

## ภาคผนวกที่ 4

เอกสารสอบเทียบความถูกต้องของเครื่องมือตรวจวัดคุณภาพสิ่งแวดล้อม

**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง  
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม**

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
<b>1. คุณภาพอากาศในบรรยากาศ</b> Formaldehyde	Gas Sampler Box No. B03, B06, B08, B14, B15, B16	HPLC
Methanol	Mass Flow Meter	GC/MS
NO <sub>2</sub>	NO <sub>2</sub> Analyzer No. R01	NO <sub>2</sub> Analyzer No. R01
<b>2. คุณภาพอากาศจากปล่อง</b> CO	Personal Pump SKC No.B66 Rotameter No. H-R02	Digital Balance
NO <sub>x</sub>	Vacuum Gauge	Spectrophotometer
Formaldehyde	Personal Pump SKC No. B66, B72, R08 Rotameter No. L-R02	Digital Balance
Methanol	Personal Pump SKC No. B71, R24 Rotameter No. L-R02	Digital Balance
<b>3. ระดับเสียง</b> L <sub>eq</sub> 24 hr และ L <sub>90</sub>	Acoustic Calibrator Sound Level Meter ACO-R19, R29, R31, R32, R33	- -
<b>4. คุณภาพน้ำ</b> pH	-	pH Meter
TSS	-	Digital Balance
TDS	-	Digital Balance
BOD <sub>5</sub>	-	BOD Analyzer
COD	-	COD Reactor
Grease & Oil	-	Digital Balance
Formaldehyde	-	Spectrophotometer
Methanol	-	Spectrophotometer
TPH	-	Digital Balance
<b>5. คุณภาพอากาศในสถานประกอบการ</b> Formaldehyde	Personal Pump SKC No. B49, B65, B71, B72, B77, B93, R07, R21, R33, R36, R39, R43 Rotameter No. L-R02, R03, R04	GC/MS
Methanol	Personal Pump SKC No. B49, B65, B71, B72, B77, B93, R07, R21, R33, R36, R39, R43 Rotameter No. L-R02, R03, R04	GC/MS
<b>6. ระดับเสียงในการทำงาน</b> Leq	Acoustic Calibrator Sound Level Meter ACO-B29, B36, R40, R41, R50, R51, R52	- -
Noise Dose	Noise Dose Meter No. NMD-R02, R03, R05, R35	-

คุณภาพอากาศในบรรยากาศ



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

## Gas Sampler Box Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Dry Cal DCL-ML

S/N : 136164

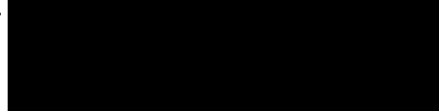
### Calibration Data

Gas Sampler Data		Calibration Data					
No.	Rotameter	Date	Setting (Constant Flow) (ml/min)	Actual Flow Rate (ml/min)			
				Sampling Line A		Sampling Line B	
				Normal Condition	Standard Condition	Normal Condition	Standard Condition
B01	2 (A&B)	01/06/2022	200	200.4	199.0	200.6	199.2
B02	2 (A&B)	01/06/2022	200	200.6	199.1	200.5	199.0
B03	2 (A&B)	03/06/2022	200	200.5	199.0	200.5	199.1
B04	2 (A&B)	02/06/2022	200	200.5	199.1	200.6	199.2
B05	2 (A&B)	01/06/2022	200	200.4	199.0	200.5	199.1
B06	2 (A&B)	01/06/2022	200	200.5	199.1	200.4	198.9
B07	2 (A&B)	03/06/2022	200	200.3	198.9	200.5	199.1
B08	2 (A&B)	01/06/2022	200	200.5	199.1	200.4	199.0
B09	2 (A&B)	01/06/2022	200	200.4	199.0	200.3	198.9
B10	2 (A&B)	02/06/2022	200	200.5	199.0	200.5	199.0
B11	2 (A&B)	01/06/2022	200	200.4	199.0	200.7	199.2
B12	2 (A&B)	01/06/2022	200	200.5	199.1	200.5	199.0
B13	2 (A&B)	02/06/2022	200	200.4	199.0	200.5	199.1
B14	2 (A&B)	02/06/2022	200	200.5	199.0	200.4	198.9
B15	2 (A&B)	03/06/2022	200	200.6	199.2	200.6	199.2
B16	2 (A&B)	01/06/2022	200	200.5	199.0	200.5	199.1
B17	2 (A&B)	01/06/2022	200	200.5	199.0	200.4	199.0

Calibrated by :



Approved by





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				Sampling Line A		Sampling Line B	
				Normal Condition	Standard Condition	Normal Condition	Standard Condition
B01	2 (A&B)	01/09/2022	200	200.6	199.2	200.4	199.0
B02	2 (A&B)	01/09/2022	200	200.4	199.0	200.5	199.0
B03	2 (A&B)	02/09/2022	200	200.6	199.2	200.6	199.1
B04	2 (A&B)	01/09/2022	200	200.4	199.0	200.4	199.0
B05	2 (A&B)	01/09/2022	200	200.5	199.1	200.6	199.1
B06	2 (A&B)	05/09/2022	200	200.4	199.0	200.5	199.1
B07	2 (A&B)	01/09/2022	200	200.6	199.1	200.5	199.0
B08	2 (A&B)	05/09/2022	200	200.4	199.0	200.4	199.0
B09	2 (A&B)	02/09/2022	200	200.5	199.0	200.6	199.2
B10	2 (A&B)	01/09/2022	200	200.6	199.1	200.5	199.0
B11	2 (A&B)	05/09/2022	200	200.6	199.1	200.7	199.3
B12	2 (A&B)	01/09/2022	200	200.5	199.0	200.5	199.0
B13	2 (A&B)	05/09/2022	200	200.4	199.0	200.7	199.2
B14	2 (A&B)	01/09/2022	200	200.6	199.1	200.6	199.2
B15	2 (A&B)	02/09/2022	200	200.4	199.0	200.5	199.0
B16	2 (A&B)	02/09/2022	200	200.6	199.1	200.5	199.1
B17	2 (A&B)	01/09/2022	200	200.5	199.0	200.6	199.1

