERENCE No : 68471-2

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** : 10-Mar-23

**APPROVED BY** : 

**ISSUED DATE** : 16-Mar-23

**RECEIVED DATE** : 10-Mar-23





CERTIFICATE No : 23M2442

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : BSA224S-CW  
MANUFACTURER : SARTORIUS S/N : 36591843  
ID No : BA 09/61 RECEIVED DATE : 10-Mar-23  
AIR PRESSURE : 1010mbar  $\pm$  1mbar CALIBRATION DATE : 10-Mar-23  
AMBIENT TEMPERATURE : 23° C  $\pm$  1° C RELATIVE HUMIDITY : 49 %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 :-

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

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 CENTRAL BUREAU OF WEIGHTS&MEASURES

### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

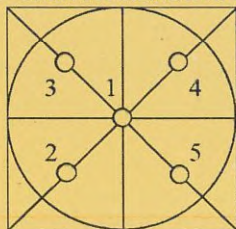
2. TARE FUNCTION : NORMAL

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	0.000058
0.1	0.1000	0.0000	0.000059
0.2	0.2000	0.0000	0.000059
0.5	0.5000	0.0000	0.000060
1.0	1.0000	0.0000	0.000060
2.0	2.0000	0.0000	0.000061
5.0	5.0000	0.0000	0.000063
10.0	10.0000	0.0000	0.000067
20.0	20.0001	-0.0001	0.000073
50.0	50.0000	0.0000	0.00011
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	99.9999
3	99.9998
4	100.0001
5	100.0000
OFF-CENTER LOADING	0.0002

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





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** : 

**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

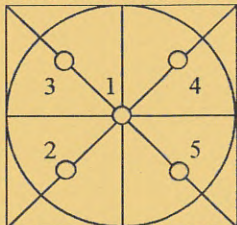
2. TARE FUNCTION : NORMAL

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-U017D

Calibration Date : 3 Apr 23  
 Submitted by : S.P.S CONSULTING SERVICE CO.,LTD  
 7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol,  
 Chatuchak, Bangkok, Thailand 10900

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. E00522  
 Barometric ref : S/N. E00522  
 Water Temp ref : S/N. 11431  
 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

(Natenapha Pisatkunchon)

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](http://www.qcalibration.com)

CERTIFICATE No : 23T0959

REFERENCE No : 68047-2

PAGE : 1 OF 3

## Certificate of Calibration

EQUIPMENT : COD REACTOR

MANUFACTURER : HACH

MODEL : DRB200

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 : 07-Feb-23

APPROVED BY :   
PONGSAK J.

ISSUED DATE : 07-Feb-23

RECEIVED DATE : 31-Jan-23





CERTIFICATE No : 23T0959

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : COD REACTOR  
MANUFACTURER : HACH  
ID NUMBER : CRB 05/59  
RECEIVED DATE : 31-Jan-23  
AMBIENT TEMPERATURE : 23° C ± 1° C

MODEL : DRB200  
SERIAL NUMBER : 15110C0235  
CALIBRATION DATE : 07-Feb-23  
RELATIVE HUMIDITY : 52 %RH ± 10 % RH

### CONDITION OF THIS RESULTS OF CALIBRATION

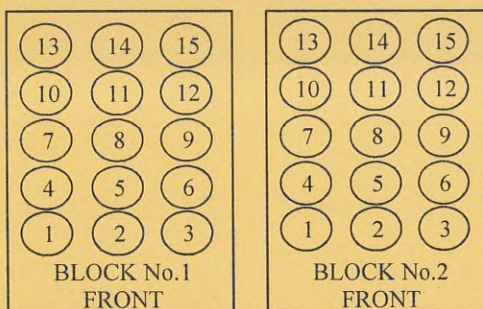
1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT TEMPERATURE RECORDER WITH THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON 15 POINTS AND LOCATED ONE THERMOCOUPLE IN EACH OF THE FOUR CORNERS OF THE REACTOR AND PLACED THE EIGHTH THERMOCOUPLE AT THE CENTER OF THE REACTOR.

