

ภาคผนวกที่ 4

เอกสารสอบเทียบความถูกต้องของเครื่องมือตรวจวัดคุณภาพสิ่งแวดล้อม

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**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม**

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
1. คุณภาพอากาศจากปล่อง Total Suspended Particulate (TSP)	Console No. B04, R04, R05 Pitot Tube No. B38, B58	Digital Balance
Oxides of Nitrogen (NO _x)	Vacuum Gauge	Spectrophotometer
Sulfur Dioxide (SO ₂)	Personal Pump No. SCK No. R31, R33 R34, R35, R41, R44 Rotameter No. H-R02, R03, R04, R05, R06	Digital Balance
2. คุณภาพอากาศในบรรยากาศ Total Suspended Particulate (TSP)	High Volume Air Sampler No. R02, R03, R04, R06	Digital Balance
Particulate Matter less than 10 microns (PM-10)	High Volume PM-10 Air Sampler No. R01, R06, R07, R09	Digital Balance
Sulfur Dioxide (SO ₂)	SO ₂ Analyzer No. R02, R03, R07, R08	SO ₂ Analyzer No. R02, R03, R07, R08
Nitrogen Dioxide (NO ₂)	NO ₂ Analyzer No. R01, R03, R07, R11	NO ₂ Analyzer No. R01, R03, R07, R11
3. เชื้อราและแบคทีเรีย TCB	-	Incubator
FCB	-	Water Bath
Total Dust	Personal Pump SKC No. B11, B50 Rotameter No. H-R02	Digital Balance
Respirable Dust	Personal Pump SKC No. B45, B99 Rotameter No. H-R02	Digital Balance
4. คุณภาพน้ำ 4.1 คุณภาพน้ำเสีย Temperature	-	Thermometer
pH	-	pH Meter
Total Dissolved Solids (TDS)	-	Digital Balance
BOD ₅	-	BOD Analyzer
COD	-	COD Reactor
Grease & Oil	-	Digital Balance
TKN	-	Digital Balance

**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม (ต่อ)**

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
4. คุณภาพน้ำ (ต่อ)		
4.2 คุณภาพน้ำใต้ดิน		
pH	-	pH Meter
Lead	-	ICP
Mercury	-	AAS
Nickel	-	ICP
Arsenic	-	AAS
Copper	-	ICP
Total Suspended Solids (TSS)	-	Digital Balance
Total Dissolved Solids (TDS)	-	Digital Balance
4.3 คุณภาพน้ำในบ่อ		
Temperature	-	Thermometer
pH	-	pH Meter
Total Dissolved Solids (TDS)	-	Digital Balance
BOD ₅	-	BOD Analyzer
COD	-	COD Reactor
Grease & Oil	-	Digital Balance
4.4 คุณภาพน้ำผิวดิน		
Temperature	-	Thermometer
pH	-	pH Meter
BOD ₅	-	BOD Analyzer
COD	-	COD Reactor
Total Dissolved Solids (TDS)	-	Digital Balance
Nitrate-Nitrogen	-	Spectrophotometer
4.5 คุณภาพน้ำฝน		
pH	-	pH Meter
Nitrate	-	Spectrophotometer
Sulfate	-	Spectrophotometer

**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม (ต่อ)**

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
5. คุณภาพอากาศในสถานประกอบการ Total Dust	Personal Pump SKC No. B42, B44, B72 Rotameter No. H-R02	Digital Balance
Respirable Dust	Personal Pump SKC No. B32, B48, B77 Rotameter No. H-R02	Digital Balance
6. ระดับเสียง 6.1 ระดับเสียงในบรรยากาศ L_{eq} 24 hr, L_{90} , L_{max} , L_{dn} และเสียงรบกวน	Acoustic Calibrator Sound Level Meter No. ACO-B29, NL 21-B01	-
6.2.ระดับเสียงในสถานประกอบการ L_{eq} 8 hr	Acoustic Calibrator Sound Level Meter No. ACO-B09, B10	-
Noise Dose	Acoustic Calibrator Sound Level Meter No. NMD-R02, R03	-
7. ระดับความร้อน WBGT	Heat Meter No. B12, B30, B31, R09, R11, R14, R15, R16	-

ลำดับที่ 1

คุณภาพอากาศจากปล่อง



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	01/12/2022	1.007	49.94
B02	8002514	02/12/2022	1.002	49.41
B03	1503016	05/12/2022	1.004	50.46
B04	00006659	01/12/2022	1.007	49.43
B05	00007428	01/12/2022	0.998	49.80
R01	1561	01/12/2022	1.004	49.52
R02	8002513	01/12/2022	1.003	49.77
R03	1570	05/12/2022	1.008	49.68
R04	8002519	05/12/2022	0.997	50.12
R05	1503015	01/12/2022	1.003	50.08

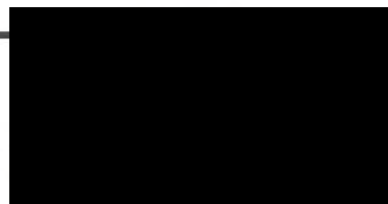
Remark : Accept Value of y (test) is $0.97 < y < 1.03$

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

Calibrated by :



Approved by :





บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
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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
B36	S	0.99	02/11/2022	0.83	0.84
B37	S	0.99	01/11/2022	0.84	0.83
B38	S	0.99	02/11/2022	0.84	0.85
B39	S	0.99	04/11/2022	0.84	0.84
B40	S	0.99	02/11/2022	0.85	0.84
B41	S	0.99	02/11/2022	0.84	0.85
B44	S	0.99	02/11/2022	0.84	0.83
B45	S	0.99	01/11/2022	0.84	0.83
B46	S	0.99	01/11/2022	0.84	0.85
B47	S	0.99	03/11/2022	0.84	0.84
B48	S	0.99	03/11/2022	0.83	0.84
B49	S	0.99	04/11/2022	0.85	0.84
B54	S	0.99	01/11/2022	0.83	0.84
B56	S	0.99	01/11/2022	0.84	0.85
B57	S	0.99	04/11/2022	0.85	0.84
B58	S	0.99	04/11/2022	0.84	0.84

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

Calibrated by :

Approved by :

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VACUUM GAUGE
MANUFACTURER : HI-LIGHT
MODEL / TYPE : N/A
SERIAL NO. : N/A[64-220066-1]
CLID. NO. : 212201112
JOB CONTROL NO. : 220720073201

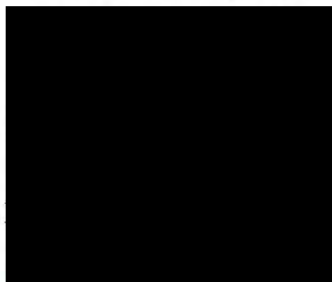
CUSTOMER : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24 ROAD., JOMPOL,
CHATUCHAK, BANGKOK 10900

DATE OF RECEIVED : 20 July 2022

DATE OF ISSUED : 22 July 2022

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 :



22 July 2022

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. Q22073201

F3-011-04/01-12

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REPORT OF CALIBRATION

FOR

NOMENCLATURE : VACUUM GAUGE
MANUFACTURER : HI-LIGHT
MODEL / TYPE : N/A
SERIAL NO. : N/A[64-220066-1]
DATE OF CALIBRATION : 21 July 2022

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 744 S/N. 9226007 with Pressure Module Model 700PV4 S/N. 19298401.

TRACEABILITY :

The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand).
Certificate No. MP-0196-21, Due Date 17 November 2022.

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. **Q22073201**

F3-011-04/01-12

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@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 (inHg)		Correction (inHg)	
	Up	Down	Up	Down
0	0.0	0.0	0.0	0.0
-5	-4.6	-4.7	+0.4	+0.3
-10	-9.5	-9.6	+0.5	+0.4
-15	-14.4	-14.5	+0.6	+0.5
-20	-19.4	-19.5	+0.6	+0.5
-25	-24.5	-24.5	+0.5	+0.5
-30	-29.5	-29.5	+0.5	+0.5

Uncertainty of measurement ± 0.2 inHg

Transmitting fluid : Air.

Technical Note. k factor 1 kPa = 0.2952998 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. Q22073201

F3-011-04/01-12

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@clccalibration



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	03/01/2023	1,000	1,500	2,000	993	1,508	2,004	1.008x - 13.936	0.999
R02	SKC	224-PCXR4	626450	06/01/2023	1,000	2,000	3,000	998	1,499	1,990	0.989x + 12.268	1.000
R03	SKC	224-PCXR4	691592	06/01/2023	1,000	1,500	2,000	1,003	1,500	2,004	1.011x - 21.761	0.999
R04	SKC	224-PCXR4	691672	06/01/2023	1,000	1,500	2,000	996	1,493	1,995	0.997x - 1.563	1.000
R05	SKC	224-PCXR4	798470	06/01/2023	1,000	1,500	2,000	993	1,505	1,999	1.014x - 31.752	0.999
R06	SKC	224-PCXR4	798456	06/01/2023	1,000	1,500	2,000	993	1,498	1,994	1.003x - 8.555	1.000
R07	SKC	224-PCXR4	798480	04/01/2023	1,000	1,500	2,000	994	1,490	1,999	1.007x - 16.073	1.000
R08	SKC	224-PCXR4	883215	04/01/2023	1,000	1,500	2,000	1,011	1,501	2,005	0.999x + 3.207	1.000
R09	SKC	224-PCXR4	034650	04/01/2023	1,000	1,500	2,000	991	1,504	2,002	1.018x - 35.900	0.999
R10	SKC	224-PCXR4	091765	04/01/2023	1,000	1,500	2,000	997	1,512	1,994	0.999x + 0.977	1.000
R11	SKC	224-PCXR4	091763	03/01/2023	1,000	1,500	2,000	1,000	1,499	2,002	1.013x - 25.119	0.999
R12	SKC	224-PCXR4	091568	03/01/2023	1,000	1,500	2,000	997	1,501	1,999	1.001x - 4.906	1.000
R13	SKC	224-PCXR4	091638	03/01/2023	1,000	1,500	2,000	1,002	1,499	1,994	0.992x + 9.636	1.000
R14	SKC	224-PCXR4	091764	03/01/2023	1,000	1,500	2,000	994	1,502	1,999	1.014x - 30.212	0.999
R15	SKC	224-PCXR8	529457	03/01/2023	1,000	1,500	2,000	1,001	1,500	2,004	1.006x - 11.941	1.000
R16	SKC	224-PCXR8	529643	05/01/2023	1,000	1,500	2,000	998	1,497	1,994	1.000x - 4.686	1.000
R17	SKC	224-PCXR8	529645	05/01/2023	1,000	1,500	2,000	994	1,509	2,000	1.015x - 30.731	0.999
R18	SKC	224-PCXR8	566756	05/01/2023	1,000	1,500	2,000	991	1,498	1,998	1.001x - 6.840	1.000
R19	SKC	224-PCXR8	566802	05/01/2023	1,000	1,500	2,000	1,002	1,499	2,000	1.010x - 21.027	0.999
R20	SKC	224-PCXR8	529089	03/01/2023	1,000	1,500	2,000	991	1,501	2,003	1.020x - 39.916	0.999
R21	SKC	224-PCXR8	665728	03/01/2023	1,000	1,500	2,000	998	1,493	1,999	1.000x - 5.404	1.000
R22	SKC	224-PCXR8	707444	03/01/2023	1,000	1,500	2,000	1,002	1,500	2,002	1.004x - 7.135	1.000
R23	SKC	224-PCXR8	761067	03/01/2023	1,000	1,500	2,000	998	1,494	1,991	0.993x + 4.132	1.000
R24	SKC	224-PCXR8	707893	04/01/2023	1,000	1,500	2,000	996	1,505	2,000	1.008x - 17.553	0.999
R25	SKC	224-PCXR8	761052	04/01/2023	1,000	1,500	2,000	1,010	1,499	1,993	0.984x + 23.464	1.000
R26	SKC	224-PCXR8	707956	04/01/2023	1,000	1,500	2,000	1,002	1,500	2,004	1.009x - 15.842	1.000
R27	SKC	224-PCXR8	707398	04/01/2023	1,000	1,500	2,000	996	1,503	2,001	1.005x - 13.449	1.000
R28	SKC	224-PCXR8	707481	04/01/2023	1,000	1,500	2,000	1,004	1,500	2,002	1.010x - 19.288	0.999
R29	SKC	224-PCXR8	707402	03/01/2023	1,000	1,500	2,000	1,004	1,493	1,991	0.988x + 14.167	1.000
R30	SKC	224-PCXR8	093811	03/01/2023	1,000	1,500	2,000	1,000	1,495	1,994	0.996x + 1.922	1.000
R31	SKC	224-PCXR8	093183	03/01/2023	1,000	1,500	2,000	1,001	1,501	2,001	1.002x - 3.618	1.000
R32	SKC	224-PCXR8	671950	03/01/2023	1,000	1,500	2,000	998	1,498	1,994	0.995x + 4.970	1.000
R33	SKC	224-PCXR4	626254	03/01/2023	1,000	1,500	2,000	995	1,502	1,999	1.014x - 31.070	0.999
R34	SKC	224-PCXR4	626131	03/01/2023	1,000	1,500	2,000	1,002	1,498	2,004	1.006x - 11.810	1.000
R35	SKC	224-PCXR8	707460	03/01/2023	1,000	1,500	2,000	999	1,498	1,995	0.994x + 6.669	1.000
R36	SKC	224-PCXR8	707446	03/01/2023	1,000	1,500	2,000	1,004	1,499	2,001	1.009x - 18.036	0.999
R37	SKC	224-PCXR8	707432	03/01/2023	1,000	1,500	2,000	996	1,499	1,998	1.000x - 2.070	1.000
R38	SKC	224-PCXR8	707349	03/01/2023	1,000	1,500	2,000	996	1,500	2,001	1.004x - 9.345	1.000
R39	SKC	224-PCXR8	761095	03/01/2023	1,000	1,500	2,000	1,001	1,496	1,994	0.997x + 2.373	1.000