Calibrated by :

Approved by :



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				Sampling Line A		Sampling Line B	
				Normal Condition	Standard Condition	Normal Condition	Standard Condition
B01	2 (A&B)	01/12/2022	200	200.4	199.0	200.5	199.1
B02	2 (A&B)	01/12/2022	200	200.5	199.1	200.8	199.3
B03	2 (A&B)	05/12/2022	200	200.4	199.0	200.5	199.0
B04	2 (A&B)	05/12/2022	200	200.8	199.3	200.7	199.3
B05	2 (A&B)	02/12/2022	200	200.5	199.1	200.4	199.0
B06	2 (A&B)	02/12/2022	200	200.4	199.0	200.5	199.1
B07	2 (A&B)	02/12/2022	200	200.8	199.4	200.9	199.5
B08	2 (A&B)	06/12/2022	200	200.4	199.0	200.5	199.1
B09	2 (A&B)	06/12/2022	200	200.6	199.2	200.4	199.0
B10	2 (A&B)	01/12/2022	200	200.6	199.1	200.5	199.1
B11	2 (A&B)	02/12/2022	200	200.4	199.0	200.7	199.3
B12	2 (A&B)	05/12/2022	200	200.8	199.4	200.5	199.0
B13	2 (A&B)	06/12/2022	200	200.6	199.1	200.8	199.3
B14	2 (A&B)	02/12/2022	200	200.7	199.2	200.5	199.1
B15	2 (A&B)	01/12/2022	200	200.4	199.0	200.7	199.2
B16	2 (A&B)	01/12/2022	200	200.6	199.1	200.4	199.0
B17	2 (A&B)	02/12/2022	200	200.5	199.0	200.6	199.1

Calibrated by :

[Redacted Signature]

Approved by :

[Redacted Signature]



## 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

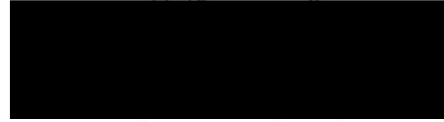
Result Of Qualification: **Passes & Certifies For 1 Year**

Qualified By



Engineer Technical Services

Approved By



AGM, Technical Services

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- The data and numbers on this document cannot be changed and replaced in any cases.
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ศูนย์บริการลูกค้าและการขาย - Technology service call center



## Certificate of Calibration

Certificate Number : SPR22050189-1

Page : 1 of 3

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

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

Equipment Name : Mass Flow Meter

Manufacturer : Dwyer

Model : GMF-2101

Serial Number : N/A

ID. Number : N/A

### Environmental Conditions

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

Received Date : 13 May 2022

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

Calibration Date : 14 May 2022

Location of Calibration : In-Lab

Recommend Due Date : 14 May 2023

Calibration Procedure : In-House Method

Date of Issue : 15 May 2022

### Method of Calibration

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

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

Calibrated by : Mr.Jirasak Pumbut

Approved by

Calibration Officer

Authorized Signatory





# Calibration Report

Certificate Number : SPR22050189-1

Page : 2 of 3

## Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Mass Flow Calibrator	AFC-COMplete-10	12532	AD2107-244-0001	24 Jul 2022

### Traceability

This certification is traceable to the International System of Unit maintained at :  
MIT - Miracle International Technology Co.,Ltd.

69/25 Moo 1 Klongsi Klonguang Pathumthani 12120 ( Thailand ) Tel: (662) 193-2220 E-Mail: [www.spmetrology.co.th](mailto:www.spmetrology.co.th)



## Result of Calibration

Certificate No. : SPR22050189-1

Page : 3 of 3

Function : Air Flow Measurement

Unit : CFM

Calibration Point	UUC Reading	Standard Reading	UUC Error	K Factor Value	Uncertainty ( ± )
0.0	0.00	0.00	0.00	1.00000	0.12
3.3	3.32	3.53	-0.21	1.06325	0.26
7.3	7.40	7.74	-0.34	1.04595	0.26
13.5	13.25	14.22	-0.97	1.07321	0.26
17.0	17.00	17.58	-0.58	1.03412	0.26

**Note:**

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

**Measurement Uncertainty**

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

- End of Certificate -

# 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:

CN10905120

## 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:

CN10005120

**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:

CN10025420

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: CN10925120



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

Source: Ei - Inert Filament: 2

Setpoint Status: Pass

Signal to Noise: 422

Agilent Recommended:  $\geq$  320

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**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

## 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-GQ3SKOMV

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\_9PS 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 3:15:28 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: 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 3:26:13 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\ND_FID.D\FID 1A.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\FID 1A.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	AccRestarted	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	RPPA - 5975C Inert XL with TAD SQ: - Source: EI - Inert	None
March 29, 2022 3:33:09 PM	End	Execution	RPPA - 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: seenguthal.tarek  
 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 3:33:43 PM	End	Execution	Tune EI - 5976C 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 3:38:48 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,DI DATASIM.MS
March 29, 2022 3:38:53 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



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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 : 02 August 2022

BRAND : API

MODEL : 200E

NO. NOX-R01

SERIAL NO. 769

#### Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 20 September 2021

Serial No. : 421

#### Reference Standard Gas

Standard Gas : Nitric Oxide (NO)

Cylinder No. : D636192

Certified Date : 20 April 2022

Expired Date : 20 April 2024

Cylinder Conc. : 49.1 ppm

#### CALIBRATING CONDITION

Pressure 1011 mmbar

Temp. 24.5 °C

% RH 49

#### 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	0.11	-	0	-
NO Span	400	399.8	-0.050	400.0	1.004
NO <sub>x</sub> Span	400	400.2	0.050	400.0	1.009

