

ภาคผนวกที่ 5

เอกสารการสอบเทียบเครื่องมือ

ภาคผนวกที่ 5-1	เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศจากปล่อง
ภาคผนวกที่ 5-2	เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศในบรรยากาศ
ภาคผนวกที่ 5-3	เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียงในบรรยากาศ
ภาคผนวกที่ 5-4	เอกสารสอบเทียบเครื่องมือการตรวจวิเคราะห์คุณภาพน้ำ
ภาคผนวกที่ 5-5	เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศในสถานประกอบการ
ภาคผนวกที่ 5-6	เอกสารสอบเทียบเครื่องมือการตรวจวัดเสียงในสถานประกอบการ
ภาคผนวกที่ 5-7	เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียงที่ลูกจ้างได้รับ เฉลี่ยตลอดระยะเวลา (TWA)
ภาคผนวกที่ 5-8	เอกสารสอบเทียบเครื่องมือการตรวจระดับความเข้มแสงสว่างในสถานประกอบการ

**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์ผลกระทบสิ่งแวดล้อม**

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
1. คุณภาพอากาศจากปล่อง		
Chlorine	Console No. R05 Pitot Tube No. B24, B33	Ion Chromatography
Sulfur Dioxide	Personal Pump SKC No. R24 Rotameter No. H-R01, R02	-
Oxide of Nitrogen	Vacuum Gauge	Spectrophotometer
Hydrogen Chloride	Console No. R05 Pitot Tube No. B24	Ion Chromatography
Total Suspended Particulate	Console No. B05 Pitot Tube No. B24, B45	Digital Balance
Dioxins	Console No. R05 Pitot Tube No. B09	GC-MS
2. คุณภาพอากาศในบรรยากาศ		
Nitrogen Dioxide	NO _x Analyzer No. R01, R04	NO _x Analyzer No. R01, R04
1,2-Dichloropropane	Mass Flow Meter	GC/MS
Epichlorohydrin	Personal Pump SKC No. B44, B55, B66, R02, R12, R14, R15, R21, R25, R33, R37, R40 Rotameter No. L-R04, R06	GC/FID
3. ระดับเสียงในบรรยากาศ		
L _{eq} 24 hr	Acoustic Calibrator Sound Level Meter No. ACO- R11, R12, R14, R20	-
4. คุณภาพน้ำ		
pH	-	pH Meter
BOD ₅	-	BOD Analyzer
COD	-	COD Reactor
Grease & Oil	-	Digital Balance
TSS	-	Digital Balance
TDS	-	Digital Balance
Calcium	-	ICP
Total Coliform Bacteria	-	Incubator Water bath
Temperature	-	Thermometer
1,2-Dichloropropane	-	GC/MS
1,3-Dichloropropane	-	GC/MS
Epichlorohydrin	-	GC/MS

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์ผลกระทบสิ่งแวดล้อม

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
5. คุณภาพอากาศในสถานประกอบการ Chlorine	Personal Pump No. B42, B45, B77, R19, R33, R40 Rotameter No. H-R01, R05	Spectrophotometer
Hydrogen Chloride	Personal Pump No. B17, B25, R05, R30, R44 Rotameter No. L-R05, R06	Ion Chromatography
Sulfuric Acid	Personal Pump No. R39, R34 Rotameter No. L-R05, R06	Ion Chromatography
Total Dust	Personal Pump No. R48, R22 Rotameter No. H-R05, R06	Digital Balance
Epichlorohydrin	Personal Pump No. B12, B21, B50, B52, B60, B71, R12, R13, R15, R21, R23, R28, R37 Rotameter No. L- R05, R06	GC/FID
Allyl Chloride	Personal Pump No. B03, B46, B52, R02, R06, R37 Rotameter No. L- R05, R06	GC/FID
6. ระดับเสียงในสถานประกอบการ Leq 8 hr	Acoustic Calibrator Sound Level Meter No. ACO-B18, B29, B33, B36, B41, B43	-
7. ระดับเสียงที่ลูกจ้างได้รับเฉลี่ย ตลอดระยะเวลา (TWA)	Acoustic Calibrator Noise Dose Meter No. NMD-B10, B11, B12, B13	-
8. ระดับความเข้มของแสงสว่าง ในสถานประกอบการ Light Intensity	Lux Meter No. R06	-

ภาคผนวกที่ 5-1

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศจากปล่อง



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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

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	02/02/2023	0.84	0.84
B04	S	0.99	01/02/2023	0.84	0.83
B05	S	0.99	02/02/2023	0.84	0.85
B07	S	0.99	02/02/2023	0.85	0.84
B08	S	0.99	01/02/2023	0.83	0.84
B09	S	0.99	01/02/2023	0.84	0.84
B11	S	0.99	01/02/2023	0.84	0.84
B16	S	0.99	01/02/2023	0.84	0.83
B18	S	0.99	02/02/2023	0.84	0.84
B19	S	0.99	02/02/2023	0.85	0.84
B21	S	0.99	03/02/2023	0.84	0.84
B24	S	0.99	03/02/2023	0.84	0.83
B27	S	0.99	02/02/2023	0.84	0.84
B30	S	0.99	01/02/2023	0.83	0.84
B31	S	0.99	02/02/2023	0.84	0.85
B33	S	0.99	03/02/2023	0.84	0.84
B35	S	0.99	02/02/2023	0.84	0.85

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

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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Calibration Method

Standard Pitot Tube

Calibration Data

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B05	S	0.99	02/02/2023	0.84	0.85
B07	S	0.99	02/02/2023	0.85	0.84
B08	S	0.99	01/02/2023	0.83	0.84
B09	S	0.99	01/02/2023	0.84	0.84
B11	S	0.99	01/02/2023	0.84	0.84
B16	S	0.99	01/02/2023	0.84	0.83
B18	S	0.99	02/02/2023	0.84	0.84
B19	S	0.99	02/02/2023	0.85	0.84
B21	S	0.99	03/02/2023	0.84	0.84
B24	S	0.99	03/02/2023	0.84	0.83
B27	S	0.99	02/02/2023	0.84	0.84
B30	S	0.99	01/02/2023	0.83	0.84
B31	S	0.99	02/02/2023	0.84	0.85
B33	S	0.99	03/02/2023	0.84	0.84
B35	S	0.99	02/02/2023	0.84	0.85

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

Calibrated by :

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Pitot Tube Calibration Report

Calibration Method

Standard Pitot Tube

Calibration Data

Pitot Tube Data			Calibration Data		
No.	Type of Pitot	Coefficient of Standard Pitot	Date	Avg. of Cp (test)	
				Side A	Side B
B36	S	0.99	02/02/2023	0.85	0.84
B37	S	0.99	02/02/2023	0.84	0.85
B38	S	0.99	01/02/2023	0.84	0.84
B39	S	0.99	03/02/2023	0.85	0.84
B40	S	0.99	02/02/2023	0.84	0.84
B41	S	0.99	02/02/2023	0.84	0.85
B44	S	0.99	03/02/2023	0.84	0.84
B45	S	0.99	01/02/2023	0.84	0.85
B46	S	0.99	01/02/2023	0.84	0.83
B47	S	0.99	01/02/2023	0.84	0.84
B48	S	0.99	03/02/2023	0.84	0.83
B49	S	0.99	03/02/2023	0.83	0.84
B54	S	0.99	03/02/2023	0.85	0.84
B56	S	0.99	02/02/2023	0.84	0.83
B57	S	0.99	02/02/2023	0.84	0.84
B58	S	0.99	02/02/2023	0.84	0.84

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

Calibrated by :

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Approved by :

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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (mL/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
R01	SKC	224-PCXR4	602467	06/07/2023	1,000	1,500	2,000	991	1,506	2,002	1.007x – 14.479	1.000
R02	SKC	224-PCXR4	626450	06/07/2023	1,000	2,000	3,000	997	1,497	1,988	0.988x + 12.256	1.000
R03	SKC	224-PCXR4	691592	06/07/2023	1,000	1,500	2,000	1,002	1,498	2,002	1.003x – 5.881	1.000
R04	SKC	224-PCXR4	691672	06/07/2023	1,000	1,500	2,000	995	1,491	1,994	0.997x – 2.717	1.000
R05	SKC	224-PCXR4	798470	06/07/2023	1,000	1,500	2,000	992	1,505	1,997	1.001x – 6.538	1.000
R06	SKC	224-PCXR4	798456	06/07/2023	1,000	1,500	2,000	994	1,497	1,993	0.994x – 0.976	1.000
R07	SKC	224-PCXR4	798480	04/07/2023	1,000	1,500	2,000	993	1,490	1,997	1.007x – 16.177	1.000
R08	SKC	224-PCXR4	883215	04/07/2023	1,000	1,500	2,000	1,010	1,499	2,003	0.989x + 11.332	0.999
R09	SKC	224-PCXR4	034650	04/07/2023	1,000	1,500	2,000	990	1,503	2,000	1.011x – 24.548	1.000
R10	SKC	224-PCXR4	091765	07/07/2023	1,000	1,500	2,000	996	1,509	1,992	0.999x + 0.299	1.000
R11	SKC	224-PCXR4	091763	07/07/2023	1,000	1,500	2,000	999	1,497	1,985	1.000x – 9.834	0.999
R12	SKC	224-PCXR4	091568	07/07/2023	1,000	1,500	2,000	995	1,499	1,998	1.001x – 6.774	1.000
R13	SKC	224-PCXR4	091638	07/07/2023	1,000	1,500	2,000	1,001	1,510	1,989	0.988x + 16.559	1.000
R14	SKC	224-PCXR4	091764	07/07/2023	1,000	1,500	2,000	993	1,501	1,997	1.013x – 30.102	0.999
R15	SKC	224-PCXR8	529457	07/07/2023	1,000	1,500	2,000	1,000	1,499	2,001	0.998x – 3.682	0.999
R16	SKC	224-PCXR8	529643	05/07/2023	1,000	1,500	2,000	997	1,494	1,992	0.992x + 2.530	1.000
R17	SKC	224-PCXR8	529645	05/07/2023	1,000	1,500	2,000	994	1,507	1,998	1.006x – 15.440	0.999
R18	SKC	224-PCXR8	566756	05/07/2023	1,000	1,500	2,000	990	1,496	1,996	1.000x – 6.873	1.000
R19	SKC	224-PCXR8	566802	05/07/2023	1,000	1,500	2,000	1,001	1,497	1,998	1.003x – 14.352	0.999
R20	SKC	224-PCXR8	529089	03/07/2023	1,000	1,500	2,000	990	1,499	2,001	1.019x – 39.318	0.999
R21	SKC	224-PCXR8	665728	03/07/2023	1,000	1,500	2,000	997	1,493	1,997	0.999x – 3.765	1.000
R22	SKC	224-PCXR8	707444	03/07/2023	1,000	1,500	2,000	1,002	1,511	2,001	1.000x – 2.666	0.999
R23	SKC	224-PCXR8	761067	05/07/2023	1,000	1,500	2,000	1,011	1,475	1,989	0.980x + 20.504	0.999
R24	SKC	224-PCXR8	707893	04/07/2023	1,000	1,500	2,000	995	1,507	1,998	1.007x – 16.619	0.999
R25	SKC	224-PCXR8	761052	04/07/2023	1,000	1,500	2,000	1,009	1,494	1,993	0.984x + 21.169	1.000
R26	SKC	224-PCXR8	707956	06/07/2023	1,000	1,500	2,000	1,011	1,499	2,004	1.001x – 3.674	0.999
R27	SKC	224-PCXR8	707398	06/07/2023	1,000	1,500	2,000	995	1,499	1,999	1.005x – 14.830	1.000
R28	SKC	224-PCXR8	707481	04/07/2023	1,000	1,500	2,000	1,003	1,499	2,000	1.001x – 11.858	0.998
R29	SKC	224-PCXR8	707402	04/07/2023	1,000	1,500	2,000	1,002	1,492	1,987	0.985x + 16.145	1.000
R30	SKC	224-PCXR8	093811	07/07/2023	1,000	1,500	2,000	999	1,492	1,991	0.994x + 4.391	1.000
R31	SKC	224-PCXR8	093183	04/07/2023	1,000	1,500	2,000	1,000	1,499	1,999	0.989x + 8.339	0.999
R32	SKC	224-PCXR8	671950	04/07/2023	1,000	1,500	2,000	997	1,499	1,991	0.995x + 4.048	1.000
R33	SKC	224-PCXR4	626254	04/07/2023	1,000	1,500	2,000	993	1,501	1,998	1.014x – 32.194	0.999
R34	SKC	224-PCXR4	626131	04/07/2023	1,000	1,500	2,000	1,001	1,498	2,002	1.006x – 12.316	1.000
R35	SKC	224-PCXR8	707460	03/07/2023	1,000	1,500	2,000	998	1,496	1,993	0.993x + 5.945	1.000
R36	SKC	224-PCXR8	707446	07/07/2023	1,000	1,500	2,000	1,003	1,497	1,999	1.008x – 18.814	0.999
R37	SKC	224-PCXR8	707432	07/07/2023	1,000	1,500	2,000	995	1,497	1,998	0.995x + 5.662	1.000
R38	SKC	224-PCXR8	707349	07/07/2023	1,000	1,500	2,000	996	1,498	1,999	1.002x – 7.662	1.000
R39	SKC	224-PCXR8	761095	04/07/2023	1,000	1,500	2,000	1,000	1,514	1,992	0.984x + 18.826	0.999

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (mL/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
H-R01	Dwyer	VFB-65	05/07/2023	500	1,000	2,000	501.2	993.0	1978.7	0.999x – 3.855	0.999
H-R02	Dwyer	VFB-65	05/07/2023	500	1,000	2,000	501.5	998.1	1986.7	1.000x – 2.024	1.000
H-R03	Dwyer	VFB-65	04/07/2023	500	1,000	2,000	501.2	989.3	1995.7	0.992x + 3.827	1.000
H-R04	Dwyer	VFB-65	10/07/2023	500	1,000	2,000	496.3	991.2	2014.5	1.006x – 10.883	1.000
H-R05	Dwyer	VFB-65	05/07/2023	500	1,000	2,000	499.1	987.9	1988.7	1.002x – 6.676	1.000
H-R06	Dwyer	VFB-65	06/07/2023	500	1,000	2,000	504.7	994.0	1980.6	0.998x – 1.539	0.999

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)

CERTIFICATE OF CALIBRATION FOR

NOMENCLATURE : VACUUM GAUGE
MANUFACTURER : HI-LIGHT
MODEL / TYPE : N/A
SERIAL NO. : N/A[64-220088-1]
CLID. NO. : 212301419
JOB CONTROL NO. : 230725081570

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

DATE OF RECEIVED : 25 July 2023

DATE OF ISSUED : 31 July 2023

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

Calibrated By : Sittipong Pimdee
Calibration Engineer



Approved By : Mongkol Yotsoontorn
Authorized Signatory
31 July 2023



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. Q23081570

F3-011-04/01-12

page 1 of 3



@clccalibration

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	VACUUM GAUGE
MANUFACTURER	:	HI-LIGHT
MODEL / TYPE	:	N/A
SERIAL NO.	:	N/A[64-220088-1]
DATE OF CALIBRATION	:	26 July 2023
DUE DATE OF CALIBRATION	:	26 July 2024

ENVIRONMENT CONDITIONS :

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

Relative Humidity : $(55 \pm 10) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPPP-05** according to **DKD-R 6-1** as calibration guidelines.

The calibration was performed by direct measurement with Document Process Calibrator and Pressure Module which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Document Process Calibrator, Fluke Model 741B S/N. 8295020 with Pressure Module Model 700PD5 S/N. 89404505.

TRACEABILITY :

The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand).

Certificate No. MP-0035-23, Due Date 02 February 2024.

UNCERTAINTY :

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor of $k = 2$. It has been evaluated according to the "Calibration of Pressure Gauges (DKD-R 6-1)" which provides a level of confidence approximately 95%.

Certificate No. Q23081570

F3-011-04/01-12

page 2 of 3



@clccalibration



CLC
Accredited
ISO/IEC 17025

CALIBRATION LABORATORY Co., LTD.

2/10-11,14, 55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230

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



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The DUC was exercised by applying a known pressure from its zero to full scale 1 times. Then 2 series of known gauge pressure were applied. The STD reading were recorded and the means value were reported in the table below.

CALIBRATION DATA

CORRECTION OF PRESSURE

DUC Test point (inHg)	STD Reading (kPa)		Conversion to inHg		Correction (inHg)	
	Up	Down	Up	Down	Up	Down
0	0.00	0.00	0.0	0.0	0.0	0.0
-5	-15.07	-15.10	-4.5	-4.5	+0.5	+0.5
-10	-32.10	-32.13	-9.5	-9.5	+0.5	+0.5
-15	-49.20	-49.23	-14.5	-14.5	+0.5	+0.5
-20	-66.26	-66.26	-19.6	-19.6	+0.4	+0.4
-25	-83.30	-83.33	-24.6	-24.6	+0.4	+0.4
-30	-100.39	-100.39	-29.6	-29.6	+0.4	+0.4

Uncertainty of measurement ± 0.2 inHg

Transmitting fluid : Air.

Technical Note. Conversion factor 1 kPa ; 0.2953003 inHg

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 008 Page 36 of 54

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

End of Certificate

Certificate No. Q23081570

F3-011-04/01-12

page 3 of 3



@clccalibration



Certificate of Calibration

Aquion : Anion (ID#894)

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

AQUION S/N : 190840059

AS-DV S/N : 190915235

for

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

ARCHEMICA LAB
บริษัท อาร์เคมีกา แล็บ จำกัด
ARCHEMICA LAB CO.,LTD

Operator Signature : Nutdanai

Date : Jul 3, 2023

(Mr.Nutdanai Laekhwan)

Applications Chemist

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY



451-451/1 Sirinthorn Rd., Bangbumru, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiphorn.com http://www.sithiphorn.com

NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : SP22018

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 : ORGANIC LABORATORY IV

Ambient Temperature : (24.4 ± 5) °C
Relative Humidity : (60.1 ± 25) %

Received Date : 30 AUGUST 2022
Calibration Date : 30 AUGUST 2022
Date of Issue : 31 AUGUST 2022

Calibrated by :

Nathakorn Pisutpaisan

Approved by :


(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.

Continuation of Calibration Certificate

Cert. No. : SP22018

Job No. : VC65SP0008

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

<u>Material</u>	<u>Ref. type</u>	<u>Cell serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Holmium liquid	RM-HL	29706	87569	13/10/2022
Didymium liquid	RM-DL	28912	87588	15/10/2022
Neutral density filter	RM-1N2N3N	13877	87600	15/10/2022
Potassium dichromate solutions	RM-0204060810	14204	87614	16/10/2022
Potassium Iodide solution	-	KI-0701-001	CI-0090-22	08/04/2024

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	467.8	-0.02	0.16	2.00
	536.56	536.5	-0.06	0.16	2.00
	640.50	640.5	0.00	0.16	2.00
RM-DL	740.09	740.0	-0.09	0.16	2.00
	864.94	865.2	0.26	0.16	2.00

UUC* = Unit Under Calibration

Continuation of Calibration Certificate

Cert. No. : SP22018

Job No. : VC65SP0008

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	1.0524	1.0539	0.0015	0.0028	2.00
		29914	0.7	0.7454	0.7459	0.0005	0.0029	2.00
		29381	0.5	0.5426	0.5426	0.0000	0.0028	2.00
	546.1	29360	1.0	0.9822	0.9810	-0.0012	0.0028	2.00
		29914	0.7	0.6962	0.6960	-0.0002	0.0028	2.00
		29381	0.5	0.5076	0.5070	-0.0006	0.0029	2.00
	590.0	29360	1.0	1.0221	1.0202	-0.0019	0.0028	2.00
		29914	0.7	0.7238	0.7230	-0.0008	0.0029	2.00
		29381	0.5	0.5364	0.5360	-0.0004	0.0031	2.00
	635.0	29360	1.0	0.9751	0.9732	-0.0019	0.0028	2.00
		29914	0.7	0.6912	0.6902	-0.0010	0.0029	2.00
		29381	0.5	0.5214	0.5210	-0.0004	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	0.2436	0.2419	-0.0017	0.0101	2.00	
		40	0.4905	0.4855	-0.0050	0.0115	2.00	
		60	0.7453	0.7388	-0.0065	0.0067	2.00	
		80	0.9920	0.9839	-0.0081	0.0071	2.00	
		100	1.2487	1.2414	-0.0073	0.0073	2.00	

UUC* = Unit Under Calibration

Condition of this result of calibration : Spectrophotometer PERKINELMER Model Lambda 25 S/N 501S141230

Resolution of Wavelength Mode 0.1 nm

Resolution of Photometric Mode 0.0001 A

Parameter Setting

Measurement Mode Wavelength, Absorbance

Wavelength Scan 1100 nm-190 nm

Scanning Speed 7.5 nm/min

Data Pitch 0.1 nm

Band width(Wavelength) 1.0 nm

Band width(Vis) 1.0 nm

Band width(Uv) 1.0 nm

Stray Light** UUC* Reading at 220 nm

Transimission T(%)	Absorbance(A)
0.0107	3.9886

**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

**QUALITY CALIBRATION CO.,LTD.**

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

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

www.qcalibration.com

CERTIFICATE No : 23M2441

REFERENCE No : 68471-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : METTLER TOLEDO

MODEL : XS105DU

SERIAL No : 1126422905

ID No : BA 05/50

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 10-Mar-23

APPROVED BY : PONGSAK J.

ISSUED DATE : 16-Mar-23

RECEIVED DATE : 10-Mar-23

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



CERTIFICATE No : 23M2441

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU
MANUFACTURER : METTLER TOLEDO S/N : 1126422905
ID No : BA 05/50 RECEIVED DATE : 10-Mar-23
AIR PRESSURE : 1010mbar \pm 1mbar CALIBRATION DATE : 10-Mar-23
AMBIENT TEMPERATURE : 23°C \pm 1°C RELATIVE HUMIDITY : 49 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.

4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

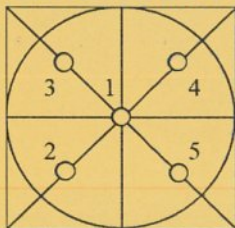
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.00000	0.00000	0.000039
0.02	0.02000	0.00000	0.000039
0.10	0.10000	0.00000	0.000039
0.20	0.20001	-0.00001	0.000040
0.50	0.50001	-0.00001	0.000040
1.00	1.00000	0.00000	0.000041
2.00	2.00003	-0.00003	0.000042
5.00	5.00001	-0.00001	0.000046
10.00	10.00003	-0.00003	0.000053
20.00	20.00005	-0.00005	0.000067
50.00	50.00001	-0.00001	0.00011
100.00	100.00001	-0.00001	0.00019
200.00	200.00001	-0.00001	0.00032

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	50.0000
2	50.0001
3	50.0000
4	50.0000
5	49.9999
OFF-CENTER LOADING	0.0001

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

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

END OF CALIBRATION REPORT

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

Company Name:	S.P.S. Consulting Service Co.,Ltd		
Address (Instrument Location):	7 Soi Phaholyothin24 Phaholyothin Road, Jompol, Chatuchak, Bangkok, 10900.		
Serial Number:	648N4050804	PM Number:	1 of 2
Customer Name (if applicable):	Ms. Naruecha	Telephone Number:	NA
Service Engineer Name:	Monchai Kitcharoenkeat	Service Order Number:	WO-01852714
Date PM Performed: (DD-MMM-YYYY)	22-Feb-2023	Next PM Due Date: (DD-MMM-YYYY)	22-Aug-2023

Part Number	Release	Publication Date	
TH09370064	C	March 2013	

Scope

The purpose of this PM is to ensure the continued functionality of the T u r b o m a s s / C l a r u s M S S Q 8 M S 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	
Clarus SQ8	648N4050804	Turbomass 6.4	
Atom X	US14113002	Tekma AtomX	

Parts lists

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

Additional Tools Required for PM				
Part Number (if applicable)	Description	Quantity	Serial #	Calibration Due Date (MM/YY)
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 (x) to check off those steps in the checklist that have been completed.