Calibrated by :

Approved by :



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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R²
R40	SKC	224-PCXR4	612753	05/01/2023	1,000	1,500	2,000	1,001	1,502	2,003	1.012x – 23.564	0.999
R41	SKC	224-PCXR4	626140	05/01/2023	1,000	1,500	2,000	992	1,509	2,001	1.017x – 32.442	0.999
R42	SKC	224-PCXR4	626463	05/01/2023	1,000	1,500	2,000	998	1,493	1,999	1.001x – 2.963	1.000
R43	SKC	224-PCXR4	626129	05/01/2023	1,000	1,500	2,000	1,003	1,501	2,003	1.010x – 18.945	0.999
R44	SKC	224-PCXR4	602753	05/01/2023	1,000	1,500	2,000	1,002	1,496	1,993	0.995x + 2.529	1.000
R45	SKC	224-PCXR4	626137	05/01/2023	1,000	1,500	2,000	992	1,505	2,002	1.019x – 37.408	0.999

Calibrated by :

Approved by :



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
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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 ²
H-R01	Dwyer	VFB-65	05/01/2023	500	1,000	2,000	503.3	992.4	1978.7	0.999x - 3.199	0.999
H-R02	Dwyer	VFB-65	04/01/2023	500	1,000	2,000	501.2	995.3	1985.7	1.002x - 5.186	1.000
H-R03	Dwyer	VFB-65	04/01/2023	500	1,000	2,000	501.7	987.7	1996.9	0.994x + 1.679	1.000
H-R04	Dwyer	VFB-65	04/01/2023	500	1,000	2,000	496.4	989.6	2019.5	1.008x - 13.614	1.000
H-R05	Dwyer	VFB-65	06/01/2023	500	1,000	2,000	497.2	987.7	1988.1	1.004x - 9.360	1.000
H-R06	Dwyer	VFB-65	06/01/2023	500	1,000	2,000	505.2	992.4	1979.8	0.999x - 2.816	0.999
Calibrated by : <div style="border: 1px solid black; width: 150px; height: 30px; display: inline-block; margin-left: 10px;"></div>				Approved by : <div style="border: 1px solid black; width: 200px; height: 60px; display: inline-block; margin-left: 10px;"></div>							

**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 : 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

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



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 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. : SP22018

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

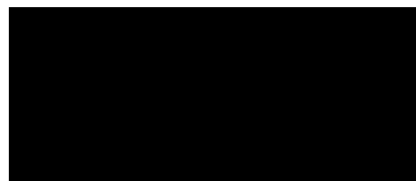
Ambient Temperature : (24.4 ± 5) °C
Relative Humidity : (60.1 ± 25) %

Received Date : 30 AUGUST 2022
Calibration Date : 30 AUGUST 2022
Date of Issue : 31 AUGUST 2022

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. : SP22018

Job No. : VC65SP0008

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	87569	13/10/2022
Didymium liquid	RM-DL	28912	87588	15/10/2022
Neutral density filter	RM-1N2N3N	13877	87600	15/10/2022
Potassium dichromate solutions	RM-0204060810	14204	87614	16/10/2022
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	361.4	0.15	0.16	2.00
	467.82	467.8	-0.02	0.16	2.00
	536.56	536.5	-0.06	0.16	2.00
	640.50	640.5	0.00	0.16	2.00
RM-DL	740.09	740.0	-0.09	0.16	2.00
	864.94	865.2	0.26	0.16	2.00

UUC* = Unit Under Calibration

Continuation of Calibration Certificate

Cert. No. : SP22018
Job No. : VC65SP0008
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	1.0524	1.0539	0.0015	0.0028	2.00
		29914	0.7	0.7454	0.7459	0.0005	0.0029	2.00
		29381	0.5	0.5426	0.5426	0.0000	0.0028	2.00
	546.1	29360	1.0	0.9822	0.9810	-0.0012	0.0028	2.00
		29914	0.7	0.6962	0.6960	-0.0002	0.0028	2.00
		29381	0.5	0.5076	0.5070	-0.0006	0.0029	2.00
	590.0	29360	1.0	1.0221	1.0202	-0.0019	0.0028	2.00
		29914	0.7	0.7238	0.7230	-0.0008	0.0029	2.00
		29381	0.5	0.5364	0.5360	-0.0004	0.0031	2.00
	635.0	29360	1.0	0.9751	0.9732	-0.0019	0.0028	2.00
		29914	0.7	0.6912	0.6902	-0.0010	0.0029	2.00
		29381	0.5	0.5214	0.5210	-0.0004	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	0.2436	0.2419	-0.0017	0.0101	2.00	
		40	0.4905	0.4855	-0.0050	0.0115	2.00	
		60	0.7453	0.7388	-0.0065	0.0067	2.00	
		80	0.9920	0.9839	-0.0081	0.0071	2.00	
		100	1.2487	1.2414	-0.0073	0.0073	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	
Transmission T(%)	Absorbance(A)
0.0107	3.9886

**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

ลำดับที่ 2

คุณภาพอากาศในบรรยากาศ



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

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
R01	SKC	224-PCXR4	602467	03/01/2023	1,000	1,500	2,000	993	1,508	2,004	1.008x - 13.936	0.999
R02	SKC	224-PCXR4	626450	06/01/2023	1,000	2,000	3,000	998	1,499	1,990	0.989x + 12.268	1.000
R03	SKC	224-PCXR4	691592	06/01/2023	1,000	1,500	2,000	1,003	1,500	2,004	1.011x - 21.761	0.999
R04	SKC	224-PCXR4	691672	06/01/2023	1,000	1,500	2,000	996	1,493	1,995	0.997x - 1.563	1.000
R05	SKC	224-PCXR4	798470	06/01/2023	1,000	1,500	2,000	993	1,505	1,999	1.014x - 31.752	0.999
R06	SKC	224-PCXR4	798456	06/01/2023	1,000	1,500	2,000	993	1,498	1,994	1.003x - 8.555	1.000
R07	SKC	224-PCXR4	798480	04/01/2023	1,000	1,500	2,000	994	1,490	1,999	1.007x - 16.073	1.000
R08	SKC	224-PCXR4	883215	04/01/2023	1,000	1,500	2,000	1,011	1,501	2,005	0.999x + 3.207	1.000
R09	SKC	224-PCXR4	034650	04/01/2023	1,000	1,500	2,000	991	1,504	2,002	1.018x - 35.900	0.999
R10	SKC	224-PCXR4	091765	04/01/2023	1,000	1,500	2,000	997	1,512	1,994	0.999x + 0.977	1.000
R11	SKC	224-PCXR4	091763	03/01/2023	1,000	1,500	2,000	1,000	1,499	2,002	1.013x - 25.119	0.999
R12	SKC	224-PCXR4	091568	03/01/2023	1,000	1,500	2,000	997	1,501	1,999	1.001x - 4.906	1.000
R13	SKC	224-PCXR4	091638	03/01/2023	1,000	1,500	2,000	1,002	1,499	1,994	0.992x + 9.636	1.000
R14	SKC	224-PCXR4	091764	03/01/2023	1,000	1,500	2,000	994	1,502	1,999	1.014x - 30.212	0.999
R15	SKC	224-PCXR8	529457	03/01/2023	1,000	1,500	2,000	1,001	1,500	2,004	1.006x - 11.941	1.000
R16	SKC	224-PCXR8	529643	05/01/2023	1,000	1,500	2,000	998	1,497	1,994	1.000x - 4.686	1.000
R17	SKC	224-PCXR8	529645	05/01/2023	1,000	1,500	2,000	994	1,509	2,000	1.015x - 30.731	0.999
R18	SKC	224-PCXR8	566756	05/01/2023	1,000	1,500	2,000	991	1,498	1,998	1.001x - 6.840	1.000
R19	SKC	224-PCXR8	566802	05/01/2023	1,000	1,500	2,000	1,002	1,499	2,000	1.010x - 21.027	0.999
R20	SKC	224-PCXR8	529089	03/01/2023	1,000	1,500	2,000	991	1,501	2,003	1.020x - 39.916	0.999
R21	SKC	224-PCXR8	665728	03/01/2023	1,000	1,500	2,000	998	1,493	1,999	1.000x - 5.404	1.000
R22	SKC	224-PCXR8	707444	03/01/2023	1,000	1,500	2,000	1,002	1,500	2,002	1.004x - 7.135	1.000
R23	SKC	224-PCXR8	761067	03/01/2023	1,000	1,500	2,000	998	1,494	1,991	0.993x + 4.132	1.000
R24	SKC	224-PCXR8	707893	04/01/2023	1,000	1,500	2,000	996	1,505	2,000	1.008x - 17.553	0.999
R25	SKC	224-PCXR8	761052	04/01/2023	1,000	1,500	2,000	1,010	1,499	1,993	0.984x + 23.464	1.000
R26	SKC	224-PCXR8	707956	04/01/2023	1,000	1,500	2,000	1,002	1,500	2,004	1.009x - 15.842	1.000
R27	SKC	224-PCXR8	707398	04/01/2023	1,000	1,500	2,000	996	1,503	2,001	1.005x - 13.449	1.000
R28	SKC	224-PCXR8	707481	04/01/2023	1,000	1,500	2,000	1,004	1,500	2,002	1.010x - 19.288	0.999
R29	SKC	224-PCXR8	707402	03/01/2023	1,000	1,500	2,000	1,004	1,493	1,991	0.988x + 14.167	1.000
R30	SKC	224-PCXR8	093811	03/01/2023	1,000	1,500	2,000	1,000	1,495	1,994	0.996x + 1.922	1.000
R31	SKC	224-PCXR8	093183	03/01/2023	1,000	1,500	2,000	1,001	1,501	2,001	1.002x - 3.618	1.000
R32	SKC	224-PCXR8	671950	03/01/2023	1,000	1,500	2,000	998	1,498	1,994	0.995x + 4.970	1.000
R33	SKC	224-PCXR4	626254	03/01/2023	1,000	1,500	2,000	995	1,502	1,999	1.014x - 31.070	0.999
R34	SKC	224-PCXR4	626131	03/01/2023	1,000	1,500	2,000	1,002	1,498	2,004	1.006x - 11.810	1.000
R35	SKC	224-PCXR8	707460	03/01/2023	1,000	1,500	2,000	999	1,498	1,995	0.994x + 6.669	1.000
R36	SKC	224-PCXR8	707446	03/01/2023	1,000	1,500	2,000	1,004	1,499	2,001	1.009x - 18.036	0.999
R37	SKC	224-PCXR8	707432	03/01/2023	1,000	1,500	2,000	996	1,499	1,998	1.000x - 2.070	1.000
R38	SKC	224-PCXR8	707349	03/01/2023	1,000	1,500	2,000	996	1,500	2,001	1.004x - 9.345	1.000
R39	SKC	224-PCXR8	761095	03/01/2023	1,000	1,500	2,000	1,001	1,496	1,994	0.997x + 2.373	1.000

Calibrated by :

Approved by :



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
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CALIBRATION REPORT

CHEMILUMINESCENT NO / NO₂ / NO_x ANALYZER

DATE : 15 January 2023

BRAND : API

MODEL : 200E

NO. NOX-R01

SERIAL NO. 769

Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 04 August 2022

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	399.8	-0.050	400.0	1.006
NO _x Span	400	400.2	0.050	400.0	1.009

API Model 200A 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	93.9	mV	-20 - 150
HVPS	672	V	420 - 900 constant
RCELL TEMP	50.5	°C	50 ± 1
BOX TEMP	29.0	°C	8 - 48
PMT TEMP	7.1	°C	7 ± 2
MOLY TEMP	315.4	°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 _x Span Conc	400	PPB	20 - 20,000
NO Slope	1.006	-	1.0 ± 0.3
NO _x Slope	1.009	-	1.0 ± 0.3
NO Offset	1.3	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 :

