
เอกสารการสอบเทียบความถูกต้องของเครื่องมือ

**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม**

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
1. คุณภาพอากาศ <u>คุณภาพอากาศในบรรยากาศ</u> - Total Suspended Particulate - Nitrogen Dioxide - o-Xylene - Maleic Anhydride <u>คุณภาพอากาศจากปล่อง</u> - Total Suspended Particulate - Oxide of Nitrogen - Carbon Monoxide - o-Xylene - Maleic Anhydride <u>คุณภาพอากาศในสถานประกอบการ</u> - Total Dust - Octhanol - Dioctyl Phthalate - o-Xylene	- High Volume Air Sampler No. B19, B32, B43 - NO _x Analyzer No. B08, B19, B20 - Personal Pump SKC No. B02, B03, B07, B09, B11 - Rotameter No. L-B01 - Personal Pump SKC No. B02, B03, B07, B09, B11 - Rotameter No. L-B01 - Console No. B03 - Pitot Tube No. B36 - Vacuum Gauge - Personal Pump SKC No. B70 - Rotameter No. H-B08 - Personal Pump SKC No. B03 - Rotameter No. L-B08 - Pitot Tube No. B36 - Personal Pump SKC No. B03 - Rotameter No. L-B08 - Pitot Tube No. B36 - Personal Pump SKC No. B45, B11 - Rotameter No. H-B06, H-B01 - Personal Pump SKC No. B56, B97 - Rotameter No. L-B06, L-B01 - Personal Pump SKC No. B37, B71, B73, B76, B87, B98 - Rotameter No. H-B06, H-B01 - Personal Pump SKC No. B58, B63 - Rotameter No. L-B06, L-B01	- Digital Balance - NO _x Analyzer No. B08, B19, B20 - GC/FID - HPLC Meter - Digital Balance - Spectrophotometer - CO Analyzer No. B01 - GC/FID - HPLC Meter - Digital Balance - GC/FID - GC/FID - GC/FID

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม (ต่อ)

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
2. ระดับเสียง <u>ระดับเสียงในบรรยากาศ</u> - L_{eq} 24 hr <u>ระดับเสียงในสถานประกอบการ</u> - L_{eq} 8 hr และ L_{max} - Noise Dose	- Acoustic Calibrator - Sound Level Meter No. ACO-B24 - Acoustic Calibrator - Sound Level Meter No. ACO-B29, B36, B41, R51 - Acoustic Calibrator - Noise Dosimeter No. NMD-B16, B17, B18	- - -
3. คุณภาพน้ำ <u>คุณภาพน้ำทิ้ง</u> - pH - Total Suspended Solids - Total Dissolved Solid - COD - BOD_5 - Grease & Oil <u>คุณภาพน้ำใต้ดินจากบ่อสังเกตการณ์</u> - pH - o-Xylene - Phthalate esters - 2-Ethylhexanol - Total Petroleum Hydrocarbon	- - - - - - - - -	- pH Meter - Digital Balance - Digital Balance - COD Reactor - DO Meter - Digital Balance - pH Meter - GC/MS - GC/MS - GC/MS - GC/FID
4. ระดับความเข้มของแสงสว่างในสถานประกอบการ - Light	- Lux Meter No. B10	-

คุณภาพอากาศ



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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	02/05/2025	y = 1.180x-4.939	0.999
B02	B02	02/05/2025	y = 1.156x-3.058	0.999
B03	B03	02/05/2025	y = 1.139x-4.505	0.998
B04	B04	05/05/2025	y = 1.168x-4.342	0.997
B05	B05	05/05/2025	y = 1.181x-7.8.13	0.997
B06	B06	01/05/2025	y = 1.185x-4.081	0.998
B07	B07	01/05/2025	y = 1.173x-5.069	0.997
B08	B08	01/05/2025	y = 1.141x-3.533	0.996
B09	B09	01/05/2025	y = 1.163x-3.805	0.999
B10	B10	01/05/2025	y = 1.079x-2.229	0.997
B11	B11	02/05/2025	y = 1.169x-3.130	0.999
B12	B12	02/05/2025	y = 1.173x-3.515	0.998
B13	B13	02/05/2025	y = 1.187x-4.231	0.996
B14	B14	02/05/2025	y = 1.157x-4.001	0.999
B15	B15	02/05/2025	y = 1.093x-2.530	0.999
B16	B16	01/05/2025	y = 1.168x-5.027	0.997
B17	B17	01/05/2025	y = 1.149x-3.125	0.997
B18	B18	01/05/2025	y = 1.120x-1.685	0.998
B19	B19	02/05/2025	y = 1.166x-4.175	0.997
B20	B20	02/05/2025	y = 1.107x-0.981	0.999
B21	B21	01/05/2025	y = 1.184x-6.199	0.998
B22	B22	01/05/2025	y = 1.162x-2.993	0.996
B23	B23	05/05/2025	y = 1.155x-2.556	0.997
B24	B24	05/05/2025	y = 1.158x-4.429	0.999
B25	B25	05/05/2025	y = 1.127x-1.558	0.998
B26	B26	05/05/2025	y = 1.137x-3.875	0.997
B27	B27	01/05/2025	y = 1.185x-6.360	0.999
B28	B28	01/05/2025	y = 1.180x-6.028	0.996
B29	B29	01/05/2025	y = 1.148x-2.869	0.998
B30	B30	01/05/2025	y = 1.125x-0.258	0.996
B31	B31	01/05/2025	y = 1.154x-4.528	0.996
B32	B32	02/05/2025	y = 1.179x-4.299	0.997
B33	B33	02/05/2025	y = 1.144x-1.976	0.999
B34	B34	05/05/2025	y = 1.135x-2.931	0.998

Calibrated by :

Adul Dangklom
(Mr.Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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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	05/05/2025	y = 1.179x-3.347	0.996
B36	B36	05/05/2025	y = 1.166x-3.602	0.998
B37	B37	05/05/2025	y = 1.086x+1.195	0.998
B38	B38	01/05/2025	y = 1.149x-5.480	0.998
B39	B39	01/05/2025	y = 1.130x-3.044	0.999
B40	B40	01/05/2025	y = 1.142x-3.372	0.999
B41	B41	01/05/2025	y = 1.180x-3.769	0.997
B42	B42	01/05/2025	y = 1.158x-2.865	0.998
B43	B43	05/05/2025	y = 1.170x-3.980	0.996
B44	B44	05/05/2025	y = 1.143x-1.683	0.997
R01	R01	05/05/2025	y = 1.132x-2.374	0.999
R02	R02	05/05/2025	y = 1.146x-3.852	0.997
R03	R03	02/05/2025	y = 1.128x-2.825	0.999
R04	R04	02/05/2025	y = 1.149x-3.932	0.998
R05	R05	02/05/2025	y = 1.107x+0.389	0.997
R06	R06	01/05/2025	y = 1.145x-2.356	0.996
R07	R07	01/05/2025	y = 1.072x-0.849	0.999
R08	R08	01/05/2025	y = 1.161x-4.426	0.996
R09	R09	02/05/2025	y = 1.129x-2.040	0.996
R10	R10	02/05/2025	y = 1.167x-4.503	0.998
R11	R11	02/05/2025	y = 1.139x-3.520	0.996
R12	R12	02/05/2025	y = 1.110x-1.762	0.996
R13	R13	05/05/2025	y = 1.187x-6.302	0.998
R14	R14	05/05/2025	y = 1.144x-2.722	0.996
R15	R15	05/05/2025	y = 1.137x-4.842	0.999
R16	R16	05/05/2025	y = 1.183x-5.960	0.998
R17	R17	01/05/2025	y = 1.158x-3.663	0.998
R18	R18	01/05/2025	y = 1.185x-4.771	0.997
R19	R19	01/05/2025	y = 1.173x-5.427	0.998
R20	R20	01/05/2025	y = 1.175x-6.682	0.999

Calibrated by :

Adul Dangklom
(Mr.Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

Temperature 25 ± 3 °C
Pressure 1010 ± 15 mmbar

Personal Pump Data

Calibration Data

No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)			y	R ²
					1	2	3	1	2	3		
801	SKC	224-PCXR4	262101	01/04/2025	1,000	1,500	2,000	998	1,494	2,002	1.001x - 3.594	1.000
802	SKC	224-PCXR4	626166	01/04/2025	1,000	1,500	2,000	995	1,508	2,003	1.000x - 12.605	1.000
903	SKC	224-PCXR4	612968	03/04/2025	1,000	1,500	2,000	1,003	1,502	2,006	1.006x - 7.796	1.000
904	SKC	224-PCXR4	602804	03/04/2025	1,000	1,500	2,000	1,001	1,499	2,013	1.000x - 7.060	0.999
905	SKC	224-PCXR4	612693	03/04/2025	1,000	1,500	2,000	1,004	1,498	2,007	1.003x - 2.435	1.000
906	SKC	224-PCXR4	262188	03/04/2025	1,000	1,500	2,000	1,003	1,512	2,004	1.000x + 0.696	1.000
907	SKC	224-PCXR4	626262	02/04/2025	1,000	1,500	2,000	1,012	1,504	1,996	0.994x + 10.330	0.999
908	SKC	224-PCXR4	626100	03/04/2025	1,000	1,500	2,000	996	1,511	2,007	1.010x - 14.048	1.000
909	SKC	224-PCXR4	626479	03/04/2025	1,000	1,500	2,000	999	1,510	2,003	1.003x - 4.677	1.000
910	SKC	224-PCXR4	091950	03/04/2025	1,000	1,500	2,000	1,002	1,498	2,004	1.004x - 6.544	1.000
911	SKC	224-PCXR4	364315	04/04/2025	1,000	1,500	2,000	1,013	1,505	2,010	1.002x + 2.171	1.000
912	SKC	224-PCXR4	034656	04/04/2025	1,000	1,500	2,000	1,004	1,506	2,009	1.008x - 9.391	1.000
913	SKC	224-PCXR4	602073	03/04/2025	1,000	1,500	2,000	1,001	1,497	2,012	1.009x - 9.645	1.000
914	SKC	224-PCXR4	626313	03/04/2025	1,000	1,500	2,000	1,004	1,515	1,997	1.002x - 1.275	0.999
915	SKC	224-PCXR4	626474	03/04/2025	1,000	1,500	2,000	999	1,497	1,996	1.000x - 2.511	1.000
916	SKC	224-PCXR4	626477	03/04/2025	1,000	1,500	2,000	1,012	1,504	2,007	0.997x + 8.160	1.000
917	SKC	224-PCXR4	626860	01/04/2025	1,000	1,500	2,000	997	1,506	1,999	1.001x - 1.435	1.000
918	SKC	224-PCXR4	691484	02/04/2025	1,000	1,500	2,000	1,007	1,493	2,005	0.998x + 4.350	1.000
919	SKC	224-PCXR4	691599	03/04/2025	1,000	1,500	2,000	1,004	1,513	2,001	1.003x - 2.043	1.000
920	SKC	224-PCXR4	691567	03/04/2025	1,000	1,500	2,000	999	1,504	1,998	0.999x + 0.556	1.000
921	SKC	224-PCXR4	691531	03/04/2025	1,000	1,500	2,000	1,004	1,499	1,997	1.003x - 7.572	0.999
922	SKC	224-PCXR4	691654	04/04/2025	1,000	1,500	2,000	1,008	1,504	2,006	1.005x - 4.941	1.000
923	SKC	224-PCXR4	798593	04/04/2025	1,000	1,500	2,000	995	1,499	1,998	1.002x - 4.955	1.000
924	SKC	224-PCXR4	626365	04/04/2025	1,000	1,500	2,000	1,002	1,501	1,996	0.999x - 1.539	1.000
925	SKC	224-PCXR4	798489	04/04/2025	1,000	1,500	2,000	1,010	1,515	2,001	0.990x + 16.203	0.999
926	SKC	224-PCXR4	798479	03/04/2025	1,000	1,500	2,000	999	1,492	1,999	0.996x - 0.596	1.000
927	SKC	224-PCXR4	691673	03/04/2025	1,000	1,500	2,000	996	1,498	2,002	1.004x - 6.496	1.000
928	SKC	224-PCXR4	691570	03/04/2025	1,000	1,500	2,000	1,004	1,499	1,994	0.993x + 8.068	1.000
929	SKC	224-PCXR4	626472	03/04/2025	1,000	1,500	2,000	1,001	1,501	1,995	0.994x + 9.567	1.000
930	SKC	224-PCXR4	691489	01/04/2025	1,000	1,500	2,000	996	1,507	2,003	1.006x - 12.489	1.000
931	SKC	224-PCXR4	691509	02/04/2025	1,000	1,500	2,000	1,010	1,509	2,008	1.003x - 3.858	0.999
932	SKC	224-PCXR4	091567	02/04/2025	1,000	1,500	2,000	996	1,497	1,997	0.998x - 0.764	1.000
933	SKC	224-PCXR4	091756	03/04/2025	1,000	1,500	2,000	998	1,508	2,006	1.007x - 13.441	0.999
934	SKC	224-PCXR4	612962	03/04/2025	1,000	1,500	2,000	1,004	1,494	1,995	0.993x + 8.471	1.000
935	SKC	224-PCXR4	602682	03/04/2025	1,000	1,500	2,000	999	1,491	2,001	1.000x - 2.275	1.000
936	SKC	224-PCXR4	626164	03/04/2025	1,000	1,500	2,000	1,004	1,499	1,997	0.995x + 5.109	1.000
937	SKC	224-PCXR4	626256	03/04/2025	1,000	1,500	2,000	998	1,503	1,996	0.996x + 5.729	1.000
938	SKC	224-PCXR4	626167	03/04/2025	1,000	1,500	2,000	996	1,509	2,004	1.006x - 15.248	0.999
939	SKC	224-PCXR4	034637	02/04/2025	1,000	1,500	2,000	1,006	1,505	2,010	1.011x - 15.064	0.999
940	SKC	224-PCXR4	798349	03/04/2025	1,000	1,500	2,000	997	1,510	2,008	1.012x - 19.381	1.000