### 2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH TC TYPE K	HYDRA 2635A	8009008	22T7511	10-Jul-23

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	149.4
	2	149.5
	3	149.4
	4	149.4
	5	149.7
	6	149.4
	7	149.6
	8	149.6
	9	149.6
	10	149.7
	11	149.5
	12	149.3
	13	149.3
	14	149.5
	15	149.8
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





# QUALITY CALIBRATION CO.,LTD.

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

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

[www.qcalibration.com](http://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** :

**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

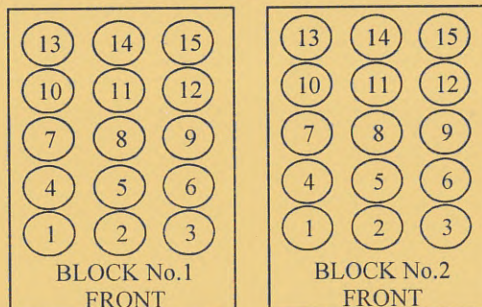
1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT TEMPERATURE RECORDER WITH THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON 15 POINTS AND LOCATED ONE THERMOCOUPLE IN EACH OF THE FOUR CORNERS OF THE REACTOR AND PLACED THE EIGHTH THERMOCOUPLE AT THE CENTER OF THE REACTOR.

### 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	150.1
	6	150.7
	7	149.9
	8	149.9
	9	150.8
	10	149.5
	11	150.2
	12	150.0
	13	149.5
	14	149.5
	15	149.6
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 MULTIP  
COVERAGE FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

F-G010 F





## MAINTENANCE AND TEST CERTIFICATE MODEL

### OPTIMA 5300DV

<b>Customer :</b> <u>S.P.S.Consulting Service Co.,Ltd</u>	Date Tested: <u>January 4, 2024</u>	
	Recommendation Recertification	
<b>Address :</b> <u>7 Soi Phaholyothin 24</u>	Period <u>6</u> Months	
<u>Paholyothin Road</u>	Recertification Due: <u>July 4, 2024</u>	
<u>Jompol Chatuchak, Bangkok 1090</u>	Date Last Certified: <u>July 6, 2023</u>	
<b>User Name:</b> <u>K.Phenpha Vipasthawatt</u>	Visit Number: <u>2 of 2</u>	
<b>Phone:</b> <u>083-9269252</u>	PerkinElmer Phone: <u>02-719-6420 ext 206</u>	
<b>Fax:</b> <u>02-513-4221</u>	PerkinElmer Fax: <u>02-318-5597</u>	

CONFIGURATION TESTED		ACCESSORIES/COMPONENT NOT INCLUDED
<b>MODEL</b>	<b>SERIAL NUMBER</b>	
<u>OPTIMA 5300DV</u>	<u>077C7042401</u>	
<b>TESTED EQUIPMENT</b>	<b>CALIBRATION NUMBER</b>	<b>EXPIRATION</b>
<u>IPV Methods</u>		
<b>TEST STANDARD USED</b>	<b>PART NUMBER</b>	<b>EXPIRATION DATE</b>
<u>Multielement Standard</u>	<u>N069-1579</u>	<u>December 30, 2024</u>
<u>Wavecal Solution</u>	<u>N058-2152</u>	<u>March 30, 2024</u>
<u>VIS Wavecal solution</u>	<u>N930-2946</u>	<u>February 28, 2024</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>November 30, 2024</u>
<b>CUSTOMER SUPPLIED</b>	<b>COMMENTS</b>	<b>CUSTOMER INITIALS</b>
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		



## MAINTENANCE AND TEST CERTIFICATE MODEL

### OPTIMA 5300DV

**SERIAL NUMBER** 077C7042401**DATE TESTED** January 4, 2024**1. MECHANICAL CHECKS**

- |  |                             |
|--|-----------------------------|
| A. Inspect and clean all fans and filters.                                       | <input type="checkbox"/> OK |
| B. Inspect and replace as necessary, all torch components including the RF coil. | <input type="checkbox"/> OK |
| C. Inspect all tubing for sign of clacking or leaking.                           | <input type="checkbox"/> OK |
| D. Adjust water and gas pressure regulator settings.                             | <input type="checkbox"/> OK |
| E. Inspect and leak check pneumatics drawers.                                    | <input type="checkbox"/> OK |
| F. Clean the exterior of the instrument.   | <input type="checkbox"/> OK |

**2. OPTICAL CHECKS**

- |   |                             |
|---|-----------------------------|
| A. Inspect and clean all optical components.        | <input type="checkbox"/> OK |
| B. As required, check and replace all purgefilters. | <input type="checkbox"/> OK |
| C. Recheck optical alignment.                       | <input type="checkbox"/> OK |

**3. COOLING SYSTEM CHECKS**

- |   |                              |
|---|------------------------------|
| A. Perform preventive maintenance on chiller. | <input type="checkbox"/> OK  |
| B. Flush out the chiller every year.          | <input type="checkbox"/> N/A |

