

ภาคผนวกที่ 4

เอกสารสอบเทียบความถูกต้องของเครื่องมือ

ตรวจวัดคุณภาพสิ่งแวดล้อม

**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม**

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
1. คุณภาพอากาศจากปล่องระบาย		
Total Suspended Particulate	Console No. R01, R05 Pitot Tube No. B24, B38	Digital Balance
Oxides of Nitrogen	Vacuum Gauge	Spectrophotometer
Carbon Monoxide	Personal Pump SKC No. R10, R14, R33 Rotameter No. H-R03, R04	CO Analyzer No. R01
Sulfur Dioxide	Personal Pump SKC No. R10, R33 Rotameter No. H- R03, R04	-
Copper	Console No. R01, R05 Pitot Tube No. B24, B38	ICP
2. คุณภาพอากาศในบรรยากาศ		
Total Suspended Particulate (TSP)	High Volume Air Sampler No. R01, R04, R05, R15	Digital Balance
Particulate Matter less than 10 microns (PM-10)	High Volume PM-10 Air Sampler No. R02, R06, R08, R09	Digital Balance
Copper	High Volume Air Sampler No. R01, R04, R05, R15	ICP
Carbon Monoxide	CO Analyzer No. B05, B06, R01, R02	CO Analyzer No. B05, B06, R01, R02
Nitrogen Dioxide (NO ₂)	NO ₂ Analyzer No. B06, B08, B09, B13	NO ₂ Analyzer No. B06, B08, B09, B13
3. คุณภาพน้ำใต้ดิน		
pH	-	pH Meter
Conductivity	-	Conductivity Meter
Total Dissolved Solids	-	Digital Balance
Total Suspended Solids	-	Digital Balance
Nitrate Nitrogen	-	Spectrophotometer
Total Coliform Bacteria	-	Incubator Water Bath
Fecal Coliform Bacteria	-	Incubator Water Bath
Calcium	-	ICP
Magnesium	-	ICP
Total Iron	-	ICP
Manganese	-	ICP
Aluminium	-	ICP
Lead	-	ICP
Mercury	-	AAS
Nickel	-	ICP
Copper	-	ICP
Arsenic	-	AAS

**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม (ต่อ)**

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
4. ระดับเสียงในบรรยากาศ L_{eq} 24 hr, L_{90} , L_{max} และระดับเสียงรบกวน	Acoustic Calibrator Sound Level Meter : ACO-R12, R29, R32, R51, R52	-
5. ระดับเสียงในสถานประกอบการ L_{eq} 8 hr และ L_{max}	Acoustic Calibrator Sound Level Meter : ACO-R40, R41, R50, R51 Sound Level Meter : NMD-B04, B05, B16, B17,	-
TWA	Acoustic Calibrator Sound Level Meter : NMD-B01, B08, B09, B10, B11, B16, B17, B18, B19, B20	-
6. คุณภาพอากาศในสถานประกอบการ Copper Dust	Personal Pump SKC No. B31, B57, B58, B71, B77, R35 Rotameter No. H-R02	ICP
Copper Fume	Personal Pump SKC No. B31, B57, B58, B71, B77, R35 Rotameter No. H-R02	ICP
CO	Personal Pump SKC No. B05, B13, B65, R20, R33, R35 Rotameter No. L-R02	CO Analyzer No. R01
7. ระดับความร้อน WBGT	Digital Thermometer Heat Stress WBGT Meter No. R05, R07, R08	-

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	02/03/2022	0.998	50.11
B02	8002514	02/03/2022	0.996	49.25
B03	1503016	03/03/2022	0.998	50.20
B04	00006659	03/03/2022	1.005	49.64
B05	00007428	03/03/2022	1.002	49.80
R01	1561	02/03/2022	1.003	50.18
R02	8002513	03/03/2022	0.999	49.38
R03	1570	04/03/2022	1.003	49.14
R04	8002519	04/03/2022	0.999	49.52
R05	1503015	01/03/2022	1.007	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)



Calibration Method

Standard Pitot Tube

Remark : Accept value of C_p (test) is $0.84 + 0.01$



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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	03/05/2022	0.83	0.84
B37	S	0.99	05/05/2022	0.84	0.84
B38	S	0.99	05/05/2022	0.85	0.84
B39	S	0.99	03/05/2022	0.85	0.84
B40	S	0.99	06/05/2022	0.84	0.83
B41	S	0.99	03/05/2022	0.85	0.84
B44	S	0.99	03/05/2022	0.83	0.84
B45	S	0.99	06/05/2022	0.84	0.84
B46	S	0.99	03/05/2022	0.83	0.84
B47	S	0.99	06/05/2022	0.84	0.84
B48	S	0.99	03/05/2022	0.83	0.84
B49	S	0.99	03/05/2022	0.84	0.85
B54	S	0.99	02/05/2022	0.84	0.85
B56	S	0.99	02/05/2022	0.85	0.84
B57	S	0.99	04/05/2022	0.84	0.84
B58	S	0.99	04/05/2022	0.84	0.83

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



Certificate of Calibration

Certificate No. : 64-220066-1

Page : 1 of 2

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

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

Equipment : Vacuum Gauge

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

ID No. : 1/60

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

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

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

Date of Received : 02 July 2021

Date of Calibration : 05 July 2021

Date of Issue : 05 July 2021

Calibrated by : Satja Sangkhum

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

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

Pressure Calibrator & Pressure Sensors Modules

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

Approved by :



The Uncertainties are for a confidence probability of approximately 95%

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



Certificate of Calibration

Certificate No. : 64-220066-1

Page : 2 of 2

Result of Calibration : Without Adjustment

Function : Vacuum measurement

Condition of calibration :

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

Standard Reading (in Hg)	UUC Reading (in Hg)	Correction (in Hg)
0.00	0	0.0
-4.69	-5	0.3
-9.57	-10	0.4
-14.67	-15	0.3
-19.71	-20	0.3
-29.93	-30	0.1
-29.92	-30	0.1
-19.69	-20	0.3
-14.69	-15	0.3
-9.58	-10	0.4
-4.69	-5	0.3
0.00	0	0.0

Remark

UUC : Unit Under Calibration

The uncertainty is combined hysteresis

The uncertainty of measurement was with in ± 0.39 in Hg

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

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

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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	R²
R01	SKC	224-PCXR4	602467	04/04/2022	1,000	1,500	2,000	993	1,508	2,004	1.020x - 38.784	0.999
R02	SKC	224-PCXR4	626450	04/04/2022	1,000	2,000	3,000	999	1,499	1,990	0.989x + 12.627	1.000
R03	SKC	224-PCXR4	691592	04/04/2022	1,000	1,500	2,000	1,003	1,500	2,004	1.012x - 22.479	0.999
R04	SKC	224-PCXR4	691672	01/04/2022	1,000	1,500	2,000	996	1,493	1,993	0.998x - 2.561	1.000
R05	SKC	224-PCXR4	798470	01/04/2022	1,000	1,500	2,000	994	1,506	1,999	1.015x - 30.635	0.999
R06	SKC	224-PCXR4	798456	04/04/2022	1,000	1,500	2,000	994	1,498	1,994	1.002x - 7.438	1.000
R07	SKC	224-PCXR4	798480	04/04/2022	1,000	1,500	2,000	994	1,490	2,000	1.008x - 16.831	1.000
R08	SKC	224-PCXR4	883215	01/04/2022	1,000	1,500	2,000	1,001	1,502	2,005	1.015x - 26.627	0.999
R09	SKC	224-PCXR4	034650	01/04/2022	1,000	1,500	2,000	991	1,504	2,002	1.018x - 36.538	0.999
R10	SKC	224-PCXR4	091765	01/04/2022	1,000	1,500	2,000	996	1,512	1,993	1.000x + 0.219	1.000
R11	SKC	224-PCXR4	091763	12/04/2022	1,000	1,500	2,000	1,001	1,499	2,002	1.012x - 23.923	0.999
R12	SKC	224-PCXR4	091568	12/04/2022	1,000	1,500	2,000	997	1,501	1,999	1.001x - 4.986	1.000
R13	SKC	224-PCXR4	091638	04/04/2022	1,000	1,500	2,000	1,002	1,498	1,993	0.991x + 10.793	1.000
R14	SKC	224-PCXR4	091764	04/04/2022	1,000	1,500	2,000	994	1,502	1,998	1.013x - 29.256	0.999
R15	SKC	224-PCXR8	529457	01/04/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.013x - 24.345	0.999
R16	SKC	224-PCXR8	529643	04/04/2022	1,000	1,500	2,000	998	1,497	1,994	0.997x + 0.060	1.000
R17	SKC	224-PCXR8	529645	04/04/2022	1,000	1,500	2,000	994	1,509	2,000	1.015x - 30.571	0.999
R18	SKC	224-PCXR8	566756	04/04/2022	1,000	1,500	2,000	991	1,496	1,998	1.002x - 7.678	1.000
R19	SKC	224-PCXR8	566802	01/04/2022	1,000	1,500	2,000	1,003	1,499	2,000	1.010x - 20.189	0.999
R20	SKC	224-PCXR8	529089	04/04/2022	1,000	1,500	2,000	990	1,501	2,003	1.020x - 40.036	0.999
R21	SKC	224-PCXR8	665728	01/04/2022	1,000	1,500	2,000	999	1,493	1,999	1.000x - 5.364	1.000
R22	SKC	224-PCXR8	707444	04/04/2022	1,000	1,500	2,000	1,002	1,500	2,001	1.011x - 21.215	0.999
R23	SKC	224-PCXR8	761067	11/04/2022	1,000	1,500	2,000	998	1,494	1,992	0.994x + 3.095	1.000
R24	SKC	224-PCXR8	707893	01/04/2022	1,000	1,500	2,000	996	1,505	2,001	1.014x - 29.040	0.999
R25	SKC	224-PCXR8	761052	01/04/2022	1,000	1,500	2,000	998	1,500	1,992	0.992x + 7.630	1.000
R26	SKC	224-PCXR8	707956	12/04/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.013x - 24.417	0.999
R27	SKC	224-PCXR8	707398	04/04/2022	1,000	1,500	2,000	996	1,503	2,001	1.013x - 28.725	0.999
R28	SKC	224-PCXR8	707481	11/04/2022	1,000	1,500	2,000	1,004	1,500	2,003	1.010x - 19.368	0.999
R29	SKC	224-PCXR8	707402	01/04/2022	1,000	1,500	2,000	1,005	1,491	1,991	0.988x + 14.326	1.000
R30	SKC	224-PCXR8	093811	01/04/2022	1,000	1,500	2,000	998	1,495	1,994	0.998x - 1.268	1.000
R31	SKC	224-PCXR8	093183	01/04/2022	1,000	1,500	2,000	1,001	1,501	2,001	1.012x - 23.001	0.999
R32	SKC	224-PCXR8	671950	04/04/2022	1,000	1,500	2,000	1,000	1,498	1,994	0.994x + 7.762	1.000
R33	SKC	224-PCXR4	626254	12/04/2022	1,000	1,500	2,000	992	1,502	1,999	1.016x - 34.141	0.999
R34	SKC	224-PCXR4	626131	01/04/2022	1,000	1,500	2,000	1,002	1,498	2,004	1.012x - 24.294	0.999
R35	SKC	224-PCXR8	707460	04/04/2022	1,000	1,500	2,000	998	1,498	1,995	0.994x + 5.672	1.000
R36	SKC	224-PCXR8	707446	01/04/2022	1,000	1,500	2,000	1,003	1,500	2,001	1.010x - 19.192	0.999
R37	SKC	224-PCXR8	707432	01/04/2022	1,000	1,500	2,000	999	1,499	1,998	0.999x + 0.554	1.000
R38	SKC	224-PCXR8	707349	01/04/2022	1,000	1,500	2,000	996	1,500	2,002	1.015x - 31.640	0.999
R39	SKC	224-PCXR8	761095	12/04/2022	1,000	1,500	2,000	1,001	1,496	1,994	0.997x + 2.652	1.000



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Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R²
H-R01	Dwyer	VFB-65	04/04/2022	500	1,000	2,000	503.1	992.4	1979.1	0.999x + 3.360	0.999
H-R02	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	500.8	995.3	1986.1	1.002x + 5.536	1.000
H-R03	Dwyer	VFB-65	04/04/2022	500	1,000	2,000	502.1	987.7	1997.3	0.994x + 1.910	1.000
H-R04	Dwyer	VFB-65	04/04/2022	500	1,000	2,000	496.4	989.6	2019.5	1.009x - 13.763	1.000
H-R05	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	496.8	987.7	1987.7	1.004x - 9.632	1.000
H-R06	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	505.2	992.4	1979.4	0.999x + 2.749	0.999

**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 : 22M2567

REFERENCE No : 64386-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : METTLER TOLEDO

MODEL : XS 105DU

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 :**CALIBRATION DATE** :**APPROVED BY** :**ISSUED DATE** : 17-Mar-22**RECEIVED DATE** : 11-Mar-22

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



CERTIFICATE No : 22M2567

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS 105DU
MANUFACTURER : METTLER TOLEDO S/N : 1126422905
ID No : BA 05/50 RECEIVED DATE : 11-Mar-22
AIR PRESSURE : 1008mbar \pm 1mbar CALIBRATION DATE : 11-Mar-22
AMBIENT TEMPERATURE : 22° 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	C02210415	09-Feb-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 CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

2. TARE FUNCTION : NORMAL

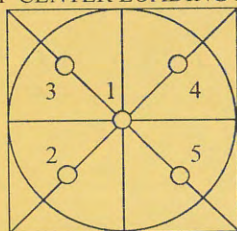
3. REPEATABILITY OF READING AT 20 g WAS 0.000004 g

4. REPEATABILITY OF READING AT 100 g WAS 0.000048 g

5. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.00000	0.00000	0.000058
0.02	0.01999	0.00001	0.000058
0.10	0.09999	0.00001	0.000059
0.20	0.19999	0.00001	0.000059
0.50	0.50001	-0.00001	0.000058
1.00	1.00001	-0.00001	0.000059
2.00	2.00000	0.00000	0.000059
5.00	5.00001	-0.00001	0.000061
10.00	10.00005	-0.00005	0.000063
20.00	20.00006	-0.00006	0.000069
50.00	50.00000	0.00000	0.000111
100.00	100.00001	-0.00001	0.00019
120.00	120.00001	-0.00001	0.00022

6. OFF CENTER LOADING ERROR



POINT	READING (g)	
1	10.00001	50.0000
2	10.00002	50.0000
3	10.00001	50.0000
4	10.00001	50.0000
5	10.00002	50.0001
OFF-CENTER LOADING	0.00001	0.0001


NOTE: THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT PRODUCTION AREA

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

END OF CALIBRATION REPORT

Lambda UV Preventive Maintenance (PM)

Company Name:	S.P.S. CONSULTING SERVICE CO., LTD.		
Address:	7, Soi Phaholyothin24, Ladyao, Jatujak, Bangkok		
User Name:	K. Benjawan	WO Number:	WO-01550999
Telephone Number:	086-141-2523	PM Number:	6 of 6 P
Customer Support Engineer:	K. Anon	Certificate Number:	UV2004-2022
Date PM Performed: (DD-MMM-YYYY)	25-Jan-2022	Next PM Due Date: (DD-MMM-YYYY)	25-Jul-2022

Part Number	Release	Publication Date	
09370504	B	March 2013	

Scope

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

General Instructions:

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

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Component List

Component Specific Model	Serial #	Software Version		Configuration Notes
Lambda 25	501S14123010	6.2.0.0741	STD	1.27
NA	NA	NA	NA	NA

Parts Lists

Parts Included with the PM				
Part Number (if applicable)	Description	Quantity	Serial Number	Expiration Date (MM/YY)
B250 0099	Stray Light standard			
	Nal cell	1	1943	Jan-22
	NaNO2 cell	1	2963	
	KCl cell	1	31030	
	H2O	1	71497	
B050 7805	Secondary Standards for calibration of wavelength and photometric accuracy or use NBS/NIST 390 standards			
	Gray Glass G1	1	2926	Jan-22
	Gray Glass G2	1	3501	
	Gray Glass G3	1	2552	
	Holmium Glass	1	1085	

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

Procedure Checklist

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

1. General:

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

2. Optical checks:

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

3. Mechanical:

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

4. Test:

Refer to Appendix A for the specifications of the instrument being tested.

- ☒ D2 Wavelength accuracy

	Actual Value	Specification
Accuracy at 656.1 nm	656.16	± 0.1

☒ Holmium Oxide wavelength accuracy

Filter ID #		1085		
Test	Calibration Value	Actual Value	Deviation	Specification
279.3 nm	279.3	279.39	-0.09	± 0.5
360.8 nm	360.9	360.93	-0.03	± 0.5
459.9 nm	460.0	460.07	-0.07	± 0.5
536.4 nm	536.2	536.40	-0.20	± 0.5

☒ Scattered Light.

Test	Filter ID #	Result	Specification
NaI @ 220 nm	1943	0.0133	< 0.02 %T
NaNO ₂ @ 340 nm	2963	-0.1296	< 0.02 %T
NaNO ₂ @ 370 nm	2963	-0.0002	< 0.02 %T
KCl @ 200 nm	31030	2.4808	≥ 2 A

☒ Baseline Flatness.

Corrected Baseline	Specification
0.000163	± 0.001 A

☒ Noise Test @ 500 nm.

Actual Value	Specification
0.0000240	± 0.00008 A

☒ Photometric Accuracy.

Filter 1 ID #		2926		
Test	Calibrated Value	Actual Value	Deviation	Specification
440 nm	0.3483	0.3493	-0.0010	± 0.006 A
546 nm	0.3029	0.3046	-0.0017	± 0.006 A
635 nm	0.3200	0.3232	-0.0032	± 0.006 A
Filter 2 ID #		3501		
Test	Calibrated Value	Actual Value	Deviation	Specification
440 nm	1.001	1.0024	-0.0014	± 0.006 A
546 nm	0.9797	0.9813	-0.0016	± 0.006 A
635 nm	1.0285	1.0325	-0.0040	± 0.006 A
Filter 3 ID #		2552		
Test	Calibrated Value	Actual Value	Deviation	Specification
440 nm	0.489	0.4935	-0.0045	± 0.006 A
546 nm	0.4582	0.4595	-0.0013	± 0.006 A
635 nm	0.5046	0.5075	-0.0029	± 0.006 A

5. Accessory (where applicable):

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

6. Review:

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

Additional Comments

Additional Comments Regarding the PM

Review

<p><i>The preventive maintenance checks and if applicable performance tests for Lambda UV have been completed.</i></p>	
<p>This Lambda UV Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> <i>the preventive maintenance.</i></p>	
<p>Review of Preventive Maintenance:</p>	
<p>Authorized PerkinElmer Representative:</p> <div style="background-color: #cccccc; height: 30px; width: 100%;"></div>	<p>Date:</p> <p>25-Jan-2022 (DD-MM-YYYY)</p>
<p>Authorized Customer Representative:</p>	<p>Date:</p> <p>25-Jan-2022 (DD-MM-YYYY)</p>



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

Calibration Report				
Non-Dispersive Infrared CO Analyzer				
Date :	04 May 2022	Brand :	API	Model :
No.	CO-R01			Serial No.
				704
Calibrator (Dilution System)				
Brand	: API	Model	: 700	
Last Cal. Date	: 20 September 2021	Serial No.	: 421	
Reference Standard Gas				
Standard Gas	: Carbon Monoxide (CO)		Cylinder No.	: D196045
Certified Date	: 16 April 2022	Expired Date	: 15 April 2024	Cylinder Conc.
				: 4,570 ppm
Calibrating Condition				
Pressure	1011	mmbar	Temp.	24.5 °C
			% RH	48
Calibration Setting				
Span	Initial Reading (Before Adj.), PPM			Final Reading (After Adj.), PPM
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero	0	-0.10	-	0
CO Span	40.00	40.08	0.200	40.00
API Model 300E CO Analyzer Check List				
Parameter	Observed Value	Units	Nominal Range	
Range	50	PPM	0-1000 ppm	
Stability	0.10	PPM	< 1 ppm With Zero Air	
CO Measure	4014.1	mV	2500-4800 mV	
CO Reference	3947.6	mV	2500-4800 mV	
Measure/Reference Ratio	1.180	-	1.1-1.3 W/Zero Air	
Sample Pressure	28.7	In-Hg-A	~2" < Ambient Absolute Pressure	
Sample Flow	805	CC/Min	800 ± 10%	
Sample Temperature	48.3	°C	48 ± 4	
Bench Temperature	48.2	°C	48 ± 2	
Wheel Temperature	68.4	°C	68 ± 2	
Box Temperature	30.8	°C	Ambient Temp + 7 ± 10	
Photo-Drive	3026.1	mV	250 mV to 4750 mV	
Slope	1.017	-	1.0 ± 0.3	
Offset	0.2	-	0 ± 0.3	



