ภาคผนวก ง-2

เอกสารสอบเทียบเครื่องมือตรวจวัด

บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด

ตารางสรุปรายการเอกสารสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม

ดัชนีการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
1. คุณภาพอากาศในบรรยากาศ		
Total Suspended Particulate	High Volume Air Sampler No. B18, B34, B35, B38,	Digital Balance
Sulfur Dioxide	Personal Pump SKC No. B01, B02, B08, B09 Rotameter No. L-B10	Spectrophotometer
Hydrogen Sulfide	Personal Pump SKC No. B01, B02, B08, B09 Rotameter No. L-B10	Spectrophotometer
Carbon Monoxide	Personal Pump SKC No. B33, B40, B65, B78 Rotameter No. L-B10	IR
Methyl Mercaptan	Personal Pump SKC No. B01, B02, B08, B09 Rotameter No. L-B10	GC/FPD
Dimethyl Disulfide	Personal Pump SKC No. B01, B02, B08, B09 Rotameter No. L-B10	GC/FPD
Nitrogen Dioxide	$NO/NO_2/NO_x$ Analyzer No. B05, B09, B12, B19	$NO/NO_2/NO_x$ Analyzer No. B05, B09, B12, B19
2. ระดับเสียงในบรรยากาศ		
L_{eq} 24 hr, L_{90} 24 hr, L_{max} และ L_{dn}	Acoustic Calibrator Sound Level Meter No. ACO-B29, B39 Sound Level Meter No. CR-B09	-
3. คุณภาพอากาศจากปล่อง		
Total Suspended Particulate	Console No. B01, B03 Pitot Tube No. B35, B40	Digital Balance
Carbon Monoxide	Personal Pump SKC No. B59, B73, B79 Rotameter No. H-B08	IR
Sulfur Dioxide	Personal Pump SKC No. B05, B79 Rotameter No. H-B08	-
Oxides of Nitrogen	Vacuum Gauge	Spectrophotometer
Hydrogen Sulfide	Personal Pump SKC No. B05, B59, B73 Rotameter No. H-B08	-
Chlorine	Personal Pump SKC No. B21 Rotameter No. H-B09	IC
Dimethyl Disulfide	Personal Pump SKC No. B59 Rotameter No. L-B08	GC/PFPD
Methyl Mercaptan	Personal Pump SKC No. B79 Rotameter No. L-B08	GC/PFPD
4. คุณภาพอากาศในสถานประกอบการ		
Sodium Hydroxide	Personal Pump SKC No. B51, B62 Rotameter No. H-B10	-
Hydrogen Sulfide	Personal Pump SKC No. B89, B93 Rotameter No. L-B10	IC
Sulfur Dioxide	Personal Pump SKC No. B82 Rotameter No. H-B10	-

คุณภาพอากาศในบรรยากาศ

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High Volume Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard	Model : TE 5025A	S/N : 3611

Calibration Data				
High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft^3/min)	R^2
B01	B01	04/11/2024	y = 1.163x-2.904	0.998
B02	B02	04/11/2024	y = 1.132x+0.834	0.998
B03	B03	05/11/2024	y = 1.135x-2.920	0.999
B04	B04	01/11/2024	y = 1.183x-3.418	0.999
B05	B05	05/11/2024	y = 1.187x-5.657	0.999
B06	B06	05/11/2024	y = 1.143x-1.432	0.996
B07	B07	05/11/2024	y = 1.203x-6.640	0.998
B08	B08	01/11/2024	y = 1.151x-3.986	0.998
B09	B09	04/11/2024	y = 1.193x-5.144	0.998
B10	B10	05/11/2024	y = 1.172x-1.576	0.998
B11	B11	05/11/2024	y = 1.167x-3.909	0.997
B12	B12	06/11/2024	y = 1.159x-3.861	0.999
B13	B13	01/11/2024	y = 1.122x-2.328	0.998
B14	B14	01/11/2024	y = 1.177x-3.556	0.996
B15	B15	01/11/2024	y = 1.181x-3.355	0.999
B16	B16	06/11/2024	y = 1.182x-5.201	0.996
B17	B17	06/11/2024	y = 1.147x-1.345	0.998
B18	B18	01/11/2024	y = 1.180x-4.634	0.998
B19	B19	04/11/2024	y = 1.164x-4.313	0.997
B20	B20	04/11/2024	y = 1.161x-3.097	0.998
B21	B21	01/11/2024	y = 1.141x-3.592	0.997
B22	B22	05/11/2024	y = 1.182x-5.917	0.997
B23	B23	05/11/2024	y = 1.173x-3.417	0.997
B24	B24	05/11/2024	y = 1.077x-0.363	0.998
B25	B25	01/11/2024	Y = 1.055x+2.460	0.999
B26	B26	01/11/2024	y = 1.120x-2.009	0.998
B27	B27	04/11/2024	y = 1.167x-4.826	0.999
B28	B28	04/11/2024	y = 1.196x-6.003	0.997
B29	B29	01/11/2024	y = 1.153x-1.833	0.997
B30	B30	04/11/2024	y = 1.155x-2.149	0.996
B31	B31	04/11/2024	y = 1.148x-3.317	0.998
B32	B32	05/11/2024	y = 1.124x-1.205	0.996
B33	B33	05/11/2024	y = 1.186x-3.999	0.996
B34	B34	01/11/2024	y = 1.147x-3.571	0.998

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High Volume Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard	Model : TE 5025A	S/N : 3611

Calibration Data

High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft^3/min)	R^2
B35	B35	04/11/2024	y = 1.159x-2.093	0.999
B36	B36	04/11/2024	y = 1.167x-3.333	0.996
B37	B37	06/11/2024	y = 1.152x-2.051	0.997
B38	B38	04/11/2024	y = 1.144x-4.581	0.998
B39	B39	05/11/2024	y = 1.160x-3.397	0.997
B40	B40	01/11/2024	y = 1.168x-3.661	0.996
B41	B41	04/11/2024	y = 1.150x-2.581	0.999
B42	B42	04/11/2024	y = 1.177x-4.883	0.997
B43	B43	01/11/2024	y = 1.165x-3.033	0.998
B44	B44	05/11/2024	y = 1.173x-1.743	0.999
R01	R01	04/11/2024	y = 1.134x-3.385	0.998
R02	R02	04/11/2024	y = 1.173x-4.742	0.998
R03	R03	04/11/2024	y = 1.166x-4.405	0.998
R04	R04	01/11/2024	y = 1.133x-2.807	0.998
R05	R05	01/11/2024	y = 1.148x-2.112	0.997
R06	R06	01/11/2024	y = 1.196x-4.533	0.998
R07	R07	01/11/2024	y = 1.082x+0.340	0.999
R08	R08	01/11/2024	y = 1.112x-1.862	0.997
R09	R09	04/11/2024	y = 1.166x-3.534	0.997
R10	R10	04/11/2024	y = 1.191x-4.707	0.998
R11	R11	05/11/2024	y = 1.170x-4.815	0.997
R12	R12	05/11/2024	y = 1.138x-3.913	0.998
R13	R13	05/11/2024	y = 1.105x-2.238	0.998
R14	R14	06/11/2024	y = 1.183x-3.021	0.999
R15	R15	06/11/2024	y = 1.190x-5.879	0.999
R16	R16	06/11/2024	y = 1.137x-3.608	0.999
R17	R17	01/11/2024	y = 1.140x-2.475	0.998
R18	R18	01/11/2024	y = 1.142x-2.703	0.998
R19	R19	01/11/2024	y = 1.134x-4.199	0.999
R20	R20	04/11/2024	y = 1.147x-3.807	0.998

Calibr [redacted]

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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	± 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
B01	SKC	224-PCXR8	262101	03/10/2024	1,000	1,500	2,000	1,006	1,505	2,012	1.013x – 17.267	0.999
B02	SKC	224-PCXR8	626166	03/10/2024	1,000	1,500	2,000	998	1,500	1,995	1.000x - 2.067	1.000
B03	SKC	224-PCXR8	612968	02/10/2024	1,000	1,500	2,000	1,005	1,494	2,006	0.998x + 4.721	0.999
B04	SKC	224-PCXR8	602804	03/10/2024	1,000	1,500	2,000	996	1,511	2,007	1.012x - 19.485	0.999
B05	SKC	224-PCXR8	612693	02/10/2024	1,000	1,500	2,000	1,005	1,504	2,008	1.004x – 4.306	1.000
B06	SKC	224-PCXR8	262188	02/10/2024	1,000	1,500	2,000	1,013	1,505	2,008	0.996x + 6.748	0.999
B07	SKC	224-PCXR8	626262	02/10/2024	1,000	1,500	2,000	1,005	1,506	2,010	1.011x - 12.753	1.000
B08	SKC	224-PCXR8	626100	03/10/2024	1,000	1,500	2,000	1,000	1,498	1,993	0.995x + 5.105	1.000
B09	SKC	224-PCXR8	626479	02/10/2024	1,000	1,500	2,000	1,005	1,494	2,002	0.996x + 5.969	1.000
B10	SKC	224-PCXR8	091950	02/10/2024	1,000	1,500	2,000	1,004	1,504	2,008	1.011x – 15.436	1.000
B11	SKC	224-PCXR8	564315	03/10/2024	1,000	1,500	2,000	1,010	1,497	2,001	0.993x + 10.007	1.000
B12	SKC	224-PCXR8	034656	04/10/2024	1,000	1,500	2,000	998	1,507	2,005	1.013x - 22.552	0.999
B13	SKC	224-PCXR8	602073	03/10/2024	1,000	1,500	2,000	1,001	1,494	2,000	0.998x + 1.307	1.000
B14	SKC	224-PCXR8	626313	03/10/2024	1,000	1,500	2,000	1,014	1,504	2,013	0.999x + 8.699	1.000
B15	SKC	224-PCXR8	626474	03/10/2024	1,000	1,500	2,000	1,006	1,513	2,008	1.002x – 0.788	0.999
B16	SKC	224-PCXR8	626477	03/10/2024	1,000	1,500	2,000	1,001	1,514	2,009	1.009x - 11.678	1.000
B17	SKC	224-PCXR8	626860	02/10/2024	1,000	1,500	2,000	1,018	1,513	2,013	0.997x + 11.094	0.999
B18	SKC	224-PCXR8	691484	02/10/2024	1,000	1,500	2,000	999	1,498	1,999	1.000x + 0.668	1.000
B19	SKC	224-PCXR8	691599	03/10/2024	1,000	1,500	2,000	1,000	1,508	2,007	1.004x - 5.189	1.000
B20	SKC	224-PCXR8	691587	03/10/2024	1,000	1,500	2,000	997	1,514	2,005	1.010x – 12.129	1.000
B21	SKC	224-PCXR8	691531	04/10/2024	1,000	1,500	2,000	996	1,499	2,000	1.001x – 1.875	1.000
B22	SKC	224-PCXR8	691654	03/10/2024	1,000	1,500	2,000	999	1,508	2,006	1.008x – 13.641	1.000
B23	SKC	224-PCXR8	798393	03/10/2024	1,000	1,500	2,000	1,001	1,494	1,995	0.996x + 3.954	1.000
B24	SKC	224-PCXR8	626363	02/10/2024	1,000	1,500	2,000	999	1,492	2,003	1.001x – 3.994	1.000
B25	SKC	224-PCXR8	798489	03/10/2024	1,000	1,500	2,000	1,001	1,501	1,995	0.993x + 10.846	1.000
B26	SKC	224-PCXR8	798479	03/10/2024	1,000	1,500	2,000	996	1,507	2,004	1.007x - 13.888	1.000
B27	SKC	224-PCXR8	691673	03/10/2024	1,000	1,500	2,000	1,006	1,505	2,009	1.010x – 14.064	0.999
B28	SKC	224-PCXR8	691570	03/10/2024	1,000	1,500	2,000	996	1,510	2,008	1.012x – 19.941	0.999
B29	SKC	224-PCXR8	626472	03/10/2024	1,000	1,500	2,000	1,005	1,502	2,005	1.006x – 9.763	1.000
B30	SKC	224-PCXR8	691489	03/10/2024	1,000	1,500	2,000	1,004	1,501	2,008	1.009x – 13.737	1.000
B31	SKC	224-PCXR8	691509	03/10/2024	1,000	1,500	2,000	1,012	1,497	1,997	0.990x + 14.932	1.000
B32	SKC	224-PCXR8	091567	03/10/2024	1,000	1,500	2,000	1,010	1,510	2,008	1.003x – 3.978	0.999
B33	SKC	224-PCXR8	091756	02/10/2024	1,000	1,500	2,000	998	1,512	2,005	1.007x – 10.478	1.000
B34	SKC	224-PCXR8	612962	02/10/2024	1,000	1,500	2,000	999	1,504	2,000	1.001x – 0.963	1.000
B35	SKC	224-PCXR8	602682	02/10/2024	1,000	1,500	2,000	1,004	1,498	2,002	0.996x + 5.501	1.000
B36	SKC	224-PCXR8	626164	02/10/2024	1,000	1,500	2,000	1,008	1,507	2,004	1.000x + 2.331	1.000
B37	SKC	224-PCXR8	626256	04/10/2024	1,000	1,500	2,000	1,008	1,505	2,008	1.002x - 2.423	1.000
B38	SKC	224-PCXR8	626167	04/10/2024	1,000	1,500	2,000	997	1,499	1,998	1.001x – 2.994	1.000
B39	SKC	224-PCXR8	034637	08/10/2024	1,000	1,500	2,000	998	1,504	1,999	1.006x – 8.599	1.000
B40	SKC	[redacted]										

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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	± 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	02/10/2024	1,000	1,500	2,000	1,010	1,497	2,001	0.994x + 9.527	1.000
B42	SKC	224-PCXR4	626041	04/10/2024	1,000	1,500	2,000	998	1,507	2,005	1.009x - 14.416	0.999
B43	SKC	224-PCXR4	036636	03/10/2024	1,000	1,500	2,000	1,005	1,494	2,001	0.995x + 6.369	1.000
B44	SKC	224-PCXR8	529341	03/10/2024	1,000	1,500	2,000	1,010	1,494	2,000	0.990x + 14.704	1.000
B45	SKC	224-PCXR8	529594	02/10/2024	1,000	1,500	2,000	1,014	1,504	2,010	0.997x + 11.890	1.000
B46	SKC	224-PCXR8	566743	04/10/2024	1,000	1,500	2,000	1,006	1,514	2,009	1.002x – 1.391	0.999
B47	SKC	224-PCXR8	566747	02/10/2024	1,000	1,500	2,000	1,000	1,513	2,009	1.009x - 11.714	1.000
B48	SKC	224-PCXR8	566753	04/10/2024	1,000	1,500	2,000	1,020	1,513	2,012	0.995x + 15.140	0.999
B49	SKC	224-PCXR8	566780	04/10/2024	1,000	1,500	2,000	999	1,498	2,000	1.000x + 0.144	1.000
B50	SKC	224-PCXR8	500400	04/10/2024	1,000	1,500	2,000	1,000	1,508	2,006	1.004x – 5.541	1.000
B51	SKC	224-PCXR8	500363	04/10/2024	1,000	1,500	2,000	996	1,506	2,005	1.007x - 10.582	1.000
B52	SKC	224-PCXR8	093186	03/10/2024	1,000	1,500	2,000	998	1,509	2,003	1.006x - 10.386	1.000
B53	SKC	224-PCXR8	707670	03/10/2024	1,000	1,500	2,000	1,000	1,493	1,996	0.994x + 4.977	0.999
B54	SKC	224-PCXR3	509821	02/10/2024	1,000	1,500	2,000	1,001	1,493	2,008	1.006x - 9.295	1.000
B55	SKC	224-PCXR3	510710	04/10/2024	1,000	1,500	2,000	999	1,508	2,004	1.005x - 8.519	1.000
B56	SKC	224-PCXR3	511450	03/10/2024	1,000	1,500	2,000	1,003	1,502	2,012	1.008x – 10.418	1.000
B57	SKC	224-PCXR3	510798	02/10/2024	1,000	1,500	2,000	997	1,503	2,005	1.009x – 15.639	1.000
B58	SKC	224-PCXR3	509852	02/10/2024	1,000	1,500	2,000	1,016	1,517	2,008	0.996x + 13.453	0.999
B59	SKC	224-PCXR3	509862	04/10/2024	1,000	1,500	2,000	999	1,511	2,010	1.010x - 14.912	0.999
B60	SKC	224-PCXR3	512655	02/10/2024	1,000	1,500	2,000	1,009	1,514	1,996	0.992x + 12.737	0.999
B61	SKC	224-PCXR3	503915	04/10/2024	1,000	1,500	2,000	1,005	1,503	2,006	1.011x - 15.735	0.999
B62	SKC	224-PCXR3	505975	03/10/2024	1,000	1,500	2,000	1,006	1,513	2,008	1.002x - 0.788	0.999
B63	SKC	224-PCXR3	511432	02/10/2024	1,000	1,500	2,000	1,020	1,513	2,013	0.995x + 14.152	0.999
B64	SKC	224-PCXR3	508302	04/10/2024	1,000	1,500	2,000	1,000	1,508	2,007	1.004x - 5.189	1.000
B65	SKC	224-PCXR3	508310	02/10/2024	1,000	1,500	2,000	997	1,514	2,005	1.006x – 7.652	1.000
B66	SKC	224-PCXR3	509861	04/10/2024	1,000	1,500	2,000	996	1,499	2,003	1.009x - 13.421	1.000
B67	SKC	224-PCXR3	506295	03/10/2024	1,000	1,500	2,000	998	1,510	2,004	1.010x – 17.666	0.999
B68	SKC	224-PCXR3	505872	03/10/2024	1,000	1,500	2,000	998	1,494	1,997	0.996x + 2.043	1.000
B69	SKC	224-PCXR3	508375	04/10/2024	1,000	1,500	2,000	996	1,499	2,003	1.004x – 4.961	1.000
B70	SKC	224-PCXR3	510623	03/10/2024	1,000	1,500	2,000	1,002	1,504	2,000	1.002x – 1.959	1.000
B71	SKC	224-PCXR3	508367	03/10/2024	1,000	1,500	2,000	996	1,503	1,999	1.003x – 5.913	1.000
B72	SKC	224-PCXR3	505977	04/10/2024	1,000	1,500	2,000	997	1,499	1,996	0.998x - 0.140	1.000
B73	SKC	224-PCXR3	512606	02/10/2024	1,000	1,500	2,000	1,005	1,504	2,007	1.008x – 11.262	1.000
B74	SKC	224-PCXR3	505993	03/10/2024	1,000	1,500	2,000	998	1,504	2,002	1.005x – 10.110	1.000
B75	SKC	224-PCXR3	509820	02/10/2024	1,000	1,500	2,000	1,004	1,503	2,007	1.009x - 12.679	1.000
B76	SKC	224-PCXR3	509811	04/10/2024	1,000	1,500	2,000	1,005	1,493	2,003	0.997x + 5.309	1.000
B77	SKC	224-PCXR3	508301	02/10/2024	1,000	1,500	2,000	998	1,495	2,002	1.002x – 3.498	1.000
B78	SKC	224-PCXR3	510677	03/10/2024	1,000	1,500	2,000	1,015	1,505	2,010	1.003x – 0.420	0.999
B79	SKC	224-PCXR3	510920	04/10/2024	1,000	1,500	2,000	999	1,493	2,004	1.008x – 14.332	1.000

Calibrat[redacted]

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

Rotameter Calibration Report (For Personal Pump 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	02/10/2024	50	100	200	50.8	99.7	201.2	0.990x + 1.455	1.000
L-B02	Dwyer	VFA-21	04/10/2024	50	100	200	50.3	98.8	199.5	1.003x - 0.022	0.999
L-B03	Dwyer	VFA-21	04/10/2024	50	100	200	50.6	100.7	200.1	1.002x + 0.030	1.000
L-B04	Dwyer	VFA-21	04/10/2024	50	100	200	50.9	101.3	201.6	0.993x + 2.147	1.000
L-B05	Dwyer	VFA-21	03/10/2024	50	100	200	49.9	102.0	200.2	1.001x + 0.423	1.000
L-B06	Dwyer	VFA-21	03/10/2024	50	100	200	50.2	100.7	200.9	0.999x + 0.931	1.000
L-B07	Dwyer	VFA-21	01/10/2024	50	100	200	50.1	100.5	200.9	0.999x + 1.192	0.999
L-B08	Dwyer	VFA-21	02/10/2024	50	100	200	50.1	101.2	199.0	1.001x - 0.298	1.000
L-B09	Dwyer	VFA-21	01/10/2024	50	100	200	50.2	99.0	202.1	1.001x + 0.711	0.999
[redacted]										+ 0.455	1.000

[redacted]

era Detudom)

ความเร็วและทิศทางลม

THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 26 November, 2024 Certification No. 423/24

Object : Weather Station

Manufacturer : NRG

Mode No. : LR20

Mfg Code : 428007169

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

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1011.2 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119 : HOOK GAGE NO 1425

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: Thermoschneider No.9188 : testo, testo 645 Serial No. 02848057

PTB220 No. V1220015

[redacted]

(Authorised Signatory)

for the Chief

Sub-Standard Instrument

THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

Sensor Young Model 05103 Serial 57243 Certification No. 423/24

26 November, 2024 Page : 2 of 6

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
Ultrasonic Anemometer	Pressure	Vacumm	Velocity	Velocity	Correction
m/sec	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.01	-	-	-	0.98	0.03
3.02	-	-	-	3.00	0.02
5.00	-	-	-	4.97	0.03
7.00	-	-	-	7.00	0.00
9.02	-	-	-	8.99	0.03
11.01	-	-	-	11.00	0.01
13.01	-	-	-	12.98	0.03
15.01	-	-	-	15.03	-0.02
17.02	-	-	-	17.00	0.02
20.02	-	-	-	20.03	-0.01

Wind Aloft Plotting Board. US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRETION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrat[redacted]

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

Certification No. 423/24

26 November, 2024 Page : 3 of 6

Standard Barometer Pressure	Tested Barometer Pressure	Correction
29.86	29.71	0.15
29.87	29.73	0.14
29.87	29.74	0.13
29.88	29.75	0.13
29.89	29.76	0.13
29.90	29.77	0.13
29.91	29.78	0.13
29.91	29.79	0.12
29.90	29.78	0.12
29.89	29.77	0.12
29.88	29.76	0.12
29.87	29.74	0.13
29.85	29.71	0.14
29.85	29.70	0.15
29.84	29.69	0.15
29.83	29.67	0.16
29.89	29.68	0.21
29.90	29.69	0.21
29.91	29.71	0.20
29.92	29.73	0.19
[redacted]	Average	0.15

Calibration & Test Section

Meteorological Instruments Bureau

THAI METEOROLOGICAL DEPARTMENT
4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

Certification No. 423/24

26 November, 2024

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.6	45.6	0.0
30.2	30.3	-0.1
15.6	15.7	-0.1

[redacted]
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

THAI METEOROLOGICAL DEPARTMENT
4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

Sensor Model RH-5X P/N 4414

Certification No. 423/24

26 November, 2024

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading % R.H.	Correction % R.H.
45.1	44.2	0.90
63.2	60.8	2.40
95.2	91.5	3.70

[redacted]
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

Date of Issue 26 November, 2024

Certification No. 423/24

Page: 6 of 6

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ยี่ห้อ NovaLynx แบบ TIPPING BUCKET Product No. 260-2500 Code.Wind Speed No1 ทำการสอบเทียบกับแก้ววัดฝนแบบแก้วตวง GAUGE DIAMETER 8.0 INCHES, NEGRETTI & ZAMBRA LONDON No. 71082 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.25 mm./TIP)

กรมอุตุนิยมวิทยา METEOROLOGICAL DEPARTMENT

ลงชื่อ.....

(นายวัชรพล ทรัพย์วัฒน์)

วิศวกรชำนาญการ

THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 26 November, 2024

Certification No. 424/24

Page : 1 of 6

Object : Weather Station

Manufacturer : NRG

Mode No. : LR20

Mfg Code : 30905581

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

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1011.5 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119 : HOOK GAGE NO 1425

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: Thermoschneider No.9188 : testo, testo 645 Serial No. 02848057

[redacted] pe PTB220 No. V1220015

(Authorised Signatory)

for the Chief

Sub-Standard Instrument

กรมอุตุนิยมวิทยา METEOROLOGICAL DEPARTMENT

THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

Sensor Young Model 05103 Serial 68983 Certification No. 424/24

26 November, 2024 Page : 2 of 6

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
Ultrasonic Anemometer	Pressure	Vacumm	Velocity	Velocity	Correction
m/sec	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.00	-	-	-	0.98	0.02
3.02	-	-	-	3.02	0.00
5.00	-	-	-	4.98	0.02
7.00	-	-	-	7.02	-0.02
9.02	-	-	-	9.00	0.02
11.01	-	-	-	11.02	-0.01
13.01	-	-	-	13.00	0.01
15.01	-	-	-	14.99	0.02
17.02	-	-	-	17.04	-0.02
20.02	-	-	-	20.04	-0.02

Wind Aloft Plotting Board. US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRETION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibr[redacted]

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

Certification No. 424/24

26 November, 2024 Page : 3 of 6

Standard Barometer Pressure	Tested Barometer Pressure	Correction
29.86	29.72	0.14
29.87	29.73	0.14
29.87	29.73	0.14
29.88	29.74	0.14
29.89	29.72	0.17
29.90	29.74	0.16
29.91	29.76	0.15
29.91	29.77	0.14
29.90	29.75	0.15
29.89	29.72	0.17
29.88	29.71	0.17
29.87	29.69	0.18
29.85	29.68	0.17
29.85	29.69	0.16
29.84	29.67	0.17
29.83	29.69	0.14
29.89	29.74	0.15
29.90	29.75	0.15
29.91	29.77	0.14
29.92	29.78	0.14
	Average	0.15

Cal[redacted]

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

THAI METEOROLOGICAL DEPARTMENT
4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

Certification No. 424/24

26 November, 2024

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.6	45.5	0.1
30.2	30.3	-0.1
15.6	15.6	0.0

Cali[redacted]

Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

THAI METEOROLOGICAL DEPARTMENT
4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

Sensor Model RH-5X P/N 4414

Certification No. 424/24

26 November, 2024

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading % R.H.	Correction % R.H.
45.1	44.6	0.50
63.2	60.7	2.50
95.2	91.4	3.80

Cal[redacted]

Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

Date of Issue 26 November, 2024

Certification No. 424/24

Page: 6 of 6

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ยี่ห้อ NovaLynx แบบ TIPPING BUCKET Product No. 260-2500 Code.Wind Speed No. 2 ทำการสอบเทียบกับแก้ววัดฝนแบบแก้วตวง GAUGE DIAMETER 8.0 INCHES, NEGRETTI & ZAMBRA LONDON No. 71082 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.25 mm./TIP)

กรมอุตุนิยมวิทยา METEOROLOGICAL DEPARTMENT

ลงชื่อ.....