Calibrated by :

Abul Dangkton
(Mr. Abul Dangkton)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

Temperature 25 ± 3 °C
Pressure 1010 ± 15 mmbar

Personal Pump Data

Calibration Data

No.	Brand	Model	Serial No.	Date	Flow Rate (mL/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)			y	R ²
					1	2	3	1	2	3		
B81	SKC	224-PCXR4	612669	03/04/2025	1,000	1,500	2,000	1,005	1,502	2,004	1.005x - 8.923	1.000
B82	SKC	224-PCXR4	626041	03/04/2025	1,000	1,500	2,000	1,004	1,501	2,008	1.009x - 13.856	1.000
B83	SKC	224-PCXR4	034636	01/04/2025	1,000	1,500	2,000	1,012	1,497	1,996	0.990x + 15.132	1.000
B84	SKC	224-PCXR4	529341	01/04/2025	1,000	1,500	2,000	1,011	1,511	2,008	1.002x - 0.860	0.999
B85	SKC	224-PCXR4	529594	04/04/2025	1,000	1,500	2,000	993	1,512	2,003	1.009x - 14.476	1.000
B86	SKC	224-PCXR4	566743	04/04/2025	1,000	1,500	2,000	1,006	1,508	2,008	1.000x - 0.100	0.999
B87	SKC	224-PCXR4	566747	04/04/2025	1,000	1,500	2,000	999	1,510	2,010	1.010x - 14.444	1.000
B88	SKC	224-PCXR4	566753	01/04/2025	1,000	1,500	2,000	1,010	1,506	2,006	0.999x + 2.782	1.000
B89	SKC	224-PCXR4	566780	04/04/2025	1,000	1,500	2,000	1,003	1,504	2,004	1.003x - 2.183	1.000
B90	SKC	224-PCXR4	500400	04/04/2025	1,000	1,500	2,000	1,002	1,493	1,995	0.994x + 5.841	1.000
B91	SKC	224-PCXR4	500363	04/04/2025	1,000	1,500	2,000	998	1,511	2,011	1.013x - 19.465	0.999
B92	SKC	224-PCXR4	093186	02/04/2025	1,000	1,500	2,000	997	1,505	2,006	1.008x - 12.641	1.000
B93	SKC	224-PCXR4	707670	02/04/2025	1,000	1,500	2,000	1,004	1,503	2,007	1.007x - 7.992	1.000
B94	SKC	224-PCXR3	599821	02/04/2025	1,000	1,500	2,000	1,005	1,504	2,008	1.010x - 15.060	0.999
B95	SKC	224-PCXR3	510710	02/04/2025	1,000	1,500	2,000	1,001	1,495	1,997	0.996x + 5.073	1.000
B96	SKC	224-PCXR3	511450	02/04/2025	1,000	1,500	2,000	1,003	1,494	1,996	0.991x - 13.385	1.000
B97	SKC	224-PCXR3	510798	03/04/2025	1,000	1,500	2,000	997	1,511	2,009	1.014x - 21.540	0.999
B98	SKC	224-PCXR3	509652	03/04/2025	1,000	1,500	2,000	1,006	1,493	2,002	1.001x - 4.094	1.000
B99	SKC	224-PCXR3	509862	03/04/2025	1,000	1,500	2,000	995	1,502	2,003	1.012x - 21.564	1.000
B00	SKC	224-PCXR3	512655	03/04/2025	1,000	1,500	2,000	998	1,507	2,004	1.010x - 18.510	0.999
B61	SKC	224-PCXR3	503913	03/04/2025	1,000	1,500	2,000	997	1,499	2,001	1.002x - 4.374	1.000
B62	SKC	224-PCXR3	505975	01/04/2025	1,000	1,500	2,000	1,002	1,503	2,005	1.008x - 11.138	1.000
B63	SKC	224-PCXR3	511432	04/04/2025	1,000	1,500	2,000	998	1,502	1,996	0.996x + 3.970	1.000
B64	SKC	224-PCXR3	508302	04/04/2025	1,000	1,500	2,000	1,005	1,509	2,008	1.009x - 10.402	1.000
B65	SKC	224-PCXR3	508310	04/04/2025	1,000	1,500	2,000	1,004	1,503	2,007	1.010x - 14.088	1.000
B66	SKC	224-PCXR3	509861	04/04/2025	1,000	1,500	2,000	1,003	1,504	2,010	1.006x - 12.369	1.000
B67	SKC	224-PCXR3	506295	04/04/2025	1,000	1,500	2,000	1,002	1,498	2,004	0.998x + 4.290	1.000
B68	SKC	224-PCXR3	505872	04/04/2025	1,000	1,500	2,000	999	1,504	1,998	1.000x + 4.456	1.000
B69	SKC	224-PCXR3	508375	02/04/2025	1,000	1,500	2,000	1,004	1,498	2,002	0.996x + 5.501	1.000
B70	SKC	224-PCXR3	510623	02/04/2025	1,000	1,500	2,000	996	1,497	2,005	1.005x - 8.735	1.000
B71	SKC	224-PCXR3	508367	02/04/2025	1,000	1,500	2,000	1,013	1,505	2,009	1.008x + 4.324	0.999
B72	SKC	224-PCXR3	505977	02/04/2025	1,000	1,500	2,000	997	1,494	2,003	1.006x - 11.330	1.000
B73	SKC	224-PCXR3	512606	01/04/2025	1,000	1,500	2,000	1,010	1,507	2,004	0.998x + 5.129	1.000
B74	SKC	224-PCXR3	505993	01/04/2025	1,000	1,500	2,000	998	1,499	2,010	1.009x - 11.942	1.000
B75	SKC	224-PCXR3	509620	01/04/2025	1,000	1,500	2,000	995	1,511	2,004	1.011x - 18.966	0.999
B76	SKC	224-PCXR3	509811	01/04/2025	1,000	1,500	2,000	998	1,504	2,010	1.012x - 20.993	0.999
B77	SKC	224-PCXR3	508301	03/04/2025	1,000	1,500	2,000	1,007	1,509	2,008	1.001x + 3.750	1.000
B78	SKC	224-PCXR3	510677	04/04/2025	1,000	1,500	2,000	998	1,508	2,001	1.003x - 3.728	1.000
B79	SKC	224-PCXR3	510920	04/04/2025	1,000	1,500	2,000	1,001	1,501	1,994	0.999x - 1.819	1.000



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	19 June 2025	BRAND :	API	MODEL :	200E
NO.	NOX-808	SERIAL NO.	4336		
Calibrator (Dilution System)					
Brand :	Teledyne	Model :	700E		
Last Cal. Date :	28 October 2024	Serial No. :	201-5		
Reference Standard Gas					
Standard Gas :	Nitric Oxide (NO)	Cylinder No. :	A007265V		
Certified Date :	05 January 2023	Expired Date :	05 January 2026	Cylinder Conc. :	48.8 ppm
CALIBRATING CONDITION					
Pressure :	1011 mmbar	Temp. :	24.6 °C	% RH :	50
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Diff	Analyzer Response	Slope
Zero	0	0.10	-	0	-
NO Span	400	399.8	-0.050	400.0	1.006
NO _x Span	400	400.1	0.025	400.0	1.009
API Model 200E NO _x Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	510	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	103.5	mV	-20 - 150		
AZERO	94.2	mV	-20 - 150		
HVPS	675	V	420 - 900 constant		
RCELL TEMP	50.0	°C	50 ± 1		
BOX TEMP	28.8	°C	8 - 48		
PMT TEMP	7.2	°C	7 ± 2		
MOLY TEMP	315.4	°C	315 ± 5		
RCELL PRESS	8.3	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.6	IN-Hg-A	25 - 30 constant		
NO Span Conc	400	PPB	20 - 20,000		
NO _x Span Conc	400	PPB	20 - 20,000		
NO Slope	1.006	-	1.0 ± 0.3		
NO _x Slope	1.009	-	1.0 ± 0.3		
NO Offset	1.4	mV	-20 to +150		
NO _x Offset	0.9	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by : Peera Detudom
(Mr.Peera Detudom)



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	19 June 2025	BRAND :	API	MODEL :	200E
NO.	NOX-819	SERIAL NO.	353		
Calibrator (Dilution System)					
Brand :	Teledyne	Model :	700E		
Last Cal. Date :	28 October 2024	Serial No. :	201-5		
Reference Standard Gas					
Standard Gas :	Nitric Oxide (NO)	Cylinder No. :	A007265V		
Certified Date :	05 January 2023	Expired Date :	05 January 2026	Cylinder Conc. :	48.8 ppm
CALIBRATING CONDITION					
Pressure :	1011 mmbar	Temp. :	24.6 °C	% RH :	50
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Diff	Analyzer Response	Slope
Zero	0	0.11	-	0	-
NO Span	400	399.9	-0.025	400.0	1.008
NO _x Span	400	400.2	0.050	400.0	1.011
API Model 200E NO _x Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	509	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	103.0	mV	-20 - 150		
AZERO	93.7	mV	-20 - 150		
HVPS	673	V	420 - 900 constant		
RCELL TEMP	50.5	°C	50 ± 1		
BOX TEMP	29.4	°C	8 - 48		
PMT TEMP	7.3	°C	7 ± 2		
MOLY TEMP	314.9	°C	315 ± 5		
RCELL PRESS	8.5	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.7	IN-Hg-A	25 - 30 constant		
NO Span Conc	400	PPB	20 - 20,000		
NO _x Span Conc	400	PPB	20 - 20,000		
NO Slope	1.008	-	1.0 ± 0.3		
NO _x Slope	1.011	-	1.0 ± 0.3		
NO Offset	1.5	mV	-20 to +150		
NO _x Offset	0.9	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)


Approved by : Peera Detudom
(Mr.Peera Detudom)



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



CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	19 June 2025	BRAND :	API	MODEL :	TML-41M
NO.	NOX-B20	SERIAL NO.	N02782		
Calibrator (Dilution System)					
Brand	: Teledyne			Model	: 700E
Last Cal. Date	: 28 October 2024			Serial No.	: 201-S
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)			Cylinder No.	: A007265V
Certified Date	: 05 January 2023			Expired Date	: 05 January 2026
Cylinder Conc.	: 48.8 ppm				
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°C
% RH	50				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Diff	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	399.6	-0.100	400.0	1.004
NO ₂ Span	400	399.8	-0.050	400.0	1.008
API Model TML-41M NO _x Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	512	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	103.3	mV	-20 - 150		
AZERO	94.1	mV	-20 - 150		
HVPS	669	V	420 - 900 constant		
RCCELL TEMP	50.3	°C	50 ± 1		
BOX TEMP	29.2	°C	8 - 48		
PMT TEMP	7.4	°C	7 ± 2		
MOLY TEMP	314.7	°C	315 ± 5		
RCCELL PRESS	8.2	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.4	IN-Hg-A	25 - 30 constant		
NO Span Conc	400	PPB	20 - 20,000		
NO ₂ Span Conc	400	PPB	20 - 20,000		
NO Slope	1.004	-	1.0 ± 0.3		
NO ₂ Slope	1.008	-	1.0 ± 0.3		
NO Offset	1.0	mV	-20 to +150		
NO ₂ Offset	0.6	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by : 
(Mr. Abdul Dangklom)

Approved by : 
(Mr. Peera Detudom)



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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)			Actual (Q std.)			Value From Calibration Curve	
				Flow Rate (Reading)							
				1	2	3	1	2	3	y	R ²
L-801	Dwyer	VFA-21	01/04/2025	50	100	200	49.7	99.0	200.9	0.993x + 0.389	1.000
L-802	Dwyer	VFA-21	03/04/2025	50	100	200	50.1	100.2	199.3	0.995x + 1.127	0.999
L-803	Dwyer	VFA-21	04/04/2025	50	100	200	50.4	100.7	201.1	0.992x + 1.381	1.000
L-804	Dwyer	VFA-21	01/04/2025	50	100	200	50.8	99.0	198.2	0.998x + 0.410	0.999
L-805	Dwyer	VFA-21	02/04/2025	50	100	200	50.6	99.5	198.9	0.993x + 0.837	1.000
L-806	Dwyer	VFA-21	03/04/2025	50	100	200	50.1	100.2	201.7	1.002x - 0.009	1.000
L-807	Dwyer	VFA-21	03/04/2025	50	100	200	50.3	101.7	200.5	0.996x + 1.584	1.000
L-808	Dwyer	VFA-21	01/04/2025	50	100	200	50.8	99.2	199.4	0.991x + 0.972	1.000
L-809	Dwyer	VFA-21	04/04/2025	50	100	200	50.5	99.6	199.7	0.996x + 1.101	0.999
L-810	Dwyer	VFA-21	04/04/2025	50	100	200	50.4	101.5	202.0	0.998x + 1.243	1.000
Calibrated by :  (Mr. Abdul Dangklom)				Approved by :  (Mr. Peera Detudom)							



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Console Calibration Report

Calibration Method

Critical Orifices

Calibration Data

Console Data		Calibration Data		
No.	Serial No.	Date	y	DH _g (mmH ₂ O)
B01	1563	03/03/2025	1.003	49.40
B02	8002514	03/03/2025	1.004	49.57
B03	1503016	04/03/2025	0.999	49.93
B04	00006659	04/03/2025	0.996	49.88
B05	00007428	04/03/2025	1.007	49.14
R01	1561	05/03/2025	0.996	49.32
R02	8002513	04/03/2025	1.003	49.96
R03	1570	04/03/2025	0.998	50.08
R04	8002519	03/03/2025	0.997	49.53
R05	1503015	05/03/2025	1.005	50.25

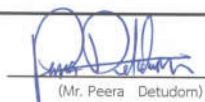
Remark : Accept Value of y (test) is $0.97 < y < 1.03$

Accept Value of DH_g (test) is 46.7 ± 6.4 (mmH₂O)

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :


(Mr. Peera Detudom)



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Pitot Tube Calibration Report

Calibration Method

Standard Pitot Tube

Calibration Data

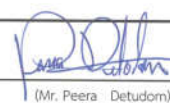
Pitot Tube Data			Calibration Data		
No.	Type of Pitot	Coefficient of Standard Pitot	Date	Avg. of Cp (test)	
				Side A	Side B
B03	S	0.99	01/05/2025	0.84	0.83
B04	S	0.99	01/05/2025	0.84	0.84
B05	S	0.99	01/05/2025	0.85	0.84
B07	S	0.99	01/05/2025	0.84	0.83
B08	S	0.99	01/05/2025	0.85	0.84
B09	S	0.99	02/05/2025	0.83	0.84
B11	S	0.99	01/05/2025	0.84	0.85
B16	S	0.99	01/05/2025	0.84	0.84
B18	S	0.99	01/05/2025	0.84	0.83
B19	S	0.99	01/05/2025	0.85	0.84
B21	S	0.99	02/05/2025	0.84	0.84
B24	S	0.99	05/05/2025	0.85	0.84
B27	S	0.99	05/05/2025	0.85	0.84
B30	S	0.99	05/05/2025	0.84	0.85
B31	S	0.99	05/05/2025	0.84	0.84
B33	S	0.99	01/05/2025	0.84	0.85
B35	S	0.99	01/05/2025	0.84	0.84

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

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :


(Mr. Peera Detudom)



CERTIFICATE No : 25M2254
REFERENCE No : 76365-1

PAGE : 1 OF 2

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 : ATSAWIN Y.

