

ภาคผนวกที่ 4

เอกสารสอบเทียบความถูกต้องของเครื่องมือ

ตรวจวัดคุณภาพสิ่งแวดล้อม

**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม**

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
คุณภาพอากาศในบรรยากาศ		
Total Suspended Particulate (TSP)	High Volume Air Sampler No. R01, R02, R13	Digital Balance
Particulate Matter less than 10 microns (PM-10)	High Volume PM-10 Air Sampler No. R01, R02, R05	Digital Balance
Nitrogen Dioxide (NO ₂)	NO ₂ Analyzer No. R04, R08, R11	NO ₂ Analyzer No. R04, R08, R11
คุณภาพอากาศจากปล่องระบาย		
Total Suspended Particulate	Console No. R03, R05 Pitot Tube No. B41, B44	Digital Balance
Oxides of Nitrogen	Vacuum Gauge	Spectrophotometer
Hydrogen Chloride	Personal Pump SKC No. R13 Rotameter No. H-R03	IC
Hydrogen Fluoride	Personal Pump SKC No. R13 Rotameter No. H-R03	IC
คุณภาพอากาศในสถานประกอบการ		
Total Dust	Personal Pump SKC No. R05, R10, R13, R22, R34, R35, R37 Rotameter No. H-R04	Digital Balance
Respirable Dust	Personal Pump SKC No. R05, R10, R20, R31, R40 Rotameter No. H-R04	Digital Balance
Aluminum Fume	Personal Pump SKC No. R32, R40 Rotameter No. H- R04	ICP
Hydrogen Chloride	Personal Pump SKC No. R19 Rotameter No. L- R04	IC
Hydrogen Fluoride	Personal Pump SKC No. R19 Rotameter No. L- R04	IC
Ammonia	Personal Pump SKC No. R18 Rotameter No. L- R04	IC
ระดับเสียงในบรรยากาศ		
L _{eq} 24 hr, L _{max} , L ₉₀ และเสียงรบกวน	Acoustic Calibrator Sound Level Meter : ACO-R04, R05, R20, R42, R48	-

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม (ต่อ)

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
ระดับเสียงในสถานประกอบการ L_{eq} 8 hr และ L_{max}	Acoustic Calibrator Sound Level Meter : ACO-R06, R07, R11, R26, R34, R43	-
TWA	Sound Level Meter : NMD-R04, R21, R23, R28	
คุณภาพน้ำทิ้ง		
pH	-	pH Meter
Total Dissolved Solids	-	Digital Balance
Total Suspended Solids	-	Digital Balance
BOD ₅	-	BOD Analyzer
COD	-	COD Reactor
Grease & Oil	-	Digital Balance
Total Aluminum	-	ICP
ระดับความร้อนในสถานประกอบการ WBGT	Heat Meter No. R14, R15, R16	-

คุณภาพอากาศในบรรยากาศ



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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

High Volume Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3440


Calibration Data

High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
B35	B35	02/11/2020	$y = 1.055x + 2.713$	0.998
B36	B36	02/11/2020	$y = 1.196x - 4.657$	1.000
B37	B37	02/11/2020	$y = 1.217x - 4.758$	0.998
B38	B38	02/11/2020	$y = 1.099x - 0.537$	0.996
B39	B39	02/11/2020	$y = 1.306x - 7.957$	0.998
B40	B40	02/11/2020	$y = 1.073x + 1.979$	1.000
B41	B41	02/11/2020	$y = 1.148x - 2.354$	0.997
B42	B42	03/11/2020	$y = 1.223x - 5.417$	0.995
B43	B43	02/11/2020	$y = 1.315x - 7.592$	0.999
B44	B44	09/11/2020	$y = 1.304x - 9.236$	0.996
R01	R01	09/11/2020	$y = 1.183x - 2.477$	0.999
R02	R02	09/11/2020	$y = 1.090x + 0.075$	1.000
R03	R03	09/11/2020	$y = 1.170x - 2.616$	0.998
R04	R04	03/11/2020	$y = 1.105x + 1.441$	1.000
R05	R05	03/11/2020	$y = 1.066x + 2.595$	0.995
R06	R06	03/11/2020	$y = 1.154x - 1.156$	0.999
R07	R07	03/11/2020	$y = 1.329x - 9.592$	1.000
R08	R08	03/11/2020	$y = 1.266x - 8.017$	1.000
R09	R09	03/11/2020	$y = 1.190x - 4.738$	0.998
R10	R10	05/11/2020	$y = 1.273x - 5.674$	1.000
R11	R11	03/11/2020	$y = 1.236x - 6.162$	0.997
R12	R12	05/11/2020	$y = 1.238x - 5.408$	0.998
R13	R13	04/11/2020	$y = 1.110x + 1.165$	0.999
R14	R14	05/11/2020	$y = 1.137x + 0.733$	0.996
R15	R15	05/11/2020	$y = 1.210x - 5.345$	0.998
R16	R16	04/11/2020	$y = 1.135x - 1.170$	0.997
R17	R17	05/11/2020	$y = 1.103x - 0.565$	0.999
R18	R18	05/11/2020	$y = 1.266x - 6.094$	0.998
R19	R19	05/11/2020	$y = 1.135x + 0.444$	0.999
R20	R20	05/11/2020	$y = 1.131x - 1.678$	1.000

Calibrated by :

Phakhinai Khongkomnerd
(Mr. Phakhinai Khongkomnerd)

Approved by :


(Mr. Peera Detudom)



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High Volume PM-10 Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3440

Calibration Data

High Volume PM-10 Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
R01	R01	05/11/2020	$y = 1.541x - 15.814$	1.000
R02	R02	05/11/2020	$y = 1.172x - 2.728$	0.995
R03	R03	02/11/2020	$y = 1.320x - 9.986$	0.996
R04	R04	02/11/2020	$y = 1.203x - 2.337$	0.998
R05	R05	02/11/2020	$y = 1.141x - 0.012$	1.000
R06	R06	03/11/2020	$y = 1.259x - 4.780$	0.999
R07	R07	03/11/2020	$y = 1.137x - 2.336$	1.000
R08	R08	03/11/2020	$y = 1.129x - 0.712$	0.998
R09	R09	05/11/2020	$y = 1.098x + 0.030$	0.999
R10	R10	03/11/2020	$y = 1.110x - 0.975$	0.997
R11	R11	03/11/2020	$y = 1.280x - 6.917$	1.000
R12	R12	04/11/2020	$y = 1.170x - 4.271$	1.000
R13	R13	04/11/2020	$y = 1.127x + 0.230$	0.998
R14	R14	04/11/2020	$y = 1.254x - 5.487$	0.996
R15	R15	04/11/2020	$y = 1.066x + 1.749$	0.995
R16	R16	03/11/2020	$y = 1.302x - 7.320$	0.998
R17	R17	03/11/2020	$y = 1.154x - 0.508$	0.997
R18	R18	02/11/2020	$y = 1.219x - 5.352$	0.999
R19	R19	02/11/2020	$y = 1.140x - 1.276$	1.000
R20	R20	02/11/2020	$y = 1.318x - 8.324$	0.996

Calibrated by :

Phakhinai Khongkomnerd
(Mr. Phakhinai Khongkomnerd)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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CALIBRATION REPORT

CHEMILUMINESCENT NO / NO₂ / NO_x ANALYZER

DATE : 08 November 2020

BRAND : API

MODEL : 200E

NO. NOX-R04

SERIAL NO. 4411

Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 07 August 2020

Serial No. : 911

Reference Standard Gas

Standard Gas : Nitric Oxide (NO)

Cylinder No. : A00771SK

Certified Date : 19 July 2019

Expired Date : 18 July 2021

Cylinder Conc. : 48.6 ppm

CALIBRATING CONDITION

Pressure 1011 mmbar

Temp. 24.6 °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	400.2	0.050	400.0	1.006
NO _x Span	400	400.4	0.100	400.0	1.012

API Model 200E NO_x 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	94.0	mV	-20 - 150
HVPS	672	V	420 - 900 constant
RCELL TEMP	50.4	°C	50 ± 1
BOX TEMP	29.3	°C	8 - 48
PMT TEMP	7.1	°C	7 ± 2
MOLY TEMP	315.3	°C	315 ± 5
RCELL PRESS	8.2	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 _x Span Conc	400	PPB	20 - 20,000
NO Slope	1.006	-	1.0 ± 0.3
NO _x Slope	1.012	-	1.0 ± 0.3
NO Offset	1.5	mV	-20 to +150
NO _x 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

Calibrated by :

Phakhinai Khongkomnerd
(Mr.Phakhinai Khongkomnerd)

Approved by :

Peera Detudom
(Mr.Peera Detudom)



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CALIBRATION REPORT

CHEMILUMINESCENT NO / NO₂ / NO_x ANALYZER

DATE : 08 November 2020

BRAND : API

MODEL : 200E

NO. NOX-R08

SERIAL NO. 243

Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 07 August 2020

Serial No. : 911

Reference Standard Gas

Standard Gas : Nitric Oxide (NO)

Cylinder No. : A00771SK

Certified Date : 19 July 2019

Expired Date : 18 July 2021

Cylinder Conc. : 48.6 ppm

CALIBRATING CONDITION

Pressure 1011 mmbar

Temp. 24.6 °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	399.5	-0.125	400.0	1.002
NO _x Span	400	399.7	-0.075	400.0	1.004

