

ภาคผนวกที่ ง

เอกสารสอบเทียบความถูกต้องของเครื่องมือตรวจวัดคุณภาพสิ่งแวดล้อม

**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม**

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
คุณภาพอากาศจากปล่อง ฝุ่นละอองรวม (TSP)	Console No. B01, B04, B05 Pitot Tube No. B04, B35, B49, B56	Digital Balance
ก๊าซซัลเฟอร์ไดออกไซด์ (SO ₂)	Personal Pump SKC No. B14, B16, B21, B27, B37, B53 Rotameter No. H-B07, B08, B09	-
ก๊าซออกไซด์ของไนโตรเจน (NO _x)	Vacuum Gauge	Spectrophotometer
ระดับเสียงในบรรยากาศ ระดับเสียงเฉลี่ย 1 ชั่วโมง (L _{eq} 1 hr) ระดับเสียงเฉลี่ย 24 ชั่วโมง (L _{eq} 24 hr) ระดับเสียงสูงสุด (L _{max}) ระดับเสียงเฉลี่ยกลางวัน-กลางคืน (L _{dn}) ระดับเสียงเปอร์เซ็นต์ไทล์ที่ 90 (L ₉₀)	Sound Level Calibrator Sound Level Meter No. ACO-B18, B25, B26, B27, B41 CR-B05	-
คุณภาพน้ำ		
ความเป็นกรดและด่าง	-	pH Meter
ความนำไฟฟ้า	-	Conductivity Meter
อุณหภูมิ	-	Thermometer
ความขุ่น	-	Turbidity Meter
สารที่ละลายได้ทั้งหมด	-	Digital Balance
สารแขวนลอย	-	Digital Balance
ปริมาณสารทั้งหมด	-	Digital Balance
ซีโอดี	-	COD Reactor
บีโอดี	-	BOD Analyzer
น้ำมันและไขมัน	-	Digital Balance
ฟอสเฟต	-	Spectrophotometer
ฟลูออไรด์	-	Spectrophotometer
ไนเตรท	-	Spectrophotometer
ไนเตรท-ไนโตรเจน	-	Spectrophotometer
ไซยาไนด์คิดเทียบเป็นไฮโดรเจนไซยาไนด์	-	Spectrophotometer
ซิลิเกต	-	Spectrophotometer
แคลเซียม	-	ICP
แมกนีเซียม	-	ICP
แบคทีเรียกลุ่มโคลิฟอร์มทั้งหมด	-	Incubator
แบคทีเรียกลุ่มฟิคอลโคลิฟอร์ม	-	Incubator
ปรอท	-	AAS
แคดเมียม	-	AAS
ตะกั่ว	-	AAS/ICP
สังกะสี	-	AAS/ICP
ทองแดง	-	AAS/ICP
นิกเกิล	-	ICP
แบเรียม	-	ICP

**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม (ต่อ)**

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
คุณภาพน้ำ (ต่อ)		
เหล็ก	-	ICP
อาร์เซนิก	-	AAS
เซเลเนียม	-	AAS
แมงกานีส	-	ICP
โครเมียมชนิดเฮกซะวาเลนต์	-	Spectrophotometer
เชื้อสิจิโอเนลลา	-	Incubator
ระดับความร้อนในสถานประกอบการ WBGT	Digital Thermometer Heat Stress WBGT Meter NO. B13, B28, B29, B30, B31, B33, B35, B36, B37	-
ระดับเสียงในสถานประกอบการ ระดับเสียงเฉลี่ย 8 ชั่วโมง (L_{eq} 8 hr) ระดับเสียงสูงสุด (L_{max})	Acoustic Calibrator Sound Level Meter No. ACO-B29, B36, B41, B43, R40, R41, R50, R51, R52 CR-B03, B05, B10 Noise Dose Meter No. NMD- B01, B02, B03, B04, B05, B06, B07, B08, B09, B10, B11, B12, B13, B14, B15, R01, R02	-
ปริมาณเสียงสะสมแบบติดตัวบุคคล Noise Dose	Noise Dose Meter No. NMD- B01, B12, B13, B14, B15, B16, B17, B18, B19, B20	-
ระดับความเข้มของแสงสว่างในสถานประกอบการ Light Intensity	Light Meter No. B08, B09, R09	-
คุณภาพอากาศในสถานประกอบการ Total Dust	Personal Pump SKC No. B45, B61, B74, B76, B89, R23 Rotameter No. H-B10	Digital Balance
Sulfuric Acid	Personal Pump SKC No. B54, B61, B62, B74, B75, B82, R23 Rotameter No. L-B10	IC
Hydrogen Chloride	Personal Pump SKC No. B45, B76, B89 Rotameter No. H-B10	-
Sodium Hydroxide	Personal Pump SKC No. B62, B74, B82 Rotameter No. L-B10	IC
Ammonia	Personal Pump SKC No. B45, B61, B62, B74 Rotameter No. L-B10	IC

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม (ต่อ)

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
คุณภาพอากาศในสถานประกอบการ (ต่อ) Chlorine	Personal Pump SKC No. B62, B75, B89, R23 Rotameter No. H-B10	Spectrophotometer



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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	ΔH_{g} (mmH ₂ O)
B01	1563	01/06/2022	0.999	50.02
B02	8002514	03/06/2022	1.002	49.37
B03	1503016	06/06/2022	1.003	50.46
B04	00006659	02/06/2022	1.002	49.71
B05	00007428	02/06/2022	0.997	49.55
R01	1561	02/06/2022	0.999	49.94
R02	8002513	03/06/2022	0.994	50.51
R03	1570	06/06/2022	1.002	49.68
R04	8002519	02/06/2022	1.004	49.55
R05	1503015	01/06/2022	0.997	50.14

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

Accept Value of ΔH_{g} (test) is 46.7 ± 6.4 (mmH₂O)

Calibrated by :

Phakhinai Khongkomnerd
(Mr. Phakhinai Khongkomnerd)

Approved by :

(Signature)
(Mr. Peera Detudom)



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Console Calibration Report

Calibration Method

Critical Orifices

Calibration Data

Console Data		Calibration Data		
No.	Serial No.	Date	y	ΔH_{g} (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 ΔH_{g} (test) is 46.7 ± 6.4 (mmH₂O)

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(Mr. Phakhinai Khongkomnerd)

Approved by :

(Signature)
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Pitot Tube Calibration Report

Calibration Method

Standard Pitot Tube

Calibration Data

Pitot Tube Data			Calibration Data		
No.	Type of Pitot	Coefficient of Standard Pitot	Date	Avg. of Cp (test)	
				Side A	Side B
B03	S	0.99	01/02/2022	0.83	0.84
B04	S	0.99	02/02/2022	0.84	0.84
B05	S	0.99	01/02/2022	0.84	0.84
B07	S	0.99	01/02/2022	0.84	0.84
B08	S	0.99	01/02/2022	0.84	0.85
B09	S	0.99	02/02/2022	0.84	0.84
B11	S	0.99	02/02/2022	0.83	0.84
B16	S	0.99	02/02/2022	0.83	0.84
B18	S	0.99	03/02/2022	0.84	0.84
B19	S	0.99	03/02/2022	0.85	0.84
B21	S	0.99	02/02/2022	0.84	0.84
B24	S	0.99	04/02/2022	0.85	0.84
B27	S	0.99	04/02/2022	0.84	0.84
B30	S	0.99	04/02/2022	0.84	0.84
B31	S	0.99	02/02/2022	0.83	0.84
B33	S	0.99	02/02/2022	0.84	0.84
B35	S	0.99	03/02/2022	0.84	0.84

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

Calibrated by :

Phakhinai Khongkomnerd

(Mr. Phakhinai Khongkomnerd)

Approved by :

Peera Detudom

(Mr. Peera Detudom)



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Pitot Tube Calibration Report

Calibration Method

Standard Pitot Tube

Calibration Data

Pitot Tube Data			Calibration Data		
No.	Type of Pitot	Coefficient of Standard Pitot	Date	Avg. of Cp (test)	
				Side A	Side B
B03	S	0.99	03/05/2022	0.84	0.85
B04	S	0.99	03/05/2022	0.84	0.84
B05	S	0.99	05/05/2022	0.84	0.83
B07	S	0.99	06/05/2022	0.85	0.84
B08	S	0.99	03/05/2022	0.84	0.84
B09	S	0.99	05/05/2022	0.83	0.84
B11	S	0.99	03/05/2022	0.83	0.84
B16	S	0.99	05/05/2022	0.85	0.84
B18	S	0.99	06/05/2022	0.84	0.85
B19	S	0.99	05/05/2022	0.84	0.83
B21	S	0.99	03/05/2022	0.84	0.85
B24	S	0.99	03/05/2022	0.83	0.84
B27	S	0.99	06/05/2022	0.84	0.85
B30	S	0.99	03/05/2022	0.84	0.84
B31	S	0.99	03/05/2022	0.83	0.84
B33	S	0.99	06/05/2022	0.83	0.84
B35	S	0.99	03/05/2022	0.84	0.84

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

Calibrated by :

Phakhinai Khongkomnerd

(Mr. Phakhinai Khongkomnerd)

Approved by :

Peera Detudom

(Mr. Peera Detudom)



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Pitot Tube Calibration Report

Calibration Method

Standard Pitot Tube

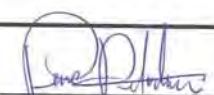
Calibration Data

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

Calibrated by : Phakhinai Khongkomnerd
(Mr. Phakhinai Khongkomnerd)

Approved by :


(Mr. Peera Detudom)



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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
B01	SKC	224-PCXR4	262101	05/01/2022	1,000	1,500	2,000	995	1,496	1,995	0.999x - 1.938	1.000
B02	SKC	224-PCXR4	626166	05/01/2022	1,000	1,500	2,000	998	1,504	2,001	1.011x - 24.413	0.999
B03	SKC	224-PCXR4	612968	05/01/2022	1,000	1,500	2,000	995	1,490	1,995	1.001x - 6.653	1.000
B04	SKC	224-PCXR4	602804	05/01/2022	1,000	1,500	2,000	996	1,496	1,993	0.999x - 4.391	1.000
B05	SKC	224-PCXR4	612693	05/01/2022	1,000	1,500	2,000	1,003	1,500	2,003	1.012x - 21.952	0.999
B06	SKC	224-PCXR4	262188	05/01/2022	1,000	1,500	2,000	996	1,504	2,000	1.012x - 26.866	0.999
B07	SKC	224-PCXR4	626262	05/01/2022	1,000	1,500	2,000	998	1,492	1,994	0.996x + 1.898	1.000
B08	SKC	224-PCXR4	626100	05/01/2022	1,000	1,500	2,000	1,003	1,499	2,003	1.011x - 21.912	0.999
B09	SKC	224-PCXR4	626479	05/01/2022	1,000	1,500	2,000	997	1,490	1,994	0.994x + 3.550	1.000
B10	SKC	224-PCXR4	091950	06/01/2022	1,000	1,500	2,000	994	1,504	2,001	1.016x - 32.434	0.999
B11	SKC	224-PCXR8	564315	06/01/2022	1,000	1,500	2,000	994	1,490	1,998	1.004x - 10.450	1.000
B12	SKC	224-PCXR4	034656	06/01/2022	1,000	1,500	2,000	1,001	1,503	2,003	1.012x - 22.618	0.999
B13	SKC	224-PCXR4	602073	06/01/2022	1,000	1,500	2,000	995	1,498	1,994	1.000x - 3.701	1.000
B14	SKC	224-PCXR4	626313	05/01/2022	1,000	1,500	2,000	998	1,491	1,988	0.992x + 6.286	1.000
B15	SKC	224-PCXR4	626474	07/01/2022	1,000	1,500	2,000	1,003	1,501	2,004	1.012x - 22.048	0.999
B16	SKC	224-PCXR4	626477	07/01/2022	1,000	1,500	2,000	993	1,504	2,000	1.015x - 31.345	0.999
B17	SKC	224-PCXR4	626860	07/01/2022	1,000	1,500	2,000	997	1,495	1,992	0.995x + 2.034	1.000
B18	SKC	224-PCXR4	691484	07/01/2022	1,000	1,500	2,000	1,003	1,501	2,001	1.009x - 18.586	0.999
B19	SKC	224-PCXR4	691599	07/01/2022	1,000	1,500	2,000	992	1,499	1,997	1.003x - 9.253	1.000
B20	SKC	224-PCXR4	691587	07/01/2022	1,000	1,500	2,000	992	1,504	1,999	1.015x - 31.915	0.999
B21	SKC	224-PCXR4	691531	07/01/2022	1,000	1,500	2,000	993	1,499	1,992	1.000x - 5.273	1.000
B22	SKC	224-PCXR4	691654	07/01/2022	1,000	1,500	2,000	1,005	1,501	2,003	1.010x - 18.195	0.999
B23	SKC	224-PCXR4	798393	07/01/2022	1,000	1,500	2,000	993	1,505	2,002	1.017x - 34.683	0.999
B24	SKC	224-PCXR4	626363	07/01/2022	1,000	1,500	2,000	1,000	1,501	2,005	1.016x - 28.338	0.999
B25	SKC	224-PCXR4	798489	06/01/2022	1,000	1,500	2,000	1,000	1,495	1,997	0.997x + 2.018	1.000
B26	SKC	224-PCXR4	798479	06/01/2022	1,000	1,500	2,000	997	1,497	1,990	0.994x + 3.251	1.000
B27	SKC	224-PCXR4	691673	06/01/2022	1,000	1,500	2,000	994	1,503	2,001	1.015x - 31.951	0.999
B28	SKC	224-PCXR4	691570	06/01/2022	1,000	1,500	2,000	1,000	1,500	2,003	1.015x - 27.022	0.999
B29	SKC	224-PCXR4	626472	06/01/2022	1,000	1,500	2,000	999	1,494	1,998	1.002x - 6.856	1.000
B30	SKC	224-PCXR4	691489	06/01/2022	1,000	1,500	2,000	1,003	1,500	2,004	1.013x - 24.106	0.999
B31	SKC	224-PCXR4	691509	06/01/2022	1,000	1,500	2,000	995	1,495	1,995	1.001x - 4.894	1.000
B32	SKC	224-PCXR4	091567	06/01/2022	1,000	1,500	2,000	994	1,504	2,001	1.014x - 28.868	0.999
B33	SKC	224-PCXR4	091756	06/01/2022	1,000	1,500	2,000	996	1,496	1,991	0.995x + 3.183	1.000
B34	SKC	224-PCXR4	612962	06/01/2022	1,000	1,500	2,000	1,001	1,501	2,002	1.012x - 22.531	0.999
B35	SKC	224-PCXR4	602682	06/01/2022	1,000	1,500	2,000	993	1,498	1,996	1.002x - 8.448	1.000
B36	SKC	224-PCXR4	626164	05/01/2022	1,000	1,500	2,000	1,000	1,497	1,999	0.999x - 3.231	1.000
B37	SKC	224-PCXR4	626256	05/01/2022	1,000	1,500	2,000	994	1,504	2,002	1.016x - 31.604	0.999
B38	SKC	224-PCXR4	626167	10/01/2022	1,000	1,500	2,000	999	1,497	1,996	1.000x - 1.875	1.000
B39	SKC	224-PCXR4	034637	10/01/2022	1,000	1,500	2,000	1,002	1,500	2,002	1.012x - 23.643	0.999
B40	SKC	224-PCXR4	798349	10/01/2022	1,000	1,500	2,000	993	1,505	2,000	1.016x - 32.992	0.999

Calibrated by :


(Mr. Phakhinai Khongkomnerd)

Approved by :


(Mr. Peera Detudom)