General:

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

Mechanical:

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

Electrical:

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

Operational Tests:

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

**PC Maintenance:**

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

Review:

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

Additional Comments

Additional Comments Regarding the PM

Review

<i>The preventive maintenance checks and if applicable performance tests for Turbomass/ Clarus Mass/ SQ8 have been completed.</i>	
<i>This Turbomass/ClarusMS/SQ8 Pass the preventive maintenance.</i>	
Review of Preventive Maintenance:	
Authorized PerkinElmer Representative Monchai Kitcharoenkeat	Date: 22-Feb-2023 (DD-MMM-YYYY)
Authorized Customer Representative:	Date: 22-Feb-2023 (DD-MMM-YYYY)

ภาคผนวกที่ 5-2

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศในบรรยากาศ



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@spscn.com. www.spscn.com

CALIBRATION REPORT

CHEMILUMINESCENT NO / NO₂ / NO_x ANALYZER

DATE : 06 August 2023

BRAND : API

MODEL : 200E

NO. NOX-R01

SERIAL NO. 769

Calibrator (Dilution System)

Brand : API Model : 700
Last Cal. Date : 06 September 2022 Serial No. : 421

Reference Standard Gas

Standard Gas : Nitric Oxide (NO) Cylinder No. : D636192
Certified Date : 20 April 2022 Expired Date : 20 April 2024 Cylinder Conc. : 49.1 ppm

CALIBRATING CONDITION

Pressure 1011 mmbar Temp. 24.5 °C % RH 48

CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	399.6	-0.100	400.0	1.003
NO _x Span	400	399.9	-0.025	400.0	1.007

API Model 200E NO_x Analyzer Check List

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	500 standard
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air
SAMPLE FLOW	504	cc/min	500 ± 50
OZONE FLOW	78	cc/min	80 ± 15
PMT	103.3	mV	-20 - 150
AZERO	94.1	mV	-20 - 150
HVPS	675	V	420 - 900 constant
RCELL TEMP	50.1	°C	50 ± 1
BOX TEMP	29.0	°C	8 - 48
PMT TEMP	7.2	°C	7 ± 2
MOLY TEMP	315.2	°C	315 ± 5
RCELL PRESS	8.3	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.5	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO _x Span Conc	400	PPB	20 - 20,000
NO Slope	1.003	-	1.0 ± 0.3
NO _x Slope	1.007	-	1.0 ± 0.3
NO Offset	1.1	mV	-20 to +150
NO _x Offset	0.7	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)



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

CALIBRATION REPORT

CHEMILUMINESCENT NO / NO₂ / NO_x ANALYZER

DATE : 06 August 2023

BRAND : API

MODEL : 200E

NO. NOX-R04

SERIAL NO. 4411

Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 06 September 2022

Serial No. : 421

Reference Standard Gas

Standard Gas : Nitric Oxide (NO)

Cylinder No. : D636192

Certified Date : 20 April 2022

Expired Date : 20 April 2024

Cylinder Conc. : 49.1 ppm

CALIBRATING CONDITION

Pressure 1011 mmbar

Temp. 24.5 °C

% RH 48

CALIBRATION SETTING

Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.11	-	0	-
NO Span	400	400.1	0.025	400.0	1.007
NO _x Span	400	400.3	0.075	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	512	cc/min	500 ± 50
OZONE FLOW	79	cc/min	80 ± 15
PMT	103.2	mV	-20 - 150
AZERO	94.0	mV	-20 - 150
HVPS	671	V	420 - 900 constant
RCELL TEMP	50.2	°C	50 ± 1
BOX TEMP	29.3	°C	8 - 48
PMT TEMP	7.1	°C	7 ± 2
MOLY TEMP	314.8	°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	1.007	-	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)



Certificate of Calibration

Certificate Number : SPR23050422-1

Page : 1 of 3

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

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

Equipment Name : Mass Flow Meter

Manufacturer : Dwyer

Model : GMF-2101

Serial Number : N/A

ID. Number : MF01/51

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-CPM-04-13

Received Date : 26 May 2023

Calibration Date : 29 May 2023

Recommend Due Date : 29 May 2024

Date of Issue : 30 May 2023

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.Jirasak Pumbut

Calibration Officer

Approved by :

(Mr.Prayoon Topart)

Authorized Signatory



Calibration Report

Certificate Number : SPR23050422-1

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Mass Flow Calibrator	AFC-COMPLETE-10	12532	AD2207-177-0001	17 Jul 2023
Standard Flow Meter	520-H	200353	MW-0071-22	25 Aug 2023

Traceability

This certification is traceable to the International System of Unit maintained at :
MIT - Miracle International Technology Co.,Ltd.
MesaLabs - Mesa Laboratories, Inc.NVLEP Lab Code 200661-0 (ISO17025)

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่มือการใช้งานเครื่องวัด www.spmetrology.com



Result of Calibration

Certificate No. : SPR23050422-1

Page : 3 of 3

Function : Air Flow Measurement

Unit : mL/min

Calibration Point	UUC Reading	Standard Reading	UUC Error	K Factor Value	Uncertainty (±)
0.0	0.00	0.00	0.00	1.00000	0.12
3.3	3.42	3.59	-0.17	1.04971	0.26
7.3	7.52	7.78	-0.26	1.03457	0.26
13.5	13.83	14.34	-0.51	1.03688	0.26
17.0	17.12	17.65	-0.53	1.03096	0.26

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 -



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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (mL/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
B41	SKC	224-PCXR4	612669	10/07/2023	1,000	1,500	2,000	998	1,495	1,989	0.995x + 1.833	1.000
B42	SKC	224-PCXR4	626041	10/07/2023	1,000	1,500	2,000	1,003	1,496	1,989	0.985x + 18.950	1.000
B43	SKC	224-PCXR4	034636	05/07/2023	1,000	1,500	2,000	999	1,500	1,990	0.990x + 11.352	1.000
B44	SKC	224-PCXR8	529341	10/07/2023	1,000	1,500	2,000	1,001	1,500	2,000	1.003x - 8.128	1.000
B45	SKC	224-PCXR8	529594	06/07/2023	1,000	1,500	2,000	998	1,500	1,985	0.988x + 13.443	1.000
B46	SKC	224-PCXR8	566743	04/07/2023	1,000	1,500	2,000	994	1,504	2,000	1.006x - 14.882	1.000
B47	SKC	224-PCXR8	566747	04/07/2023	1,000	1,500	2,000	1,001	1,500	2,002	1.012x - 24.217	0.999
B48	SKC	224-PCXR8	566753	10/07/2023	1,000	1,500	2,000	999	1,491	1,996	1.002x - 11.236	1.000
B49	SKC	224-PCXR8	566780	04/07/2023	1,000	1,500	2,000	1,002	1,501	2,004	1.012x - 23.640	0.999
B50	SKC	224-PCXR8	500400	10/07/2023	1,000	1,500	2,000	1,000	1,506	2,000	0.997x + 1.566	1.000
B51	SKC	224-PCXR8	500363	04/07/2023	1,000	1,500	2,000	995	1,502	1,998	1.010x - 25.405	0.999
B52	SKC	224-PCXR8	093186	10/07/2023	1,000	1,500	2,000	993	1,494	1,990	0.995x + 0.992	1.000
B53	SKC	224-PCXR8	707670	05/07/2023	1,000	1,500	2,000	1,001	1,499	2,000	1.007x - 16.304	0.999
B54	SKC	224-PCXR3	509821	03/07/2023	1,000	1,500	2,000	992	1,500	2,000	1.017x - 35.039	0.999
B55	SKC	224-PCXR3	510710	10/07/2023	1,000	1,500	2,000	999	1,493	1,990	0.993x + 2.638	1.000
B56	SKC	224-PCXR3	511450	04/07/2023	1,000	1,500	2,000	1,001	1,498	1,999	1.004x - 9.108	1.000
B57	SKC	224-PCXR3	510798	10/07/2023	1,000	1,500	2,000	996	1,490	1,997	1.005x - 13.675	1.000
B58	SKC	224-PCXR3	509852	05/07/2023	1,000	1,500	2,000	999	1,497	1,997	1.006x - 19.133	0.999
B59	SKC	224-PCXR3	509862	06/07/2023	1,000	1,500	2,000	995	1,501	1,993	1.001x - 5.136	1.000
B60	SKC	224-PCXR3	512655	06/07/2023	1,000	1,500	2,000	1,001	1,498	2,015	1.017x - 25.660	1.000
B61	SKC	224-PCXR3	503915	05/07/2023	1,000	1,500	2,000	992	1,488	1,997	1.004x - 13.766	1.000
B62	SKC	224-PCXR3	505975	06/07/2023	1,000	1,500	2,000	998	1,493	1,994	0.996x + 0.183	1.000
B63	SKC	224-PCXR3	511432	04/07/2023	1,000	1,500	2,000	989	1,499	1,998	1.010x - 24.150	1.000
B64	SKC	224-PCXR3	508302	03/07/2023	1,000	1,500	2,000	997	1,491	1,987	0.990x + 8.411	1.000
B65	SKC	224-PCXR3	508310	10/07/2023	1,000	1,500	2,000	1,011	1,499	2,000	0.998x + 0.263	0.999
B66	SKC	224-PCXR3	509861	10/07/2023	1,000	1,500	2,000	1,001	1,489	1,990	0.987x + 13.691	1.000
B67	SKC	224-PCXR3	506295	04/07/2023	1,000	1,500	2,000	994	1,506	2,009	1.012x - 20.281	1.000
B68	SKC	224-PCXR3	505872	04/07/2023	1,000	1,500	2,000	1,001	1,489	1,996	0.994x + 3.757	1.000
B69	SKC	224-PCXR3	508375	04/07/2023	1,000	1,500	2,000	1,001	1,498	1,998	1.008x - 19.635	0.999
B70	SKC	224-PCXR3	510623	05/07/2023	1,000	1,500	2,000	991	1,502	1,994	1.001x - 5.451	1.000
B71	SKC	224-PCXR3	508367	10/07/2023	1,000	1,500	2,000	991	1,504	2,000	1.016x - 35.155	0.999
B72	SKC	224-PCXR3	505977	05/07/2023	1,000	1,500	2,000	1,000	1,498	1,992	0.992x + 7.080	1.000
B73	SKC	224-PCXR3	512606	05/07/2023	1,000	1,500	2,000	1,000	1,499	2,002	1.000x - 7.240	0.999
B74	SKC	224-PCXR3	505993	05/07/2023	1,000	1,500	2,000	995	1,495	1,992	0.996x - 2.446	1.000
B75	SKC	224-PCXR3	509820	05/07/2023	1,000	1,500	2,000	995	1,495	1,989	0.995x + 1.829	1.000
B76	SKC	224-PCXR3	509811	04/07/2023	1,000	1,500	2,000	992	1,497	1,997	1.005x - 14.428	1.000
B77	SKC	224-PCXR3	508301	04/07/2023	1,000	1,500	2,000	999	1,499	2,001	1.008x - 21.556	0.999
B78	SKC	224-PCXR3	510677	05/07/2023	1,000	1,500	2,000	994	1,502	1,997	1.012x - 28.449	0.999
B79	SKC	224-PCXR3	510920	03/07/2023	1,000	1,500	2,000	993	1,492	1,992	1.000x - 5.853	1.000

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

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (mL/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
R01	SKC	224-PCXR4	602467	06/07/2023	1,000	1,500	2,000	991	1,506	2,002	1.007x – 14.479	1.000
R02	SKC	224-PCXR4	626450	06/07/2023	1,000	2,000	3,000	997	1,497	1,988	0.988x + 12.256	1.000
R03	SKC	224-PCXR4	691592	06/07/2023	1,000	1,500	2,000	1,002	1,498	2,002	1.003x – 5.881	1.000
R04	SKC	224-PCXR4	691672	06/07/2023	1,000	1,500	2,000	995	1,491	1,994	0.997x – 2.717	1.000
R05	SKC	224-PCXR4	798470	06/07/2023	1,000	1,500	2,000	992	1,505	1,997	1.001x – 6.538	1.000
R06	SKC	224-PCXR4	798456	06/07/2023	1,000	1,500	2,000	994	1,497	1,993	0.994x – 0.976	1.000
R07	SKC	224-PCXR4	798480	04/07/2023	1,000	1,500	2,000	993	1,490	1,997	1.007x – 16.177	1.000
R08	SKC	224-PCXR4	883215	04/07/2023	1,000	1,500	2,000	1,010	1,499	2,003	0.989x + 11.332	0.999
R09	SKC	224-PCXR4	034650	04/07/2023	1,000	1,500	2,000	990	1,503	2,000	1.011x – 24.548	1.000
R10	SKC	224-PCXR4	091765	07/07/2023	1,000	1,500	2,000	996	1,509	1,992	0.999x + 0.299	1.000
R11	SKC	224-PCXR4	091763	07/07/2023	1,000	1,500	2,000	999	1,497	1,985	1.000x – 9.834	0.999
R12	SKC	224-PCXR4	091568	07/07/2023	1,000	1,500	2,000	995	1,499	1,998	1.001x – 6.774	1.000
R13	SKC	224-PCXR4	091638	07/07/2023	1,000	1,500	2,000	1,001	1,510	1,989	0.988x + 16.559	1.000
R14	SKC	224-PCXR4	091764	07/07/2023	1,000	1,500	2,000	993	1,501	1,997	1.013x – 30.102	0.999
R15	SKC	224-PCXR8	529457	07/07/2023	1,000	1,500	2,000	1,000	1,499	2,001	0.998x – 3.682	0.999
R16	SKC	224-PCXR8	529643	05/07/2023	1,000	1,500	2,000	997	1,494	1,992	0.992x + 2.530	1.000
R17	SKC	224-PCXR8	529645	05/07/2023	1,000	1,500	2,000	994	1,507	1,998	1.006x – 15.440	0.999
R18	SKC	224-PCXR8	566756	05/07/2023	1,000	1,500	2,000	990	1,496	1,996	1.000x – 6.873	1.000
R19	SKC	224-PCXR8	566802	05/07/2023	1,000	1,500	2,000	1,001	1,497	1,998	1.003x – 14.352	0.999
R20	SKC	224-PCXR8	529089	03/07/2023	1,000	1,500	2,000	990	1,499	2,001	1.019x – 39.318	0.999
R21	SKC	224-PCXR8	665728	03/07/2023	1,000	1,500	2,000	997	1,493	1,997	0.999x – 3.765	1.000
R22	SKC	224-PCXR8	707444	03/07/2023	1,000	1,500	2,000	1,002	1,511	2,001	1.000x – 2.666	0.999
R23	SKC	224-PCXR8	761067	05/07/2023	1,000	1,500	2,000	1,011	1,475	1,989	0.980x + 20.504	0.999
R24	SKC	224-PCXR8	707893	04/07/2023	1,000	1,500	2,000	995	1,507	1,998	1.007x – 16.619	0.999
R25	SKC	224-PCXR8	761052	04/07/2023	1,000	1,500	2,000	1,009	1,494	1,993	0.984x + 21.169	1.000
R26	SKC	224-PCXR8	707956	06/07/2023	1,000	1,500	2,000	1,011	1,499	2,004	1.001x – 3.674	0.999
R27	SKC	224-PCXR8	707398	06/07/2023	1,000	1,500	2,000	995	1,499	1,999	1.005x – 14.830	1.000
R28	SKC	224-PCXR8	707481	04/07/2023	1,000	1,500	2,000	1,003	1,499	2,000	1.001x – 11.858	0.998
R29	SKC	224-PCXR8	707402	04/07/2023	1,000	1,500	2,000	1,002	1,492	1,987	0.985x + 16.145	1.000
R30	SKC	224-PCXR8	093811	07/07/2023	1,000	1,500	2,000	999	1,492	1,991	0.994x + 4.391	1.000
R31	SKC	224-PCXR8	093183	04/07/2023	1,000	1,500	2,000	1,000	1,499	1,999	0.989x + 8.339	0.999
R32	SKC	224-PCXR8	671950	04/07/2023	1,000	1,500	2,000	997	1,499	1,991	0.995x + 4.048	1.000
R33	SKC	224-PCXR4	626254	04/07/2023	1,000	1,500	2,000	993	1,501	1,998	1.014x – 32.194	0.999
R34	SKC	224-PCXR4	626131	04/07/2023	1,000	1,500	2,000	1,001	1,498	2,002	1.006x – 12.316	1.000
R35	SKC	224-PCXR8	707460	03/07/2023	1,000	1,500	2,000	998	1,496	1,993	0.993x + 5.945	1.000
R36	SKC	224-PCXR8	707446	07/07/2023	1,000	1,500	2,000	1,003	1,497	1,999	1.008x – 18.814	0.999
R37	SKC	224-PCXR8	707432	07/07/2023	1,000	1,500	2,000	995	1,497	1,998	0.995x + 5.662	1.000
R38	SKC	224-PCXR8	707349	07/07/2023	1,000	1,500	2,000	996	1,498	1,999	1.002x – 7.662	1.000
R39	SKC	224-PCXR8	761095	04/07/2023	1,000	1,500	2,000	1,000	1,514	1,992	0.984x + 18.826	0.999

Calibrated by :


(Mr. Abdul Dangklom)

Approved by :


(Mr. Peera Detudom)



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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (mL/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
R40	SKC	224-PCXR4	612753	07/07/2023	1,000	1,500	2,000	1,000	1,500	2,001	1.007x - 13.778	1.000
R41	SKC	224-PCXR4	626140	05/07/2023	1,000	1,500	2,000	991	1,508	2,006	1.021x - 39.143	0.999
R42	SKC	224-PCXR4	626463	05/07/2023	1,000	1,500	2,000	997	1,492	1,997	1.000x - 2.482	1.000
R43	SKC	224-PCXR4	626129	05/07/2023	1,000	1,500	2,000	1,002	1,500	2,003	1.011x - 20.839	0.999
R44	SKC	224-PCXR4	602753	05/07/2023	1,000	1,500	2,000	1,001	1,494	1,991	0.994x + 2.925	1.000
R45	SKC	224-PCXR4	626137	05/07/2023	1,000	1,500	2,000	991	1,504	2,000	1.018x - 37.211	0.999

Calibrated by :


(Mr. Adul Dangkom)

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

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (mL/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
L-R01	Dwyer	VFA-21	05/07/2023	50	100	200	50.6	100.9	204.1	0.983x + 2.913	1.000
L-R02	Dwyer	VFA-21	05/07/2023	50	100	200	50.4	101.9	200.8	1.003x – 0.034	0.999
L-R03	Dwyer	VFA-21	04/07/2023	50	100	200	50.1	100.1	202.1	1.006x + 0.170	1.000
L-R04	Dwyer	VFA-21	10/07/2023	50	100	200	50.2	100.8	203.3	1.002x + 0.502	1.000
L-R05	Dwyer	VFA-21	05/07/2023	50	100	200	50.1	101.1	202.8	0.999x + 0.445	0.999
L-R06	Dwyer	VFA-21	06/07/2023	50	100	200	50.7	101.3	202.5	0.998x + 1.435	1.000

Calibrated by :

Adul Dangklorn
(Mr. Adul Dangklorn)

Approved by :

Peera Detudom
(Mr. Peera Detudom)

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

Company Name:	S.P.S. Consulting Service Co.,Ltd		
Address (Instrument Location):	7 Soi Phaholyothin24 Phaholyothin Road, Jompol, Chatuchak, Bangkok, 10900.		
Serial Number:	648N4050804	PM Number:	1 of 2
Customer Name (if applicable):	Ms. Naruecha	Telephone Number:	NA
Service Engineer Name:	Monchai Kitcharoenkeat	Service Order Number:	WO-01852714
Date PM Performed: (DD-MMM-YYYY)	22-Feb-2023	Next PM Due Date: (DD-MMM-YYYY)	22-Aug-2023

Part Number	Release	Publication Date	
TH09370064	C	March 2013	

Scope

The purpose of this PM is to ensure the continued functionality of the T u r b o m a s s / C l a r u s M S S Q 8 M S 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	
Clarus SQ8	648N4050804	Turbomass 6.4	
Atom X	US14113002	Tekma AtomX	

Parts lists

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

Additional Tools Required for PM				
Part Number (if applicable)	Description	Quantity	Serial #	Calibration Due Date (MM/YY)
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 (x) to check off those steps in the checklist that have been completed.

General:

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

Mechanical:

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

Electrical:

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

Operational Tests:

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

**PC Maintenance:**

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

Review:

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

Additional Comments

Additional Comments Regarding the PM

Review

<i>The preventive maintenance checks and if applicable performance tests for Turbomass/ Clarus Mass/ SQ8 have been completed.</i>	
<i>This Turbomass/ClarusMS/SQ8 Pass the preventive maintenance.</i>	
Review of Preventive Maintenance:	
Authorized PerkinElmer Representative Monchai Kitcharoenkeat	Date: 22-Feb-2023 (DD-MMM-YYYY)
Authorized Customer Representative:	Date: 22-Feb-2023 (DD-MMM-YYYY)



GAS CHROMATOGRAPH TEST CERTIFICATION

Certificate No. : SV0822/20530

Instrument Type : GC

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 : 10/08/2022

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) = 118,103 Counts.





Detector Sensitivity (FID)

Detector Response	Result	Specification
Baseline Noise (μV)	2.94	≤ 50
Baseline Drift (%)	0.18	≤ 1
Sensitivity (S/N for C15)	4,000	$\geq 1,024$

Temperature Specification

Temperature	Set	Result	Specification
Column Oven ($^{\circ} C$)	80	80	± 5
Injector ($^{\circ} C$)	220	220	± 5
Detector ($^{\circ} C$)	300	300	± 5
Incubator ($^{\circ} C$)	60	N/A	± 5

Relative Standard Deviation % (% RSD)

Checkout Procedure	Result	Specification
Area C15 (%)	1.68	≤ 5
Retention Time C15(%)	0.01	≤ 0.5

APPROVAL :

Signature: Suwarot.Engineer : Suwarot TrikainutDate : 10/08/2022



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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	117,172
C15 Area 2	119,182
C15 Area 3	117,982
C15 Area 4	118,589
C15 Area 5	117,592
C15 Area Average	118,103
* % RSD (< 5 %)	1.68

* 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	Sumarot.	
Date	10/08/2022	



Comments	-		
Reviewed by	Sashu P.	Date	10/08/2022



VARIAN



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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 RT 1	4.048
C15 RT 2	4.048
C15 RT 3	4.048
C15 RT 4	4.048
C15 RT 5	4.048
C15 RT Average	4.000
* % RSD (< 0.5 %)	0.01

* 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	Sumrat.	
Date	10/08/2022	



Comments	-		
Reviewed by	Sumrat P.	Date	10/08/2022



VARIAN

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

Sample ID: **fid std**

Operator (Inj): **suwarot**

Injection Date: **16/08/2022**

Calc Date: **16/08/2022**

Run Time (min): **7.993**

Workstation:

Instrument (Inj): **Varian Star #1**



VARIAN

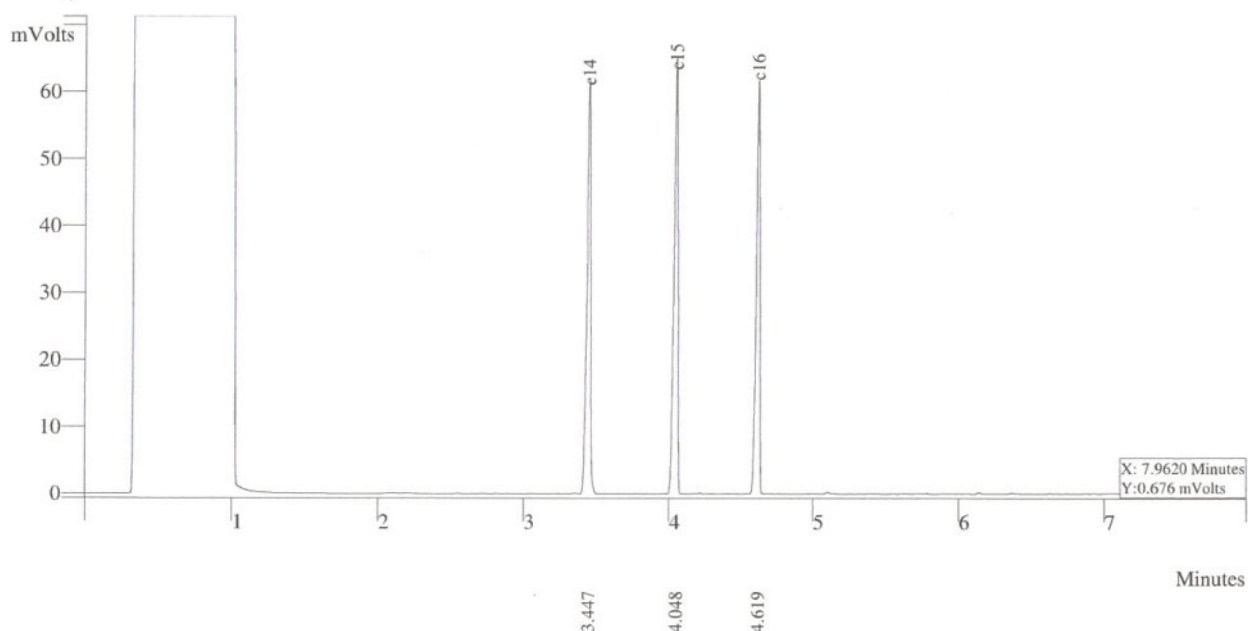
Run Mode: **Analysis**

Peak Measurement: **Peak Area**

Calculation Type: **Percent**

c:\star\data\tu\cal2022\fid2022001.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	32.2988	3.477	112355	VP	1.7
2	c15	33.6834	4.048	117172	VV	1.5
3	c16	34.0178	4.619	118335	VP	1.5
Totals		100.0000		347862		



THAI UNIQUE CO.,LTD.

1 Of 1

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

Sample ID: **fid std**

Operator (Inj): **suwarot**

Injection Date: **16/08/2022**

Calc Date: **16/08/2022**

Run Time (min): **7.993**

Workstation:

Instrument (Inj): **Varian Star #1**



VARIAN

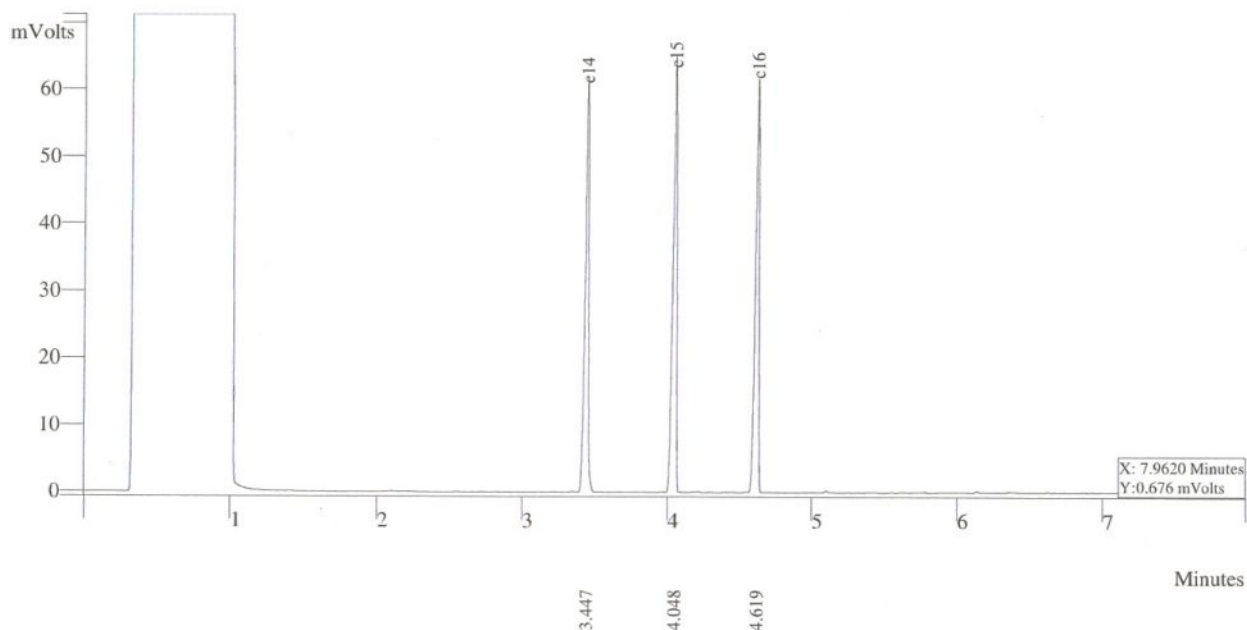
Run Mode: **Analysis**

Peak Measurement: **Peak Area**

Calculation Type: **Percent**

c:\star\data\tu\cal2022\fid2022002.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	32.2988	3.477	112755	VP	1.7
2	c15	33.6834	4.048	119182	VV	1.5
3	c16	34.0178	4.619	118265	VP	1.5
Totals		100.0000		348205		



THAI UNIQUE CO.,LTD.

1 Of 1

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

Sample ID: **fid std**

Operator (Inj): suwarot

Injection Date: 16/08/2022

Calc Date: 16/08/2022

Run Time (min): 7.993

Workstation:

Instrument (Inj): Varian Star #1



VARIAN

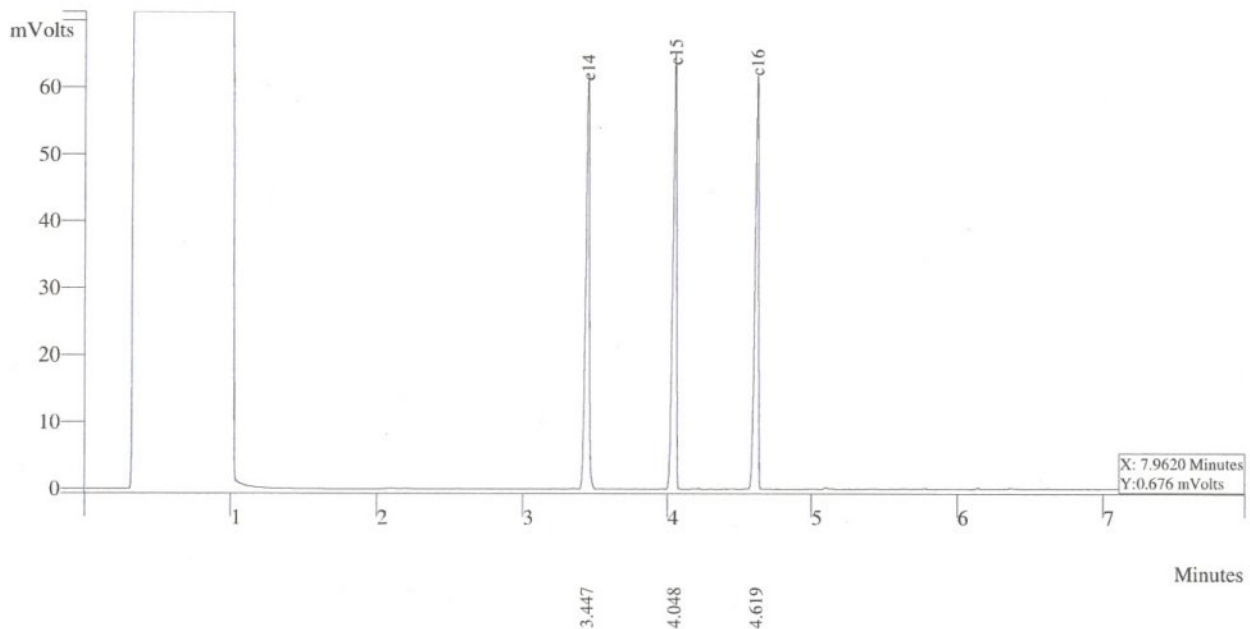
Run Mode: Analysis

Peak Measurement: Peak Area

Calculation Type: Percent

c:\star\data\tu\cal2022\fid2022003.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	32.2988	3.477	112755	VP	1.7
2	c15	33.6834	4.048	117982	VV	1.5
3	c16	34.0178	4.619	118265	VP	1.5
Totals		100.0000		348205		



THAI UNIQUE CO.,LTD.

