

## ภาคผนวกที่ 4

### เอกสารการสอบเทียบความถูกต้องของเครื่องมือ

**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง  
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม**

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
<b>1. คุณภาพอากาศ</b>		
<u>คุณภาพอากาศในบรรยากาศ</u>		
- Total Suspended Particulate	- High Volume Air Sampler No. B10, B11, B27	- Digital Balance
- Nitrogen Dioxide	- NO <sub>x</sub> Analyzer No. B06, B08, B18	- NO <sub>x</sub> Analyzer No. B06, B08, B18
- o-Xylene	- Personal Pump SKC No. B04, B06, B07, B13, B35	- GC/FID
- Maleic Anhydride	- Rotameter No. L-B04 - Personal Pump SKC No. B01, B03, B04, B05, B08 - Rotameter No. L-B04	- HPLC Meter
<u>คุณภาพอากาศจากปล่อง</u>		
- Total Suspended Particulate	- Console No. B05 - Pitot Tube No. B48	- Digital Balance
- Oxide of Nitrogen	- Vacuum Gauge	- Spectrophotometer
- Carbon Monoxide	- Personal Pump SKC No. B26 - Rotameter No. H-B08	- CO Analyzer No. B08
- o-Xylene	- Personal Pump SKC No. B40 - Rotameter No. L-B08 - Pitot Tube No. B49	- GC/FID
- Maleic Anhydride	- Personal Pump SKC No. B26 - Rotameter No. H-B08 - Pitot Tube No. B49	- HPLC Meter
<u>คุณภาพอากาศในสถานประกอบการ</u>		
- Total Dust	- Personal Pump SKC No. B11, B52 - Rotameter No. H-B07, H-B08	- Digital Balance
- Octhanol	- Personal Pump SKC No. B26, B41 - Rotameter No. L-B07, L-B08	- GC/FID
- Dioctyl Phthalate	- Personal Pump SKC No. B01, B04, B21, B29, B35, B60 - Rotameter No. H-B07, H-B08	- GC/FID
- o-Xylene	- Personal Pump SKC No. B13, B51 - Rotameter No. L-B07, L-B08	- GC/FID

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง  
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม (ต่อ)

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
<b>2. ระดับเสียง</b> <u>ระดับเสียงในบรรยากาศ</u> - $L_{eq}$ 24 hr  <u>ระดับเสียงในสถานประกอบการ</u> - $L_{eq}$ 8 hr และ $L_{max}$  - Noise Dose	- Acoustic Calibrator - Sound Level Meter No. ACO-B21  - Acoustic Calibrator - Sound Level Meter No. ACO-B06, B22, B38, B40  - Acoustic Calibrator - Noise Dosimeter No. NMD-B01, B02, B03	-   -   -
<b>3. คุณภาพน้ำ</b> <u>คุณภาพน้ำทิ้ง</u> - pH - Total Suspended Solids - Total Dissolved Solid - COD - $BOD_5$ - Grease & Oil <u>คุณภาพน้ำใต้ดินจากบ่อสังเกตการณ์</u> - pH - o-Xylene - Phthalate esters - 2-Ethylhexanol - Total Petroleum Hydrocarbon	- - - - - - - - -	- pH Meter - Digital Balance - Digital Balance - COD Reactor - DO Meter - Digital Balance  - pH Meter - GC/MS - GC/MS - GC/MS - GC/FID
<b>4. ระดับความเข้มของแสงสว่างในสถานประกอบการ</b> - Light	- Lux Meter No. B10	-

คุณภาพอากาศ





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

## High Volume Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3611

### Calibration Data

High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft <sup>3</sup> /min)	R <sup>2</sup>
B01	B01	01/08/2022	$y = 1.310x - 7.517$	0.998
B02	B02	01/08/2022	$y = 1.098x + 2.659$	0.997
B03	B03	01/08/2022	$y = 1.089x + 0.857$	0.998
B04	B04	01/08/2022	$y = 1.206x - 3.858$	0.995
B05	B05	01/08/2022	$y = 1.285x - 7.595$	0.997
B06	B06	01/08/2022	$y = 1.287x - 6.981$	0.998
B07	B07	01/08/2022	$y = 1.197x - 4.681$	0.998
B08	B08	01/08/2022	$y = 1.224x - 5.592$	0.999
B09	B09	01/08/2022	$y = 1.275x - 6.394$	0.997
B10	B10	01/08/2022	$y = 1.121x + 1.091$	0.995
B11	B11	04/08/2022	$y = 1.165x - 2.766$	0.998
B12	B12	04/08/2022	$y = 1.230x - 4.896$	0.998
B13	B13	01/08/2022	$y = 1.249x - 6.430$	0.996
B14	B14	02/08/2022	$y = 1.232x - 4.320$	0.996
B15	B15	02/08/2022	$y = 1.134x - 0.926$	0.997
B16	B16	02/08/2022	$y = 1.261x - 6.890$	0.998
B17	B17	02/08/2022	$y = 1.175x - 2.039$	0.997
B18	B18	02/08/2022	$y = 1.290x - 7.805$	0.999
B19	B19	02/08/2022	$y = 1.375x - 11.753$	0.995
B20	B20	02/08/2022	$y = 1.262x - 7.100$	0.999
B21	B21	03/08/2022	$y = 1.142x - 1.809$	0.999
B22	B22	02/08/2022	$y = 1.289x - 8.540$	0.997
B23	B23	02/08/2022	$y = 1.216x - 4.912$	0.999
B24	B24	01/08/2022	$y = 1.147x - 1.299$	1.000
B25	B25	02/08/2022	$y = 1.025x + 3.341$	0.997
B26	B26	02/08/2022	$y = 1.184x - 3.486$	0.995
B27	B27	03/08/2022	$y = 1.237x - 6.825$	0.996
B28	B28	02/08/2022	$y = 1.284x - 7.704$	0.998
B29	B29	02/08/2022	$y = 1.305x - 8.854$	0.996
B30	B30	03/08/2022	$y = 1.227x - 5.387$	0.996
B31	B31	03/08/2022	$y = 1.215x - 4.628$	0.995
B32	B32	03/08/2022	$y = 1.313x - 8.558$	0.995
B33	B33	03/08/2022	$y = 1.330x - 7.545$	1.000
B34	B34	03/08/2022	$y = 1.287x - 8.617$	0.999

Calibrated by :

Approved by :



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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

CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO <sub>2</sub> / NO <sub>x</sub> ANALYZER					
DATE :	24 October 2022	BRAND :	API	MODEL :	200E
NO.	NOX-B06	SERIAL NO.	2286		
Calibrator (Dilution System)					
Brand	: API			Model	: 700
Last Cal. Date	: 04 August 2022			Serial No.	: 911
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	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	399.7	-0.075	400.0	1.004
NO <sub>x</sub> Span	400	400.1	0.025	400.0	1.007
API Model 200E NO <sub>x</sub> 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	669	V	420 - 900 constant		
RCELL TEMP	50.0	°C	50 ± 1		
BOX TEMP	28.9	°C	8 - 48		
PMT TEMP	7.2	°C	7 ± 2		
MOLY TEMP	315.4	°C	315 ± 5		
RCELL PRESS	8.2	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 <sub>x</sub> Span Conc	400	PPB	20 - 20,000		
NO Slope	1.004	-	1.0 ± 0.3		
NO <sub>x</sub> Slope	1.007	-	1.0 ± 0.3		
NO Offset	1.2	mV	-20 to +150		
NO <sub>x</sub> Offset	0.8	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 : \_\_\_\_\_

Approved : \_\_\_\_\_





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### CALIBRATION REPORT

#### CHEMILUMINESCENT NO / NO<sub>2</sub> / NO<sub>x</sub> ANALYZER

DATE : 24 October 2022

BRAND : API

MODEL : 200E

NO. NOX-B08

SERIAL NO. 4336

#### Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 04 August 2022

Serial No. : 911

#### 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	400.2	0.050	400.0	1.009
NO <sub>x</sub> Span	400	400.3	0.075	400.0	1.013

#### API Model 200E NO<sub>x</sub> 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	511	cc/min	500 ± 50
OZONE FLOW	79	cc/min	80 ± 15
PMT	103.0	mV	-20 - 150
AZERO	93.8	mV	-20 - 150
HVPS	672	V	420 - 900 constant
RCELL TEMP	50.1	°C	50 ± 1
BOX TEMP	29.0	°C	8 - 48
PMT TEMP	7.4	°C	7 ± 2
MOLY TEMP	314.8	°C	315 ± 5
RCELL PRESS	8.3	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.4	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO <sub>x</sub> Span Conc	400	PPB	20 - 20,000
NO Slope	1.009	-	1.0 ± 0.3
NO <sub>x</sub> Slope	1.013	-	1.0 ± 0.3
NO Offset	1.6	mV	-20 to +150
NO <sub>x</sub> Offset	1.0	mV	-20 to 150
Stability at Zero	0.1	PPB	< 0.2
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas

Calibrated by : \_\_\_\_\_

Approved \_\_\_\_\_



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## CALIBRATION REPORT

### CHEMILUMINESCENT NO / NO<sub>2</sub> / NO<sub>x</sub> ANALYZER

DATE : 24 October 2022

BRAND : API

MODEL : TML-41M

NO. NOX-B18

SERIAL NO. N07543

#### Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 04 August 2022

Serial No. : 911

#### 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	1.002
NO <sub>x</sub> Span	400	399.8	-0.050	400.0	1.005

#### API Model TML-41M NO<sub>x</sub> 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	508	cc/min	500 ± 50
OZONE FLOW	78	cc/min	80 ± 15
PMT	103.2	mV	-20 - 150
AZERO	94.0	mV	-20 - 150
HVPS	670	V	420 - 900 constant
RCELL TEMP	50.2	°C	50 ± 1
BOX TEMP	29.4	°C	8 - 48
PMT TEMP	7.5	°C	7 ± 2
MOLY TEMP	315.1	°C	315 ± 5
RCELL PRESS	8.4	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.6	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO <sub>x</sub> Span Conc	400	PPB	20 - 20,000
NO Slope	1.002	-	1.0 ± 0.3
NO <sub>x</sub> Slope	1.005	-	1.0 ± 0.3
NO Offset	1.1	mV	-20 to +150
NO <sub>x</sub> 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 :

Approved





บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด  
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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 <sup>2</sup>
B01	SKC	224-PCXR4	262101	04/07/2022	1,000	1,500	2,000	994	1,497	1,998	1.002x - 4.028	1.000
B02	SKC	224-PCXR4	626166	01/07/2022	1,000	1,500	2,000	1,002	1,505	2,001	1.009x - 20.106	0.999
B03	SKC	224-PCXR4	612968	04/07/2022	1,000	1,500	2,000	996	1,494	2,001	1.006x - 12.907	1.000
B04	SKC	224-PCXR4	602804	04/07/2022	1,000	1,500	2,000	1,000	1,502	1,996	1.001x - 2.688	1.000
B05	SKC	224-PCXR4	612693	04/07/2022	1,000	1,500	2,000	1,003	1,499	2,003	1.012x - 22.383	0.999
B06	SKC	224-PCXR4	262188	04/07/2022	1,000	1,500	2,000	996	1,508	2,009	1.020x - 35.110	0.999
B07	SKC	224-PCXR4	626262	01/07/2022	1,000	1,500	2,000	998	1,492	1,995	0.992x + 6.884	1.000
B08	SKC	224-PCXR4	626100	01/07/2022	1,000	1,500	2,000	1,003	1,499	2,003	1.012x - 23.269	0.999
B09	SKC	224-PCXR4	626479	01/07/2022	1,000	1,500	2,000	997	1,490	1,994	0.993x + 3.909	1.000
B10	SKC	224-PCXR4	091950	01/07/2022	1,000	1,500	2,000	993	1,503	2,001	1.017x - 33.950	0.999
B11	SKC	224-PCXR8	564315	04/07/2022	1,000	1,500	2,000	995	1,490	1,999	1.004x - 10.290	1.000
B12	SKC	224-PCXR4	034656	04/07/2022	1,000	1,500	2,000	1,003	1,503	2,003	1.010x - 19.404	0.999
B13	SKC	224-PCXR4	602073	04/07/2022	1,000	1,500	2,000	995	1,500	1,999	1.001x - 3.554	1.000
B14	SKC	224-PCXR4	626313	04/07/2022	1,000	1,500	2,000	999	1,491	1,988	0.992x + 7.243	1.000
B15	SKC	224-PCXR4	626474	04/07/2022	1,000	1,500	2,000	1,003	1,502	2,005	1.013x - 23.723	0.999
B16	SKC	224-PCXR4	626477	01/07/2022	1,000	1,500	2,000	994	1,504	2,001	1.015x - 31.425	0.999
B17	SKC	224-PCXR4	626860	04/07/2022	1,000	1,500	2,000	997	1,495	1,991	0.997x - 0.558	1.000
B18	SKC	224-PCXR4	691484	01/07/2022	1,000	1,500	2,000	1,003	1,500	2,001	1.009x - 18.825	0.999
B19	SKC	224-PCXR4	691599	01/07/2022	1,000	1,500	2,000	995	1,503	1,999	1.005x - 7.985	1.000
B20	SKC	224-PCXR4	691587	01/07/2022	1,000	1,500	2,000	993	1,504	1,999	1.014x - 30.719	0.999
B21	SKC	224-PCXR4	691531	04/07/2022	1,000	1,500	2,000	993	1,499	1,994	1.001x - 7.187	1.000
B22	SKC	224-PCXR4	691654	01/07/2022	1,000	1,500	2,000	1,004	1,501	2,003	1.011x - 19.990	0.999
B23	SKC	224-PCXR4	798393	04/07/2022	1,000	1,500	2,000	993	1,505	2,002	1.017x - 34.763	0.999
B24	SKC	224-PCXR4	626363	01/07/2022	1,000	1,500	2,000	1,000	1,502	2,000	1.011x - 22.826	0.999
B25	SKC	224-PCXR4	798489	04/07/2022	1,000	1,500	2,000	1,001	1,512	2,001	0.998x + 4.850	1.000
B26	SKC	224-PCXR4	798479	05/07/2022	1,000	1,500	2,000	999	1,499	1,993	0.996x + 2.692	1.000
B27	SKC	224-PCXR4	691673	05/07/2022	1,000	1,500	2,000	993	1,503	2,002	1.017x - 32.988	0.999
B28	SKC	224-PCXR4	691570	05/07/2022	1,000	1,500	2,000	1,001	1,500	2,002	1.012x - 23.632	0.999
B29	SKC	224-PCXR4	626472	05/07/2022	1,000	1,500	2,000	999	1,494	1,998	1.002x - 6.856	1.000
B30	SKC	224-PCXR4	691489	05/07/2022	1,000	1,500	2,000	1,004	1,500	2,004	1.013x - 22.910	0.999
B31	SKC	224-PCXR4	691509	04/07/2022	1,000	1,500	2,000	993	1,495	1,998	1.004x - 9.879	1.000
B32	SKC	224-PCXR4	091567	05/07/2022	1,000	1,500	2,000	992	1,504	2,001	1.016x - 32.243	0.999
B33	SKC	224-PCXR4	091756	05/07/2022	1,000	1,500	2,000	994	1,496	1,991	0.996x + 0.634	1.000
B34	SKC	224-PCXR4	612962	05/07/2022	1,000	1,500	2,000	1,002	1,501	2,002	1.011x - 21.693	0.999
B35	SKC	224-PCXR4	602682	04/07/2022	1,000	1,500	2,000	993	1,498	1,996	1.001x - 7.411	1.000
B36	SKC	224-PCXR4	626164	04/07/2022	1,000	1,500	2,000	999	1,495	1,999	1.000x - 4.946	1.000
B37	SKC	224-PCXR4	626256	01/07/2022	1,000	1,500	2,000	994	1,506	2,000	1.014x - 28.892	0.999
B38	SKC	224-PCXR4	626167	04/07/2022	1,000	1,500	2,000	997	1,497	1,996	1.002x - 5.504	1.000
B39	SKC	224-PCXR4	034637	04/07/2022	1,000	1,500	2,000	1,003	1,500	2,002	1.011x - 22.048	0.999
B40	SKC	224-PCXR4	798349	05/07/2022	1,000	1,500	2,000	992	1,505	1,998	1.015x - 32.514	0.999