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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.)			y	
					1	2	3	1	2	3	y	R ²
B41	SKC	224-PCXR4	612669	10/01/2022	1,000	1,500	2,000	998	1,496	1,989	0.994x + 2.680	1.000
B42	SKC	224-PCXR4	626041	07/01/2022	1,000	1,500	2,000	1,003	1,498	1,993	0.990x + 11.710	1.000
B43	SKC	224-PCXR4	034636	05/01/2022	1,000	1,500	2,000	998	1,500	1,992	0.992x + 8.392	1.000
B44	SKC	224-PCXR8	529341	07/01/2022	1,000	1,500	2,000	1,004	1,500	2,003	1.011x - 21.139	0.999
B45	SKC	224-PCXR8	529594	07/01/2022	1,000	1,500	2,000	997	1,498	1,992	0.995x + 2.728	1.000
B46	SKC	224-PCXR8	566743	07/01/2022	1,000	1,500	2,000	994	1,504	2,002	1.015x - 32.087	0.999
B47	SKC	224-PCXR8	566747	07/01/2022	1,000	1,500	2,000	1,002	1,501	2,003	1.013x - 23.580	0.999
B48	SKC	224-PCXR8	566753	07/01/2022	1,000	1,500	2,000	1,000	1,494	1,996	0.996x + 1.567	1.000
B49	SKC	224-PCXR8	566780	07/01/2022	1,000	1,500	2,000	1,002	1,501	2,004	1.012x - 22.236	0.999
B50	SKC	224-PCXR8	500400	07/01/2022	1,000	1,500	2,000	1,000	1,493	1,996	0.995x + 3.641	1.000
B51	SKC	224-PCXR8	500363	07/01/2022	1,000	1,500	2,000	995	1,504	2,000	1.013x - 27.704	0.999
B52	SKC	224-PCXR8	093186	07/01/2022	1,000	1,500	2,000	995	1,498	1,994	0.997x - 0.283	1.000
B53	SKC	224-PCXR8	707670	10/01/2022	1,000	1,500	2,000	1,002	1,499	2,004	1.012x - 23.580	0.999
B54	SKC	224-PCXR3	509821	05/01/2022	1,000	1,500	2,000	994	1,501	2,001	1.015x - 32.043	0.999
B55	SKC	224-PCXR3	510710	06/01/2022	1,000	1,500	2,000	1,000	1,494	1,994	0.994x + 4.830	1.000
B56	SKC	224-PCXR3	511450	06/01/2022	1,000	1,500	2,000	1,004	1,502	2,002	1.010x - 19.248	0.999
B57	SKC	224-PCXR3	510798	06/01/2022	1,000	1,500	2,000	997	1,492	1,996	0.996x + 1.747	1.000
B58	SKC	224-PCXR3	509852	06/01/2022	1,000	1,500	2,000	997	1,499	2,000	1.011x - 27.010	0.999
B59	SKC	224-PCXR3	509862	06/01/2022	1,000	1,500	2,000	997	1,495	1,991	0.995x + 3.833	1.000
B60	SKC	224-PCXR3	512655	06/01/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.013x - 24.688	0.999
B61	SKC	224-PCXR3	503915	06/01/2022	1,000	1,500	2,000	994	1,488	1,999	1.005x - 12.631	1.000
B62	SKC	224-PCXR3	505975	10/01/2022	1,000	1,500	2,000	994	1,491	1,995	1.002x - 8.089	1.000
B63	SKC	224-PCXR3	511432	10/01/2022	1,000	1,500	2,000	992	1,501	2,000	1.016x - 33.906	0.999
B64	SKC	224-PCXR3	508302	10/01/2022	1,000	1,500	2,000	998	1,493	1,990	0.994x + 4.272	1.000
B65	SKC	224-PCXR3	508310	10/01/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.012x - 23.077	0.999
B66	SKC	224-PCXR3	509861	10/01/2022	1,000	1,500	2,000	997	1,494	1,994	0.995x + 3.953	1.000
B67	SKC	224-PCXR3	506295	10/01/2022	1,000	1,500	2,000	993	1,507	2,002	1.017x - 34.005	0.999
B68	SKC	224-PCXR3	505872	13/01/2022	1,000	1,500	2,000	1,000	1,495	1,994	0.995x + 4.188	1.000
B69	SKC	224-PCXR3	508375	13/01/2022	1,000	1,500	2,000	1,002	1,501	2,002	1.011x - 21.984	0.999
B70	SKC	224-PCXR3	510623	13/01/2022	1,000	1,500	2,000	995	1,490	1,997	1.001x - 7.267	1.000
B71	SKC	224-PCXR3	508367	13/01/2022	1,000	1,500	2,000	991	1,506	2,001	1.017x - 35.429	0.999
B72	SKC	224-PCXR3	505977	13/01/2022	1,000	1,500	2,000	1,001	1,498	1,991	0.991x + 8.882	1.000
B73	SKC	224-PCXR3	512606	13/01/2022	1,000	1,500	2,000	1,001	1,501	2,004	1.013x - 23.520	0.999
B74	SKC	224-PCXR3	505993	13/01/2022	1,000	1,500	2,000	996	1,495	1,995	1.000x - 5.161	1.000
B75	SKC	224-PCXR3	509820	13/01/2022	1,000	1,500	2,000	996	1,499	1,992	0.996x + 1.831	1.000
B76	SKC	224-PCXR3	509811	13/01/2022	1,000	1,500	2,000	995	1,496	1,998	1.003x - 9.050	1.000
B77	SKC	224-PCXR3	508301	13/01/2022	1,000	1,500	2,000	1,001	1,500	2,004	1.014x - 26.595	0.999
B78	SKC	224-PCXR3	510677	13/01/2022	1,000	1,500	2,000	994	1,504	1,999	1.013x - 28.238	0.999
B79	SKC	224-PCXR3	510920	12/01/2022	1,000	1,500	2,000	994	1,493	1,994	0.999x - 4.304	1.000

Calibrated by :

Phakhinai Khongkomerd
(Mr. Phakhinai Khongkomerd)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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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.)			y	
					1	2	3	1	2	3	y	R ²
B80	SKC	224-PCXR3	504569	12/01/2022	1,000	1,500	2,000	1,003	1,499	2,002	1.010x - 20.915	0.999
B81	SKC	224-PCXR3	503480	10/01/2022	1,000	1,500	2,000	994	1,499	2,000	1.015x - 31.401	0.999
B82	SKC	224-PCXR3	505673	10/01/2022	1,000	1,500	2,000	993	1,499	1,996	1.003x - 7.857	1.000
B83	SKC	224-PCXR3	510785	13/01/2022	1,000	1,500	2,000	1,000	1,500	2,002	1.012x - 23.548	0.999
B84	SKC	224-PCXR3	508333	12/01/2022	1,000	1,500	2,000	995	1,497	1,992	0.997x - 0.016	1.000
B85	SKC	224-PCXR3	505757	10/01/2022	1,000	1,500	2,000	993	1,502	1,999	1.014x - 30.555	0.999
B86	SKC	224-PCXR3	512625	10/01/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.013x - 23.520	0.999
B87	SKC	224-PCXR3	504324	13/01/2022	1,000	1,500	2,000	997	1,499	1,997	1.000x - 1.667	1.000
B88	SKC	224-PCXR3	508307	13/01/2022	1,000	1,500	2,000	996	1,495	1,992	0.996x + 0.451	1.000
B89	SKC	224-PCXR3	509860	13/01/2022	1,000	1,500	2,000	1,000	1,501	2,003	1.013x - 25.008	0.999
B90	SKC	224-PCXR3	508366	13/01/2022	1,000	1,500	2,000	992	1,502	2,001	1.017x - 33.531	0.999
B91	SKC	224-PCXR3	510919	13/01/2022	1,000	1,500	2,000	998	1,498	1,997	1.001x - 4.563	1.000
B92	SKC	224-PCXR3	510987	13/01/2022	1,000	1,500	2,000	1,003	1,501	2,004	1.012x - 21.996	0.999
B93	SKC	224-PCXR3	509845	13/01/2022	1,000	1,500	2,000	1,000	1,498	1,999	1.000x - 3.059	1.000

Calibrated by :

Phakhinai Khongkomerd
(Mr. Phakhinai Khongkomerd)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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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.)			y		R ²	
					1	2	3	1	2	3				
B01	SKC	224-PCXR4	262101	01/04/2022	1,000	1,500	2,000	998	1,497	1,998	1.001x - 3.748	1.000		
B02	SKC	224-PCXR4	626166	04/04/2022	1,000	1,500	2,000	1,002	1,505	2,001	1.010x - 20.455	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	1,998	1.001x - 3.928	1.000		
B05	SKC	224-PCXR4	612693	12/04/2022	1,000	1,500	2,000	1,003	1,498	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	626202	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	091960	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	034050	01/04/2022	1,000	1,500	2,000	1,000	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 - 30.827	0.999		
B17	SKC	224-PCXR4	626860	04/04/2022	1,000	1,500	2,000	997	1,485	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 - 20.785	0.999		
B23	SKC	224-PCXR4	785393	12/04/2022	1,000	1,500	2,000	994	1,505	2,002	1.017x - 33.667	0.999		
B24	SKC	224-PCXR4	626365	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	788460	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	788479	12/04/2022	1,000	1,500	2,000	995	1,499	1,993	0.997x + 1.853	1.000		
B27	SKC	224-PCXR4	691672	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 - 22.421	0.999		
B31	SKC	224-PCXR4	691509	12/04/2022	1,000	1,500	2,000	999	1,495	1,995	1.002x - 7.968	1.000		
B32	SKC	224-PCXR4	091567	04/04/2022	1,000	1,500	2,000	993	1,504	2,001	1.015x - 30.206	0.999		
B33	SKC	224-PCXR4	091756	01/04/2022	1,000	1,500	2,000	994	1,496	1,991	0.998x + 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	626104	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	1,508	2,002	1.016x - 31.285	0.999		
B38	SKC	224-PCXR4	636167	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	788349	12/04/2022	1,000	1,500	2,000	992	1,505	2,000	1.017x - 34.109	0.999		

Calibrated by :

Phakchira Khongkumnerd
(Mr. Phakchira Khongkumnerd)

Approved by :

Peera Detation
(Mr. Peera Detation)



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data									
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve		
					Setting			Actual (Q std.)					
					1	2	3	1	2	3	y	R ²	
B41	SKC	224-PCXR4	612669	04/04/2022	1,000	1,500	2,000	998	1,496	1,998	0.994x + 3.829	1.000	
B42	SKC	224-PCXR4	620041	01/04/2022	1,000	1,500	2,000	1,002	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 + 12.838	1.000	
B44	SKC	224-PCXR8	629341	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 - 33.294	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	566752	01/04/2022	1,000	1,500	2,000	999	1,494	1,997	0.999x + 1.795	1.000	
B49	SKC	224-PCXR8	566789	12/04/2022	1,000	1,500	2,000	1,008	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 - 26.266	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 + 2.915	1.000	
B60	SKC	224-PCXR3	512656	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	505972	12/04/2022	1,000	1,500	2,000	993	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	505302	04/04/2022	1,000	1,500	2,000	997	1,493	1,999	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	508298	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 - 21.688	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	506267	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 - 4.365	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	1,496	1,998	1.007x - 15.040	1.000	
B77	SKC	224-PCXR3	508301	01/04/2022	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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S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com, www.spscon.com

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3		y
B90	SKC	224-PCXR3	504669	01/04/2022	1,000	1,500	2,000	1,003	1,499	2,001	1.010x - 20.517	0.999
B81	SKC	224-PCXR3	503460	01/04/2022	1,000	1,500	2,000	994	1,499	2,000	1.015x - 31.561	0.999
B82	SKC	224-PCXR3	505073	01/04/2022	1,000	1,500	2,000	993	1,498	1,996	1.002x - 7.299	1.000
B83	SKC	224-PCXR3	510785	04/04/2022	1,000	1,500	2,000	1,000	1,500	2,002	1.012x - 23.787	0.999
B84	SKC	224-PCXR3	508833	04/04/2022	1,000	1,500	2,000	995	1,497	1,991	0.997x - 0.383	1.000
B85	SKC	224-PCXR3	505757	04/04/2022	1,000	1,500	2,000	993	1,502	1,999	1.014x - 30.476	0.999
B86	SKC	224-PCXR3	512625	12/04/2022	1,000	1,500	2,000	1,003	1,502	2,004	1.012x - 22.463	0.999
B87	SKC	224-PCXR3	504324	11/04/2022	1,000	1,500	2,000	998	1,496	2,000	1.001x - 2.305	1.000
B88	SKC	224-PCXR3	505307	04/04/2022	1,000	1,500	2,000	997	1,498	1,993	0.996x + 1.212	1.000
B89	SKC	224-PCXR3	509660	19/04/2022	1,000	1,500	2,000	1,000	1,501	2,003	1.014x - 25.646	0.999
B90	SKC	224-PCXR3	508366	04/04/2022	1,000	1,500	2,000	992	1,502	2,001	1.017x - 33.850	0.999
B91	SKC	224-PCXR3	510910	04/04/2022	1,000	1,500	2,000	998	1,498	1,996	1.000x - 3.765	1.000
B92	SKC	224-PCXR3	510987	04/04/2022	1,000	1,500	2,000	1,003	1,501	2,004	1.012x - 21.316	0.999
B93	SKC	224-PCXR3	509845	12/04/2022	1,000	1,500	2,000	1,000	1,498	1,998	1.000x - 2.201	1.000

Calibrated by :

Phakhinai Khongkorned
(Mr. Phakhinai Khongkorned)

Approved by :

Mr. Peera Detudom
(Mr. Peera Detudom)



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

Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data				Calibration Data							
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)			y	R ²
				1	2	3	1	2	3		
H-B01	Dwyer	VFB-65	05/01/2022	500	1,000	2,000	497.9	988.8	1983.7	0.998x - 4.774	1.000
H-B02	Dwyer	VFB-65	05/01/2022	500	1,000	2,000	498.7	1002.2	1983.0	0.998x - 1.083	1.000
H-B03	Dwyer	VFB-65	06/01/2022	500	1,000	2,000	497.9	996.3	2004.2	1.003x - 5.511	1.000
H-B04	Dwyer	VFB-65	06/01/2022	500	1,000	2,000	498.8	999.1	1985.1	0.998x - 1.448	1.000
H-B05	Dwyer	VFB-65	06/01/2022	500	1,000	2,000	497.4	997.6	1993.3	0.993x + 6.450	1.000
H-B06	Dwyer	VFB-65	07/01/2022	500	1,000	2,000	497.2	998.8	1985.9	0.992x + 5.181	1.000
H-B07	Dwyer	VFB-65	07/01/2022	500	1,000	2,000	498.9	998.3	1991.8	0.995x + 3.563	1.000
H-B08	Dwyer	VFB-65	06/01/2022	500	1,000	2,000	496.2	992.4	1984.0	0.997x - 1.707	1.000
H-B09	Dwyer	VFB-65	07/01/2022	500	1,000	2,000	502.5	999.1	2007.2	1.003x - 4.310	1.000
H-B10	Dwyer	VFB-65	05/01/2022	500	1,000	2,000	497.3	989.9	2017.0	0.994x + 4.485	1.000

Calibrated by :

Phakhinai Khongkorned
(Mr. Phakhinai Khongkorned)

Approved by :

Mr. Peera Detudom
(Mr. Peera Detudom)



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Tel : (662) 939-4370-72 Fax : (662) 513-4321 E-mail : sales@spscs.com, www.spscs.com

Rotameter Calibration Report (For Personal Pump High Flow Adjust)											
Calibration Method : Dry Cal Primary Flowmeter				Model : Defender 510-II				S/N : 136164			
Calibration Data											
Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
H-B01	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	505.5	988.5	1973.5	0.990x + 8.911	1.000
H-B02	Dwyer	VFB-65	04/04/2022	500	1,000	2,000	495.5	997.8	1995.2	0.998x - 4.832	1.000
H-B03	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	499.1	987.5	2009.2	1.004x - 15.366	0.999
H-B04	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	500.4	999.1	2008.7	0.999x - 2.127	1.000
H-B05	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	498.6	997.4	1972.3	0.981x + 20.608	1.000
H-B06	Dwyer	VFB-65	05/04/2022	500	1,000	2,000	501.0	993.4	1981.4	1.006x + 12.163	0.999
H-B07	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	504.5	988.6	2018.3	1.001x + 1.713	1.000
H-B08	Dwyer	VFB-65	04/04/2022	500	1,000	2,000	499.8	999.2	1975.4	0.996x - 3.367	0.999
H-B09	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	503.7	1007.0	2014.8	0.994x - 14.587	1.000
H-B10	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	493.7	996.6	2012.4	0.986x + 0.535	1.000

Calibrated by : (Mr. Phakchai Khongkomsed)	Approved by : (Mr. Peera Deudom)
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CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhprachasin 3 Rd., Bangpood, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cml@hotmail.com



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 ± 2) °C

Relative Humidity : (50 ± 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

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

Approved by :

(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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

CAL-F0031-03



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

- o0o -

1.8



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 : TETNITHI W.

CALIBRATION DATE : 11-Mar-22

APPROVED BY : PONGSAK J.

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.



QUALITY CALIBRATION CO.,LTD.

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

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

www.qcalibration.com

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

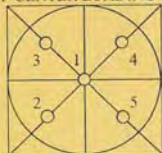
3. REPEATABILITY OF READING AT 20 g WAS 0.000004 g

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	0.00011
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
2	10.00002
3	10.00001
4	10.00001
5	10.00002
OFF-CENTER LOADING	0.00001

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

F-G010 REV 02



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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Lambda UV Preventive Maintenance (PM)

Page 1

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

The preventive maintenance checks and if applicable performance tests for Lambda UV have been completed.

This Lambda UV Passes ☒ Fails ☐ the preventive maintenance.

Review of Preventive Maintenance:	
Authorized PerkinElmer Representative:	Date:
Anon Leenthawonkit 	25-Jan-2022 (DD-MM-YYYY)
Authorized Customer Representative:	Date:
	25-Jan-2022 (DD-MM-YYYY)

Request No. 21-65/0455

MTC No. EEL. BP. 41/0465

CALIBRATION CERTIFICATE

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

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

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

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

Serial No. : 130006

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1,500) kPa

Standards used : 1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.

2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.

3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.

4. Digital Multimeter Agilent 34401A S/N MY44005560.

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer Keithley 2015-P S/N 4106495.

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

Calibration Procedure: CP-102-04 based on IEC 60942-2003. The sound pressure level of instrument was measured by standard microphone using an insert voltage technique.

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

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

Date of Receipt : 22 Apr. 2022

Date of Calibration : 28 Apr. 2022

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. 21-65/0455

MTC No. EEL. BP. 41/0465

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	93.93	-0.07	± 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	1.44	± 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 :

N. N. N.
(Mr. Nuttapong Niljrusvanit)

Taw
(Mr. Tawikiat Iamsamran)

Date of Calibration : 28 Apr. 2022

Date of Issue : 28 Apr. 2022

Approved by :

Prasert Kluaypa
(Mr. Prasert Kluaypa)
Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011265042601787001

2 / 2

End of Certificate

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FM.BL.MTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0374

MTC No. EEL. BP. 47/0365

CALIBRATION CERTIFICATE

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

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

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

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : Cirrus

Model : CR-515

Serial No. : 92002

Ambient Environment

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

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

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

- Standards used : 1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
4. Digital Multimeter Agilent 34401A S/N MY44005560.
5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
6. Audio Analyzer Keithley 2015-P S/N 4106495.
7. Condenser Microphone Bruel&Kjaer 4180 S/N 2889871.

