

ภาคผนวก ค-2

เอกสารสอบเทียบความถูกต้อง
ของเครื่องมือเก็บตัวอย่าง

Certificate of Calibration

Certificate No. : 64-220066-1

Page : 1 of 2

Submitted by :

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

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

Equipment :

Vacuum Gauge

Manufacturer : HI-LIGHT

Model : N/A

ID No. : 1/60

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

Environment :

Ambient Temperature : $(20 \pm 2) ^\circ \text{C}$ Relative Humidity : $(50 \pm 10) \%$

Date of Received :

02 July 2021

Date of Calibration :

05 July 2021

Date of Issue :

05 July 2021

Calibrated by : Saifa 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

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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%

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CAL-F0031-03



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					Value From Calibration Curve	
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)			R ²	
					1	2	3	y	
B01	SKC	224-PCX84	262101	01/04/2022	1,000	1,500	2,000	994	1,497
B02	SKC	224-PCX84	626166	04/04/2022	1,000	1,500	2,000	1,002	1,002
B03	SKC	224-PCX84	612968	04/04/2022	1,000	1,500	2,000	998	1,494
B04	SKC	224-PCX84	602804	01/04/2022	1,000	1,500	2,000	1,000	1,002
B05	SKC	224-PCX84	612693	12/04/2022	1,000	1,500	2,000	1,003	1,499
B06	SKC	224-PCX84	262188	01/04/2022	1,000	1,500	2,000	995	1,008
B07	SKC	224-PCX84	626262	01/04/2022	1,000	1,500	2,000	998	1,492
B08	SKC	224-PCX84	626100	12/04/2022	1,000	1,500	2,000	1,003	1,499
B09	SKC	224-PCX84	626479	11/04/2022	1,000	1,500	2,000	997	1,490
B10	SKC	224-PCX84	091190	04/04/2022	1,000	1,500	2,000	994	1,503
B11	SKC	224-PCX84	644316	06/04/2022	1,000	1,500	2,000	995	1,490
B12	SKC	224-PCX84	034656	01/04/2022	1,000	1,500	2,000	1,003	1,503
B13	SKC	224-PCX84	602073	12/04/2022	1,000	1,500	2,000	995	1,500
B14	SKC	224-PCX84	626313	05/04/2022	1,000	1,500	2,000	998	1,491
B15	SKC	224-PCX84	626474	01/04/2022	1,000	1,500	2,000	1,003	1,502
B16	SKC	224-PCX84	626477	11/04/2022	1,000	1,500	2,000	994	1,504
B17	SKC	224-PCX84	626860	04/04/2022	1,000	1,500	2,000	997	1,495
B18	SKC	224-PCX84	691484	04/04/2022	1,000	1,500	2,000	1,003	1,501
B19	SKC	224-PCX84	691199	01/04/2022	1,000	1,500	2,000	995	1,503
B20	SKC	224-PCX84	691587	04/04/2022	1,000	1,500	2,000	993	1,504
B21	SKC	224-PCX84	691131	04/04/2022	1,000	1,500	2,000	993	1,499
B22	SKC	224-PCX84	691054	04/04/2022	1,000	1,500	2,000	1,004	1,501
B23	SKC	224-PCX84	798393	12/04/2022	1,000	1,500	2,000	994	1,505
B24	SKC	224-PCX84	626563	04/04/2022	1,000	1,500	2,000	1,002	1,502
B25	SKC	224-PCX84	798489	01/04/2022	1,000	1,500	2,000	1,001	1,512
B26	SKC	224-PCX84	798479	12/04/2022	1,000	1,500	2,000	996	1,499
B27	SKC	224-PCX84	691073	04/04/2022	1,000	1,500	2,000	993	1,503
B28	SKC	224-PCX84	691170	04/04/2022	1,000	1,500	2,000	1,001	1,500
B29	SKC	224-PCX84	626472	05/04/2022	1,000	1,500	2,000	999	1,494
B30	SKC	224-PCX84	691480	06/04/2022	1,000	1,500	2,000	1,004	1,500
B31	SKC	224-PCX84	691509	12/04/2022	1,000	1,500	2,000	993	1,495
B32	SKC	224-PCX84	091467	04/04/2022	1,000	1,500	2,000	993	1,504
B33	SKC	224-PCX84	091756	01/04/2022	1,000	1,500	2,000	994	1,496
B34	SKC	224-PCX84	612962	04/04/2022	1,000	1,500	2,000	1,002	1,501
B35	SKC	224-PCX84	626262	11/04/2022	1,000	1,500	2,000	994	1,498
B36	SKC	224-PCX84	626164	04/04/2022	1,000	1,500	2,000	1,000	1,497
B37	SKC	224-PCX84	626256	04/04/2022	1,000	1,500	2,000	994	1,506
B38	SKC	224-PCX84	626167	01/04/2022	1,000	1,500	2,000	997	1,497
B39	SKC	224-PCX84	034637	04/04/2022	1,000	1,500	2,000	1,003	1,502
B40	SKC	224-PCX84	798349	12/04/2022	1,000	1,500	2,000	992	1,505

Calibrated by : Phukhrai Khongkornerd (Mr. Phukhrai Khongkornerd)
 Approved by : Phu D. D. D. (Mr. Peera Dindom)

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					Value From Calibration Curve	
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)			R ²	
					1	2	3	y	
B41	SKC	224-PCX84	612669	04/04/2022	1,000	1,500	2,000	998	1,496
B42	SKC	224-PCX84	626041	01/04/2022	1,000	1,500	2,000	1,003	1,498
B43	SKC	224-PCX84	034036	11/04/2022	1,000	1,500	2,000	1,001	1,501
B44	SKC	224-PCX84	529341	01/04/2022	1,000	1,500	2,000	1,002	1,501
B45	SKC	224-PCX84	529394	12/04/2022	1,000	1,500	2,000	997	1,498
B46	SKC	224-PCX84	566743	04/04/2022	1,000	1,500	2,000	994	1,504
B47	SKC	224-PCX84	566747	01/04/2022	1,000	1,500	2,000	1,002	1,500
B48	SKC	224-PCX84	566763	01/04/2022	1,000	1,500	2,000	999	1,494
B49	SKC	224-PCX84	566780	12/04/2022	1,000	1,500	2,000	1,003	1,502
B50	SKC	224-PCX84	500400	01/04/2022	1,000	1,500	2,000	1,002	1,495
B51	SKC	224-PCX84	500463	01/04/2022	1,000	1,500	2,000	995	1,504
B52	SKC	224-PCX84	092186	11/04/2022	1,000	1,500	2,000	995	1,498
B53	SKC	224-PCX84	707670	01/04/2022	1,000	1,500	2,000	1,002	1,499
B54	SKC	224-PCX84	509821	11/04/2022	1,000	1,500	2,000	993	1,501
B55	SKC	224-PCX84	510710	01/04/2022	1,000	1,500	2,000	1,000	1,494
B56	SKC	224-PCX84	511450	01/04/2022	1,000	1,500	2,000	1,002	1,500
B57	SKC	224-PCX84	510798	12/04/2022	1,000	1,500	2,000	997	1,493
B58	SKC	224-PCX84	509552	04/04/2022	1,000	1,500	2,000	1,001	1,498
B59	SKC	224-PCX84	509802	01/04/2022	1,000	1,500	2,000	996	1,503
B60	SKC	224-PCX84	512655	01/04/2022	1,000	1,500	2,000	1,002	1,500
B61	SKC	224-PCX84	509315	12/04/2022	1,000	1,500	2,000	994	1,489
B62	SKC	224-PCX84	509575	12/04/2022	1,000	1,500	2,000	999	1,494
B63	SKC	224-PCX84	511432	01/04/2022	1,000	1,500	2,000	991	1,501
B64	SKC	224-PCX84	508302	04/04/2022	1,000	1,500	2,000	997	1,493
B65	SKC	224-PCX84	508310	01/04/2022	1,000	1,500	2,000	1,002	1,500
B66	SKC	224-PCX84	509861	12/04/2022	1,000	1,500	2,000	1,002	1,491
B67	SKC	224-PCX84	509595	12/04/2022	1,000	1,500	2,000	993	1,507
B68	SKC	224-PCX84	508572	12/04/2022	1,000	1,500	2,000	1,002	1,491
B69	SKC	224-PCX84	508375	01/04/2022	1,000	1,500	2,000	1,001	1,500
B70	SKC	224-PCX84	510623	11/04/2022	1,000	1,500	2,000	992	1,503
B71	SKC	224-PCX84	508367	12/04/2022	1,000	1,500	2,000	991	1,506
B72	SKC	224-PCX84	509577	12/04/2022	1,000	1,500	2,000	1,001	1,498
B73	SKC	224-PCX84	512606	01/04/2022	1,000	1,500	2,000	1,001	1,501
B74	SKC	224-PCX84	509593	12/04/2022	1,000	1,500	2,000	996	1,495
B75	SKC	224-PCX84	509811	12/04/2022	1,000	1,500	2,000	992	1,498
B76	SKC	224-PCX84	509811	12/04/2022	1,000	1,500	2,000	992	1,498
B77	SKC	224-PCX84	508301	12/04/2022	1,000	1,500	2,000	1,000	1,501
B78	SKC	224-PCX84	510677	01/04/2022	1,000	1,500	2,000	996	1,499
B79	SKC	224-PCX84	510920	01/04/2022	1,000	1,500	2,000	994	1,493