API Model 200E NO_x 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	102.9	mV	-20 - 150
AZERO	93.7	mV	-20 - 150
HVPS	673	V	420 - 900 constant
RCELL TEMP	50.1	°C	50 ± 1
BOX TEMP	28.8	°C	8 - 48
PMT TEMP	7.0	°C	7 ± 2
MOLY TEMP	314.7	°C	315 ± 5
RCELL PRESS	8.4	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.6	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO _x Span Conc	400	PPB	20 - 20,000
NO Slope	1.002	-	1.0 ± 0.3
NO _x Slope	1.004	-	1.0 ± 0.3
NO Offset	0.9	mV	-20 to +150
NO _x Offset	0.5	mV	-20 to 150
Stability at Zero	0.1	PPB	< 0.2
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas

Calibrated by :

Phakhinai Khongkomnerd
(Mr.Phakhinai Khongkomnerd)

Approved by :

(Mr.Peera Detudom)



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CALIBRATION REPORT

CHEMILUMINESCENT NO / NO₂ / NO_x ANALYZER

DATE : 08 November 2020

BRAND : API

MODEL : 200E

NO. NOX-R11

SERIAL NO. 2621

Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 07 August 2020

Serial No. : 911

Reference Standard Gas

Standard Gas : Nitric Oxide (NO)

Cylinder No. : A00771SK

Certified Date : 19 July 2019

Expired Date : 18 July 2021

Cylinder Conc. : 48.6 ppm

CALIBRATING CONDITION

Pressure 1011 mmbar

Temp. 24.6 °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	400.1	0.025	400.0	1.004
NO _x Span	400	400.3	0.075	400.0	1.008

API Model 200E NO_x 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	509	cc/min	500 ± 50
OZONE FLOW	78	cc/min	80 ± 15
PMT	103.1	mV	-20 - 150
AZERO	94.2	mV	-20 - 150
HVPS	671	V	420 - 900 constant
RCELL TEMP	50.2	°C	50 ± 1
BOX TEMP	29.5	°C	8 - 48
PMT TEMP	7.3	°C	7 ± 2
MOLY TEMP	314.9	°C	315 ± 5
RCELL PRESS	8.3	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 _x Span Conc	400	PPB	20 - 20,000
NO Slope	1.004	-	1.0 ± 0.3
NO _x Slope	1.008	-	1.0 ± 0.3
NO Offset	1.1	mV	-20 to +150
NO _x Offset	0.6	mV	-20 to 150
Stability at Zero	0.1	PPB	< 0.2
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas

Calibrated by : Phakhinai Khongkomnerd
(Mr.Phakhinai Khongkomnerd)

Approved by : 
(Mr.Peera Detudom)

**QUALITY CALIBRATION CO.,LTD.**

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

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

www.qcalibration.com

CERTIFICATE No : 20M2735

REFERENCE No : 56381-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : METTLER TOLEDO

MODEL : XS105

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 : TETNITHI W.

CALIBRATION DATE : 20-Mar-20

APPROVED BY : 
PONGSAK J.

ISSUED DATE : 26-Mar-20

RECEIVED DATE : 20-Mar-20



QUALITY CALIBRATION CO.,LTD.

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

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

www.qcalibration.com

CERTIFICATE No : 20M2735

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105
MANUFACTURER : METTLER TOLEDO S/N : 1126422905
ID No : BA 05/50 RECEIVED DATE : 20-Mar-20
AIR PRESSURE : 1011mbar \pm 1mbar CALIBRATION DATE : 20-Mar-20
AMBIENT TEMPERATURE : 20°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 4:2006 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS ADJUSTED USING INTERNAL WEIGHT TO ADJUST. 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. THE INTERNAL WEIGHT WAS CHECKED BY USING

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-I-151	SM9/2562	23-Jan-21
2) STANDARD WEIGHT	E2	15843	SM9/2562	23-Jan-21

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

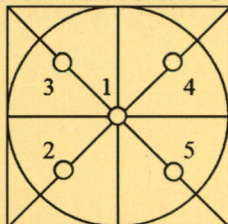
3. REPEATABILITY OF READING AT 20 g WAS 0 g

4. REPEATABILITY OF READING AT 100 g WAS 0 g

5. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.00000	0.00000	0.000030
0.02	0.02000	0.00000	0.000030
0.10	0.10000	0.00000	0.000030
0.20	0.20000	0.00000	0.000031
0.50	0.50001	-0.00001	0.000031
1.00	1.00000	0.00000	0.000060
2.00	2.00000	0.00000	0.000058
5.00	5.00000	0.00000	0.000063
10.00	10.00000	0.00000	0.000067
20.00	20.00000	0.00000	0.000073
50.00	50.00000	0.00000	0.00013
100.00	100.00000	0.00000	0.00019
120.00	120.00001	-0.00001	0.00022

6. OFF CENTER LOADING ERROR



POINT	READING (g)	
1	20.00000	50.0000
2	20.00000	50.0000
3	20.00000	50.0001
4	20.00000	50.0000
5	20.00000	50.0000
OFF-CENTER LOADING	0.00000	0.0001

7. INTERNAL WEIGHT ERROR :-0.00003333333320229 g

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

คุณภาพอากาศจากปล่องระบาย



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

Console Calibration Report

Calibration Method

Critical Orifices

Calibration Data

Console Data		Calibration Data		
No.	Serial No.	Date	y	$\Delta H_{@}$ (mmH ₂ O)
B01	1563	01/09/2020	1.002	50.41
B02	8002514	02/09/2020	0.998	49.62
B03	1503016	02/09/2020	0.997	50.25
B04	2883	01/09/2020	1.004	49.52
B05	1609067	02/09/2020	0.996	48.86
R01	1561	01/09/2020	0.997	49.67
R02	8002513	01/09/2020	0.998	50.07
R03	1570	02/09/2020	1.006	49.20
R04	8002519	03/09/2020	1.004	51.21
R05	1503015	03/09/2020	1.003	50.11

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

Accept Value of $\Delta H_{@}$ (test) is 46.7 ± 6.4 (mmH₂O)

Calibrated by :

Phakhinai Khongkomnerd
(Mr. Phakhinai Khongkomnerd)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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

Pitot Tube Calibration Report

Calibration Method

Standard Pitot Tube

Calibration Data

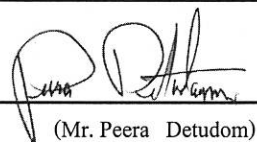
Pitot Tube Data			Calibration Data		
No.	Type of Pitot	Coefficient of Standard Pitot	Date	Avg. of Cp (test)	
				Side A	Side B
B36	S	0.99	05/11/2020	0.85	0.84
B37	S	0.99	05/11/2020	0.84	0.83
B38	S	0.99	05/11/2020	0.85	0.84
B39	S	0.99	05/11/2020	0.84	0.84
B40	S	0.99	04/11/2020	0.83	0.84
B41	S	0.99	04/11/2020	0.84	0.84
B44	S	0.99	04/11/2020	0.84	0.83
B45	S	0.99	04/11/2020	0.84	0.85
B46	S	0.99	10/11/2020	0.84	0.84
B47	S	0.99	11/11/2020	0.84	0.83
B48	S	0.99	11/11/2020	0.84	0.84
B49	S	0.99	11/11/2020	0.84	0.84
B54	S	0.99	03/11/2020	0.84	0.84
B56	S	0.99	03/11/2020	0.84	0.83
B57	S	0.99	03/11/2020	0.85	0.84
B58	S	0.99	03/11/2020	0.83	0.84

Remark : Accept value of Cp (test) is 0.84 ± 0.01

Calibrated by :

Phakhinai Khongkomnerd
(Mr.Phakhinai Khongkomnerd)

Approved by :


(Mr. Peera Detudom)

Certificate of Calibration

Certificate No. : 63-220086-4

Page : 1 of 2

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

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

Equipment : Vacuum Gauge

Manufacturer : HI-LIGHT **Model :** N/A

ID No. : 3

Range : 0 in Hg to -30 in Hg **Resolution :** 1 in Hg

Environment : Ambient Temperature : $(20 \pm 2) ^\circ \text{C}$

Relative Humidity : $(50 \pm 10) \%$

Date of Received : 24 June 2020

Date of Calibration : 26 June 2020

Date of Issue : 26 June 2020

Calibrated by : Satja Sangkhum

Calibration Method : In-house method CAL-M2201 based on BS EN 837-1:2016 with Pressure Calibrator

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

Pressure Calibrator & Pressure Sensors Modules

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
220007	MP-0036-20	11 Mar 2022	National Institute of Metrology (Thailand), (NIMT)
220001	MP-0036-20	11 Mar 2022	National Institute of Metrology (Thailand), (NIMT)

Approved by :

(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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

Certificate of Calibration

Certificate No. : 63-220086-4

Page : 2 of 2

Result of Calibration : Without Adjustment

Function : Vacuum measurement

Condition of calibration :

- 1 Scale and conversion factor is 1 kPa = 0.295 in Hg
- 2 Angle of mounting from horizontal at 90 °
- 3 UUC reading after lightly tapped
- 4 Reference plane of UUC at center of Gauge
- 5 UUC calibrated by using clean air as pressure media
6. UUC Condition As-Received : Good

Standard Reading (in Hg)	UUC Reading (in Hg)	Correction (in Hg)
0.00	0	0.0
-4.86	-5	0.1
-9.91	-10	0.1
-15.12	-15	-0.1
-20.30	-20	-0.3
-27.51	-30	2.5
-27.47	-30	2.5
-20.33	-20	-0.3
-15.13	-15	-0.1
-9.92	-10	0.1
-4.84	-5	0.2
0.00	0	0.0