Calibration Procedure: CP-102-04 based on IEC 60942-2003; The sound pressure level 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 Mar. 2022

Date of Calibration : 19 Mar. 2022

1 / 2

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FM.BL.MTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0374

MTC No. EEL. BP. 47/0365

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

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

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

1. Sound Pressure Level

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

2. Frequency

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

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.00	± 0.50	$\pm 3.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

(Mr. Weerachai Deechaiyae)

Approved by :

(Mr. Prawate Khuaypa)
Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref : 2011265031401103001

Date of Calibration : 19 Mar. 2022

Date of Issue : 22 Mar. 2022

End of Certificate

2 / 2

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บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอย พหลโยธิน 24 ถนนพหลโยธิน แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10900
Tel : (662) 939-970-72, Fax : (662) 513-4323, E-mail : sales@spscon.com, www.spscon.com

Noise B_077/22

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
ACO-B25	ACO	6236	00182006	08 February 2022	94.1	94.0
ACO-B26	ACO	6236	00182007	08 February 2022	94.0	94.0
ACO-B27	ACO	6236	00182008	08 February 2022	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.96 \pm 0.40 dB	

Calibrated by :

(Mr. Phakinnai Khongkornnerd)

Approved by :

(Mr. Peca Denudom)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
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Tel : (662) 979-4375-77 Fax : (662) 613-4221 E-mail : sales@spsconsulting.com, www.spsconsulting.com

Noise B_303/22

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 March 2022
		Due Date	28 March 2023

Calibration Data

Sound Level Meter Data

Calibration Data

SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B18	ACO	6236	00172048	26 May 2022	93.9	94.0
ACO-B41	ACO	6236	00192032	26 May 2022	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.93 ± 0.10 dB	

Calibrated by :

Phakhinai Khongkomnerd
(Mr. Phakhinai Khongkomnerd)

Approved by :

(Mr. Peera Detadom)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
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Tel : (662) 979-4375-77 Fax : (662) 613-4221 E-mail : sales@spsconsulting.com, www.spsconsulting.com

Noise B_303_1/22

Sound Level Meter Calibration Report

Acoustic Calibrator Data

Brand	CIRRUS	Number	AC-CR01/63
Model	CR515	Serial No.	92002
Calibration Range	94 dB, 1000 Hz	Last Calibration	19 March 2022
		Due Date	19 March 2023

Calibration Data

Sound Level Meter Data

Calibration Data

SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
CR-B05	Cirrus	CR161B	G301134	26 May 2022	93.9	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.99 ± 0.10 dB	

Calibrated by :

Phakhinai Khongkomnerd
(Mr. Phakhinai Khongkomnerd)

Approved by :

(Mr. Peera Detadom)



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 : Walalak Sirithean

Approved by : 
Approved Signatory

(✓) Malee Butkruea
() Salthip Meangmai
() Warakorn Lerngagtrakul

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.



Cert. No.: 21CH1216
Page.: 2 of 2

Condition of this calibration result

1. Reference Standard Instrument : -

Instrument	Serial No.	ID No.	Cert. No.	Due Date
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

Buffer Solution	Manufacturer	Lot No.	Exp. date
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 (±mV)	Coverage factor k
	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 (±)	Coverage factor k
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

A 0032410



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
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TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert.No.: 22CH140
Page.: 1 of 2

Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : Mettler Toledo
Model : SevenCompact
Serial No. : C141708983
ID No. : -
Condition As-Received: Used Item
Received Date : 31 January 2022
Calibration Date : 02 February 2022
Reference : 2201-0954WSC-1
Submitted by : S.P.S. Consulting Service Co.,Ltd.
7 Soi Phahonyothin 24, Phahonyothin Rd.,
Chom Phon, Chatuchak, Bangkok 10900
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure: In-house method :
- CP-CH6 ; based on direct measurement by
using certified reference material (CRM)

Calibrated by : Warakorn Lerngagtrakul

Approved by :

Malee
Approved Signatory

- (✓) Malee Butkruea
() Saithip Meangmai
() Warakorn Lerngagtrakul

Issue Date : 10 February 2022

The Uncertainties are for a confidence probability of approximately 95%

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



Cert.No.: 22CH140
Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	1963878	130RC095	21I977	17 Sep 2022

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

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

2. Certified Reference Materials :-

- Conductivity calibration solution, CPA chem Ltd., The measurement results are traceable to SI
through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Conductivity Solution	Manufacturer	Lot No.	Exp. date
147.0 µS/cm	CPA Chem	761020	02 Aug 2022
1413.0 µS/cm	CPA Chem	761021	02 Aug 2022
12.880 mS/cm	CPA Chem	761022	02 Aug 2022
111.3 mS/cm	CPA Chem	768164	12 Sep 2022

- Control Conductivity calibration solution temperature by Water bath (25±0.1) °C

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

Calibration results

Function : Conductivity Measurement

(*) After Adjustment at 0.147, 1.413, 12.880, 111.3 mS/cm
Conductivity Electrode Serial No.: 5821320179

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (±)	Coverage factor k
147.0 µS/cm	148.1 µS/cm	147.0 µS/cm	0.99 µS/cm	2.00
1413.0 µS/cm	1413 µS/cm	1413 µS/cm	9.2 µS/cm	2.00
12.880 mS/cm	12.61 mS/cm	12.88 mS/cm	0.086 mS/cm	2.00
111.3 mS/cm	105.7 mS/cm	111.4 mS/cm	0.76 mS/cm	2.00

Remark

- UUC* = Unit Under Calibration

- 147.0 µS/cm Adjustment Cell constant = 0.550585 cm⁻¹

- 1413.0 µS/cm Adjustment Cell constant = 0.554585 cm⁻¹

- 12.880 mS/cm Adjustment Cell constant = 0.562585 cm⁻¹

- 111.3 mS/cm Adjustment Cell constant = 0.578585 cm⁻¹

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 %.

-oOo-

A 0037795

a 1093760

Certificate of Calibration

Certificate No. : 65-400210-1

Page : 1 of 2

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

Equipment : Liquid in Glass Thermometer

Manufacturer : SK

Model : N/A

Range : 0 °C to 100 °C

Resolution : 1 °C

Serial No. : N/A

Immersion : Total

ID No. : TM21/59

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

Relative Humidity : (50 ± 15) %

Line Voltage : (220 ± 22) VAC

Date of Received : 19 April 2022

Date of Calibration : 23 April 2022

Date of Issue : 23 April 2022

Calibrated by : Chortip Samchusri

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

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

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

2. Standard Digital Thermometer

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

Approved by :

(Bunjerd Masri)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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



Certificate of Calibration

Certificate No. : 65-400210-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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

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

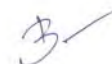
Remark

UUC : Unit Under Calibration

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

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

- 000 -






TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)

CALIBRATION AND TESTING EQUIPMENT SERVICES

534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

TEL. 0-2717-3000-24 FAX. 0-2719-9484

Cert.No.: 22CH578

Page.: 1 of 2

Certificate of Calibration

Equipment : Turbidity Meter
Manufacturer : Eutech
Model : Cyberscan WL TB1000
Serial No. : 201802206
ID. No. : TB 03/61
Condition As-Received: Used Item
Received Date : 25 April 2022
Calibration Date : 27 April 2022
Reference : 2204-0619WN-1
Submitted by : S.P.S. Consulting Service Co.,Ltd.
7 Phaholyothin 24, Phaholyothin Road.,
Jompol, Chatuchak, Bangkok 10900
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 20) %
Calibration Procedure : In - house method : CP-CH11
based on direct measurement by
using Formazin standard solution

Calibrated by : Walalak Sirithean

Approved by :

Malee Butkruea
Approved Signatory

- (/) Malee Butkruea
() Saithip Meangmai
() Warakorn Lernagtrakul

Issue Date : 3 May 2022

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 Calibration and Testing Equipment Services.



Cert.No. : 22CH578

Page. : 2 of 2

Condition of this calibration result

1. Reference Standard Instruments :

This certification is traceable to the International System of unit (SI unit) through
Technology Promotion Association (Thailand-Japan).

Instruments	Serial No.	ID No.	Certificate No.	Due date
1) Thermo-Hygrograph	1102794	130EC009	21H2601	8 Dec 2022
2) Electronic Balance	N03679	140RC001	21MM429	21 Sep 2022

2. Standard Material : The Formazin suspension has been prepared gravimetric from

Material	Manufacturer	Lot No.	Assay
1) Hexamethylenetetramine	HIMEDIA	0000493947	99.65%
2) Hydrazinium Sulfate	HIMEDIA	0000522014	99.40%

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

Calibration result

Performing three - Formazin suspension standard curve by using 0,10,1000 NTU
Turbidity Meter Serial Number : 201802206

Standard Formazine suspension (NTU)	UUC* Reading (NTU)	Uncertainty of Measurement (± NTU)	Coverage Factor k
20	19.4	0.38	2.00
40	39.3	0.40	2.00
100	98.9	0.73	2.00
400	389	1.5	2.00

Remark

- UUC* = Unit Under Calibration
- NTU = Nephelometric Turbidity Units

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 0008721

a 1106496



CERTIFICATE No : 22M2569
REFERENCE No : 64386-3

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : SARTORIUS
MODEL : BSA224S-CW
SERIAL No : 36591843
ID No : BA 09/61
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : TETNITHI W.
CALIBRATION DATE : 11-Mar-22

APPROVED BY : PONGSAK J.

ISSUED DATE : 17-Mar-22

RECEIVED DATE : 11-Mar-22



Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : BSA224S-CW
MANUFACTURER : SARTORIUS S/N : 36591843
ID No : BA 09/61 RECEIVED DATE : 11-Mar-22
AIR PRESSURE : 1008mbar \pm 1mbar CALIBRATION DATE : 11-Mar-22
AMBIENT TEMPERATURE : 22° C \pm 1° C RELATIVE HUMIDITY : 51 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

- 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.
- REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-1-151	C02210415	09-Feb-23
- THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
- THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
- 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

- ZERO SETTING FUNCTION : NORMAL
- TARE FUNCTION : NORMAL
- REPEATABILITY OF READING AT 200 g WAS 0.000048 g
- DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.0000	0.0000	0.000078
0.10	0.1000	0.0000	0.000078
0.20	0.2000	0.0000	0.000078
0.50	0.5000	0.0000	0.000079
1.00	1.0000	0.0000	0.000079
2.00	2.0000	0.0000	0.000080
5.00	5.0000	0.0000	0.000081
10.00	10.0000	0.0000	0.000084
20.00	20.0000	0.0000	0.000089
50.00	50.0000	0.0000	0.00011
100.00	100.0000	0.0000	0.00019
200.00	199.9999	0.0001	0.00032

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	99.9999
2	99.9999
3	100.0000
4	99.9999
5	99.9998
OFF-CENTER LOADING	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

**QUALITY CALIBRATION CO.,LTD.**

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

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

www.qcalibration.comCERTIFICATE No : 22T0570
REFERENCE No : 63773-2

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : COD REACTOR
MANUFACTURER : HACH
MODEL : DRB 200
SERIAL No : 15110C0498
ID No : DRB 06/59
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : CHAICHARN CH.

CALIBRATION DATE : 21-Jan-22

APPROVED BY : PONGSAR J.

ISSUED DATE : 21-Jan-22

RECEIVED DATE : 19-Jan-22

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

F-G010 REV : 02

**QUALITY CALIBRATION CO.,LTD.**

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

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

CERTIFICATE No : 22T0570

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : COD REACTOR
MANUFACTURER : HACH
ID NUMBER : DRB 06/59
RECEIVED DATE : 19-Jan-22
AMBIENT TEMPERATURE : 23° C ± 1° C
MODEL : DRB 200
SERIAL NUMBER : 15110C0498
CALIBRATION DATE : 21-Jan-22
RELATIVE HUMIDITY : 52 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH TC TYPE K	HYDRA 2635A	8009008	21T6767	10-Jul-22

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT**TEMPERATURE MEASUREMENT ACCURACY TEST**

Block No.	1	2
Controller temperature (°C)	145	145
Indicating Temperature	145	145
Measured Temperature (°C) at Spread Locations	1	150.5
	2	150.6
	3	149.7
	4	150.2
	5	149.9
	6	150.1
	7	150.1
	8	149.7
	9	150.6
	10	149.6
	11	149.9
	12	149.6
	13	149.7
	14	149.8
	15	149.6
Uncertainty of Measurement(± °C)	0.86	0.86

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

NOTE 2 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

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

END OF CALIBRATION REPORT

F-G010 REV : 02



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 FAX. 0-2719-9484

Cert.No.: 22TW98

Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : 5000-230V
Serial No. : 15B100751
ID No. : -
Received Date : 20 April 2022
Test Date : 21 April 2022
Reference : 2204-0429WC-1
Submitted by : S.P.S. Consulting Service Co.,Ltd.
7 Phaholyothin 24, Phaholyothin Road.,
Jompol, Chatuchak, Bangkok 10900
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
Test Procedure : In - house method : CP-CH9
by Comparison Technique with Azide Modification Method
Tested by : Walalak Sirithean
Approved by : 
Approved Signatory
(/) Malee Butkruea
() Saithip Meangmai
() Warakorn Lerngagtrakul
Issue Date : 25 April 2022

B 0286555



Cert.No.: 22TW98

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

This certification is traceable to the International System of Unit through the reference standards laboratory of Industrial Calibration Center, Technology Promotion Association (Thailand-Japan).

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1) Burette	-	130BU10	21CG1389	25 Mar 2023
2) Balance	1126143764	140RC004	21MM430	21 Sep 2022

2. Standard Material :-

Material	Manufacturer	Lot.No.	Assay
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 14J100195


Titration Method (Azide Modification Method)	DO Meter Reading	Standard Deviation
(mg/L)	(mg/L)	(mg/L)
8.12	8.14	0.0084

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency. The environmental impact control and present to organization it may concerned intend to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full, without written approval of the laboratory

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a 1105753

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><i>This Lambda UV Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.</i></p>	
<p align="center">Review of Preventive Maintenance:</p>	
<p>Authorized PerkinElmer Representative:</p> <p align="center">Anon Leenthawonkit </p>	<p>Date:</p> <p align="center">25-Jan-2022 (DD-MM-YYYY)</p>
<p>Authorized Customer Representative:</p>	<p>Date:</p> <p align="center">25-Jan-2022 (DD-MM-YYYY)</p>



WO-01513756/2022

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

Customer :	<u>S.P.S.Consulting Service Co.,Ltd</u>	Date Tested:	<u>January 12, 2022</u>
Address :	<u>7 Soi Phaholyothin 24</u>	Recommendation Recertification	
	<u>Paholyothin Road</u>	Period	<u>6 Months</u>
	<u>Jompol Chatuchak, Bangkok 1090</u>	Recertification Due:	<u>July 12, 2022</u>
User Name:	<u>K.Phenpha Vipasthawatt</u>	Date Last Certified:	<u>July 14, 2021</u>
Phone:	<u>083-9269252</u>	Visit Number:	<u>2 of 2</u>
Fax:	<u>02-513-4221</u>	PerkinElmer Phone:	<u>02-719-6420 ext 206</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>		

Page 1 of 4



WO-01513756/2022

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

SERIAL NUMBER	<u>077C8011701</u>	DATE TESTED	<u>January 12, 2022</u>
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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

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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)
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			
<input checked="" type="checkbox"/> meets			
<input type="checkbox"/> 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: <i>Wiphan Promlumda</i>			
(Mr. Wiphan Promlumda)			
Service Engineer			



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 :

K. Nathapong

(Mr. Nathapong Krudaum)



Page 1 of 2

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

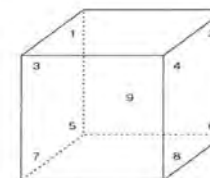
Calibration Temperature (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Stability ¹ (°C)	Measured Uniformity ² (°C)	Overall Variation ³ (°C)
35	35.0	35.0	0.12	0.40	0.45
41.5	41.5	41.5	0.11	0.39	0.51

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

Page 2 of 2

PinAAcle 900Z Preventive Maintenance (PM)

Company Name:	S.P.S.CONSULTING SERVICE CO.,LTD.		
Address (Instrument Location):	PHAHOLYOTHIN RD, JOMPON, BANGKOK, 51, TH, 10900		
Serial Number:	PZAS19090402	PM Number:	1/2
Customer Name (if applicable):	K. PHENPHA	Telephone Number:	083-926-9252
Customer Support Engineer Name:	K. DUANG	Service Order Number:	WO-01473846
Date PM Performed: (DD-MMM-YYYY)	01-Jun-2022	Next PM Due Date: (DD-MMM-YYYY)	01-Dec-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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PerkinElmer shall not be liable for incidental or consequential damages in connection with the furnishing or use of this document.

Component List

Component / Specific Model	Serial #	Configuration Notes
AS900	AS9419052359	Syngistix 3.1

Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
B0501696	Fan Filters	2
B3002013	THGA Contact Cylinders	1
B3141064	Glycerol for THGA Cooling	N/A

Additional Reagents and Standards Required for PM

Part Number (if applicable)	Description	Quality	Batch/Lot #	Expired Date (MM/YY)
N9300244	GFAAS Mixed Standard	AR	56-021CRY1	30-Jun-2023

Additional Reagents and Standards Required for PM (Customer Support Solution)

Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
N/A	DI Water	250 ml.	AR	AR
N/A	0.5% HNO ₃	250 ml.	AR	AR

Additional Tools Required for PM			
Part Number (if applicable)	Description	Quantity	Serial #
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	255	Passed
External Flow Rate	100 mL/min \pm 10 mL/min	105	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	0.0002	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	5.6	Passed
Precision	\leq 2.0 %	0.56	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	\leq 16.5 pg/0.0044 A-s	14.1	Passed
Zeeman Ratio	0.52 \pm 0.04	0.53	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

$$\begin{aligned} \text{Zeeman Ratio} &= \frac{\text{Atomic Signal (Peak area)}}{\text{Atomic Signal (Peak area)} + \text{Background Signal (Peak area)}} \\ &= \frac{0.1609}{0.1609 + 0.1377} \\ &= 0.53 \end{aligned}$$



REPLACE PM KIT FOR PinAAcle900Z

Review

The preventive maintenance checks and if applicable performance tests for PinAAcle 900Z have been completed.

This PinAAcle 900Z Passes ☒ Fails ☐ the preventive maintenance.

Review of Preventive Maintenance:

Authorized PerkinElmer Representative:		Date: 01-Jun-2022 (DD-MM-YYYY)
Authorized Customer Representative:		Date: 01-Jun-2022 (DD-MM-YYYY)



CALIBRATION LABORATORY CO., LTD.