**4. PERFORMANCE CHECKS**

- |                            |                             |
|----------------------------|-----------------------------|
| A. Torch View Alignment.   | <input type="checkbox"/> OK |
| B. Wavelength Calibration. | <input type="checkbox"/> OK |





## MAINTENANCE AND TEST CERTIFICATE MODEL

### OPTIMA 5300DV

**SERIAL NUMBER :** 077C7042401
**DATE TESTED :** January 4, 2024

PARAMETER		SPECIFICATION		FINAL VALUE	
<b>Spectral Resolution : UV</b>	<b>As</b>	<b>193.696 nm</b>	$\leq 0.007$	<u>0.00529</u>	
	<b>Ni</b>	<b>231.604 nm</b>	$\leq 0.008$	<u>0.00672</u>	
	<b>Ni</b>	<b>341.476 nm</b>	$\leq 0.012$	<u>0.00793</u>	
<b>Spectral Resolution : VIS</b>	<b>La</b>	<b>408.672 nm</b>	$\leq 0.020$	<u>0.01588</u>	
	<b>Ba</b>	<b>455.403 nm</b>	$\leq 0.025$	<u>0.02280</u>	
<b>Precision</b>					
	<b>As</b>	<b>193.656 nm</b>	% RSD < 1.0	<u>0.92</u>	%
	<b>Zn</b>	<b>213.856 nm</b>	% RSD < 1.0	<u>0.95</u>	%
	<b>Mn</b>	<b>257.610 nm</b>	% RSD < 1.0	<u>0.75</u>	%
	<b>La</b>	<b>379.478 nm</b>	% RSD < 1.0	<u>0.44</u>	%
	<b>Ba</b>	<b>455.403 nm</b>	% RSD < 1.0	<u>0.46</u>	%
	<b>Ba</b>	<b>493.408 nm</b>	% RSD < 1.0	<u>0.37</u>	%
<b>Detection Limits : Axial</b>	<b>Tl</b>	<b>190.080 nm</b>	3(sd)	<u>19.99</u>	ppb
	<b>As</b>	<b>193.696 nm</b>	3(sd)	<u>26.66</u>	ppb
	<b>Pb</b>	<b>220.353 nm</b>	3(sd)	<u>1.81</u>	ppb
<b>Detection Limits : Radial</b>	<b>As</b>	<b>193.696 nm</b>	3(sd)	<u>38.21</u>	ppb
	<b>Zn</b>	<b>213.856 nm</b>	3(sd)	<u>2.48</u>	ppb
	<b>Mn</b>	<b>257.610 nm</b>	3(sd)	<u>0.59</u>	ppb
	<b>La</b>	<b>379.478 nm</b>	3(sd)	<u>5.52</u>	ppb
	<b>Ba</b>	<b>455.403 nm</b>	3(sd)	<u>0.13</u>	ppb
	<b>Ba</b>	<b>493.408 nm</b>	3(sd)	<u>1.08</u>	ppb
<b>BEC : Axial (IB X 500)/(IS-IB)</b>	<b>Cd</b>	<b>226.502 nm</b>	$\leq 150$ ppb	<u>141.47</u>	
<b>BEC : Radial (IB X 1000)/(IS-IB)</b>	<b>Mn</b>	<b>257.610 nm</b>	$\leq 45$ ppb	<u>29.04</u>	



## MAINTENANCE AND TEST CERTIFICATE MODEL

### OPTIMA 5300DV

**SERIAL NUMBER** 077C7042401**DATE TESTED** January 4, 2024**Remarks :**

Commissioning follow as commissioning performance sheets.

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This is to certify that the above tests have been performed and the configuration tested



meets



does not meet

the PerkinElmer Specifications listed on this certificate.

This certificate does not modify PerkinElmer's standard terms and condition of sale,  
including warranty terms.

**Service Department PerkinElmer Ltd.**

**Authorized Representative:**

( Mr. Wiphan Promlumda )

Service Engineer

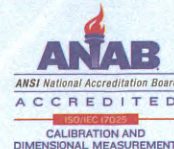


ภาคผนวกที่ 4-7

ระดับความร้อนในสถานประกอบการ



ID LINE : IEC17025



## Certificate of Calibration

Certificate Number : SPR24030285-1

Page : 1 of 3

Customer : S.P.S. CONSULTING SERVICE CO., LTD.