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

Customer : <u>S.P.S.Consulting Service Co.,Ltd</u>	Date Tested: <u>January 12, 2022</u>	
	Recommendation Recertification	
Address : <u>7 Soi Phaholyothin 24</u>	Period <u>6</u> Months	
<u>Paholyothin Road</u>	Recertification Due: <u>July 12, 2022</u>	
<u>Jompol Chatuchak, Bangkok 1090</u>	Date Last Certified: <u>July 14, 2021</u>	
User Name: <u>K.Phenpha Viphasathawat</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>August 30, 2022</u>
<u>Wavecal Solution</u>	<u>N058-2152</u>	<u>January 30, 2022</u>
<u>VIS Wavecal solution</u>	<u>N930-2946</u>	<u>June 30, 2022</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>August 30, 2022</u>
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C8011701
DATE TESTED January 12, 2022
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 : 077C8011701			DATE TESTED : January 12, 2022		
PARAMETER	SPECIFICATION			FINAL VALUE	
Spectral Resolution : UV	As	193.696 nm	≤ 0.007	0.00554	
	Ni	231.604 nm	≤ 0.008	0.00725	
	Ni	341.476 nm	≤ 0.012	0.00752	
Spectral Resolution : VIS	La	408.672 nm	≤ 0.020	0.01616	
	Ba	455.403 nm	≤ 0.025	0.02416	
Precision					
	As	193.656 nm	% RSD < 1.0	0.34	%
	Zn	213.856 nm	% RSD < 1.0	0.27	%
	Mn	257.610 nm	% RSD < 1.0	0.41	%
	La	379.478 nm	% RSD < 1.0	0.57	%
	Ba	455.403 nm	% RSD < 1.0	0.33	%
	Ba	493.408 nm	% RSD < 1.0	0.26	%
Detection Limits : Axial	Tl	190.080 nm	3(sd)	5.51	ppb
	As	193.696 nm	3(sd)	8.59	ppb
	Pb	220.353 nm	3(sd)	0.50	ppb
Detection Limits : Radial	As	193.696 nm	3(sd)	21.00	ppb
	Zn	213.856 nm	3(sd)	0.32	ppb
	Mn	257.610 nm	3(sd)	0.18	ppb
	La	379.478 nm	3(sd)	0.44	ppb
	Ba	455.403 nm	3(sd)	0.17	ppb
	Ba	493.408 nm	3(sd)	0.12	ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd	226.502 nm	≤ 150 ppb	12.46	
BEC : Radial (IB X 1000)/(IS-IB)	Mn	257.610 nm	≤ 45 ppb	30.82	



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C8011701**DATE TESTED** January 12, 2022**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:

Service Engineer

คุณภาพอากาศในบรรยากาศ



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

High Volume Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3095

Calibration Data

High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
B35	B35	02/05/2022	$y = 1.345x - 12.323$	0.999
B36	B36	03/05/2022	$y = 1.154x - 4.565$	0.999
B37	B37	04/05/2022	$y = 1.139x - 2.122$	0.996
B38	B38	06/05/2022	$y = 1.126x - 2.401$	0.999
B39	B39	02/05/2022	$y = 1.188x - 5.455$	0.998
B40	B40	06/05/2022	$y = 1.156x - 3.823$	0.995
B41	B41	06/05/2022	$y = 1.187x - 6.052$	0.997
B42	B42	04/05/2022	$y = 1.063x + 0.537$	0.998
B43	B43	04/05/2022	$y = 1.258x - 9.645$	0.998
B44	B44	03/05/2022	$y = 1.252x - 9.964$	0.999
R01	R01	02/05/2022	$y = 1.220x - 6.992$	0.999
R02	R02	10/05/2022	$y = 1.121x - 3.616$	0.997
R03	R03	02/05/2022	$y = 1.161x - 5.046$	0.999
R04	R04	06/05/2022	$y = 1.115x - 1.773$	0.999
R05	R05	06/05/2022	$y = 1.217x - 7.663$	0.998
R06	R06	04/05/2022	$y = 1.245x - 8.155$	0.996
R07	R07	06/05/2022	$y = 1.042x + 1.155$	0.995
R08	R08	04/05/2022	$y = 1.220x - 6.674$	0.998
R09	R09	04/05/2022	$y = 1.192x - 5.710$	0.997
R10	R10	10/05/2022	$y = 1.209x - 6.199$	0.999
R11	R11	02/05/2022	$y = 1.101x - 2.414$	0.999
R12	R12	10/05/2022	$y = 1.209x - 6.618$	0.995
R13	R13	10/05/2022	$y = 1.158x - 3.923$	0.999
R14	R14	06/05/2022	$y = 1.128x - 2.065$	0.999
R15	R15	04/05/2022	$y = 1.014x + 2.496$	0.998
R16	R16	04/05/2022	$y = 1.159x - 5.442$	0.997
R17	R17	10/05/2022	$y = 1.203x - 5.717$	0.999
R18	R18	02/05/2022	$y = 1.325x - 12.252$	0.997
R19	R19	03/05/2022	$y = 1.246x - 7.147$	0.998
R20	R20	04/05/2022	$y = 1.230x - 7.354$	0.999



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High Volume PM-10 Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3095

Calibration Data

High Volume PM-10 Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
R01	R01	06/05/2022	y = 1.220x-6.822	0.999
R02	R02	16/05/2022	y = 1.196x-6.112	0.998
R03	R03	04/05/2022	y = 1.172x-3.836	1.000
R04	R04	06/05/2022	y = 1.094x-1.025	0.998
R05	R05	06/05/2022	y = 1.118x-2.214	0.999
R06	R06	03/05/2022	y = 1.327x-9.050	0.999
R07	R07	10/05/2022	y = 1.123x-1.146	0.998
R08	R08	06/05/2022	y = 1.178x-4.322	0.998
R09	R09	06/05/2022	y = 1.182x-5.965	0.998
R10	R10	10/05/2022	y = 1.131x-2.385	0.997
R11	R11	03/05/2022	y = 1.275x-7.441	0.999
R12	R12	10/05/2022	y = 1.173x-4.483	0.997
R13	R13	10/05/2022	y = 1.230x-5.394	1.000
R14	R14	03/05/2022	y = 1.157x-2.812	0.998
R15	R15	03/05/2022	y = 1.242x-7.800	0.997
R16	R16	02/05/2022	y = 1.240x-6.268	0.999
R17	R17	10/05/2022	y = 1.183x-4.691	0.995
R18	R18	04/05/2022	y = 1.166x-3.714	0.999
R19	R19	04/05/2022	y = 1.239x-7.405	0.998
R20	R20	03/05/2022	y = 1.145x-4.137	0.999



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Calibration Report					
Non-Dispersive Infrared CO Analyzer					
Date :	02 May 2022	Brand :	API	Model :	300E
No.	CO-B05			Serial No.	3116
Calibrator (Dilution System)					
Brand : API			Model : 700		
Last Cal. Date : 20 September 2021			Serial No. : 421		
Reference Standard Gas					
Standard Gas : Carbon Monoxide (CO)			Cylinder No. : D196045		
Certified Date : 16 April 2022		Expired Date : 15 April 2024		Cylinder Conc. : 4,570 ppm	
Calibrating Condition					
Pressure	1011	mmbar	Temp.	24.5	°C
				% RH	48
Calibration Setting					
Span	Initial Reading (Before Adj.), PPM			Final Reading (After Adj.), PPM	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	
Zero	0	0.10	-	0	
CO Span	40.00	40.05	0.125	40.00	
API Model 300E CO Analyzer Check List					
Parameter	Observed Value	Units	Nominal Range		
Range	50	PPM	0-1000 ppm		
Stability	0.10	PPM	< 1 ppm With Zero Air		
CO Measure	4013.8	mV	2500-4800 mV		
CO Reference	3946.1	mV	2500-4800 mV		
Measure/Reference Ratio	1.180	-	1.1-1.3 W/Zero Air		
Sample Pressure	28.7	In-Hg-A	~2" < Ambient Absolute Pressure		
Sample Flow	804	CC/Min	800 ± 10%		
Sample Temperature	48.3	°C	48 ± 4		
Bench Temperature	48.1	°C	48 ± 2		
Wheel Temperature	68.3	°C	68 ± 2		
Box Temperature	30.8	°C	Ambient Temp + 7 ± 10		
Photo-Drive	3024.8	mV	250 mV to 4750 mV		
Slope	1.017	-	1.0 ± 0.3		
Offset	0.2	-	0 ± 0.3		



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

Calibration Report					
Non-Dispersive Infrared CO Analyzer					
Date :	02 May 2022	Brand :	API	Model :	300E
No.	CO-B06			Serial No.	3117
Calibrator (Dilution System)					
Brand : API			Model : 700		
Last Cal. Date : 20 September 2021			Serial No. : 421		
Reference Standard Gas					
Standard Gas : Carbon Monoxide (CO)			Cylinder No. : D196045		
Certified Date : 16 April 2022		Expired Date : 15 April 2024		Cylinder Conc. : 4,570 ppm	
Calibrating Condition					
Pressure	1011	mmbar	Temp.	24.5	°C
				% RH	48
Calibration Setting					
Span	Initial Reading (Before Adj.), PPM			Final Reading (After Adj.), PPM	
Set Point	Expected Concentration	Analyzer Response		%Dif	
Zero	0	-0.10		-	
CO Span	40.00	39.95		-0.125	
API Model 300E CO Analyzer Check List					
Parameter	Observed Value	Units	Nominal Range		
Range	50	PPM	0-1000 ppm		
Stability	0.10	PPM	< 1 ppm With Zero Air		
CO Measure	4015.1	mV	2500-4800 mV		
CO Reference	3947.6	mV	2500-4800 mV		
Measure/Reference Ratio	1.180	-	1.1-1.3 W/Zero Air		
Sample Pressure	28.6	In-Hg-A	~2" < Ambient Absolute Pressure		
Sample Flow	805	CC/Min	800 ± 10%		
Sample Temperature	48.3	°C	48 ± 4		
Bench Temperature	48.2	°C	48 ± 2		
Wheel Temperature	68.5	°C	68 ± 2		
Box Temperature	30.9	°C	Ambient Temp + 7 ± 10		
Photo-Drive	3029.1	mV	250 mV to 4750 mV		
Slope	1.017	-	1.0 ± 0.3		
Offset	0.2	-	0 ± 0.3		



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Calibration Report					
Non-Dispersive Infrared CO Analyzer					
Date :	04 May 2022	Brand :	API	Model :	300E
No.	CO-R01			Serial No.	704
Calibrator (Dilution System)					
Brand : API			Model : 700		
Last Cal. Date : 20 September 2021			Serial No. : 421		
Reference Standard Gas					
Standard Gas : Carbon Monoxide (CO)			Cylinder No. : D196045		
Certified Date : 16 April 2022		Expired Date : 15 April 2024		Cylinder Conc. : 4,570 ppm	
Calibrating Condition					
Pressure	1011	mmbar	Temp.	24.5	°C
			% RH	48	
Calibration Setting					
Span	Initial Reading (Before Adj.), PPM			Final Reading (After Adj.), PPM	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	
Zero	0	-0.10	-	0	
CO Span	40.00	40.08	0.200	40.00	
API Model 300E CO Analyzer Check List					
Parameter	Observed Value	Units	Nominal Range		
Range	50	PPM	0-1000 ppm		
Stability	0.10	PPM	< 1 ppm With Zero Air		
CO Measure	4014.1	mV	2500-4800 mV		
CO Reference	3947.6	mV	2500-4800 mV		
Measure/Reference Ratio	1.180	-	1.1-1.3 W/Zero Air		
Sample Pressure	28.7	In-Hg-A	~2" < Ambient Absolute Pressure		
Sample Flow	805	CC/Min	800 ± 10%		
Sample Temperature	48.3	°C	48 ± 4		
Bench Temperature	48.2	°C	48 ± 2		
Wheel Temperature	68.4	°C	68 ± 2		
Box Temperature	30.8	°C	Ambient Temp + 7 ± 10		
Photo-Drive	3026.1	mV	250 mV to 4750 mV		
Slope	1.017	-	1.0 ± 0.3		
Offset	0.2	-	0 ± 0.3		



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Calibration Report					
Non-Dispersive Infrared CO Analyzer					
Date :	04 May 2022	Brand :	API	Model :	300E
No.	CO-R02			Serial No.	171-S
Calibrator (Dilution System)					
Brand : API			Model : 700		
Last Cal. Date : 20 September 2021			Serial No. : 421		
Reference Standard Gas					
Standard Gas : Carbon Monoxide (CO)			Cylinder No. : D196045		
Certified Date : 16 April 2022		Expired Date : 15 April 2024		Cylinder Conc. : 4,570 ppm	
Calibrating Condition					
Pressure	1011	mmbar	Temp.	24.5	°C
				% RH	48
Calibration Setting					
Span	Initial Reading (Before Adj.), PPM			Final Reading (After Adj.), PPM	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	
Zero	0	0.10	-	0	
CO Span	40.00	39.96	-0.100	40.00	
API Model 300E CO Analyzer Check List					
Parameter	Observed Value	Units	Nominal Range		
Range	50	PPM	0-1000 ppm		
Stability	0.10	PPM	< 1 ppm With Zero Air		
CO Measure	4014.5	mV	2500-4800 mV		
CO Reference	3948.7	mV	2500-4800 mV		
Measure/Reference Ratio	1.179	-	1.1-1.3 W/Zero Air		
Sample Pressure	28.5	In-Hg-A	~2" < Ambient Absolute Pressure		
Sample Flow	813	CC/Min	800 ± 10%		
Sample Temperature	48.4	°C	48 ± 4		
Bench Temperature	48.1	°C	48 ± 2		
Wheel Temperature	68.3	°C	68 ± 2		
Box Temperature	30.8	°C	Ambient Temp + 7 ± 10		
Photo-Drive	3031.1	mV	250 mV to 4750 mV		
Slope	1.017	-	1.0 ± 0.3		
Offset	0.2	-	0 ± 0.3		



CALIBRATION REPORT

CHEMILUMINESCENT NO / NO₂ / NO_x ANALYZER

DATE : 15 May 2022

BRAND : API

MODEL : 200E

NO. NOX-B06

SERIAL NO. 2286

Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 05 August 2021

Serial No. : 911

Reference Standard Gas

Standard Gas : Nitric Oxide (NO)

Cylinder No. : A00681SK

Certified Date : 24 August 2020

Expired Date : 24 August 2022

Cylinder Conc. : 51.0 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	-
NO Span	400	399.7	-0.075	400.0	1.005
NO _x Span	400	400.1	0.025	400.0	1.009

API Model 200E NO_x Analyzer Check List

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	500 standard
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air
SAMPLE FLOW	511	cc/min	500 ± 50
OZONE FLOW	79	cc/min	80 ± 15
PMT	103.2	mV	-20 - 150
AZERO	94.0	mV	-20 - 150
HVPS	673	V	420 - 900 constant
RCELL TEMP	50.0	°C	50 ± 1
BOX TEMP	28.8	°C	8 - 48
PMT TEMP	7.2	°C	7 ± 2
MOLY TEMP	314.8	°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	1.005	-	1.0 ± 0.3
NO _x Slope	1.009	-	1.0 ± 0.3
NO Offset	1.1	mV	-20 to +150
NO _x Offset	0.6	mV	-20 to 150
Stability at Zero	0.1	PPB	< 0.2
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas



CALIBRATION REPORT

CHEMILUMINESCENT NO / NO₂ / NO_x ANALYZER

DATE : 15 May 2022

BRAND : API

MODEL : 200E

NO. NOX-B08

SERIAL NO. 4336

Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 05 August 2021

Serial No. : 911

Reference Standard Gas

Standard Gas : Nitric Oxide (NO)

Cylinder No. : A00681SK

Certified Date : 24 August 2020

Expired Date : 24 August 2022

Cylinder Conc. : 51.0 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	-
NO Span	400	400.2	0.050	400.0	1.009
NO _x Span	400	400.3	0.075	400.0	1.012

API Model 200E NO_x Analyzer Check List

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	500 standard
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air
SAMPLE FLOW	504	cc/min	500 ± 50
OZONE FLOW	78	cc/min	80 ± 15
PMT	102.9	mV	-20 - 150
AZERO	93.7	mV	-20 - 150
HVPS	672	V	420 - 900 constant
RCELL TEMP	50.1	°C	50 ± 1
BOX TEMP	29.0	°C	8 - 48
PMT TEMP	7.4	°C	7 ± 2
MOLY TEMP	315.1	°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	1.009	-	1.0 ± 0.3
NO _x Slope	1.012	-	1.0 ± 0.3
NO Offset	1.6	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



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CALIBRATION REPORT

CHEMILUMINESCENT NO / NO₂ / NO_x ANALYZER

DATE : 15 May 2022

BRAND : API

MODEL : 200E

NO. NOX-B09

SERIAL NO. 4412

Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 05 August 2021

Serial No. : 911

Reference Standard Gas

Standard Gas : Nitric Oxide (NO)

Cylinder No. : A00681SK

Certified Date : 24 August 2020

Expired Date : 24 August 2022

Cylinder Conc. : 51.0 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	-
NO Span	400	399.8	-0.050	400.0	1.006
NO _x Span	400	400.2	0.050	400.0	1.010

API Model 200E NO_x Analyzer Check List

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	500 standard
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air
SAMPLE FLOW	507	cc/min	500 ± 50
OZONE FLOW	78	cc/min	80 ± 15
PMT	103.4	mV	-20 - 150
AZERO	94.1	mV	-20 - 150
HVPS	669	V	420 - 900 constant
RCELL TEMP	50.2	°C	50 ± 1
BOX TEMP	29.5	°C	8 - 48
PMT TEMP	7.1	°C	7 ± 2
MOLY TEMP	315.2	°C	315 ± 5
RCELL PRESS	8.4	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.6	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO _x Span Conc	400	PPB	20 - 20,000
NO Slope	1.006	-	1.0 ± 0.3
NO _x Slope	1.010	-	1.0 ± 0.3
NO Offset	1.2	mV	-20 to +150
NO _x Offset	0.8	mV	-20 to 150
Stability at Zero	0.1	PPB	< 0.2
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas



CALIBRATION REPORT

CHEMILUMINESCENT NO / NO₂ / NO_x ANALYZER

DATE : 15 May 2022

BRAND : API

MODEL : 200A

NO. NOX-B13

SERIAL NO. 1983

Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 05 August 2021

Serial No. : 911

Reference Standard Gas

Standard Gas : Nitric Oxide (NO)

Cylinder No. : A00681SK

Certified Date : 24 August 2020

Expired Date : 24 August 2022

Cylinder Conc. : 51.0 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	-
NO Span	400	399.6	-0.100	400.0	0.998
NO _x Span	400	399.8	-0.050	400.0	1.003

API Model 200E NO_x Analyzer Check List

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	500 standard
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air
SAMPLE FLOW	510	cc/min	500 ± 50
OZONE FLOW	79	cc/min	80 ± 15
PMT	103.3	mV	-20 - 150
AZERO	94.2	mV	-20 - 150
HVPS	675	V	420 - 900 constant
RCELL TEMP	50.4	°C	50 ± 1
BOX TEMP	29.3	°C	8 - 48
PMT TEMP	7.5	°C	7 ± 2
MOLY TEMP	314.9	°C	315 ± 5
RCELL PRESS	8.3	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.4	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO _x Span Conc	400	PPB	20 - 20,000
NO Slope	0.998	-	1.0 ± 0.3
NO _x Slope	1.003	-	1.0 ± 0.3
NO Offset	1.0	mV	-20 to +150
NO _x Offset	0.5	mV	-20 to 150
Stability at Zero	0.1	PPB	< 0.2
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas



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CALIBRATION REPORT

NON-DISPERSIVE INFRARED CO ANALYZER

DATE : 15 May 2022

BRAND : API

MODEL : 300E

NO. CO-B05

SERIAL NO. 3116

Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 20 September 2021

Serial No. : 421

Reference Standard Gas

Standard Gas : Carbon Monoxide (CO)

Cylinder No. : D196045

Certified Date : 16 April 2022

Expired Date : 15 April 2024

Cylinder Conc. : 4,570 PPM

CALIBRATING CONDITION

Pressure 1011 mmbar

Temp. 24.5 °C

% RH 49

CALIBRATION SETTING

Span	Initial Reading (Before Adj.),PPM			Final Reading (After Adj.),PPM
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero	0	-0.10	-	0
CO Span	40.00	39.95	-0.125	40.00

API Model 300E CO Analyzer Check list

Parameter	Observed Value	Units	Nominal Range
RANGE	50	PPM	0-1000 ppm
STABILITY	0.10	PPM	< 1 ppm with zero air
CO MEASURE	4013.2	mV	2500-4800 mV
CO REFERENCE	3946.6	mV	2500-4800 mV
MEASURE/REFERENCE RATIO	1.180	-	1.1-1.3 w/zero air
SAMPLE PRESSURE	28.5	In-Hg-A	~2" < ambient absolute pressure
SAMPLE FLOW	806	cc/min	800 ± 10%
SAMPLE TEMPERATURE	48.3	°C	48 ± 4
BENCH TEMPERATURE	48.1	°C	48 ± 2
WHEEL TEMPERATURE	68.2	°C	68 ± 2
BOX TEMPERATURE	30.7	°C	Ambient temp + 7 ± 10
PHOTO-DRIVE	3025.1	mV	250 mV to 4750 mV
SLOPE	1.017	-	1.0 ± 0.3
OFFSET	0.2	-	0 ± 0.3



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CALIBRATION REPORT

NON-DISPERSIVE INFRARED CO ANALYZER

DATE : 15 May 2022

BRAND : API

MODEL : 300E

NO. CO-B06

SERIAL NO. 3117

Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 20 September 2021

Serial No. : 421

Reference Standard Gas

Standard Gas : Carbon Monoxide (CO)

Cylinder No. : D196045

Certified Date : 16 April 2022

Expired Date : 15 April 2024

Cylinder Conc. : 4,570 PPM

CALIBRATING CONDITION

Pressure 1011 mmbar

Temp. 24.5 °C

% RH 49

CALIBRATION SETTING

Span	Initial Reading (Before Adj.),PPM			Final Reading (After Adj.),PPM
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero	0	0.11	—	0
CO Span	40.00	40.12	0.300	40.00