2/10-11, 14, 55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail: sale@cal-laboratory.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
(THERMAL ENVIRONMENT MONITOR)

MANUFACTURER : 3M

MODEL / TYPE : QUESTemp®34

SERIAL NO. : TEL080034

CLID. NO. : 231801937

JOB CONTROL NO. : 211026102931

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

DATE OF RECEIVED : 26 October 2021

DATE OF ISSUED : 29 October 2021

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

Calibrated By : Oranut Kamchatphai
Calibration Engineer



Approved By : Mongkol Yotsoontorn
Authorized Signatory
29 October 2021



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. Q21102931

F3-011-04/01-12

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@clccalibration



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



REPORT OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
(THERMAL ENVIRONMENT MONITOR)
MANUFACTURER : 3M
MODEL / TYPE : QUESTemp^o34
SERIAL NO. : TEL080034
DATE OF CALIBRATION : 27 October 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. 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. 44602.
Temperature & Humidity Chamber, PGC Model 9141-5116 S/N. 1304261.

TRACEABILITY :

The measurements are traceable to International System of Units (SI), through Thunder Scientific Corporation.
Certificate No.18815, Due Date 11 November 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. Q21102931

F3-011-04/01-12

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@clccalibration



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



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The 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 ($^\circ\text{C}$)	Actual Temperature ($^\circ\text{C}$)	DUC Reading ($^\circ\text{C}$)	Correction ($^\circ\text{C}$)	Uncertainty \pm ($^\circ\text{C}$)
30.0	30.07	30.1	-0.03	0.40
35.0	34.92	34.8	+0.12	
40.0	40.09	39.9	+0.19	

2. CORRECTION OF TEMPERATURE : DRY

Test point ($^\circ\text{C}$)	Actual Temperature ($^\circ\text{C}$)	DUC Reading ($^\circ\text{C}$)	Correction ($^\circ\text{C}$)	Uncertainty \pm ($^\circ\text{C}$)
30.0	30.07	30.2	-0.13	0.40
35.0	34.92	35.0	-0.08	
40.0	40.09	40.2	-0.11	

3. CORRECTION OF TEMPERATURE : GLOBE

Test point ($^\circ\text{C}$)	Actual Temperature ($^\circ\text{C}$)	DUC Reading ($^\circ\text{C}$)	Correction ($^\circ\text{C}$)	Uncertainty \pm ($^\circ\text{C}$)
30.0	30.07	30.1	-0.03	0.40
35.0	34.92	34.8	+0.12	
40.0	40.09	39.9	+0.19	

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. Q21102931

F3-011-04/01-12

page 3 of 3



@clccalibration



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10900
Tel : (662) 939-4170-72 Fax : (662) 513-4221 E-mail : sales@spscs.com www.spscs.com

Heat B078_1/22

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: B11	Verification Date	: 24 May 2022
Brand	: 3M	Ambient Temp.	: 24.5 °C
Model	: QUESTemp [®] 34	Barometric Pressure	: 1011 mmHg
Serial No.	: TEL080034	Relative Humidity	: 49 %
Verification Module (Electronic Sensor Check) :			
Verification Module No. : 21 WB = 12.5 °C , DB = 47.1 °C , G = 69.3 °C			
Result of Verification : Without Adjustment			
Wet Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.5	0.0	± 0.5
Dry Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.0	0.1	± 0.5
Globe Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.3	0.0	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by : Phakhinai Khongkornnerd
(Mr. Phakhinai Khongkornnerd)

Approved by :

(Mr. Peera Detudom)



CALIBRATION LABORATORY Co., LTD.

2/10-11, M.55 Soi Prasert Manulit 29 Yaek 4, Prasert Manulit Rd., Ladphrao, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail: sale@cal-laboratory.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
[AREA HEAT STRESS MONITOR]
MANUFACTURER : METROSONICS
MODEL / TYPE : hs-32
SERIAL NO. : MCE030011
CLID. NO. : 231802280
JOB CONTROL NO. : 220423041338

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

DATE OF RECEIVED : 23 April 2022

DATE OF ISSUED : 27 April 2022

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

Calibrated By :

Pimsiri Hemtanon

Calibration Engineer

(Signature)

Approved By :

Mongkol Yotsoontorn

Authorized Signatory

27 April 2022



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

Certificate No. Q22041338

F3-011-04/01-12

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calibration



CALIBRATION LABORATORY CO., LTD.

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



REPORT OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
[AREA HEAT STRESS MONITOR]
MANUFACTURER : METROSONICS
MODEL / TYPE : hs-32
SERIAL NO. : MCE030011
DATE OF CALIBRATION : 26 April 2022

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$ Relative Humidity : $(55 \pm 10) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. WI-305-74. 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. 19317, Due Date 09 July 2022.

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:2021)"

Certificate No. Q22041338

F3-011-04/01-12

page 2 of 3



@calibration



CALIBRATION LABORATORY CO., LTD.

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



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The 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 ($^\circ\text{C}$)	Actual Temperature ($^\circ\text{C}$)	DUC Reading ($^\circ\text{C}$)	Correction ($^\circ\text{C}$)	Uncertainty \pm ($^\circ\text{C}$)
30.0	30.00	29.9	+0.10	0.40
35.0	34.99	34.8	+0.19	
40.0	39.97	39.8	+0.17	

2. CORRECTION OF TEMPERATURE : DRY

Test point ($^\circ\text{C}$)	Actual Temperature ($^\circ\text{C}$)	DUC Reading ($^\circ\text{C}$)	Correction ($^\circ\text{C}$)	Uncertainty \pm ($^\circ\text{C}$)
30.0	30.00	29.7	+0.30	0.40
35.0	34.99	34.6	+0.39	
40.0	39.97	39.6	+0.37	

3. CORRECTION OF TEMPERATURE : GLOBE BULB

Test point ($^\circ\text{C}$)	Actual Temperature ($^\circ\text{C}$)	DUC Reading ($^\circ\text{C}$)	Correction ($^\circ\text{C}$)	Uncertainty \pm ($^\circ\text{C}$)
30.0	30.00	29.6	+0.40	0.40
35.0	34.99	34.6	+0.39	
40.0	39.97	39.6	+0.37	

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. Q22041338

F3-011-04/01-12

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7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจตุจักร กรุงเทพมหานคร 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 935-4370-72 Fax : (662) 513-4221 E-mail : sale@spscs.com www.spscs.com

Heat B078_2/22

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	B21	Verification Date	24 May 2022
Brand	3M	Ambient Temp.	24.5 °C
Model	QUESTemp [®] 32	Barometric Pressure	1011 mmbar
Serial No.	MCE030011	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	69.4	-0.1	± 0.5
UUC [*] = UNIT UNDER CALIBRATION			

Verified by : Phakthina Khongkumnerd
(Mr. Phakthina Khongkumnerd)

Approved by :

(Signature)
(Mr. Peera Detudom)



CALIBRATION LABORATORY CO., LTD.

2/10-11, 14, 55 Soi Prasart Manukit 29 Yaek 4, Prasart Manukit Rd., Ladphrao, Bangkok 10230
Tel 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail: sale@cal-laboratory.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
(THERMAL ENVIRONMENT MONITOR)
MANUFACTURER : 3M
MODEL / TYPE : QUESTemp[®]32
SERIAL NO. : TPH050002
CLID. NO. : 231801939
JOB CONTROL NO. : 220324031296

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

DATE OF RECEIVED : 24 March 2022

DATE OF ISSUED : 26 March 2022

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

Calibrated By : Oranut Kamchatphai
Calibration Engineer

(Signature)

Approved By : Mongkol Yotsoontorn
Authorized Signatory
26 March 2022



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

Certificate No. Q22031296

F3-011-04/01-12

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CALIBRATION LABORATORY Co.,LTD.

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



REPORT OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
(THERMAL ENVIRONMENT MONITOR)
MANUFACTURER : 3M
MODEL / TYPE : QUESTemp[®]32
SERIAL NO. : TPH050002
DATE OF CALIBRATION : 25 March 2022

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$ Relative Humidity : $(55 \pm 10) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. WI-305-74. 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. 19317, Due Date 09 July 2022.

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:2021)"

Certificate No. Q22031296

F3-011-04/01-12

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calibration

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 ($^\circ\text{C}$)	Actual Temperature ($^\circ\text{C}$)	DUC Reading ($^\circ\text{C}$)	Correction ($^\circ\text{C}$)	Uncertainty \pm ($^\circ\text{C}$)
30.0	30.07	30.2	-0.13	0.40
35.0	35.01	35.2	-0.19	
40.0	40.01	40.2	-0.19	

2. CORRECTION OF TEMPERATURE : DRY

Test point ($^\circ\text{C}$)	Actual Temperature ($^\circ\text{C}$)	DUC Reading ($^\circ\text{C}$)	Correction ($^\circ\text{C}$)	Uncertainty \pm ($^\circ\text{C}$)
30.0	30.07	30.2	-0.13	0.40
35.0	35.01	35.2	-0.19	
40.0	40.01	40.2	-0.19	

3. CORRECTION OF TEMPERATURE : GLOBE BULB

Test point ($^\circ\text{C}$)	Actual Temperature ($^\circ\text{C}$)	DUC Reading ($^\circ\text{C}$)	Correction ($^\circ\text{C}$)	Uncertainty \pm ($^\circ\text{C}$)
30.0	30.07	30.2	-0.13	0.40
35.0	35.01	35.2	-0.19	
40.0	40.01	40.2	-0.19	

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. Q22031296

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calibration



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7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 939-1370-72 Fax : (662) 513-4321 E-mail : sales@spsc.com, www.spsc.com

Heat B078_3/22

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No. :	B24	Verification Date :	24 May 2022
Brand :	3M	Ambient Temp. :	24.5 °C
Model :	QUESTemp [®] 32	Barometric Pressure :	1011 mmbar
Serial No. :	TPH050002	Relative Humidity :	49 %
Verification Module (Electronic Sensor Check) :			
Verification Module No. : 21 WB = 12.5 °C , DB = 47.1 °C , G = 69.3 °C			
Result of Verification : Without Adjustment			
Wet Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.6	-0.1	± 0.5
Dry Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.0	0.1	± 0.5
Globe Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.2	0.1	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by : Phakthinai Khongkomherd
(Mr. Phakthinai Khongkomherd)

Approved by :
(Mr. Peera Detudom)



CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail: sales@cal-laboratory.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
[THERMAL ENVIRONMENT MONITOR]

MANUFACTURER : 3M
MODEL / TYPE : QUESTemp[®]32

SERIAL NO. : TPH050015

CLID. NO. : 231801947

JOB CONTROL NO. : 220324031297

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

7 SOI PHAHOLYOTHIN 24 ROAD., JOMPOL,

CHATUCHAK, BANGKOK 10900

DATE OF RECEIVED : 24 March 2022

DATE OF ISSUED : 26 March 2022

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

Calibrated By : Oranut Kamchatphai
Calibration Engineer

Approved By : Mongkol Yotsoontorn
Authorized Signatory

26 March 2022



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

Certificate No. Q22031297

F3-011-04/01-12

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CALIBRATION LABORATORY CO., LTD.

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



REPORT OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
[THERMAL ENVIRONMENT MONITOR]
MANUFACTURER : 3M
MODEL / TYPE : QUESTemp^o32
SERIAL NO. : TPH050015
DATE OF CALIBRATION : 25 March 2022

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$ Relative Humidity : $(55 \pm 10) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. **WI-305-74**. 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. 19317, Due Date 09 July 2022.

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:2021)"

Certificate No. Q22031297

F3-011-04/01-12

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@clcalibration

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 ($^\circ\text{C}$)	Actual Temperature ($^\circ\text{C}$)	DUC Reading ($^\circ\text{C}$)	Correction ($^\circ\text{C}$)	Uncertainty \pm ($^\circ\text{C}$)
30.0	30.03	30.2	-0.17	0.40
35.0	35.00	35.1	-0.10	
40.0	40.03	40.2	-0.17	

2. CORRECTION OF TEMPERATURE : DRY

Test point ($^\circ\text{C}$)	Actual Temperature ($^\circ\text{C}$)	DUC Reading ($^\circ\text{C}$)	Correction ($^\circ\text{C}$)	Uncertainty \pm ($^\circ\text{C}$)
30.0	30.03	30.2	-0.17	0.40
35.0	35.00	35.1	-0.10	
40.0	40.03	40.2	-0.17	

3. CORRECTION OF TEMPERATURE : GLOBE BULB

Test point ($^\circ\text{C}$)	Actual Temperature ($^\circ\text{C}$)	DUC Reading ($^\circ\text{C}$)	Correction ($^\circ\text{C}$)	Uncertainty \pm ($^\circ\text{C}$)
30.0	30.03	30.2	-0.17	0.40
35.0	35.00	35.1	-0.10	
40.0	40.03	40.0	+0.03	

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. Q22031297

F3-011-04/01-12

page 3 of 3



@clcalibration

Heat B078_4/22

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	B32	Verification Date	24 May 2022
Brand	3M	Ambient Temp.	24.5 °C
Model	QUESTemp ^o 32	Barometric Pressure	1011 mmbar
Serial No.	TPH050015	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	12.3	0.2	± 0.5
Dry Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	46.9	0.2	± 0.5
Globe Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.3	0.0	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by : Phakhinai Khongkornerd
(Mr. Phakhinai Khongkornerd)

Approved by :
(Mr. Peera Detudom)



CALIBRATION LABORATORY CO., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
(THERMAL ENVIRONMENT MONITOR)
MANUFACTURER : QUEST TECHNOLOGIES
MODEL / TYPE : QUES TEMP ° 46
SERIAL NO. : TSI010028
CLID. NO. : 232002960
JOB CONTROL NO. : 211026102934
CUSTOMER : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24 ROAD., JOMPOL,
CHATUCHAK, BANGKOK 10900

DATE OF RECEIVED : 26 October 2021

DATE OF ISSUED : 30 October 2021

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

Calibrated By : Oranut Kamchatphai
Calibration Engineer

Approved By : Mongkol Yotsoontorn
Authorized Signatory
30 October 2021



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. Q21102934

F3-011-04/01-12

page 1 of 3



@clccalibration



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



REPORT OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
(THERMAL ENVIRONMENT MONITOR)
MANUFACTURER : QUEST TECHNOLOGIES
MODEL / TYPE : QUES TEMP ° 46
SERIAL NO. : TSI010028
DATE OF CALIBRATION : 27 October 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. 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. 44602.
Temperature & Humidity Chamber, PGC Model 9141-5116 S/N. 1304261.

TRACEABILITY :

The measurements are traceable to International System of Units (SI), through Thunder Scientific Corporation.
Certificate No.18815, Due Date 11 November 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. Q21102934

F3-011-04/01-12

page 2 of 3



@clc calibration



CALIBRATION LABORATORY CO.,LTD.

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



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The 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 $\pm (^\circ\text{C})$
30.0	30.20	31.9	-1.70	0.40
35.0	35.02	36.7	-1.68	
40.0	40.19	40.4	-0.21	

Note. * means Calibrations marked " Not TISI Accredited " in this Certificate have been included for completeness.

2. CORRECTION OF TEMPERATURE : DRY

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty $\pm (^\circ\text{C})$
30.0	30.07	29.9	+0.17	0.40
35.0	34.92	34.8	+0.12	
40.0	40.09	39.9	+0.19	

3. CORRECTION OF TEMPERATURE : GLOBE

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty $\pm (^\circ\text{C})$
30.0	30.07	29.9	+0.17	0.40
35.0	34.92	34.8	+0.12	
40.0	40.09	39.9	+0.19	

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. Q21102934

F3-011-04/01-12

page 3 of 3



@clc calibration



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S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอย พหลโยธิน 24 ถนนพหลโยธิน แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10900
Tel : (662) 938-4270-72 Fax : (662) 513-4221 E-mail : sales@spscon.com , www.spscon.com

Heat B078_5/22

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: B36	Verification Date	: 24 May 2022
Brand	: QUEST TECHNOLOGIES	Ambient Temp.	: 24.5 °C
Model	: QUESTemp ^o 46	Barometric Pressure	: 1011 mmbar
Serial No.	: TSI010028	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	12.3	0.2	± 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			

Verified by : Prakhinai Khongkomherd
(Mr. Phakhinai Khongkomherd)

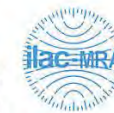
Approved by :

(Mr. Peera Detudom)



CALIBRATION LABORATORY CO., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
(THERMAL ENVIRONMENT MONITOR)
MANUFACTURER : QUEST TECHNOLOGIES
MODEL / TYPE : QUES TEMP ° 46
SERIAL NO. : TSI010004
CLID. NO. : 232002963
JOB CONTROL NO. : 211026102933

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

DATE OF RECEIVED : 26 October 2021

DATE OF ISSUED : 30 October 2021

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

Calibrated By : Oranut Kamchatphai
Calibration Engineer

(Signature)

Approved By : Mongkol Yotsoontorn
Authorized Signatory
30 October 2021



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. Q21102933

F3-011-04/01-12

page 1 of 3



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CALIBRATION LABORATORY CO., LTD.

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



REPORT OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
(THERMAL ENVIRONMENT MONITOR)
MANUFACTURER : QUEST TECHNOLOGIES
MODEL / TYPE : QUES TEMP ° 46
SERIAL NO. : TSI010004
DATE OF CALIBRATION : 27 October 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**. 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. 44602.
Temperature & Humidity Chamber, PGC Model 9141-5116 S/N. 1304261.

TRACEABILITY :

The measurements are traceable to International System of Units (SI), through Thunder Scientific Corporation.
Certificate No.18815, Due Date 11 November 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. Q21102933

F3-011-04/01-12

page 2 of 3



@clccalibration



CALIBRATION LABORATORY CO., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The 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 ($^\circ\text{C}$)	Actual Temperature ($^\circ\text{C}$)	DUC Reading ($^\circ\text{C}$)	Correction ($^\circ\text{C}$)	Uncertainty \pm ($^\circ\text{C}$)
30.0	30.20	31.3	-1.10	0.40
35.0	35.02	36.5	-1.48	
40.0	40.19	40.3	-0.11	

Note. * means Calibrations marked " Not TISI Accredited " in this Certificate have been included for completeness.