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

Equipment Name : Area Heat Stress Monitor

Manufacturer : Quest Technologies

Model : QUESTemp 34

Serial Number : TEH090208

ID. Number : R08

### Environmental Conditions

Ambient Temperature :  $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$

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

Location of Calibration : In-Lab

Calibration Procedure : SP-CPT-04-13

Received Date : 19 Mar 2024

Calibration Date : 20 Mar 2024

Recommend Due Date : 20 Mar 2025

Date of Issue : 21 Mar 2024

### Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr. Navaporn Uengseng

Calibration Officer

Approved by :

  
( Ms. Bussakorn Chaikaew )

Authorized Signatory





ID LINE : IEC17025



## Calibration Report

Certificate Number : SPR24030285-1

Page : 2 of 3

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Humidity Chamber	TH-80S	N/A	SPR24020149-7	23 Feb 2025
THERMO-HYGROMETER	5020A	A47046	QR24-0167	26 Jan 2025

### Traceability

This certification is traceable to the International System of Unit maintained at :  
SP Metrology - SP Metrology system (Thailand) Co.Ltd.

Quality Reborn Co., Ltd





ID LINE : IEC17025



## Result of Calibration

Certificate No. : SPR24030285-1

Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty ( ± )
30.0	30.012	29.8	-0.212	0.20
35.0	35.010	34.8	-0.210	0.20
40.0	40.015	39.8	-0.215	0.20

Temperature Accuracy in the Measurement. (DRY)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty ( ± )
30.0	30.012	29.7	-0.312	0.20
35.0	35.010	34.7	-0.310	0.20
40.0	40.015	39.7	-0.315	0.20

Temperature Accuracy in the Measurement. (GLOBE)

Unit : °C

Humidity Setting	Standard Reading	UUC Reading	Error	Uncertainty ( ± )
30.0	30.012	29.8	-0.212	0.20
35.0	35.010	34.8	-0.210	0.20
40.0	40.015	39.8	-0.215	0.20

### Note :

The result of calibration was found accurate as show on date and place of calibration only.  
This Certificate is not certified for any commercial transaction.

### Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor  $k = 2$ , providing a level of confidence approximately 95%.

- End of Certificate -





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

Heat R022\_1

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: R08	Verification Date	: 04 April 2024
Brand	: Quest Technologie	Ambient Temp.	: 24.5 °C
Model	: QUESTemp 34	Barometric Pressure	: 1011 mmbar
Serial No.	: TEH090208	Relative Humidity	: 49 %
Verification Module (Electronic Sensor Check) :			
Verification Module No. : 21 WB = 12.5 °C , DB = 47.1 °C , G = 69.3 °C			
Result of Verification : Without Adjustment			
Wet Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.4	0.1	± 0.5
Dry Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.1	0.0	± 0.5
Globe Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.4	-0.1	± 0.5
UUC* = UNIT UNDER CALIBRATION			



## Certificate of Calibration

Certificate Number : SPR23090267-3

Page : 1 of 3

Customer : S.P.S. CONSULTING SERVICE CO., LTD.

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

Equipment Name : Area Heat Stress Monitor

Manufacturer : Quest Technologies

Model : QUESTemp 36

Serial Number : TKE060012

ID. Number : R09

### Environmental Conditions

Ambient Temperature :  $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$

Received Date : 18 Sep 2023

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

Calibration Date : 18 Sep 2023

Location of Calibration : In-Lab

Recommend Due Date : 18 Sep 2024

Calibration Procedure : SP-CPT-04-13

Date of Issue : 19 Sep 2023

### Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Lapon Naimpoung

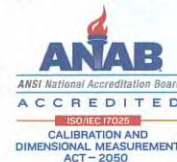
Calibration Officer

Approved by :

( Mr.Nirut Loha )

Authorized Signatory





## Calibration Report

Certificate Number : SPR23090267-3

Page : 2 of 3

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Humidity Chamber	TH-80S	N/A	SPR23010480-5	22 Feb 2024
THERMO-HYGROMETER	5020A	A47046	QR23-0176	26 Jan 2024

### Traceability

This certification is traceable to the International System of Unit maintained at :  
SP Metrology - SP Metrology system (Thailand) Co.Ltd.