(นายวัชรพล ทรัพย์วัฒน์)

วิศวกรชำนาญการ

ระดับเสียงในบรรยากาศ

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

NSC-TISI-TIS 17025
CALIBRATION 0037

Request No. 21-67/0304 **MTC No.** EEL. BP. 109/0267

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/N4106495.
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 : 22 Feb. 2024

Date of Calibration : 4 Mar. 2024

1 /

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

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

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304 **MTC No.** EEL. BP. 109/0267

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 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 IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	93.85	-0.15	± 0.10	±0.75 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	999.9	-0.1	± 1.5	±2.0%

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	1.65	± 0.50	±4.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by : [redacted] **Approved by :**

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 4 Mar. 2024

Date of Issue : 5 Mar. 2024

Ref : 2011267022200795001

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

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

คุณภาพอากาศจากปล่อง

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

Console Calibration Report

Calibration Method	Critical Orifices

Calibration Data

Console Data		Calibration Data		
No.	Serial No.	Date	y	$\Delta H_@$ (mmH_2O)
B01	1563	02/09/2024	0.998	50.16
B02	8002514	04/09/2024	1.002	50.08
B03	1503016	02/09/2024	1.005	50.02
B04	00006659	03/09/2024	0.997	49.84
B05	00007428	02/09/2024	1.003	49.95
R01	1561	03/09/2024	0.998	50.11
R02	8002513	04/09/2024	0.997	49.97
R03	1570	03/09/2024	1.004	49.82
R04	8002519	02/09/2024	0.996	49.74
R05	1503015	04/09/2024	0.999	49.88

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

Accept Value of $\Delta H_@$ (test) is 46.7 ± 6.4 (mmH_2O)

Calibrated by [redacted]

บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
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Pitot Tube Calibration Report

Calibration Method	Standard Pitot Tube

Calibration Data

Pitot Tube Data			Calibration Data		
No.	Type of Pitot	Coefficience of Standard Pitot	Date	Avg. of Cp (test)	
				Side A	Side B
B03	S	0.99	05/11/2024	0.84	0.85
B04	S	0.99	05/11/2024	0.84	0.83
B05	S	0.99	01/11/2024	0.84	0.85
B07	S	0.99	04/11/2024	0.84	0.84
B08	S	0.99	04/11/2024	0.84	0.85
B09	S	0.99	04/11/2024	0.84	0.84
B11	S	0.99	01/11/2024	0.84	0.83
B16	S	0.99	05/11/2024	0.84	0.84
B18	S	0.99	04/11/2024	0.84	0.84
B19	S	0.99	04/11/2024	0.84	0.83
B21	S	0.99	04/11/2024	0.84	0.84
B24	S	0.99	01/11/2024	0.85	0.84
B27	S	0.99	05/11/2024	0.84	0.84
B30	S	0.99	04/11/2024	0.84	0.83
B31	S	0.99	05/11/2024	0.84	0.84
B33	S	0.99	05/11/2024	0.85	0.84
B35	S	0.99	01/11/2024	0.84	0.84

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

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Pitot Tube Calibration Report

Calibration Method	Standard Pitot Tube

Calibration Data

Pitot Tube Data			Calibration Data		
No.	Type of Pitot	Coefficience of Standard Pitot	Date	Avg. of Cp (test)	
				Side A	Side B
B36	S	0.99	04/11/2024	0.84	0.84
B37	S	0.99	04/11/2024	0.84	0.84
B38	S	0.99	04/11/2024	0.85	0.84
B39	S	0.99	05/11/2024	0.84	0.84
B40	S	0.99	05/11/2024	0.84	0.83
B41	S	0.99	01/11/2024	0.85	0.84
B44	S	0.99	01/11/2024	0.84	0.84
B45	S	0.99	04/11/2024	0.84	0.84
B46	S	0.99	05/11/2024	0.85	0.84
B47	S	0.99	05/11/2024	0.84	0.84
B48	S	0.99	05/11/2024	0.84	0.83
B49	S	0.99	05/11/2024	0.84	0.84
B54	S	0.99	05/11/2024	0.85	0.84
B56	S	0.99	05/11/2024	0.84	0.83
B57	S	0.99	01/11/2024	0.84	0.85
B58	S	0.99	01/11/2024	0.83	0.84

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

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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 ± 3 °C
Pressure . 1010 ± 15 mmbar

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min) Setting 1	Setting 2	Setting 3	Actual (Q std.) 1	Actual (Q std.) 2	Actual (Q std.) 3	Value From Calibration Curve y	Value From Calibration Curve R^2
B01	SKC	224-PCXR4	262101	03/10/2024	1,000	1,500	2,000	1,006	1,505	2,012	1.013x – 17.267	0.999
B02	SKC	224-PCXR4	626166	03/10/2024	1,000	1,500	2,000	998	1,500	1,995	1.000x - 2.067	1.000
B03	SKC	224-PCXR4	612968	02/10/2024	1,000	1,500	2,000	1,005	1,494	2,006	0.998x + 4.721	0.999
B04	SKC	224-PCXR4	602804	03/10/2024	1,000	1,500	2,000	996	1,511	2,007	1.012x - 19.485	0.999
B05	SKC	224-PCXR4	612693	02/10/2024	1,000	1,500	2,000	1,005	1,504	2,008	1.004x – 4.306	1.000
B06	SKC	224-PCXR4	262188	02/10/2024	1,000	1,500	2,000	1,013	1,505	2,008	0.996x + 6.748	0.999
B07	SKC	224-PCXR4	626262	02/10/2024	1,000	1,500	2,000	1,005	1,506	2,010	1.011x - 12.753	1.000
B08	SKC	224-PCXR4	626100	03/10/2024	1,000	1,500	2,000	1,000	1,498	1,993	0.995x + 5.105	1.000
B09	SKC	224-PCXR4	626479	02/10/2024	1,000	1,500	2,000	1,005	1,494	2,002	0.996x + 5.969	1.000
B10	SKC	224-PCXR4	091950	02/10/2024	1,000	1,500	2,000	1,004	1,504	2,008	1.011x – 15.436	1.000
B11	SKC	224-PCXR8	564315	03/10/2024	1,000	1,500	2,000	1,010	1,497	2,001	0.993x + 10.007	1.000
B12	SKC	224-PCXR4	034656	04/10/2024	1,000	1,500	2,000	998	1,507	2,005	1.013x - 22.552	0.999
B13	SKC	224-PCXR4	602073	03/10/2024	1,000	1,500	2,000	1,001	1,494	2,000	0.998x + 1.307	1.000
B14	SKC	224-PCXR4	626313	03/10/2024	1,000	1,500	2,000	1,014	1,504	2,013	0.999x + 8.699	1.000
B15	SKC	224-PCXR4	626474	03/10/2024	1,000	1,500	2,000	1,006	1,513	2,008	1.002x – 0.788	0.999
B16	SKC	224-PCXR4	626477	03/10/2024	1,000	1,500	2,000	1,001	1,514	2,009	1.009x - 11.678	1.000
B17	SKC	224-PCXR4	626860	02/10/2024	1,000	1,500	2,000	1,018	1,513	2,013	0.997x + 11.094	0.999
B18	SKC	224-PCXR4	691484	02/10/2024	1,000	1,500	2,000	999	1,498	1,999	1.000x + 0.668	1.000
B19	SKC	224-PCXR4	691599	03/10/2024	1,000	1,500	2,000	1,000	1,508	2,007	1.004x - 5.189	1.000
B20	SKC	224-PCXR4	691587	03/10/2024	1,000	1,500	2,000	997	1,514	2,005	1.010x – 12.129	1.000
B21	SKC	224-PCXR4	691531	04/10/2024	1,000	1,500	2,000	996	1,499	2,000	1.001x – 1.875	1.000
B22	SKC	224-PCXR4	691654	03/10/2024	1,000	1,500	2,000	999	1,508	2,006	1.008x – 13.641	1.000
B23	SKC	224-PCXR4	798393	03/10/2024	1,000	1,500	2,000	1,001	1,494	1,995	0.996x + 3.954	1.000
B24	SKC	224-PCXR4	626363	02/10/2024	1,000	1,500	2,000	999	1,492	2,003	1.001x – 3.994	1.000
B25	SKC	224-PCXR4	798489	03/10/2024	1,000	1,500	2,000	1,001	1,501	1,995	0.993x + 10.846	1.000
B26	SKC	224-PCXR4	798479	03/10/2024	1,000	1,500	2,000	996	1,507	2,004	1.007x - 13.888	1.000
B27	SKC	224-PCXR4	691673	03/10/2024	1,000	1,500	2,000	1,006	1,505	2,009	1.010x – 14.064	0.999
B28	SKC	224-PCXR4	691570	03/10/2024	1,000	1,500	2,000	996	1,510	2,008	1.012x – 19.941	0.999
B29	SKC	224-PCXR4	626472	03/10/2024	1,000	1,500	2,000	1,005	1,502	2,005	1.006x – 9.763	1.000
B30	SKC	224-PCXR4	691489	03/10/2024	1,000	1,500	2,000	1,004	1,501	2,008	1.009x – 13.737	1.000
B31	SKC	224-PCXR4	691509	03/10/2024	1,000	1,500	2,000	1,012	1,497	1,997	0.990x + 14.952	1.000
B32	SKC	224-PCXR4	091567	03/10/2024	1,000	1,500	2,000	1,010	1,510	2,008	1.003x – 3.978	0.999
B33	SKC	224-PCXR4	091756	02/10/2024	1,000	1,500	2,000	998	1,512	2,005	1.007x – 10.478	1.000
B34	SKC	224-PCXR4	612962	02/10/2024	1,000	1,500	2,000	999	1,504	2,000	1.001x – 0.963	1.000
B35	SKC	224-PCXR4	602682	02/10/2024	1,000	1,500	2,000	1,004	1,498	2,002	0.996x + 5.501	1.000
B36	SKC	224-PCXR4	626164	02/10/2024	1,000	1,500	2,000	1,008	1,507	2,004	1.000x + 2.331	1.000
B37	SKC	224-PCXR4	626256	04/10/2024	1,000	1,500	2,000	1,008	1,505	2,008	1.002x - 2.423	1.000
B38	SKC	224-PCXR4	626167	04/10/2024	1,000	1,500	2,000	997	1,499	1,998	1.001x – 2.994	1.000
B39	SKC	224-PCXR4	034637	04/10/2024	1,000	1,500	2,000	998	1,504	1,999	1.004x – 8.599	1.000
B40	SKC	224-PCXR4	798349	04/10/2024	1,000	1,500	2,000	1,001	1,500	1,994	0.999x - 2.619	1.000

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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter | Model : Defender 510-H | S/N : 136164

Environmental Conditions
Temperature . 25 ± 3 °C
Pressure . 1010 ± 15 mmbar

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min) Setting 1	Setting 2	Setting 3	Actual (Q std.) 1	Actual (Q std.) 2	Actual (Q std.) 3	Value From Calibration Curve y	Value From Calibration Curve R^2
B41	SKC	224-PCXR4	612669	02/10/2024	1,000	1,500	2,000	1,010	1,497	2,001	0.994x + 9.527	1.000
B42	SKC	224-PCXR4	626041	04/10/2024	1,000	1,500	2,000	998	1,507	2,005	1.009x - 14.416	0.999
B43	SKC	224-PCXR4	036636	03/10/2024	1,000	1,500	2,000	1,005	1,496	2,001	0.995x + 6.369	1.000
B44	SKC	224-PCXR8	529341	03/10/2024	1,000	1,500	2,000	1,010	1,494	2,000	0.990x + 14.704	1.000
B45	SKC	224-PCXR8	529594	02/10/2024	1,000	1,500	2,000	1,014	1,504	2,010	0.997x + 11.890	1.000
B46	SKC	224-PCXR8	566743	04/10/2024	1,000	1,500	2,000	1,006	1,514	2,009	1.002x – 1.391	0.999
B47	SKC	224-PCXR8	566747	02/10/2024	1,000	1,500	2,000	1,000	1,513	2,009	1.009x - 11.714	1.000
B48	SKC	224-PCXR8	566753	04/10/2024	1,000	1,500	2,000	1,020	1,513	2,012	0.995x + 15.140	0.999
B49	SKC	224-PCXR8	566780	04/10/2024	1,000	1,500	2,000	999	1,498	2,000	1.000x + 0.144	1.000
B50	SKC	224-PCXR8	500400	04/10/2024	1,000	1,500	2,000	1,000	1,508	2,006	1.004x – 5.541	1.000
B51	SKC	224-PCXR8	500363	04/10/2024	1,000	1,500	2,000	996	1,506	2,005	1.007x - 10.582	1.000
B52	SKC	224-PCXR8	093186	03/10/2024	1,000	1,500	2,000	998	1,509	2,003	1.006x - 10.386	1.000
B53	SKC	224-PCXR8	707670	03/10/2024	1,000	1,500	2,000	1,000	1,493	1,996	0.994x + 4.977	0.999
B54	SKC	224-PCXR3	509821	02/10/2024	1,000	1,500	2,000	1,001	1,493	2,008	1.006x - 9.295	1.000
B55	SKC	224-PCXR3	510710	04/10/2024	1,000	1,500	2,000	999	1,508	2,004	1.005x - 8.519	1.000
B56	SKC	224-PCXR3	511450	03/10/2024	1,000	1,500	2,000	1,003	1,502	2,012	1.008x – 10.418	1.000
B57	SKC	224-PCXR3	510798	02/10/2024	1,000	1,500	2,000	997	1,503	2,005	1.009x – 15.639	1.000
B58	SKC	224-PCXR3	509852	02/10/2024	1,000	1,500	2,000	1,016	1,517	2,008	0.996x + 13.453	0.999
B59	SKC	224-PCXR3	509862	04/10/2024	1,000	1,500	2,000	999	1,511	2,010	1.010x - 14.912	0.999
B60	SKC	224-PCXR3	512655	02/10/2024	1,000	1,500	2,000	1,009	1,514	1,996	0.992x + 12.737	0.999
B61	SKC	224-PCXR3	503915	04/10/2024	1,000	1,500	2,000	1,005	1,503	2,006	1.011x - 15.735	0.999
B62	SKC	224-PCXR3	505975	03/10/2024	1,000	1,500	2,000	1,006	1,513	2,008	1.002x - 0.788	0.999
B63	SKC	224-PCXR3	511432	02/10/2024	1,000	1,500	2,000	1,020	1,513	2,013	0.995x + 14.152	0.999
B64	SKC	224-PCXR3	508302	04/10/2024	1,000	1,500	2,000	1,000	1,508	2,007	1.004x - 5.189	1.000
B65	SKC	224-PCXR3	508310	02/10/2024	1,000	1,500	2,000	997	1,514	2,005	1.006x – 7.652	1.000
B66	SKC	224-PCXR3	509861	04/10/2024	1,000	1,500	2,000	996	1,499	2,003	1.009x - 13.421	1.000
B67	SKC	224-PCXR3	506295	03/10/2024	1,000	1,500	2,000	998	1,510	2,004	1.010x – 17.666	0.999
B68	SKC	224-PCXR3	505872	03/10/2024	1,000	1,500	2,000	998	1,494	1,997	0.996x + 2.043	1.000
B69	SKC	224-PCXR3	508375	04/10/2024	1,000	1,500	2,000	996	1,499	2,003	1.004x – 4.961	1.000
B70	SKC	224-PCXR3	510623	03/10/2024	1,000	1,500	2,000	1,002	1,504	2,000	1.002x – 1.959	1.000
B71	SKC	224-PCXR3	508367	03/10/2024	1,000	1,500	2,000	996	1,503	1,999	1.003x – 5.913	1.000
B72	SKC	224-PCXR3	505977	04/10/2024	1,000	1,500	2,000	997	1,499	1,996	0.998x - 0.140	1.000
B73	SKC	224-PCXR3	512606	02/10/2024	1,000	1,500	2,000	1,005	1,504	2,007	1.008x – 11.262	1.000
B74	SKC	224-PCXR3	505993	03/10/2024	1,000	1,500	2,000	998	1,504	2,002	1.005x – 10.110	1.000
B75	SKC	224-PCXR3	509820	02/10/2024	1,000	1,500	2,000	1,004	1,503	2,007	1.009x - 12.679	1.000
B76	SKC	224-PCXR3	509811	04/10/2024	1,000	1,500	2,000	1,005	1,493	2,003	0.997x + 5.309	1.000
B77	SKC	224-PCXR3	508301	02/10/2024	1,000	1,500	2,000	998	1,495	2,002	1.002x – 3.498	1.000
B78	SKC	224-PCXR3	510677	03/10/2024	1,000	1,500	2,000	1,015	1,505	2,010	1.003x – 0.420	0.999
B79	SKC	224-PCXR3	510920	04/10/2024	1,000	1,500	2,000	999	1,493	2,004	1.008x – 14.332	1.000

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Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter	Model : Defender 510-H	S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R^2
H-801	Dwyer	VFB-65	02/10/2024	500	1,000	2,000	502.4	998.3	1992.4	0.996x + 5.889	1.000
H-802	Dwyer	VFB-65	04/10/2024	500	1,000	2,000	498.5	1001.9	2009.0	0.997x + 5.707	1.000
H-803	Dwyer	VFB-65	04/10/2024	500	1,000	2,000	499.2	996.1	2011.4	1.004x - 11.451	0.999
H-804	Dwyer	VFB-65	04/10/2024	500	1,000	2,000	504.0	999.2	1995.1	0.995x + 7.219	1.000
H-805	Dwyer	VFB-65	03/10/2024	500	1,000	2,000	498.7	1001.8	2007.6	0.997x + 4.568	1.000
H-806	Dwyer	VFB-65	03/10/2024	500	1,000	2,000	497.3	999.1	2012.1	1.005x - 11.101	0.999
H-807	Dwyer	VFB-65	01/10/2024	500	1,000	2,000	503.0	1004.1	1992.6	0.998x + 6.074	1.000
H-808	Dwyer	VFB-65	02/10/2024	500	1,000	2,000	503.7	1000.4	1994.6	0.992x + 12.996	1.000
H-809	Dwyer	VFB-65	01/10/2024	500	1,000	2,000	501.3	1001.6	1990.3	0.999x + 4.046	0.999
H-810	Dwyer	VFB-65	01/10/2024	500	1,000	2,000	500.3	1002.0	1992.6	0.995x + 8.990	1.000

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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-801	Dwyer	VFA-21	02/10/2024	50	100	200	50.8	99.7	201.2	0.990x + 1.455	1.000
L-802	Dwyer	VFA-21	04/10/2024	50	100	200	50.3	98.8	199.5	1.003x - 0.022	0.999
L-803	Dwyer	VFA-21	04/10/2024	50	100	200	50.6	100.7	200.1	1.002x + 0.030	1.000
L-804	Dwyer	VFA-21	04/10/2024	50	100	200	50.9	101.3	201.6	0.993x + 2.147	1.000
L-805	Dwyer	VFA-21	03/10/2024	50	100	200	49.9	102.0	200.2	1.001x + 0.423	1.000
L-806	Dwyer	VFA-21	03/10/2024	50	100	200	50.2	100.7	200.9	0.999x + 0.931	1.000
L-807	Dwyer	VFA-21	01/10/2024	50	100	200	50.1	100.5	200.9	0.999x + 1.192	0.999
L-808	Dwyer	VFA-21	02/10/2024	50	100	200	50.1	101.2	199.0	1.001x - 0.298	1.000
L-809	Dwyer	VFA-21	01/10/2024	50	100	200	50.2	99.0	202.1	1.001x + 0.711	0.999
L-810	Dwyer	VFA-21	01/10/2024	50	100	200	50.3	100.2	201.7	1.003x + 0.455	1.000

[redacted]

QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com

NSC-TISI-TIS17025 CALIBRATION 0049

Certificate of Calibration

EQUIPMENT	:	DIGITAL BALANCE
MANUFACTURER	:	METTLER TOLEDO
MODEL	:	XS105DU
SERIAL No	:	1126422905
ID No	:	BA05/50
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	:	[redacted]
CALIBRATION DATE	:	
APPROVED BY	:	
ISSUED DATE	:	14-Mar-24
RECEIVED DATE	:	08-Mar-24

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.
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Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com

Calibration Report

EQUIPMENT	:	DIGITAL BALANCE	**MODEL**	:	XS105DU
MANUFACTURER	:	METTLER TOLEDO	**S/N**	:	1126422905
ID No	:	BA05/50	**RECEIVED DATE**	:	08-Mar-24
AIR PRESSURE	:	1010mbar ± 1mbar	**CALIBRATION DATE**	:	08-Mar-24
AMBIENT TEMPERATURE	:	25° C ± 1° C	**RELATIVE HUMIDITY**	:	53 %RH ± 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 LINEARLITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN.
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-I-151	M2302013S	02-Feb-25
2) STANDARD WEIGHT	E2	15843	M2302014S	02-Feb-25

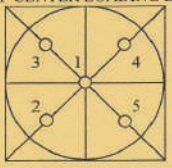
3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
   - NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 200 g WAS 0.000055 g
4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (± g)
0.00	0.00000	0.00000	0.000065
0.02	0.02001	-0.00001	0.000065
0.10	0.10002	-0.00002	0.000066
0.20	0.20001	-0.00001	0.000066
0.50	0.50001	-0.00001	0.000065
1.00	1.00003	-0.00003	0.000066
2.00	2.00001	-0.00001	0.000067
5.00	5.00001	-0.00001	0.000068
10.00	9.99994	0.00006	0.000070
20.00	20.00008	-0.00008	0.000078
50.00	50.0000	0.0000	0.00013
100.00	100.0001	-0.0001	0.00019
120.00	120.0001	-0.0001	0.00022

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	50.0000
2	50.0000
3	50.0000
4	50.0000
5	50.0000
OFF-CENTER LOADING	0.0000

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

END OF CALIBRATION REPORT

[redacted]

PerkinElmer
For the Better

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:	[redacted]	**WO Number :**	WO-02860803
Telephone No.:		**Certificate Number:**	IR1164-2024
Customer Support Engineer:	Tanongsak	**PM Number :**	1 of 1
Date PM Performed: (DD-MMM-YYYY)	14-Aug-2024	**Next PM Due Date:** (DD-MMM-YYYY)	14-Aug-2025

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	KBr B/S

Parts Lists

Parts Included with the PM				
Part Number (if applicable)	**Description**	**Quantity**	**Batch/Lot/SN #**	**Expiration Date** (MM/YY)
N0171159	Desiccant	2	NA	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	15.85	2.61

☒ EndStop

End Stop	Specification	Value
	+/- 50	3.00

☒ Zero Path

Zero Path	Specification	Value
	+/- 20	4.00

☒ Energy

Energy	Specification	Value
	NA	14454.00

☒ Gain

Gain	Specification	Value
	Less than +/- 9.5	6.85 / -8.26

☒ Match

Match	Specification	Value
	NA	3.22

3. Performance Test:

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

	Detector Type	Typical SNR
Signal to Noise Ratio	DTGS (MIR)	2858.78

4. Wavenumber Calibrate:

☒ Wavenumber Calibrate

Certified Value (cm-1)	Value	Specification	Difference (cm-1)
3082.22	3082.06	+/- 0.5	0.16
3060.14	3060.00	+/- 0.5	0.14
1601.38	1601.40	+/- 0.5	-0.02
1583.04	1583.27	+/- 0.5	-0.23
1028.42	1028.51	+/- 0.5	-0.09

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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 ☒ ***Fails*** ☐ ***the preventive maintenance.***

Review of Preventive Maintenance:	
Authorized PerkinElmer Representative: [redacted]	Date: 14-Aug-2024 (DD-MMM-YYYY)
Authorized Customer Representative:	Date: 14-Aug-2024 (DD-MMM-YYYY)

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY
451-451/1 Sirinthorn Road, Bangbumru, Bangplud, Bangkok, 10700 Thailand
Tel. +66 2433 8331 Email : calibration@sithiphorn.com

SITHIPORN associates

ilac-MRA

NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : SP24020
Pages 1 of 3

Calibration Certificate

Equipment :	UV-VIS SPECTROPHOTOMETER
Manufacturer :	PERKINELMER
Model :	LAMBDA 25
Serial No.:	501S14123010
ID No.:	SP03/58
Calibration Mode :	WAVELENGTH ACCURACY PHOTOMETRIC ACCURACY
Condition As Found :	GOOD
Customer :	S.P.S. CONSULTING SERVICE CO., LTD. 7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN ROAD, CHOMPHON, CHATUCHAK, BANGKOK 10900, THAILAND.
Location :	WET CHEMISTRY LABORATORY IV
Ambient Temperature :	(28.1 ± 5) °C
Relative Humidity :	(47.2 ± 25) %
Received Date :	27 AUGUST 2024
Calibration Date :	27 AUGUST 2024
Date of Issue :	27 AUGUST 2024

Calibrated by : [redacted]

Approved by :

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY
451-451/1 Sirinthorn Road, Bangbumru, Bangplud, Bangkok, 10700 Thailand
Tel. +66 2433 8331 Email : calibration@sithiphorn.com

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NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : SP24020
Job No. : VC67SP0013
Pages : 2 of 3

Calibration Method :

This instrument was calibrated by using on-site calibration procedure In-house method : CP-SP-01
The calibration procedure to direct measurement wavelength accuracy by using wavelength standard solution, Photometric accuracy by using absorbance standard filter and absorbance standard solution
The calibration procedure used was based on ASTM E275-01,ASTM E925-02

Condition of this result of calibration :

1. Certified reference materials

Material	Ref. type	Cell serial No.	Cert. No.	Due Date
Holmium liquid	RM-HL	29706	106864	01/11/2024
Didymium liquid	RM-DL	28912	106905	02/11/2024
Neutral density filter	RM-1N2N3N	13877	106918	03/11/2024
Potassium dichromate solutions	RM-0204060810	14204	106902	02/11/2024
Potassium Iodide solution	-	KI-0701-001	CI-0185-24	14/05/2026

2. This result of calibration was found accurate as shown on date and place of calibration only.
3. This certificate is traceable to the international system of unit maintained at :
   3.1 The UK National Physical Laboratory (NPL)
   3.2 The National Institute of Standards and Technology,NIST.

Result of calibration : Wavelength Accuracy

(Without adjustment)

Material	Certified Values of Reference Material (nm)	UUC* Reading (nm)	Error (nm)	Uncertainty ± (nm)	k Factor
RM-HL	278.13	278.3	0.17	0.16	2.00
	361.25	361.4	0.15	0.16	2.00
	467.82	467.7	-0.12	0.16	2.00
	536.56	536.5	-0.06	0.16	2.00
	640.50	640.4	-0.10	0.16	2.00
RM-DL	740.09	739.9	-0.19	0.16	2.00
	864.94	865.2	0.26	0.16	2.00

UUC* = Unit Under Calibration

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NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : SP24020
Job No. : VC67SP0013
Pages : 3 of 3

Result of calibration : Photometric Accuracy

(Without adjustment)

Material	Wavelength (nm)	Filter S/N	Nominal Absorbance (A)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor
Neutral Density glass filter	440.0	29360	1.0	1.0517	1.0550	0.0033	0.0029	2.00
		29914	0.7	0.7445	0.7460	0.0015	0.0029	2.00
		29381	0.5	0.5416	0.5431	0.0015	0.0030	2.00
	546.1	29360	1.0	0.9821	0.9820	-0.0001	0.0028	2.00
		29914	0.7	0.6961	0.6958	-0.0003	0.0028	2.00
		29381	0.5	0.5073	0.5080	0.0007	0.0029	2.00
	590.0	29360	1.0	1.0222	1.0210	-0.0012	0.0028	2.00
		29914	0.7	0.7237	0.7221	-0.0016	0.0029	2.00
		29381	0.5	0.5361	0.5361	0.0000	0.0031	2.00
	635.0	29360	1.0	0.9753	0.9745	-0.0008	0.0028	2.00
		29914	0.7	0.6910	0.6900	-0.0010	0.0029	2.00
		29381	0.5	0.5211	0.5210	-0.0001	0.0032	2.00

Material	Wavelength (nm)	Solution (mg/l)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor
RM-0204060810	235.0	20	0.2422	0.2418	-0.0004	0.0101	2.00
		40	0.4866	0.4852	-0.0014	0.0115	2.00
		60	0.7414	0.7389	-0.0025	0.0067	2.00
		80	0.9858	0.9842	-0.0016	0.0093	2.00
		100	1.2442	1.2414	-0.0028	0.0086	2.00

UUC* = Unit Under Calibration

Condition of this result of calibration : Spectrophotometer PERKINELMER Model Lambda 25 S/N 501S14123010

Resolution of Wavelength Mode	0.1 nm
Resolution of Photometric Mode	0.0001 A
Parameter Setting	
Measurement Mode	Wavelength, Absorbance
Wavelength Scan	1100 nm-190 nm
Scanning Speed	7.5 nm/min
Data Pitch	0.1 nm
Band width(Wavelength)	1.0 nm
Band width(Vis)	1.0 nm
Band width(Uv)	1.0 nm

Stray Light** UUC* Reading at 220 nm	
Transimission T(%)	Absorbance(A)
0.0117	3.8659

**Specific Acceptance :
Transmission $\leq$ 1.0 T(%), Absorbance $\geq$ 2.0 A
**Stray light not TISI Accredited

The reported uncertainty is based on a standard uncertainty mutiplied by a coverage factor *k*, providing a level of confidence of approximately 95%

End of Calibration Certificate

ARCHEMICA

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.