Remark

UUC : Unit Under Calibration

The uncertainty is combined hysteresis

The uncertainty of measurement was with in ± 0.39 in Hg

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

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

- o0o -



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด

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

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

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
R01	SKC	224-PCXR4	602467	01/10/2020	1,000	1,500	2,000	1,002	1,499	2,001	1.010x - 21.766	0.999
R02	SKC	224-PCXR4	626450	01/10/2020	1,000	2,000	3,000	996	1,491	1,993	0.997x - 0.092	1.000
R03	SKC	224-PCXR4	691592	01/10/2020	1,000	1,500	2,000	1,011	1,527	2,005	1.007x - 7.744	0.998
R04	SKC	224-PCXR4	691672	01/10/2020	1,000	1,500	2,000	996	1,495	1,991	0.997x - 0.865	1.000
R05	SKC	224-PCXR4	798470	01/10/2020	1,000	1,500	2,000	1,002	1,499	2,000	1.010x - 20.220	0.999
R06	SKC	224-PCXR4	798456	01/10/2020	1,000	1,500	2,000	994	1,494	2,004	1.019x - 36.035	0.999
R07	SKC	224-PCXR4	798480	01/10/2020	1,000	1,500	2,000	998	1,493	1,998	1.000x - 4.918	1.000
R08	SKC	224-PCXR4	883215	01/10/2020	1,000	1,500	2,000	990	1,495	2,004	1.023x - 43.134	0.999
R09	SKC	224-PCXR4	034650	01/10/2020	1,000	1,500	2,000	1,013	1,526	2,006	1.005x - 4.002	0.998
R10	SKC	224-PCXR4	091765	01/10/2020	1,000	1,500	2,000	1,000	1,495	1,990	0.991x + 8.382	1.000
R11	SKC	224-PCXR4	091763	01/10/2020	1,000	1,500	2,000	1,000	1,496	1,997	0.998x - 0.789	1.000
R12	SKC	224-PCXR4	091568	01/10/2020	1,000	1,500	2,000	1,012	1,528	2,007	1.007x - 5.819	0.998
R13	SKC	224-PCXR4	091638	02/10/2020	1,000	1,500	2,000	1,002	1,501	2,001	1.011x - 22.352	0.999
R14	SKC	224-PCXR4	091764	02/10/2020	1,000	1,500	2,000	996	1,495	1,991	0.995x + 2.635	1.000
R15	SKC	224-PCXR8	529457	02/10/2020	1,000	1,500	2,000	990	1,496	2,004	1.023x - 41.894	0.999
R16	SKC	224-PCXR8	529643	02/10/2020	1,000	1,500	2,000	997	1,495	1,995	0.998x - 1.558	1.000
R17	SKC	224-PCXR8	529645	02/10/2020	1,000	1,500	2,000	1,010	1,527	2,005	1.007x - 6.820	0.998
R18	SKC	224-PCXR8	566756	02/10/2020	1,000	1,500	2,000	1,000	1,500	2,002	1.013x - 24.357	0.999
R19	SKC	224-PCXR8	566802	02/10/2020	1,000	1,500	2,000	995	1,492	1,992	0.996x - 0.582	1.000
R20	SKC	224-PCXR8	529089	02/10/2020	1,000	1,500	2,000	997	1,496	2,003	1.017x - 32.994	0.999
R21	SKC	224-PCXR8	665728	02/10/2020	1,000	1,500	2,000	1,000	1,495	1,992	0.993x + 6.321	1.000
R22	SKC	224-PCXR8	707444	02/10/2020	1,000	1,500	2,000	1,011	1,526	2,009	1.010x - 10.363	0.998
R23	SKC	224-PCXR8	761067	02/10/2020	1,000	1,500	2,000	991	1,496	2,007	1.024x - 44.087	0.999
R24	SKC	224-PCXR8	707893	02/10/2020	1,000	1,500	2,000	998	1,489	1,993	0.999x - 5.277	1.000
R25	SKC	224-PCXR8	761052	02/10/2020	1,000	1,500	2,000	1,000	1,496	1,994	0.993x + 7.772	1.000
R26	SKC	224-PCXR8	707956	02/10/2020	1,000	1,500	2,000	1,001	1,500	2,003	1.013x - 24.811	0.999
R27	SKC	224-PCXR8	707398	05/10/2020	1,000	1,500	2,000	1,000	1,494	1,991	0.990x + 8.565	1.000
R28	SKC	224-PCXR8	707481	06/10/2020	1,000	1,500	2,000	1,013	1,529	2,008	1.007x - 6.453	0.997
R29	SKC	224-PCXR8	707402	05/10/2020	1,000	1,500	2,000	995	1,506	2,000	1.012x - 26.713	0.999
R30	SKC	224-PCXR8	093811	05/10/2020	1,000	1,500	2,000	996	1,493	1,992	0.998x - 1.279	1.000
R31	SKC	224-PCXR8	093183	05/10/2020	1,000	1,500	2,000	1,001	1,492	1,993	0.995x + 3.456	1.000
R32	SKC	224-PCXR8	671950	05/10/2020	1,000	1,500	2,000	998	1,506	2,002	1.013x - 28.163	0.998
R33	SKC	224-PCXR4	626254	05/10/2020	1,000	1,500	2,000	999	1,488	1,995	0.997x - 0.415	1.000
R34	SKC	224-PCXR4	626131	05/10/2020	1,000	1,500	2,000	1,001	1,500	2,001	1.009x - 19.841	0.999
R35	SKC	224-PCXR8	707460	05/10/2020	1,000	1,500	2,000	999	1,492	1,993	0.996x - 0.785	1.000
R36	SKC	224-PCXR8	707446	06/10/2020	1,000	1,500	2,000	992	1,502	1,998	1.016x - 34.011	0.999
R37	SKC	224-PCXR8	707432	06/10/2020	1,000	1,500	2,000	999	1,497	1,992	0.994x + 4.906	1.000
R38	SKC	224-PCXR8	707349	06/10/2020	1,000	1,500	2,000	995	1,494	1,988	0.994x + 3.408	1.000
R39	SKC	224-PCXR8	761095	06/10/2020	1,000	1,500	2,000	990	1,495	2,001	1.020x - 39.156	0.999

Calibrated by :

Phakhinai Khongkomnerd
(Mr. Phakhinai Khongkomnerd)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด

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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	R²
H-R01	Dwyer	VFB-65	01/10/2020	500	1,000	2,000	501.3	999.8	1978.1	0.998x – 0.901	1.000
H-R02	Dwyer	VFB-65	01/10/2020	500	1,000	2,000	496.2	993.5	1997.8	1.004x – 7.870	1.000
H-R03	Dwyer	VFB-65	01/10/2020	500	1,000	2,000	499.1	998.2	1991.4	1.001x – 3.966	1.000
H-R04	Dwyer	VFB-65	02/10/2020	500	1,000	2,000	496.3	996.8	2009.9	0.997x – 0.266	1.000
H-R05	Dwyer	VFB-65	02/10/2020	500	1,000	2,000	499.9	994.1	2005.5	1.000x – 1.842	1.000
H-R06	Dwyer	VFB-65	02/10/2020	500	1,000	2,000	496.0	987.4	2009.0	1.002x – 7.396	1.000

Calibrated by :

Phakhinai Khongkomnerd
(Mr. Phakhinai Khongkomnerd)

Approved by :

Peera Detudom
(Mr. Peera Detudom)

**QUALITY CALIBRATION CO.,LTD.**

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

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

www.qcalibration.com

CERTIFICATE No : 20M2735

REFERENCE No : 56381-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : METTLER TOLEDO

MODEL : XS105

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 : TETNITHI W.

CALIBRATION DATE : 20-Mar-20

APPROVED BY : 
PONGSAK J.

ISSUED DATE : 26-Mar-20

RECEIVED DATE : 20-Mar-20



QUALITY CALIBRATION CO.,LTD.

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

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

www.qcalibration.com

CERTIFICATE No : 20M2735

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105
MANUFACTURER : METTLER TOLEDO S/N : 1126422905
ID No : BA 05/50 RECEIVED DATE : 20-Mar-20
AIR PRESSURE : 1011mbar \pm 1mbar CALIBRATION DATE : 20-Mar-20
AMBIENT TEMPERATURE : 20°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 4:2006 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS ADJUSTED USING INTERNAL WEIGHT TO ADJUST. 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. THE INTERNAL WEIGHT WAS CHECKED BY USING

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-I-151	SM9/2562	23-Jan-21
2) STANDARD WEIGHT	E2	15843	SM9/2562	23-Jan-21

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

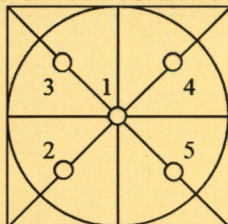
3. REPEATABILITY OF READING AT 20 g WAS 0 g

4. REPEATABILITY OF READING AT 100 g WAS 0 g

5. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.00000	0.00000	0.000030
0.02	0.02000	0.00000	0.000030
0.10	0.10000	0.00000	0.000030
0.20	0.20000	0.00000	0.000031
0.50	0.50001	-0.00001	0.000031
1.00	1.00000	0.00000	0.000060
2.00	2.00000	0.00000	0.000058
5.00	5.00000	0.00000	0.000063
10.00	10.00000	0.00000	0.000067
20.00	20.00000	0.00000	0.000073
50.00	50.00000	0.00000	0.00013
100.00	100.00000	0.00000	0.00019
120.00	120.00001	-0.00001	0.00022

6. OFF CENTER LOADING ERROR



POINT	READING (g)	
1	20.00000	50.0000
2	20.00000	50.0000
3	20.00000	50.0001
4	20.00000	50.0000
5	20.00000	50.0000
OFF-CENTER LOADING	0.00000	0.0001

7. INTERNAL WEIGHT ERROR :-0.00003333333320229 g

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

Lambda UV Preventive Maintenance (PM)

Company Name:	S.P.S. CONSULTING SERVICE CO., LTD.		
Address:	7 Phaholyothin 24 Chompol Chatujak Bangkok		
User Name:	เบญจวรรณ	WO Number:	WO-00859705
Telephone Number:	086-141-2523	PM Number:	3 of 6 P
Customer Support Engineer:	Kerkkiat Kerdasil	Certificate Number:	UV5051-2020
Date PM Performed: (DD-MMM-YYYY)	13-Aug-2020	Next PM Due Date: (DD-MMM-YYYY)	13-Feb-2021

Scope

The purpose of this PM is to ensure the continued functionality of the PerkinElmer Lambda UV/Vis Spectrophotometer by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer. The customer should save their method before the PM begins.