Approved by :



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@spscn.com. www.spscn.com

CALIBRATION REPORT

CHEMILUMINESCENT NO / NO₂ / NO_x ANALYZER

DATE : 15 January 2023

BRAND : API

MODEL : 200E

NO. NOX-R03

SERIAL NO. 4410

Calibrator (Dilution System)

Brand : API	Model : 700
Last Cal. Date : 04 August 2022	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	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.11	-	0	-
NO Span	400	399.6	-0.100	400.0	1.004
NO _x Span	400	399.8	-0.050	400.0	1.007

API Model 200A 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	102.9	mV	-20 - 150
AZERO	93.8	mV	-20 - 150
HVPS	671	V	420 - 900 constant
RCELL TEMP	50.4	°C	50 ± 1
BOX TEMP	29.1	°C	8 - 48
PMT TEMP	7.3	°C	7 ± 2
MOLY TEMP	315.1	°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	1.007	-	1.0 ± 0.3
NO Offset	1.1	mV	-20 to +150
NO _x Offset	0.7	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 :

Approved by :



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@spscor.com, www.spscor.com

CALIBRATION REPORT

CHEMILUMINESCENT NO / NO₂ / NO_x ANALYZER

DATE : 15 January 2023

BRAND : API

MODEL : 200E

NO. NOX-R07

SERIAL NO. 4468

Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 04 August 2022

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	400.1	0.025	400.0	1.008
NO _x Span	400	400.2	0.050	400.0	1.011

API Model 200A 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	513	cc/min	500 ± 50
OZONE FLOW	79	cc/min	80 ± 15
PMT	103.4	mV	-20 - 150
AZERO	94.2	mV	-20 - 150
HVPS	675	V	420 - 900 constant
RCELL TEMP	50.2	°C	50 ± 1
BOX TEMP	29.3	°C	8 - 48
PMT TEMP	7.5	°C	7 ± 2
MOLY TEMP	314.7	°C	315 ± 5
RCELL PRESS	8.3	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	1.008	—	1.0 ± 0.3
NO _x Slope	1.011	—	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 :

Approved by :



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

CALIBRATION REPORT

CHEMILUMINESCENT NO / NO₂ / NO_x ANALYZER

DATE : 15 January 2023

BRAND : API

MODEL : 200E

NO. NOX-R11

SERIAL NO. 2621

Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 04 August 2022

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	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.11	-	0	-
NO Span	400	400.2	0.050	400.0	1.010
NO _x Span	400	400.3	0.075	400.0	1.013

API Model 200A 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	510	cc/min	500 ± 50
OZONE FLOW	79	cc/min	80 ± 15
PMT	103.3	mV	-20 - 150
AZERO	94.1	mV	-20 - 150
HVPS	669	V	420 - 900 constant
RCELL TEMP	50.1	°C	50 ± 1
BOX TEMP	29.2	°C	8 - 48
PMT TEMP	7.3	°C	7 ± 2
MOLY TEMP	314.9	°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	1.010	-	1.0 ± 0.3
NO _x Slope	1.013	-	1.0 ± 0.3
NO Offset	1.7	mV	-20 to +150
NO _x 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

Calibrated by :

Approved by :



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@spscn.com. www.spscn.com

CALIBRATION REPORT

SO₂ FLUORESCENT ANALYZER

DATE : 15 January 2023

BRAND : API

MODEL : 100E

NO. SO₂-R02

SERIAL NO. 3431

Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 04 August 2022

Serial No. : 911

Reference Standard Gas

Standard Gas : Sulphur Dioxide (SO₂)

Cylinder No. : A00814SK

Certified Date : 21 June 2021

Expired Date : 21 June 2029

Cylinder Conc. : 50.0 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	-
SO ₂ Span	400.0	400.1	0.025	400.0	1.007

API Model 100E SO₂ Analyzer Check list

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	0-500
SAMPLE PRESS	28.5	in-Hg	25-35
SAMPLE FLOW	656	cc/min	650 ± 10%
PMT	102.9	mV	-20-150 with Zero Air
UV LAMP	3017.5	mV	1000-4900
STR. LGT	61.3	PPB	<100
DRK PMT	62.9	mV	-50 - 200
DRK LMP	57.8	mV	-50 - 200
HVPS	671	V	550-900 constant
DCPS	2524	mV	2500 ± 200
RCELL TEMP	50.3	°C	50 ± 1
BOX TEMP	29.1	°C	5-40
PMT TEMP	7.2	°C	7 ± 2.0
SO ₂ Span Conc	400	PPB	20-20,000
SO ₂ Slope	1.007	-	1.0 ± 0.3
SO ₂ Offset	21.8	mV	<250
Stability at Zero	0.1	PPB	<0.2
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)

Calibrated by :

Approved by :



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด

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CALIBRATION REPORT

SO₂ FLUORESCENT ANALYZER

DATE : 15 January 2023

BRAND : API

MODEL : 100E

NO. SO₂-R03

SERIAL NO. 3488

Calibrator (Dilution System)

Brand : API Model : 700

Last Cal. Date : 04 August 2022 Serial No. : 911

Reference Standard Gas

Standard Gas : Sulphur Dioxide (SO₂) Cylinder No. : A00814SK

Certified Date : 21 June 2021 Expired Date : 21 June 2029 Cylinder Conc. : 50.0 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	0.11	-	0	-
SO ₂ Span	400.0	400.3	0.075	400.0	1.014

API Model 100E SO₂ Analyzer Check list

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	0-500
SAMPLE PRESS	28.4	in-Hg	25-35
SAMPLE FLOW	659	cc/min	650 ± 10%
PMT	103.3	mV	-20-150 with Zero Air
UV LAMP	3042.1	mV	1000-4900
STR. LGT	61.7	PPB	<100
DRK PMT	63.2	mV	-50 - 200
DRK LMP	58.1	mV	-50 - 200
HVPS	675	V	550-900 constant
DCPS	2528	mV	2500 ± 200
RCELL TEMP	50.0	°C	50 ± 1
BOX TEMP	28.8	°C	5-40
PMT TEMP	7.1	°C	7 ± 2.0
SO ₂ Span Conc	400	PPB	20-20,000
SO ₂ Slope	1.014	-	1.0 ± 0.3
SO ₂ Offset	22.2	mV	<250
Stability at Zero	0.1	PPB	<0.2
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)

Calibrated by :

Approved by :



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด

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CALIBRATION REPORT

SO₂ FLUORESCENT ANALYZER

DATE : 15 January 2023

BRAND : TELEDYNE

MODEL : TML-60

NO. SO₂-R07

SERIAL NO. TRS1068

Calibrator (Dilution System)

Brand	: API	Model	: 700
Last Cal. Date	: 04 August 2022	Serial No.	: 911

Reference Standard Gas

Standard Gas	: Sulphur Dioxide (SO ₂)	Cylinder No.	: A00814SK
Certified Date	: 21 June 2021	Expired Date	: 21 June 2029
		Cylinder Conc.	: 50.0 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	
	Expected Concentration	Analyzer Response	% Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
SO ₂ Span	400.0	399.8	-0.050	400.0	1.005

API Model TML-60 SO₂ Analyzer Check list

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	0-500
SAMPLE PRESS	28.6	in-Hg	25-35
SAMPLE FLOW	654	cc/min	650 ± 10%
PMT	103.0	mV	-20-150 with Zero Air
UV LAMP	3026.5	mV	1000-4900
STR. LGT	61.9	PPB	<100
DRK PMT	63.5	mV	-50 - 200
DRK LMP	58.3	mV	-50 - 200
HVPS	669	V	550-900 constant
DCPS	2519	mV	2500 ± 200
RCELL TEMP	50.1	°C	50 ± 1
BOX TEMP	29.4	°C	5-40
PMT TEMP	7.3	°C	7 ± 2.0
SO ₂ Span Conc	400	PPB	20-20,000
SO ₂ Slope	1.005	-	1.0 ± 0.3
SO ₂ Offset	21.9	mV	<250
Stability at Zero	0.1	PPB	<0.2
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)

Calibrated by :



Approved by :





บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด

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

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CALIBRATION REPORT

SO₂ FLUORESCENT ANALYZER

DATE : 15 January 2023

BRAND : TELEDYNE

MODEL : TML-60

NO. SO₂-R08

SERIAL NO. TRS1064

Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 04 August 2022

Serial No. : 911

Reference Standard Gas

Standard Gas : Sulphur Dioxide (SO₂)

Cylinder No. : A00814SK

Certified Date : 21 June 2021

Expired Date : 21 June 2029

Cylinder Conc. : 50.0 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	-
SO ₂ Span	400.0	399.7	-0.075	400.0	1.003

API Model TML-60 SO₂ Analyzer Check list

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	0-500
SAMPLE PRESS	28.7	in-Hg	25-35
SAMPLE FLOW	657	cc/min	650 ± 10%
PMT	103.2	mV	-20-150 with Zero Air
UV LAMP	3047.8	mV	1000-4900
STR. LGT	61.5	PPB	<100
DRK PMT	63.0	mV	-50 - 200
DRK LMP	57.7	mV	-50 - 200
HVPS	673	V	550-900 constant
DCPS	2520	mV	2500 ± 200
RCELL TEMP	50.4	°C	50 ± 1
BOX TEMP	29.3	°C	5-40
PMT TEMP	7.5	°C	7 ± 2.0
SO ₂ Span Conc	400	PPB	20-20,000
SO ₂ Slope	1.003	-	1.0 ± 0.3
SO ₂ Offset	22.1	mV	<250
Stability at Zero	0.1	PPB	<0.2
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)

Calibrated by :

Approved by :

**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 : 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

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



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

ลำดับที่ 3

เชื่อว่า แบคทีเรีย และฝุ่นละอองในอากาศ



MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

214 Bangwaek Rd. Bangpai Bangkae Bangkok 10160
Tel.: 0-2865-4647-8 Fax: 0-2865-4649 <http://www.mit.in.th>



CALIBRATION CERTIFICATE

Certificate No. : S2022090647-0003

Date Issued : 03-Oct-22

Customer : S.P.S. CONSULTING SERVICE CO., LTD.
7 Soi Phaholyothin 24 Phaholyothin Road., Jompol, Chatuchak,
Bangkok 10900

Equipment : Incubator

Manufacturer : BINDER

Model : BD 115

Serial No. : 12-16967

ID No./Tag No. : IN 05/56

Date Received : 30-Sep-22

Date Calibrated : 30-Sep-22

Calibrated by : Mr. Surat Aumarb

Calibration Method or Calibration Procedure Used

Standard method : CP-05 TLAS G-20.

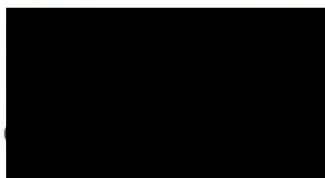
This certificate is traceable to national standards, which realize the units of measurement according to the International System of Units (SI).

Result of Calibration

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

This certificate may not be reproduced other than in full except with the prior written approval of the Miracle International Technology Company Limited.

Approved by:



Page 1 of 2

Certificate No. : S2022090647-0003

Environment : Ambient Temperature : Start record 26.5 °C, Stop record 26.6 °C
Relative Humidity : Start record 54.8 %RH, Stop record 54.6 %RH

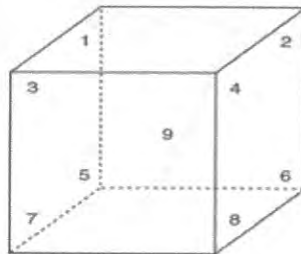
Calibration Temperature (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Stability ¹ (°C)	Measured Uniformity ² (°C)	Overall Variation ³ (°C)
35	35.0	35.0	0.03	0.07	0.14
41.5	41.5	41.5	0.03	0.08	0.15

Without adjustment

Calibration Temperature (°C)	STD No. 1 (°C)	STD No. 2 (°C)	STD No. 3 (°C)	STD No. 4 (°C)	STD No. 5 (°C)	STD No. 6 (°C)	STD No. 7 (°C)	STD No. 8 (°C)	STD No. 9 (°C)	Uncertainty ⁴ ±°C
35	34.88	34.86	34.89	34.90	34.93	34.92	34.95	34.89	34.93	0.18
41.5	41.40	41.33	41.32	41.41	41.43	41.43	41.38	41.33	41.37	0.18

Note : Probe No. 9 is Reference Probe

Setting Air Fresh No. 0



Condition As-Received : Used Item

The measurement results and statements of conformity with specification only relate to the item calibrated.

Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Certificate No. AD2207-125-0001 for Digital Thermometer with Probe (Agilent) Module 1 (73) NTC, Pt1000 Serial No. MY44024042, Due 01-Feb-23

- Notes :
1. The temperature stability is the one-half of greatest maximum difference of measured temperatures at any one probe.
 2. The temperature uniformity is the maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time.
 3. Overall variation is the difference of maximum and minimum measured temperatures throughout observation time.
 4. The uncertainty of measurement is included temperature stability.
 5. The temperature uniformity, stability, overall variation and indicating temperature is applicable to all air or gas filled temperature controlled enclosures at atmospheric pressure.