API Model 300E CO Analyzer Check list

Parameter	Observed Value	Units	Nominal Range
RANGE	50	PPM	0-1000 ppm
STABILITY	0.10	PPM	< 1 ppm with zero air
CO MEASURE	4015.6	mV	2500-4800 mV
CO REFERENCE	3947.9	mV	2500-4800 mV
MEASURE/REFERENCE RATIO	1.180	—	1.1-1.3 w/zero air
SAMPLE PRESSURE	28.4	In-Hg-A	~2" < ambient absolute pressure
SAMPLE FLOW	808	cc/min	800 ± 10%
SAMPLE TEMPERATURE	48.2	°C	48 ± 4
BENCH TEMPERATURE	48.0	°C	48 ± 2
WHEEL TEMPERATURE	68.5	°C	68 ± 2
BOX TEMPERATURE	30.6	°C	Ambient temp + 7 ± 10
PHOTO-DRIVE	3030.4	mV	250 mV to 4750 mV
SLOPE	1.017	—	1.0 ± 0.3
OFFSET	0.2	—	0 ± 0.3



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CALIBRATION REPORT

NON-DISPERSIVE INFRARED CO ANALYZER

DATE : 15 May 2022

BRAND : API

MODEL : 300E

NO. CO-R01

SERIAL NO. 704

Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 20 September 2021

Serial No. : 421

Reference Standard Gas

Standard Gas : Carbon Monoxide (CO)

Cylinder No. : D196045

Certified Date : 16 April 2022

Expired Date : 15 April 2024

Cylinder Conc. : 4,570 PPM

CALIBRATING CONDITION

Pressure 1011 mmbar

Temp. 24.5 °C

% RH 49

CALIBRATION SETTING

Span	Initial Reading (Before Adj.),PPM			Final Reading (After Adj.),PPM
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero	0	-0.10	-	0
CO Span	40.00	40.06	0.150	40.00

API Model 300E CO Analyzer Check list

Parameter	Observed Value	Units	Nominal Range
RANGE	50	PPM	0-1000 ppm
STABILITY	0.10	PPM	< 1 ppm with zero air
CO MEASURE	4014.8	mV	2500-4800 mV
CO REFERENCE	3948.1	mV	2500-4800 mV
MEASURE/REFERENCE RATIO	1.180	-	1.1-1.3 w/zero air
SAMPLE PRESSURE	28.3	In-Hg-A	~2" < ambient absolute pressure
SAMPLE FLOW	807	cc/min	800 ± 10%
SAMPLE TEMPERATURE	48.3	°C	48 ± 4
BENCH TEMPERATURE	48.0	°C	48 ± 2
WHEEL TEMPERATURE	68.4	°C	68 ± 2
BOX TEMPERATURE	30.8	°C	Ambient temp + 7 ± 10
PHOTO-DRIVE	3027.3	mV	250 mV to 4750 mV
SLOPE	1.017	-	1.0 ± 0.3
OFFSET	0.2	-	0 ± 0.3



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CALIBRATION REPORT

NON-DISPERSIVE INFRARED CO ANALYZER

DATE : 15 May 2022

BRAND : API

MODEL : 300E

NO. CO-R02

SERIAL NO. 171-S

Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 20 September 2021

Serial No. : 421

Reference Standard Gas

Standard Gas : Carbon Monoxide (CO)

Cylinder No. : D196045

Certified Date : 16 April 2022

Expired Date : 15 April 2024

Cylinder Conc. : 4,570 PPM

CALIBRATING CONDITION

Pressure 1011

mmbar

Temp. 24.5

°C

% RH

49

CALIBRATION SETTING

Span	Initial Reading (Before Adj.),PPM			Final Reading (After Adj.),PPM
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero	0	0.10	-	0
CO Span	40.00	39.97	-0.075	40.00

API Model 300E CO Analyzer Check list

Parameter	Observed Value	Units	Nominal Range
RANGE	50	PPM	0-1000 ppm
STABILITY	0.10	PPM	< 1 ppm with zero air
CO MEASURE	4015.1	mV	2500-4800 mV
CO REFERENCE	3949.4	mV	2500-4800 mV
MEASURE/REFERENCE RATIO	1.179	-	1.1-1.3 w/zero air
SAMPLE PRESSURE	28.7	In-Hg-A	~2" < ambient absolute pressure
SAMPLE FLOW	811	cc/min	800 ± 10%
SAMPLE TEMPERATURE	48.4	°C	48 ± 4
BENCH TEMPERATURE	48.1	°C	48 ± 2
WHEEL TEMPERATURE	68.3	°C	68 ± 2
BOX TEMPERATURE	30.7	°C	Ambient temp + 7 ± 10
PHOTO-DRIVE	3032.6	mV	250 mV to 4750 mV
SLOPE	1.017	-	1.0 ± 0.3
OFFSET	0.2	-	0 ± 0.3

**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 : 22M2567

REFERENCE No : 64386-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : METTLER TOLEDO

MODEL : XS 105DU

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 :**CALIBRATION DATE** :**APPROVED BY** :**ISSUED DATE** : 17-Mar-22**RECEIVED DATE** : 11-Mar-22

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



CERTIFICATE No : 22M2567

PAGE : 2 OF 2

Calibration Report

EQUIPMENT	:	DIGITAL BALANCE	MODEL	:	XS 105DU
MANUFACTURER	:	METTLER TOLEDO	S/N	:	1126422905
ID No	:	BA 05/50	RECEIVED DATE	:	11-Mar-22
AIR PRESSURE	:	1008mbar \pm 1mbar	CALIBRATION DATE	:	11-Mar-22
AMBIENT TEMPERATURE	:	22° 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	C02210415	09-Feb-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:-

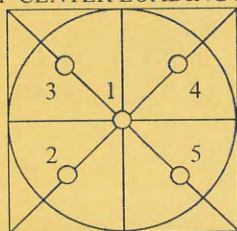
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 20 g WAS 0.000004 g
4. REPEATABILITY OF READING AT 100 g WAS 0.000048 g
5. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.00000	0.00000	0.000058
0.02	0.01999	0.00001	0.000058
0.10	0.09999	0.00001	0.000059
0.20	0.19999	0.00001	0.000059
0.50	0.50001	-0.00001	0.000058
1.00	1.00001	-0.00001	0.000059
2.00	2.00000	0.00000	0.000059
5.00	5.00001	-0.00001	0.000061
10.00	10.00005	-0.00005	0.000063
20.00	20.00006	-0.00006	0.000069
50.00	50.0000	0.0000	0.00011
100.00	100.0001	-0.0001	0.00019
120.00	120.0001	-0.0001	0.00022

6. OFF CENTER LOADING ERROR



POINT	READING (g)	
1	10.00001	50.0000
2	10.00002	50.0000
3	10.00001	50.0000
4	10.00001	50.0000
5	10.00002	50.0001
OFF-CENTER LOADING	0.00001	0.0001

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

END OF CALIBRATION REPORT



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

Customer : <u>S.P.S.Consulting Service Co.,Ltd</u>	Date Tested: <u>January 12, 2022</u>	
	Recommendation Recertification	
Address : <u>7 Soi Phaholyothin 24</u>	Period <u>6</u> Months	
<u>Paholyothin Road</u>	Recertification Due: <u>July 12, 2022</u>	
<u>Jompol Chatuchak, Bangkok 1090</u>	Date Last Certified: <u>July 14, 2021</u>	
User Name: <u>K.Phenpha Viphasathawat</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>August 30, 2022</u>
<u>Wavecal Solution</u>	<u>N058-2152</u>	<u>January 30, 2022</u>
<u>VIS Wavecal solution</u>	<u>N930-2946</u>	<u>June 30, 2022</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>August 30, 2022</u>
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C8011701
DATE TESTED January 12, 2022
1. MECHANICAL CHECKS

A. Inspect and clean all fans and filters.

☐ OK

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

☐ OK

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

☐ OK

D. Adjust water and gas pressure regulator settings.

☐ OK

E. Inspect and leak check pneumatics drawers.

☐ OK

F. Clean the exterior of the instrument.

☐ OK

2. OPTICAL CHECKS

A. Inspect and clean all optical components.

☐ OK

B. As required, check and replace all purgefilters.

☐ OK

C. Recheck optical alignment.

☐ OK

3. COOLING SYSTEM CHECKS

A. Perform preventive maintenance on chiller.

☐ OK

B. Flush out the chiller every year.

☐ N/A

4. PERFORMANCE CHECKS

A. Torch View Alignment.

☐ OK

B. Wavelength Calibration.

☐ OK



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : 077C8011701

DATE TESTED : January 12, 2022

PARAMETER	SPECIFICATION			FINAL VALUE	
Spectral Resolution : UV	As	193.696 nm	≤ 0.007	0.00554	
	Ni	231.604 nm	≤ 0.008	0.00725	
	Ni	341.476 nm	≤ 0.012	0.00752	
Spectral Resolution : VIS	La	408.672 nm	≤ 0.020	0.01616	
	Ba	455.403 nm	≤ 0.025	0.02416	
Precision					
	As	193.656 nm	% RSD < 1.0	0.34	%
	Zn	213.856 nm	% RSD < 1.0	0.27	%
	Mn	257.610 nm	% RSD < 1.0	0.41	%
	La	379.478 nm	% RSD < 1.0	0.57	%
	Ba	455.403 nm	% RSD < 1.0	0.33	%
	Ba	493.408 nm	% RSD < 1.0	0.26	%
Detection Limits : Axial	Tl	190.080 nm	3(sd)	5.51	ppb
	As	193.696 nm	3(sd)	8.59	ppb
	Pb	220.353 nm	3(sd)	0.50	ppb
Detection Limits : Radial	As	193.696 nm	3(sd)	21.00	ppb
	Zn	213.856 nm	3(sd)	0.32	ppb
	Mn	257.610 nm	3(sd)	0.18	ppb
	La	379.478 nm	3(sd)	0.44	ppb
	Ba	455.403 nm	3(sd)	0.17	ppb
	Ba	493.408 nm	3(sd)	0.12	ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd	226.502 nm	≤ 150 ppb	12.46	
BEC : Radial (IB X 1000)/(IS-IB)	Mn	257.610 nm	≤ 45 ppb	30.82	



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C8011701**DATE TESTED** January 12, 2022**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:**

Service Engineer

คุณภาพน้ำใต้ดิน



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert.No.: 21CH1216

Page.: 1 of 2

Certificate of Calibration

Equipment :	pH Meter
Manufacturer :	HANNA
Model :	HI 3512
Serial No. :	08685754
ID No. :	-
Condition As-Received:	Used Item
Received Date :	14 September 2021
Calibration Date :	16 September 2021
Reference :	2109-0508WN-1
Submitted by :	S.P.S. Consulting Service Co.,Ltd. 7 Phaholyothin 24, Phaholyothin Road, Jompol, Chatuchak, Bangkok10900
Ambient Temperature :	(25 ± 2.5) °C
Relative Humidity :	(50 ± 15) %
Calibration Procedure :	In - house method : - CP-CH5 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)

Calibrated by :

Approved by :

(✓) Malee Butkruea
() Saithip Meangmai
() Warakorn Lernagtrakul

Issue Date :

22 September 2021

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 head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0032410



Cert. No.: 21CH1216

Page.: 2 of 2

Condition of this calibration result

1. Reference Standard Instrument : -

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Document Process Calibrator	46530031	130RC098	20E3666	14 Oct 2021

This certification is traceable to the International System of Unit maintained at:-

- Traceable to National Institute of Metrology (Thailand), NIMT

2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

<u>Buffer Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
pH 4.008	CPA chem	754028	28 June 2023
pH 6.985	CPA chem	725927	12 Jan 2022
pH 10.015	CPA chem	761018	02 Aug 2022

3. This certificate is valid only to the item calibrated on date and place of calibration.

Calibration Results**Function : mV Measurement****Performing standard curve by Fluke at pH (4,7,10)**

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (\pm mV)	Coverage factor <i>k</i>
	pH	mV	mV	pH		
pH Meter S/N.: 08685754	4.000	177.48	177.9	4.000	0.058	2.00
	7.000	0.00	0.4	7.000	0.058	2.00
	10.000	-177.48	-177.2	10.000	0.058	2.00

Function : pH Measurement**Performing three buffers standard curve by using buffer nominal pH (4,7,10)**

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (\pm)	Coverage factor <i>k</i>
pH Electrode S/N.: 061416CM	4.008	4.008	169.2	0.0046	2.00
	6.985	6.985	-4.4	0.0075	2.00
	10.015	10.013	-178.9	0.013	2.05

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor *k*, providing a level of confidence of approximately 95 %.

-o0o-

a 1072797



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 : 21E3592
REFERENCE No : 60760-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : CONDUCTIVITY METER
MANUFACTURER : EUTECH
MODEL : CON 150
SERIAL No : 2746308
ID No : CD 04/61
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 :

CALIBRATION DATE :

APPROVED BY :

ISSUED DATE : 02-Apr-21

RECEIVED DATE : 31-Mar-21

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



QUALITY CALIBRATION CO.,LTD.

235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 21E3592

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : CONDUCTIVITY METER
MANUFACTURER : EUTECH
SERIAL NUMBER : 2746308
RECEIVED DATE : 31-Mar-21
AMBIENT TEMPERATURE : 20 °C ± 1 °C
MODEL : CON 150
ID No : CD 04/61
CALIBRATION DATE : 02-Apr-21
RELATIVE HUMIDITY : 50 % RH ± 15% RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT METHOD. THE DISPLAY AND ELECTROD WAS CALIBRATED BY USING STANDARD CONDUCTIVITY BUFFER SOLUTION IN CONTROLLED TEMPERATURE BATH.
2. REFERENCE STANDARD INSTRUMENTS :-

<u>INSTRUMENT</u>	<u>MODEL</u>	<u>LOT No</u>	<u>CERTIFICATE No</u>	<u>DUE DATE</u>
1) REFERENCE MATERIAL	00652-26	CC20562	4066-11793752	09-Dec-21
2) REFERENCE MATERIAL	00652-30	CC20458	4173-11692041	04-Nov-21
3) REFERENCE MATERIAL	00652-32	CC20466	4068-11695401	05-Nov-21
4) REFERENCE MATERIAL	00652-34	CC20523	4069-11762897	01-Dec-21
5) BATH	260014	1247 48074	20T9392	10-Sep-21
6) STANDARD THERMOMETER	421504	55000379	20T9616	10-Sep-21

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO :-
 - NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST), USA.
 - NATIONAL INSTITUTE OF METROLOGY (THAILAND)

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

1. DISPLAY UNIT WITH ELECTROD S/N CONSEN91W

CONDUCTIVITY BUFFER SOLUTION	UUC READING	CORRECTION	VALUE BEFORE ADJUSTMENT	UNIT	UNCERTAINTY OF MEASUREMENT (±)	COVERAGE FACTOR k
99.0	99.4	-0.40	N/A	µS/cm	3.0	2.0
1413.0	1413	0.00	N/A	µS/cm	30	2.0
9.992	9.55	0.44	N/A	mS/cm	0.21	2.0
99.915	80.3	19.62	N/A	mS/cm	2.1	2.0

2. DISPLAY UNIT WITH TEMPERATURE

STANDARD READING (°C)	UUC READING (°C)	CORRECTION	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT (±°C)	COVERAGE FACTOR k
25.003	25.0	0.0	N/A	0.0085	2.0

UUC : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT

**QUALITY CALIBRATION CO.,LTD.**

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

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

www.qcalibration.comCERTIFICATE No : 21M3167
REFERENCE No : 60627-3

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : SARTORIUS

MODEL : BSA224S-CW

SERIAL No : 36591843

ID No : BA 09/61

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY :**CALIBRATION DATE** :**APPROVED BY** :**ISSUED DATE** : 20-Mar-21**RECEIVED DATE** : 19-Mar-21

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QUALITY CALIBRATION CO., LTD.



CERTIFICATE No : 21M3167

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : BSA224S-CW
MANUFACTURER : SARTORIUS S/N : 36591843
ID No : BA 09/61 RECEIVED DATE : 19-Mar-21
AIR PRESSURE : 1009mbar \pm 1mbar CALIBRATION DATE : 19-Mar-21
AMBIENT TEMPERATURE : 24°C \pm 1°C RELATIVE HUMIDITY : 52 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 6:2019 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS ADJUSTED USING WEIGHT OF QUALITY CALIBRATION TO ADJUST. THE BALANCE HAS NO ZERO TRACKING FUNCTION. REPEATABILITY WAS MEASURED BY USING 10 REPEATED MEASUREMENTS. LINEARITY WAS MEASURED COVERING 10 POINTS, EVENLY SPREAD OVER THE RANGE. THE INSTRUMENT WAS SET ZERO BEFORE PERFORMING THE LINEARITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-I-151	C02210415	09-Feb-23
2) STANDARD WEIGHT	E2	15843	C02210419	10-Feb-23
3) STANDARD WEIGHT	E2	QK-I-349	M2103235S	26-Mar-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 CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

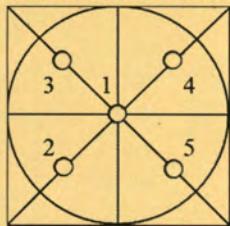
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000045 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.0	0.0000	0.0000	0.000075
0.1	0.1000	0.0000	0.000075
0.2	0.2000	0.0000	0.000076
0.5	0.5000	0.0000	0.000076
1.0	1.0000	0.0000	0.000077
2.0	2.0000	0.0000	0.000077
5.0	5.0000	0.0000	0.000079
10.0	10.0000	0.0000	0.000082
20.0	20.0000	0.0000	0.000086
50.0	50.0000	0.0000	0.00013
100.0	100.0001	-0.0001	0.00019
200.0	199.9997	0.0003	0.00032

5. OFF CENTER LOADING ERROR




POINT	READING (g)
1	100.0000
2	100.0000
3	100.0001
4	100.0000
5	99.9999
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

Lambda UV Preventive Maintenance (PM)

Company Name:	S.P.S. CONSULTING SERVICE CO., LTD.		
Address:	7, Soi Phaholyothin24, Ladyao, Jatujak, Bangkok		
User Name:	K. Benjawan	WO Number:	WO-01338285
Telephone Number:	086-141-2523	PM Number:	6 of 6 P
Customer Support Engineer:	K. Anon	Certificate Number:	UV2043-2021
Date PM Performed: (DD-MMM-YYYY)	27-Jul-2021	Next PM Due Date: (DD-MMM-YYYY)	27-Jan-2022

Part Number	Release	Publication Date	
09370504	B	March 2013	

Scope

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

General Instructions:

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

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Component List

Component Specific Model	Serial #	Software Version		Configuration Notes
Lambda 25	501S14123010	6.2.0.0741	STD	1.27
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

Parts Lists

Parts Included with the PM				
Part Number (if applicable)	Description	Quantity	Batch/Lot/SN #	Expiration Date (MM/YY)
B250 0999	Stray Light standard			
	Nal cell	1	11200	Oct-21
	NaNO2 cell	1	21175	
	KCl cell	1	31873	
	H2O	1	72075	
B050 7805	Secondary Standards for calibration of wavelength and photometric accuracy or use NBS/NIST 390 standards			
	Gray Glass G1	1	4660	Oct-21
	Gray Glass G2	1	4575	
	Gray Glass G3	1	4525	
	Holmium Glass	1	5499	

Additional Tools Required for PM				
Part Number (if applicable)	Description	Quantity	Serial #	Calibration Due Date (MM/YY)
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

Procedure Checklist

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

1. General:

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

2. Optical checks:

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

3. Mechanical:

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

4. Test:

Refer to Appendix A for the specifications of the instrument being tested.

- ☒ D2 Wavelength accuracy

	Actual Value	Specification
Accuracy at 656.1 nm	656.09	± 0.1

☒ Holmium Oxide wavelength accuracy

Filter ID #		5499		
Test	Calibration Value	Actual Value	Deviation	Specification
279.3 nm	279.3	279.37	-0.07	± 0.5
360.8 nm	360.9	360.92	-0.02	± 0.5
459.9 nm	459.9	460.00	-0.10	± 0.5
536.4 nm	536.2	536.33	-0.13	± 0.5

☒ Scattered Light.

Test	Filter ID #	Result	Specification
NaI @ 220 nm	11200	-0.1294	< 0.02 %T
NaNO ₂ @ 340 nm	21175	0.0034	< 0.02 %T
NaNO ₂ @ 370 nm	21175	0.0027	< 0.02 %T
KCl @ 200 nm	31873	2.2355	≥ 2 A

☒ Baseline Flatness.

Corrected Baseline	Specification
0.000316	± 0.001 A

☒ Noise Test @ 500 nm.

Actual Value	Specification
0.0000250	± 0.00008 A

☒ Photometric Accuracy.