Calibrated by : Phukhrai Khongkornerd (Mr. Phukhrai Khongkornerd)
 Approved by : Phu D. D. D. (Mr. Peera Dindom)

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter	Model : Defender 510-H	S/N : 136164
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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. act.)				
					1	2	3	1	2	3	y	R ²
R01	SKC	224-PCXR8	602467	04/04/2022	1,000	1,500	2,000	993	1,508	2,004	1.020x - 38.784	0.999
R02	SKC	224-PCXR8	624460	04/04/2022	1,000	2,000	3,000	999	1,499	1,990	0.989x + 12.627	1.000
R03	SKC	224-PCXR8	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-PCXR8	691672	01/04/2022	1,000	1,500	2,000	996	1,493	1,993	0.998x - 2.561	1.000
R05	SKC	224-PCXR8	798470	01/04/2022	1,000	1,500	2,000	994	1,506	1,999	1.015x - 30.635	0.999
R06	SKC	224-PCXR8	798456	04/04/2022	1,000	1,500	2,000	994	1,498	1,994	1.002x - 7.438	1.000
R07	SKC	224-PCXR8	798460	04/04/2022	1,000	1,500	2,000	994	1,490	2,000	1.008x - 16.831	1.000
R08	SKC	224-PCXR8	843215	01/04/2022	1,000	1,500	2,000	1,001	1,502	2,005	1.015x - 26.627	0.999
R09	SKC	224-PCXR8	034650	01/04/2022	1,000	1,500	2,000	991	1,504	2,002	1.018x - 36.538	0.999
R10	SKC	224-PCXR8	091765	01/04/2022	1,000	1,500	2,000	996	1,512	1,993	1.000x + 0.219	1.000
R11	SKC	224-PCXR8	091763	12/04/2022	1,000	1,500	2,000	1,001	1,499	2,002	1.012x - 23.923	0.999
R12	SKC	224-PCXR8	091568	12/04/2022	1,000	1,500	2,000	997	1,501	1,999	1.001x - 4.966	1.000
R13	SKC	224-PCXR8	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-PCXR8	091764	04/04/2022	1,000	1,500	2,000	994	1,502	1,998	1.013x - 29.356	0.999
R15	SKC	224-PCXR8	529457	01/04/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.013x - 24.345	0.999
R16	SKC	224-PCXR8	529643	04/04/2022	1,000	1,500	2,000	998	1,497	1,994	0.997x + 0.060	1.000
R17	SKC	224-PCXR8	529645	04/04/2022	1,000	1,500	2,000	994	1,509	2,000	1.015x - 30.571	0.999
R18	SKC	224-PCXR8	566756	04/04/2022	1,000	1,500	2,000	991	1,496	1,998	1.002x - 7.676	1.000
R19	SKC	224-PCXR8	566802	01/04/2022	1,000	1,500	2,000	1,003	1,499	2,000	1.010x - 20.189	0.999
R20	SKC	224-PCXR8	529089	04/04/2022	1,000	1,500	2,000	990	1,501	2,003	1.020x - 40.036	0.999
R21	SKC	224-PCXR8	665728	01/04/2022	1,000	1,500	2,000	999	1,493	1,999	1.000x - 5.364	1.000
R22	SKC	224-PCXR8	707444	01/04/2022	1,000	1,500	2,000	1,002	1,500	2,001	1.011x - 21.315	0.999
R23	SKC	224-PCXR8	701067	11/04/2022	1,000	1,500	2,000	998	1,494	1,992	0.994x + 3.095	1.000
R24	SKC	224-PCXR8	707593	01/04/2022	1,000	1,500	2,000	996	1,505	2,001	1.014x - 29.040	0.999
R25	SKC	224-PCXR8	701052	01/04/2022	1,000	1,500	2,000	998	1,500	1,992	0.992x + 7.630	1.000
R26	SKC	224-PCXR8	707566	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	707598	04/04/2022	1,000	1,500	2,000	996	1,503	2,001	1.013x - 28.725	0.999
R28	SKC	224-PCXR8	707481	11/04/2022	1,000	1,500	2,000	1,004	1,500	2,003	1.010x - 19.368	0.999
R29	SKC	224-PCXR8	707022	01/04/2022	1,000	1,500	2,000	1,005	1,491	1,991	0.988x + 14.326	1.000
R30	SKC	224-PCXR8	093811	01/04/2022	1,000	1,500	2,000	998	1,495	1,994	0.998x - 1.268	1.000
R31	SKC	224-PCXR8	693183	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-PCXR8	626254	12/04/2022	1,000	1,500	2,000	992	1,502	1,999	1.016x - 34.141	0.999
R34	SKC	224-PCXR8	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	701095	12/04/2022	1,000	1,500	2,000	1,001	1,496	1,994	0.997x + 2.652	1.000

Calibrated by : Phakthrai Khongkumret (Mr. Phakthrai Khongkumret)	Approved by : Phakthrai Khongkumret (Mr. Peera Dindom)
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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
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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			R ²
H-R01	Dwyer	VFB-65	04/04/2022	500	1,000	2,000	503.1	992.4	1979.1	0.998x + 3.360	0.999	
H-R02	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	500.8	995.3	1986.1	1.002x + 5.536	1.000	
H-R03	Dwyer	VFB-65	04/04/2022	500	1,000	2,000	502.1	987.7	1997.3	0.994x + 1.910	1.000	
H-R04	Dwyer	VFB-65	04/04/2022	500	1,000	2,000	496.4	989.6	2019.5	1.009x - 13.763	1.000	
H-R05	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	496.8	987.7	1987.7	1.004x - 9.632	1.000	
H-R06	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	505.2	992.4	1979.4	0.999x + 2.749	0.999	

Calibrated by : Phakthrai Khongkumret (Mr. Phakthrai Khongkumret)	Approved by : Phakthrai Khongkumret (Mr. Peera Dindom)
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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	PerkinElmer For the Better