1 Of 1

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

Sample ID: **fid std**

Operator (Inj): **suwarot**

Injection Date: **16/08/2022**

Calc Date: **16/08/2022**

Run Time (min): **7.993**

Workstation:

Instrument (Inj): **Varian Star #1**



VARIAN

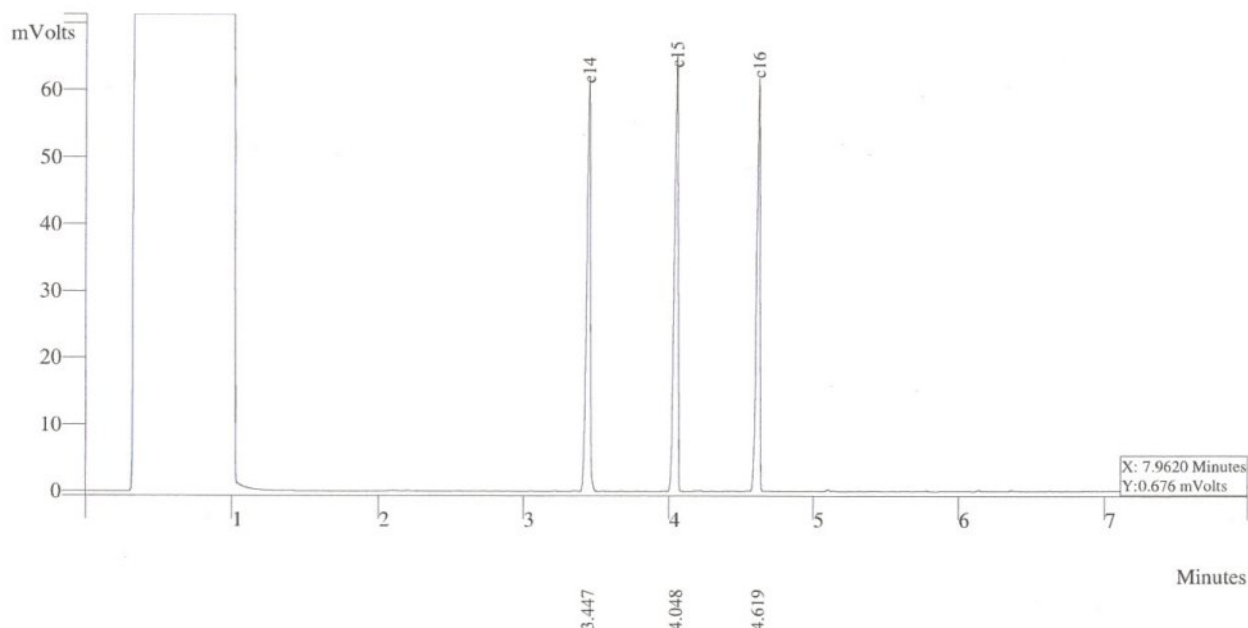
Run Mode: **Analysis**

Peak Measurement: **Peak Area**

Calculation Type: **Percent**

c:\star\data\tu\cal2022\fid2022004.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	32.2988	3.377	113755	VP	1.7
2	c15	33.6834	4.048	118589	VV	1.5
3	c16	34.3178	4.619	128265	VP	1.5
Totals		100.0000		360202		



THAI UNIQUE CO.,LTD.

1 Of 1

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

Sample ID: **fid std**

Operator (Inj): **suwarot**

Injection Date: **16/08/2022**

Calc Date: **16/08/2022**

Run Time (min): **7.993**

Workstation:

Instrument (Inj): **Varian Star #1**



VARIAN

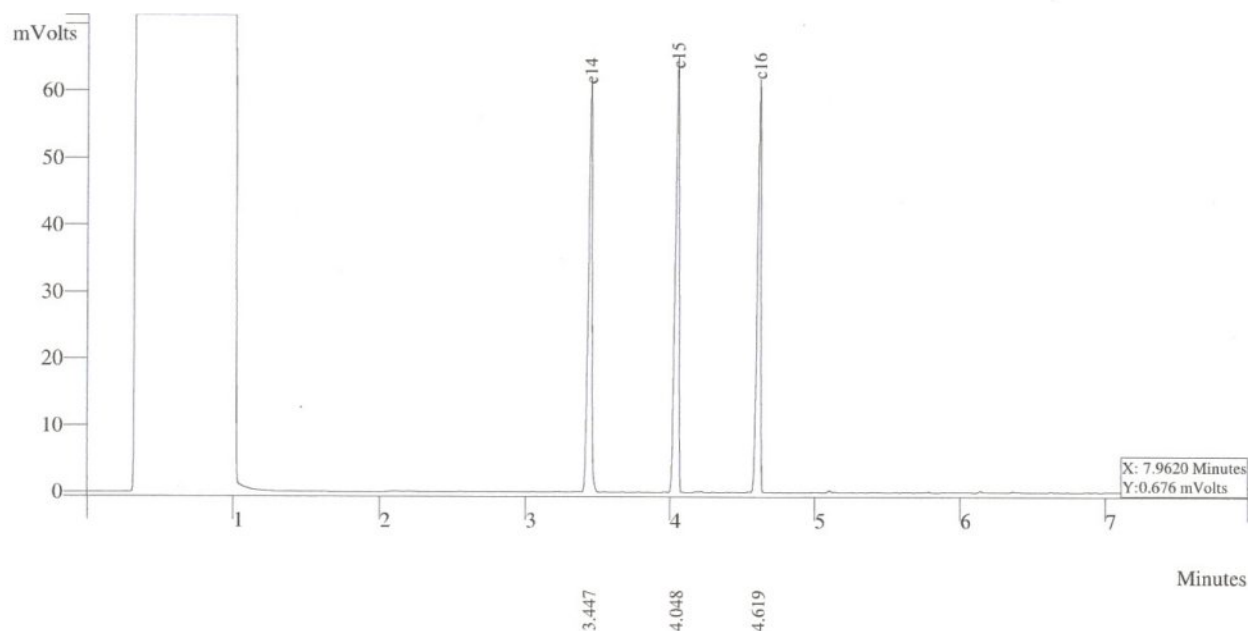
Run Mode: **Analysis**

Peak Measurement: **Peak Area**

Calculation Type: **Percent**

c:\star\data\tu\cal2022\fid2022005.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	32.2988	3.377	115755	VP	1.7
2	c15	33.6834	4.048	117592	VV	1.5
3	c16	34.3178	4.619	138265	VP	1.5
Totals		100.0000		369202		



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1 Of 1

The graph shows a vertical y-axis on the left with numerical labels from 0 to 20 in increments of 1. The horizontal x-axis at the top is labeled with values 0.0, 0.5, 1.0, 1.5, and 2.0, with the unit 'mVolts' at the far right. The plot area is empty, with no data points or lines.