#### 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	507	cc/min	500 ± 50
OZONE FLOW	78	cc/min	80 ± 15
PMT	103.2	mV	-20 - 150
AZERO	94.0	mV	-20 - 150
HVPS	674	V	420 - 900 constant
RCELL TEMP	50.2	°C	50 ± 1
BOX TEMP	29.5	°C	8 - 48
PMT TEMP	7.4	°C	7 ± 2
MOLY TEMP	315.3	°C	315 ± 5
RCELL PRESS	8.5	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.7	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO <sub>x</sub> Span Conc	400	PPB	20 - 20,000
NO Slope	1.004	-	1.0 ± 0.3
NO <sub>x</sub> Slope	1.009	-	1.0 ± 0.3
NO Offset	1.3	mV	-20 to +150
NO <sub>x</sub> Offset	0.9	mV	-20 to 150
Stability at Zero	0.1	PPB	< 0.2
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas

Calibrated by :

Approved by



คุณภาพอากาศจากปล่อง



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

### Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

#### Environmental Conditions

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

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R²
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	0.982x + 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	510877	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, 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 °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
R01	SKC	224-PCXR4	602467	01/07/2022	1,000	1,500	2,000	993	1,508	2,004	1.020x - 38.744	0.998
R02	SKC	224-PCXR4	626450	01/07/2022	1,000	2,000	3,000	998	1,499	1,990	0.989x + 12.348	1.000
R03	SKC	224-PCXR4	691592	04/07/2022	1,000	1,500	2,000	1,003	1,500	2,004	1.012x - 22.080	0.999
R04	SKC	224-PCXR4	691672	01/07/2022	1,000	1,500	2,000	996	1,493	1,993	0.997x - 1.763	1.000
R05	SKC	224-PCXR4	798470	04/07/2022	1,000	1,500	2,000	994	1,506	1,999	1.013x - 30.077	0.999
R06	SKC	224-PCXR4	798456	04/07/2022	1,000	1,500	2,000	994	1,496	1,994	1.002x - 7.319	1.000
R07	SKC	224-PCXR4	798480	04/07/2022	1,000	1,500	2,000	994	1,490	2,000	1.008x - 17.031	1.000
R08	SKC	224-PCXR4	883215	05/07/2022	1,000	1,500	2,000	1,001	1,502	2,005	1.015x - 26.148	0.999
R09	SKC	224-PCXR4	034650	01/07/2022	1,000	1,500	2,000	991	1,504	2,002	1.018x - 36.777	0.999
R10	SKC	224-PCXR4	091765	04/07/2022	1,000	1,500	2,000	996	1,512	1,994	1.000x + 0.100	1.000
R11	SKC	224-PCXR4	091763	01/07/2022	1,000	1,500	2,000	1,000	1,499	2,002	1.013x - 25.598	0.999
R12	SKC	224-PCXR4	091568	04/07/2022	1,000	1,500	2,000	997	1,501	1,999	1.001x - 4.866	1.000
R13	SKC	224-PCXR4	091638	04/07/2022	1,000	1,500	2,000	1,002	1,498	1,993	0.991x + 10.115	1.000
R14	SKC	224-PCXR4	091784	04/07/2022	1,000	1,500	2,000	994	1,502	1,999	1.013x - 29.654	0.999
R15	SKC	224-PCXR8	529457	01/07/2022	1,000	1,500	2,000	1,001	1,500	2,004	1.013x - 25.263	0.999
R16	SKC	224-PCXR8	529643	01/07/2022	1,000	1,500	2,000	998	1,497	1,994	0.997x - 0.379	1.000
R17	SKC	224-PCXR8	529645	01/07/2022	1,000	1,500	2,000	994	1,509	2,000	1.014x - 30.173	0.999
R18	SKC	224-PCXR8	566756	04/07/2022	1,000	1,500	2,000	991	1,496	1,998	1.001x - 6.880	1.000
R19	SKC	224-PCXR8	566802	01/07/2022	1,000	1,500	2,000	1,003	1,499	2,000	1.010x - 19.831	0.999
R20	SKC	224-PCXR8	529089	01/07/2022	1,000	1,500	2,000	990	1,500	2,003	1.020x - 40.235	0.999
R21	SKC	224-PCXR8	665728	04/07/2022	1,000	1,500	2,000	998	1,493	1,999	1.001x - 5.604	1.000
R22	SKC	224-PCXR8	707444	04/07/2022	1,000	1,500	2,000	1,002	1,500	2,001	1.011x - 21.494	0.999
R23	SKC	224-PCXR8	761067	04/07/2022	1,000	1,500	2,000	998	1,494	1,992	0.994x + 2.896	1.000
R24	SKC	224-PCXR8	707893	01/07/2022	1,000	1,500	2,000	996	1,505	2,000	1.013x - 27.843	0.999
R25	SKC	224-PCXR8	761052	04/07/2022	1,000	1,500	2,000	998	1,500	1,993	0.993x + 6.633	1.000
R26	SKC	224-PCXR8	707956	04/07/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.013x - 24.298	0.999
R27	SKC	224-PCXR8	707398	01/07/2022	1,000	1,500	2,000	996	1,503	2,001	1.013x - 28.844	0.999
R28	SKC	224-PCXR8	707481	04/07/2022	1,000	1,500	2,000	1,004	1,500	2,003	1.010x - 19.727	0.999
R29	SKC	224-PCXR8	707402	01/07/2022	1,000	1,500	2,000	1,005	1,491	1,991	0.988x + 13.928	1.000
R30	SKC	224-PCXR8	093811	01/07/2022	1,000	1,500	2,000	998	1,495	1,994	0.998x - 1.149	1.000
R31	SKC	224-PCXR8	093183	01/07/2022	1,000	1,500	2,000	1,001	1,501	2,001	1.012x - 23.161	0.999
R32	SKC	224-PCXR8	671950	04/07/2022	1,000	1,500	2,000	1,000	1,498	1,994	0.993x + 7.961	1.000
R33	SKC	224-PCXR4	626254	04/07/2022	1,000	1,500	2,000	992	1,502	1,999	1.017x - 34.540	0.999
R34	SKC	224-PCXR4	626131	04/07/2022	1,000	1,500	2,000	1,002	1,498	2,004	1.013x - 25.091	0.999
R35	SKC	224-PCXR8	707460	04/07/2022	1,000	1,500	2,000	998	1,498	1,995	0.994x + 5.472	1.000
R36	SKC	224-PCXR8	707446	01/07/2022	1,000	1,500	2,000	1,003	1,500	2,001	1.009x - 19.272	0.999
R37	SKC	224-PCXR8	707432	01/07/2022	1,000	1,500	2,000	999	1,499	1,998	0.998x + 0.243	1.000
R38	SKC	224-PCXR8	707349	01/07/2022	1,000	1,500	2,000	996	1,500	2,002	1.015x - 32.039	0.999
R39	SKC	224-PCXR8	761095	04/07/2022	1,000	1,500	2,000	1,001	1,496	1,994	0.997x + 2.333	1.000