Calibrated by :

Approved by





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.)			y	R <sup>2</sup>
					1	2	3	1	2	3		
B41	SKC	224-PCXR4	612669	06/07/2022	1,000	1,500	2,000	998	1,496	1,990	0.994x + 3.749	1.000
B42	SKC	224-PCXR4	626041	06/07/2022	1,000	1,500	2,000	1,003	1,498	1,995	0.990x + 12.946	1.000
B43	SKC	224-PCXR4	034636	06/07/2022	1,000	1,500	2,000	999	1,501	1,992	0.991x + 10.805	1.000
B44	SKC	224-PCXR8	529341	06/07/2022	1,000	1,500	2,000	1,002	1,501	2,003	1.012x - 21.857	0.999
B45	SKC	224-PCXR8	529594	04/07/2022	1,000	1,500	2,000	997	1,498	1,989	0.994x + 4.563	1.000
B46	SKC	224-PCXR8	566743	01/07/2022	1,000	1,500	2,000	994	1,504	2,002	1.016x - 33.363	0.999
B47	SKC	224-PCXR8	566747	04/07/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.013x - 25.000	0.999
B48	SKC	224-PCXR8	566753	04/07/2022	1,000	1,500	2,000	999	1,494	1,998	0.999x - 2.194	1.000
B49	SKC	224-PCXR8	566780	04/07/2022	1,000	1,500	2,000	1,003	1,502	2,003	1.012x - 22.626	0.999
B50	SKC	224-PCXR8	500400	04/07/2022	1,000	1,500	2,000	1,002	1,495	2,002	1.001x - 3.458	1.000
B51	SKC	224-PCXR8	500363	04/07/2022	1,000	1,500	2,000	995	1,504	2,000	1.012x - 26.388	0.999
B52	SKC	224-PCXR8	093186	04/07/2022	1,000	1,500	2,000	995	1,497	1,994	0.997x - 1.360	1.000
B53	SKC	224-PCXR8	707670	04/07/2022	1,000	1,500	2,000	1,002	1,499	2,002	1.010x - 20.947	0.999
B54	SKC	224-PCXR3	509821	01/07/2022	1,000	1,500	2,000	993	1,501	2,001	1.016x - 33.878	0.999
B55	SKC	224-PCXR3	510710	01/07/2022	1,000	1,500	2,000	1,000	1,494	1,993	0.993x + 5.432	1.000
B56	SKC	224-PCXR3	511450	01/07/2022	1,000	1,500	2,000	1,002	1,500	2,001	1.011x - 20.804	0.999
B57	SKC	224-PCXR3	510798	01/07/2022	1,000	1,500	2,000	997	1,493	1,998	1.001x - 3.199	1.000
B58	SKC	224-PCXR3	509852	05/07/2022	1,000	1,500	2,000	1,001	1,498	1,999	1.007x - 19.033	0.999
B59	SKC	224-PCXR3	509862	05/07/2022	1,000	1,500	2,000	996	1,503	1,994	0.997x + 3.115	1.000
B60	SKC	224-PCXR3	512655	04/07/2022	1,000	1,500	2,000	1,002	1,500	2,003	1.012x - 23.691	0.999
B61	SKC	224-PCXR3	503915	04/07/2022	1,000	1,500	2,000	994	1,489	1,998	1.004x - 11.866	1.000
B62	SKC	224-PCXR3	505975	04/07/2022	1,000	1,500	2,000	999	1,494	1,996	0.997x - 0.104	1.000
B63	SKC	224-PCXR3	511432	01/07/2022	1,000	1,500	2,000	991	1,501	1,999	1.017x - 35.541	0.999
B64	SKC	224-PCXR3	508302	01/07/2022	1,000	1,500	2,000	997	1,493	1,989	0.992x + 5.947	1.000
B65	SKC	224-PCXR3	508310	04/07/2022	1,000	1,500	2,000	1,002	1,500	2,003	1.012x - 22.949	0.999
B66	SKC	224-PCXR3	509861	05/07/2022	1,000	1,500	2,000	1,002	1,491	1,991	0.988x + 13.425	1.000
B67	SKC	224-PCXR3	506295	01/07/2022	1,000	1,500	2,000	993	1,507	2,004	1.017x - 32.945	0.999
B68	SKC	224-PCXR3	505872	01/07/2022	1,000	1,500	2,000	1,002	1,491	1,997	0.994x + 5.755	1.000
B69	SKC	224-PCXR3	508375	01/07/2022	1,000	1,500	2,000	1,001	1,500	2,000	1.010x - 21.569	0.999
B70	SKC	224-PCXR3	510623	04/07/2022	1,000	1,500	2,000	992	1,503	1,997	1.002x - 6.533	1.000
B71	SKC	224-PCXR3	508367	05/07/2022	1,000	1,500	2,000	990	1,506	2,002	1.018x - 37.184	0.999
B72	SKC	224-PCXR3	505977	05/07/2022	1,000	1,500	2,000	1,001	1,498	1,993	0.993x + 5.652	1.000
B73	SKC	224-PCXR3	512606	04/07/2022	1,000	1,500	2,000	1,001	1,501	2,005	1.013x - 24.278	0.999
B74	SKC	224-PCXR3	505993	01/07/2022	1,000	1,500	2,000	996	1,495	1,994	1.000x - 4.682	1.000
B75	SKC	224-PCXR3	509820	01/07/2022	1,000	1,500	2,000	996	1,499	1,990	0.994x + 3.625	1.000
B76	SKC	224-PCXR3	509811	04/07/2022	1,000	1,500	2,000	993	1,498	1,998	1.007x - 14.602	1.000
B77	SKC	224-PCXR3	508301	04/07/2022	1,000	1,500	2,000	1,000	1,501	2,004	1.014x - 26.842	0.999
B78	SKC	224-PCXR3	510677	04/07/2022	1,000	1,500	2,000	996	1,503	1,998	1.012x - 27.121	0.999
B79	SKC	224-PCXR3	510920	04/07/2022	1,000	1,500	2,000	994	1,493	1,994	0.999x - 3.506	1.000

Calibrated by :

Approved by :





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	R²
B01	SKC	224-PCXR4	262101	06/10/2022	1,000	1,500	2,000	994	1,497	1,998	1.001x - 3.789	1.000
B02	SKC	224-PCXR4	626166	03/10/2022	1,000	1,500	2,000	1,002	1,505	2,001	1.009x - 19.707	0.999
B03	SKC	224-PCXR4	612968	03/10/2022	1,000	1,500	2,000	996	1,494	2,001	1.006x - 12.308	1.000
B04	SKC	224-PCXR4	602804	03/10/2022	1,000	1,500	2,000	1,000	1,502	2,000	1.004x - 5.919	1.000
B05	SKC	224-PCXR4	612693	06/10/2022	1,000	1,500	2,000	1,003	1,499	2,003	1.012x - 22.622	0.999
B06	SKC	224-PCXR4	262188	06/10/2022	1,000	1,500	2,000	995	1,507	1,999	1.005x - 11.738	1.000
B07	SKC	224-PCXR4	626262	04/10/2022	1,000	1,500	2,000	998	1,492	1,995	0.993x + 6.405	1.000
B08	SKC	224-PCXR4	626100	04/10/2022	1,000	1,500	2,000	1,002	1,499	2,003	1.013x - 24.18	0.999
B09	SKC	224-PCXR4	626479	06/10/2022	1,000	1,500	2,000	996	1,490	1,994	0.994x + 1.675	1.000
B10	SKC	224-PCXR4	091950	03/10/2022	1,000	1,500	2,000	993	1,503	2,001	1.017x - 34.588	0.999
B11	SKC	224-PCXR8	564315	06/10/2022	1,000	1,500	2,000	994	1,490	2,003	1.007x - 14.438	1.000
B12	SKC	224-PCXR4	034656	03/10/2022	1,000	1,500	2,000	1,003	1,503	2,003	1.010x - 19.005	0.999
B13	SKC	224-PCXR4	602073	03/10/2022	1,000	1,500	2,000	995	1,500	1,993	0.997x + 2.708	1.000
B14	SKC	224-PCXR4	626313	03/10/2022	1,000	1,500	2,000	998	1,491	1,988	0.992x + 6.007	1.000
B15	SKC	224-PCXR4	626474	03/10/2022	1,000	1,500	2,000	1,003	1,502	2,005	1.003x - 10.123	0.999
B16	SKC	224-PCXR4	626477	03/10/2022	1,000	1,500	2,000	993	1,504	2,001	1.015x - 31.624	0.999
B17	SKC	224-PCXR4	626860	03/10/2022	1,000	1,500	2,000	997	1,494	1,991	0.997x - 0.239	1.000
B18	SKC	224-PCXR4	691484	03/10/2022	1,000	1,500	2,000	1,003	1,500	2,001	1.008x - 16.073	0.999
B19	SKC	224-PCXR4	691599	03/10/2022	1,000	1,500	2,000	993	1,503	2,000	1.005x - 8.623	1.000
B20	SKC	224-PCXR4	691587	03/10/2022	1,000	1,500	2,000	991	1,504	1,999	1.016x - 33.631	0.999
B21	SKC	224-PCXR4	691531	06/10/2022	1,000	1,500	2,000	993	1,500	1,994	1.001x - 6.669	1.000
B22	SKC	224-PCXR4	691654	04/10/2022	1,000	1,500	2,000	1,003	1,501	2,003	1.011x - 20.429	0.999
B23	SKC	224-PCXR4	798393	04/10/2022	1,000	1,500	2,000	993	1,505	2,002	1.018x - 34.843	0.999
B24	SKC	224-PCXR4	626363	06/10/2022	1,000	1,500	2,000	999	1,502	2,000	1.012x - 23.225	0.999
B25	SKC	224-PCXR4	798489	06/10/2022	1,000	1,500	2,000	1,001	1,512	2,001	0.998x + 5.049	1.000
B26	SKC	224-PCXR4	798479	06/10/2022	1,000	1,500	2,000	999	1,499	1,993	0.996x + 2.892	1.000
B27	SKC	224-PCXR4	691673	06/10/2022	1,000	1,500	2,000	994	1,503	1,999	1.011x - 22.778	0.999
B28	SKC	224-PCXR4	691570	04/10/2022	1,000	1,500	2,000	1,001	1,500	2,002	1.007x - 13.301	1.000
B29	SKC	224-PCXR4	626472	06/10/2022	1,000	1,500	2,000	1,000	1,496	1,998	1.002x - 5.261	1.000
B30	SKC	224-PCXR4	691489	03/10/2022	1,000	1,500	2,000	1,007	1,500	2,004	1.010x - 18.482	0.999
B31	SKC	224-PCXR4	691509	03/10/2022	1,000	1,500	2,000	993	1,497	1,998	1.004x - 8.882	1.000
B32	SKC	224-PCXR4	091567	03/10/2022	1,000	1,500	2,000	992	1,504	2,001	1.007x - 15.930	1.000
B33	SKC	224-PCXR4	091756	06/10/2022	1,000	1,500	2,000	994	1,496	1,991	0.996x + 0.714	1.000
B34	SKC	224-PCXR4	612962	03/10/2022	1,000	1,500	2,000	1,002	1,501	2,001	1.009x - 17.944	0.999
B35	SKC	224-PCXR4	602682	03/10/2022	1,000	1,500	2,000	993	1,498	1,995	1.001x - 7.331	1.000
B36	SKC	224-PCXR4	626164	06/10/2022	1,000	1,500	2,000	999	1,495	1,999	1.000x - 4.866	1.000
B37	SKC	224-PCXR4	626256	06/10/2022	1,000	1,500	2,000	994	1,506	1,999	1.013x - 28.214	0.999
B38	SKC	224-PCXR4	626167	06/10/2022	1,000	1,500	2,000	997	1,496	1,996	1.002x - 6.342	1.000
B39	SKC	224-PCXR4	034637	06/10/2022	1,000	1,500	2,000	1,006	1,500	2,001	1.008x - 16.624	0.999
B40	SKC	224-PCXR4	798349	05/10/2022	1,000	1,500	2,000	994	1,505	1,998	1.014x - 29.642	0.999

Calibrated by :

Approved by :