Injection Date: 16/8/2565 14:32 Calculation Date: 16/8/2565 15:12

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

** GC Workstation Version 6.41 ** 03334-6390-826-0764 **

```
Run Mode      : Blank Baseline
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

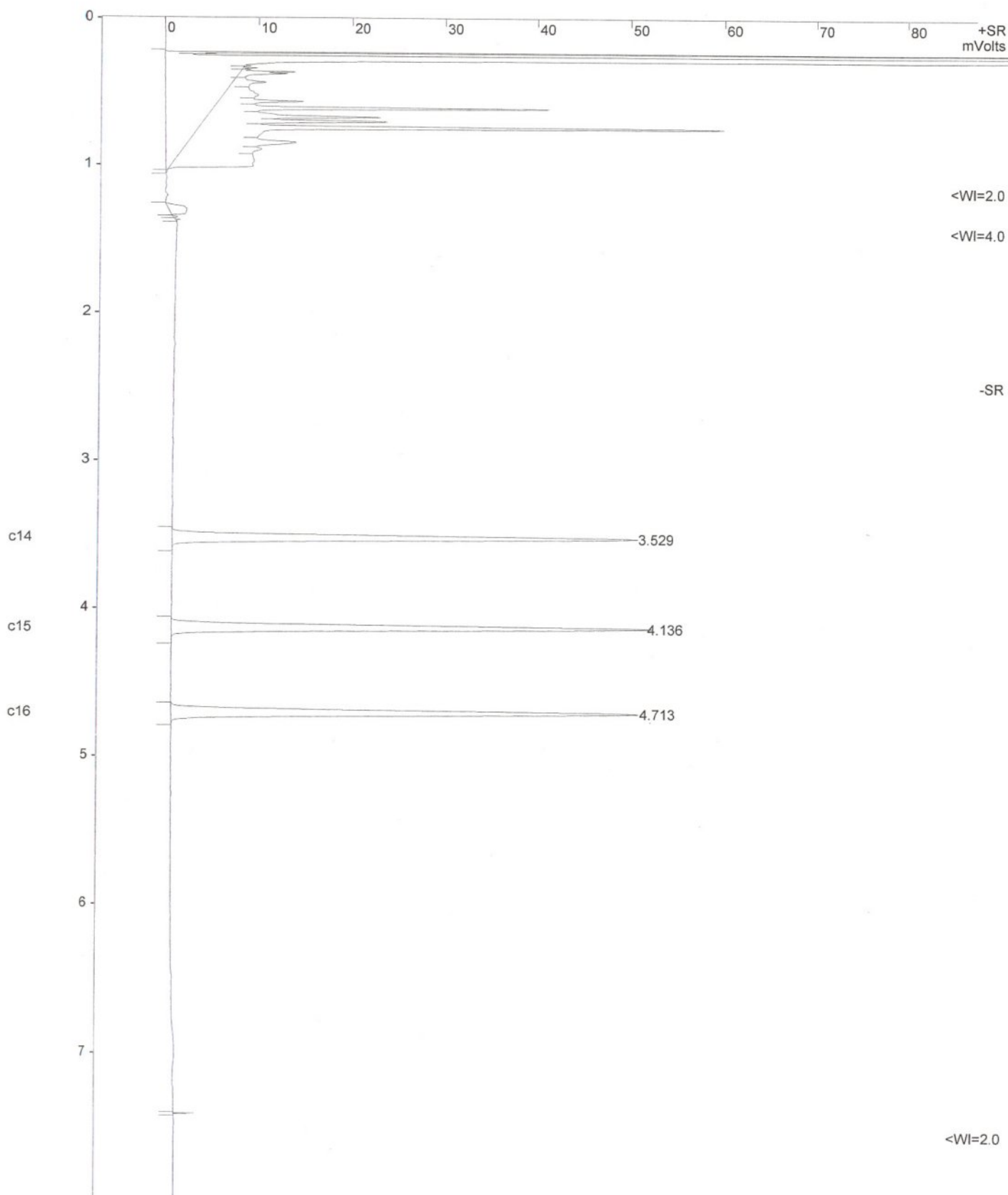
Detected Peaks: 0 Rejected Peaks: 0 Identified Peaks: 0

Multiplier: 1 Divisor: 1 Unidentified Peak Factor: 0

Baseline Offset: -2 microVolts LSB: 1 microVolts

Noise (used): 32 microVolts - monitored before this run

Manual injection



Title :
 Run File : c:\star\data\tu\cal2022\fid2022003.run
 Method File : d:\c       gc\c      .N     \drive-d\2017\2022\08\fid2022003-front.mth
 Sample ID : fid2022

Injection Date: 16/8/2565 10:51 Calculation Date: 16/8/2565 11:02

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

** GC Workstation Version 6.41 ** 03334-6390-826-0764 **

Run Mode : Analysis
 Peak Measurement: Peak Area
 Calculation Type: Percent

Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1	c14	32.2988	3.529	-0.000	112355	BB	2.1	
2	c15	33.6834	4.136	0.000	117172	BB	2.1	
3	c16	34.0178	4.713	-0.000	118335	BB	2.2	
Totals:		100.0000		0.000	347862			

Total Unidentified Counts : 0 counts

Detected Peaks: 4 Rejected Peaks: 1 Identified Peaks: 3

Multiplier: 1 Divisor: 1 Unidentified Peak Factor: 0

Baseline Offset: -28 microVolts LSB: 1 microVolts

Noise (used): 26 microVolts - monitored before this run

Manual injection

Data Handling: All Coefficients for All Peaks are Zero
 Data Handling: Default to A%



GAS CHROMATOGRAPH TEST CERTIFICATION

Certificate No. : SV0823/21044

Instrument Type : GC

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 : 09/08/2023

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) = 362,972 Counts.





Detector Sensitivity (FID)

Detector Response	Result	Specification
Baseline Noise (μ V)	1.47	≤ 50
Baseline Drift (%)	0.09	≤ 1
Sensitivity (S/N for C15)	19,600	$\geq 1,024$

Temperature Specification

Temperature	Set	Result	Specification
Column Oven ($^{\circ}$ C)	80	80	± 5
Injector ($^{\circ}$ C)	220	220	± 5
Detector ($^{\circ}$ C)	300	300	± 5
Incubator ($^{\circ}$ C)	60	N/A	± 5

Relative Standard Deviation % (% RSD)

Checkout Procedure	Result	Specification
Area C15 (%)	1.52	≤ 5
Retention Time C15(%)	0.01	≤ 0.5

APPROVAL :

Signature: Suwarot.Engineer : Suwarot TrikainutDate : 09/08/2023



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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	357,863
C15 Area 2	357,824
C15 Area 3	367,724
C15 Area 4	361,724
C15 Area 5	369,724
C15 Area Average	362,972
* % RSD (< 5 %)	1.52

* 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	Samarot.	
Date	09/08/2023	



Comments	-		
Reviewed by	Samarot P.	Date	09/08/2023



VARIAN



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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	4.125
C15 RT 2	4.125
C15 RT 3	4.125
C15 RT 4	4.124
C15 RT 5	4.124
C15 RT Average	4.122
* % RSD (< 0.5 %)	0.01

* 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	Samarot.	
Date	09/08/2023	



Comments	-		
Reviewed by	Samarot P.	Date	09/08/2023



VARIAN

Title :
Run File : d:\cfíÁÛÅ gc\cfíÁÛÅ·Ñé\$EÁ'\drive-d\2017\2023\08\blk2023.run
Method File : C:\star\data\TU\cal2023\baseline FID.mth
Sample ID : Blk2023

Injection Date: 9/8/2566 13:13 Calculation Date: 9/8/2566 13:34

Operator : watsamon Detector Type: 3800 (10 Volts)
Workstation: GC-LAB Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 21.208 min

** GC Workstation Version 6.41 ** 03334-6390-826-0764 **

Chart Speed = 1.03 cm/min Attenuation = 1 Zero Offset = 3%
Start Time = 0.000 min End Time = 21.208 min Min / Tick = 1.00



Title :
Run File : d:\c       gc\c      .N      \drive-d\2017\2023\08\blk2023.run
Method File : C:\star\data\TU\cal2023\baseline FID.mth
Sample ID : Blk2023

Injection Date: 9/8/2566 13:13 Calculation Date: 9/8/2566 13:34

Operator : watsamon Detector Type: 3800 (10 Volts)
Workstation: GC-LAB Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 21.208 min

** GC Workstation Version 6.41 ** 03334-6390-826-0764 **

Run Mode : Blank Baseline
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: -14 microVolts LSB: 1 microVolts

Noise (used): 19 microVolts - monitored before this run

Manual injection

Title : c:\star\data\tu\cal2023\fid\calfid2023003.run
Run File : d:\method-gc\star c\star\method\cp-wax\without glasswool\calfid2023003-front.mth
Method File : Manual Sample
Sample ID : Manual Sample

Injection Date: 9/8/2566 10:31 Calculation Date: 9/8/2566 10:40

Operator : watsamon
Workstation: Local Disk
Instrument :
Channel : Front = FID
Detector Type: 3800 (10 Volts)
Bus Address : 44
Sample Rate : 10.00 Hz
Run Time : 7.993 min

** GC Workstation Version 6.41 ** 03334-6390-826-0764 **

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

Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1	C14	33.8385	3.520	-0.003	362495	BB	2.2	C
2	C15	33.4804	4.125	-0.006	357824	BB	2.3	C
3	C16	32.6143	4.699	-0.001	344951	BB	2.2	
					=====	----	----	----
Totals:		99.9332			-0.010			

Status Codes:
C - Out of calibration range
Total Unidentified Counts : 0 counts
Detected Peaks: 3 Rejected Peaks: 0 Identified Peaks: 3
Multiplier: 1 Divisor: 1 Unidentified Peak Factor: 0

Baseline Offset: 28 microVolts LSB: 1 microVolts

Noise (used): 26 microVolts - monitored before this run

Manual injection

Calib. out of range; No Recovery Action Specified

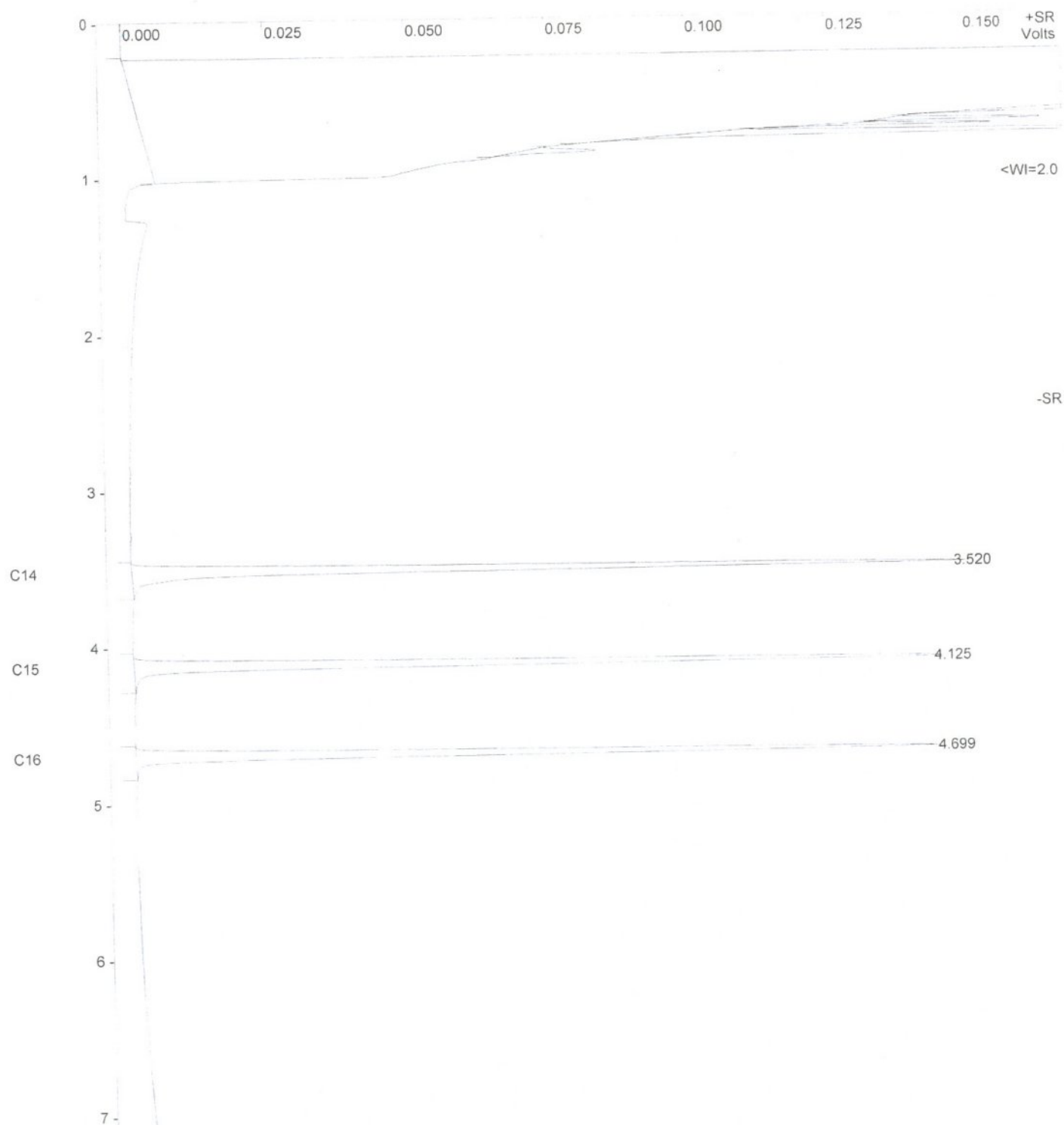
Title :
Run File : c:\star\data\tu\cal2023\fid\calfid2023003.run
Method File : d:\method-gc\star c\star\method\cp-wax\without glasswool\calfid2023003-front.mth
Sample ID : Manual Sample

Injection Date: 9/8/2566 10:31 Calculation Date: 9/8/2566 10:40

Operator : watsamon Detector Type: 3800 (10 Volts)
Workstation: Local Disk Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 7.993 min

** GC Workstation Version 6.41 ** 03334-6390-826-0764 **

Chart Speed = 2.73 cm/min Attenuation = 70 Zero Offset = 2%
Start Time = 0.000 min End Time = 7.993 min Min / Tick = 1.00



Sample ID: **fid std**

Operator (Inj): Suwarot

Injection Date: 09/08/2023

Calc Date: 09/08/2023

Run Time (min): 7.993

Workstation: Local Disk

Instrument (Inj):



VARIAN

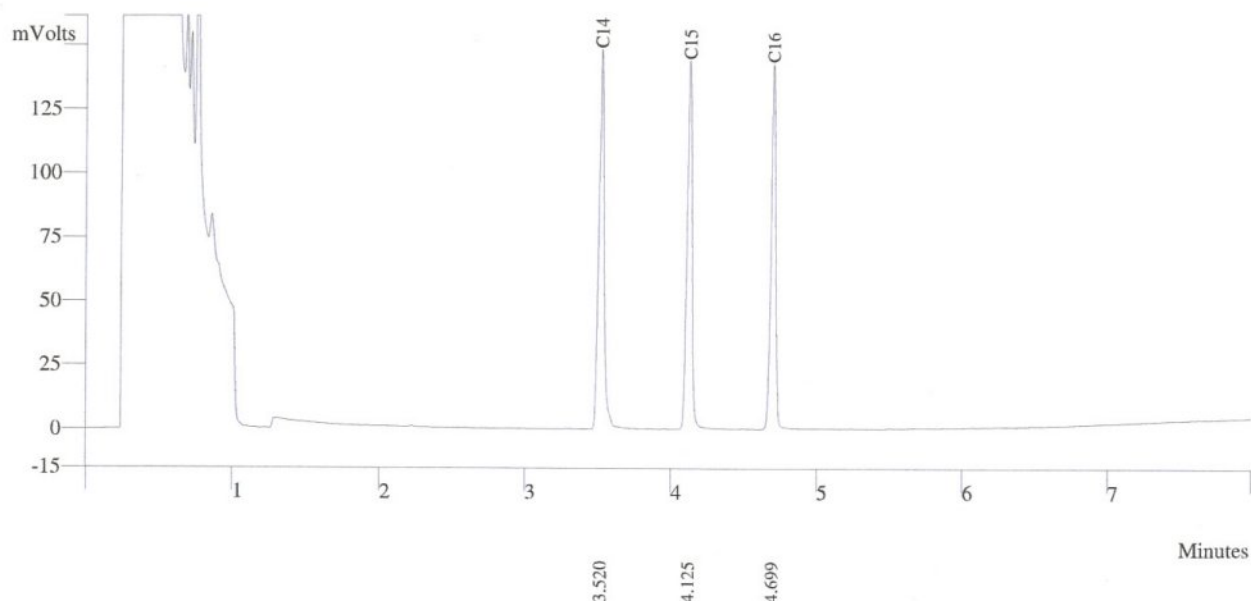
Run Mode: Analysis

Peak Measurement: Peak Area

Calculation Type: External Std.

c:\star\data\tu\cal2023\fid\calfid2023001.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	33.8385	3.520	359491	BB	2.2
2	C15	33.4804	4.125	357863	BB	2.3
3	C16	32.6143	4.699	344951	BB	2.2
Totals		99.9312		1062305		

Sample ID: **fid std**

Operator (Inj): Suwarot

Injection Date: 09/08/2023

Calc Date: 09/08/2023

Run Time (min): 7.993

Workstation: Local Disk

Instrument (Inj):



VARIAN

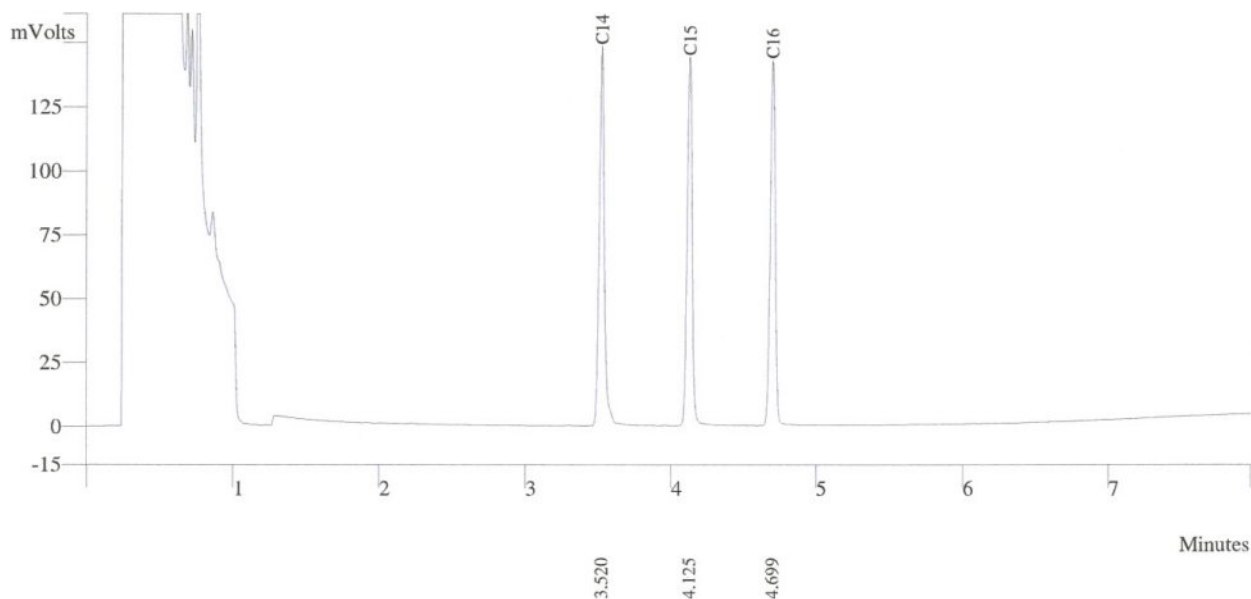
Run Mode: Analysis

Peak Measurement: Peak Area

Calculation Type: External Std.

c:\star\data\tu\cal2023\fid\calfid2023001.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	33.8385	3.520	362495	BB	2.2
2	C15	33.4804	4.125	357824	BB	2.3
3	C16	32.6143	4.699	344951	BB	2.2
	Totals	99.9332		1065270		



Sample ID: **fid std**

Operator (Inj): Suwarot

Injection Date: 09/08/2023

Calc Date: 09/08/2023

Run Time (min): 7.993

Workstation: Local Disk

Instrument (Inj):



VARIAN

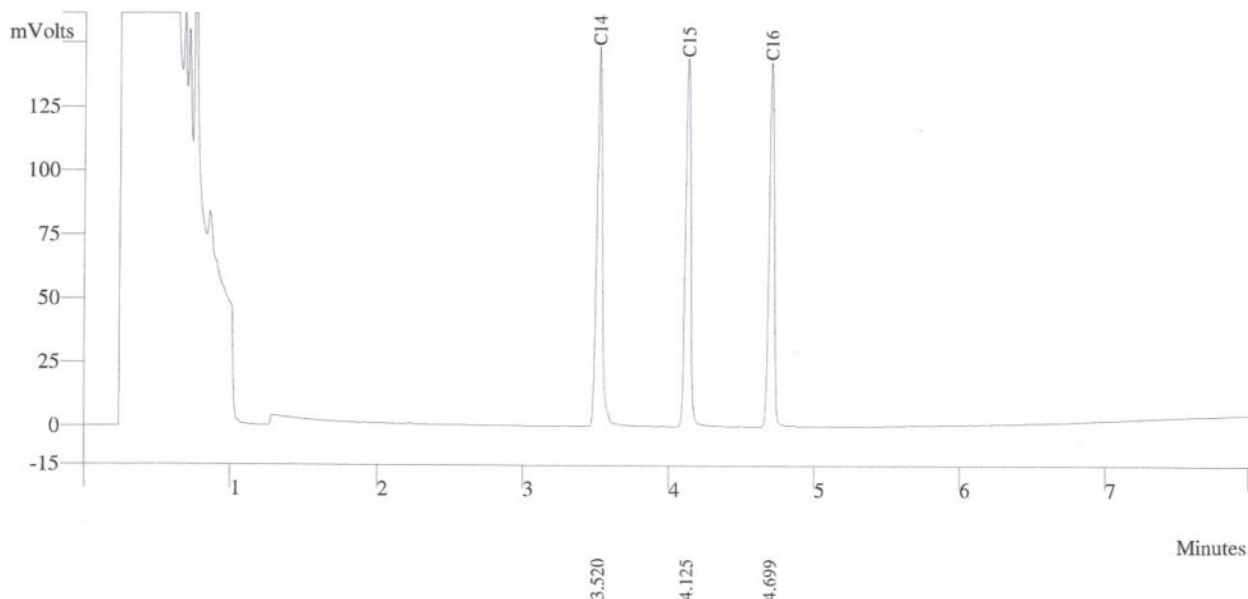
Run Mode: Analysis

Peak Measurement: Peak Area

Calculation Type: External Std.

c:\star\data\tu\cal2023\fid\calfid2023002.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	33.8385	3.520	362495	BB	2.2
2	C15	33.4824	4.125	367724	BB	2.3
3	C16	32.6143	4.699	354951	BB	2.2
Totals		99.9352		1085170		



Sample ID: **fid std**



VARIAN

Operator (Inj): Suwarot

Injection Date: 09/08/2023

Calc Date: 09/08/2023

Run Time (min): 7.993

Workstation: Local Disk

Instrument (Inj):

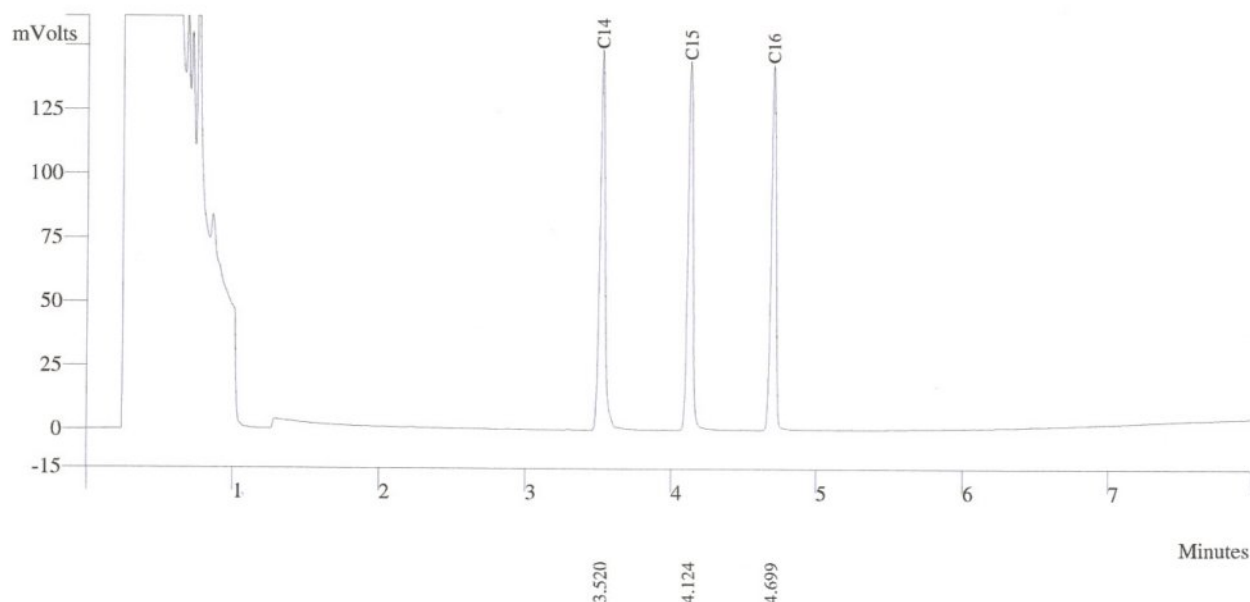
Run Mode: Analysis

Peak Measurement: Peak Area

Calculation Type: External Std.

c:\star\data\tu\cal2023\fid\calfid2023002.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	33.8385	3.520	362495	BB	2.2
2	C15	33.4824	4.124	361724	BB	2.3
3	C16	32.6143	4.699	354991	BB	2.2
Totals		99.9352		1079210		



Sample ID: **fid std**

Operator (Inj): Suwarot

Injection Date: 09/08/2023

Calc Date: 09/08/2023

Run Time (min): 7.993

Workstation: Local Disk

Instrument (Inj):



VARIAN

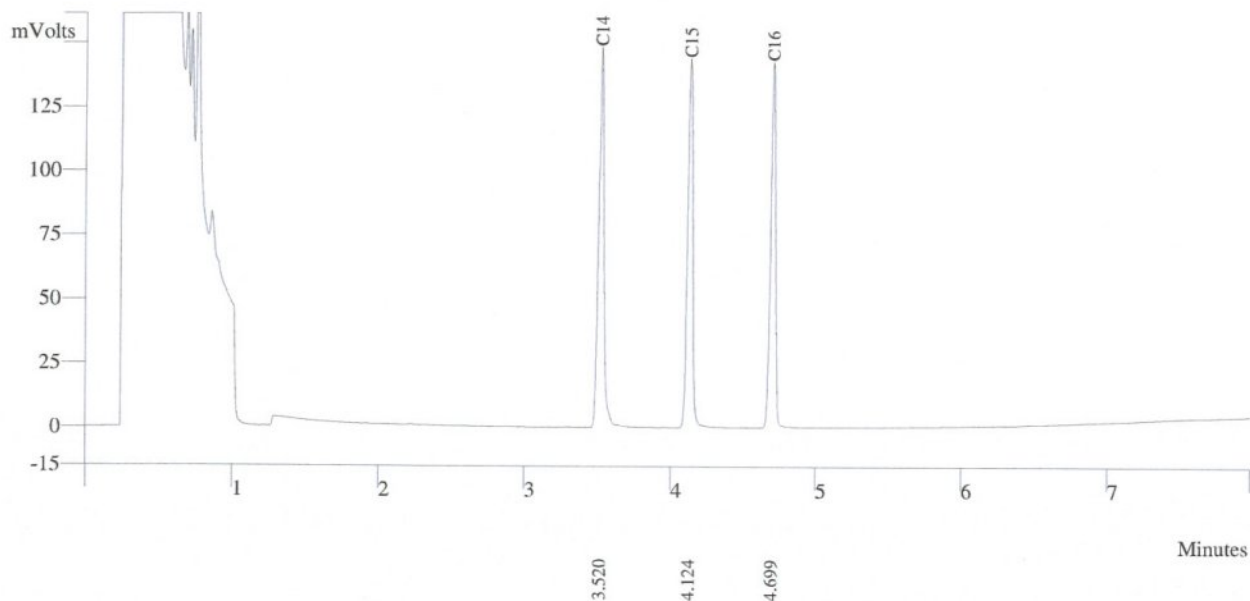
Run Mode: Analysis

Peak Measurement: Peak Area

Calculation Type: External Std.

c:\star\data\tu\cal2023\fid\calfid2023002.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	33.8385	3.520	362495	BB	2.2
2	C15	33.4824	4.124	369724	BB	2.3
3	C16	32.6143	4.699	354591	BB	2.2
	Totals	99.9552		1087210		



Agilent Technologies

Certificate of Analysis

FID-TCD Performance Evaluation Sample Kit

Agilent Part

Number: 5080-8842, 18710-60170

Sample Lot

Number: 0006637856

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

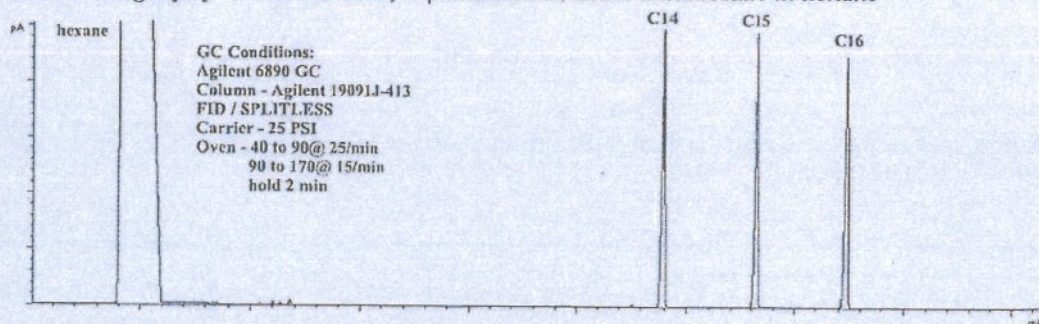
Calibrated Class A glassware and clean bottles were used in the manufacture of this standard. Balances used in the manufacture of this standard are calibrated with weights traceable to NIST in compliance with ANSI/NC SL Z-540-1 and ISO 9001.

Purities:

n-tetradecane	99.6%
n-pentadecane	99%
n-hexadecane	99%
hexane	99%

Typical Analytical Spectrum or Chromatography

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



Date of release: 30 September 2021

Date of expiration: 31 October 2023

Monica Bourgeois

Monica Bourgeois
QMS Representative

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

Service Manager

ภาคผนวกที่ 5-3

เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียงในบรรยากาศ



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

Noise R_421/23

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	29 March 2023
		Due Date	29 March 2024

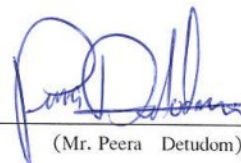
Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-R11	ACO	6236	00172038	06 August 2023	94.0	94.0
ACO-R12	ACO	6236	00172040	06 August 2023	94.1	94.0
ACO-R14	ACO	6236	00172061	06 August 2023	94.0	94.0
ACO-R20	ACO	6236	00182003	06 August 2023	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.94 ± 0.10 dB	

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :


(Mr. Peera Detudom)

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0413

MTC No. EEL. BP. 109/0366

CALIBRATION CERTIFICATE

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

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

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

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

Serial No. : 130006

Ambient Environment

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

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

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

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

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

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

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

Date of Receipt : 27 Mar. 2023

Date of Calibration : 29 Mar. 2023

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.BL.MTC.002 Rev.4

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

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

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

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0413

MTC No. EEL. BP. 109/0366

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	93.94	-0.06	± 0.10	± 0.40 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	999.9	-0.1	± 1.5	$\pm 1.0\%$

3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.80	± 0.50	$\pm 3.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :


(Mr. Weerachai Deechaiyae)

Approved by :


(Mr. Prawate Kluaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 29 Mar. 2023

Date of Issue : 30 Mar. 2023

Ref : 2011266032701228001

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.BL.MTC.002 Rev.4

Head Office

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

Office/Laboratory

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

Office

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

ภาคผนวกที่ 5-4

เอกสารสอบเทียบเครื่องมือการตรวจวิเคราะห์คุณภาพน้ำ

**QUALITY CALIBRATION CO.,LTD.**

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



CERTIFICATE No : 22E9693
REFERENCE No : 66476-1

PAGE : 1 OF 3

Certificate of Calibration

EQUIPMENT : pH METER
MANUFACTURER : HANNA
MODEL : HI 3512
SERIAL No : TH118035
ID No : pH 04/56
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 : 15-Sep-22

APPROVED BY : PONGSAK J.

ISSUED DATE : 15-Sep-22

RECEIVED DATE : 14-Sep-22

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

**QUALITY CALIBRATION CO.,LTD.**

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

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

CERTIFICATE No : 22E9693

PAGE : 2 OF 3

Calibration Report

EQUIPMENT : pH METER
MANUFACTURER : HANNA
ID No : pH 04/56
RECEIVED DATE : 14-Sep-22
AMBIENT TEMPERATURE : 20 ° C ± 1 ° C

MODEL : HI 3512
SERIAL NUMBER : TH118035
CALIBRATION DATE : 15-Sep-22
RELATIVE HUMIDITY : 50 % RH ± 10% RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT METHOD BASED ON WI-TQ-062 AND WI-TQ-063. THE DISPLAY UNIT WAS TESTED BY GENERATING STANDARD VOLTAGE TO THE UNIT AND READ THE VALUE COMPARED WITH CALCULATED VALUE. THE DISPLAY AND ELECTRODE WAS CALIBRATED BY USING STANDARD pH BUFFER
2. REFERENCE STANDARD INSTRUMENTS :-

<u>INSTRUMENT</u>	<u>MODEL</u>	<u>SERIAL No/ LOT No</u>	<u>CERTIFICATE No</u>	<u>DUE DATE</u>
1) pH STANDARD SOLUTION	00651-06	CC719181	4880-12119147	05-Apr-23
2) pH STANDARD SOLUTION	00651-08	CC718727	4881-12110709	31-Mar-23
3) pH STANDARD SOLUTION	00651-10	CC717045	4882-12065386	17-Mar-23
4) PROCESS CALIBRATOR	CA150	91S6079	22E1145	31-Mar-23
5) BATH	260014	1247 48074	22T9870	13-Sep-23
6) THERMOMETER WITH PROBE	421504	55000379	22T9904	13-Sep-23

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

RESULT OF CALIBRATION : ADJUSTMENT**1. DISPLAY UNIT ONLY**SLOPE FACTOR $k = 2.303 RT/F = 59 \text{ mV/pH}$

mV APPLIED	UUC READING (mV)	CORRECTION (mV)	UUC READING (pH)	UNCERTAINTY OF MEASUREMENT (± mV)	COVERAGE FACTOR k
414.11	414.8	-0.69	-0.171	0.14	2.0
354.95	355.6	-0.65	0.860	0.14	2.0
295.80	296.4	-0.60	1.892	0.14	2.0
236.64	237.2	-0.56	2.922	0.14	2.0
177.48	178.0	-0.52	3.954	0.14	2.0
118.32	118.8	-0.48	4.985	0.14	2.0
59.16	59.7	-0.54	6.016	0.14	2.0
0.00	0.5	-0.50	7.049	0.14	2.0
-59.16	-58.8	-0.36	8.136	0.14	2.0
-118.32	-117.9	-0.42	9.223	0.14	2.0
-177.48	-177.1	-0.38	10.311	0.14	2.0
-236.64	-236.3	-0.34	11.399	0.14	2.0
-295.80	-295.5	-0.30	12.487	0.14	2.0
-354.95	-354.7	-0.25	13.575	0.14	2.0
-414.11	-413.9	-0.21	14.662	0.14	2.0

END OF CALIBRATION REPORT PAGE 2 OF 3

**QUALITY CALIBRATION CO.,LTD.**

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

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

CERTIFICATE No : 22E9693

PAGE : 3 OF 3

Calibration Report**RESULT OF CALIBRATION (CONTINUE) :****2. DISPLAY UNIT WITH pH ELECTRODE S/N: 09081C6M**

STANDARD pH BUFFER SOLUTION (pH)	UUC READING (pH)	CORRECTION (pH)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT (\pm pH)	COVERAGE FACTOR k
4.007	4.007	0.000	3.996	0.012	2.0
7.004	7.006	-0.002	6.944	0.012	2.0
10.016	10.012	0.004	10.194	0.014	2.0

3. DISPLAY UNIT WITH TEMPERATURE

STANDARD READING ($^{\circ}$ C)	UUC READING ($^{\circ}$ C)	CORRECTION ($^{\circ}$ C)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT (\pm $^{\circ}$ C)	COVERAGE FACTOR k
25.003	25.0	0.003	---	0.0085	2.0

4. PERCENT SLOPE 100%

UUC : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT

**QUALITY CALIBRATION CO.,LTD.**

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



CERTIFICATE No : 23E8494
REFERENCE No : 70413-1


PAGE : 1 OF 3

Certificate of Calibration

EQUIPMENT : pH METER
MANUFACTURER : HANNA
MODEL : HI 3512
SERIAL No : TH118035
ID No : pH04/56
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 : 06-Sep-23

APPROVED BY : 
PONGSAK J.

ISSUED DATE : 06-Sep-23

RECEIVED DATE : 31-Aug-23

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



QUALITY CALIBRATION CO.,LTD.

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

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

CERTIFICATE No : 23E8494

PAGE : 2 OF 3

Calibration Report

EQUIPMENT : pH METER
MANUFACTURER : HANNA
ID No : pH04/56
RECEIVED DATE : 31-Aug-23
AMBIENT TEMPERATURE : 23 ° C ± 3 ° C
MODEL : HI 3512
SERIAL NUMBER : TH118035
CALIBRATION DATE : 06-Sep-23
RELATIVE HUMIDITY : 50 % RH ± 10% RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT METHOD BASED ON WI-TQ-062 AND WI-TQ-063. THE DISPLAY UNIT WAS TESTED BY GENERATING STANDARD VOLTAGE TO THE UNIT AND READ THE VALUE COMPARED WITH CALCULATED VALUE. THE DISPLAY AND ELECTRODE WAS CALIBRATED BY USING STANDARD pH BUFFER
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No/ LOT No	CERTIFICATE No	DUE DATE
1) pH STANDARD SOLUTION	00651-06	CC767907	4880-13836406	29-Dec-24
2) pH STANDARD SOLUTION	00651-08	CC765602	4881-13757019	18-Nov-24
3) pH STANDARD SOLUTION	00651-10	CC767180	4882-13813369	14-Dec-24
4) PROCESS CALIBRATOR	CA150	91S6079	23E1312	19-Apr-24
5) BATH	260014	1247 48074	22T9870	13-Sep-23
6) THERMOMETER WITH PROBE	421504	55000379	22T9904	13-Sep-23

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 SI UNIT MAINTAINED AT :-
 - NATIONAL INSTITUTE OF STANDARD AND TECHNOLOGY, USA.
 - NATIONAL INSTITUTE OF METROLOGY (THAILAND)

RESULT OF CALIBRATION : ADJUSTMENT

1. DISPLAY UNIT ONLY

SLOPE FACTOR $k = 2.303 \text{ RT/F} = 59 \text{ mV/pH}$

mV APPLIED	UUC READING (mV)	CORRECTION (mV)	UUC READING (pH)	UNCERTAINTY OF MEASUREMENT (± mV)	COVERAGE FACTOR k
414.11	414.6	-0.49	-0.290	0.15	2.00
354.95	355.4	-0.45	0.741	0.15	2.00
295.80	296.3	-0.50	1.773	0.15	2.00
236.64	237.1	-0.46	2.804	0.15	2.00
177.48	177.9	-0.42	3.835	0.15	2.00
118.32	118.7	-0.38	4.867	0.15	2.00
59.16	59.6	-0.44	5.898	0.15	2.00
0.00	0.4	-0.40	6.930	0.15	2.00
-59.16	-58.8	-0.36	7.961	0.15	2.00
-118.32	-117.9	-0.42	8.992	0.15	2.00
-177.48	-177.1	-0.38	10.024	0.15	2.00
-236.64	-236.3	-0.34	11.055	0.15	2.00
-295.80	-295.5	-0.30	12.087	0.15	2.00
-354.95	-354.6	-0.35	13.118	0.15	2.00
-414.11	-413.8	-0.31	14.149	0.15	2.00

END OF CALIBRATION REPORT PAGE 2 OF 3



CERTIFICATE No : 23E8494

PAGE : 3 OF 3

Calibration Report

RESULT OF CALIBRATION (CONTINUE) :**2. DISPLAY UNIT WITH pH ELECTRODE S/N: 09081C6M**

STANDARD pH BUFFER SOLUTION (pH)	UUC READING (pH)	CORRECTION (pH)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT (\pm pH)	COVERAGE FACTOR k
4.006	4.006	0.000	4.015	0.012	2.00
7.000	7.000	0.000	6.914	0.012	2.00
10.008	10.010	-0.002	9.996	0.014	2.00

3. DISPLAY UNIT WITH TEMPERATURE

STANDARD READING ($^{\circ}$ C)	UUC READING ($^{\circ}$ C)	CORRECTION ($^{\circ}$ C)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT (\pm $^{\circ}$ C)	COVERAGE FACTOR k
25.005	25.0	0.005	---	0.0085	2.00

4. PERCENT SLOPE 100%

UUC : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT

CERT.No.: HS-U017D

Calibration Date : 3 Apr 23
Submitted by : S.P.S CONSULTING SERVICE CO.,LTD
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol,
Chatuchak, Bangkok, Thailand 10900

Avg Room Temp : 20 °C
Avg Water Temp : 20 °C
Air Pressure : 760.00 mmHg
Salinity : 0 ppt

Model : YSI 5000
S/N : 15B100751
Probe : YSI 5010
S/N : 22D100097
ID NO. : -
Air Temp ref : S/N. E00522
Barometric ref : S/N. E00522
Water Temp ref : S/N. 11431
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)	9.08	(PASS)	-
Measurement 5 (mg/l)	9.08	(PASS)	-
Measurement 6 (mg/l)	9.08	(PASS)	-
Measurement 7 (mg/l)	9.08	(PASS)	-
Measurement 8 (mg/l)	9.08	(PASS)	-
Measurement 9 (mg/l)	9.08	(PASS)	-
Measurement 10 (mg/l)	9.08	(PASS)	-

Mean Measurement	9.08	mg/l	-	-
Inaccuracy	0.01	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 Pisatkunchon)

**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 : 23T0959

REFERENCE No : 68047-2