End of Certificate



CERTIFICATE No : 23T2448

REFERENCE No : 68471-8

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : WATER BATH

MANUFACTURER : MEMMERT

MODEL : WNB29

SERIAL No : L614.0123

ID No : WB 05/58

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 : CHAICHARN CH.

CALIBRATION DATE : 10-Mar-23

APPROVED BY :



ISSUED DATE : 17-Mar-23

RECEIVED DATE : 10-Mar-23



CERTIFICATE No : 23T2448

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : WATER BATH
MANUFACTURER : MEMMERT
ID NUMBER : WB 05/58
RECEIVED DATE : 10-Mar-23
AMBIENT TEMPERATURE : 26 °C ± 1 °C
MODEL : WNB29
SERIAL NUMBER : L614.0123
CALIBRATION DATE : 10-Mar-23
RELATIVE HUMIDITY : 51 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO ASTM E715-80 (REAPPROVED 2001) BY COMPARISON WITH CALIBRATED RTD. THE PROBES WERE PLACED ON FIVE POINTS AND LOCATED ONE PROBE IN EACH OF THE FOUR CORNERS OF THE BATH AND PLACED THE FIFTH RTD WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE WATER VOLUME (REFERENCE LOCATION) UNDER NO LOAD CONDITION.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH RTD	2625A	6603614	22T7514	05-Jul-23

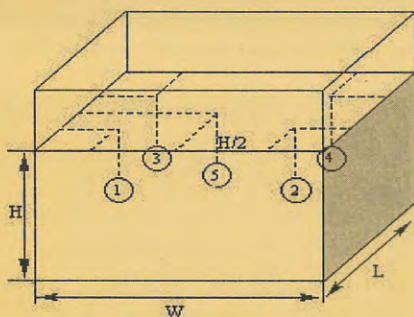
3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.

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



PROBE INSTALLATION
POSITION IN THE BATH

GENERAL INFORMATION

Overall Variation of Ambient Temperature around the Bath (°C) : 0.9

Overall Variation of Line Voltage (V) : 0

Instrument Condition : Normal

BATH PERFORMANCE

Controller Temperature (°C)	Temperature Stability (±°C)	Radius Uniformity (°C)	Axial Uniformity (°C)	Overall Variation (°C)
50.4	0.12	0.14	0.15	0.34
60.4	0.18	0.23	0.19	0.50

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations					Uncertainty (± °C)
		#1	#2	#3	#4	Ref. 5	
50.4	50.4	49.45	49.42	49.36	49.32	49.42	0.19
60.4	60.4	60.17	60.20	60.06	59.97	60.18	0.25

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

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



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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
B01	SKC	224-PCXR4	262101	03/01/2023	1,000	1,500	2,000	993	1,497	1,998	1.003x - 5.584	1.000
B02	SKC	224-PCXR4	626166	03/01/2023	1,000	1,500	2,000	1,003	1,505	2,001	1.009x - 19.667	0.999
B03	SKC	224-PCXR4	612968	03/01/2023	1,000	1,500	2,000	996	1,494	2,000	1.006x - 12.109	1.000
B04	SKC	224-PCXR4	602804	04/01/2023	1,000	1,500	2,000	1,000	1,502	1,995	1.000x - 0.893	1.000
B05	SKC	224-PCXR4	612693	04/01/2023	1,000	1,500	2,000	1,003	1,500	2,003	1.012x - 22.224	0.999
B06	SKC	224-PCXR4	262188	03/01/2023	1,000	1,500	2,000	995	1,508	2,005	1.011x - 20.273	1.000
B07	SKC	224-PCXR4	626262	03/01/2023	1,000	1,500	2,000	998	1,492	1,995	0.993x + 6.086	1.000
B08	SKC	224-PCXR4	626100	03/01/2023	1,000	1,500	2,000	1,003	1,500	2,003	1.012x - 23.308	0.999
B09	SKC	224-PCXR4	626479	03/01/2023	1,000	1,500	2,000	996	1,490	1,994	0.995x + 1.117	1.000
B10	SKC	224-PCXR4	091950	03/01/2023	1,000	1,500	2,000	992	1,503	2,001	1.018x - 36.582	0.999
B11	SKC	224-PCXR8	564315	05/01/2023	1,000	1,500	2,000	996	1,490	1,999	1.003x - 8.256	1.000
B12	SKC	224-PCXR4	034656	05/01/2023	1,000	1,500	2,000	1,003	1,503	2,003	1.010x - 19.324	0.999
B13	SKC	224-PCXR4	602073	05/01/2023	1,000	1,500	2,000	995	1,500	1,998	1.001x - 3.474	1.000
B14	SKC	224-PCXR4	626313	04/01/2023	1,000	1,500	2,000	999	1,491	1,988	0.992x + 6.844	1.000
B15	SKC	224-PCXR4	626474	04/01/2023	1,000	1,500	2,000	1,001	1,502	2,005	1.014x - 25.558	0.999
B16	SKC	224-PCXR4	626477	04/01/2023	1,000	1,500	2,000	994	1,504	2,001	1.015x - 31.345	0.999
B17	SKC	224-PCXR4	626860	04/01/2023	1,000	1,500	2,000	997	1,494	1,991	0.997x - 0.359	1.000
B18	SKC	224-PCXR4	691484	04/01/2023	1,000	1,500	2,000	1,003	1,500	2,001	1.008x - 17.589	0.999
B19	SKC	224-PCXR4	691599	03/01/2023	1,000	1,500	2,000	993	1,503	1,999	1.007x - 11.574	1.000
B20	SKC	224-PCXR4	691587	03/01/2023	1,000	1,500	2,000	992	1,504	1,999	1.015x - 32.235	0.999
B21	SKC	224-PCXR4	691531	03/01/2023	1,000	1,500	2,000	993	1,499	1,994	1.001x - 7.107	1.000
B22	SKC	224-PCXR4	691654	05/01/2023	1,000	1,500	2,000	1,003	1,501	2,003	1.011x - 21.107	0.999
B23	SKC	224-PCXR4	798393	05/01/2023	1,000	1,500	2,000	992	1,507	2,002	1.018x - 34.883	0.999
B24	SKC	224-PCXR4	626363	05/01/2023	1,000	1,500	2,000	1,000	1,502	2,000	1.011x - 22.387	0.999
B25	SKC	224-PCXR4	798489	05/01/2023	1,000	1,500	2,000	1,001	1,492	2,001	0.998x + 1.101	1.000
B26	SKC	224-PCXR4	798479	05/01/2023	1,000	1,500	2,000	999	1,500	1,993	0.996x + 4.008	1.000
B27	SKC	224-PCXR4	691673	04/01/2023	1,000	1,500	2,000	994	1,503	2,002	1.016x - 32.071	0.999
B28	SKC	224-PCXR4	691570	04/01/2023	1,000	1,500	2,000	1,002	1,500	2,002	1.012x - 22.515	0.999
B29	SKC	224-PCXR4	626472	04/01/2023	1,000	1,500	2,000	1,000	1,496	1,998	1.001x - 4.942	1.000
B30	SKC	224-PCXR4	691489	03/01/2023	1,000	1,500	2,000	1,004	1,510	2,004	1.008x - 12.460	0.999
B31	SKC	224-PCXR4	691509	03/01/2023	1,000	1,500	2,000	992	1,497	1,998	1.006x - 12.711	1.000
B32	SKC	224-PCXR4	091567	05/01/2023	1,000	1,500	2,000	991	1,504	2,001	1.016x - 32.322	0.999
B33	SKC	224-PCXR4	091756	05/01/2023	1,000	1,500	2,000	993	1,497	1,991	0.997x - 0.004	1.000
B34	SKC	224-PCXR4	612962	05/01/2023	1,000	1,500	2,000	1,002	1,501	2,002	1.007x - 14.195	1.000
B35	SKC	224-PCXR4	602682	05/01/2023	1,000	1,500	2,000	993	1,498	1,995	1.002x - 8.448	1.000
B36	SKC	224-PCXR4	626164	03/01/2023	1,000	1,500	2,000	999	1,496	1,999	1.001x - 5.424	1.000
B37	SKC	224-PCXR4	626256	03/01/2023	1,000	1,500	2,000	994	1,506	1,999	1.013x - 27.815	0.999
B38	SKC	224-PCXR4	626167	03/01/2023	1,000	1,500	2,000	997	1,496	1,996	0.999x - 0.997	1.000
B39	SKC	224-PCXR4	034637	03/01/2023	1,000	1,500	2,000	1,005	1,501	2,001	1.010x - 18.618	0.999
B40	SKC	224-PCXR4	798349	05/01/2023	1,000	1,500	2,000	994	1,506	1,999	1.014x - 29.602	0.999

Calibrated by :

Approved by :



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
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7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
B41	SKC	224-PCXR4	612669	05/01/2023	1,000	1,500	2,000	998	1,497	1,990	0.997x + 0.718	1.000
B42	SKC	224-PCXR4	626041	05/01/2023	1,000	1,500	2,000	1,004	1,498	1,991	0.986x + 18.291	1.000
B43	SKC	224-PCXR4	034636	05/01/2023	1,000	1,500	2,000	1,000	1,501	1,992	0.991x + 11.882	1.000
B44	SKC	224-PCXR8	529341	06/01/2023	1,000	1,500	2,000	1,002	1,502	2,002	1.005x - 9.213	1.000
B45	SKC	224-PCXR8	529594	06/01/2023	1,000	1,500	2,000	999	1,501	1,989	0.991x + 11.184	1.000
B46	SKC	224-PCXR8	566743	06/01/2023	1,000	1,500	2,000	995	1,504	2,002	1.014x - 30.571	0.999
B47	SKC	224-PCXR8	566747	06/01/2023	1,000	1,500	2,000	1,002	1,502	2,004	1.013x - 24.601	0.999
B48	SKC	224-PCXR8	566753	04/01/2023	1,000	1,500	2,000	1,000	1,494	1,998	0.998x + 0.319	1.000
B49	SKC	224-PCXR8	566780	04/01/2023	1,000	1,500	2,000	1,003	1,502	2,006	1.013x - 23.982	0.999
B50	SKC	224-PCXR8	500400	04/01/2023	1,000	1,500	2,000	1,001	1,496	2,002	1.001x - 3.538	1.000
B51	SKC	224-PCXR8	500363	04/01/2023	1,000	1,500	2,000	996	1,504	1,999	1.011x - 25.031	0.999
B52	SKC	224-PCXR8	093186	04/01/2023	1,000	1,500	2,000	995	1,496	1,994	0.997x - 0.602	1.000
B53	SKC	224-PCXR8	707670	03/01/2023	1,000	1,500	2,000	1,002	1,500	2,002	1.008x - 15.403	0.999
B54	SKC	224-PCXR3	509821	03/01/2023	1,000	1,500	2,000	993	1,502	2,001	1.017x - 34.237	0.999
B55	SKC	224-PCXR3	510710	03/01/2023	1,000	1,500	2,000	999	1,494	1,994	0.997x - 0.989	1.000
B56	SKC	224-PCXR3	511450	03/01/2023	1,000	1,500	2,000	1,002	1,500	2,001	1.004x - 8.081	1.000
B57	SKC	224-PCXR3	510798	06/01/2023	1,000	1,500	2,000	997	1,492	1,998	1.000x - 2.680	1.000
B58	SKC	224-PCXR3	509852	06/01/2023	1,000	1,500	2,000	1,000	1,498	1,999	1.007x - 18.953	0.999
B59	SKC	224-PCXR3	509862	06/01/2023	1,000	1,500	2,000	996	1,503	1,994	0.997x + 3.235	1.000
B60	SKC	224-PCXR3	512655	06/01/2023	1,000	1,500	2,000	1,002	1,500	2,003	1.006x - 11.407	1.000
B61	SKC	224-PCXR3	503915	06/01/2023	1,000	1,500	2,000	994	1,489	1,998	1.004x - 12.623	1.000
B62	SKC	224-PCXR3	505975	06/01/2023	1,000	1,500	2,000	999	1,494	1,996	0.997x + 0.343	1.000
B63	SKC	224-PCXR3	511432	03/01/2023	1,000	1,500	2,000	991	1,501	1,999	1.016x - 34.624	0.999
B64	SKC	224-PCXR3	508302	03/01/2023	1,000	1,500	2,000	997	1,492	1,989	0.992x + 6.226	1.000
B65	SKC	224-PCXR3	508310	03/01/2023	1,000	1,500	2,000	1,002	1,500	2,003	1.007x - 13.936	1.000
B66	SKC	224-PCXR3	509861	03/01/2023	1,000	1,500	2,000	1,002	1,491	1,991	0.987x + 14.183	1.000
B67	SKC	224-PCXR3	506295	04/01/2023	1,000	1,500	2,000	993	1,508	2,004	1.009x - 15.555	1.000
B68	SKC	224-PCXR3	505872	04/01/2023	1,000	1,500	2,000	1,002	1,490	1,997	0.995x + 3.841	1.000
B69	SKC	224-PCXR3	508375	04/01/2023	1,000	1,500	2,000	1,002	1,499	2,000	1.010x - 20.772	0.999
B70	SKC	224-PCXR3	510623	05/01/2023	1,000	1,500	2,000	992	1,503	1,997	1.002x - 5.855	1.000
B71	SKC	224-PCXR3	508367	05/01/2023	1,000	1,500	2,000	992	1,506	2,002	1.017x - 34.791	0.999
B72	SKC	224-PCXR3	505977	05/01/2023	1,000	1,500	2,000	1,001	1,498	1,993	0.991x + 8.962	1.000
B73	SKC	224-PCXR3	512606	05/01/2023	1,000	1,500	2,000	1,002	1,501	2,005	1.009x - 14.785	1.000
B74	SKC	224-PCXR3	505993	05/01/2023	1,000	1,500	2,000	996	1,495	1,994	1.000x - 6.916	1.000
B75	SKC	224-PCXR3	509820	04/01/2023	1,000	1,500	2,000	995	1,498	1,990	0.996x + 1.791	1.000
B76	SKC	224-PCXR3	509811	04/01/2023	1,000	1,500	2,000	993	1,498	1,998	1.006x - 14.322	1.000
B77	SKC	224-PCXR3	508301	04/01/2023	1,000	1,500	2,000	1,000	1,501	2,003	1.014x - 26.603	0.999
B78	SKC	224-PCXR3	510677	04/01/2023	1,000	1,500	2,000	995	1,503	1,999	1.013x - 28.158	0.999
B79	SKC	224-PCXR3	510920	03/01/2023	1,000	1,500	2,000	994	1,493	1,994	0.999x - 4.184	1.000