General Instructions:

The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM. Always check with the customer before making any changes that may affect the customer's analysis should be signed by an authorized PerkinElmer and customer representative and left with the customer. Update the PM sticker and instrument logbook as required.

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Component List

Component Specific Model	Serial #	Software Version		Configuration Notes
LAMBDA25	501S14123010	6.2.0.0741	STD	1.27
NA	NA	NA	NA	NA

Standard Lists

Part Number (If applicable)	Description	Quantity	Batch/Lot/SN#	Expiration Date (MM-YY)
B250 0999	Stray Light Standard			
	NaI	1	1705	Jun-21
	NaNO2	1	21060	
	KCl	1	31280	
	H2O	1	71015	
RM-1N2N3N	Secondary Standard for calibration of wavelength and photometric accuracy or use NBS/NIST 930 standards			
	Gray Glass G1	1	1882	Jun-21
	Gray Glass G2	1	1882	
	Gray Glass G3	1	1502	
	Holmium Oxide	1	1822	
	NA	NA	NA	
	NA	NA	NA	

Additional Parts Required for PM					
Part Number (if applicable)	Description	Quantity	Serial #		Remark
NA	NA	NA	NA		NA
NA	NA	NA	NA		NA
NA	NA	NA	NA		NA
Additional Reagents and Standards Required for PM					
Part Number (if applicable)	Description	Quantity	Batch/Lot #		Expiration Date (MM/YY)
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA

Procedure Checklist

Use (✓) to check off those steps in the checklist that have been completed.

1. General:

- ☒ Review the instrument performance with the customer and document any recent problems.
- ☒ Inspect the customer log book and make any appropriate PM entries.
- ☒ Perform general inspection of system for cleanliness.

2. Optical checks:

- ☒ Lamp Alignment/Energy
- ☒ Sample Compartment Windows/Monochromator
- ☒ Mirror and Grating Alignment
- ☒ Cell Holder Alignment

3. Mechanical:

- ☒ Physical inspection – Please write any comments in the additional comments section.
- ☒ Grating Drive Mechanism.
- ☒ Lamp Change Mechanism.
- ☒ Slit Drive Manual Servo.

4. Performance Test:

- ☒ D2 Wavelength accuracy

	Actual Value	Specification
Accuracy at 656.1 nm	656.14	± 0.1

- ☒ Holmium Oxide wavelength accuracy. (Specification ± 0.5 nm.)

Filter ID #		1822	
Test	Calibration Value	Actual Value	Deviation
279.3 nm	279.3	279.39	0.09
360.8 nm	360.9	361	0.10
459.9 nm	460.0	460.15	0.15
536.4 nm	536.3	536.42	0.12

- ☒ Stay Light.

Test	Filter ID #	Result	Specification
NaI @ 220 nm	1705	0.0096	< 0.02 %T
NaNO ₂ @ 340 nm	21060	0.0113	< 0.02 %T
NaNO ₂ @ 370 nm	21060	-0.0040	< 0.02 %T
KCl @ 200 nm	31280	2.8254	≥ 2 A

- ☒ Baseline Flatness.

Corrected Baseline	Specification
0.000211	± 0.001 A

- ☒ Noise Test @ 500 nm.

Actual Value	Specification
0.000016	± 0.00008 A

☒ Photometric Accuracy. (Specification ± 0.006 A.)

Filter 1 ID #		1882	
Test	Calibrated Value	Actual Value	Deviation
440 nm	0.3375	0.3373	-0.0002
546.1 nm	0.3053	0.3055	0.0002
635 nm	0.3279	0.3285	0.0006
Filter 2 ID #		1882	
Test	Calibrated Value	Actual Value	Deviation
440 nm	0.9898	0.9912	0.0014
546.1 nm	0.9422	0.9435	0.0013
635 nm	0.9380	0.9390	0.0010
Filter 3 ID #		1502	
Test	Calibrated Value	Actual Value	Deviation
440 nm	0.4969	0.4978	0.0009
546.1 nm	0.4667	0.4677	0.0010
635 nm	0.4818	0.4829	0.0011

5. Accessory (where applicable):

- ☐ Integrating Sphere
- ☐ Reflecting Attachment
- ☐ Cell Changer
- ☐ Sipper
- ☐ Auto Sampler

6. Review:

- ☒ Review with the customer PM work performed.
- ☒ Review with the customer routine maintenance procedures.
- ☒ Discuss recommended customer-supplied materials to have on hand
- ☒ Attach PM sticker.

Additional Comments

Additional Comments Regarding the PM

Review

<p><i>The preventive maintenance checks and if applicable performance tests for Lambda UV have been completed.</i></p>	
<p><i>This Lambda UV Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.</i></p>	
<p align="center"><i>Review of Preventive Maintenance:</i></p>	
<p>Authorized PerkinElmer Representative:</p> <p align="center"><i>Kerkkiat</i></p>	<p>Date:</p> <p align="center">13-Aug-2020 (DD-MMM-YYYY)</p>
<p>Authorized Customer Representative:</p>	<p>Date:</p> <p align="center">(DD-MMM-YYYY)</p>



Certificate of Calibration

ICS-1500: Anion & Cation (ID#189)

This certificate is to verify that instrument below are calibrated

By Archemica Lab Co., Ltd.

ICS-1500

S/N: 03110527

For

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



Operator Signature: _____

Date: July 17, 2020

(Mr. Thitipong Piromkripuk)

Applications Chemist

คุณภาพอากาศในสถานประกอบการ



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

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
R01	SKC	224-PCXR4	602467	01/10/2020	1,000	1,500	2,000	1,002	1,499	2,001	1.010x - 21.766	0.999
R02	SKC	224-PCXR4	626450	01/10/2020	1,000	2,000	3,000	996	1,491	1,993	0.997x - 0.092	1.000
R03	SKC	224-PCXR4	691592	01/10/2020	1,000	1,500	2,000	1,011	1,527	2,005	1.007x - 7.744	0.998
R04	SKC	224-PCXR4	691672	01/10/2020	1,000	1,500	2,000	996	1,495	1,991	0.997x - 0.865	1.000
R05	SKC	224-PCXR4	798470	01/10/2020	1,000	1,500	2,000	1,002	1,499	2,000	1.010x - 20.220	0.999
R06	SKC	224-PCXR4	798456	01/10/2020	1,000	1,500	2,000	994	1,494	2,004	1.019x - 36.035	0.999
R07	SKC	224-PCXR4	798480	01/10/2020	1,000	1,500	2,000	998	1,493	1,998	1.000x - 4.918	1.000
R08	SKC	224-PCXR4	883215	01/10/2020	1,000	1,500	2,000	990	1,495	2,004	1.023x - 43.134	0.999
R09	SKC	224-PCXR4	034650	01/10/2020	1,000	1,500	2,000	1,013	1,526	2,006	1.005x - 4.002	0.998
R10	SKC	224-PCXR4	091765	01/10/2020	1,000	1,500	2,000	1,000	1,495	1,990	0.991x + 8.382	1.000
R11	SKC	224-PCXR4	091763	01/10/2020	1,000	1,500	2,000	1,000	1,496	1,997	0.998x - 0.789	1.000
R12	SKC	224-PCXR4	091568	01/10/2020	1,000	1,500	2,000	1,012	1,528	2,007	1.007x - 5.819	0.998
R13	SKC	224-PCXR4	091638	02/10/2020	1,000	1,500	2,000	1,002	1,501	2,001	1.011x - 22.352	0.999
R14	SKC	224-PCXR4	091764	02/10/2020	1,000	1,500	2,000	996	1,495	1,991	0.995x + 2.635	1.000
R15	SKC	224-PCXR8	529457	02/10/2020	1,000	1,500	2,000	990	1,496	2,004	1.023x - 41.894	0.999
R16	SKC	224-PCXR8	529643	02/10/2020	1,000	1,500	2,000	997	1,495	1,995	0.998x - 1.558	1.000
R17	SKC	224-PCXR8	529645	02/10/2020	1,000	1,500	2,000	1,010	1,527	2,005	1.007x - 6.820	0.998
R18	SKC	224-PCXR8	566756	02/10/2020	1,000	1,500	2,000	1,000	1,500	2,002	1.013x - 24.357	0.999
R19	SKC	224-PCXR8	566802	02/10/2020	1,000	1,500	2,000	995	1,492	1,992	0.996x - 0.582	1.000
R20	SKC	224-PCXR8	529089	02/10/2020	1,000	1,500	2,000	997	1,496	2,003	1.017x - 32.994	0.999
R21	SKC	224-PCXR8	665728	02/10/2020	1,000	1,500	2,000	1,000	1,495	1,992	0.993x + 6.321	1.000
R22	SKC	224-PCXR8	707444	02/10/2020	1,000	1,500	2,000	1,011	1,526	2,009	1.010x - 10.363	0.998
R23	SKC	224-PCXR8	761067	02/10/2020	1,000	1,500	2,000	991	1,496	2,007	1.024x - 44.087	0.999
R24	SKC	224-PCXR8	707893	02/10/2020	1,000	1,500	2,000	998	1,489	1,993	0.999x - 5.277	1.000
R25	SKC	224-PCXR8	761052	02/10/2020	1,000	1,500	2,000	1,000	1,496	1,994	0.993x + 7.772	1.000
R26	SKC	224-PCXR8	707956	02/10/2020	1,000	1,500	2,000	1,001	1,500	2,003	1.013x - 24.811	0.999
R27	SKC	224-PCXR8	707398	05/10/2020	1,000	1,500	2,000	1,000	1,494	1,991	0.990x + 8.565	1.000
R28	SKC	224-PCXR8	707481	06/10/2020	1,000	1,500	2,000	1,013	1,529	2,008	1.007x - 6.453	0.997
R29	SKC	224-PCXR8	707402	05/10/2020	1,000	1,500	2,000	995	1,506	2,000	1.012x - 26.713	0.999
R30	SKC	224-PCXR8	093811	05/10/2020	1,000	1,500	2,000	996	1,493	1,992	0.998x - 1.279	1.000
R31	SKC	224-PCXR8	093183	05/10/2020	1,000	1,500	2,000	1,001	1,492	1,993	0.995x + 3.456	1.000
R32	SKC	224-PCXR8	671950	05/10/2020	1,000	1,500	2,000	998	1,506	2,002	1.013x - 28.163	0.998
R33	SKC	224-PCXR4	626254	05/10/2020	1,000	1,500	2,000	999	1,488	1,995	0.997x - 0.415	1.000
R34	SKC	224-PCXR4	626131	05/10/2020	1,000	1,500	2,000	1,001	1,500	2,001	1.009x - 19.841	0.999
R35	SKC	224-PCXR8	707460	05/10/2020	1,000	1,500	2,000	999	1,492	1,993	0.996x - 0.785	1.000
R36	SKC	224-PCXR8	707446	06/10/2020	1,000	1,500	2,000	992	1,502	1,998	1.016x - 34.011	0.999
R37	SKC	224-PCXR8	707432	06/10/2020	1,000	1,500	2,000	999	1,497	1,992	0.994x + 4.906	1.000
R38	SKC	224-PCXR8	707349	06/10/2020	1,000	1,500	2,000	995	1,494	1,988	0.994x + 3.408	1.000
R39	SKC	224-PCXR8	761095	06/10/2020	1,000	1,500	2,000	990	1,495	2,001	1.020x - 39.156	0.999