PAGE : 1 OF 3

Certificate of Calibration

EQUIPMENT : COD REACTOR

MANUFACTURER : HACH

MODEL : DRB200


SERIAL No : 15110C0235

ID No : CRB 05/59

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

CALIBRATED BY : CHAICHARN CH.

CALIBRATION DATE : 07-Feb-23

APPROVED BY : 
PONGSAK J.

ISSUED DATE : 07-Feb-23

RECEIVED DATE : 31-Jan-23



QUALITY CALIBRATION CO.,LTD.

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

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

CERTIFICATE No : 23T0959

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : COD REACTOR
MANUFACTURER : HACH
ID NUMBER : CRB 05/59
RECEIVED DATE : 31-Jan-23
AMBIENT TEMPERATURE : 23° C ± 1° C
MODEL : DRB200
SERIAL NUMBER : 15110C0235
CALIBRATION DATE : 07-Feb-23
RELATIVE HUMIDITY : 52 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

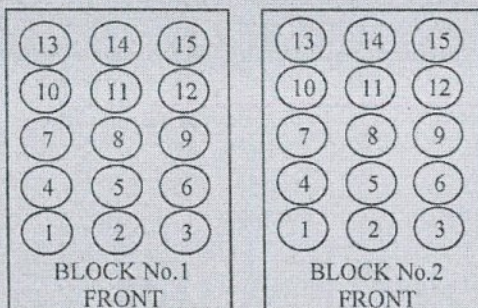
1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT TEMPERATURE RECORDER WITH THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON 15 POINTS AND LOCATED ONE THERMOCOUPLE IN EACH OF THE FOUR CORNERS OF THE REACTOR AND PLACED THE EIGHTH THERMOCOUPLE AT THE CENTER OF THE REACTOR.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH TC TYPE K	HYDRA 2635A	8009008	22T7511	10-Jul-23

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



TEMPERATURE MEASUREMENT ACCURACY TEST

Block No.	1	2
Controller temperature (°C)	145	145
Indicating Temperature	145	145
Measured Temperature (°C) at Spread Locations	1	149.4
	2	149.5
	3	149.4
	4	149.4
	5	149.7
	6	149.4
	7	149.6
	8	149.6
	9	149.7
	10	149.7
	11	149.5
	12	149.3
	13	149.5
	14	149.8
	15	149.6
Uncertainty of Measurement(± °C)	0.86	0.86

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

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

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

END OF CALIBRATION REPORT



CERTIFICATE No : 23M2442

REFERENCE No : 68471-2

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : SARTORIUS

MODEL : BSA224S-CW

SERIAL No : 36591843

ID No : BA 09/61

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 10-Mar-23

APPROVED BY :  PONGSAK J.

ISSUED DATE : 16-Mar-23

RECEIVED DATE : 10-Mar-23



CERTIFICATE No : 23M2442

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : BSA224S-CW
MANUFACTURER : SARTORIUS S/N : 36591843
ID No : BA 09/61 RECEIVED DATE : 10-Mar-23
AIR PRESSURE : 1010mbar \pm 1mbar CALIBRATION DATE : 10-Mar-23
AMBIENT TEMPERATURE : 23° C \pm 1° C RELATIVE HUMIDITY : 49 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.

4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

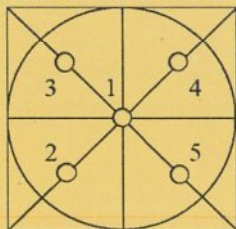
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.0	0.0000	0.0000	0.000058
0.1	0.1000	0.0000	0.000059
0.2	0.2000	0.0000	0.000059
0.5	0.5000	0.0000	0.000060
1.0	1.0000	0.0000	0.000060
2.0	2.0000	0.0000	0.000061
5.0	5.0000	0.0000	0.000063
10.0	10.0000	0.0000	0.000067
20.0	20.0001	-0.0001	0.000073
50.0	50.0000	0.0000	0.00011
100.0	100.0001	-0.0001	0.00019
200.0	200.0000	0.0000	0.00032

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	100.0000
2	99.9999
3	99.9998
4	100.0001
5	100.0000
OFF-CENTER LOADING	0.0002

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



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

Customer : <u>S.P.S.Consulting Service Co.,Ltd</u>	Date Tested: <u>July 6, 2023</u>	
	Recommendation Recertification	
Address : <u>7 Soi Phaholyothin 24</u>	Period <u>6</u> Months	
<u>Paholyothin Road</u>	Recertification Due: <u>January 6, 2024</u>	
<u>Jompol Chatuchak, Bangkok 1090</u>	Date Last Certified: <u>January 11, 2023</u>	
User Name: <u>K.Phenpha Vipasthawatt</u>	Visit Number: <u>1 of 2</u>	
Phone: <u>083-9269252</u>	PerkinElmer Phone: <u>02-719-6420 ext 206</u>	
Fax: <u>02-513-4221</u>	PerkinElmer Fax: <u>02-318-5597</u>	

CONFIGURATION TESTED		ACCESSORIES/COMPONENT NOT INCLUDED
MODEL	SERIAL NUMBER	
<u>OPTIMA 5300DV</u>	<u>077C7042401</u>	
TESTED EQUIPMENT	CALIBRATION NUMBER	EXPIRATION
<u>IPV Methods</u>		
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
<u>Multielement Standard</u>	<u>N069-1579</u>	<u>October 30, 2023</u>
<u>Wavecal Solution</u>	<u>N058-2152</u>	<u>September 30, 2023</u>
<u>VIS Wavecal solution</u>	<u>N930-2946</u>	<u>August 30, 2023</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>November 30, 2023</u>
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401**DATE TESTED** July 6, 2023**1. MECHANICAL CHECKS**

- | | |
|--|-----------------------------|
| A. Inspect and clean all fans and filters. | <input type="checkbox"/> OK |
| B. Inspect and replace as necessary, all torch components including the RF coil. | <input type="checkbox"/> OK |
| C. Inspect all tubing for sign of clacking or leaking. | <input type="checkbox"/> OK |
| D. Adjust water and gas pressure regulator settings. | <input type="checkbox"/> OK |
| E. Inspect and leak check pneumatics drawers. | <input type="checkbox"/> OK |
| F. Clean the exterior of the instrument. | <input type="checkbox"/> OK |

2. OPTICAL CHECKS

- | | |
|---|-----------------------------|
| A. Inspect and clean all optical components. | <input type="checkbox"/> OK |
| B. As required, check and replace all purgefilters. | <input type="checkbox"/> OK |
| C. Recheck optical alignment. | <input type="checkbox"/> OK |

3. COOLING SYSTEM CHECKS

- | | |
|---|------------------------------|
| A. Perform preventive maintenance on chiller. | <input type="checkbox"/> OK |
| B. Flush out the chiller every year. | <input type="checkbox"/> N/A |

4. PERFORMANCE CHECKS

- | | |
|----------------------------|-----------------------------|
| A. Torch View Alignment. | <input type="checkbox"/> OK |
| B. Wavelength Calibration. | <input type="checkbox"/> OK |



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : 077C7042401
DATE TESTED : July 6, 2023

PARAMETER		SPECIFICATION		FINAL VALUE	
Spectral Resolution : UV	As 193.696 nm	≤ 0.007		0.00534	
	Ni 231.604 nm	≤ 0.008		0.00682	
	Ni 341.476 nm	≤ 0.012		0.00794	
Spectral Resolution : VIS	La 408.672 nm	≤ 0.020		0.01613	
	Ba 455.403 nm	≤ 0.025		0.02282	
Precision					
	As 193.656 nm	% RSD	< 1.0	0.23	%
	Zn 213.856 nm	% RSD	< 1.0	0.09	%
	Mn 257.610 nm	% RSD	< 1.0	0.58	%
	La 379.478 nm	% RSD	< 1.0	0.38	%
	Ba 455.403 nm	% RSD	< 1.0	0.42	%
	Ba 493.408 nm	% RSD	< 1.0	0.41	%
Detection Limits : Axial	Tl 190.080 nm	3(sd)		2.37	ppb
	As 193.696 nm	3(sd)		6.78	ppb
	Pb 220.353 nm	3(sd)		0.82	ppb
Detection Limits : Radial	As 193.696 nm	3(sd)		23.56	ppb
	Zn 213.856 nm	3(sd)		2.85	ppb
	Mn 257.610 nm	3(sd)		3.66	ppb
	La 379.478 nm	3(sd)		5.10	ppb
	Ba 455.403 nm	3(sd)		0.12	ppb
	Ba 493.408 nm	3(sd)		1.17	ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd 226.502 nm	≤ 150 ppb		117.07	
BEC : Radial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 45 ppb		22.09	



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401DATE TESTED July 6, 2023**Remarks :**

Commissioning follow as commissioning performance sheets.

This is to certify that the above tests have been performed and the configuration tested



meets



does not meet

the PerkinElmer Specifications listed on this certificate.

This certificate does not modify PerkinElmer's standard terms and condition of sale,
including warranty terms.

Service Department PerkinElmer Ltd.

Authorized Representative:



(Mr. Wiphan Promlumda)

Service Engineer



MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

214 Bangwaek Rd. Bangpai Bangkae Bangkok 10160
Tel.: 0-2865-4647-8 Fax: 0-2865-4649 <http://www.mit.in.th>



CALIBRATION CERTIFICATE

Certificate No. : S2022090647-0003

Date Issued : 03-Oct-22

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

Equipment : Incubator

Manufacturer : BINDER

Model : BD 115

Serial No. : 12-16967

ID No./Tag No. : IN 05/56

Date Received : 30-Sep-22

Date Calibrated : 30-Sep-22

Calibrated by : Mr. Surat Aumarb

Calibration Method or Calibration Procedure Used

Standard method : CP-05 TLAS G-20.

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

Result of Calibration

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

This certificate may not be reproduced other than in full except with the prior written approval of the Miracle International Technology Company Limited.

Approved by:

Sarayuth T.
(Mr. Sarayuth Tochua)



Page 1 of 2

Certificate No. : S2022090647-0003

Environment : Ambient Temperature : Start record 26.5 °C, Stop record 26.6 °C
Relative Humidity : Start record 54.8 %RH, Stop record 54.6 %RH

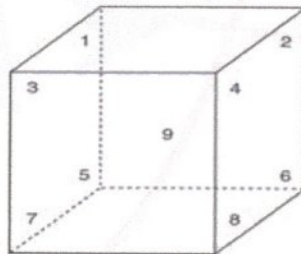
Calibration Temperature (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Stability ¹ (°C)	Measured Uniformity ² (°C)	Overall Variation ³ (°C)
35	35.0	35.0	0.03	0.07	0.14
41.5	41.5	41.5	0.03	0.08	0.15

Without adjustment

Calibration Temperature (°C)	STD No. 1 (°C)	STD No. 2 (°C)	STD No. 3 (°C)	STD No. 4 (°C)	STD No. 5 (°C)	STD No. 6 (°C)	STD No. 7 (°C)	STD No. 8 (°C)	STD No. 9 (°C)	Uncertainty ⁴ ±°C
35	34.88	34.86	34.89	34.90	34.93	34.92	34.95	34.89	34.93	0.18
41.5	41.40	41.33	41.32	41.41	41.43	41.43	41.38	41.33	41.37	0.18

Note : Probe No. 9 is Reference Probe

Setting Air Fresh No. 0



Condition As-Received : Used Item

The measurement results and statements of conformity with specification only relate to the item calibrated.

Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Certificate No. AD2207-125-0001 for Digital Thermometer with Probe (Agilent) Module 1 (73) NTC, Pt1000 Serial No. MY44024042, Due 01-Feb-23

- Notes :
1. The temperature stability is the one-half of greatest maximum difference of measured temperatures at any one probe.
 2. The temperature uniformity is the maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time.
 3. Overall variation is the difference of maximum and minimum measured temperatures throughout observation time.
 4. The uncertainty of measurement is included temperature stability.
 5. The temperature uniformity, stability, overall variation and indicating temperature is applicable to all air or gas filled temperature controlled enclosures at atmospheric pressure.

End of Certificate



MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

214 Bangwack Rd. Bangpai Bangkae Bangkok 10160
Tel.: 0-2865-4647-8 Fax: 0-2865-4649 <http://www.mit.in.th>



CALIBRATION CERTIFICATE

Certificate No. : S2023090437-0003

Date Issued : 28-Sep-23

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

Equipment : Incubator

Manufacturer : BINDER

Model : BD 115

Serial No. : 12-16967

ID No./Tag No. : IN 05/56

Date Received : 22-Sep-23

Date Calibrated : 22-Sep-23

Calibrated by : Mr. Jame Khaothong

Calibration Method or Calibration Procedure Used

Standard method : CP-05 TLAS G-20.

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

Result of Calibration

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

This certificate may not be reproduced other than in full except with the prior written approval of the Miracle International Technology Company Limited.

Approved by:

Sarayuth T.
(Mr. Sarayuth Tochua)



Page 1 of 2

Certificate No. : S2023090437-0003

Environment : Ambient Temperature : Start record 24.3 °C, Stop record 24.5 °C

Relative Humidity : Start record 54.8 %RH, Stop record 54.6 %RH

Calibration Temperature (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Stability ¹ (°C)	Measured Uniformity ² (°C)	Overall Variation ³ (°C)
35	35.0	35.0	0.08	0.17	0.31
41.5	41.5	41.5	0.04	0.18	0.25

Without adjustment

Calibration Temperature (°C)	STD No. 1 (°C)	STD No. 2 (°C)	STD No. 3 (°C)	STD No. 4 (°C)	STD No. 5 (°C)	STD No. 6 (°C)	STD No. 7 (°C)	STD No. 8 (°C)	STD No. 9 (°C)	Uncertainty ⁴ ±°C
35	34.83	34.85	34.97	34.82	34.84	34.95	34.90	34.80	34.93	0.23
41.5	41.36	41.38	41.46	41.32	41.28	41.48	41.40	41.33	41.44	0.23

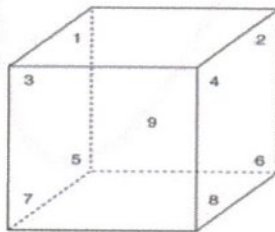
Calibration Temperature (°C)	MPE (±°C)	Pass / Fail with Guard Band								
		No. 1 (°C)	No. 2 (°C)	No. 3 (°C)	No. 4 (°C)	No. 5 (°C)	No. 6 (°C)	No. 7 (°C)	No. 8 (°C)	No. 9 (°C)
35.00	0.5	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
41.50	0.5	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

Pass = $|\text{error}| + |\text{uncertainty}| \leq |\text{MPE}|$

Fail = $|\text{error}| + |\text{uncertainty}| > |\text{MPE}|$

Note : Probe No. 9 is Reference Probe

Setting Air Fresh No. 0



Condition As-Received : Used Item

The measurement results and statements of conformity with specification only relate to the item calibrated.

Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Certificate No. L202306247-001 for Data Acquisition STD-286 Module 1 Serial No. MY44023139, Due 24-Dec-23

Notes : 1. The temperature stability is the one-half of greatest maximum difference of measured temperatures at any one probe.

2. The temperature uniformity is the maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time.

3. Overall variation is the difference of maximum and minimum measured temperatures throughout observation time.

4. The uncertainty of measurement is included temperature stability.

5. The temperature uniformity, stability, overall variation and indicating temperature is applicable to all air or gas filled temperature controlled enclosures at atmospheric pressure.

End of Certificate



QUALITY CALIBRATION CO.,LTD.

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

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

www.qcalibration.com



CERTIFICATE No : 23T2448

REFERENCE No : 68471-8

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : WATER BATH

MANUFACTURER : MEMMERT

MODEL : WNB29

SERIAL No : L614.0123


ID No : WB 05/58

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : CHAICHARN CH.

CALIBRATION DATE : 10-Mar-23

APPROVED BY : 
PONGSAK J.

ISSUED DATE : 17-Mar-23

RECEIVED DATE : 10-Mar-23

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



CERTIFICATE No : 23T2448

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : WATER BATH
MANUFACTURER : MEMMERT
ID NUMBER : WB 05/58
RECEIVED DATE : 10-Mar-23
AMBIENT TEMPERATURE : 26 °C ± 1 °C
MODEL : WNB29
SERIAL NUMBER : L614.0123
CALIBRATION DATE : 10-Mar-23
RELATIVE HUMIDITY : 51 %RH ± 10 % RH

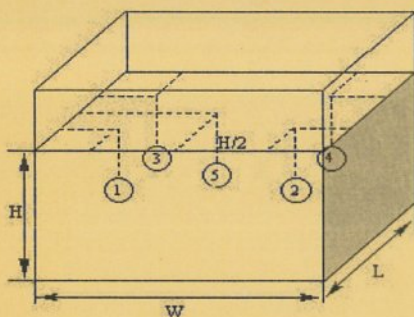
CONDITION OF THIS RESULTS OF CALIBRATION

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

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH RTD	2625A	6603614	22T7514	05-Jul-23

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



PROBE INSTALLATION
POSITION IN THE BATH

GENERAL INFORMATION

Overall Variation of Ambient Temperature around the Bath (°C) : 0.9
Overall Variation of Line Voltage (V) : 0
Instrument Condition : Normal

BATH PERFORMANCE

Controller Temperature (°C)	Temperature Stability (±°C)	Radius Uniformity (°C)	Axial Uniformity (°C)	Overall Variation (°C)
50.4	0.12	0.14	0.15	0.34
60.4	0.18	0.23	0.19	0.50

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations					Uncertainty (± °C)
		#1	#2	#3	#4	Ref. 5	
50.4	50.4	49.45	49.42	49.36	49.32	49.42	0.19
60.4	60.4	60.17	60.20	60.06	59.97	60.18	0.25

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

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

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

END OF CALIBRATION REPORT

Certificate of Calibration

Certificate No. : 66-400065-2

Page : 1 of 2

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

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

Equipment : Liquid in Glass Thermometer

Manufacturer : SK

Model : N/A

Range : 0 °C to 100 °C

Resolution : 1 °C

Serial No. : N/A

Immersion : Total

ID No. : TM21/59

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

Relative Humidity : (50 ± 15) %

Line Voltage : (220 ± 22) VAC

Date of Received : 01 February 2023

Date of Calibration : 06 February 2023

Date of Issue : 06 February 2023

Calibrated by : Chortip Samchusri

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

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

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

2. Standard Digital Thermometer

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

Approved by :



(Bunjerd Masri)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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



Certificate of Calibration

Certificate No. : 66-400065-2

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Ice point check : UUC* reading 0 °C Standard reading 0.3606 °C

Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
20.3607	20	0.4	0.31

Remark

UUC : Unit Under Calibration

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

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

- o0o -



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

Company Name:	S.P.S. Consulting Service Co.,Ltd		
Address (Instrument Location):	7 Soi Phaholyothin24 Phaholyothin Road, Jompol, Chatuchak, Bangkok, 10900.		
Serial Number:	648N4050804	PM Number:	1 of 2
Customer Name (if applicable):	Ms. Naruecha	Telephone Number:	NA
Service Engineer Name:	Monchai Kitcharoenkeat	Service Order Number:	WO-01852714
Date PM Performed: (DD-MMM-YYYY)	22-Feb-2023	Next PM Due Date: (DD-MMM-YYYY)	22-Aug-2023

Part Number	Release	Publication Date	
TH09370064	C	March 2013	

Scope

The purpose of this PM is to ensure the continued functionality of the T u r b o m a s s / C l a r u s M S S Q 8 M S 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	
Clarus SQ8	648N4050804	Turbomass 6.4	
Atom X	US14113002	Tekma AtomX	

Parts lists

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

Additional Tools Required for PM				
Part Number (if applicable)	Description	Quantity	Serial #	Calibration Due Date (MM/YY)
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 (x) to check off those steps in the checklist that have been completed.

General:

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

Mechanical:

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

Electrical:

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

Operational Tests:

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

PC Maintenance:

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



Review:

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

Additional Comments

Additional Comments Regarding the PM

Review

<p><i>The preventive maintenance checks and if applicable performance tests for Turbomass/ Clarus Mass/ SQ8 have been completed.</i></p>		
<p><i>This Turbomass/ClarusMS/SQ8 Pass the preventive maintenance.</i></p>		
<p>Review of Preventive Maintenance:</p>		
<p>Authorized PerkinElmer Representative Monchai Kitcharoenkeat</p>		<p>Date: 22-Feb-2023 (DD-MMM-YYYY)</p>
<p>Authorized Customer Representative:</p>		<p>Date: 22-Feb-2023 (DD-MMM-YYYY)</p>

ภาคผนวกที่ 5-5

เอกสารสอบเทียบเครื่องมือการตรวจวัด
คุณภาพอากาศในสถานประกอบการ



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด

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

7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900

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

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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

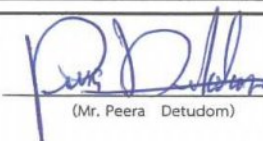
Temperature : 25 \pm 3 $^{\circ}$ C
Pressure : 1010 \pm 15 mmbar

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
B01	SKC	224-PCXR4	262101	03/07/2023	1,000	1,500	2,000	992	1,495	1,996	1.001x - 4.542	1.000
B02	SKC	224-PCXR4	626166	03/07/2023	1,000	1,500	2,000	1,002	1,504	1,999	1.009x - 20.101	0.999
B03	SKC	224-PCXR4	612968	10/07/2023	1,000	1,500	2,000	995	1,493	1,999	1.005x - 12.388	1.000
B04	SKC	224-PCXR4	602804	05/07/2023	1,000	1,500	2,000	999	1,501	1,992	0.998x - 0.040	1.000
B05	SKC	224-PCXR4	612693	03/07/2023	1,000	1,500	2,000	1,002	1,498	2,000	1.010x - 21.803	0.999
B06	SKC	224-PCXR4	262188	05/07/2023	1,000	1,500	2,000	994	1,506	2,004	1.011x - 20.811	1.000
B07	SKC	224-PCXR4	626262	10/07/2023	1,000	1,500	2,000	997	1,490	1,993	0.992x + 6.399	1.000