Calibrated by :

Approved by :



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

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	05/01/2023	500	1,000	2,000	503.3	992.4	1978.7	0.999x - 3.199	0.999
H-R02	Dwyer	VFB-65	04/01/2023	500	1,000	2,000	501.2	995.3	1985.7	1.002x - 5.186	1.000
H-R03	Dwyer	VFB-65	04/01/2023	500	1,000	2,000	501.7	987.7	1996.9	0.994x + 1.679	1.000
H-R04	Dwyer	VFB-65	04/01/2023	500	1,000	2,000	496.4	989.6	2019.5	1.008x - 13.614	1.000
H-R05	Dwyer	VFB-65	06/01/2023	500	1,000	2,000	497.2	987.7	1988.1	1.004x - 9.360	1.000
H-R06	Dwyer	VFB-65	06/01/2023	500	1,000	2,000	505.2	992.4	1979.8	0.999x - 2.816	0.999

Calibrated by :

Approved by :

ลำดับที่ 4

คุณภาพน้ำ

Certificate of Calibration

Certificate No. : 65-400210-1

Page : 1 of 2

Submitted by : S. P. S Consulting Service Co.,Ltd.
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900

Equipment : Liquid in Glass Thermometer
Manufacturer : SK **Model :** N/A
Range : 0 °C to 100 °C **Resolution :** 1 °C
Serial No. : N/A **Immersion :** Total
ID No. : TM21/59

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

Date of Received : 19 April 2022

Date of Calibration : 23 April 2022

Date of Issue : 23 April 2022

Calibrated by : Chortip Samchusri

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4001 based on ASTM E77-07 by compared with PRT in the liquid bath at the constant controlled temperature.

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

ID No.	Cert. No.	Due Date	Traceability
400001	TT-0016-22	07 Feb 2024	National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
400003	21E1850	14 Jun 2023	National Institute of Metrology Thailand (NIMT)
400004	21E1850	14 Jun 2023	National Institute of Metrology Thailand (NIMT)

Approved by :

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.



www.calibratech.co.th

Certificate of Calibration

Certificate No. : 65-400210-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Ice point check : UUC* reading 0 °C Standard reading 0.6439 °C

Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
20.6690	20	0.7	0.31

Remark

UUC : Unit Under Calibration

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

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

- o0o -



**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 : 22E9693

REFERENCE No : 66476-1

PAGE : 1 OF 3

Certificate of Calibration

EQUIPMENT : pH METER

MANUFACTURER : HANNA

MODEL : HI 3512

SERIAL No : TH118035

ID No : pH 04/56

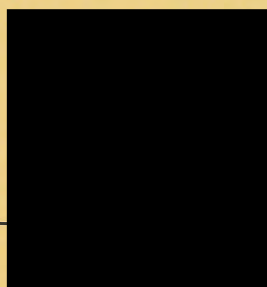
CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 15-Sep-22

APPROVED BY :



ISSUED DATE : 15-Sep-22

RECEIVED DATE : 14-Sep-22

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF
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CERTIFICATE No : 22E9693

PAGE : 2 OF 3

Calibration Report

EQUIPMENT : pH METER
MANUFACTURER : HANNA
ID No : pH 04/56
RECEIVED DATE : 14-Sep-22
AMBIENT TEMPERATURE : 20 ° C ± 1 ° C
MODEL : HI 3512
SERIAL NUMBER : TH118035
CALIBRATION DATE : 15-Sep-22
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	CC719181	4880-12119147	05-Apr-23
2) pH STANDARD SOLUTION	00651-08	CC718727	4881-12110709	31-Mar-23
3) pH STANDARD SOLUTION	00651-10	CC717045	4882-12065386	17-Mar-23
4) PROCESS CALIBRATOR	CA150	91S6079	22E1145	31-Mar-23
5) BATH	260014	1247 48074	22T9870	13-Sep-23
6) THERMOMETER WITH PROBE	421504	55000379	22T9904	13-Sep-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 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	414.8	-0.69	-0.171	0.14	2.0
354.95	355.6	-0.65	0.860	0.14	2.0
295.80	296.4	-0.60	1.892	0.14	2.0
236.64	237.2	-0.56	2.922	0.14	2.0
177.48	178.0	-0.52	3.954	0.14	2.0
118.32	118.8	-0.48	4.985	0.14	2.0
59.16	59.7	-0.54	6.016	0.14	2.0
0.00	0.5	-0.50	7.049	0.14	2.0
-59.16	-58.8	-0.36	8.136	0.14	2.0
-118.32	-117.9	-0.42	9.223	0.14	2.0
-177.48	-177.1	-0.38	10.311	0.14	2.0
-236.64	-236.3	-0.34	11.399	0.14	2.0
-295.80	-295.5	-0.30	12.487	0.14	2.0
-354.95	-354.7	-0.25	13.575	0.14	2.0
-414.11	-413.9	-0.21	14.662	0.14	2.0

END OF CALIBRATION REPORT PAGE 2 OF 3



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

CERTIFICATE No : 22E9693

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
4.007	4.007	0.000	3.996	0.012	2.0
7.004	7.006	-0.002	6.944	0.012	2.0
10.016	10.012	0.004	10.194	0.014	2.0

3. DISPLAY UNIT WITH TEMPERATURE

STANDARD READING (°C)	UUC READING (°C)	CORRECTION (°C)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT (\pm °C)	COVERAGE FACTOR k
25.003	25.0	0.003	---	0.0085	2.0

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

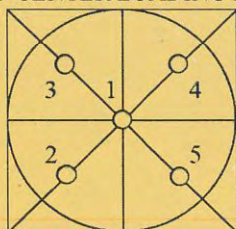
2. TARE FUNCTION : NORMAL

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

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.

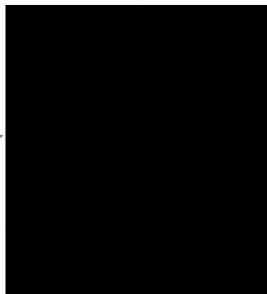
Calibration Details

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.





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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 : 22T10972
REFERENCE No : 66837-1

PAGE : 1 OF 3

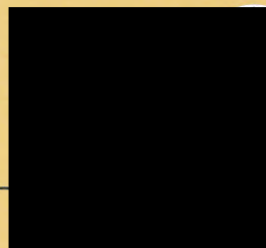
Certificate of Calibration

EQUIPMENT : COD REACTOR
MANUFACTURER : HACH
MODEL : DRB 200
SERIAL No : 15110C0497
ID No : DRB 04/59
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 : 20-Dec-22

APPROVED BY :



ISSUED DATE : 20-Dec-22

RECEIVED DATE : 20-Dec-22

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 : 22T10972

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : COD REACTOR
MANUFACTURER : HACH
ID NUMBER : DRB 04/59
RECEIVED DATE : 20-Dec-22
AMBIENT TEMPERATURE : 23° C ± 1° C

MODEL : DRB 200
SERIAL NUMBER : 15110C0497
CALIBRATION DATE : 20-Dec-22
RELATIVE HUMIDITY : 52 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

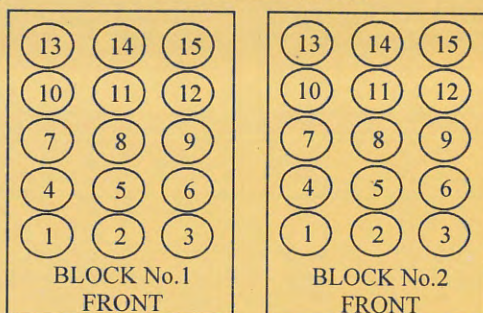
1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT TEMPERATURE RECORDER WITH THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON 15 POINTS AND LOCATED ONE THERMOCOUPLE IN EACH OF THE FOUR CORNERS OF THE REACTOR AND PLACED THE EIGHTH THERMOCOUPLE AT THE CENTER OF THE REACTOR.

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	149.8
	2	149.6
	3	149.7
	4	149.8
	5	149.9
	6	149.8
	7	149.8
	8	149.8
	9	149.9
	10	149.8
	11	149.9
	12	149.7
	13	149.9
	14	149.9
	15	149.7
Uncertainty of Measurement(± °C)	0.86	0.86

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHA

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

END OF CALIBRATION REPORT



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

Customer : <u>S.P.S.Consulting Service Co.,Ltd</u>	Date Tested: <u>January 11, 2023</u>	
	Recommendation Recertification	
Address : <u>7 Soi Phaholyothin 24</u>	Period <u>6</u> Months	
<u>Paholyothin Road</u>	Recertification Due: <u>July 11, 2023</u>	
<u>Jompol Chatuchak, Bangkok 1090</u>	Date Last Certified: <u>July 11, 2022</u>	
User Name: <u>K.Phenpha Vipasthawatt</u>	Visit Number: <u>2 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>May 30, 2023</u>
<u>Wavecal Solution</u>	<u>N058-2152</u>	<u>February 28, 2023</u>
<u>VIS Wavecal solution</u>	<u>N930-2946</u>	<u>August 30, 2023</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>November 30, 2023</u>
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401

DATE TESTED January 11, 2023

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 11, 2023

PARAMETER		SPECIFICATION		FINAL VALUE	
Spectral Resolution : UV	As 193.696 nm	≤ 0.007		<u>0.00504</u>	
	Ni 231.604 nm	≤ 0.008		<u>0.00646</u>	
	Ni 341.476 nm	≤ 0.012		<u>0.00768</u>	
Spectral Resolution : VIS	La 408.672 nm	≤ 0.020		<u>0.01597</u>	
	Ba 455.403 nm	≤ 0.025		<u>0.02185</u>	
Precision					
	As 193.656 nm	% RSD	< 1.0	<u>0.89</u>	%
	Zn 213.856 nm	% RSD	< 1.0	<u>0.77</u>	%
	Mn 257.610 nm	% RSD	< 1.0	<u>0.51</u>	%
	La 379.478 nm	% RSD	< 1.0	<u>0.44</u>	%
	Ba 455.403 nm	% RSD	< 1.0	<u>0.44</u>	%
	Ba 493.408 nm	% RSD	< 1.0	<u>0.46</u>	%
Detection Limits : Axial	Tl 190.080 nm	3(sd)		<u>4.04</u>	ppb
	As 193.696 nm	3(sd)		<u>3.58</u>	ppb
	Pb 220.353 nm	3(sd)		<u>1.90</u>	ppb
Detection Limits : Radial	As 193.696 nm	3(sd)		<u>47.72</u>	ppb
	Zn 213.856 nm	3(sd)		<u>1.02</u>	ppb
	Mn 257.610 nm	3(sd)		<u>0.68</u>	ppb
	La 379.478 nm	3(sd)		<u>1.43</u>	ppb
	Ba 455.403 nm	3(sd)		<u>0.10</u>	ppb
	Ba 493.408 nm	3(sd)		<u>0.36</u>	ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd 226.502 nm	≤ 150 ppb		<u>58.36</u>	
BEC : Radial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 45 ppb		<u>104142.80</u>	