2. CORRECTION OF TEMPERATURE : DRY

Test point ($^\circ\text{C}$)	Actual Temperature ($^\circ\text{C}$)	DUC Reading ($^\circ\text{C}$)	Correction ($^\circ\text{C}$)	Uncertainty \pm ($^\circ\text{C}$)
30.0	30.07	30.0	+0.07	0.40
35.0	34.92	34.9	+0.02	
40.0	40.09	39.9	+0.19	

3. CORRECTION OF TEMPERATURE : GLOBE

Test point ($^\circ\text{C}$)	Actual Temperature ($^\circ\text{C}$)	DUC Reading ($^\circ\text{C}$)	Correction ($^\circ\text{C}$)	Uncertainty \pm ($^\circ\text{C}$)
30.0	30.07	30.1	-0.03	0.40
35.0	34.92	35.0	-0.08	
40.0	40.09	39.9	+0.19	

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. Q21102933

F3-011-04/01-12

page 3 of 3



@clccalibration

Heat B078_6/22

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	B37	Verification Date	24 May 2022
Brand	QUEST TECHNOLOGIES	Ambient Temp.	24.5 °C
Model	QUESTemp ⁰ 46	Barometric Pressure	1011 mmbar
Serial No.	TS1010004	Relative Humidity	49 %
Verification Module (Electronic Sensor Check) :			
Verification Module No. : 21 WB = 12.5 °C , DB = 47.1 °C , G = 69.3 °C			
Result of Verification : Without Adjustment			
Wet Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.4	0.1	± 0.5
Dry Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.1	0.0	± 0.5
Globe Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.3	0.0	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by : Phakhinai Khongkhamnerd
(Mr. Phakhinai Khongkhamnerd)

Approved by :
(Mr. Peera Detudom)



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0455

MTC No. EEL. BP. 41/0465

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 :

Ambient Environment

Description : Sound Calibrator

Temperature : (23 ± 3) °C

Manufacturer : ACO

Relative Humidity : (50 ± 15) %

Model : 2127

Ambient Pressure : (101.325 ± 1,500) kPa

Serial No. : 130006

Standards used : 1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.

2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.

3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.

4. Digital Multimeter Agilent 34401A S/N MY44005560.

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer Keithley 2015-P S/N 4106495.

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

Calibration Procedure: CP-102-04 based on IEC 60942-2003. The sound pressure level of instrument was measured by standard microphone using an insert voltage technique.

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

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

Date of Receipt : 22 Apr. 2022

Date of Calibration : 28 Apr. 2022

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FM.BLMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0455

MTC No. EEL. BP. 41/0465

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 Brüel&Kjaer 4180	93.93	-0.07	± 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 Brüel&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 Brüel&Kjaer 4180	1.44	± 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 :

N. N. N.
(Mr. Nuttapong Niljrusvanit)

T. M. E.
(Mr. Tawikiat Iamsamran)

Date of Calibration : 28 Apr. 2022

Date of Issue : 28 Apr. 2022

Approved by :

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

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011265042601787001

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End of Certificate

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FM.BLMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0378

MTC No. EEL. BP. 52/0365

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. : 182011

Microphone : Type 7052NR No.69840

Preamplifier : -

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjaer 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&Kjaer 2636 S/N 1537484.

Date of Receipt : 14 Mar. 2022

Date of Calibration : 4-5 Apr. 2022

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FM.BLMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0378

MTC No. EEL, BP, 52/0365

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 : 4-5 Apr. 2022

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P_n

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0378

MTC No. EEL, BP, 52/0365

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test				Tolerance
	Measured Value (dB)		Deviation	Uncertainty	Limit Class 2
	Before adjust	After adjust	(dB)	(±dB)	(±dB)
113.93	116.1	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)
22.4	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	18.7	0.10
C-Weighting	32.1	0.10
Flat	38.9	0.10

Date of Calibration : 4-5 Apr. 2022

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0378

MTC No. EEL. BP. 52/0365

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	-1.0	-1.0	0.40	1.4
4 000	-0.2	0.0	-0.2	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	0.0	0.0	0.20	2.5
125	0.0	0.0	0.0	0.20	2.0
250	0.0	0.0	0.0	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	0.0	0.0	0.20	2.6
4 000	-0.3	-0.3	0.0	0.20	3.6
8 000	-0.5	-0.4	-0.2	0.20	5.6

Date of Calibration : 4-5 Apr. 2022

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0378

MTC No. EEL. BP. 52/0365

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)
122	122.0	0.0	0.30	1.4
121	120.9	-0.1	0.32	1.4
120	119.9	-0.1	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 : 4-5 Apr. 2022

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Request No. 21-65/0378

MTC No. EEL. BP. 52/0365

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	104.0	0.0	0.30	1.4
99	99.0	0.0	0.30	1.4
94	94.1	0.1	0.30	1.4
89	88.9	-0.1	0.30	1.4
84	84.1	0.1	0.30	1.4
79	79.2	0.2	0.30	1.4
74	74.0	0.0	0.30	1.4
69	68.9	-0.1	0.30	1.4
64	63.9	-0.1	0.30	1.4
59	58.9	-0.1	0.30	1.4
54	53.9	-0.1	0.30	1.4
49	48.9	-0.1	0.30	1.4
44	44.0	0.0	0.30	1.4
39	38.9	-0.1	0.30	1.4
34	34.0	0.0	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 : 4-5 Apr. 2022

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0378

MTC No. EEL. BP. 52/0365

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	125.0	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 (\pm dB)	Tolerance Limits Class 2 (dB)
Fast	200	115.9	-0.1	0.20	± 1.3
	2	97.8	-1.2	0.20	+1.3; -2.8
	0.25	89.5	-0.5	0.20	+1.8; -5.3
Slow	200	109.5	-0.1	0.20	± 1.3
	2	89.9	-0.1	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 : 4-5 Apr. 2022

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FM.BLMTC.002 Rev.4

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E-mail : sumalee@tistr.or.th

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0378

MTC No. EEL. BP. 52/0365

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	125.7	0.3	0.20	2.4
Positive half cycle	124.4	124.3	-0.1	0.20	1.4
Negative half cycle	124.4	124.3	-0.1	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			
131.1	131.1	0.0	0.30	1.8

Calibrated by :

Pannasit Ph.

(Mr. Pannasit Phasingsri)

Approved by :

Prawate Kluaypa

(Mr. Prawate Kluaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref: 2011265031401123002

Date of Calibration : 4-5 Apr. 2022

Date of Issue : 7 Apr. 2022

End of Certificate

8 / 8

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0378

MTC No. EEL. BP. 55/0365

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 : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial No. : 192027

Microphone : Type 7052NR No.61756

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.

Ambient Environment

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

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

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

Date of Receipt : 14 Mar. 2022

Date of Calibration : 30 Mar. 2022

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0378

MTC No. EEL, BP. 55/0365

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 : 30 Mar. 2022

2 / 8

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0378

MTC No. EEL, BP. 55/0365

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test			Tolerance	
	Measured Value (dB)		Deviation (dB)	Uncertainty (\pm dB)	Limit Class 2 (\pm dB)
	Before adjust	After adjust			
113.92	115.1	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 116.8 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (\pm dB)
21.4	0.10

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

Frequency Weighting	Measured Value (dB)	Uncertainty (\pm dB)
A-Weighting	15.4	0.10
C-Weighting	20.9	0.10
Flat	24.8	0.10

Date of Calibration : 30 Mar. 2022

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0378

MTC No. EEL, BP, 55/0365

3. Acoustical 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)	Flat (dB)		
125	0.3	0.3	0.2	0.40	2.0
1 000	-0.3	-0.3	-0.2	0.40	1.4
4 000	1.1	1.1	1.5	0.40	3.6

4. Electrical 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)	Flat (dB)		
63	0.2	0.0	-0.1	0.20	2.5
125	0.1	0.1	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	-0.1	0.0	0.20	2.6
4 000	-0.5	-0.4	-0.1	0.20	3.6
8 000	-0.6	-0.6	-0.3	0.20	5.6

Date of Calibration : 30 Mar. 2022

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0378

MTC No. EEL, BP, 55/0365

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	93.9	-0.1	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)
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 : 30 Mar. 2022

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

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (+dB)	Tolerance Limits Class 2 (\pm dB)
104	104.0	0.0	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	84.2	0.2	0.30	1.4
79	79.2	0.2	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	59.1	0.1	0.30	1.4
54	54.1	0.1	0.30	1.4
49	49.1	0.1	0.30	1.4
44	44.2	0.2	0.30	1.4
39	39.2	0.2	0.30	1.4
34	34.2	0.2	0.30	1.4
33	33.3	0.3	0.30	1.4
32	32.4	0.4	0.30	1.4
31	31.4	0.4	0.30	1.4
30	30.5	0.5	0.30	1.4

Date of Calibration : 30 Mar. 2022

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0378

MTC No. EEL. BP. 55/0365

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	125.0	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 (\pm dB)	Tolerance Limits Class 2 (dB)
Fast	200	115.9	-0.1	0.20	± 1.3
	2	98.9	-0.1	0.20	+1.3; -2.8
	0.25	89.8	-0.2	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 : 30 Mar. 2022

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0378

MTC No. EEL. BP. 55/0365

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	125.7	0.3	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			
133.0	133.0	0.0	0.30	1.8

Calibrated by :

Pannasit Ph.

(Mr. Pannasit Phasingsri)

Tawikiat

(Mr. Tawikiat Iamsamran)

Date of Calibration : 30 Mar. 2022

Date of Issue : 31 Mar. 2022

Approved by :

Prawate Kluaypa

(Mr. Prawate Kluaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref : 2011265031401123005

End of Certificate

8 / 8

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FM.BLMTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0378

MTC No. EEL. BP. 53/0365

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 : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial No. : 192032

Microphone : Type 7052NR No.73330

Preamplifier : -

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.5) 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 Mar. 2022

Date of Calibration : 30 Mar. 2022

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0378

MTC No. EEL. BP. 53/0365

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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 : 30 Mar. 2022

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0378

MTC No. EEL. BP. 53/0365

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test				Tolerance
	Measured Value (dB)		Deviation	Uncertainty	Limit Class 2
	Before adjust	After adjust	(dB)	(±dB)	(±dB)
113.92	114.4	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 114.9 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
20.1	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	14.9	0.10
C-Weighting	20.6	0.10
Flat	25.2	0.10

Date of Calibration : 30 Mar. 2022

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FM.BLMTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0378

MTC No. EEL. BP. 53/0365

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	0.0	0.40	2.0
1 000	-0.4	-0.4	-0.3	0.40	1.4
4 000	0.8	0.8	1.2	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	0.0	-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	-0.1	-0.1	0.20	2.6
4 000	-0.4	-0.4	-0.2	0.20	3.6
8 000	-0.6	-0.7	-0.3	0.20	5.6

Date of Calibration : 30 Mar. 2022

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0378

MTC No. EEL. BP. 53/0365

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)
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 : 30 Mar. 2022

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Request No. 21-65/0378

MTC No. EEL, BP. 53/0365

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	104.0	0.0	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	84.2	0.2	0.30	1.4
79	79.1	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	39.1	0.1	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	30.4	0.4	0.30	1.4

Date of Calibration : 30 Mar. 2022

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Request No. 21-65/0378

MTC No. EEL, BP. 53/0365

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	98.6	-0.4	0.20	+1.3; -2.8
	0.25	89.5	-0.5	0.20	+1.8; -5.3
Slow	200	109.5	-0.1	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 : 30 Mar. 2022

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0378

MTC No. EEL. BP. 53/0365

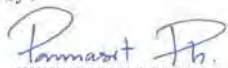
9. Peak C sound level

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	125.7	0.3	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

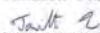
10. Overload indication

Measured value (dB)		Deviated value (dB)	Uncertainty (+dB)	Tolerance Limits Class 2 (+dB)
Positive one-half cycle	Negative one-half cycle			
133.0	133.0	0.0	0.30	1.8

Calibrated by :



(Mr. Pannasit Phasingsri)



(Mr. Tawikiat Iamsamran)

Date of Calibration : 30 Mar. 2022

Date of Issue : 31 Mar. 2022

Approved by :



(Mr. Prawate Kluaypa)



Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref : 2011265031401123003

End of Certificate

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0378

MTC No. EEL. BP. 54/0365

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 : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial No. : 192034

Microphone : Type 7052NR No.58244

Preamplifier : -

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.5) 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 Mar. 2022

Date of Calibration : 23-28 Mar. 2022

1 / 8

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0378

MTC No. EEL. BP. 54/0365

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 : 23-28 Mar. 2022

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0378

MTC No. EEL. BP. 54/0365

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			
113.95	114.5	114.0	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 115.3 dB.

2. Self-generated noise

2.1 Normal test

Measured value	Uncertainty
(dB)	(±dB)
21.9	0.10

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

Frequency	Measured Value	Uncertainty
Weighting	(dB)	(±dB)
A-Weighting	15.1	0.10
C-Weighting	20.4	0.10
Flat	24.4	0.10

Date of Calibration : 23-28 Mar. 2022

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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	0.3	0.2	0.1	0.40	2.0
1 000	-0.3	-0.3	-0.2	0.40	1.4
4 000	1.0	1.0	1.3	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	0.3	0.1	-0.1	0.20	2.5
125	0.1	0.1	0.0	0.20	2.0
250	0.1	0.0	0.0	0.20	1.9
500	0.1	0.1	0.0	0.20	1.9
1 000	0.0	0.0	0.0	0.20	1.4
2 000	-0.1	-0.1	0.0	0.20	2.6
4 000	-0.4	-0.3	-0.1	0.20	3.6
8 000	-0.6	-0.5	-0.3	0.20	5.6

Date of Calibration : 23-28 Mar. 2022

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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)
122	122.0	0.0	0.30	1.4
121	121.0	0.0	0.30	1.4
120	120.0	0.0	0.30	1.4
119	119.0	0.0	0.30	1.4
114	113.9	-0.1	0.30	1.4
109	109.0	0.0	0.30	1.4

Date of Calibration : 23-28 Mar. 2022

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0378

MTC No. EEL. BP. 54/0365

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	104.0	0.0	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	79.1	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	54.1	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	39.1	0.1	0.30	1.4
34	34.2	0.2	0.30	1.4
33	33.2	0.2	0.30	1.4
32	32.3	0.3	0.30	1.4
31	31.4	0.4	0.30	1.4
30	30.4	0.4	0.30	1.4

Date of Calibration : 23-28 Mar. 2022

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0378

MTC No. EEL. BP. 54/0365

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	125.0	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 (\pm dB)	Tolerance Limits Class 2 (dB)
Fast	200	115.9	-0.1	0.20	± 1.3
	2	98.9	-0.1	0.20	+1.3; -2.8
	0.25	89.5	-0.5	0.20	+1.8; -5.3
Slow	200	109.5	-0.1	0.20	± 1.3
	2	89.8	-0.2	0.20	+1.3; -5.3
SEL	200	110.0	0.0	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 : 23-28 Mar. 2022

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0378

MTC No. EEL. BP. 54/0365


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	125.7	0.3	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

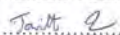
10. Overload indication

Measured value (dB)		Deviated value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
Positive one-half cycle	Negative one-half cycle			
133.0	133.0	0.0	0.30	1.8

Calibrated by :



(Mr. Pannasit Phasingsri)



(Mr. Tawikiat Iamsamran)

Date of Calibration : 23-28 Mar. 2022

Date of Issue : 29 Mar. 2022

Approved by :



(Mr. Prawate Kluaypa)



Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref : 2011265031401123004

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 :

Description : Integrating Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial No. : 192052

Microphone : Type 7052NR No.73351

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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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 Acoustic Signal (dB)	Unit Under Test			Tolerance	
	Measured Value (dB)		Deviation	Uncertainty	Limit Class 2
	Before adjust	After adjust	(dB)	(\pm dB)	(\pm 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 (\pm 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 (\pm 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

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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 (\pm dB)	Tolerance Limits Class 2 (\pm 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 (\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	115.8	-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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FM.BLMTC.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

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 :

Panya Phasingsri
(Mr. Panya Phasingsri)
Tawikiat Iamsamran
(Mr. Tawikiat Iamsamran)

Approved by :

Prawate Kludappa
(Mr. Prawate Kludappa)
Acting Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 20-22 Sep. 2021

Date of Issue : 22 Sep. 2021

Ref: 2011264091403810001

End of Certificate

8 / 8

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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. 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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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

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 Acoustic Signal (dB)	Unit Under Test				Tolerance
	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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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

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 (±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	124.1	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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Request No. 21-64/0840

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

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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 :

Panya Phasingsri
(Mr. Panya Phasingsri)
Tawikiat Iamsamran
(Mr. Tawikiat Iamsamran)

Prawate Khuaypa
(Mr. Prawate Khuaypa)
Acting Director
Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 20-22 Sep. 2021

Date of Issue : 22 Sep. 2021

Ref: 2011264091403810002

End of Certificate

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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.