Filter 1 ID #		4660		
Test	Calibrated Value	Actual Value	Deviation	Specification
440 nm	0.3208	0.3240	-0.0032	± 0.006 A
546 nm	0.3029	0.3049	-0.0020	± 0.006 A
635 nm	0.3572	0.3584	-0.0012	± 0.006 A
Filter 2 ID #		4575		
Test	Calibrated Value	Actual Value	Deviation	Specification
440 nm	1.06	1.0627	-0.0027	± 0.006 A
546 nm	0.9835	0.9851	-0.0016	± 0.006 A
635 nm	1.007	1.0087	-0.0017	± 0.006 A
Filter 3 ID #		4525		
Test	Calibrated Value	Actual Value	Deviation	Specification
440 nm	0.4981	0.4998	-0.0017	± 0.006 A
546 nm	0.4739	0.4751	-0.0012	± 0.006 A
635 nm	0.5274	0.5286	-0.0012	± 0.006 A

5. Accessory (where applicable):

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

6. Review:

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

Additional Comments

Additional Comments Regarding the PM

Review

<i>The preventive maintenance checks and if applicable performance tests for Lambda UV have been completed.</i>	
<i>This Lambda UV Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.</i>	
Review of Preventive Maintenance:	
Authorized PerkinElmer Representative: <div style="background-color: #cccccc; width: 300px; height: 40px; margin-top: 5px;"></div>	Date: 9-Aug-21 (DD-MM-YYYY)
Authorized Customer Representative:	Date: 9-Aug-21 (DD-MM-YYYY)



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. : SS2110-013-0003

Date Issued : 04-Oct-21

Customer & Calibrated Place : 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 : 01-Oct-21

Date Calibrated : 01-Oct-21

Calibrated by : Mr. Jame Khaothong

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 :



Certificate No. : SS2110-013-0003

Environment : Ambient Temperature : Start record 26.0 °C, Stop record 25.7 °C
Relative Humidity : Start record 56.5 %RH, Stop record 55.7 %RH

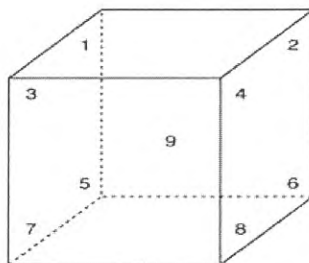
Calibration Temperature (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Stability ¹ (°C)	Measured Uniformity ² (°C)	Overall Variation ³ (°C)
35	35.0	35.0	0.12	0.40	0.45
41.5	41.5	41.5	0.11	0.39	0.51

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	35.01	35.11	34.95	35.00	34.99	34.95	35.07	35.07	35.23	0.23
41.5	41.47	41.47	41.40	41.49	41.37	41.33	41.43	41.51	41.62	0.22

Note : Probe No. 9 is Reference Probe

Setting Air Fresh No. 0



Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Certificate No. AD2107-034-0001 for Digital Thermometer with Probe (Agilent) Module 1 (245) Serial No. US37005130, Due 04-Feb-22

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



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



NSC-TISI-TIS17025
CALIBRATION 0049

CERTIFICATE No : 21T3175

REFERENCE No : 60627-7

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : WATER BATH

MANUFACTURER : MEMMERT

MODEL : WPE45

SERIAL No : L715.0400

ID No : WB 06/58

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 :

CALIBRATION DATE :

APPROVED BY :

ISSUED DATE : 20-Mar-21

RECEIVED DATE : 19-Mar-21

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



CERTIFICATE No : 21T3175

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : WATER BATH
MANUFACTURER : MEMMERT
ID NUMBER : WB 06/58
RECEIVED DATE : 19-Mar-21
AMBIENT TEMPERATURE : 25 °C ± 1 °C

MODEL : WPE45
SERIAL NUMBER : L715.0400
CALIBRATION DATE : 19-Mar-21
RELATIVE HUMIDITY : 55 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

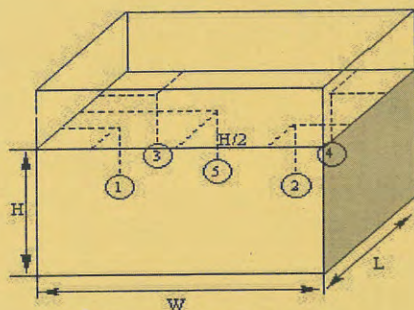
1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO ASTM E715-80 (REAPPROVED 2001) BY COMPARISON WITH CALIBRATED RTD. THE PROBES WERE PLACED ON FIVE POINTS AND LOCATED ONE PROBE IN EACH OF THE FOUR CORNERS OF THE BATH AND PLACED THE FIFTH RTD WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE WATER VOLUME (REFERENCE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

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH RTD	2635A	7286308	20T6464	06-Jul-21

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH 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) : 0.3
Overall Variation of Line Voltage (V) : 0
Instrument Condition : Normal
Bath Inner Size (W*L*H) : 60*40*24 cm

BATH PERFORMANCE

Controller Temperature (°C)	Indicating Temperature (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
44.5	44.5	0.03	0.00	0.06

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations					Uncertainty (± °C)
		#1	#2	#3	#4	Ref. 5	
44.5	44.5	44.52	44.53	44.52	44.53	44.52	0.14

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



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

Customer : <u>S.P.S.Consulting Service Co.,Ltd</u>	Date Tested: <u>July 14, 2021</u>	
	Recommendation Recertification	
Address : <u>7 Soi Phaholyothin 24</u>	Period <u>6</u> Months	
<u>Paholyothin Road</u>	Recertification Due: <u>January 14, 2022</u>	
<u>Jompol Chatuchak, Bangkok 1090</u>	Date Last Certified: <u>January 19, 2021</u>	
User Name: <u>K.Phenpha Viphasathawat</u>	Visit Number: <u>1 of 2</u>	
Phone: <u>083-9269252</u>	PerkinElmer Phone: <u>02-719-6420 ext 206</u>	
Fax: <u>02-513-4221</u>	PerkinElmer Fax: <u>02-318-5597</u>	

CONFIGURATION TESTED		ACCESSORIES/COMPONENT NOT INCLUDED
MODEL	SERIAL NUMBER	
<u>OPTIMA 5300DV</u>	<u>077C7042401</u>	
TESTED EQUIPMENT	CALIBRATION NUMBER	EXPIRATION
<u>IPV Methods</u>		
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
<u>Multielement Standard</u>	<u>N069-1579</u>	<u>July 30, 2021</u>
<u>Wavecal Solution</u>	<u>N058-2152</u>	<u>January 30, 2022</u>
<u>VIS Wavecal solution</u>	<u>N930-2946</u>	<u>June 30, 2022</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>October 30, 2021</u>
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C8011701DATE TESTED July 14, 2021**1. MECHANICAL CHECKS**

A. Inspect and clean all fans and filters.

☐ OK

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

☐ OK

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

☐ OK

D. Adjust water and gas pressure regulator settings.

☐ OK

E. Inspect and leak check pneumatics drawers.

☐ OK

F. Clean the exterior of the instrument.

☐ OK**2. OPTICAL CHECKS**

A. Inspect and clean all optical components.

☐ OK

B. As required, check and replace all purgefilters.

☐ OK

C. Recheck optical alignment.

☐ OK**3. COOLING SYSTEM CHECKS**

A. Perform preventive maintenance on chiller.

☐ OK

B. Flush out the chiller every year.

☐ N/A**4. PERFORMANCE CHECKS**

A. Torch View Alignment.

☐ OK

B. Wavelength Calibration.

☐ OK



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : 077C8011701

DATE TESTED : July 14, 2021

PARAMETER	SPECIFICATION			FINAL VALUE	
Spectral Resolution : UV	As	193.696 nm	≤ 0.007	0.00570	
	Ni	231.604 nm	≤ 0.008	0.00724	
	Ni	341.476 nm	≤ 0.012	0.00744	
Spectral Resolution : VIS	La	408.672 nm	≤ 0.020	0.01622	
	Ba	455.403 nm	≤ 0.025	0.02408	
Precision					
	As	193.656 nm	% RSD < 1.0	0.95	%
	Zn	213.856 nm	% RSD < 1.0	1.00	%
	Mn	257.610 nm	% RSD < 1.0	0.92	%
	La	379.478 nm	% RSD < 1.0	0.66	%
	Ba	455.403 nm	% RSD < 1.0	0.64	%
	Ba	493.408 nm	% RSD < 1.0	0.50	%
Detection Limits : Axial	Tl	190.080 nm	3(sd)	4.16	ppb
	As	193.696 nm	3(sd)	6.42	ppb
	Pb	220.353 nm	3(sd)	2.29	ppb
Detection Limits : Radial	As	193.696 nm	3(sd)	19.68	ppb
	Zn	213.856 nm	3(sd)	1.06	ppb
	Mn	257.610 nm	3(sd)	0.10	ppb
	La	379.478 nm	3(sd)	1.65	ppb
	Ba	455.403 nm	3(sd)	0.16	ppb
	Ba	493.408 nm	3(sd)	0.44	ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd	226.502 nm	≤ 150 ppb	61.14	
BEC : Radial (IB X 1000)/(IS-IB)	Mn	257.610 nm	≤ 45 ppb	40.96	



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C8011701**DATE TESTED** July 14, 2021**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**

Service Engineer

PinAAcle 900Z Preventive Maintenance (PM)

Company Name:	S.P.S. CONSULTING SERVICE CO., LTD		
Address (Instrument Location):	7 Soi Phaholyothin 24 Phaholyothin Road., Jompol, Chatuchak, Bangkok 10110		
Serial Number:	PZAS19090402	PM Number:	2/2
Customer Name (if applicable):	K. PHENPHA	Telephone Number:	083-926-9252
Customer Support Engineer Name:	K. DUANG	Service Order Number:	WO-01473846
Date PM Performed: (DD-MMM-YYYY)	01-Dec-2021	Next PM Due Date: (DD-MMM-YYYY)	01-Jun-2022
Standard Labor Hours to Complete PM :		5 hours	

Part Number	Release	Publication Date	
09370144 Rev.9	A	January 2018	

Scope

The purpose of this PM is to ensure the continued functionality of the PinAAcle 900Z 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

Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
B0501696	Fan Filters	N/A
B3002013	THGA Contact Cylinders	N/A
B3141064	Glycerol for THGA Cooling	N/A

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quality	Batch/Lot #	Expired Date (MM/YY)
N9300244	GFAAS Mixed Standard	AR	53-255CRY1	28-Feb-2022

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 #
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.
- ☒ Check the drain system for signs of wear. Replace worn or damaged parts.
- ☒ 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.
- ☒ 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

4. Electrical:

- ✓ Inspect PC boards. Clean if necessary.
- ✓ 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. After PM Performance tests [THGA]:

7.1 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	250	Passed
External Flow Rate	100 mL/min \pm 10 mL/min	100	Passed

7.2 Chromium Baseline Noise

Description: Signal to noise check.

Parameter	Specification	Results	Pass/Fail
Baseline Noise	\leq 0.005 Abs.	0.0001	Passed
Standard Deviation	\leq 0.005	0.0001	Passed

7.3 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	\leq 7.0 pg/0.0044 A-s	3.8	Passed
Precision	\leq 2.0 %	1.64	Passed

7.4 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	13.9	Passed
Zeeman Ratio	0.52 ± 0.04	0.52	Passed

8. 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	$= \frac{\text{Atomic Signal (Peak area)}}{\text{Atomic Signal (Peak area)} + \text{Background Signal (Peak area)}}$ $= \frac{0.1593}{0.1593+0.1414}$ $= 0.52$

Review

<i>The preventive maintenance checks and if applicable performance tests for PinAAcle 900Z have been completed.</i>		
<i>This PinAAcle 900Z Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.</i>		
Review of Preventive Maintenance:		
Authorized PerkinElmer Representative:	<div style="background-color: #cccccc; width: 100%; height: 100px;"></div>	Date: 01-Dec-2021 <small>(DD-MMM-YYYY)</small>
Authorized Customer Representative:	<div style="background-color: #cccccc; width: 100%; height: 100px;"></div>	Date: 01-Dec-2021 <small>(DD-MMM-YYYY)</small>

ระดับเสียงในบรรยากาศ

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0528

MTC No. EEL. BP. 17/0564

CALIBRATION CERTIFICATE

Submitted by : S.P.S. Consulting Services 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 generated by sound calibrator under test shall be measured by standard microphone using an insert voltage technique.

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

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

Date of Receipt : 6 May 2021

Date of Calibration : 15 May 2021

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

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0528

MTC No. EEL. BP. 17/0564

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	93.96	-0.04	± 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	1.26	± 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 :



Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 15 May 2021

Date of Issue : 18 May 2021

Ref : 2011264050601894002

End of Certificate

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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_241/22

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-R12	ACO	6236	00172040	15 May 2022	94.1	94.0
ACO-R29	ACO	6236	00192041	15 May 2022	94.0	94.0
ACO-R32	ACO	6236	00192044	15 May 2022	94.1	94.0
ACO-R50	ACO	6236	00192062	15 May 2022	94.0	94.0
ACO-R51	ACO	6236	00192063	15 May 2022	94.1	94.0
ACO-R52	ACO	6236	00192064	15 May 2022	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.93 ± 0.10 dB	

ระดับเสียงในสถานประกอบการ

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0528

MTC No. EEL. BP. 17/0564

CALIBRATION CERTIFICATE

Submitted by : S.P.S. Consulting Services 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 generated by sound calibrator under test shall be measured by standard microphone using an insert voltage technique.

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

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

Date of Receipt : 6 May 2021

Date of Calibration : 15 May 2021

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

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FM.BL.MTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0528

MTC No. EEL. BP. 17/0564

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	93.96	-0.04	± 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	1.26	± 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 :



Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 15 May 2021

Date of Issue : 18 May 2021

Ref : 2011264050601894002

End of Certificate

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0840

MTC No. EEL. BP. 41/0964

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., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Ambient Environment

Description : Integrating Sound Level Meter

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

Manufacturer : ACO

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

Model : 6236

Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$

Serial No. : 192052

Microphone : Type 7052NR No.73351

Preamplifier : -

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 14 Sep. 2021

Date of Calibration : 20-22 Sep. 2021

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

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FM.BL.MTC.002 Rev.4

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0840

MTC No. EEL. BP. 41/0964

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
11. Digital Multimeter Agilent 34401A S/N MY44005560.
12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the 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.

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%.

Date of Calibration : 20-22 Sep. 2021

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

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0840

MTC No. EEL. BP. 41/0964

1. Absolute Sensitivity

Reference	Unit Under Test				Tolerance
Acoustic Signal (dB)	Measured Value (dB)		Deviation (dB)	Uncertainty (+dB)	Limit Class 2 (+dB)
	Before adjust	After adjust			
113.94	115.2	113.9	0.0	0.30	1.4

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 113.3 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
16.3	0.10

2.2 The microphone of the sound level meter was replaced by electrical signal input device

Frequency Weighting	Measured Value (dB)	Uncertainty (±dB)
A-Weighting	11.2	0.10
C-Weighting	17.1	0.10
Flat	21.3	0.10

Date of Calibration : 20-22 Sep. 2021

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0840

MTC No. EEL. BP. 41/0964

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
125	0.1	-0.1	-0.1	0.40	2.0
1 000	-1.0	-0.9	-0.9	0.40	1.4
4 000	-0.6	-0.6	-0.3	0.40	3.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
63	0.2	0.0	0.0	0.20	2.5
125	0.1	0.0	0.0	0.20	2.0
250	0.1	0.0	0.0	0.20	1.9
500	0.1	0.0	0.0	0.20	1.9
1 000	0.0	0.0	0.0	0.20	1.4
2 000	-0.1	0.0	0.0	0.20	2.6
4 000	-0.4	-0.4	0.0	0.20	3.6
8 000	-0.7	-0.6	-0.1	0.20	5.6

Date of Calibration : 20-22 Sep. 2021

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

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0840

MTC No. EEL. BP. 41/0964

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (+dB)	Tolerance Limits Class 2 (+dB)
A-weighting	94.0	0.0	0.20	0.4
C-weighting	94.0	0.0	0.20	0.4
Flat	94.0	0.0	0.20	0.4

5.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (+dB)	Tolerance Limits Class 2 (+dB)
Fast	94.0	0.0	0.20	0.3
Slow	94.0	0.0	0.20	0.3
Leq	94.0	0.0	0.20	0.3

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (+dB)	Tolerance Limits Class 2 (+dB)
124	124.0	0.0	0.30	1.4
123	123.1	0.1	0.30	1.4
122	122.0	0.0	0.30	1.4
121	121.1	0.1	0.30	1.4
120	120.0	0.0	0.30	1.4
119	119.0	0.0	0.30	1.4
114	114.0	0.0	0.30	1.4
109	109.0	0.0	0.30	1.4

Date of Calibration : 20-22 Sep. 2021

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

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FM.BL.MTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0840

MTC No. EEL. BP. 41/0964

6. Level linearity on the reference level range (cont.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
104	103.9	-0.1	0.30	1.4
99	99.0	0.0	0.30	1.4
94	94.0	0.0	0.30	1.4
89	89.0	0.0	0.30	1.4
84	84.1	0.1	0.30	1.4
79	78.9	-0.1	0.30	1.4
74	74.1	0.1	0.30	1.4
69	69.1	0.1	0.30	1.4
64	64.0	0.0	0.30	1.4
59	59.0	0.0	0.30	1.4
54	54.0	0.0	0.30	1.4
49	49.0	0.0	0.30	1.4
44	44.1	0.1	0.30	1.4
39	39.0	0.0	0.30	1.4
34	34.1	0.1	0.30	1.4
33	33.1	0.1	0.30	1.4
32	32.1	0.1	0.30	1.4
31	31.2	0.2	0.30	1.4
30	30.2	0.2	0.30	1.4

Date of Calibration : 20-22 Sep. 2021

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FM.BL.MTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0840

MTC No. EEL. BP. 41/0964

7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (+dB)	Tolerance Limits Class 2 (+dB)
40-130	125	125.1	0.1	0.30	1.4
30-120	115	115.0	0.0	0.30	1.4
20-110	105	105.0	0.0	0.30	1.4
20-100	95	95.0	0.0	0.30	1.4
20-90	85	85.0	0.0	0.30	1.4
20-80	75	75.0	0.0	0.30	1.4

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (+dB)	Tolerance Limits Class 2 (dB)
Fast	200	115.8	-0.2	0.20	± 1.3
	2	97.9	-1.1	0.20	+1.3; -2.8
	0.25	88.3	-1.7	0.20	+1.8; -5.3
Slow	200	109.4	-0.2	0.20	± 1.3
	2	89.8	-0.2	0.20	+1.3; -5.3
SEL	200	109.9	-0.1	0.20	± 1.3
	2	90.0	0.0	0.20	+1.3; -2.8
	0.25	80.9	-0.1	0.20	+1.8; -5.3

Date of Calibration : 20-22 Sep. 2021

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0840

MTC No. EEL. BP. 41/0964

9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (\pm dB)	Tolerance limits Class 2 (\pm dB)
Complete cycle	125.4	125.8	0.4	0.20	2.4
Positive half cycle	124.4	124.2	-0.2	0.20	1.4
Negative half cycle	124.4	124.2	-0.2	0.20	1.4

10. Overload indication

Measured value (dB)		Deviated value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
Positive one-half cycle	Negative one-half cycle			
133.1	133.0	0.1	0.30	1.8

Calibrated by :
Approved by :


Laboratory

Date of Calibration : 20-22 Sep. 2021

Industrial Metrology and Testing Service Centre
Date of Issue : 22 Sep. 2021

Ref : 2011264091403810001

End of Certificate

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0840

MTC No. EEL. BP. 42/0964

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., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Integrating Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial No. : 192053

Microphone : Type 7052NR No.73352

Preamplifier : -

Ambient Environment

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

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

Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 14 Sep. 2021

Date of Calibration : 20-22 Sep. 2021

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Request No. 21-64/0840

MTC No. EEL. BP. 42/0964

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
11. Digital Multimeter Agilent 34401A S/N MY44005560.
12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the 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.

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%.