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401**DATE TESTED** January 11, 2023**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:

PinAAcle 900T Preventive Maintenance (PM)

Company Name:	SPS CONSULTING SERVICE CO.,LTD.		
Address (Instrument Location):	7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD. JOMPOL, CHATUCHAK, BANGKOK		
Serial Number:	PTCS14111103	PM Number:	1-2
Customer Name (if applicable):	K. PHENPHA	Telephone Number:	083-926-9252
Customer Support Engineer Name:	K. DUANG	Service Order Number:	WO-02044564
Date PM Performed: (DD-MMM-YYYY)	06-Jan-2023	Next PM Due Date: (DD-MMM-YYYY)	06-Jul-2023
Standard Labor Hours to Complete PM :		5 hours	

Part Number	Release	Publication Date	
09370143 Rev.9	A	January 2018	

Scope

The purpose of this PM is to ensure the continued functionality of the PinAAcle 900T 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 or calibration, including a current back-up of system software and/or data files. The completed document 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 #	Configuration Notes
AS900	AS9S14B1002	WINLAB 32

Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
B0501696	Fan Filters	2
B3002013	THGA Contact Cylinders	1
B3141064	Glycerol for THGA Cooling	N/A
N3160156	O-Ring Kits for Sampling Introduction (Stainless Steels Nebulizer)	N/A
N3160157	O-Ring Kits for Sampling Introduction (Plastic Nebulizer)	2
N9301714	Replacement Acetylene Filter Cartridge	1
TH001022	Replacement Air Filter Cartridge	2

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quality	Batch/Lot #	Expired Date (MM/YY)
N9300183	1000 mg/L Copper Standard	AR	26-87CUY1	30-Jan-2024
N9300244	GFAAS Mixed Standard	AR	56-021CRY1	30-Jun-2023

Additional Reagents and Standards Required for PM (Customer Support Solution)				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
N/A	DI Water	250 ml.	AR	AR
N/A	0.5% HNO ₃	250 ml.	AR	AR

Additional Tools Required for PM			
Part Number (if applicable)	Description	Quantity	Serial #
N1013000	0.2A Neutral density filter	1	MG0-252
N1013002	1.0A Neutral density filter	1	MG2-358
B3100652 Or N9307029	Electronic Flow Meter	1	NA
B0505495	Test Jig	1	NA
03030997	System 2 EDL Driver	1	03030997
N3050605	As System 2 EDL	1	16148
N3050121	Cu Lumina HCL	1	092216-010130
N3050109	Ba Lumina HCL	1	102416-040160
N3050139	K Lumina HCL	1	110716-010060
N3050152	Ni Lumina HCL	1	100516-030190
N3050119	Cr Lumina HCL	1	091911-020150

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. PC Instrument Software:

- ✓ Instrument Software user files/databases archived, packed, and/or deleted as needed.

3. Mechanical:

- ✓ Inspect and clean all fans and filters. Replace filters if necessary
- ✓ Inspect all gas and water lines for leaks and/or wear. Replace if needed. Thoroughly inspect all quick connects. Replace the Y connector, P/N 09921079, if needed.
- ✓ Clean exterior of the instrument.

3.1 Flame Technique

- ✓ Inspect the burner head, burner chamber, and nebulizer. Clean if needed as stated in the Hardware Guide.
- ✓ Check burner head dimensions with the feeler gauge as stated in the Hardware Guide in the Maintenance chapter section on cleaning the burner head and checking sloth width. Replace if out of specification
- ✓ Check the condition of the end cap, burner head, and nebulizer O-rings. Replace if necessary.
- ✓ Check the drain system for signs of wear. Replace worn or damaged parts.
- ✓ Visually check for proper flame conditions when igniting the Air-C₂H₂ and N₂O-C₂H₂ flames (if applicable).

3.2 THGA Technique

- ✓ Inspect the pole pieces and clean where the pole pieces contact the furnace. Replace the pole piece p-rings as needed, P/N's B0501018 & B0501250. Grease the O-rings as needed with Apiezon L grease, P/N 09905148
- ✓ Inspect the four insulation pads on the front contact housing of the THGA in furnace. If the pads are missing replace the THGA furnace or replace the insulator pads on the furnace.
- ✓ Inspect the graphite tube and clean the contact cylinders. Replace if necessary.
- ✓ Check internal and external gas flows with the Electronic Gas Flow Meter and the Gas Flow Test Probe as described in the Service Manual. Correct if necessary.
- ✓ Check furnace open/close function.
- ✓ Verify the operation of the GFTV Camera for proper operation and viewing alignment in the furnace camera Tube View window. Align if needed.
- ✓ Check the operation of the Halogen Light ASSY for the GFTV Camera. Replace if needed.
- ✓ Check the water level/quality in the recirculation (if applicable). Add distilled water if necessary.
- ✓ Check the cooling system fluid flow rate with the FCS In-Line Flow Meter for proper levels if needed. Refer to SDB# COSY008.STN

- ✓ Perform Cooling System maintenance if needed per SDB# COSY005.STN.
- ✓ Check auto sampler operation.
- ✓ Perform an auto sampler check valve test as described in the Service Manual.
- ✓ Lubricate the spindles of the auto sampler pumps and all moving parts of the tray mechanics as described in the Service Manual.
- ✓ Inspect the auto sampler sampling capillary as described in the Service Manual. Replace if necessary.

4. Electrical:

- ✓ Inspect PC boards. Clean if necessary.
- ✓ Carefully check all internal and external cable connections.
- ✓ Check instrument firmware revisions upgrade to current levels (if necessary)
- ✓ Run Diagnostics Test within the Advanced function of the Spectrometer page. Check the results in the service log folder in the Spectrometer BM Log Viewer.

5. Optics:

- ✓ Inspect and clean the sample compartment windows, if needed.
- ✓ Inspect and clean the furnace windows, if needed.
- ✓ Inspect and clean the GFTV camera lens, if needed.
- ✓ Inspect optics. Clean or replace if necessary,

6. Gasses:

- ✓ Verify that the Gasses supplied to the instrument are within the pressure and purity specifications found in the PinAAcle 900 Series Pre-installation Checklist SDB.
- ✓ Verify that the air filter element is dry. Replace if necessary.

7. Flame Interlock Check:

Description: Check to ensure that all safety interlocks are closed.

Parameter	Specification	Test Results	Pass/Fail
Flame Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Drain Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Nebulizer Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
C ₂ H ₂ Pressure Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Air Pressure Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Burner Head Sensor	Choosing Nitrous Oxide as the oxidant should trigger an interlock shuts down	Active	Passed

8. After PM Performance tests [Flame]:

8.1 Detector Linearity with Barium

Description: Ensures that the detector is linear in the Visible Range.

Parameter	Specification	Certificate Value at 553.6 nm (Abs.)	Test Results	Pass/Fail
1.0 A ND Filter	± 5% from Cert.	0.9798	0.1982	Passed
0.2 A ND Filter	± 5% from Cert.	0.2042	0.9942	Passed

8.2 Baseline Noise at 1.0 Absorbance with Barium

Description: Ensures that a high absorbance will not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0014	Passed

8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.001	0.0001	Passed

8.4 D₂ Background Compensation with Copper

Description: Verifies the instruments ability to compensate for Background absorption.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0083	Passed

8.5 AA-BG Baseline Noise with Copper

Description: Ensures that background correction does not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0002	Passed

8.6 AA-BG Baseline Noise with Arsenic

Description: Ensures that background correction does not produce excessive noise at a low wavelength.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0021	Passed

8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

Standard Copper Sensitivity	Specification	Results (Abs.)	Pass/Fail
5 mg/L Sensitivity SS Neb (if applicable)	> 0.250 Abs.	NA	Not Applicable
2 mg/L Sensitivity HS Neb (if applicable)	> 0.250 Abs.	0.3281	Passed

9. After PM Performance tests [THGA]:

9.1 Furnace Gas Flows

Description: Ensures the flow rates are within specification.

Parameter	Specification	Test Results	Pass/Fail
Internal Flow Rate	250 mL/min \pm 25 mL/min	255	Passed
External Flow Rate	100 mL/min \pm 10 mL/min	105	Passed

9.2 Chromium Baseline Noise

Description: Signal to noise check.

Parameter	Specification	Results	Pass/Fail
Baseline Noise	≤ 0.005 Abs.	0.0000	Passed
Standard Deviation	≤ 0.005	0.0002	Passed

9.3 Chromium Characteristic Mass and Precision

Description: Calculate the characteristic mass using the characteristic mass tool and precision from the integrated absorbance values.

Parameter	Specification	Results	Pass/Fail
Cr m_0 Results	≤ 7.0 pg/0.0044 A-s	5.7	Passed
Precision	≤ 2.0 %	0.74	Passed

9.4 Copper Characteristic Mass and Zeeman Ratio

Description: Calculate the characteristic mass using the characteristic mass tool and check the Zeeman Ratio.

Parameter	Specification	Results	Pass/Fail
Cu m ₀ Result	≤ 16.5 pg/0.0044 A-s	12.3	Passed
Zeeman Ratio	0.52 ± 0.04	0.54	Passed

10. 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	
Zeeman Ratio	$= \frac{\text{Atomic Signal (Peak area)}}{\text{Atomic Signal (Peak area)} + \text{Background Signal (Peak area)}}$ $= \frac{0.1855}{0.1855+0.1563}$ $= 0.54$
REPLACE PM KIT	

Review

<i>The preventive maintenance checks and if applicable performance tests for PinAAcle 900T have been completed.</i>		
<i>This PinAAcle 900T Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.</i>		
Review of Preventive Maintenance:		
Authorized PerkinElmer Representative:		Date: 06-Jan-2023 <small>(DD-MMM-YYYY)</small>
Authorized Customer Representative:		Date: 06-Jan-2023 <small>(DD-MMM-YYYY)</small>

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. : SP22018

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

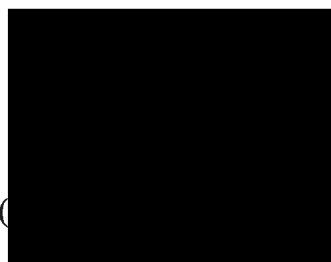
Customer : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN ROAD,
CHOMPHON, CHATUCHAK,
BANGKOK 10900, THAILAND.

Location : ORGANIC LABORATORY IV

Ambient Temperature : (24.4 ± 5) °C
Relative Humidity : (60.1 ± 25) %

Received Date : 30 AUGUST 2022
Calibration Date : 30 AUGUST 2022
Date of Issue : 31 AUGUST 2022

Calibrated by :



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. : SP22018

Job No. : VC65SP0008

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	87569	13/10/2022
Didymium liquid	RM-DL	28912	87588	15/10/2022
Neutral density filter	RM-1N2N3N	13877	87600	15/10/2022
Potassium dichromate solutions	RM-0204060810	14204	87614	16/10/2022
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	361.4	0.15	0.16	2.00
	467.82	467.8	-0.02	0.16	2.00
	536.56	536.5	-0.06	0.16	2.00
	640.50	640.5	0.00	0.16	2.00
RM-DL	740.09	740.0	-0.09	0.16	2.00
	864.94	865.2	0.26	0.16	2.00

UUC* = Unit Under Calibration

Continuation of Calibration Certificate

Cert. No. : SP22018

Job No. : VC65SP0008

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	1.0524	1.0539	0.0015	0.0028	2.00
		29914	0.7	0.7454	0.7459	0.0005	0.0029	2.00
		29381	0.5	0.5426	0.5426	0.0000	0.0028	2.00
	546.1	29360	1.0	0.9822	0.9810	-0.0012	0.0028	2.00
		29914	0.7	0.6962	0.6960	-0.0002	0.0028	2.00
		29381	0.5	0.5076	0.5070	-0.0006	0.0029	2.00
	590.0	29360	1.0	1.0221	1.0202	-0.0019	0.0028	2.00
		29914	0.7	0.7238	0.7230	-0.0008	0.0029	2.00
		29381	0.5	0.5364	0.5360	-0.0004	0.0031	2.00
	635.0	29360	1.0	0.9751	0.9732	-0.0019	0.0028	2.00
		29914	0.7	0.6912	0.6902	-0.0010	0.0029	2.00
		29381	0.5	0.5214	0.5210	-0.0004	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	0.2436	0.2419	-0.0017	0.0101	2.00	
		40	0.4905	0.4855	-0.0050	0.0115	2.00	
		60	0.7453	0.7388	-0.0065	0.0067	2.00	
		80	0.9920	0.9839	-0.0081	0.0071	2.00	
		100	1.2487	1.2414	-0.0073	0.0073	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

Transmission T(%) Absorbance(A)

0.0107

3.9886

**Specific Acceptance :

Transmission ≤ 1.0 T(%), Absorbance ≥ 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