Calibrated by :



Approved by :





บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด  
S.P.S. CONSULTING SERVICE CO., LTD.  
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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@spscn.com, www.spscn.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-R01	Dwyer	VFB-65	04/07/2022	500	1,000	2,000	503.3	992.4	1978.7	0.999x - 3.250	0.999
H-R02	Dwyer	VFB-65	04/07/2022	500	1,000	2,000	501.2	995.3	1985.7	1.002x - 4.979	1.000
H-R03	Dwyer	VFB-65	04/07/2022	500	1,000	2,000	502.5	989.9	1996.9	0.993x + 3.105	1.000
H-R04	Dwyer	VFB-65	01/07/2022	500	1,000	2,000	496.4	989.6	2019.5	1.009x - 13.684	1.000
H-R05	Dwyer	VFB-65	01/07/2022	500	1,000	2,000	497.2	990.3	1988.1	1.003x - 8.079	1.000
H-R06	Dwyer	VFB-65	04/07/2022	500	1,000	2,000	504.6	992.4	1979.4	1.000x - 3.305	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

Rotameter Calibration Report (For Personal Pump Low Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R <sup>2</sup>
L-R01	Dwyer	VFA-21	04/07/2022	50	100	200	50.2	101.0	203.5	0.988x + 2.342	1.000
L-R02	Dwyer	VFA-21	04/07/2022	50	100	200	50.1	101.3	200.5	1.006x - 0.768	0.999
L-R03	Dwyer	VFA-21	04/07/2022	50	100	200	50.5	99.8	202.3	1.016x - 0.811	1.000
L-R04	Dwyer	VFA-21	01/07/2022	50	100	200	50.2	100.9	200.6	1.009x - 1.208	0.999
L-R05	Dwyer	VFA-21	01/07/2022	50	100	200	50.2	100.4	203.0	0.991x + 1.666	1.000
L-R06	Dwyer	VFA-21	04/07/2022	50	100	200	50.6	99.1	201.5	1.002x - 0.007	1.000

Calibrated by :

Approved by :



**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** : 

**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

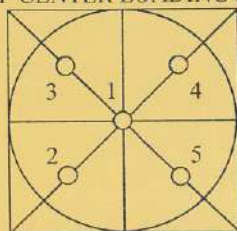
3. REPEATABILITY OF READING AT 20 g WAS 0.000004 g

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	50.0000	0.0000	0.00011
100.00	100.0001	-0.0001	0.00019
120.00	120.0001	-0.0001	0.00022

6. OFF CENTER LOADING ERROR



POINT	READING (g)	
1	10.00001	50.0000
2	10.00002	50.0000
3	10.00001	50.0000
4	10.00001	50.0000
5	10.00002	50.0001
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





# CALIBRATION LABORATORY Co., LTD.

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



## CERTIFICATE OF CALIBRATION

### FOR

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

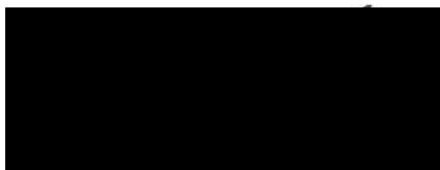
CUSTOMER : S.P.S. CONSULTING SERVICE CO., LTD.  
7 SOI PHAHOLYOTHIN 24 ROAD., JOMPOL,  
CHATUCHAK, BANGKOK 10900

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



@clccalibration

## 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



## ***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

<p><i>The preventive maintenance checks and if applicable performance tests for Lambda UV have been completed.</i></p>	
<p><b>This Lambda UV Passes</b> <input checked="" type="checkbox"/> <b>Fails</b> <input type="checkbox"/> <i>the preventive maintenance.</i></p>	
<p><b>Review of Preventive Maintenance:</b></p>	
<p>Authorized PerkinElmer Representative:</p> <div style="background-color: black; width: 250px; height: 40px; margin-left: 100px;"></div>	<p>Date:</p> <p>25-Jan-2022 (DD-MM-YYYY)</p>
<p>Authorized Customer Representative:</p>	<p>Date:</p> <p>25-Jan-2022 (DD-MM-YYYY)</p>

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.