CALIBRATION DATE : 07-Mar-25

APPROVED BY : PONGSAK J.

ISSUED DATE : 13-Mar-25

RECEIVED DATE : 07-Mar-25

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



F-G010 REV 03



CERTIFICATE No : 25M2254

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : METTLER TOLEDO
ID No : BA05/50
AIR PRESSURE : 1009mbar \pm 1mbar
AMBIENT TEMPERATURE : 24° C \pm 1° C
MODEL : XS105DU
S/N : 1126422905
RECEIVED DATE : 07-Mar-25
CALIBRATION DATE : 07-Mar-25
RELATIVE HUMIDITY : 54 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 6:2019 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS NOT ADJUSTED BEFORE CALIBRATION. THE BALANCE HAS NO ZERO TRACKING FUNCTION. REPEATABILITY WAS MEASURED BY USING 10 REPEATED MEASUREMENTS. LINEARITY WAS MEASURED COVERING 10 POINTS, EVENLY SPREAD OVER THE RANGE. THE INSTRUMENT WAS SET ZERO BEFORE PERFORMING THE LINEARITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-1-151	C02250116	28-Jan-27
2) STANDARD WEIGHT	E2	15843	C02250117	29-Jan-27

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)

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 120 g WAS 0.000055 g
4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.00000	0.00000	0.000065
0.02	0.01999	0.00001	0.000065
0.10	0.10001	-0.00001	0.000066
0.20	0.20001	-0.00001	0.000066
0.50	0.50002	-0.00002	0.000065
1.00	1.00003	-0.00003	0.000066
2.00	2.00001	-0.00001	0.000067
5.00	5.00002	-0.00002	0.000068
10.00	10.00000	0.00000	0.000070
20.00	20.00004	-0.00004	0.000078
50.00	50.00000	0.00000	0.00013
100.00	100.0001	-0.0001	0.00019
120.00	120.0002	-0.0002	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



F-G010 REV 03



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

RUN CHROMATOGRAM TEST

DETECTOR : Flame Ionization Detector (FID Channel Front)

INJECTOR : Capillary Injector Model 1079

GC CONDITION:

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

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

Sample: 1 µL Injection FID Test Sample 0.218 g/L C14,C15,C16 in hexane

SENSITIVITY TEST: C15. (Area count) = 156,955 Counts.



บริษัท ไทยยูนิค จำกัด THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200
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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)	2.85	≤ 50
Baseline Drift (%)	0.09	≤ 1
Sensitivity (S/N for C15)	16,400	≥ 1,024

Temperature Specification

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

Relative Standard Deviation % (% RSD)

Checkout Procedure	Result	Specification
Area C15 (%)	1.71	≤ 5
Retention Time C15(%)	0	≤ 0.5

APPROVAL :

Signature: Suwatrot

Engineer : Suwatrot Trikinut

Date : 05/08/2024



VARIAN

1/2

SERVICE DEPARTMENT
FR-SV-029 Rev. 04



VARIAN

2/2

SERVICE DEPARTMENT
FR-SV-029 Rev. 04



บริษัท ไทยยูนิค จำกัด THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200
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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	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 Area 1	157,309
C15 Area 2	159,359
C15 Area 3	157,349
C15 Area 4	152,379
C15 Area 5	158,379
C15 Area Average	156,955
* % RSD (< 5 %)	1.71

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

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

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

Compliance	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Performance by	Samarat.	
Date	05/08/2567	



Comments	-		
Reviewed by	Sarat P.	Date	05/08/2024



บริษัท ไทยยูนิค 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

Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 RT 1	4.128
C15 RT 2	4.128
C15 RT 3	4.128
C15 RT 4	4.128
C15 RT 5	4.128
C15 RT Average	4.128
* % 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 C15 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.)

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

Compliance	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Performance by	Samarat.	
Date	05/08/2024	



Comments	-		
Reviewed by	Sarat P.	Date	05/08/2024



VARIAN

1/1

SERVICE DEPARTMENT



VARIAN

1/1

SERVICE DEPARTMENT

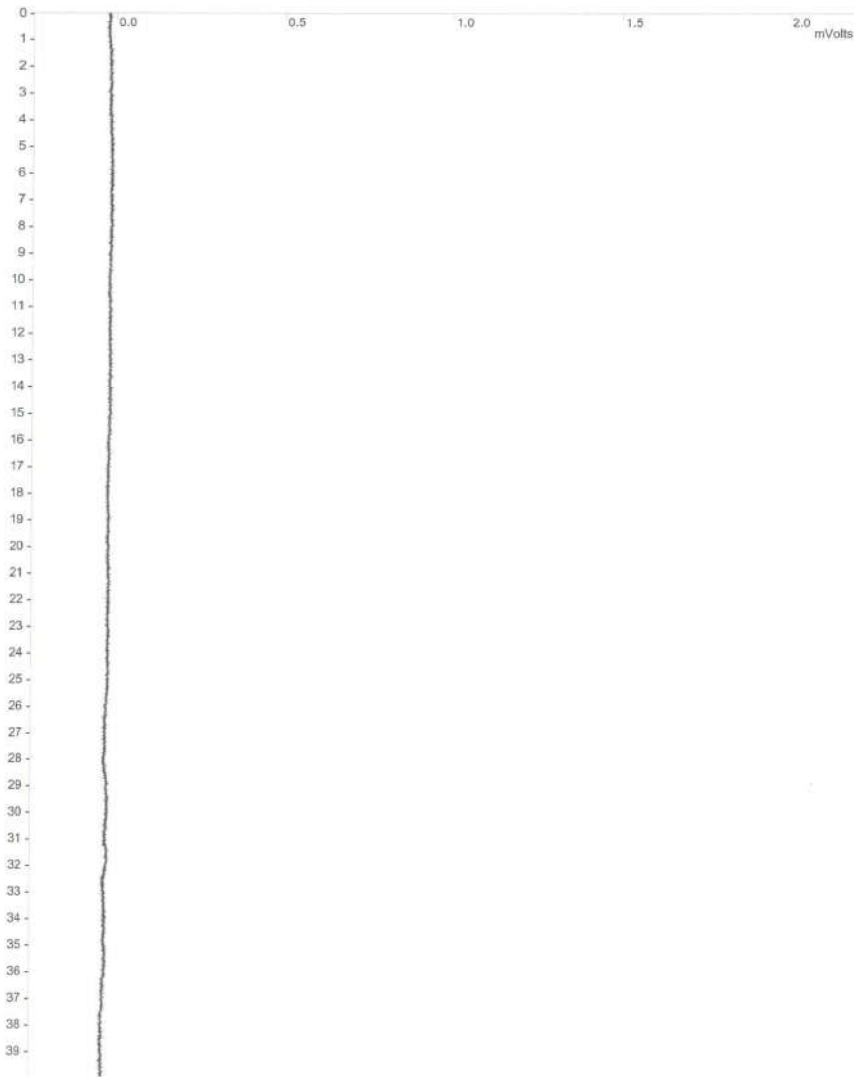
Title :
Run File : f:\ \sps2024\cal2024\baseline2024002.run
Method File : D:\Method-GC\star C\Star\TU\cal0203\baseline FID.mth
Sample ID : Baseline2024

Injection Date: 5/8/2567 14:01 Calculation Date: 5/8/2567 14:41

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

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

Chart Speed = 0.56 cm/min Attenuation = 1 Zero Offset = 10%
Start Time = 0.000 min End Time = 39.960 min Min / Tick = 1.00



Title :
Run File : f:\ \sps2024\cal2024\baseline2024002.run
Method File : D:\Method-GC\star C\Star\TU\cal0203\baseline FID.mth
Sample ID : Baseline2024

Injection Date: 5/8/2567 14:01 Calculation Date: 5/8/2567 14:41

Operator : suwarot Detector Type: 3800 (10 Volts)
Workstation: Local Disk Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID 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: -16 microVolts LSB: 1 microVolts
Noise (used): 22 microVolts - monitored before this run
Manual injection
Data Handling: No peaks

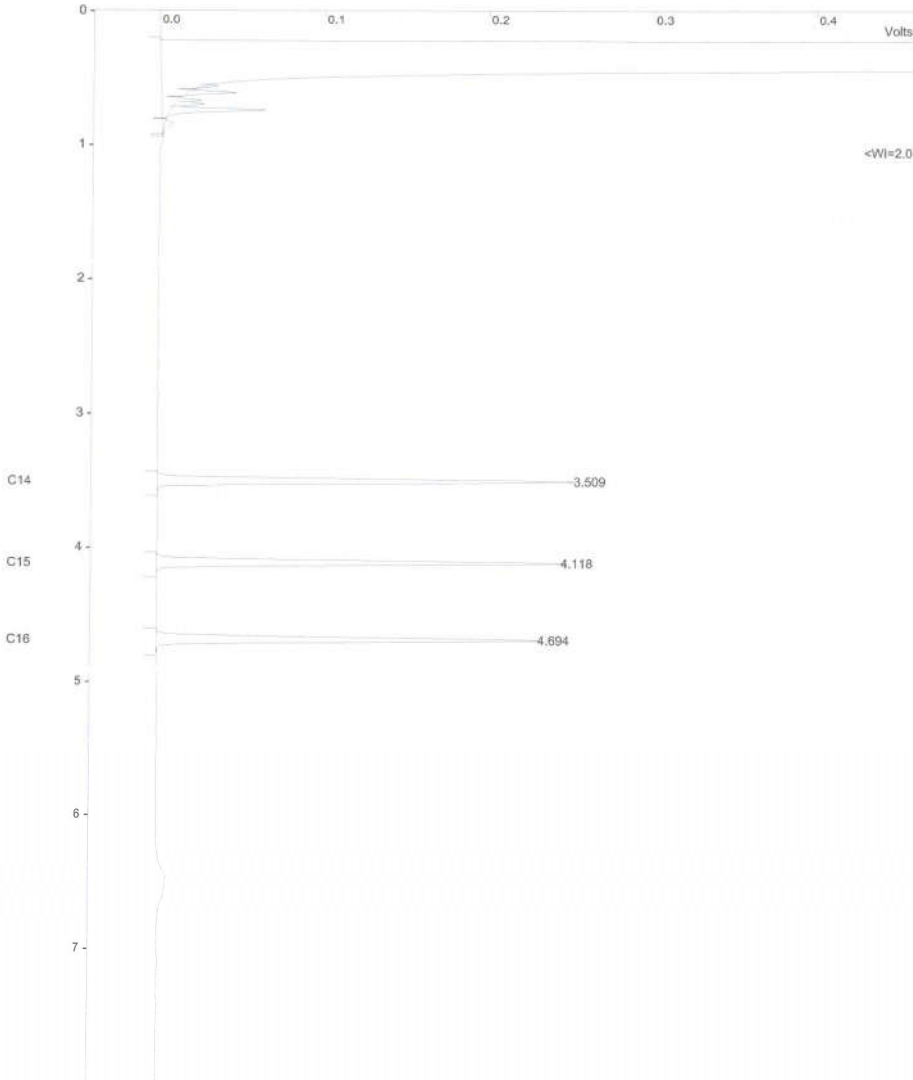
Title :
Run File : f:\sps2024\cal2024\fid2024003.run
Method File : d:\cafid2024003-front.mth
Sample ID : FID2024

Injection Date: 5/8/2567 9:16 Calculation Date: 5/8/2567 9:26

Operator : suwarot Detector Type: 3800 (10 Volts)
Workstation: GC-LAB Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 7.993 min

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

Chart Speed = 2.83 cm/min Attenuation = 205 Zero Offset = 8%
Start Time = 0.000 min End Time = 7.993 min Min / Tick = 1.00



Print Date: Sat Jan 01 19:35:30 2005 Page 1 of 1

Title :
Run File : f:\sps2024\cal2024\fid2024003.run
Method File : d:\fid2024003-front.mth
Sample ID : FID2024