ลำดับที่ 5

ระดับเสียงในบรรยากาศ

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0413

MTC No. EEL. BP. 109/0366

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

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 : 27 Mar. 2023

Date of Calibration : 29 Mar. 2023

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. 21-66/0413

MTC No. EEL. BP. 109/0366

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

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

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	93.94	-0.06	± 0.10	± 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	999.9	-0.1	± 1.5	$\pm 1.0\%$

3. Total distortion

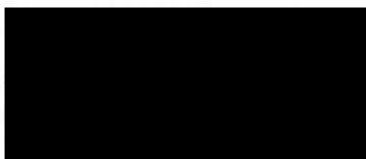
Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.80	± 0.50	$\pm 3.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :



Approved by :



Director
TISTR

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 29 Mar. 2023

Date of Issue : 30 Mar. 2023

Ref : 2011266032701228001

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
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_010/23

Sound Level Meter Calibration Report

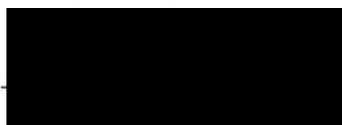
Acoustic Calibrator Data

Brand	ACO	Number	AC 03/56
Model	2127	Serial No.	130006
Calibration Range	94 dB, 1000 Hz	Last Calibration	28 April 2022
		Due Date	28 April 2023

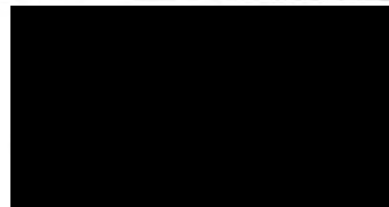
Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B29	ACO	6236	00182011	15 January 2023	94.0	94.0
NL 21-BO1	RION	NL-21	00554245	15 January 2023	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.93 ± 0.10 dB	

Calibrated by :



Approved by :



ลำดับที่ 6

ระดับเสียงในสถานประกอบการ



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0358

MTC No. EEL. BP. 22/0366

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 : 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 : 3 Mar. 2023

Date of Calibration : 13 Mar. 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. 21-66/0358

MTC No. EEL. BP. 22/0366

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

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

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	93.99	-0.01	± 0.10	± 0.40 dB

2. Frequency

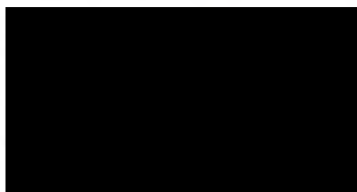
Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1000.3	0.3	± 1.5	$\pm 1.0\%$

3. Total Distortion

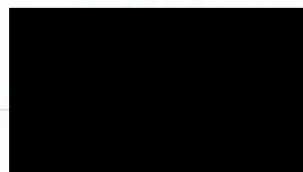
Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.39	± 0.50	$\pm 3.0\%$

- Note :
1. No adjustment.
 2. The calibrator pressure correction was not included.
 3. The microphone volume correction was not included.

Calibrated by :



Approved by :



Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 13 Mar. 2023

Date of Issue : 14 Mar. 2023

Ref : 2011266030300928001

2 / 2

End of Certificate

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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

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0413

MTC No. EEL. BP. 109/0366

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

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 : 27 Mar. 2023

Date of Calibration : 29 Mar. 2023

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. 21-66/0413

MTC No. EEL. BP. 109/0366

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

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

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	93.94	-0.06	± 0.10	± 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	999.9	-0.1	± 1.5	$\pm 1.0\%$

3. Total distortion

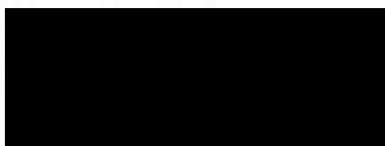
Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.80	± 0.50	$\pm 3.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :



Approved by :



Director
TISTR

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 29 Mar. 2023

Date of Issue : 30 Mar. 2023

Ref : 2011266032701228001

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
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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



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_087/23

Noise Dose Meter Calibration Report

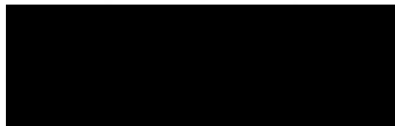
Acoustic Calibrator Data

Brand	SVANTEK	Number	SV 06/62
Model	SV34	Serial No.	33139
Calibration Range	114 dB, 1000 Hz	Last Calibration	19 September 2022
		Due Date	19 September 2023

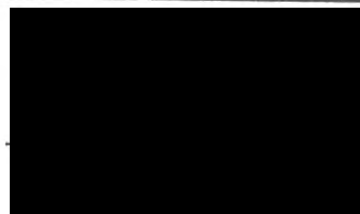
Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NMD-R03	SVANTEK	SV-104IS	60153	09 February 2023	113.6	113.6
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					113.63± 0.10 dB	

Calibrated by :



Approved by :





Noise R_022/23

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	28 April 2022
		Due Date	28 April 2023

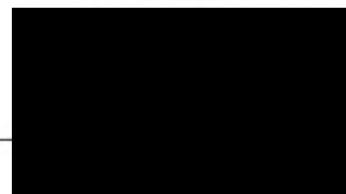
Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NL 21-B01	RION	NL-21	00554245	18 January 2023	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.93 ± 0.10 dB	

Calibrated by :



Approved by :





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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

Noise R_022-1/23

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	19 March 2022
		Due Date	19 March 2023

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
CR-B09	Cirrus	CR161B	G301401	18 January 2023	94.1	94.0
CR-B10	Cirrus	CR161B	G301407	18 January 2023	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.99 ± 0.10 dB	

Calibrated by :



Approved by :





Noise Dose R_023/23

Noise Dose Meter Calibration Report

Acoustic Calibrator Data

Brand	SVANTEK	Number	SV 06/62
Model	SV34	Serial No.	33139
Calibration Range	114 dB, 1000 Hz	Last Calibration	19 September 2022
		Due Date	19 September 2023

Calibration Data

Sound Level Meter Data

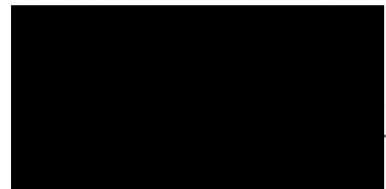
Calibration Data

SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NMD-R02	SVANTEK	SV-104IS	60152	18 January 2023	113.6	113.6
NMD-R03	SVANTEK	SV-104IS	60153	18 January 2023	113.5	113.6
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					113.63 ± 0.10 dB	

Calibrated by :



Approved by :





Noise Dose R_023/23

Noise Dose Meter Calibration Report

Acoustic Calibrator Data

Brand	SVANTEK	Number	SV 06/62
Model	SV34	Serial No.	33139
Calibration Range	114 dB, 1000 Hz	Last Calibration	19 September 2022
		Due Date	19 September 2023

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NMD-R05	SVANTEK	SV-104IS	60155	18 January 2023	113.6	113.6
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					113.63± 0.10 dB	

Calibrated by :



Approved by :





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

Noise R_022-1/23

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	19 March 2022
		Due Date	19 March 2023

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
CR-B09	Cirrus	CR161B	G301401	18 January 2023	94.1	94.0
CR-B10	Cirrus	CR161B	G301407	18 January 2023	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.99 \pm 0.10 dB	

Calibrated by :



Approved by :



ลำดับที่ 7

คุณภาพอากาศในสถานประกอบการ



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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
B01	SKC	224-PCXR4	262101	03/01/2023	1,000	1,500	2,000	993	1,497	1,998	1.003x - 5.584	1.000
B02	SKC	224-PCXR4	626166	03/01/2023	1,000	1,500	2,000	1,003	1,505	2,001	1.009x - 19.667	0.999
B03	SKC	224-PCXR4	612968	03/01/2023	1,000	1,500	2,000	996	1,494	2,000	1.006x - 12.109	1.000
B04	SKC	224-PCXR4	602804	04/01/2023	1,000	1,500	2,000	1,000	1,502	1,995	1.000x - 0.893	1.000
B05	SKC	224-PCXR4	612693	04/01/2023	1,000	1,500	2,000	1,003	1,500	2,003	1.012x - 22.224	0.999
B06	SKC	224-PCXR4	262188	03/01/2023	1,000	1,500	2,000	995	1,508	2,005	1.011x - 20.273	1.000
B07	SKC	224-PCXR4	626262	03/01/2023	1,000	1,500	2,000	998	1,492	1,995	0.993x + 6.086	1.000
B08	SKC	224-PCXR4	626100	03/01/2023	1,000	1,500	2,000	1,003	1,500	2,003	1.012x - 23.308	0.999
B09	SKC	224-PCXR4	626479	03/01/2023	1,000	1,500	2,000	996	1,490	1,994	0.995x + 1.117	1.000
B10	SKC	224-PCXR4	091950	03/01/2023	1,000	1,500	2,000	992	1,503	2,001	1.018x - 36.582	0.999
B11	SKC	224-PCXR8	564315	05/01/2023	1,000	1,500	2,000	996	1,490	1,999	1.003x - 8.256	1.000
B12	SKC	224-PCXR4	034656	05/01/2023	1,000	1,500	2,000	1,003	1,503	2,003	1.010x - 19.324	0.999
B13	SKC	224-PCXR4	602073	05/01/2023	1,000	1,500	2,000	995	1,500	1,998	1.001x - 3.474	1.000
B14	SKC	224-PCXR4	626313	04/01/2023	1,000	1,500	2,000	999	1,491	1,988	0.992x + 6.844	1.000
B15	SKC	224-PCXR4	626474	04/01/2023	1,000	1,500	2,000	1,001	1,502	2,005	1.014x - 25.558	0.999
B16	SKC	224-PCXR4	626477	04/01/2023	1,000	1,500	2,000	994	1,504	2,001	1.015x - 31.345	0.999
B17	SKC	224-PCXR4	626860	04/01/2023	1,000	1,500	2,000	997	1,494	1,991	0.997x - 0.359	1.000
B18	SKC	224-PCXR4	691484	04/01/2023	1,000	1,500	2,000	1,003	1,500	2,001	1.008x - 17.589	0.999
B19	SKC	224-PCXR4	691599	03/01/2023	1,000	1,500	2,000	993	1,503	1,999	1.007x - 11.574	1.000
B20	SKC	224-PCXR4	691587	03/01/2023	1,000	1,500	2,000	992	1,504	1,999	1.015x - 32.235	0.999
B21	SKC	224-PCXR4	691531	03/01/2023	1,000	1,500	2,000	993	1,499	1,994	1.001x - 7.107	1.000
B22	SKC	224-PCXR4	691654	05/01/2023	1,000	1,500	2,000	1,003	1,501	2,003	1.011x - 21.107	0.999
B23	SKC	224-PCXR4	798393	05/01/2023	1,000	1,500	2,000	992	1,507	2,002	1.018x - 34.883	0.999
B24	SKC	224-PCXR4	626363	05/01/2023	1,000	1,500	2,000	1,000	1,502	2,000	1.011x - 22.387	0.999
B25	SKC	224-PCXR4	798489	05/01/2023	1,000	1,500	2,000	1,001	1,492	2,001	0.998x + 1.101	1.000
B26	SKC	224-PCXR4	798479	05/01/2023	1,000	1,500	2,000	999	1,500	1,993	0.996x + 4.008	1.000
B27	SKC	224-PCXR4	691673	04/01/2023	1,000	1,500	2,000	994	1,503	2,002	1.016x - 32.071	0.999
B28	SKC	224-PCXR4	691570	04/01/2023	1,000	1,500	2,000	1,002	1,500	2,002	1.012x - 22.515	0.999
B29	SKC	224-PCXR4	626472	04/01/2023	1,000	1,500	2,000	1,000	1,496	1,998	1.001x - 4.942	1.000
B30	SKC	224-PCXR4	691489	03/01/2023	1,000	1,500	2,000	1,004	1,510	2,004	1.008x - 12.460	0.999
B31	SKC	224-PCXR4	691509	03/01/2023	1,000	1,500	2,000	992	1,497	1,998	1.006x - 12.711	1.000
B32	SKC	224-PCXR4	091567	05/01/2023	1,000	1,500	2,000	991	1,504	2,001	1.016x - 32.322	0.999
B33	SKC	224-PCXR4	091756	05/01/2023	1,000	1,500	2,000	993	1,497	1,991	0.997x - 0.004	1.000
B34	SKC	224-PCXR4	612962	05/01/2023	1,000	1,500	2,000	1,002	1,501	2,002	1.007x - 14.195	1.000
B35	SKC	224-PCXR4	602682	05/01/2023	1,000	1,500	2,000	993	1,498	1,995	1.002x - 8.448	1.000
B36	SKC	224-PCXR4	626164	03/01/2023	1,000	1,500	2,000	999	1,496	1,999	1.001x - 5.424	1.000
B37	SKC	224-PCXR4	626256	03/01/2023	1,000	1,500	2,000	994	1,506	1,999	1.013x - 27.815	0.999
B38	SKC	224-PCXR4	626167	03/01/2023	1,000	1,500	2,000	997	1,496	1,996	0.999x - 0.997	1.000
B39	SKC	224-PCXR4	034637	03/01/2023	1,000	1,500	2,000	1,005	1,501	2,001	1.010x - 18.618	0.999
B40	SKC	224-PCXR4	798349	05/01/2023	1,000	1,500	2,000	994	1,506	1,999	1.014x - 29.602	0.999