Date of Calibration : 20-22 Sep. 2021

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0840

MTC No. EEL. BP. 42/0964

1. Absolute Sensitivity

Reference	Unit Under Test				Tolerance
Acoustic Signal (dB)	Measured Value (dB)		Deviation (dB)	Uncertainty (+dB)	Limit Class 2 (+dB)
	Before adjust	After adjust			
113.94	114.8	113.9	0.0	0.30	1.4

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 114.7 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
17.6	0.10

2.2 The microphone of the sound level meter was replaced by electrical signal input device

Frequency Weighting	Measured Value (dB)	Uncertainty (±dB)
A-Weighting	13.5	0.10
C-Weighting	19.3	0.10
Flat	23.4	0.10

Date of Calibration : 20-22 Sep. 2021

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0840

MTC No. EEL. BP. 42/0964

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
125	-0.1	-0.1	-0.1	0.40	2.0
1 000	-0.8	-0.7	-0.7	0.40	1.4
4 000	-0.7	-0.7	-0.4	0.40	3.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
63	0.1	0.1	0.1	0.20	2.5
125	0.0	0.1	0.1	0.20	2.0
250	0.0	0.1	0.1	0.20	1.9
500	0.0	0.0	0.0	0.20	1.9
1 000	0.0	0.0	0.0	0.20	1.4
2 000	-0.1	0.0	0.1	0.20	2.6
4 000	-0.4	-0.3	0.1	0.20	3.6
8 000	-0.6	-0.5	-0.1	0.20	5.6

Date of Calibration : 20-22 Sep. 2021

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Request No. 21-64/0840

MTC No. EEL. BP. 42/0964

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
A-weighting	94.0	0.0	0.20	0.4
C-weighting	94.0	0.0	0.20	0.4
Flat	94.0	0.0	0.20	0.4

5.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
Fast	94.0	0.0	0.20	0.3
Slow	94.0	0.0	0.20	0.3
Leq	94.0	0.0	0.20	0.3

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
124	124.1	0.1	0.30	1.4
123	123.1	0.1	0.30	1.4
122	122.1	0.1	0.30	1.4
121	121.1	0.1	0.30	1.4
120	120.1	0.1	0.30	1.4
119	119.1	0.1	0.30	1.4
114	114.1	0.1	0.30	1.4
109	109.1	0.1	0.30	1.4

Date of Calibration : 20-22 Sep. 2021

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MTC No. EEL. BP. 42/0964

6. Level linearity on the reference level range (cont.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
104	104.1	0.1	0.30	1.4
99	99.1	0.1	0.30	1.4
94	94.1	0.1	0.30	1.4
89	89.1	0.1	0.30	1.4
84	84.1	0.1	0.30	1.4
79	79.1	0.1	0.30	1.4
74	74.2	0.2	0.30	1.4
69	69.2	0.2	0.30	1.4
64	64.2	0.2	0.30	1.4
59	59.2	0.2	0.30	1.4
54	54.3	0.3	0.30	1.4
49	49.2	0.2	0.30	1.4
44	44.4	0.4	0.30	1.4
39	39.3	0.3	0.30	1.4
34	34.3	0.3	0.30	1.4
33	33.3	0.3	0.30	1.4
32	32.3	0.3	0.30	1.4
31	31.5	0.5	0.30	1.4
30	30.5	0.5	0.30	1.4

Date of Calibration : 20-22 Sep. 2021

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0840

MTC No. EEL. BP. 42/0964

7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
40-130	125	125.1	0.1	0.30	1.4
30-120	115	115.0	0.0	0.30	1.4
20-110	105	105.0	0.0	0.30	1.4
20-100	95	95.0	0.0	0.30	1.4
20-90	85	85.0	0.0	0.30	1.4
20-80	75	75.0	0.0	0.30	1.4

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (dB)
Fast	200	115.6	-0.4	0.20	± 1.3
	2	98.0	-1.0	0.20	+1.3; -2.8
	0.25	88.4	-1.6	0.20	+1.8; -5.3
Slow	200	109.4	-0.2	0.20	± 1.3
	2	89.8	-0.2	0.20	+1.3; -5.3
SEL	200	109.9	-0.1	0.20	± 1.3
	2	90.0	0.0	0.20	+1.3; -2.8
	0.25	80.9	-0.1	0.20	+1.8; -5.3

Date of Calibration : 20-22 Sep. 2021

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

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0840

MTC No. EEL. BP. 42/0964

9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (\pm dB)	Tolerance limits Class 2 (\pm dB)
Complete cycle	125.4	125.8	0.4	0.20	2.4
Positive half cycle	124.4	124.2	-0.2	0.20	1.4
Negative half cycle	124.4	124.2	-0.2	0.20	1.4

10. Overload indication

Measured value (dB)		Deviated value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
Positive one-half cycle	Negative one-half cycle			
133.1	133.1	0.0	0.30	1.8

Calibrated by :

Approved by :

Date of Calibration : 20-22 Sep. 2021

Industrial Metrology and Testing Service Centre

Date of Issue : 22 Sep. 2021

Ref : 2011264091403810002

End of Certificate

8 / 8

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FM.BL.MTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0764

MTC No. EEL. BP. 29/0864

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., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Integrating Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial No. : 00192062

Microphone : Type 7052NR No.73361

Preamplifier : -

Ambient Environment

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

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

Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$

Standards used :

1. Band Pass Filter Wavetek 752A S/N 90010494.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2633526.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 9 Aug. 2021

Date of Calibration : 24-31 Aug. 2021

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0764

MTC No. EEL. BP. 29/0864

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
11. Digital Multimeter Agilent 34401A S/N MY44005560.
12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the 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.

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%.

Date of Calibration : 24-31 Aug. 2021

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1. Absolute Sensitivity

Reference	Unit Under Test				Tolerance
Acoustic Signal (dB)	Measured Value (dB)		Deviation (dB)	Uncertainty (±dB)	Limit Class 2 (±dB)
	Before adjust	After adjust			
113.94	114.6	113.9	0.0	0.30	1.4

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 113.9 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
16.1	0.10

2.2 The microphone of the sound level meter was replaced by electrical signal input device

Frequency Weighting	Measured Value (dB)	Uncertainty (±dB)
A-Weighting	12.5	0.26
C-Weighting	18.5	0.45
Flat	22.6	0.40

Date of Calibration : 24-31 Aug. 2021

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
125	0.1	-0.1	-0.1	0.40	2.0
1 000	-0.6	-0.4	-0.4	0.40	1.4
4 000	0.9	0.7	1.1	0.40	3.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
63	0.2	0.0	0.1	0.20	2.5
125	0.0	0.1	0.1	0.20	2.0
250	0.0	0.0	0.1	0.20	1.9
500	0.0	0.0	0.0	0.20	1.9
1 000	0.0	0.0	0.0	0.20	1.4
2 000	-0.2	-0.1	0.1	0.20	2.6
4 000	-0.5	-0.4	0.0	0.20	3.6
8 000	-0.6	-0.6	-0.1	0.20	5.6

Date of Calibration : 24-31 Aug. 2021

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0764

MTC No. EEL. BP. 29/0864

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
A-weighting	94.0	0.0	0.20	0.4
C-weighting	94.0	0.0	0.20	0.4
Flat	94.1	0.1	0.20	0.4

5.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
Fast	94.0	0.0	0.20	0.3
Slow	94.0	0.0	0.20	0.3
Leq	94.0	0.0	0.20	0.3

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
123	123.1	0.1	0.30	1.4
122	122.1	0.1	0.30	1.4
121	121.1	0.1	0.30	1.4
120	120.1	0.1	0.30	1.4
119	119.1	0.1	0.30	1.4
114	114.1	0.1	0.30	1.4
109	109.1	0.1	0.30	1.4

Date of Calibration : 24-31 Aug. 2021

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Request No. 21-64/0764

MTC No. EEL. BP. 29/0864

6. Level linearity on the reference level range (cont.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
104	104.1	0.1	0.30	1.4
99	99.1	0.1	0.30	1.4
94	94.0	0.0	0.30	1.4
89	89.1	0.1	0.30	1.4
84	84.1	0.1	0.30	1.4
79	79.1	0.1	0.30	1.4
74	74.2	0.2	0.30	1.4
69	69.2	0.2	0.30	1.4
64	64.1	0.1	0.30	1.4
59	59.0	0.0	0.30	1.4
54	54.1	0.1	0.30	1.4
49	49.1	0.1	0.30	1.4
44	44.1	0.1	0.30	1.4
39	39.0	0.0	0.30	1.4
34	34.2	0.2	0.30	1.4
33	33.2	0.2	0.30	1.4
32	32.2	0.2	0.30	1.4
31	31.3	0.3	0.30	1.4
30	30.3	0.3	0.30	1.4

Date of Calibration : 24-31 Aug. 2021

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0764

MTC No. EEL. BP. 29/0864

7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (+dB)	Tolerance Limits Class 2 (+dB)
40-130	125	125.0	0.0	0.30	1.4
30-120	115	115.0	0.0	0.30	1.4
20-110	105	105.0	0.0	0.30	1.4
20-100	95	95.0	0.0	0.30	1.4
20-90	85	84.9	-0.1	0.30	1.4
20-80	75	74.9	-0.1	0.30	1.4

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (+dB)	Tolerance Limits Class 2 (dB)
Fast	200	115.8	-0.2	0.20	± 1.3
	2	97.8	-1.2	0.20	+1.3; -2.8
	0.25	88.1	-1.9	0.20	+1.8; -5.3
Slow	200	109.4	-0.2	0.20	± 1.3
	2	89.8	-0.2	0.20	+1.3; -5.3
SEL	200	109.9	-0.1	0.20	± 1.3
	2	90.0	0.0	0.20	+1.3; -2.8
	0.25	80.9	-0.1	0.20	+1.8; -5.3

Date of Calibration : 24-31 Aug. 2021

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FM.BL.MTC.002 Rev.4

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0764

MTC No. EEL. BP. 29/0864

9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (\pm dB)	Tolerance limits Class 2 (\pm dB)
Complete cycle	125.4	125.8	0.4	0.20	2.4
Positive half cycle	124.4	124.2	-0.2	0.20	1.4
Negative half cycle	124.4	124.2	-0.2	0.20	1.4

10. Overload indication

Measured value (dB)		Deviated value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
Positive one-half cycle	Negative one-half cycle			
133.1	133.0	0.1	0.30	1.8

Calibrated by :

Approved by :

Date of Calibration : 24-31 Aug. 2021

Industrial Metrology and Testing Service Centre

Date of Issue : 6 Sep. 2021

Ref : 2011264080903328003

End of Certificate

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0840

MTC No. EEL. BP. 43/0964

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., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Integrating Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial No. : 192063

Microphone : Type 7052NR No.73362

Preamplifier : -

Ambient Environment

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

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

Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 14 Sep. 2021

Date of Calibration : 20-22 Sep. 2021

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FM.BL.MTC.002 Rev.4

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0840

MTC No. EEL. BP. 43/0964

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
11. Digital Multimeter Agilent 34401A S/N MY44005560.
12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the 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.

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%.

Date of Calibration : 20-22 Sep. 2021

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0840

MTC No. EEL. BP. 43/0964

1. Absolute Sensitivity

Reference	Unit Under Test				Tolerance
Acoustic Signal	Measured Value (dB)		Deviation	Uncertainty	Limit Class 2
	Before adjust	After adjust			
(dB)			(dB)	(+dB)	(+dB)
113.94	114.2	113.9	0.0	0.30	1.4

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 113.1 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
18.9	0.10

2.2 The microphone of the sound level meter was replaced by electrical signal input device

Frequency Weighting	Measured Value (dB)	Uncertainty (±dB)
A-Weighting	17.3	0.10
C-Weighting	31.1	0.10
Flat	39.0	0.10

Date of Calibration : 20-22 Sep. 2021

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0840

MTC No. EEL. BP. 43/0964

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (+dB)	Tolerance Limits Class 2 (+dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
125	0.1	0.0	-0.1	0.40	2.0
1 000	-0.9	-0.9	-0.8	0.40	1.4
4 000	-1.0	-0.9	-0.6	0.40	3.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (+dB)	Tolerance Limits Class 2 (+dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
63	0.2	0.1	0.1	0.20	2.5
125	0.1	0.1	0.1	0.20	2.0
250	0.1	0.0	0.0	0.20	1.9
500	0.1	0.0	0.0	0.20	1.9
1 000	0.0	0.0	0.0	0.20	1.4
2 000	-0.1	0.0	0.1	0.20	2.6
4 000	-0.5	-0.4	0.1	0.20	3.6
8 000	-0.7	-0.6	-0.1	0.20	5.6

Date of Calibration : 20-22 Sep. 2021

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0840

MTC No. EEL. BP. 43/0964

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (+dB)	Tolerance Limits Class 2 (+dB)
A-weighting	94.0	0.0	0.20	0.4
C-weighting	94.0	0.0	0.20	0.4
Flat	94.1	0.1	0.20	0.4

5.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (+dB)	Tolerance Limits Class 2 (+dB)
Fast	94.0	0.0	0.20	0.3
Slow	94.0	0.0	0.20	0.3
Leq	94.0	0.0	0.20	0.3

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (+dB)	Tolerance Limits Class 2 (+dB)
124	124.1	0.1	0.30	1.4
123	123.0	0.0	0.30	1.4
122	122.1	0.1	0.30	1.4
121	121.1	0.1	0.30	1.4
120	120.1	0.1	0.30	1.4
119	119.1	0.1	0.30	1.4
114	114.0	0.0	0.30	1.4
109	109.0	0.0	0.30	1.4

Date of Calibration : 20-22 Sep. 2021

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Request No. 21-64/0840

MTC No. EEL. BP. 43/0964

6. Level linearity on the reference level range (cont.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
104	104.1	0.1	0.30	1.4
99	99.0	0.0	0.30	1.4
94	94.0	0.0	0.30	1.4
89	89.0	0.0	0.30	1.4
84	84.0	0.0	0.30	1.4
79	79.1	0.1	0.30	1.4
74	74.2	0.2	0.30	1.4
69	69.1	0.1	0.30	1.4
64	64.0	0.0	0.30	1.4
59	59.0	0.0	0.30	1.4
54	54.0	0.0	0.30	1.4
49	49.0	0.0	0.30	1.4
44	44.1	0.1	0.30	1.4
39	39.0	0.0	0.30	1.4
34	34.1	0.1	0.30	1.4
33	33.2	0.2	0.30	1.4
32	32.2	0.2	0.30	1.4
31	31.3	0.3	0.30	1.4
30	30.3	0.3	0.30	1.4

Date of Calibration : 20-22 Sep. 2021

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0840

MTC No. EEL. BP. 43/0964

7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
40-130	125	125.1	0.1	0.30	1.4
30-120	115	115.0	0.0	0.30	1.4
20-110	105	105.0	0.0	0.30	1.4
20-100	95	95.0	0.0	0.30	1.4
20-90	85	85.0	0.0	0.30	1.4
20-80	75	75.0	0.0	0.30	1.4

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (dB)
Fast	200	115.6	-0.4	0.20	± 1.3
	2	98.3	-0.7	0.20	+1.3; -2.8
	0.25	88.7	-1.3	0.20	+1.8; -5.3
Slow	200	109.4	-0.2	0.20	± 1.3
	2	89.8	-0.2	0.20	+1.3; -5.3
SEL	200	109.9	-0.1	0.20	± 1.3
	2	89.9	-0.1	0.20	+1.3; -2.8
	0.25	80.9	-0.1	0.20	+1.8; -5.3

Date of Calibration : 20-22 Sep. 2021

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Request No. 21-64/0840

MTC No. EEL. BP. 43/0964

9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (+dB)	Tolerance limits Class 2 (+dB)
Complete cycle	125.4	125.8	0.4	0.20	2.4
Positive half cycle	124.4	124.2	-0.2	0.20	1.4
Negative half cycle	124.4	124.2	-0.2	0.20	1.4

10. Overload indication

Measured value (dB)		Deviated value (dB)	Uncertainty (+dB)	Tolerance Limits Class 2 (+dB)
Positive one-half cycle	Negative one-half cycle			
133.1	133.0	0.1	0.30	1.8

Calibrated by :

Approved by :



Date of Calibration : 20-22 Sep. 2021

Industrial Metrology and Testing Service Centre

Date of Issue : 22 Sep. 2021

Ref : 2011264091403810003

End of Certificate

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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_094/22

Sound Level Meter Calibration Report

Acoustic Calibrator Data

Brand	ACO	Number	AC 03/56
Model	2127	Serial No.	130006
Calibration Range	94 dB, 1000 Hz	Last Calibration	15 May 2021
		Due Date	15 May 2022

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NL 21-01	RION	NL-21	00554245	17 February 2022	94.0	94.0
ACO-R40	ACO	6236	00192052	17 February 2022	94.1	94.0
ACO-R41	ACO	6236	00192053	17 February 2022	94.0	94.0
ACO-R50	ACO	6236	00192062	17 February 2022	94.1	94.0
ACO-R51	ACO	6236	00192063	17 February 2022	94.1	94.0
ACO-R52	ACO	6236	00192064	17 February 2022	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.96 ± 0.40 dB	

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0776

MTC No. EEL. BP. 44/0864

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 : Rion

Model : NC-73

Serial No. : 10727909

Ambient Environment

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

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

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

- Standards used :
1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
 2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
 3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
 4. Digital Multimeter Agilent 34401A S/N MY44005560.
 5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
 6. Audio Analyzer Panasonic VP-7722A S/N 041477D122.
 7. Condenser Microphone B&K 4180 S/N 2633526.

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

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

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

Date of Receipt : 16 Aug. 2021

Date of Calibration : 18 Aug. 2021

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FM.BL.MTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0776

MTC No. EEL. BP. 44/0864

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	93.88	-0.12	± 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	980.9	-19.1	± 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	1.56	± 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 :



Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 18 Aug. 2021

Date of Issue : 23 Aug. 2021

Ref : 2011264081603374001

End of Certificate

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0840

MTC No. EEL. BP. 41/0964

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., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Ambient Environment

Description : Integrating Sound Level Meter

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

Manufacturer : ACO

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

Model : 6236

Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$

Serial No. : 192052

Microphone : Type 7052NR No.73351

Preamplifier : -

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 14 Sep. 2021

Date of Calibration : 20-22 Sep. 2021

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0840

MTC No. EEL. BP. 41/0964

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
11. Digital Multimeter Agilent 34401A S/N MY44005560.
12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

This instrument has been calibrated against standards maintained at the 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.

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%.

Date of Calibration : 20-22 Sep. 2021

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0840

MTC No. EEL. BP. 41/0964

1. Absolute Sensitivity

Reference	Unit Under Test			Tolerance	
Acoustic Signal (dB)	Measured Value (dB)		Deviation	Uncertainty	Limit Class 2 (±dB)
	Before adjust	After adjust	(dB)	(±dB)	
113.94	115.2	113.9	0.0	0.30	1.4

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 113.3 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
16.3	0.10

2.2 The microphone of the sound level meter was replaced by electrical signal input device

Frequency Weighting	Measured Value (dB)	Uncertainty (±dB)
A-Weighting	11.2	0.10
C-Weighting	17.1	0.10
Flat	21.3	0.10

Date of Calibration : 20-22 Sep. 2021

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0840

MTC No. EEL. BP. 41/0964

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
125	0.1	-0.1	-0.1	0.40	2.0
1 000	-1.0	-0.9	-0.9	0.40	1.4
4 000	-0.6	-0.6	-0.3	0.40	3.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
63	0.2	0.0	0.0	0.20	2.5
125	0.1	0.0	0.0	0.20	2.0
250	0.1	0.0	0.0	0.20	1.9
500	0.1	0.0	0.0	0.20	1.9
1 000	0.0	0.0	0.0	0.20	1.4
2 000	-0.1	0.0	0.0	0.20	2.6
4 000	-0.4	-0.4	0.0	0.20	3.6
8 000	-0.7	-0.6	-0.1	0.20	5.6

Date of Calibration : 20-22 Sep. 2021

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0840

MTC No. EEL. BP. 41/0964

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (+dB)	Tolerance Limits Class 2 (+dB)
A-weighting	94.0	0.0	0.20	0.4
C-weighting	94.0	0.0	0.20	0.4
Flat	94.0	0.0	0.20	0.4

5.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Uncertainty (+dB)	Tolerance Limits Class 2 (+dB)
Fast	94.0	0.0	0.20	0.3
Slow	94.0	0.0	0.20	0.3
Leq	94.0	0.0	0.20	0.3

6. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (+dB)	Tolerance Limits Class 2 (+dB)
124	124.0	0.0	0.30	1.4
123	123.1	0.1	0.30	1.4
122	122.0	0.0	0.30	1.4
121	121.1	0.1	0.30	1.4
120	120.0	0.0	0.30	1.4
119	119.0	0.0	0.30	1.4
114	114.0	0.0	0.30	1.4
109	109.0	0.0	0.30	1.4

Date of Calibration : 20-22 Sep. 2021

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

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FM.BL.MTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0840

MTC No. EEL. BP. 41/0964

6. Level linearity on the reference level range (cont.)

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
104	103.9	-0.1	0.30	1.4
99	99.0	0.0	0.30	1.4
94	94.0	0.0	0.30	1.4
89	89.0	0.0	0.30	1.4
84	84.1	0.1	0.30	1.4
79	78.9	-0.1	0.30	1.4
74	74.1	0.1	0.30	1.4
69	69.1	0.1	0.30	1.4
64	64.0	0.0	0.30	1.4
59	59.0	0.0	0.30	1.4
54	54.0	0.0	0.30	1.4
49	49.0	0.0	0.30	1.4
44	44.1	0.1	0.30	1.4
39	39.0	0.0	0.30	1.4
34	34.1	0.1	0.30	1.4
33	33.1	0.1	0.30	1.4
32	32.1	0.1	0.30	1.4
31	31.2	0.2	0.30	1.4
30	30.2	0.2	0.30	1.4

Date of Calibration : 20-22 Sep. 2021

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0840

MTC No. EEL. BP. 41/0964

7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (+dB)	Tolerance Limits Class 2 (+dB)
40-130	125	125.1	0.1	0.30	1.4
30-120	115	115.0	0.0	0.30	1.4
20-110	105	105.0	0.0	0.30	1.4
20-100	95	95.0	0.0	0.30	1.4
20-90	85	85.0	0.0	0.30	1.4
20-80	75	75.0	0.0	0.30	1.4

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (+dB)	Tolerance Limits Class 2 (dB)
Fast	200	115.8	-0.2	0.20	± 1.3
	2	97.9	-1.1	0.20	+1.3; -2.8
	0.25	88.3	-1.7	0.20	+1.8; -5.3
Slow	200	109.4	-0.2	0.20	± 1.3
	2	89.8	-0.2	0.20	+1.3; -5.3
SEL	200	109.9	-0.1	0.20	± 1.3
	2	90.0	0.0	0.20	+1.3; -2.8
	0.25	80.9	-0.1	0.20	+1.8; -5.3

Date of Calibration : 20-22 Sep. 2021

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0840

MTC No. EEL. BP. 41/0964

9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (\pm dB)	Tolerance limits Class 2 (\pm dB)
Complete cycle	125.4	125.8	0.4	0.20	2.4
Positive half cycle	124.4	124.2	-0.2	0.20	1.4
Negative half cycle	124.4	124.2	-0.2	0.20	1.4

10. Overload indication

Measured value (dB)		Deviated value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
Positive one-half cycle	Negative one-half cycle			
133.1	133.0	0.1	0.30	1.8

Calibrated by :

Approved by :

Date of Calibration : 20-22 Sep. 2021

Industrial Metrology and Testing Service Centre

Date of Issue : 22 Sep. 2021

Ref : 2011264091403810001

End of Certificate

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

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FM.BL.MTC.002 Rev.4

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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_251/22

Sound Level Meter Calibration Report

Acoustic Calibrator Data

Brand	RION	Number	AC 02/40
Model	NC-73	Serial No.	10727909
Calibration Range	94 dB, 1000 Hz	Last Calibration	16 August 2021
		Due Date	18 August 2022

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-R40	ACO	6236	00192052	18 May 2022	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.88 ± 0.40 dB	



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0841

MTC No. EEL. BP. 46/0964

CALIBRATION CERTIFICATE

Submitted by : S.P.S CONSULTING SERVICE CO.,LTD.