Calibrated by :

Phakhinai Khongkomnerd
(Mr. Phakhinai Khongkomnerd)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
R40	SKC	224-PCXR4	612753	06/10/2020	1,000	1,500	2,000	994	1,496	1,993	0.997x - 1.586	1.000
R41	SKC	224-PCXR4	626140	06/10/2020	1,000	1,500	2,000	1,004	1,501	2,002	1.011x - 21.360	0.999
R42	SKC	224-PCXR4	626463	07/10/2020	1,000	1,500	2,000	997	1,494	1,989	0.993x + 6.146	1.000
R43	SKC	224-PCXR4	626129	07/10/2020	1,000	1,500	2,000	992	1,503	2,002	1.018x - 36.824	0.999
R44	SKC	224-PCXR4	602753	07/10/2020	1,000	1,500	2,000	1,000	1,500	2,001	1.012x - 24.110	0.999
R45	SKC	224-PCXR4	626137	06/10/2020	1,000	1,500	2,000	996	1,496	1,991	0.994x + 3.356	1.000

Calibrated by :

Phakhinai Khongkomnerd
(Mr. Phakhinai Khongkomnerd)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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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	R²
H-R01	Dwyer	VFB-65	01/10/2020	500	1,000	2,000	501.3	999.8	1978.1	0.998x – 0.901	1.000
H-R02	Dwyer	VFB-65	01/10/2020	500	1,000	2,000	496.2	993.5	1997.8	1.004x – 7.870	1.000
H-R03	Dwyer	VFB-65	01/10/2020	500	1,000	2,000	499.1	998.2	1991.4	1.001x – 3.966	1.000
H-R04	Dwyer	VFB-65	02/10/2020	500	1,000	2,000	496.3	996.8	2009.9	0.997x – 0.266	1.000
H-R05	Dwyer	VFB-65	02/10/2020	500	1,000	2,000	499.9	994.1	2005.5	1.000x – 1.842	1.000
H-R06	Dwyer	VFB-65	02/10/2020	500	1,000	2,000	496.0	987.4	2009.0	1.002x – 7.396	1.000

Calibrated by :

Phakhinai Khongkomnerd
 (Mr. Phakhinai Khongkomnerd)

Approved by :

Peera Detudom
 (Mr. Peera Detudom)



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

Rotameter Calibration Report (For Personal Pump 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 ²
L-R01	Dwyer	VFA-21	01/10/2020	50	100	200	50.0	100.9	198.9	0.991x + 0.978	1.000
L-R02	Dwyer	VFA-21	01/10/2020	50	100	200	49.6	100.2	198.2	0.989x + 0.835	1.000
L-R03	Dwyer	VFA-21	01/10/2020	50	100	200	49.4	100.0	198.5	1.002x - 0.728	1.000
L-R04	Dwyer	VFA-21	02/10/2020	50	100	200	50.1	100.2	198.1	0.991x + 0.423	1.000
L-R05	Dwyer	VFA-21	02/10/2020	50	100	200	50.0	98.6	198.6	1.009x - 1.420	1.000
L-R06	Dwyer	VFA-21	02/10/2020	50	100	200	50.0	99.4	198.8	1.001x - 0.416	1.000

Calibrated by :

Phakhinai Khongkomnerd
 (Mr. Phakhinai Khongkomnerd)

Approved by :

Peera Detudom
 (Mr. Peera Detudom)

**QUALITY CALIBRATION CO.,LTD.**

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

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

www.qcalibration.com

CERTIFICATE No : 20M2735

REFERENCE No : 56381-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : METTLER TOLEDO

MODEL : XS105

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 : TETNITHI W.

CALIBRATION DATE : 20-Mar-20

APPROVED BY : 
PONGSAK J.

ISSUED DATE : 26-Mar-20

RECEIVED DATE : 20-Mar-20



QUALITY CALIBRATION CO.,LTD.

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

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

www.qcalibration.com

CERTIFICATE No : 20M2735

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105
MANUFACTURER : METTLER TOLEDO S/N : 1126422905
ID No : BA 05/50 RECEIVED DATE : 20-Mar-20
AIR PRESSURE : 1011mbar \pm 1mbar CALIBRATION DATE : 20-Mar-20
AMBIENT TEMPERATURE : 20°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 4:2006 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS ADJUSTED USING INTERNAL WEIGHT TO ADJUST. 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. THE INTERNAL WEIGHT WAS CHECKED BY USING

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-I-151	SM9/2562	23-Jan-21
2) STANDARD WEIGHT	E2	15843	SM9/2562	23-Jan-21

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

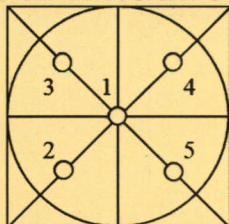
3. REPEATABILITY OF READING AT 20 g WAS 0 g

4. REPEATABILITY OF READING AT 100 g WAS 0 g

5. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.00000	0.00000	0.000030
0.02	0.02000	0.00000	0.000030
0.10	0.10000	0.00000	0.000030
0.20	0.20000	0.00000	0.000031
0.50	0.50001	-0.00001	0.000031
1.00	1.00000	0.00000	0.000060
2.00	2.00000	0.00000	0.000058
5.00	5.00000	0.00000	0.000063
10.00	10.00000	0.00000	0.000067
20.00	20.00000	0.00000	0.000073
50.00	50.00000	0.00000	0.00013
100.00	100.00000	0.00000	0.00019
120.00	120.00001	-0.00001	0.00022

6. OFF CENTER LOADING ERROR



POINT	READING (g)	
1	20.00000	50.0000
2	20.00000	50.0000
3	20.00000	50.0001
4	20.00000	50.0000
5	20.00000	50.0000
OFF-CENTER LOADING	0.00000	0.0001

7. INTERNAL WEIGHT ERROR :-0.00003333333320229 g

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 IPV TEST CERTIFICATE MODEL

OPTIMA 5300DV

Customer : <u>S.P.S.Consulting Service Co.,Ltd</u>	Date Tested: <u>July 21, 2020</u>	
	Recommendation Recertification	
Address : <u>7 Soi Phaholyothin 24</u>	Period <u>6</u> Months	
<u>Paholyothin Road</u>	Recertification Due: <u>January 21, 2021</u>	
<u>Jompol Chatuchak, Bangkok 1090</u>	Date Last Certified: <u>January 22, 2020</u>	
User Name: <u>K.Phenpha Viphasathawat</u>	Visit Number: <u>1 of 2</u>	
Phone: <u>083-9269252</u>	PerkinElmer Phone: <u>02-719-6420 ext 206</u>	
Fax: <u>02-513-4221</u>	PerkinElmer Fax: <u>02-318-5597</u>	