Quality Reborn Co., Ltd



## Result of Calibration

Certificate No. : SPR23090267-3

Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty ( ± )
30.0	30.014	30.1	0.086	0.20
35.0	35.012	35.1	0.088	0.20
40.0	40.013	40.1	0.087	0.20

Temperature Accuracy in the Measurement. (DRY)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty ( ± )
30.0	30.014	30.1	0.086	0.20
35.0	35.012	35.1	0.088	0.20
40.0	40.013	40.1	0.087	0.20

Temperature Accuracy in the Measurement. (GLOBE)

Unit : °C

Humidity Setting	Standard Reading	UUC Reading	Error	Uncertainty ( ± )
30.0	30.014	30.1	0.086	0.20
35.0	35.012	35.1	0.088	0.20
40.0	40.013	40.1	0.087	0.20

### Note:

The result of calibration was found accurate as show on date and place of calibration only.  
This Certificate is not certified for any commercial transaction.

### Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor  $k = 2$ , providing a level of confidence approximately 95%.

- End of Certificate -





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

Heat R022\_2

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: R09	Verification Date	: 04 April 2024
Brand	: Quest Technologies	Ambient Temp.	: 24.5 °C
Model	: QUESTemp 36	Barometric Pressure	: 1011 mmbar
Serial No.	: TKE060012	Relative Humidity	: 49 %
Verification Module (Electronic Sensor Check) :			
Verification Module No. : 21 WB = 12.5 °C , DB = 47.1 °C , G = 69.3 °C			
Result of Verification : Without Adjustment			
Wet Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.5	0.0	± 0.5
Dry Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.1	0.0	± 0.5
Globe Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.3	0.0	± 0.5
UUC* = UNIT UNDER CALIBRATION			





ID LINE : IEC17025



## Certificate of Calibration

Certificate Number : SPR24030285-3

Page : 1 of 3

Customer : S.P.S. CONSULTING SERVICE CO., LTD.

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

Equipment Name : Area Heat Stress Monitor

Manufacturer : Quest Technologies

Model : QUESTemp 32

Serial Number : TPE070001

ID. Number : R12

### Environmental Conditions

Ambient Temperature :  $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$

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

Location of Calibration : In-Lab

Calibration Procedure : SP-CPT-04-13

Received Date : 19 Mar 2024

Calibration Date : 20 Mar 2024

Recommend Due Date : 20 Mar 2025

Date of Issue : 21 Mar 2024

### Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr. Navaporn Uengseng

Calibration Officer

Approved by :



( Ms. Bussakorn Chaikaew )

Authorized Signatory





ID LINE : IEC17025



## Calibration Report

Certificate Number : SPR24030285-3

Page : 2 of 3

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Humidity Chamber	TH-80S	N/A	SPR24020149-7	23 Feb 2025
THERMO-HYGROMETER	5020A	A47046	QR24-0167	26 Jan 2025

### Traceability

This certification is traceable to the International System of Unit maintained at :  
SP Metrology - SP Metrology system (Thailand) Co.Ltd.  
Quality Reborn Co., Ltd





ID LINE : IEC17025



## Result of Calibration

Certificate No. : SPR24030285-3

Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty ( ± )
30.0	30.012	29.9	-0.112	0.20
35.0	35.010	34.9	-0.110	0.20
40.0	40.015	39.9	-0.115	0.20

Temperature Accuracy in the Measurement. (DRY)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty ( ± )
30.0	30.012	30.1	0.088	0.20
35.0	35.010	35.1	0.090	0.20
40.0	40.015	40.1	0.085	0.20

Temperature Accuracy in the Measurement. (GLOBE)

Unit : °C

Humidity Setting	Standard Reading	UUC Reading	Error	Uncertainty ( ± )
30.0	30.012	30.1	0.088	0.20
35.0	35.010	35.1	0.090	0.20
40.0	40.015	40.1	0.085	0.20

### Note :

The result of calibration was found accurate as show on date and place of calibration only.  
This Certificate is not certified for any commercial transaction.

### Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor  $k = 2$ , providing a level of confidence approximately 95%.

- End of Certificate -





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

Heat R022\_3

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: R12	Verification Date	: 04 April 2024
Brand	: Quest Technologie	Ambient Temp.	: 24.5 °C
Model	: QUESTemp 32	Barometric Pressure	: 1011 mmbar
Serial No.	: TPE070001	Relative Humidity	: 49 %
Verification Module (Electronic Sensor Check) :			
Verification Module No. : 21 WB = 12.5 °C , DB = 47.1 °C , G = 69.3 °C			
Result of Verification : Without Adjustment			
Wet Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.5	0.0	± 0.5
Dry Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.0	0.1	± 0.5
Globe Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.2	0.1	± 0.5
UUC* = UNIT UNDER CALIBRATION			