Operator Signa [redacted] **e 24, 2024**

Test Engineer

บริษัท ไทยยูนีค จำกัด THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200

80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200

Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@thaiunique.com, Website : www.thaiunique.com

GAS CHROMATOGRAPH TEST CERTIFICATION

Certificate No. : SV0824/22063

Instrument Type : Gas Chromatography

Model :CP- 3800

Serial Number : 00734

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

Address : 7 Phahonyothin Soi 24 Phahonyothin Rd. Ladyao Chatuchak Bangkok 10900

Date : 05/08/2024

ELECTRONIC TEST

CPU	☑ PASS	☐ FAIL
LCD TEST	☑ PASS	☐ FAIL
VENT TEST	☑ PASS	☐ FAIL
KEY ECHO TEST	☑ PASS	☐ FAIL
DESTRUCTION RAM TEST	☑ PASS	☐ FAIL

RUN CHROMATOGRAM TEST

DETECTOR : Pulsed Flame Photometric Detector (PFPD Channel Rear)

INJECTOR : Capillary Injector Model 1079

GC CONDITION:

Column	80 ºC hold 1 min., rate 20 ºC/min. to 200 ºC hold 1min.
Injector	220 ºC
Detector	300 ºC
Carrier flow	5 mL/min
H2 flow	13 mL/min
Air1 flow	20 mL/min
Air2 flow	10 mL/min

Column: Capillary Column CP sil 5 CB 0.25 ID x 15 M

Sample: 1 µL Injection FPD Test Sample 0.002% Dodecanethiol, Methyl Parathion in Iso-octane

SENSITIVITY TEST: Methyl Parathion (Area count) = 228,241 Counts

VARIAN

SERVICE DEPARTMENT

FR-SV-029 Rev. 04

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Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@thaiunique.com, Website : www.thaiunique.com

Detector Sensitivity (FID)

Detector Response	Result	Specification
Baseline Noise (µV)	8.57	≤ 50
Baseline Drift (%)	0.09	≤ 1
Sensitivity (S/N for Methyl Parathion)	10,017	≥ 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 Methyl Parathion (%)	1.27	≤ 5
Retention Time Methyl Parathion (%)	0	≤ 0.5

APPR[redacted]
Signat[redacted]
Engin[redacted]
Date : 05/08/2024

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Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@thaiunique.com, Website : www.thaiunique.com

Results Integrated System Testing

Checkout Procedure	PFPD
Detector Position	Rear
Inlet Type	1079 Injector
Methyl Parathion Area 1	229,765
Methyl Parathion Area 2	229,865
Methyl Parathion Area 3	229,045
Methyl Parathion Area 4	229,465
Methyl Parathion Area 5	223,065
Methyl Parathion Area Average	228,241
* % RSD (< 5 %)	1.27

* 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 Methyl Parathion 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.)

% RSD = (std.dev / avg) * 100

Compliance	☑ Pass	☐ Fail	
Performance by	[redacted]		
Date	05/08/2024		

Comments	[redacted]		
Reviewed by	[redacted]	Date	05/08/2024

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Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@thaiunique.com, Website : www.thaiunique.com

Results Integrated System Testing

Checkout Procedure	PFPD
Detector Position	Rear
Inlet Type	1079 Injector
Methyl Parathion RT 1	5.986
Methyl Parathion RT 2	5.986
Methyl Parathion RT 3	5.986
Methyl Parathion RT 4	5.986
Methyl Parathion RT 5	5.986
Methyl Parathion RT Average	5.986
*** % RSD (< 0.5 %)**	0

* The precision specification should be less than 0.5 % RSD ** (Relative Standard Deviation) for an Auto sampler injection and less than 0.5 % for Manual injections. To calculate the %RSD, select the RT Methyl Parathion peak for each of the five (5) samples.

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

% RSD = (std.dev / avg) * 100

Compliance	☑ Pass	☐ Fail
Performance by	[redacted]	
Date	05/08/2024	

Comments	[redacted]		
Reviewed by		Date	05/08/2024

VARIAN

SERVICE DEPARTMENT

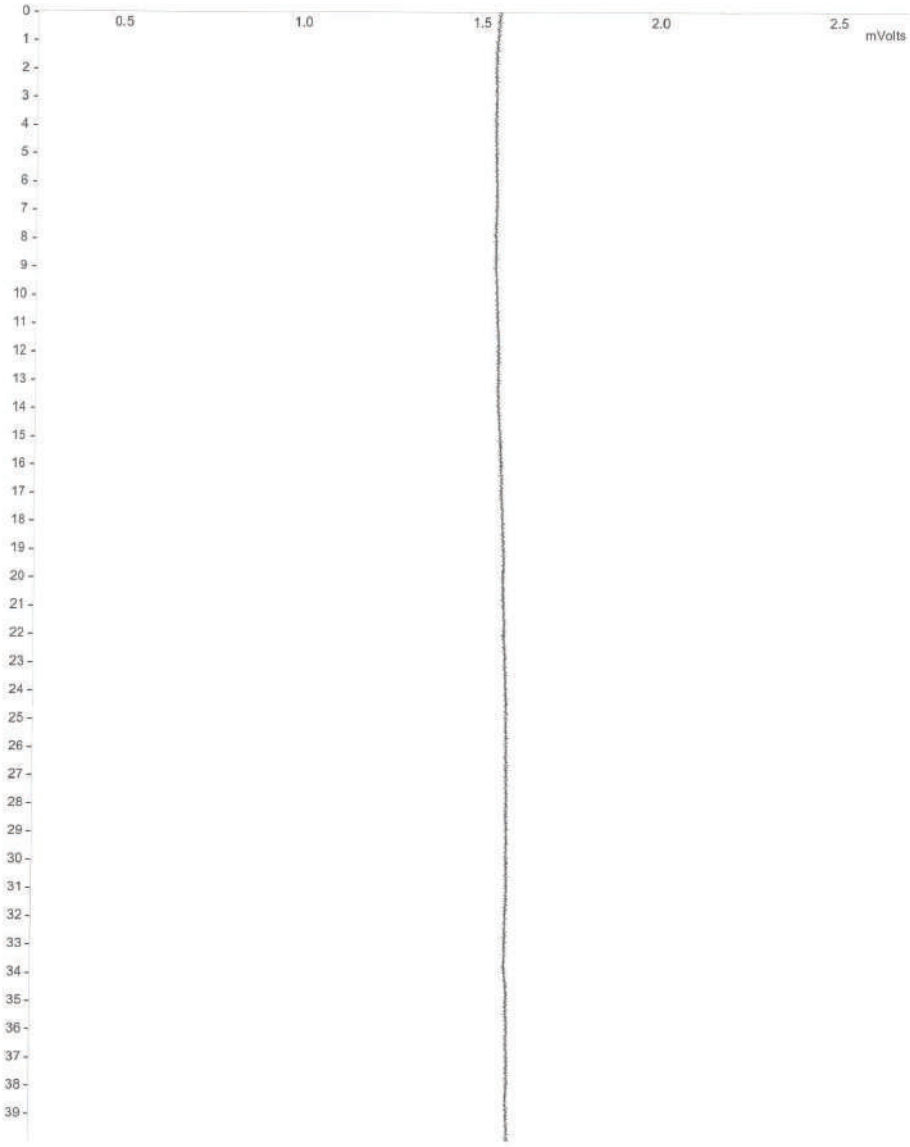
```
Title       :
Run File    : f:\ \sps2024\cal2024\baseline pfpd2024.run
Method File : D:\Method-GC\star C\Star\TU\cal2024\cal0204\baseline FID.mth
Sample ID   : pfpd2024

Injection Date: 5/8/2567 15:35        Calculation Date: 5/8/2567 16:15

Operator    : suwarot                 Detector Type: 3800 (10 Volts)
Workstation: Local Disk               Bus Address  : 44
Instrument :                          Sample Rate  : 10.00 Hz
Channel     : Rear= PFPD              Run Time     : 39.960 min

** LC Workstation Version 6.20 ** 02511-7390-ae7-0265 **

Chart Speed =    0.56 cm/min   Attenuation = 1              Zero Offset = -12%
Start Time  =    0.000   min    End Time    = 39.960  min   Min / Tick  = 1.00
```



Print Date: Sat Jan 01 19:20:21 2005 Page 1 of 1

Title :
Run File : f:\ \sps2024\cal2024\baseline pfpd2024.run
Method File : D:\Method-GC\star C\Star\TU\cal2024\cal0204\baseline FID.mth
Sample ID : pfpd2024

Injection Date: 5/8/2567 15:35 Calculation Date: 5/8/2567 16:15

Operator : suwarot Detector Type: 3800 (10 Volts)
Workstation: Local Disk Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Rear = PFPD Run Time : 39.960 min

** LC Workstation Version 6.20 ** 02511-7390-ae7-0265 **

Run Mode : Analysis
Peak Measurement: Peak Area
Calculation Type: External Standard

Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
Totals:		0.0000		0.000	0			

Total Unidentified Counts : 0 counts

Detected Peaks: 0 Rejected Peaks: 0 Identified Peaks: 0

Multiplier: 1 Divisor: 1 Unidentified Peak Factor: 0

Baseline Offset: 1579 microVolts LSB: 1 microVolts

Noise (used): 30 microVolts - monitored before this run

Manual injection

Data Handling: No peaks

****

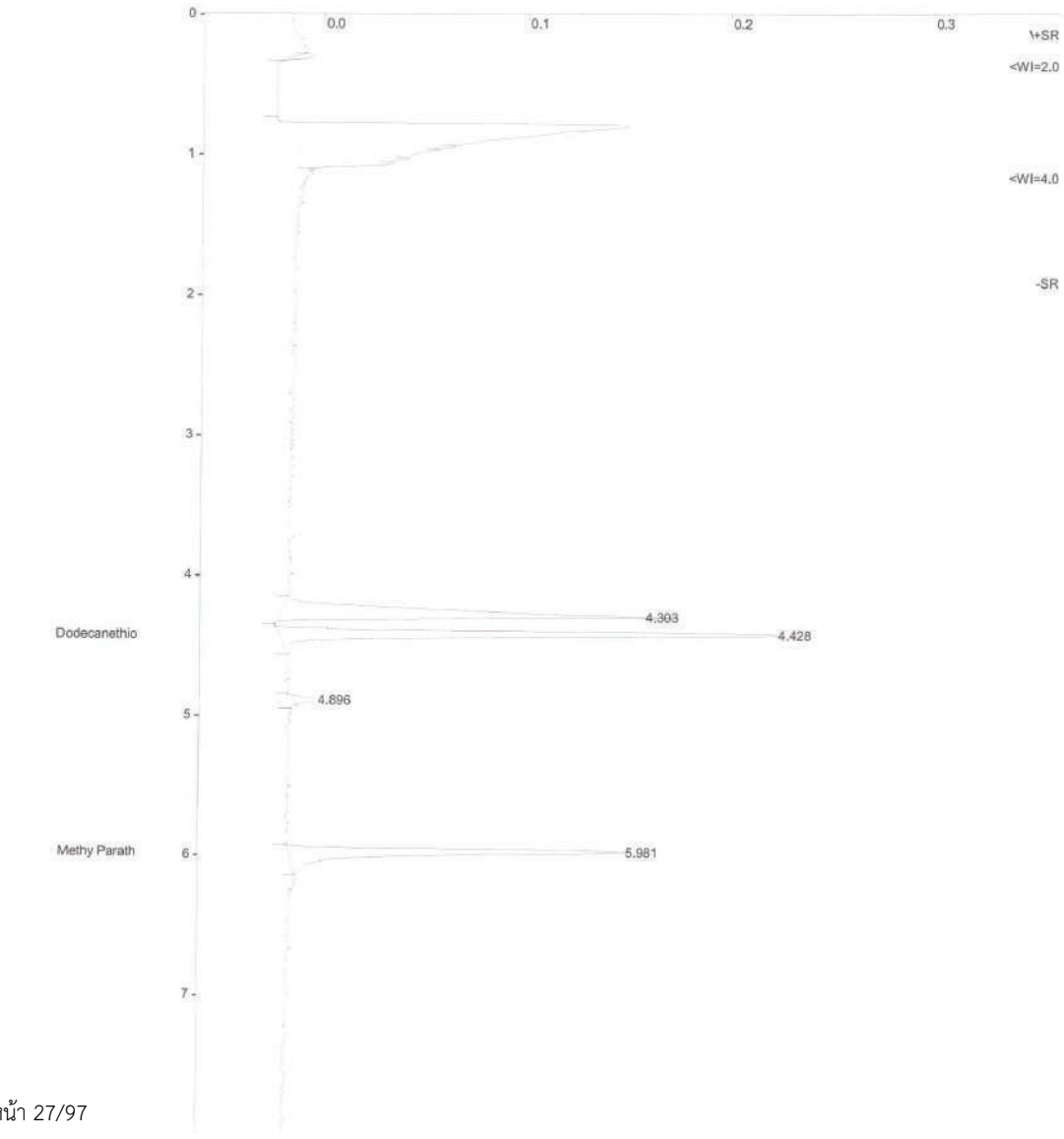
Title :
Run File : d:\calpfpd2024\sps cal 2024\cal pfpd 2024\cal pfpd001.run
Method File : D:\Method-GC\star C\Star\TU\cal 2024\pfpd.mth
Sample ID : cal pfpd

Injection Date: 05/08/2567 09:40 Calculation Date:05/08/2567 09:48

Operator : suwarot Detector Type: 3800 (10 Volts)
Workstation: Local Disk Bus Address : 44
Instrument : Varian Star #1 Sample Rate : 10.00 Hz
Channel : Rear = PFPD Run Time : 7.993 min

** GC Workstation Version 6.20 ** 03334-6390-826-0764 **

Chart Speed = 2.83 cm/min Attenuation = 159 Zero Offset = 14%
Start Time = 0.000 min End Time = 7.993 min Min / Tick = 1.00



Print Date: Mon Oct 08 15:50:59 2024 Page 1 of 1

Title :
Run File : d:\calpfpd2024\sps cal 2024\cal pfpd 2024\cal pfpd001.run
Method File : D:\Method-GC\star C\Star\TU\cal 2024\Spfpd.mth
Sample ID : baseline

Injection Date: 05/08/2567 09:40 Calculation Date:05/08/2567 09:48

Operator : suwarot Detector Type: 3800 (10 Volts)
Workstation: Local Disk Bus Address : 44
Instrument : Varian Star #1 Sample Rate : 10.00 Hz
Channel : Rear - PFPD Run Time : 7.993 min

** GC Workstation Version 6.20 ** 03334-6390-826-0764 **

Run Mode : Analysis
Peak Measurement: Peak Area
Calculation Type: External Standard

Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1	Dodecanethio	36.8031	4.428	-0.054	412865	PB	2.7	C
2	Methy Parath	44.1871	5.981	-0.017	247872	BB	2.6	C
	Totals:	80.9902		-0.071	660737			

Status Codes:
C - Out of calibration range

Total Unidentified Counts : 720837 counts

Detected Peaks: 4 Rejected Peaks: 0 Identified Peaks: 2

Multiplier: 1 Divisor: 1 Unidentified Peak Factor: 0

Baseline Offset: -16357 microVolts LSB: 1 microVolts

Noise (used): 2956 microVolts - monitored before this run

Manual injection

Calib. out of range; No Recovery Action Specified

****

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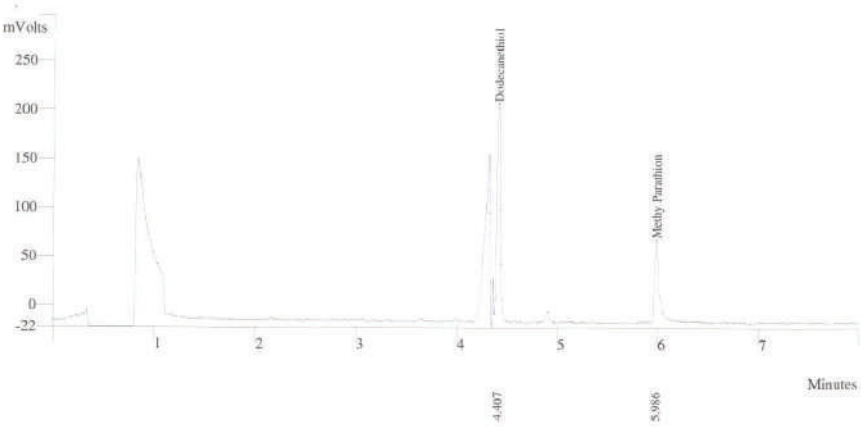
Sample ID: **pfpd std**

Operator (Inj): [redacted]
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: Local Disk
Instrument (Inj): Varian Star #1

VARIAN

Run Mode: Analysis
Peak Measurement: Peak Area
Calculation Type: External Std.

c:\star\data\tu\cal2024\cal pfpd 2024\cal pfpd001.run A = PFPD 10V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	Dodecanethiol	33.9796	4.407	443921	PB	2.5
2	Methy Parathion	22.2717	5.986	229765	BB	2.5
	Totals	**56.2513**		**673686**		

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1 Of 1

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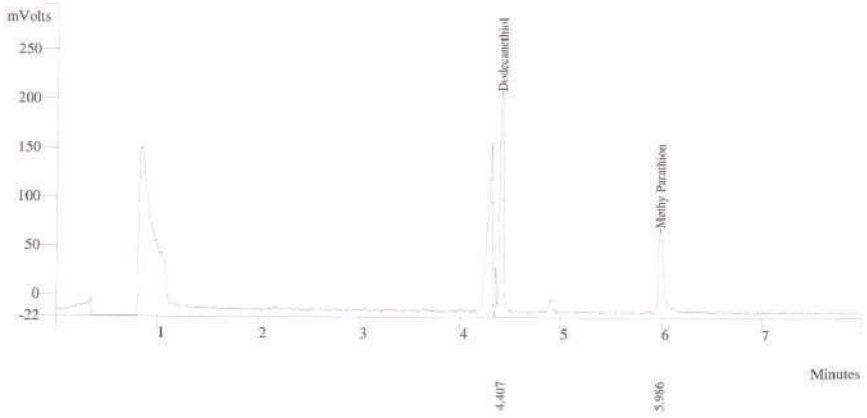
Sample ID: **pfpd std**

Operator (Inj): [redacted]
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: Local Disk
Instrument (Inj): Varian Star #1

VARIAN

Run Mode: Analysis
Peak Measurement: Peak Area
Calculation Type: External Std.

c:\star\data\tu\cal2024\cal pfpd 2024\cal pfpd002.run A = PFPD 10V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	Dodecanethiol	32.9896	4.407	448981	PB	2.5
2	Methy Parathion	20.2717	5.986	229865	BB	2.5
	Totals	**53.2613**		**678846**		

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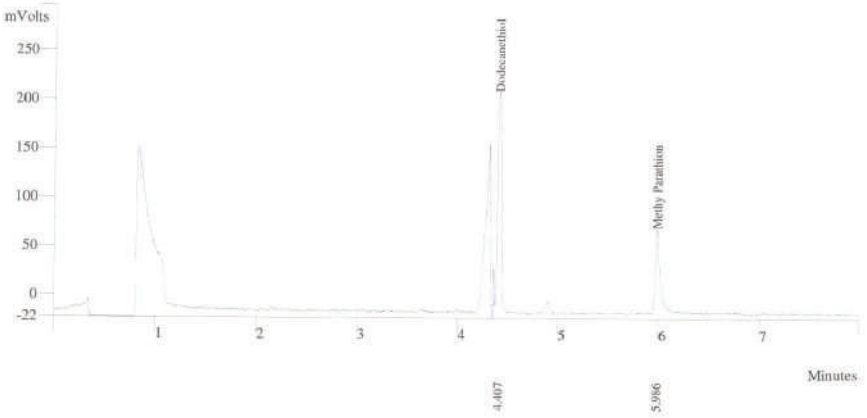
Sample ID: pfpd std

Operator (Inj): [redacted]
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: Local Disk
Instrument (Inj): Varian Star #1

VARIAN

Run Mode: Analysis
Peak Measurement: Peak Area
Calculation Type: External Std.

c:\star\data\tu\cal2024\cal pfpd 2024\cal pfpd003.run A = PFPD 10V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	Dodecanethiol	32.9896	4.407	428985	PB	2.5
2	Methy Parathion	21.2717	5.986	229045	BB	2.5
	Totals	**54.2613**		**658030**		

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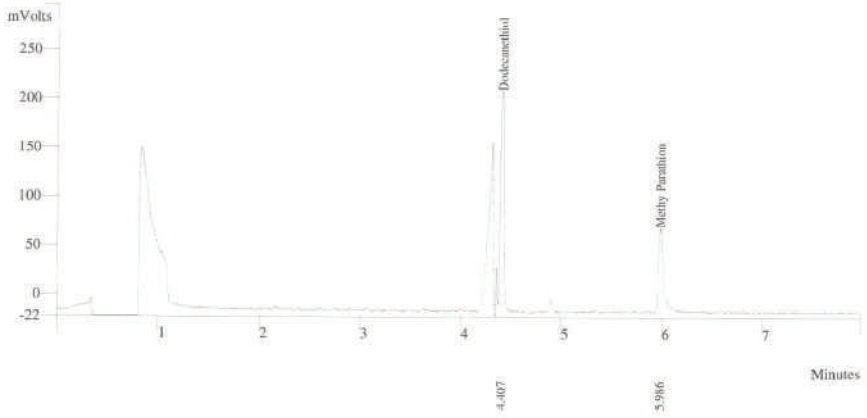
Sample ID: **pfpd std**

Operator (Inj): [redacted]
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: Local Disk
Instrument (Inj): Varian Star #1

VARIAN

Run Mode: Analysis
Peak Measurement: Peak Area
Calculation Type: External Std.

c:\star\data\tu\cal2024\cal pfpd 2024\cal pfpd004.run A = PFPD 10V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	Dodecanethiol	32.9896	4.407	438981	PB	2.5
2	Methy Parathion	21.2717	5.986	229465	BB	2.5
	Totals	**54.2613**		**668446**		

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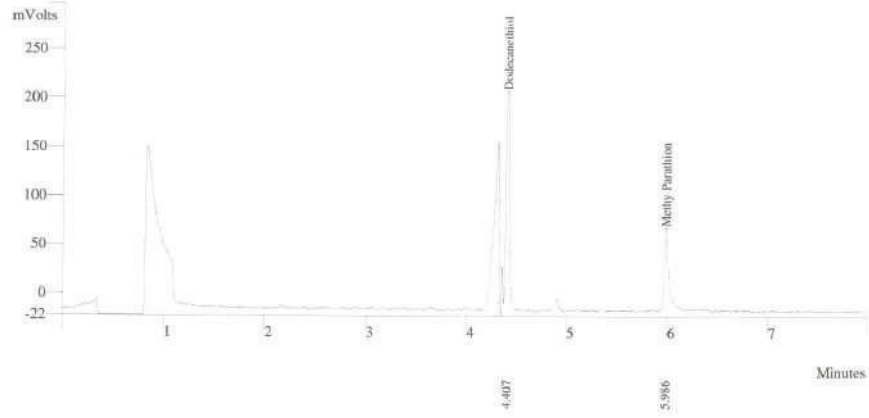
Sample ID: **pfpd std**

Operator (Inj): [redacted]
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: Local Disk
Instrument (Inj): Varian Star #1

VARIAN

Run Mode: Analysis
Peak Measurement: Peak Area
Calculation Type: External Std.

c:\star\data\tu\cal2024\cal pfpd 2024\cal pfpd005.run A = PFPD 10V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	Dodecanethiol	32.9896	4.407	459283	PB	2.5
2	Methy Parathion	21.2717	5.986	223065	BB	2.5
	Totals	**54.2613**		**682348**		

THAI UNIQUE CO.,LTD.

Measuretronix Limited
2425/2 Lat Phrao Road, Saphan Song
Wangthonglang, Bangkok 10310, Thailand
Phone : 0-2514-1000, 0-2514-1234
Fax : 0-2514-0001, 0-2514-0003
Website : www.measuretronix.com

NSC-TISI-TIS 17025
CALIBRATION 0210

Certificate of Calibration

Certificate Number	: LF24-0278
Equipment	: Thermometer
Manufacturer	: Fluke
Model	: 51
Serial Number	: 5910857
Asset Number	: 5910857
Customer	: Thai Unique Co., Ltd.
	80-82 Prachathipatai Road,
	Bangkhunphrom, Pranakorn,
	Bangkok 10200
Date of Calibrate	: 26-Jun-2024
Date of Issue	: 27-Jun-2024

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

This calibration certificate applies only to the item identified and shall not be reproduced other than in full, without specific written approved by Measuretronix Cal-Lab. Calibration certificates without signature are not valid.

The measurements marked with an asterisk (*) in this certificate are outside our range of accreditation. They have been included for completeness.

The Calibration interval (Cal.Due) is the responsibility of the end user.

[redacted]

Measuretronix Limited

Calibration Report

UUC : Fluke 51 Thermometer
Serial No. : 5910857
Asset No. : 5910857
Procedure : CP-LF-04:Rev.02
Note : Refer to Fluke 51,52 Operator's Manual Rev 1 3/86, Oct 1985

Customer : Thai Unique Co., Ltd.
Address : 80-82 Prachathipatai Road, Bangkhunphrom, Pranakorn, Bangkok 10200

Certificate No. : LF24-0278
Report data type : As-Found
Date of Calibrate : 26-Jun-2024
Date of Receive : 17-Jun-2024

Environment condition
Temperature : 23 °C ± 3 °C
Humidity : 50 %RH ± 20 %RH

Measuretronix Cal-Lab certifies that the above listed instrument meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). The measurements are traceable to national or international measurement standards or accept fundamental or natural physical constants or have been derived by approved ratio techniques as state in the Standard Used below. The policies and procedures used comply with ISO/IEC 17025:2017.

This report applies only to the item identified and shall not be reproduced other than in full, without specific written approved by Measuretronix Cal-Lab.

The uncertainties shown are the expanded uncertainties, which calculated from the standard uncertainties multiplied by a coverage factor of k = 2, providing a measurement confidence level of approximately 95%.

No statement of compliance with specifications is made or implied on this certificate.