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

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

Instrument Calibrated :

Description : Acoustic Calibrator

Manufacturer : SVANTEK

Model : SV34

Serial No. : 33139

Ambient Environment

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

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

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

Standards used : 1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
4. Digital Multimeter Agilent 34401A S/N MY44005560.
5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
6. Audio Analyzer Panasonic VP-7722A S/N 041477D122.
7. Condenser Microphone B&K 4180 S/N 2889871.

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

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

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

Date of Receipt : 14 Sep. 2021

Date of Calibration : 17 Sep. 2021

The results relate only to the items tested or calibrated.

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FM.BL.MTC.002 Rev.3

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0841

MTC No. EEL. BP. 46/0964

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

Nominal Output of Unit Under Test = 114 dB re 20 μ Pa at 1000 Hz

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	113.67	-0.33	± 0.10	± 0.75 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	1000.0	0.0	± 1.5	$\pm 2.0\%$

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	0.24	± 0.50	$\pm 4.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :



Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 17 Sep. 2021

Date of Issue : 20 Sep. 2021

Ref : 2011264091403811002

End of Certificate

2 / 2

The results relate only to the items tested or calibrated.

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FM.BL.MTC.002 Rev.3

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0397

MTC No. EEL. BP. 92/0365

CALIBRATION CERTIFICATE

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

Address : 7 Soi Phaholyothin 24, Phaholyothin Rd., 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 : Noise Dosimeter

Manufacturer : Svantek

Model : SV-104IS

Serial No. : 80854

Ambient Environment

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

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

Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$

Standards used :

Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358 with Coupler UA0915 S/N 2810358.

Calibration Procedure :

This instrument was calibrated by using calibration procedure no CP-102-01, which was based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). This calibration procedure was related to the acoustical signal test of frequency weightings using a multifunction acoustic calibrator.

This instrument has been calibrated against standards maintained at the 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.

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%.

Date of Receipt : 18 Mar. 2022

Date of Calibration : 23 Mar. 2022

1 / 2

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FM.BL.MTC.002 Rev.4

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Request No. 21-65/0397

MTC No. EEL. BP. 92/0365

Acoustic signal test of frequency weightings

Frequency (Hz)	Deviation from response curve		Uncertainty (+dB)	Tolerance Limits Class 2 (+dB)
	A-weighting (dB)	C-weighting (dB)		
125	-0.4	-0.4	0.25	2.0
1 000	0.1	0.0	0.25	1.4
4 000	-0.1	-0.1	0.25	3.6

- Note :**
- 1) There was no adjustment.
 - 2) The calibration was performed at a sound pressure level of 114 dB.
 - 3) The measured values did not include the correction of microphone of UUT.
 - 4) The deviation was produced from the absolute difference between the measured values and the responding sound pressure levels in IEC 61672-1 (2002).

Calibrated by :

Approved by :

...

**Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre**

Ref : 2011265031801270004

Date of Calibration : 23 Mar. 2022

Date of Issue : 23 Mar. 2022

2 / 2

End of Certificate

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0397

MTC No. EEL. BP. 93/0365

CALIBRATION CERTIFICATE

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

Address : 7 Soi Phaholyothin 24, Phaholyothin Rd., 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 : Noise Dosimeter

Manufacturer : Svantek

Model : SV-104IS

Serial No. : 80856

Ambient Environment

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

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

Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$

Standards used :

Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358 with Coupler UA0915 S/N 2810358.

Calibration Procedure :

This instrument was calibrated by using calibration procedure no CP-102-01, which was based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). This calibration procedure was related to the acoustical signal test of frequency weightings using a multifunction acoustic calibrator.

This instrument has been calibrated against standards maintained at the 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.

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%.

Date of Receipt : 18 Mar. 2022

Date of Calibration : 23 Mar. 2022

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Request No. 21-65/0397

MTC No. EEL. BP. 93/0365

Acoustic signal test of frequency weightings

Frequency (Hz)	Deviation from response curve		Uncertainty (+dB)	Tolerance Limits Class 2 (+dB)
	A-weighting (dB)	C-weighting (dB)		
125	-0.1	-0.1	0.25	2.0
1 000	0.2	0.0	0.25	1.4
4 000	0.8	0.8	0.25	3.6

- Note :**
- 1) There was no adjustment.
 - 2) The calibration was performed at a sound pressure level of 114 dB.
 - 3) The measured values did not include the correction of microphone of UUT.
 - 4) The deviation was produced from the absolute difference between the measured values and the responding sound pressure levels in IEC 61672-1 (2002).

Calibrated by :

Approved by :

**Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre**

Ref : 2011265031801270005

Date of Calibration : 23 Mar. 2022

Date of Issue : 23 Mar. 2022

2 / 2

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

Request No. 21-65/0389

MTC No. EEL. BP. 70/0365

CALIBRATION CERTIFICATE

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

Address : 7 Soi Phaholyothin 24, Phaholyothin Rd., 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 : Noise Dosimeter

Manufacturer : Svantek

Model : SV-104IS

Serial No. : 106120

Ambient Environment

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

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

Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$

Standards used :

Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358 with Coupler UA0915 S/N 2810358.

Calibration Procedure :

This instrument was calibrated by using calibration procedure no CP-102-01, which was based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). This calibration procedure was related to the acoustical signal test of frequency weightings using a multifunction acoustic calibrator.

This instrument has been calibrated against standards maintained at the 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.

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%.

Date of Receipt : 16 Mar. 2022

Date of Calibration : 18 Mar. 2022

1 / 2

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

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FM.BL.MTC.002 Rev.4

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

Fax. (66) 0 2323 9165

E-mail : mtc@tistr.or.th

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Fax. (66) 0 2579 8592

E-mail : sumalee@tistr.or.th

Request No. 21-65/0389

MTC No. EEL. BP. 70/0365

Acoustic signal test of frequency weightings

Frequency (Hz)	Deviation from response curve		Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
	A-weighting (dB)	C-weighting (dB)		
125	0.0	0.0	0.25	2.0
1 000	0.2	0.0	0.25	1.4
4 000	0.1	0.2	0.25	3.6

- Note :**
- 1) There was no adjustment.
 - 2) The calibration was performed at a sound pressure level of 114 dB.
 - 3) The measured values did not include the correction of microphone of UUT.
 - 4) The deviation was produced from the absolute difference between the measured values and the responding sound pressure levels in IEC 61672-1 (2002).

Calibrated by :

Approved by :

...

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011265031601187001

Date of Calibration : 18 Mar. 2022

Date of Issue : 18 Mar. 2022

2 / 2

End of Certificate

The results relate only to the items tested/calibrated or value assigned.
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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0389

MTC No. EEL. BP. 71/0365

CALIBRATION CERTIFICATE

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

Address : 7 Soi Phaholyothin 24, Phaholyothin Rd., 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 : Noise Dosimeter

Manufacturer : Svantek

Model : SV-104IS

Serial No. : 106122

Standards used :

Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358 with Coupler UA0915 S/N 2810358.

Calibration Procedure :

This instrument was calibrated by using calibration procedure no CP-102-01, which was based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). This calibration procedure was related to the acoustical signal test of frequency weightings using a multifunction acoustic calibrator.

This instrument has been calibrated against standards maintained at the 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.

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%.

Date of Receipt : 16 Mar. 2022

Date of Calibration : 18 Mar. 2022

1 / 2

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

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FM.BL.MTC.002 Rev.4

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E-mail : sumalee@tistr.or.th

Request No. 21-65/0389

MTC No. EEL. BP. 71/0365

Acoustic signal test of frequency weightings

Frequency (Hz)	Deviation from response curve		Uncertainty (+dB)	Tolerance Limits Class 2 (+dB)
	A-weighting (dB)	C-weighting (dB)		
125	0.4	0.3	0.25	2.0
1 000	0.2	0.0	0.25	1.4
4 000	0.3	0.3	0.25	3.6

- Note :
- 1) There was no adjustment.
 - 2) The calibration was performed at a sound pressure level of 114 dB.
 - 3) The measured values did not include the correction of microphone of UUT.
 - 4) The deviation was produced from the absolute difference between the measured values and the responding sound pressure levels in IEC 61672-1 (2002).

Calibrated by :

Approved by :

...

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011265031601187002

Date of Calibration : 18 Mar. 2022

Date of Issue : 18 Mar. 2022

2 / 2

End of Certificate

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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_185/22

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	17 September 2021
		Due Date	17 September 2022

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NMD-B04	SVANTEK	SV-104IS	80854	26 April 2022	113.6	113.6
NMD-B05	SVANTEK	SV-104IS	80856	26 April 2022	113.5	113.6
NMD-B11	SVANTEK	SV-104IS	80831	26 April 2022	113.6	113.6
NMD-B12	SVANTEK	SV-104IS	80832	26 April 2022	113.5	113.6
NMD-B15	SVANTEK	SV-104IS	80880	26 April 2022	113.6	113.6
NMD-B16	SVANTEK	SV-104IS	106120	26 April 2022	113.5	113.6
NMD-B17	SVANTEK	SV-104IS	106122	26 April 2022	113.6	113.6
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					113.67± 0.75 dB	



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0397

MTC No. EEL. BP. 89/0365

CALIBRATION CERTIFICATE

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

Address : 7 Soi Phaholyothin 24, Phaholyothin Rd., 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 : Noise Dosimeter

Manufacturer : Svantek

Model : SV-104IS

Serial No. : 80840

Ambient Environment

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

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

Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$

Standards used :

Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358 with Coupler UA0915 S/N 2810358.

Calibration Procedure :

This instrument was calibrated by using calibration procedure no CP-102-01, which was based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). This calibration procedure was related to the acoustical signal test of frequency weightings using a multifunction acoustic calibrator.

This instrument has been calibrated against standards maintained at the 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.

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%.

Date of Receipt : 18 Mar. 2022

Date of Calibration : 23 Mar. 2022

1 / 2

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

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Request No. 21-65/0397

MTC No. EEL. BP. 89/0365

Acoustic signal test of frequency weightings

Frequency (Hz)	Deviation from response curve		Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)		
125	0.4	0.5	0.25	2.0
1 000	0.2	0.0	0.25	1.4
4 000	0.0	0.0	0.25	3.6

- Note :**
- 1) There was no adjustment.
 - 2) The calibration was performed at a sound pressure level of 114 dB.
 - 3) The measured values did not include the correction of microphone of UUT.
 - 4) The deviation was produced from the absolute difference between the measured values and the responding sound pressure levels in IEC 61672-1 (2002).

Calibrated by :

Approved by :



**Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre**

Ref : 2011265031801270001

Date of Calibration : 23 Mar. 2022

Date of Issue : 23 Mar. 2022

2 / 2

End of Certificate

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

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0397

MTC No. EEL. BP. 89/0365

CALIBRATION CERTIFICATE

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

Address : 7 Soi Phaholyothin 24, Phaholyothin Rd., 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 : Noise Dosimeter

Manufacturer : Svantek

Model : SV-104IS

Serial No. : 80840

Ambient Environment

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

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

Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$

Standards used :

Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358 with Coupler UA0915 S/N 2810358.

Calibration Procedure :

This instrument was calibrated by using calibration procedure no CP-102-01, which was based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). This calibration procedure was related to the acoustical signal test of frequency weightings using a multifunction acoustic calibrator.

This instrument has been calibrated against standards maintained at the 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.

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%.

Date of Receipt : 18 Mar. 2022

Date of Calibration : 23 Mar. 2022

1 / 2

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

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FM.BL.MTC.002 Rev.4

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Request No. 21-65/0397

MTC No. EEL. BP. 89/0365

Acoustic signal test of frequency weightings

Frequency (Hz)	Deviation from response curve		Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)		
125	0.4	0.5	0.25	2.0
1 000	0.2	0.0	0.25	1.4
4 000	0.0	0.0	0.25	3.6

- Note :**
- 1) There was no adjustment.
 - 2) The calibration was performed at a sound pressure level of 114 dB.
 - 3) The measured values did not include the correction of microphone of UUT.
 - 4) The deviation was produced from the absolute difference between the measured values and the responding sound pressure levels in IEC 61672-1 (2002).

Calibrated by :

Approved by :

..

**Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre**

Ref : 2011265031801270001

Date of Calibration : 23 Mar. 2022

Date of Issue : 23 Mar. 2022

2 / 2

End of Certificate

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บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
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Tel : (662) 939-4370-72, Fax : (662) 513-4221. E-mail : sale@spscon.com., www.spscon.com

Noise Dose R_252/22

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	17 September 2021
		Due Date	17 September 2022

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NMD-B01	SVANTEK	SV-104IS	80840	18 May 2022	113.6	113.6
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					113.67+ 0.75 dB	



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0363

MTC No. EEL. BP. 32/0365

CALIBRATION CERTIFICATE

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

Address : 7 Soi Phaholyothin 24, Phaholyothin Rd., 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 : Noise Dosimeter

Manufacturer : Svantek

Model : SV-104IS

Serial No. : 80818

Ambient Environment

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

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

Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$

Standards used :

Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358 with Coupler UA0915 S/N 2810358.

Calibration Procedure :

This instrument was calibrated by using calibration procedure no CP-102-01, which was based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). This calibration procedure was related to the acoustical signal test of frequency weightings using a multifunction acoustic calibrator.

This instrument has been calibrated against standards maintained at the 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.

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%.

Date of Receipt : 7 Mar. 2022

Date of Calibration : 9 Mar. 2022

1 / 2

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

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FM.BL.MTC.002 Rev.4

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E-mail : sumalee@tistr.or.th

Request No. 21-65/0363

MTC No. EEL. BP. 32/0365

Acoustic signal test of frequency weightings

Frequency (Hz)	Deviation from response curve		Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
	A-weighting (dB)	C-weighting (dB)		
125	0.3	0.3	0.25	2.0
1 000	0.2	0.0	0.25	1.4
4 000	0.1	0.0	0.25	3.6

- Note :**
- 1) There was no adjustment.
 - 2) The calibration was performed at a sound pressure level of 114 dB.
 - 3) The measured values did not include the correction of microphone of UUT.
 - 4) The deviation was produced from the absolute difference between the measured values and the responding sound pressure levels in IEC 61672-1 (2002).

Calibrated by :

Approved by :

..

**Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre**

Ref : 2011265030701010003

Date of Calibration : 9 Mar. 2022

Date of Issue : 9 Mar. 2022

2 / 2

End of Certificate

The results relate only to the items tested/calibrated or value assigned.
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FM.BL.MTC.002 Rev.4

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Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

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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

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E-mail : sumalee@tistr.or.th



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0363

MTC No. EEL. BP. 33/0365

CALIBRATION CERTIFICATE

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

Address : 7 Soi Phaholyothin 24, Phaholyothin Rd., 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 : Noise Dosimeter

Manufacturer : Svantek

Model : SV-104IS

Serial No. : 80829

Ambient Environment

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

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

Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$

Standards used :

Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358 with Coupler UA0915 S/N 2810358.

Calibration Procedure :

This instrument was calibrated by using calibration procedure no CP-102-01, which was based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). This calibration procedure was related to the acoustical signal test of frequency weightings using a multifunction acoustic calibrator.

This instrument has been calibrated against standards maintained at the 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.

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%.

Date of Receipt : 7 Mar. 2022

Date of Calibration : 9 Mar. 2022

1 / 2

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

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FM.BL.MTC.002 Rev.4

Head Office

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Fax. (66) 0 2579 8592

E-mail : sumalee@tistr.or.th

Request No. 21-65/0363

MTC No. EEL. BP. 33/0365

Acoustic signal test of frequency weightings

Frequency (Hz)	Deviation from response curve		Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)		
125	0.0	-0.1	0.25	2.0
1 000	0.2	0.0	0.25	1.4
4 000	1.0	1.1	0.25	3.6

- Note :**
- 1) There was no adjustment.
 - 2) The calibration was performed at a sound pressure level of 114 dB.
 - 3) The measured values did not include the correction of microphone of UUT.
 - 4) The deviation was produced from the absolute difference between the measured values and the responding sound pressure levels in IEC 61672-1 (2002).

Calibrated by :

Approved by :

....

**Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre**

Ref : 2011265030701010004

Date of Calibration : 9 Mar. 2022

Date of Issue : 9 Mar. 2022

2 / 2

End of Certificate

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0363

MTC No. EEL, BP. 34/0365

CALIBRATION CERTIFICATE

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

Address : 7 Soi Phaholyothin 24, Phaholyothin Rd., 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 :

Ambient Environment

Description : Noise Dosimeter

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

Manufacturer : Svantek

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

Model : SV-104IS

Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$

Serial No. : 80830

Standards used :

Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358 with Coupler UA0915 S/N 2810358.

Calibration Procedure :

This instrument was calibrated by using calibration procedure no CP-102-01, which was based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). This calibration procedure was related to the acoustical signal test of frequency weightings using a multifunction acoustic calibrator.

This instrument has been calibrated against standards maintained at the 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.

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%.

Date of Receipt : 7 Mar. 2022

Date of Calibration : 9 Mar. 2022

1 / 2

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Request No. 21-65/0363

MTC No. EEL. BP. 34/0365

Acoustic signal test of frequency weightings

Frequency (Hz)	Deviation from response curve		Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)		
125	0.0	-0.1	0.25	2.0
1 000	0.2	0.0	0.25	1.4
4 000	0.7	0.8	0.25	3.6

- Note :**
- 1) There was no adjustment.
 - 2) The calibration was performed at a sound pressure level of 114 dB.
 - 3) The measured values did not include the correction of microphone of UUT.
 - 4) The deviation was produced from the absolute difference between the measured values and the responding sound pressure levels in IEC 61672-1 (2002).

Calibrated by :

Approved by :



**Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre**

Ref : 2011265030701010005

Date of Calibration : 9 Mar. 2022

Date of Issue : 9 Mar. 2022

2 / 2

End of Certificate

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

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0193

MTC No. EEL. BP. 90/1264

CALIBRATION CERTIFICATE

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

Address : 7 Soi Phaholyothin 24, Phaholyothin Rd., 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 : Noise Dosimeter

Manufacturer : Svantek

Model : SV-104IS

Serial No. : 80831

Ambient Environment

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

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

Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$

Standards used :

Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358 with Coupler UA0915 S/N 2810358.

Calibration Procedure :

This instrument was calibrated by using calibration procedure no CP-102-01, which was based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). This calibration procedure was related to the acoustical signal test of frequency weightings using a multifunction acoustic calibrator.

This instrument has been calibrated against standards maintained at the 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.

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%.

Date of Receipt : 22 Dec. 2021

Date of Calibration : 28 Dec. 2021

1 / 2

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

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FM.BL.MTC.002 Rev.4

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E-mail : sumalee@tistr.or.th

Request No. 21-65/0193

MTC No. EEL. BP. 90/1264

Acoustic signal test of frequency weightings

Frequency (Hz)	Deviation from response curve		Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
	A-weighting (dB)	C-weighting (dB)		
125	0.2	0.2	0.25	2.0
1 000	0.0	-0.1	0.25	1.4
4 000	0.1	0.4	0.25	3.6

- Note :**
- 1) There was no adjustment.
 - 2) The calibration was performed at a sound pressure level of 114 dB.
 - 3) The measured values did not include the correction of microphone of UUT.
 - 4) The deviation was produced from the absolute difference between the measured values and the responding sound pressure levels in IEC 61672-1 (2002).

Calibrated by :

Approved by :



Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011264122205281005

Date of Calibration : 28 Dec. 2021

Date of Issue : 4 Jan. 2022

2 / 2

End of Certificate

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.



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_186/22

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	17 September 2021
		Due Date	17 September 2022

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NMD-B06	SVANTEK	SV-104IS	80816	26 April 2022	113.6	113.6
NMD-B07	SVANTEK	SV-104IS	80817	26 April 2022	113.5	113.6
NMD-B08	SVANTEK	SV-104IS	80818	26 April 2022	113.5	113.6
NMD-B09	SVANTEK	SV-104IS	80829	26 April 2022	113.6	113.6
NMD-B10	SVANTEK	SV-104IS	80830	26 April 2022	113.6	113.6
NMD-B11	SVANTEK	SV-104IS	80831	26 April 2022	113.6	113.6
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					113.67 ± 0.75 dB	



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0841

MTC No. EEL. BP. 45/0964

CALIBRATION CERTIFICATE

Submitted by : S.P.S CONSULTING SERVICE CO.,LTD.
Address : 7 Soi Phaholyothin 24, Phaholyothin Road, Jompol, Chatuchak, Bangkok 10900.
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
: Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Acoustic Calibrator
Manufacturer : SVANTEK
Model : SV34
Serial No. : 33146

Ambient Environment

Temperature : $(23 \pm 3) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15) \%$
Ambient Pressure : $(101.325 \pm 1.500) \text{ kPa}$

Standards used :

1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
4. Digital Multimeter Agilent 34401A S/N MY44005560.
5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
6. Audio Analyzer Panasonic VP-7722A S/N 041477D122.
7. Condenser Microphone B&K 4180 S/N 2889871

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

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

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

Date of Receipt : 14 Sep. 2021

Date of Calibration : 17 Sep. 2021

The results relate only to the items tested or calibrated.