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  
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Amphoe Muang, Changwat Samutprakan 10280, Thailand  
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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

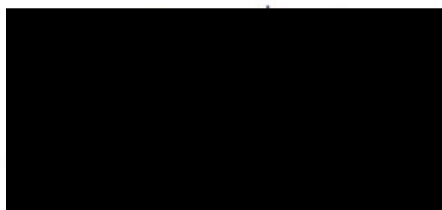
Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	999.9	-0.1	$\pm 1.5$	$\pm 1.0\%$

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 :



Approved by :



Director  
TISTR

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

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

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

FM.BLMTC.002 Rev.4

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E-mail : sumalee@tistr.or.th



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

Noise R\_407/22

### 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-R19	ACO	6236	00182001	02 August 2022	94.0	94.0
ACO-R29	ACO	6236	00192041	02 August 2022	94.1	94.0
ACO-R31	ACO	6236	00192043	02 August 2022	94.1	94.0
ACO-R32	ACO	6236	00192044	02 August 2022	94.0	94.0
ACO-R33	ACO	6236	00192045	02 August 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 :



คุณภาพน้ำ





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert.No.: 21CH1216

Page.: 1 of 2

## Certificate of Calibration

**Equipment :** pH Meter  
**Manufacturer :** HANNA  
**Model :** HI 3512  
**Serial No. :** 08685754  
**ID No. :** -  
**Condition As-Received:** Used Item  
**Received Date :** 14 September 2021  
**Calibration Date :** 16 September 2021  
**Reference :** 2109-0508WN-1  
**Submitted by :** S.P.S. Consulting Service Co.,Ltd.  
7 Phaholyothin 24, Phaholyothin Road,  
Jompol, Chatuchak, Bangkok10900  
**Ambient Temperature :** (25 ± 2.5) °C  
**Relative Humidity :** (50 ± 15) %  
**Calibration Procedure :** In - house method :  
- CP-CH5 by direct measurement with standard  
voltage calibrator and direct measurement  
with certified reference material (CRM)

**Calibrated by :** Walalak Sirithean

**Approved by :**

- (✓) Malee Butkruea  
( ) Saithip Meangmai  
( ) Warakorn Lernagtrakul

**Issue Date :** 22 September 2021

The Uncertainties are for a confidence probability of approximately 95%

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

A 0032410



Cert. No.: 21CH1216

Page.: 2 of 2

**Condition of this calibration result**

1. Reference Standard Instrument : -

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Document Process Calibrator	46530031	130RC098	20E3666	14 Oct 2021

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

- Traceable to National Institute of Metrology (Thailand), NIMT

2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,  
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

<u>Buffer Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
pH 4.008	CPA chem	754028	28 June 2023
pH 6.985	CPA chem	725927	12 Jan 2022
pH 10.015	CPA chem	761018	02 Aug 2022

3. This certificate is valid only to the item calibrated on date and place of calibration.

**Calibration Results****Function : mV Measurement**

Performing standard curve by Fluke at pH (4,7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement ( $\pm$ mV)	Coverage factor <i>k</i>
	pH	mV	mV	pH		
pH Meter S/N.: 08685754	4.000	177.48	177.9	4.000	0.058	2.00
	7.000	0.00	0.4	7.000	0.058	2.00
	10.000	-177.48	-177.2	10.000	0.058	2.00

**Function : pH Measurement**

Performing three buffers standard curve by using buffer nominal pH (4,7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement ( $\pm$ )	Coverage factor <i>k</i>
pH Electrode S/N.: 061416CM	4.008	4.008	169.2	0.0046	2.00
	6.985	6.985	-4.4	0.0075	2.00
	10.015	10.013	-178.9	0.013	2.05

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

-o0o-



**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** : [REDACTED]

**ISSUED DATE** : 15-Sep-22

**RECEIVED DATE** : 14-Sep-22

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



**QUALITY CALIBRATION CO.,LTD.**

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

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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 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.**

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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 : 22M2569

REFERENCE No : 64386-3

PAGE : 1 OF 2

## Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : SARTORIUS

MODEL : BSA224S-CW

SERIAL No : 36591843

ID No : BA 09/61

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : TETNITHI W.

CALIBRATION DATE : 11-Mar-22

APPROVED BY : 

ISSUED DATE : 17-Mar-22

RECEIVED DATE : 11-Mar-22





CERTIFICATE No : 22M2569

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : BSA224S-CW  
MANUFACTURER : SARTORIUS S/N : 36591843  
ID No : BA 09/61 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

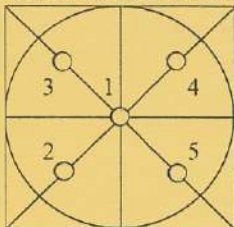
2. TARE FUNCTION : NORMAL

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	99.9999
3	100.0000
4	99.9999
5	99.9998
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





**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: black; width: 150px; height: 30px; 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) (mg/L)</b>	<b>DO Meter Reading (mg/L)</b>	<b>Standard Deviation (mg/L)</b>
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

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a 1105753



# 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

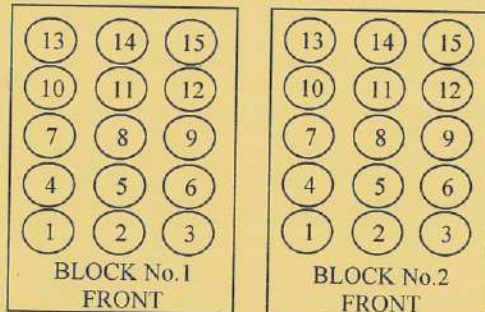
1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT TEMPERATURE RECORDER WITH THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON 15 POINTS AND LOCATED ONE THERMOCOUPLE IN EACH OF THE FOUR CORNERS OF THE REACTOR AND PLACED THE EIGHTH THERMOCOUPLE AT THE CENTER OF THE REACTOR.