CONFIGURATION TESTED		ACCESSORIES/COMPONENT NOT INCLUDED
MODEL	SERIAL NUMBER	
<u>OPTIMA 5300DV</u>	<u>077C7042401</u>	
TESTED EQUIPMENT	CALIBRATION NUMBER	EXPIRATION
<u>IPV Methods</u>		
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
<u>Multielement Standard</u>	<u>N069-1579</u>	<u>November 30, 2020</u>
<u>Wavecal Solution</u>	<u>N058-2152</u>	<u>March 30, 2021</u>
<u>VIS Wavecal solution</u>	<u>N930-2946</u>	<u>December 30, 2020</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>April 30, 2021</u>
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		



MAINTENANCE AND IPV TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C8011701DATE TESTED July 21, 2020**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 IPV TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : 077C8011701DATE TESTED : July 21, 2020

PARAMETER	SPECIFICATION			FINAL VALUE	
Spectral Resolution : UV	As	193.696 nm	≤ 0.007	0.00595	
	Ni	231.604 nm	≤ 0.008	0.00791	
	Ni	341.476 nm	≤ 0.012	0.00767	
Spectral Resolution : VIS	La	408.672 nm	≤ 0.020	0.01602	
	Ba	455.403 nm	≤ 0.025	0.02034	
Precision					
	As	193.656 nm	% RSD < 1.0	0.94	%
	Zn	213.856 nm	% RSD < 1.0	0.86	%
	Mn	257.610 nm	% RSD < 1.0	0.53	%
	La	379.478 nm	% RSD < 1.0	0.41	%
	Ba	455.403 nm	% RSD < 1.0	0.39	%
	Ba	493.408 nm	% RSD < 1.0	0.38	%
Detection Limits : Axial	Tl	190.080 nm	3(sd)	1.91	ppb
	As	193.696 nm	3(sd)	2.79	ppb
	Pb	220.353 nm	3(sd)	1.14	ppb
Detection Limits : Radial	As	193.696 nm	3(sd)	40.70	ppb
	Zn	213.856 nm	3(sd)	1.13	ppb
	Mn	257.610 nm	3(sd)	0.18	ppb
	La	379.478 nm	3(sd)	2.89	ppb
	Ba	455.403 nm	3(sd)	0.25	ppb
	Ba	493.408 nm	3(sd)	1.00	ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd	226.502 nm	≤ 150 ppb	80.49	
BEC : Radial (IB X 1000)/(IS-IB)	Mn	257.610 nm	≤ 45 ppb	43.05	



MAINTENANCE AND IPV TEST CERTIFICATE MODEL
OPTIMA 5300DV

SERIAL NUMBER 077C8011701

DATE TESTED July 21, 2020

Remarks :

Commissioning follow as commissioning performance sheets.

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



Certificate of Calibration

ICS-1500: Anion & Cation (ID#189)

This certificate is to verify that instrument below are calibrated

By Archemica Lab Co., Ltd.

ICS-1500

S/N: 03110527

For

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



Operator Signature: _____

Date: July 17, 2020

(Mr. Thitipong Piromkripuk)

Applications Chemist

ระดับเสียงในบรรยากาศ



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

975 Moo 4, Bangpoo Industrial Estate, Soi 8, Sukhumvit Road km 37,

Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280

Tel: +66 2709 4860-8 Fax: +66 2324 0917-8



Certificate No.: 0229SV20
Operation No.: CP2020060015

Certificate of Calibration

Equipment: Sound Calibrator
Manufacturer: ACO
Model/Type: 2127
Serial No.: 130006
ID No.: 03
Customer: S.P.S. Consunting Co., Ltd.
Address: 7 Soi Phaholyothin 24, Phaholyothin Road,
Jompol, Chatuchak, Bangkok 10900
Received Date: 12 June 2020
Calibrated Date: 15 June 2020
Issued Date: 16 June 2020
Calibrated by: Ms. Juntaporn Kunhakom

Approved by:


(Mr. Sittichai Swaksuriyawong)
Group Manager


The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor $k = 2.00$, providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.

Certificate No.: 0229SV20

Calibration Report

Equipment: Sound Calibrator
Manufacturer: ACO
Model/Type: 2127
Serial No.: 130006
ID No.: 03
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Pressure: (101.3 ± 1.5) kPa

Method of Calibration :-

IEC 60942:2017

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1007-19	30 October 2020
2) Waveform Generator	33511B	MY52302264	551220083074940	17 June 2020
3) Audio Analyzing DMM	2015-P	000136E	551220083255908	3 October 2020
4) Pressure humidity and Temperature Transmitter	PTU301	L3950483	CL1-P200020 0177TE20	12 March 2021 21 April 2021

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

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

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

Reference standards instrument for Electrical function

- Micro Precision Calibration Laboratory (Thailand); A2LA Accredited Calibration No.935.06

Result of Calibration:-

1. Function : Sound pressure level

Normal	Specified Sound	Measured value	Deviated value ^[1]	Acceptance limit ^[3]
Frequency (Hz)	Pressure level (dB)	(dB)	(dB)	(dB)
1000	94	93.92	-0.08	±0.25

2. Function : Frequency

Normal Sound	Specified Frequency	Measured value	Deviated value ^[2]	Acceptance limit ^[3]
Pressure level (dB)	(Hz)	(Hz)	(%)	(%)
94	1000	999.9	0.0	±0.7

Certificate No.: 0229SV20

Calibration Report

3. Function : Total distortion + noise

Normal Sound Pressure level (dB)	Normal Frequency (Hz)	Measured value ^[4] (%)	Acceptance limit ^[5] (%)
94	1000	1.1	2.5

Uncertainty of measurement

Function	Uncertainty	Maximum-permitted uncertainty of measurement
Sound pressure level	0.10 dB	0.15 dB
Frequency	0.10 %	0.20 %
Total distortion + noise	0.40 %	0.50 %

- Note:
- [1] The deviated value is the absolute value of the difference between the measured value and the corresponding specified sound pressure level.
 - [2] The deviated value is the absolute value of the difference in percent between the measured value and the corresponding specified frequency.
 - [3] The acceptance limit is for the deviated value.
 - [4] The measured value is the total distortion + noise, measured over the frequency range from 20 Hz to 20 kHz.
 - [5] The acceptance limit is for the Measured value.

Remarks: 1. Acceptance limit was IEC 60942:2017 Class 1.

-- End of Report --



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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_422/20

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	15 June 2020
		Due Date	15 June 2021

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-R04	ACO	6236	00142005	08 November 2020	94.1	94.0
ACO-R05	ACO	6236	00142020	08 November 2020	94.0	94.0
ACO-R20	ACO	6236	00182003	08 November 2020	94.1	94.0
ACO-R42	ACO	6236	00192054	08 November 2020	94.1	94.0
ACO-R48	ACO	6236	00192060	08 November 2020	94.0	94.0
Acoustic Certified Value : Electrical and Electronics Institute Foundation for Industrial Development					93.92 ± 0.25 dB	

Calibrated by :

Phakhinai Khongkomnerd
(Mr. Phakhinai Khongkomnerd)

Approved by :

Peera Detudom
(Mr. Peera Detudom)

ระดับเสียงในสถานประกอบการ



ELECTRICAL AND ELECTRONICS INSTITUTE
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Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280

Tel: +66 2709 4860-8 Fax: +66 2324 0917-8



Certificate No.: 0229SV20
Operation No.: CP2020060015

Certificate of Calibration

Equipment: Sound Calibrator
Manufacturer: ACO
Model/Type: 2127
Serial No.: 130006
ID No.: 03
Customer: S.P.S. Consunting Co., Ltd.
Address: 7 Soi Phaholyothin 24, Phaholyothin Road,
Jompol, Chatuchak, Bangkok 10900
Received Date: 12 June 2020
Calibrated Date: 15 June 2020
Issued Date: 16 June 2020
Calibrated by: Ms. Juntaporn Kunhakom

Approved by:


(Mr. Sittichai Swaksuriyawong)
Group Manager


The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor $k = 2.00$, providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.

Certificate No.: 0229SV20

Calibration Report

Equipment: Sound Calibrator
Manufacturer: ACO
Model/Type: 2127
Serial No.: 130006
ID No.: 03
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Pressure: (101.3 ± 1.5) kPa

Method of Calibration :-

IEC 60942:2017

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1007-19	30 October 2020
2) Waveform Generator	33511B	MY52302264	551220083074940	17 June 2020
3) Audio Analyzing DMM	2015-P	000136E	551220083255908	3 October 2020
4) Pressure humidity and Temperature Transmitter	PTU301	L3950483	CL1-P200020 0177TE20	12 March 2021 21 April 2021

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

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

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

Reference standards instrument for Electrical function

- Micro Precision Calibration Laboratory (Thailand); A2LA Accredited Calibration No.935.06

Result of Calibration:-

1. Function : Sound pressure level

Normal	Specified Sound	Measured value	Deviated value ^[1]	Acceptance limit ^[3]
Frequency (Hz)	Pressure level (dB)	(dB)	(dB)	(dB)
1000	94	93.92	-0.08	±0.25

2. Function : Frequency

Normal Sound	Specified Frequency	Measured value	Deviated value ^[2]	Acceptance limit ^[3]
Pressure level (dB)	(Hz)	(Hz)	(%)	(%)
94	1000	999.9	0.0	±0.7

Certificate No.: 0229SV20

Calibration Report

3. Function : Total distortion + noise

Normal Sound Pressure level (dB)	Normal Frequency (Hz)	Measured value ^[4] (%)	Acceptance limit ^[5] (%)
94	1000	1.1	2.5

Uncertainty of measurement

Function	Uncertainty	Maximum-permitted uncertainty of measurement
Sound pressure level	0.10 dB	0.15 dB
Frequency	0.10 %	0.20 %
Total distortion + noise	0.40 %	0.50 %

- Note:
- [1] The deviated value is the absolute value of the difference between the measured value and the corresponding specified sound pressure level.
 - [2] The deviated value is the absolute value of the difference in percent between the measured value and the corresponding specified frequency.
 - [3] The acceptance limit is for the deviated value.
 - [4] The measured value is the total distortion + noise, measured over the frequency range from 20 Hz to 20 kHz.
 - [5] The acceptance limit is for the Measured value.