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
NA	NA	NA	NA

Parts Lists

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

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

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								Value From Calibration Curve	
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)				Actual (Q std.)		y	R ²
					1	2	3	Setting	1	2		
B01	SKC	224-PCXR4	262101	01/04/2022	1,000	1,500	2,000	994	1,497	1,998	1.001x - 3.749	1.000
B02	SKC	224-PCXR4	626166	04/04/2022	1,000	1,500	2,000	1,002	1,505	2,001	1.010x - 20.465	0.999
B03	SKC	224-PCXR4	612966	04/04/2022	1,000	1,500	2,000	996	1,494	2,000	1.006x - 12.966	1.000
B04	SKC	224-PCXR4	602804	01/04/2022	1,000	1,500	2,000	1,000	1,502	1,996	1.001x - 2.928	1.000
B05	SKC	224-PCXR4	612693	12/04/2022	1,000	1,500	2,000	1,003	1,499	2,003	1.012x - 23.061	0.999
B06	SKC	224-PCXR4	262188	01/04/2022	1,000	1,500	2,000	995	1,508	1,999	1.012x - 25.219	0.999
B07	SKC	224-PCXR4	626262	01/04/2022	1,000	1,500	2,000	998	1,492	1,995	0.992x + 6.804	1.000
B08	SKC	224-PCXR4	626100	12/04/2022	1,000	1,500	2,000	1,003	1,499	2,003	1.012x - 22.750	0.999
B09	SKC	224-PCXR4	626479	11/04/2022	1,000	1,500	2,000	997	1,490	1,994	0.994x + 3.331	1.000
B10	SKC	224-PCXR4	091950	04/04/2022	1,000	1,500	2,000	994	1,503	2,001	1.016x - 32.594	0.999
B11	SKC	224-PCXR4	664315	06/04/2022	1,000	1,500	2,000	995	1,490	1,998	1.003x - 9.054	1.000
B12	SKC	224-PCXR4	034656	01/04/2022	1,000	1,500	2,000	1,003	1,503	2,003	1.011x - 19.603	0.999
B13	SKC	224-PCXR4	602673	12/04/2022	1,000	1,500	2,000	995	1,500	1,999	1.001x - 4.072	1.000
B14	SKC	224-PCXR4	626313	05/04/2022	1,000	1,500	2,000	998	1,491	1,988	0.992x + 5.727	1.000
B15	SKC	224-PCXR4	626474	01/04/2022	1,000	1,500	2,000	1,003	1,502	2,005	1.012x - 22.726	0.999
B16	SKC	224-PCXR4	626477	11/04/2022	1,000	1,500	2,000	994	1,504	2,000	1.014x - 30.627	0.999
B17	SKC	224-PCXR4	626860	04/04/2022	1,000	1,500	2,000	997	1,495	1,991	0.997x + 0.479	1.000
B18	SKC	224-PCXR4	691484	04/04/2022	1,000	1,500	2,000	1,003	1,501	2,001	1.010x - 19.424	0.999
B19	SKC	224-PCXR4	691399	01/04/2022	1,000	1,500	2,000	995	1,503	1,999	1.005x - 8.324	1.000
B20	SKC	224-PCXR4	691387	04/04/2022	1,000	1,500	2,000	993	1,504	1,999	1.014x - 30.520	0.999
B21	SKC	224-PCXR4	691331	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 - 20.768	0.999
B23	SKC	224-PCXR4	798393	12/04/2022	1,000	1,500	2,000	994	1,505	2,002	1.017x - 33.567	0.999
B24	SKC	224-PCXR4	626363	04/04/2022	1,000	1,500	2,000	1,000	1,502	2,005	1.016x - 28.210	0.999
B25	SKC	224-PCXR4	798469	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	798470	12/04/2022	1,000	1,500	2,000	998	1,499	1,993	0.997x + 1.855	1.000
B27	SKC	224-PCXR4	691673	04/04/2022	1,000	1,500	2,000	993	1,503	2,001	1.017x - 33.826	0.999
B28	SKC	224-PCXR4	691570	04/04/2022	1,000	1,500	2,000	1,001	1,500	2,002	1.013x - 24.230	0.999
B29	SKC	224-PCXR4	626472	06/04/2022	1,000	1,500	2,000	999	1,494	1,998	1.002x - 6.378	1.000
B30	SKC	224-PCXR4	691480	06/04/2022	1,000	1,500	2,000	1,004	1,500	2,004	1.012x - 22.431	0.999
B31	SKC	224-PCXR4	691509	12/04/2022	1,000	1,500	2,000	993	1,495	1,995	1.002x - 7.965	1.000
B32	SKC	224-PCXR4	091567	04/04/2022	1,000	1,500	2,000	993	1,504	2,001	1.015x - 30.208	0.999
B33	SKC	224-PCXR4	091756	01/04/2022	1,000	1,500	2,000	994	1,496	1,991	0.996x + 0.475	1.000
B34	SKC	224-PCXR4	612962	04/04/2022	1,000	1,500	2,000	1,002	1,501	2,002	1.011x - 21.135	0.999
B35	SKC	224-PCXR4	602682	11/04/2022	1,000	1,500	2,000	994	1,488	1,996	1.001x - 6.493	1.000
B36	SKC	224-PCXR4	636164	04/04/2022	1,000	1,500	2,000	1,000	1,497	1,999	0.999x - 2.993	1.000
B37	SKC	224-PCXR4	626256	01/04/2022	1,000	1,500	2,000	994	1,506	2,002	1.016x - 31.285	0.999
B38	SKC	224-PCXR4	650167	04/04/2022	1,000	1,500	2,000	997	1,497	1,996	1.001x - 4.387	1.000
B39	SKC	224-PCXR4	034637	04/04/2022	1,000	1,500	2,000	1,003	1,500	2,002	1.012x - 22.527	0.999
B40	SKC	224-PCXR4	798349	12/04/2022	1,000	1,500	2,000	992	1,505	2,000	1.017x - 34.109	0.999

Calibrated by : Phukhrai Khongkumrod (Mr. Phukhrai Khongkumrod)

Approved by : Phukhrai Khongkumrod (Mr. Peera Detdum)

คุณภาพอากาศในสถานประกอบการ

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter	Model : Defender 510-H	S/N : 136164
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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.)		y	R ²		
1	2	3	1	2	3							
B41	SKC	224-PCXR84	612659	04/04/2022	1,000	1,500	2,000	998	1,496	1,989	0.994x + 3.829	1,000
B42	SKC	224-PCXR84	616041	01/04/2022	1,000	1,400	2,000	1,003	1,498	1,993	0.990x + 12.348	1,000
B43	SKC	224-PCXR84	034636	11/04/2022	1,000	1,500	2,000	1,001	1,501	1,992	0.990x + 12.839	1,000
B44	SKC	224-PCXR88	529341	01/04/2022	1,000	1,400	2,000	1,002	1,501	2,002	1.011x - 21.577	0.999
B45	SKC	224-PCXR88	529594	12/04/2022	1,000	1,500	2,000	997	1,498	1,992	0.995x + 2.928	1,000
B46	SKC	224-PCXR88	566743	04/04/2022	1,000	1,400	2,000	994	1,504	2,002	1.016x - 33.204	0.999
B47	SKC	224-PCXR88	566747	01/04/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.013x - 34.202	0.999
B48	SKC	224-PCXR88	566753	01/04/2022	1,000	1,400	2,000	999	1,494	1,997	0.999x + 1.795	1,000
B49	SKC	224-PCXR88	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-PCXR88	500400	01/04/2022	1,000	1,400	2,000	1,002	1,495	2,002	1.001x + 2.000	1,000
B51	SKC	224-PCXR88	500363	01/04/2022	1,000	1,500	2,000	995	1,504	2,000	1.012x - 26.268	0.999
B52	SKC	224-PCXR88	092186	11/04/2022	1,000	1,400	2,000	995	1,498	1,994	0.997x - 1.140	1,000
B53	SKC	224-PCXR88	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-PCXR88	509821	11/04/2022	1,000	1,400	2,000	993	1,501	2,001	1.016x - 33.718	0.999
B55	SKC	224-PCXR83	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-PCXR83	511450	01/04/2022	1,000	1,400	2,000	1,002	1,500	2,001	1.011x - 30.684	0.999
B57	SKC	224-PCXR83	510798	12/04/2022	1,000	1,500	2,000	997	1,493	1,998	1.001x + 3.398	1,000
B58	SKC	224-PCXR83	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-PCXR83	509862	01/04/2022	1,000	1,500	2,000	996	1,503	1,995	0.998x + 2.916	1,000
B60	SKC	224-PCXR83	512655	01/04/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.013x - 33.891	0.999
B61	SKC	224-PCXR83	503915	12/04/2022	1,000	1,500	2,000	994	1,489	1,999	1.004x - 11.766	1,000
B62	SKC	224-PCXR83	505975	12/04/2022	1,000	1,500	2,000	999	1,494	1,995	0.997x - 0.103	1,000
B63	SKC	224-PCXR83	511432	01/04/2022	1,000	1,500	2,000	991	1,501	2,000	1.017x - 36.139	0.999
B64	SKC	224-PCXR83	508302	04/04/2022	1,000	1,500	2,000	997	1,493	1,990	0.994x + 3.982	1,000
B65	SKC	224-PCXR83	508310	01/04/2022	1,000	1,500	2,000	1,002	1,500	2,003	1.012x - 32.109	0.999
B66	SKC	224-PCXR83	508461	12/04/2022	1,000	1,500	2,000	1,003	1,491	1,991	0.987x + 14.701	1,000
B67	SKC	224-PCXR83	508395	12/04/2022	1,000	1,500	2,000	993	1,507	2,004	1.017x - 32.104	0.999
B68	SKC	224-PCXR83	508572	12/04/2022	1,000	1,500	2,000	1,002	1,491	1,997	0.994x + 5.556	1,000
B69	SKC	224-PCXR83	508375	01/04/2022	1,000	1,500	2,000	1,001	1,500	2,000	1.010x - 21.689	0.999
B70	SKC	224-PCXR83	510823	11/04/2022	1,000	1,500	2,000	992	1,503	1,997	1.002x - 6.693	0.999
B71	SKC	224-PCXR83	508367	12/04/2022	1,000	1,500	2,000	991	1,506	2,002	1.018x - 36.227	0.999
B72	SKC	224-PCXR83	509577	12/04/2022	1,000	1,500	2,000	1,001	1,498	1,993	0.992x + 7.987	1,000
B73	SKC	224-PCXR83	512606	01/04/2022	1,000	1,500	2,000	1,001	1,501	2,005	1.014x - 34.517	0.999
B74	SKC	224-PCXR83	509593	12/04/2022	1,000	1,500	2,000	996	1,495	1,994	0.998x - 4.963	1,000
B75	SKC	224-PCXR83	509820	12/04/2022	1,000	1,500	2,000	996	1,499	1,992	0.995x + 2.429	1,000
B76	SKC	224-PCXR83	509811	12/04/2022	1,000	1,500	2,000	992	1,498	1,998	1.007x - 15.040	1,000
B77	SKC	224-PCXR83	508301	12/04/2022	1,000	1,500	2,000	1,000	1,501	2,003	1.014x - 36.643	0.999
B78	SKC	224-PCXR83	510677	01/04/2022	1,000	1,500	2,000	996	1,503	1,999	1.012x - 37.520	0.999
B79	SKC	224-PCXR83	510920	01/04/2022	1,000	1,500	2,000	994	1,493	1,994	0.99x - 3.705	1,000