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, Chaluchak, 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 <sup>2</sup>
B41	SKC	224-PCXR4	612669	05/10/2022	1,000	1,500	2,000	998	1,496	1,990	0.994x + 3.271	1.000
B42	SKC	224-PCXR4	626041	06/10/2022	1,000	1,500	2,000	1,005	1,498	1,994	0.988x + 15.619	1.000
B43	SKC	224-PCXR4	034636	06/10/2022	1,000	1,500	2,000	999	1,501	1,992	0.991x + 10.565	1.000
B44	SKC	224-PCXR8	529341	06/10/2022	1,000	1,500	2,000	1,002	1,502	2,002	1.011x - 21.418	0.999
B45	SKC	224-PCXR8	529594	06/10/2022	1,000	1,500	2,000	998	1,498	1,989	0.993x + 5.959	1.000
B46	SKC	224-PCXR8	566743	06/10/2022	1,000	1,500	2,000	994	1,504	2,002	1.016x - 32.885	0.999
B47	SKC	224-PCXR8	566747	06/10/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.013x - 24.960	0.999
B48	SKC	224-PCXR8	566753	03/10/2022	1,000	1,500	2,000	999	1,494	1,998	0.999x - 2.114	1.000
B49	SKC	224-PCXR8	566780	05/10/2022	1,000	1,500	2,000	1,003	1,502	2,003	1.012x - 22.706	0.999
B50	SKC	224-PCXR8	500400	06/10/2022	1,000	1,500	2,000	1,001	1,495	2,002	1.001x - 3.737	1.000
B51	SKC	224-PCXR8	500363	06/10/2022	1,000	1,500	2,000	995	1,504	1,999	1.011x - 25.590	0.999
B52	SKC	224-PCXR8	093186	03/10/2022	1,000	1,500	2,000	995	1,496	1,994	0.997x - 1.161	1.000
B53	SKC	224-PCXR8	707670	03/10/2022	1,000	1,500	2,000	1,002	1,500	2,002	1.010x - 20.668	0.999
B54	SKC	224-PCXR3	509821	03/10/2022	1,000	1,500	2,000	993	1,500	2,001	1.017x - 34.516	0.999
B55	SKC	224-PCXR3	510710	03/10/2022	1,000	1,500	2,000	999	1,494	1,994	0.995x + 2.521	1.000
B56	SKC	224-PCXR3	511450	03/10/2022	1,000	1,500	2,000	1,002	1,500	2,001	1.004x - 7.562	1.000
B57	SKC	224-PCXR3	510798	06/10/2022	1,000	1,500	2,000	997	1,492	1,998	0.996x +1.109	1.000
B58	SKC	224-PCXR3	509852	06/10/2022	1,000	1,500	2,000	1,000	1,498	1,999	1.007x - 19.113	0.999
B59	SKC	224-PCXR3	509862	03/10/2022	1,000	1,500	2,000	996	1,503	1,994	0.997x + 2.955	1.000
B60	SKC	224-PCXR3	512655	03/10/2022	1,000	1,500	2,000	1,005	1,500	2,003	1.010x - 19.862	0.999
B61	SKC	224-PCXR3	503915	04/10/2022	1,000	1,500	2,000	994	1,489	1,998	1.004x - 11.786	1.000
B62	SKC	224-PCXR3	505975	03/10/2022	1,000	1,500	2,000	999	1,494	1,996	0.997x - 0.064	1.000
B63	SKC	224-PCXR3	511432	03/10/2022	1,000	1,500	2,000	991	1,501	1,999	1.017x - 35.461	0.999
B64	SKC	224-PCXR3	508302	03/10/2022	1,000	1,500	2,000	997	1,492	1,989	0.992x + 6.266	1.000
B65	SKC	224-PCXR3	508310	06/10/2022	1,000	1,500	2,000	1,002	1,500	2,003	1.011x - 21.992	0.999
B66	SKC	224-PCXR3	509861	06/10/2022	1,000	1,500	2,000	1,002	1,491	1,991	0.988x + 13.904	1.000
B67	SKC	224-PCXR3	506295	06/10/2022	1,000	1,500	2,000	993	1,508	2,004	1.017x - 32.785	0.999
B68	SKC	224-PCXR3	505872	05/10/2022	1,000	1,500	2,000	1,002	1,491	1,997	0.994x + 5.237	1.000
B69	SKC	224-PCXR3	508375	05/10/2022	1,000	1,500	2,000	1,001	1,499	2,000	1.010x - 21.330	0.999
B70	SKC	224-PCXR3	510623	05/10/2022	1,000	1,500	2,000	992	1,503	1,997	1.002x - 6.054	1.000
B71	SKC	224-PCXR3	508367	05/10/2022	1,000	1,500	2,000	990	1,506	2,002	1.018x - 37.025	0.999
B72	SKC	224-PCXR3	505977	05/10/2022	1,000	1,500	2,000	1,001	1,498	1,993	0.993x + 5.731	1.000
B73	SKC	224-PCXR3	512606	05/10/2022	1,000	1,500	2,000	1,001	1,501	2,005	1.014x - 24.397	0.999
B74	SKC	224-PCXR3	505993	05/10/2022	1,000	1,500	2,000	996	1,495	1,994	0.999x - 4.284	1.000
B75	SKC	224-PCXR3	509820	05/10/2022	1,000	1,500	2,000	996	1,498	1,990	0.995x + 2.987	1.000
B76	SKC	224-PCXR3	509811	03/10/2022	1,000	1,500	2,000	993	1,498	1,998	1.006x - 14.003	1.000
B77	SKC	224-PCXR3	508301	06/10/2022	1,000	1,500	2,000	1,000	1,501	2,003	1.014x - 25.845	0.999
B78	SKC	224-PCXR3	510677	06/10/2022	1,000	1,500	2,000	996	1,503	1,999	1.012x - 27.321	0.999
B79	SKC	224-PCXR3	510920	06/10/2022	1,000	1,500	2,000	994	1,493	1,994	0.999x - 3.905	1.000

Calibrated by :

Approved by :





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

Rotameter Calibration Report (For Personal Pump 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 <sup>2</sup>
H-B01	Dwyer	VFB-65	04/07/2022	500	1,000	2,000	505.3	989.5	1973.5	0.990x + 8.629	1.000
H-B02	Dwyer	VFB-65	04/07/2022	500	1,000	2,000	495.3	997.8	1995.3	0.999x - 1.842	1.000
H-B03	Dwyer	VFB-65	05/07/2022	500	1,000	2,000	497.9	987.5	2010.2	1.006x - 16.084	0.999
H-B04	Dwyer	VFB-65	05/07/2022	500	1,000	2,000	500.4	999.5	2008.7	0.998x - 1.698	1.000
H-B05	Dwyer	VFB-65	01/07/2022	500	1,000	2,000	498.6	997.4	1982.3	0.988x + 13.004	1.000
H-B06	Dwyer	VFB-65	04/07/2022	500	1,000	2,000	503.9	994.2	1981.4	1.005x - 8.757	0.999
H-B07	Dwyer	VFB-65	04/07/2022	500	1,000	2,000	504.1	993.3	2018.3	1.002x - 1.639	1.000
H-B08	Dwyer	VFB-65	01/07/2022	500	1,000	2,000	500.2	999.2	1975.8	0.996x + 3.649	0.999
H-B09	Dwyer	VFB-65	01/07/2022	500	1,000	2,000	503.7	1006.6	2014.3	0.994x + 14.328	1.000
H-B10	Dwyer	VFB-65	04/07/2022	500	1,000	2,000	496.9	998.6	2012.4	0.997x + 3.130	1.000

Calibrated by :

Approved by :



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด

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

7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900  
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Rotameter Calibration Report (For Personal Pump Low Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Rotameter Data				Calibration Data							
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R <sup>2</sup>
L-B01	Dwyer	VFA-21	04/07/2022	50	100	200	50.7	99.1	198.9	0.986x + 1.078	1.000
L-B02	Dwyer	VFA-21	04/07/2022	50	100	200	50.2	99.4	198.3	1.004x - 1.615	0.999
L-B03	Dwyer	VFA-21	05/07/2022	50	100	200	50.8	98.8	198.3	1.016x - 2.213	1.000
L-B04	Dwyer	VFA-21	05/07/2022	50	100	200	49.9	102.0	201.1	0.994x + 1.640	1.000
L-B05	Dwyer	VFA-21	01/07/2022	50	100	200	50.5	98.1	200.8	0.991x + 0.476	1.000
L-B06	Dwyer	VFA-21	04/07/2022	50	100	200	50.3	100.5	203.0	0.999x + 0.476	0.999
L-B07	Dwyer	VFA-21	04/07/2022	50	100	200	49.4	100.8	199.7	1.016x - 1.898	1.000
L-B08	Dwyer	VFA-21	01/07/2022	50	100	200	49.8	101.3	198.1	0.999x - 0.218	1.000
L-B09	Dwyer	VFA-21	01/07/2022	50	100	200	49.6	99.6	200.7	1.010x - 1.907	0.999
L-B10	Dwyer	VFA-21	04/07/2022	50	100	200	51.0	100.2	202.8	0.992x + 2.266	1.000

Calibrated by :

Approved by :



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด  
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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 <sup>2</sup>
H-B01	Dwyer	VFB-65	05/10/2022	500	1,000	2,000	505.3	990.7	1975.7	0.990x + 8.856	1.000
H-B02	Dwyer	VFB-65	04/10/2022	500	1,000	2,000	495.7	997.8	1995.3	0.994x + 4.025	1.000
H-B03	Dwyer	VFB-65	04/10/2022	500	1,000	2,000	498.3	987.5	2010.2	1.004x - 14.483	0.999
H-B04	Dwyer	VFB-65	05/10/2022	500	1,000	2,000	501.2	999.9	2008.7	0.998x - 0.511	1.000
H-B05	Dwyer	VFB-65	05/10/2022	500	1,000	2,000	499.0	997.4	1972.3	0.987x + 14.507	1.000
H-B06	Dwyer	VFB-65	05/10/2022	500	1,000	2,000	503.9	993.4	1981.4	1.006x - 9.415	0.999
H-B07	Dwyer	VFB-65	05/10/2022	500	1,000	2,000	504.1	989.0	2018.3	1.002x - 2.255	1.000
H-B08	Dwyer	VFB-65	04/10/2022	500	1,000	2,000	499.8	999.2	1975.8	0.997x + 2.922	0.999
H-B09	Dwyer	VFB-65	06/10/2022	500	1,000	2,000	503.7	1006.6	2014.3	0.993x + 14.424	1.000
H-B10	Dwyer	VFB-65	06/10/2022	500	1,000	2,000	496.9	998.6	2012.4	0.998x + 1.450	1.000

Calibrated by :

Approved by :



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด  
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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			Date	Flow Rate (ml/min)						Value From Calibration Curve	
No.	Brand	Model		Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R <sup>2</sup>
				L-B01	Dwyer	VFA-21	05/10/2022	50	100	200	50.7
L-B02	Dwyer	VFA-21	04/10/2022	50	100	200	49.8	99.4	198.3	1.012x - 2.104	1.000
L-B03	Dwyer	VFA-21	04/10/2022	50	100	200	50.8	99.2	198.3	1.009x - 1.844	0.999
L-B04	Dwyer	VFA-21	04/10/2022	50	100	200	49.9	101.6	201.1	0.996x + 1.334	1.000
L-B05	Dwyer	VFA-21	04/10/2022	50	100	200	50.1	98.5	200.8	0.992x + 0.311	1.000
L-B06	Dwyer	VFA-21	04/10/2022	50	100	200	50.3	100.5	203.4	1.009x + 0.376	1.000
L-B07	Dwyer	VFA-21	04/10/2022	50	100	200	49.4	100.8	199.7	1.005x - 1.24	0.999
L-B08	Dwyer	VFA-21	04/10/2022	50	100	200	49.8	101.3	198.1	0.998x - 0.116	1.000
L-B09	Dwyer	VFA-21	06/10/2022	50	100	200	49.6	99.2	200.7	1.013x - 1.491	1.000
L-B10	Dwyer	VFA-21	06/10/2022	50	100	200	50.6	100.2	202.8	0.993x + 2011	1.000

Calibrated by :

Approved by :





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

## Console Calibration Report

Calibration Method

Critical Orifices

### Calibration Data

Console Data		Calibration Data		
No.	Serial No.	Date	y	$\Delta H_{@}$ (mmH <sub>2</sub> O)
B01	1563	01/09/2022	1.004	50.11
B02	8002514	02/09/2022	1.006	49.25
B03	1503016	05/09/2022	1.008	50.30
B04	00006659	05/09/2022	1.005	47.45
B05	00007428	01/09/2022	1.002	49.96
R01	1561	02/09/2022	1.003	49.86
R02	8002513	05/09/2022	1.006	50.09
R03	1570	05/09/2022	1.004	49.23
R04	8002519	01/09/2022	1.005	49.17
R05	1503015	01/09/2022	0.996	49.68

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

Accept Value of  $\Delta H_{@}$  (test) is  $46.7 \pm 6.4$  (mmH<sub>2</sub>O)

Calibrated by :

[Redacted Signature]

Approved by :

[Redacted Signature]



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด  
S.P.S. CONSULTING SERVICE CO., LTD.  
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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
B36	S	0.99	01/08/2022	0.83	0.84
B37	S	0.99	01/08/2022	0.84	0.84
B38	S	0.99	02/08/2022	0.85	0.84
B39	S	0.99	02/08/2022	0.85	0.84
B40	S	0.99	02/08/2022	0.84	0.84
B41	S	0.99	02/08/2022	0.84	0.84
B44	S	0.99	02/08/2022	0.83	0.84
B45	S	0.99	01/08/2022	0.84	0.85
B46	S	0.99	01/08/2022	0.84	0.84
B47	S	0.99	03/08/2022	0.84	0.84
B48	S	0.99	03/08/2022	0.83	0.84
B49	S	0.99	01/08/2022	0.84	0.84
B54	S	0.99	01/08/2022	0.84	0.83
B56	S	0.99	01/08/2022	0.84	0.84
B57	S	0.99	04/08/2022	0.83	0.84
B58	S	0.99	04/08/2022	0.84	0.83

Remark : Accept value of Cp (test) is  $0.84 \pm 0.01$

Calibrated by :

Approved

## CERTIFICATE OF CALIBRATION

### FOR

NOMENCLATURE : VACUUM GAUGE  
MANUFACTURER : HI-LIGHT  
MODEL / TYPE : N/A  
SERIAL NO. : N/A[64-220066-1]  
CLID. NO. : 212201112  
JOB CONTROL NO. : 220720073201

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

DATE OF RECEIVED : 20 July 2022

DATE OF ISSUED : 22 July 2022

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  
22 July 2022



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

Certificate No. Q22073201

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[64-220066-1]**  
**DATE OF CALIBRATION** : **21 July 2022**

---

#### ENVIRONMENT CONDITIONS :

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

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

#### PROCEDURE USED :

This instrument was calibrated under procedure No. **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 744 S/N. 9226007 with Pressure Module Model 700PV4 S/N. 19298401.

#### TRACEABILITY :

The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand).  
Certificate No. MP-0196-21, Due Date 17 November 2022.

#### 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. **Q22073201**

F3-011-04/01-12

page 2 of 3







**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



ANSI National Accreditation Board  
**ACCREDITED**  
ISO/IEC 17025  
CALIBRATION AND  
DIMENSIONAL MEASUREMENT  
ACDM-2814

## 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 ( inHg )		Correction ( inHg )	
	Up	Down	Up	Down
0	0.0	0.0	0.0	0.0
-5	-4.6	-4.7	+0.4	+0.3
-10	-9.5	-9.6	+0.5	+0.4
-15	-14.4	-14.5	+0.6	+0.5
-20	-19.4	-19.5	+0.6	+0.5
-25	-24.5	-24.5	+0.5	+0.5
-30	-29.5	-29.5	+0.5	+0.5

Uncertainty of measurement  $\pm 0.2$  inHg

Transmitting fluid : Air.