Remarks: 1. Acceptance limit was IEC 60942:2017 Class 1.

-- End of Report --



CALIBRATION CERTIFICATE

Date of issue: 2019-07-08

Certificate No: 14012891-2

Page: 1/3

OBJECT OF CALIBRATION

Manufacturer: **Svantek**

Model: **SV34**

Serial No.: 33142

Description: Acoustical Calibrator accuracy class 2 with nominal level
 $L_{p, \text{nom1}} = 114 \text{ dB}$, and nominal frequency $f_{n1} = 1000 \text{ Hz}$.

ENVIRONMENTAL CONDITIONS

Temperature: 23.2 °C

Humidity: 47.3 %

Pressure: 101.16 hPa

DATE OF CALIBRATION 2019-07-08

APPROVED BY B. Hunt

AcSoft
sound & vibration

AcSoft Calibration | Bedford Technology Park
Thurleigh | Bedford | MK44 2YA

+44 (0) 1234 639550

www.acsoft.co.uk

Date of issue: 2019-07-08**Certificate No:** 14012891-2**Page:** 2/3**CALIBRATION RESULTS**

The calibrator submitted for testing has successfully completed the IEC 60942:2003 (BS EN 60942:2003), for the environmental conditions under which the tests were performed.

The results are presented on page 3 of this certificate (including measurement uncertainty).

UNCERTAINTY OF MEASUREMENTS

Level:	0.15	dB
Frequency:	0.1	Hz
Distortion:	0.1	%

NOTES

1. The information appearing on this certificate has been compiled specifically for this instrument. This calibration certificate is produced with traceable and advanced equipment which permit comprehensive quality assurance verification of all data supplied herein.
2. The measurements in this document are traceable to GUM (Central Office of Measures), Poland
3. This calibration certificate shall not be reproduced except in full, without written permission from Svantek UK Ltd.

REFERENCE EQUIPMENT

Description	Manufacturer	Model	Serial Number
Pistonphone	GRAS	42AP	236167
Acoustical Calibrator	Svantek	SV30A	44775
Sound & Vibration Analyser	Svantek	SV912AE	15940
Digital Multimeter	Keithley	2015THD	1065133
Reference Microphone	GRAS	40AF	207373
Thermo-Barometer	LAB-EL	LB-706B	912

Date of issue: 2019-07-08

Certificate No: 14012891-2

Page: 3/3

**CALIBRATION
RESULTS**

Calibration results are as follows:

SPL

L_{pn}	ΔL_p	$U(L_p)$	$\Delta L_{p,dop}$, dB	
dB	dB	dB	class 1	class 2
113.59	-0.41	0.15	$\pm 0,4$	$\pm 0,6$

Frequency

f_n	δf	$U(f)$	δf_{dop} , w %	
Hz	Hz	Hz	class 1	class 2
999.96	-0.04	0.1	$\pm 1,0$ ($\pm 10\text{Hz}$)	$\pm 2,0$ ($\pm 20\text{Hz}$)

THD – 1kHz

h_n	$U(h)$	δh_{dop} , %	
%	%	class 1	class 2
0.25	0.1	3,0	4,0



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Noise R_423/20

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	15 June 2020
		Due Date	15 June 2021

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-R06	ACO	6236	00152005	09 November 2020	94.1	94.0
ACO-R07	ACO	6236	00152080	09 November 2020	94.0	94.0
ACO-R26	ACO	6236	00192038	09 November 2020	94.0	94.0
ACO-R34	ACO	6236	00192046	09 November 2020	94.1	94.0
ACO-R43	ACO	6236	00192055	09 November 2020	94.0	94.0
Acoustic Certified Value : Electrical and Electronics Institute Foundation for Industrial Development					93.92 ± 0.25 dB	

Calibrated by :

Phakhinai Khongkomnerd
(Mr. Phakhinai Khongkomnerd)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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

Noise R_513/20

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	15 June 2020
		Due Date	15 June 2021

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-R11	ACO	6236	00172038	04 December 2020	94.0	94.0
Acoustic Certified Value : Electrical and Electronics Institute Foundation for Industrial Development					93.92 ± 0.25 dB	

Calibrated by :

Phakhinai Khongkomnerd
(Mr. Phakhinai Khongkomnerd)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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Noise Dose R_424/20

Noise Dose Meter Calibration Report

Acoustic Calibrator Data

Brand	SVANTEK	Number	SV 02/60
Model	SV34	Serial No.	33142
Calibration Range	114 dB, 1000 Hz	Last Calibration	14 October 2020
		Due Date	14 October 2021

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NMD-R04	SVANTEK	SV-104IS	60154	09 November 2020	113.6	113.5
NMD-R21	SVANTEK	SV-104IS	80800	09 November 2020	113.5	113.5
NMD-R23	SVANTEK	SV-104IS	80802	09 November 2020	113.5	113.5
NMD-R28	SVANTEK	SV-104IS	80839	09 November 2020	113.6	113.5
Acoustic Certified Value : Thailand Institute of Scientific And Technological Research (TISTR)					113.54 ± 0.75 dB	

Calibrated by :

Phakhinai Khongkornerd
(Mr. Phakhinai Khongkornerd)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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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 Dose R_514/20

Noise Dose Meter Calibration Report

Acoustic Calibrator Data

Brand	SVANTEK	Number	SV 02/60
Model	SV34	Serial No.	33142
Calibration Range	114 dB, 1000 Hz	Last Calibration	14 October 2020
		Due Date	14 October 2021

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NMD-R28	SVANTEK	SV-104IS	80839	04 December 2020	113.5	113.5
Acoustic Certified Value : Thailand Institute of Scientific And Technological Research (TISTR)					113.54± 0.75 dB	

Calibrated by :

Phakhinai Khongkomnerd
(Mr. Phakhinai Khongkomnerd)

Approved by :

Peer Detudom
(Mr. Peera Detudom)

คุณภาพน้ำทิ้ง

Certificate of Calibration

Certificate No. : 63-420052-1

Page : 1 of 2

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

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

Equipment : pH Meter with electrode

pH meter

Manufacturer : Hanna

Model : HI 3512

Range : N/A pH

Resolution : 0.001 pH

Serial No. : 08685754

ID No. : PH 04/56

Electrode

Model : HI 1332

Serial No. : 04310F4M

Environment : Ambient Temperature : (25 ± 2) °C

Relative Humidity : (50 ± 15) %

Date of Received : 21 April 2020

Date of Calibration : 23 April 2020

Date of Issue : 23 April 2020

Calibrated by : Bunjerd Masri

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

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

1. Multiproduct Calibrator

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
440001	19E779	13 Feb 2021	National Institute of Metrology Thailand (NIMT)

2. Standard Buffer Solution

<u>pH</u>	<u>Cert. No.</u>	<u>Lot No.</u>	<u>Exp. Date</u>	<u>Traceability</u>
4.003	TRM-S2003	280319	29 Jul 2020	National Institute of Metrology Thailand (NIMT)
7.025	TRM-S2005	280119	29 Jul 2020	National Institute of Metrology Thailand (NIMT)
10.008	TRM-S2007	080719	29 Jul 2020	National Institute of Metrology Thailand (NIMT)

Approved by :
(Bunjerd Masri)
Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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

Certificate of Calibration

Certificate No. : 63-420052-1

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Electrical measurement

pH meter

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

Adjustment Curve at nominal pH	Applied Voltage (mV)	Nominal Value (pH)	UUC Reading		Correction (mV)	Uncertainty (± mV)
			(pH)	(mV)		
4, 7, 10	177.4800	4	4.000	177.8	-0.3	0.060
	0.0000	7	7.000	0.3	-0.3	0.058
	-177.4800	10	10.000	-177.2	+0.3	0.060

Function : pH meter with electrode

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

Adjustment Curve at nominal pH	Standard Buffer (pH)	UUC Reading (pH)	Correction (pH)	Uncertainty (± pH)
4, 7, 10	4.003	4.005	-0.002	0.025
	7.025	7.017	0.008	0.024
	10.008	10.010	-0.002	0.070

Remark

UUC : Unit Under Calibration

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

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

- 000 -

B-5

**QUALITY CALIBRATION CO.,LTD.**

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

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

www.qcalibration.com

CERTIFICATE No : 20M2737

REFERENCE No : 56381-3

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 : TETNITHI W.

CALIBRATION DATE : 20-Mar-20

APPROVED BY : 
PONGSAK J.

ISSUED DATE : 21-Mar-20

RECEIVED DATE : 20-Mar-20

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



QUALITY CALIBRATION CO.,LTD.