Injection Date: 5/8/2567 9:16 Calculation Date: 5/8/2567 9:26

Operator : suwarot Detector Type: 3800 (10 Volts)
Workstation: GC-LAB Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 7.993 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
1	C14	54.1202	3.509	-0.005	163565	BB	2.1	C
2	C15	53.5241	4.118	-0.005	157309	BB	2.2	C
3	C16	52.2361	4.694	0.001	146804	BB	2.3	C
Totals:		159.8804		-0.009	1704289			

Status Codes:
C - Out of calibration range

Total Unidentified Counts : 69332200 counts

Detected Peaks: 11 Rejected Peaks: 0 Identified Peaks: 3

Multiplier: 1 Divisor: 1 Unidentified Peak Factor: 0

Baseline Offset: -29 microVolts LSB: 1 microVolts

Noise (used): 28 microVolts - monitored before this run

Manual injection

Calib. out of range; No Recovery Action Specified

Sample ID: fid std

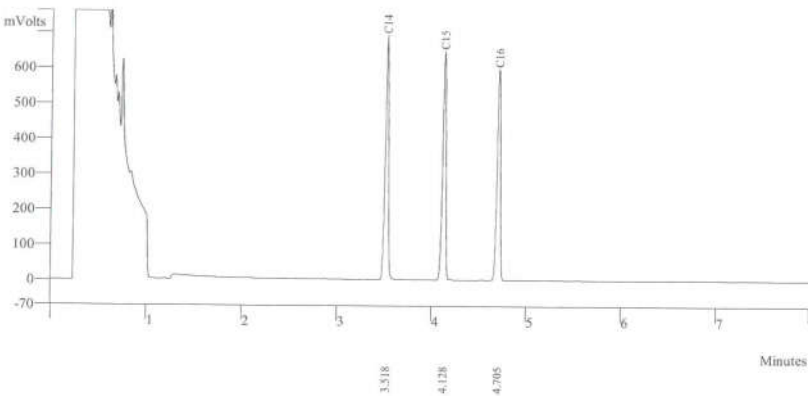
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):



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

c:\star\data\tu\cal2024\fild2024001.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	152.6865	3.518	163565	BB	2.2
2	C15	147.1889	4.128	157309	BB	2.3
3	C16	138.7997	4.705	146804	BB	2.3
Totals		438.6751		467678		

Sample ID: fid std

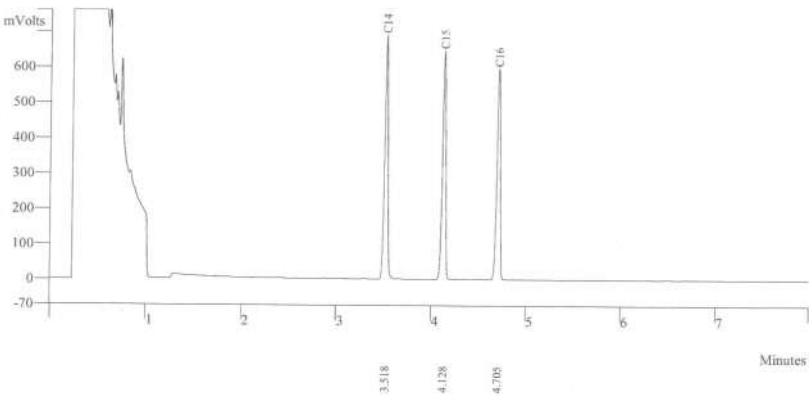
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):



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

c:\star\data\tu\cal2024\fild2024002.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	152.6865	3.518	168565	BB	2.2
2	C15	137.1189	4.128	159359	BB	2.3
3	C16	128.7997	4.705	147834	BB	2.3
Totals		418.6042		475758		

Sample ID: fid std

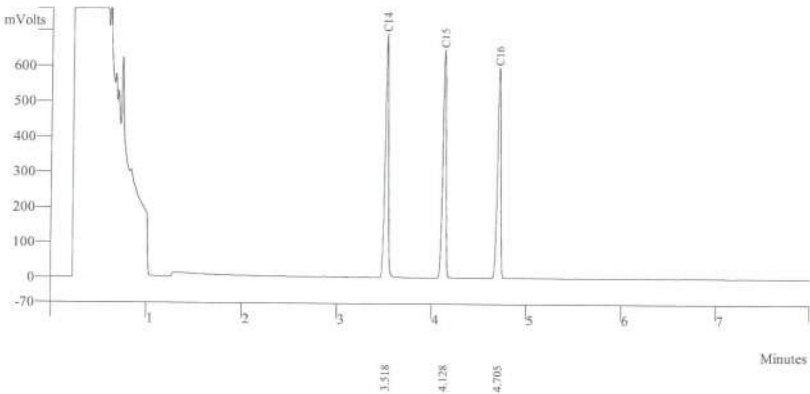
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):



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

c:\star\data\tu\cal2024\fid2024003.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	152.7865	3.518	169535	BB	2.2
2	C15	197.1159	4.128	157349	BB	2.3
3	C16	128.5997	4.705	149834	BB	2.3
Totals		478.5021		476718		

Sample ID: fid std

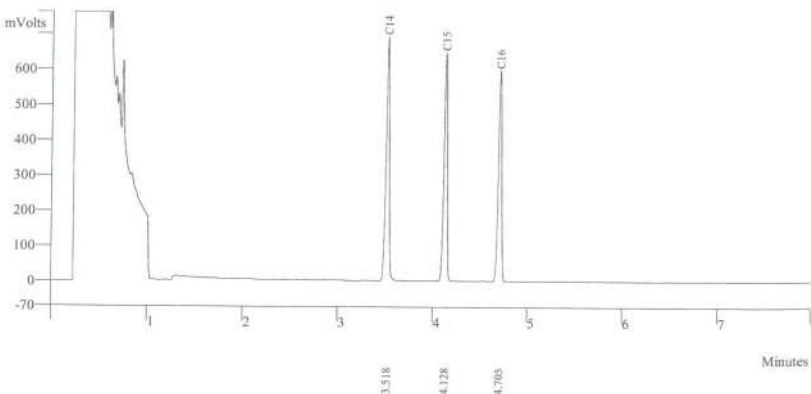
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):



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

c:\star\data\tu\cal2024\fid2024004.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	162.7865	3.518	165521	BB	2.2
2	C15	157.1159	4.128	152379	BB	2.3
3	C16	138.5997	4.705	146834	BB	2.3
Totals		458.5021		464734		



Sample ID: **fid std**

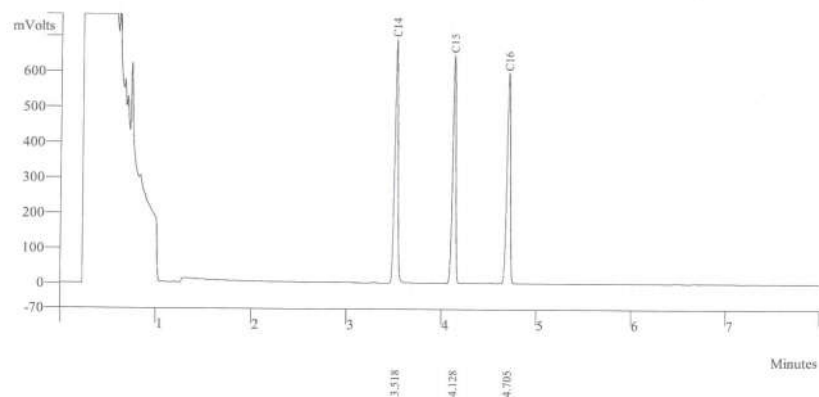
Operator (Inj): suwarot
 Injection Date: 05/08/2024
 Calc Date: 05/08/2024
 Run Time (min): 7.993
 Workstation: GC-LAB
 Instrument (Inj):



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

c:\star\data\tu\cal2024\fid2024005.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result (j)	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	162.7965	3.518	164521	BB	2.2
2	C15	137.1159	4.128	158379	BB	2.3
3	C16	128.1947	4.705	149834	BB	2.3
Totals		428.1071		472734		



THAI UNIQUE CO.,LTD.

1 OF 1



Agilent Technologies

Certificate of Analysis

FID-TCD Performance Evaluation Sample Kit

Agilent Part Number: 5080-8842, 18710-60170

Sample Lot Number: 0006750304

This analytical reference material was manufactured and verified in accordance with an ISO 9001 registered quality system, and the analyte concentrations were verified by an ISO 17025 accredited laboratory. The certified value for each analyte was determined gravimetrically.

Concentrations:		
n-tetradecane	0.218 g/L ($\pm 0.5\%$)	0.033 w/w %
n-pentadecane	0.218 g/L ($\pm 0.5\%$)	0.033 w/w %
n-hexadecane	0.218 g/L ($\pm 0.5\%$)	0.033 w/w %

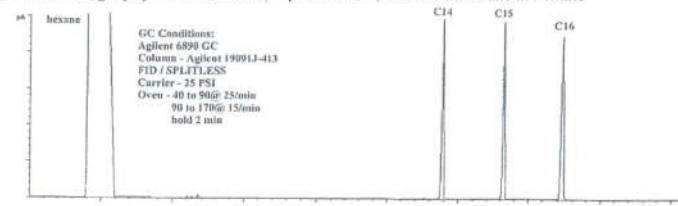
Solvent: hexane

Calibrated Class A glassware and clean bottles were used in the manufacture of this standard. Balances used in the manufacture of this standard are calibrated with weights traceable to NIST in compliance with ANSI/NCSL Z-540-1 and ISO 9001.

Purities:	
n-tetradecane	99.6%
n-pentadecane	99%
n-hexadecane	99.5%
hexane	99%

Typical Analytical Spectrum or Chromatography

GC Chromatography – n-tetradecane, n-pentadecane, and n-hexadecane in hexane



Date of release: 30 June 2023

Date of expiration: 31 July 2025

Monica Bourgeois
 Monica Bourgeois
 QMS Representative

Certificate of Calibration

Certificate No.: WK2312-031-1

Page 1 of 2

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

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

Calibration Method : CP-WK-M10

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 coverage factor $k=2$, providing a level of confidence approximately 95%

Calibrated by : Mr.Taywanat Hansuwankul

Approved by :

Ms. Budsagorn Patcha

Authorized Signatory

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

Calibration Results

Certificate No. : WK2312-031-1

Page 2 of 2

Calibration Result of the Accuracy

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



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 Prachathipatal 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.

Calibrated by

Nanthiya Ngampring
Mrs. Nanthiya Ngampring
Metrology Technician

Approved by

A. S.
Mrs. Arunee Bamrungtham
Cal-Lab Manager

Certificate No. : LF24-0278

Model : 51

Serial No. : 5910857

Page 1 of 3



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 Prachathipatal 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

Certificate No. : LF24-0278

Model : 51

Serial No. : 5910857

Page 2 of 3

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

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

S. Pohtongkam

S. Pohtongkam

Service Manager

Performance Maintenance Protocol

2690/2695/e2695 Separations Module

Waters system:	HPLC01/57
PM date:	02-Jul-2025

Guidelines

This performance maintenance (PM) protocol outlines maintenance tasks you should regularly perform on Waters systems. Regular maintenance ensures optimum performance and uninterrupted trouble-free operation.

Schedule

Waters recommends that performance maintenance visits be performed once a year. Systems under heavy use or using aggressive solvents need more frequent maintenance. For detailed maintenance schedules, refer to the appropriate user guide located on Waters.com. Failure to follow the maintenance schedules as described in the user guide might result in unreliable operation and inaccurate laboratory results.

Safety considerations

Some protocols might involve removing instrument covers, exposing the performer to high voltages, high currents, and moving parts. This presents risks of electric shock or damage to the instrument. To reduce these risks, Waters recommends that these protocols be conducted by certified Waters field service engineers with access to the latest information on Waters products. Waters is not responsible for actions initiated by an unqualified performer. If you are unsure, have a Waters certified field service engineer conduct the performance maintenance activity.

Waters Quality Parts

Waters designs and manufactures Waters Quality Parts® to the same strict regulatory standards it uses for its high-performance Waters systems. Waters recommends using Waters Quality Parts for all maintenance activities. Failure to use Waters Quality Parts might compromise laboratory results and reliability.

Customer education

Waters offers courses on operating and maintaining its high-performance systems, as well as courses designed to help you maintain professional competency and further your knowledge in chromatography, mass spectrometry, and Waters data systems. For more information on available training courses, visit [Waters Educational Services](#) on Waters.com.

Qualification/compliance services

Waters Compliance Services help you achieve and maintain the regulatory compliance of your LC and MS instruments and software with a combination of expertise, compliant-ready systems and software, and a portfolio of services to ensure that you consistently obtain quality data. To learn more, visit [Qualification/Compliance Services](#) on Waters.com.

PM task overview

Table 1 is an overview of the PM tasks performed.

Note: For instructions on performing these procedures, refer to the [Waters Alliance e2695 Separations Module Operator's Guide](#).

Table 1 - PM tasks

Inspect	Replace/rebuild	Verify	Optional calibration tests ¹
Firmware version	Filters	Initialization diagnostics	Flow rate accuracy
Lifetime counter	Solvent management components	Pressure test	Gradient proportioning valve
Solvent manager door filter	Sample management components	Adjust the seals	Injection accuracy
Fan	Lithium battery ²	Compression check	
Valves			
Carousel drive mechanism			
PerformancePlus™ degasser			
Seal wash system			
Fittings and tubing (leaks)			
Error logs			

¹ Waters field service engineers perform optional calibration tests as part of a Total Assurance with Calibration Plan. For an additional charge, Waters can perform these tests for customers without this plan. Some of these tests require chemistry kits not supplied in the performance maintenance kit. For details on performing the optional calibration tests, see the appropriate user guide on Waters.com.

² Only Waters field service engineers can replace batteries.

PM task descriptions

Performance maintenance consists of three task categories:

- Inspect
- Replace or rebuild parts
- Verify

Note: If the instrument fails pre- or post-performance maintenance inspections or verifications, it might need additional service beyond the scope of this protocol. Such service might incur additional parts and labor charges.