B08	SKC	224-PCXR4	626100	07/07/2023	1,000	1,500	2,000	1,002	1,498	2,005	1.013x - 26.473	0.999
B09	SKC	224-PCXR4	626479	05/07/2023	1,000	1,500	2,000	996	1,489	1,991	0.993x + 1.797	1.000
B10	SKC	224-PCXR4	091950	06/07/2023	1,000	1,500	2,000	991	1,501	1,999	1.017x - 36.784	0.999
B11	SKC	224-PCXR8	564315	10/07/2023	1,000	1,500	2,000	995	1,489	1,997	1.003x - 8.260	1.000
B12	SKC	224-PCXR4	034656	07/07/2023	1,000	1,500	2,000	1,002	1,501	2,003	1.004x - 7.152	1.000
B13	SKC	224-PCXR4	602073	05/07/2023	1,000	1,500	2,000	994	1,499	1,996	1.000x - 3.092	1.000
B14	SKC	224-PCXR4	626313	07/07/2023	1,000	1,500	2,000	998	1,491	1,987	0.991x + 8.312	1.000
B15	SKC	224-PCXR4	626474	07/07/2023	1,000	1,500	2,000	1,000	1,500	2,003	1.009x - 17.930	0.999
B16	SKC	224-PCXR4	626477	04/07/2023	1,000	1,500	2,000	993	1,502	1,999	1.014x - 31.373	0.999
B17	SKC	224-PCXR4	626860	04/07/2023	1,000	1,500	2,000	996	1,493	1,989	0.996x - 0.944	1.000
B18	SKC	224-PCXR4	691484	04/07/2023	1,000	1,500	2,000	1,002	1,499	1,999	1.008x - 17.894	0.999
B19	SKC	224-PCXR4	691599	06/07/2023	1,000	1,500	2,000	992	1,501	1,997	1.005x - 10.491	1.000
B20	SKC	224-PCXR4	691587	03/07/2023	1,000	1,500	2,000	990	1,502	1,998	1.009x - 21.898	1.000
B21	SKC	224-PCXR4	691531	10/07/2023	1,000	1,500	2,000	992	1,476	1,993	1.000x - 11.272	1.000
B22	SKC	224-PCXR4	691654	05/07/2023	1,000	1,500	2,000	1,002	1,500	2,002	1.011x - 21.141	0.999
B23	SKC	224-PCXR4	798393	10/07/2023	1,000	1,500	2,000	992	1,505	2,000	1.017x - 33.720	0.999
B24	SKC	224-PCXR4	626363	05/07/2023	1,000	1,500	2,000	999	1,501	1,997	1.003x - 8.933	1.000
B25	SKC	224-PCXR4	798489	10/07/2023	1,000	1,500	2,000	1,000	1,491	1,998	0.996x + 1.689	1.000
B26	SKC	224-PCXR4	798479	04/07/2023	1,000	1,500	2,000	999	1,498	1,991	0.993x + 6.351	1.000
B27	SKC	224-PCXR4	691673	10/07/2023	1,000	1,500	2,000	993	1,502	2,000	1.015x - 32.306	0.999
B28	SKC	224-PCXR4	691570	04/07/2023	1,000	1,500	2,000	1,002	1,498	1,999	1.005x - 12.188	1.000
B29	SKC	224-PCXR4	626472	04/07/2023	1,000	1,500	2,000	999	1,496	1,998	1.002x - 6.471	1.000
B30	SKC	224-PCXR4	691489	06/07/2023	1,000	1,500	2,000	1,002	1,508	2,004	1.002x - 7.722	0.999
B31	SKC	224-PCXR4	691509	10/07/2023	1,000	1,500	2,000	991	1,475	1,995	0.999x - 10.348	1.000
B32	SKC	224-PCXR4	091567	05/07/2023	1,000	1,500	2,000	990	1,501	1,998	1.011x - 24.321	1.000
B33	SKC	224-PCXR4	091756	05/07/2023	1,000	1,500	2,000	992	1,496	1,990	0.991x + 4.498	1.000
B34	SKC	224-PCXR4	612962	07/07/2023	1,000	1,500	2,000	1,001	1,499	2,000	1.006x - 14.460	0.999
B35	SKC	224-PCXR4	602682	05/07/2023	1,000	1,500	2,000	992	1,497	1,994	1.002x - 9.742	1.000
B36	SKC	224-PCXR4	626164	05/07/2023	1,000	1,500	2,000	998	1,496	1,999	1.000x - 6.056	1.000
B37	SKC	224-PCXR4	626256	03/07/2023	1,000	1,500	2,000	993	1,505	1,997	1.005x - 13.443	1.000
B38	SKC	224-PCXR4	626167	03/07/2023	1,000	1,500	2,000	996	1,496	1,996	1.001x - 3.347	1.000
B39	SKC	224-PCXR4	034637	10/07/2023	1,000	1,500	2,000	1,004	1,499	1,999	1.009x - 18.599	0.999
B40	SKC	224-PCXR4	798349	06/07/2023	1,000	1,500	2,000	993	1,504	1,997	1.013x - 29.094	0.999

Calibrated by :


(Mr. Abdul Dangklom)

Approved by :


(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 : sale@spscon.com... www.spscon.com

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (mL/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
B41	SKC	224-PCXR4	612669	10/07/2023	1,000	1,500	2,000	998	1,495	1,989	0.995x + 1.833	1.000
B42	SKC	224-PCXR4	626041	10/07/2023	1,000	1,500	2,000	1,003	1,496	1,989	0.985x + 18.950	1.000
B43	SKC	224-PCXR4	034636	05/07/2023	1,000	1,500	2,000	999	1,500	1,990	0.990x + 11.352	1.000
B44	SKC	224-PCXR8	529341	10/07/2023	1,000	1,500	2,000	1,001	1,500	2,000	1.003x - 8.128	1.000
B45	SKC	224-PCXR8	529594	06/07/2023	1,000	1,500	2,000	998	1,500	1,985	0.988x + 13.443	1.000
B46	SKC	224-PCXR8	566743	04/07/2023	1,000	1,500	2,000	994	1,504	2,000	1.006x - 14.882	1.000
B47	SKC	224-PCXR8	566747	04/07/2023	1,000	1,500	2,000	1,001	1,500	2,002	1.012x - 24.217	0.999
B48	SKC	224-PCXR8	566753	10/07/2023	1,000	1,500	2,000	999	1,491	1,996	1.002x - 11.236	1.000
B49	SKC	224-PCXR8	566780	04/07/2023	1,000	1,500	2,000	1,002	1,501	2,004	1.012x - 23.640	0.999
B50	SKC	224-PCXR8	500400	10/07/2023	1,000	1,500	2,000	1,000	1,506	2,000	0.997x + 1.566	1.000
B51	SKC	224-PCXR8	500363	04/07/2023	1,000	1,500	2,000	995	1,502	1,998	1.010x - 25.405	0.999
B52	SKC	224-PCXR8	093186	10/07/2023	1,000	1,500	2,000	993	1,494	1,990	0.995x + 0.992	1.000
B53	SKC	224-PCXR8	707670	05/07/2023	1,000	1,500	2,000	1,001	1,499	2,000	1.007x - 16.304	0.999
B54	SKC	224-PCXR3	509821	03/07/2023	1,000	1,500	2,000	992	1,500	2,000	1.017x - 35.039	0.999
B55	SKC	224-PCXR3	510710	10/07/2023	1,000	1,500	2,000	999	1,493	1,990	0.993x + 2.638	1.000
B56	SKC	224-PCXR3	511450	04/07/2023	1,000	1,500	2,000	1,001	1,498	1,999	1.004x - 9.108	1.000
B57	SKC	224-PCXR3	510798	10/07/2023	1,000	1,500	2,000	996	1,490	1,997	1.005x - 13.675	1.000
B58	SKC	224-PCXR3	509852	05/07/2023	1,000	1,500	2,000	999	1,497	1,997	1.006x - 19.133	0.999
B59	SKC	224-PCXR3	509862	06/07/2023	1,000	1,500	2,000	995	1,501	1,993	1.001x - 5.136	1.000
B60	SKC	224-PCXR3	512655	06/07/2023	1,000	1,500	2,000	1,001	1,498	2,015	1.017x - 25.660	1.000
B61	SKC	224-PCXR3	503915	05/07/2023	1,000	1,500	2,000	992	1,488	1,997	1.004x - 13.766	1.000
B62	SKC	224-PCXR3	505975	06/07/2023	1,000	1,500	2,000	998	1,493	1,994	0.996x + 0.183	1.000
B63	SKC	224-PCXR3	511432	04/07/2023	1,000	1,500	2,000	989	1,499	1,998	1.010x - 24.150	1.000
B64	SKC	224-PCXR3	508302	03/07/2023	1,000	1,500	2,000	997	1,491	1,987	0.990x + 8.411	1.000
B65	SKC	224-PCXR3	508310	10/07/2023	1,000	1,500	2,000	1,011	1,499	2,000	0.998x + 0.263	0.999
B66	SKC	224-PCXR3	509861	10/07/2023	1,000	1,500	2,000	1,001	1,489	1,990	0.987x + 13.691	1.000
B67	SKC	224-PCXR3	506295	04/07/2023	1,000	1,500	2,000	994	1,506	2,009	1.012x - 20.281	1.000
B68	SKC	224-PCXR3	505872	04/07/2023	1,000	1,500	2,000	1,001	1,489	1,996	0.994x + 3.757	1.000
B69	SKC	224-PCXR3	508375	04/07/2023	1,000	1,500	2,000	1,001	1,498	1,998	1.008x - 19.635	0.999
B70	SKC	224-PCXR3	510623	05/07/2023	1,000	1,500	2,000	991	1,502	1,994	1.001x - 5.451	1.000
B71	SKC	224-PCXR3	508367	10/07/2023	1,000	1,500	2,000	991	1,504	2,000	1.016x - 35.155	0.999
B72	SKC	224-PCXR3	505977	05/07/2023	1,000	1,500	2,000	1,000	1,498	1,992	0.992x + 7.080	1.000
B73	SKC	224-PCXR3	512606	05/07/2023	1,000	1,500	2,000	1,000	1,499	2,002	1.000x - 7.240	0.999
B74	SKC	224-PCXR3	505993	05/07/2023	1,000	1,500	2,000	995	1,495	1,992	0.996x - 2.446	1.000
B75	SKC	224-PCXR3	509820	05/07/2023	1,000	1,500	2,000	995	1,495	1,989	0.995x + 1.829	1.000
B76	SKC	224-PCXR3	509811	04/07/2023	1,000	1,500	2,000	992	1,497	1,997	1.005x - 14.428	1.000
B77	SKC	224-PCXR3	508301	04/07/2023	1,000	1,500	2,000	999	1,499	2,001	1.008x - 21.556	0.999
B78	SKC	224-PCXR3	510677	05/07/2023	1,000	1,500	2,000	994	1,502	1,997	1.012x - 28.449	0.999
B79	SKC	224-PCXR3	510920	03/07/2023	1,000	1,500	2,000	993	1,492	1,992	1.000x - 5.853	1.000

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

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
B80	SKC	224-PCXR3	504569	03/07/2023	1,000	1,500	2,000	1,001	1,497	2,000	1.003x - 8.782	1.000
B81	SKC	224-PCXR3	503480	07/07/2023	1,000	1,500	2,000	995	1,498	1,998	1.013x - 30.294	0.999
B82	SKC	224-PCXR3	505673	05/07/2023	1,000	1,500	2,000	993	1,497	1,994	0.999x - 4.901	1.000
B83	SKC	224-PCXR3	510785	06/07/2023	1,000	1,500	2,000	1,009	1,498	1,999	1.001x - 4.996	0.999
B84	SKC	224-PCXR3	508333	06/07/2023	1,000	1,500	2,000	996	1,497	1,989	0.992x + 4.965	1.000
B85	SKC	224-PCXR3	505757	06/07/2023	1,000	1,500	2,000	993	1,500	2,000	1.008x - 18.691	1.000
B86	SKC	224-PCXR3	512625	03/07/2023	1,000	1,500	2,000	1,013	1,501	2,002	0.998x + 2.223	0.999
B87	SKC	224-PCXR3	504324	07/07/2023	1,000	1,500	2,000	997	1,494	1,998	0.992x + 6.303	1.000
B88	SKC	224-PCXR3	508307	07/07/2023	1,000	1,500	2,000	994	1,497	1,991	0.996x + 0.893	1.000
B89	SKC	224-PCXR3	509860	07/07/2023	1,000	1,500	2,000	999	1,498	2,000	0.999x - 6.614	0.999
B90	SKC	224-PCXR3	508366	04/07/2023	1,000	1,500	2,000	992	1,507	1,998	1.006x - 13.854	1.000
B91	SKC	224-PCXR3	510919	04/07/2023	1,000	1,500	2,000	999	1,497	1,995	0.991x + 7.076	1.000
B92	SKC	224-PCXR3	510987	04/07/2023	1,000	1,500	2,000	1,001	1,500	1,997	1.002x + 7.550	1.000
B93	SKC	224-PCXR3	509845	04/07/2023	1,000	1,500	2,000	995	1,495	2,002	1.000x - 7.598	0.999
B94	SKC	224-PCXR8	A127871	03/07/2023	1,000	1,500	2,000	999	1,518	2,005	1.004x - 7.809	0.999
B95	SKC	224-PCXR8	A127921	05/07/2023	1,000	1,500	2,000	992	1,501	2,000	1.015x - 32.023	0.999
B96	SKC	224-PCXR8	A127942	03/07/2023	1,000	1,500	2,000	997	1,497	1,994	0.999x - 3.203	1.000
B97	SKC	224-PCXR8	A127955	03/07/2023	1,000	1,500	2,000	1,002	1,500	2,001	1.010x - 20.261	0.999
B98	SKC	224-PCXR8	A127956	03/07/2023	1,000	1,500	2,000	995	1,495	1,996	1.002x - 6.403	1.000

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

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (mL/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
R01	SKC	224-PCXR4	602467	06/07/2023	1,000	1,500	2,000	991	1,506	2,002	1.007x – 14.479	1.000
R02	SKC	224-PCXR4	626450	06/07/2023	1,000	2,000	3,000	997	1,497	1,988	0.988x + 12.256	1.000
R03	SKC	224-PCXR4	691592	06/07/2023	1,000	1,500	2,000	1,002	1,498	2,002	1.003x – 5.881	1.000
R04	SKC	224-PCXR4	691672	06/07/2023	1,000	1,500	2,000	995	1,491	1,994	0.997x – 2.717	1.000
R05	SKC	224-PCXR4	798470	06/07/2023	1,000	1,500	2,000	992	1,505	1,997	1.001x – 6.538	1.000
R06	SKC	224-PCXR4	798456	06/07/2023	1,000	1,500	2,000	994	1,497	1,993	0.994x – 0.976	1.000
R07	SKC	224-PCXR4	798480	04/07/2023	1,000	1,500	2,000	993	1,490	1,997	1.007x – 16.177	1.000
R08	SKC	224-PCXR4	883215	04/07/2023	1,000	1,500	2,000	1,010	1,499	2,003	0.989x + 11.332	0.999
R09	SKC	224-PCXR4	034650	04/07/2023	1,000	1,500	2,000	990	1,503	2,000	1.011x – 24.548	1.000
R10	SKC	224-PCXR4	091765	07/07/2023	1,000	1,500	2,000	996	1,509	1,992	0.999x + 0.299	1.000
R11	SKC	224-PCXR4	091763	07/07/2023	1,000	1,500	2,000	999	1,497	1,985	1.000x – 9.834	0.999
R12	SKC	224-PCXR4	091568	07/07/2023	1,000	1,500	2,000	995	1,499	1,998	1.001x – 6.774	1.000
R13	SKC	224-PCXR4	091638	07/07/2023	1,000	1,500	2,000	1,001	1,510	1,989	0.988x + 16.559	1.000
R14	SKC	224-PCXR4	091764	07/07/2023	1,000	1,500	2,000	993	1,501	1,997	1.013x – 30.102	0.999
R15	SKC	224-PCXR8	529457	07/07/2023	1,000	1,500	2,000	1,000	1,499	2,001	0.998x – 3.682	0.999
R16	SKC	224-PCXR8	529643	05/07/2023	1,000	1,500	2,000	997	1,494	1,992	0.992x + 2.530	1.000
R17	SKC	224-PCXR8	529645	05/07/2023	1,000	1,500	2,000	994	1,507	1,998	1.006x – 15.440	0.999
R18	SKC	224-PCXR8	566756	05/07/2023	1,000	1,500	2,000	990	1,496	1,996	1.000x – 6.873	1.000
R19	SKC	224-PCXR8	566802	05/07/2023	1,000	1,500	2,000	1,001	1,497	1,998	1.003x – 14.352	0.999
R20	SKC	224-PCXR8	529089	03/07/2023	1,000	1,500	2,000	990	1,499	2,001	1.019x – 39.318	0.999
R21	SKC	224-PCXR8	665728	03/07/2023	1,000	1,500	2,000	997	1,493	1,997	0.999x – 3.765	1.000
R22	SKC	224-PCXR8	707444	03/07/2023	1,000	1,500	2,000	1,002	1,511	2,001	1.000x – 2.666	0.999
R23	SKC	224-PCXR8	761067	05/07/2023	1,000	1,500	2,000	1,011	1,475	1,989	0.980x + 20.504	0.999
R24	SKC	224-PCXR8	707893	04/07/2023	1,000	1,500	2,000	995	1,507	1,998	1.007x – 16.619	0.999
R25	SKC	224-PCXR8	761052	04/07/2023	1,000	1,500	2,000	1,009	1,494	1,993	0.984x + 21.169	1.000
R26	SKC	224-PCXR8	707956	06/07/2023	1,000	1,500	2,000	1,011	1,499	2,004	1.001x – 3.674	0.999
R27	SKC	224-PCXR8	707398	06/07/2023	1,000	1,500	2,000	995	1,499	1,999	1.005x – 14.830	1.000
R28	SKC	224-PCXR8	707481	04/07/2023	1,000	1,500	2,000	1,003	1,499	2,000	1.001x – 11.858	0.998
R29	SKC	224-PCXR8	707402	04/07/2023	1,000	1,500	2,000	1,002	1,492	1,987	0.985x + 16.145	1.000
R30	SKC	224-PCXR8	093811	07/07/2023	1,000	1,500	2,000	999	1,492	1,991	0.994x + 4.391	1.000
R31	SKC	224-PCXR8	093183	04/07/2023	1,000	1,500	2,000	1,000	1,499	1,999	0.989x + 8.339	0.999
R32	SKC	224-PCXR8	671950	04/07/2023	1,000	1,500	2,000	997	1,499	1,991	0.995x + 4.048	1.000
R33	SKC	224-PCXR4	626254	04/07/2023	1,000	1,500	2,000	993	1,501	1,998	1.014x – 32.194	0.999
R34	SKC	224-PCXR4	626131	04/07/2023	1,000	1,500	2,000	1,001	1,498	2,002	1.006x – 12.316	1.000
R35	SKC	224-PCXR8	707460	03/07/2023	1,000	1,500	2,000	998	1,496	1,993	0.993x + 5.945	1.000
R36	SKC	224-PCXR8	707446	07/07/2023	1,000	1,500	2,000	1,003	1,497	1,999	1.008x – 18.814	0.999
R37	SKC	224-PCXR8	707432	07/07/2023	1,000	1,500	2,000	995	1,497	1,998	0.995x + 5.662	1.000
R38	SKC	224-PCXR8	707349	07/07/2023	1,000	1,500	2,000	996	1,498	1,999	1.002x – 7.662	1.000
R39	SKC	224-PCXR8	761095	04/07/2023	1,000	1,500	2,000	1,000	1,514	1,992	0.984x + 18.826	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 \pm 3 $^{\circ}$ C
Pressure . 1010 \pm 15 mmbar

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (mL/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
R40	SKC	224-PCXR4	612753	07/07/2023	1,000	1,500	2,000	1,000	1,500	2,001	1.007x - 13.778	1.000
R41	SKC	224-PCXR4	626140	05/07/2023	1,000	1,500	2,000	991	1,508	2,006	1.021x - 39.143	0.999
R42	SKC	224-PCXR4	626463	05/07/2023	1,000	1,500	2,000	997	1,492	1,997	1.000x - 2.482	1.000
R43	SKC	224-PCXR4	626129	05/07/2023	1,000	1,500	2,000	1,002	1,500	2,003	1.011x - 20.839	0.999
R44	SKC	224-PCXR4	602753	05/07/2023	1,000	1,500	2,000	1,001	1,494	1,991	0.994x + 2.925	1.000
R45	SKC	224-PCXR4	626137	05/07/2023	1,000	1,500	2,000	991	1,504	2,000	1.018x - 37.211	0.999

Calibrated by :


(Mr. Adul Dangkom)

Approved by :


(Mr. Peera Detudom)



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Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (mL/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
H-R01	Dwyer	VFB-65	05/07/2023	500	1,000	2,000	501.2	993.0	1978.7	0.999x – 3.855	0.999
H-R02	Dwyer	VFB-65	05/07/2023	500	1,000	2,000	501.5	998.1	1986.7	1.000x – 2.024	1.000
H-R03	Dwyer	VFB-65	04/07/2023	500	1,000	2,000	501.2	989.3	1995.7	0.992x + 3.827	1.000
H-R04	Dwyer	VFB-65	10/07/2023	500	1,000	2,000	496.3	991.2	2014.5	1.006x – 10.883	1.000
H-R05	Dwyer	VFB-65	05/07/2023	500	1,000	2,000	499.1	987.9	1988.7	1.002x – 6.676	1.000
H-R06	Dwyer	VFB-65	06/07/2023	500	1,000	2,000	504.7	994.0	1980.6	0.998x – 1.539	0.999

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(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

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (mL/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
L-R01	Dwyer	VFA-21	05/07/2023	50	100	200	50.6	100.9	204.1	0.983x + 2.913	1.000
L-R02	Dwyer	VFA-21	05/07/2023	50	100	200	50.4	101.9	200.8	1.003x – 0.034	0.999
L-R03	Dwyer	VFA-21	04/07/2023	50	100	200	50.1	100.1	202.1	1.006x + 0.170	1.000
L-R04	Dwyer	VFA-21	10/07/2023	50	100	200	50.2	100.8	203.3	1.002x + 0.502	1.000
L-R05	Dwyer	VFA-21	05/07/2023	50	100	200	50.1	101.1	202.8	0.999x + 0.445	0.999
L-R06	Dwyer	VFA-21	06/07/2023	50	100	200	50.7	101.3	202.5	0.998x + 1.435	1.000

Calibrated by :

Adul Dangklorn
(Mr. Adul Dangklorn)

Approved by :

Peera Detudom
(Mr. Peera Detudom)

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY



451-451/1 Sirinthorn Rd.,Bangbumru, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com

NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : SP22018

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 : ORGANIC LABORATORY IV

Ambient Temperature : (24.4 \pm 5) °C
Relative Humidity : (60.1 \pm 25) %

Received Date : 30 AUGUST 2022
Calibration Date : 30 AUGUST 2022
Date of Issue : 31 AUGUST 2022

Calibrated by :

Nathakorn Pisutpaisan

Approved by :


(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.

Continuation of Calibration Certificate

Cert. No. : SP22018

Job No. : VC65SP0008

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

<u>Material</u>	<u>Ref. type</u>	<u>Cell serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Holmium liquid	RM-HL	29706	87569	13/10/2022
Didymium liquid	RM-DL	28912	87588	15/10/2022
Neutral density filter	RM-1N2N3N	13877	87600	15/10/2022
Potassium dichromate solutions	RM-0204060810	14204	87614	16/10/2022
Potassium Iodide solution	-	KI-0701-001	CI-0090-22	08/04/2024

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	467.8	-0.02	0.16	2.00
	536.56	536.5	-0.06	0.16	2.00
	640.50	640.5	0.00	0.16	2.00
RM-DL	740.09	740.0	-0.09	0.16	2.00
	864.94	865.2	0.26	0.16	2.00

UUC* = Unit Under Calibration

Continuation of Calibration Certificate

Cert. No. : SP22018

Job No. : VC65SP0008

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	1.0524	1.0539	0.0015	0.0028	2.00
		29914	0.7	0.7454	0.7459	0.0005	0.0029	2.00
		29381	0.5	0.5426	0.5426	0.0000	0.0028	2.00
	546.1	29360	1.0	0.9822	0.9810	-0.0012	0.0028	2.00
		29914	0.7	0.6962	0.6960	-0.0002	0.0028	2.00
		29381	0.5	0.5076	0.5070	-0.0006	0.0029	2.00
	590.0	29360	1.0	1.0221	1.0202	-0.0019	0.0028	2.00
		29914	0.7	0.7238	0.7230	-0.0008	0.0029	2.00
		29381	0.5	0.5364	0.5360	-0.0004	0.0031	2.00
	635.0	29360	1.0	0.9751	0.9732	-0.0019	0.0028	2.00
		29914	0.7	0.6912	0.6902	-0.0010	0.0029	2.00
		29381	0.5	0.5214	0.5210	-0.0004	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	0.2436	0.2419	-0.0017	0.0101	2.00	
		40	0.4905	0.4855	-0.0050	0.0115	2.00	
		60	0.7453	0.7388	-0.0065	0.0067	2.00	
		80	0.9920	0.9839	-0.0081	0.0071	2.00	
		100	1.2487	1.2414	-0.0073	0.0073	2.00	

UUC* = Unit Under Calibration

Condition of this result of calibration : Spectrophotometer PERKINELMER Model Lambda 25 S/N 501S141230

Resolution of Wavelength Mode 0.1 nm

Resolution of Photometric Mode 0.0001 A

Parameter Setting

Measurement Mode Wavelength, Absorbance

Wavelength Scan 1100 nm-190 nm

Scanning Speed 7.5 nm/min

Data Pitch 0.1 nm

Band width(Wavelength) 1.0 nm

Band width(Vis) 1.0 nm

Band width(Uv) 1.0 nm

Stray Light** UUC* Reading at 220 nm

Transimission T(%)	Absorbance(A)
0.0107	3.9886

**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

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY



451-451/1 Sirinthorn Rd., Bangbumru, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiphorn.com <http://www.sithiphorn.com>

NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : SP23016

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 : ORGANIC LABORATORY IV
Ambient Temperature : (25.0 ± 5) °C
Relative Humidity : (48.4 ± 25) %
Received Date : 30 AUGUST 2023
Calibration Date : 30 AUGUST 2023
Date of Issue : 31 AUGUST 2023

Calibrated by :

Nathakorn Pisutpaisan

Approved by :


(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.

Continuation of Calibration Certificate

Cert. No. : SP23016

Job No. : VC66SP0014

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

<u>Material</u>	<u>Ref. type</u>	<u>Cell serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
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-0090-22	08/04/2024

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)

<u>Material</u>	<u>Certified Values of Reference Material (nm)</u>	<u>UUC* Reading (nm)</u>	<u>Error (nm)</u>	<u>Uncertainty ± (nm)</u>	<u>k Factor</u>
RM-HL	278.13	278.3	0.17	0.16	2.00
	361.25	361.3	0.05	0.16	2.00
	467.82	468.0	0.18	0.16	2.00
	536.56	536.6	0.04	0.16	2.00
	640.50	640.4	-0.10	0.16	2.00
RM-DL	740.09	740.0	-0.09	0.16	2.00
	864.94	865.0	0.06	0.16	2.00

UUC* = Unit Under Calibration

Continuation of Calibration Certificate

Cert. No. : SP23016

Job No. : VC66SP0014

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	1.0564	0.0047	0.0031	2.00
		29914	0.7	0.7445	0.7460	0.0015	0.0032	2.00
		29381	0.5	0.5416	0.5429	0.0013	0.0032	2.00
	546.1	29360	1.0	0.9821	0.9849	0.0028	0.0030	2.00
		29914	0.7	0.6961	0.6961	0.0000	0.0030	2.00
		29381	0.5	0.5073	0.5073	0.0000	0.0030	2.00
	590.0	29360	1.0	1.0222	1.0244	0.0022	0.0030	2.00
		29914	0.7	0.7237	0.7234	-0.0003	0.0030	2.00
		29381	0.5	0.5361	0.5360	-0.0001	0.0031	2.00
	635.0	29360	1.0	0.9753	0.9775	0.0022	0.0030	2.00
		29914	0.7	0.6910	0.6910	0.0000	0.0030	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	0.2462	0.0040	0.0101	2.00	
		40	0.4866	0.4900	0.0034	0.0115	2.00	
		60	0.7414	0.7390	-0.0024	0.0068	2.00	
		80	0.9858	0.9871	0.0013	0.0093	2.00	