### 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 MULTIPLIED BY A COVERAGE FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

## ***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

<p><i>The preventive maintenance checks and if applicable performance tests for Lambda UV have been completed.</i></p>	
<p><b>This Lambda UV Passes</b> <input checked="" type="checkbox"/> <b>Fails</b> <input type="checkbox"/> <i>the preventive maintenance.</i></p>	
<p><b>Review of Preventive Maintenance:</b></p>	
<p>Authorized PerkinElmer Representative:</p> <div style="background-color: black; width: 200px; height: 30px; margin: 5px 0;"></div>	<p>Date:</p> <p>25-Jan-2022 (DD-MM-YYYY)</p>
<p>Authorized Customer Representative:</p>	<p>Date:</p> <p>25-Jan-2022 (DD-MM-YYYY)</p>

# 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 :**



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

**Continuation of Calibration Certificate**

**Cert. No. : SP22018**

**Job No. : VC65SP0008**

**Pages : 2 of 3**

**Calibration Method :**

This instrument was calibrated by using on-site calibration procedure In-house method : CP-SP-01

The calibration procedure to direct measurement wavelength accuracy by using wavelength standard solution, Photometric accuracy by using absorbance standard filter and absorbance standard solution

The calibration procedure used was based on ASTM E275-01,ASTM E925-02

**Condition of this result of calibration :**

**1. Certified reference materials**

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

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

**3. This certificate is traceable to the international system of unit maintained at :**

3.1 The UK National Physical Laboratory (NPL)

3.2 The National Institute of Standards and Technology,NIST.

**Result of calibration : Wavelength Accuracy**

(Without adjustment)

<u>Material</u>	<u>Certified Values of Reference Material (nm)</u>	<u>UUC* Reading (nm)</u>	<u>Error (nm)</u>	<u>Uncertainty ± (nm)</u>	<u>k Factor</u>
<b>RM-HL</b>	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
<b>RM-DL</b>	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**



คุณภาพอากาศในสถานประกอบการ



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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R²
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	510877	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 :



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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>
B80	SKC	224-PCXR3	504569	01/07/2022	1,000	1,500	2,000	1,003	1,499	2,001	1.011x - 21.873	0.999
B81	SKC	224-PCXR3	503480	01/07/2022	1,000	1,500	2,000	996	1,499	2,000	1.013x - 28.489	0.999
B82	SKC	224-PCXR3	505673	04/07/2022	1,000	1,500	2,000	993	1,499	1,996	1.001x - 6.102	1.000
B83	SKC	224-PCXR3	510785	05/07/2022	1,000	1,500	2,000	1,000	1,499	2,002	1.012x - 24.266	0.999
B84	SKC	224-PCXR3	508333	04/07/2022	1,000	1,500	2,000	997	1,495	1,991	0.996x + 1.460	1.000
B85	SKC	224-PCXR3	505757	01/07/2022	1,000	1,500	2,000	993	1,502	1,998	1.013x - 29.678	0.999
B86	SKC	224-PCXR3	512625	01/07/2022	1,000	1,500	2,000	1,003	1,502	2,004	1.012x - 22.383	0.999
B87	SKC	224-PCXR3	504324	06/07/2022	1,000	1,500	2,000	998	1,496	2,000	1.001x - 2.385	1.000
B88	SKC	224-PCXR3	508307	06/07/2022	1,000	1,500	2,000	997	1,498	1,994	0.997x + 1.093	1.000
B89	SKC	224-PCXR3	509860	06/07/2022	1,000	1,500	2,000	1,000	1,500	2,003	1.014x - 25.845	0.999
B90	SKC	224-PCXR3	508366	06/07/2022	1,000	1,500	2,000	992	1,502	2,000	1.015x - 32.055	0.999
B91	SKC	224-PCXR3	510919	04/07/2022	1,000	1,500	2,000	1,000	1,498	1,996	0.999x - 0.694	1.000
B92	SKC	224-PCXR3	510987	04/07/2022	1,000	1,500	2,000	1,002	1,501	2,004	1.013x - 23.312	0.999
B93	SKC	224-PCXR3	509845	05/07/2022	1,000	1,500	2,000	1,000	1,496	1,998	1.000x - 2.501	1.000
B94	SKC	224-PCXR8	A127871	05/07/2022	1,000	1,500	2,000	1,000	1,500	2,002	1.014x - 25.765	0.999
B95	SKC	224-PCXR8	A127921	05/07/2022	1,000	1,500	2,000	992	1,502	2,001	1.016x - 33.052	0.999
B96	SKC	224-PCXR8	A127942	05/07/2022	1,000	1,500	2,000	996	1,498	1,996	1.002x - 5.799	1.000
B97	SKC	224-PCXR8	A127955	05/07/2022	1,000	1,500	2,000	1,003	1,501	2,003	1.012x - 21.717	0.999
B98	SKC	224-PCXR8	A127956	05/07/2022	1,000	1,500	2,000	1,000	1,498	1,998	0.999x - 1.863	0.999

Calibrated by :

Approved by :