Inspect

1. If the instrument is off, power it on and allow it to complete software checks.
2. Inspect the firmware and, if appropriate, update it.
3. Inspect the lifetime counter and record the eluent delivered and injection count.
4. Ensure that the solvent manager door filter is clear of debris and dust; clean if necessary.
5. Ensure that the fan grate on the rear of the instrument is clear of debris and dust; clean if necessary.
6. Inspect the following for leaks, precipitation, corrosion, proper operation, or any obvious damage:
 - Valves – prime/vent; high pressure 1 and 2; low pressure 3; gradient proportioning
 - Carousel drive mechanism
 - PerformancePlus degasser
 - Seal wash system
 - Fittings and tubings
7. Review error logs for any errors and troubleshoot as necessary.

Replace or rebuild parts

Using the parts in the PM kit, replace or rebuild parts as necessary.

Note: For instructions on replacing parts, see the appropriate user manual on Waters.com.

Verify

After completing the maintenance tasks, verify instrument performance:

1. Power-on the instrument and allow it to complete on-board software checks.
2. Using Methanol at 1mL/min and a back pressure of at least 1700 psi, inspect the delta pressure and record results. If delta is larger than 2.5% of the system pressure, run the static leak test to locate a possible leak.
3. Adjust the seals from the Diagnostics menu and record the results.
4. Perform a compression check and record the results.

Note: For information on priming all solvent lines and purging injectors, refer to the [Waters Alliance e2695 Separations Module Operator's Guide](#).

Results/checklist

A Waters field service engineer completes the test results, checklist, and confirmation sections.

Test results

Table 2 - Firmware version

Firmware revision	3.00
-------------------	------

Table 3 – Lifetime counter results

	Lifetime counters
Eluent delivered	526.5
Injection count	26126

Table 4 – Pressure test

System pressure	Delta pressure	Acceptable delta range	Pass or fail
1712	13	< 2.5% system pressure	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

Table 5 - Adjust seals test results³

Seal data	New	Previous	Acceptable range	Pass or fail
Top	46	42	30 to 80	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
Bottom	119	118	80 to 200	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
Width	73	76	50 to 120	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

Table 6 - Compression check test results³

Parameter	Value	Pass or fail
Compression volume	1 µL	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
Delta decay pressure	1.2 psi	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
Final pressure	108.0 psi	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

³ For information on adjusting the seals and checking compression, refer to the [Waters Alliance e2695 Separations Module Operator's Guide](#).

Table 7 - Optional calibration test results – flow rate accuracy

	Timer
Serial/ID number	DKSH-INS-02
Calibration date	01-Apr-2025

Table 8 - Optional calibration test results – flow rate accuracy

Value	Pass or fail
3.0 min Expected result: 2:51 to 3:09 minutes	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

Table 9 - Optional calibration test results – gradient proportioning valve

Solvent	Measured volume	Pass or fail
A	25 mL	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
B	25 mL	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
Expected result: B cylinder volume = A cylinder volume ±3 mL		

Table 10 - Optional calibration test results – injection accuracy

	Balance
Serial/ID number	BA 08/61
Calibration date	N/A

Table 11 - Optional calibration test results – injection accuracy

W1	W2	Programmed volume (µL)	Calculated volume (µL)	Pass or fail
3.6019 g	3.3061 g	50 µL	49.3 µL Expected result: 50 µL± 2.0 µL	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
N/A g	N/A g	12 µL	N/A µL Expected result: 12 µL± 1.0 µL	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

Checklist**Note:** Select N/A if the task does not apply.**Inspect**

All inspect tasks completed	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
Comments: No comments.	

Replace/Rebuild

Filters	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
Solvent management components	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
Sample management components	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
Lithium battery	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A
Comments: Replace P/N: 700004073, P/N: 700011783	

Verify

All verify tasks completed	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
Comments: No comments.	

Performance maintenance confirmation

I confirm on behalf of _____ S.P.S. CONSULTING SERVICE COMPANY LIMITED	
Company name	
that this performance maintenance procedure has been satisfactorily completed on: _____ M13SM7942A	
Serial no.	
Signed: _____ Customer	Date: 02-Jul-2025
_____ Supawadee Saentawisuk Print name	
I certify that the maintenance procedure has been successfully completed.	
Signed: _____ Waters engineer	Date: 02-Jul-2025
_____ Chanwat Lertsapanant Print name	
Comments: No comments.	
No comments.	

Waters Corporation
34 Maple Street
Milford, Massachusetts
01757 USA

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Performance Maintenance Protocol

2487/2488/2489 Dual λ Absorbance Detector

Waters system:	HPLC01/ 57
PM date:	02-Jul-2025

Guidelines

This performance maintenance (PM) protocol outlines maintenance tasks you should regularly perform on Waters systems. Regular maintenance ensures optimum performance and uninterrupted trouble-free operation.

Schedule

Waters recommends that performance maintenance visits be performed once a year. Systems under heavy use or using aggressive solvents need more frequent maintenance. For detailed maintenance schedules, refer to the appropriate user guide located on Waters.com. Failure to follow the maintenance schedules as described in the user guide might result in unreliable operation and inaccurate laboratory results.

Safety considerations

Some protocols might involve removing instrument covers, exposing the performer to high voltages, high currents, and moving parts. This presents risks of electric shock or damage to the instrument. To reduce these risks, Waters recommends that these protocols be conducted by certified Waters field service engineers with access to the latest information on Waters products. Waters is not responsible for actions initiated by an unqualified performer. If you are unsure, have a Waters certified field service engineer conduct the performance maintenance activity.

Waters Quality Parts

Waters designs and manufactures Waters Quality Parts® to the same strict regulatory standards it uses for its high-performance Waters systems. Waters recommends using Waters Quality Parts for all maintenance activities. Failure to use Waters Quality Parts might compromise laboratory results and reliability.

Customer education

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Qualification/compliance services

Waters Compliance Services help you achieve and maintain the regulatory compliance of your LC and MS instruments and software with a combination of expertise, compliant-ready systems and software, and a portfolio of services to ensure that you consistently obtain quality data. To learn more, visit [Qualification/Compliance Services](#) on Waters.com.

PM task overview

Table 1 is an overview of the PM tasks performed.

Note: For instructions on performing these procedures, refer to the online Help or the appropriate user manual on Waters.com.

Table 1 – PM tasks

Inspect	Replace/rebuild	Verify	Optional calibration tests ¹
Firmware version	Lamp	Initialization diagnostics	Wavelength accuracy
Fan	Lithium battery ²	Wavelength calibration	
Flow cell			
Fittings and tubing			

¹ Waters field service engineers perform optional calibration tests as part of a Total Assurance with Calibration Plan. For an additional charge, Waters can perform these tests for customers without this plan. Some of these tests require chemistry kits not supplied in the performance maintenance kit. For details on performing the optional calibration tests, see the appropriate user guide on Waters.com.

² Only Waters field service engineers can replace batteries. The battery is not replaced for the 2489 when performing preventive maintenance.

PM task descriptions

Performance maintenance consists of three task categories:

- Inspect
- Replace or rebuild parts
- Verify

Note: If the instrument fails pre- or post-performance maintenance inspections or verifications, it might need additional service beyond the scope of this protocol. Such service might incur additional parts and labor charges.

Inspect

1. If the instrument is off, power it on and allow it to complete software checks.
2. Inspect the firmware and, if appropriate, update it.
3. Ensure that the fan grate on the rear of the instrument is clear of debris and dust; clean if necessary.
4. Inspect the flow cell for leaks.
5. Inspect tubing and fittings for leaks.

Replace or rebuild parts

Using the parts in the PM kit, replace or rebuild parts as necessary.

Note: For instructions on replacing parts, see the appropriate user manual on Waters.com.

Verify

After completing the maintenance tasks, verify instrument performance:

1. Power-on the instrument and allow it to complete on-board software checks.
2. Perform a manual wavelength calibration and record the results.

Results/checklist

A Waters field service engineer completes the test results, checklist, and confirmation sections.

Test results

Table 2 – Firmware version

Firmware version	1.41.2272
------------------	-----------

Table 3 – Verify wavelength calibration results

Pass or fail	Maximum deviation
<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	0.03 nm

Table 4 – Optional calibration – wavelength accuracy test solution

	Test solution
Lot number	N/A
Expiration date	N/A

Table 5 – Optional calibration – wavelength accuracy test results

Peak value (nm)	Pass or fail
N/A Expected result: 255 ± 2 nm	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
N/A Expected result: 379 ± 2 nm	<input type="checkbox"/> Pass <input type="checkbox"/> Fail
N/A Expected result: 522 ± 2 nm	<input type="checkbox"/> Pass <input type="checkbox"/> Fail

Checklist

Note: Select N/A if the task does not apply.

Inspect

All inspect tasks completed	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
	Comments:No comments.

Replace/Rebuild

Lamp	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A
Lithium battery	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A
	Comments:Lamp S/N:311132 =2455 Hr.

Verify

All verify tasks completed	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
	Comments:No comments.

Optional calibration tests

All optional calibration tests completed	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A
	Comments:No comments.

Performance maintenance confirmation

I confirm on behalf of <u>S.P.S. CONSULTING SERVICE COMPANY LIMITED</u>	
<i>Company name</i>	
that this performance maintenance procedure has been satisfactorily completed on:	<u>B1487E998A</u>
	<i>Serial no.</i>
Signed: <u>Supawadee</u>	Date: <u>02-Jul-2025</u>
<i>Customer</i>	
<u>Supawadee Saentawisuk</u>	
<i>Print name</i>	
I certify that the maintenance procedure has been successfully completed.	
Signed: <u>CHANWAT I.</u>	Date: <u>02-Jul-2025</u>
<i>Waters engineer</i>	
<u>Chanwat Lertsapanant</u>	
<i>Print name</i>	
Comments: <u>No comments.</u>	
<u>No comments.</u>	

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Milford, Massachusetts
01757 USA

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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 : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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

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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

Pete

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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	
Transmission T(%)	Absorbance(A)
0.0117	3.8659

**Specific Acceptance :

Transmission ≤ 1.0 T(%), Absorbance ≥ 2.0 A

**Stray light not TISI Accredited

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

End of Calibration Certificate

Pete

ระดับเสียง



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
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7 Soi Phaholyothin 24, Phaholyothin Rd., Jomjol, Chatsuchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sales@spscn.com, www.spnscn.com

Noise B_306/25

Sound Level Meter Calibration Report

Acoustic Calibrator Data

Brand	ACO	Number	AC 03/56
Model	2127	Serial No.	130006
Calibration Range	94 dB, 1000 Hz	Last Calibration	21 February 2025
		Due Date	21 February 2026

Calibration Data

Sound Level Meter Data				Calibration Data	
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]
					Before Adjustment After Adjustment
ACO-B24	ACO	6236	00182005	18 June 2025	93.9 93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.81 ± 0.10 dB

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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

Noise B_295/25

Sound Level Meter Calibration Report

Acoustic Calibrator Data

Brand	ACO	Number	AC 03/56
Model	2127	Serial No.	130006
Calibration Range	94 dB, 1000 Hz	Last Calibration	21 February 2025
		Due Date	21 February 2026

Calibration Data

Sound Level Meter Data				Calibration Data	
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]
					Before Adjustment After Adjustment
ACO-B29	ACO	6236	00182011	22 June 2025	93.7 93.9
ACO-B36	ACO	6236	00192027	22 June 2025	93.8 93.9
ACO-B41	ACO	6236	00192032	22 June 2025	93.9 93.9
ACO-R51	ACO	6236	00192063	22 June 2025	93.8 93.9
ACO-R52	ACO	6236	00192064	22 June 2025	93.9 93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.81 ± 0.10 dB

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)

Noise Dose B_295_1/25

Noise Dose Meter Calibration Report

Acoustic Calibrator Data

Brand	SVANTEK	Number	SV 03/60
Model	SV34	Serial No.	83820
Calibration Range	114 dB, 1000 Hz	Last Calibration	06 August 2024
		Due Date	06 August 2025

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NMD-B16	SVANTEK	SV-104IS	106120	22 June 2025	113.9	114.0
NMD-B17	SVANTEK	SV-104IS	106122	22 June 2025	114.0	114.0
NMD-B18	SVANTEK	SV-104IS	106123	22 June 2025	114.0	114.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					114.03± 0.10 dB	

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0220

MTC No. EEL. BP. 45/0268

CALIBRATION CERTIFICATE

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

Instrument Calibrated :

Description : Acoustic Calibrator
Manufacturer : Cirrus Research plc
Model : CR:515
Serial No. : 92002

Ambient Environment

Temperature : (23 ± 3) °C
Relative Humidity : (50 ± 15) %
Ambient Pressure : (101.325 ± 1.500) kPa

Standards used :

- Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
- Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
- Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
- Digital Multimeter Agilent 34401A S/N MY44005560.
- Pressure Transmitter Vaisala PTB202AD S/N T0650001.
- Audio Analyzer Panasonic VP-7722A S/N 041477D122.
- 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 : 19 Feb. 2025

Date of Calibration : 21 Feb. 2025

1/2

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

FM.BLMTC.002 Rev.5

Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9036
Fax. (66) 0 2577 9009

Office/Laboratory

668 Mu 2 Tambon Bangpoomai, Amphoe Muang Samutprakan,
Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
(66) 08 3219 9440
E-mail : mtc@tistr.or.th Website : www.tistr.or.th

Office

196 Phahonyothin Road, Ladyao, Chatuchak,
Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
(66) 08 1889 6827



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0220

MTC No. EEL. BP. 45/0268

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

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

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	93.98	-0.02	± 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	1000.1	0.1	± 1.5	$\pm 1.0\%$

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	0.65	± 0.50	$\pm 3.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

(Mr. Weerachai Deechaiyae)

Approved by :

(Mr. Kawate Khuaypa)
Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 21 Feb. 2025

Date of Issue : 24 Feb. 2025

Ref : 2011268021900739002

End of Certificate

2 / 2

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

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

FM.BLMTC.002 Rev.5

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
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Fax. (66) 0 2577 9009

Office/Laboratory
668 Mu 2 Tambon Bangpoochai, Amphoe Muang Samutprakan,
Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
(66) 08 3219 9440
E-mail : mtc@tistr.or.th Website : www.tistr.or.th

Office
196 Phahonyothin Road, Ladyao, Chatuchak,
Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
(66) 08 1889 6827

คุณภาพน้ำ



CALIBRATION LABORATORY Co., LTD.