Technical Note. k factor 1 kPa = 0.2952998 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. Q22073201

F3-011-04/01-12

page 3 of 3



@clccalibration



**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](http://www.qcalibration.com)

CERTIFICATE No : 22M2567

REFERENCE No : 64386-1

PAGE : 1 OF 2

**Certificate of Calibration**

**EQUIPMENT** : DIGITAL BALANCE

**MANUFACTURER** : METTLER TOLEDO

**MODEL** : XS 105DU

**SERIAL No** : 1126422905

**ID No** : BA 05/50

**CONDITION AS RECEIVED** : USED ITEM

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

**CALIBRATED BY** : TETNITHI W.

**CALIBRATION DATE** : 11-Mar-22

**APPROVED BY** : [REDACTED]  
PONGSAK J.

**ISSUED DATE** : 17-Mar-22

**RECEIVED DATE** : 11-Mar-22

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





CERTIFICATE No : 22M2567

PAGE : 2 OF 2

## Calibration Report

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

**CONDITION OF THIS RESULTS OF CALIBRATION**

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

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-I-151	C02210415	09-Feb-23

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

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

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

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

**RESULT OF CALIBRATION** :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

2. TARE FUNCTION : NORMAL

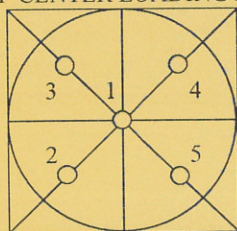
3. REPEATABILITY OF READING AT 20 g WAS 0.000004 g

4. REPEATABILITY OF READING AT 100 g WAS 0.000048 g

5. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY ( $\pm$ g)
0.00	0.00000	0.00000	0.000058
0.02	0.01999	0.00001	0.000058
0.10	0.09999	0.00001	0.000059
0.20	0.19999	0.00001	0.000059
0.50	0.50001	-0.00001	0.000058
1.00	1.00001	-0.00001	0.000059
2.00	2.00000	0.00000	0.000059
5.00	5.00001	-0.00001	0.000061
10.00	10.00005	-0.00005	0.000063
20.00	20.00006	-0.00006	0.000069
50.00	50.00000	0.00000	0.000111
100.00	100.00001	-0.00001	0.00019
120.00	120.00001	-0.00001	0.00022

6. OFF CENTER LOADING ERROR



POINT	READING (g)	
1	10.00001	50.0000
2	10.00002	50.0000
3	10.00001	50.0000
4	10.00001	50.0000
5	10.00002	50.00001
OFF-CENTER LOADING	0.00001	0.0001

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

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

END OF CALIBRATION REPORT





## 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 ( $\mu$ V)	2.94	$\leq 50$
Baseline Drift (%)	0.18	$\leq 1$
Sensitivity ( S/N for C15)	4,000	$\geq 1,024$

## Temperature Specification

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

## Relative Standard Deviation % ( % RSD)

Checkout Procedure	Result	Specification
Area C15 ( %)	1.68	$\leq 5$
Retention Time C15( %)	0.01	$\leq 0.5$

APPROVA

Signature:

Engineer : Suwarot Trikainut

Date : 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		
Date	10/08/2022	



Comments			
Reviewed by		Date	10/08/2022



VARIAN





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		
Date	10/08/2022	



Comments			
Reviewed by		Date	10/08/2022



# 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**

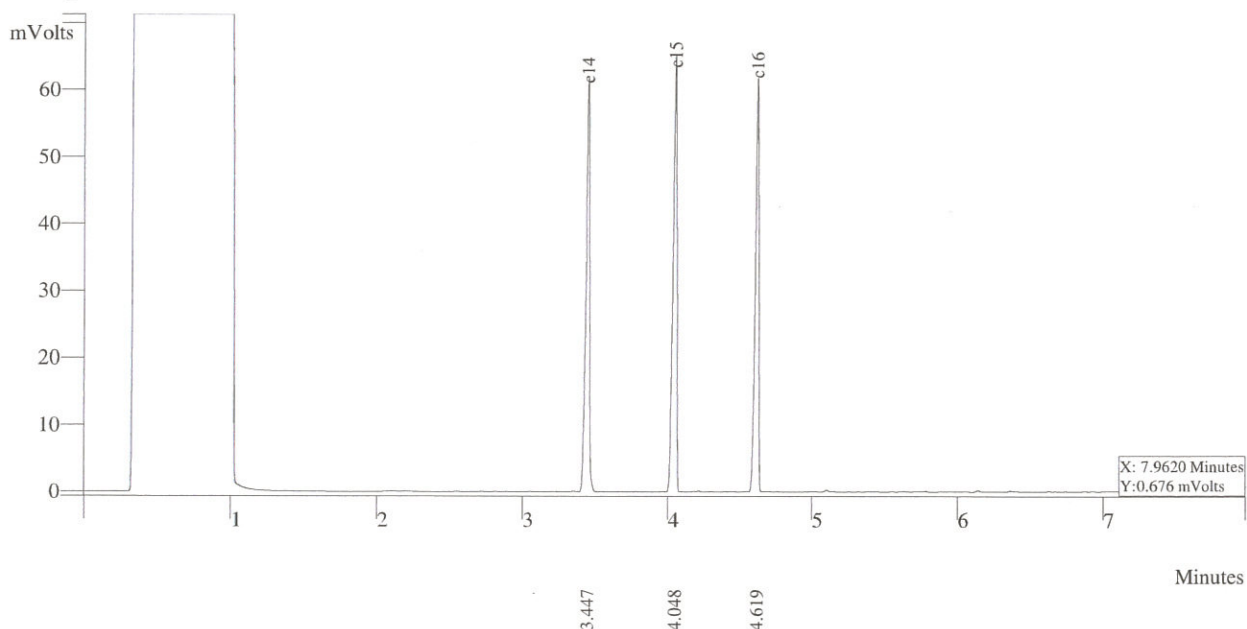
Run Mode: **Analysis**

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**

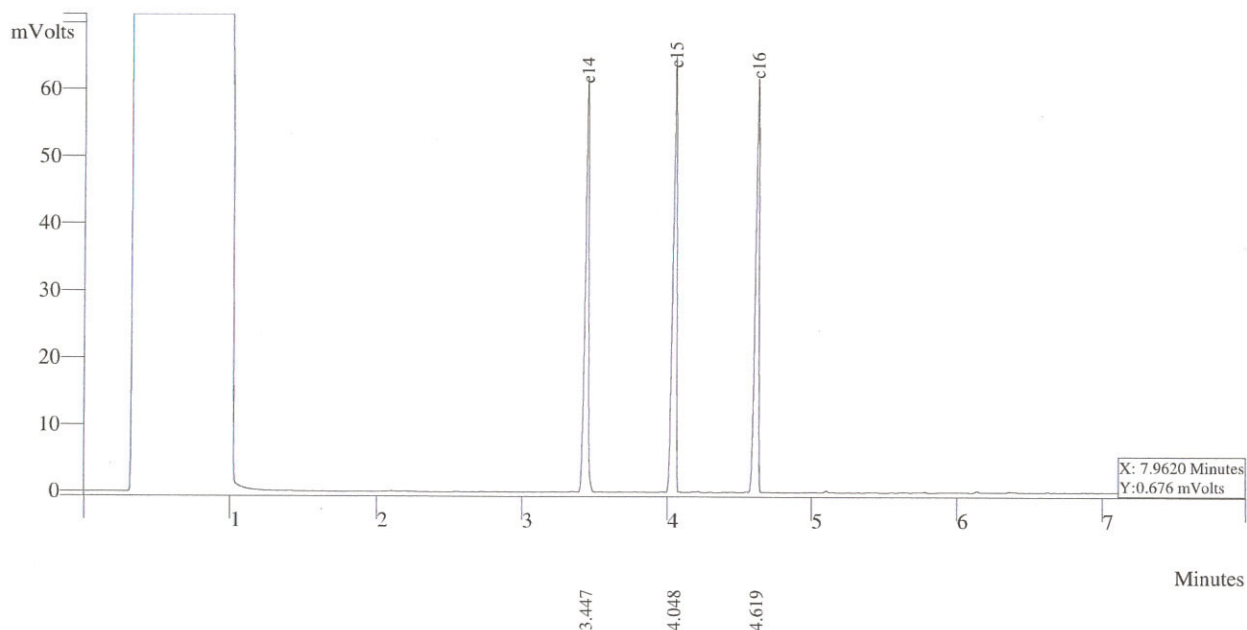
Run Mode: **Analysis**

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**

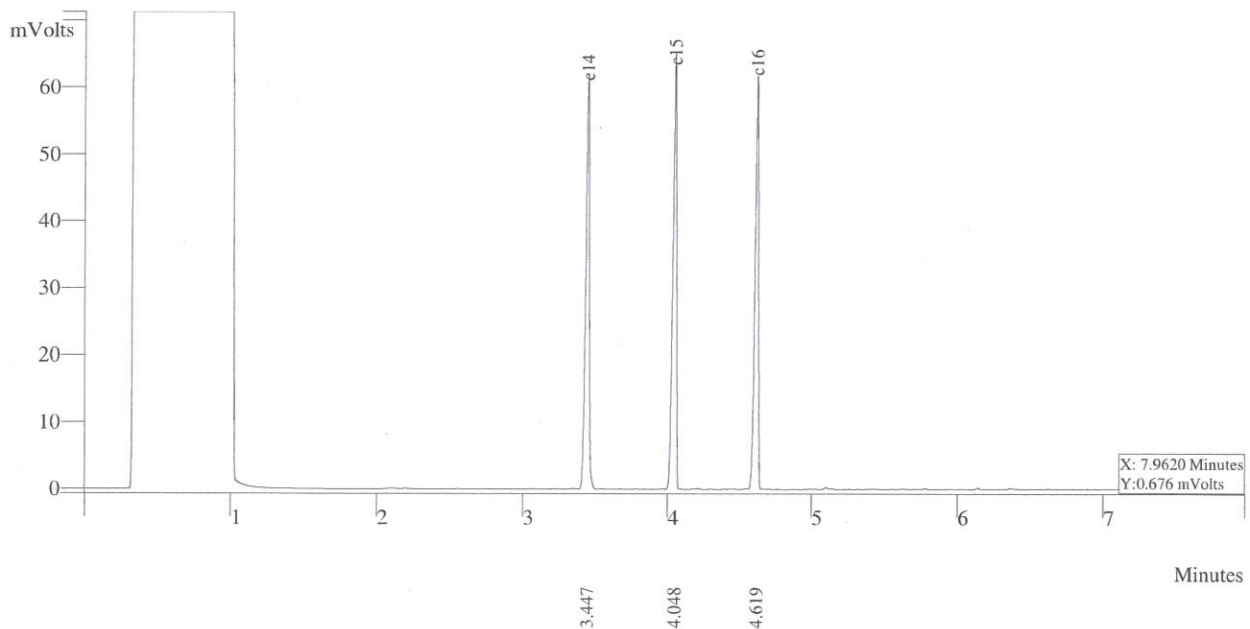
Run Mode: Analysis

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**

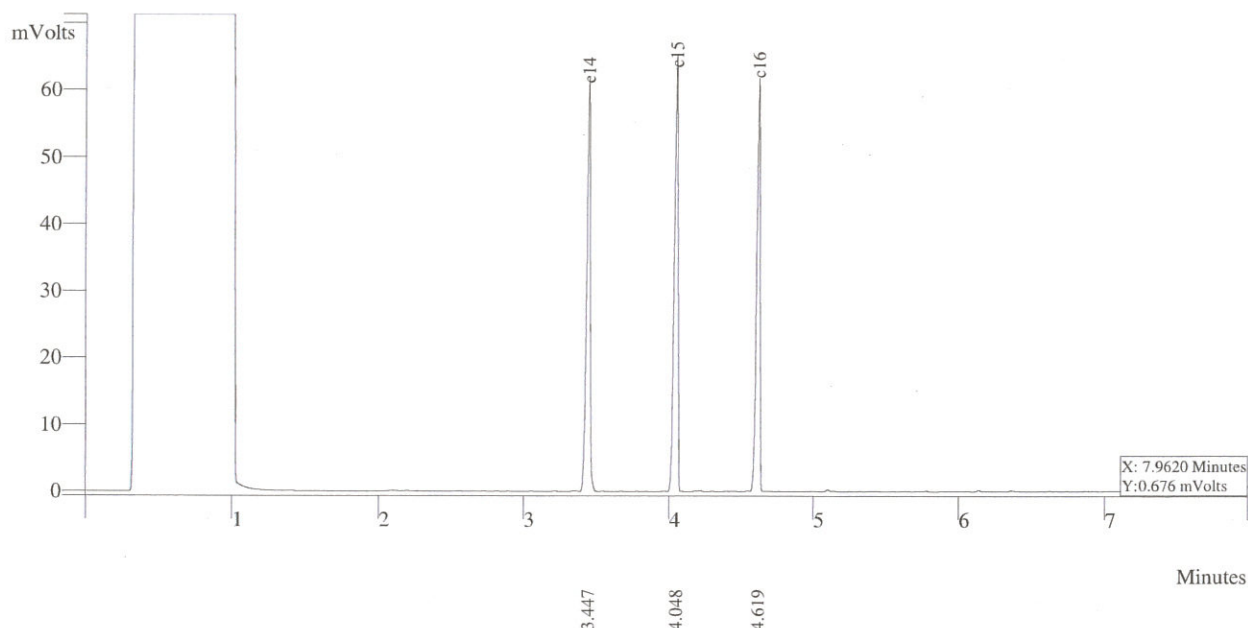
Run Mode: Analysis

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**

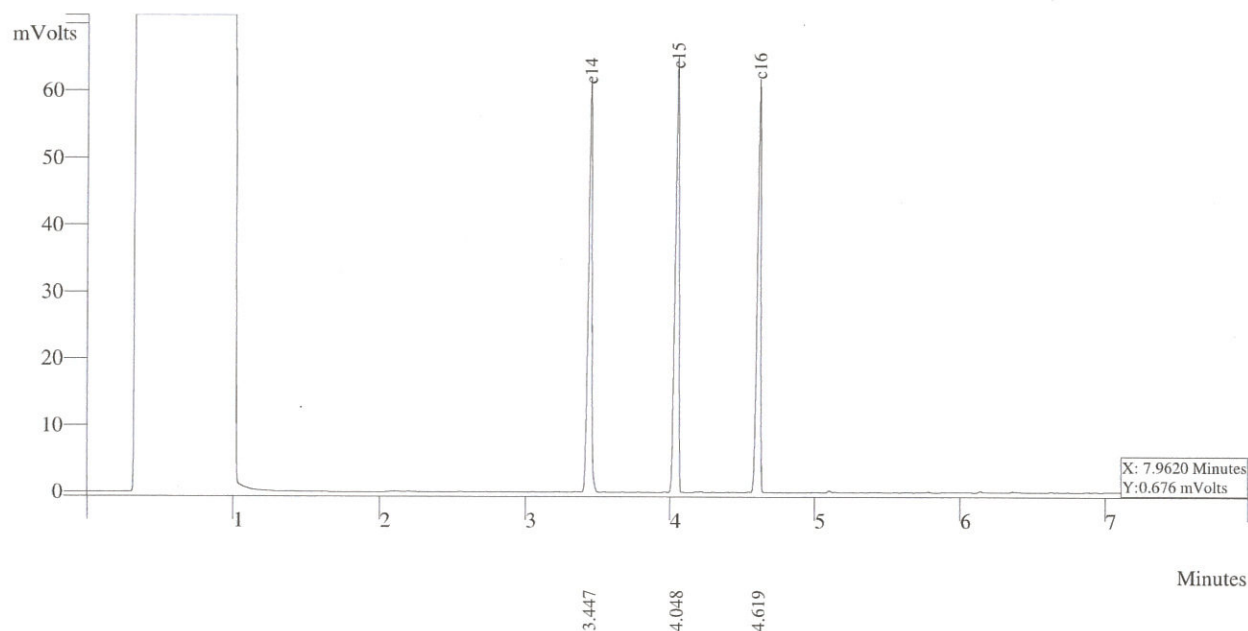
Run Mode: **Analysis**

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

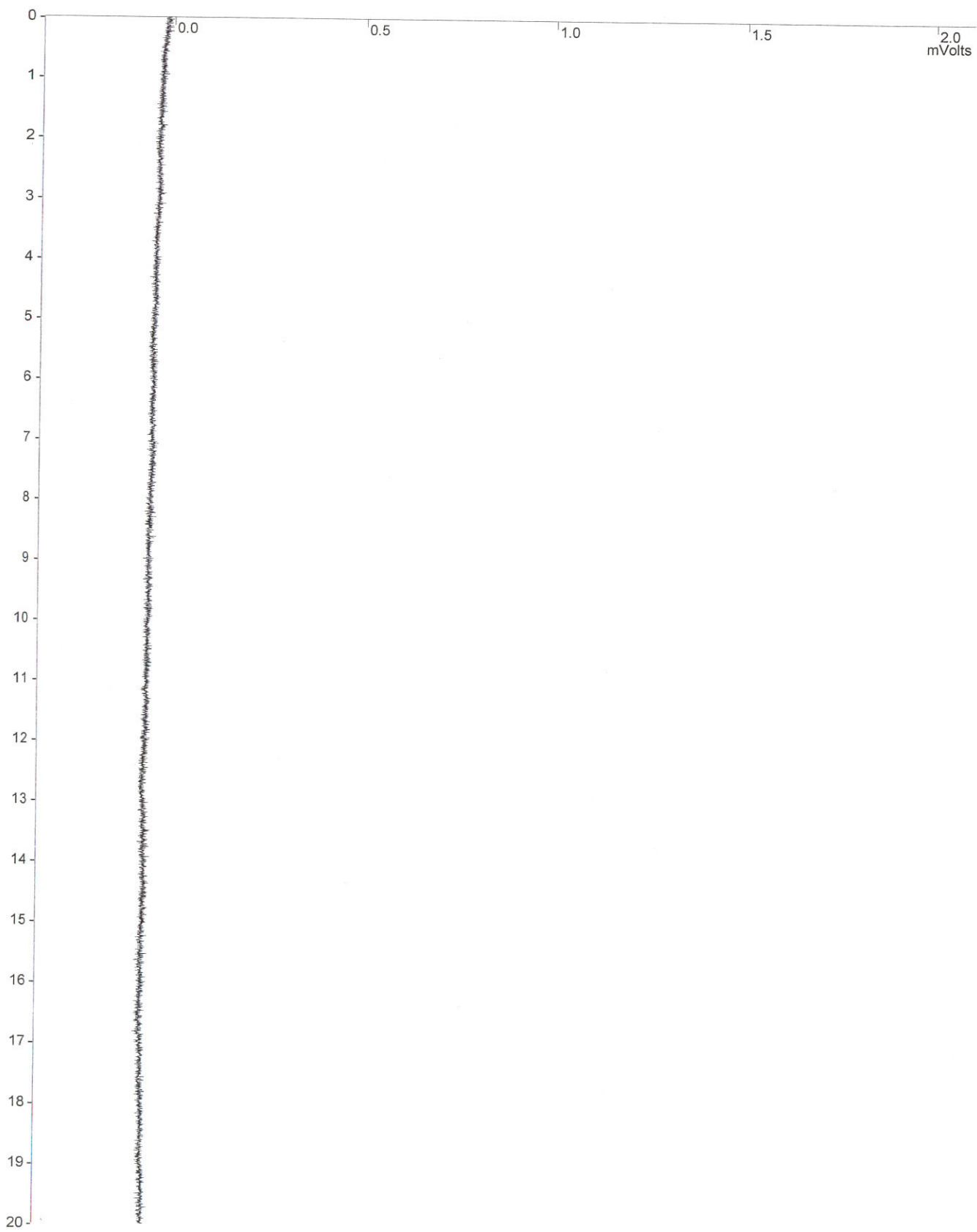
Title :  
Run File : d:\ćéíÁÜÅ gc\ćéíÁÜÅ·Ñé\$ĚÁ'\drive-d\2017\2022\08\baseline.run  
Method File : D:\Method-GC\star C\Star\TU\Cal2021\baseline FID.mth  
Sample ID : baseline

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 \*\*

Chart Speed = 1.09 cm/min	Attenuation = 1	Zero Offset = 14%
Start Time = 0.000 min	End Time = 20.000 min	Min / Tick = 1.00





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

\*\*\*\*\*

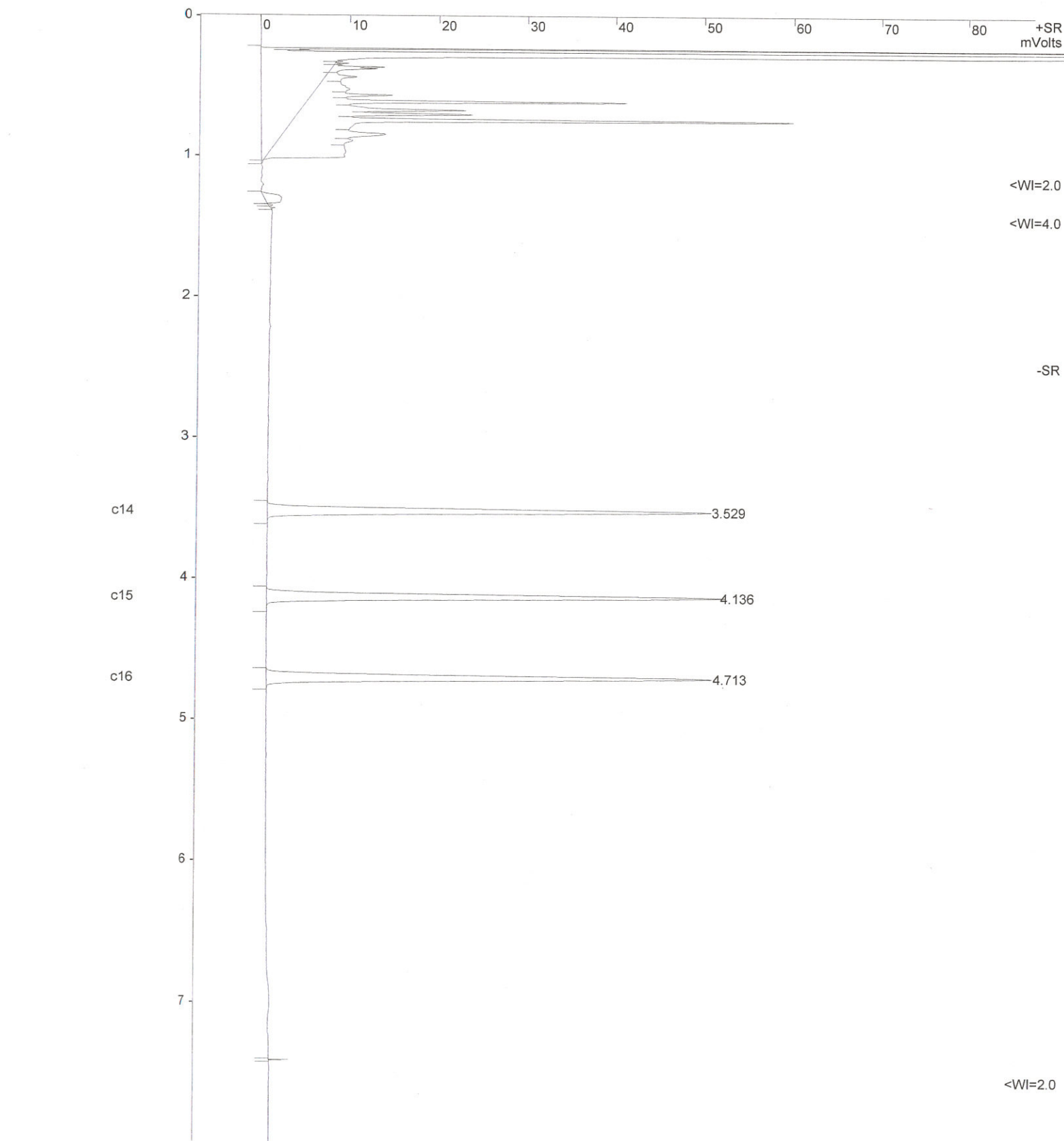
Title :  
Run File : c:\star\data\tu\cal2022\fid2022003.run  
Method File : d:\gc\fid2022\gc\fid2022003-front.mth  
Sample ID : fid2022

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 \*\*

Chart Speed = 2.73 cm/min      Attenuation = 40      Zero Offset = 7%  
Start Time = 0.000 min      End Time = 7.993 min      Min / Tick = 1.00



Title :  
Run File : c:\star\data\tu\cal2022\fid2022003.run  
Method File : d:\gc\gc\fid2022\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%

\*\*\*\*\*



## CERTIFICATE OF QUALIFICATION

Qualification Date : 22 June 2022

Next Due : 22 June 2023

<b>Certificate No.</b>	QUAL2022-004
<b>Customer Name</b>	S.P.S Consulting Service Co.,Ltd.
<b>Address</b>	7 Soi Phaholyothin 24, Phaholyothin Road, Ladyao, Jatujak, Bangkok, 10900
<b>Phone</b>	+66 (0) 2939 4370
<b>Fax</b>	-

## Instrument Identification

Model	Serial No.	Manufacturer
e2695	M13SM7942A	WATERS
Column Heater/Cooler	C14SMC892G	WATERS
2489 UV/Vis Detector	B1487E998A	WATERS
TCM	A14TC2310G	WATERS
CHM	L13PRM568M	WATERS
PCR	M13CHM092M	WATERS
RMA	J13RMA889M	WATERS
RMA	J13RMA890M	WATERS

## Operational And Performance Qualification Test Completed

<input checked="" type="checkbox"/> 1. System Precision 250uL	<input checked="" type="checkbox"/> 6. Flow Rate Linearity Accuracy
<input checked="" type="checkbox"/> 2. Wavelength Accuracy	<input checked="" type="checkbox"/> 7. Compositional Precision
<input checked="" type="checkbox"/> 3. Detector Linearity Sensitivity	<input checked="" type="checkbox"/> 8. Noise and Drift
<input checked="" type="checkbox"/> 4. Injector Linearity Accuracy	<input checked="" type="checkbox"/> 9. Signal to Noise
<input checked="" type="checkbox"/> 5. Injector Carryover	<input checked="" type="checkbox"/> 10. Temperature Accuracy

Result Of Qualification: **Passes & Certifies For 1 Year**

Qualified By



( Mr. Tanatip Intarikanond )  
Engineer Technical Services

Approved By



( Mr. Wiyawat Phongwittaya )  
AGM, Technical Services

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**DKSH (Thailand) Limited**


2106 Fantree 4 Building, Sukhumvit Rd., Phrakhanong-Tai, Phrakhanong, Bangkok 10260, Thailand  
Phone +662 301 7200, Fax +66 2333 1014, www.dksh.co.th/tech

ศูนย์บริการลูกค้าด้านการขาย - Technology service call center



### ***Lambda UV Preventive Maintenance (PM)***

<b>Company Name:</b>	S.P.S. CONSULTING SERVICE CO., LTD.		
<b>Address:</b>	7, Soi Phaholyothin24, Ladyao, Jatujak, Bangkok		
<b>User Name:</b>	K. Benjawan	<b>WO Number:</b>	WO-01550999
<b>Telephone Number:</b>	086-141-2523	<b>PM Number:</b>	6 of 6 P
<b>Customer Support Engineer:</b>	K. Anon	<b>Certificate Number:</b>	UV2004-2022
<b>Date PM Performed:</b> (DD-MMM-YYYY)	25-Jan-2022	<b>Next PM Due Date:</b> (DD-MMM-YYYY)	25-Jul-2022

<b>Part Number</b>	<b>Release</b>	<b>Publication Date</b>	
09370504	B	March 2013	

#### **Scope**

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

#### **General Instructions:**

The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM. Always check with the customer before making any changes that may affect the customer's analysis should be signed by an authorized PerkinElmer and customer representative and left with the customer. Update the PM sticker and instrument logbook as required.

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## Component List

Component Specific Model	Serial #	Software Version		Configuration Notes
Lambda 25	501S14123010	6.2.0.0741	STD	1.27
NA	NA	NA	NA	NA

## Parts Lists

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



Additional Tools Required for PM					
Part Number (if applicable)	Description	Quantity	Serial #		Remark
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-

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

## Procedure Checklist

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

### 1. General:

- ☒ Review the instrument performance with the customer and document any recent problems.
- ☒ Inspect the customer log book and make any appropriate PM entries.
- ☒ Perform general inspection of system for cleanliness.

### 2. Optical checks:

- ☒ Lamp Alignment/Energy
- ☒ Sample Compartment Windows/Monochromator
- ☒ Mirror and Grating Alignment
- ☒ Cell Holder Alignment

### 3. Mechanical:

- ☒ Physical inspection – Please write any comments in the additional comments section.
- ☒ Grating Drive Mechanism.
- ☒ Lamp Change Mechanism.
- ☐ Slit Drive Manual Servo.

### 4. Test:

Refer to Appendix A for the specifications of the instrument being tested.

- ☒ D2 Wavelength accuracy

	Actual Value	Specification
Accuracy at 656.1 nm	656.16	± 0.1

☒ Holmium Oxide wavelength accuracy

Filter ID #		1085		
Test	Calibration Value	Actual Value	Deviation	Specification
279.3 nm	279.3	279.39	-0.09	± 0.5
360.8 nm	360.9	360.93	-0.03	± 0.5
459.9 nm	460.0	460.07	-0.07	± 0.5
536.4 nm	536.2	536.40	-0.20	± 0.5

☒ Scattered Light.

Test	Filter ID #	Result	Specification
NaI @ 220 nm	1943	0.0133	< 0.02 %T
NaNO <sub>2</sub> @ 340 nm	2963	-0.1296	< 0.02 %T
NaNO <sub>2</sub> @ 370 nm	2963	-0.0002	< 0.02 %T
KCl @ 200 nm	31030	2.4808	≥ 2 A

☒ Baseline Flatness.

Corrected Baseline	Specification
0.000163	± 0.001 A

☒ Noise Test @ 500 nm.

Actual Value	Specification
0.0000240	± 0.00008 A

☒ Photometric Accuracy.

Filter 1 ID #		2926		
Test	Calibrated Value	Actual Value	Deviation	Specification
440 nm	0.3483	0.3493	-0.0010	± 0.006 A
546 nm	0.3029	0.3046	-0.0017	± 0.006 A
635 nm	0.3200	0.3232	-0.0032	± 0.006 A
Filter 2 ID #		3501		
Test	Calibrated Value	Actual Value	Deviation	Specification
440 nm	1.001	1.0024	-0.0014	± 0.006 A
546 nm	0.9797	0.9813	-0.0016	± 0.006 A
635 nm	1.0285	1.0325	-0.0040	± 0.006 A
Filter 3 ID #		2552		
Test	Calibrated Value	Actual Value	Deviation	Specification
440 nm	0.489	0.4935	-0.0045	± 0.006 A
546 nm	0.4582	0.4595	-0.0013	± 0.006 A
635 nm	0.5046	0.5075	-0.0029	± 0.006 A



**5. Accessory (where applicable):**

- ☐ Integrating Sphere
- ☐ Reflecting Attachment
- ☐ Cell Changer
- ☐ Sipper
- ☐ Auto Sampler

**6. Review:**

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

## Additional Comments


Additional Comments Regarding the PM

## Review

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

*This Lambda UV Passes ☒ Fails ☐ the preventive maintenance.*

### Review of Preventive Maintenance:

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

# 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

Material	Ref. type	Cell serial No.	Cert. No.	Due Date
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

Transmission T(%) Absorbance(A)

0.0107

3.9886

\*\*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



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@spsccon.com., www.spsccon.com

Calibration Report					
Non-Dispersive Infrared CO Analyzer					
Date :	02 November 2022	Brand :	Thermo	Model :	48C
No.	CO-B08	Serial No.	0508011067		
Calibrator (Dilution System)					
Brand :	API		Model :	700	
Last Cal. Date :	06 September 2022		Serial No. :	421	
Reference Standard Gas					
Standard Gas :	Carbon Monoxide (CO)		Cylinder No. :	D196045	
Certified Date :	16 April 2022	Expired Date :	15 April 2024	Cylinder Conc. :	4,570 ppm
Calibrating Condition					
Pressure	1011	mmbar	Temp.	24.6	°C
			% RH	48	
Calibration Setting					
Span	Initial Reading (Before Adj.),PPM			Final Reading (After Adj.),PPM	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	
Zero	0	-0.10	-	0	
CO Span	40.00	40.04	0.100	40.00	
Instrument Status					
Chamber Temp	47.4	°C	Flow	1.5	LPM
Pressure	730.8	mm Hg	Motor Speed	100.00	%

Calibrated by :



Approved

(Mr. Peera Detudom)



ระดับเสียง

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0455

MTC No. EEL. BP. 41/0465

## CALIBRATION CERTIFICATE

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

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

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

### Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

Serial No. : 130006

### 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 : 22 Apr. 2022

Date of Calibration : 28 Apr. 2022

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

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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. 21-65/0455