		100	1.2442	1.2480	0.0038	0.0087	2.00	

UUC* = Unit Under Calibration

Condition of this result of calibration : Spectrophotometer PERKINELMER Model Lambda 25 S/N 501S141230

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)
0.0111	3.9564

**Specific Acceptance :

Transmission \leq 1.0 T(%), Absorbance \geq 2.0 A

**Stray light not TISI Accredited

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

End of Calibration Certificate



Certificate of Calibration

Aquion : Anion (ID#894)

This certificate is to verify that instrument below are calibrated

by Archemica Lab Co.,Ltd.

AQUION S/N : 190840059

AS-DV S/N : 190915235

for

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

ARCHEMICA LAB
บริษัท อาร์เคมีกา แล็บ จำกัด
ARCHEMICA LAB CO.,LTD

Operator Signature : Nutdanai

Date : Jul 3, 2023

(Mr.Nutdanai Laekhwan)

Applications Chemist

**QUALITY CALIBRATION CO.,LTD.**

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

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

www.qcalibration.com

CERTIFICATE No : 23M2441

REFERENCE No : 68471-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : METTLER TOLEDO

MODEL : XS105DU

SERIAL No : 1126422905

ID No : BA 05/50

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 10-Mar-23

APPROVED BY : PONGSAK J.

ISSUED DATE : 16-Mar-23

RECEIVED DATE : 10-Mar-23

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



CERTIFICATE No : 23M2441

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU
MANUFACTURER : METTLER TOLEDO S/N : 1126422905
ID No : BA 05/50 RECEIVED DATE : 10-Mar-23
AIR PRESSURE : 1010mbar \pm 1mbar CALIBRATION DATE : 10-Mar-23
AMBIENT TEMPERATURE : 23°C \pm 1°C RELATIVE HUMIDITY : 49 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.

4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

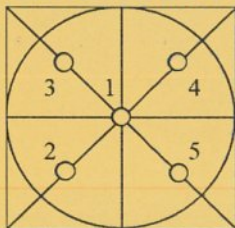
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.00000	0.00000	0.000039
0.02	0.02000	0.00000	0.000039
0.10	0.10000	0.00000	0.000039
0.20	0.20001	-0.00001	0.000040
0.50	0.50001	-0.00001	0.000040
1.00	1.00000	0.00000	0.000041
2.00	2.00003	-0.00003	0.000042
5.00	5.00001	-0.00001	0.000046
10.00	10.00003	-0.00003	0.000053
20.00	20.00005	-0.00005	0.000067
50.00	50.00001	-0.00001	0.00011
100.00	100.00001	-0.00001	0.00019
200.00	200.00001	-0.00001	0.00032

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	50.0000
2	50.0001
3	50.0000
4	50.0000
5	49.9999
OFF-CENTER LOADING	0.0001

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

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

END OF CALIBRATION REPORT



GAS CHROMATOGRAPH TEST CERTIFICATION

Certificate No. : SV0822/20530

Instrument Type : GC

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 : 10/08/2022

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) = 118,103 Counts.





Detector Sensitivity (FID)

Detector Response	Result	Specification
Baseline Noise (μV)	2.94	≤ 50
Baseline Drift (%)	0.18	≤ 1
Sensitivity (S/N for C15)	4,000	$\geq 1,024$

Temperature Specification

Temperature	Set	Result	Specification
Column Oven ($^{\circ} C$)	80	80	± 5
Injector ($^{\circ} C$)	220	220	± 5
Detector ($^{\circ} C$)	300	300	± 5
Incubator ($^{\circ} C$)	60	N/A	± 5

Relative Standard Deviation % (% RSD)

Checkout Procedure	Result	Specification
Area C15 (%)	1.68	≤ 5
Retention Time C15(%)	0.01	≤ 0.5

APPROVAL :

Signature: Suwarot.Engineer : Suwarot TrikainutDate : 10/08/2022



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	117,172
C15 Area 2	119,182
C15 Area 3	117,982
C15 Area 4	118,589
C15 Area 5	117,592
C15 Area Average	118,103
* % RSD (< 5 %)	1.68

* 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	Sumarot.	
Date	10/08/2022	



Comments	-		
Reviewed by	Sashin P.	Date	10/08/2022



VARIAN



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	4.048
C15 RT 2	4.048
C15 RT 3	4.048
C15 RT 4	4.048
C15 RT 5	4.048
C15 RT Average	4.000
* % RSD (< 0.5 %)	0.01

* 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	Sumrat.	
Date	10/08/2022	



Comments	-		
Reviewed by	Sumrat P.	Date	10/08/2022



VARIAN

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

Sample ID: **fid std**

Operator (Inj): **suwarot**

Injection Date: **16/08/2022**

Calc Date: **16/08/2022**

Run Time (min): **7.993**

Workstation:

Instrument (Inj): **Varian Star #1**



VARIAN

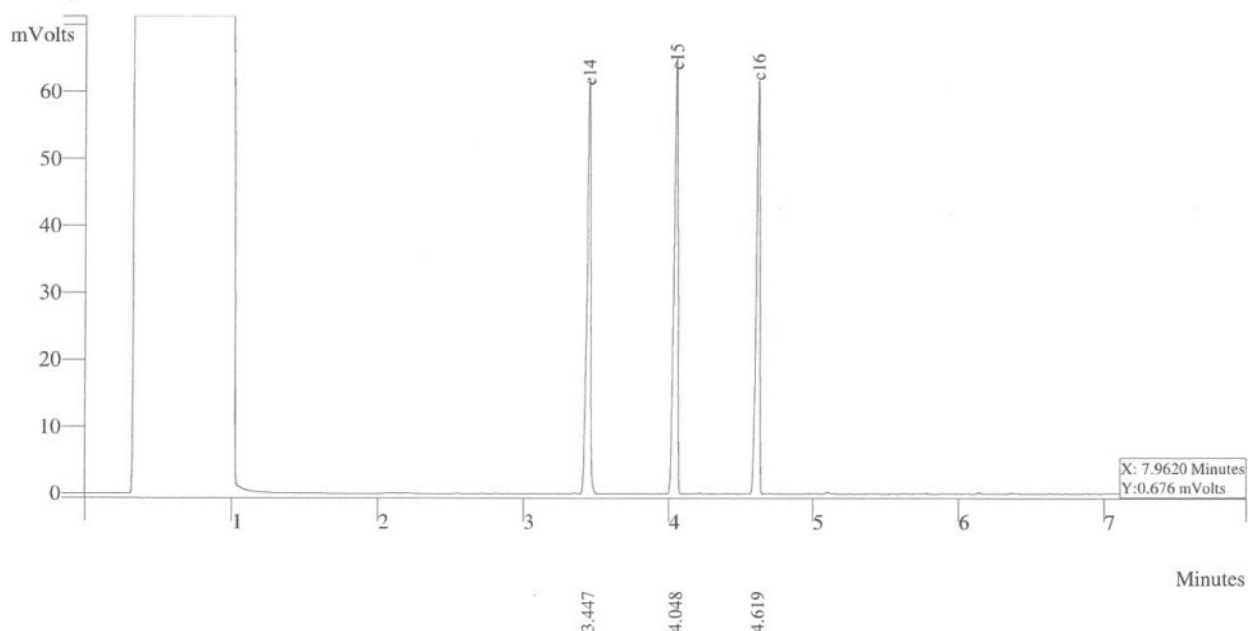
Run Mode: **Analysis**

Peak Measurement: **Peak Area**

Calculation Type: **Percent**

c:\star\data\tu\cal2022\fid2022001.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	32.2988	3.477	112355	VP	1.7
2	c15	33.6834	4.048	117172	VV	1.5
3	c16	34.0178	4.619	118335	VP	1.5
Totals		100.0000		347862		



THAI UNIQUE CO.,LTD.

1 Of 1

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

Sample ID: **fid std**

Operator (Inj): **suwarot**

Injection Date: **16/08/2022**

Calc Date: **16/08/2022**

Run Time (min): **7.993**

Workstation:

Instrument (Inj): **Varian Star #1**



VARIAN

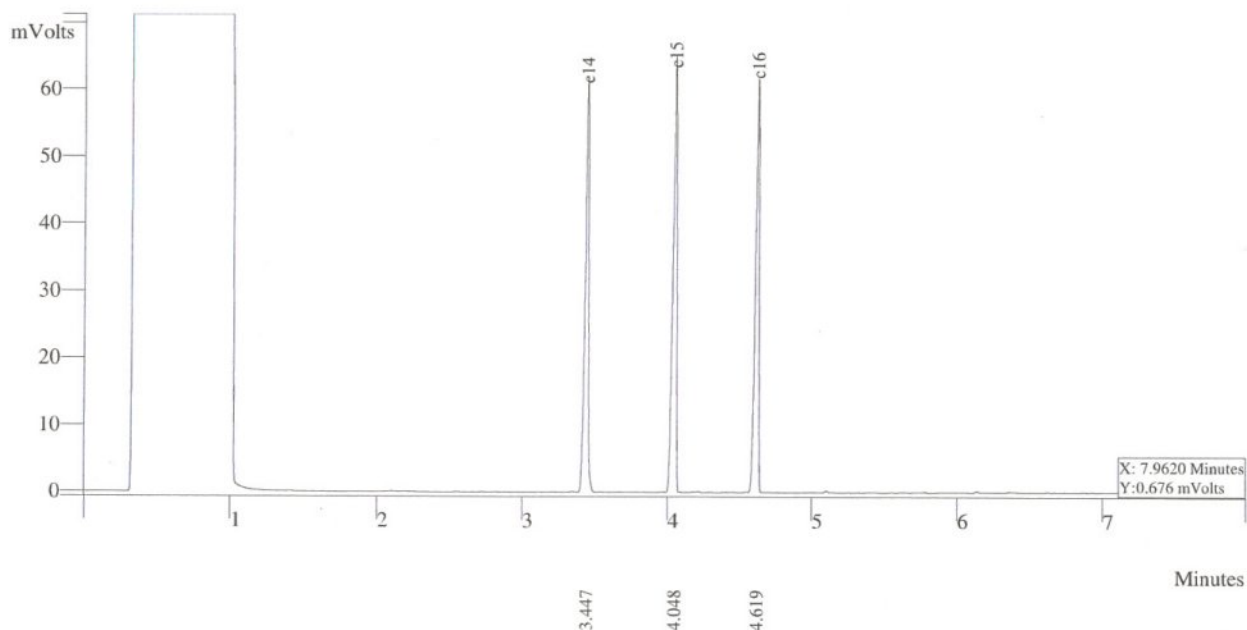
Run Mode: **Analysis**

Peak Measurement: **Peak Area**

Calculation Type: **Percent**

c:\star\data\tu\cal2022\fid2022002.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	32.2988	3.477	112755	VP	1.7
2	c15	33.6834	4.048	119182	VV	1.5
3	c16	34.0178	4.619	118265	VP	1.5
Totals		100.0000		348205		



THAI UNIQUE CO.,LTD.

1 Of 1

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

Sample ID: **fid std**

Operator (Inj): **suwarot**

Injection Date: **16/08/2022**

Calc Date: **16/08/2022**

Run Time (min): **7.993**

Workstation:

Instrument (Inj): **Varian Star #1**



VARIAN

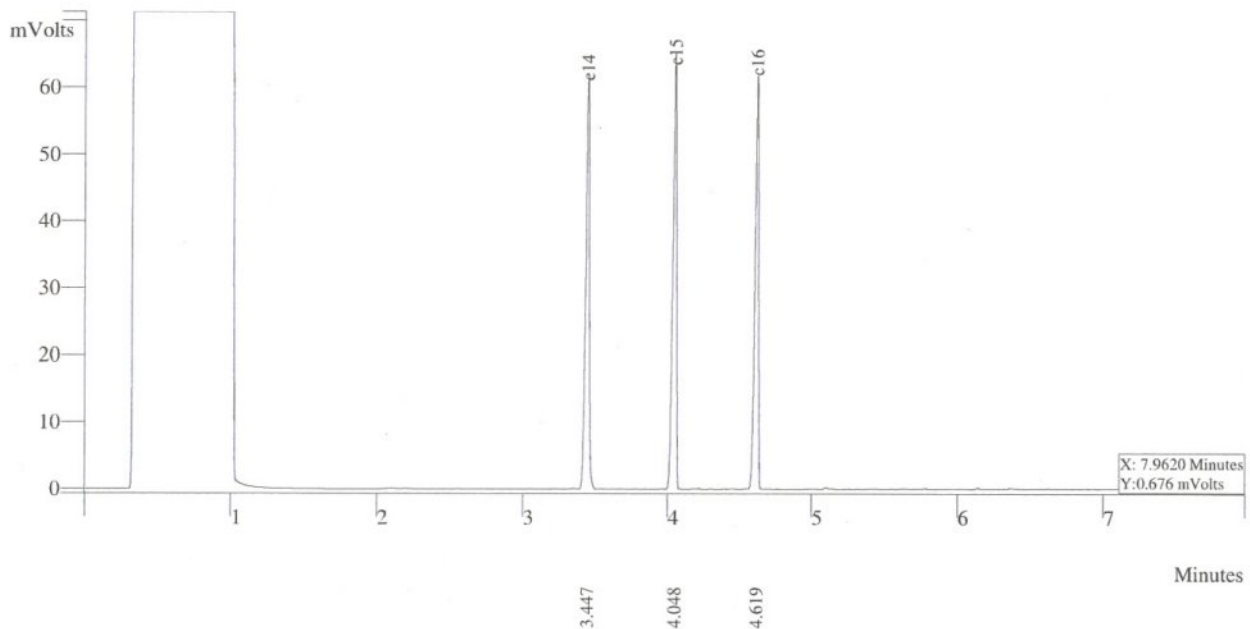
Run Mode: **Analysis**

Peak Measurement: **Peak Area**

Calculation Type: **Percent**

c:\star\data\tu\cal2022\fid2022003.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	32.2988	3.477	112755	VP	1.7
2	c15	33.6834	4.048	117982	VV	1.5
3	c16	34.0178	4.619	118265	VP	1.5
Totals		100.0000		348205		



THAI UNIQUE CO.,LTD.

1 Of 1

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

Sample ID: **fid std**

Operator (Inj): **suwarot**

Injection Date: **16/08/2022**

Calc Date: **16/08/2022**

Run Time (min): **7.993**

Workstation:

Instrument (Inj): **Varian Star #1**



VARIAN

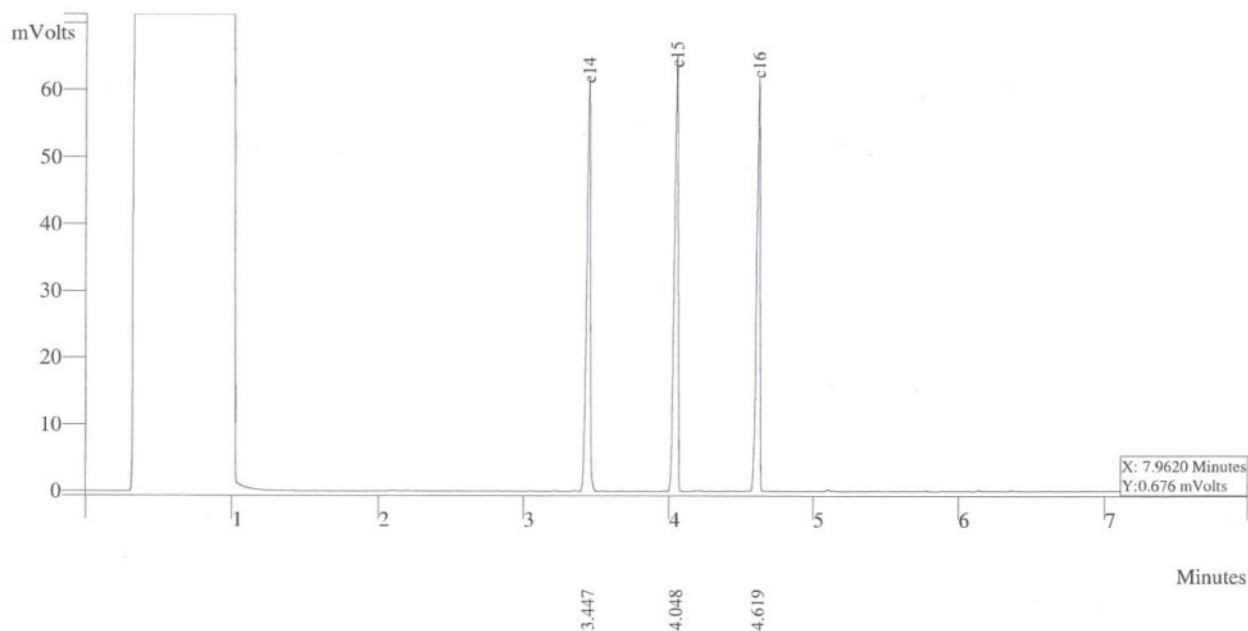
Run Mode: **Analysis**

Peak Measurement: **Peak Area**

Calculation Type: **Percent**

c:\star\data\tu\cal2022\fid2022004.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	32.2988	3.377	113755	VP	1.7
2	c15	33.6834	4.048	118589	VV	1.5
3	c16	34.3178	4.619	128265	VP	1.5
Totals		100.0000		360202		



THAI UNIQUE CO.,LTD.

1 Of 1

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

Sample ID: **fid std**

Operator (Inj): **suwarot**

Injection Date: **16/08/2022**

Calc Date: **16/08/2022**

Run Time (min): **7.993**

Workstation:

Instrument (Inj): **Varian Star #1**



VARIAN

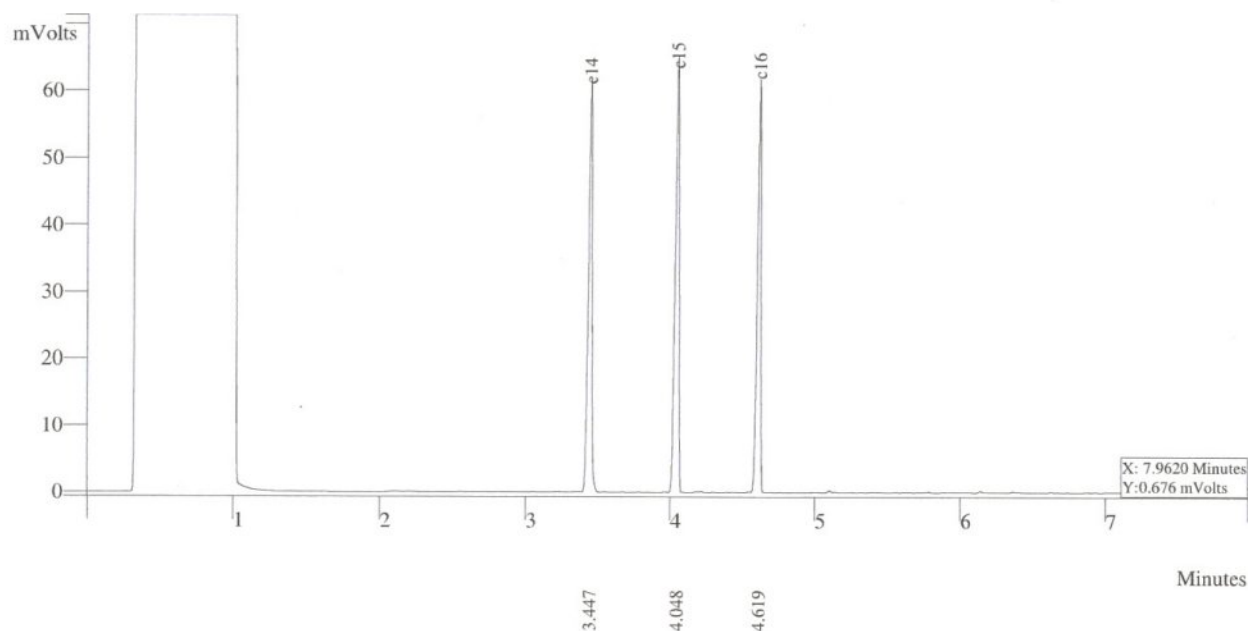
Run Mode: **Analysis**

Peak Measurement: **Peak Area**

Calculation Type: **Percent**

c:\star\data\tu\cal2022\fid2022005.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	32.2988	3.377	115755	VP	1.7
2	c15	33.6834	4.048	117592	VV	1.5
3	c16	34.3178	4.619	138265	VP	1.5
Totals		100.0000		369202		



THAI UNIQUE CO.,LTD.

1 Of 1

The graph shows a vertical y-axis on the left with numerical labels from 0 to 20 in increments of 1. The horizontal x-axis at the top is labeled with values 0.0, 0.5, 1.0, 1.5, and 2.0, with the unit 'mVolts' at the far right. The plot area is empty, with no data points or lines.

Title :
Run File : d:\c       gc\c      .N     \drive-d\2017\2022\08\baseline.run
Method File : D:\Method-GC\star C\Star\TU\Cal2021\baseline FID.mth
Sample ID : baseline

Injection Date: 16/8/2565 14:32 Calculation Date: 16/8/2565 15:12

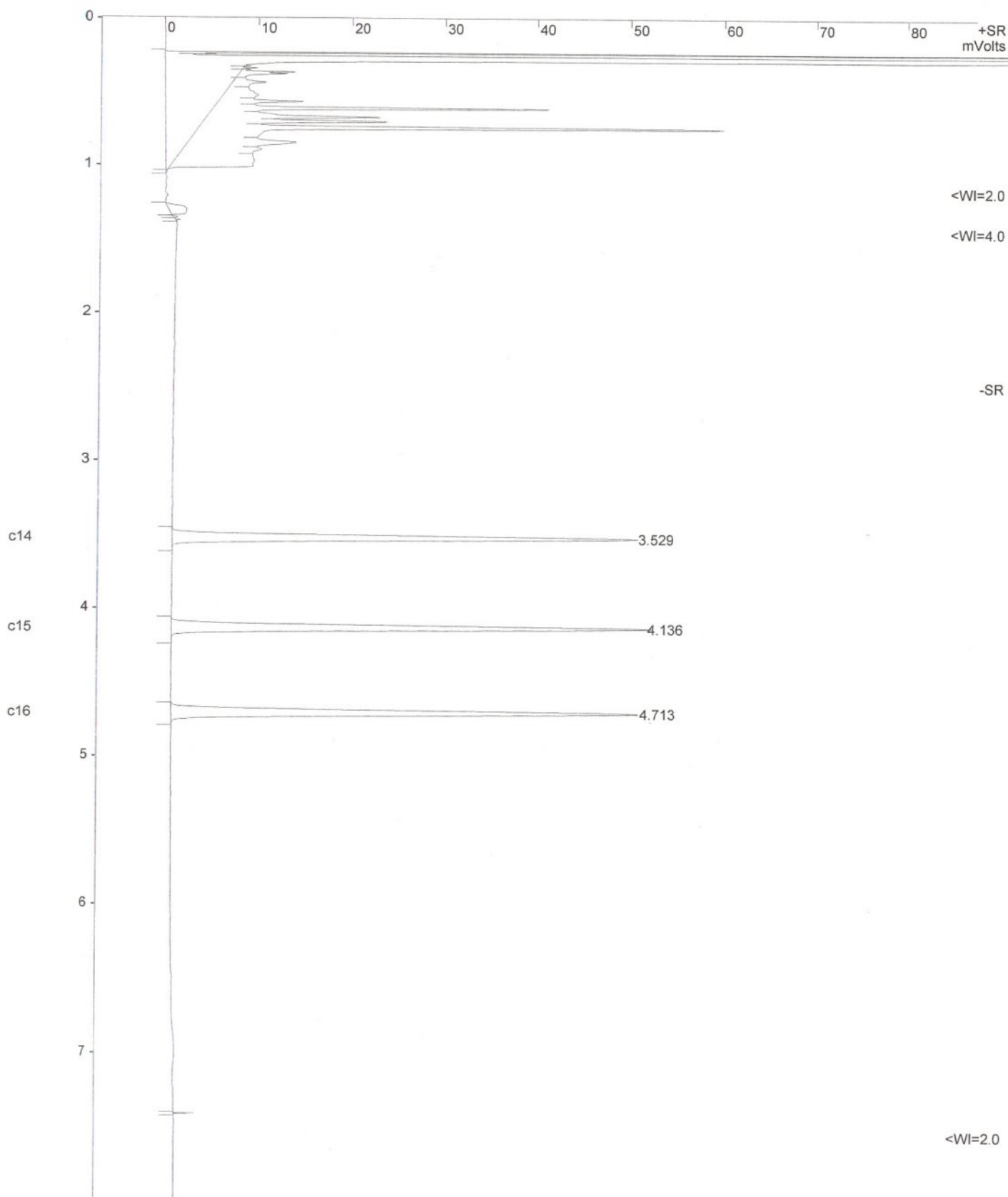
Operator : suwarot Detector Type: 3800 (10 Volts)
Workstation: Local Disk Bus Address : 44
Instrument : baseline Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 39.960 min

** GC Workstation Version 6.41 ** 03334-6390-826-0764 **

Run Mode : Blank Baseline
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: -2 microVolts LSB: 1 microVolts
Noise (used): 32 microVolts - monitored before this run
Manual injection



Title :
 Run File : c:\star\data\tu\cal2022\fid2022003.run
 Method File : d:\c       gc\c      .N     \drive-d\2017\2022\08\fid2022003-front.mth
 Sample ID : fid2022

Injection Date: 16/8/2565 10:51 Calculation Date: 16/8/2565 11:02

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

** GC Workstation Version 6.41 ** 03334-6390-826-0764 **

Run Mode : Analysis
 Peak Measurement: Peak Area
 Calculation Type: Percent

Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1	c14	32.2988	3.529	-0.000	112355	BB	2.1	
2	c15	33.6834	4.136	0.000	117172	BB	2.1	
3	c16	34.0178	4.713	-0.000	118335	BB	2.2	
Totals:		100.0000		0.000	347862			

Total Unidentified Counts : 0 counts

Detected Peaks: 4 Rejected Peaks: 1 Identified Peaks: 3

Multiplier: 1 Divisor: 1 Unidentified Peak Factor: 0

Baseline Offset: -28 microVolts LSB: 1 microVolts

Noise (used): 26 microVolts - monitored before this run

Manual injection

Data Handling: All Coefficients for All Peaks are Zero
 Data Handling: Default to A%



GAS CHROMATOGRAPH TEST CERTIFICATION

Certificate No. : SV0823/21044

Instrument Type : GC

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 : 09/08/2023

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) = 362,972 Counts.





Detector Sensitivity (FID)

Detector Response	Result	Specification
Baseline Noise (μ V)	1.47	≤ 50
Baseline Drift (%)	0.09	≤ 1
Sensitivity (S/N for C15)	19,600	$\geq 1,024$

Temperature Specification

Temperature	Set	Result	Specification
Column Oven ($^{\circ}$ C)	80	80	± 5
Injector ($^{\circ}$ C)	220	220	± 5
Detector ($^{\circ}$ C)	300	300	± 5
Incubator ($^{\circ}$ C)	60	N/A	± 5

Relative Standard Deviation % (% RSD)

Checkout Procedure	Result	Specification
Area C15 (%)	1.52	≤ 5
Retention Time C15(%)	0.01	≤ 0.5

APPROVAL :

Signature: Suwarot.Engineer : Suwarot TrikainutDate : 09/08/2023



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	357,863
C15 Area 2	357,824
C15 Area 3	367,724
C15 Area 4	361,724
C15 Area 5	369,724
C15 Area Average	362,972
* % RSD (< 5 %)	1.52

* 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	Samarot.	
Date	09/08/2023	



Comments	-		
Reviewed by	Samarot P.	Date	09/08/2023



VARIAN



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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	4.125
C15 RT 2	4.125
C15 RT 3	4.125
C15 RT 4	4.124
C15 RT 5	4.124
C15 RT Average	4.122
* % RSD (< 0.5 %)	0.01

* 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	Samarot.	
Date	09/08/2023	



Comments	-		
Reviewed by	Samarot P.	Date	09/08/2023



VARIAN

Title :
Run File : d:\cfíÁÛÅ gc\cfíÁÛÅ·ÑéŞĖÁ'\drive-d\2017\2023\08\blk2023.run
Method File : C:\star\data\TU\cal2023\baseline FID.mth
Sample ID : Blk2023

Injection Date: 9/8/2566 13:13 Calculation Date: 9/8/2566 13:34

Operator : watsamon Detector Type: 3800 (10 Volts)
Workstation: GC-LAB Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 21.208 min

** GC Workstation Version 6.41 ** 03334-6390-826-0764 **

Chart Speed = 1.03 cm/min Attenuation = 1 Zero Offset = 3%
Start Time = 0.000 min End Time = 21.208 min Min / Tick = 1.00



Title :
Run File : d:\c       gc\c      .N      \drive-d\2017\2023\08\blk2023.run
Method File : C:\star\data\TU\cal2023\baseline FID.mth
Sample ID : Blk2023

Injection Date: 9/8/2566 13:13 Calculation Date: 9/8/2566 13:34

Operator : watsamon Detector Type: 3800 (10 Volts)
Workstation: GC-LAB Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 21.208 min

** GC Workstation Version 6.41 ** 03334-6390-826-0764 **

Run Mode : Blank Baseline
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: -14 microVolts LSB: 1 microVolts

Noise (used): 19 microVolts - monitored before this run

Manual injection

Title : c:\star\data\tu\cal2023\fid\calfid2023003.run
Run File : d:\method-gc\star c\star\method\cp-wax\without glasswool\calfid2023003-front.mth
Method File : Manual Sample
Sample ID : Manual Sample

Injection Date: 9/8/2566 10:31 Calculation Date: 9/8/2566 10:40

Operator : watsamon
Workstation: Local Disk
Instrument :
Channel : Front = FID
Detector Type: 3800 (10 Volts)
Bus Address : 44
Sample Rate : 10.00 Hz
Run Time : 7.993 min

** GC Workstation Version 6.41 ** 03334-6390-826-0764 **

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

Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1	C14	33.8385	3.520	-0.003	362495	BB	2.2	C
2	C15	33.4804	4.125	-0.006	357824	BB	2.3	C
3	C16	32.6143	4.699	-0.001	344951	BB	2.2	
					=====	----	----	----
Totals:		99.9332			-0.010			

Status Codes:
C - Out of calibration range
Total Unidentified Counts : 0 counts
Detected Peaks: 3 Rejected Peaks: 0 Identified Peaks: 3
Multiplier: 1 Divisor: 1 Unidentified Peak Factor: 0

Baseline Offset: 28 microVolts LSB: 1 microVolts

Noise (used): 26 microVolts - monitored before this run

Manual injection

Calib. out of range; No Recovery Action Specified

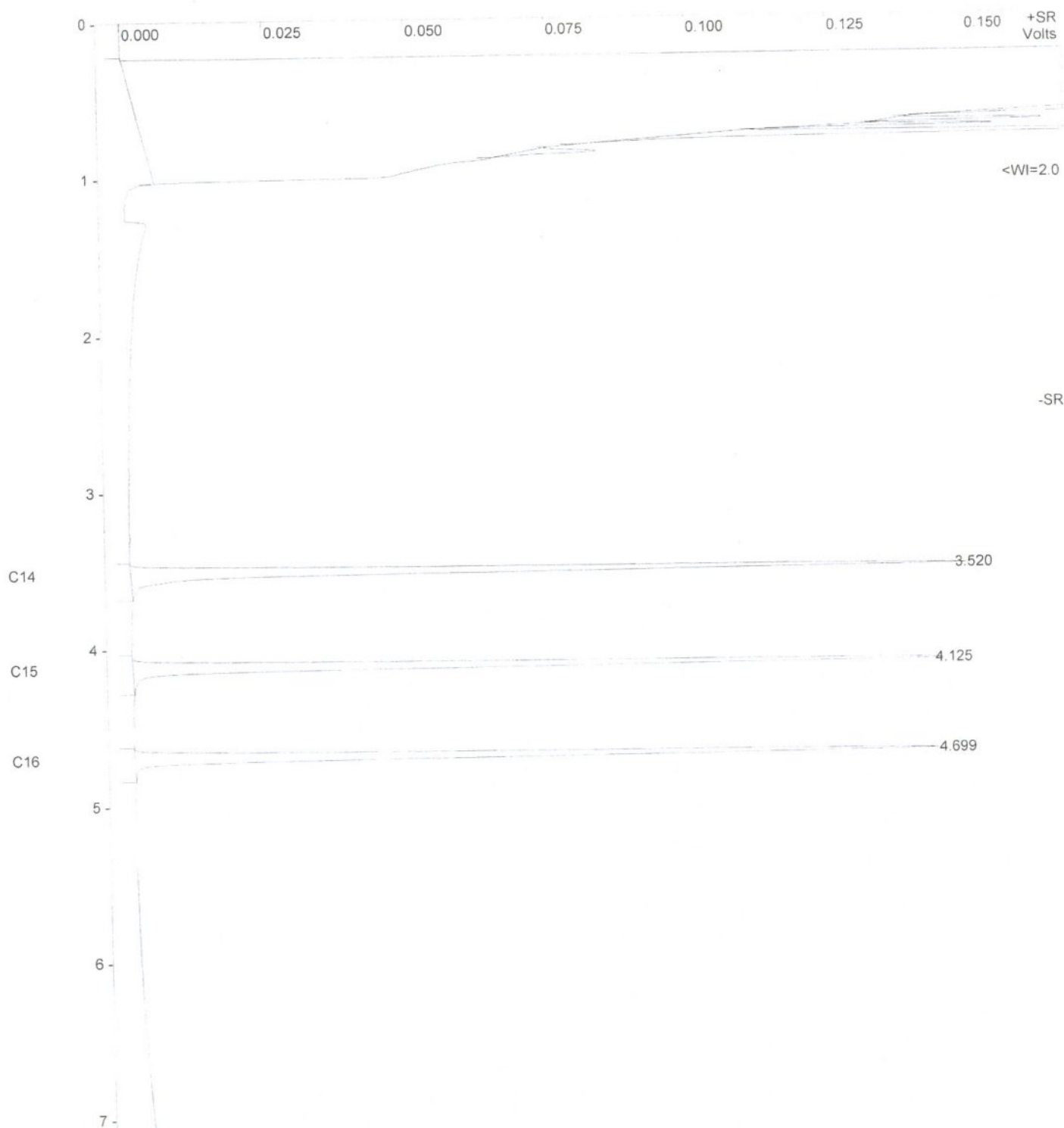
Title :
Run File : c:\star\data\tu\cal2023\fid\calfid2023003.run
Method File : d:\method-gc\star c\star\method\cp-wax\without glasswool\calfid2023003-front.mth
Sample ID : Manual Sample

Injection Date: 9/8/2566 10:31 Calculation Date: 9/8/2566 10:40

Operator : watsamon Detector Type: 3800 (10 Volts)
Workstation: Local Disk Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 7.993 min

** GC Workstation Version 6.41 ** 03334-6390-826-0764 **

Chart Speed = 2.73 cm/min Attenuation = 70 Zero Offset = 2%
Start Time = 0.000 min End Time = 7.993 min Min / Tick = 1.00



Sample ID: **fid std**



VARIAN

Operator (Inj): Suwarot

Injection Date: 09/08/2023

Calc Date: 09/08/2023

Run Time (min): 7.993

Workstation: Local Disk

Instrument (Inj):

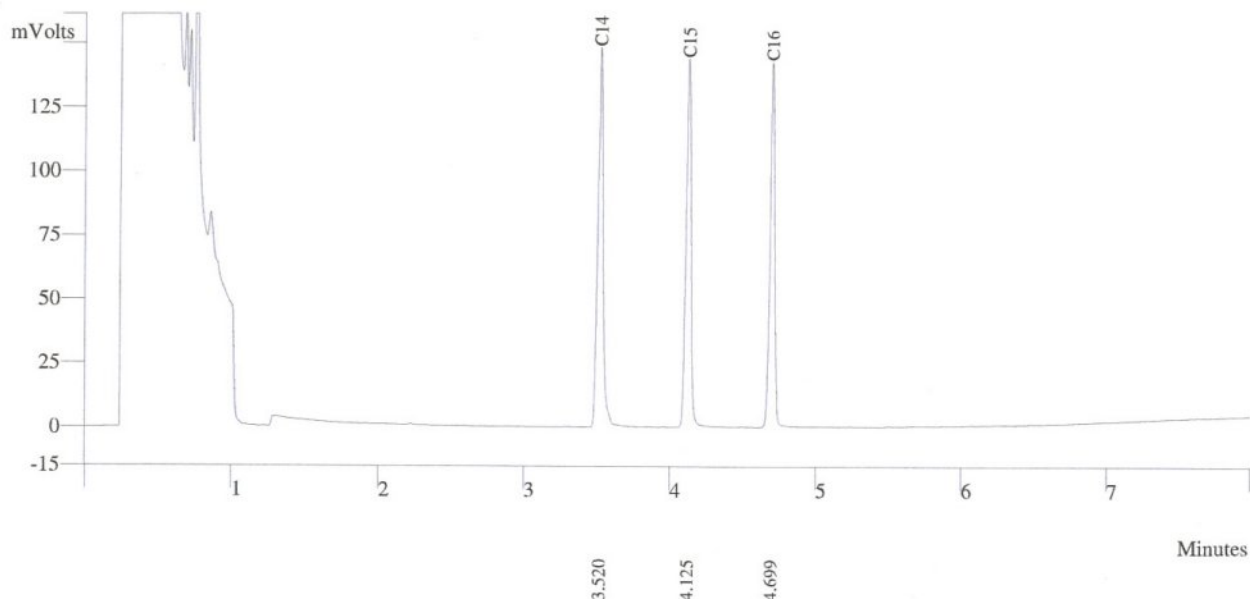
Run Mode: Analysis

Peak Measurement: Peak Area

Calculation Type: External Std.

c:\star\data\tu\cal2023\fid\calfid2023001.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	33.8385	3.520	359491	BB	2.2
2	C15	33.4804	4.125	357863	BB	2.3
3	C16	32.6143	4.699	344951	BB	2.2
Totals		99.9312		1062305		



Sample ID: **fid std**

Operator (Inj): Suwarot

Injection Date: 09/08/2023

Calc Date: 09/08/2023

Run Time (min): 7.993

Workstation: Local Disk

Instrument (Inj):



VARIAN

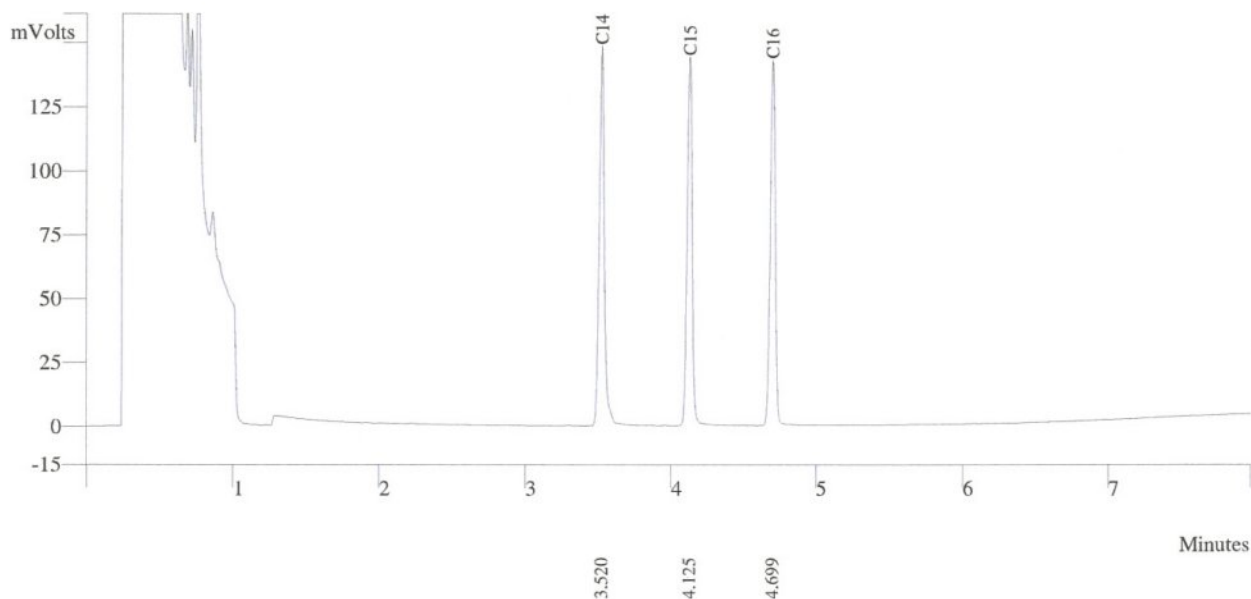
Run Mode: Analysis

Peak Measurement: Peak Area

Calculation Type: External Std.

c:\star\data\tu\cal2023\fid\calfid2023001.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	33.8385	3.520	362495	BB	2.2
2	C15	33.4804	4.125	357824	BB	2.3
3	C16	32.6143	4.699	344951	BB	2.2
	Totals	99.9332		1065270		



Sample ID: **fid std**

Operator (Inj): Suwarot

Injection Date: 09/08/2023

Calc Date: 09/08/2023

Run Time (min): 7.993

Workstation: Local Disk

Instrument (Inj):



VARIAN

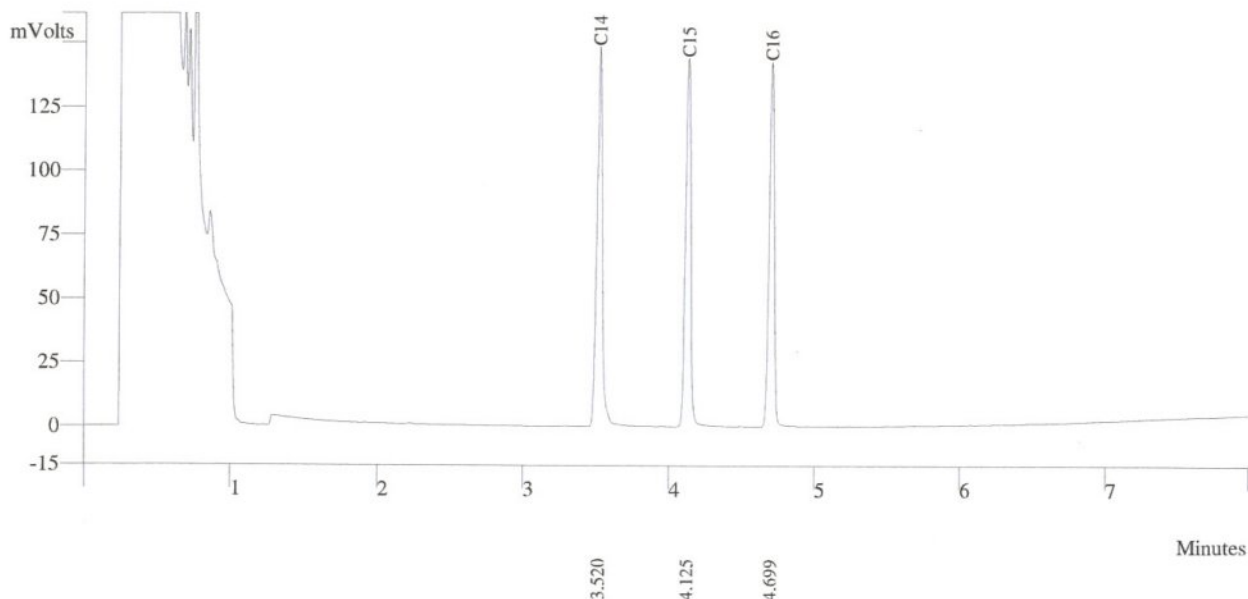
Run Mode: Analysis

Peak Measurement: Peak Area

Calculation Type: External Std.

c:\star\data\tu\cal2023\fid\calfid2023002.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	33.8385	3.520	362495	BB	2.2
2	C15	33.4824	4.125	367724	BB	2.3
3	C16	32.6143	4.699	354951	BB	2.2
Totals		99.9352		1085170		



Sample ID: **fid std**



VARIAN

Operator (Inj): Suwarot

Injection Date: 09/08/2023

Calc Date: 09/08/2023

Run Time (min): 7.993

Workstation: Local Disk

Instrument (Inj):

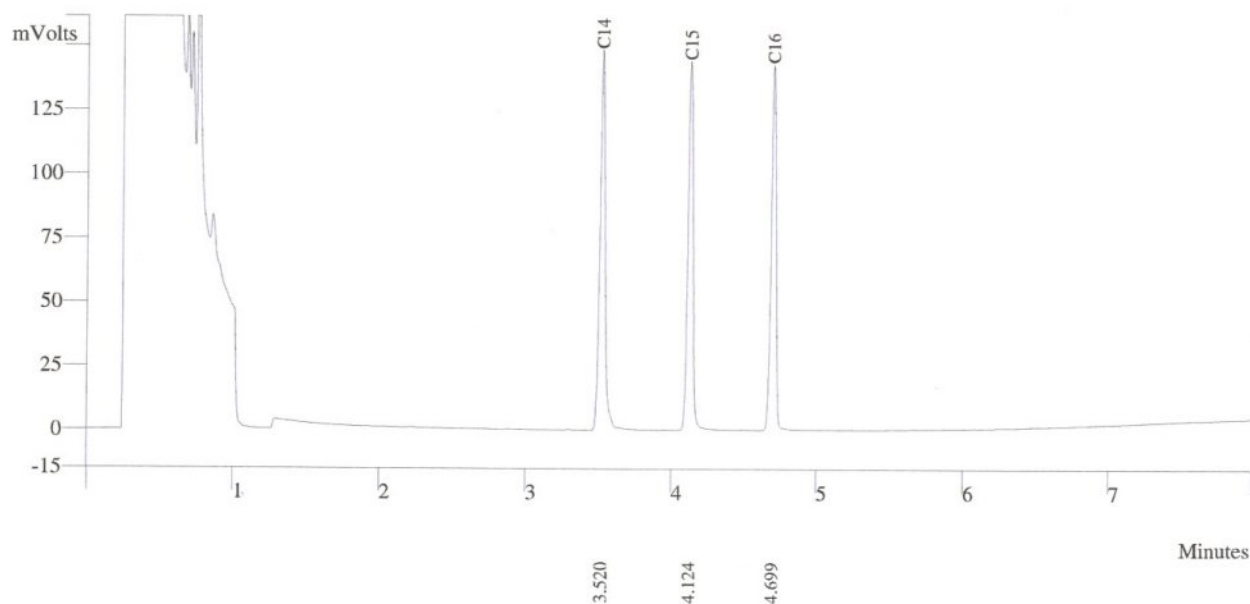
Run Mode: Analysis

Peak Measurement: Peak Area

Calculation Type: External Std.

c:\star\data\tu\cal2023\fid\calfid2023002.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	33.8385	3.520	362495	BB	2.2
2	C15	33.4824	4.124	361724	BB	2.3
3	C16	32.6143	4.699	354991	BB	2.2
Totals		99.9352		1079210		



Sample ID: **fid std**

Operator (Inj): Suwarot

Injection Date: 09/08/2023

Calc Date: 09/08/2023

Run Time (min): 7.993

Workstation: Local Disk

Instrument (Inj):



VARIAN

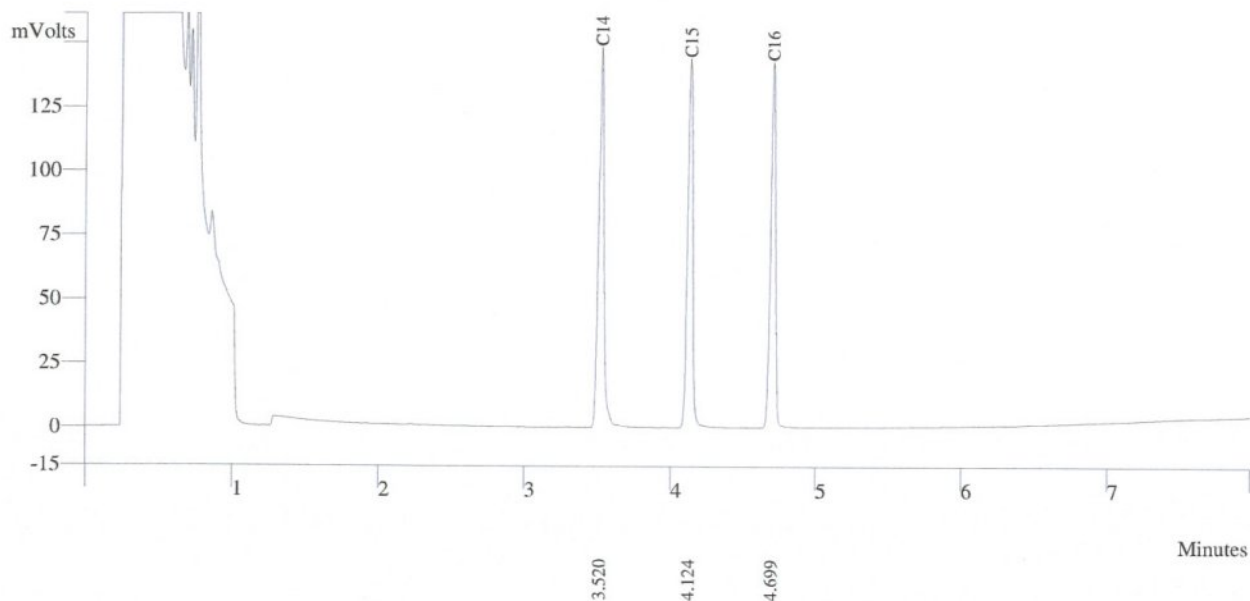
Run Mode: Analysis

Peak Measurement: Peak Area

Calculation Type: External Std.

c:\star\data\tu\cal2023\fid\calfid2023002.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	33.8385	3.520	362495	BB	2.2
2	C15	33.4824	4.124	369724	BB	2.3
3	C16	32.6143	4.699	354591	BB	2.2
	Totals	99.9552		1087210		



Agilent Technologies

Certificate of Analysis

FID-TCD Performance Evaluation Sample Kit

Agilent Part
Number: 5080-8842, 18710-60170

Sample Lot
Number: 0006637856

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

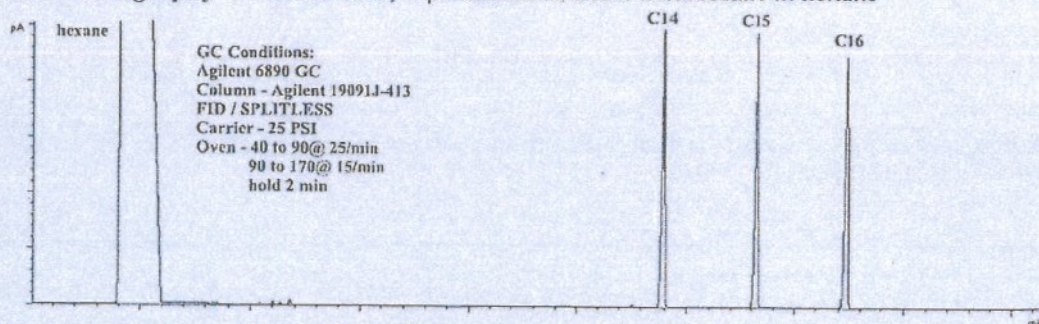
Calibrated Class A glassware and clean bottles were used in the manufacture of this standard. Balances used in the manufacture of this standard are calibrated with weights traceable to NIST in compliance with ANSI/NC SL Z-540-1 and ISO 9001.

Purities:

n-tetradecane	99.6%
n-pentadecane	99%
n-hexadecane	99%
hexane	99%

Typical Analytical Spectrum or Chromatography

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



Date of release: 30 September 2021

Date of expiration: 31 October 2023

Monica Bourgeois
Monica Bourgeois
QMS Representative

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

Service Manager

ภาคผนวกที่ 5-6

เอกสารสอบเทียบเครื่องมือการตรวจวัด
ระดับเสียงในสถานประกอบการ



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

Noise R_417/23

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	29 March 2023
		Due Date	29 March 2024

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B18	ACO	6236	00172048	09 August 2023	94.0	94.0
ACO-B29	ACO	6236	00182011	09 August 2023	94.1	94.0
ACO-B33	ACO	6236	00182015	09 August 2023	94.0	94.0
ACO-B36	ACO	6236	00192027	09 August 2023	94.1	94.0
ACO-B41	ACO	6236	00192032	09 August 2023	94.0	94.0
ACO-B43	ACO	6236	00192034	09 August 2023	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.94 ± 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. 21-66/0413

MTC No. EEL. BP. 109/0366

CALIBRATION CERTIFICATE

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

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

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

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

Serial No. : 130006

Ambient Environment

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

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

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

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

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

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

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

Date of Receipt : 27 Mar. 2023

Date of Calibration : 29 Mar. 2023

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.BL.MTC.002 Rev.4

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

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

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

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0413

MTC No. EEL. BP. 109/0366

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	93.94	-0.06	± 0.10	± 0.40 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	999.9	-0.1	± 1.5	$\pm 1.0\%$

3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.80	± 0.50	$\pm 3.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :


(Mr. Weerachai Deechaiyae)

Approved by :


(Mr. Prawate Kluaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 29 Mar. 2023

Date of Issue : 30 Mar. 2023

Ref : 2011266032701228001

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.BL.MTC.002 Rev.4

Head Office

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

Office/Laboratory

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

Office

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



Certificate of Calibration

Certificate Number : SPR23030423-6

Page : 1 of 3

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

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