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



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : pH METER
MANUFACTURER : HANNA
MODEL / TYPE : HI3512/HI1332/HI7662-T
SERIAL NO. : 08685754/11250B7M/092806BN[PH04/56]
CLID. NO. : 272501562
JOB CONTROL NO. : 250617070523
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

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

DATE OF RECEIVED : 17 June 2025

DATE OF ISSUED : 20 June 2025

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Sukgasem Sechanart
Wenick Inchaisri
Calibration Engineer

Approved By : Mongkol Yotsoontorn
Authorized Signatory
20 June 2025



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

Certificate No. Q25070523

F3-011-05/12-23

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CALIBRATION LABORATORY Co., LTD.

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



REPORT OF CALIBRATION

FOR

NOMENCLATURE : pH METER
MANUFACTURER : HANNA
MODEL / TYPE : HI3512/HI1332/HI7662-T
SERIAL NO. : 08685754/11250B7M/092806BN[PH04/56]
DATE OF CALIBRATION : 18 June 2025

ENVIRONMENT CONDITIONS :

Temperature : $(25 \pm 2.5) ^\circ\text{C}$ Relative Humidity : $(50 \pm 15) \% \text{ RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPCH-01 [pH Meter]. The calibration was performed by direct measurement with Certified Reference Material (CRM).

This instrument was calibrated under procedure No. CLC-CPTH-04 [Temperature] based on ASTM E 644-04 as calibration guidelines. The calibration was performed by using Calibration Bath, Precision Thermometer and IPRT which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. pH Standard Solution, NIMT TRM CODE TRM-S-2003, TRM CODE TRM-S-2007.
2. pH Standard Solution, Control Company Catalog Number 06664260,11754256, Lot Number CC787362.
3. Calibration Bath, Kambic Model OB-22/2 ULT S/N. 17115653.
4. Precision Thermometer, ASL Model F250 S/N. 1334023800.
5. IPRT, Wika Model CTP5000-250-D S/N. PO00043543-1-10-1.

Certificate No. Q25070523

F3-011-05/12-23

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CALIBRATION LABORATORY Co., LTD.

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



TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand).
Lot Number. 080124, 120124. Due Date 23 January 2026.
2. The measurements are traceable to International System of Units (SI), through Control Company.
Certificate No. 4281-14495731, Due Date 27 September 2025.
3. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd.
Certificate No. Q24120999, Due Date 26 November 2025.
4. The measurements are traceable to International System of Units (SI), through Thailand Institute of Scientific and Technological Research (TISTR). Certificate No. PSL-T 1042/67, Due Date 16 October 2025.
5. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand).
Certificate No. TT-0146-24, Due Date 28 October 2025.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor complies with the table which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q25070523

F3-011-05/12-23

page 3 of 4



CALIBRATION LABORATORY Co., LTD.

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



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The table in the following gives the calibration results and associated measurement uncertainties of pH meter.

CALIBRATION DATA

1. pH METER RESULT @ 25 °C

Standard pH Buffer Solution (pH)	pH Meter Reading (pH)	pH Meter Reading (mV)	Correction (pH)	Uncertainty of pH Measurement (\pm pH)	k Factor
4.003	4.005	168.2	-0.002	0.010	2,00
7.005	7.010	-8.1	-0.005	0.013	2,00
10.015	10.010	-177.7	+0.005	0.014	2,00

Technical Note. Setting function CAL 3 point (4,7,10).

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 015 Page 4 of 68

2. TEMPERATURE RESULT

Immersion depth (mm)	Actual Temperature (°C)	DUC Reading (°C)	Correction (°C)	Uncertainty \pm (°C)
100	25.00	25.0	0.00	0.07

Technical Note. Type of sensor : Thermistor

Probe \varnothing 3 mm

Materials : Metal Sheath.

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor of $k = 2,00$.

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 015 Page 56 of 68

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

End of Certificate

Certificate No. Q25070523

F3-011-05/12-23

page 4 of 4





CERTIFICATE No : 25M2256
REFERENCE No : 76365-3

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : SARTORIUS
MODEL : BSA224S-CW
SERIAL No : 36591843
ID No : BA09/61
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 07-Mar-25

APPROVED BY : PONGSAK J.

ISSUED DATE : 13-Mar-25

RECEIVED DATE : 07-Mar-25

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



F-G010 REV 03



CERTIFICATE No : 25M2256

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : SARTORIUS
ID No : BA09/61
AIR PRESSURE : 1009mbar \pm 1mbar
AMBIENT TEMPERATURE : 24° C \pm 1° C
MODEL : BSA224S-CW
S/N : 36591843
RECEIVED DATE : 07-Mar-25
CALIBRATION DATE : 07-Mar-25
RELATIVE HUMIDITY : 52 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 6:2019 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS NOT ADJUSTED BEFORE CALIBRATION. THE BALANCE HAS NO ZERO TRACKING FUNCTION. REPEATABILITY WAS MEASURED BY USING 10 REPEATED MEASUREMENTS. LINEARITY WAS MEASURED COVERING 10 POINTS, EVENLY SPREAD OVER THE RANGE. THE INSTRUMENT WAS SET ZERO BEFORE PERFORMING THE LINEARITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-1-151	C02250116	28-Jan-27
2) STANDARD WEIGHT	E2	15843	C02250117	29-Jan-27

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.

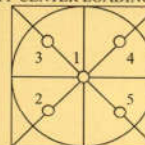
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND)

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

- ZERO SETTING FUNCTION : NORMAL
- TARE FUNCTION : NORMAL
- REPEATABILITY OF READING AT 200 g WAS 0.000071 g
- DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.0000	0.0000	0.00012
0.10	0.1000	0.0000	0.00012
0.20	0.2000	0.0000	0.00012
0.50	0.5000	0.0000	0.00012
1.00	1.0000	0.0000	0.00012
2.00	2.0000	0.0000	0.00012
5.00	5.0000	0.0000	0.00012
10.00	10.0000	0.0000	0.00012
20.00	20.0001	-0.0001	0.00012
50.00	50.0000	0.0000	0.00014
100.00	100.0001	-0.0001	0.00019
200.00	200.0001	-0.0001	0.00032

5. OFF CENTER LOADING ERROR



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



F-G010 REV 03

**QUALITY CALIBRATION CO., LTD.**

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

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

www.qcalibration.com

CERTIFICATE No : 25T0520

REFERENCE No : 75853-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : COD REACTOR

MANUFACTURER : HACH

MODEL : DRB 200

SERIAL No : 15110C0497

ID No : DRB 05/59

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : CHAICHARN CH.

CALIBRATION DATE : 27-Jan-25

APPROVED BY :
PONGSAK J.

ISSUED DATE : 27-Jan-25

RECEIVED DATE : 15-Jan-25

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

F-G010 REV : 03

**QUALITY CALIBRATION CO., LTD.**

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

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

CERTIFICATE No : 25T0520

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : COD REACTOR

MANUFACTURER : HACH

ID NUMBER : DRB 05/59

RECEIVED DATE : 15-Jan-25

AMBIENT TEMPERATURE : 23° C ± 1° C

MODEL : DRB 200

SERIAL NUMBER : 15110C0497

CALIBRATION DATE : 27-Jan-25

RELATIVE HUMIDITY : 53 %RH ± 10 % RH

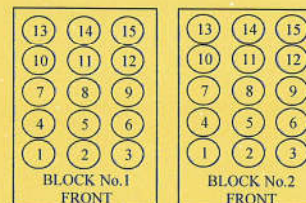
CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT METHOD WITH CALIBRATED THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON POINTS AND LOCATED AS THE PICTURE.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH TC TYPE K	HYDRA 2635A	6635300	24T6468	26-Jun-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 QUALITY CALIBRATION CO., LTD.**RESULT OF CALIBRATION :-** WITHOUT ADJUSTMENT

Block No.		1	2
Calibration Point (°C)		150	150
Controller temperature (°C)		144	144
Indicating Temperature		144	144
Measured Temperature (° C) at Spread Locations	1	150.01	149.57
	2	150.69	150.44
	3	150.40	149.46
	4	150.22	149.89
	5	150.27	149.75
	6	150.51	150.45
	7	150.24	150.03
	8	150.20	150.08
	9	150.14	150.14
	10	149.70	149.83
	11	149.58	149.89
	12	149.46	149.79
	13	148.77	149.03
	14	148.99	149.14
	15	149.02	149.62
Uncertainty of Measurement(± °C)		0.87	0.87

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

NOTE 2 : LOCATION 10 WAS REFERENCE LOCATION.

NOTE 3 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

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

F-G010 REV : 03



CERT.No.: HS-W015C

Harikul Science Co.,Ltd.
694 Soi Ratchadanivet 24, Pracharatbamphe,
Samsaenok, Huaikhwang, Bangkok 10310
Tel: 0-2274-2456 Fax: 0-2274-2443
Email: info@harikul.com www.harikul.com
Certificate of Calibration

Calibration Date : 18 Mar 25	Model : YSI 5000
Submitted by : S.P.S CONSULTING SERVICE CO.,LTD	S/N : 15B100751
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol,	Probe : YSI 5010
Chatuchak, Bangkok, Thailand 10900	S/N : 22D100097
	ID NO. : -
Avg Room Temp : 20 °C	Air Temp ref : S/N. F8065C26
Avg Water Temp : 20 °C	Barometric ref : S/N. F8065C26
Air Pressure : 760.00 mmHg	Water Temp ref : -
Salinity : 0 ppt	ID NO. HS001
	Technician : Kittipong M.

Calibration Details

Calibration Point	100% air sat. (@20 °C, DO = 9.09 mg/l)	(status)	(status)
Measurement 1 (mg/l)	9.08	(PASS)	-
Measurement 2 (mg/l)	9.08	(PASS)	-
Measurement 3 (mg/l)	9.08	(PASS)	-
Measurement 4 (mg/l)	9.07	(PASS)	-
Measurement 5 (mg/l)	9.07	(PASS)	-
Measurement 6 (mg/l)	9.07	(PASS)	-
Measurement 7 (mg/l)	9.07	(PASS)	-
Measurement 8 (mg/l)	9.07	(PASS)	-
Measurement 9 (mg/l)	9.07	(PASS)	-
Measurement 10 (mg/l)	9.07	(PASS)	-

Mean Measurement	9.07	mg/l	-	-
Inaccuracy	0.02	mg/l	-	-

Overall Status (PASS)

Manufacturer Specification

Accuracy = +/- 0.02 mg/l

- 1) This certificate is issued based on the result that are found as shown on date and place of test only.
- 2) The calibration procedure followed in accordance with Harikul Science Co., Ltd.
- 3) This result shall not be used for advertising purpose.

Technician Signature
(Kittipong Maekwong)

Laboratory Manager
(Natenapha Pisatunkhonor)



GC Clarus 600/680 Preventive Maintenance (PM)

Company Name:	S.P.S. Consulting Service Co.,Ltd		
Address (Instrument Location):	7 Soi Phaholyothin 24 Phaholyothin Road, Jompol, Chatuchak, Bangkok, 10900.		
Serial Number:	680S14042502	Service Tag:	N68APSSFIXMP
Customer Name (if applicable):	Ms.Naruecha	PM number:	1 of 2
Service Engineer Name:	Monchai Kitcharoenkeat	Service Order Number:	WO-
Date PM Performed: (DD-MMM-YYYY)	22-Feb-2025	Next PM Due Date: (DD-MMM-YYYY)	22-Aug-2025

Part Number	Release	Publication Date	
TH09370070	C	August 2016	

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
Clarus680	680S14042502	Totalchrom6.3.2	PSS, PSS, FID,
Clarus SQ8T	648N4050804	Turbomass 6.4	
AtomX	US14113002	Tekma AtomX	

Parts Lists

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

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 0.33 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.



- ☒ 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 6.5
- ☒ 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 1.12 mV.
Detector Channel B NA 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.



Additional Comments

Additional Comments Regarding the PM

Review

<i>The preventive maintenance checks and if applicable performance tests for Clarus600/680 GC have been completed.</i>	
<i>This Clarus600/680 GC</i>	<i>Pass</i>
<i>the preventive maintenance.</i>	
Review of Preventive Maintenance:	
Authorized PerkinElmer Representative: Monchai Kitcharenkeat	Date: 22-Feb-2025 (DD-MMM-YYYY)
Authorized Customer Representative: Ms.Naruecha	Date: 22-Feb-2025 (DD-MMM-YYYY)



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

RUN CHROMATOGRAM TEST

DETECTOR : Flame Ionization Detector (FID Channel Front)

INJECTOR : Capillary Injector Model 1079

GC CONDITION:

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

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

Sample: 1 µL Injection FID Test Sample 0.218 g/L C14,C15,C16 in hexane

SENSITIVITY TEST: C15. (Area count) = 156,955 Counts.



บริษัท ไทยยูนิค จำกัด

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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)	2.85	≤ 50
Baseline Drift (%)	0.09	≤ 1
Sensitivity (S/N for C15)	16,400	≥ 1,024

Temperature Specification

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

Relative Standard Deviation % (% RSD)

Checkout Procedure	Result	Specification
Area C15 (%)	1.71	≤ 5
Retention Time C15(%)	0	≤ 0.5

APPROVAL :

Signature: Suwarot.