Remark : *The units of uncertainty values in this report are referred to the below details :*
*"**Volt**" or "**V**' for voltage, "**Ampere**" or "**A**" for current, "**Ohm**" or "Ω" for resistance, "**Farad**" or "**F**"for capacitance, "**Hertz**" or "**Hz**" for frequency, "**deg C**" or "**°C**" for degree Celsius, "**deg F**" or "**°F**" for degree Fahrenheit, etc.*

Standard Used

Serial/Asset	Description	Traceable	Cert.No.	Cal.Date	Due Date
6400011	Fluke 5500A Calibrator	NIMT	EE-0017-24	7-Mar-2024	6-Mar-2025

Test Data

TEST	RANGE	Nominal Value	UUC Tol. (+/-)	Test Result	Error	Uncertainty (+/-)
		THERMOCOUPLE MEASUREMENT CALIBRATION				
		TYPE K THERMOCOUPLE				
1		-195.0 °C*	0.9 °C	-195.4 °C	-0.4 °C	0.27 °C
2		-100.0 °C	0.8 °C	-100.5 °C	-0.5 °C	0.21 °C
3		-50.0 °C	0.8 °C	-50.2 °C	-0.2 °C	0.21 °C
4		0.0 °C	0.7 °C	0.0 °C	0.0 °C	0.21 °C
5		100.0 °C	0.8 °C	100.1 °C	0.1 °C	0.21 °C
6		300.0 °C	1.0 °C	300.2 °C	0.2 °C	0.21 °C
7		500.0 °C	1.2 °C	500.1 °C	0.1 °C	0.21 °C
8		1365.0 °C	2.1 °C	1365.2 °C	0.2 °C	0.32 °C
		TYPE J THERMOCOUPLE				
9		-195.0 °C*	1.0 °C	-194.4 °C	0.6 °C	0.22 °C
10		-100.0 °C	0.9 °C	-99.3 °C	0.7 °C	0.18 °C
11		-50.0 °C	0.9 °C	-49.4 °C	0.6 °C	0.18 °C
12		0.0 °C	0.8 °C	0.5 °C	0.5 °C	0.18 °C
13		100.0 °C	0.9 °C	100.4 °C	0.4 °C	0.18 °C
14		300.0 °C	1.1 °C	300.8 °C	0.8 °C	0.18 °C
15		755.0 °C	1.6 °C	755.3 °C	0.3 °C	0.18 °C

End of Calibration Report

WK Electric Co.,Ltd.
68/242 Moo 5, Sawaipracharaj Rd., Tumbol Ladsawai, Amphur Lamlukka, Pathumthani 12150
Tel. +66 2993 4773, +66 2153 7132-3 Fax. +66 2994 5509 E-mail : wk.calibrations@gmail.com www.wk-etc.com

Certificate of Calibration

Certificate No.: WK2312-031-1

Customer : THAI UNIQUE CO., LTD.
80-82 PRACHATHIPATAI RD., BANGKHUNPHROM,
PRANAKORN, BANGKOK 10200

Instrument : AMD Flow Meter
Manufacturer : Agilent Technologies
Model : G6691A
Serial No. : MY16470347
Identity No. : SV-DF-001
Range : 0 ml/min to 750 ml/min
Resolution : See to data
Calibration Method : CP-WK-M10

Ambient Temperature : (23 ± 2) °C
Humidity : (50 ±15) %RH
Received Date : 6-Dec-23
Calibrated Date : 7-Dec-23
Issued Date : 12-Dec-23
Calibrated Location : In Lab

Reference standard instruments :

Instrument	Serial No.	Certificate No.	Due Date	Traceability to
Flow Calibrator	140215-134	L202304114-001	18-Apr-25	MIT
Primary Flow Calibrator	1107-S	WK2305-049-5	22-May-24	WK Electric Co.,Ltd.

MIT : Miracle International Technology Co.,Ltd.
This result calibrate was found accurate as shown on date place of calibrate only
This certificate is traceability to the International System of Unit (SI)

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

Calibrated [redacted]

This certificate may not be reproduced except in full unless permission for the reproduction has been obtained in writing from the laboratory.

WK Electric Co.,Ltd.
68/242 Moo 5, Sawaipracharaj Rd., Tumbol Ladsawai, Amphur Lamlukka, Pathumthani 12150
Tel. +66 2993 4773, +66 2153 7132-3 Fax. +66 2994 5509 E-mail : wk.calibrations@gmail.com www.wk-etc.com

Calibration Results

Certificate No. : WK2312-031-1

Calibration Result of the Accuracy

Function : Flow Measurement
Range : 0 ml/min to 750 ml/min
Resolution : 0.01 / 0.1 / 1 ml/min

Unit : ml/min

UUC Setting		STD Reading	Error	Uncertainty (±)	Tolerance Limit Values (ml/min)
Scale	ml/min				
0	0.00	0.00	0.00	3.3	-0.20 ~ 0.20
50	50.7	51.15	-0.45	3.3	48.80 ~ 51.20
300	300	300.4	-0.4	3.3	293.8 ~ 306.2
450	450	450.7	-0.7	3.3	440.8 ~ 459.2
550	550	549.5	0.5	3.3	533.5 ~ 566.5
650	650	649.3	0.7	3.3	630.5 ~ 669.5
700	700	699.2	0.8	3.3	679.0 ~ 721.0

(X) Without Adjustment ( ) After Adjustment

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**** End of Certificate****

Certificate

It is hereby certified that

Suwarot Trikainut

Has successfully completed the Application Training for

Basic Gas Chromatography and Sampler

Training Contents were:

Hardware Operation, Software Operation, Data analysis and Troubleshooting : Model

CP-3800, 3900, 450-GC, 430-GC, 456-GC, 436-GC

At Thai Unique Co., Ltd, Bangkok, Thailand

On 15th March, 2019

[redacted]

คุณภาพอากาศในสถานประกอบการ

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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter | Model : Defender 510-H | S/N : 136164

Environmental Conditions
Temperature . 25 ± 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	02/10/2024	1,000	1,500	2,000	1,010	1,497	2,001	0.994x + 9.527	1.000
B42	SKC	224-PCXR4	626041	04/10/2024	1,000	1,500	2,000	998	1,507	2,005	1.009x - 14.416	0.999
B43	SKC	224-PCXR4	030636	03/10/2024	1,000	1,500	2,000	1,005	1,496	2,001	0.995x + 6.369	1.000
B44	SKC	224-PCXR8	529341	03/10/2024	1,000	1,500	2,000	1,010	1,494	2,000	0.990x + 14.704	1.000
B45	SKC	224-PCXR8	529594	02/10/2024	1,000	1,500	2,000	1,014	1,504	2,010	0.997x + 11.890	1.000
B46	SKC	224-PCXR8	566743	04/10/2024	1,000	1,500	2,000	1,006	1,514	2,009	1.002x - 1.391	0.999
B47	SKC	224-PCXR8	566747	02/10/2024	1,000	1,500	2,000	1,000	1,513	2,009	1.009x - 11.714	1.000
B48	SKC	224-PCXR8	566753	04/10/2024	1,000	1,500	2,000	1,020	1,513	2,012	0.995x + 15.140	0.999
B49	SKC	224-PCXR8	566780	04/10/2024	1,000	1,500	2,000	999	1,498	2,000	1.000x + 0.144	1.000
B50	SKC	224-PCXR8	500400	04/10/2024	1,000	1,500	2,000	1,000	1,508	2,006	1.004x - 5.541	1.000
B51	SKC	224-PCXR8	500363	04/10/2024	1,000	1,500	2,000	996	1,506	2,005	1.007x - 10.582	1.000
B52	SKC	224-PCXR8	093186	03/10/2024	1,000	1,500	2,000	998	1,509	2,003	1.006x - 10.386	1.000
B53	SKC	224-PCXR8	707670	03/10/2024	1,000	1,500	2,000	1,000	1,493	1,996	0.994x + 4.977	0.999
B54	SKC	224-PCXR3	509821	02/10/2024	1,000	1,500	2,000	1,001	1,493	2,008	1.006x - 9.295	1.000
B55	SKC	224-PCXR3	510710	04/10/2024	1,000	1,500	2,000	999	1,508	2,004	1.005x - 8.519	1.000
B56	SKC	224-PCXR3	511450	03/10/2024	1,000	1,500	2,000	1,003	1,502	2,012	1.008x - 10.418	1.000
B57	SKC	224-PCXR3	510798	02/10/2024	1,000	1,500	2,000	997	1,503	2,005	1.009x - 15.639	1.000
B58	SKC	224-PCXR3	509852	02/10/2024	1,000	1,500	2,000	1,016	1,517	2,008	0.996x + 13.453	0.999
B59	SKC	224-PCXR3	509862	04/10/2024	1,000	1,500	2,000	999	1,511	2,010	1.010x - 14.912	0.999
B60	SKC	224-PCXR3	512655	02/10/2024	1,000	1,500	2,000	1,009	1,514	1,996	0.992x + 12.737	0.999
B61	SKC	224-PCXR3	503915	04/10/2024	1,000	1,500	2,000	1,005	1,503	2,006	1.011x - 15.735	0.999
B62	SKC	224-PCXR3	505975	03/10/2024	1,000	1,500	2,000	1,006	1,513	2,008	1.002x - 0.788	0.999
B63	SKC	224-PCXR3	511432	02/10/2024	1,000	1,500	2,000	1,020	1,513	2,013	0.995x + 14.152	0.999
B64	SKC	224-PCXR3	508302	04/10/2024	1,000	1,500	2,000	1,000	1,508	2,007	1.004x - 5.189	1.000
B65	SKC	224-PCXR3	508310	02/10/2024	1,000	1,500	2,000	997	1,514	2,005	1.006x - 7.652	1.000
B66	SKC	224-PCXR3	509861	04/10/2024	1,000	1,500	2,000	996	1,499	2,003	1.009x - 13.421	1.000
B67	SKC	224-PCXR3	506295	03/10/2024	1,000	1,500	2,000	998	1,510	2,004	1.010x - 17.666	0.999
B68	SKC	224-PCXR3	505872	03/10/2024	1,000	1,500	2,000	998	1,494	1,997	0.996x + 2.043	1.000
B69	SKC	224-PCXR3	508375	04/10/2024	1,000	1,500	2,000	996	1,499	2,003	1.004x - 4.961	1.000
B70	SKC	224-PCXR3	510623	03/10/2024	1,000	1,500	2,000	1,002	1,504	2,000	1.002x - 1.959	1.000
B71	SKC	224-PCXR3	508367	03/10/2024	1,000	1,500	2,000	996	1,503	1,999	1.003x - 5.913	1.000
B72	SKC	224-PCXR3	505977	04/10/2024	1,000	1,500	2,000	997	1,499	1,996	0.998x - 0.140	1.000
B73	SKC	224-PCXR3	512606	02/10/2024	1,000	1,500	2,000	1,005	1,504	2,007	1.008x - 11.262	1.000
B74	SKC	224-PCXR3	505993	03/10/2024	1,000	1,500	2,000	998	1,504	2,002	1.005x - 10.110	1.000
B75	SKC	224-PCXR3	509820	02/10/2024	1,000	1,500	2,000	1,004	1,503	2,007	1.009x - 12.679	1.000
B76	SKC	224-PCXR3	509811	04/10/2024	1,000	1,500	2,000	1,005	1,493	2,003	0.997x + 5.309	1.000
B77	SKC	224-PCXR3	508301	02/10/2024	1,000	1,500	2,000	998	1,495	2,002	1.002x - 3.498	1.000
B78	SKC	224-PCXR3	510677	03/10/2024	1,000	1,500	2,000	1,015	1,505	2,010	1.003x - 0.420	0.999
B79	SKC	224-PCXR3	510920	04/10/2024	1,000	1,500	2,000	999	1,493	2,004	1.008x - 14.332	1.000

[redacted]

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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter	Model : Defender 510-H	S/N : 136164

Environmental Conditions

Temperature . 25 ± 3 °C
Pressure . 1010 ± 15 mmbar

Personal Pump Data				Calibration Data								
					Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
No.	Brand	Model	Serial No.	Date	1	2	3	1	2	3	y	R^2
B80	SKC	224-PCXR3	504569	03/10/2024	1,000	1,500	2,000	998	1,507	2,003	1.007x – 12.517	1.000
B81	SKC	224-PCXR3	503480	03/10/2024	1,000	1,500	2,000	997	1,496	1,997	1.001x - 3.994	1.000
B82	SKC	224-PCXR3	505673	03/10/2024	1,000	1,500	2,000	1,005	1,503	2,006	1.001x – 1.851	0.999
B83	SKC	224-PCXR3	510785	02/10/2024	1,000	1,500	2,000	1,001	1,505	2,000	0.999x + 0.108	1.000
B84	SKC	224-PCXR3	508333	02/10/2024	1,000	1,500	2,000	1,003	1,504	1,999	1.001x - 1.315	1.000
B85	SKC	224-PCXR3	505757	02/10/2024	1,000	1,500	2,000	1,003	1,506	2,001	1.003x - 1.855	1.000
B86	SKC	224-PCXR3	512625	04/10/2024	1,000	1,500	2,000	1,000	1,501	1,998	1.000x - 1.111	1.000
B87	SKC	224-PCXR3	504324	04/10/2024	1,000	1,500	2,000	999	1,509	2,007	1.009x – 15.683	0.999
B88	SKC	224-PCXR3	508307	04/10/2024	1,000	1,500	2,000	999	1,500	1,996	0.996x + 4.825	1.000
B89	SKC	224-PCXR3	509860	04/10/2024	1,000	1,500	2,000	1,002	1,503	2,006	1.008x – 10.170	1.000
B90	SKC	224-PCXR3	508366	02/10/2024	1,000	1,500	2,000	999	1,506	2,003	1.000x – 0.612	1.000
B91	SKC	224-PCXR3	510919	02/10/2024	1,000	1,500	2,000	1,011	1,504	2,001	0.991x + 17.894	1.000
B92	SKC	224-PCXR3	510987	03/10/2024	1,000	1,500	2,000	1,004	1,505	2,008	1.008x - 10.210	1.000
B93	SKC	224-PCXR3	509845	03/10/2024	1,000	1,500	2,000	1,005	1,505	2,005	1.005x – 5.793	1.000
B94	SKC	224-PCXR8	A127871	03/10/2024	1,000	1,500	2,000	1,003	1,503	2,001	1.003x – 3.458	1.000
B95	SKC	224-PCXR8	A127921	01/10/2024	1,000	1,500	2,000	998	1,506	2,006	1.008x – 11.706	1.000
B96	SKC	224-PCXR8	A127942	01/10/2024	1,000	1,500	2,000	1,003	1,502	2,000	0.999x + 2.679	1.000
B97	SKC	224-PCXR8	A127955	01/10/2024	1,000	1,500	2,000	1,004	1,505	2,008	1.010x – 12.557	1.000
B98	SKC	224-PCXR8	A127956	01/10/2024	1,000	1,500	2,000	998	1,497	2,001	1.004x – 8.311	1.000

[redacted]

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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									
				Flow Rate (ml/min)						Value From Calibration Curve		
				Flow Rate (Reading)			Actual (Q std.)					
No.	Brand	Model	Date	1	2	3	1	2	3	y	R^2	
H-801	Dwyer	VFB-65	02/10/2024	500	1,000	2,000	502.4	998.3	1992.4	0.996x + 5.889	1.000	
H-802	Dwyer	VFB-65	04/10/2024	500	1,000	2,000	498.5	1001.9	2009.0	0.997x + 5.707	1.000	
H-803	Dwyer	VFB-65	04/10/2024	500	1,000	2,000	499.2	996.1	2011.4	1.004x - 11.451	0.999	
H-804	Dwyer	VFB-65	04/10/2024	500	1,000	2,000	504.0	999.2	1995.1	0.995x + 7.219	1.000	
H-805	Dwyer	VFB-65	03/10/2024	500	1,000	2,000	498.7	1001.8	2007.6	0.997x + 4.568	1.000	
H-806	Dwyer	VFB-65	03/10/2024	500	1,000	2,000	497.3	999.1	2012.1	1.005x - 11.101	0.999	
H-807	Dwyer	VFB-65	01/10/2024	500	1,000	2,000	503.0	1004.1	1992.6	0.998x + 6.074	1.000	
H-808	Dwyer	VFB-65	02/10/2024	500	1,000	2,000	503.7	1000.4	1994.6	0.992x + 12.996	1.000	
H-809	Dwyer	VFB-65	01/10/2024	500	1,000	2,000	501.3	1001.6	1990.3	0.999x + 4.046	0.999	
H-810	Dwyer	VFB-65	01/10/2024	500	1,000	2,000	500.3	1002.0	1992.6	0.995x + 8.990	1.000	

[redacted]

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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-801	Dwyer	VFA-21	02/10/2024	50	100	200	50.8	99.7	201.2	0.990x + 1.455	1.000
L-802	Dwyer	VFA-21	04/10/2024	50	100	200	50.3	98.8	199.5	1.003x - 0.022	0.999
L-803	Dwyer	VFA-21	04/10/2024	50	100	200	50.6	100.7	200.1	1.002x + 0.030	1.000
L-804	Dwyer	VFA-21	04/10/2024	50	100	200	50.9	101.3	201.6	0.993x + 2.147	1.000
L-805	Dwyer	VFA-21	03/10/2024	50	100	200	49.9	102.0	200.2	1.001x + 0.423	1.000
L-806	Dwyer	VFA-21	03/10/2024	50	100	200	50.2	100.7	200.9	0.999x + 0.931	1.000
L-807	Dwyer	VFA-21	01/10/2024	50	100	200	50.1	100.5	200.9	0.999x + 1.192	0.999
L-808	Dwyer	VFA-21	02/10/2024	50	100	200	50.1	101.2	199.0	1.001x - 0.298	1.000
L-809	Dwyer	VFA-21	01/10/2024	50	100	200	50.2	99.0	202.1	1.001x + 0.711	0.999
L-810	Dwyer	VFA-21	01/10/2024	50	100	200	50.3	100.2	201.7	1.003x + 0.455	1.000

[redacted]

ARCHEMICA

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[redacted], Ltd.

Operato[redacted]ne 24, 2024

Test Engineer

บริษัท ศูนย์วิเคราะห์น้ำ จำกัด

THC Calibration Services
THAI HEART CALIBRATION CO., LTD.
102/1 Moo 5, Phraek Sa, Muang, Samut Prakan 10280
Tel. 0-2894-2162, 0-2757-8495, 0-2757-8496 Fax. 0-2757-8507

ilac-MRA ANAB ACCREDITED ISO/IEC 17025 CALIBRATION LABORATORY AC-2695

CERTIFICATE OF CALIBRATION

Certificate No.: C0-1808005/23 **Page** 1 **of total** 4 **pages**

Customer WATER ANALYSIS CENTER CO., LTD.
1/94 Moo 5, T.Kanham,
A.U-thai, Ayutthaya 13210

Equipment pH Meter
Manufacturer METTLER TOLEDO **Model** SevenCompact S220
Serial No. B327527211 **ID No.** WWL 0068
Description Range : 0 - 14 pH, Resolution : 0.01 pH

Environmental Conditions Ambient Temperature: (20 ± 2) °C
Relative Humidity: (50 ± 10) %
Atmospheric Pressure: -
Calibration Location Jayhawks Laboratory (CL&GL)
Received Date 18 August 2023
Calibration Date 18 August 2023
Date of Issue 21 August 2023
Condition of Artifacts Used conditions but can be calibrated

[redacted]

( ) (Krisyosl K.) ( ) (Sakda Y.) (Dr. Ekachai Puttitwong)
( ) (Patiphan K.) (✓) (Onnapa P.)
( ) (Pongsak H.) ( ) (Nitiphong K.)
( ) (Kanung C.) ( ) (Nonthachai K.)
( ) (Pramong P.) ( ) (Noppol P.)

This calibration certificate shall not be reproduced other than in full except with the prior written approval of the Thai Heart Calibration Co., Ltd.

THC Calibration Services
THAI HEART CALIBRATION CO., LTD.
102/1 Moo 5, Phraek Sa, Muang, Samut Prakan 10280
Tel. 0-2894-2162, 0-2757-8495, 0-2757-8496 Fax. 0-2757-8507
ilac-MRA ANAB ACCREDITED ISO/IEC 17025 CALIBRATION LABORATORY AC-2695

Reference Method:
- The calibration method used was CP-178 based on an in-house method.
- This certificate can be traceable to the national standards, which is realized the shown measurement units according to the International System of Units (SI Units).

Reference Standard:

Type	pH Value	Lot No.	Due Date	Traceability
pH Standard Solution	4.01	030822	Feb. 9, 2024	NIMT
	7.01	300522	Feb. 9, 2024	
	10.01	230822	Feb. 7, 2024	

Type	Model	Serial No.	Certificate No.	Due Date	Traceability
Documenting Process Calibrator	754	2630521	I0-2412001/22	Dec. 23, 2023	THC
Digital Thermometer with Sensor	1523 / 5622	1709138 / 4605984-005	I0-0806001/23	Jun. 8, 2024	

Remark: This certificate is traceable to the International System of Unit (SI Unit) through:
- NIMT, National Institute of Metrology (Thailand).
- THC, Thai Heart Calibration Co., Ltd.

Measurement Results:

1. Function Simulated pH Meter

Standard Applied	Nominal Value	UUC Reading		Uncertainty
(mV)	(pH)	pH	mV	(± mV)
177.48	4.00	4.01	177.4	0.060
0.00	7.00	7.00	0.0	0.060
-177.48	10.00	10.01	-177.4	0.060

UUC : Unit Under Calibration
Note : Adjust Curve to simulate pH (4,7,10)

Calibrated by Kittipong

Certificate No.: C0-1808005/23 **Page** 3 **of total** 4 **pages**

Measurement Results (Cont.):

2. Calibration of pH Electrode (Serial No.: 3222623)

pH Standard Solution	Measured Value		Uncertainty
(pH)	(pH)	(mV)	(± pH)
4.01	4.01	180.0	0.013
7.01	7.00	4.0	0.013
10.01	10.01	-172.0	0.013

Note : Adjust Curve to Buffer Solution pH (4,7,10)
Temperature stability of micro bath : 25 ± 0.2°C

The above reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor k = 2.00, providing a level of confidence approximately 95%.

Calibrated by [redacted]

THC Calibration Services
THAI HEART CALIBRATION CO., LTD.
112/1 Moo 5, Phraek Sa, Muang, Samut Prakan 10280
Tel. 0-2757-8503, 0-2757-8504, 0-2757-8506, Fax. 0-2757-8507
ilac-MRA ANAB ACCREDITED ISO/IEC 17025 CALIBRATION LABORATORY AC-2695

Certificate No.: C0-1808005/23 **Page** 4 **of total** 4 **pages**

Reference Method:

- The calibration method used was CP-096 based on an in-house method.
- The temperature scale used was an ITS-90.
- This certificate can be traceable to the national standards, which is realized the shown measurement units according to the International System of Units (SI Units).

Reference Standard Instruments:

Type	Model	Serial No.	Cert. No.	Due Date	Traceability
Thermometer Readout	1529-R	B7C853	I0-0911001/22	Nov. 9, 2023	THC
Platinum Resistance Thermometer	5626	4854	C0A30047	Oct. 22, 2023	FLUKE
Liquid Bath	XORTS-40A	XO111019	I0-2405001/23	May 25, 2025	THC

Remark: This certificate is traceable to the International System of Unit (SI Unit) through:
- THC, Thai Heart Calibration Co., Ltd.
- FLUKE, Fluke Comporation, U.S.A.

Measurement Results: (X) Without Adjustment

Dimension of probe : Diameter 4 mm. Sensor Type : RTD (PT100)

Immersion Depth (mm.)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
120	22.00	22.2	-0.20	0.065
120	25.00	25.2	-0.20	0.065
120	28.00	28.2	-0.20	0.065

UUC : Unit Under Calibration

The above reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor k = 2.00, providing a level of confidence approximately 95%.

- End of Certificate -

Calibrated by [redacted]

ก ง-2 หน้า 39/97

MCAL
MASTER CALIBRATION CO.,LTD.

Master Calibration Co.,Ltd.
547 Soi Ratchadanivat, Kwaeng Samsennok, Khet Huaykwang, Bangkok 10310
Tel. : (02) 274 2978-9, (02) 2742987-8 Fax : (02) 274 2518, (02) 274 2989
Website : www.mastercalibration.com E-mail : calibrate@mastercalibration.com

Certificate of Calibration

NSC-TISI-TIS 17025
CALIBRATION 0183

TEMPERATURE
CONTROLLER ENCLOSURES

Certificate No.: MC 2307702

Customer	:	Water Analysis Center Co., Ltd. 1/94 Moo 5, T.Kantham, A.U-Thai, Ayutthaya 13210.		
Reference Job No.	:	23-1577	Received Date	: 11 July 2023
Description	:	Refrigerator		
Manufacturer	:	SANDEN INTERCOOL	Model	: SEC-1500SBD
Serial No.	:	SEC1500201A-0708-00304	ID. No.	: WWL0038
Marking	:	Additionally for the purpose of identification by this laboratory a label marked with this certificate number (MC 2307702) has been attached to the case.		
Method	:	In-House calibration procedure MWI-T-033 this method is reference to TLAS G-20 "Temperature Controlled Enclosures".		
Location of Calibration	:	Water Analysis Center Co., Ltd. ; Laboratory.		
Environmental Conditions	:	Ambient Temperature : (25.3 to 25.9) °C Relative Humidity : (65.2 to 67.9) %		
Date of Calibration	:	11 July 2023	Date of Issue	: 12 July 2023

Checked b [redacted]

The uncertainties are for a confidence probability of approximately 95%

This certificate is issued in accordance with the conditions of accreditation granted by the National Standardization Council of Thailand-Office of the National Standardization Council that has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of Master Calibration Co.,Ltd.

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MASTER CALIBRATION CO.,LTD.
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Tel. : (02) 274 2978-9, (02) 2742987-8 Fax : (02) 274 2518, (02) 274 2989
Website : www.mastercalibration.com E-mail : calibrate@mastercalibration.com

The Reference Standard Instrument :

Description	Certificate No.	Serial No.	Due date	Traceable thru
Data Acquisition/Switch Unit	MC 2303173	MY41010916	9 Mar 2024	MCAL
With Thermocouple Type " T " ID. No.17/1 to 17/9				

Traceability :

The measurement standard traceable to the international system of units (SI) through certificate as mentioned above

1. Calibration Procedure:

This Instrument was calibration according to TLAS G-20 by comparison with calibrated thermocouple type T under no load condition. The Thermocouples were placed on nine points and located one thermocouple in each of the eigh corners of the chamber and was away from the each wall of 5 cm to 10 cm. And placed the ninth thermocouple within 2.5 cm of the geometric center of the chamber.

Temperature Uniformity - the maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady state conditions. The reference sensor should preferably be located at the geometric center of the chamber.

Temperature Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.

Overall Variation - The Difference of the maximum and minmum measured temperatures throughout observation.

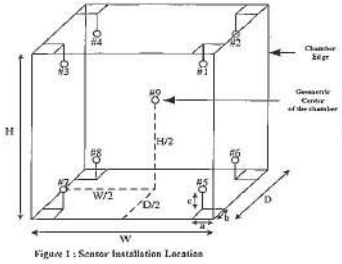


Figure 1 : Sensor Installation Location

Overall Ambient Temperature around the Chamber veriation : 3.2 °C
Overall Line Voltage variation : 0.1 V
Chamber Size (W*H*D) : 171 cm x 157 cm x 60 cm

Checked [redacted]

[MCF-Q-077 ; Rev.6 ; Date : 22/04/2021]

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Website : www.mastercalibration.com E-mail : calibrate@mastercalibration.com

2. Result of calibration :

Temperature Measurement Accuracy Test

Indicating Temperature (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (±°C)
	#1	#2	#3	#4	#5	#6	#7	#8	Ref. #9	
2.5	4.4	4.2	4.2	4.2	4.0	3.9	4.1	4.0	3.8	0.86

Chamber Characterization Result

Controller Temperature (°C)	Indicating Temperature (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
2.0	2.5	1.50	1.01	3.3

The 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 %.

This certificate will certify of the calibrated equipment only.