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

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www.qcalibration.com

CERTIFICATE No : 20M2737

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : BSA224S-CW
MANUFACTURER : SARTORIUS S/N : 36591843
ID No : BA 09/61 RECEIVED DATE : 20-Mar-20
AIR PRESSURE : 1008mbar \pm 1mbar CALIBRATION DATE : 20-Mar-20
AMBIENT TEMPERATURE : 20° C \pm 1° C RELATIVE HUMIDITY : 52 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 4:2006 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS ADJUSTED USING INTERNAL WEIGHT TO ADJUST. 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. THE INTERNAL WEIGHT WAS CHECKED BY USING

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-I-151	SM9/2562	23-Jan-21
2) STANDARD WEIGHT	E2	15843	SM9/2562	23-Jan-21

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

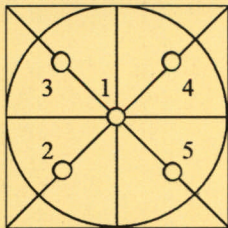
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000048 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.0	0.0000	0.0000	0.000078
0.1	0.1000	0.0000	0.000078
0.2	0.2000	0.0000	0.000078
0.5	0.5000	0.0000	0.000079
1.0	1.0000	0.0000	0.000079
2.0	2.0000	0.0000	0.000078
5.0	5.0000	0.0000	0.000081
10.0	10.0000	0.0000	0.000084
20.0	20.0000	0.0000	0.000089
50.0	50.0000	0.0000	0.00013
100.0	100.0000	0.0000	0.00019
200.0	200.0003	-0.0003	0.00032

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	100.0000
2	100.0000
3	100.0000
4	100.0001
5	100.0000
OFF-CENTER LOADING	0.0001

6. INTERNAL WEIGHT ERROR : 0 g

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-R013D

Calibration Date : 25 Apr 20
Submitted by : S.P.S CONSULTING SERVICE CO.,LTD
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol,
Chatuchak, Bangkok, Thailand 10900

Model : YSI 5100
S/N : 01H1079AB
Probe : YSI 5010
S/N : 14J100195
ID NO. : -
Air Temp ref : S/N. E00522
Barometric ref : S/N. E00522
Water Temp ref : S/N. 11431
Technician : Kittipong M.

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

Calibration Details

Calibration Point	100% air sat. (@20 °C, DO = 9.09 mg/l)	(status)	(status)
Measurement 1 (mg/l)	9.09	(PASS)	-
Measurement 2 (mg/l)	9.09	(PASS)	-
Measurement 3 (mg/l)	9.08	(PASS)	-
Measurement 4 (mg/l)	9.07	(PASS)	-
Measurement 5 (mg/l)	9.07	(PASS)	-
Measurement 6 (mg/l)	9.07	(PASS)	-
Measurement 7 (mg/l)	9.07	(PASS)	-
Measurement 8 (mg/l)	9.06	(PASS)	-
Measurement 9 (mg/l)	9.06	(PASS)	-
Measurement 10 (mg/l)	9.06	(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



Laboratory Manager



QUALITY CALIBRATION CO.,LTD.

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

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

www.qcalibration.com

CERTIFICATE No : 20T0606

REFERENCE No : 55428-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : COD REACTOR

MANUFACTURER : HACH

MODEL : DRB200

SERIAL No : 15110C0235

ID No : DRB 02/59

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 : 23-Jan-20

APPROVED BY : 
PONGSAK J.

ISSUED DATE : 29-Jan-20

RECEIVED DATE : 21-Jan-20



CERTIFICATE No : 20T0606

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : COD REACTOR
MANUFACTURER : HACH
ID NUMBER : DRB 02/59
RECEIVED DATE : 21-Jan-20
AMBIENT TEMPERATURE : 23° C ± 1° C

MODEL : DRB200
SERIAL NUMBER : 15110C0235
CALIBRATION DATE : 23-Jan-20
RELATIVE HUMIDITY : 52 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

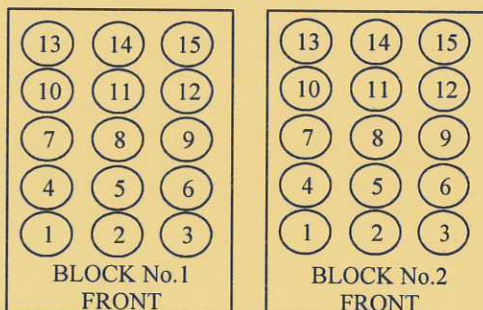
1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TLAS G-20 BY COMPARISON WITH CALIBRATED THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON 19 POINTS AND LOCATED AS THE PICTURE BELOW AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND PLACED THE TENTH THERMOCOUPLE WITHIN 2.5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

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH TC TYPE K	HYDRA 2635A	8009008	19T6775	20-Jul-20

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	146
Indicating Temperature	145	146
Measured Temperature (°C) at Spread Locations	1	149.7
	2	149.7
	3	149.8
	4	149.7
	5	150.2
	6	150.5
	7	150.0
	8	150.1
	9	150.0
	10	149.8
	11	150.0
	12	150.0
	13	149.7
	14	149.8
	15	150.2
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



MAINTENANCE AND IPV TEST CERTIFICATE MODEL

OPTIMA 5300DV

Customer : <u>S.P.S.Consulting Service Co.,Ltd</u>	Date Tested: <u>July 21, 2020</u>	
	Recommendation Recertification	
Address : <u>7 Soi Phaholyothin 24</u>	Period <u>6</u> Months	
<u>Paholyothin Road</u>	Recertification Due: <u>January 21, 2021</u>	
<u>Jompol Chatuchak, Bangkok 1090</u>	Date Last Certified: <u>January 22, 2020</u>	
User Name: <u>K.Phenpha Viphashtawat</u>	Visit Number: <u>1 of 2</u>	
Phone: <u>083-9269252</u>	PerkinElmer Phone: <u>02-719-6420 ext 206</u>	
Fax: <u>02-513-4221</u>	PerkinElmer Fax: <u>02-318-5597</u>	

CONFIGURATION TESTED		ACCESSORIES/COMPONENT NOT INCLUDED
MODEL	SERIAL NUMBER	
<u>OPTIMA 5300DV</u>	<u>077C7042401</u>	
TESTED EQUIPMENT	CALIBRATION NUMBER	EXPIRATION
<u>IPV Methods</u>		
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
<u>Multielement Standard</u>	<u>N069-1579</u>	<u>November 30, 2020</u>
<u>Wavecal Solution</u>	<u>N058-2152</u>	<u>March 30, 2021</u>
<u>VIS Wavecal solution</u>	<u>N930-2946</u>	<u>December 30, 2020</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>April 30, 2021</u>
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		



MAINTENANCE AND IPV TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C8011701DATE TESTED July 21, 2020**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 IPV TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : 077C8011701			DATE TESTED : July 21, 2020		
PARAMETER	SPECIFICATION			FINAL VALUE	
Spectral Resolution : UV	As	193.696 nm	≤ 0.007	0.00595	
	Ni	231.604 nm	≤ 0.008	0.00791	
	Ni	341.476 nm	≤ 0.012	0.00767	
Spectral Resolution : VIS	La	408.672 nm	≤ 0.020	0.01602	
	Ba	455.403 nm	≤ 0.025	0.02034	
Precision					
	As	193.656 nm	% RSD < 1.0	0.94	%
	Zn	213.856 nm	% RSD < 1.0	0.86	%
	Mn	257.610 nm	% RSD < 1.0	0.53	%
	La	379.478 nm	% RSD < 1.0	0.41	%
	Ba	455.403 nm	% RSD < 1.0	0.39	%
	Ba	493.408 nm	% RSD < 1.0	0.38	%
Detection Limits : Axial	Tl	190.080 nm	3(sd)	1.91	ppb
	As	193.696 nm	3(sd)	2.79	ppb
	Pb	220.353 nm	3(sd)	1.14	ppb
Detection Limits : Radial	As	193.696 nm	3(sd)	40.70	ppb
	Zn	213.856 nm	3(sd)	1.13	ppb
	Mn	257.610 nm	3(sd)	0.18	ppb
	La	379.478 nm	3(sd)	2.89	ppb
	Ba	455.403 nm	3(sd)	0.25	ppb
	Ba	493.408 nm	3(sd)	1.00	ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd	226.502 nm	≤ 150 ppb	80.49	
BEC : Radial (IB X 1000)/(IS-IB)	Mn	257.610 nm	≤ 45 ppb	43.05	



MAINTENANCE AND IPV TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C8011701DATE TESTED July 21, 2020**Remarks :**

Commissioning follow as commissioning performance sheets.

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

ระดับความร้อนในสถานประกอบการ



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 B182_1/20

Heat Stress WBGT Meter Verification Report

Verification Data

Heat Stress WBGT Meter No.	: R14	Verification Date	: 13 September 2020
Brand	: 3M	Ambient Temp.	: 24.5 °C
Model	: QUESTemp ^o 46	Barometric Pressure	: 1010 mmbar
Serial No.	: TSH120011	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	47.0	0.1	± 0.5

Globe Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.5	-0.2	± 0.5

UUC* = UNIT UNDER CALIBRATION

Verified by : Phakhinai Khongkomnerd
(Mr. Phakhinai Khongkomnerd)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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 B182_2/20

Heat Stress WBGT Meter Verification Report

Verification Data

Heat Stress WBGT Meter No.	: R15	Verification Date	: 13 September 2020
Brand	: 3M	Ambient Temp.	: 24.5 °C
Model	: QUESTemp ^o 46	Barometric Pressure	: 1010 mmbar
Serial No.	: TSI010006	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

Verified by : Phakhinai Khongkomnerd
(Mr. Phakhinai Khongkomnerd)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
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7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
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Tel : (662) 939-4370-72. Fax : (662) 513-4221. E-mail : sale@spscon.com.. www.spscon.com

Heat B182_3/20

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: R16	Verification Date	: 13 September 2020
Brand	: 3M	Ambient Temp.	: 24.5 °C
Model	: QUESTemp ^o 46	Barometric Pressure	: 1010 mmbar
Serial No.	: TSH120025	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	12.7	-0.2	± 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			

Verified by : Phakhinai Khongkomnerd
(Mr. Phakhinai Khongkomnerd)

Approved by :

Peera Detudom
(Mr. Peera Detudom)