Calibrated by :

Approved by :



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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R²
B41	SKC	224-PCXR4	612669	05/01/2023	1,000	1,500	2,000	998	1,497	1,990	0.997x + 0.718	1.000
B42	SKC	224-PCXR4	626041	05/01/2023	1,000	1,500	2,000	1,004	1,498	1,991	0.986x + 18.291	1.000
B43	SKC	224-PCXR4	034636	05/01/2023	1,000	1,500	2,000	1,000	1,501	1,992	0.991x + 11.882	1.000
B44	SKC	224-PCXR8	529341	06/01/2023	1,000	1,500	2,000	1,002	1,502	2,002	1.005x - 9.213	1.000
B45	SKC	224-PCXR8	529594	06/01/2023	1,000	1,500	2,000	999	1,501	1,989	0.991x + 11.184	1.000
B46	SKC	224-PCXR8	566743	06/01/2023	1,000	1,500	2,000	995	1,504	2,002	1.014x - 30.571	0.999
B47	SKC	224-PCXR8	566747	06/01/2023	1,000	1,500	2,000	1,002	1,502	2,004	1.013x - 24.601	0.999
B48	SKC	224-PCXR8	566753	04/01/2023	1,000	1,500	2,000	1,000	1,494	1,998	0.998x + 0.319	1.000
B49	SKC	224-PCXR8	566780	04/01/2023	1,000	1,500	2,000	1,003	1,502	2,006	1.013x - 23.982	0.999
B50	SKC	224-PCXR8	500400	04/01/2023	1,000	1,500	2,000	1,001	1,496	2,002	1.001x - 3.538	1.000
B51	SKC	224-PCXR8	500363	04/01/2023	1,000	1,500	2,000	996	1,504	1,999	1.011x - 25.031	0.999
B52	SKC	224-PCXR8	093186	04/01/2023	1,000	1,500	2,000	995	1,496	1,994	0.997x - 0.602	1.000
B53	SKC	224-PCXR8	707670	03/01/2023	1,000	1,500	2,000	1,002	1,500	2,002	1.008x - 15.403	0.999
B54	SKC	224-PCXR3	509821	03/01/2023	1,000	1,500	2,000	993	1,502	2,001	1.017x - 34.237	0.999
B55	SKC	224-PCXR3	510710	03/01/2023	1,000	1,500	2,000	999	1,494	1,994	0.997x - 0.989	1.000
B56	SKC	224-PCXR3	511450	03/01/2023	1,000	1,500	2,000	1,002	1,500	2,001	1.004x - 8.081	1.000
B57	SKC	224-PCXR3	510798	06/01/2023	1,000	1,500	2,000	997	1,492	1,998	1.000x - 2.680	1.000
B58	SKC	224-PCXR3	509852	06/01/2023	1,000	1,500	2,000	1,000	1,498	1,999	1.007x - 18.953	0.999
B59	SKC	224-PCXR3	509862	06/01/2023	1,000	1,500	2,000	996	1,503	1,994	0.997x + 3.235	1.000
B60	SKC	224-PCXR3	512655	06/01/2023	1,000	1,500	2,000	1,002	1,500	2,003	1.006x - 11.407	1.000
B61	SKC	224-PCXR3	503915	06/01/2023	1,000	1,500	2,000	994	1,489	1,998	1.004x - 12.623	1.000
B62	SKC	224-PCXR3	505975	06/01/2023	1,000	1,500	2,000	999	1,494	1,996	0.997x + 0.343	1.000
B63	SKC	224-PCXR3	511432	03/01/2023	1,000	1,500	2,000	991	1,501	1,999	1.016x - 34.624	0.999
B64	SKC	224-PCXR3	508302	03/01/2023	1,000	1,500	2,000	997	1,492	1,989	0.992x + 6.226	1.000
B65	SKC	224-PCXR3	508310	03/01/2023	1,000	1,500	2,000	1,002	1,500	2,003	1.007x - 13.936	1.000
B66	SKC	224-PCXR3	509861	03/01/2023	1,000	1,500	2,000	1,002	1,491	1,991	0.987x + 14.183	1.000
B67	SKC	224-PCXR3	506295	04/01/2023	1,000	1,500	2,000	993	1,508	2,004	1.009x - 15.555	1.000
B68	SKC	224-PCXR3	505872	04/01/2023	1,000	1,500	2,000	1,002	1,490	1,997	0.995x + 3.841	1.000
B69	SKC	224-PCXR3	508375	04/01/2023	1,000	1,500	2,000	1,002	1,499	2,000	1.010x - 20.772	0.999
B70	SKC	224-PCXR3	510623	05/01/2023	1,000	1,500	2,000	992	1,503	1,997	1.002x - 5.855	1.000
B71	SKC	224-PCXR3	508367	05/01/2023	1,000	1,500	2,000	992	1,506	2,002	1.017x - 34.791	0.999
B72	SKC	224-PCXR3	505977	05/01/2023	1,000	1,500	2,000	1,001	1,498	1,993	0.991x + 8.962	1.000
B73	SKC	224-PCXR3	512606	05/01/2023	1,000	1,500	2,000	1,002	1,501	2,005	1.009x - 14.785	1.000
B74	SKC	224-PCXR3	505993	05/01/2023	1,000	1,500	2,000	996	1,495	1,994	1.000x - 6.916	1.000
B75	SKC	224-PCXR3	509820	04/01/2023	1,000	1,500	2,000	995	1,498	1,990	0.996x + 1.791	1.000
B76	SKC	224-PCXR3	509811	04/01/2023	1,000	1,500	2,000	993	1,498	1,998	1.006x - 14.322	1.000
B77	SKC	224-PCXR3	508301	04/01/2023	1,000	1,500	2,000	1,000	1,501	2,003	1.014x - 26.603	0.999
B78	SKC	224-PCXR3	510677	04/01/2023	1,000	1,500	2,000	995	1,503	1,999	1.013x - 28.158	0.999
B79	SKC	224-PCXR3	510920	03/01/2023	1,000	1,500	2,000	994	1,493	1,994	0.999x - 4.184	1.000

Calibrated by :

Approved by :



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

Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
H-R01	Dwyer	VFB-65	05/01/2023	500	1,000	2,000	503.3	992.4	1978.7	0.999x - 3.199	0.999
H-R02	Dwyer	VFB-65	04/01/2023	500	1,000	2,000	501.2	995.3	1985.7	1.002x - 5.186	1.000
H-R03	Dwyer	VFB-65	04/01/2023	500	1,000	2,000	501.7	987.7	1996.9	0.994x + 1.679	1.000
H-R04	Dwyer	VFB-65	04/01/2023	500	1,000	2,000	496.4	989.6	2019.5	1.008x - 13.614	1.000
H-R05	Dwyer	VFB-65	06/01/2023	500	1,000	2,000	497.2	987.7	1988.1	1.004x - 9.360	1.000
H-R06	Dwyer	VFB-65	06/01/2023	500	1,000	2,000	505.2	992.4	1979.8	0.999x - 2.816	0.999

Calibrated by :

Approved by :

ลำดับที่ 8

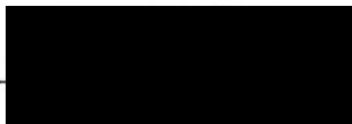
ระดับความร้อนในสถานประกอบการ



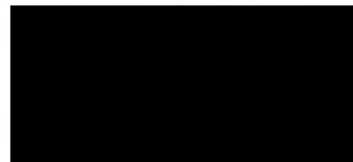
Heat B010_6/23

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: B12	Verification Date	: 18 January 2023
Brand	: 3M	Ambient Temp.	: 24.5 °C
Model	: QUESTemp ^o 32	Barometric Pressure	: 1011 mmbar
Serial No.	: TPA100010	Relative Humidity	: 49 %
Verification Module (Electronic Sensor Check) :			
Verification Module No. : <u>21</u> WB = <u>12.5</u> °C , DB = <u>47.1</u> °C , G = <u>69.3</u> °C			
Result of Verification : Without Adjustment			
Wet Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.6	-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 :



Approved by :



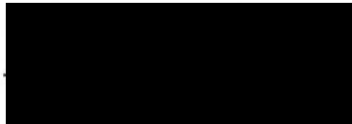


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S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72. Fax : (662) 513-4221. E-mail : sale@spscon.com.,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

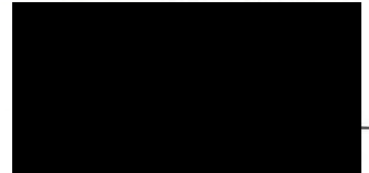
Heat B010_7/23

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: B30	Verification Date	: 18 January 2023
Brand	: 3M	Ambient Temp.	: 24.5 °C
Model	: QUESTemp ^o 32	Barometric Pressure	: 1011 mmbar
Serial No.	: TPH050057	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	69.3	0.0	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by :



Approved by :



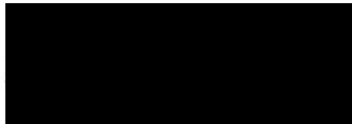


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S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
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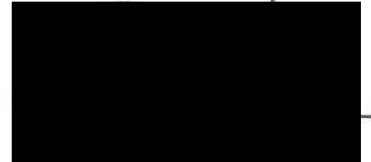
Heat B010_8/23

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: B31	Verification Date	: 18 January 2023
Brand	: 3M	Ambient Temp.	: 24.5 °C
Model	: QUESTemp ^o 32	Barometric Pressure	: 1011 mmbar
Serial No.	: TPH050047	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	69.3	0.0	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by :



Approved by :





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 B010_1/23

Heat Stress WBGT Meter Verification Report

Verification Data

Heat Stress WBGT Meter No.	: R09	Verification Date	: 18 January 2023
Brand	: 3M	Ambient Temp.	: 24.5 °C
Model	: QUESTemp ^o 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

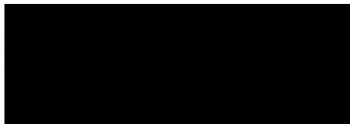
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.2	-0.1	± 0.5

Globe Probe Temperature Measurement

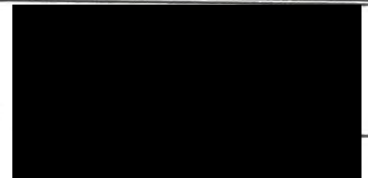
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.3	0.0	± 0.5

UUC* = UNIT UNDER CALIBRATION

Verified by :



Approved by :



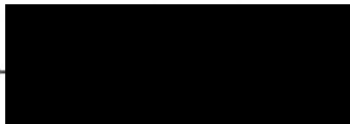


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S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
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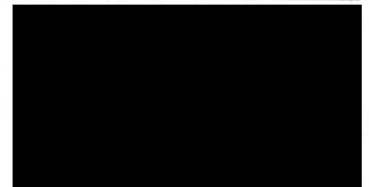
Heat B010_2/23

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: R11	Verification Date	: 18 January 2023
Brand	: 3M	Ambient Temp.	: 24.5 °C
Model	: QUESTemp ^{OTM} 32	Barometric Pressure	: 1011 mmbar
Serial No.	: TPM010103	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	12.6	-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	69.3	0.0	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by :



Approved by :





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 B010_3/23

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: R14	Verification Date	: 18 January 2023
Brand	: 3M	Ambient Temp.	: 24.5 °C
Model	: QUESTemp ^o 46	Barometric Pressure	: 1011 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	69.2	0.1	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by :



Approved by :





บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด

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

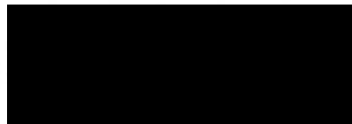
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900

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

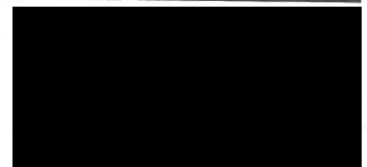
Heat B010_4/23

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: R15	Verification Date	: 18 January 2023
Brand	: 3M	Ambient Temp.	: 24.5 °C
Model	: QUESTemp ^o 46	Barometric Pressure	: 1011 mmbar
Serial No.	: TSIO10006	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	69.4	-0.1	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by :



Approved by :





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 B010_5/23

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: R16	Verification Date	: 18 January 2023
Brand	: 3M	Ambient Temp.	: 24.5 °C
Model	: QUESTemp ^o 46	Barometric Pressure	: 1011 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	12.4	0.1	± 0.5
Dry Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	46.9	0.2	± 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 :



Approved by :