End of Certificate

Checked [redacted]

ภาคผนวก ง-2 หน้า 41/97

THC Calibration Services

THAI HEART CALIBRATION CO., LTD.
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Tel. 0-2384-2162, 0-2757-3426, 0-2757-3963 Fax. 0-2757-3507

ilac-MRA ANAB ACCREDITED ISO/IEC 17025 CALIBRATION LABORATORY AC-2695

CERTIFICATE OF CALIBRATION

Certificate No.: C0-1907007/23 **Page** 1 **of total** 2 **pages**

Customer WATER ANALYSIS CENTER CO., LTD.
1/94 Moo 5, T.Kanham,
A.U-thai, Ayutthaya 13210

Equipment Conductivity Meter
Manufacturer EUTECH **Model** CON 2700
Serial No. 2657889 **ID No.** WWL 0136
Description -

Environmental Conditions Ambient Temperature: (20 ± 2) °C
Relative Humidity: (50 ± 10) %
Atmospheric Pressure: -
Calibration Location Jayhawks Laboratory (CL&GL)
Received Date 19 July 2023
Calibration Date 19 July 2023
Date of Issue 20 July 2023
Co [redacted]
Cl

( )
( ) (Pattiphan K.) (✓) (Onnapa P.)
( ) (Pongsak H.) ( ) (Nitiphong K.)
( ) (Kanung C.) ( ) (Nonthachai K.)
( ) (Pramong P.) ( ) (Noppol P.)

This calibration certificate shall not be reproduced other than in full except with the prior written approval of the Thai Heart Calibration Co., Ltd.

THC Calibration Services
THAI HEART CALIBRATION CO., LTD.
112/1 Moo 5, Phraek Sa, Muang, Samut Prakan 10280
Tel. 0-2394-2162, 0-2757-3153, 0-2757-3196 Fax. 0-2757-3507

ilac-MRA ANAB ACCREDITED ISO/IEC 17025 CALIBRATION LABORATORY AC-2695

Reference Method:

- The calibration method used was CP-177 based on an in-house method.
- This certificate can be traceable to the national standards, which is realized the shown measurement units according to the International System of Units (SI Units).

Reference Standard :

Meterial	Batch Value	Lot Number	Due Date	Traceability
Conductivity Standard Solution	147.8 µS/cm	S220611005	Dec. 6, 2023	SCP Science
	1.425 mS/cm	S220812006	May 31, 2024	

Remark: This certificate is traceable to the International System of Unit (SI Unit) through:
- SCP Science.

Measurement Results: (Probe Serial No. : 93X219065)

Conductivity Standard Solution	Measured Value	Correction	Uncertainty (±)
147.8 µS/cm	147.5 µS/cm	0.3 µS/cm	2.5 µS/cm
1.425 mS/cm	1.427 mS/cm	-0.002 mS/cm	0.0051 mS/cm

Note : Adjustment points: 147.8µS/cm 1.425mS/cm

The above reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -

Calibrated by Onnapa

DKSH

ilac-MRA NSC-TISI-TIS 17025 Calibration 0087

Certificate of Calibration

Equipment:	Balance	Certificate No.:	C01241754
Model:	BL 210S	Issued Date:	05 June 2024
Serial No. (or ID.):	15808131 (WWL 0022)	Job No.:	WO-00030302
Manufacturer:	Sartorius	Page:	1 of 2
Condition:	In condition		

Customer: Water Analysis Center Co., Ltd.
1/94 Moo 5, Rojana Industrial Park, Rojana Road,
Tambol Kanham, Amphur U-Thai, Ayutthaya 13210 Thailand

Environment Condition: Temperature 26 °C ± 0.2 °C
Humidity 50 %RH ± 2.6 %RH

Calibration Place: Water Analysis Center Co., Ltd. (ห้องเครื่องชั่ง)
1/94 Moo 5, Rojana Industrial Park, Rojana Road,
Tambol Kanham, Amphur U-Thai, Ayutthaya 13210 Thailand

Calibration By: Mr. Polawad Ruamirup
Calibration Date: 05 June 2024
The Method used: In-house method, CAL-WI-47, based on UKAS Lab 14
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Co., Ltd. Certificate No. C02240400

[redacted]

International or national standards or other recognized national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

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2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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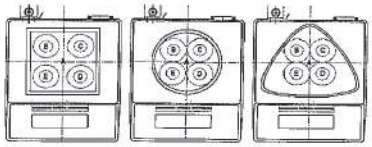
เอกสารผนวก ง-2 หน้า 42/97

DKSH

Calibration Results:

Without Adjustment

Eccentric Error: Weight to be 1/3 or 1/2 of Maximum capacity, taken from the center of the pan as a zero reference.



Nominal Test Value 100 (g)

Reference Points (g)				
A	B	C	D	E
-	0.0000	0.0001	0.0000	-0.0002

Repeatability: Determination of the standard deviation of weighing balance., Readability 0.0001 (g)

Nominal test value (g)	Standard Deviation
20	0.00004
200	0.00006

Error of indication from nominal or conventional mass value., Readability 0.0001 (g)

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Error of indication (g)	Uncertainty (g)	k
1	1.00001	1.0000	0.0000	0.00011	2.04
2	2.00002	2.0000	0.0000	0.00011	2.04
5	5.00002	5.0000	0.0000	0.00011	2.04
10	10.00001	10.0000	0.0000	0.00011	2.04
20	20.00001	20.0000	0.0000	0.00012	2.03
50	50.00003	50.0000	0.0000	0.00013	2.02
70	70.00004	70.0000	0.0000	0.00016	2.01
100	99.99996	100.0001	0.0001	0.00017	2.01
120	119.99997	120.0002	0.0002	0.00021	2.00
150	149.99999	150.0002	0.0002	0.00024	2.00
200	199.99996	200.0004	0.0004	0.00030	2.00

The End of Certificate

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Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

MCAL
MASTER CALIBRATION CO.,LTD.

Master Calibration Co.,Ltd.
547 Soi Ratchadanivat, Kwaeng Samsennok, Khet Huaykwang, Bangkok 10310
Tel. : (02) 274 2978-9, (02) 2742987-8 Fax : (02) 274 2518, (02) 274 2989
Website : www.mastercalibration.com E-mail : calibrate@mastercalibration.com

Certificate of Calibration

LIQUID BATH

ilac-MRA
NSC-TISI-TIS 17025
CALIBRATION 0183

Certificate No.: MC 2314268

Customer	: Water Analysis Center Co., Ltd. 1/94 Moo 5, T.Kantham, A.U-Thai, Ayutthaya 13210.		
Reference Job No.	: 23-2833	Received Date	: 15 December 2023
Description	: Water Bath		
Manufacturer	: ESSTELL	Model	: EWB-122D
Serial No.	: 20180508122	ID. No.	: WWL 0214
Marking	: Additionally for the purpose of identification by this laboratory a label marked with this certificate number (MC 2314268) has been attached to the case.		
Method	: In-House calibration procedure MWI-T-029 this method is reference to ASTM E715 "Liquid Bath".		
Location of Calibration	: Water Analysis Center Co., Ltd. ; Laboratory.		
Environmental Condition	: Ambient Temperature : (29.4 to 29.8) °C Relative Humidity : (49.0 to 52.0) %		
Date of Calibration	: 15 December 2023	Date of Issue	: 19 December 2023

Chec[redacted]

The uncertainties are for a confidence probability of approximately 95%

This certificate is issued in accordance with the conditions of accreditation granted by the National Standardization Council of Thailand-Office of the National Standardization Council that has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of Master Calibration Co.,Ltd.

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Tel. : (02) 274 2978-9, (02) 2742987-8 Fax : (02) 274 2518, (02) 274 2989
Website : www.mastercalibration.com E-mail : calibrate@mastercalibration.com

Reference Standard Instrument :

Description	Certificate No.	Serial No.	Due date	Traceable thru
Data Acquisition/Switch Unit	MC 2301270	MY44020009	9 Mar 2024	MCAL
With Thermocouple Type " T " ID. No.27/1 to 27/5				

Traceability :

The measurement standard traceable to the international system of units (SI) through certificate as mentioned above

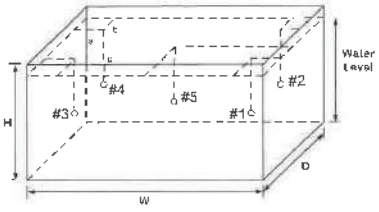
1. Calibration Procedure:

This Instrument was calibration according to ASTM E715 - 2007 by comparison with calibrated sensor under no load condition. The sensor were placed on five points and located one sensor in each of the eigh corners of the chamber and was away from the each wall of 5 cm to 10 cm. And placed the five sensor within 2.5 cm of the geometric center of the chamber.

Temperature Uniformity - the maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady state conditions. The reference sensor should preferably be located at the geometric center of the chamber.

Temperature Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.

Overall Variation - The Difference of the maximum and minimum measured temperatures throughout observation.



- Overall Ambient Temperature around the Chamber veriation : 1.3 °C
- Overall Line Voltage variation : 0.0 V
- Chamber Size (W*H*D) : 50 cm x 12 cm x 30 cm
- Water Level : 7 cm

Checked by : Chalermkit

MCAL
MASTER CALIBRATION CO.,LTD.
547 Soi Ratchadamivat, Kwaeng Samsennok, Khet Huaykwang, Bangkok 10310
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Website : www.mastercalibration.com E-mail : calibrate@mastercalibration.com

2. Result of calibration :

Temperature Measurement Accuracy Test

Indicating Temperature	Measured Temperature (°C) at Spread Locations					Uncertainty
(°C)	#1	#2	#3	#4	Ref. #5	(±°C)
45.0	44.5	44.4	44.5	44.5	44.6	0.45

Chamber Characterization Result

Desired Temperature (°C)	Controller Temperature (°C)	Indicating Temperature (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
44.5	45.0	45.0	0.62	0.88	1.5

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k = 2.0, providing a level of confidence of approximately 95 %.

This certificate will certify of the calibrated equipment only.

End of Certificate

Checked by : Chalermkit

บริษัท ปัญจพล พัลพ์ อินดัสตรี้ จำกัด (มหาชน)

DKSH

Certificate of Calibration

Equipment:	Hot Air Oven	Certificate No.:	C31240108
Model:	UF110	Issued Date:	16 January 2024
Serial No.(or ID):	B423.1065	Job No.:	WO-00014012
Manufacturer:	Memmert	Page:	1 of 3
Condition:	New	Ventilation Valve:	Closed
Shelves(pc.):	2		

Customer: PANJAPOL PULP INDUSTRY PUBLIC COMPANY LIMITED
51/1 Moo 3 T.Hormok, A.Bangsai,
Ayutthaya 13190 Thailand

Environment Condition:

Temperature:	25 °C	±	0.7	°C
Humidity:	45 %RH	±	4.0	%RH
Voltage:	220 VAC	±	1.2	VAC

Calibration Place: PANJAPOL PULP INDUSTRY PUBLIC COMPANY LIMITED (Lab Waste Water)
51/1 Moo 3 T.Hormok, A.Bangsai,
Ayutthaya 13190 Thailand

Calibration By: Mr. Siwapan Srijan

Calibration Date: 16 January 2024

The Method used: In house method, CAL-WI-16, base on TLAS-G20

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10230013

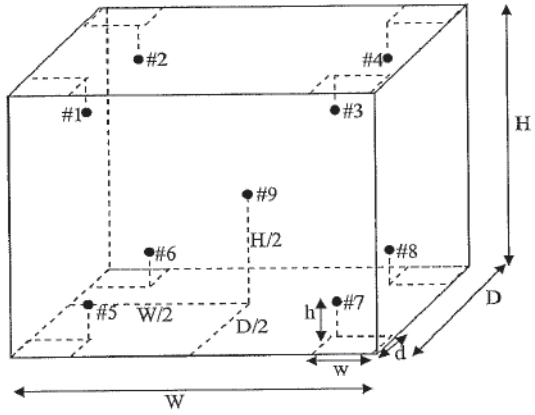
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This [illegible] international or national standard or other recognized national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

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2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand



Standard Installation Locations

Volume (Calibration Zone)= 50 (Liters)

Inside chamber:	W = 56 (cm)	D = 40 (cm)	H = 48 (cm)
Standard Locations (#1, #2, #3, #4):	w = 6 (cm)	d = 5 (cm)	h = 5 (cm)
Standard Locations (#5, #6, #7, #8):	w = 6 (cm)	d = 5 (cm)	h = 5 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	101	102	103	104	105	106	107	108	109

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.

Measured Temperature: The average reading of standards at any positions or location.

Measured Uniformity: The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

Overall Variation: The difference of maximum and minimum measured temperatures throughout observation time.

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2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Calibration Results:

Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 104.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	104.12	0.12	0.39
#2	103.53	-0.47	0.39
#3	104.16	0.16	0.39
#4	104.12	0.12	0.39
#5	104.51	0.51	0.39
#6	104.30	0.30	0.39
#7	103.54	-0.46	0.41
#8	103.72	-0.28	0.39
#9	104.41	0.41	0.39

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
104.0	104.0	104.0	104.12	103.53	104.16	104.12	104.51	104.30	103.54	103.72	104.41	0.41

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
104.0	0.98	0.14	1.17

Note: * Maximum uncertainty of the each position

The End of Certificate

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2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Statements of conformity:

This conformity certificate documents the validity of the following statements of conformity based on the measurement results of corresponding calibration certificate:

The correction of indication determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, TLAS-G20. Therefore, those parameters have not been assessed separately.

Tolerance and Decision rules:

Assessment of the conformity of the measurement device are done based on direct comparison of the relevant measurement results with the tolerances and decision rule are prescribed by the customer.

Decision rule :

- ☐ Choice A — Binary Statement for Simple Acceptance Rule (w = 0), Specific Risk < 50% PFA.
- ☑ Choice B — Non-binary statement with guard band (w = 1 U), Pass or Fail Specific Risk < 2.5% PFA and Condition Pass or Condition Fail Specific Risk < 50% PFA.
- ☐ Choice C — Customer defined, Customers may define arbitrary multiple of r to have applied as guard band (w = r U).

; PFA – Probability of False Accept

[redacted]

Without adjustment

Desired Temperature : 104.0°C Tolerances : 1.0 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 104.0 °C

Locations	Measured (°C)	Correction* (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	104.12	0.12	0.39	1.0	Pass
#2	103.53	-0.47	0.39	1.0	Pass
#3	104.16	0.16	0.39	1.0	Pass
#4	104.12	0.12	0.39	1.0	Pass
#5	104.51	0.51	0.39	1.0	Pass
#6	104.30	0.30	0.39	1.0	Pass
#7	103.54	-0.46	0.41	1.0	Pass
#8	103.72	-0.28	0.39	1.0	Pass
#9	104.41	0.41	0.39	1.0	Pass

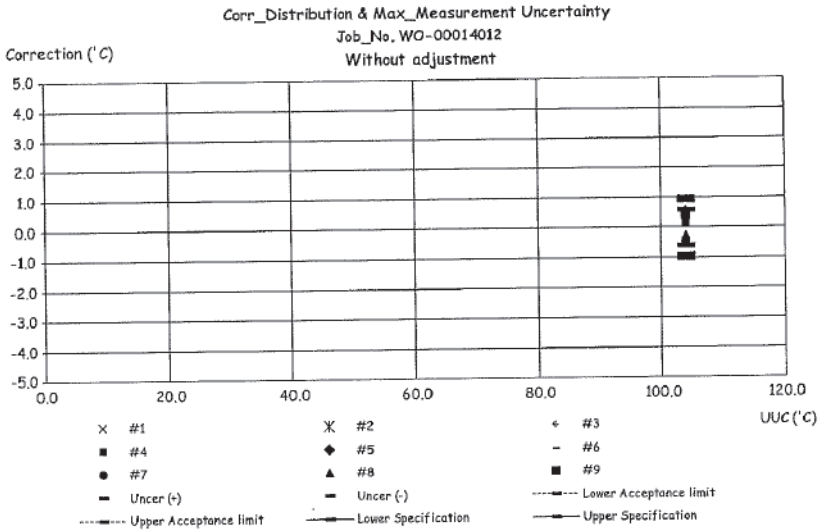
Correction* = Measured Temperature - Desired Temperature

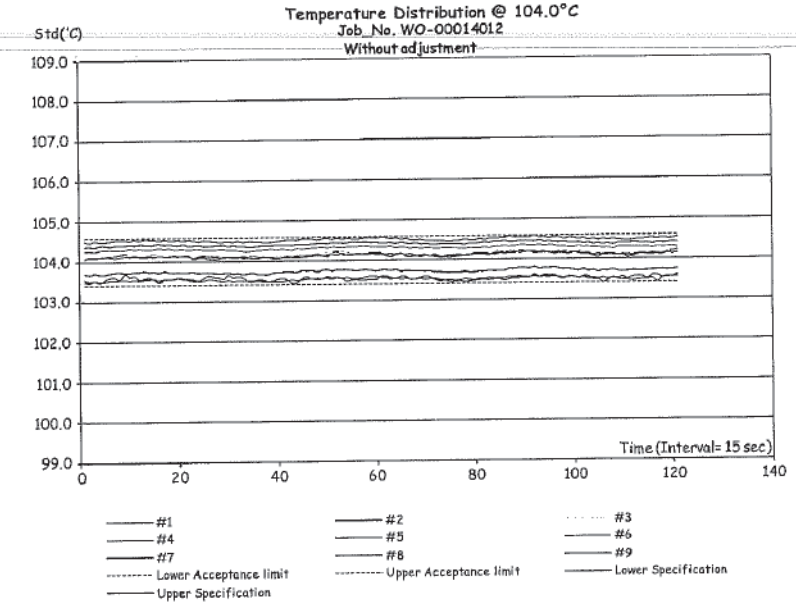
The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use

The End of Statements of Conformity

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ภาคผนวก ง-2 หน้า 47/97





DKSH

ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00014012

ชนิดเครื่องมือ: Hot Air Oven รุ่น: UF110

หมายเลขเครื่อง: B423.1065

ตรวจสอบ (รับ) 16 Jan 2024		รายการตรวจเช็ค	ตรวจสอบ (ส่ง) 16 Jan 2024		หมายเหตุ
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
☑	☐	1. สายไฟ	☑	☐	
☑	☐	2. การทำงาน Main Switch	☑	☐	
☑	☐	3. การทำงาน Selector Key	☑	☐	
☑	☐	4. การแสดงผล Display	☑	☐	
☑	☐	5. การทำงาน พัดลม	☑	☐	
☑	☐	6. สภาพ Lever of Ventilation valve	☑	☐	
☑	☐	7. สภาพ Lever door open / close	☑	☐	
☑	☐	8. สภาพ Door seal	☑	☐	
☑	☐	9. การทำงานของระบบ Safety	☑	☐	
☐	☐	10. การทำงานของระบบทำความเย็น	☐	☐	ไม่มี
☐	☐	11. การทำงานของระบบทำความชื้น	☐	☐	ไม่มี
☑	☐	12. สภาพตัวเครื่อง	☑	☐	
☑	☐	13. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง	☑	☐	

ข้อแนะนำ : _____

_____

Mr. Siwapan Srijan

Service Engineer

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260
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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000 FAX. 0-2719-9484

Certificate of Testing

Equipment :	DO Meter
Manufacturer :	Horiba
Model :	LAQUA-DO210
Serial No. :	HE4A0033
ID No. :	-
Received Date :	14 May 2024
Test Date :	15 May 2024
Reference :	2405-0413WN-1
Submitted by :	Panjapol Pulp Industry Public Company Limited 540, 540/1 Soi Bangkhae 7, Bangkhae, Bangkhae, Bangkok 10160
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 :	[redacted]
Approved by :	

( ) Unnopphol Harachai
( ) Ponpan Paipim
(✓) Saithip Meangmai

Issue Date : 17 May 2024

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	23CG1172	22 Mar 2025
2. Balance	14233821	110RC001	23MM405	16 July 2024

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.: 9K1J0040

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.20	8.20	0.0055

This report was certified only for the instrument we tested.It is allowable to use for study 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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TEL. 0-2717-3000-29 FAX. 0-2719-9484

NSC-TISI-TIS17025
CALIBRATION 6008

Certificate of Calibration

Equipment :	pH meter with Sensor
Manufacturer :	Eutech
Model :	pH 150
Serial No. :	3015462
ID No. :	-
Submitted by :	Panjapol Pulp Industry Public Company Limited 51/1 Moo 3 T.Hormok, A.Bangsai, Ayutthaya 13190
Location :	Laboratory (Panjapol Pulp Industry Public Company Limited)
Received Order :	02 October 2023
Calibrated Date :	02 October 2023
Ambient Temperature :	(26 ± 10) °C
Relative Humidity :	(50 ± 30) %
AC Line Voltage :	(220 ± 22) V
Calibrated by :	[redacted]
Approved by :	

( ) Pornthippa Tameyakul
(✓) Suwit Imjai

Issue Date : 11 October 2023

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.

Equipment : pH meter with Sensor
Condition As-Received : Used Item
Reference : 2310-0002ON-6

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Digital Thermometer	A7B843	23I24	TPA	04 Jan 2024

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 141

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor *k*
20.0	100	20.003	19.6	-0.403	0.16	2.00
25.0	100	25.001	24.6	-0.401	0.16	2.00
30.0	100	30.001	29.6	-0.401	0.16	2.00

UUC* : Unit Under Calibration

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

-o0o-

[redacted]

a 1183701

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484

NSC-TISI-TIS17025
CALIBRATION 0008

Cert.No.: 23CHO599
Page.: 1 of 2

Certificate of Calibration

Equipment :	pH Meter
Manufacturer :	Eutech
Model :	pH 150
Serial No. :	3015462
ID No. :	-
Condition As-Received:	Used Item
Received Date :	02 October 2023
Calibration Date :	02 October 2023
Reference :	2310-0002ON-5
Submitted by :	Panjapol-Pulp-Industry Public Company Limited 51/1 Moo 3 T.Hormok A.Bangsai, Ayutthaya 13190
Calibration Place :	Laboratory (Panjapol Pulp Industry Public Company Limited)
Ambient Temperature :	(27.1 - 28.3) °C
Relative Humidity :	(51.1 - 48.5) %
Calibration Procedure :	In - house method : - CP-OCH2 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)

Calibrated by : [redacted]

Approved by :

(√) Saithip Meangmai
( ) Warakorn Lerngagtrakul
( ) Ponpan Paipim

Issue Date : 11 October 2023

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0059347

Condition of this calibration result

1. Reference Standard Instrument : -

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	46530031	130RC098	23E3105	18 Sep 2024
2) Digital Thermometer	-	130RC018	23T1595	13 Sep 2024

This certification is traceable to the International System of Unit maintained through:-
- Technology Promotion Association (Thailand - Japan)

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	863832	28 Dec 2024
pH 6.986	CPA chem	863833	28 Dec 2023
pH 10.010	CPA chem	863835	28 Dec 2023

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.: 3015462	4.00	177.48	177.5	4.01	0.058	2.00
	7.00	0.00	0.3	7.00	0.058	2.00
	10.00	-177.48	-177.1	10.01	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.: 01X099323	4.008	4.01	179.7	0.0086	2.00
	6.986	6.94	7.0	0.014	2.00
	10.010	10.02	-169.3	0.026	2.00

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-

[redacted]

a 1183702

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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534/4 PATTANAKARN ROAD,SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484

NSC-TISI-TIS17025
CALIBRATION 0008

Certificate of Calibration

Equipment :	Electronic Balance
Manufacturer :	Shimadzu
Model :	ATX224
Serial No. :	D307037776
ID No. :	-
Submitted by :	Panjapol Paper Industry Co.,Ltd. 51/1 Moo 3 T.Hormok, A.Bangsai, Ayutthaya-13190
Location :	Laboratory (Panjapol Paper Industry Co.,Ltd.)
Received order :	14 December 2023
Calibration Date :	14 December 2023
Ambient Temperature :	15 °C to 40 °C
Relative Humidity :	30 % to 90 %
Calibrated by :	[redacted]
Approved by :	( ) Pornthippa Tameyakul ( ) Ponpan Paipim (✓) Suwit Imjai
Issue Date :	27 December 2023

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.

Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2312-0064ON-6

Procedure used :-

Calibration were conducted using in-house calibration procedure CP-OB01 according to direct measurement method against standard weight.

Condition of this result of calibration

1. Reference standard instruments:-

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	15884	24053	70RC007	MM-0010-22	20 Jan 2024

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This result of calibration was made on requested at the point specified by customer.
4. This certificate is not certified for any commercial transaction.
5. This certification is traceable to the International System of Unit.

Result of calibration ( ) Without Adjustment (*) After Adjustment by Internal Calibration
Range capacity : 0 g to 220 g **Resolution** 0.0001 g

Before Adjustment :

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
100	99.9988	+0.0012	0.17	2
200	199.9978	+0.0022	0.29	2

After Adjustment :

1. **Determination of the standard deviation of weighing machine** (n = 10)

Applied Weight (g)	Standard Deviation of Reading (g)
100	0.00005
200	0.00005

[redacted]

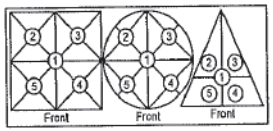
Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2312-0064ON-6

Cert.No.: 23MM723

Result of calibration

2. Effect of off center loading

A mass of 100 g was placed to various position on the pan.
The weighing machine reading error obtained is given in the table



Position 1 (g)	Position 2 (g)	Position 3 (g)	Position 4 (g)	Position 5 (g)	Maximum difference between off-center and central loading (g)
0.0000	+0.0003	-0.0002	-0.0002	+0.0002	0.0003

3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
Unload	0.0000	0.0000	0.11	2.05
0.1	0.1000	0.0000	0.11	2.05
0.5	0.5000	0.0000	0.11	2.05
1	1.0001	-0.0001	0.11	2.05
5	5.0000	0.0000	0.12	2.05
10	10.0000	0.0000	0.12	2.05
20	20.0002	-0.0002	0.12	2.04
50	50.0003	-0.0003	0.14	2
100	100.0000	0.0000	0.17	2
150	150.0001	-0.0001	0.29	2
200	200.0000	0.0000	0.29	2

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-

[redacted]

a 1195722

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484

Cert. No.: 23TM1472

Certificate of Calibration

Equipment : Block Heater
Manufacturer : HACH
Model : DRB 200
Serial No. : 19030C0168
ID No. : -
Submitted by : Panjapol Pulp Industry Public Company Limited
51/1 Moo 3 T.Hormok,
A.Bangsai,
Ayutthaya 13190
Location : Laboratory
(Panjapol Pulp Industry Public Company Limited)

Received Order : 2 October 2023
Calibration Date : 2 - 3 October 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : [redacted]

Approved by :

( ) Pornthippa Tameyakul
( ) Ponpan Paipim
(✓) Suwit Imjai

Issue Date : 11 October 2023

The Uncertainties are for a confidence probability of approximately 95%.