Calibrated by : Phukhrai Khongkumnerd (Mr. Phukhrai Khongkumnerd)

Approved by : Mr. Peera Deudom

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter	Model : Defender 510-H	S/N : 136164
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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.)		y	R ²		
1	2	3	1	2	3							
B80	SKC	224-PCXR3	504569	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	503480	01/04/2022	1,000	1,400	2,000	994	1,499	2,000	1.016x - 31.561	0.999
B82	SKC	224-PCXR3	505673	01/04/2022	1,000	1,100	2,000	993	1,499	1,996	1.002x - 7.239	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	508333	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 - 2.303	1.000
B88	SKC	224-PCXR3	508307	04/04/2022	1,000	1,500	2,000	997	1,498	1,993	0.996x + 1.212	1.000
B89	SKC	224-PCXR3	509860	12/04/2022	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	510919	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 - 21.916	0.999
B93	SKC	224-PCXR3	509845	12/04/2022	1,000	1,500	2,000	1,000	1,498	1,998	1.000x - 2.281	1.000

Calibrated by : Phukhrai Khongkumnerd (Mr. Phukhrai Khongkumnerd)


Approved by : Mr. Peera Deudom

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter	Model : Defender 510-H	S/N : 1361164
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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		
R01	SKC	224-PCXR4	602467	04/04/2022	1,000	1,500	2,000	993	1,508	2,004	1.020x - 38.784	R ²
R02	SKC	224-PCXR4	626450	04/04/2022	1,000	2,000	3,000	999	1,499	1,990	0.989x + 12.637	1,000
R03	SKC	224-PCXR4	691592	04/04/2022	1,000	1,500	2,000	1,003	1,500	2,004	1.012x - 22.479	0.999
R04	SKC	224-PCXR4	691672	01/04/2022	1,000	1,500	2,000	996	1,493	1,993	0.998x - 2.561	1,000
R05	SKC	224-PCXR4	798470	01/04/2022	1,000	1,500	2,000	994	1,506	1,999	1.015x - 30.635	0.999
R06	SKC	224-PCXR4	798456	04/04/2022	1,000	1,500	2,000	994	1,498	1,994	1.002x - 7.438	1,000
R07	SKC	224-PCXR4	798460	04/04/2022	1,000	1,500	2,000	994	1,490	2,000	1.008x - 16.831	1,000
R08	SKC	224-PCXR4	863215	01/04/2022	1,000	1,500	2,000	1,001	1,502	2,005	1.015x - 26.627	0.999
R09	SKC	224-PCXR4	034650	01/04/2022	1,000	1,500	2,000	991	1,504	2,002	1.018x - 36.538	0.999
R10	SKC	224-PCXR4	091765	01/04/2022	1,000	1,500	2,000	996	1,512	1,993	1.000x + 0.219	1,000
R11	SKC	224-PCXR4	091763	12/04/2022	1,000	1,500	2,000	1,001	1,499	2,002	1.012x - 23.923	0.999
R12	SKC	224-PCXR4	091568	12/04/2022	1,000	1,500	2,000	997	1,501	1,999	1.001x - 4.986	1,000
R13	SKC	224-PCXR4	091638	04/04/2022	1,000	1,500	2,000	1,002	1,498	1,993	0.991x + 10.793	1,000
R14	SKC	224-PCXR4	091764	04/04/2022	1,000	1,500	2,000	994	1,502	1,998	1.013x - 29.256	0.999
R15	SKC	224-PCXR8	529457	01/04/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.013x - 24.345	0.999
R16	SKC	224-PCXR8	529643	04/04/2022	1,000	1,500	2,000	998	1,497	1,994	0.997x + 0.060	1,000
R17	SKC	224-PCXR8	529645	04/04/2022	1,000	1,500	2,000	994	1,509	2,000	1.015x - 30.571	0.999
R18	SKC	224-PCXR8	560756	04/04/2022	1,000	1,500	2,000	991	1,496	1,998	1.002x - 7.676	1,000
R19	SKC	224-PCXR8	566802	01/04/2022	1,000	1,500	2,000	1,003	1,499	2,000	1.010x - 20.189	0.999
R20	SKC	224-PCXR8	529089	04/04/2022	1,000	1,500	2,000	990	1,501	2,003	1.020x - 40.036	0.999
R21	SKC	224-PCXR8	665726	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 - 21.315	0.999
R23	SKC	224-PCXR8	701067	11/04/2022	1,000	1,500	2,000	998	1,494	1,992	0.994x + 3.095	1,000
R24	SKC	224-PCXR8	707593	01/04/2022	1,000	1,500	2,000	996	1,505	2,001	1.014x - 29.040	0.999
R25	SKC	224-PCXR8	701052	01/04/2022	1,000	1,500	2,000	998	1,500	1,992	0.992x + 7.630	1,000
R26	SKC	224-PCXR8	707566	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	707598	04/04/2022	1,000	1,500	2,000	996	1,503	2,001	1.013x - 28.725	0.999
R28	SKC	224-PCXR8	707481	11/04/2022	1,000	1,500	2,000	1,004	1,500	2,003	1.010x - 19.368	0.999
R29	SKC	224-PCXR8	707402	01/04/2022	1,000	1,500	2,000	1,005	1,491	1,991	0.988x + 14.326	1,000
R30	SKC	224-PCXR8	093811	01/04/2022	1,000	1,500	2,000	998	1,495	1,994	0.998x - 1.268	1,000
R31	SKC	224-PCXR8	693183	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	636131	01/04/2022	1,000	1,500	2,000	1,002	1,498	2,004	1.012x - 24.294	0.999
R35	SKC	224-PCXR4	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	701095	12/04/2022	1,000	1,500	2,000	1,001	1,496	1,994	0.997x + 2.652	1,000

Calibrated by : Phukhrai Khongkumnerd (Mr. Phukhrai Khongkumnerd)	Approved by :  (Mr. Perna Dindom)
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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter	Model : Defender 510-H	S/N : 1361164
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Environmental Conditions
Temperature : 25 ± 3 °C
Pressure : 1010 ± 15 mmbar