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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. : 00192062

Microphone : Type 7052NR No.73361

Preamplifier : -

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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FM.BLMTC.002 Rev.3



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0764

MTC No. EEL. BP. 29/0864

9. Power Amplifier Brüel&Kjaer 2706 S/N 1517650.
10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
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12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

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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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FM.BL.MTC.002 Rev.3

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0764

MTC No. EEL. BP. 29/0864

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test				Tolerance
	Measured Value (dB)		Deviation	Uncertainty	Limit Class 2
	Before adjust	After adjust	(dB)	(\pm dB)	(\pm dB)
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 (\pm 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 (\pm 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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E-mail: sunalee@tistr.or.th

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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FM.BLMTC.002 Rev.3

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)
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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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

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 (\pm dB)	Tolerance Limits Class 2 (\pm 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 (\pm 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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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:

Panya Phasingsri

(Mr. Panya Phasingsri)

Wittawat Supanich

(Mr. Wittawat Supanich)

Date of Calibration : 24-31 Aug. 2021

Date of Issue : 6 Sep. 2021

Approved by:

Prawate Klunypa

(Mr. Prawate Klunypa)

Acting Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref: 2011264080903328003

End of Certificate

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FM.BLMTC.002 Rev.3

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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.BLMTC.002 Rev.4

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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 Tammy 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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FM.BLMTC.002 Rev.4

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0840

MTC No. EEL, BP, 43/0964

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test				Tolerance
	Measured Value (dB)		Deviation	Uncertainty	Limit Class 2
	Before adjust	After adjust	(dB)	(\pm dB)	(\pm 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 (\pm 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 (\pm 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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FM.BLMTC.002 Rev.4

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 (\pm dB)	Tolerance Limits Class 2 (\pm 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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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	\pm 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	\pm 1.3
	2	89.8	-0.2	0.20	+1.3; -5.3
SEL	200	109.9	-0.1	0.20	\pm 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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FM.BLMTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

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 (\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 :

.....
(Mr. Panya Phasingsri)
.....
(Mr. Tawikiat Iamsamran)

Approved by :

.....
(Mr. Prawate Kluaypa)
.....
Acting Director
Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 20-22 Sep. 2021

Date of Issue : 22 Sep. 2021

Ref : 2011264091403810003

End of Certificate

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0840

MTC No. EEL. BP. 44/0964

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. : 192064
Microphone : Type 7052NR No.73345
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. 44/0964

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. 44/0964

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test				Tolerance
	Measured Value (dB)		Deviation	Uncertainty	Limit Class 2
	Before adjust	After adjust	(dB)	(\pm dB)	(\pm dB)
113.94	115.3	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 113.4 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (\pm 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 (\pm dB)
A-Weighting	13.2	0.10
C-Weighting	18.9	0.10
Flat	23.1	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. 44/0964

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	-0.3	0.0	0.0	0.40	2.0
1 000	-0.9	-0.9	-0.8	0.40	1.4
4 000	-0.3	-0.5	-0.2	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	-0.3	0.0	-0.1	0.20	2.5
125	-0.3	0.0	0.0	0.20	2.0
250	-0.3	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	0.0	-0.1	0.0	0.20	2.6
4 000	-0.2	-0.4	0.7	0.20	3.6
8 000	-0.4	-0.7	-0.2	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. 44/0964

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	124.0	0.0	0.30	1.4
123	123.1	0.1	0.30	1.4
122	122.1	0.1	0.30	1.4
121	121.0	0.0	0.30	1.4
120	120.1	0.1	0.30	1.4
119	118.9	-0.1	0.30	1.4
114	114.0	0.0	0.30	1.4
109	108.8	-0.2	0.30	1.4

Date of Calibration : 20-22 Sep. 2021

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Request No. 21-64/0840

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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	104.0	0.0	0.30	1.4
99	99.0	0.0	0.30	1.4
94	94.0	0.0	0.30	1.4
89	88.9	-0.1	0.30	1.4
84	84.1	0.1	0.30	1.4
79	79.0	0.0	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	33.2	0.2	0.30	1.4
32	32.2	0.2	0.30	1.4
31	31.2	0.2	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. 44/0964

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	125.0	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	94.9	-0.1	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 (\pm 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 : 20-22 Sep. 2021

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Request No. 21-64/0840

MTC No. EEL. BP. 44/0964

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 :

Panya Phasingsri
(Mr. Panya Phasingsri)
Tawikiat Iamsamran
(Mr. Tawikiat Iamsamran)

Approved by :

Prawate Klunaypa
(Mr. Prawate Klunaypa)
Acting Director
Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 20-22 Sep. 2021

Date of Issue : 22 Sep. 2021

Ref : 2011264091403810004

End of Certificate

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0374

MTC No. EEL. BP. 47/0365

CALIBRATION CERTIFICATE

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

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

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

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : Cirrus

Model : CR-515

Serial No. : 92002

Ambient Environment

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

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

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

Standards used : 1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
4. Digital Multimeter Agilent 34401A S/N MY44005560.
5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
6. Audio Analyzer Keithley 2015-P S/N 4106495.
7. Condenser Microphone Bruel&Kjaer 4180 S/N 2889871.

Calibration Procedure: CP-102-04 based on IEC 60942-2003; The sound pressure level 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 Mar. 2022

Date of Calibration : 19 Mar. 2022

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0374

MTC No. EEL. BP. 47/0365

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 Brüel&Kjaer 4180	93.99	-0.01	± 0.10	± 0.40 dB

2. Frequency

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

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Brüel&Kjaer 4180	1.00	± 0.50	$\pm 3.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

(Mr. Weerachai Deechaiyae)

Approved by :

(Mr. Prawate Khuaypa)
Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref: 2011265031401103001

Date of Calibration : 19 Mar. 2022

Date of Issue : 22 Mar. 2022

End of Certificate

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FMBL.MTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0455

MTC No. EEL. BP. 42/0465

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 : Sound Level Meter

Manufacturer : Cirrus

Model : CR:161B

Serial No. : G301155

Microphone : Cirrus MK224 No.212381D

Preamplifier : No.9630F

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.5) kPa

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjaer 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&Kjaer 2636 S/N 1537484.

Date of Receipt : 26 Apr. 2022

Date of Calibration : 10-11 May 2022

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FMBL.MTC.002 Rev.4

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 : 10-11 May 2022

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Ph

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1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test				Tolerance limit Class 1 (±dB)
	Measured Value (dB)		Deviation (dB)	Uncertainty (±dB)	
	Before adjust	After adjust			
93.71	93.7	94.0	0.3	0.50	1.1

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 94.0 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)
18.1	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	under-range	-
C-Weighting	20.3	0.10
Flat	30.0	0.10

Note: The under-range means that the indicator cannot display the value in range 20-140 dB.

Date of Calibration : 10-11 May 2022

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 1 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
125	0.1	-0.1	-0.1	0.40	1.5
1 000	0.0	0.0	0.0	0.40	1.1
4 000	0.2	0.3	0.5	0.40	1.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 1 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
63	0.5	0.2	0.2	0.20	1.5
125	0.3	0.1	0.1	0.20	1.5
250	0.2	0.0	0.0	0.20	1.4
500	0.1	0.0	0.0	0.20	1.4
1 000	0.0	0.0	0.0	0.20	1.1
2 000	-0.2	0.0	0.0	0.20	1.6
4 000	-0.3	-0.2	0.0	0.20	1.6
8 000	-0.5	-0.4	-0.1	0.20	+2.1; -3.1
16 000	0.2	0.3	-0.2	0.20	+3.5; -17.0

Date of Calibration : 10-11 May 2022

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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 1 (±dB)
A-weighting	114.0	0.0	0.20	0.4
C-weighting	114.0	0.0	0.20	0.4
Flat	114.0	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 1 (±dB)
Fast	114.0	0.0	0.20	0.3
Slow	114.0	0.0	0.20	0.3
Leq	114.0	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 1 (±dB)
138	138.1	0.1	0.30	1.1
137	137.1	0.1	0.30	1.1
136	136.1	0.1	0.30	1.1
135	135.1	0.1	0.30	1.1
134	134.1	0.1	0.30	1.1
129	129.1	0.1	0.30	1.1
124	124.0	0.0	0.30	1.1

Date of Calibration : 10-11 May 2022

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

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 1 (\pm dB)
119	118.9	-0.1	0.30	1.1
114	114.0	0.0	0.30	1.1
109	109.1	0.1	0.30	1.1
104	104.0	0.0	0.30	1.1
99	99.0	0.0	0.30	1.1
94	94.0	0.0	0.30	1.1
89	89.0	0.0	0.30	1.1
84	83.9	-0.1	0.30	1.1
79	79.1	0.1	0.30	1.1
74	74.0	0.0	0.30	1.1
69	69.0	0.0	0.30	1.1
64	64.0	0.0	0.30	1.1
59	59.0	0.0	0.30	1.1
54	54.0	0.0	0.30	1.1
49	49.0	0.0	0.30	1.1
44	44.0	0.0	0.30	1.1
39	39.0	0.0	0.30	1.1
34	33.9	-0.1	0.30	1.1
29	29.0	0.0	0.30	1.1
24	24.1	0.1	0.30	1.1

Date of Calibration : 10-11 May 2022

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7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 1 (\pm dB)
20-140	135	135.0	0.0	0.30	1.1

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 1 (dB)
Fast	200	136.0	0.0	0.20	± 0.8
	2	118.9	-0.1	0.20	+1.3; -1.8
	0.25	109.8	-0.2	0.20	+1.3; -3.3
Slow	200	129.5	-0.1	0.20	± 0.8
	2	109.9	-0.1	0.20	+1.3; -3.3
SEL	200	130.0	0.0	0.20	± 0.8
	2	110.0	0.0	0.20	+1.3; -1.8
	0.25	100.9	-0.1	0.20	+1.3; -3.3

Date of Calibration : 10-11 May 2022

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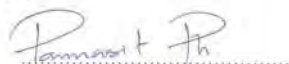
9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (\pm dB)	Tolerance limits Class 1 (\pm dB)
Complete cycle	135.4	135.7	0.3	0.20	2.4
Positive half cycle	134.4	134.2	-0.2	0.20	1.4
Negative half cycle	134.4	134.3	-0.1	0.20	1.4

10. Overload indication

Measured value (dB)		Deviated value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 1 (\pm dB)
Positive one-half cycle	Negative one-half cycle			
140.7	140.6	0.1	0.30	1.8

Calibrated by :



(Mr. Pannasit Phasingsri)

Approved by :



(Mr. Prayate Kloaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 10-11 May 2022

Date of Issue : 11 May 2022

Ref : 2011265042601787002

End of Certificate

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FM.BLMTC.002 Rev.4

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 : Sound Level Meter
Manufacturer : Cirrus
Model : CR-161B
Serial No. : G301134
Microphone : Cirrus MK224 No.212824A
Preamplifier : No.10324F

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.
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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 : 26 Apr. 2022

Date of Calibration : 10-11 May 2022

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9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
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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 : 10-11 May 2022

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E-mail : surmalee@tistr.or.th

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test				Tolerance limit Class 1 (±dB)
	Measured Value (dB)		Deviation (dB)	Uncertainty (±dB)	
	Before adjust	After adjust			
93,71	94.4	94.0	0.3	0.50	1.1

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 94.0 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (\pm dB)
18.1	0.36

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

Frequency Weighting	Measured Value (dB)	Uncertainty (\pm dB)
A-Weighting	under-range	--
C-Weighting	19.8	0.10
Flat	29.4	0.10

Note: The under-range means that the indicator cannot display the value in range 20-140 dB.

Date of Calibration : 10-11 May 2022

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P.

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 1 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
125	0.1	-0.1	-0.1	0.40	1.5
1 000	0.0	0.0	0.0	0.40	1.1
4 000	0.8	0.9	1.1	0.40	1.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 1 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
63	0.5	0.2	0.2	0.20	1.5
125	0.3	0.1	0.1	0.20	1.5
250	0.2	0.1	0.1	0.20	1.4
500	0.1	0.0	0.0	0.20	1.4
1 000	0.0	0.0	0.0	0.20	1.1
2 000	-0.1	0.0	0.0	0.20	1.6
4 000	0.5	-0.2	0.0	0.45	1.6
8 000	1.8	-0.3	-0.1	0.20	+2.1; -3.1
16 000	0.1	0.3	-0.2	0.20	+3.5; -17.0

Date of Calibration : 10-11 May 2022

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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 1 (±dB)
A-weighting	114.0	0.0	0.20	0.4
C-weighting	114.0	0.0	0.20	0.4
Flat	114.0	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 1 (±dB)
Fast	114.0	0.0	0.20	0.3
Slow	114.0	0.0	0.20	0.3
Leq	114.0	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 1 (±dB)
138	138.0	0.0	0.30	1.1
137	137.0	0.0	0.30	1.1
136	136.0	0.0	0.30	1.1
135	135.0	0.0	0.30	1.1
134	134.0	0.0	0.30	1.1
129	129.0	0.0	0.30	1.1
124	124.0	0.0	0.30	1.1

Date of Calibration : 10-11 May 2022

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

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class I (\pm dB)
119	119.0	0.0	0.30	1.1
114	114.0	0.0	0.30	1.1
109	109.0	0.0	0.30	1.1
104	104.0	0.0	0.30	1.1
99	99.0	0.0	0.30	1.1
94	94.0	0.0	0.30	1.1
89	89.0	0.0	0.30	1.1
84	83.9	-0.1	0.30	1.1
79	79.0	0.0	0.30	1.1
74	73.9	-0.1	0.30	1.1
69	69.0	0.0	0.30	1.1
64	63.9	-0.1	0.30	1.1
59	58.9	-0.1	0.30	1.1
54	53.9	-0.1	0.30	1.1
49	48.9	-0.1	0.30	1.1
44	43.9	-0.1	0.30	1.1
39	38.9	-0.1	0.30	1.1
34	33.9	-0.1	0.30	1.1
29	28.9	-0.1	0.30	1.1
24	24.0	0.0	0.30	1.1

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7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class I (\pm dB)
20-140	135	135.0	0.0	0.30	1.1

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class I (dB)
Fast	200	136.0	0.0	0.20	± 0.8
	2	118.9	-0.1	0.20	+1.3; -1.8
	0.25	109.8	-0.2	0.20	+1.3; -3.3
Slow	200	129.5	-0.1	0.20	± 0.8
	2	109.9	-0.1	0.20	+1.3; -3.3
SEL	200	130.0	0.0	0.20	± 0.8
	2	110.0	0.0	0.20	+1.3; -1.8
	0.25	100.9	-0.1	0.20	+1.3; -3.3

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0455

MTC No. EEL. BP. 43/0465

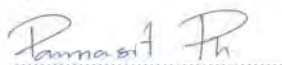
9. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (\pm dB)	Tolerance limits Class 1 (\pm dB)
Complete cycle	135.4	135.7	0.3	0.20	2.4
Positive half cycle	134.4	134.2	-0.2	0.20	1.4
Negative half cycle	134.4	134.3	-0.1	0.20	1.4

10. Overload indication

Measured value (dB)		Deviated value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 1 (\pm dB)
Positive one-half cycle	Negative one-half cycle			
140.7	140.6	0.1	0.30	1.8

Calibrated by :



(Mr. Pannasit Phasingsri)

Approved by :



(Mr. Prawate Klaiyapa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 10-11 May 2022

Date of Issue : 11 May 2022

Ref : 2011265042601787003

End of Certificate

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FM.BLMTC.002 Rev.4

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0527

MTC No. EEL. BP. 15/0564

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 : Sound Level Meter
Manufacturer : Cirrus
Model : CR161B
Serial No. : G301407
Microphone : Cirrus MK224 No.212824A
Preamplifier : No.10324F

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 : 6 May 2021

Date of Calibration : 21-27 May 2021

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FM.BLMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0527

MTC No. EEL. BP. 15/0564

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 : 21-27 May 2021

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0527

MTC No. EEL. BP. 15/0564

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Unit Under Test				Tolerance limit Class (+dB)
	Measured Value (dB)		Deviation (dB)	Uncertainty (+dB)	
	Before adjust	After adjust			
93.71	93.6	93.7	0.0	0.50	1.1

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 93.7 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (+dB)
17.9	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	under-range	-
C-Weighting	19.9	0.10
Flat	29.5	0.10

Note: The under-range means that the indicator cannot display the value in range 20-140 dB.

Date of Calibration : 21-27 May 2021

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 1 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
125	0.3	0.2	0.1	0.40	1.5
1 000	-0.6	-0.6	-0.6	0.40	1.1
4 000	0.5	0.6	0.8	0.40	1.6

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from response curve			Uncertainty (±dB)	Tolerance Limits Class 1 (±dB)
	A-weighting (dB)	C-weighting (dB)	Flat (dB)		
63	0.5	0.1	0.2	0.20	1.5
125	0.3	0.1	0.0	0.20	1.5
250	0.2	0.0	0.0	0.20	1.4
500	0.1	0.0	0.0	0.20	1.4
1 000	0.0	0.0	0.0	0.20	1.1
2 000	-0.1	0.0	0.0	0.20	1.6
4 000	-0.3	-0.2	0.0	0.20	1.6
8 000	-0.5	-0.3	-0.1	0.20	+2.1; -3.1
16 000	0.2	0.3	-0.2	0.20	+3.5; -17.0

Date of Calibration : 21-27 May 2021

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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 1 (±dB)
A-weighting	114.0	0.0	0.20	0.4
C-weighting	114.0	0.0	0.20	0.4
Flat	114.0	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 1 (±dB)
Fast	114.0	0.0	0.20	0.3
Slow	114.0	0.0	0.20	0.3
Leq	114.0	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 1 (±dB)
138	138.0	0.0	0.30	1.1
137	137.0	0.0	0.30	1.1
136	136.0	0.0	0.30	1.1
135	135.0	0.0	0.30	1.1
134	134.0	0.0	0.30	1.1
129	129.0	0.0	0.30	1.1
124	124.0	0.0	0.30	1.1

Date of Calibration : 21-27 May 2021

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

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 1 (\pm dB)
119	119.0	0.0	0.30	1.1
114	114.0	0.0	0.30	1.1
109	109.0	0.0	0.30	1.1
104	104.0	0.0	0.30	1.1
99	99.0	0.0	0.30	1.1
94	94.0	0.0	0.30	1.1
89	89.0	0.0	0.30	1.1
84	84.0	0.0	0.30	1.1
79	79.0	0.0	0.30	1.1
74	73.9	-0.1	0.30	1.1
69	68.9	-0.1	0.30	1.1
64	63.9	-0.1	0.30	1.1
59	58.9	-0.1	0.30	1.1
54	53.9	-0.1	0.30	1.1
49	49.0	0.0	0.30	1.1
44	43.9	-0.1	0.30	1.1
39	39.0	0.0	0.30	1.1
34	34.0	0.0	0.30	1.1
29	29.1	0.1	0.30	1.1
24	24.3	0.3	0.30	1.1

Date of Calibration : 21-27 May 2021

6 / 8

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

7. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 1 (\pm dB)
20-140	135	135.0	0.0	0.30	1.1

8. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured Value (dB)	Deviated Value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 1 (dB)
Fast	200	136.0	0.0	0.20	± 0.8
	2	118.9	-0.1	0.20	+1.3; -1.8
	0.25	109.8	-0.2	0.20	+1.3; -3.3
Slow	200	129.5	-0.1	0.20	± 0.8
	2	109.9	-0.1	0.20	+1.3; -3.3
SEL	200	130.0	0.0	0.20	± 0.8
	2	110.0	0.0	0.20	+1.3; -1.8
	0.25	100.9	-0.1	0.20	+1.3; -3.3

Date of Calibration : 21-27 May 2021

7 / 8

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0527

MTC No. EEL. BP. 15/0564


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 1 (\pm dB)
Complete cycle	135.4	135.7	0.3	0.20	2.4
Positive half cycle	134.4	134.2	-0.2	0.20	1.4
Negative half cycle	134.4	134.3	-0.1	0.20	1.4

10. Overload indication

Measured value (dB)		Deviated value (dB)	Uncertainty (\pm dB)	Tolerance Limits Class 1 (\pm dB)
Positive one-half cycle	Negative one-half cycle			
140.7	140.6	0.1	0.30	1.8

Calibrated by :


(Mr. Komkrit Laohasiri)

Approved by :


(Mr. Prawate Kluaypa)
Acting Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref: 2011264050601893001

End of Certificate

8 / 8

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. 21-64/0841

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

1/2

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. 21-64/0841

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 Brüel&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 Brüel&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 Brüel&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 :

(Signature)
(Mr. Weerachai Deechaiyae)

Approved by :

(Signature)
(Mr. Prawate Khuaypa)
Acting Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref : 2011264091403811002

Date of Calibration : 17 Sep. 2021

Date of Issue : 20 Sep. 2021

End of Certificate

2 / 2

The results relate only to the items tested or calibrated.