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A 0012035

Equipment : Block Heater
Condition As-Received : Used Item
Reference : 2310-0002ON-3

Cert. No.: 23TM1472

Procedure Used :-

As agreed with customer the calibration was perform using in-house calibration method according to directed measurement method with Data Acquisition which connected with Thermocouple Type T.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

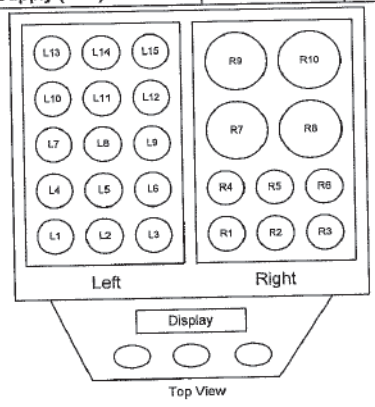
Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY44073381	23LM95	TPA	19 June 2024

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Heat transfer medium used : Alumina (Alumilum Hydroxide)

Environment during calibration	Beginning	Finished
Temp.(°C)	27	26
REL.Humi.(%)	48	52
AC Supply (Volt)	225	225



Top View

Left		Right	
Position	ID No. of Sensor	Position	ID No. of Sensor
L1	23-01TC-01	R1	23-01TC-01
L2	23-01TC-02	R2	23-01TC-02
L3	23-01TC-03	R3	23-01TC-03
L4	23-01TC-04	R4	23-01TC-04
L5	23-01TC-05	R5	23-01TC-05
L6	23-01TC-06	R6	23-01TC-06
L7	23-01TC-07	R7	23-01TC-07
L8	23-01TC-08	R8	23-01TC-08
L9	23-01TC-09	R9	23-01TC-09
L10	23-01TC-10	R10	23-01TC-10
L11	23-01TC-01	-	-
L12	23-01TC-02	-	-
L13	23-01TC-03	-	-
L14	23-01TC-04	-	-
L15	23-01TC-05	-	-

[redacted]

Equipment : Block Heater
Condition As-Received : Used Item
Reference : 2310-0002ON-3

Cert. No.: 23TM1472

Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Calibration Point : 148 °C

UUC* Setting (°C)	UUC* Reading (°C)	Measured Temperature (°C) Position						Temperature stability (± °C)	Uncertainty (±°C)	Coverage Factor k
		Left			Right					
Left		L13	L14	L15	R9	R10		Left		
		145.225	144.696	144.518						
		L10	L11	L12	147.650	147.147		0.068		
144	144	144.959	144.992	144.186					1.1	2
		L7	L8	L9	R7	R8				
Right		148.448	147.885	147.833	147.634	148.773		Right		
		L4	L5	L6	R4	R5	R6			
		148.572	148.330	147.692	148.947	148.916	147.708	0.082		
144	144	L1	L2	L3	R1	R2	R3			
		148.747	148.328	148.553	144.959	144.992	144.186			

Calibration Point : 150 °C

UUC* Setting (°C)	UUC* Reading (°C)	Measured Temperature (°C) Position						Temperature stability (± °C)	Uncertainty (±°C)	Coverage Factor k
		Left			Right					
Left		L13	L14	L15	R9	R10		Left		
		146.638	146.519	147.038						
		L10	L11	L12	150.926	149.905		0.11		
146	146	147.764	146.864	147.390					1.1	2
		L7	L8	L9	R7	R8				
Right		149.679	150.368	150.140	149.707	150.400		Right		
		L4	L5	L6	R4	R5	R6			
		150.209	150.371	151.385	151.932	151.282	150.336	0.13		
146	146	L1	L2	L3	R1	R2	R3			
		151.095	149.384	149.675	151.594	150.994	149.849			

Average* : The average of 30 values in each position.
Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.
UUC* : Unit Under Calibration
Note : The reported uncertainty of measurement was included stability and excluded uniformity .

[redacted]

Equipment : Block Heater
Condition As-Received : Used Item
Reference : 2310-0002ON-3
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Calibration Point : 152 °C

UUC* Setting (°C)	UUC* Reading (°C)	Measured Temperature (°C) Position						Temperature stability (± °C)	Uncertainty (±°C)	Coverage Factor *k*
		Left			Right					
Left		L13	L14	L15	R9	R10		Left		
		149.620	149.127	148.939						
		L10	L11	L12	152.174	151.723		0.076		
148	148	149.639	149.468	148.710	R7	R8			1.1	2
		L7	L8	L9						
Right		152.963	152.458	152.414	151.892	153.230		Right		
		L4	L5	L6	R4	R5	R6			
		152.839	152.635	152.428	154.163	153.504	153.057	0.099		
148	148	L1	L2	L3	R1	R2	R3			
		153.075	152.709	152.982	153.437	153.385	152.206			

Average* : The average of 30 values in each position.
Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.
UUC* : Unit Under Calibration
Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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 %.

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[redacted]

a 1183705

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484

NSC-TISI-TIS17025
CALIBRATION 0008

Certificate of Calibration

Equipment : Cooled Incubator
Manufacturer : Lovibond
Model : TC 140 G
Serial No. : 0714/000024
ID No. : IN-002
Submitted by : Panjapol Pulp Industry Public Company Limited
51/1 Moo 3 T.Hormok,
A.Bangsai,
Ayutthaya 13190
Location : Laboratory
(Panjapol Pulp Industry Public Company Limited)

Received Order : 02 October 2023
Calibration Date : 02 October 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : [redacted]

Approved by :

( ) Pornthippa Tameyakul
( ) Ponpan Paipim
(✓) Suwit Imjai

Issue Date : 11 October 2023

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.

A 0059343

Equipment : Cooled Incubator
Condition As-Received : Used Item
Reference : 2310-0002ON-1

Cert. No.: 23TM1404
Page : 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

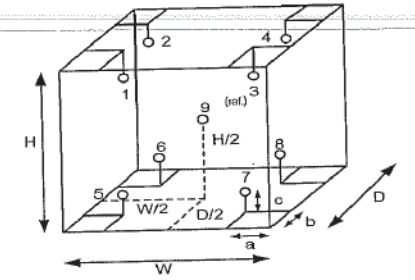
Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013823	23LM66	TPA	25 Mar 2024

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	25	26
REL.Humid. (%)	62	65
AC Supply (Volt)	220	221



Position :	Ref. Std. ID No.:
1	21-17RTD-01
2	21-17RTD-02
3	17RTD-03
4	17RTD-04
5	17RTD-05
6	17RTD-06
7	17RTD-07
8	23-17RTD-08
9 (ref.)	23-17RTD-09

Probe Installation Details :

a = 5.0 cm
b = 5.0 cm
c = 5.0 cm

Dimension of Chamber :

D = 0.44 m
W = 0.51 m
H = 0.70 m
Capacity = 0.16 m³

[redacted]

a 1183711

Equipment : Cooled Incubator
Condition As-Received : Used Item
Reference : 2310-0002ON-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 23TM1404
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor *k*
20.0	20.5	-	0.44	0.36	0.97	2

Calibration Point (°C)	Measured Temperature (°C) Position									Uncertainty (±°C)
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	20.046	19.928	20.068	20.112	19.975	19.945	20.042	19.970	19.972	0.57

Average* : The average of 30 values in each position.
Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.
Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.
UUC* : Unit Under Calibration
Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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 %.

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[redacted]

a 1183710

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484

NSC-TISI-TIS17025
CALIBRATION 0008

Certificate of Calibration

Equipment :	Refrigerator
Manufacturer :	Sanden Intercool
Model :	SRR-0681A
Serial No. :	170100006
ID No. :	-
Submitted by :	Panjapol Pulp Industry Public Company Limited 51/1 Moo 3 T.Hormok, A.Bangsai, Ayutthaya 13190
Location :	Laboratory (Panjapol Pulp Industry Public Company Limited)
Received Order :	02 October 2023
Calibration Date :	02 October 2023
Ambient Temperature :	(26 ± 10) °C
Relative Humidity :	(50 ± 30) %
Calibrated by :	[redacted]
Approved by :	( ) Pornthippa Tameyakul ( ) Ponpan Paipim (✓) Suwit Imjai
Issue Date :	11 October 2023

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.

A 0059344

Equipment : Refrigerator
Condition As-Received : Used Item
Reference : 2310-0002ON-2

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013823	23LM66	TPA	25 Mar 2024

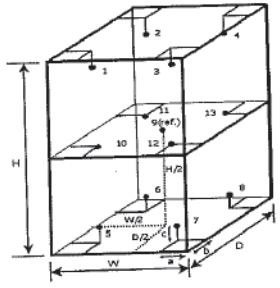
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	25	25
REL.Humi. (%)	62	68
AC Supply (Volt)	220	221

Position :	Ref. Std. ID No.:
1	22-17TC-01
2	23-17TC-02
3	19-17TC-03
4	19-17TC-04
5	19-17TC-05
6	19-17TC-06
7	19-17TC-07
8	19-17TC-08
9 (ref.)	19-17TC-09
10	19-17TC-10
11	19-17TC-11
12	23-17TC-12
13	19-17TC-13



Dimension of Chamber :

D =	0.55	m
W =	0.80	m
H =	1.3	m
Capacity =	0.57	m³

Probe Installation Details :

a =	10	cm
b =	10	cm
c =	10	cm

[redacted]

a 1183709

Equipment : Refrigerator
Condition As-Received : Used Item
Reference : 2310-0002ON-2
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 23TM1405

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor *k*
4.0	4.0	4.8	2.2	1.1	4.6	2

Calibration Point (°C)	Measured Temperature (°C) Position									Uncertainty (±°C)
	1	2	3	4	5	6	7	8	9 (ref.)	
4.0	3.772	2.908	3.720	3.023	2.785	2.691	2.919	2.751	2.857	3.0
	10	11	12	13						
	3.122	2.614	2.868	2.654						

Average* : The average of 30 values in each position.
Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.
Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.
UUC* : Unit Under Calibration
Note : The reported uncertainty of measurement was included stability and excluded uniformity.

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-

[redacted]

บริษัท สไมล์ แล็บบอราทอรี่ จำกัด

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Mechanical Engineering Standards Laboratory Soi 1, Bangpoo Industrial Estate, Muang, Samutprakan 10280, Thailand.

Request No.23-67/0202 MTC.No.23-67/0202

Number of page(s) 2

CALIBRATION CERTIFICATE

Nomenclature : **DRYCAL FLOWMETER**

Manufacturer : BIOS International Corporation, U.S.A.

Serial No.: 130230

Model : DCL-M

Scale range : 100 ml/min to 7 l/min

Subdivision : (0.0001, 0.001) l/min

Submitted by : **SMILE LABORATORY CO.,LTD.**

563/1 Thoet Thai Rd., Bangwa Phasicharoen,

Bangkok 10160, Thailand.

Received date : 19 January 2024 **Condition of measured item :** Normal

Calibration date : 26 January 2024

Standard :

Standard	Certificate No.	Date due	Traceability
RTD Thermometer	PSL-T 643/65	1-Jun-24	TISTR
Molbox/PressureTransducer/UpStream	MP-0076-23	2-Apr-25	NIMT
Primary Flow Calibrator S/N 117982	MW-0034-23	11-Jun-25	NIMT
Primary Flow Calibrator S/N 119521	MW-0033-23	6-Jun-25	NIMT

[redacted]

Ref. 20152670111001500001

Issued Date 29 January 2024

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.

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Office
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Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

NSC-TISI-TIS 17025
CALIBRATION 0060

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Mechanical Engineering Standards Laboratory Soi 1, Bangpoo Industrial Estate, Muang, Samutprakan 10280, Thailand.

Calibration point : (0.05, 0.1, 0.2, 0.5, 1, 2, 2.5) l/min

Ambient condition : Temperature (23 ± 3) °C , Relative humidity (55 ± 15) %

Atmospheric pressure (1010±13) hPa

Calibration method : The flowmeter (UUC) was calibrated by comparison method with standard flowmeter according to CP-370.01.

The reported value is the value that converted to value at reference condition within pressure and temperature of the actual gas entering the UUC

Measurement data :

UUC Value (l/min)	Standard Value (l/min)	Temperature (°C)	Pressure (hPa)	Deviation (%)	Uncertainty (%)
0.05111	0.049209	24.974	1010.61	+3.86	0.99
0.10064	0.097087	24.947	1010.73	+3.66	0.99
0.20014	0.19349	24.918	1010.85	+3.43	0.98
0.50055	0.48515	24.913	1011.17	+3.17	0.99
1.0018	0.97068	24.876	1011.75	+3.20	0.86
2.0024	1.9429	24.879	1012.73	+3.06	0.86
2.5073	2.4350	24.831	1013.23	+2.97	0.86

The reported expanded uncertainties are based on standard uncertainties multiplied by a coverage factor k=2, which provides a level of confidence of approximately 95%.

The end of calibration certificate.

The results relate only to the items tested/calibrated or value assigned.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BL.MTC.002 Rev.4

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Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
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Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

บริษัท สไมล์ แล็บบอราทอรี่ จำกัด
Smile Laboratory Co., Ltd.
563/1 ถนนโพธิ์แทย แขวงบางหว้า เขตภาษีเจริญ กรุงเทพฯ 10160 โทรศัพท์ 02-227-0265 โทรสาร 02-454-0317
563/1 Thoet Thai Rd., Bangwa, Phasicharoen, Bangkok 10160 Tel. 02-227-0265 Fax. 02-454-0317

Air Sampling Pump Calibration Report

Report No : PP-67040394

Calibrate Date : 03rd April 2024

Equipment Type : Air Sampling Pump
Equipment Rang : 0.05-2.00 L/min
Calibration type : DRYCAL FLOWMETER
Calibration Rang : 0.05-5.00 L/min
Volume for Calibration : 1.0, 2.5 L/min
Environment Condition : 25.0 /deg C.
Environment Pressure : 758 mm Hg.
Customer Name : บริษัท ปิญจพล พัลพ์ อินดัสตรี้ จำกัด (มหาชน)

Item	Air Sampling Pump Serial Number	Flow Rate	First Time	Second Time	Third Time	Forth Time	Average
1	S/N 6611	1.0 L/min	1.0000	1.0001	1.0002	1.0005	1.0002
2	S/N 6612	2.5 L/min	2.5000	2.5004	2.5008	2.5009	2.5005
3	S/N 6616	1.0 L/min	1.0000	1.0003	1.0006	1.0002	1.0003
4	S/N 7311	2.5 L/min	2.5000	2.5003	2.5006	2.5003	2.5003
5	S/N 04732	2.5 L/min	2.5000	2.5004	2.5006	2.5002	2.5003
6	S/N 04756	2.5 L/min	2.5000	2.5001	2.5002	2.5004	2.5002

SMILE Laboratory

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ADVANTAGE CENTER CO., LTD.
59/494 M.6, Frakham Road, T.Kukhot, Lumlookkar, Pathumthani 12130 Thailand.
Tel. (66-2) 9873248-50 Fax: (66-2) 9873252 E-mail: info.accl2662@gmail.com
pornsak2008@yahoo.co.th
www.accl-calibration.com
www.accl-cal.com

CALIBRATION LABORATORY

Certificate No. RA-2402243-6

Job No.: RA-2402243

Certificate of Calibration

FOR

Equipment Name : Area Heat Stress Monitors
Manufacturer : Metrosonics
Calibration Procedure : CPT-04-11
Model : hs-32
Received Date : Feb 21, 2024
Serial Number : MEC030005
Calibration Date : Feb 22, 2024
Customer Code : N/A
Recommended Due Date : N/A
Location of Calibration : In Lab
Customer Name : Smile Laboratory Co.,Ltd.
563/1 Thoet Thai Rd., Bangwa,Phasicharoen,Bangkok 10160

Environmental Conditions

Ambient Temperature : (25 ± 2) ℃ **Relative Humidity :** (50 ± 15) %RH

Result : No Adjustment (See data attached in page 3 to the end of certificate)

1. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95%.
2. The Unit Under Calibration (UUC) has been calibrated by using the working standard which is traceable to SI-Units. The calibration procedure documented is intended to implement the requirements of ISO/IEC 17025 : 2017
3. The working standard is indicated in page 2 of this certificate.
4. This report applies to the item calibrated and shall not be reproduced except in full, without written approval by Calibration Laboratory, Advantage Center Co., Ltd.

Calibrat

Date of Issue : Mar 5, 2024 **Laboratory Management**

Test Equipment Calibration, In-house Calibration Preparations, Source Inspection ISO 9000 / 14000 Consultation, Statistical Quality Control, Statistical Production Control, New Product Sourcing, Troubleshooting, Safety Engineering consultations / Applications for world wide Approvals and Certifications.

ADVANTAGE CENTER CO., LTD.

59/494 M.6, Frakham Road, T.Kukhot, Lumlookkar, Pathumthani 12130 Thailand.
Tel. (66-2) 9873248-50 Fax: (66-2) 9873252 E-mail: info.accl2662@gmail.com
pornsak2008@yahoo.co.th

Certificate No.: RA-2402243-6

Reference Standards

Equipment Name	Serial No.	Certificate No.	Due Date	Traceability to
Data Logger	ID.ACCL0200	EL51626/23	Mar 1, 2024	PCAL

Traceability

This calibration is traceable to the International System of Unit via :

- PCAL : Professional Calibration & Services Co., Ltd.

Test Equipment Calibration, In-house Calibration Preparations, Source Inspection ISO 9000 / 14000 Consultation, Statistical Quality Control, Statistical Production Control, New Product Sourcing, Troubleshooting, Safety Engineering consultations / Applications for world wide Approvals and Certifications.

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pornsak2008@yahoo.co.th

Certificate No. : RA-2402243-6

Result of Calibration

1. Temperature measurement (WET)

STD Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty of Measurement (±°C)
30.017	29.9	0.117	0.50
32.019	31.9	0.119	0.50
34.017	33.9	0.117	0.50
36.020	35.9	0.120	0.50
38.022	37.9	0.122	0.50

2. Temperature measurement (DRY)

STD Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty of Measurement (±°C)
30.018	29.9	0.118	0.50
32.018	31.9	0.118	0.50
34.021	33.9	0.121	0.50
36.023	35.9	0.123	0.50
38.023	37.9	0.123	0.50

3. Temperature measurement (GLOBE)

STD Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty of Measurement (±°C)
30.017	29.9	0.117	0.50
32.019	31.9	0.119	0.50
34.022	33.9	0.122	0.50
36.022	35.9	0.122	0.50
38.024	37.9	0.124	0.50

STD = Standard
UUC = Unit Under Calibration

- End of Certificate -

Test Equipment Calibration, In-house Calibration Preparations, Source Inspection ISO 9000 / 14000 Consultation, Statistical Quality Control, Statistical Production Control, New Product Sourcing, Troubleshooting, Safety Engineering consultations / Applications for world wide Approvals and Certifications.

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ilac-MRA

ANAB
AMSI National Accreditation Board
ACCREDITED
ISO/IEC 17025
CALIBRATION LABORATORY

CALIBRATION LABORATORY

Certificate No. RA-2402243-7

Job No.: RA-2402243

Certificate of Calibration

FOR

Equipment Name : Area Heat Stress Monitors

Manufacturer : Metrosonics

Model : hs-32

Serial Number : MCI090009

Customer Code : N/A

Location of Calibration : In Lab

Customer Name : Smile Laboratory Co.,Ltd.
563/1 Thoet Thai Rd., Bangwa,Phasicharoen,Bangkok 10160

Calibration Procedure : CPT-04-11

Received Date : Feb 21, 2024

Calibration Date : Feb 22, 2024

Recommended Due Date : N/A

Environmental Conditions

Ambient Temperature : (25 ± 2) °C **Relative Humidity :** (50 ± 15) %RH

Result : No Adjustment (See data attached in page 3 to the end of certificate)

1. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95%.
2. The Unit Under Calibration (UUC) has been calibrated by using the working standard which is traceable to SI-Units. The calibration procedure documented is intended to implement the requirements of ISO/IEC 17025 : 2017
3. The working standard is indicated in page 2 of this certificate.
4. This report applies to the item calibrated and shall not be reproduced except in full, without written approval by Calibration Laboratory, Advantage Center Co., Ltd.

Calibrated by [redacted]

Date of Issue : Mar 5, 2024 **Laboratory Management**

Test Equipment Calibration, In-house Calibration Preparations, Source Inspection ISO 9000 / 14000 Consultation, Statistical Quality Control, Statistical Production Control, New Product Sourcing, Troubleshooting, Safety Engineering consultations / Applications for world wide Approvals and Certifications.

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pornsak2008@yahoo.co.th

Certificate No.: RA-2402243-7

Reference Standards

Equipment Name	Serial No.	Certificate No.	Due Date	Traceability to
Data Logger	ID.ACCL0200	EL51626/23	Mar 1, 2024	PCAL

Traceability

This calibration is traceable to the International System of Unit via :

- PCAL : Professional Calibration & Services Co., Ltd.

ACCL LM01

Test Equipment Calibration, In-house Calibration Preparations, Source Inspection ISO 9000 / 14000 Consultation, Statistical Quality Control, Statistical Production Control, New Product Sourcing, Troubleshooting, Safety Engineering consultations / Applications for world wide Approvals and Certifications.

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pornsak2008@yahoo.co.th

Certificate No. : RA-2402243-7

Result of Calibration

1. Temperature measurement (WET)

STD Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty of Measurement (±°C)
30.021	29.9	0.121	0.50
32.022	31.9	0.122	0.50
34.022	33.9	0.122	0.50
36.023	35.9	0.123	0.50
38.023	37.9	0.123	0.50

2. Temperature measurement (DRY)

STD Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty of Measurement (±°C)
30.017	29.9	0.117	0.50
32.019	31.9	0.119	0.50
34.021	33.9	0.121	0.50
36.016	35.9	0.116	0.50
38.022	37.9	0.122	0.50

3. Temperature measurement (GLOBE)

STD Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty of Measurement (±°C)
30.021	29.9	0.121	0.50
32.019	31.9	0.119	0.50
34.017	33.9	0.117	0.50
36.021	35.9	0.121	0.50
38.022	37.9	0.122	0.50

STD = Standard
UUC = Unit Under Calibration

- End of Certificate -

Test Equipment Calibration, In-house Calibration Preparations, Source Inspection ISO 9000 / 14000 Consultation, Statistical Quality Control, Statistical Production Control, New Product Sourcing, Troubleshooting, Safety Engineering consultations / Applications for world wide Approvals and Certifications.

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pornsak2008@yahoo.co.th

CALIBRATION LABORATORY

Certificate No. RA-2402243-8
Job No.: RA-2402243

Certificate of Calibration

FOR

Equipment Name : Area Heat Stress Monitors
Manufacturer : Metrosonics
Model : hs-32
Serial Number : MCI040013
Customer Code : N/A
Location of Calibration : In Lab
Customer Name : Smile Laboratory Co.,Ltd.
563/1 Thoet Thai Rd., Bangwa,Phasicharoen,Bangkok 10160

Calibration Procedure : CPT-04-11
Received Date : Feb 21, 2024
Calibration Date : Feb 22, 2024
Recommended Due Date : N/A

Environmental Conditions
Ambient Temperature : (25 ± 2) °C **Relative Humidity :** (50 ± 15) %RH
Result : No Adjustment (See data attached in page 3 to the end of certificate)

1. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95%.
2. The Unit Under Calibration (UUC) has been calibrated by using the working standard which is traceable to SI-Units. The calibration procedure documented is intended to implement the requirements of ISO/IEC 17025 : 2017
3. The working standard is indicated in page 2 of this certificate.
4. This report applies to the item calibrated and shall not be reproduced except in full, without written approval by Calibration Laboratory, Advantage Center Co., Ltd.

Calibrated by [redacted]

Date of Issue : Mar 5, 2024 **Laboratory Management**

Test Equipment Calibration, In-house Calibration Preparations, Source Inspection ISO 9000 / 14000 Consultation, Statistical Quality Control, Statistical Production Control, New Product Sourcing, Troubleshooting, Safety Engineering consultations / Applications for world wide Approvals and Certifications.

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pornsak2008@yahoo.co.th

Certificate No.: RA-2402243-8

Reference Standards

Equipment Name	Serial No.	Certificate No.	Due Date	Traceability to
Data Logger	ID.ACCL0200	EL51626/23	Mar 1, 2024	PCAL

Traceability

This calibration is traceable to the International System of Unit via :

- PCAL : Professional Calibration & Services Co., Ltd.

Test Equipment Calibration, In-house Calibration Preparations, Source Inspection ISO 9000 / 14000 Consultation, Statistical Quality Control, Statistical Production Control, New Product Sourcing, Troubleshooting, Safety Engineering consultations / Applications for world wide Approvals and Certifications.

ADVANTAGE CENTER CO., LTD.

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pornsak2008@yahoo.co.th

Certificate No. : RA-2402243-8

Result of Calibration

1. Temperature measurement (WET)

STD Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty of Measurement (±°C)
30.019	29.9	0.119	0.50
32.019	31.9	0.119	0.50
34.022	33.9	0.122	0.50
36.021	35.9	0.121	0.50
38.021	37.9	0.121	0.50

2. Temperature measurement (DRY)

STD Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty of Measurement (±°C)
30.018	29.9	0.118	0.50
32.018	31.9	0.118	0.50
34.021	33.9	0.121	0.50
36.021	35.9	0.121	0.50
39.024	37.9	1.124	0.50

3. Temperature measurement (GLOBE)

STD Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty of Measurement (±°C)
30.019	29.9	0.119	0.50
32.019	31.9	0.119	0.50
34.018	33.9	0.118	0.50
36.021	35.9	0.121	0.50
38.023	37.9	0.123	0.50

STD = Standard
UUC = Unit Under Calibration

- End of Certificate -

Test Equipment Calibration, In-house Calibration Preparations, Source Inspection ISO 9000 / 14000 Consultation, Statistical Quality Control, Statistical Production Control, New Product Sourcing, Troubleshooting, Safety Engineering consultations / Applications for world wide Approvals and Certifications.

GIIC Calibration Laboratory

700/20-21 Phaholyothin Rd., Samsennai, Phayathai,
Bangkok 10400 Thailand

Tel : +66 (02) 615 4999
Fax : +66 (02) 615 4644
E-mail : cal@giic.co.th

NSC-TISI-TIS 17025

CERTIFICATE No.: CAL01773-23 PAGE: 1 OF: 3

Certificate of Calibration

Equipment :	DIGITAL LIGHT METER
Manufacturer :	KEPLER
Model / Type :	KLM-25L
Serial No. :	200101886
ID No. :	-
Customer :	Smile Laboratory Co.,Ltd.
	563/1 Thoet Thai Rd., Bangwa, Phasicharoen, Bangkok, 10160
C.S.R. No. :	L0001800-23
Received Date :	19 December 2023
Calibration Date :	21 December 2023
Calibrated By :	MR. TONTRAKARN SRIKACHA
Approved By :	MR. NATTAPOL KINGKAEW
Issue Date :	21 December 2023

[redacted]

The uncertainties are for a level of confidence of approximately 95%.

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GIIC Calibration Laboratory

CALIBRATION REPORT

Condition of this calibration result :

1. Environment : Temperature : (23 ± 3) °C
   Relative Humidity : (50 ± 15) %

2. Reference / Procedure Used :
   - This Instrument was calibrated by substitution with reference illuminance meter, the Instrument and reference illuminance meter were mounted with the plane of its diffuser vertical and normal to the direction of measurement Calibration was illuminated by the luminous standard lamp (operated at colour temperature 2856K) according to GIIC Calibration Laboratory calibration procedure No.GIICLAB-CP-L01.

3. Reference Standard Instrument :

Instrument	Model	Serial No	Certificate No	Due Dated
Illuminance meter	PMA2200 / PMA2130	25531 / 025000	TP-1021-23	8 Jun 24

4. This Certification is traceable to the SI unit through :
   - The National Institute of Metrology (Thailand) .

5. Uncertainty :
   - The reported uncertainty of measurement was estimated and based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95%.

GIIC Calibration Laboratory

CERTIFICATE No.: CAL01773-23 PAGE: 3 OF: 3

CALIBRATION REPORT

All data shown below were as received value : Without adjustment

Calibration result :

Function: Illuminance Measurement L9

[1]UUC Range (lux)	Standard Setting (lux)	[1]UUC Reading (lux)	Error (lux)	Uncertainty of measurement ± (lux)
AUTO RANGE	0	0.00	0.00	0.60
	50	50.2	0.2	1.6
	250	250.7	0.7	6.5
	500	502	2	13
	1000	1005	5	26
	1500	1506	6	36
	2000	2010	10	48
	3000	3016	16	72
	4000	4030	30	96
	5000	5040	40	0.12 klux

[1]UUC = Unit Under Calibration

This result of calibration was found accurated as show on data and place of calibration for the calibrated item only.

- END -

ภาคผนวก ง-2 หน้า 67/97

NSC-TISI-TIS 17025
CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0580 **MTC No.** EEL. BP. 10/0766

CALIBRATION CERTIFICATE

Submitted by : Smile Laboratory Co.,Ltd.

Address : 563/1, Thoet Thai Rd., Bangwa, Phasicharoen, Bangkok, 10160, Thailand.

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 : Quest Technologies

Model : QC-20

Serial No. : QF4090085

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 Panasonic VP-7722A S/N 041477D122.
7. Condenser Microphone B&K 4180 S/N 2633526.