MTC No. EEL. BP. 41/0465

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

Nominal Output of Unit Under Test = 94 dB re 20 $\mu$ Pa at 1000 Hz

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	93.93	-0.07	$\pm 0.10$	$\pm 0.40$ 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	$\pm 1.5$	$\pm 1.0\%$

3. Total Distortion

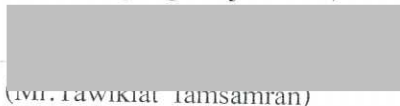
Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.44	$\pm 0.50$	$\pm 3.0\%$

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

Calibrated by :



(Mr. Nuttapong Niljrusvanit)



(Mr. Pawikiat Jamsamran)

Approved by :



(Mr. Prawate Kluaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 28 Apr. 2022

Date of Issue : 28 Apr. 2022

Ref : 2011265042601787001

2 / 2

End of Certificate

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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





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 B\_591/22

### Sound Level Meter Calibration Report

#### Acoustic Calibrator Data

Brand	ACO	Number	AC 03/56
Model	2127	Serial No.	130006
Calibration Range	94 dB, 1000 Hz	Last Calibration	28 April 2022
		Due Date	28 April 2023

#### Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B21	ACO	6236	00172059	24 October 2022	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.93 ± 0.10 dB	

Calibrated by :



Approved by :





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 B\_587/22

## Sound Level Meter Calibration Report

### Acoustic Calibrator Data

Brand	ACO	Number	AC 03/56
Model	2127	Serial No.	130006
Calibration Range	94 dB, 1000 Hz	Last Calibration	28 April 2022
		Due Date	28 April 2023

### Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B06	ACO	6236	00142003	26 October 2022	94.0	94.0
ACO-B22	ACO	6236	00172060	26 October 2022	94.1	94.0
ACO-B38	ACO	6236	00192029	26 October 2022	93.9	94.0
ACO-B40	ACO	6236	00192031	26 October 2022	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.93 ± 0.10 dB	

Calibrated by :



Approved by :

(Mr. Peera Detudom)



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

**Request No.** 21-65/0397

**MTC No. EEL. BP.** 89/0365

## CALIBRATION CERTIFICATE

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

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

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

### Instrument Calibrated :

Description : Noise Dosimeter

Manufacturer : Svantek

Model : SV-104IS

Serial No. : 80840

### Ambient Environment

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

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

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

### Standards used :

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

### Calibration Procedure :

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

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

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

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

**Date of Receipt** : 18 Mar. 2022

**Date of Calibration** : 23 Mar. 2022

1 / 2

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FM.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



Request No. 21-65/0397

MTC No. EEL. BP. 89/0365

**Acoustic signal test of frequency weightings**

Frequency (Hz)	Deviation from response curve		Uncertainty ( $\pm$ dB)	Tolerance Limits Class 2 ( $\pm$ dB)
	A-weighting (dB)	C-weighting (dB)		
125	0.4	0.5	0.25	2.0
1 000	0.2	0.0	0.25	1.4
4 000	0.0	0.0	0.25	3.6

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

Calibrated by :

.....

(Mr. Sanaey Grajang)

Approved by :

(Mr. Prawate Kluaypa)

Director

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

Ref : 2011265031801270001

**Date of Calibration** : 23 Mar. 2022

**Date of Issue** : 23 Mar. 2022

2 / 2

End of Certificate

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

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**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

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**Office/Laboratory**

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Amphoe Muang, Changwat Samutprakan 10280, Thailand  
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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. 21-65/0397

MTC No. EEL. BP. 90/0365

## CALIBRATION CERTIFICATE

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

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

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

**Instrument Calibrated :**

**Ambient Environment**

Description : Noise Dosimeter

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

Manufacturer : Svantek

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

Model : SV-104IS

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

Serial No. : 80842

**Standards used :**

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

**Calibration Procedure :**

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

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

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

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

**Date of Receipt** : 18 Mar. 2022

**Date of Calibration** : 23 Mar. 2022

1 / 2

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FM.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

Request No. 21-65/0397

MTC No. EEL. BP. 90/0365

**Acoustic signal test of frequency weightings**

Frequency (Hz)	Deviation from response curve		Uncertainty ( $\pm$ dB)	Tolerance Limits Class 2 ( $\pm$ dB)
	A-weighting (dB)	C-weighting (dB)		
125	0.4	0.4	0.25	2.0
1 000	0.2	0.0	0.25	1.4
4 000	-0.4	-0.4	0.25	3.6

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

Calibrated by :

.....  
(Mr. Sanaey Grajang)

Approved by :

.....  
(Mr. Prawate Kluaypa)

**Director**

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

Ref : 2011265031801270002

**Date of Calibration** : 23 Mar. 2022

**Date of Issue** : 23 Mar. 2022

2 / 2

End of Certificate

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.



Request No. 21-65/0397

MTC No. EEL. BP. 91/0365

## CALIBRATION CERTIFICATE

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

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

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

**Instrument Calibrated :**

Description : Noise Dosimeter

Manufacturer : Svantek

Model : SV-104IS

Serial No. : 80852

**Ambient Environment**

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

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

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

**Standards used :**

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

**Calibration Procedure :**

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

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

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

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

**Date of Receipt** : 18 Mar. 2022

**Date of Calibration** : 23 Mar. 2022

1 / 2

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



Request No. 21-65/0397

MTC No. EEL. BP. 91/0365

Acoustic signal test of frequency weightings

Frequency (Hz)	Deviation from response curve		Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)		
125	0.1	0.1	0.25	2.0
1 000	0.2	0.0	0.25	1.4
4 000	0.4	0.5	0.25	3.6

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

Calibrated by :

.....

(Mr. Sanaey Grajang)

Approved by :

.....

(Mr. Prawate Kluaypa)

Director

Electrical and Electronic Standards Laboratory  
Industrial Metrology and Testing Service Centre

Ref : 2011265031801270003

Date of Calibration : 23 Mar. 2022

Date of Issue : 23 Mar. 2022

2 / 2

End of Certificate

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

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Amphoe Muang, Changwat Samutprakan 10280, Thailand

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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



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 B\_588\_1/22

### Noise Dose Meter Calibration Report

#### Acoustic Calibrator Data

Brand	SVANTEK	Number	SV 06/62
Model	SV34	Serial No.	33139
Calibration Range	114 dB, 1000 Hz	Last Calibration	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-B01	SVANTEK	SV-104IS	80840	26 October 2022	113.6	113.6
NMD-B02	SVANTEK	SV-104IS	80842	26 October 2022	113.6	113.6
NMD-B03	SVANTEK	SV-104IS	80852	26 October 2022	113.6	113.6
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					113.63 ± 0.10 dB	

Calibrated by :



Approved by :



คุณภาพน้ำ



**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, Bangkae, 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/</u> <u>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 (± 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 (°C)	UUC READING (°C)	CORRECTION (°C)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT (± °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





CERTIFICATE No : 22M2568

REFERENCE No : 64386-2

PAGE : 1 OF 2

**Certificate of Calibration**

**EQUIPMENT** : DIGITAL BALANCE

**MANUFACTURER** : SARTORIUS

**MODEL** : BSA224S-CW

**SERIAL No** : 36591842

**ID No** : BA 08/61

**CONDITION AS RECEIVED** : USED ITEM

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

**CALIBRATED BY** : TETNITHI W.

**CALIBRATION DATE** : 11-Mar-22

**APPROVED BY** :   
PONGSAK J.

**ISSUED DATE** : 17-Mar-22

**RECEIVED DATE** : 11-Mar-22





CERTIFICATE No : 22M2568

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : BSA224S-CW  
MANUFACTURER : SARTORIUS S/N : 36591842  
ID No : BA 08/61 RECEIVED DATE : 11-Mar-22  
AIR PRESSURE : 1008mbar  $\pm$  1mbar CALIBRATION DATE : 11-Mar-22  
AMBIENT TEMPERATURE : 22°C  $\pm$  1°C RELATIVE HUMIDITY : 51 %RH  $\pm$  10 % RH

### CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 6:2019 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS ADJUSTED USING WEIGHT OF QUALITY CALIBRATION TO ADJUST. THE BALANCE HAS NO ZERO TRACKING FUNCTION. REPEATABILITY WAS MEASURED BY USING 10 REPEATED MEASUREMENTS. LINEARITY WAS MEASURED COVERING 10 POINTS, EVENLY SPREAD OVER THE RANGE. THE INSTRUMENT WAS SET ZERO BEFORE PERFORMING THE LINEARITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN.

2. REFERENCE STANDARD INSTRUMENTS :-

<u>INSTRUMENT</u>	<u>MODEL</u>	<u>SERIAL No</u>	<u>CERTIFICATE No</u>	<u>DUE DATE</u>
1) STANDARD WEIGHT SET	E2	QK-I-151	C02210415	09-Feb-23

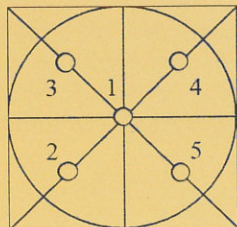
3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.  
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.  
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL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

### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 200 g WAS 0.000048 g
4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

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

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	99.9999
2	100.0000
3	99.9999
4	100.0000
5	100.0000
OFF-CENTER LOADING	0.0001

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

END OF CALIBRATION REPORT





# QUALITY CALIBRATION CO.,LTD.

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

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

[www.qcalibration.com](http://www.qcalibration.com)

CERTIFICATE No : 22T0570

REFERENCE No : 63773-2

PAGE : 1 OF 2

## Certificate of Calibration

**EQUIPMENT** : COD REACTOR

**MANUFACTURER** : HACH

**MODEL** : DRB 200

**SERIAL No** : 15110C0498

**ID No** : DRB 06/59

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

**CALIBRATED BY** : CHAICHARN CH.

**CALIBRATION DATE** : 21-Jan-22

**APPROVED BY** : [REDACTED]  
PONGSAK J.

**ISSUED DATE** : 21-Jan-22

**RECEIVED DATE** : 19-Jan-22





# 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 : 22T0570

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : COD REACTOR  
MANUFACTURER : HACH  
ID NUMBER : DRB 06/59  
RECEIVED DATE : 19-Jan-22  
AMBIENT TEMPERATURE : 23° C ± 1° C

MODEL : DRB 200  
SERIAL NUMBER : 15110C0498  
CALIBRATION DATE : 21-Jan-22  
RELATIVE HUMIDITY : 52 %RH ± 10 % RH

### CONDITION OF THIS RESULTS OF CALIBRATION

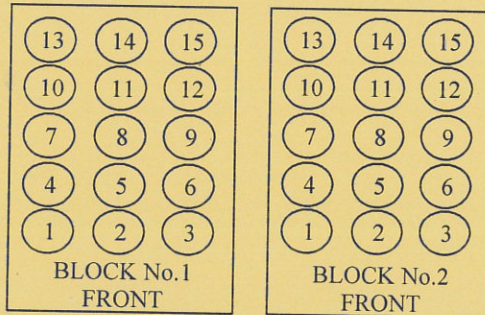
1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT TEMPERATURE RECORDER WITH THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON 15 POINTS AND LOCATED ONE THERMOCOUPLE IN EACH OF THE FOUR CORNERS OF THE REACTOR AND PLACED THE EIGHTH THERMOCOUPLE AT THE CENTER OF THE REACTOR.

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



### TEMPERATURE MEASUREMENT ACCURACY TEST

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

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

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

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

END OF CALIBRATION REPORT





**TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)**  
**CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES**

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

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

**Cert.No.:** 22TW98

**Page.:** 1 of 2

## Certificate of Testing

<b>Equipment :</b>	DO Meter
<b>Manufacturer :</b>	YSI
<b>Model :</b>	5000-230V
<b>Serial No. :</b>	15B100751
<b>ID No. :</b>	-
<b>Received Date :</b>	20 April 2022
<b>Test Date :</b>	21 April 2022
<b>Reference :</b>	2204-0429WC-1
<b>Submitted by :</b>	S.P.S. Consulting Service Co.,Ltd. 7 Phaholyothin 24, Phaholyothin Road., Jompol, Chatuchak, Bangkok 10900
<b>Laboratory Condition :</b>	Temperature ( $25 \pm 5$ ) °C Humidity ( $50 \pm 20$ ) %
<b>Test Procedure :</b>	In - house method : CP-CH9 by Comparison Technique with Azide Modification Method
<b>Tested by :</b>	Walalak Sirithean
<b>Approved by :</b>	<div style="background-color: gray; width: 200px; height: 40px; margin: 0 auto;"></div> Approved Signatory
<input checked="" type="checkbox"/> Malee Butkruea <input type="checkbox"/> Saithip Meangmai <input type="checkbox"/> Warakorn Lerngagtrakul	
<b>Issue Date :</b>	25 April 2022



Cert.No.: 22TW98

Page.: 2 of 2

**Condition of this result of calibration**

1. Reference Standard Instruments :

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

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

2. Standard Material :-

<u>Material</u>	<u>Manufacturer</u>	<u>Lot.No.</u>	<u>Assay</u>
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

**Result :** Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 14J100195

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

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

-o0o-

a 1105753



# Certificate of System Qualification

GC-OQ + GCMS-OQ

System ID: CN10925120  
Organization Name: S.P.S Consulting service  
Organization Location: 7 Soi Phaholyothin Road, Ladyao, Khet Jatujak, Bangkok 10900  
Date: March 29, 2022 3:56:41 PM  
EQP Name: AgilentRecommended , AgilentRecommended  
EQP Revision: GC.02.50, GCMS.02.50  
Overall Qualification Status: Pass

## System Inspection and Basic Safety and Operation

Name: 7890

Setpoint Status: Pass

## Overall System Inspection and Basic Safety and Operation Test Status

Pass

## Inlet Pressure Decay

Name: 7890

Back SSL

Setpoint Status:

Pass

Pressure:

25.0 psi

Pressure Change:

-0.2 psi /5 minutes

Agilent Recommended:

&gt;= -2.0 and &lt;= 0.5

## Overall Inlet Pressure Decay Test Status

Pass

## Inlet Pressure Accuracy

Name: 7890

Back SSL

Date: March 29, 2022 3:56:41 PM  
System ID: CN10925120

## Setpoint Status:

Pass

Setpoint                      Actual

Inlet Pressure:    25.0    psi            25.0    psi

Accuracy:                      0.0    psi

Agilent Recommended:    <=    1.2

## Overall Inlet Pressure Accuracy Test Status

Pass

## Inlet Pressure Accuracy

Name:

7890

Front

SSL

## Setpoint Status:

Pass

Setpoint                      Actual

Inlet Pressure:    25.0    psi            25.0    psi

Accuracy:                      0.0    psi

Agilent Recommended:    <=    1.2

## Overall Inlet Pressure Accuracy Test Status

Pass

## Detector Flow Accuracy

Name:

7890

Front

FID

## Setpoint Status:

Pass

Flow Type:

Fuel

Setpoint:

30.0

mL/min

Measured Flow:

30.4

mL/min

Accuracy:

0.4

mL/min

Agilent Recommended:

&lt;=

10.0

% setpoint

(

3.0

mL/min

)

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Date:

March 29, 2022 3:56:41 PM

System ID:

CN10025120

## Setpoint Status:

Pass

Flow Type:

Oxidizer

Setpoint:

400.0

mL/min

Measured Flow:

392.6

mL/min

Accuracy:

7.4

mL/min

Agilent Recommended:

&lt;=

10.0

% setpoint

(

40.0

mL/min

)

Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

## Setpoint Status:

Pass

Flow Type:

Makeup

Setpoint:

25.0

mL/min

Measured Flow:

25.4

mL/min

Accuracy:

0.4

mL/min

Agilent Recommended:

&lt;=

10.0

% setpoint

(

2.5

mL/min

)

Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

## Overall Detector Flow Accuracy Test Status

Pass

## GC Oven Temperature Accuracy

Name:

7890

Setpoint Status:

Pass

Zone:

Oven

Setpoint/Actual

Temperature:

230.0

230.6

°C

Accuracy:

0.6

°C

Agilent Recommended:

&gt;=

-1.0

% setpoint in K

(

-5.0

°C )

&lt;=

1.0

% setpoint in K

(

5.0

°C )

Date:

March 29, 2022 3:56:41 PM

System ID:

CN10025120



**Setpoint Status:**

Pass

Zone:

Oven

Setpoint/Actual

Temperature:

100.0 100.3 °C

Accuracy:

0.3 °C

Agilent Recommended:

&gt;= -1.0 % setpoint in K

( -3.7 °C )

&lt;= 1.0 % setpoint in K

( 3.7 °C )

**Overall GC Oven Temperature Accuracy Test Status**

Pass

**GC Oven Temperature Stability**

Name:

7890

**Setpoint Status:**

Pass

Setpoint/Average

Temperature:

100.0 100.2333 °C

Stability:

0.1 °C

Agilent Recommended:

&lt;= 0.5

**Overall GC Oven Temperature Stability Test Status**

Pass

**Scouting Run**

Tested Combination1

Back

SSL

/ Front

FID

Manual Injection

Name:

Not applicable

**Setpoint Status:**

Completed

Injection Volume on Column:

1.0 uL

**Overall Scouting Run Status**

Completed

**Noise and Drift**

Tested Combination1

Back

SSL

/ Front

FID

Date:

March 29, 2022 3:56:41 PM

System ID:

CN10025120

Name: 7890

Setpoint Status: Pass

Base Signal: 12.1 pA

ASTM Noise

counts

712.29

<= 768.00

Agilent Recommended:

Status: Pass

Drift

counts/Hr

275.82

<= 19200.00

Pass

#### Overall Noise and Drift Test Status

Pass

#### Signal to Noise

Tested Combination1 Back SSL / Front FID

Manual Injection

Name: 7890

Setpoint Status: Pass

Signal to Noise: 874687

Agilent Recommended: >= 300000

#### Overall Signal to Noise Test Status

Pass

#### Log Amp

Tested Combination2 Front SSL / External SQ

Name: 5975C Inert XL with TAD

Setpoint Status: Pass

#### Overall Log Amp Test Status

Pass

#### RFPA

Date: March 29, 2022 3:56:41 PM  
System ID: CN10025120

Tested Combination2	Front	SSL	/ External	SQ
Name:	5975C inert XL with TAD			
Setpoint Status:	Pass			
Amu:	1050	m/z	Drift After Five Minutes:	RFPA Voltage:
			4	485
			mV	mV
Agilent Recommended:	>=	-100	and	<= 100
				<= 1100
Overall RFPA Test Status				
Pass				

## Tune EI

Tested Combination2	Front	SSL	/ External	SQ
Name:	5975C inert XL with TAD			
Setpoint Status:	Pass			
Filament:	1			
Setpoint Status:	Pass			
Filament:	2			
Overall Tune EI Test Status				
Pass				

## Signal to Noise EI

Tested Combination2	Front	SSL	/ External	SQ
Name:	5975C inert XL with TAD			
Source:	EI - Inert	Filament:	1	
Setpoint Status:	Pass			
Signal to Noise:	332			
Agilent Recommended:	>= 320			

Date: March 29, 2022 3:56:41 PM  
System ID: CN10020420



Source: EI - Inert Filament: 2

Setpoint Status: Pass

Signal to Noise: 422

Agilent Recommended:  $\geq$  320

---

**Overall Signal to Noise EI Test Status**

Pass

# Instrument Details

## Purpose

This section describes the as found system configuration.

## Details

### System

System ID	CN10925120
Manufacturer	Agilent Technologies
Name	7890

### Tested Combination1

Injection Technique	Manual Injection
Sampler Identifier	Sampler 1
Inlet	Back
Detector	Front
LTM Included?	No

### Tested Combination2

Injection Technique	Manual Injection
Sampler Identifier	Sampler 2
Inlet	Front
Detector	External
LTM Included?	No

### Sampler 1

Manufacturer	Agilent Technologies
Type	Manual Injection
Usage	Sample Injection
Syringe Volume (µL)	10

### Sampler 2

Manufacturer	Agilent Technologies
Type	Manual Injection
Usage	Sample Injection
Syringe Volume (µL)	10

---

**Date:** March 29, 2022 3:56:41 PM  
**System ID:** CN10925120

## Mainframe 1

Manufacturer	Agilent Technologies
Name	7890
Model Number	G3440A
Serial Number	CN10925120
Firmware Revision	A.01.10.3
Oven Type	Standard

## Inlet 1

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

## Inlet 2

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Back
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

## Detector 1

Manufacturer	Agilent Technologies
Name	7890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Front
Makeup Gas	Nitrogen



## Detector 2

Manufacturer	Agilent Technologies
Name	Mass Spectrometer
Type	Mass Spectrometer
Location	External

## Mass Spectrometer 1

Manufacturer	Agilent Technologies
Type	SQ
Name	5975C inert XL with TAD
Serial Number	US91732743
Firmware Revision	5975 5.02.07
High Vacuum System	Turbo Pump
Scouting Run Standard	OFN Std

## MS EI Source 1

Manufacturer	Agilent Technologies
Source Type	EI - Inert
Number of filaments	2

# Electronic Signature

## Purpose

This signature page was created and published because the ACE sign-off action was executed, which is valid for the entire document, including attachments. The ACE sign-off is an electronic signature that requires two distinct identification components: unique username and personal password. The Agilent representative who has delivered this service understands the meaning and legal status of an electronic signature. As a trained official operator, the Agilent representative has a unique password and logon to access ACE and electronically sign this document. (Other e-signatures can be applied to this document using a Document Content Management or other suitable method defined in your data access and control procedures.)

## Details

Full Name of Signer:	Saenguthai Tarak
Logged On User Name:	saenguthai.tarak@non.agilent.com
Signature Creation Date:	March 29, 2022
Reason for Signature:	Executed protocol and published this original version of document

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Date:	March 29, 2022 3:56:41 PM
System ID:	CN10925120

User Name: saenguthai.tarak  
 Hostname: LAPTOP-CQ3\$KOMV

System Id: CN10925120  
 Print Date: March 29, 2022 3:56:43 PM

OQ\_GCMS\_SPS CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 29, 2022 1:45:41 PM	Audit	SessionCreated	Session	None
March 29, 2022 1:45:41 PM	Start	Configuration	Session	None
March 29, 2022 1:45:41 PM	Audit	Entitlement	Licensing	User is Nonpaying and does not require an unlock code
March 29, 2022 1:46:18 PM	Audit	EqpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks/Gc/Configurations/02.50/Gc.02.50.eqp], EQP File Name: [Gc.02.50.eqp], EQP Name: [AgilentRecommended] EQP details for hyphenated technique [GcMs] - File path: [ProtocolPacks/GcMs/Configurations/02.50/GcMs.02.50.eqp], EQP File Name: [GcMs.02.50.eqp], EQP Name: [AgilentRecommended]
March 29, 2022 1:46:20 PM	End	Configuration	Session	None
March 29, 2022 1:46:24 PM	Start	Qualification	Session	OQ
March 29, 2022 1:46:24 PM	Start	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	None
March 29, 2022 1:47:33 PM	End	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	Run Count : 1



User Name: saenguthai.tarak  
 Hostname: LAPTOP-CQ3SKOMV

System Id: CN10925120  
 Print Date: March 29, 2022 3:56:43 PM

## OQ\_GCMS\_SPS CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 29, 2022 1:47:36 PM	Start	Execution	Inlet Pressure Decay - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None
March 29, 2022 1:47:47 PM	End	Execution	Inlet Pressure Decay - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	Run Count : 1
March 29, 2022 1:47:48 PM	Start	Execution	Inlet Pressure Accuracy - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
March 29, 2022 1:47:53 PM	End	Execution	Inlet Pressure Accuracy - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
March 29, 2022 1:47:54 PM	Start	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
March 29, 2022 1:48:02 PM	End	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
March 29, 2022 1:48:04 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None
March 29, 2022 1:48:18 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
March 29, 2022 1:48:20 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	None
March 29, 2022 1:48:26 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count : 1

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Date: March 29, 2022 3:56:41 PM  
 System ID: CN10925120

User Name: saenguthai.tarak  
 Hostname: LAPTOP-CQ3SKOMV

System Id: CN10925120  
 Print Date: March 29, 2022 3:56:43 PM

## OQ\_GCMS\_SPS CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 29, 2022 1:48:27 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
March 29, 2022 1:48:40 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
March 29, 2022 1:48:42 PM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature ; Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
March 29, 2022 1:49:00 PM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature ; Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
March 29, 2022 1:49:03 PM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature ; Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
March 29, 2022 1:49:06 PM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature ; Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
March 29, 2022 1:49:30 PM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature ; Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
March 29, 2022 1:49:31 PM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature ; Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
March 29, 2022 1:49:33 PM	Start	Execution	GC Oven Temperature Stability - 7890: - Temperature ; Oven - S: 100.0°C - L: <= 0.5°C	None

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Date: March 29, 2022 3:56:41 PM  
 System ID: CN10925120

User Name: saenguthai.tarak  
 Hostname: LAPTOP-CQ3SKOMV

System Id: CN10925120  
 Print Date: March 29, 2022 3:56:43 PM

## OQ\_GCMS\_SPS CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 29, 2022 1:50:29 PM	Audit	Data	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry
March 29, 2022 1:50:30 PM	End	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
March 29, 2022 3:15:23 PM	Start	Execution	GC Scouting Run - Manual Injection, Back SSL, Front FID: - Part of System Preparation - No limits associated	None
March 29, 2022 3:15:26 PM	Start	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
March 29, 2022 3:15:39 PM	Start	Execution	GC Scouting Run - Manual Injection, Back SSL, Front FID: - Part of System Preparation - No limits associated	None
March 29, 2022 3:16:02 PM	Audit	Data	GC Scouting Run - Manual Injection, Back SSL, Front FID: - Part of System Preparation - No limits associated	Data files Path : F:\PMOQ2022\SC_FID.D\FID 1A.ch
March 29, 2022 3:16:37 PM	End	Execution	GC Scouting Run - Manual Injection, Back SSL, Front FID: - Part of System Preparation - No limits associated	Run Count : 1
March 29, 2022 3:16:39 PM	Start	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
March 29, 2022 3:25:39 PM	Start	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None

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Date: March 29, 2022 3:56:41 PM  
 System ID: CN10925120



User Name: saenguthal.tarak  
 Hostname: LAPTOP-CQ3SKOMV

System Id: CN10925120  
 Print Date: March 29, 2022 3:56:43 PM

## OQ\_GCMS\_SPS CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 29, 2022 3:26:13 PM	Audit	Data	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Data files Path : F:\PMOQ2022\IND_FID.D\FID1A.ch
March 29, 2022 3:26:19 PM	End	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Run Count : 1
March 29, 2022 3:27:37 PM	Start	Execution	Signal to Noise - Manual Injection, Back SSL, Front FID: - Detector FID - L: >= 300000	None
March 29, 2022 3:27:49 PM	Audit	Data	Signal to Noise - Manual Injection, Back SSL, Front FID: - Detector FID - L: >= 300000	Data files Path : F:\PMOQ2022\SN_FID.D\FID1A.ch
March 29, 2022 3:28:18 PM	End	Execution	Signal to Noise - Manual Injection, Back SSL, Front FID: - Detector FID - L: >= 300000	Run Count : 1
March 29, 2022 3:29:49 PM	Audit	AcqRestarted	Session	None
March 29, 2022 3:30:44 PM	Audit	SessionReloaded	Session	None
March 29, 2022 3:30:47 PM	Start	Qualification	Session	OQ
March 29, 2022 3:30:53 PM	Start	Execution	Log Amp - 5975C Inert XL with TAD SQ: - Source: EI - Inert	None
March 29, 2022 3:31:02 PM	End	Execution	Log Amp - 5975C Inert XL with TAD SQ: - Source: EI - Inert	Run Count : 1
March 29, 2022 3:31:05 PM	Start	Execution	RFP - 5975C Inert XL with TAD SQ: - Source: EI - Inert	None
March 29, 2022 3:33:09 PM	End	Execution	RFP - 5975C Inert XL with TAD SQ: - Source: EI - Inert	Run Count : 1
March 29, 2022 3:33:11 PM	Start	Execution	Tune EI - 5975C Inert XL with TAD SQ: - Source: - EI - Inert Filament 1 (Qualitative - No setpoints associated)	None

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Date: March 29, 2022 3:56:41 PM  
 System ID: CN10925120

User Name: saenguthai.tarak  
 Hostname: LAPTOP-CQ3SKQMV

System Id: CN10925120  
 Print Date: March 29, 2022 3:56:43 PM

## OQ\_GCMS\_SPS CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 29, 2022 3:33:43 PM	End	Execution	Tune EI - 5975C Inert XL with TAD SQ: - Source: - EI - Inert Filament 1 (Qualitative - No setpoints associated)	Run Count : 1
March 29, 2022 3:33:45 PM	Start	Execution	Tune EI - 5975C Inert XL with TAD SQ: - Source: - EI - Inert Filament 2 (Qualitative - No setpoints associated)	None
March 29, 2022 3:34:05 PM	End	Execution	Tune EI - 5975C Inert XL with TAD SQ: - Source: - EI - Inert Filament 2 (Qualitative - No setpoints associated)	Run Count : 1
March 29, 2022 3:34:37 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 320	None
March 29, 2022 3:34:51 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 320	Data files Path : F:\PMOQ2022\SN_F1_05.D\ DATASIM.MS
March 29, 2022 3:35:27 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 320	Run Count : 1
March 29, 2022 3:35:30 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 320	None
March 29, 2022 3:35:58 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 320	None

User Name: saenguthai.tarak  
Hostname: LAPTOP-CQ3SKOMV

System Id: CN10925120  
Print Date: March 29, 2022 3:56:43 PM

## OQ\_GCMS\_SPS CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 29, 2022 3:36:32 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 320	None
March 29, 2022 3:36:46 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 320	Data files Path : F:\PMOQ2022\SN_F2_05.D\ DATASIM.MS
March 29, 2022 3:36:53 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 320	Run Count : 1
March 29, 2022 3:36:58 PM	End'	Qualification	Session	OQ
March 29, 2022 3:36:58 PM	Start	Reporting	Session	None
March 29, 2022 3:50:19 PM	Audit	Reporting	Session	Report Generated : Certificate





## 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 ( $\mu$ V)	2.94	$\leq 50$
Baseline Drift (%)	0.18	$\leq 1$
Sensitivity ( S/N for C15)	4,000	$\geq 1,024$

## Temperature Specification

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

## Relative Standard Deviation % ( % RSD)

Checkout Procedure	Result	Specification
Area C15 ( %)	1.68	$\leq 5$
Retention Time C15( %)	0.01	$\leq 0.5$

APPROVAL

Signature: 