Personal Pump Data			Calibration Data											
No.	Brand	Model	Serial No.	Date	Setting			Flow Rate (ml/min)			Actual (Q _{ud})		Value From Calibration Curve	
					1	2	3	1	2	3	1	2	3	Y
R40	SKC	224-PCX84	612753	01/04/2022	1,000	1,500	2,000	1,002	1,501	2,003	1.012x - 33.005	0.999		
R41	SKC	224-PCX84	626140	01/04/2022	1,000	1,500	2,000	991	1,509	2,002	1.018x - 35.114	0.999		
R42	SKC	224-PCX84	626163	01/04/2022	1,000	1,500	2,000	995	1,493	2,000	1.003x - 7.470	1.000		
R43	SKC	224-PCX84	636129	04/04/2022	1,000	1,500	2,000	1,002	1,501	2,003	1.012x - 22.495	0.999		
R44	SKC	224-PCX84	602753	01/04/2022	1,000	1,500	2,000	1,002	1,495	1,994	0.996x + 1.133	1.000		
R45	SKC	224-PCX84	636137	01/04/2022	1,000	1,500	2,000	992	1,505	2,002	1.019x - 37.368	0.999		

Calibrated by : Phukhrai Khongkumnerd (Mr. Phukhrai Khongkumnerd)	Approved by :  (Mr. Perna Dindom)
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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					
Rotameter Data				Calibration Data							
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
H-R01	Dwyer	VFB-65	04/04/2022	500	1,000	2,000	503.1	992.4	1979.1	0.999x + 3.260	0.999
H-R02	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	500.8	995.3	1986.1	1.002x + 5.536	1.000
H-R03	Dwyer	VFB-65	04/04/2022	500	1,000	2,000	502.1	987.7	1997.3	0.994x + 1.910	1.000
H-R04	Dwyer	VFB-65	04/04/2022	500	1,000	2,000	496.4	989.6	2019.5	1.009x - 13.763	1.000
H-R05	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	496.8	987.7	1987.7	1.004x - 9.632	1.000
H-R06	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	505.2	992.4	1979.4	0.999x + 2.749	0.999


Calibrated by : <u>Prakhira Khongkornrat</u> (Mr.Prakhira Khongkornrat)	Approved by :  (Mr. Peera Deutakon)
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Calibrated by : Phukhrai Khongkarned (Mr. Phukhrai Khongkarned)

Approved by :

(Mr. Petra Detulom)

Rotameter Calibration Report (For Personal Pump Low Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter				Model : Defender 510-H				S/N : 136164					
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	98.6	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	0.985x + 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	1.016x + 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	0.990x + 0.281	1.000		
L-B09	Dwyer	VFA-21	01/04/2022	50	100	200	49.2	99.6	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 : Phukhira Khongkornmed (Mr.Phukhira Khongkornmed)				Approved by :  (Mr. Perra Detdon)									

Calibrated by :

Phukhrai Khongkarned (Mr. Phukhrai Khongkarned)

Approved by :

(Mr. Petra Detulom)

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
MANUFACTURER : METTLER TOLEDO
ID No : BA 05/50
AIR PRESSURE : 1008mbar \pm 1mbar
AMBIENT TEMPERATURE : 22 $^{\circ}$ C \pm 1 $^{\circ}$ C
RELATIVE HUMIDITY : 49 %RH \pm 10 % RH
MODEL : XS 105DU
S/N : 1126422905
RECEIVED DATE : 11-Mar-22
CALIBRATION DATE : 11-Mar-22
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 :-

1. STANDARD WEIGHT SET E2 QK-1151 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

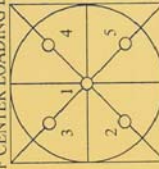
3. REPEATABILITY OF READING AT 20 g WAS 0.000004 g

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	100.0001	-0.0001	0.00019
120.00	120.0001	-0.0001	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

Spectrum BX Preventive Maintenance (PM)

Company Name:	S.P.S. Consulting Service Co.,Ltd.		
Address:	7 Soi Phaholyothin 24 ,Phaholyothin Rd.,Jompol, Chatuchak,Bangkok 10900		
User Name:	K.Saratjan Wewsuwan	WO Number :	WO-01336830
Telephone No.:	088-316-2833	Certificate Number:	IR1057-2021
Customer Support Engineer:	Tanongsak	PM Number :	2 of 2
Date PM Performed: (DD-MMM-YYYY)	31-Aug-2021	Next PM Due Date: (DD-MMM-YYYY)	31-Aug-2022

Scope

The purpose of this PM is to ensure the continued functionality of the Spectrum FTIR Spectrophotometer by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer.
The document can be used for spectrum One, Spectrum One, NTS, Spectrum 100, Spectrum 100N, Spectrum Optica, Spectrum 4000F and the Frontier Series of FTIR Spectrophotometers.
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.

General Instructions :

The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM. Always check with the customer before making any changes that may affect the customer's analysis or calibration, including a current back-up of system software and/or data files. The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer.
Update the PM sticker and instrument logbook as required.

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Component List

Component / Specific Model	Serial #	Software Version	Configuration Notes
Spectrum BX	70366	5.3.1 Std	KB: B/S

Parts Lists

Parts Included with the PM			
Part Number (if applicable)	Description	Quantity	Batch/Lot/SN #
N0171159	Desiccant	2	NA
			Expiration Date (MM/YY)
			NA

Procedure Checklist

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

1. General:

- ☒ Source and Source Mirror
- ☒ Beam splitter
- ☒ Optical Unit Windows
- ☒ Mirror

2. Mechanical:

- ☒ Motors including Electronics unit fan
- ☒ Purge seals
- ☒ Change Desiccant

3. Electronics Check:

- ☒ Laser Output

1000, Paragon, RX or BX Laser Output	Specification	Value	Laser Gain
	16 +/- 1	16.03	3.68

- ☒ EndStop

End Stop	Specification	Value
	+/- 50	2.00

- ☒ Zero Path

Zero Path	Specification	Value
	+/- 20	-5.00

- ☒ Energy

Energy	Specification	Value
	NA	15015.00

- ☒ Gain

Gain	Specification	Value
	Less than +/- 9.5	7.11 / -8.63

- ☒ Match

Match	Specification	Value
	NA	3.36

3. Performance Test:

- ☒ Signal to Noise Ratio (SNR) – (Record typical SNR Value).

	Detector Type	Typical SNR
Signal to Noise Ratio	DTGS (MIR)	3457.81

4. Wavenumber Calibrate:

- ☒ Wavenumber Calibrate

Certified Value (cm-1)	Value	Specification	Difference (cm-1)
3082.22	3082.08	+/- 0.5	0.14
3060.14	3060.02	+/- 0.5	0.12
1601.38	1601.40	+/- 0.5	-0.02
1583.04	1583.29	+/- 0.5	-0.25
1028.42	1028.53	+/- 0.5	-0.11


6. Review:

- ☒ Review with the customer PM work performed.
- ☒ Reset desiccant and service intervals on maintenance dialog.
- ☒ 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 FTIR have been completed.	
Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.	
Review of Preventive Maintenance:	
Authorized PerkinElmer Representative: 	Date: 31-Aug-2021 (DD-MMM-YYYY)
Authorized Customer Representative:	Date: 31-Aug-2021 (DD-MMM-YYYY)



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.



บริษัท อีอาร์เคมิคา ลาบ จำกัด
ARCHEMICA LAB CO.,LTD.