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FM.BLMTC.002 Rev.3



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 :

Ambient Environment

Description : Noise Dosimeter

Temperature : (23 ± 3) °C

Manufacturer : Svantek

Relative Humidity : (50 ± 15) %

Model : SV-104IS

Ambient Pressure : (101.325 ± 1.5) kPa

Serial No. : 80840

Standards used :

Multifunction Acoustic Calibrator Brüel&Kjaer 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.BLMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

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 :

(Signature)
(Mr. Sanaey Grajang)

Approved by :

(Signature)
(Mr. Prawate Klauyapa)
Director
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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FB.LMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0397

MTC No. EEL. BP. 90/0365

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. : 80842

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.5) 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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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0397

MTC No. EEL. BP. 90/0365

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	0.2	0.0	0.25	1.4
4 000	-0.4	-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 :

Mr. Sanaey Grajang
(Mr. Sanaey Grajang)

Approved by :

Mr. Prayate Kluyapa
(Mr. Prayate Kluyapa)
Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011265031801270002

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. 91/0365

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 : Svanter

Model : SV-104IS

Serial No. : 80852

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.5) 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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FM.BLMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0397

MTC No. EEL. BP. 91/0365

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	0.4	0.5	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 :

(Signature)
.....
(Mr. Sanaey Grajang)

Approved by :

(Signature)
.....
(Mr. Prawate Kluyapa)

Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011265031801270003

Date of Calibration : 23 Mar. 2022

Date of Issue : 23 Mar. 2022

2 / 2

End of Certificate

This results relate only to the items tested/calibrated or value assigned.
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FM.BLMTC.002 Rev.4

Head Office
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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 : Svanitek

Model : SV-104IS

Serial No. : 80854

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.5) 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

This 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.BLMTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

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 :

Mr. Sanaey Grajang
(Mr. Sanaey Grajang)

Approved by :

Mr. Prawate Kluyapa
(Mr. Prawate Kluyapa)
Director

**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

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

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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 : Svanetek

Model : SV-104IS

Serial No. : 80856

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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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0397

MTC No. EEL. BP. 93/0365

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	-0.1	-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 :

G. Sany
(Mr. Sanaey Grajang)

Approved by :

Prawate Kluaypa
(Mr. Prawate Kluaypa)
Director
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

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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. 21-65/0363

MTC No. EEL. BP. 30/0365

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. : 80816

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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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0363

MTC No. EEL. BP. 30/0365

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	0.2	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 :

G. Sany
.....
(Mr. Sanaey Grajang)

Approved by :

Prasert Kluaypa
.....
(Mr. Prasert Kluaypa)
Director
Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre
Ref : 2011265030701010001

Date of Calibration : 9 Mar. 2022

Date of Issue : 9 Mar. 2022

2 / 2

End of Certificate

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FM.BLMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0363

MTC No. EEL. BP. 31/0365

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. : 80817

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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FM.BLMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0363

MTC No. EEL. BP. 31/0365

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	-0.8	-0.8	0.25	2.0
1 000	-0.7	-0.6	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 :

(Mr. Sanaey Grajang)

Approved by :

(Mr. Prawate Kluaypa)

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref : 2011265030701010002

Date of Calibration : 9 Mar. 2022

Date of Issue : 9 Mar. 2022

2 / 2

End of Certificate

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FMBL/MTC.002 Rev.4



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 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.5) 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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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

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 :

G. Sany
 (Mr. Sanaey Grajang)

Approved by :

Mr. Prawate Kluaypa
 (Mr. Prawate Kluaypa)
 Director
 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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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 : Syntek

Model : SV-1041S

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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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

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 :

Mr. Sanaey Grajang
.....
(Mr. Sanaey Grajang)

Approved by :

Mr. Prawate Kluyapa
.....
(Mr. Prawate Kluyapa)

Director

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

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End of Certificate

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

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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., Jompoi, 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. : 80830

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.5) 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.BLMTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

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 :

Mr. Sanaey Grajang
(Mr. Sanaey Grajang)

Approved by :

Mr. Prawate Klauyapa
(Mr. Prawate Klauyapa)
Director

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.
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FM.BL.MTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0193

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 :

Ambient Environment

Description : Noise Dosimeter

Temperature : (23 ± 3) °C

Manufacturer : Svanitek

Relative Humidity : (50 ± 15) %

Model : SV-104IS

Ambient Pressure : (101.325 ± 1.5) kPa

Serial No. : 80831

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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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0193

MTC No. EEL. BP. 90/1264

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	0.2	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 :

Gr. Sany
(Mr. Sanaey Grajang)

Approved by :

Prasit Kluyapa
(Mr. Prasit Kluyapa)
Acting Director
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.
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FM.BLMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0193

MTC No. EEL. BP. 91/1264

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,
Sri 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Noise Dosimeter

Manufacturer : Svanitek

Model : SV-104IS

Serial No. : 80832

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.5) 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.BLMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0193

MTC No. EEL. BP. 91/1264

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	-0.4	0.25	2.0
1 000	-0.1	-0.1	0.25	1.4
4 000	0.5	0.5	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 :

Mr. Sanaey
(Mr. Sanaey Grajang)

Approved by :

Mr. Prawate Khunypa
(Mr. Prawate Khunypa)
Acting Director
Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre
Ref : 2011264122205281002

Date of Calibration : 28 Dec. 2021

Date of Issue : 4 Jan. 2022

2 / 2

End of Certificate

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FM.BLMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0193

MTC No. EEL. BP. 92/1264

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 : Svanitek

Model : SV-104IS

Serial No. : 80834

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.5) 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.BLMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0193

MTC No. EEL. BP. 92/1264

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	-0.2	-0.4	0.25	2.0
1 000	0.0	-0.1	0.25	1.4
4 000	0.5	0.6	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 :

Mr. Sanaey
(Mr. Sanaey Grajang)

Approved by :

Mr. Prawate Kluaypa
(Mr. Prawate Kluaypa)
Acting Director
Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011264122205281003

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.
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FM.BL.MTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0193

MTC No. EEL. BP. 93/1264

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 : Svanetek

Model : SV-104IS

Serial No. : 80875

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.5) 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



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0193

MTC No. EEL. BP. 93/1264

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	0.0	0.0	0.25	1.4
4 000	0.2	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 :

Mr. Sanaey Grajang
(Mr. Sanaey Grajang)

Approved by :

Mr. Prawate Klauyapa
(Mr. Prawate Klauyapa)
Acting Director
Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre
Ref : 2011264122205281004

Date of Calibration : 28 Dec. 2021

Date of Issue : 4 Jan. 2022

2 / 2

End of Certificate

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FM.BLMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0193

MTC No. EEL. BP. 94/1264

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. : 80880

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

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FM.BLMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0193

MTC No. EEL. BP. 94/1264

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	0.0	-0.1	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 :

G. Sanaey
(Mr. Sanaey Grajang)

Approved by :

Prasit Kluaypa
(Mr. Prasit Kluaypa)
Acting Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref: 2011264122205281001

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.

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FM.BLMTC.002 Rev.4



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจตุจักร กรุงเทพฯ 10900
Tel. (662) 579-8220-72 Fax. (662) 513-4231 E-mail: sales@spscs.com, www.spscs.com

Noise B_304_1/22

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-B29	ACO	6236	00182011	22 May 2022	94.0	94.0
ACO-B36	ACO	6236	00192027	22 May 2022	94.0	94.0
ACO-B41	ACO	6236	00192032	22 May 2022	93.9	94.0
ACO-B43	ACO	6236	00192034	22 May 2022	94.0	94.0
ACO-R40	ACO	6236	00192052	22 May 2022	93.9	94.0
ACO-R41	ACO	6236	00192053	22 May 2022	93.9	94.0
ACO-R50	ACO	6236	00192062	22 May 2022	93.9	94.0
ACO-R51	ACO	6236	00192063	22 May 2022	94.0	94.0
ACO-R52	ACO	6236	00192064	22 May 2022	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.93 ± 0.10 dB	

Calibrated by :

(Mr. Phakthai Khongkorn)

Approved by :

Mr. Peera Detadom
(Mr. Peera Detadom)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
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7 Soi Phaholyothin 24, Phaholyothin Rd., Juntarak, Chaitachak, Bangkok 10000
Tel : (662) 979-4770-72, Fax : (662) 513-4221, E-mail : sales@spsc.com, www.spsc.com

Noise B_304_2/22

Sound Level Meter Calibration Report

Acoustic Calibrator Data

Brand	CIRRUS	Number	AC-CR01/63
Model	CR515	Serial No.	92002
Calibration Range	94 dB, 1000 Hz	Last Calibration	19 March 2022
		Due Date	19 March 2023

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
CR-B03	Cirrus	CR161B	G301155	22 May 2022	93.9	94.0
CR-B05	Cirrus	CR161B	G301134	22 May 2022	93.9	94.0
CR-B10	Cirrus	CR161B	G301407	22 May 2022	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.99 ± 0.10 dB	

Calibrated by :

(Mr. Phakthinai Khongkonnerd)

Approved by :

(Mr. Peera Detadom)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
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Noise Dose B_304_3/22

Noise Dose Meter Calibration Report

Acoustic Calibrator Data

Brand	SVANTEK	Number	SV 06/62
Model	SV 34	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	22 May 2022	113.6	113.6
NMD-B02	SVANTEK	SV-104IS	80842	22 May 2022	113.6	113.6
NMD-B03	SVANTEK	SV-104IS	80852	22 May 2022	113.5	113.6
NMD-B04	SVANTEK	SV-104IS	80854	22 May 2022	113.5	113.6
NMD-B05	SVANTEK	SV-104IS	80856	22 May 2022	113.5	113.6
NMD-B06	SVANTEK	SV-104IS	80816	22 May 2022	113.6	113.6
NMD-B07	SVANTEK	SV-104IS	80817	22 May 2022	113.6	113.6
NMD-B08	SVANTEK	SV-104IS	80818	22 May 2022	113.6	113.6
NMD-B09	SVANTEK	SV-104IS	80829	22 May 2022	113.5	113.6
NMD-B10	SVANTEK	SV-104IS	80830	22 May 2022	113.6	113.6
NMD-B11	SVANTEK	SV-104IS	80831	22 May 2022	113.5	113.6
NMD-B12	SVANTEK	SV-104IS	80832	22 May 2022	113.5	113.6
NMD-B13	SVANTEK	SV-104IS	80834	22 May 2022	113.6	113.6
NMD-B14	SVANTEK	SV-104IS	80875	22 May 2022	113.6	113.6
NMD-B15	SVANTEK	SV-104IS	80880	22 May 2022	113.6	113.6
NMD-R02	SVANTEK	SV-104IS	60152	22 May 2022	113.6	113.6
NMD-R03	SVANTEK	SV-104IS	60153	22 May 2022	113.5	113.6
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					113.67 ± 0.10 dB	

Calibrated by :

(Mr. Phakthinai Khongkonnerd)

Approved by :

(Mr. Peera Detadom)



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 IC, 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

1/2

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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 μPa at 1000 Hz

Acoustic Output in dB re 20 μPa , Corrected to Reference Conditions: 101.325 kPa, 23.0 $^\circ\text{C}$ 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	$\pm 0.75 \text{ dB}$

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 :

(Mr. Weerachai Deechaiyae)

Approved by :

(Mr. Prawate Khuaypa)
Acting Director

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

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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

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FM.BLMTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0397

MTC No. EEL. BP. 89/0365

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	0.4	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 :

(Signature)
.....
(Mr. Sanaey Grajang)

Approved by :

(Signature)
.....
(Mr. Prawate Klauypa)
Director

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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FM.BLMTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0193

MTC No. EEL. BP. 91/1264

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. : 80832

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.5) 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

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FM.BLMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0193

MTC No. EEL. BP. 91/1264

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	-0.4	0.25	2.0
1 000	-0.1	-0.1	0.25	1.4
4 000	0.5	0.5	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 :

Mr. Sanaey
.....
(Mr. Sanaey Grajang)

Approved by :

Mr. Prawate Khuyyap
.....
(Mr. Prawate Khuyyap)
Acting Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011264122205281002

Date of Calibration : 28 Dec. 2021

Date of Issue : 4 Jan. 2022

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End of Certificate

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FM.BLMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0193

MTC No. EEL, BP. 92/1264

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. : 80834

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.BLMTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0193

MTC No. EEL, BP. 92/1264

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	-0.2	-0.4	0.25	2.0
1 000	0.0	-0.1	0.25	1.4
4 000	0.5	0.6	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 :

Mr. Sanaey Grajang
(Mr. Sanaey Grajang)

Approved by :

Mr. Prawate Kluaypa
(Mr. Prawate Kluaypa)

Acting Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011264122205281003

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.
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FM.BLMTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0193

MTC No. EEL. BP. 93/1264

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. : 80875

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

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0193

MTC No. EEL. BP. 93/1264

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	0.0	0.0	0.25	1.4
4 000	0.2	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 :

Mr. Sanaey Grajang
(Mr. Sanaey Grajang)

Approved by :

Mr. Prawate Klauyapa
(Mr. Prawate Klauyapa)

Acting Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011264122205281004

Date of Calibration : 28 Dec. 2021

Date of Issue : 4 Jan. 2022

2 / 2

End of Certificate

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FM.BL.MTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0193

MTC No. EEL. BP. 94/1264

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 : Svanter

Model : SV-104IS

Serial No. : 80880

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

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0193

MTC No. EEL. BP. 94/1264

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	-0.4	-0.5	0.25	2.0
1 000	0.0	-0.1	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 :

Gr. Sany
(Mr. Sanaey Grajang)

Approved by :

Prasat Kluaypa
(Mr. Prasat Kluaypa)
Acting Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011264122205281001

Date of Calibration : 28 Dec. 2021

Date of Issue : 4 Jan. 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. 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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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

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 :

G. Sanaey
(Mr. Sanaey Grajang)

Approved by :

Prawate Kluaypa
(Mr. Prawate Kluaypa)

Director

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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FM.BLMTC.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

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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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

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 :

G. Sarny
.....
(Mr. Sarny Grajang)

Approved by :

Prawate Kluyapa
.....
(Mr. Prawate Kluyapa)

Director
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



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 ± 3) °CRelative Humidity : (50 ± 15) %Ambient Pressure : (101.325 ± 1.5) 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.

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.BLMTC.002 Rev.4

Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office

196 Phaholyothin Road, Chatuchak, Bangkok 10900,
Thailand
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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

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 :

G. Sarny
(Mr. Sarny Grajang)

Approved by :

Mr. Prawate Kluaypa
(Mr. Prawate Kluaypa)

Director

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

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

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FM.BLMTC.002 Rev.4

Head Office

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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-1041S

Serial No. : 106124

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

This 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.

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang
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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

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 :

Mr. Sanaey Grajang
(Mr. Sanaey Grajang)

Approved by :

Mr. Prawate Kluyapa
(Mr. Prawate Kluyapa)

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

This 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.

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang
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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

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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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

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 :

Mr. Sanaey Grajang
(Mr. Sanaey Grajang)

Approved by :

Mr. Prawate Khuaypa
(Mr. Prawate Khuaypa)

Director

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

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.

Head Office
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S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอย พหลโยธิน 24 แขวงพญาไท เขตพญาไท กรุงเทพฯ 10900
Tel : (662) 939-4300-72 Fax : (662) 513-4321 E-mail : sales@spscon.com, www.spscon.com

Noise Dose B 288_1/22

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	22 May 2022	113.6	113.6
NMD-B12	SVANTEK	SV-104IS	80832	22 May 2022	113.6	113.6
NMD-B13	SVANTEK	SV-104IS	80834	22 May 2022	113.6	113.6
NMD-B14	SVANTEK	SV-104IS	80875	22 May 2022	113.6	113.6
NMD-B15	SVANTEK	SV-104IS	80880	22 May 2022	113.5	113.6
NMD-B16	SVANTEK	SV-104IS	106120	22 May 2022	113.5	113.6
NMD-B17	SVANTEK	SV-104IS	106122	22 May 2022	113.6	113.6
NMD-B18	SVANTEK	SV-104IS	106123	22 May 2022	113.5	113.6
NMD-B19	SVANTEK	SV-104IS	106124	22 May 2022	113.6	113.6
NMD-B20	SVANTEK	SV-104IS	106131	22 May 2022	113.6	113.6
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					113.67 ± 0.10 dB	

Calibrated by :

Phukhinai Khongkumnerd
(Mr. Phukhinai Khongkumnerd)

Approved by :

(Mr. Peera Detudom)

Industrial Calibration Co., Ltd.