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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R <sup>2</sup>
R01	SKC	224-PCXR4	602467	06/10/2022	1,000	1,500	2,000	993	1,508	2,004	1.020x - 38.145	0.999
R02	SKC	224-PCXR4	626450	06/10/2022	1,000	2,000	3,000	998	1,499	1,990	0.989x + 12.189	1.000
R03	SKC	224-PCXR4	691592	03/10/2022	1,000	1,500	2,000	1,004	1,500	2,004	1.011x - 21.482	0.999
R04	SKC	224-PCXR4	691672	03/10/2022	1,000	1,500	2,000	996	1,493	1,994	0.997x - 0.766	1.000
R05	SKC	224-PCXR4	798470	06/10/2022	1,000	1,500	2,000	994	1,505	1,999	1.014x - 30.635	0.999
R06	SKC	224-PCXR4	798456	06/10/2022	1,000	1,500	2,000	994	1,498	1,994	1.002x - 7.000	1.000
R07	SKC	224-PCXR4	798480	06/10/2022	1,000	1,500	2,000	994	1,490	1,999	1.008x - 16.751	1.000
R08	SKC	224-PCXR4	883215	06/10/2022	1,000	1,500	2,000	1,001	1,501	2,005	1.014x - 26.148	0.999
R09	SKC	224-PCXR4	034650	06/10/2022	1,000	1,500	2,000	991	1,504	2,002	1.018x - 36.179	0.999
R10	SKC	224-PCXR4	091765	06/10/2022	1,000	1,500	2,000	996	1,512	1,994	1.000x + 0.140	1.000
R11	SKC	224-PCXR4	091763	06/10/2022	1,000	1,500	2,000	1,000	1,499	2,002	1.013x - 25.678	0.999
R12	SKC	224-PCXR4	091568	06/10/2022	1,000	1,500	2,000	997	1,501	1,999	1.001x - 5.065	1.000
R13	SKC	224-PCXR4	091638	06/10/2022	1,000	1,500	2,000	1,002	1,499	1,994	0.992x + 9.636	1.000
R14	SKC	224-PCXR4	091764	06/10/2022	1,000	1,500	2,000	994	1,502	1,999	1.014x - 30.053	0.999
R15	SKC	224-PCXR8	529457	06/10/2022	1,000	1,500	2,000	1,001	1,500	2,004	1.013x - 25.023	0.999
R16	SKC	224-PCXR8	529643	06/10/2022	1,000	1,500	2,000	998	1,497	1,994	0.998x - 1.017	1.000
R17	SKC	224-PCXR8	529645	06/10/2022	1,000	1,500	2,000	994	1,509	2,000	1.015x - 30.372	0.999
R18	SKC	224-PCXR8	566756	06/10/2022	1,000	1,500	2,000	991	1,498	1,998	1.001x - 6.880	1.000
R19	SKC	224-PCXR8	566802	06/10/2022	1,000	1,500	2,000	1,003	1,499	2,000	1.009x - 19.751	0.999
R20	SKC	224-PCXR8	529089	06/10/2022	1,000	1,500	2,000	990	1,501	2,003	1.020x - 40.195	0.999
R21	SKC	224-PCXR8	665728	06/10/2022	1,000	1,500	2,000	998	1,493	1,999	1.001x - 6.003	1.000
R22	SKC	224-PCXR8	707444	06/10/2022	1,000	1,500	2,000	1,002	1,500	2,002	1.011x - 21.733	0.999
R23	SKC	224-PCXR8	761067	06/10/2022	1,000	1,500	2,000	998	1,494	1,991	0.993x + 36.535	1.000
R24	SKC	224-PCXR8	707893	06/10/2022	1,000	1,500	2,000	996	1,505	2,000	1.013x - 27.803	0.999
R25	SKC	224-PCXR8	761052	05/10/2022	1,000	1,500	2,000	998	1,499	1,993	0.993x + 6.713	1.000
R26	SKC	224-PCXR8	707956	05/10/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.013x - 24.058	0.999
R27	SKC	224-PCXR8	707398	05/10/2022	1,000	1,500	2,000	996	1,503	2,001	1.006x - 15.683	1.000
R28	SKC	224-PCXR8	707461	05/10/2022	1,000	1,500	2,000	1,004	1,500	2,003	1.010x - 19.687	0.999
R29	SKC	224-PCXR8	707402	05/10/2022	1,000	1,500	2,000	1,005	1,493	1,991	0.988x + 14.366	1.000
R30	SKC	224-PCXR8	093811	05/10/2022	1,000	1,500	2,000	999	1,495	1,994	0.997x - 0.8069	1.000
R31	SKC	224-PCXR8	093183	06/10/2022	1,000	1,500	2,000	1,001	1,501	2,001	1.012x - 22.523	0.999
R32	SKC	224-PCXR8	671950	06/10/2022	1,000	1,500	2,000	1,000	1,498	1,994	0.994x + 8.041	1.000
R33	SKC	224-PCXR4	626254	06/10/2022	1,000	1,500	2,000	993	1,502	1,999	1.016x - 33.303	0.999
R34	SKC	224-PCXR4	626131	06/10/2022	1,000	1,500	2,000	1,002	1,498	2,004	1.013x - 24.453	0.999
R35	SKC	224-PCXR8	707460	06/10/2022	1,000	1,500	2,000	999	1,498	1,995	0.994x + 6.709	1.000
R36	SKC	224-PCXR8	707446	06/10/2022	1,000	1,500	2,000	1,003	1,499	2,001	1.009x - 19.432	0.999
R37	SKC	224-PCXR8	707432	06/10/2022	1,000	1,500	2,000	997	1,499	1,998	0.998x + 0.116	1.000
R38	SKC	224-PCXR8	707349	05/10/2022	1,000	1,500	2,000	996	1,500	2,002	1.015x - 31.540	0.999
R39	SKC	224-PCXR8	761095	05/10/2022	1,000	1,500	2,000	1,001	1,496	1,994	0.997x + 2.094	1.000

Calibrated by :

Approved by :



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R²
R40	SKC	224-PCXR4	612753	05/10/2022	1,000	1,500	2,000	1,001	1,501	2,003	1.012x - 23.763	0.999
R41	SKC	224-PCXR4	626140	05/10/2022	1,000	1,500	2,000	991	1,509	2,001	1.017x - 33.836	0.999
R42	SKC	224-PCXR4	626463	05/10/2022	1,000	1,500	2,000	995	1,493	1,999	1.003x - 6.593	1.000
R43	SKC	224-PCXR4	626129	05/10/2022	1,000	1,500	2,000	1,002	1,501	2,003	1.005x - 16.073	0.999
R44	SKC	224-PCXR4	602753	05/10/2022	1,000	1,500	2,000	1,002	1,496	1,993	0.996x + 1.571	1.000
R45	SKC	224-PCXR4	626137	05/10/2022	1,000	1,500	2,000	992	1,505	2,002	1.019x - 37.487	0.999

Calibrated by :

Approved by :