Operator Signature : K. Channarong Date : Jan 5, 2022

(Mr. Channarong Khiao-Un)

Test Engineer



MAINTENANCE AND TEST CERTIFICATE MODEL OPTIMA 5300DV

Customer : S.P.S.Consulting Service Co.,Ltd		Date Tested: January 12, 2022	
Address : 7 Soi Phaholyothin 24		Period 6 Months	
Paholyothin Road		Recertification Due: July 12, 2022	
Jompol Chatuchak, Bangkok 1090		Date Last Certified: July 14, 2021	
User Name: K.Phenpha Viphaasthawatt		Visit Number: 2 of 2	
Phone: 083-9269252	PerkinElmer Phone: 02-719-6420 ext 206		
Fax: 02-513-4221	PerkinElmer Fax: 02-318-5597		

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



MAINTENANCE AND TEST CERTIFICATE MODEL OPTIMA 5300DV

SERIAL NUMBER 077C7042401	DATE TESTED January 12, 2022
1. MECHANICAL CHECKS	
A. Inspect and clean all fans and filters.	<input type="checkbox"/> OK
B. Inspect and replace as necessary, all torch components including the RF coil.	<input type="checkbox"/> OK
C. Inspect all tubing for sign of clacking or leaking.	<input type="checkbox"/> OK
D. Adjust water and gas pressure regulator settings.	<input type="checkbox"/> OK
E. Inspect and leak check pneumatics drawers.	<input type="checkbox"/> OK
F. Clean the exterior of the instrument.	<input type="checkbox"/> OK
2. OPTICAL CHECKS	
A. Inspect and clean all optical components.	<input type="checkbox"/> OK
B. As required, check and replace all purgefilters.	<input type="checkbox"/> OK
C. Recheck optical alignment.	<input type="checkbox"/> OK
3. COOLING SYSTEM CHECKS	
A. Perform preventive maintenance on chiller.	<input type="checkbox"/> OK
B. Flush out the chiller every year.	<input type="checkbox"/> N/A
4. PERFORMANCE CHECKS	
A. Torch View Alignment.	<input type="checkbox"/> OK
B. Wavelength Calibration.	<input type="checkbox"/> OK



MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

SERIAL NUMBER : 077C7042401		DATE TESTED : January 12, 2022	
PARAMETER	SPECIFICATION	FINAL VALUE	
Spectral Resolution : UV	As 193.696 nm	≤ 0.007	0.00554
	Ni 231.604 nm	≤ 0.008	0.00725
	Ni 341.476 nm	≤ 0.012	0.00752
Spectral Resolution : VIS	La 408.672 nm	≤ 0.020	0.01616
	Ba 455.403 nm	≤ 0.025	0.02416
Precision	As 193.656 nm	% RSD < 1.0	0.34 %
	Zn 213.856 nm	% RSD < 1.0	0.27 %
	Mn 257.610 nm	% RSD < 1.0	0.41 %
	La 379.478 nm	% RSD < 1.0	0.57 %
	Ba 455.403 nm	% RSD < 1.0	0.33 %
	Ba 493.408 nm	% RSD < 1.0	0.26 %
Detection Limits : Axial	Tl 190.080 nm	3(sd)	5.51 ppb
	As 193.696 nm	3(sd)	8.59 ppb
	Pb 220.353 nm	3(sd)	0.50 ppb
Detection Limits : Radial	As 193.696 nm	3(sd)	21.00 ppb
	Zn 213.856 nm	3(sd)	0.32 ppb
	Mn 257.610 nm	3(sd)	0.18 ppb
	La 379.478 nm	3(sd)	0.44 ppb
	Ba 455.403 nm	3(sd)	0.17 ppb
	Ba 493.408 nm	3(sd)	0.12 ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd 226.502 nm	≤ 150 ppb	12.46
BEC : Radial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 45 ppb	30.82



MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

SERIAL NUMBER	077C7042401	DATE TESTED	January 12, 2022
Remarks :	Commissioning follow as commissioning performance sheets.		
<hr/>			
<hr/>			
<hr/>			
<hr/>			
<hr/>			
<hr/>			
This is to certify that the above tests have been performed and the configuration tested			
<div><input checked="" type="checkbox"/> meets</div> <div><input type="checkbox"/> does not meet</div>			
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>D. W. Ho</i> (<i>W. S. N. S. N.</i>)			
(Mr. Wiphan Promlunda)			
Service Engineer			



GAS CHROMATOGRAPH TEST CERTIFICATION

Certificate No. : SV0821/20202
Instrument Type : GC
Model : CP-3800
Serial Number : 00734
Organization : S.P.S. Consulting Service Co., Ltd.
Address : 7 Phahonyothin Soi 24 Phahonyothin Rd. Ladao Chatuchak Bangkok 10900
Date : 10/08/2021

ELECTRONIC TEST

CPU	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
LCD TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
VENT TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
KEY ECHO TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
DESTRUCTION RAM TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL

RUN CHROMATOGRAM TEST

DETECTOR : Flame Ionization Detector (FID Channel Front)

INJECTOR : Capillary Injector Model 1079

GC CONDITION:

Column	80 °C hold 1 min., rate 20 °C/min. to 200 °C hold 1 min.
Injector	220 °C
Detector	300 °C
Column flow	5 mL/min
Makeup flow	25 mL/min
Air flow	300 mL/min
Hydrogen flow	30 mL/min

Column:Capillary Column CP sil 5 CB 0.25 ID x 15 M
Sample: 1 µL Injection FID Test Sample 0.218 g/L C14,C15,C16 in hexane
SENSITIVITY TEST: C15. (Area count) = 144,661 Counts.



VARIAN



Detector Sensitivity (FID)

Detector Response	Result	Specification
Baseline Noise (µV)	2.94	≤ 50
Baseline Drift (%)	0.24	≤ 1
Sensitivity (S/N for C15)	2,295	≥ 1,024

Temperature Specification

Temperature	Set	Result	Specification
Column Oven (° C)	80	80	± 5
Injector (° C)	220	220	± 5
Detector (° C)	300	300	± 5
Incubator (° C)	60	N/A	± 5

Relative Standard Deviation % (% RSD)

Checkout Procedure	Result	Specification
Area C15 (%)	2.53	≤ 5
Retention Time C15(%)	0.04	≤ 0.5

APPROVAL :

Signature: *Suparat*

Engineer : Suvarot Trikanut

Date : 10/08/2021



VARIAN



Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 Area 1	149,057
C15 Area 2	140,715
C15 Area 3	146,288
C15 Area 4	140,957
C15 Area 5	146,288
C15 Area Average	144,661
* % RSD (< 5 %)	2.53

* The precision specification should be less than 2.0 % RSD ** (Relative Standard Deviation) for an Auto sampler injection and less than 5 % for Manual injections. To calculate the %RSD, select the C15 peak area for each of the five (5) samples.

** (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)

$$\% \text{ RSD} = (\text{std.dev} / \text{avg}) * 100$$

Compliance	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Performance by	Sumrat.	
Date	10/08/2021	



Comments	
Reviewed by	Sumrat
Date	10/08/2021



VARIAN

1/1

SERVICE DEPARTMENT



Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 Area 1	149,057
C15 Area 2	140,715
C15 Area 3	146,288
C15 Area 4	140,957
C15 Area 5	146,288
C15 Area Average	144,661
* % RSD (< 5 %)	2.53

* The precision specification should be less than 2.0 % RSD ** (Relative Standard Deviation) for an Auto sampler injection and less than 5 % for Manual injections. To calculate the %RSD, select the C15 peak area for each of the five (5) samples.

** (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)

$$\% \text{ RSD} = (\text{std.dev} / \text{avg}) * 100$$

Compliance	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Performance by	Sumrat.	
Date	10/08/2021	