Calibration Procedure: CP-102-04 based on IEC 60942-2003. The sound pressure level 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 : 5 Jul. 2023

Date of Calibration : 14 Jul. 2023

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Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

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E-mail : sumalee@tistr.or.th

Request No. 21-66/0580 **MTC No.** EEL. BP. 10/0766

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 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 IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	93.85	-0.15	± 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	1000.4	0.4	± 1.5	±1.0%

3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.40	± 0.50	±3.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Date of Calibration : 14 Jul. 2023

[redacted]

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0580 **MTC No.** EEL. BP. 10/0766

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 IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	114.01	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	1000.4	0.4	± 1.5	±1.0%

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	0.44	± 0.50	±3.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by : [redacted]

Date of Calibration : 14 Jul. 2023

Date of Issue : 17 Jul. 2023

Industrial Metrology and Testing Service Centre

Ref : 2011266070502629001

End of Certificate

3 / 3

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CALIBRATION LABORATORY

Certificate No. RA-2403030-15

Job No. RA-2403030

Certificate of Calibration

FOR

Equipment Name : Sound Level Meter
Manufacturer : Bruel & Kjaer
Model : 2238
Serial Number : 2524296
Customer Code : N/A
Location of Calibration : In Lab
Customer Name : Smile Laboratory Co.,Ltd.
563/1 Thoet Thai Rd., Bangwa,Phasicharoen,Bangkok 10160

Calibration Procedure : CPE-04-01
Received Date : Apr 1, 2024
Calibration Date : Apr 1, 2024
Recommended Due Date : N/A

CONDITION AS RECEIVED : Normal

Environmental Conditions

Ambient Temperature : (25 ± 2) °C **Relative Humidity :** (50 ± 15) %RH

Result : No Adjustment (See data attached in page 3 to the end of certificate)

1. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95%.
2. The Unit Under Calibration (UUC) has been calibrated by using the working standard which is traceable to SI-Units. The calibration procedure documented is intended to implement the requirements of ISO/IEC 17025 : 2017
3. The working standard is indicated in page 2 of this certificate.
4. This report applies to the item calibrated and shall not be reproduced except in full, without written approval by Calibration Laboratory, Advantage Center Co., Ltd.

Calibrated by [redacted]

Date of Issue : Apr 2, 2024 **Laboratory Management**

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pornsak2008@yahoo.co.th

Certificate No.: RA-2403030-15

Reference Standards

Equipment Name	Serial No.	Certificate No.	Due Date	Traceability to
Sound Calibrator	170603302	EEL.BP.108/1066	Oct 30, 2024	TISTR

Traceability

This calibration is traceable to the International System of Unit via :

- TISTR : Thailand Institute of Scientific and Technological Research

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pornsak2008@yahoo.co.th

Certificate No. : RA-2403030-15

Result of Calibration

Calibration Range : 94 dB, 114 dB **Function :** Mesurement @ 1 kHz

Select A

STD Setting	UUC Reading		Error		Uncertainty of Measurement (± dB)
	Fast	Slow	Fast	Slow	
94 dB	94.1	94.1	0.1	0.1	0.88
114 dB	114.2	114.2	0.2	0.2	0.88

Select C

STD Setting	UUC Reading		Error		Uncertainty of Measurement (± dB)
	Fast	Slow	Fast	Slow	
94 dB	94.1	94.1	0.1	0.1	0.88
114 dB	114.2	114.2	0.2	0.2	0.88

Select Z

STD Setting	UUC Reading		Error		Uncertainty of Measurement (± dB)
	Fast	Slow	Fast	Slow	
94 dB	94.1	94.1	0.1	0.1	0.88
114 dB	114.2	114.2	0.2	0.2	0.88

STD = Standard

UUC = Unit Under Calibration

- End of Certificate -

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CALIBRATION LABORATORY

Certificate No. RA-2403030-14

Job No. RA-2403030

Certificate of Calibration

FOR

Equipment Name : Sound Level Meter

Manufacturer : Pulsar Instrument **Calibration Procedure :** CPE-04-01

Model : 44 **Received Date :** Feb 5, 2024

Serial Number : PN1912 **Calibration Date :** Feb 20, 2024

Customer Code : N/A **Recommended Due Date :** N/A

Location of Calibration : In Lab

Customer Name : Smile Laboratory Co.,Ltd.
563/1 Thoet Thai Rd., Bangwa,Phasicharoen,Bangkok 10160

CONDITION AS RECEIVED : Normal

Environmental Conditions

Ambient Temperature : (25 ± 2) °C **Relative Humidity :** (50 ± 15) %RH

Result : No Adjustment (See data attached in page 3 to the end of certificate)

1. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95%.
2. The Unit Under Calibration (UUC) has been calibrated by using the working standard which is traceable to SI-Units. The calibration procedure documented is intended to implement the requirements of ISO/IEC 17025 : 2017
3. The working standard is indicated in page 2 of this certificate.
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Calibrated [redacted]

Date of Issue : Mar 13, 2024 **Laboratory Management**

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Certificate No.: RA-2403030-14

Reference Standards

Equipment Name	Serial No.	Certificate No.	Due Date	Traceability to
Sound Calibrator	170603302	EEL.BP.108/1066	Oct 30, 2024	TISTR

Traceability

This calibration is traceable to the International System of Unit via :

- TISTR : Thailand Institute of Scientific and Technological Research

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Certificate No. : RA-2403030-14

Result of Calibration

Calibration Range : 94 dB, 114 dB **Function :** Mesurement @ 1 kHz

Select A

STD Setting	UUC Reading		Error		Uncertainty of Measurement (± dB)
	Fast	Slow	Fast	Slow	
94 dB	94.1	94.1	0.1	0.1	0.88
114 dB	114.1	114.1	0.1	0.1	0.88

Select C

STD Setting	UUC Reading		Error		Uncertainty of Measurement (± dB)
	Fast	Slow	Fast	Slow	
94 dB	94.1	94.1	0.1	0.1	0.88
114 dB	114.1	114.1	0.1	0.1	0.88

Select Z

STD Setting	UUC Reading		Error		Uncertainty of Measurement (± dB)
	Fast	Slow	Fast	Slow	
94 dB	94.1	94.1	0.1	0.1	0.88
114 dB	114.2	114.2	0.2	0.2	0.88

STD = Standard

UUC = Unit Under Calibration

- End of Certificate -

Test Equipment Calibration, In-house Calibration Preparations, Source Inspection ISO 9000 / 14000 Consultation, Statistical Quality Control, Statistical Production Control, New Product Sourcing, Troubleshooting, Safety Engineering consultations / Applications for world wide Approvals and Certifications.

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CALIBRATION LABORATORY

CALIBRATION LABORATORY

Certificate No. RA-2401042-12

Job No. RA-2401042

Certificate of Calibration

FOR

Equipment Name : Sound Level Meter
Manufacturer : Pulsar Instrument
Model : 44
Serial Number : PN2350
Customer Code : N/A
Location of Calibration : In Lab
Customer Name : Smile Laboratory Co., Ltd.
563/1 Thoet Thai Rd., Bangwa, Phasicharoen, Bangkok 10160

Calibration Procedure : CPE-04-01
Received Date : Jan 22, 2024
Calibration Date : Jan 24, 2024
Recommended Due Date : N/A

CONDITION AS RECEIVED : Normal

Environmental Conditions

Ambient Temperature : (25 ± 2) °C **Relative Humidity :** (50 ± 15) %RH

Result : No Adjustment (See data attached in page 3 to the end of certificate)

1. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95%.
2. The Unit Under Calibration (UUC) has been calibrated by using the working standard which is traceable to SI-Units. The calibration procedure documented is intended to implement the requirements of ISO/IEC 17025 : 2017
3. The working standard is indicated in page 2 of this certificate.
4. This report applies to the item calibrated and shall not be reproduced except in full, without written approval by Calibration Laboratory, Advantage Center Co., Ltd.

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Certificate No.: RA-2401042-12

Reference Standards

Equipment Name	Serial No.	Certificate No.	Due Date	Traceability to
Sound Calibrator	170603302	EEL.BP.108/1066	Oct 30, 2024	TISTR

Traceability

This calibration is traceable to the International System of Unit via :

- TISTR : Thailand Institute of Scientific and Technological Research

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pornsak2008@yahoo.co.th

Certificate No. : RA-2401042-12

Result of Calibration

Calibration Range : 94 dB, 114 dB **Function :** Mesurement @ 1 kHz

Select A Fast response

STD Setting	UUC Reading (dB)	Correction (dB)	Uncertainty of Measurement (± dB)
94.56 dB	94.5	0.06	0.88
114.52 dB	114.6	-0.08	0.88

Select A Slow response

STD Setting	UUC Reading (dB)	Correction (dB)	Uncertainty of Measurement (± dB)
94.56 dB	94.5	0.06	0.88
114.52 dB	114.6	-0.08	0.88

Select C Fast response

STD Setting	UUC Reading (dB)	Correction (dB)	Uncertainty of Measurement (± dB)
94.56 dB	94.5	0.06	0.88
114.52 dB	114.6	-0.08	0.88

Select C Slow response

STD Setting	UUC Reading (dB)	Correction (dB)	Uncertainty of Measurement (± dB)
94.56 dB	94.5	0.06	0.88
114.52 dB	114.6	-0.08	0.88

STD = Standard

UUC = Unit Under Calibration

- End of Certificate -

Test Equipment Calibration, In-house Calibration Preparations, Source Inspection ISO 9000 / 14000 Consultation, Statistical Quality Control, Statistical Production Control, New Product Sourcing, Troubleshooting, Safety Engineering consultations / Applications for world wide Approvals and Certifications.

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CALIBRATION LABORATORY

Certificate No. RA-2401042-11

Job No. RA-2401042

Certificate of Calibration

FOR

Equipment Name : Sound Level Meter
Manufacturer : Pulsar Instrument
Model : 44
Serial Number : PN2348
Customer Code : N/A
Location of Calibration : In Lab
Customer Name : Smile Laboratory Co., Ltd.
563/1 Thoet Thai Rd., Bangwa, Phasicharoen, Bangkok 10160

Calibration Procedure : CPE-04-01
Received Date : Jan 22, 2024
Calibration Date : Jan 24, 2024
Recommended Due Date : N/A

CONDITION AS RECEIVED : Normal

Environmental Conditions

Ambient Temperature : (25 ± 2) °C **Relative Humidity :** (50 ± 15) %RH

Result : No Adjustment (See data attached in page 3 to the end of certificate)

1. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95%.
2. The Unit Under Calibration (UUC) has been calibrated by using the working standard which is traceable to SI-Units. The calibration procedure documented is intended to implement the requirements of ISO/IEC 17025 : 2017
3. The working standard is indicated in page 2 of this certificate.
4. This report applies to the item calibrated and shall not be reproduced except in full, without written approval by Calibrati[redacted]

Calibrated by

Date of Issue : Jan 24, 2024 **Laboratory Management**

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Certificate No.: RA-2401042-11

Reference Standards

Equipment Name	Serial No.	Certificate No.	Due Date	Traceability to
Sound Calibrator	170603302	EEL.BP.108/1066	Oct 30, 2024	TISTR

Traceability

This calibration is traceable to the International System of Unit via :

- TISTR : Thailand Institute of Scientific and Technological Research

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Certificate No. : RA-2401042-11

Result of Calibration

Calibration Range : 94 dB, 114 dB **Function :** Mesurement @ 1 kHz

Select A Fast response

STD Setting	UUC Reading (dB)	Correction (dB)	Uncertainty of Measurement (± dB)
94.56 dB	94.5	0.06	0.88
114.52 dB	114.6	-0.08	0.88

Select A Slow response

STD Setting	UUC Reading (dB)	Correction (dB)	Uncertainty of Measurement (± dB)
94.56 dB	94.5	0.06	0.88
114.52 dB	114.6	-0.08	0.88

Select C Fast response

STD Setting	UUC Reading (dB)	Correction (dB)	Uncertainty of Measurement (± dB)
94.56 dB	94.5	0.06	0.88
114.52 dB	114.5	0.02	0.88

Select C Slow response

STD Setting	UUC Reading (dB)	Correction (dB)	Uncertainty of Measurement (± dB)
94.56 dB	94.5	0.06	0.88
114.52 dB	114.5	0.02	0.88

STD = Standard

UUC = Unit Under Calibration

- End of Certificate -

Test Equipment Calibration, In-house Calibration Preparations, Source Inspection ISO 9000 / 14000 Consultation, Statistical Quality Control, Statistical Production Control, New Product Sourcing, Troubleshooting, Safety Engineering consultations / Applications for world wide Approvals and Certifications.

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CALIBRATION LABORATORY

Certificate No. RA-2401042-13

Job No. RA-2401042

Certificate of Calibration

FOR

Equipment Name : Sound Level Meter

Manufacturer : Pulsar Instrument

Model : 44

Serial Number : PN1934

Customer Code : N/A

Location of Calibration : In Lab

Customer Name : Smile Laboratory Co., Ltd.
563/1 Thoet Thai Rd., Bangwa, Phasicharoen, Bangkok 10160

Calibration Procedure : CPE-04-01

Received Date : Jan 22, 2024

Calibration Date : Jan 24, 2024

Recommended Due Date : N/A

CONDITION AS RECEIVED : Normal

Environmental Conditions

Ambient Temperature : (25 ± 2) °C **Relative Humidity :** (50 ± 15) %RH

Result : No Adjustment (See data attached in page 3 to the end of certificate)

1. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95%.
2. The Unit Under Calibration (UUC) has been calibrated by using the working standard which is traceable to SI-Units. The calibration procedure documented is intended to implement the requirements of ISO/IEC 17025 : 2017
3. The working standard is indicated in page 2 of this certificate.
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Calibrated by [redacted]

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Tel. (66-2) 9873248-50 Fax: (66-2) 9873252 E-mail: info.accl2662@gmail.com
pornsak2008@yahoo.co.th

Certificate No.: RA-2401042-13

Reference Standards

Equipment Name	Serial No.	Certificate No.	Due Date	Traceability to
Sound Calibrator	170603302	EEL.BP.108/1066	Oct 30, 2024	TISTR

Traceability

This calibration is traceable to the International System of Unit via :

- TISTR : Thailand Institute of Scientific and Technological Research

ACCL LM01

Test Equipment Calibration, In-house Calibration Preparations, Source Inspection ISO 9000 / 14000 Consultation, Statistical Quality Control, Statistical Production Control, New Product Sourcing, Troubleshooting, Safety Engineering consultations / Applications for world wide Approvals and Certifications.

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pornsak2008@yahoo.co.th

Certificate No. : RA-2401042-13

Result of Calibration

Calibration Range : 94 dB, 114 dB **Function :** Mesurement @ 1 kHz

Select A Fast response

STD Setting	UUC Reading (dB)	Correction (dB)	Uncertainty of Measurement (± dB)
94.56 dB	94.4	0.16	0.88
114.52 dB	114.5	0.02	0.88

Select A Slow response

STD Setting	UUC Reading (dB)	Correction (dB)	Uncertainty of Measurement (± dB)
94.56 dB	94.5	0.06	0.88
114.52 dB	114.5	0.02	0.88

Select C Fast response

STD Setting	UUC Reading (dB)	Correction (dB)	Uncertainty of Measurement (± dB)
94.56 dB	94.5	0.06	0.88
114.52 dB	114.5	0.02	0.88

Select C Slow response

STD Setting	UUC Reading (dB)	Correction (dB)	Uncertainty of Measurement (± dB)
94.56 dB	94.5	0.06	0.88
114.52 dB	114.5	0.02	0.88

STD = Standard

UUC = Unit Under Calibration

- End of Certificate -

ACCL LM01

Test Equipment Calibration, In-house Calibration Preparations, Source Inspection ISO 9000 / 14000 Consultation, Statistical Quality Control, Statistical Production Control, New Product Sourcing, Troubleshooting, Safety Engineering consultations / Applications for world wide Approvals and Certifica

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TAF Calibration Laboratory 3519

CERTIFICATE OF CALIBRATION

NO. 20240120110

Name of Product:	Sound Level Meter
Model	ST-21D
Serial Number:	820790
Specification:	Class 2
Conclusion:	Pass
Date of calibration:	2024-01-14
Due Date:	2025-01-13

Calibrated by: Jim Lin

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II. This certificate is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.
III. This certificate of calibration shall not be reproduced except in full, without written permission of the Scarlet Tech Co Ltd Taiwan.

1. Preliminary inspection： OK
2. Type & serial No. of Microphone： AWA14421A-000329
3. Adjustments to indicated sound levels：

Type of Calibrator B&K 4231

Sound Pressure Level 94.0 dB

4. Measuring up limit：138 dBA
5. Frequency weightings (Acoustic signal tests for Z weighting, other electric signal tests.)

Equivalent Free-field Sound Level (reference environment conditions) 93.8 dB

Nominal frequency /Hz	Frequency weighting / dB			Nominal frequency /Hz	Frequency weighting / dB		
	A	C	Z		A	C	Z
20	-50.3	-6.1	-0.3	1000	0.1	0.0	0.0
31.5	-39.5	-3.1	0.0	2000	1.3	-0.1	0.0
63	-26.2	-0.8	0.0	4000	1.3	-0.6	0.0
125	-16.2	-0.2	0.0	8000	-1.1	-3.1	-0.1
250	-8.7	-0.1	0.0	12500	-11.0	-13.0	0.0
500	-3.2	0.0	0.0	/	/	/	/

6. Self-generated noise

Microphone replaced by electrical input signal device

25.0 dB(A)	26.2 dB(C)	33.3 dB(Z)

7. F&S Weighting

Rate of the F weighting decrease（dB/s）	35.1
Rate of the S weighting decrease（dB/s）	4.4
Deviation of F&S	-0.1

8. Level Linearity (A-weighting at frequency 1 kHz)

Reference sound level 90.0 dB

Max error at 10dB steps upper reference sound level 0.1 dB

Max error at 1dB steps within 5dB of the upper limit linear operating range 0.0 dB

Max error at 10dB steps below reference sound level 0.1 dB

Max error at 1dB steps within 5dB upper the lower limit linear operating range 0.1 dB

9. Tone burst response（A Weighting）:

Single Toneburst duration /ms	Toneburst response /dB			
	LAFmax-LA	LASmax-LA	LAE-LA	LAeqT-LA
500	0.0	-4.0	-2.9	-7.0
200	-1.0	-7.4	-6.9	-7.0
2	-18.2	-26.9	-26.9	-7.0
0.25	-27.1	/	-36.1	-7.0

10. Peak C sound level （500Hz）:

Cycle	One cycle	nominal value	Positive half	nominal value	Negative half	nominal value
LCpeak-LC(dB)	3.5	3.5	2.3	2.4	2.3	2.4

11. Overload indication: Pass

12. Statistical analysis function

Sweep signal maximum indicated sound level: 123.0 dB

Sweep amplitude: 40 dB

Scan cycle time: 60 S; Measurement period: 180 S.

Items	Measured value/dB	Theoretical calculated value/dB	Error/dB
LAeq,T	113.3	113.4	-0.1
L5	121.0	121.0	0.0
L10	119.0	119.0	0.0
L50	103.0	103.0	0.0
L90	87.1	87.0	0.1
L95	85.1	85.0	0.1

Uncertainty of measurement results: 0.4 dB (k=2)

Environment conditions:

Air temperature: 20 ℃

Relative humidity: 50 %

Static pressure: 101.8 kPa

Test specifications:

1. All Scarlet's Sound level Meter has been calibrated in accordance with the requirements as specified in ISO 17025 and the lab calibration procedure SMTP004-CA-152.
2. The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of ±20%.
3. The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responses of the Sound Level Meter.

References:

IEC 61672-3 Sound Level Meters Part 3: Periodic tests

SCARLET | TECH

CERTIFICATE OF CALIBRATION

NO. 20231009169

Name of Product:	Sound Level Meter
Model:	ST-21D
Serial Number:	821044
Specification:	Class 2
Conclusion:	Pass
Date of calibration:	2023-10-18
Due Date:	2024-10-17

Calibrat[redacted]

SCARLET TECH CO., LTD. SCARLET | TECH 科技有限公司

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II. This certificate is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.
III. This certificate of calibration shall not be reproduced except in full, without written permission of the Scarlet Tech Co Ltd Taiwan.

1. Preliminary inspection: OK

2. Type & serial No. of Microphone: AWA14421A-000677

3. Adjustments to indicated sound levels:

Type of Calibrator B&K 4231

Sound Pressure Level 94.0 dB

Equivalent Free-field Sound Level (reference environment conditions) 93.8 dB

4. Measuring up limit: 138 dBA

5. Frequency weightings (Acoustic signal tests for Z weighting, other electric signal tests.)

Nominal frequency /Hz	Frequency weighting / dB			Nominal frequency /Hz	Frequency weighting / dB		
	A	C	Z		A	C	Z
20	-50.4	-6.2	-0.3	1000	0.0	0.0	0.0
31.5	-39.4	-3.0	0.0	2000	1.3	-0.1	0.0
63	-26.2	-0.8	0.0	4000	1.3	-0.6	0.0
125	-16.2	-0.2	0.0	8000	-1.2	-3.2	0.0
250	-8.6	-0.1	0.0	12500	-11.1	-13.1	0.0
500	-3.2	0.0	0.0	/	/	/	/

6. Self-generated noise

Microphone replaced by electrical input signal device

25.0 dB(A)	26.5 dB(C)	35.1 dB(Z)

7. F&S Weighting

Rate of the F weighting decrease (dB/s)	35.0
Rate of the S weighting decrease (dB/s)	4.3
Deviation of F&S	0.0

8. Level Linearity (A-weighting at frequency 1 kHz)

Reference sound level 90.0 dB

Max error at 10dB steps upper reference sound level 0.1 dB

Max error at 1dB steps within 5dB of the upper limit linear operating range 0.0 dB

Max error at 10dB steps below reference sound level 0.1 dB

Max error at 1dB steps within 5dB upper the lower limit linear operating range 0.1 dB

9. Tone burst response (A Weighting) :

Single Toneburst duration /ms	Toneburst response /dB			
	L_{ASmax}-L_A	L_{ASmax}-L_A	L_{AE}-L_A	$L_{Aeq,T}$-L_A
500	0.0	-4.0	-2.9	-7.0
200	-1.0	-16.9	-6.9	-7.0
2	-18.2	-26.9	-26.9	-7.0
0.25	-27.1	/	-36.0	-7.0

10. Peak C sound level (500Hz) :

Cycle	One cycle	nominal value	Positive half	nominal value	Negative half	nominal value
LCpeak-LC(dB)	3.5	3.5	2.3	2.4	2.3	2.4

11. Overload indication: Pass

12. Statistical analysis function

Sweep signal maximum indicated sound level: 123.0 dB

Sweep amplitude: 40 dB

Scan cycle time: 60 S; Measurement period: 180 S.

Items	Measured value/dB	Theoretical calculated value/dB	Error/dB
LAeq,T	113.3	113.4	-0.1
L5	121.0	121.0	0.0
L10	119.0	119.0	0.0

L50	103.0	103.0	0.0
L90	87.1	87.0	0.1
L95	85.1	85.0	0.1

Uncertainty of measurement results: 0.4 dB (k=2)

Environment conditions:

Air temperature: 25 °C

Relative humidity: 60 %

Static pressure: 101.8 kPa

References:

IEC 61672-3 Sound Level Meters Part 3: Periodic tests

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CERTIFICATE OF CALIBRATION

NO. 20231009168

Name of Product:	Sound Level Meter
Model:	ST-21D
Serial Number:	821043
Specification:	Class 2
Conclusion:	Pass
Date of calibration:	2023-10-18
Due Date:	2024-10-17

Calibrated by: [redacted]

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III. This certificate of calibration shall not be reproduced except in full, without written permission of the Scarlet Tech Co Ltd Taiwan.

1. Preliminary inspection: OK

2. Type & serial No. of Microphone: AWA14421A-000644

3. Adjustments to indicated sound levels:

Type of Calibrator B&K 4231

Sound Pressure Level 94.0 dB

Equivalent Free-field Sound Level (reference environment conditions) 93.8 dB

4. Measuring up limit: 138 dBA

5. Frequency weightings (Acoustic signal tests for Z weighting, other electric signal tests.)

Nominal frequency /Hz	Frequency weighting / dB			Nominal frequency /Hz	Frequency weighting / dB		
	A	C	Z		A	C	Z
20	-50.3	-6.2	-0.1	1000	0.1	0.0	0.0
31.5	-39.5	-3.1	-0.2	2000	1.3	-0.1	0.0
63	-26.2	-0.9	0.0	4000	1.3	-0.6	0.0
125	-16.2	-0.2	0.0	8000	-1.2	-3.2	0.0
250	-8.6	0.0	0.0	12500	-11.0	-13.0	0.0
500	-3.2	0.0	0.0	/	/	/	/

6. Self-generated noise

Microphone replaced by electrical input signal device

25.2 dB(A)	27.1 dB(C)	37.5 dB(Z)

7. F&S Weighting

Rate of the F weighting decrease（dB/s）	35.0
Rate of the S weighting decrease（dB/s）	4.4
Deviation of F&S	-0.1

8. Level Linearity (A-weighting at frequency 1 kHz)

Reference sound level 90.0 dB

Max error at 10dB steps upper reference sound level 0.1 dB

Max error at 1dB steps within 5dB of the upper limit linear operating range 0.0 dB

Max error at 10dB steps below reference sound level 0.1 dB

Max error at 1dB steps within 5dB upper the lower limit linear operating range 0.1 dB

9. Tone burst response（A Weighting）:

Single Toneburst duration /ms	Toneburst response /dB			
	L_{AFmax}-L_A	L_{ASmax}-L_A	L_{AE}-L_A	L_{AeqT}-L_A
500	0.0	-4.0	-2.9	-7.0
200	-1.0	-16.9	-6.9	-7.0
2	-18.2	-26.9	-26.9	-7.0
0.25	-27.2	/	-36.0	-7.0

10. Peak C sound level（500Hz）:

Cycle	One cycle	nominal value	Positive half	nominal value	Negative half	nominal value
LCpeak-LC(dB)	3.5	3.5	2.4	2.4	2.3	2.4

11. Overload indication: Pass

12. Statistical analysis function

Sweep signal maximum indicated sound level: 123.0 dB

Sweep amplitude: 40 dB

Scan cycle time: 60 S; Measurement period: 180 S.

Items	Measured value/dB	Theoretical calculated value/dB	Error/dB
LAeq,T	113.3	113.4	-0.1
L5	121.0	121.0	0.0
L10	119.0	119.0	0.0
L50	103.0	103.0	0.0
L90	87.1	87.0	0.1
L95	85.1	85.0	0.1

Uncertainty of measurement results: 0.4 dB (k=2)

Environment conditions:

Air temperature: 25 ℃

Relative humidity: 60 %

Static pressure: 101.8 kPa

References:

IEC 61672-3 Sound Level Meters Part 3: Periodic tests

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CERTIFICATE OF CALIBRATION

NO. 20231009167

Name of Product:	Sound Level Meter
Model:	ST-21D
Serial Number:	821042
Specification:	Class 2
Conclusion:	Pass
Date of calibration:	2023-10-18
Due Date:	2024-10-17

Calibrate [redacted]

I. This report certifies that all calibration equipment used in the test is traceable with the internal ISO9001 procedures and meets all specification given in the Manual(s) or respectively surpass then, and applies only to the unit identified above.

II. This certificate is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.

III. This certificate of calibration shall not be reproduced except in full, without written permission of the Scarlet Tech Co Ltd Taiwan.