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Rotameter Calibration Report (For Personal Pump Low Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R <sup>2</sup>
L-R01	Dwyer	VFA-21	04/07/2022	50	100	200	50.2	101.0	203.5	0.988x + 2.342	1.000
L-R02	Dwyer	VFA-21	04/07/2022	50	100	200	50.1	101.3	200.5	1.006x - 0.768	0.999
L-R03	Dwyer	VFA-21	04/07/2022	50	100	200	50.5	99.8	202.3	1.016x - 0.811	1.000
L-R04	Dwyer	VFA-21	01/07/2022	50	100	200	50.2	100.9	200.6	1.009x - 1.208	0.999
L-R05	Dwyer	VFA-21	01/07/2022	50	100	200	50.2	100.4	203.0	0.991x + 1.666	1.000
L-R06	Dwyer	VFA-21	04/07/2022	50	100	200	50.6	99.1	201.5	1.002x - 0.007	1.000

Calibrated by :

Approved by :





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Rotameter Calibration Report (For Personal Pump Low Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R²
L-R01	Dwyer	VFA-21	04/10/2022	50	100	200	50.2	101.0	203.9	0.987x + 2.546	1.000
L-R02	Dwyer	VFA-21	05/10/2022	50	100	200	50.1	101.3	200.5	1.007x - 0.870	0.999
L-R03	Dwyer	VFA-21	06/10/2022	50	100	200	50.1	99.8	202.3	1.017x - 1.042	1.000
L-R04	Dwyer	VFA-21	06/10/2022	50	100	200	50.2	100.9	201.0	1.008x - 1.004	0.999
L-R05	Dwyer	VFA-21	05/10/2022	50	100	200	50.2	100.8	203.0	0.990x + 1.973	1.000
L-R06	Dwyer	VFA-21	04/10/2022	50	100	200	50.2	99.1	201.5	1.004x - 0.364	1.000

Calibrated by :



Approved by :





# 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

Inlet Pressure:      Setpoint      Actual  
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

Inlet Pressure:      Setpoint      Actual  
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:

CN10905120

## 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:

CN10005120

**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:

CN10025420

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: CN10925120



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

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

## 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

## Regulatory Disclaimer

This document provides a protocol to verify and record instrument configuration and evidence of proper operation. It has been prepared from our interpretation of applicable regulations as well as industry best practices. The document is designed to provide an important component of a complete compliance package. Validation depends upon many factors and use of this protocol alone does not assure compliance. Agilent Technologies makes no promises or representations as to its sufficiency for any specific regulatory program.

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

User Name: saenguthai.tarak  
 Hostname: LAPTOP-GQ3SKOMV

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\_9PS 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 3:15:28 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: 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 3:26:13 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\ND_FID.D\FID 1A.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\FID 1A.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	AccRestarted	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	RPPA - 5975C Inert XL with TAD SQ: - Source: EI - Inert	None
March 29, 2022 3:33:09 PM	End	Execution	RPPA - 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: seenguthal.tarek  
 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 3:33:43 PM	End	Execution	Tune EI - 5976C 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 3:38:48 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,DI DATASIM.MS
March 29, 2022 3:38:53 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

ระดับเสียงในการทำงาน

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.

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

FM.BL.MTC.002 Rev.4

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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

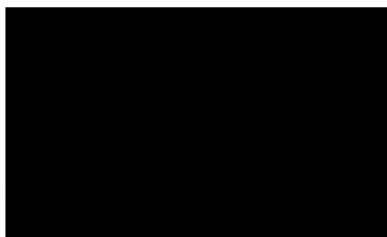
Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	999.9	-0.1	$\pm 1.5$	$\pm 1.0\%$

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 :



Approved by :



Date of Calibration : 28 Apr. 2022

Date of Issue : 28 Apr. 2022

Electrical and Electronic Standards Laboratory  
Industrial Metrology and Testing Service Centre

Ref : 2011265042601787001

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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.BLMTC.002 Rev.4

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Noise R\_406/22

### Sound Level Meter Calibration Report

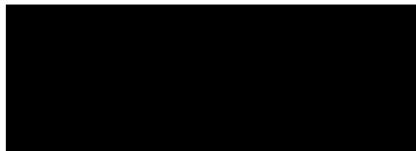
#### Acoustic Calibrator Data

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

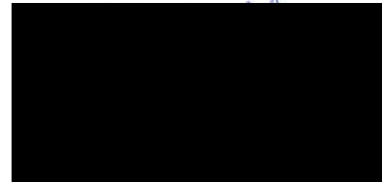
#### Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B29	ACO	6236	00182011	02 August 2022	94.0	94.0
ACO-B36	ACO	6236	00192027	02 August 2022	94.1	94.0
ACO-R40	ACO	6236	00192052	02 August 2022	94.0	94.0
ACO-R41	ACO	6236	00192053	02 August 2022	94.0	94.0
ACO-R50	ACO	6236	00192062	02 August 2022	94.1	94.0
ACO-R51	ACO	6236	00192063	02 August 2022	94.0	94.0
ACO-R52	ACO	6236	00192064	02 August 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 :





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Noise Dose R\_405/22

### 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	17 September 2021
		Due Date	17 September 2022

#### Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NMD-R02	SVANTEK	SV-104IS	60152	02 August 2022	113.6	113.6
NMD-R03	SVANTEK	SV-104IS	60153	02 August 2022	113.5	113.6
NMD-R05	SVANTEK	SV-104IS	60155	02 August 2022	113.6	113.6
NMD-R27	SVANTEK	SV-104IS	80837	02 August 2022	113.6	113.6
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					113.67 ± 0.10 dB	

Calibrated by :



Approved by :





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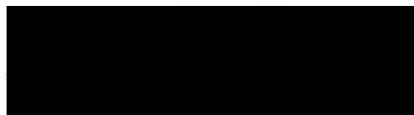
Noise Dose R\_439/22

### 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	17 September 2021	
				Due Date	17 September 2022	

Calibration Data						
Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NMD-R35	SVANTEK	SV-104IS	80873	25 August 2022	113.5	113.6
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					113.67 ± 0.10 dB	

Calibrated by :



Approved by :