38/41 Moo. 3, Lum Luk Ka Road., Khu Khot Subdistrict,

Lam Luk Ka District, Phatum Thani 12130 Thailand.

Tel : +66 (02) 991 0440

Fax : +66 (02) 531 6294

Email : info@industrial.co.th

dB bar
%RH VA
m/s kg

INDUSTRIAL CALIBRATION CO.,LTD.

The Measure of Quality

CERTIFICATE No.CAL06052-21..... PAGE1..... OF2.....

Certificate of Calibration

Equipment : HEAVY DUTY LIGHT METER

Manufacture : EXTECH

Model / Type : 407026

Serial No. : A.052156

ID No. : N/A

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

7 SOI PHAHOLYOTHIN 24 ROAD., JOMPOL, CHATUCHAK, BANGKOK 10900

Environment: 25 +/- 3°C (IN-HOUSE); 50 +/- 20%RH

Date Of Receipt : JUNE 24, 2021

Date Of Calibration : JUNE 26, 2021

Calibration By : CHICHAWADEE CHANTAKHAD

Approved By :

(CHINNAWAT DUMPUT)

Date of Issue : JUNE 26, 2021

MEASUREMENT UNCERTAINTY :

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR $k = 2$, WHICH EFFECTIVE DEGREE OF FREEDOM $V_{eff} > 100$ CORRESPONDS A LEVEL OF CONFIDENCE OF APPROXIMATELY 95 %

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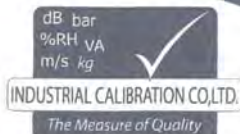
Industrial Calibration Co., Ltd.

38/41 Moo. 3, Lum Luk Ka Road., Khu Khot Subdistrict,
Lam Luk Ka District, Phatum Thani 12130 Thailand.

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Email : info@industrial.co.th



CERTIFICATE No.CAL06052-21..... PAGE2..... OF2.....

Calibration Report

ORDER No. : 2008-242

RECEIVED DATE : JUNE 24, 2021

CALIBRATION DATE : JUNE 26, 2021

DESCRIPTION:		MANUFACTURER:	
HEAVY DUTY LIGHT METER		EXTECH	
MODEL:	SERIAL No.	IDENTIFICATION No:	MADE IN :
407026	A.052156	N/A	N/A
CALIBRATION METHOD : CALIBRATION WAS CONDUCTED USING IN-HOUSE METHOD BASED ON REFERENCE LAMP COMPARISON BY LIGHT METER			
REFERENCE STANDARD :			
DESCRIPTION :	MODEL	S/N No.	CERTIFICATE No.
DATA LOGGER LIGHT METER	DT-8809A	11094203	PL08069/21

TRACEABILITY:

THE CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT: -
-NATIONAL INSTITUTE OF METROLOGY THAILAND (NIMT)

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

FUNTION : LIGHT MEASUREMENT

RANGE : 2000 LUX

RESOLUTION : 1 LUX

UUC	STANDARD	UUC*	UUC*	UNCERTAINTY
RANGE	READING	READING	CORRECTION	MEASUREMENT
(LUX)	(LUX)	(LUX)	(LUX)	(±LUX)
0	000	000	0	0.9
2000	2002	1998	4	20

REMARK : UUC* UNIT UNDER CALIBRATION

- END OF CERTIFICATE -

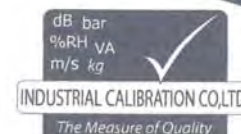
Industrial Calibration Co., Ltd.

38/41 Moo. 3, Lum Luk Ka Road., Khu Khot Subdistrict,
Lam Luk Ka District, Phatum Thani 12130 Thailand.

Tel : +66 (02) 991 0440

Fax : +66 (02) 531 6294

Email : info@industrial.co.th



CERTIFICATE No.CAL06048-21..... PAGE1..... OF2.....

Certificate of Calibration

Equipment : HEAVY DUTY LIGHT METER

Manufacture : EXTECH

Model / Type : 407026

Serial No. : A.052239

ID No. : N/A

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

7 SOI PHAHOLYOTHIN 24 ROAD., JOMPOL, CHATUCHAK, BANGKOK 10900

Environment: 25 +/- 3°C (IN-HOUSE); 50 +/- 20%RH

Date Of Receipt : JUNE 24, 2021

Date Of Calibration : JUNE 26, 2021

Calibration By : CHICHAWADEE CHANTAKHAD

Approved By : (CHINNAWAT DUMPUT)

Date of Issue : JUNE 26, 2021

MEASUREMENT UNCERTAINTY :

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON STANDARD UNCERTAINTY MULTIPLIED BY A
COVERAGE FACTOR $k = 2$, WHICH EFFECTIVE DEGREE OF FREEDOM $V_{eff} > 100$ CORRESPONDS A LEVEL OF
CONFIDENCE OF APPROXIMATELY 95 %

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Industrial Calibration Co., Ltd.

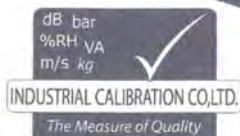
38/41 Moo. 3, Lum Luk Ka Road., Khu Khot Subdistrict,

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Email : info@industrial.co.th



CERTIFICATE No.CAL06048-21..... PAGE2..... OF2.....

Calibration Report

ORDER No. : 2008-242

RECEIVED DATE : JUNE 24, 2021

CALIBRATION DATE : JUNE 26, 2021

DESCRIPTION: HEAVY DUTY LIGHT METER		MANUFACTURER: EXTECH	
MODEL: 407026	SERIAL No. A.052239	IDENTIFICATION No: N/A	MADE IN : N/A
CALIBRATION METHOD : CALIBRATION WAS CONDUCTED USING IN-HOUSE METHOD BASED ON REFERENCE LAMP COMPARISON BY LIGHT METER			
REFERENCE STANDARD :			
DESCRIPTION : DATA LOGGER LIGHT METER	MODEL DT-8809A	S/N No. 11094203	CERTIFICATE No. PL06069/21

TRACEABILITY:

THE CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT : -
-NATIONAL INSTITUTE OF METROLOGY THAILAND (NIMT)

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

FUNTION : LIGHT MEASUREMENT

RANGE : 2000 LUX

RESOLUTION : 1 LUX

UUC	STANDARD	UUC*	UUC*	UNCERTAINTY
RANGE	READING	READING	CORRECTION	MEASUREMENT
(LUX)	(LUX)	(LUX)	(LUX)	(±LUX)
0	000	000	0	0.9
2000	2002	1998	4	20

REMARK : UUC* UNIT UNDER CALIBRATION

- END OF CERTIFICATE -

Industrial Calibration Co., Ltd.

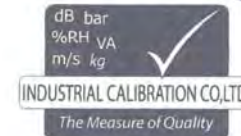
38/41 Moo. 3, Lum Luk Ka Road., Khu Khot Subdistrict,

Lam Luk Ka District, Phatum Thani 12130 Thailand.

Tel : +66 (02) 991 0440

Fax : +66 (02) 531 6294

Email : info@industrial.co.th



CERTIFICATE No.CAL01019-22..... PAGE1..... OF2.....

Certificate of Calibration

Equipment : HEAVY DUTY LIGHT METER

Manufacture : EXTECH

Model / Type : 407026

Serial No. : A.055623

ID No. : N/A

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

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

Environment: 25 +/- 3°C (IN-HOUSE); 50 +/- 20%RH

Date Of Receipt : JAN 12, 2022

Date Of Calibration : JAN 14, 2022

Calibration By : CHICHAWADEE CHANTAKHAD

Approved By :

(CHINNAWAT DUMPUT)

Date of Issue : JAN 14, 2022

MEASUREMENT UNCERTAINTY :

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON STANDARD UNCERTAINTY MULTIPLIED BY A
COVERAGE FACTOR k = 2, WHICH EFFECTIVE DEGREE OF FREEDOM $\nu_{eff} > 100$ CORRESPONDS A LEVEL OF
CONFIDENCE OF APPROXIMATELY 95 %

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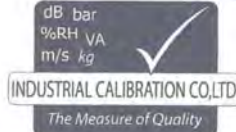
Industrial Calibration Co., Ltd.

38/41 Moo. 3, Lum Luk Ka Road., Khu Khoi Subdistrict,
Lam Luk Ka District, Phatum Thani 12130 Thailand.

Tel : +66 (02) 991 0440

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CERTIFICATE No. CAL01019-22 PAGE 2 OF 2

Calibration Report

ORDER No. : 2009-012

RECEIVED DATE JAN 12, 2022

CALIBRATION DATE : JAN 14, 2022

DESCRIPTION:		MANUFACTURER:	
HEAVY DUTY LIGHT METER		EXTECH	
MODEL:	SERIAL No.	IDENTIFICATION No:	MADE IN :
407026	A.055623	N/A	N/A
CALIBRATION METHOD :			
CALIBRATION WAS CONDUCTED USING IN-HOUSE METHOD BASED ON REFERENCE LAMP COMPARISON BY LIGHT METER			
REFERENCE STANDARD :			
DESCRIPTION :	MODEL	S/N No.	CERTIFICATE No.
DATA LOGGER LIGHT METER	DT-8809A	11094203	PL06069/21

TRACEABILITY:

THE CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
-NATIONAL INSTITUTE OF METROLOGY THAILAND (NIMT)

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

FUNTION : LIGHT MEASUREMENT

RANGE : 2000 LUX

RESOLUTION : 1 LUX

UUC	STANDARD	UUC*	UUC*	UNCERTAINTY
RANGE	READING	READING	CORRECTION	MASUREMENT
(LUX)	(LUX)	(LUX)	(LUX)	(±LUX)
0	000	000	0	0.9
2000	1995	1998	-3	20

REMARK : UUC* UNIT UNDER CALIBRATION

- END OF CERTIFICATE -



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S.P.S. CONSULTING SERVICE CO., LTD.
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7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chulachak, Bangkok 10900
Tel : (662) 539-4370-77, Fax : (662) 513-4221, E-mail : sale@spscon.com, www.spscon.com

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

Temperature 25 ± 3 °C
Pressure 1010 ± 15 mmbar

Personal Pump Data					Calibration Data							
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R 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	620041	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 + 12.838	1.000
B44	SKC	224-PCXR6	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-PCXR6	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 - 33.294	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	566758	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 + 2.915	1.000
B60	SKC	224-PCXR3	512656	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	503916	12/04/2022	1,000	1,500	2,000	994	1,489	1,999	1.004x - 11.786	1.000
B62	SKC	224-PCXR3	505978	12/04/2022	1,000	1,500	2,000	993	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	505302	04/04/2022	1,000	1,500	2,000	997	1,493	1,999	0.994x + 3.992	1.000
B65	SKC	224-PCXR3	508310	01/04/2022	1,000	1,500	2,000	1,002	1,500	2,002	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	508298	12/04/2022	1,000	1,500	2,000	993	1,507	2,004	1.017x - 33.104	0.999
B68	SKC	224-PCXR3	505875	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 - 21.688	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	506367	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	998	1,503	1,999	1.012x - 27.520	0.999
B79	SKC	224-PCXR3	510820	01/04/2022	1,000	1,500	2,000	994	1,493	1,994	0.999x - 3.705	1.000

Calibrated by :

Phakthira Khongkumnerd
(Mr. Phakthira Khongkumnerd)

Approved by :

Perera Detadom
(Mr. Perera Detadom)



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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
B80	SKC	224-PCXR3	504669	01/04/2022	1,000	1,500	2,000	1,003	1,499	2,001	1.010x - 20.517	0.999
B81	SKC	224-PCXR3	503460	01/04/2022	1,000	1,500	2,000	994	1,499	2,000	1.015x - 31.561	0.999
B82	SKC	224-PCXR3	505073	01/04/2022	1,000	1,500	2,000	993	1,498	1,996	1.002x - 7.299	1.000
B83	SKC	224-PCXR3	510785	04/04/2022	1,000	1,500	2,000	1,000	1,500	2,002	1.012x - 23.787	0.999
B84	SKC	224-PCXR3	508833	04/04/2022	1,000	1,500	2,000	995	1,497	1,991	0.997x - 0.383	1.000
B85	SKC	224-PCXR3	505757	04/04/2022	1,000	1,500	2,000	993	1,502	1,999	1.014x - 30.476	0.999
B86	SKC	224-PCXR3	512625	12/04/2022	1,000	1,500	2,000	1,003	1,502	2,004	1.012x - 22.463	0.999
B87	SKC	224-PCXR3	504324	11/04/2022	1,000	1,500	2,000	998	1,496	2,000	1.001x - 2.305	1.000
B88	SKC	224-PCXR3	505307	04/04/2022	1,000	1,500	2,000	997	1,498	1,993	0.996x + 1.212	1.000
B89	SKC	224-PCXR3	509660	19/04/2022	1,000	1,500	2,000	1,000	1,501	2,003	1.014x - 25.646	0.999
B90	SKC	224-PCXR3	508366	04/04/2022	1,000	1,500	2,000	992	1,502	2,001	1.017x - 33.850	0.999
B91	SKC	224-PCXR3	510910	04/04/2022	1,000	1,500	2,000	998	1,498	1,996	1.000x - 3.765	1.000
B92	SKC	224-PCXR3	510987	04/04/2022	1,000	1,500	2,000	1,003	1,501	2,004	1.012x - 21.316	0.999
B93	SKC	224-PCXR3	509845	12/04/2022	1,000	1,500	2,000	1,000	1,498	1,998	1.000x - 2.201	1.000

Calibrated by :

Phukhina Khongkornrue

(Mr. Phukhina Khongkornrue)

Approved by :

Perera Detadon

(Mr. Perera Detadon)



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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	1,496	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	683215	01/04/2022	1,000	1,500	2,000	1,001	1,502	2,005	1.015x - 28.627	0.999
R09	SKC	224-PCXR4	034650	01/04/2022	1,000	1,500	2,000	991	1,504	2,002	1.018x - 36.536	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 - 23.933	0.999
R12	SKC	224-PCXR4	091598	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	1,503	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	529642	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 - 30.671	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	566502	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	529088	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 - 26.725	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	1,002	1,491	1,991	0.998x + 14.328	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

Calibrated by :

Phukhina Khongkornrue

(Mr. Phukhina Khongkornrue)

Approved by :

Perera Detadon

(Mr. Perera Detadon)



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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-B01	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	503.3	988.5	1973.5	0.990x + 8.611	1.000
H-B02	Dwyer	VFB-65	04/04/2022	500	1,000	2,000	495.5	997.8	1995.3	0.998x - 4.832	1.000
H-B03	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	499.1	987.5	2009.3	1.004x - 15.366	0.999
H-B04	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	500.4	999.1	2008.7	0.999x - 2.127	1.000
H-B05	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	498.6	997.4	1972.3	0.981x + 20.608	1.000
H-B06	Dwyer	VFB-65	05/04/2022	500	1,000	2,000	501.0	993.4	1981.4	1.006x + 12.163	0.999
H-B07	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	504.5	988.6	2018.3	1.001x + 1.713	1.000
H-B08	Dwyer	VFB-65	04/04/2022	500	1,000	2,000	499.8	999.2	1975.4	0.996x - 3.367	0.999
H-B09	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	503.7	1007.0	2014.8	0.994x - 14.587	1.000
H-B10	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	493.7	996.6	2012.4	0.986x + 0.535	1.000

Calibrated by : Phakhirai Khongkorned (Mr. Phakhirai Khongkorned)
Approved by : (Mr. Peera Demdom)



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, Chulachak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spsc.com, www.spsc.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-B01	Dwyer	VFA-21	01/04/2022	50	100	200	50.7	99.5	198.5	$0.985x + 1.282$	1.000
L-B02	Dwyer	VFA-21	04/04/2022	50	100	200	49.8	99.8	198.3	$1.016x - 2.084$	1.000
L-B03	Dwyer	VFA-21	01/04/2022	50	100	200	50.4	98.8	197.9	$1.017x - 2.648$	1.000
L-B04	Dwyer	VFA-21	01/04/2022	50	100	200	49.5	101.6	201.1	$0.995x + 1.217$	1.000
L-B05	Dwyer	VFA-21	01/04/2022	50	100	200	50.1	98.1	201.2	$0.993x + 0.208$	1.000
L-B06	Dwyer	VFA-21	05/04/2022	50	100	200	50.3	100.1	202.6	$1.010x + 0.004$	1.000
L-B07	Dwyer	VFA-21	01/04/2022	50	100	200	49.8	100.4	200.1	$1.016x - 1.655$	1.000
L-B08	Dwyer	VFA-21	04/04/2022	50	100	200	50.2	100.9	198.1	$0.999x - 0.281$	1.000
L-B09	Dwyer	VFA-21	01/04/2022	50	100	200	49.2	99.0	201.1	$1.022x - 2.466$	1.000
L-B10	Dwyer	VFA-21	01/04/2022	50	100	200	50.6	100.2	203.2	$0.992x + 2.233$	1.000

Calibrated by : Phakhirai Khongkorned (Mr. Phakhirai Khongkorned)
Approved by : (Mr. Peera Demdom)



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 : TETNITHI W.
CALIBRATION DATE : 11-Mar-22

APPROVED BY : PONGSAK J.

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-J-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	0.00011
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



Certificate of Calibration

Aquion : Anion (ID#894)

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

AQUION S/N : 190840059

AS-DV S/N : 190915235

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

ARCHERICA LAB
บริษัท อีเคมิคัล แล็บ จำกัด
ARCHEMICA LAB CO.,LTD

Operator Signature : K. CHANNARONG Date : Jul 5, 2021

(Mr. Channarong Khiao-Un)

Test Engineer



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><i>This Lambda UV Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.</i></p>	
<p>Review of Preventive Maintenance:</p>	
<p>Authorized PerkinElmer Representative:</p> <p>Anon Leenthawonkit </p>	<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>