Comments	
Reviewed by	Sumrat
Date	10/08/2021



VARIAN

1/1

SERVICE DEPARTMENT

High Volume Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard			Model : TE 5025A	S/N : 3095
Calibration Data				
High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (l/min)	R ²
B01	B01	04/05/2022	y = 1.313x - 9.642	0.999
B02	B02	02/05/2022	y = 1.082x + 2.593	1.000
B03	B03	04/05/2022	y = 1.045x + 0.757	0.998
B04	B04	04/05/2022	y = 1.161x - 3.677	0.996
B05	B05	02/05/2022	y = 1.218x - 6.416	1.000
B06	B06	04/05/2022	y = 1.235x - 6.768	0.998
B07	B07	06/05/2022	y = 1.178x - 5.564	0.999
B08	B08	02/05/2022	y = 1.222x - 6.991	1.000
B09	B09	04/05/2022	y = 1.240x - 6.649	0.996
B10	B10	04/05/2022	y = 1.091x + 0.142	0.995
B11	B11	04/05/2022	y = 1.120x - 2.107	1.000
B12	B12	02/05/2022	y = 1.102x - 1.916	0.996
B13	B13	03/05/2022	y = 1.187x - 5.240	0.999
B14	B14	06/05/2022	y = 1.290x - 9.276	0.998
B15	B15	03/05/2022	y = 1.093x - 0.919	0.999
B16	B16	04/05/2022	y = 1.233x - 6.745	0.999
B17	B17	03/05/2022	y = 1.172x - 3.414	0.998
B18	B18	04/05/2022	y = 1.259x - 8.700	1.000
B19	B19	03/05/2022	y = 1.307x - 10.268	0.999
B20	B20	02/05/2022	y = 1.232x - 7.260	0.999
B21	B21	04/05/2022	y = 1.209x - 7.461	0.996
B22	B22	02/05/2022	y = 1.239x - 7.827	0.999
B23	B23	03/05/2022	y = 1.227x - 6.159	0.999
B24	B24	03/05/2022	y = 1.075x - 0.925	0.997
B25	B25	04/05/2022	y = 0.997x + 2.795	0.998
B26	B26	04/05/2022	y = 1.185x - 5.015	0.998
B27	B27	06/05/2022	y = 1.148x - 5.099	0.996
B28	B28	04/05/2022	y = 1.221x - 6.454	1.000
B29	B29	02/05/2022	y = 1.181x - 5.705	0.995
B30	B30	04/05/2022	y = 1.136x - 3.406	0.999
B31	B31	04/05/2022	y = 1.114x - 1.568	0.999
B32	B32	04/05/2022	y = 1.249x - 6.749	1.000
B33	B33	06/05/2022	y = 1.195x - 4.397	0.996
B34	B34	04/05/2022	y = 1.222x - 7.759	0.999

Calibrated by :

Phakthini Khongkorn
(Mr. Phakthini Khongkorn)

Approved by :

Peera Detudom
(Mr. Peera Detudom)

คุณภาพอากาศในบรรยากาศ

Gas Sampler Box Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Dry Cal DCL-ML

S/N : 136164

Calibration Data							
Gas Sampler Data		Calibration Data					
No.	Rotameter	Date	Setting (Constant Flow) (ml/min)	Actual Flow Rate (ml/min)			
				Sampling Line A		Sampling Line B	
				Normal Condition	Standard Condition		
B01	2 (A&B)	03/03/2022	200	200.5	199.0	200.4	199.0
B02	2 (A&B)	03/03/2022	200	200.3	198.9	200.5	199.1
B03	2 (A&B)	03/03/2022	200	200.5	199.1	200.5	199.0
B04	2 (A&B)	03/03/2022	200	200.4	198.9	200.6	199.2
B05	2 (A&B)	03/03/2022	200	200.5	199.1	200.5	199.1
B06	2 (A&B)	03/03/2022	200	200.6	199.2	200.4	199.0
B07	2 (A&B)	03/03/2022	200	200.5	199.0	200.5	199.1
B08	2 (A&B)	03/03/2022	200	200.5	199.1	200.5	199.0
B09	2 (A&B)	03/03/2022	200	200.6	199.2	200.5	199.1
B10	2 (A&B)	03/03/2022	200	200.4	198.9	200.5	199.0
B11	2 (A&B)	03/03/2022	200	200.6	199.2	200.6	199.1
B12	2 (A&B)	03/03/2022	200	200.5	199.1	200.6	199.2
B13	2 (A&B)	03/03/2022	200	200.5	199.1	200.5	199.1
B14	2 (A&B)	03/03/2022	200	200.6	199.1	200.6	199.2
B15	2 (A&B)	03/03/2022	200	200.6	199.1	200.5	199.0
B16	2 (A&B)	03/03/2022	200	200.4	199.0	200.5	199.1
B17	2 (A&B)	03/03/2022	200	200.5	199.0	200.5	199.1

Calibrated by :

Phakthai Khongkorn
 (Mr. Phakthai Khongkorn)

Approved by :

Phakthai Khongkorn
 (Mr. Peera Detudom)

CALIBRATION REPORT

CHEMILUMINESCENT NO / NO_x / NO₂ ANALYZER

DATE : 22 May 2022 BRAND : API MODEL : 200A
 NO. NOX-B02 SERIAL NO. 2409

Calibrator (Dilution System)

Brand : API Model : 700
 Last Cal. Date : 05 August 2021 Serial No. : 911

Reference Standard Gas

Standard Gas : Nitric Oxide (NO) Cylinder No. : A00917SK
 Certified Date : 01 June 2020 Expired Date : 01 June 2022 Cylinder Conc. : 49.9 ppm

CALIBRATING CONDITION

Pressure : 1011 mmbar Temp. : 24.5 °C % RH : 48

CALIBRATION SETTING

Span	Initial Reading (Before Adj.) PPB	Final Reading (After Adj.) PPB
Set Point	Expected Concentration	% Diff
Zero	0	0.10
NO Span	400	400.2
NO _x Span	400	400.3
API Model 200A NO _x Analyzer Check List		
	Observed Value	Units
RANGE	500	PPB
STABILITY (Zero Gas)	0.1	PPB
SAMPLE FLOW	510	cc/min
OZONE FLOW	79	cc/min
PMT	103.3	mV
AZERO	94.1	mV
HVPS	673	V
RCCELL TEMP	50.4	°C
BOX TEMP	29.3	°C
PMT TEMP	7.5	°C
MOLY TEMP	315.4	°C
RCCELL PRESS	8.3	IN-Hg-A
SAMPLE PRESS	28.4	IN-Hg-A
NO Span Conc	400	PPB
NO _x Span Conc	400	PPB
NO Slope	1.008	-
NO _x Slope	1.012	-
NO Offset	1.6	mV
NO _x Offset	1.0	mV
Stability at Zero	0.1	PPB
Stability at Span	0.2	PPB

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	500 standard
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air
SAMPLE FLOW	510	cc/min	500 ± 50
OZONE FLOW	79	cc/min	80 ± 15
PMT	103.3	mV	-20 - 150
AZERO	94.1	mV	-20 - 150
HVPS	673	V	420 - 900 constant
RCCELL TEMP	50.4	°C	50 ± 1
BOX TEMP	29.3	°C	8 - 48
PMT TEMP	7.5	°C	7 ± 2
MOLY TEMP	315.4	°C	315 ± 5
RCCELL PRESS	8.3	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.4	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO _x Span Conc	400	PPB	20 - 20,000
NO Slope	1.008	-	1.0 ± 0.3
NO _x Slope	1.012	-	1.0 ± 0.3
NO Offset	1.6	mV	-20 to +150
NO _x Offset	1.0	mV	-20 to 150
Stability at Zero	0.1	PPB	< 0.2
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas

Calibrated by : Phakthai Khongkorn
 (Mr. Phakthai Khongkorn)

Approved by :

Phakthai Khongkorn
 (Mr. Peera Detudom)

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



CERTIFICATE No : 22M2567

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : METTLER TOLEDO
ID No : BA 05/50
AIR PRESSURE : 1008mbar \pm 1mbar
AMBIENT TEMPERATURE : 22 $^{\circ}$ C \pm 1 $^{\circ}$ C
RELATIVE HUMIDITY : 49 %RH \pm 10 % RH
MODEL : XS 105DU
S/N : 1126422905
RECEIVED DATE : 11-Mar-22
CALIBRATION DATE : 11-Mar-22
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 :-

1. STANDARD WEIGHT SET E2 QK-1-151 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

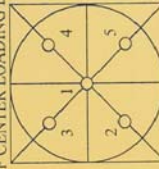
3. REPEATABILITY OF READING AT 20 g WAS 0.000004 g

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	100.0001	-0.0001	0.00019
120.00	120.0001	-0.0001	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

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	 PerkinElmer For the Better
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
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 <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.	
Review of Preventive Maintenance:	
Authorized PerkinElmer Representative: Anon Leenthawonkit	Date: 25-Jan-2022 (DD-MM-YYYY)
Authorized Customer Representative:	Date: 25-Jan-2022 (DD-MM-YYYY)

Noise R_270/22

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

Sound Level Meter Data				Calibration Data	
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]
					Before Adjustment
ACO-R03	ACO	6236	00132031	22 May 2022	94.1
ACO-R19	ACO	6236	00182001	22 May 2022	94.0
ACO-R45	ACO	6236	00192057	22 May 2022	94.0
ACO-R46	ACO	6236	00192058	22 May 2022	94.1
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.93 ± 0.10 dB

Calibrated by :

Phatnirai Khongkornmeed
 (Mr. Phatnirai Khongkornmeed)

Approved by :