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 172048

ID. Number : ACO-B18

Environmental Conditions

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

Received Date : 24 Mar 2023

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

Calibration Date : 07 Apr 2023

Location of Calibration : In-Lab

Recommend Due Date : 07 Apr 2024

Calibration Procedure : SP-CPE-04-01

Date of Issue : 08 Apr 2023

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.

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

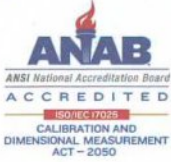
Calibrated by : Mr.Chumpon Dokpikul

Calibration Officer

Approved by :

(Mr.Nirut Loha)

Authorized Signatory



Calibration Report

Certificate Number : SPR23030423-6

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 114/0166	17 Jan 2024

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR23030423-6

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.1	94.1	0.1	0.1	0.15
114	114.0	114.0	0.0	0.0	0.15

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 $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



Certificate of Calibration

Certificate Number : SPR23030423-2

Page : 1 of 3

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

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

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 182011

ID. Number : ACO-B29

Environmental Conditions

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

Received Date : 24 Mar 2023

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

Calibration Date : 28 Mar 2023

Location of Calibration : In-Lab

Recommend Due Date : 28 Mar 2024

Calibration Procedure : SP-CPE-04-01

Date of Issue : 29 Mar 2023

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.

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr. Karoon Pengsalung

Calibration Officer

Approved by :

(Mr. Nirut Loha)

Authorized Signatory



Calibration Report

Certificate Number : SPR23030423-2

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 114/0166	17 Jan 2024

Traceability

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

TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR23030423-2

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.2	94.2	0.2	0.2	0.15
114	114.0	114.0	0.0	0.0	0.15

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 $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



Certificate of Calibration

Certificate Number : SPR23040335-1

Page : 1 of 3

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

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

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 182015

ID. Number : ACO-B33

Environmental Conditions

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

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

Location of Calibration : In-Lab

Calibration Procedure : SP-CPE-04-01

Received Date : 28 Apr 2023

Calibration Date : 28 Apr 2023

Recommend Due Date : 28 Apr 2024

Date of Issue : 29 Apr 2023

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.

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

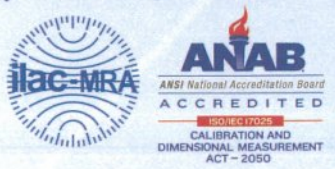
Calibrated by : Mr. Karoon Pengsalung

Calibration Officer

Approved by :


(Mr. Prayoon Topart)

Authorized Signatory



Calibration Report

Certificate Number : SPR23040335-1

Page : 2 of 3

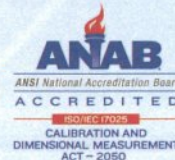
Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 114/0166	17 Jan 2024

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 ตู้สาย www.สอวทศ.คอม



Result of Calibration

Certificate No. : SPR23040335-1

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.2	94.2	0.2	0.2	0.15
114	114.1	114.1	0.1	0.1	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.2	94.2	0.2	0.2	0.15
114	114.1	114.1	0.1	0.1	0.15

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 $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



Certificate of Calibration

Certificate Number : SPR23030423-3

Page : 1 of 3

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

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

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 192027

ID. Number : ACO-B36

Environmental Conditions

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

Received Date : 24 Mar 2023

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

Calibration Date : 28 Mar 2023

Location of Calibration : In-Lab

Recommend Due Date : 28 Mar 2024

Calibration Procedure : SP-CPE-04-01

Date of Issue : 29 Mar 2023

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.

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

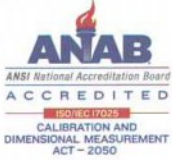
Calibrated by : Mr.Karoon Pengsalung

Approved by :

Calibration Officer

(Mr.Nirut Loha)

Authorized Signatory



Calibration Report

Certificate Number : SPR23030423-3

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 114/0166	17 Jan 2024

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR23030423-3

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.2	94.2	0.2	0.2	0.15
114	113.9	113.9	-0.1	-0.1	0.15

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 $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



Certificate of Calibration

Certificate Number : SPR23030423-4

Page : 1 of 3

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

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

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 192032

ID. Number : ACO-B41

Environmental Conditions

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

Received Date : 24 Mar 2023

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

Calibration Date : 28 Mar 2023

Location of Calibration : In-Lab

Recommend Due Date : 28 Mar 2024

Calibration Procedure : SP-CPE-04-01

Date of Issue : 29 Mar 2023

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.

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr. Karoon Pengsalung

Calibration Officer

Approved by :

(Mr. Nirut Loha)

Authorized Signatory



Calibration Report

Certificate Number : SPR23030423-4

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 114/0166	17 Jan 2024

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR23030423-4

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.1	94.1	0.1	0.1	0.15
114	114.0	114.0	0.0	0.0	0.15

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 $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



Certificate of Calibration

Certificate Number : SPR23030423-5

Page : 1 of 3

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

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

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 192034

ID. Number : ACO-B43

Environmental Conditions

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

Received Date : 24 Mar 2023

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

Calibration Date : 28 Mar 2023

Location of Calibration : In-Lab

Recommend Due Date : 28 Mar 2024

Calibration Procedure : SP-CPE-04-01

Date of Issue : 29 Mar 2023

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.

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Karoon Pengsalung

Calibration Officer

Approved by :

(Mr.Nirut Loha)

Authorized Signatory



Calibration Report

Certificate Number : SPR23030423-5

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 114/0166	17 Jan 2024

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR23030423-5

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.1	94.1	0.1	0.1	0.15
114	114.0	114.0	0.0	0.0	0.15

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 $k = 2.00$, providing a level of confidence approximately 95%.

– End of Certificate –

ภาคผนวกที่ 5-7

เอกสารสอบเทียบเครื่องมือการตรวจวัด
ระดับเสียงที่ลูกจ้างได้รับเฉลี่ยตลอดระยะเวลา (TWA)



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

Noise Dose R_418/23

Noise Dose Meter Calibration Report

Acoustic Calibrator Data

Brand	SVANTEK	Number	SV 06/62
Model	SV34	Serial No.	33139
Calibration Range	114 dB, 1000 Hz	Last Calibration	19 September 2022
		Due Date	19 September 2023

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NMD-B10	SVANTEK	SV-104IS	80830	09 August 2023	113.6	113.6
NMD-B11	SVANTEK	SV-104IS	80831	09 August 2023	113.5	113.6
NMD-B12	SVANTEK	SV-104IS	80832	09 August 2023	113.6	113.6
NMD-B13	SVANTEK	SV-104IS	80834	09 August 2023	113.6	113.6
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					113.63± 0.10 dB	

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)

Request No. 21-65/0760

MTC No. EEL. BP. 24/0965

CALIBRATION CERTIFICATE

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

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

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

Instrument Calibrated :

Description : Acoustic Calibrator

Manufacturer : SVANTEK

Model : SV34

Serial No. : 33139

Ambient Environment

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

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

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

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer Panasonic VP-7722A S/N 041477D122.

7. Condenser Microphone Bruel&Kjaer 4180 S/N 2633526.

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

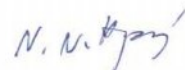
This instrument has been calibrated against standards maintained at Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

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

Date of Receipt : 13 Sep. 2022

Date of Calibration : 19 Sep. 2022

1 / 2



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

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FM.BL.MTC.002 Rev.4

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E-mail : sumalee@tistr.or.th

Request No. 21-65/0760

MTC No. EEL. BP. 24/0965

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

Nominal Output of Unit Under Test = 114 dB re 20 μ Pa at 1000 Hz**Acoustic Output in dB re 20 μ Pa, Corrected to Reference Conditions: 101.325 kPa, 23.0 °C and 50 %RH.****1. Sound Pressure Level**

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	113.63	-0.37	± 0.10	± 0.75 dB

2. Frequency

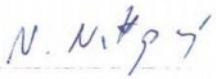
Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	1000.0	0.0	± 1.5	± 2.0 %

3. Total Distortion

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

- Note :**
1. No adjustment.
 2. The calibrator pressure correction was not included.
 3. The microphone volume correction was not included.

Calibrated by :


(Mr. Nuttapong Niljrusvanit)

Approved by :


(Mr. Prawate Kluaypa)
Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 19 Sep. 2022

Date of Issue : 20 Sep. 2022

Ref : 2011265091304034002

2 / 2

End of Certificate

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

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0344

MTC No. EEL. BP. 161/0266

CALIBRATION CERTIFICATE

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

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

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

Instrument Calibrated :

Description : Noise Dosimeter

Manufacturer : Svantek

Model : SV-104IS

Serial No. : 80830

Ambient Environment

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

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

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

Standards used :

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

Calibration Procedure :

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

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

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

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

Date of Receipt : 27 Feb. 2023

Date of Calibration : 7 Mar. 2023

1 / 2

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FM.BL.MTC.002 Rev.4

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Request No. 21-66/0344

MTC No. EEL. BP. 161/0266

Acoustic signal test of frequency weightings

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

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

Calibrated by :

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

Approved by :

Prawate Kluaypa
.....
(Mr. Prawate Kluaypa)

Director

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

Ref : 2011266022700826004

Date of Calibration : 7 Mar. 2023

Date of Issue : 8 Mar. 2023

2 / 2

End of Certificate

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0064

MTC No. EEL. BP. 1/1165

CALIBRATION CERTIFICATE

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

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

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

Instrument Calibrated :

Description : Noise Dosimeter

Manufacturer : Svantek

Model : SV-104IS

Serial No. : 80831

Ambient Environment

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

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

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

Standards used :

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

Calibration Procedure :

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

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

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

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

Date of Receipt : 1 Nov. 2022

Date of Calibration : 7 Nov. 2022

1 / 2

G. Samy

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

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FM.BL.MTC.002 Rev.4

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E-mail : sumalee@tistr.or.th

Request No. 21-66/0064


MTC No. EEL. BP. 1/1165

Acoustic signal test of frequency weightings

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

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

Calibrated by :


.....
(Mr. Sanaey Grajang)

Approved by :


.....
(Mr. Prawate Kluaypa)

Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011265110104700001

Date of Calibration : 7 Nov. 2022

Date of Issue : 8 Nov. 2022

2 / 2

End of Certificate

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

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FM.BL.MTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0064

MTC No. EEL. BP. 2/1165

CALIBRATION CERTIFICATE

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

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

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

Instrument Calibrated :

Description : Noise Dosimeter

Manufacturer : Svantek

Model : SV-104IS

Serial No. : 80832

Ambient Environment

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

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

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

Standards used :

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

Calibration Procedure :

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

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

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

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

Date of Receipt : 1 Nov. 2022

Date of Calibration : 7 Nov. 2022

1 / 2

Gr. Saming

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

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FM.BL.MTC.002 Rev.4

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Fax. (66) 0 2579 8592

E-mail : sumalee@tistr.or.th

Request No. 21-66/0064


MTC No. EEL. BP. 2/1165

Acoustic signal test of frequency weightings

Frequency (Hz)	Deviation from response curve		Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)		
125	-0.4	-1.5	0.25	2.0
1 000	0.0	-0.3	0.25	1.4
4 000	0.1	-0.1	0.25	3.6

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

Calibrated by :


.....
(Mr. Sanaey Grajang)

Approved by :



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

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011265110104700002

Date of Calibration : 7 Nov. 2022

Date of Issue : 8 Nov. 2022

2 / 2

End of Certificate

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FM.BL.MTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0064

MTC No. EEL. BP. 3/1165

CALIBRATION CERTIFICATE

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

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

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

Instrument Calibrated :

Description : Noise Dosimeter

Manufacturer : Svantek

Model : SV-104IS

Serial No. : 80834

Ambient Environment

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

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

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

Standards used :

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

Calibration Procedure :

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

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

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

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

Date of Receipt : 1 Nov. 2022

Date of Calibration : 7 Nov. 2022

1 / 2

Gr. Samy

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FM.BL.MTC.002 Rev.4

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E-mail : sumalee@tistr.or.th

Request No. 21-66/0064


MTC No. EEL. BP. 3/1165

Acoustic signal test of frequency weightings

Frequency (Hz)	Deviation from response curve		Uncertainty (\pm dB)	Tolerance Limits Class 2 (\pm dB)
	A-weighting (dB)	C-weighting (dB)		
125	-0.1	-0.5	0.25	2.0
1 000	-0.1	-0.2	0.25	1.4
4 000	0.3	0.3	0.25	3.6

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

Calibrated by :


.....
(Mr. Sanaey Grajang)

Approved by :



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

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011265110104700003

Date of Calibration : 7 Nov. 2022

Date of Issue : 8 Nov. 2022

2 / 2

End of Certificate

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

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FM.BL.MTC.002 Rev.4

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ภาคผนวกที่ 5-8

เอกสารสอบเทียบเครื่องมือการตรวจวัด
ระดับความเข้มของแสงสว่างในสถานประกอบการ

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : LUX METER
MANUFACTURER : EXTECH INSTRUMENTS
MODEL / TYPE : 407026
SERIAL NO. : A.052318/A.052318 [LUX-R06]
CLID. NO. : 252201552
JOB CONTROL NO. : 230725081563

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

DATE OF RECEIVED : 25 July 2023

DATE OF ISSUED : 31 July 2023

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

Calibrated By : Suwit Phuanbusabong
Calibration Engineer



Approved By : Mongkol Yotsoontorn
Authorized Signatory
31 July 2023



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. Q23081563

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REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	LUX METER
MANUFACTURER	:	EXTECH INSTRUMENTS
MODEL / TYPE	:	407026
SERIAL NO.	:	A.052318/A.052318 [LUX-R06]
DATE OF CALIBRATION	:	26 July 2023
DUE DATE OF CALIBRATION	:	26 July 2024

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, Bentham Model ORM400/DH400VL S/N. 27710,27585/3.

TRACEABILITY :

The measurements are traceable to International System of Units (SI) , through Optical Test and Calibration Ltd.
Certificate No. 144408/ABU, Due Date 03 April 2024.

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)"

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CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

LUX METER

STD Applied (lux)	DUC Reading (lux)	Correction (lux)	Uncertainty \pm (% of rdg.)
100	104	-4	2.6
200	208	-8	2.6
300	312	-12	2.6
1000	1035	-35	2.6
2000	2070	-70	2.6
3000	3100	-100	3.6

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 008 Page 46 of 54

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

End of Certificate

Certificate No. Q23081563

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