Engineer : Suwarot Trikainut

Date : 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		
Date	10/08/2022	



Comments			
Reviewed by		Date	10/08/2022



VARIAN





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		
Date	10/08/2022	



Comments			
Reviewed by		Date	10/08/2022



# 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**

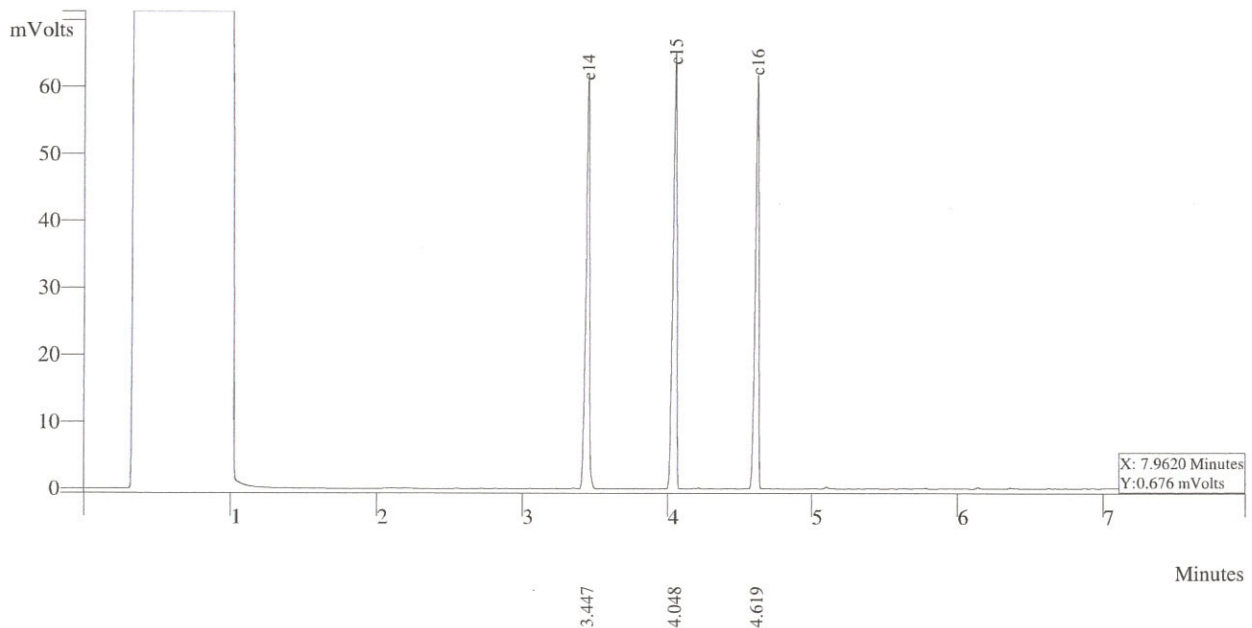
Run Mode: **Analysis**

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**

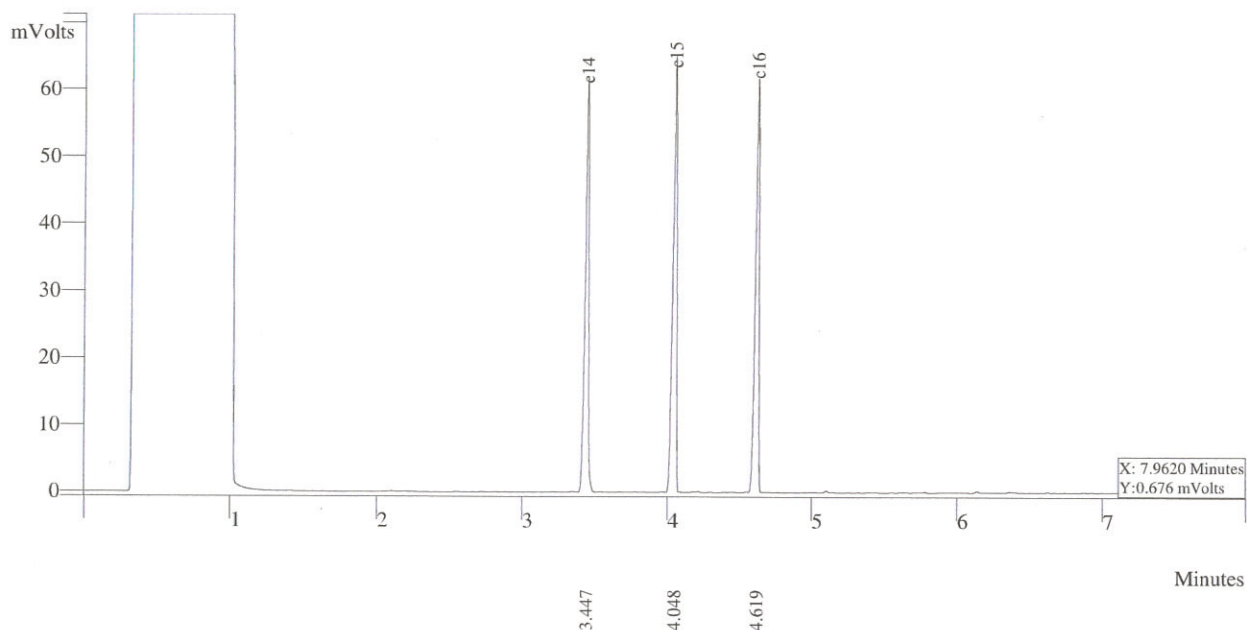
Run Mode: **Analysis**

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**

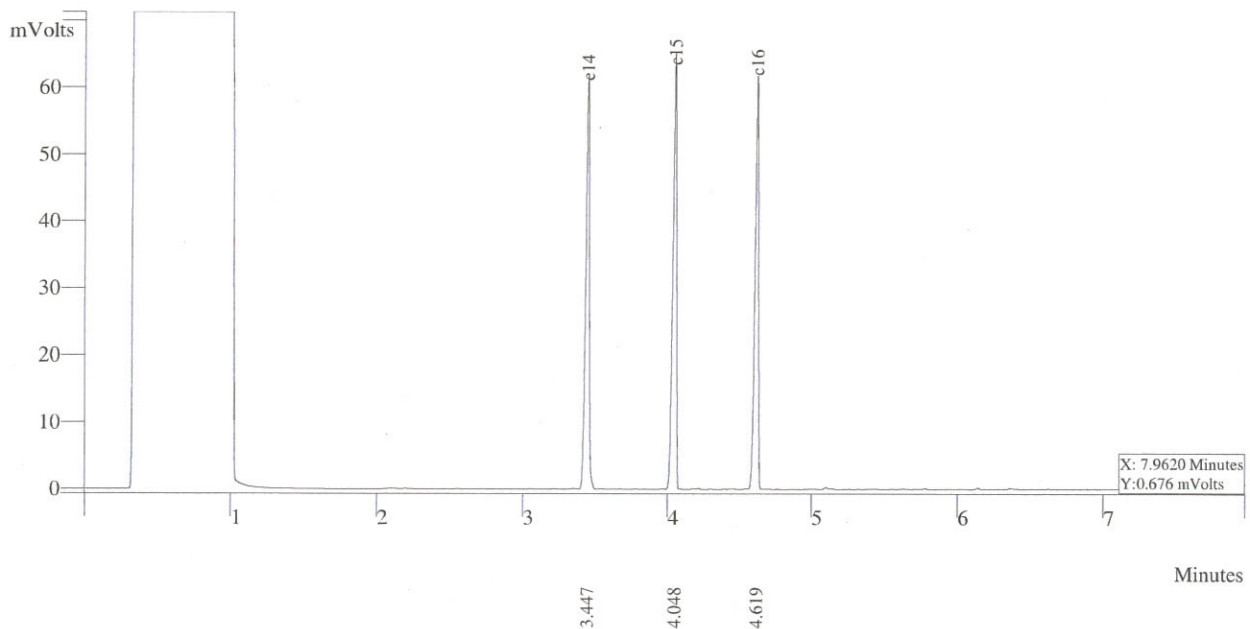
Run Mode: Analysis

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**

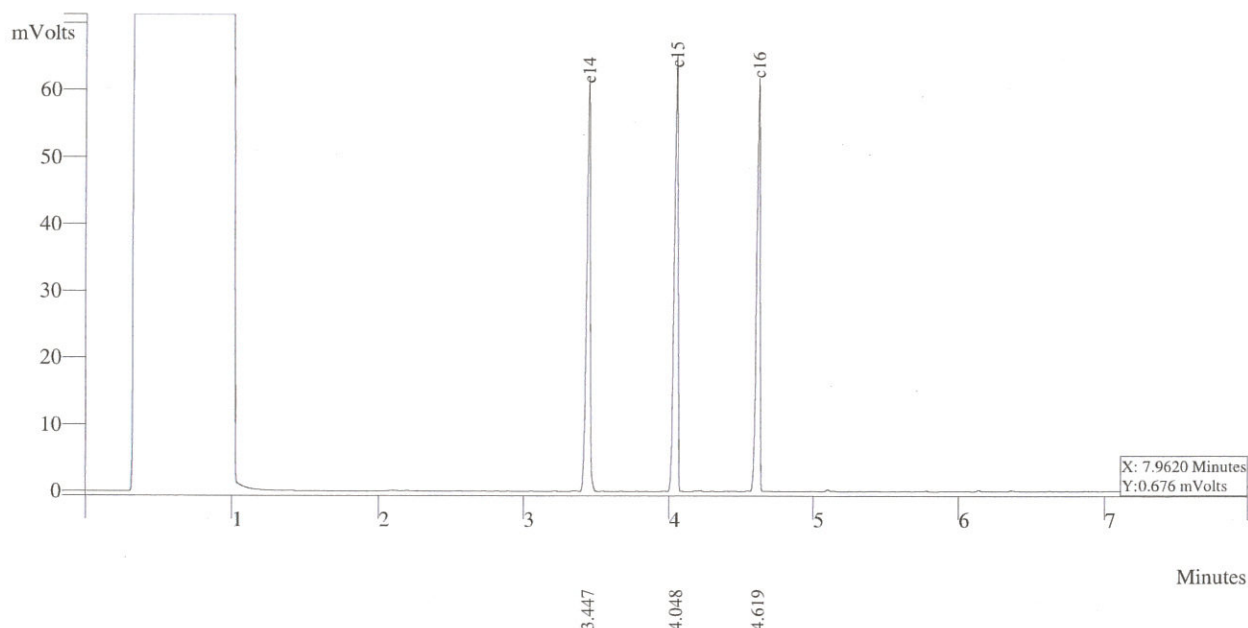
Run Mode: Analysis

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**

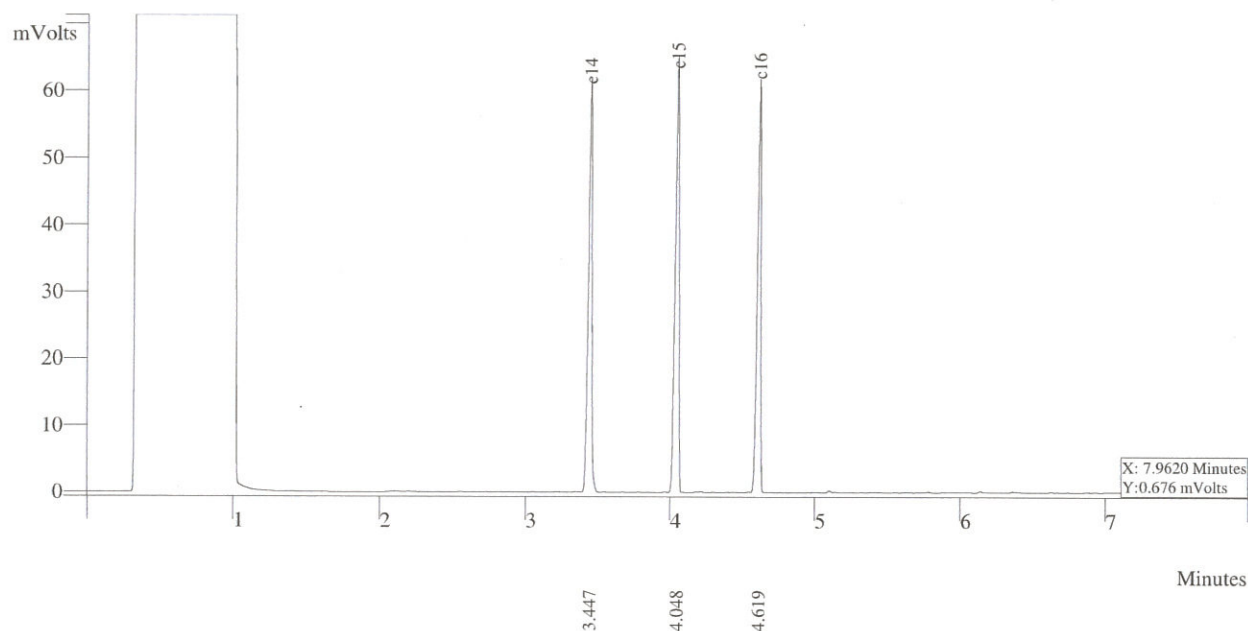
Run Mode: **Analysis**

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

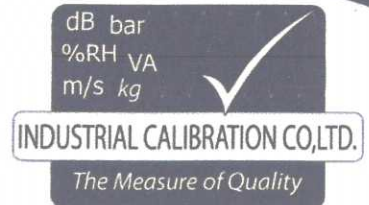


ระดับความเข้มของแสงสว่าง

## Industrial Calibration Co., Ltd.

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

Tel : +66 (02) 991 0440  
Fax : +66 (02) 531 6294  
Email : info@industrial.co.th



CERTIFICATE No. ....CAL01020-22..... PAGE .....1..... OF .....2.....

# Certificate of Calibration

Equipment : HEAVY DUTY LIGHT METER

Manufacture : EXTECH

Model / Type : 407026

Serial No. : A.055543

ID No. : N/A

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


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

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

Date Of Receipt : JAN 12, 2022

Date Of Calibration : JAN 14, 2022

Calibration By : CHICHAWADEE CHANTAKHAD

Approved By :   
(CHINNAWAT DUMPUT)

Date of Issue : JAN 14, 2022

### MEASUREMENT UNCERTAINTY :

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

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

# Industrial Calibration Co., Ltd.

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

Tel : +66 (02) 991 0440

Fax : +66 (02) 531 6294

Email : info@industrial.co.th

dB bar  
%RH VA  
m/s kg



INDUSTRIAL CALIBRATION CO.,LTD.

The Measure of Quality

CERTIFICATE No. ....CAL01020-22..... PAGE .....2..... OF .....2.....

## Calibration Report

ORDER No. : 2009-012

RECEIVED DATE :JAN 12, 2022

CALIBRATION DATE : JAN 14, 2022

<b>DESCRIPTION:</b> HEAVY DUTY LIGHT METER		<b>MANUFACTURER:</b> EXTECH	
<b>MODEL:</b> 407026	<b>SERIAL No.</b> A.055543	<b>IDENTIFICATION No:</b> N/A	<b>MADE IN :</b> N/A
<b>CALIBRATION METHOD :</b> CALIBRATION WAS CONDUCTED USING IN-HOUSE METHOD BASED ON REFERENCE LAMP COMPARISON BY LIGHT METER			
<b>REFERENCE STANDARD :</b>			
<b>DESCRIPTION :</b> DATA LOGGER LIGHT METER	<b>MODEL</b> DT-8809A	<b>S/N No.</b> 11094203	<b>CERTIFICATE No.</b> PL06069/21

### TRACEABILITY:

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

### RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

FUNTION : LIGHT MEASUREMENT

RANGE : 2000 LUX

RESOLUTION : 1 LUX

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

REMARK : UUC\* UNIT UNDER CALIBRATION

- END OF CERTIFICATE -