1. Preliminary inspection: OK

2. Type & serial No. of Microphone: AWA14421A-000606

3. Adjustments to indicated sound levels:

Type of Calibrator B&K 4231

Sound Pressure Level 94.0 dB

Equivalent Free-field Sound Level (reference environment conditions) 93.8 dB

4. Measuring up limit: 138 dBA

5. Frequency weightings (Acoustic signal tests for Z weighting, other electric signal tests.)

Nominal frequency /Hz	Frequency weighting / dB			Nominal frequency /Hz	Frequency weighting / dB		
	A	C	Z		A	C	Z
20	-50.3	-8.3	-0.1	1000	0.1	0.0	0.0
31.5	-39.4	-2.9	-0.1	2000	1.4	-0.1	0.1
63	-26.1	-0.8	0.0	4000	1.3	-0.6	0.1
125	-16.1	-0.2	0 0	8000	-1.2	-3.1	0.1
250	-8.6	0.0	0.0	12500	-11.0	-13.0	0.0
500	-3.2	0.0	0.0	/	/	/	/

6. Self-generated noise

Microphone replaced by electrical input signal device

25.1 dB(A)	26.5 dB(C)	34.6 dB(Z)

7. F&S Weighting

Rate of the F weighting decrease (dB/s)	35.0
Rate of the S weighting decrease (dB/s)	4.3
Deviation of F&S	0.1

8. Level Linearity (A-weighting at frequency 1 kHz)

Reference sound level 90.0 dB

Max error at 10dB steps upper reference sound level 0.1 dB

Max error at 1dB steps within 5dB of the upper limit linear operating range 0.0 dB

Max error at 10dB steps below reference sound level 0.1 dB

Max error at 1dB steps within 5dB upper the lower limit linear operating range 0.1 dB

9. Tone burst response (A Weighting):

Single Toneburst duration /ms	Toneburst response /dB			
	L_{AFmax}-L_A	L_{ASmax}-L_A	L_{AE}-L_A	L_{Aeq}-L_A
500	0.0	-4.0	-2.9	-7.0
200	-1.0	-16.9	-6.9	-7.0
2	-18.2	-26.9	-26.9	-7.0
0.25	-27.1	/	-36.0	-7.0

10. Peak C sound level (500Hz):

Cycle	One cycle	nominal value	Positive half	nominal value	Negative half	nominal value
LCpeak-LC[dB]	3.5	3.5	2.3	2.4	2.3	2.4

11. Overload indication: Pass

12. Statistical analysis function

Sweep signal maximum indicated sound level: 123.0 dB

Sweep amplitude: 40 dB

Scan cycle time: 60 S; Measurement period: 180 S.

Items	Measured value/dB	Theoretical calculated value/dB	Error/dB
LAeq,T	113.3	113.4	-0.1
L5	121.0	121.0	0.0
L10	119.0	119.0	0.0

L50	103.0	103.0	0.0
L90	87.1	87.0	0.1
L95	85.1	85.0	0.1

Uncertainty of measurement results: 0.4 dB (k=2)

Environment conditions:

Air temperature: 25 °C

Relative humidity: 60 %

Static pressure: 101.8 kPa

References:

IEC 61672-3 Sound Level Meters Part 3: Periodic tests

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pornsak2008@yahoo.co.th

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CALIBRATION LABORATORY

CALIBRATION LABORATORY

Certificate No. RA-2401042-7

Job No. RA-2401042

Certificate of Calibration

FOR

Equipment Name : Sound Level Meter

Manufacturer : RION

Model : NL-21

Serial Number : 00265092

Customer Code : N/A

Location of Calibration : In Lab

Customer Name : Smile Laboratory Co., Ltd.
563/1 Thoet Thai Rd., Bangwa, Phasicharoen, Bangkok 10160

Calibration Procedure : CPE-04-01

Received Date : Jan 22, 2024

Calibration Date : Jan 24, 2024

Recommended Due Date : N/A

CONDITION AS RECEIVED : Normal

Environmental Conditions

Ambient Temperature : (25 ± 2) °C **Relative Humidity :** (50 ± 15) %RH

Result : No Adjustment (See data attached in page 3 to the end of certificate)

1. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95%.
2. The Unit Under Calibration (UUC) has been calibrated by using the working standard which is traceable to SI-Units. The calibration procedure documented is intended to implement the requirements of ISO/IEC 17025 : 2017
3. The working standard is indicated in page 2 of this certificate.
4. This report applies to the item calibrated and shall not be reproduced except in full, without written approval by Calibration Laboratory, Advantage Center Co., Ltd.

Calibra [redacted]

Test Equipment Calibration, In-house Calibration Preparations, Source Inspection ISO 9000 - 14000 Consultation, Statistical Quality Control, Statistical Production Control, New Product Sourcing, Troubleshooting, Safety Engineering consultations - Applications for world wide Approvals and Certifications.

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pornsak2008@yahoo.co.th

Certificate No.: RA-2401042-7

Reference Standards

Equipment Name	Serial No.	Certificate No.	Due Date	Traceability to
Sound Calibrator	170603302	EEL.BP.108/1066	Oct 30, 2024	TISTR

Traceability

This calibration is traceable to the International System of Unit via :

- TISTR : Thailand Institute of Scientific and Technological Research

Test Equipment Calibration, In-house Calibration Preparations, Source Inspection ISO 9000 / 14000 Consultation, Statistical Quality Control, Statistical Production Control, New Product Sourcing, Troubleshooting, Safety Engineering consultations / Applications for world wide Approvals and Certifications.

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pornsak2008@yahoo.co.th

Certificate No. : RA-2401042-7

Result of Calibration

Calibration Range : 94 dB, 114 dB **Function :** Mesurement @ 1 kHz

Select A Fast response

STD Setting	UUC Reading (dB)	Correction (dB)	Uncertainty of Measurement (± dB)
94.56 dB	94.5	0.06	0.88
114.52 dB	114.5	0.02	0.88

Select A Slow response

STD Setting	UUC Reading (dB)	Correction (dB)	Uncertainty of Measurement (± dB)
94.56 dB	94.5	0.06	0.88
114.52 dB	114.6	-0.08	0.88

Select C Fast response

STD Setting	UUC Reading (dB)	Correction (dB)	Uncertainty of Measurement (± dB)
94.56 dB	94.5	0.06	0.88
114.52 dB	114.5	0.02	0.88

Select C Slow response

STD Setting	UUC Reading (dB)	Correction (dB)	Uncertainty of Measurement (± dB)
94.56 dB	94.5	0.06	0.88
114.52 dB	114.6	-0.08	0.88

STD = Standard

UUC = Unit Under Calibration

- End of Certificate -

Test Equipment Calibration, In-house Calibration Preparations, Source Inspection ISO 9000 / 14000 Consultation, Statistical Quality Control, Statistical Production Control, New Product Sourcing, Troubleshooting, Safety Engineering consultations / Applications for world wide Approvals and Certifications.

บริษัท อีโค่ คอนซัลแทนท์ จำกัด

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484

ISO/IEC 17025
ISO 9001
ISO 14001
NSC-TISI-TIS17025
CALIBRATION 0008

Cert.No.: 21CH1558
Page.: 1 of 3

Certificate of Calibration

Equipment :	pH Meter
Manufacturer :	Mettler Toledo
Model :	Five Easy
Serial No. :	B617389478
ID No. :	PH-02
Condition As-Received:	Used Item
Received Date :	05 November 2021
Calibration Date :	09 November 2021
Reference :	2111-0236WN-1
Submitted by :	Eco Consultant Co.,Ltd. 32/3-4 Moo 4, Tambon Talkoa, Amphur Samkhok, Phatum Thanee 12160
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) - CP-CH8 by comparison with standard thermometer

[redacted]

Issue Date : 16 November 2021

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services

A 0032759

Cert.No.: 21CH1558
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	21E2682	25 Aug 2022
2) Ref. Standard Thermometer	3240076	60RC033	21H93	14 Feb 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 : 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	761016	02 Aug 2023
pH 6.982	CPA chem	761017	02 Aug 2022
pH 10.015	CPA chem	761016	02 Aug 2023

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	Coverage factor
	pH	mV	mV	pH	(±mV)	k
pH Meter	4.00	177.48	177	4.01	0.58	2.00
S/N.: B617389478	7.00	0.00	0	7.01	0.58	2.00
	10.00	-177.48	-177	10.01	0.58	2.00

[redacted]

a 1081116

Calibration Results

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.: 9418196	4.008	3.99	175	0.0086	2.05
	6.982	6.99	5	0.012	2.07
	10.015	9.98	-165	0.013	2.07

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe:

- Model : -
- Serial No. : 9418196

Dimension of probe:

- Length : 120 mm.
- Diameter : 12 mm.
- Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (±°C)	Coverage factor *k*
25.0	25.003	25.2	0.197	0.20	2.00

Remark : - UUC* = Unit Under Calibration

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

-o0o-

[redacted]

a 1081115

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Purge and Trap Sampler Preventive Maintenance (PM)

Company Name:	Eco consultant Co.,Ltd		
Address (Instrument Location):	32/3-4 Moo4 T.Taiko, Amphur. Samkok, Pathumthani. 12160 Thailand		
Serial Number:	US16264002	**PM Number:**	2 of 2
Customer Name (if applicable):	Ms.Thitima	**Telephone Number**	02-9044366
Service Engineer Name:	Pramote Chaisorn	**Service Order Number:**	WO-01583164
Date PM Performed: (DD-MMM-YYYY)	30-May-2022	**Next PM Due Date:** (DD-MMM-YYYY)	30-Nov- 2022

Part Number	Release	Publication Date	
TH09370088	B	May 2013	PerkinElmer

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

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

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Component List

Component / Specific Model	Serial #	Firmware Version	Configuration Notes
Clarus680	680S15052702	REV.5.1.81	Clarus680
Lenovo Thinkcenter	Sn: MJ02GYPQ	Window7	Lenovo Thinkcenter

Parts Lists

Parts Included with the PM				
Part Number (if applicable)	**Description**	**Quantity**	**Batch/Lot #**	**Expiration Date** (MM/YY)
N/A				

Additional Tools Required for PM				
Part Number (if applicable)	**Description**	**Quantity**	**Serial #**	**Calibration Due Date** (MM/YY)
LF021-050	Fluke179 multimeter	1	22460228	4-Nov-2022

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	**Description**	**Quantity**	**Batch/Lot #**	**Expiration Date** (MM/YY)
N/A				

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Procedure Checklist

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

1. **General:**

- ☒ Ask customer about unit's performance since last visit.
- ☒ Check incoming AC line Voltage for proper levels and grounding.

2. **Mechanical:**

- ☒ Check all mechanical adjustments. Adjust if necessary.
- ☒ Inspect all gas line filters & traps. Replace if necessary with customer supplied spares.
- ☒ Leak-check all fittings from gas source to instrument.
- ☒ Inspect the sample needle.
- ☒ Inspect Analytical trap.
- ☒ Check and replace pencil filter (if necessary).
- ☒ Perform a complete system leak test & replace any defective seals or fittings with customer supplied spares.
- ☒ Check that all carrier gas controls & solenoids are functioning correctly
- ☒ Check and clean the vial lift assembly
- ☒ Check and clean the robot arm assembly.
- ☒ Check and clean the sparger glassware(Change if necessary).
- ☒ Check and clean the Cooling part.
- ☒ Clean exterior of instrument.

3. **Electrical:**

- ☒ Inspect and clean PC boards.
- ☒ Check for any loose cables & connectors.
- ☒ Check unit's firmware version & upgrade to current levels if necessary.
- ☒ Check all power supply voltages.
- ☒ Check the oven, transfer line & heated valve temperatures rise & stabilize when set to 150°C.

4. **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

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Additional Comments

Additional Comments Regarding the PM

Review

The preventive maintenance checks and if applicable performance tests for Purge and Trap sampler have been completed.

This Purge and Trap ☒*Passes* ☐ *Fails* *the preventive maintenance.*

[redacted]

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GC Clarus 600/680 Preventive Maintenance (PM)

Company Name:	**Eco Consultant Co.,Ltd.**		
Address (Instrument Location):	32/3-4 Moo4 T.Talko, Amphur. Samkok, Pathumthani, 12160 Thailand		
Serial Number:	680S11052702	**Service Tag:**	N68APSSFXM
Customer Name (if applicable):	Ms.Thitima	**PM number:**	2 of 2
Service Engineer Name:	Pramote Chaisorn	**Service Order Number:**	WO-01600510
Date PM Performed: (DD-MMM-YYYY)	30-May-2022	**Next PM Due Date:** (DD-MMM-YYYY)	30-Nov-2022

Part Number	Release	Publication Date
TH09370070	C	August 2015

PerkinElmer

Scope
The purpose of this PM is to ensure the continued functionality of the Clarus 600 and Clarus 680 GC by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer. The customer should save their method before the PM begins.

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

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Component List

Component / Specific Model	Serial #	Software Version	Configuration Notes
Lenovo Thinkcenter	Sn: MJ02GYPQ	Window7	

Parts Lists

Additional Tools Required for PM				
Part Number (if applicable)	**Description**	**Quantity**	**Serial #**	**Calibration Due Date** (MM/YY)
LF020-050	Fluke Multimeter	1	22460228	04-Nov-2022

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	**Description**	**Quantity**	**Batch/Lot #**	**Expiration Date** (MM/YY)
N/A				

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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.
- ☑ Check incoming AC line voltage for proper levels and grounding.
  L-N 220 Volt
  L-G 220 Volt
  N-G 0.40 Volt

  **Neutral to ground not more than 0.5 volts peak to peak*
- ☑ Inspect all gas line filters and traps; Replace if necessary with customer supplied spares.
  Carrier gas ☑ Helium ☐ Nitrogen ☐ Hydrogen
  Moisture level ☑ Good ☐ Need to replace ☐ Other _____

  Detector gas ☑ Air Zero ☑ Hydrogen ☐ Nitrogen ☐ Helium
  Moisture level ☑ Good ☐ Need to replace ☐ Other _____
- ☑ Inspect the customer log book and make any appropriate PM entries.
- ☑ Leak check all fittings from the gas source to instrument.
  Gas leakage ☑ Pass ☐ Fail Comment _____
- ☑ Perform general inspection of system for cleanliness.
- ☑ Inspect for functional and clean electronic cooling and oven vent fans
  Electronic cooling fan ☑ Yes ☐ No
  Oven cooling fan ☑ Yes ☐ No

2. Electronic :

- ☑ Check oven temperature. Calibrate if necessary.
  Oven temperature set point 150 °C ☑ Pass ☐ Fail
- ☐ Check sub-ambient option. (If installed).
  Oven temperature set point 5 °C ☐ Pass ☐ Fail
- ☑ Perform routine maintenance on detector/injector. Replace parts as necessary with customer supplied spares.

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- ☑ Check flows, including split flows if applicable. Calibrate if necessary.
  Carrier flow Pass
  Split flow Pass
- ☑ Check detector gas flows and adjust if necessary.
  Detector flow Pass
- ☑ Autosampler installed ☑ Yes ☐ No
  Check autosampler sensor for wear and replace if necessary.
  Vial sensor Pass
  Door sensor Pass
  Tower sensor Pass
  Plunger sensor Pass
  Elevator sensor Pass
- ☑ Remove syringe, manually flush. Replace with customer supplied spare if necessary.
- ☑ Check firmware version. Upgrade to current levels if necessary.
  Firmware version 7.0.1
- ☑ Measure all accessible power supply voltages.
  5 Volt Pass
  +15 Volt Pass
  -15 Volt Pass
  24 Volt Pass
- ☑ Record all detector voltage signal.
  Detector Channel A 0.85 mV.
  Detector Channel B N/A mV.

3. Diagnostics Tests:

- ☑ Run instrument diagnostics.
  ☑ BRAM Pass
  ☑ EPROM Pass
- ☑ Run Autosampler diagnostics.
  ☑ BRAM Pass
  ☑ EPROM Pass

4. 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.

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Additional Comments

Additional Comments Regarding the PM

Review

The preventive maintenance checks and if applicable performance tests for Clarus600/680 GC have been completed.

This Clarus600/680 GC **Pass** *the preventive maintenance.*

[redacted]

Turbomass/Clarus Mass/ SQ8 MS Preventive Maintenance (PM)

Company Name:	**Eco Consultant Co.,Ltd.**		
Address (Instrument Location):	32/3-4 Moo4 T.Taiko, Amphur. Samkok, Pathumthani, 12160 Thailand		
Serial Number:	648N5052104	**PM Number:**	2 of 2
Customer Name (if applicable):	Ms.Thitima	**Telephone Number:**	NA
Service Engineer Name:	Pramote Chaisom	**Service Order Number:**	WO-01600509
Date PM Performed: (DD-MMM-YYYY)	30-May-2022	**Next PM Due Date:** (DD-MMM-YYYY)	30-Nov-2022

Part Number	Release	Publication Date
TH09370064	C	March 2013

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Scope
The purpose of this PM is to ensure the continued functionality of the Turbomass/Clarus MS SQ8 MS by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer. The customer should save their method before the PM begins.

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

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Component List

Component / Specific Model	Serial #	Software Version	Configuration Notes
N/A			

Parts lists

Parts Included with the PM				
Part Number (if applicable)	**Description**	**Quantity**	**Batch/Lot #**	**Expiration Date** (MM/YY)
N/A				

Additional Tools Required for PM				
Part Number (If applicable)	**Description**	**Quantity**	**Serial #**	**Calibration Due Date** (MM/YY)
LF020-050	Fluke179 multimeter	1	22460228	4-Nov-2022

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	**Description**	**Quantity**	**Batch/Lot #**	**Expiration Date** (MM/YY)
N/A				

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Procedure Checklist

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

General:

- ☑ Column type Elite 5ms
- ☑ Carrier gas flow rate 1 ml/min.
- ☑ Review the instrument performance with the customer and document any recent problems.
- ☑ Inspect the customer log book and make any appropriate PM entries.
- ☑ Check incoming AC line voltage for proper levels and grounding.

Mechanical:

- ☑ Inspect and clean all fans and filters.
- ☑ Check the level of FC-43 calibration compound in reference gas bulb and fill if necessary.
- ☑ Change the oil in the fore pump.
- ☑ Inspect cartridge in fore pump vacuum filter; replace adsorbent bead if necessary.
- ☑ Replace the exhaust vapor mist filter on the fore pump.
- ☑ Remove and clean the ion source assembly. Use the Insulator Replacement Kit and/or Optics Replacement Kit if necessary
- ☑ Replace the filament.
- ☑ Remove and clean the pre-quad rods.
- ☑ Observe Wide Range Gauge pressure; clean/adjust if required.
- ☑ Inspect and clean as needed all PC boards and bottom inside of MS chassis.

Electrical:

- ☑ Check head amp offset. Adjust if necessary for proper value (Service Manual).

Operational Tests:

- ☑ Vacuum pressure.
- ☑ Air/water leak check
- ☑ AutoTune and mass calibration.
- ☑ Make a Chromatographic injection to verify peak shape and integrity only (not meant for sensitivity test).

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PC Maintenance:

- ☑ Delete all unnecessary temporary files.
- ☑ Empty deleted files from recycle bin.
- ☑ Perform hard drive defragmentation.

Review:

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

Additional Comments

Additional Comments Regarding the PM

Review

The preventive maintenance checks and if applicable performance tests for Turbomass/ Clarus Mass/ SQ8 have been completed.

This Turbomass/ClarusMS/SQ8 **Pass** *the preventive maintenance.*

[redacted]

(DD-MMM-YYYY)

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MAINTENANCE AND IPV TEST CERTIFICATE MODEL
OPTIMA 8000

Customer :	ECO Consultance	Date Tested:	March 24, 2022
		Recommendation Recertification Period	6
Address :	13 32/13 หมู่ 4	Recertification Due:	September 23, 2021
	ตำบล ท้ายเกาะ อำเภอสามโคก	Date Last Certified:	March 23, 2022
	ปทุมธานี 12160	Visit Number:	2 of 2
User Name:	Koofa	PerkinElmer Phone:	02-719-6420 ext 206
Phone:		PerkinElmer Fax:	02-318-5597
Email:			

CONFIGURATION TESTED		ACCESSORIES/COMPONENT NOT INCLUDED
MODEL	SERIAL NUMBER	
OPTIMA 8000	078N1408041C	WinLab32 Version 5.5.0.0714
TESTED EQUIPMENT	CALIBRATION NUMBER	EXPIRATION
IPV Methods		
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
Mixed standard 1/10	N069-1579	AUG 30, 2022
Mixed standard 1/100	N930-0221	MAY 30, 2023
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
2 % HNO3		
10 % HNO3		

PerkinEler Ltd. 290 Soi 17, Rama 9 Road, Khwang Bangkapi, Khet Huay Kwang, Bangkok 10310, Thailand

ICP016023

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MAINTENANCE AND IPV TEST CERTIFICATE MODEL
OPTIMA 8000

SERIAL NUMBER : 078N1408041C DATE TESTED : March 24, 2022

PARAMETER			SPECIFICATION		FINAL VALUE	
Spectral Resolution : UV	As	193.696 nm	≤ 0.009		0.00755	nm
	Ni	231.604 nm	≤ 0.011		0.00892	nm
	Ni	341.476 nm	≤ 0.015		0.01363	nm
Spectral Resolution : VIS	Ba	455.403 nm	≤ 0.020		0.01609	nm
Precision						
	Zn	206.200 nm	% RSD	≤ 1.0	0.94	%
	Mg	280.271 nm	% RSD	≤ 1.0	0.65	%
	Mg	285.213 nm	% RSD	≤ 1.0	0.91	%
	Ba	455.403 nm	% RSD	≤ 1.0	0.30	%
Detection Limits : Axial	As	193.696 nm	3(SD) ppb		7.29	ppb
	Se	196.026 nm	3(SD) ppb		1.21	ppb
	Tl	190.801 nm	3(SD) ppb		4.71	ppb
	Pb	220.353 nm	3(SD) ppb		3.25	ppb
Detection Limits : Radial	As	193.696 nm	3(SD) ppb		8.79	ppb
	Zn	213.857 nm	3(SD) ppb		0.61	ppb
	Mn	257.610 nm	3(SD) ppb		0.12	ppb
	La	379.478 nm	3(SD) ppb		0.83	ppb
	Ba	455.403 nm	3(SD) ppb		0.09	ppb
	Ba	493.408 nm	3(SD) ppb		0.08	ppb
BEC : Axial (IB X 1000)/(IS-IB)	Mn	257.610 nm	≤ 30 ppb		13.25	ppb
BEC : Radial (IB X 1000)/(IS-IB)	Mn	257.610 nm	≤ 30 ppb		28.69	ppb

PerkinEler Ltd. 290 Soi 17, Rama 9 Road, Khwang Bangkapi, Khet Huay Kwang, Bangkok 10310, Thailand

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ICP016023

078N1110509C

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http://www.perkinelmer.com

Service Report

Work Order Number	Activity Code	Billing Type	Requested Start Date	Model	Serial Number
WO-01602313	Planned Maintenance	Contract	18/01/2565 15:29 น.	ICPN078011	078S1408041C

Service Representative Name	Contract Number	Expiry Date	Equipment ID	System ID
Siangwong, Khwanchai	SC-0035494235	12/06/2023	N/A	N/A

UDI Number
N/A

Equipment Location	Bill To Name
บริษัท อีโค คอนซัลแทนท์ จำกัด สำนักสามโคก จังหวัดปทุมธานี 37 12160 TH	บริษัท อีโค คอนซัลแทนท์ จำกัด สำนักสามโคก จังหวัดปทุมธานี 37 12160 TH

Customer Contact	Phone Number	Fax Number	Email	Purchase Order
K.Pannipa,	095-4589562	N/A	pannipa@loreesa-corp.com	ECO 020/63

Work Description

- Clean sample introduction, mirrors, lens, instrument exterior
- Perform WL Cal and Instrument test

Start Date	End Date
24/03/2022	24/03/2022
24/03/2022	24/03/2022

Work Description

Tools Used

Quantity	Calibrated Tool	Description	Serial Number	Last Calibration Date	Next Calibration Date
*** No Calibrated Tools Used ***					

Material Used

Part Number	Part Description	Note	Lot/Serial Number	Quantity
*** No Parts Used ***				

Labour Details

Part Number	Part Description	Start Date	Quantity

[redacted]

PerkinElmer TruQ

Atomic Spectroscopy Standard

Certificate of Analysis

PerkinElmer Number: N0691579
Description: Multi-Element Standard
Matrix: 2% HNO_3
Lot Number: 57-024CRX1

Certification Date: NOV - - 2021
Expiration Date: MAY 3 0 2023

*** Instrumental Analysis using ICP Spectrometer:**

Analyte	Labeled	Measured	SRM	Analyte	Labeled	Measured	SRM
As	50.0 µg/mL	50.1 µg/mL	3103a*	Ni	10.0 µg/mL	10.0 µg/mL	3136*
K	50.0 µg/mL	50.3 µg/mL	3141a*	Sr	10.0 µg/mL	10.0 µg/mL	3153a*
La	10.0 µg/mL	10.0 µg/mL	3127a*	Zn	10.0 µg/mL	10.0 µg/mL	3168a*
Li	10.0 µg/mL	10.0 µg/mL	3129a*	Ba	1.00 µg/mL	1.01 µg/mL	3104a*
Mn	10.0 µg/mL	10.1 µg/mL	3132*	Mg	1.00 µg/mL	1.01 µg/mL	3131a*

* - Indicates NIST SRM † - Indicates CRM (when NIST SRM is not available)

Reference Multi: Lot# 2-84MJ, 3-168MJ, 4-39MJ

Refer to side 2 for details of certification.

Balances are calibrated with weight sets traceable to NIST

We guarantee that our PerkinElmer TruQ Atomic Spectroscopy Standards are stable and accurate to ±0.5% of certified concentration until the expiration date, provided the standards are kept tightly capped and stored under normal laboratory conditions. This value is the sum of cumulative errors associated with the analytical determinations, pipetting, and diluting to final volume. For these solutions we use high purity acids. ASTM Type I water (18 megohm double deionized), and leached, triple-cleaned bo

[redacted]

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U.S.A. Toll Free: 1-800-762-4000

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Certificate of Completion

This certifies that

Khwanchai Siangwong

Has successfully completed

ICP Optima 8000 & Optima 2000/4000/7000 DV

Completed on 4/17/2021 02:54 PM Eastern/New York

Certified By: Fred Rubino

Global Training Leader

Print Date: May 19, 2016, 10:44 AM

This Certificate has been generated electronically from PerkinElmer Learning Management System, LMS ES-009-000, 0-05-55-11.

PerkinElmer Pure

Atomic Spectroscopy Standard

ISO 9001

Certificate of Analysis

PerkinElmer Number: N9300221
Description: Instrument Calibration Standard 4
Matrix: 5% HNO_3
Lot Number: 54-134CRY1

Certification Date: FEB -- 2021
Expiration Date: AUG 30 2022

*** Instrumental Analysis using OPTIMA 7300 DV ICP Spectrometer:**

Analyte	Labeled	Measured	SRM	Analyte	Labeled	Measured	SRM
As	100 µg/mL	100 µg/mL	3103a*	Pb	50.0 µg/mL	50.1 µg/mL	3128*
Tl	100 µg/mL	101 µg/mL	3158*	Se	50.0 µg/mL	49.9 µg/mL	3149*
Cd	50.0 µg/mL	50.0 µg/mL	3108*				

* - Indicates NIST SRM † - Indicates CRM (when NIST SRM is not available)

Reference Multi: Lot# 52-179CR, 1-177YJ

Refer to side 2 for details of certification.

Balances are calibrated with weight sets traceable to NIST

We guarantee that our PerkinElmer Pure Atomic Spectroscopy Standards are stable and accurate to ±0.5% of certified concentration until the expiration date, provided the standards are kept tightly capped and stored under normal laboratory conditions. This value is the sum of cumulative errors associated with the analytical determinations, pipetting, and diluting to final volume. For these

ed bottles. All glas

[redacted]

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4000