Engineer : Suwarot Trikinut

Date : 05/08/2024



VARIAN

1/2

SERVICE DEPARTMENT
FR-SV-029 Rev. 04



VARIAN

2/2

SERVICE DEPARTMENT
FR-SV-029 Rev. 04



บริษัท ไทยยูนิค 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

Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 Area 1	157,309
C15 Area 2	159,359
C15 Area 3	157,349
C15 Area 4	152,379
C15 Area 5	158,379
C15 Area Average	156,955
* % RSD (< 5 %)	1.71

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

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

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

Compliance	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Performance by	Samarat.	
Date	05/08/2567	



Comments	-		
Reviewed by	Sarat P.	Date	05/08/2024



บริษัท ไทยยูนิค 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

Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 RT 1	4.128
C15 RT 2	4.128
C15 RT 3	4.128
C15 RT 4	4.128
C15 RT 5	4.128
C15 RT Average	4.128
* % 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 C15 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.)

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

Compliance	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Performance by	Samarat.	
Date	05/08/2024	



Comments	-		
Reviewed by	Sarat P.	Date	05/08/2024



VARIAN

1/1

SERVICE DEPARTMENT



VARIAN

1/1

SERVICE DEPARTMENT

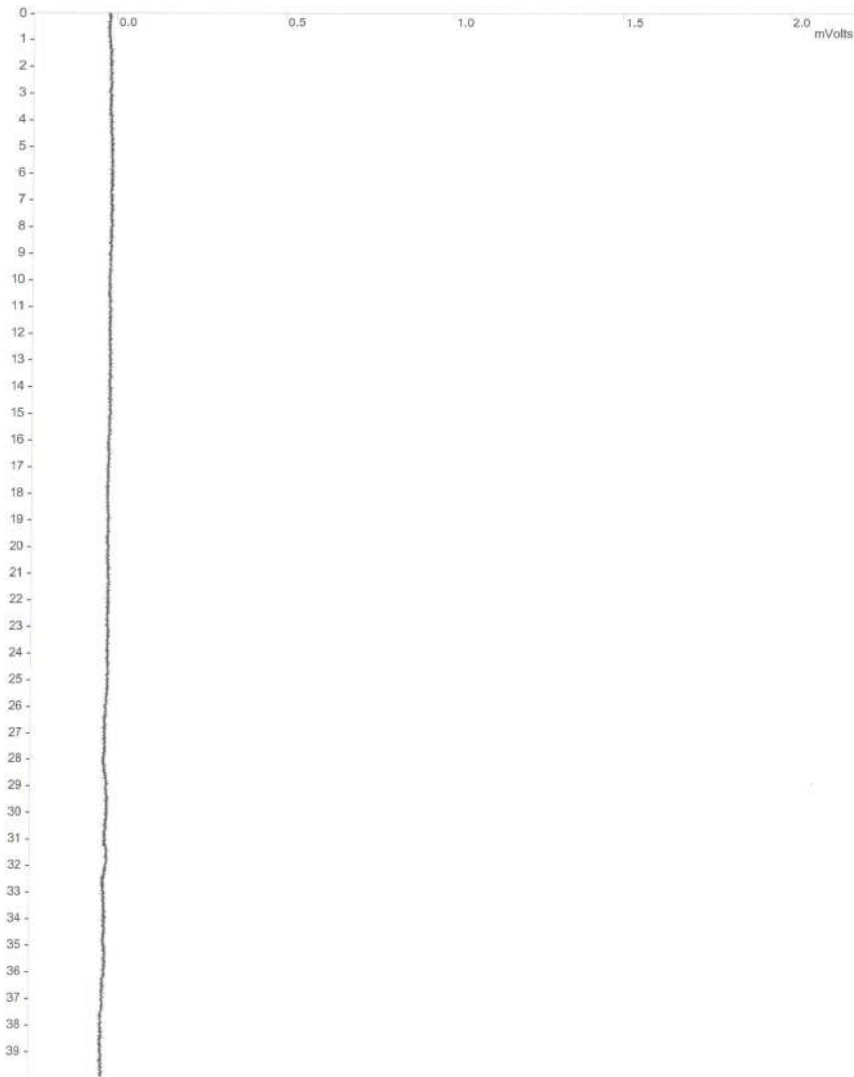
Title :
Run File : f:\ \sps2024\cal2024\baseline2024002.run
Method File : D:\Method-GC\star C\Star\TU\cal0203\baseline FID.mth
Sample ID : Baseline2024

Injection Date: 5/8/2567 14:01 Calculation Date: 5/8/2567 14:41

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

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

Chart Speed = 0.56 cm/min Attenuation = 1 Zero Offset = 10%
Start Time = 0.000 min End Time = 39.960 min Min / Tick = 1.00



Title :
Run File : f:\ \sps2024\cal2024\baseline2024002.run
Method File : D:\Method-GC\star C\Star\TU\cal0203\baseline FID.mth
Sample ID : Baseline2024

Injection Date: 5/8/2567 14:01 Calculation Date: 5/8/2567 14:41

Operator : suwarot Detector Type: 3800 (10 Volts)
Workstation: Local Disk Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID 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: -16 microVolts LSB: 1 microVolts
Noise (used): 22 microVolts - monitored before this run
Manual injection
Data Handling: No peaks

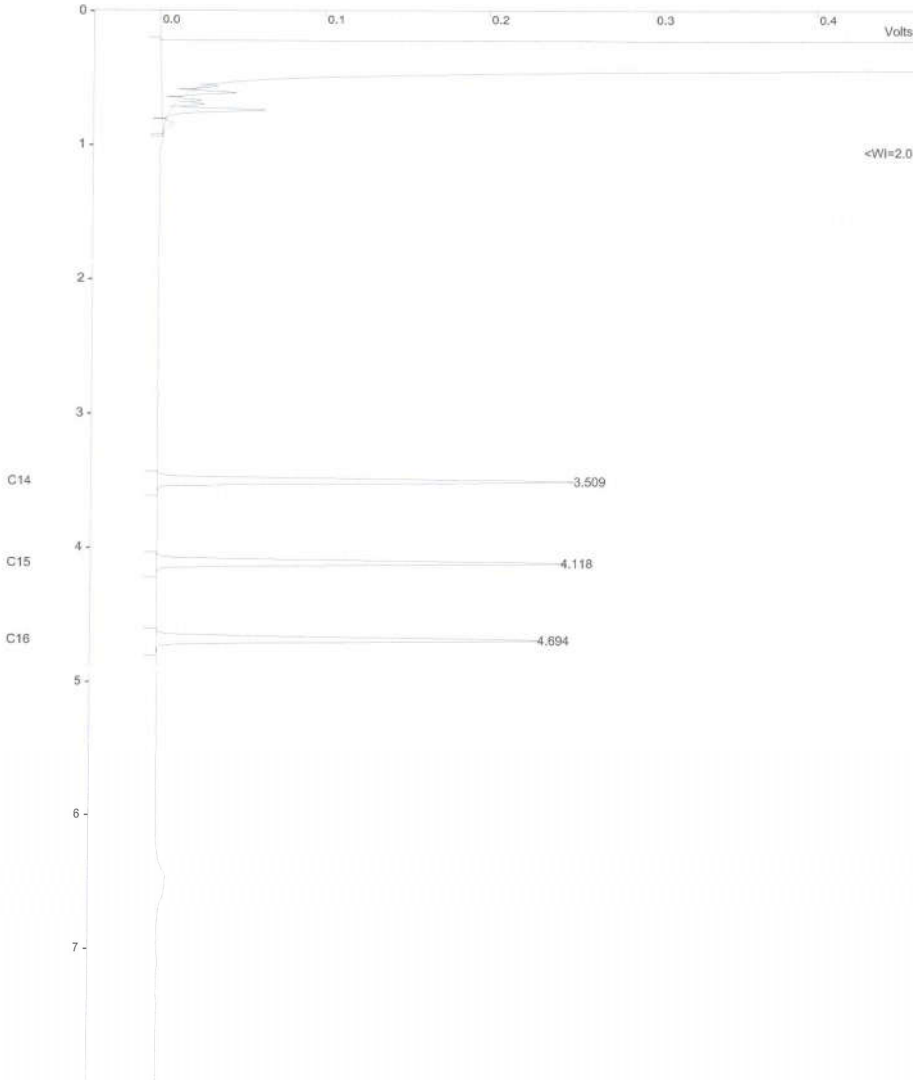
Title :
Run File : f:\sps2024\cal2024\fid2024003.run
Method File : d:\cafid2024003-front.mth
Sample ID : FID2024

Injection Date: 5/8/2567 9:16 Calculation Date: 5/8/2567 9:26

Operator : suwarot Detector Type: 3800 (10 Volts)
Workstation: GC-LAB Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 7.993 min

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

Chart Speed = 2.83 cm/min Attenuation = 205 Zero Offset = 8%
Start Time = 0.000 min End Time = 7.993 min Min / Tick = 1.00



Print Date: Sat Jan 01 19:35:30 2005 Page 1 of 1

Title :
Run File : f:\sps2024\cal2024\fid2024003.run
Method File : d:\fid2024003-front.mth
Sample ID : FID2024

Injection Date: 5/8/2567 9:16 Calculation Date: 5/8/2567 9:26

Operator : suwarot Detector Type: 3800 (10 Volts)
Workstation: GC-LAB Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 7.993 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
1	C14	54.1202	3.509	-0.005	163565	BB	2.1	C
2	C15	53.5241	4.118	-0.005	157309	BB	2.2	C
3	C16	52.2361	4.694	0.001	146804	BB	2.3	C
Totals:		159.8804		-0.009	1704289			

Status Codes:
C - Out of calibration range

Total Unidentified Counts : 69332200 counts

Detected Peaks: 11 Rejected Peaks: 0 Identified Peaks: 3

Multiplier: 1 Divisor: 1 Unidentified Peak Factor: 0

Baseline Offset: -29 microVolts LSB: 1 microVolts

Noise (used): 28 microVolts - monitored before this run

Manual injection

Calib. out of range; No Recovery Action Specified

Sample ID: fid std

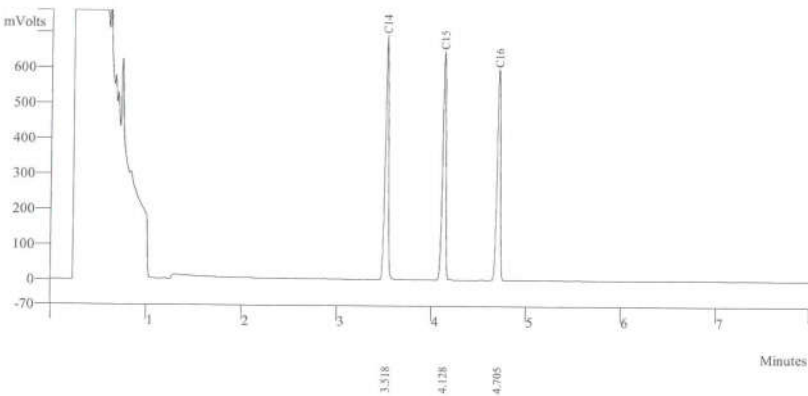
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):



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

c:\star\data\tu\cal2024\fid2024001.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	152.6865	3.518	163565	BB	2.2
2	C15	147.1889	4.128	157309	BB	2.3
3	C16	138.7997	4.705	146804	BB	2.3
Totals		438.6751		467678		

Sample ID: fid std

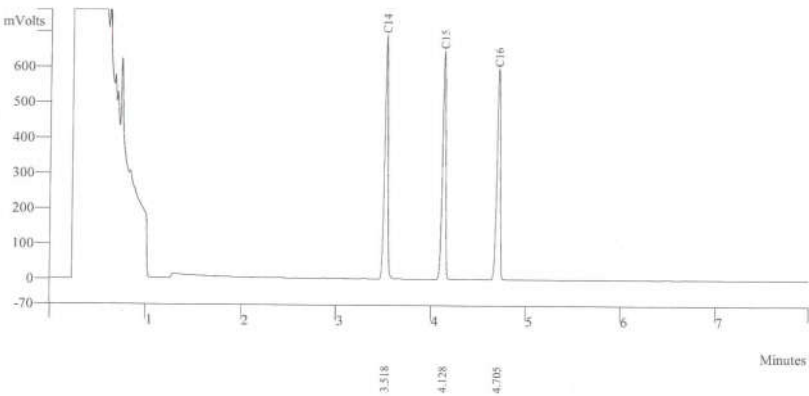
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):



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

c:\star\data\tu\cal2024\fid2024002.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	152.6865	3.518	168565	BB	2.2
2	C15	137.1189	4.128	159359	BB	2.3
3	C16	128.7997	4.705	147834	BB	2.3
Totals		418.6042		475758		

Sample ID: fid std

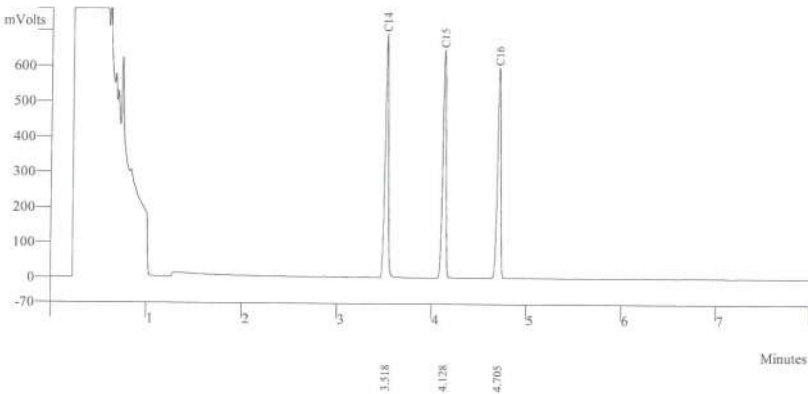
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):