(Signature)
 (Mr. Petra Denakorn)

ระดับเสียง

Noise R_285/22

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

Sound Level Meter Data			
SIM No.	Brand	Model	Serial No.
ACO-R40	ACO	6236	00192052
ACO-R41	ACO	6236	00192053
ACO-R50	ACO	6236	00192062
NL 21-B01	RION	NL-21	00554245

Calibration Data			
Date	Actual Reading (dB)		
	Before Adjustment	After Adjustment	
25 May 2022	94.1	94.0	
25 May 2022	94.0	94.0	
25 May 2022	94.1	94.0	
25 May 2022	94.0	94.0	

Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR) 93.93 ± 0.10 dB

Calibrated by : Phakchai Khongkornrod (Mr. Phakchai Khongkornrod)

Approved by : (Mr. Peera Denadom)

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 :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

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

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

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 : numpai@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 : mtg@tistr.or.th

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196 Phaholyothin Road, Chatuchak, Bangkok 10900,
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Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

FM&L-MTC.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 I
1/2 inch Briel&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 I
1/2 inch Briel&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 I
1/2 inch Briel&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 :

(Mr. Nutapong Nijrusvanti)

Approved by :

(Mr. Prawate Klunypa)

(Mr. Tawikiat Iamsaman)

Date of Calibration : 28 Apr. 2022

Date of Issue : 28 Apr. 2022

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011265042601787001

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

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 : rumpal@tistr.or.th Website: www.tistr.or.th

Office/Laboratory

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Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office

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

FMBL.MTC.002 Rev.4



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
25 หมู่ 3 ตำบลคลองห้า อำเภอกองกลาง จังหวัดปทุมธานี 10160
7 หมู่ 1 ตำบลคลองหลวง อำเภอคลองหลวง จังหวัดปทุมธานี 10160
Tel. (662) 579-4370-72, Fax : (662) 512-4321, E-mail : ssp@spscs.com, www.spscs.com

Noise Dose R. 287/22

Noise Dose Meter Calibration Report

Acoustic Calibrator Data			
Brand	SVANTEK	Number	SV 06/62
Model	SV84	Serial No.	33139
Calibration Range	114 dB, 1000 Hz	Last Calibration	17 September 2021
		Due Date	17 September 2022

Sound Level Meter Data				Calibration Data	
SLM No.	Brand	Model	Serial No.	Date	Actual Reading (dB)
NMD-B06	SVANTEK	SV-104IS	80816	23 May 2022	113.6
NMD-B07	SVANTEK	SV-104IS	80817	23 May 2022	113.6
NMD-B08	SVANTEK	SV-104IS	80818	23 May 2022	113.6
NMD-R02	SVANTEK	SV-104IS	60152	23 May 2022	113.6
NMD-R03	SVANTEK	SV-104IS	60153	23 May 2022	113.6
NMD-R05	SVANTEK	SV-104IS	60155	23 May 2022	113.6
NMD-R06	SVANTEK	SV-104IS	60146	23 May 2022	113.6
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					113.67 ± 0.10 dB

Calibrated by :

(Mr. Phakthirai Khongkornmud)

Approved by :

(Mr. Peera Deudom)



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 Brüel&Kjær 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.

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, Soei 1C, Bangpoo Industrial Estate, Sukhumvit Road, Chatuchak, Bangkok 10900, Thailand
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Fax. (66) 0 2577 9009
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FM.BL.MTC.002 Rev.3



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 20µPa at 1000 Hz

Acoustic Output in dB re 20µPa, 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
1/2 inch Brüel&Kjær 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
1/2 inch Brüel&Kjær 4180	1000.0	0.0	± 1.5	$\pm 2.0 \%$

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit
1/2 inch Brüel&Kjær 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. Pawate Klunypa)
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

The results relate only to the items tested or calibrated.

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

Head Office

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FM.BL.MTC.002 Rev.3

Heat B104_1/22

Heat Stress WBGT Meter Verification Report					
Verification Data					
Heat Stress WBGT Meter No.	: B07	Verification Date	: 23 May 2022		
Brand	: 3M	Ambient Temp.	: 24.5 °C		
Model	: QUESTemp [®] 34	Barometric Pressure	: 1011 mmbar		
Serial No.	: TEG040059	Relative Humidity	: 49 %		
Verification Module (Electronic Sensor Check) :					
Verification Module No. :	21	WB = 12.5 °C , DB = 47.1 °C , G = 69.3 °C			
Result of Verification : Without Adjustment					
Wet Probe Temperature Measurement					
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)		
12.5	12.4	0.1	± 0.5		
Dry Probe Temperature Measurement					
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)		
47.1	47.0	0.1	± 0.5		
Globe Probe Temperature Measurement					
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)		
69.3	69.4	-0.1	± 0.5		
UUC* = UNIT UNDER CALIBRATION					

Verified by : Phakthai Hongkornmet
 (Mr. Phakthai Hongkornmet)

Approved by : Peera Detudom
 (Mr. Peera Detudom)

ระดับความร้อนในสถานประกอบการ

Heat Stress WBGT Meter Verification Report

Verification Data				
Heat Stress WBGT Meter No.	: B11	Verification Date	: 23 May 2022	
Brand	: 3M	Ambient Temp.	: 24.5 °C	
Model	: QUESTemp [®] 34	Barometric Pressure	: 1011 mmbar	
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	47.2	-0.1	± 0.5	
Globe Probe Temperature Measurement				
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)	
69.3	69.3	0.0	± 0.5	
UUC* = UNIT UNDER CALIBRATION				

Verified by : Prathinai Khongkornwong
(Mr. Prathinai Khongkornwong)

Approved by : Pr. Peera Deudom
(Mr. Peera Deudom)

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
MANUFACTURER : 3M
MODEL / TYPE : QUESTemp[®] 34
SERIAL NO. : TEG040059
CLID, NO. : 231802517
JOB CONTROL NO. : 220423041339

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



Approved By : Mongkol Yotsontorn
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. Q22041339
F3-011-04/01-12





REPORT OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
(THERMAL ENVIRONMENT MONITOR)
MANUFACTURER : 3M
MODEL / TYPE : QUESTemp^o 34
SERIAL NO. : TEG040059
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. Q22041339

F3-011-04/01-12



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	30.00	29.6	+0.40	0.40
35.0	34.99	34.6	+0.39	
40.0	39.97	39.6	+0.37	

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	29.6	+0.40	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	29.9	+0.10	0.40
35.0	34.99	34.7	+0.29	
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. Q22041339

F3-011-04/01-12





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



CLC
Accredited
ISO/IEC 17025

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
(THERMAL ENVIRONMENT MONITOR)

MANUFACTURER : 3M

MODEL / TYPE : QUESTemp^o34

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

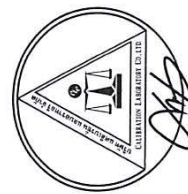
DATE OF ISSUED : 29 October 2021

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

page 1 of 3



@clcalibration



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



CLC
Accredited
ISO/IEC 17025

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

page 2 of 3



@clcalibration



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 Email: sale@cal-laboratory.com



NSG-TISI-PTS 17025
CALIBRATION 0059
CLC

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

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

CALIBRATION DATA

1. CORRECTION OF TEMPERATURE : WET

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	30.07	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 (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° 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 (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° 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

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@clcalibration

Industrial Calibration Co., Ltd.

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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. CAL06051-21 PAGE 1 OF 2

Certificate of Calibration

Equipment : HEAVY DUTY LIGHT METER

Manufacture : EXTECH

Model / Type : 407026

Serial No. : A.052323

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 :

(CHINNANAT-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 %

This certificate may not be reproduced other than in full except with the prior written approval of industrial calibration laboratory.

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dB bar
%RH VA
m/s kg

INDUSTRIAL CALIBRATION CO., LTD.

The Measure of Quality

CERTIFICATE No. CAL06051-21 PAGE 2 OF 2

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.052323	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.
DATA LOGGER LIGHT METER		DT-8809A	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*	UNCERTAINTY
RANGE	READING	CORRECTION	MASUREMENT
(LUX)	(LUX)	(LUX)	(4LUX)
0	000	0	0.9
2000	2002	4	20

REMARK : UUC* UNIT UNDER CALIBRATION

- END OF CERTIFICATE -