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.3

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0841

MTC No. EEL. BP. 45/0964

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

Nominal Output of Unit Under Test = 114 dB re 20 μ Pa at 1000 Hz

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	113.65	-0.35	± 0.10	± 0.75 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	1000.0	0.0	± 1.5	$\pm 2.0\%$

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	0.48	± 0.50	$\pm 4.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

Approved by :



Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 17 Sep. 2021

Date of Issue : 20 Sep. 2021

Ref : 2011264091403811001

End of Certificate

2 / 2

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FM.BL.MTC.002 Rev.3

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Request No. 21-65/0389

MTC No. EEL. BP. 70/0365

CALIBRATION CERTIFICATE

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

Address : 7 Soi Phaholyothin 24, Phaholyothin Rd., 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 : Noise Dosimeter

Manufacturer : Svantek

Model : SV-104IS

Serial No. : 106120

Ambient Environment

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

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

Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$

Standards used :

Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358 with Coupler UA0915 S/N 2810358.

Calibration Procedure :

This instrument was calibrated by using calibration procedure no CP-102-01, which was based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). This calibration procedure was related to the acoustical signal test of frequency weightings using a multifunction acoustic calibrator.

This instrument has been calibrated against standards maintained at the 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.

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%.

Date of Receipt : 16 Mar. 2022

Date of Calibration : 18 Mar. 2022

1 / 2

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

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FM.BL.MTC.002 Rev.4

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Fax. (66) 0 2579 8592

E-mail : sumalee@tistr.or.th

Request No. 21-65/0389

MTC No. EEL. BP. 70/0365

Acoustic signal test of frequency weightings

Frequency (Hz)	Deviation from response curve		Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)		
125	0.0	0.0	0.25	2.0
1 000	0.2	0.0	0.25	1.4
4 000	0.1	0.2	0.25	3.6

- Note :**
- 1) There was no adjustment.
 - 2) The calibration was performed at a sound pressure level of 114 dB.
 - 3) The measured values did not include the correction of microphone of UUT.
 - 4) The deviation was produced from the absolute difference between the measured values and the responding sound pressure levels in IEC 61672-1 (2002).

Calibrated by :

Approved by :



Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011265031601187001

Date of Calibration : 18 Mar. 2022

Date of Issue : 18 Mar. 2022

2 / 2

End of Certificate

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

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0389

MTC No. EEL. BP. 71/0365

CALIBRATION CERTIFICATE

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

Address : 7 Soi Phaholyothin 24, Phaholyothin Rd., 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 : Noise Dosimeter

Manufacturer : Svantek

Model : SV-104IS

Serial No. : 106122

Ambient Environment

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

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

Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$

Standards used :

Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358 with Coupler UA0915 S/N 2810358.

Calibration Procedure :

This instrument was calibrated by using calibration procedure no CP-102-01, which was based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). This calibration procedure was related to the acoustical signal test of frequency weightings using a multifunction acoustic calibrator.

This instrument has been calibrated against standards maintained at the 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.

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%.

Date of Receipt : 16 Mar. 2022

Date of Calibration : 18 Mar. 2022

1 / 2

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

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Fax. (66) 0 2323 9165

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Office

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Thailand

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

Fax. (66) 0 2579 8592

E-mail : sumalee@tistr.or.th

Request No. 21-65/0389

MTC No. EEL. BP. 71/0365

Acoustic signal test of frequency weightings

Frequency (Hz)	Deviation from response curve		Uncertainty (+dB)	Tolerance Limits Class 2 (+dB)
	A-weighting (dB)	C-weighting (dB)		
125	0.4	0.3	0.25	2.0
1 000	0.2	0.0	0.25	1.4
4 000	0.3	0.3	0.25	3.6

- Note :**
- 1) There was no adjustment.
 - 2) The calibration was performed at a sound pressure level of 114 dB.
 - 3) The measured values did not include the correction of microphone of UUT.
 - 4) The deviation was produced from the absolute difference between the measured values and the responding sound pressure levels in IEC 61672-1 (2002).

Calibrated by :

Approved by :

...

**Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre**

Ref : 2011265031601187002

Date of Calibration : 18 Mar. 2022

Date of Issue : 18 Mar. 2022

2 / 2

End of Certificate

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

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FM.BL.MTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0389

MTC No. EEL. BP. 72/0365

CALIBRATION CERTIFICATE

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

Address : 7 Soi Phaholyothin 24, Phaholyothin Rd., 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 : Noise Dosimeter

Manufacturer : Svantek

Model : SV-104IS

Serial No. : 106123

Ambient Environment

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

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

Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$

Standards used :

Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358 with Coupler UA0915 S/N 2810358.

Calibration Procedure :

This instrument was calibrated by using calibration procedure no CP-102-01, which was based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). This calibration procedure was related to the acoustical signal test of frequency weightings using a multifunction acoustic calibrator.

This instrument has been calibrated against standards maintained at the 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.

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%.

Date of Receipt : 16 Mar. 2022

Date of Calibration : 18 Mar. 2022

1 / 2

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E-mail : sumalee@tistr.or.th

Request No. 21-65/0389

MTC No. EEL. BP. 72/0365

Acoustic signal test of frequency weightings

Frequency (Hz)	Deviation from response curve		Uncertainty (+dB)	Tolerance Limits Class 2 (+dB)
	A-weighting (dB)	C-weighting (dB)		
125	0.3	-0.1	0.25	2.0
1 000	0.1	0.0	0.25	1.4
4 000	0.0	0.0	0.25	3.6

- Note :**
- 1) There was no adjustment.
 - 2) The calibration was performed at a sound pressure level of 114 dB.
 - 3) The measured values did not include the correction of microphone of UUT.
 - 4) The deviation was produced from the absolute difference between the measured values and the responding sound pressure levels in IEC 61672-1 (2002).

Calibrated by :

Approved by :



**Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre**

Ref : 2011265031601187003

Date of Calibration : 18 Mar. 2022

Date of Issue : 18 Mar. 2022

2 / 2

End of Certificate

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0389

MTC No. EEL. BP. 73/0365

CALIBRATION CERTIFICATE

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

Address : 7 Soi Phaholyothin 24, Phaholyothin Rd., 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 : Noise Dosimeter

Manufacturer : Svantek

Model : SV-104IS

Serial No. : 106124

Standards used :

Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358 with Coupler UA0915 S/N 2810358.

Calibration Procedure :

This instrument was calibrated by using calibration procedure no CP-102-01, which was based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). This calibration procedure was related to the acoustical signal test of frequency weightings using a multifunction acoustic calibrator.

This instrument has been calibrated against standards maintained at the 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.

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%.

Date of Receipt : 16 Mar. 2022

Date of Calibration : 18 Mar. 2022

1 / 2

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E-mail : sumalee@tistr.or.th

Request No. 21-65/0389

MTC No. EEL. BP. 73/0365

Acoustic signal test of frequency weightings

Frequency (Hz)	Deviation from response curve		Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)		
125	0.0	-0.2	0.25	2.0
1 000	0.1	0.0	0.25	1.4
4 000	-0.3	-0.3	0.25	3.6

- Note :**
- 1) There was no adjustment.
 - 2) The calibration was performed at a sound pressure level of 114 dB.
 - 3) The measured values did not include the correction of microphone of UUT.
 - 4) The deviation was produced from the absolute difference between the measured values and the responding sound pressure levels in IEC 61672-1 (2002).

Calibrated by :

Approved by :



Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011265031601187004

Date of Calibration : 18 Mar. 2022

Date of Issue : 18 Mar. 2022

2 / 2

End of Certificate

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

Request No. 21-65/0389

MTC No. EEL. BP. 74/0365

CALIBRATION CERTIFICATE

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

Address : 7 Soi Phaholyothin 24, Phaholyothin Rd., 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 : Noise Dosimeter

Manufacturer : Svantek

Model : SV-104IS

Serial No. : 106131

Ambient Environment

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

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

Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$

Standards used :

Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358 with Coupler UA0915 S/N 2810358.

Calibration Procedure :

This instrument was calibrated by using calibration procedure no CP-102-01, which was based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). This calibration procedure was related to the acoustical signal test of frequency weightings using a multifunction acoustic calibrator.

This instrument has been calibrated against standards maintained at the 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.

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%.

Date of Receipt : 16 Mar. 2022

Date of Calibration : 18 Mar. 2022

1 / 2

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E-mail : sumalee@tistr.or.th

Request No. 21-65/0389

MTC No. EEL. BP. 74/0365

Acoustic signal test of frequency weightings

Frequency (Hz)	Deviation from response curve		Uncertainty (+dB)	Tolerance Limits Class 2 (+dB)
	A-weighting (dB)	C-weighting (dB)		
125	0.3	0.3	0.25	2.0
1 000	0.2	0.0	0.25	1.4
4 000	-0.1	0.0	0.25	3.6

- Note :**
- 1) There was no adjustment.
 - 2) The calibration was performed at a sound pressure level of 114 dB.
 - 3) The measured values did not include the correction of microphone of UUT.
 - 4) The deviation was produced from the absolute difference between the measured values and the responding sound pressure levels in IEC 61672-1 (2002).

Calibrated by :

Approved by :



**Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre**

Ref : 2011265031601187005

Date of Calibration : 18 Mar. 2022

Date of Issue : 18 Mar. 2022

2 / 2

End of Certificate

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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

Noise Dose R_095/22

Noise Dose Meter Calibration Report

Acoustic Calibrator Data

Brand	SVANTEK	Number	SV 05/62
Model	SV34	Serial No.	33146
Calibration Range	114 dB, 1000 Hz	Last Calibration	17 September 2021
		Due Date	17 September 2022

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NMD-B16	SVANTEK	SV-104IS	106120	17 February 2022	113.5	113.6
NMD-B17	SVANTEK	SV-104IS	106122	17 February 2022	113.6	113.6
NMD-B18	SVANTEK	SV-104IS	106123	17 February 2022	113.5	113.6
NMD-B19	SVANTEK	SV-104IS	106124	17 February 2022	113.6	113.6
NMD-B20	SVANTEK	SV-104IS	106131	17 February 2022	113.6	113.6
Acoustic Certified Value : Thailand Institute of Scientific And Technological Research (TISTR)					113.65± 0.75 dB	

คุณภาพอากาศในสถานประกอบการ



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

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
B01	SKC	224-PCXR4	262101	01/04/2022	1,000	1,500	2,000	994	1,497	1,998	1.001x - 3.749	1.000
B02	SKC	224-PCXR4	626166	04/04/2022	1,000	1,500	2,000	1,002	1,505	2,001	1.010x - 20.465	0.999
B03	SKC	224-PCXR4	612968	04/04/2022	1,000	1,500	2,000	996	1,494	2,000	1.006x - 12.986	1.000
B04	SKC	224-PCXR4	602804	01/04/2022	1,000	1,500	2,000	1,000	1,502	1,996	1.001x - 2.928	1.000
B05	SKC	224-PCXR4	612693	12/04/2022	1,000	1,500	2,000	1,003	1,499	2,003	1.012x - 23.061	0.999
B06	SKC	224-PCXR4	262188	01/04/2022	1,000	1,500	2,000	995	1,508	1,999	1.012x - 25.219	0.999
B07	SKC	224-PCXR4	626262	01/04/2022	1,000	1,500	2,000	998	1,492	1,995	0.992x + 6.804	1.000
B08	SKC	224-PCXR4	626100	12/04/2022	1,000	1,500	2,000	1,003	1,499	2,003	1.012x - 22.750	0.999
B09	SKC	224-PCXR4	626479	11/04/2022	1,000	1,500	2,000	997	1,490	1,994	0.994x + 3.231	1.000
B10	SKC	224-PCXR4	091950	04/04/2022	1,000	1,500	2,000	994	1,503	2,001	1.016x - 32.594	0.999
B11	SKC	224-PCXR8	564315	06/04/2022	1,000	1,500	2,000	995	1,490	1,998	1.003x - 9.054	1.000
B12	SKC	224-PCXR4	034656	01/04/2022	1,000	1,500	2,000	1,003	1,503	2,003	1.011x - 19.603	0.999
B13	SKC	224-PCXR4	602073	12/04/2022	1,000	1,500	2,000	995	1,500	1,999	1.001x - 4.072	1.000
B14	SKC	224-PCXR4	626313	05/04/2022	1,000	1,500	2,000	998	1,491	1,988	0.992x + 5.727	1.000
B15	SKC	224-PCXR4	626474	01/04/2022	1,000	1,500	2,000	1,003	1,502	2,005	1.012x - 22.726	0.999
B16	SKC	224-PCXR4	626477	11/04/2022	1,000	1,500	2,000	994	1,504	2,000	1.014x - 30.627	0.999
B17	SKC	224-PCXR4	626860	04/04/2022	1,000	1,500	2,000	997	1,495	1,991	0.997x + 0.479	1.000
B18	SKC	224-PCXR4	691484	04/04/2022	1,000	1,500	2,000	1,003	1,501	2,001	1.010x - 19.424	0.999
B19	SKC	224-PCXR4	691599	01/04/2022	1,000	1,500	2,000	995	1,503	1,999	1.005x - 8.224	1.000
B20	SKC	224-PCXR4	691587	04/04/2022	1,000	1,500	2,000	993	1,504	1,999	1.014x - 30.520	0.999
B21	SKC	224-PCXR4	691531	04/04/2022	1,000	1,500	2,000	993	1,499	1,992	1.000x - 4.714	1.000
B22	SKC	224-PCXR4	691654	04/04/2022	1,000	1,500	2,000	1,004	1,501	2,004	1.012x - 20.788	0.999
B23	SKC	224-PCXR4	798393	12/04/2022	1,000	1,500	2,000	994	1,505	2,002	1.017x - 33.567	0.999
B24	SKC	224-PCXR4	626363	04/04/2022	1,000	1,500	2,000	1,000	1,502	2,005	1.016x - 28.210	0.999
B25	SKC	224-PCXR4	798489	01/04/2022	1,000	1,500	2,000	1,001	1,512	2,001	0.998x + 5.009	1.000
B26	SKC	224-PCXR4	798479	12/04/2022	1,000	1,500	2,000	998	1,499	1,993	0.997x + 1.855	1.000
B27	SKC	224-PCXR4	691673	04/04/2022	1,000	1,500	2,000	993	1,503	2,001	1.017x - 33.826	0.999
B28	SKC	224-PCXR4	691570	04/04/2022	1,000	1,500	2,000	1,001	1,500	2,002	1.013x - 24.230	0.999
B29	SKC	224-PCXR4	626472	06/04/2022	1,000	1,500	2,000	999	1,494	1,998	1.002x - 6.378	1.000
B30	SKC	224-PCXR4	691489	06/04/2022	1,000	1,500	2,000	1,004	1,500	2,004	1.012x - 22.431	0.999
B31	SKC	224-PCXR4	691509	12/04/2022	1,000	1,500	2,000	993	1,495	1,995	1.002x - 7.965	1.000
B32	SKC	224-PCXR4	091567	04/04/2022	1,000	1,500	2,000	993	1,504	2,001	1.015x - 30.208	0.999
B33	SKC	224-PCXR4	091756	01/04/2022	1,000	1,500	2,000	994	1,496	1,991	0.996x + 0.475	1.000
B34	SKC	224-PCXR4	612962	04/04/2022	1,000	1,500	2,000	1,002	1,501	2,002	1.011x - 21.135	0.999
B35	SKC	224-PCXR4	602682	11/04/2022	1,000	1,500	2,000	994	1,498	1,996	1.001x - 6.493	1.000
B36	SKC	224-PCXR4	626164	04/04/2022	1,000	1,500	2,000	1,000	1,497	1,999	0.999x - 2.393	1.000
B37	SKC	224-PCXR4	626256	01/04/2022	1,000	1,500	2,000	994	1,506	2,002	1.016x - 31.285	0.999
B38	SKC	224-PCXR4	626167	04/04/2022	1,000	1,500	2,000	997	1,497	1,996	1.001x - 4.387	1.000
B39	SKC	224-PCXR4	034637	04/04/2022	1,000	1,500	2,000	1,003	1,500	2,002	1.012x - 22.527	0.999
B40	SKC	224-PCXR4	798349	12/04/2022	1,000	1,500	2,000	992	1,505	2,000	1.017x - 34.109	0.999



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

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	04/04/2022	1,000	1,500	2,000	998	1,496	1,989	0.994x + 3.829	1.000
B42	SKC	224-PCXR4	626041	01/04/2022	1,000	1,500	2,000	1,003	1,498	1,993	0.990x + 12.348	1.000
B43	SKC	224-PCXR4	034636	11/04/2022	1,000	1,500	2,000	1,001	1,501	1,992	0.990x + 12.839	1.000
B44	SKC	224-PCXR8	529341	01/04/2022	1,000	1,500	2,000	1,002	1,501	2,002	1.011x - 21.577	0.999
B45	SKC	224-PCXR8	529594	12/04/2022	1,000	1,500	2,000	997	1,498	1,992	0.995x + 2.928	1.000
B46	SKC	224-PCXR8	566743	04/04/2022	1,000	1,500	2,000	994	1,504	2,002	1.016x - 33.204	0.999
B47	SKC	224-PCXR8	566747	01/04/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.013x - 24.202	0.999
B48	SKC	224-PCXR8	566753	01/04/2022	1,000	1,500	2,000	999	1,494	1,997	0.999x + 1.795	1.000
B49	SKC	224-PCXR8	566780	12/04/2022	1,000	1,500	2,000	1,003	1,502	2,003	1.011x - 21.031	0.999
B50	SKC	224-PCXR8	500400	01/04/2022	1,000	1,500	2,000	1,002	1,495	2,002	1.001x + 2.900	1.000
B51	SKC	224-PCXR8	500363	01/04/2022	1,000	1,500	2,000	995	1,504	2,000	1.012x - 26.268	0.999
B52	SKC	224-PCXR8	093186	11/04/2022	1,000	1,500	2,000	995	1,498	1,994	0.997x - 1.240	1.000
B53	SKC	224-PCXR8	707670	01/04/2022	1,000	1,500	2,000	1,002	1,499	2,004	1.012x - 22.742	0.999
B54	SKC	224-PCXR3	509821	11/04/2022	1,000	1,500	2,000	993	1,501	2,001	1.016x - 33.718	0.999
B55	SKC	224-PCXR3	510710	01/04/2022	1,000	1,500	2,000	1,000	1,494	1,994	0.994x + 4.635	1.000
B56	SKC	224-PCXR3	511450	01/04/2022	1,000	1,500	2,000	1,002	1,500	2,001	1.011x - 20.684	0.999
B57	SKC	224-PCXR3	510798	12/04/2022	1,000	1,500	2,000	997	1,493	1,998	1.001x + 3.398	1.000
B58	SKC	224-PCXR3	509852	04/04/2022	1,000	1,500	2,000	1,001	1,498	2,000	1.007x - 19.631	0.999
B59	SKC	224-PCXR3	509862	01/04/2022	1,000	1,500	2,000	996	1,503	1,995	0.998x + 2.916	1.000
B60	SKC	224-PCXR3	512655	01/04/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.013x - 23.891	0.999
B61	SKC	224-PCXR3	503915	12/04/2022	1,000	1,500	2,000	994	1,489	1,999	1.004x - 11.786	1.000
B62	SKC	224-PCXR3	505975	12/04/2022	1,000	1,500	2,000	999	1,494	1,995	0.997x - 0.503	1.000
B63	SKC	224-PCXR3	511432	01/04/2022	1,000	1,500	2,000	991	1,501	2,000	1.017x - 36.139	0.999
B64	SKC	224-PCXR3	508302	04/04/2022	1,000	1,500	2,000	997	1,493	1,990	0.994x + 3.992	1.000
B65	SKC	224-PCXR3	508310	01/04/2022	1,000	1,500	2,000	1,002	1,500	2,003	1.012x - 23.109	0.999
B66	SKC	224-PCXR3	509861	12/04/2022	1,000	1,500	2,000	1,002	1,491	1,991	0.987x + 14.701	1.000
B67	SKC	224-PCXR3	506295	12/04/2022	1,000	1,500	2,000	993	1,507	2,004	1.017x - 33.104	0.999
B68	SKC	224-PCXR3	505872	12/04/2022	1,000	1,500	2,000	1,002	1,491	1,997	0.994x + 5.556	1.000
B69	SKC	224-PCXR3	508375	01/04/2022	1,000	1,500	2,000	1,001	1,500	2,000	1.010x - 21.689	0.999
B70	SKC	224-PCXR3	510623	11/04/2022	1,000	1,500	2,000	992	1,503	1,997	1.002x - 6.693	1.000
B71	SKC	224-PCXR3	508367	12/04/2022	1,000	1,500	2,000	991	1,506	2,002	1.018x - 36.227	0.999
B72	SKC	224-PCXR3	505977	12/04/2022	1,000	1,500	2,000	1,001	1,498	1,993	0.992x + 7.087	1.000
B73	SKC	224-PCXR3	512606	01/04/2022	1,000	1,500	2,000	1,001	1,501	2,005	1.014x - 24.517	0.999
B74	SKC	224-PCXR3	505993	12/04/2022	1,000	1,500	2,000	996	1,495	1,994	0.999x - 4.363	1.000
B75	SKC	224-PCXR3	509820	12/04/2022	1,000	1,500	2,000	996	1,499	1,992	0.995x + 2.429	1.000
B76	SKC	224-PCXR3	509811	12/04/2022	1,000	1,500	2,000	992	1,498	1,998	1.007x - 15.040	1.000
B77	SKC	224-PCXR3	508301	12/04/2022	1,000	1,500	2,000	1,000	1,501	2,003	1.014x - 26.643	0.999
B78	SKC	224-PCXR3	510677	01/04/2022	1,000	1,500	2,000	996	1,503	1,999	1.012x - 27.520	0.999
B79	SKC	224-PCXR3	510920	01/04/2022	1,000	1,500	2,000	994	1,493	1,994	0.999x - 3.705	1.000