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

c:\star\data\tu\cal2024\fid2024003.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	152.7865	3.518	169535	BB	2.2
2	C15	197.1159	4.128	157349	BB	2.3
3	C16	128.5997	4.705	149834	BB	2.3
Totals		478.5021		476718		

Sample ID: fid std

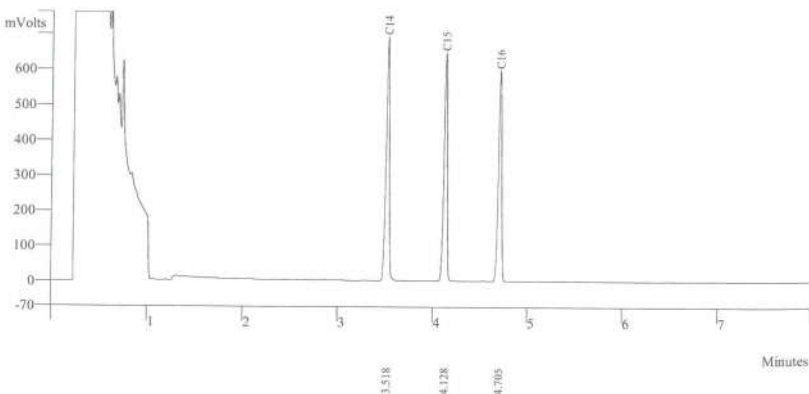
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):



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

c:\star\data\tu\cal2024\fid2024004.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	162.7865	3.518	165521	BB	2.2
2	C15	157.1159	4.128	152379	BB	2.3
3	C16	138.5997	4.705	146834	BB	2.3
Totals		458.5021		464734		



Sample ID: **fid std**

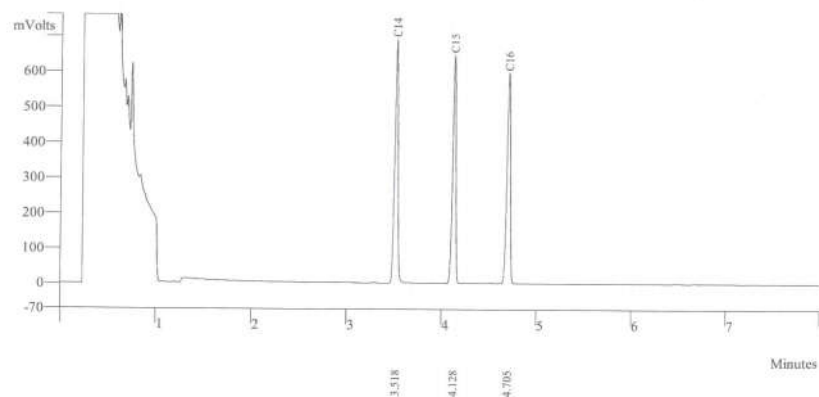
Operator (Inj): suwarot
 Injection Date: 05/08/2024
 Calc Date: 05/08/2024
 Run Time (min): 7.993
 Workstation: GC-LAB
 Instrument (Inj):



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

c:\star\data\tu\cal2024\fid2024005.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result (j)	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	162.7965	3.518	164521	BB	2.2
2	C15	137.1159	4.128	158379	BB	2.3
3	C16	128.1947	4.705	149834	BB	2.3
Totals		428.1071		472734		



THAI UNIQUE CO.,LTD.

1 OF 1



Agilent Technologies

Certificate of Analysis

FID-TCD Performance Evaluation Sample Kit

Agilent Part Number: 5080-8842, 18710-60170

Sample Lot Number: 0006750304

This analytical reference material was manufactured and verified in accordance with an ISO 9001 registered quality system, and the analyte concentrations were verified by an ISO 17025 accredited laboratory. The certified value for each analyte was determined gravimetrically.

Concentrations:		
n-tetradecane	0.218 g/L ($\pm 0.5\%$)	0.033 w/w %
n-pentadecane	0.218 g/L ($\pm 0.5\%$)	0.033 w/w %
n-hexadecane	0.218 g/L ($\pm 0.5\%$)	0.033 w/w %

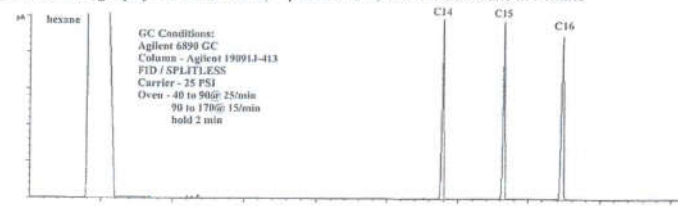
Solvent: hexane

Calibrated Class A glassware and clean bottles were used in the manufacture of this standard. Balances used in the manufacture of this standard are calibrated with weights traceable to NIST in compliance with ANSI/NCSL Z-540-1 and ISO 9001.

Purities:	
n-tetradecane	99.6%
n-pentadecane	99%
n-hexadecane	99.5%
hexane	99%

Typical Analytical Spectrum or Chromatography

GC Chromatography – n-tetradecane, n-pentadecane, and n-hexadecane in hexane



Date of release: 30 June 2023

Date of expiration: 31 July 2025

Monica Bourgeois
 Monica Bourgeois
 QMS Representative

Certificate of Calibration

Certificate No.: WK2312-031-1

Page 1 of 2

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

Ambient Temperature : $(23 \pm 2) ^\circ\text{C}$
Humidity : $(50 \pm 15) \% \text{RH}$
Received Date : 6-Dec-23
Calibrated Date : 7-Dec-23
Issued Date : 12-Dec-23
Calibrated Location : In Lab

Calibration Method : CP-WK-M10

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 coverage factor $k=2$, providing a level of confidence approximately 95%

Calibrated by : Mr.Taywanat Hansuwankul

Approved by :

Ms. Budsagorn Patcha

Authorized Signatory

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

Calibration Results

Certificate No. : WK2312-031-1

Page 2 of 2

Calibration Result of the Accuracy

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

UUC Setting		STD Reading	Error	Uncertainty (\pm)	Unit : ml/min
Scale	ml/min				Tolerance Limit Values (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****



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 Prachathipatal 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.

Calibrated by

Nanthiya Ngampring
Mrs. Nanthiya Ngampring
Metrology Technician

Approved by

A. S.
Mrs. Arunee Bamrungtham
Cal-Lab Manager

Certificate No. : LF24-0278

Model : 51

Serial No. : 5910857

Page 1 of 3



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 Prachathipatal 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

Certificate No. : LF24-0278

Model : 51

Serial No. : 5910857

Page 2 of 3

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

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

S. Pohtongkam

S. Pohtongkam

Service Manager

ระดับความร้อน



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

Heat B_155_1

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No. :	B21	Verification Date :	29 April 2025
Brand :	METROSNICS	Ambient Temp. :	24.5 °C
Model :	hs-32	Barometric Pressure :	1011 mmbar
Serial No. :	MCE030011	Relative Humidity :	49 %
Verification Module (Electronic Sensor Check) :			
Verification Module No. : 21 WB = 12.5 °C, DB = 47.1 °C, G = 69.3 °C			
Result of Verification : Without Adjustment			
Wet Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.6	-0.1	± 0.5
Dry Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.3	-0.2	± 0.5
Globe Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.2	0.1	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by : Peera Detudom
(Mr. Peera Detudom)



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

Heat B_155_2

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No. :	B22	Verification Date :	29 April 2025
Brand :	3M	Ambient Temp. :	24.5 °C
Model :	QUESTemp ^o 32	Barometric Pressure :	1011 mmbar
Serial No. :	TPK040059	Relative Humidity :	49 %
Verification Module (Electronic Sensor Check) :			
Verification Module No. : 21 WB = 12.5 °C, DB = 47.1 °C, G = 69.3 °C			
Result of Verification : Without Adjustment			
Wet Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.4	0.1	± 0.5
Dry Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.2	-0.1	± 0.5
Globe Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.3	0.0	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by : Peera Detudom
(Mr. Peera Detudom)



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR24090395-2

Page : 1 of 3

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

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

Equipment Name : Area Heat Stress Monitor

Manufacturer : Quest Technologies

Model : QUESTemp 32

Serial Number : TPK040059

ID. Number : B22-TPK040059

Environmental Conditions

Ambient Temperature : 23 °C ± 2 °C

Relative Humidity : 50 % ± 15 %

Location of Calibration : In-Lab

Calibration Procedure : SP-CPT-04-13

Received Date : 20 Sep 2024

Calibration Date : 23 Sep 2024

Recommend Due Date : 23 Sep 2025

Date of Issue : 24 Sep 2024

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr. Navaporn Uengseng

Calibration Officer

Approved by :

(Mr. Pootthipong A.)

Authorized Signatory



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24090395-2

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Humidity Chamber	TH-80S	N/A	SPR24020149-7	23 Feb 2025
THERMO-HYGROMETER	5020A	A47046	QR24-0167	26 Jan 2025

Traceability

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

SP Metrology - SP Metrology system (Thailand) Co.Ltd.

Quality Reborn Co., Ltd



ID LINE : IEC17025



Result of Calibration

Certificate Number : SPR24090395-2

Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.014	30.1	0.086	0.20
35.0	35.012	35.1	0.088	0.20
40.0	40.017	40.1	0.083	0.20

Temperature Accuracy in the Measurement. (DRY)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.014	30.2	0.186	0.20
35.0	35.012	35.2	0.188	0.20
40.0	40.017	40.2	0.183	0.20

Temperature Accuracy in the Measurement. (GLOBE)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.014	30.1	0.086	0.20
35.0	35.012	35.1	0.088	0.20
40.0	40.017	40.1	0.083	0.20

Note :

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2$, providing a level of confidence approximately 95%.

- End of Certificate -

A Trecal company



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR25030358-6

Page : 1 of 3

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

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

Equipment Name : Area Heat Stress Monitor

Manufacturer : Metrosonics

Model : hs-32

Serial Number : MCE030011

ID. Number : B21

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$

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

Location of Calibration : In-Lab

Calibration Procedure : SP-CPT-04-13

Received Date : 19 Mar 2025

Calibration Date : 27 Mar 2025

Recommend Due Date : 27 Mar 2026

Date of Issue : 28 Mar 2025

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.
The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Surasak Ritthikaew

Calibration Officer

Approved by :

(Mr.Prayoon Topart)

Authorized Signatory



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR25030358-6

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Humidity Chamber	TH-80S	N/A	SPR25010173-14	30 Jan 2026
THERMO-HYGROMETER	5020A	A47046	TMU2500342	29 Jan 2026

Traceability

This certification is traceable to the International System of Unit maintained at :
SP Metrology - SP Metrology system (Thailand) Co.Ltd.

NA - NA Caltechnologies Co., Ltd.



ID LINE : IEC17025



Result of Calibration

Certificate Number : SPR25030358-6

Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	29.985	29.8	-0.185	0.20
35.0	34.988	34.8	-0.188	0.20
40.0	39.990	39.9	-0.090	0.20

Temperature Accuracy in the Measurement. (DRY)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	29.985	29.7	-0.285	0.20
35.0	34.988	34.7	-0.288	0.20
40.0	39.990	39.8	-0.190	0.20

Temperature Accuracy in the Measurement. (GLOBE)

Unit : °C

Humidity Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	29.985	29.7	-0.285	0.20
35.0	34.988	34.7	-0.288	0.20
40.0	39.990	39.7	-0.290	0.20

Note :

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2$, providing a level of confidence approximately 95%.

- End of Certificate -

ระดับความเข้มของแสงสว่าง

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : LUX METER
MANUFACTURER : EXTECH INSTRUMENTS
MODEL / TYPE : 407026
SERIAL NO. : A.055543/A.055543
CLID. NO. : 252300057
JOB CONTROL NO. : 250701076305
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

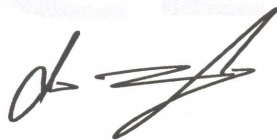
CUSTOMER : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24 ROAD., JOMPOL,
CHATUCHAK, BANGKOK 10900

DATE OF RECEIVED : 01 July 2025

DATE OF ISSUED : 03 July 2025

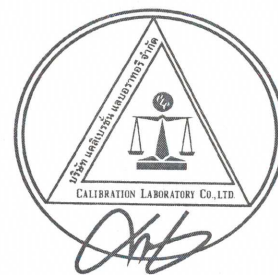
The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Suwit Phuanbusabong
Calibration Engineer



Approved By : Mongkol Yotsoontorn
Authorized Signatory

03 July 2025



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

Certificate No. Q25076305

F3-011-05/12-23

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@clccalibration

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	LUX METER
MANUFACTURER	:	EXTECH INSTRUMENTS
MODEL / TYPE	:	407026
SERIAL NO.	:	A.055543/A.055543
DATE OF CALIBRATION	:	02 July 2025
DUE DATE OF CALIBRATION	:	02 July 2026

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$

Relative Humidity : $(55 \pm 15) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPEE-18** by comparison with Photometer/Radiometer & Illuminance Sensor which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Photometer/Radiometer & Illuminance Sensor, Benthām Model ORM400/DH400VL S/N. 27710/1/27585/3.

TRACEABILITY :

The measurements are traceable to International System of Units (SI) , through Optical Test and Calibration Ltd.
Certificate No. 158628/ABU, Due Date 01 May 2027.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2,00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q25076305

F3-011-05/12-23

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CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

LUX METER RESULT

STD Applied (lux)	DUC Reading (lux)	Correction (lux)	Uncertainty \pm (% of rdg.)
100	112	-12	2.6
200	221	-21	2.6
300	329	-29	2.6
1000	1067	-67	2.6
2000	2090	-90	2.6
3000	3220	-220	3.8

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 015 Page 56 of 68

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

End of Certificate

Certificate No. Q25076305

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