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
R01	SKC	224-PCXR4	602467	04/04/2022	1,000	1,500	2,000	993	1,508	2,004	1.020x – 38.784	0.999
R02	SKC	224-PCXR4	626450	04/04/2022	1,000	2,000	3,000	999	1,499	1,990	0.989x + 12.627	1.000
R03	SKC	224-PCXR4	691592	04/04/2022	1,000	1,500	2,000	1,003	1,500	2,004	1.012x – 22.479	0.999
R04	SKC	224-PCXR4	691672	01/04/2022	1,000	1,500	2,000	996	1,493	1,993	0.998x – 2.561	1.000
R05	SKC	224-PCXR4	798470	01/04/2022	1,000	1,500	2,000	994	1,506	1,999	1.015x – 30.635	0.999
R06	SKC	224-PCXR4	798456	04/04/2022	1,000	1,500	2,000	994	1,498	1,994	1.002x – 7.438	1.000
R07	SKC	224-PCXR4	798480	04/04/2022	1,000	1,500	2,000	994	1,490	2,000	1.008x – 16.831	1.000
R08	SKC	224-PCXR4	883215	01/04/2022	1,000	1,500	2,000	1,001	1,502	2,005	1.015x – 26.627	0.999
R09	SKC	224-PCXR4	034650	01/04/2022	1,000	1,500	2,000	991	1,504	2,002	1.018x – 36.538	0.999
R10	SKC	224-PCXR4	091765	01/04/2022	1,000	1,500	2,000	996	1,512	1,993	1.000x + 0.219	1.000
R11	SKC	224-PCXR4	091763	12/04/2022	1,000	1,500	2,000	1,001	1,499	2,002	1.012x – 23.923	0.999
R12	SKC	224-PCXR4	091568	12/04/2022	1,000	1,500	2,000	997	1,501	1,999	1.001x – 4.986	1.000
R13	SKC	224-PCXR4	091638	04/04/2022	1,000	1,500	2,000	1,002	1,498	1,993	0.991x + 10.793	1.000
R14	SKC	224-PCXR4	091764	04/04/2022	1,000	1,500	2,000	994	1,502	1,998	1.013x – 29.256	0.999
R15	SKC	224-PCXR8	529457	01/04/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.013x – 24.345	0.999
R16	SKC	224-PCXR8	529643	04/04/2022	1,000	1,500	2,000	998	1,497	1,994	0.997x + 0.060	1.000
R17	SKC	224-PCXR8	529645	04/04/2022	1,000	1,500	2,000	994	1,509	2,000	1.015x – 30.571	0.999
R18	SKC	224-PCXR8	566756	04/04/2022	1,000	1,500	2,000	991	1,496	1,998	1.002x – 7.678	1.000
R19	SKC	224-PCXR8	566802	01/04/2022	1,000	1,500	2,000	1,003	1,499	2,000	1.010x – 20.189	0.999
R20	SKC	224-PCXR8	529089	04/04/2022	1,000	1,500	2,000	990	1,501	2,003	1.020x – 40.036	0.999
R21	SKC	224-PCXR8	665728	01/04/2022	1,000	1,500	2,000	999	1,493	1,999	1.000x – 5.364	1.000
R22	SKC	224-PCXR8	707444	04/04/2022	1,000	1,500	2,000	1,002	1,500	2,001	1.011x – 21.215	0.999
R23	SKC	224-PCXR8	761067	11/04/2022	1,000	1,500	2,000	998	1,494	1,992	0.994x + 3.095	1.000
R24	SKC	224-PCXR8	707893	01/04/2022	1,000	1,500	2,000	996	1,505	2,001	1.014x – 29.040	0.999
R25	SKC	224-PCXR8	761052	01/04/2022	1,000	1,500	2,000	998	1,500	1,992	0.992x + 7.630	1.000
R26	SKC	224-PCXR8	707956	12/04/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.013x – 24.417	0.999
R27	SKC	224-PCXR8	707398	04/04/2022	1,000	1,500	2,000	996	1,503	2,001	1.013x – 28.725	0.999
R28	SKC	224-PCXR8	707481	11/04/2022	1,000	1,500	2,000	1,004	1,500	2,003	1.010x – 19.368	0.999
R29	SKC	224-PCXR8	707402	01/04/2022	1,000	1,500	2,000	1,005	1,491	1,991	0.988x + 14.326	1.000
R30	SKC	224-PCXR8	093811	01/04/2022	1,000	1,500	2,000	998	1,495	1,994	0.998x – 1.268	1.000
R31	SKC	224-PCXR8	093183	01/04/2022	1,000	1,500	2,000	1,001	1,501	2,001	1.012x – 23.001	0.999
R32	SKC	224-PCXR8	671950	04/04/2022	1,000	1,500	2,000	1,000	1,498	1,994	0.994x + 7.762	1.000
R33	SKC	224-PCXR4	626254	12/04/2022	1,000	1,500	2,000	992	1,502	1,999	1.016x – 34.141	0.999
R34	SKC	224-PCXR4	626131	01/04/2022	1,000	1,500	2,000	1,002	1,498	2,004	1.012x – 24.294	0.999
R35	SKC	224-PCXR8	707460	04/04/2022	1,000	1,500	2,000	998	1,498	1,995	0.994x + 5.672	1.000
R36	SKC	224-PCXR8	707446	01/04/2022	1,000	1,500	2,000	1,003	1,500	2,001	1.010x – 19.192	0.999
R37	SKC	224-PCXR8	707432	01/04/2022	1,000	1,500	2,000	999	1,499	1,998	0.999x + 0.554	1.000
R38	SKC	224-PCXR8	707349	01/04/2022	1,000	1,500	2,000	996	1,500	2,002	1.015x – 31.640	0.999
R39	SKC	224-PCXR8	761095	12/04/2022	1,000	1,500	2,000	1,001	1,496	1,994	0.997x + 2.652	1.000



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Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
H-R01	Dwyer	VFB-65	04/04/2022	500	1,000	2,000	503.1	992.4	1979.1	0.999x + 3.360	0.999
H-R02	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	500.8	995.3	1986.1	1.002x + 5.536	1.000
H-R03	Dwyer	VFB-65	04/04/2022	500	1,000	2,000	502.1	987.7	1997.3	0.994x + 1.910	1.000
H-R04	Dwyer	VFB-65	04/04/2022	500	1,000	2,000	496.4	989.6	2019.5	1.009x - 13.763	1.000
H-R05	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	496.8	987.7	1987.7	1.004x - 9.632	1.000
H-R06	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	505.2	992.4	1979.4	0.999x + 2.749	0.999



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

Rotameter Calibration Report (For Personal Pump Low Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
L-R01	Dwyer	VFA-21	04/04/2022	50	100	200	50.2	100.6	203.5	0.983x + 2.458	1.000
L-R02	Dwyer	VFA-21	01/04/2022	50	100	200	49.7	100.9	200.5	1.008x - 1.306	0.999
L-R03	Dwyer	VFA-21	04/04/2022	50	100	200	50.1	99.8	202.3	1.018x - 1.156	1.000
L-R04	Dwyer	VFA-21	04/04/2022	50	100	200	49.8	100.9	200.6	1.009x - 1.349	0.999
L-R05	Dwyer	VFA-21	01/04/2022	50	100	200	49.8	100.4	203.4	0.992x + 1.525	1.000
L-R06	Dwyer	VFA-21	01/04/2022	50	100	200	50.2	99.1	201.9	1.003x - 0.172	1.000



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

Customer : <u>S.P.S.Consulting Service Co.,Ltd</u>	Date Tested: <u>January 12, 2022</u>	
	Recommendation Recertification	
Address : <u>7 Soi Phaholyothin 24</u>	Period <u>6</u> Months	
<u>Paholyothin Road</u>	Recertification Due: <u>July 12, 2022</u>	
<u>Jompol Chatuchak, Bangkok 1090</u>	Date Last Certified: <u>July 14, 2021</u>	
User Name: <u>K.Phenpha Viphasathawat</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>August 30, 2022</u>
<u>Wavecal Solution</u>	<u>N058-2152</u>	<u>January 30, 2022</u>
<u>VIS Wavecal solution</u>	<u>N930-2946</u>	<u>June 30, 2022</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>August 30, 2022</u>
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C8011701
DATE TESTED January 12, 2022
1. MECHANICAL CHECKS

A. Inspect and clean all fans and filters.

☐ OK

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

☐ OK

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

☐ OK

D. Adjust water and gas pressure regulator settings.

☐ OK

E. Inspect and leak check pneumatics drawers.

☐ OK

F. Clean the exterior of the instrument.

☐ OK

2. OPTICAL CHECKS

A. Inspect and clean all optical components.

☐ OK

B. As required, check and replace all purgefilters.

☐ OK

C. Recheck optical alignment.

☐ OK

3. COOLING SYSTEM CHECKS

A. Perform preventive maintenance on chiller.

☐ OK

B. Flush out the chiller every year.

☐ N/A

4. PERFORMANCE CHECKS

A. Torch View Alignment.

☐ OK

B. Wavelength Calibration.

☐ OK



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : 077C8011701

DATE TESTED : January 12, 2022

PARAMETER	SPECIFICATION			FINAL VALUE	
Spectral Resolution : UV	As 193.696 nm	≤ 0.007		0.00554	
	Ni 231.604 nm	≤ 0.008		0.00725	
	Ni 341.476 nm	≤ 0.012		0.00752	
Spectral Resolution : VIS	La 408.672 nm	≤ 0.020		0.01616	
	Ba 455.403 nm	≤ 0.025		0.02416	
Precision					
	As 193.656 nm	% RSD	< 1.0	0.34	%
	Zn 213.856 nm	% RSD	< 1.0	0.27	%
	Mn 257.610 nm	% RSD	< 1.0	0.41	%
	La 379.478 nm	% RSD	< 1.0	0.57	%
	Ba 455.403 nm	% RSD	< 1.0	0.33	%
	Ba 493.408 nm	% RSD	< 1.0	0.26	%
Detection Limits : Axial	Tl 190.080 nm	3(sd)		5.51	ppb
	As 193.696 nm	3(sd)		8.59	ppb
	Pb 220.353 nm	3(sd)		0.50	ppb
Detection Limits : Radial	As 193.696 nm	3(sd)		21.00	ppb
	Zn 213.856 nm	3(sd)		0.32	ppb
	Mn 257.610 nm	3(sd)		0.18	ppb
	La 379.478 nm	3(sd)		0.44	ppb
	Ba 455.403 nm	3(sd)		0.17	ppb
	Ba 493.408 nm	3(sd)		0.12	ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd 226.502 nm	≤ 150 ppb		12.46	
BEC : Radial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 45 ppb		30.82	



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C8011701**DATE TESTED** January 12, 2022**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:

Service Engineer



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, Chaluchak, Bangkok 10900
 Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com., www.spscon.com

Calibration Report				
Non-Dispersive Infrared CO Analyzer				
Date :	04 May 2022	Brand :	API	Model :
No.	CO-R01			Serial No.
				704
Calibrator (Dilution System)				
Brand	: API	Model	: 700	
Last Cal. Date	: 20 September 2021	Serial No.	: 421	
Reference Standard Gas				
Standard Gas	: Carbon Monoxide (CO)		Cylinder No.	: D196045
Certified Date	: 16 April 2022	Expired Date	: 15 April 2024	Cylinder Conc.
				: 4,570 ppm
Calibrating Condition				
Pressure	1011	mmbar	Temp.	24.5 °C
			% RH	48
Calibration Setting				
Span	Initial Reading (Before Adj.), PPM			Final Reading (After Adj.), PPM
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero	0	-0.10	-	0
CO Span	40.00	40.08	0.200	40.00
API Model 300E CO Analyzer Check List				
Parameter	Observed Value	Units	Nominal Range	
Range	50	PPM	0-1000 ppm	
Stability	0.10	PPM	< 1 ppm With Zero Air	
CO Measure	4014.1	mV	2500-4800 mV	
CO Reference	3947.6	mV	2500-4800 mV	
Measure/Reference Ratio	1.180	-	1.1-1.3 W/Zero Air	
Sample Pressure	28.7	In-Hg-A	~2" < Ambient Absolute Pressure	
Sample Flow	805	CC/Min	800 ± 10%	
Sample Temperature	48.3	°C	48 ± 4	
Bench Temperature	48.2	°C	48 ± 2	
Wheel Temperature	68.4	°C	68 ± 2	
Box Temperature	30.8	°C	Ambient Temp + 7 ± 10	
Photo-Drive	3026.1	mV	250 mV to 4750 mV	
Slope	1.017	-	1.0 ± 0.3	
Offset	0.2	-	0 ± 0.3	

ระดับความร้อน

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
[AREA HEAT STRESS MONITOR]
MANUFACTURER : METROSONICS
MODEL / TYPE : hs-32
SERIAL NO. : MCD070035
CLID. NO. : 231802272
JOB CONTROL NO. : 210109001835

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

DATE OF RECEIVED : 09 January 2021

DATE OF ISSUED : 13 January 2021

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

Calibrated By :

Approved By :

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. Q21001835

F3-011-04/01-12

page 1 of 3



@clccalibration

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	DIGITAL THERMOHYGRO METER [AREA HEAT STRESS MONITOR]
MANUFACTURER	:	METROSONICS
MODEL / TYPE	:	hs-32
SERIAL NO.	:	MCD070035
DATE OF CALIBRATION	:	12 January 2021

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. **WI-305-74** as calibration guidelines.

The calibration was performed by using Chilled Mirror Hygrometer and Temperature & Humidity Chamber which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Chilled Mirror Hygrometer, Edgetech Model Dew Master S/N. 36151.

Temperature & Humidity Chamber, PGC Model 9141-5114 S/N.0802282.

TRACEABILITY :

The measurements are traceable to International System of Units (SI) , through Thunder Scientific Corporation.
Certificate No. 18263, Due Date 29 April 2021.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2,00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2013)"

Certificate No. Q21001835

F3-011-04/01-12

page 2 of 3



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The table in the following gives the calibration results and associated measurement uncertainties of the measuring digital thermohygro meter [area heat stress monitor].

CALIBRATION DATA

1. CORRECTION OF TEMPERATURE : WET

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	30.02	29.7	+0.32	0.40
35.0	35.03	34.7	+0.33	
40.0	40.00	39.7	+0.30	

2. CORRECTION OF TEMPERATURE : DRY

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	30.02	29.7	+0.32	0.40
35.0	35.03	34.7	+0.33	
40.0	40.00	39.7	+0.30	

3. CORRECTION OF TEMPERATURE : GLOBE BULB

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	30.02	29.5	+0.52	0.40
35.0	35.03	34.5	+0.53	
40.0	40.00	39.5	+0.50	

Note. The Scope of Accredited TISI Certificate No. 19C087/0655 Issue 1 Page 36 of 111

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

End of Certificate

Certificate No. Q21001835

F3-011-04/01-12

page 3 of 3



@clccalibration



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

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

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

Heat B038_1/22

Heat Stress WBGT Meter Verification Report

Verification Data

Heat Stress WBGT Meter No.	: R05	Verification Date	: 28 April 2022
Brand	: METROSONICS	Ambient Temp.	: 24.5 °C
Model	: hr-32	Barometric Pressure	: 1011 mmbar
Serial No.	: MCD070035	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

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
(THERMAL ENVIRONMENT MONITOR)

MANUFACTURER : 3M

MODEL / TYPE : QUESTemp° 32

SERIAL NO. : TPE080058

CLID. NO. : 231802518

JOB CONTROL NO. : 210109001834

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

DATE OF RECEIVED : 09 January 2021

DATE OF ISSUED : 13 January 2021

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

Calibrated By :

Approved By :

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. Q21001834

F3-011-04/01-12

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REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	DIGITAL THERMOHYGRO METER (THERMAL ENVIRONMENT MONITOR)
MANUFACTURER	:	3M
MODEL / TYPE	:	QUESTemp° 32
SERIAL NO.	:	TPE080058
DATE OF CALIBRATION	:	12 January 2021

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. **WI-305-74** as calibration guidelines.

The calibration was performed by using Chilled Mirror Hygrometer and Temperature & Humidity Chamber which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Chilled Mirror Hygrometer, Edgetech Model Dew Master S/N. 36151.

Temperature & Humidity Chamber, PGC Model 9141-5114 S/N.0802282.

TRACEABILITY :

The measurements are traceable to International System of Units (SI) , through Thunder Scientific Corporation.

Certificate No. 18263, Due Date 29 April 2021.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2,00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2013)"

Certificate No. Q21001834

F3-011-04/01-12

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CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The table in the following gives the calibration results and associated measurement uncertainties of the measuring digital thermohygro meter (thermal environment monitor).

CALIBRATION DATA

1. CORRECTION OF TEMPERATURE : WET

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	30.02	29.6	+0.42	0.40
35.0	35.03	34.6	+0.43	
40.0	40.00	39.5	+0.50	

2. CORRECTION OF TEMPERATURE : DRY

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	30.02	29.5	+0.52	0.40
35.0	35.03	34.5	+0.53	
40.0	40.00	39.5	+0.50	

3. CORRECTION OF TEMPERATURE : GLOBE BULB

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	30.02	29.9	+0.12	0.40
35.0	35.03	34.8	+0.23	
40.0	40.00	39.8	+0.20	

Note. The Scope of Accredited TISI Certificate No. 19C087/0655 Issue 1 Page 36 of 111

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

End of Certificate

Certificate No. Q21001834

F3-011-04/01-12

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

Heat B038_2/22

Heat Stress WBGT Meter Verification Report

Verification Data

Heat Stress WBGT Meter No.	: R07	Verification Date	: 28 April 2022
Brand	: 3M	Ambient Temp.	: 24.5 °C
Model	: QUESTemp ^o 32	Barometric Pressure	: 1011 mmbar
Serial No.	: TPE080058	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	47.1	0.0	± 0.5

Globe Probe Temperature Measurement

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

UUC* = UNIT UNDER CALIBRATION

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
(THERMAL ENVIRONMENT MONITOR)

MANUFACTURER : 3M

MODEL / TYPE : QUESTemp° 34

SERIAL NO. : TEH090208

CLID. NO. : 231802513

JOB CONTROL NO. : 210109001838

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

DATE OF RECEIVED : 09 January 2021

DATE OF ISSUED : 13 January 2021

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

Calibrated By :

Approved By :

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. Q21001838

F3-011-04/01-12

page 1 of 3



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REPORT OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
(THERMAL ENVIRONMENT MONITOR)

MANUFACTURER : 3M

MODEL / TYPE : QUESTemp^o 34

SERIAL NO. : TEH090208

DATE OF CALIBRATION : 12 January 2021

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. **WI-305-74** as calibration guidelines.

The calibration was performed by using Chilled Mirror Hygrometer and Temperature & Humidity Chamber which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Chilled Mirror Hygrometer, Edgetech Model Dew Master S/N. 36151.

Temperature & Humidity Chamber, PGC Model 9141-5114 S/N.0802282.

TRACEABILITY :

The measurements are traceable to International System of Units (SI) , through Thunder Scientific Corporation.

Certificate No. 18263, Due Date 29 April 2021.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2,00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2013)"

Certificate No. Q21001838

F3-011-04/01-12

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CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The table in the following gives the calibration results and associated measurement uncertainties of the measuring digital thermohygro meter (thermal environment monitor).

CALIBRATION DATA

1. CORRECTION OF TEMPERATURE : WET

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	30.02	29.8	+0.22	0.40
35.0	35.03	34.8	+0.23	
40.0	40.00	39.8	+0.20	

2. CORRECTION OF TEMPERATURE : DRY

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	30.02	29.7	+0.32	0.40
35.0	35.03	34.7	+0.33	
40.0	40.00	39.7	+0.30	

3. CORRECTION OF TEMPERATURE : GLOBE BULB

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	30.02	30.1	-0.08	0.40
35.0	35.03	35.1	-0.07	
40.0	40.00	40.1	-0.10	

Note. The Scope of Accredited TISI Certificate No. 19C087/0655 Issue 1 Page 36 of 111

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

End of Certificate

Certificate No. Q21001838

F3-011-04/01-12

page 3 of 3



@clccalibration



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

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

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

Heat B038_3/22

Heat Stress WBGT Meter Verification Report

Verification Data

Heat Stress WBGT Meter No.	: R08	Verification Date	: 28 April 2022
Brand	: 3M	Ambient Temp.	: 24.5 °C
Model	: QUESTemp ^o 34	Barometric Pressure	: 1011 mmbar
Serial No.	: TEH090208	Relative Humidity	: 49 %

Verification Module (Electronic Sensor Check) :

Verification Module No. : 21 WB = 12.5 °C , DB = 47.1 °C , G = 69.3 °C

Result of Verification : Without Adjustment

Wet Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.4	0.1	± 0.5

Dry Probe Temperature Measurement

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